

Land Management Plan

A Narrative for Invasive Plant Management
and Native Plant Restoration

Lone Tree Hill
Belmont, MA

Spring 2020



PARTERRE
ECOLOGICAL

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Introduction and Primary Goals

The 119 acre Lone Tree Hill Conservation Area sits atop a mix of mafic and avalon granite bedrocks. Before its foundation in 1999, the site experienced heavy disturbance in northeastern parts (former farm and orchard) and light disturbance in forests (largely undisturbed up to 100 years in parts). This combination of land use history and geology plays out with dense invasive species in heavily disturbed/cultivated areas, to very healthy forests where surface bedrock protected the soil surface from disturbance. The purpose of this plan is to provide The Land Management Committee for Lone Tree Hill with a document that will:

- Provide a map and inventory of invasive species populations across the site
- Prioritize contractor and volunteer efforts to control invasive species and restore areas to native populations over time
- Provide detailed guidance for invasive species and meadow management techniques as well as equipment to be used
- Provide hours estimation for management areas as well as follow up timing
- Recommend guidelines for qualified contractors and monitoring reports

With this report, we hope the committee finds a working document that provides definitive steps for moving forward in managing invasive species at Lone Tree Hill, and ultimately guide the conservation area to a healthier, more diverse ecosystem for all visitors to enjoy.

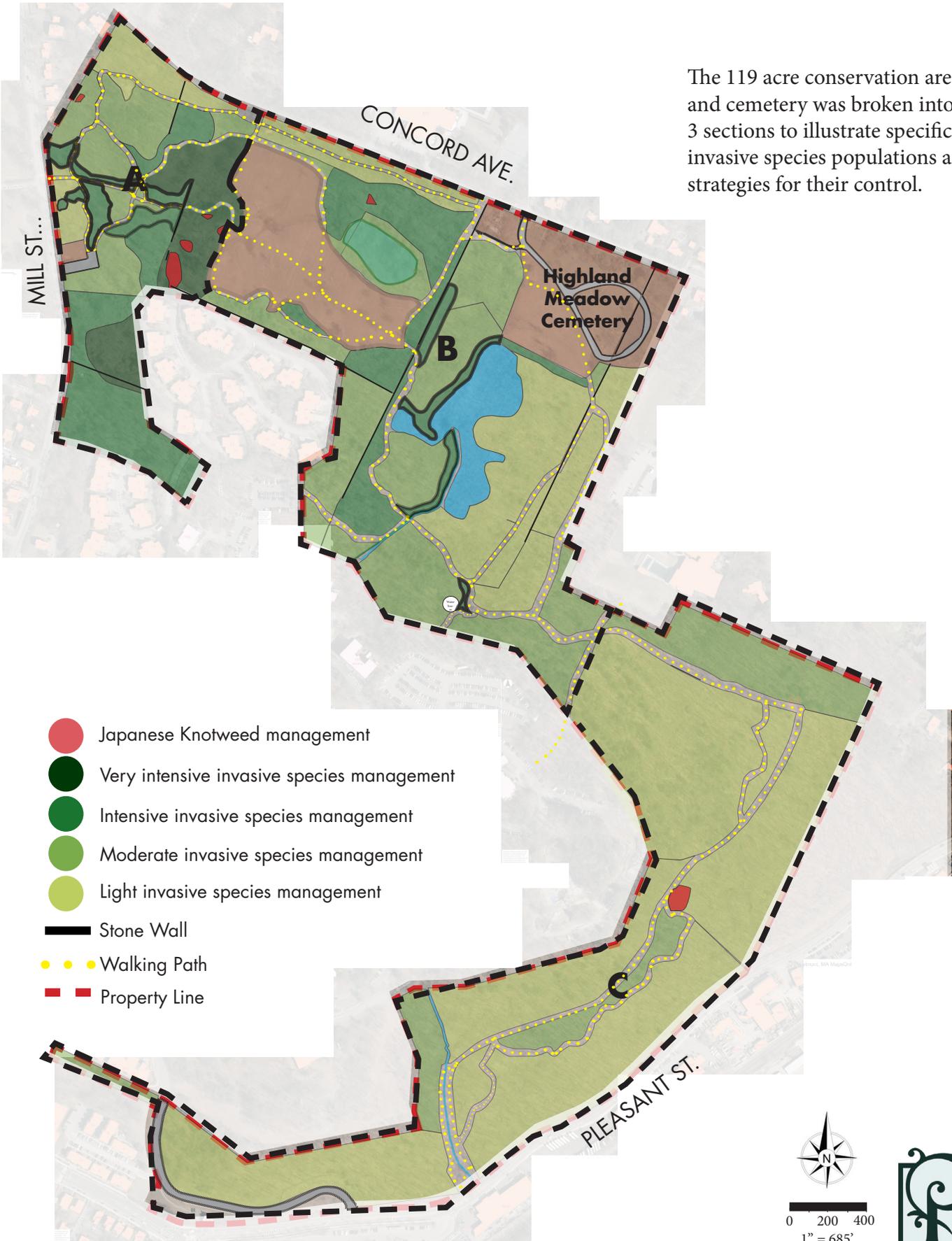


Red-Bellied Woodpecker (*Melanerpes carolinus*) feeding on insects in a dead snag near the parking entrance



Lone Tree Hill Invasive Plant Inventory

The 119 acre conservation area and cemetery was broken into 3 sections to illustrate specific invasive species populations and strategies for their control.



Lone Tree Hill Invasive Plant Inventory Area A



Area A contains the densest populations of invasive species on the site, ranging from dense shrubs and vine thickets that have overwhelmed the Oak/Hickory native canopy to mostly intact native Oak and Pitch Pine communities with isolated patches of Glossy Buckthorn.

The darkest green (174,300 sq. ft.) areas should be managed by qualified contractors only. They consist of a mix of invasive species (see inventory pg. 11) and non-native aggressive species. These have suppressed or eliminated the native plant community and will require an initial cut and removal by forestry mower or chainsaw team with at least 2 seasons of follow up herbicide treatment before revegetation with native shrubs/seed.

Dark green (218,750 sq. ft.) areas should be managed by qualified contractors. They consist of dense, mature invasive shrubs and vines with a canopy of mostly native Oak/Hickory/Pine. Removal requires machine cutting of shrubs and vines to 12-18", stacking into habitat piles, and herbicide stump application for at least 2 seasons. Due to the density of invasive species, some replanting of the native species will be required along with maintenance to establishment.

Dark green (54,752 sq. ft.) areas with an outline indicate dense stands of Glossy Buckthorn below a canopy of native trees. Cutting can be managed by qualified contractors or a trained team of volunteers (see Buckthorn Management pg. 13) Herbicide treatments should continue for at least 2 seasons. Due to the density of invasive species, some replanting of the native species will be required along with maintenance to establishment.

Olive green (181,450 sq. ft.) indicates areas where Glossy Buckthorn is the main understory but more spread out than above. Mechanical removal or cutting can be managed by qualified contractors or a trained team of volunteers (See Buckthorn Management pg. 13) for at least 2 seasons. Removal of invasive species will reduce competition to native species which can then shade out invasive seedlings. Some replanting may be required.

Light green (87,000 sq. ft.) indicates areas where the native understory and canopy is mostly intact, with isolated invasive shrubs. Cutting is best completed by a trained team of volunteers or a qualified contractors. Follow up treatment is best accomplished with cut and dab, but Buckthorn may be controlled in these areas by mechanical root removal or cutting mature shrubs every three years to keep them from producing seed. Replanting will likely not be required.

Red (8,600 sq. ft.) indicates pockets of Japanese Knotweed. They should be managed by qualified applicators using cut-stem or foliar treatment during the flowering period (late July to September). All debris should be removed from the site and disposed in a landfill.

Lone Tree Hill Area A Invasive Plant Images



Moderate density Glossy Buckthorn can be cut to 12-18" by volunteers in the spring and treated in mid summer by qualified contractors



Dense bramble of invasive Buckthorn, Bittersweet, and Honeysuckle suppressing Grey Dogwood



Roots of Garlic Mustard, Mugwort, and Burdock seeds that dominate the parking lot meadow



Invasive Bittersweet vine damaging the Red Oak canopy and Black Cherry understory



Japanese Knotweed with very dense invasive shrubs and vines in background



Lone Tree Hill Area A Invasive Plant Images



● Dense invasive bramble surrounds the western border of the Great Meadow up until the stone wall. The dead native vegetation and thick stands of invasives make it dangerous for volunteer. The area should be cut by a forestry mower followed by at least 2 seasons of herbicide application, then seeded for meadow or replanted with native shrubs



● The northern border with Concord Ave. contains a healthy Pitch Pine/Oak forest with isolated patches of Glossy Buckthorn. These best managed by cutting followed by a mid-late summer herbicide treatment, but can also be maintained to prevent seed through 2-3 year rotational cutting by volunteers



Lone Tree Hill Invasive Plant Inventory Area B

Area B contains dense populations of mixed invasive vines and shrubs along the meadow edges and surrounding the northern portion of the vernal pool. Only qualified contractors should work in wetland buffers, as too much foot traffic can damage sensitive ecosystems. Volunteers can effectively manage most of the light/moderate density areas east of the Red Maple Wetland.



The darkest green (213,275 sq. ft.) areas should be managed by qualified contractors only. They consist of a mix of Invasive species (see Inventory pg. 11) and non-native aggressive species. These have suppressed or eliminated the native plant community and will require an initial cut and removal by forestry mower or chainsaw team with at least 2 seasons of follow up herbicide treatment before revegetation with native shrubs/seed.

