Chemical Use Operation Plan

Date: 2024
FMU: Hawk Mountain Sanctuary
Prepared by: Tina Hall, Noah Rauch, Todd Bauman, Stephen Wade
Re: 2024 Invasive Plant Control

Chemical use shall be minimized on lands participating in TNC's FSC Group Certificate. There is preference that:

- *non-chemical methods are used over chemical methods*
- when chemicals are needed, chemicals are used that are not listed with any hazard ratings by FSC and are the least harmful available while also being effective
- when chemicals are used, applications are designed to treat the targeted species while minimizing exposure.

Any application of chemicals on lands in the Group requires justification via this Chemical Use Operation Plan, a record of each application provided in the Chemical Use Log, and an Environmental and Social Risks Assessment (ESRA) provided for each chemical. The use of FSC Prohibited Highly Hazardous Pesticides (HHPs) are not used except in case of an emergency situation or government order. The following shall be completed to ensure conformant chemical use.

THE FOLLOWING SHALL BE COMPLETED TO ENSURE CONFORMANT CHEMICAL USE:

		PAGE
1.	Vegetative or insect pest/s [e.g., species, host, location, approximate size, and density of infestation	**0**
2.	Threat posed by pest to natural features and forest management at this location	**0**
3.	Rationale for using this chemical treatment, rather than other means of control, comparing with the FSC Alternatives database	**0**
4.	Proposed Treatment Prescription [include timing of treatment, chemical to be used, method of application]: For SPECIFIC SEE TREATMENT TABLE on Page	**0**
5.	Active ingredients in proposed chemicals and FSC status (confirm to the FSC Chemicals List)	**0**
6.	Environmental/social risks/concerns associated with the prescription as part of integrated pest management to identify the lowest risk option for controlling the pest while minimizing/mitigating identified risks	**0**

7. Results and any necessary mitigation measures from the comparative ESRA below to ensure they are communicated and employed onsite, including site-specific risk as identified	**0**
8. Legal Requirements and Safety Precautions [include statement of how the application will comply with all laws and how the applications will comply with the safety requirements for the proposed chemical]	**0**
9. Proposed effects monitoring and protocol [brief protocol for determining the effectiveness of treatment]	**0**
10. If a lower risk of less hazardous alternative for a chemical is available, describe the plan (including actions, timelines, targets and resources) to transition to the less hazardous alternative	**0**
11. If you plant trees, supplying nurseries informed of the FSC list of prohibited chemical pesticides and encouraged to avoid use on materials entering the FMU	**0**
12. If you plant trees: List of FSC prohibited chemical pesticides as provided by nurseries	**0**

1. Describe the vegetative or insect pest/s [e.g., species, host, location, approximate size, and density of infestation:

The chemical treatments at Hawk Mountain are designed to target growing number of rapidly invading non-native plant species, particularly impacting the forest floor and shrub layer. This document describes the ongoing annual control of non-native invasive plants progressing from the Hawk Mountain Road corridor via stormwater runoff, trail heads, and trail corridors including (1) federal lands via the Appalachian Trail as well as (2) Hawk Mountain's trail network.

Targeted species include:

- **Grasses and annual weeds:** Japanese Stilt Grass, Crown Vetch, Mile-a-Minute, Chickweed, Garlic Mustard, and Oriental Lady's Thumb (Smartweed), Goutweed, Petty Spurge, Narrowleaved Bittercress.
- **Shrubs:** Japanese Barberry, Multiflora Rose, Honeysuckle, and Autumn Olive
- **Vines:** Oriental Bittersweet, and Wisteria
- **Trees:** Tree of Heaven

a. Japanese Stilt Grass – *Microstegium vimineum*
Chemicals Used: Glyphosate (Restricted), Sulfometuron-methyl, Clethodim
Patch Size for 2024: 200-300 acres
Where: See Maps

Japanese Stilt Grass – *Microstegium vimineum* – is an annual, herbaceous, sprawling grass from Asia that has invaded floodplains, streambanks, and moisture-rich forest areas throughout much of the mid-western and eastern United States. The grass was used as a dry packing material and is called "packing grass" in Japan. It was first introduced in 1919 in Tennessee as packing material for porcelain as the seeds were still viable. The grass has two important advantages that allow it to outcompete native species: it is extremely shade-tolerant, making it competitive in low-light conditions, and current observation notes it to be free of natural enemies. Annually it produces between 10 and 1,000 seeds. These seeds are then dispersed by water currents, contaminated materials such as hay, soil, potted plants, and footwear. Seeds can remain viable for at least three years in the soil seed bank. It can also spread by sprouting new shoots from the stems that come in contact with the soil. Infestations commonly start along road or trail edges, then spread outward. This is true at Hawk Mt. where it was first identified along roads and since has been spread downhill into the forest through water runoff. Additional sources of introduction include foot traffic within Hawk Mountain's trail network as well trail connections with adjoining trail systems via PA Game Lands 106 and the Appalachian Trail corridor.

- Mandy, t. "Element Stewardship Abstract for *Microstegium vimineum.*" The Nature Conservancy in collaboration with the International Network of Natural Heritage Programs and Conservation Data Centers. Arlington, VA: Natural Heritage Databases, 2000.
- Swearingen, J.M. "Japanese Stiltgrass: *Microstegium vimineum* (Trin.) Camus." *Weeds Gone Wild: Alien Plant Invaders of Natural Areas.* Plant Conservation Alliance's Alien Plant Working Group
- https://www.invasive.org/alien/fact/mivi1.htm

b. Chickweed – *Stellaria media*
Chemical Used: Glyphosate (Restricted), Triclopyr
Patch Size for 2024: 15-20 acres
Where: See Maps

Chickweed – *Stellaria media* – is a very common invasive and one of most widespread weeds globally. Chickweed should be removed before it flowers as it is a copious seeder with a very short interval between germination to flowering (four to six weeks). It can germinate in cool soils and often jumps ahead of native plants in the spring and can form large mats smothering natives.

c. Crown Vetch – *Securigera varia*
Chemical Used: Glyphosate (Restricted)
Patch Size for 2024: 3-5 acres
Where: See Maps

Crown Vetch – *Securigera varia* – was introduced from Asia and Europe and was used as erosion control by many states. It has a tight fibrous rhizome root system and can grow horizontally up to 10 feet. The plant can be difficult to remove by hand, as any remaining roots will resprout.

d. Mile-a-Minute – *Persicaria perfoliate*
Chemical Used: Glyphosate (Restricted), Sulfometuron-methyl
Patch Size for 2024: 1-2 acres
Where: See Maps

Mile-a-minute – *Persicaria perfoliate* – is a summer annual that can grow more than 20 feet during a single growing season. A single plant can produce thousands of seeds that can survive for up to six years in the soil. Seeds are dispersed by wildlife, foot traffic, and sometimes water. It was introduced with holly seeds to Pennsylvania in the 1930's. The plant also develops sharp barbs making it more difficult to remove by hand.

e. Oriental lady's thumb (smartweed) – *Persicaria longiseta (Bruijn) Kitagawa*
Chemical Used: Glyphosate (Restricted), Triclopyr
Patch Size for 2024: 5-10 acres
Where: See Maps

Oriental Lady's Thumb – *Persicaria longiseta* – is native to Asia and occurs in disturbed areas such as along roadsides and in pastures. These plants also inhabit wet areas. Several states report its propensity to populate ridgetops areas – which are not wet. Seeds are readily dispersed by foot traffic, traveling in shoe treads. If very small, when roots are not developed, the plant can be hand pulled but monocultures can quickly form dense root mats making hand pulling more difficult.

- Native Plant Atlas - https://www.invasiveplantatlas.org/subject.html?sub=6213#pubs

f. Japanese Barberry – *Berberis thunbergia*
Chemical Used: Glyphosate (Restricted)
Patch Size for 2024: 6 occurrences = 8-10 acres
Where: See Maps

Japanese Barberry – *Berberis thunbergia* – Introduced in the US from China and Japan in the 1860's as an ornamental, the shrub has invaded open woods, woodland borders, pastures and many other areas. The shrub was promoted as a replacement for Common Barberry (*Berberis vulgaris*), which is a host for black stem rust. The shrub easily spreads from residential areas into more natural areas via its seeds. The seeds have long lasting viability and are dispersed both by birds and other berry feeding animals. The shrub also contains male and female reproductive parts in one shrub

which allows one shrub to potentially create a colony. The shrub also reproduces by stems sprouts. Due to thick thorns and the non-native nature of the shrub, there is no current evidence of deer or other animals eating it. Several researchers noted an increase in deer ticks and those carrying Lyme Disease in Japanese Barberry stands. At Hawk Mt. it is found in patches across the forest floor under a canopy and in some forest clearings.

- Lyme and Barberry: (https://www.nrs.fs.fed.us/pubs/gtr/gtr-p-78papers/68wardp78.pdf).

g. Multiflora Rose – *Rosa multiflora*
Chemical Used: Triclopyr
Patch Size for 2024: 3 occurrences = 5-10 acres
Where: See Map

Multiflora Rose: – *Rosa multiflora* – The USFS An Assessment of Multiflora Rose in Northern U.S. Forests Research Note NRS-182 – documents that Multiflora Rose was introduced in 1866 to the eastern United States from Japan by the rose industry (Kaufman and Kaufman 2007). It was promoted as a plant for erosion control, as a living fence, rootstock for ornamental roses, and as a crash and snow barrier (Czarapata 2005, Kaufman and Kaufman 2007). Multiflora rose grows most vigorously in full sun, but it can also survive in the shade of the forest interior. Where multiflora rose establishes it often forms dense thickets that restrict the growth of other vegetation and reduces available site resources (e.g., light and nutrients). This vigorous plant has large, prolific thorns which are hazardous to both humans and livestock.