Dark green (43,750 sq. ft.) areas with an outline indicate dense stands of Glossy Buckthorn below a canopy of native trees. Cutting can be managed by qualified contractors or a trained team of volunteers (see Buckthorn Management pg. 13). Herbicide treatments should continue for at least 2 seasons. Due to the density of invasive species, some replanting of the native species will be required along with maintenance to establishment.

Olive green (525,750 sq. ft.) indicates areas where Glossy Buckthorn is the main understory but more spread out. Mechanical removal or cutting can be managed by qualified contractors or a trained team of volunteers (see Buckthorn Management pg. 13) for at least 2 seasons. Removal of invasive species will reduce competition to native species which can then shade out invasive seedlings. Some replanting may be required.

Light green (391,820 sq. ft.) indicates areas where the native understory and canopy is mostly intact, with isolated invasive shrubs. Cutting is best completed by a trained team of volunteers or a qualified contractors. Follow up treatment is best accomplished with cut and dab, but Buckthorn may be controlled in these areas by mechanical root removal or cutting mature shrubs every three years to keep them from producing seed. Replanting will likely not be required.



Lone Tree Hill Invasive Plant Inventory Area B



- There is a stark contrast of ecological health on either side of the Red Maple wetland brook with moderate Buckthorn stands to the west and a diverse mix of Summersweet, Highbush Blueberry, and Black Cherry to the east



- Mixed invasive vines grow into planted White Pine along the southern meadow border



- The ecosystem east of the Red Maple wetland is primarily in tact with shrubs such as Highbush Blueberry



- Dense vines mixed with Buckthorn, Honeysuckle, and Multiflora Rose on southern meadow trail



- An individual Burning Bush near the vernal pool



Lone Tree Hill Area B Invasive Plant Images



Dense invasive Common Buckthorn, Glossy Buckthorn, Honeysuckle, Crab apple, Tree of Heaven, Bittersweet, and Grape surround the northern edge of vernal pool. Qualified contractors will need to machine cut invasives and treat stems, while limiting disturbance in the sensitive area. Some replanting will be required where invasives are removed



The Southern portion of the vernal pool has light densities of Buckthorn with Highbush Blueberry and Red-Twig Dogwood. The northern portion has dense patches of Buckthorn lining the edge and should be carefully managed by a qualified contractor to limit any disturbance in the vernal pool



Lone Tree Hill Invasive Plant Inventory Area C

Area C is the largest section and contains mostly intact native Oak/Pine/Hickory forests with a healthy and diverse understory of Summersweet, Spicebush, Maple Leaf Viburnum and Witchazel. Most of the invasive species are found in eroded sections of the bike path, at an old debris dump site near trail 10, and along the northern border with Belmont Day School. Special care should be taken to limit disturbance along trails and control any mature invasive species in these areas to keep the native plant community intact.

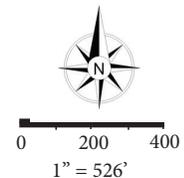
 Olive green (285,650 sq. ft.) indicates areas where Glossy Buckthorn is the main understory but more spread out. Mechanical removal or cutting can be managed by qualified contractors or a trained team of volunteers (see Buckthorn Management pg. 13) for at least 2 seasons. Removal of invasive species will reduce competition to native species which can then shade out invasive seedlings. Some replanting may be required.

 Light green (1,333,800 sq. ft.) indicates areas where the native understory and canopy is mostly intact, with isolated invasive shrubs. Cutting is best completed by a trained team of volunteers or a qualified contractors. Follow up treatment is best accomplished with cut and dab, but Buckthorn may be controlled in these areas by mechanical root removal or cutting mature shrubs every three years to keep them from producing seed. Replanting will likely not be required.

 Red (800 sq. ft.) indicates pockets of Japanese Knotweed. They should be managed by qualified applicators using cut-stem treatment during the flowering period (late July to September). All debris should be removed from the site and disposed in a landfill.



-  Stone Wall
-  Walking Path
-  Property Line



Lone Tree Hill Area C Invasive Plant Images



● Garlic Mustard occupies some of the disturbed areas along the bike paths



● Japanese Knotweed stems at an old fill site off the hospital property



● Most of the ecosystem is intact with Pine/Oak overstory and Maple Leaf Viburnum in understory



● Large Bittersweet vines off an old dump site near trail 10



● Non-native aggressive Jetbead has aggressively spread in old dump piles



Lone Tree Hill Invasive Plant Inventory

At the Lone Tree Hill Conservation area we propose controlling all invasive plant species that have developed self sustaining populations. The physiology of the invasive plants has enabled them to outcompete the native plant community and compromise the ecological value of the native plant community and the wetland areas. The dominant invasive plants can alter stormwater surface flow, moisture-holding capacity in soils and decrease wildlife habitat value.

Invasive Plant Species Identified:

Ailanthus altissima, Tree of Heaven
Alliaria petiolata, Garlic Mustard
Berberis thunbergii, Japanese Barberry
Celastrus orbiculatus, Asiatic Bittersweet
Cynanchum louiseae, Black Swallowwort
Euonymus alatus, Burning Bush
Fallopia japonica, Japanese Knotweed
Frangula alnus, Glossy Buckthorn
Lonicera morrowii, Morrow's Honeysuckle
Lythrum salicaria, Purple Loosestrife
Rhamnus cathartica, Common Buckthorn
Rosa multiflora, Multiflora Rose

*** Likely Invasive Plant Species Identified:**

Ligustrum, Privet
Malus sylvestris, Wild Crab apple
Vitis spp., Grape
Rhodotypos scandens, Black Jetbead
Philadelphus coronarius, Sweet Mock Orange

* While not listed as an Invasive Species by MIPAG (Massachusetts Invasive Plant Advisory Group) these species can dominate the shrub layer and crowd out native trees and shrubs. We recommend removal of non-native Crab Apple along with listed invasive plant species in wetland buffers and replace with native shrubs and trees.



In some portions of area A, Glossy Buckthorn (*Frangula alnus*) has completely overwhelmed the native plant community. This monoculture lacks insect diversity which form the basis of the food web. Additionally, Glossy Buckthorn berries contain a metabolite called anthroquinone. When birds feed on the berries anthroquinone can concentrate in there system and metabolize into a laxative called Emodin. This can lead to mild to severe diarrhea and poor digestion.



Invasive Plant Management Techniques

We propose a combination of manual hand removal, cut & dab herbicide, and foliar application methods to control invasive plant species within the identified project areas over a phased timeline. Once the initial identified invasive plant species have been removed by manual methods (described below), we propose seeding all exposed soil with native seed blend and begin planting identified tree, shrub and perennial plant species selected from the native plant community list that will increase the density and diversity of the existing wetland buffers.

Manual Hand Removal Methods:

Manual methods of invasive plant management will include hand pulling or cutting. To minimize soil disturbance, shallow-rooted invasive plants less than 1" in caliper will be hand pulled from the soil. Invasive plant species greater than 1" in diameter will be cut. All invasive plant material will be disposed of off site. Manual hand pulling and cutting will remove all invasive plants from the wetland buffer.

Herbicide Application Methods:

Spring cut with summer foliar treatment: *The most efficient control of invasive woody shrubs on site is to have contractors or volunteers cut invasive woody species to 12-18" in Spring, allow them to resprout, and follow up with a foliar herbicide application in mid summer to late fall (at least after cutting). This process can also be done using a cut and dab instead of foliar which is safer, but will require 2-3 times the labor. There should be no foliar application in wetland areas.*

Cut and Dab application: All invasive plant species that have a base greater than 1" in caliper are proposed for herbicide application methods. Although invasive, the root systems of plants greater than 1" in caliper usually have extensive fibrous root systems, providing soil stabilization. So we propose a cut & dab method of application of a triclopyr-based herbicide (Garlon) or glyphosate-based herbicide approved for wetland use (trade name Aquaneat) on individual cut stumps. Massachusetts Licensed Pesticide Applicators will complete all aspects of the proposed restoration.



Qualified contractors with necessary Personal Protective Equipment (PPE) should use foliar application on resprouting cut stems where concentrations are particularly high and to edit out Black Swallowwort from the meadow



Proposed cut stump treatment using hand tools and applying marking dye to eliminate possibility of treatment of stump twice, or missing stump entirely

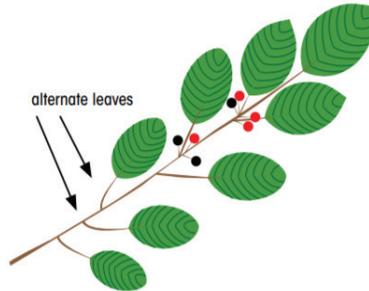


Lone Tree Hill Glossy Buckthorn ID and Management

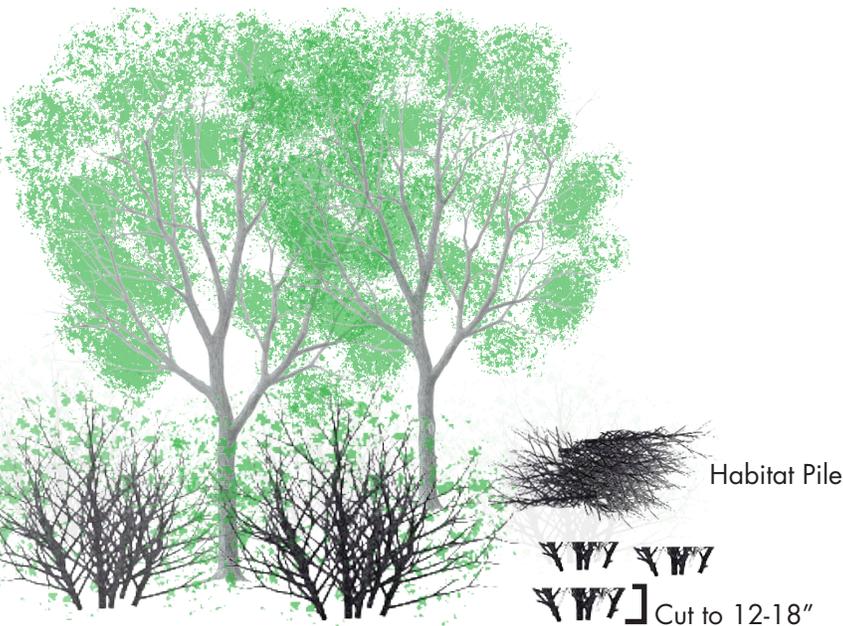
The most prevalent invasive shrub on site is Glossy Buckthorn (*Frangula alnus*). It varies in density from overwhelming the native plant community to small pockets in healthy forests.

Monocultures lack insect diversity which form the basis of the food web. Additionally, Glossy Buckthorn berries contain a metabolite called Anthroquinone. When birds feed on the berries Anthroquinone can concentrate in their system and metabolize into a laxative called Emodin. This can lead to mild to severe diarrhea and poor digestion which, in tern, leads to more Buckthorn seeds being spread and to germinate.

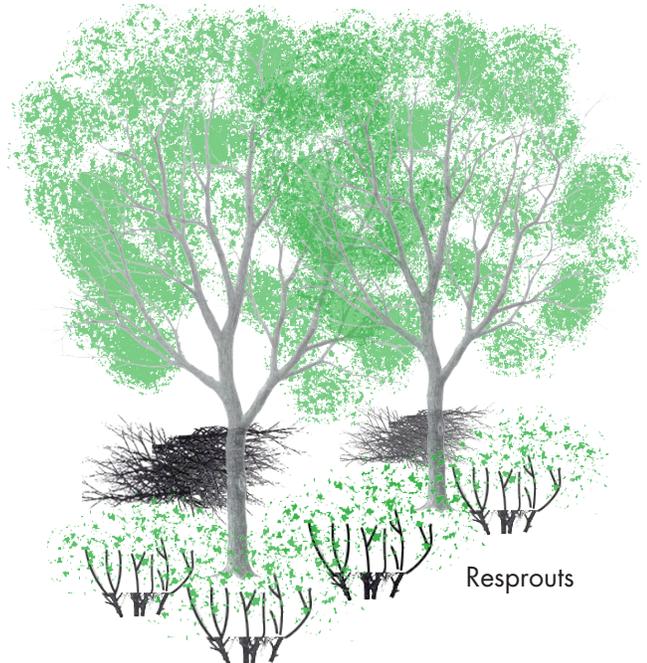
Dense and moderate populations should follow the steps below for at least 2 seasons followed by planting where necessary. In light density areas, Buckthorn can be cut and treated directly (July-Dec.), cut and removed by the roots, or can be cut on a three year rotation to prevent fruit maturation. All stem herbicide application should be done immediately after cutting. Moderate and Light density Buckthorn are excellent areas to engage volunteers.



Identification: Oval, smooth, glossy leaves with toothless leaves that are alternate along the stem. The base of the trunk has distinct, raised lenticels that look like water marks. Berries begin to appear in July and transition from red to black by winter. Terminal bud is fuzzy and brown, shaped like a goat hoof.



Dense Glossy Buckthorn can dominate the understory limiting its habitat value while keeping young saplings from the subcanopy. Mature stems should be cut to 12-18 inches in Spring (February thru May). Debris should be stacked into piles 4-6' tall to create a neat pile of debris that provides important habitat value for rodents and birds.



Cut buckthorn is allowed to resprout for at least a month after cutting is treated with herbicide by foliar or cut and dab methods after its flowering period (July to December) when carbohydrates migrate down into the roots.



Lone Tree Hill

Asiatic Bittersweet ID and Management

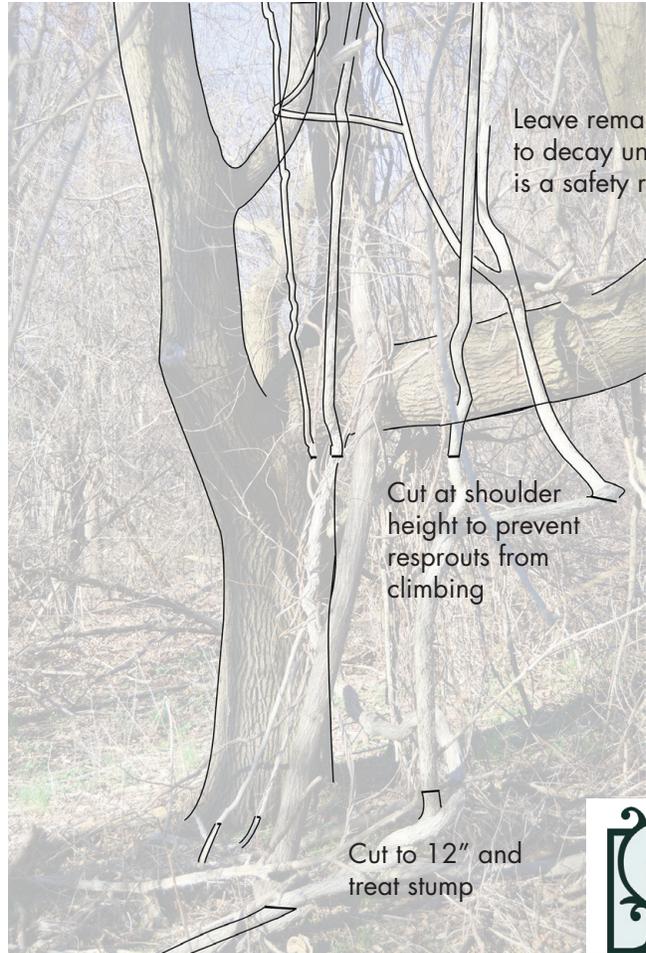
Invasive Bittersweet (*Celastrus orbiculatus*) and Grape (*Vitis* sp.) have the capacity to girdle, weaken, and even kill mature canopy trees. Without some frequency of removal, they will eventually open large holes in the canopy while suppressing saplings from filling the holes. They readily resprout after being cut and can damage the aesthetic and ecological value of meadows.

Mature stems produce thousands of bright red berries that mature in late fall and are spread by birds.

Removing the entire vines from trees is often dangerous and unnecessary (unless it poses safety risk). Our team recommends making cuts at shoulder height followed by a cut at 12" and immediate herbicide treatment. Bittersweet aggressively suckers after cutting so it is important to cut and treat during or after its flowering period (late June to December).



Identification: Alternate, circular light green leaves 2-5 in. long. Distinctive, large light colored vine. Red berries with orange casing appearing in late fall. Seedlings have light green leaves. Deep orange roots.



Lone Tree Hill Japanese Knotweed Management

Japanese Knotweed (*Fallopia japonica*) is one of the most difficult invasive species to control. Its main mode of spreading is through cut portions of its rhizomes or stem, which can actively resprout even when 1 inch in length. Growing 10-15' and shading out any competitors, Japanese Knotweed can quickly form a monoculture. It can take 2-5 seasons to fully contain through repeat herbicide treatments. It is at its weakest point during the flowering stage, when nutrients are flowing back into the roots (Aug, Sept.) Unfortunately, taproots can extend over 6' below the ground making organic treatment nearly impossible. There are two ways to approach treatment.

1. Cut and treat: For smaller areas, involves cutting the stem between the 1st and 3rd node and adding a 50% solution of Aquaneat (glyphosate), generally 5 oz per treated stem. If density is less than 5 ft per plant treat every third stem. Do this for 2-5 seasons.
2. Cut in May, foliar treat in fall: In this case, dense stands of Knotweed are mown in end of May so when they regrow they are at hip height by August. They can then be easily sprayed with a 2.5% Aquaneat (glyphosate) solution