- Kurtz, Cassandra M. ; Hansen, Mark H. 2013. An assessment of multiflora rose in northern U.S. forests. Res. Note NRS-182. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 5 p.
- Czarapata, E.J. 2005. Invasive plants of the upper Midwest: an illustrated guide to their identification and control. Madison, WI: The University of Wisconsin Press. 215 p.
- Kaufman, S.R.; Kaufman, W. 2007. Invasive plants: a guide to identification and the impacts and control of common North American species. Mechanicsburg, PA: Stackpole Books. 458 p.

h. Bush Honeysuckle – *Lonicera sp.*
Chemical Used: Triclopyr
Patch Size for 2024: 3 occurrences = 5 acres
Where: See Map

Bush Honeysuckle – *Lonicera sp.* – Several species of Bush Honeysuckle, including the shrub referred to as Amur Honeysuckle (*Lonicera maackii*), are found at Hawk Mountain. The Amur and other Bush Honeysuckles were introduced into the U.S. as

an ornamental for city landscapes in 1897. The plant was promoted for soil stabilization and reclamation programs in the 1960's. Bush Honeysuckle is a relative to the native and non-invasive Honeysuckles of the U.S. However, its ability to easily establish and grow in many environments such as lake, stream banks, floodplains, meadows, prairies, and forests makes it a forest pest. Bush Honeysuckle is rapidly spreading through forests in the northern U.S. The plant's invasive ability may in part be due to allelopathic effects on surrounding plants, a rapid growth rate relative to desirable plants, and the ability to tolerate moderate shade and outcompete neighboring plants for the available sunlight. Recent work by researchers in Ohio has shown that Bush Honeysuckle can also outcompete neighboring plants for water with its fine root system. Scientists found that the majority of Bush Honeysuckle's roots are located within the top 5 inches of the soil.

- Pfeiffer SS and DL Gorchov (2015) *The American Midland Naturalist* 173(1): 38-46.
- USDA-NRCS Plants Database: plants.usda.gov
- Castellano SM and DL Gorchov (2013) *Natural Areas Journal* 33(1): 78-80.

i. <u>Chinese Wisteria</u> – *Wisteria sinensis*
Chemical Used: Triclopyr
Patch Size for 2024: 1 acre
Where: See Map

<u>Chinese Wisteria</u> – *Wisteria sinensis* – is a deciduous, woody vine capable of growing to a height of 35 ft. (10.7 m). Stems can be up to 10 in. (25.4 cm) in diameter. Invasions often occur around previous plantings. *Wisteria* can displace native vegetation and kill trees and shrubs by girdling them. The vine has the ability to change the structure of a forest by killing trees and altering the light availability to the forest floor. Most infestations in natural areas are the result of escaped landscape plantings. The vine is a long-lived perennial, surviving 50 years or more with both aggressive vegetative reproduction and viable seed production when conditions are favorable. A native of China, it was first introduced into North America in the 1800's for ornamental purposes.

j. <u>Autumn Olive</u> – *Elaeagnus umbellata*
Chemical Used: Triclopyr
Patch Size for 2024: 3-5 acres
Where: See Map

<u>Autumn Olive:</u> – *Elaeagnus umbellata* – is native to China and Japan and was introduced into North America in 1830. Since then it has been widely planted for wildlife habitat, mine reclamation, and shelterbelts. Autumn olive is a deciduous shrub with thorny branches with silvery leaves. It invades old fields, woodland edges, and other disturbed areas. It can form a dense shrub layer which displaces

native species and closes open areas. The shrub is tolerant of a wide variety of growing conditions from wet to dry and basic to acidic soils. The shrub persists in shade with rapid growth in full sun and may produce seed as early as year 3. It is wide spreading with many sprouts, leafing out early in spring and retaining foliage late in fall leading to the exclusion of other forest plants. Plants can produce up to 30 pounds of fruit in a year. These abundant seeds are spread by birds, with seedlings able to establish in shade. It is a non-leguminous nitrogen fixer.

k. <u>Oriental Bittersweet</u> – *Celastrus orbiculatus*
Chemical Used: Triclopyr
Patch Size for 2024: 5-10 acres
Where: See Map

<u>Oriental Bittersweet:</u> – *Celastrus orbiculatus* – Originally introduced into the US as an ornamental plant in the 1860's the deciduous wood perennial is often associated with old homesites, where it has escaped in the surrounding natural areas. The vine is still widely planted as well. Oriental Bittersweet can often be confused with American Bittersweet (*Celastrus* Scandens), and it is important to identify the plant correctly – The flower arrangement is the easiest method - American vines produces flower in a single terminal panicle at the tips, while oriental produces flower in small axillary clusters. The two do hybridize. *Celastrus Orbiculatus* poses a serious threat to individual plants and plant communities due to its high reproductive rate, long range dispersal, ability to rootsucker, and rapid growth rates. Individual plants can be severely damaged and even killed by the aggressive growth habits of this vine. Tree and shrub stems are weakened and killed by the twining and climbing growth which twists around and eventually constricts solute flow (as shown by Lutz, 1943 for C. scandens). Trees with girdled stems and large amounts of vine biomass in their canopies are more susceptible to damage by wind, snow and ice storms (Siccama, et al. 1976, Langdon 1993).

- Langdon, K. 1993. Natural Resource Specialist, Great Smoky Mountains National Park, letter to John Randall, TNC Weed Specialist, dated 26 August 1993. on file at TNC Exotic Species Program.
- Lutz, H. 1943. Injury to trees caused by Celastrus and Vitis. Bulletin of the Torrey Botanical Club 70(4):436-439.
- Siccama, T. G. Weir and K. Wallace. 1976. Ice damage in a mixed hardwood forest in Connecticut in relation to Vitis infestation. Bulletin of the Torrey Botanical Club 103:180-183.
- TNC – Element Stewardship Abstract - https://www.invasive.org/weedcd/pdfs/tncweeds/celaorb.pdf

l. <u>Tree of Heaven</u> – *Ailanthus aitissima*
Chemical Used: Triclopyr
Patch Size for 2024: 10-15 acres – 5 occurrences

Where: See Map

Tree-of-Heaven: – *Ailanthus aitissima* – is a dioecious small tree with large compound leaves. The tree was introduced to the US by a gardener in Philadelphia, PA in 1784. During the 1840's gold rush in California, the species was brough over by Chinese immigrants and it is frequently found in abandoned mining sites. The tree can live in very dry, challenging conditions and was often used as an urban tree in cities. It produces abundant seeds and can also perform vegetative reproduction. One study reports that an individual tree can produce as many as 325,000 seeds in a year. The tree also produces root suckers and will resprout vigorously from cut stumps and root fragments.

m. Garlic Mustard – *Alliaria petiolata (Bieb.) Cavara & Grande*
Chemical Used: Glyphosate (Restricted)
Patch Size for 2024: 40-50 acres
Where: See Map

Garlic Mustard – *Alliaria petiolata* – was first recorded in the United States around 1868, from Long Island, New York, and was likely introduced by settlers for food and medicinal purposes. Since then, the plant has spread and is now common in the eastern US especially in riparian and floodplain areas but also many other habitats. The plant is not tolerant of highly acidic soils and thus is not found in those area. White-tailed deer assist in its spread by eating native plant species that they prefer and are adapted to eat, leaving the garlic mustard behind, however the plant can be consumed by humans, usually the younger leaves of second year plants. The plant is a biannual and forms low rosettes of kidney shaped leaves the first year, then rapidly bolts, blooms, and dies the second year. Each plant can produce 100's of seeds, which deer, humans, and car tires all disperse. It has displaced vast areas occupied by native spring wildflowers. Chemicals in garlic mustard are toxic to the larvae of native butterflies. Other chemicals within the plant have been found to affect mycorrhizal fungi associated with native trees, resulting in suppression of native tree seedling growth.

- Web Article – Invasive.org – Garlic Mustard - https://www.invasive.org/alien/pubs/midatlantic/alpe.htm

n. Narrowleaved Bittercress (*Cardamine impatiens* L.)
Chemical Used: Triclopyr**,** Glyphosate (Restricted)
Patch Size for 2024: 15-20 acres
Where: See Map

Cardamine impatiens L. Rapidly invading moist forested areas along rivers, narrowleaf bittercress is raising concerns about its invasive potential. It is not known how narrowleaf

bittercress was introduced to North America from Eurasia. It was first reported in the US in New England in 1916.

The plant is an annual or biennial forb that usually forms a rosette the first year and then the rosette dies over winter and the plant bolts and flowers the second year on an erect stem. Narrowleaf bittercress reproduces exclusively by seed and a single plant can produce up to 5,500 seeds. Narrowleaf bittercress can self-pollinate and produces prolific quantities of seed in siliques that can shoot the seed a short distance from the plant when the dried seedpods burst open. Thus, a single plant can quickly form a colony. Seeds can germinate in water and rivers and streams are considered a method of long-range dispersal. Seeds can also be moved by human, animals, and vehicles.

Minnesota Invasives Fact sheet - https://www.mda.state.mn.us/plants/pestmanagement/weedcontrol/noxiouslist/bittercress#:~:text=Prevention%20and%20management&text=Small%20infestations%20can%20be%20hand,should%20be%20bagged%20and%20disposed.

o. Gout Weed (*Aegopodium podagraria)*
Chemical Used: Triclopyr**,** Glyphosate (Restricted)
Patch Size for 2024: ½ to ¾ acre
Where: See Map

Goutweed (*Aegopodium podagraria*), also called bishop's weed and other names, is a lush, shade-loving groundcover that grows in dry, shady. The inflorescences resemble small Queen Anne's lace blossoms.