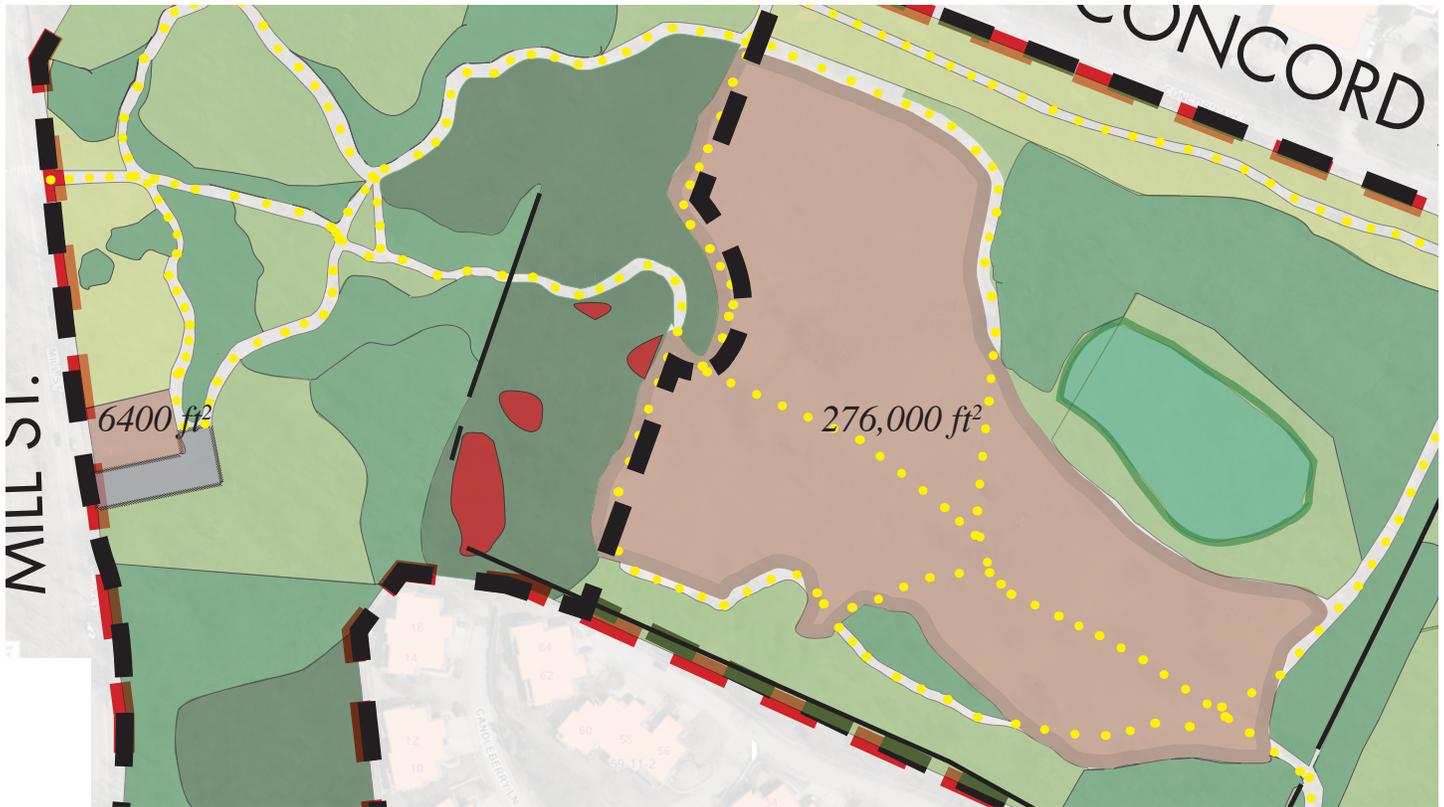
Identification: Herbaceous perennial, with long heart shaped leaves. Young sprouts can be red, rhubarb in nature. Extensive roots can spread and colonize quickly and can reach 15 ft. at maturity.



Japanese Knotweed cut in preparation for a fall herbicide foliar treatment (left). Treatment of Japanese Knotweed stems using a cut and fill method. A combination of cut and fill in the first season and foliar in the second has shown to be effective



Lone Tree Hill Meadow Management



Parking Entrance Meadow: Along the parking lot the 6400 ft² meadow contains a dense population of Queen Anne’s Lace, Garlic Mustard, Burdock, and Mugwort. It will need intensive management to be a native meadow space including:

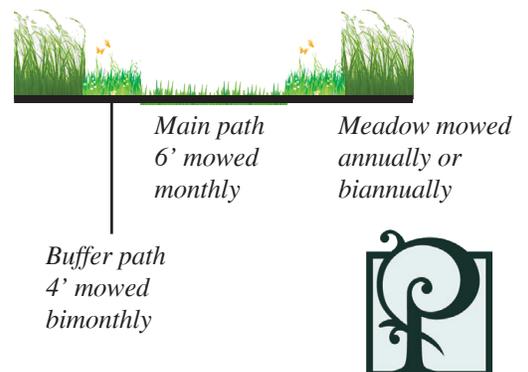
- One season of foliar herbicide (2 treatments) to kill existing non-natives and fescue grass and the seed bank.
- Light disturbance and seeding with NE showy wildflower or custom mix.
- One season of 4-6 week mowing at 4-6” height to promote seedlings and edit out annual weeds.
- Mowing once every March.
- As an alternative to chemical treatments, the soil can be machine raked 3-4 times throughout the season to limit weeds before seeding.

A Note on Mowing:

- Ticks are a perennial issue in New England and any traffic through wild areas carries some risk. Research suggests woodland habitats and moist grassy forest edges to be ideal habitat for ticks (Mass. Department of Health). Meadows have lower densities, but can still harbor ticks. It is important to keep people from brushing up against meadow grasses along paths and especially along forest edges.
- Parterre recommends mowing wider paths along woodland edges and incorporating monthly mowing of paths (6’) with bi-monthly mowing of path edges (4’ on each side) to limit physical contact with meadow grasses. See diagram on right.

The Great Meadow: At the time of this plan, it is too early to locate the invasive populations of Black Swallowwort, Glossy Buckthorn, and Bittersweet in the meadow.

- Once determined, healthy areas of the meadow will be protected using spot sprays or hand removal and areas with high densities of invasives will need to be reseeded following herbicide treatment.
- The meadow should be mown to 8” in mid to late March each year as it is a time with fewer migratory birds. Additionally, not all of the meadow needs to be mown every year. As long as woody species are being contained, leaving portions of the meadow up for two seasons can attract a whole additional set of wildlife.



Lone Tree Hill Habitat Creation

Why is deadwood important?

Snags, large down logs and dead standing trees (dead wood) can be just as valuable if not more than living trees. They provide food, nesting cavities for birds, shelter for mammals, exposed bark for bats, nutrients for the soil and even moist forest floor for reptiles and amphibians. Some studies in the northwest have shown the 40% of wildlife in old growth forests rely on dead wood for survival (Bartels, Knight). Unfortunately many natural spaces are kept clear of or are lacking dead wood to support habitat or simply grew after the land clearing of the 18th and 19th century and haven't matured enough to have a large supply.

In old growth forests in Oregon the density of dead snags is 10-18 snags per acre and 50-140 down logs per acre. This density is key to sustaining large populations of reptiles to providing space for nesting birds which are very territorial when snags are scarce.

Management impacts:

- When possible, dead trees and snags should be left standing in the natural area as long as they are not a safety risk. Special consideration should be given to trees greater than 25 inches in diameter which will support woodpecker cavities.

- Invasive trees to be removed can be cut to 12-20' above the ground to make them a safe, standing snag.
- Stacked invasive Buckthorn, Honeysuckle, Privet, Norway Maple and Crab Apple mimic the benefits of down logs and significantly increase shelter opportunities in areas where invasive species are being removed. Additionally, they limit removal of material off site, making the work more efficient and less energy intensive. These "Critter Condos" should be built 10-12 ft. across and 6' tall with larger branches on the bottom and taller on top. Ideally there are at least 2-3 piles per acre.



A "Crittter Condo" reduces disposal energy while supporting shelter and food for wildlife



A large dead Sugar Maple houses a woodpecker at Lone Tree Hill



Management Calendar for Treatment, Mowing, and Monitoring:

Task	March/ April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
<i>Remove Garlic Mustard and Lesser Celadine seedlings by hand</i>	Optimal	Optimal	Possible					Possible	Possible
<i>Foliar treatment of Black Swallowort</i>			Optimal	Not optimal	Optimal				
<i>Cutting of Glossy Buckthorn and creation of habitat piles by volunteer or contractor</i>	Optimal	Optimal	Possible	Possible	Possible	Possible	Possible	Optimal	Optimal
<i>Foliar treatment of woody invasive species</i>			Optimal	Optimal	Optimal	Optimal	Optimal		
<i>Cut and dab of woody invasive species</i>	Possible	Possible	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
<i>Full Mowing of meadow</i>	Optimal							Possible	Possible
<i>Mowing of meadow pathways</i>		Possible	Optimal	Optimal	Optimal	Optimal	Possible		
<i>Very intensive invasive species management through mechanical cutting/forestry mowing</i>	Optimal	Optimal	Not optimal					Optimal	Optimal
<i>Invasive management in wetland areas</i>			Possible	Optimal	Optimal	Optimal			
<i>Cut and treat Japanese Knotweed stems directly (bag debris for landfill)</i>					Optimal	Optimal			
<i>Invasive vine management and cut and dab treatment</i>	Possible	Possible	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
<i>Restoration planting</i>	Optimal	Optimal	Not optimal		Possible	Optimal	Optimal	Possible	
<i>Overseeding of meadow</i>	Optimal	Optimal						Possible	Optimal
<i>Monthly Monitoring Reports</i>	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal

-  *Optimal timing and efficiency*
-  *Not optimal but mostly effective*
-  *Possible, but not ideal*



Lone Tree Hill Prioritization and Estimated Hours

With such a large site with dense invasive species populations it is important to prioritize projects over time, determine ways to incorporate volunteers, and isolate the components required for large project so necessary maintenance is planned for over time. The majority of high priority areas are located in area A and become less as you move to healthier or more isolated portions of the park. Below are some considerations for high priority areas. The more an area fits in these categories, the higher priority it is.

Prioritization should reflect:

Ability to invest in follow up

maintenance: The denser the invasive species, the more initial cost and follow up maintenance. If maintenance is not sufficient, the project will fail.