Once goutweed becomes established, it spreads very readily. The underground stems of goutweed work themselves among the roots of other plants and are hard to dig out without breaking off bits that can easily sprout new plantlets. When it escapes cultivation, goutweed readily grows under forest trees and eventually pushes out native plants and their codependent fauna, reducing the natural diversity of the ecosystem. This European perennial was probably brought to North America by settlers as a spring potherb and medicinal treatment for gout and arthritis. Later, the attractive green-and-white cultivar 'Variegatum' was introduced as an ornamental groundcover.

https://www.bbg.org/article/weed_of_the_month_goutweed

p. **Petty Spurge *Euphorbia (=Chamaesyce) peplus)***
Chemical Used: Triclopyr**,** Glyphosate (Restricted)
Patch Size for 2024: ½ to ¾ acres
Where: See Map

Petty spurge is a Eurasian import that is invasive in many countries, and widely distributed in North America. The sap inhibits rapid cell proliferation and is used externally as a

traditional remedy for non-melanoma skin cancers. It is often difficult to eradicate after establishment.

Q. Bindweed *Convolvulus arvensis*
Chemical Used: Triclopyr**,** Glyphosate (Restricted)
Patch Size for 2024: 15 acres
Where: See Map

Field bindweed, *Convolvulus arvensis*, is a native of Eurasia that first was documented in California in 1884 in San Diego. By the first quarter of the twentieth century, field bindweed was proclaimed the worst weed in California and many other Western states. It most likely arrived in the United States as a contaminant in farm and garden seeds. However, because of its flowers and climbing nature, some seeds were probably planted as ornamentals, as a ground cover, in hanging baskets, or on trellises. Field bindweed has been given many names including perennial morning-glory, creeping jenny, bellbine, sheepbine, and cornbine.

2. Threat posed by pest to natural features and forest management at this location:

All the above invasives are invading the mature forest community at Hawk Mountain. Central Pennsylvania is home to many aggressive invasives and the mature forest of Hawk Mountain. would lose much of its biodiversity if these invasives were not treated. Several species have the ability to and are forming vast monocultures on the forest floor. Due to the rapid spread of these species as well as the sporadic dispersal of instances within the sanctuary, hand removal on a large scale is impractical, inefficient and less effective than chemical treatment, although hand pulling is employed where feasible.

Interestingly, several North America-wide invasives were introduced in Pennsylvania. Central Pennsylvania is a hot spot for many invasive species with 10-15 species common in the area.

The utilization of a no action alternative or non-chemical ***only*** alternative at Hawk Mountain risks a major loss of biodiversity as these invasives will persist and spread resulting in significant loss of native species, loss of key habitat, and subsequently forest diversity.

a. **Japanese Barberry:** Hawk Mountains most prolific invasive shrub species, Japanese Barberry is found in ranging in density from sporadic bushes to dense undergrowth across the forest floor. With heavy seed dispersal through means including stormwater runoff and zoochory, Japanese Barberry can become a monoculture, shading out native species.

b. **Oriental Lady's Thumb:** At Hawk Mountain Lady's Thumb is one of the species that is found to increase as Japanese Stilt Grass is removed. It is thought to have been first introduced to the sanctuary through foot traffic as it was originally found sparsely along trails and in high-traffic visitor areas. It has spread prolifically across sanctuary

grounds and can currently be found throughout the trail system, in stormwater drainages, and in small patches throughout the forest interior.

c. **Bush Honeysuckle:** At Hawk Mountain the shrub is found in isolated patches along road corridors, disturbed areas, and drainages. If untreated it forms large patches in the understory, crowding out and eliminating native species.

d. **Japanese Stilt Grass***:* At Hawk Mountain infestations commonly start along road or trail edges then spread outward. This is true at Hawk Mountain where it was first identified along roads and has subsequently spread downhill into the forest through stormwater runoff. Untreated areas can form large monoculture patches on the forest floor eliminating all other plants. It can currently be found throughout Hawk Mountain Sanctuary in varying degrees ranging from large monocultures in forested areas to isolated patches and individual plants throughout the trail system.

e. **Multiflora rose***:* At Hawk Mt. the rose is found in areas of storm water runoff such as adjacent to paved roads and along trail corridors. A unique threat of multiflora rose is the effect it has on oak. Research by USFS noted that regeneration of oak seedlings may also be affected by multiflora rose. Surveying forested plots comprised of at least 75 percent oak-hickory forest type, researchers found that in stands where the oak overstory was low (BA of oak trees ≥5 inches diameter at breast height [d.b.h.] from 0 to 60 ft2/ac) there were significantly fewer oak seedlings per acre in stands with multiflora rose than in stands where multiflora rose was not observed ($p<0.05$).

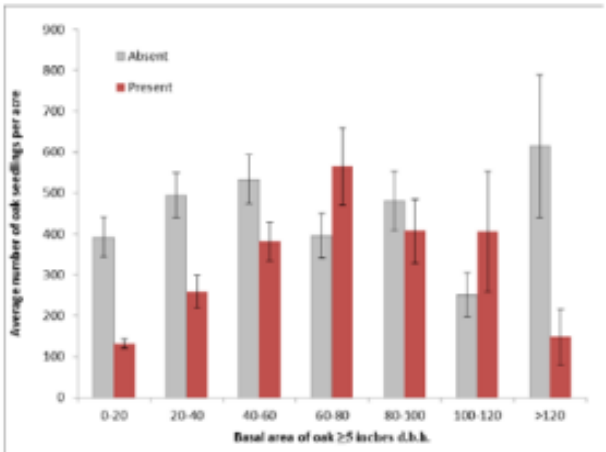


Figure 7.--Average number of oak seedlings per acre in oak-hickory forest type by oak basal area class (≥5 inches d.b.h.) for stands with and without multiflora rose.

f. **Chickweed**: At Hawk Mt. Chickweed is interspersed with Oriental Lady's thumb and Mile a Minute on the forest floor as well as along trail corridors, drainages, and parking lots. Hand pulling is not feasible due to the wide but intermittent distribution of instances within the sanctuary. The weed is primarily targeted and spot treated in conjunction with treatment regiments targeting other invasive species via backpack sprayer.

g. **Mile a Minute**: At Hawk Mt. Mile-a-Minute is found along the education trail, where emergency response vehicles are a suspected mode of introduction, as well as sporadically throughout forested areas of the sanctuary. The plant is also being found more readily along other trail corridors, where it is believed to have been introduced by foot traffic or wildlife.

h. **Crown Vetch**: At Hawk Mt Crown Vetch is predominantly found along road corridors and disturbed areas. To date, it has not spread into mature, forested areas. While vetch can be hand pulled, any remnants of the root system will resprout, making hand removal time consuming and inefficient.

i. **Wisteria:** At Hawk Mt the vine is currently only found at an onsite residence where it was likely planted some years ago. Rapid response is desired to keep it from spreading into the adjacent woods with chemical methods of management being employed due to the vines propensity to sprout and spread.

j. **Autumn Olive:** At Hawk Mt. the shrubs are predominantly found adjacent to roads and are likely spreading via stormwater runoff. The shrubs are still fairly isolated but rapid response is on-going to keep the shrub from spreading.

k. **Oriental Bittersweet:** At Hawk Mt. the vine is another species often found moving rapidly into areas that were first treated for Japanese Stilt Grass as well as along roadsides and in disturbed areas. The seeds are likely spread through stormwater runoff as well as potentially through wildlife activity.

l. **Tree-of-Heaven:** At Hawk Mt. the Ailanthus tree is found on roadsides and in water runoff where it is spreading into the forest interior, plus on ridge top sites. Chemical methods of treatment are widely recommended as the only viable method of treatment due to its association with the Spotted Lantern Fly (*Lycorma delicatula*) as well as it's propensity to produce large amounts of shoots if damaged or cut.

m. **Garlic Mustard:** At Hawk Mt. Garlic Mustard is prevalent on road edges and in drainages, evidently following storm water runoff.

n. **Narrowleaved Bittercress**: at Hawk Mt is found in high use areas, such as the native habitat garden, the trails, and along Hawk Mountain Road.

o. **Gout Weed:** At Hawk Mt. Gout weed is found in one isolated location along Hawk Mountain Road.

p. **Petty Spurge:** At Hawk Mt. Petty Spurge is found with Goutweed in an isolated location along Hawk Mountain Road.

q. **Bindweed:** At Hawk Mt. Bindweed is found primarily along Hawk Mountain Road and on our ridgetops at both Owls head and ridgetop water tanks

3. **Rationale for using this chemical treatment, rather than other means of control, comparing with the FSC Alternatives database:**

Alternatives Database: The database was checked for each species and/or chemical. Nothing was found and it is uncertain if this database is functional – checking back every couple of weeks through the summer of 2024 resulted in the same findings.

Overall rationale at Hawk Mountain: Hawk Mountain staff always considers alternative means of invasive control before using chemicals. Hawk Mountain staff considers the cost-benefit of using chemicals which: (1) are a risk to humans if used incorrectly, (2) can damage non-target species if applied incorrectly, and (3) can be very costly. However, at Hawk Mt. chemical use is the most effective and efficient way to eliminate invasive plants both before and after they've gained a dominant cover in targeted areas. Hawk Mountain has a challenging rocky terrain and often very steep topography, making navigation very arduous. Fire and mowing, which may work in other areas to control some invasives, are not feasible in this terrain. The implementation of controlled burning does not align with the sanctuaries management goals, as it requires further human impact into the landscape in the form of fire breaks, which have been observed to be a harbinger of invasive species. The large number and widespread distribution of invasive species within HMS, coupled with the challenging terrain, makes it much more cost-effective and efficient to treat targeted and applicable ancillary invasive species (as observed) with chemical spray simultaneously. However, each plant is considered individually, and spraying is done with deliberation in reference to timing, species, and product used. Hand crews or pulling plants by hand are not as effective (many of the invasives will resprout if any root material is left in the ground) and chemicals more effectively kill the species. However, Hawk Mountain staff routinely researches current data in relevant literature and continuously evaluates chemical use; working to minimize any potential harmful effects while maximizing the effectiveness and efficiency of their management efforts. Staff will continue to monitor the literature for biocontrol results and if feasible bio controls become approved for general use.

Chemicals changed or discontinued in 2024: In 2024, All chemicals utilized were the same as in the year 2023.

a. Japanese Barberry: From an IPM perspective While when small, a broader IPM approach can be taken of hand pulling and using a weed wrench to remove smaller established shrubs, the extent of the current infestation is too large for mechanical treatments alone and approved biological control methods are not available for the target species. There is a good kill response to cutting the stems down to one inch and

applying glyphosate herbicide to the stump – especially effective in July-September when the roots are collecting carbohydrates. For multiple stems, foliar treatment is also effective. Note FSC database currently has nothing listed.

Hawk Mt staff will hand pull Barberry when small enough and practical. Spot spray with Glyphosate only when the plant is lower than the applicators waist. Utilize rope winch to pull large infestations that are too large to spray.

b. Japanese Stilt grass: From an IPM perspective Controlling Japanese stilt grass over a large area can be time-consuming and difficult. Non-chemical methods of removal can take 5 to 7 years even in smaller patches. Mowing frequently and hand pulling are methods that can be used. Though, using these methods will take years to see any results because of the seed bank. Another method to control the grass and a better option for controlling larger areas of impact is the use of herbicide. At Hawk Mt. the Japanese Stilt grass is within the forest floor and impossible to mow and is of such a broad area that hand pulling is cost prohibited and inefficient, thus herbicides are the method of choice for most effective control. Note FSC database currently has nothing listed.

Hawk Mt staff will treat monocultures with Sulfometuron-methyl in the early season to gain control and follow up with treatments of glyphosate in summer until plant goes to seed. Glyphosate will be applied with a backpack spray and spot sprayed. Clethodim will be used where *Vaccinium* is present and other species that may be affected by Glyphosate.

c. Multiflora Rose: From an IPM perspective: These large plants are scattered throughout the sanctuary and are difficult to remove by hand. Herbicide is an effective and more cost-efficient method to control the spread on Hawk Mountain. Multifora rose does respond to repeated mowing's (3-6 mowing's pers season) as a control but is not easily done in steep, rocky areas. There have been many studies on biological control but many species that effect this species also effect cultivated roses. Glyphosate is recommended in the spring when the plant comes out of dormancy. Note FSC database currently has nothing listed.

At Hawk Mt., the shrub will be treated with Triclopyr as a basal bark treatment and hack and squirt.

- Hindal DF, Wong SM. Potential biocontrol of multiflora rose, Rosa multiflora. Weed Technology. 1988 Apr;2(2):122-31.

d. Chickweed: From an IPM perspective: General IPM recommendations include: targeting both above ground and underground plant structures; and hand-pull plants prior to seed maturation. Shallow tillage or hoeing will control young plants in planting beds; this control method is most effective when underlying soil is dry. In bedding plots Apply a mulch layer 3 inches deep on planting beds to reduce seed germination.

However, in a wildland situation the application of an appropriate pre-emergent herbicide prior to seed germination or an appropriate post-emergent herbicide directly to target weeds is most cost effective. While chickweed is easily removed in small patches by hand, at Hawk Mt. it is near other invasives being treated. Note FSC database currently has nothing listed.

At Hawk Mt., chickweed will be sprayed with Glyphosate mixed with alkylpolyoxethy ethers (nonionic surfactants) or with a foliar application of Triclopyr.

e. Oriental lady's thumb: From an IPM perspective: The best time to control Lady's Thumb is when the plant is young, and the soil is wet. During this time, you will have a higher probability and an easier time removing the entire root system. If you do decide to pull a mature Lady's Thumb by hand, be aware that it is very difficult to pull the taproot out, and it is likely that seeds will be dropped into the soil. The plant forms a dense and deep root mat, making hand removal very difficult.

At Hawk Mountain the plant is found mixed with other invasives and is being treated Glyphosate mixed with alkylpolyoxethy ethers (nonionic surfactants) or with a foliar application of Triclopyr. Note FSC database currently has nothing listed.

f. Crown Vetch: From an IPM perspective: Mowing and fire can be non-chemical means to control the plant, but both need to be done repeatedly. Hand pulling is ineffective due to rapid resprout from even very small species of plant material left behind. Mowing isn't an option at Hawk Mt. due to steep rocky terrain. Fire is also difficult due to the same reason. Note FSC database currently has nothing listed.

At Hawk Mountain, crown vetch will be sprayed with glyphosate.

g. Mile-a-minute: From an IPM perspective: Mile-a-minute is usually managed by physical or mechanical methods, such as hand-weeding and mowing. Such methods are more effective during early stages of plant growth before it begins to vine excessively. Selective herbicides containing triclopyr (Turflon, Garlon, Remedy). A non-selective herbicide, such as glyphosate (Roundup, Aquaneat), will also control this weed. Due to its waxy cuticle, a surfactant can be added to the tank mixture and will improve herbicide uptake by the leaves. The species has a host-specific beetle predator the mile-a-minute weevil, *Rhinocominus latipes*. The beetle has been successfully released in several locations in the US. At Hawk Mt. the beetle has not been used due to inefficiency in terms of time and cost. Mile-a-minute can also be hand pulled, however; sharp barbs make it more of a challenge. Any piles left on site should be monitored for germination.

At Hawk Mt the plant is growing with Smartweed and Japanese Stilt Grass. Initial treatments are completed via chemical methodology and followed up by hand control. At Hawk Mt., mile-a-minute will be sprayed with Sulfometuron-methyl in targeted areas, as well as glyphosate/triclopyr as a post emergent foliar application.

- https://www.fs.fed.us/foresthealth/technology/pdfs/FS_mam.pdf
- Forest Health Technology Enterprise Team *Mile-a-minute weed Biological Control*

h. Bush Honeysuckle: From an IPM Perspective: Identification of Bush Honeysuckle seedlings and hand pulling the young plants in early spring can be effective in preventing or minimizing infestations of the weedy shrub. Controlled burning in the spring can kill seedlings and the new growth of established plants. However, Bush Honeysuckle can readily resprout, therefore one burning will not control mature plants. Research indicates that mowing is only marginally effective at reducing infestations given the plant's ability to sprout from the crowns following the cutting.

Two of the most effective chemical options for Bush Honeysuckle control are Triclopyr (Remedy Ultra, Pasture Guard) and Glyphosate (Roundup, Touchdown). Research has shown that foliar applications of these herbicides are generally more effective than either cut-stump or basal bark applications.

At Hawk Mt. the shrub is growing in with Autumn Olive and bittersweet vine. Mowing and burning are not options due to the steep terrain. Bush Honeysuckle will be treated with Triclopyr as a basal bark treatment and hack and squirt treatment.

- Smith K and A Smith (2010) Controlling Non-Native Invasive Plants in Ohio Forests: Bush Honeysuckle: http://ohioline.osu.edu/for-fact/pdf/0068.pdf

i. Wisteria: From an IPM Perspective – Manual, mechanical and chemical control methods are all effective in removing and killing Wisteria. Research suggests a combination of methods often yields the best results. Cutting the vegetation plus application of concentrated systemic herbicide to the cut surfaces will provide a better kill. For large infestations, a foliar herbicide may be a better choice. There are no known biological controls.

At Hawk Mt. the large old vines will be treated with Triclopyr as a basal bark treatment and also hack and squirt.

- Plant Conservation Alliance Alien Plant Working Group – Japanese Wisteria – J. Swearingen, NPS Center for Urban Ecology, Washington, DC and T. Remaley, NPS, Gatlinburg, TN.

j. Autumn Olive: From an IPM Perspective – If located, plants should be removed as soon as possible, as they can rapidly colonize a new area. Small plants and seedlings can be hand-pulled, especially when the soil is moist. Herbicide treatment is more efficient option for eradicating larger, well-established plants as cutting only stimulates sprouting and leads to thicker growth. There are no known biological options currently available.

At Hawk Mt., the shrubs are sprayed with triclopyr as a basal bark treatment and hack and squirt treatment.

- NRCS – Pest Management – Invasive Plant Control Autumn Olive – Conservation Practice Job Sheet – NH-595.
- https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1081635.pdf

k. Oriental Bittersweet: From an IMP Perspective: Manual, mechanical and chemical controls methods are all effective in removing the vine. Often a combination of methods yields the best results and least impact to natives. Cutting the plants and then treating them with a stump applied herbicide reduces the damage to overstory trees. Foliar herbicide can also be used for large infestations. No biological controls are currently available for this plant.

At Hawk Mt., the vines are sprayed with Triclopyr as a basal bark treatment and as a hack and squirt treatment.