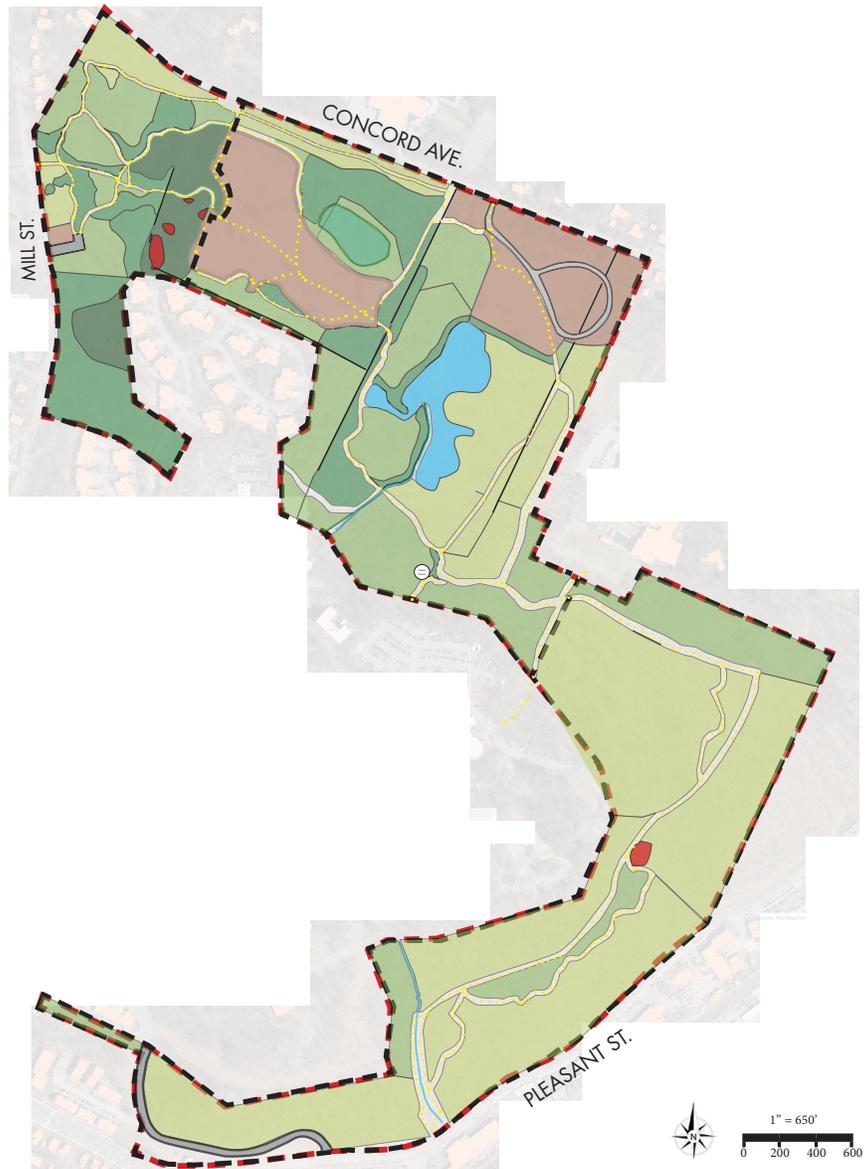
Access and visibility: Areas overwhelmed by invasive species along main paths deter from visitor experience. Prioritizing them helps others invest in the larger project.

Limit Mature Invasives: Most invasives need mature seeds/ fruit to spread into wild areas. Decreasing berry output by cutting stems will help keep populations in check.

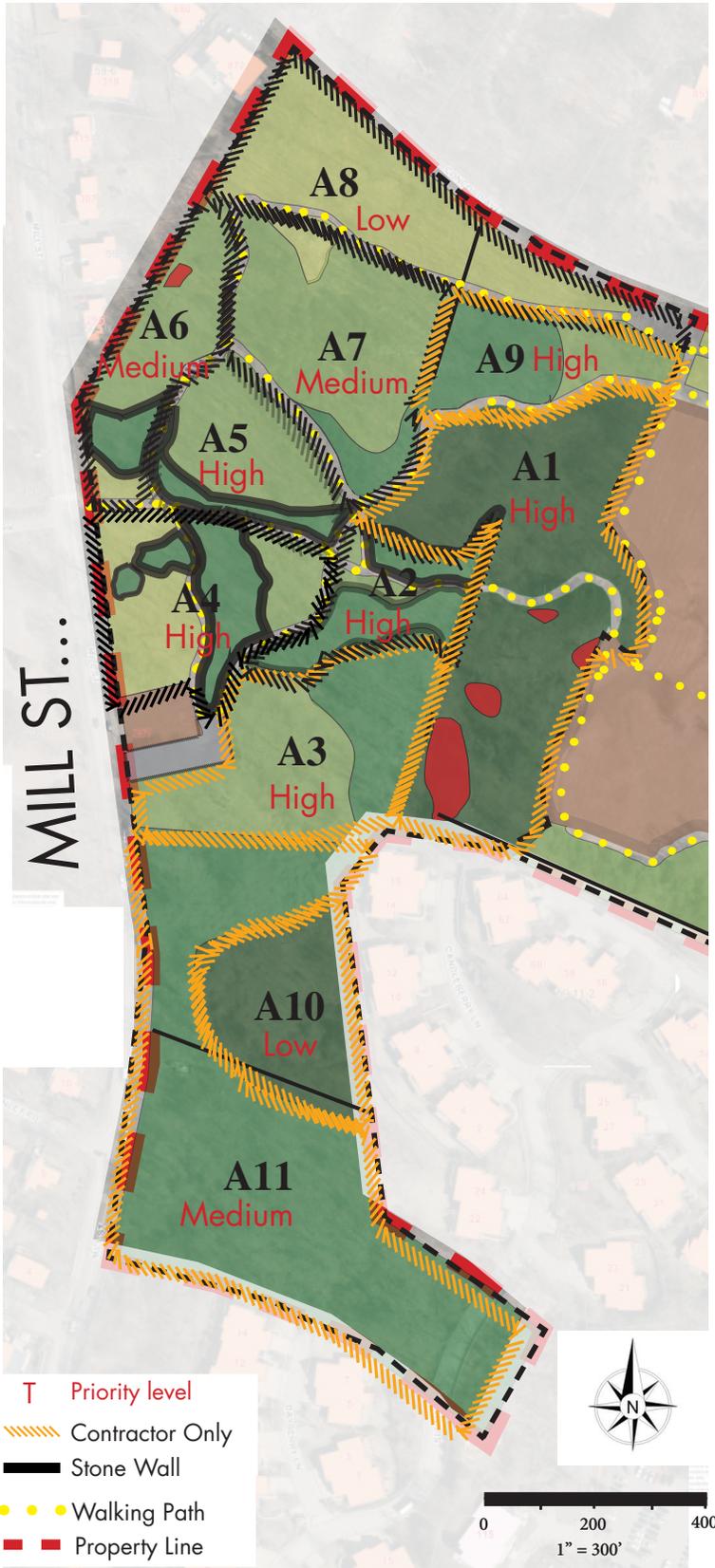
Protect Healthy areas and Canopies: Protect canopy trees overwhelmed by vines. Small populations of Buckthorn in healthy areas should be kept from maturing and further spreading

The following pages indicate:

- Estimated hours for map areas
- Whether work area should be managed by a contractor or volunteers. Contractor only areas are indicated by an Orange border
- Work hours associated with contractor site work
- Level of prioritization from High to Low indicated in red text.



Lone Tree Hill Prioritization and Estimated Hours



A1: (132,950 ft²) Dense invasive shrubs have overwhelmed canopy. Cut low in Spring followed by 1-2 seasons of herbicide before replanting.

- Spring forestry mower - 3 days + 8 hours management or Spring Contractor chainsaw - 170 Hours
- Follow up Herbicide Summer visit (16 hours) and Fall (16 hours)
- Replanting or seeding after at least 2 seasons

A2: (23,100 ft²) Cut dense Buckthorn by contractor or volunteer in Spring and stack into habitat piles. Summer Herbicide treatment.

- Contractor mowing - 32 hours
- Follow up foliar - 4 hours

A3: (65,250 ft²) Cut invasive vines from trees and shrubs in Summer and treat stems

- Cut and Stem treatment - 18 hours

A4: (43,600 ft²) Cut dense Buckthorn by contractor or volunteer in Spring and stack into habitat piles. Summer Herbicide treatment.

- Contractor mowing - 24 hours
- Follow up foliar - 4 hours

A5: (37,500 ft²) Cut dense Buckthorn by contractor or volunteer in Spring and stack into habitat piles. Summer Herbicide treatment.

- Contractor mowing - 18 hours
- Follow up foliar - 4 hours

A6: (33,100 ft²) Cut dense Buckthorn by contractor or volunteer in Spring and stack into habitat piles. Summer Herbicide treatment.

- Contractor mowing - 12 hours
- Follow up foliar - 4 hours

A7: (63,200 ft²) Cut dense Buckthorn by contractor or volunteer in Spring and stack into habitat piles. Summer Herbicide treatment.

- Contractor mowing - 24 hours
- Follow up foliar - 4 hours

A8: Limited invasive management by volunteers. Cut any mature stems to 12-18" any time of year.

A9: (23,000) Cut invasive vines from trees and shrubs in summer and stem treat

- Contractor mowing - 26 hours
- Follow up foliar - 4 hours

A10: (41,400 ft²) Dense invasive shrubs have overwhelmed canopy. Cut low in Spring followed by at least 2 seasons of herbicide before replanting.

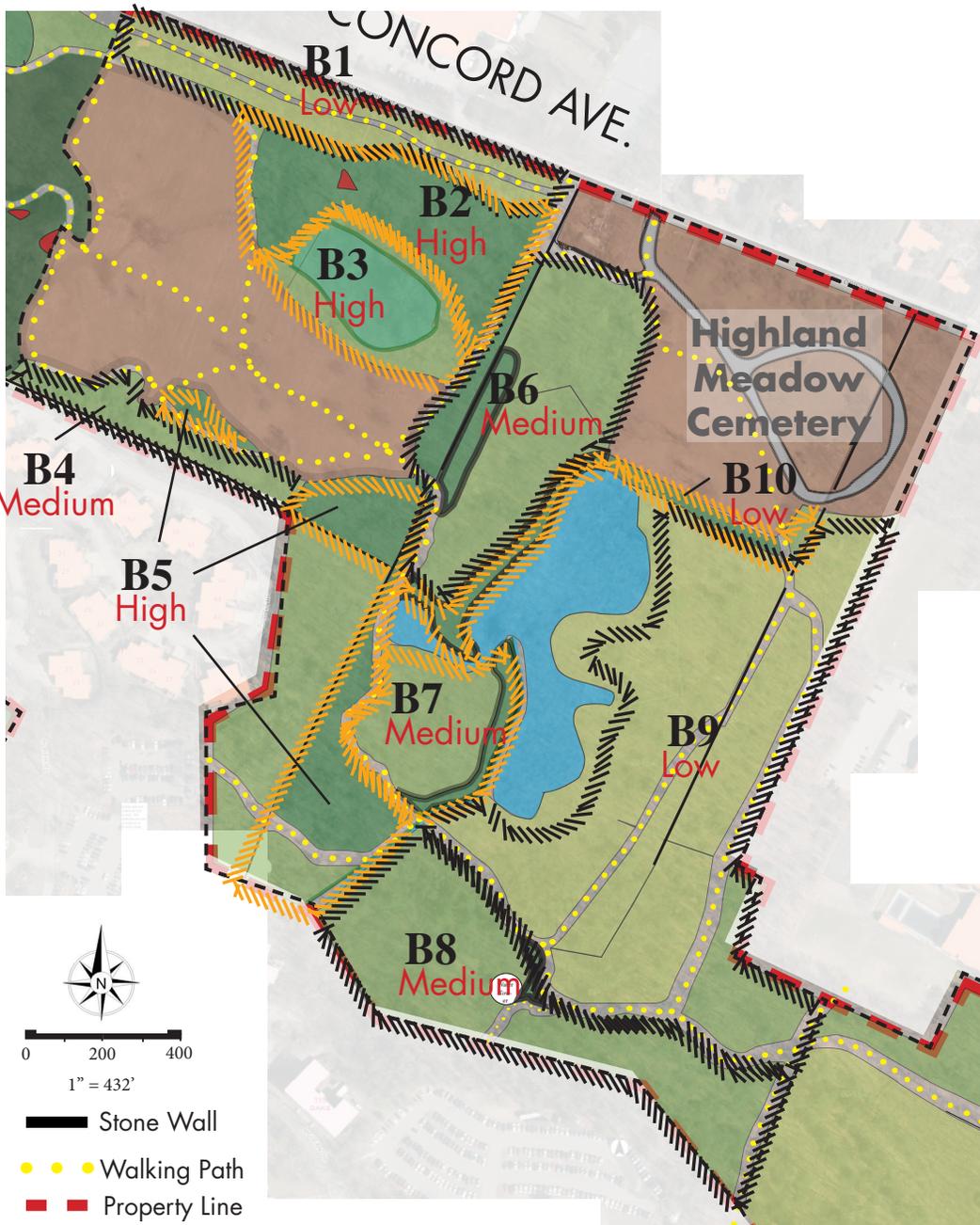
- Spring forestry mower - 1 day + 8 hours management or Spring Contractor chainsaw - 64 Hours
- Follow up Herbicide Summer visit (8 hours) and Fall (8 hours)
- Replanting or seeding after 2 seasons

A11: (162,300) Cut invasive vines from trees and shrubs in Summer and treat stems

- Cut and Stem treatment - 170 hours
- Follow up treatment at least 2 seasons - 76 hours



Lone Tree Hill Prioritization and Estimated Hours



B1: (54,300 ft²) Very little invasives along Alley, volunteers to manage seedlings periodically.

B2: (95,000 ft²) Cut dense vines and shrubs and stack into habitat piles. Summer Herbicide treatment- cut and dab.

- Contractor mowing - 48 hours
- Follow up Cut and Dab - 32 hours for at least 2 seasons.
- Revegetate after treatments.

B3: (65,000 ft²) Cut invasive vines from trees and shrubs in Summer and treat stems

- Cut and Stem treatment - 32 hours

B4: (37,250 ft²) Cut invasive vines from trees and shrubs in Summer and treat stems. Can be cut by volunteers

- Cut and Stem treatment - 16 hours

B5: (90,000 ft²) Cut dense vines and shrubs and stack into habitat piles. Summer Herbicide treatment- cut and dab.

- Contractor mowing - 72 hours
- Follow up foliar - 16 hours for at least 2 seasons.
- Revegetate after treatments.

B6: (145,000 ft²) Cut dense Buckthorn by contractor or volunteer in Spring and stack into habitat piles. Summer Herbicide treatment.

- Contractor mowing - 32 hours
- Follow up Cut and dab - 16 hours

B7: (70,500 ft²) Cut and dab dense Buckthorn by contractor or volunteer in Summer to Winter and stack into habitat piles.

B8: (173,400 ft²) Cut dense Buckthorn by contractor or volunteer in Spring and stack into habitat piles. Summer Herbicide treatment.

- Contractor mowing - 32 hours
- Follow up Foliar - 8 hours

B9: (132,950 ft²) Very little invasives along up to wetland, occasional cutting by volunteers.

B10: (342,800 ft²) Cut invasive vines from trees and shrubs in Summer and treat stems

- Cut and Stem treatment - 26 hours



Lone Tree Hill Prioritization and Estimated Hours

C1: (163,250 ft²) Moderate invasive shrubs among poison ivy. Not recommended for volunteers.

- Cut and Stem treatment - 26 hours

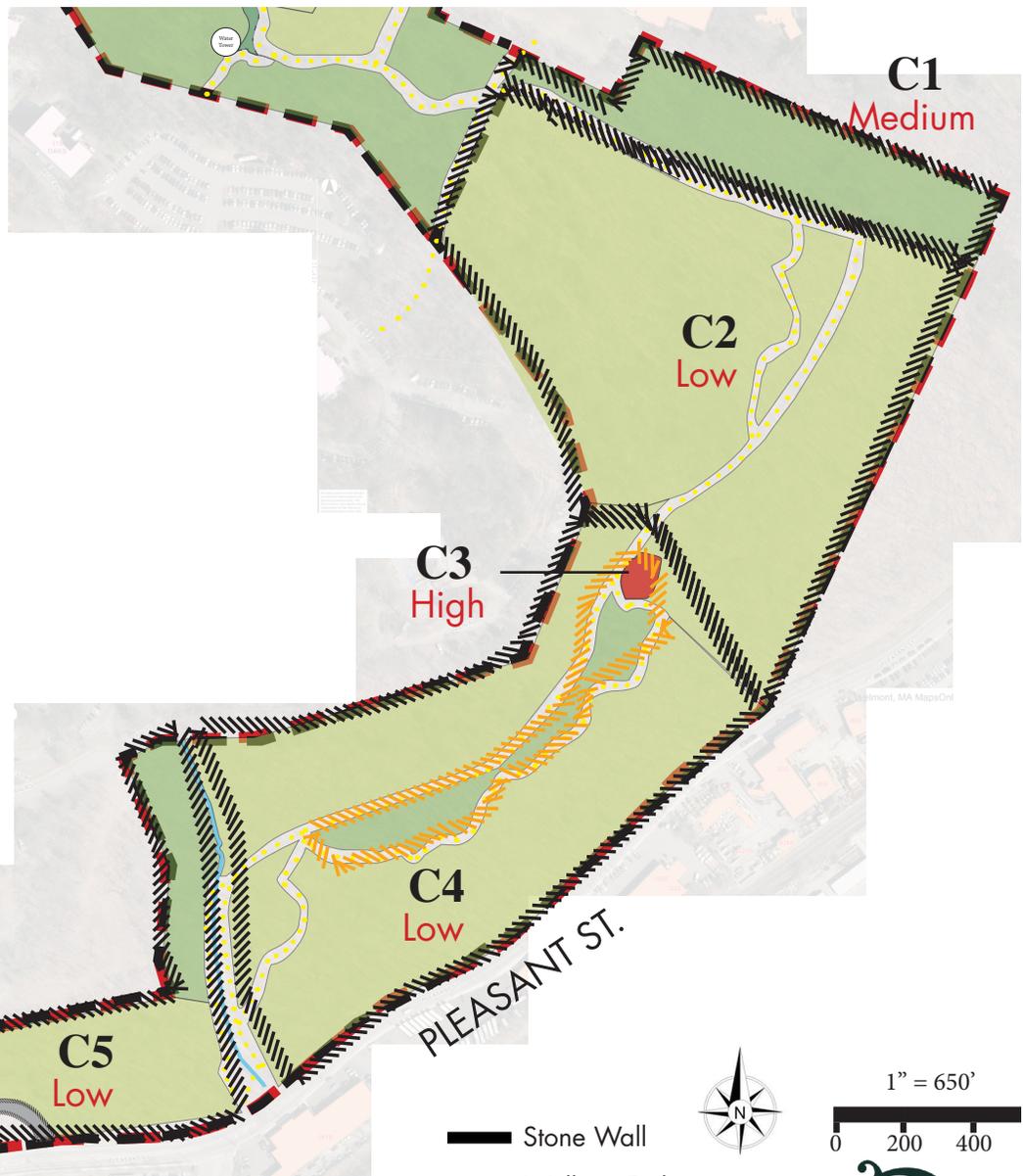
C2: (640,000 ft²) Very little invasives along up to the Oak/Hickory forest, occasional cutting by volunteers.