- NRCS – Pest Management – Invasive Plant Control Oriental Bittersweet – Conservation Practice Job Sheet – J. M. Swearingen. NPS.
- https://www.invasive.org/alien/fact/ceor1.htm

l. Tree-of-Heaven: From an IMP Perspective – Elimination of Ailanthus requires diligence, due to is nature to resprout, large seed production, and even growing from small roots chunks left in ground. Manual removal is possible when small, but any root material left will produce another plant. Cutting-girdling or mowing is often counter-productive because of the sprouting response. The most effective method recommended in most literature is to use chemicals either applied as a foliar, basal bark, cut stump or hack and squirt. The hack-and-squirt or injection method is highly effective and minimizes sprouting and suckering when applied during the summer.

There are several bio controls under investigation for Ailanthus. Several fungal pathogens are being investigated as potential control agents. Two of these *verticillium dahlia* and *Fursarium oxysporum*, have been isolated from dead and dying ailanthus trees in New York and in southern and western Virginia. However, none are available as yet, as an approved control.

At Hawk Mt, Tree-of-Heaven is being treated with Triclopyr as a basal bark treatment. Hack and squirt treatment may also be used. When performing hack and squirt treatment on Tree-of-Heaven, be sure to never girdle the tree as it allows the plant to send up shoots from the established root system.

- NRCS – Pest Management – Invasive Plant Control Tree-of-Heaven – Conservation Practice Job Sheet – J. M. Swearingen. NPS.
- https://www.invasive.org/alien/fact/aial1.htm

m. Garlic Mustard: From an IPM Perspective: Garlic mustard seeds can survive for five or more years in the soil. Effective management requires long-term effort. Hand removal of plants along with the roots is effective for light, scattered infestations. Flowering plants can be cut low to the ground in spring to prevent seed production but cut plants can resprout and often produce additional flower (thus seed) heads. Careful hand removal and bagging of plants with mature fruits can be done as soon as fruits are present. Systemic herbicides containing Glyphosate are effective but repeated treatments are usually needed because of the large seed stores in the soil. Researchers are investigating potential biological control agents, but none are available at this time. At Hawk Mt., basil year garlic mustard is being treated with glyphosate when noted with stilt grass, and otherwise are mowed on a yearly basis from April through May.

n. Narrowleaved Bittercress: From an IPM Perspective:

Persons working in areas with narrowleaf bittercress should carefully clean all boots, clothing, and equipment to ensure that they do not transport seed to uninfected locations. Monitor waterways carefully for this species. For all management options, infestation sites will need to be monitored and treated repeatedly until the seedbanks are depleted. Small infestations can be hand-pulled easily. The site should be monitored and narrowleaf bittercress plants removed in the spring, summer, and fall to prevent seed production. Plants with flowers and/or seedheads should be bagged and disposed of. Hand-pulling large infestations may result in soil disturbance that favors the germination of more narrowleaf bittercress. Therefore, at Hawk Mt. we opt to treat the plant with herbicide while treating other invasive species including smartweed, barberry, and stilt grass.

No biocontrol is currently known for this plant.

There is little information available for chemical control of narrowleaf bittercress. Following guidelines for controlling other biennial mustards such as garlic mustard, *Alliaria petiolata*, may be helpful.

o.Goutweed: From an IPM Perspective:

Goutweed is a tough one to eliminate. Remove flower heads prior to seeding so that seed production is prevented. Flowers should be cut and bagged. Plants can be dug up or pulled out of the ground. Rhizomes and pulled plants should be disposed of in the trash – not composted. Be prepared to repeat this process as any underground parts left

behind can be rejuvenated and send up new shoots. Repeating digging can create disturbance for additional invasives.

Glyphosate can be applied in the spring or summer. If the growth is older, a string trimmer could be used to first cut the plants short. Then wait a week or so for new growth. Spray the new growth; then keep a close eye on the area. Remove new plants as they appear.

Other non-chemical options to try including covering the area with a landscape fabric or plastic. These options would be better for earlier in the spring, however.

There are no biological control organisms currently available for *Aegopodium podograria* in North America. Systemic herbicides such as glyphosate (Roundup®) that are translocated to the roots and kill the entire plant are most effective for goutweed control

p.Petty Spurge: From and IPM Perspective:

While hand pulling and solarization have been used to kill spurge – because it was located along with Goutweed, herbicides were used for the sake of time and resources.

Some root and fungal diseases were looked at for biocontrol of Petty Spurge, but to-date have proven ineffective.

q.Bindweed: From an IPM Perspective:

Field bindweed is one of the most persistent and difficult-to-control weeds in landscapes and agricultural crops. It has a vigorous root and rhizome system that makes it almost impossible to control with cultivation between desirable plants or broad scale tillage alone; in fact, it often spreads infestation. Its seed has a long dormancy and can last in soil for up to 60 years. It has a climbing habit that allows the plant to grow up. In addition, rhizomes can penetrate through fabric, plastic, and other barriers. Field bindweed also is very drought tolerant and once established is difficult to control even with herbicides.

Herbicides have been effective for suppression of bindweed but have not been very effective for eradication (Table 1). If herbicides are used, supplementing them with appropriate preventive and cultural controls has the most success in eradication.

Biological control for Field bindweed includes a microscopic mite, ***Aceria malherbae***. The mites infest the newest growth of the plant by forming a leaf gall. The gall is basically a small nursery housing the developing culture of mites. This initially reduces flowering and stunts the growth of the stems. Mite overwinters on the root

buds and emerge again with spring growth. The activity of the mites can kill the bindweed.

https://ag.colorado.gov/conservation/biocontrol/field-bindweed

At Hawk Mt we decided to use herbicide on bindweed when we are seeing it in the field with other invasive species for the sake of time and resources.

4. **Proposed Treatment Prescription [include timing of treatment, chemical to be used, method of application]: For SPECIFIC SEE TREATMENT TABLE on Page**

The following methods of application will be performed:

- All ESRA recommendations and label instructions will be followed during the pesticide application process for all chemicals used including Triclopyr, Sulfometuron-methyl, and Clethodim with special consideration given to Glyphosate as it is categorized as **restricted**.
- Use proper attire including long-sleeved shirt and long pants, shoes plus socks, protective eyewear, and gloves. Chemically resistant gloves will be worn, especially when exposure will be prolonged, or contact is frequently repeated.
- Detailed training is done for all applicators – see training document.

See Treatment Table Page for Details

1. Pre-emergent application via backpack sprayer in spring of Sulfometuron-methyl to control Japanese stilt grass and Mile a Minute.
2. Post-emergent application in late spring and summer of Clethodim to control Japanese stilt grass.
3. Summer foliar treatment of Glyphosate for Japanese Stilt Grass, Japanese Barberry, Crown Vetch, and Garlic Mustard.
4. Summer foliar treatment of Triclopyr for Lady's Thumb, Mile-a-Minute, Chickweed, Narrowleaved Bittercress, Goutweed, Petty Spurge, and Bindweed.
5. Spring to winter cut stump treatment with Triclopyr for Multi-flora Rose, Autumn Olive, Honey Suckle, Bittersweet, Wisteria, Tree of Heaven, and Japanese Barberry.

5. **Active ingredients in proposed chemicals and FSC status (confirm to the FSC Chemicals List):**

- **Glyphosate:** Restricted
- **Triclopyr:** Not on the three tables of the FSC List – Link Above
- **Sulfometuron Methyl:** Not on the three tables of the FSC List – Link Above
- **Clethodim:** Not on the three tables on the FSC List – Link Above

6. **Compare Environmental/social risks/concerns associated with the prescription as part of integrated pest management to identify the lowest risk option for controlling the pest while minimizing/mitigating identified risks (may reference ESRA's, as completed and available on Connect at 4.12 on Hawk Mt. Site):**

Each of the species Hawk Mt. is actively treating are all widely spread and have no well documented, cost effective non-chemical methods – see comparable IPM above. In small infestations the plants can be handpicked or weed wrenched, however at Hawk Mountain, chemicals are needed to control the major infestations. The Glyphosate ESRA, which was adopted from the FSC ESRA, shows Glyphosate to be Restricted due to its possible carcinogenicity. Other risk associated with glyphosate are to non-target vegetation. The other chemicals triclopyr, Sulfometuron-methyl, and clethodim are not listed witin FSC hazard tables but have had ESRA's created. All risks discussed within each ESRA are highest with accidental chemical release, and all chemicals will be mitigated by mixing, filling, and storing the chemicals off-site at a secure location, with a spill kit available. Glyphosate becomes inactive upon soil or water contact. Sulfometuron methyl may persist longer in soil (the other chemicals breakdown readily). To further minimize these risks, applicators are properly insured, licensed, and trained with a verified work record of having a long history of producing desirable results in a safe and effective manner. Spray mixes will utilize herbicides for aquatic use (i.e., Aquaneat, Garlon 3A). Backpack sprayers with low-volume output are selective and will minimize damage to non-target plants.

7. **List the results and any necessary mitigation measures from the comparative ESRA below to ensure they are communicated and employed onsite, including site-specific risk as identified:**

All label recommendations, laws, and guidelines will be followed as well as those listed in the ESRA. Applications will be conducted by certified pesticide applicators using only the approved pesticides within the rates and conditions allowed on the pesticide label. Certified pesticide applicators will follow all state and local laws. Applicators will utilize PPE and follow all instructions included on the herbicide label. Hawk Mountain has two separate documents on safety – a Powerpoint on natural hazards and a specific handbook on Commercial Pesticide Technician Training Curriculum. The Curriculum contains detailed information about the years treatment areas and all PPE needed for application. Note that Hawk required ***Additional*** PPE compared to the label requirements.

8. **Legal Requirements and Safety Precautions [include statement of how the application will comply with all laws and how the applications will comply with the safety requirements for the proposed chemical]:**

In 2017, EPA finalized revisions to the Certification of Pesticide Applicators Rule. Stronger standards were enacted for those individuals applying restricted use pesticides in order to reduce their job-related risks and to help protect families, communities, and the environment from pesticide exposures.
The Worker Protection Standard (WPS) was passed by EPA in 1992, to reduce the risks of pesticide poisoning or injury to workers and handlers due to exposures when using pesticides in the production of agricultural plants on farms, nurseries, greenhouses, and forests.

The primary statute in Pennsylvania that governs the use of pesticides is the Pennsylvania Pesticide Control Act of 1973 that is enforced by the Pennsylvania Department of Agriculture (PDA) Bureau of Plant Industry. This Act regulates the labeling and registration, distribution, storage, transportation, use, application, and disposal of pesticides. The Act also establishes provisions for the classification of pesticides as restricted use; certification of pesticide applicators; the licensing of pesticide dealers, commercial and public pesticide businesses, and pest management consultants; the registration of pesticide application technicians; and several types of notification that must be made prior to a pesticide application. Authority is also given to PDA by the Act to assess enforcement actions for violations of these provisions.

9. Proposed effects monitoring and protocol [brief protocol for determining the effectiveness of treatment]:

Treatment areas will be surveyed 2-4 weeks post-treatment to determine the effectiveness of the application as well as impacts to non-target species. Additional applications may be warranted depending on the results, or spray rates for future applications modified.

10. If a lower risk of less hazardous alternative for a chemical is available, describe the plan (including actions, timelines, targets and resources) to transition to the less hazardous alternative.

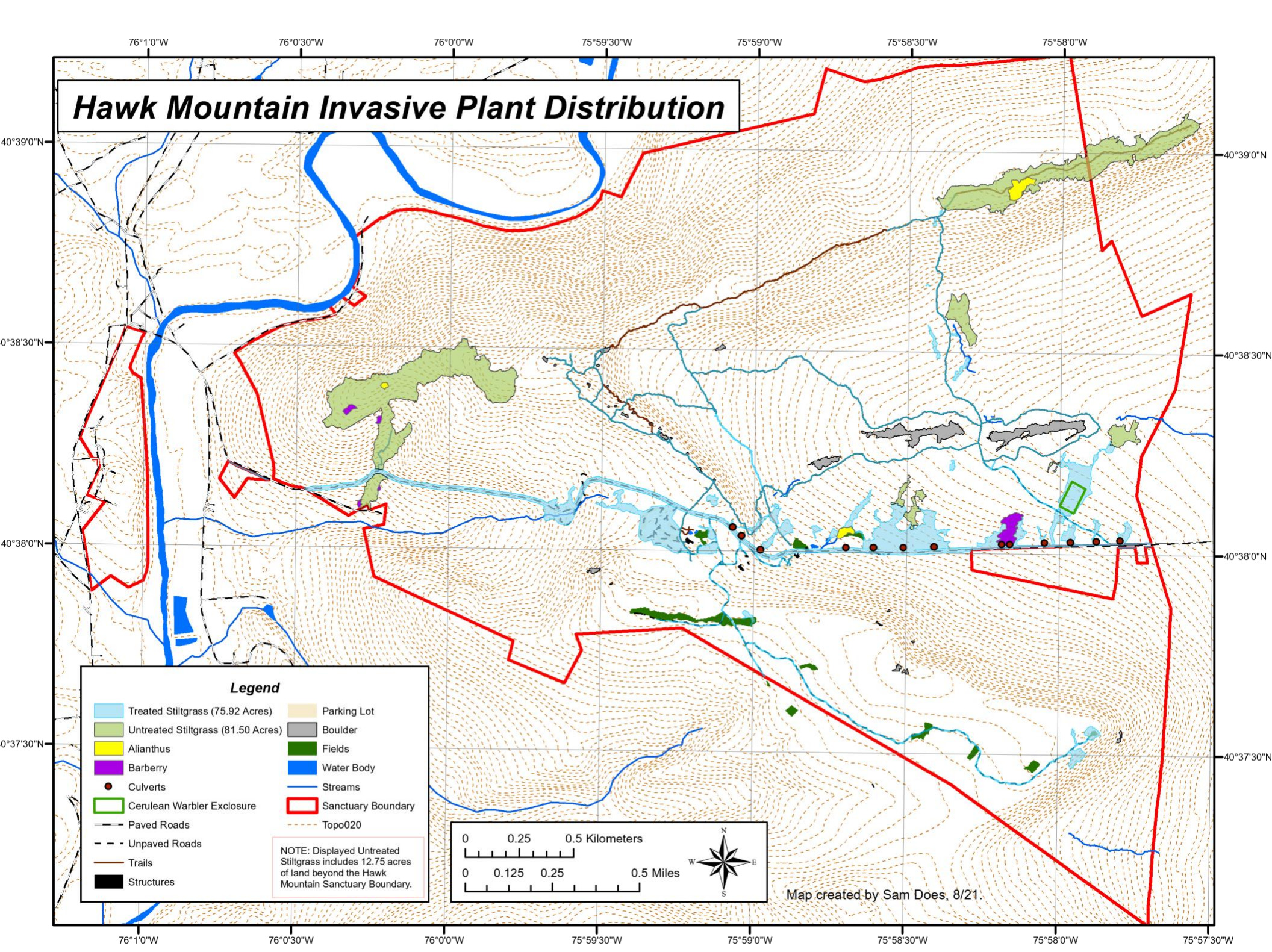
Hawk Mt. studied the literature and observed test results and decided to not implement with a chemical Quizalofop (which is restricted) for stilt grass, but instead used a less hazardous and much more specific grass chemical – clethodim – which is only harmful to monocot annuals. Staff will continue to monitor the literature for bio control results and if certain bio controls become approved for general use and meet the sanctuaries management goals, they will be considered as an alternative method of invasive plant mitigation.

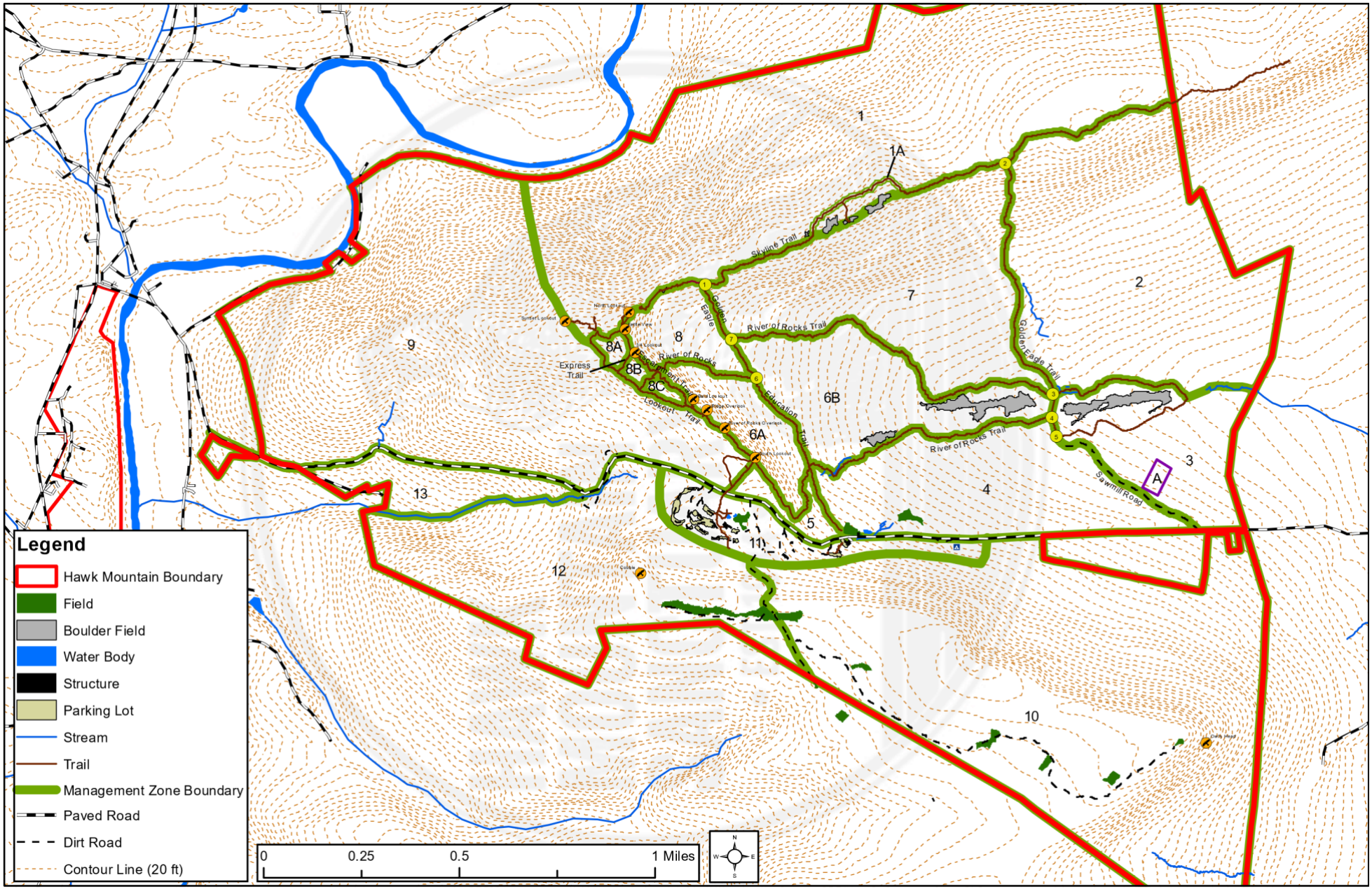
11. If you plant trees, supplying nurseries informed of the FSC list of prohibited chemical pesticides and encouraged to avoid use on materials entering the FMU:

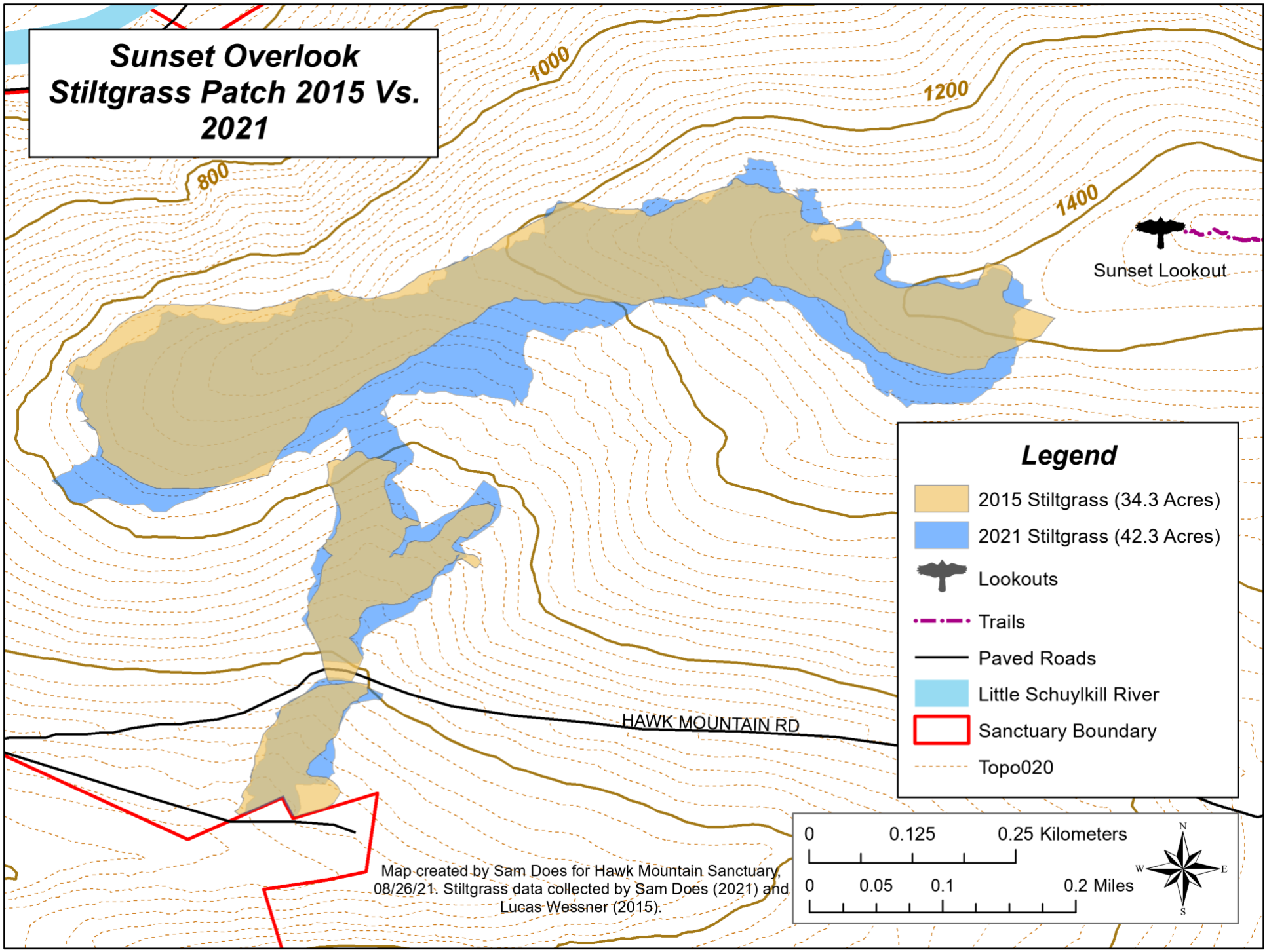
12. If you plant trees: List of FSC prohibited chemical pesticides as provided by nurseries:

No response has been received from the nursery to date.

Maps for 2024 for Plant Infestations at Hawk Mountain


Hawk Mountain Invasive Plant Distribution
76°1'0"W
76°0'30"W
76°0'0"W
75°59'30"W
75°59'0"W
75°58'30"W
75°58'0"W
75°57'30"W
40°39'0"N
40°38'30"N
40°38'0"N
40°37'30"N
Legend
Treated Stiltgrass (75.92 Acres)
Untreated Stiltgrass (81.50 Acres)
Alianthus
Barberry
Culverts
Cerulean Warbler Exclosure
Paved Roads
Unpaved Roads
Trails
Structures
Parking Lot
Boulder
Fields
Water Body
Streams
Sanctuary Boundary
Topo020
NOTE: Displayed Untreated Stiltgrass includes 12.75 acres of land beyond the Hawk Mountain Sanctuary Boundary.
0 0.25 0.5 Kilometers
0 0.125 0.25 0.5 Miles
N
W
E
S
Map created by Sam Does, 8/21.


Legend
Hawk Mountain Boundary
Field
Boulder Field
Water Body
Structure
Parking Lot
Stream
Trail
Management Zone Boundary
Paved Road
Dirt Road
Contour Line (20 ft)
0
0.25
0.5
1 Miles
N
W
E
S
1
1A
2
3
4
5
6A
6B
7
8
8A
8B
8C
9
10
11
12
13
A
Skyline Trail
Eagle
Cowhorn
River of Rocks Trail
Golden Eagle Trail
Education Trail
Lookout Trail
Express Trail
Sawmill Road


Sunset Overlook Stiltgrass Patch 2015 Vs. 2021
1000
1200
800
1400
Sunset Lookout
HAWK MOUNTAIN RD
Legend
2015 Stiltgrass (34.3 Acres)
2021 Stiltgrass (42.3 Acres)
Lookouts
Trails
Paved Roads
Little Schuylkill River
Sanctuary Boundary
Topo020
0
0.125
0.25 Kilometers
0
0.05
0.1
0.2 Miles
N
W
E
S
Map created by Sam Does for Hawk Mountain Sanctuary, 08/26/21. Stiltgrass data collected by Sam Does (2021) and Lucas Wessner (2015).

Herbicide by Zone with PPE Requirements

Note Higher requirement by Hawk than Label

Herbicide Product	Active Ingredient	Used to Treat	Zone Utilized	Treatment Timeline	Signal Word	PPE required (Label)	PPE required (HMS)
Aquaneat	Glyphosate (53.8%)	Stilt Grass // Barberry // Crown Vetch // Chickweed // Smartweed // // // Goutweed // Petty Spurge // Narrow leaved Bittercress // Bindweed	1 // 2 // 3 // 4 // 5 // 6 // 7 // 8 // 9 // 10 // 11// 12 // 13	June-August	CAUTION	x Long-sleeved shirt x Long pants x Shoes plus socks	x Long-sleeved shirt x Long pants x Shoes plus socks x Rubber Boots x Protective Eyewear x Chemical Resistant Gloves
Aquastar	Glyphosate (53.8%)	Stilt Grass // Barberry // Crown Vetch // Chickweed // Smartweed	1 // 2 // 3 // 4 // 5 // 6 // 7 // 8 // 9 // 10 // 11 // 12 // 13	June-August	CAUTION	x Long-sleeved shirt x Long pants x Shoes plus socks	x Long-sleeved shirt x Long pants x Shoes plus socks x Rubber Boots x Protective Eyewear x Chemical Resistant Gloves
Oust XP	Sulfometuron -methyl (75%)	Stilt Grass // Mile-A-Minute	4	March-May	CAUTION	x Long-sleeved shirt x Long pants x Shoes plus socks	x Long-sleeved shirt x Long pants x Shoes plus socks x Rubber Boots x Protective Eyewear x Chemical Resistant Gloves

Pathfinder 2	Triclopyr (13.6%)	Autumn Olive // Honey Suckle // Bittersweet // Wisteria // Tree of Heaven // Multiflora Rose	1 // 4 // 9 // 11 // 13	April-December	CAUTION	x Long-sleeved shirt x Long pants x Shoes plus socks x Protective eyewear x Chemical resistant gloves	x Long-sleeved shirt x Long pants x Shoes plus socks x Rubber Boots x Protective Eyewear x Chemical Resistant Gloves
Garlon 3A	Triclopyr (44.4%)	Autumn Olive // Honey Suckle // Bittersweet // Wisteria // Tree of Heaven // Multiflora Rose // Smartweed // Mile a Minute // Chickweed // Goutweed // Petty Spurge // Narrow leaved Bittercress // Bindweed	1 // 3 // 4 // 7 // 9 // 10 // 11 // 12	April-December	DANGER	x Long-sleeved shirt x Long pants x Shoes plus socks x Protective eyewear x Chemical resistant gloves	x Long-sleeved shirt x Long pants x Shoes plus socks x Rubber Boots x Protective Eyewear x Chemical Resistant Gloves
Clethodim	Clethodim (26.4%)	Stilt Grass	1 // 2 // 3 // 4 // 5 // 6 // 7 // 8 // 9 // 10	June-July	WARNING	x Long-sleeved shirt and long pants x Shoes plus socks x Protective eyewear x Chemical resistant gloves	x Long-sleeved shirt x Long pants x Shoes plus socks x Rubber Boots x Protective Eyewear x Chemical Resistant Gloves

TREATMENT PLAN – Field Season 2024

With Acreage

Zone # and Acres of Impacted	Plant Species	Treatment Plan
1 - Ridgetop – Northside// Skyline Trail Approximately 8-10 acres of mixed impact in this zone	Stiltgrass // Bindweed // Smartweed	Backpack Spray as much impact as possible utilizing on site water tanks. Treatment planned starts on Skyline Trail post # 2 and continues out to the sanctuary boundary. Utilize Glyphosate in monoculture initially and Clethodim as follow-up for edgework where vaccinium and Stilt Grass may coexist. Maintain 100-meter Buffer between treatment and research plots for PAFR (orange flagging).
1 A - Skyline Trail Relocation 0 Documented Acres	Native Forest, No Impact Documented	Monitor heavily
2 - South Side of Golden Eagle Trail Approximately 10-15 acres of mixed impact in this zone	Stiltgrass	Backpack spray as much impact as possible utilizing on site rain barrel and by bringing full packs into the field. Utilizing Glyphosate in Monoculture and Clethodim for edgework where native forest and Stilt Grass may coexist. Maintain 100 Meter Buffer between treatment and research plots for PAFR (orange flagging).
3 - Sawmill Road to property boundary & River of Rocks Trail Approximately 10-15 acres of mixed impact in this zone	Stiltgrass	Backpack spray as much impact as possible utilizing water truck. Start work from Sawmill Rd and work down and around 3A.
3 - Sawmill Road to property boundary & River of Rocks Trail	Barberry	Hand pull Barberry when small enough and practical. Spot Spray Barberry only when plant is lower than the applicators waist. Utilize rope winch to pull large infestations of barberry that are too big to spray/pull by hand.

3A - Cerulean Warbler Project Approximately 1 - 1.5 acres of mixed impact in this zone	Stiltgrass	Hand weeding at least 3x per season
3A - Cerulean Warbler Project	Barberry	Hand pull Barberry when small enough and practical. Utilize rope winch to pull large shrubs that are too big to spray/pull by hand.
4 - Leading Invasive Edge Approximately 25-35 Acres of mixed impact in this zone	Stiltgrass	Treat monocultures with Sulfometuron-methyl early season (March-May) to gain more ground. Follow up with Glyphosate Treatments (June-August) until Stilt Grass goes to seed. Treat from Hawk Mountain Road into the forest interior.
4 - Leading Invasive Edge	Barberry	Pull areas of monocultured barberry utilizing rock bars and rope winches (default for when weather conditions are not optimal for spraying). Stray Barberry shrubs may be sprayed with Glyphosate if they are below waist level.
4 - Leading Invasive Edge	Smartweed // Mile Minute // Goutweed // Petty Spurge // Bindweed // Narrow leaved Bittercress	Treat Smartweed, Mile a Minute, Goutweed, Petty Spurge, and Bindweed with Glyphosate and or Garlon 3A.
4 - Leading Invasive Edge	Honey Suckle // Autumn Olive // Bittersweet Vine // Multiflora Rose //	Treat invasive shrubs and vines with Pathfinder II as a basal bark treatment. Another viable treatment option is utilizing Garlon 3A as a hack and squirt chemical.
4 - Leading Invasive Edge	Tree Of Heaven	Treat Tree of Heaven with Pathfinder II as a basal bark treatment. Another viable treatment option is utilizing Garlon 3A (Triclopyr) as a hack and squirt chemical.

5 - Hawk Mountain Road River of Rocks South to Education Trail Approximately 2-4 Acres of mixed impact in this zone	Stiltgrass	Backpack spray as much impact as possible utilizing water truck. Utilize Glyphosate for spot spraying and Clethodim where vaccinium and other species may be affected by Glyphosate.
5 - Hawk Mountain to Road River of Rocks South to Education Trail	Smartweed// Mile a Minute	Treat Smartweed and Mile a Minute with Glyphosate or Garlon 3A (Triclopyr).
6A - Lookout trail and between both River of Rocks trails to Education Trail Approximately 1-2 acres of mixed impact in this zone	Stiltgrass	Impact continues from Zone 5 into 6A via stormwater runoff. Otherwise, the west side of the education trail is in-tact forest. Backpack spray as much impact as possible utilizing water truck. Utilize Glyphosate for spot spraying and Clethodim where vaccinium and other species may be affected by Glyphosate.
6B - Education trail south between River of Rocks upper loop Approximately 4-5 Acres of mixed impact in this zone	Stiltgrass	Backpack spray as much impact as possible utilizing water truck. Utilize Glyphosate for spot spraying and Clethodim where vaccinium and other species may be affected by Glyphosate.
6B - Education trail south between River of Rocks upper loop	Smartweed // Mile a Minute // Narrow leaved Bittercress	Treat Smartweed, Mile a Minute, and Narrowleaved bittercress with Glyphosate and or Garlon 3A (Triclopyr).
7 - Between trail Markers 1, 2, 3, and 7 Approximately 8-10 Acres of mixed impact in this zone	Stiltgrass	Backpack spray as much impact as possible utilizing water truck. Utilize Glyphosate for spot spraying and Clethodim where vaccinium and other species may be affected by Glyphosate. Search and destroy, especially for small patches of Stilt Grass.
8 - A/B/C/D Lookout trail / River of rocks trail North to post 1	Stiltgrass	Search and destroy utilizing Glyphosate for large patches and Clethodim for edge work.

Approximately 2-4 Acres of mixed impact in this zone		
9 - Sunset overlook West to Property Boundary and Hawk Mountain Road Approximately 42-50 Acres of mixed impact in this zone	Stiltgrass	Backpack spray as much impact as possible utilizing water truck. Utilize Glyphosate for spot spraying and Clethodim where vaccinium and other species may be affected by Glyphosate.
9 - Sunset overlook West to Property Boundary and Hawk Mountain Road	Barberry	Pull areas of monocultured barberry utilizing rock bars and rope winches (default for when weather conditions are not optimal for spraying). Stray barberry shrubs may be sprayed with Glyphosate if they are below waist level.
9 - Sunset overlook West to Property Boundary and Hawk Mountain Road	Tree of Heaven	Treat Tree of Heaven with Pathfinder II as a basal bark treatment. Another viable treatment option is utilizing Garlon 3A (Triclopyr) as a hack and squirt chemical.
10 - Owls Head road and surrounding area west Approximately 42-50 Acres of mixed impact in this zone	Stiltgrass	Backpack spray as much impact as possible utilizing water truck. Utilize Glyphosate for spot spraying and Clethodim where vaccinium and other species may be affected by Glyphosate. Search for, map, and destroy Stilt Grass patches on both sides of Owls head road with priority being on the North Side. Maintain 100-meter Buffer between treatment and research plots for PAFR (orange flagging, plots near Birch Field Bog).

10 - Owls Head road and surrounding area west Approximately 42-50 Acres of mixed impact in this zone	Mile-A-Minute	Treat monoculture with Sulfometuron-methyl early season (March-May) to reduce impact. Follow up with Glyphosate/Triclopyr Treatments (June-August) before Mile-A-Minute goes to seed.
11 - Visitors Center, Education Building, and Campground Approximately 20-25 Acres of mixed impact in this zone	Stiltgrass	Backpack spray as much impact as possible utilizing water truck. Utilize Glyphosate for spot spraying and Clethodim where vaccinium and other species may be affected by Glyphosate.
11 - Visitors Center, Education Building, Maintenance Building, and Campground	Honey Suckle // Autumn Olive // Bittersweet Vine // Multiflora Rose // Wisteria	Treat invasive shrubs and vines with Pathfinder II (Triclopyr) as a basal bark treatment. Another viable treatment option is utilizing Garlon 3A (Triclopyr) as a hack and squirt chemical.
11 - Visitors Center, Education Building, Maintenance Building, and Campground	Smartweed // Narrow leaved Bittercress // Mile a Minute	Treat Smartweed, Mile a Minute, and Narrowleaved bittercress with Glyphosate and or Garlon 3A (Triclopyr).
12 - Cobble Road and Hawk Mountain West Slope Approximately 15-20 Acres of mixed impact in this zone	Stiltgrass	Backpack spray as much impact as possible utilizing water truck. Utilize Glyphosate for spot spraying and Clethodim where vaccinium and other species may be affected by Glyphosate.

12 - Cobble Road and Hawk Mountain, West slope	Barberry	Pull areas of monocultured barberry utilizing rock bars and rope winches (default for when weather conditions are not optimal for spraying). Stray barberry shrubs may be sprayed with Glyphosate as long as they are below waist level.
12 - Cobble Road and Hawk Mountain, West slope	Honey Suckle // Autumn Olive // Multiflora Rose //	Treat invasive shrubs and vines with Pathfinder II (Triclopyr) as a basal bark treatment. Another viable treatment option is utilizing Garlon 3A as a hack and squirt chemical.
13 - Hawk Mountain Road to Buteo Brooke Approximately 20-25 Acres of mixed impact in this zone	Stiltgrass	Backpack spray as much impact as possible utilizing water truck. Utilize Glyphosate for spot spraying and Clethodim where vaccinium and other species may be affected by Glyphosate.
13 - Hawk Mountain Road to Buteo Brooke	Barberry	Pull areas of monocultured barberry utilizing rock bars and rope winches (default for when weather conditions are not optimal for spraying). Stray barberry shrubs may be sprayed with Glyphosate as long as they are below waist level.
13 - Hawk Mountain Road to Buteo Brooke	Honey Suckle // Autumn Olive // Multiflora Rose //	Treat invasive shrubs and vines with Pathfinder II (Triclopyr) as a basal bark treatment. Another viable treatment option is utilizing Garlon 3A (Triclopyr) as a hack and squirt chemical.

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