C3: (72,800 ft²) Cut and treat Japanese Knotweed by cut and fill during September. Cut and treat stems of aggressive and non-native shrubs.

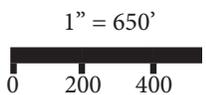
- Cut and fill and Cut and treat - 18 hours.
- Follow up over 2 years

C4: (276,300 ft²) Very little invasives along up to the Oak/Hickory forest, occasional cutting by volunteers.

C5: (252,400 ft²) Very little invasives along up to the Oak/Hickory forest, occasional cutting by volunteers.



- Stone Wall
- Walking Path
- Priority level
- Contractor Only



Lone Tree Hill Staffing and Reporting

Staffing: A key component to completing the plan effectively and to facilitating volunteers is to have contractors with experience identifying and managing invasive species. Below are some suggested guidelines for contractors.

- Field technicians working as contractors should have at least 3 years of Invasive Plant Management (IPM) and Native Plant Restoration experience.
- All operators should have a valid Massachusetts Commercial Pesticide Applicators License
- Field technicians should have a Massachusetts Invasive Species Management Certification
- Preference given to technicians with Certified Ecological Restoration Practitioners (CERP), Massachusetts Certified Horticulturists (MCH) and/or specific meadow management training.
- Expertise to train volunteers in identification and techniques.

Monitoring Reports: These can be extremely helpful in keeping the committee informed on progress while ensuring what is being done in the field follows the guidelines. They help make the management document a living document that is referred back to and changed as necessary to meet site challenges. They can also be a valuable resource toward extra funding. Reports can be per visit, monthly or biannually and could include:

- Detailed notes on work completed and photos including before and after.
- Graphic representation of volunteer and contractor completed or proposed work areas.
- Documentation of wildlife on site/changes over time
- Residents/visitor comments on the work and the site as a whole.

Monthly Monitoring Report
Alewife Stormwater Wetland
Cambridge Park Drive, Cambridge MA

August 2019

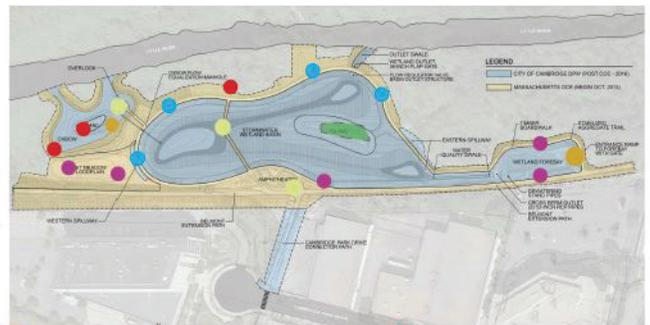


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Ironweed and Sweet Coneflower provided incredible color the whole month (6/24/19)




Lone Tree Hill Maintenance Schedule

The recommendations for restoration take into consideration the long term health of Lone Tree Hill. Once the invasive plant species have been managed in a locus area and any native plants installed, a long-term maintenance plan will be set in motion with the goal of continued control of invasive plant species on site, serve, and sustain native plant populations, and improve the native plant diversity and aesthetic beauty of Lone Tree Hill

Spring and Summer 2020

- Complete invasive species mowing and cutting of woody species to 12-18" in high priority areas, starting with Area A.
- Work to be completed by volunteers and qualified contractors.
- Mow and dispose of Japanese Knotweed stems.

Summer to Fall 2020

- Follow up treatment of invasive shrubs resprouting from cut stems. Foliar completed late June to Oct., cut and dab of stems late June to Dec.
- Foliar application of cut Japanese Knotweed. Cut and fill treatment of those left standing in spring.
- Cut and dab of vines in high priority areas from late June to Dec.
- Foliar application to Black Swallowwort from June to Sept.

Winter 2020 to Spring 2021

- Continue invasive species mowing and cutting of woody species to 12-18" in high priority areas.
- Continue mowing and disposal of remaining Japanese Knotweed.
- Foliar treatment or volunteer hand pulling of Garlic Mustard and Greater Celandine

Summer - Fall 2021

- Continue follow up treatment of invasive shrubs resprouting from cut stems. Foliar completed late June to Oct., cut and dab of stems late June to Dec.
- Foliar application of cut Japanese Knotweed. Cut and fill treatment of those left standing in spring.
- Cut and dab of vines in high priority areas from late June to Dec.
- Foliar application to Black Swallowwort from June to Sept.

Winter 2021 to Winter 2022

- Prepare and mobilize contractors or volunteers to plant in intensively managed areas.
- Continue follow up herbicide treatment or hand pulling of Garlic Mustard and Greater Celandine.
- Follow up treatment of invasive plants and protection of installed native species.

2023 and Onward

Ongoing Maintenance and Monitoring:

- After the treatments of fall 2022, the management plan should be re-evaluated. If management treatments have been successful, only monitoring and minimal hand removal should be required to keep invasive plant species from being reintroduced. Native trees, shrubs, and herbaceous forbs should dominate the restored areas.

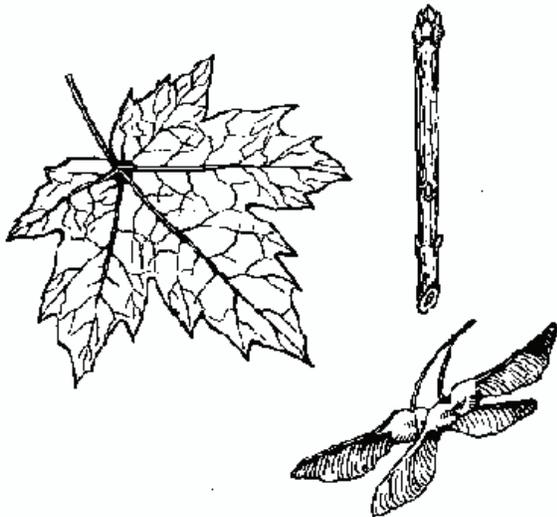




Norway Maple

Description:

Acer platanoides, Norway Maple is a tree occurring in all regions of the state in upland and wetland habitats. It is especially common in urban areas. It grows in full sun to shade. It out-competes native vegetation, including sugar maple, *Acer saccharum* which it is frequently confused with. Norway autumn color is yellow, while Sugar is orange/red. Norway has white sap, while Sugar has clear sap in the petiole (stems). Norway maple leaf points reduce to a fine "hair", while the tips of the points on Sugar leaves are rounded.



Habitat:

Norway maple is well adapted to various soils, grows in dry conditions, and can tolerate areas of soil pollution. Norway maples were widely planted in the United States as street trees and have escaped to natural habitats. Trees produce large numbers of seeds that are wind dispersed and invade natural areas, displacing native trees. Quickly establishing, they create a canopy of dense shade that prevents regeneration of native seedlings. Although thought to have allelopathic properties (meaning that the plant releases toxins that inhibit or prevent the growth of other plants), research has not been able to confirm this.

Management:

Manual methods of hand-pulling seedlings is recommended. For larger saplings, a 'Weed Wrench' is effective. Mature trees can be cut and the stump ground, or apply a Triclopyr based herbicide to the stump. Girdling the tree by cutting through the bark (cambium) layer all around the trunk is also an option. Girdling is most effective in spring and should include reducing the canopy for safety, but consider leaving trunks for habitat value.



Acer platanoides,
Norway Maple





Bittersweet

Description:

Celastrus orbiculatus, Asiatic Bittersweet is a deciduous climbing vine common in areas of disturbance in our New England forests. It has glossy, rounded leaves that are alternate with finely toothed margins. The leaves turn yellow in the fall. The fruiting plants produce small greenish flower clusters from leaf axils that mature in fall to produce high numbers of fruiting seed. The seed are noticeably yellow, globular capsules that split open at maturity to reveal red-orange fruiting seeds. Roots are also distinctly orange.



Habitat:

Bittersweet spreads easily into forest edges, woodlands, unmanaged meadows and old fields. Most disturbed sites that are not being actively managed that receive full sun are susceptible. The vine can tolerate shade but is often found in more open, sunny areas.



Management:

Asiatic Bittersweet management is a combination of manual hand pulling with cut & dab herbicide treatments. For established plants, vines should be cut to ground to reduce mass. Persistent root infestations will require repeat cutting and treatments over several seasons. Rake any seeds present, bagging in plastic bags, tying, and disposing of correctly.

Celastrus orbiculatus,
Asiatic Bittersweet





Honeysuckle

Description:

Lonicera morrowii, Morrow's honeysuckles are upright, deciduous shrubs that typically have a multi-stem mounding appearance. Oval leaves are opposite along the stem with smooth edges (no teeth or lobes) and hairy on the underside. Mature stems are often hollow on the interior and peeling on the outer bark. In the spring pairs of fragrant, tubular flowers less than an inch long are borne along the stem in the leaf axils. The fruits are red to orange, and fleshy .



Habitat:

Honeysuckles are relatively shade-intolerant and most often occur in forest edges, abandoned fields, and other open, upland habitats. Woodlands and open meadows, especially those that have been grazed or otherwise disturbed and are left unmanaged are also highly susceptible. Morrow's Honeysuckle have the greatest habitat diversity and are capable of invading wetland edges and other uncommon habitat types.



Management:

Morrow's Honeysuckle management is a combination of mechanical mowing and manual hand pulling with cut and dab herbicide treatments. When feasible, the root system is generally shallow and plants can be uprooted easily. Persistent root re-sprouting may require repeat cutting with herbicide application over several seasons to fully control.

Lonicera morrowii,
Morrow's Honeysuckle





Buckthorn

Description:

Frangula alnus, Glossy Buckthorn is a deciduous shrub that grows up to 20 ft. tall. The oblong leaves are up to 2" long, arranged alternately along the stem and are dark green on the surface, glossy above and slightly pubescent beneath. The leaves turn yellow in the fall, and remain on the plant when most other species have already lost their leaves. The yellow-green flowers are arranged in 1-8 flowered sessile, glabrous umbels. This plant flowers after the leaves expand, from May to September. The fruit ripen from red to black July to August.

Habitat:

Buckthorn thrives in early successional habitat. Abandoned agricultural or pasture lands, an opening in canopy within woodland, or unmanaged meadows are common areas. Buckthorn will also tolerate wetland soils where it can form dense stands that suppress the growth of native plant species. The seed is readily dispersed by birds, and the extended productivity of the fruit into winter allows the plant to be dispersed through the entire season.



Management:

Manual methods of hand-pulling seedlings is recommended. For larger saplings, a 'Weed Wrench' is effective. Mature Buckthorn can also be cut and the stump application of Triclopyr based herbicide. Rake any seeds present, bagging and disposing of correctly.

Frangula alnus,
Glossy buckthorn





Multiflora Rose

Description:

Rosa multiflora, Multiflora Rose is a shrub with arching canes with a mounding shape in the landscape. The leaves are divided into five to eleven sharply toothed leaflets. The base of each leaf stalk has a pair of fringed bracts which is a key identifier of the plant from other wild rose. Beginning in early summer, clusters of showy white flowers appear. The flowers are followed by developing red fruit, or hips, during the summer that remain on the plant through the winter.



Habitat:

Multiflora Rose thrives in early successional habitat. The rose has a wide tolerance for various soil, moisture, and light conditions. It occurs in dense woods, along river banks and roadsides and in open unmanaged fields. It can form a dense understory that suppresses growth of native plant species. The seed is readily dispersed by birds, and the extended productivity of the fruit into winter months allows wide spread distribution of the plant.



Management:

Manual methods of hand-pulling seedlings is effective. For more established shrubs, a combination of pruning to reduce mass followed by cut & dab treatments with a Triclopyr based herbicide is recommended. Persistent root infestations may require repeat cutting over several seasons. Rake any seeds present, bagging and disposing of correctly.

Rosa multiflora,
Multiflora rose





Japanese Knotweed

Description:

Japanese knotweed is an upright, herbaceous perennial that can grow to over 10 feet in height. Stems of Japanese knotweed are smooth, stout and swollen at joints where the leaf meets the stem. Although leaf size may vary, they are normally about 6 inches long by 3 to 4 inches wide on a mature plant, broadly oval to somewhat triangular and pointed at the tip. The greenish-white flowers occur as branched sprays in summer and are followed soon after by small winged seeds.



Habitat:

Japanese knotweed can tolerate a variety of adverse conditions including full shade to sun, high salinity and drought, compacted and saturated soils. It is often found near water sources, such as along streams and rivers, particularly disturbed sites. Originally planted in ornamental gardens, it quickly escaped to become an invasive in natural areas.



Management:

Hand cut plant approximately 2" above the ground and apply a 50% solution of glyphosate (Aquaneat®). Any portions of the root system not removed or killed by herbicide will potentially re-sprout, so follow up applications will be necessary to control population. All vegetated plant material will be bagged and disposed of to prevent reestablishment.

Fallopia japonica,
Japanese Knotweed





Black Swallow-Wort

Description:

Three species of swallow-wort are currently found in North America, two of which are considered invasive: black swallow-wort (*Cynanchum louiseae*) and pale swallow-wort (*Cynanchum rossicum*). It is a member of the plant family Asclepiadaceae, like milkweed. It is native to Europe but started spreading in the United States when it began escaping from Massachusetts botanical gardens in 1864.



Identification:

Black swallow-wort is a perennial vine with an extensive rhizomous root system. The dark green, oval shaped leaves are 3-4 in. long, and occur in opposite pairs along the stem. The small five-petaled, star shaped flowers are reddish black, about $\frac{1}{4}$ in. across, and are borne in clusters. The fruits are slender tapered pods (resembling milkweed) that turn from green to light brown as they mature. When ripe, the fruits open and release flattened seeds equipped with a downy parachute that aids in wind dispersal. The pods and seed resemble that of the native common milkweed.



Ecological Impact:

Black swallow-wort is associated with upland areas and is tolerant of a range of light and drought conditions. Typical habitats include old fields, hedgerows, urban fence lines. Swallow-worts are extremely competitive, which causes a loss in biodiversity which can also harm animals who depend on the native plants for food or habitat. Black swallow-wort's similarity to milkweed causes monarch butterflies to lay their eggs on the plant, but the larvae

Cynanchum louiseae,
Black Swallow-wort



**Description:**

Japanese Barberry makes a dense, deciduous shrub understory that grows to 8 feet. Branches are brown, deeply grooved, zigzag in form and bear a single sharp spine at each node.

The leaves are small ($\frac{1}{2}$ to $1\frac{1}{2}$ inches long), oval shaped, green, bluish-green, or dark reddish purple. Flowering occurs from mid-April to May in the northeast. Pale yellow flowers about $\frac{1}{4}$ in. Across hang in umbrella-shaped clusters of 2-4 flowers along the length of the stem. The fruits are bright red berries about $\frac{1}{3}$ " long that are borne on narrow stalks.

They mature during late summer and fall and persist through the winter.

**Habitat:**

Japanese Barberry is shade tolerant, drought resistant, and adaptable to a variety of open and forested habitats, and disturbed areas. It prefers to grow in full sun, but will flower and fruit even in heavy shade. There is also strong research to support the surprise benefit of controlling Japanese Barberry in the reduction of black legged (or deer) tick populations.

**Management:**

Japanese Barberry is a prolific seed-producer with a high germination rate, so prevention of seed production should be a management priority. Barberry also spreads by rhizome, so underground root fragments should be removed. Manual methods of hand pulling sprouts works well in small populations, but large populations may require chemical applications by applying a 2% solution of glyphosate to foliage, or a cut stumps application of a 25% solution.

Berberis thunbergii,
Japanese Barberry



**Description:**

Common buckthorn is a shrub that can grow 22 feet in height and have a trunk up to 10 inches wide. The crown shape of mature plants is spreading and irregular. When cut, the inner bark is yellow and the heartwood, pink to orange. In spring, clusters of yellow-green, four petaled flowers emerge from stems near the bases of leaf stalks. Small black fruits containing 3-4 seeds, form in the fall. Leaves are broadly oval, rounded or pointed at the tip, and have jagged, toothed margins. Leaves appear dark, glossy green on the upper surface and stay green late into fall.

**Habitat:**

Common buckthorn prefers lightly shaded conditions. An invader mainly of open oak forests, deadfall openings in forests, and forested edges, it may also be found in open fields. It is tolerant of many soil types, well drained sand, clay, poorly drained calcareous, neutral or alkaline, wet or dry.

**Management:**

Manual control works well in small populations by removing the entire root and rake any seeds present (bagging and disposing of correctly). Larger, persistent infestations may require chemical applications. Apply a 2% glyphosate (e.g., Rodeo® for wetlands; Roundup® for uplands) to leaves in late summer or cut stump application in a 25% solution.

Rhamnus cathartica,
Common Buckthorn



IDENTIFICATION AND QUALIFICATION OF APPLICANT

This plan has been developed by Miles H. Connors, Director of Ecological Services at Parterre Ecological, a division of Parterre Garden Services. Parterre Ecological Services provides Land Management Planning, expert Invasive Plant Management services, Native Plant Restoration strategies, and ongoing Maintenance and Monitoring in natural area restorations.

Our mission is to restore native plant communities to emulate, although not necessarily duplicate, the habitat type that prevailed before disruption of invasive plants. To accomplish this, we identify the dominant characteristics of individual plant species within the community, including invasive and native species. Once identified, native trees, shrubs, and perennials provide clues toward a greater native plant community that would naturally thrive in the particular environment and may have been present before disruption occurred. We then devise a Land Management Plan to discuss methods to restore the native plant community by managing invasive plant species, while seeding and planting native plants that are key species in the specific native plant community.

PLAN AUTHOR AND QUALIFICATIONS

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Miles holds an Bachelor of Science degree in Environmental Planning and Policy and Biology, with a Masters of Science in Sustainable Landscape Planning and Design. Miles is also a Massachusetts Certified Horticulturist, holds an Invasive Plant Certification from UMASS Amherst and is a Licensed Pesticide Applicator.

