# CITY COUNCIL WORK SESSION AGENDA

**Work Session - Celebration of Centenarians/Community Gardens**

**COUNCIL MEETING WILL BE ONLINE ONLY**

**Due to the COVID-19 precautions, the Council Meeting will be held online and is planned to be cablecast on Verizon 21, Comcast 71 and 996 and streamed to www.greenbeltmd.gov/municipaltv.**

**Resident participation:**
**Join Zoom Meeting**
**https://us02web.zoom.us/j/84321842126?pwd=M2dGdkZ3TmFXNW14amVTL2Q5RDB1dz09**
**OR**
**Join By phone: (301) 715-8592**
**Meeting ID: 843 2184 2126**
**Passcode: 136501**

**In advance, the hearing impaired is advised to use Video Relay Services (VRS) at 711 to submit your questions/comments or contact the City Clerk at (301) 474-8000 or email banderson@greenbeltmd.gov.**

**Wednesday, September 8, 2021**
**8:00 PM**

**Work Session Packet**

*Agenda*

- *Introductions*
- *Council Discussion*
- *Questions and Answers*
- *Other Items*

Community Gardens

Garden Shading Border Plan.pdf
Garden Border Plan Appendix A - Shading Analysis.pdf
Garden Shading Border Plan Appendix B Invasive Plants.pdf
Garden Shading Border Plan Appendix C Forest Gardens.pdf

Agenda Item No:

# City Council Work Session Agenda Item Report

Meeting Date: September 8, 2021
Submitted by: Shaniya Lashley-Mullen
Submitting Department: Administration
Item Type: Work Session Item
Agenda Section: Work Session Packet

---

**Subject:**
Community Gardens

**Suggested Action:**

**Attachments:**
Garden Shading Border Plan.pdf
Garden Border Plan Appendix A - Shading Analysis.pdf
Garden Shading Border Plan Appendix B Invasive Plants.pdf
Garden Shading Border Plan Appendix C Forest Gardens.pdf

# Action plan for remediating shade, managing invasive plants, and creating forest gardens in the Greenbelt Community Garden borders

## Preface

The Community Gardens located in the Greenbelt City Forest Preserve are a valuable resource for the residents of Greenbelt and part of Greenbelt's historic design. Shading of garden plots by trees has created a problem that needs to be addressed. The intention of this plan is to convert forest that is adjacent to the gardens to a form that does not shade the gardens and may contribute fruit, seeds and fiber to the community, and to reclaim some areas in the gardens that have been abandoned due to shading so they can function again as garden plots. The Greenbelt City Forest Preserve Advisory Board (FPAB) is aware that this plan will remove trees and accepts that impact to the Preserve because of the importance of the Community Gardens. This plan is proposed as part of stewardship of the Forest Preserve in accordance with the 2019 Forest Preserve Stewardship Guidelines and the Forest Preserve Ordinance. Our goal is to take management actions that result in both long-term forest health and thriving community gardens.

## Background

The Community Gardens were established over 80 years ago as part of the original design of the city. Three gardens remain: Gardenway, Hamilton Place and Henry's Hollow. When the Greenbelt Forest Preserve was established, those areas were incorporated as part of the Preserve. The Forest Preserve Advisory Board's report to City Council (Report No. 2013-03) requested that the city establish an 8-foot mowed buffer zone around the gardens. We believe more is needed now in order for the gardens to remain viable, in particular to address excessive shading of garden plots by tall trees bordering the gardens.

This document outlines proposed actions to assure adequate sunlight for community gardens and establish a basis for environmentally sound stewardship of boundary areas. This plan is a compromise that was created collaboratively by the FPAB and the Greenbelt Community Garden Committee (GCGC), and was approved by both. It draws on field observations and discussions by FPAB members, the Garden Club Executive Committee, and gardeners.

On July 11, 2020, FPAB and the Community Garden Club conducted a public walk-through of the gardens and we met monthly thereafter in order to collaborate on this proposal. The work that went into this plan was on the published agendas of and was discussed and reviewed extensively during public virtual meetings of the FPAB in 2020 and 2021. The Forest Preserve Advisory Board approved this action plan at its January 21, 2021 meeting and the Greenbelt Community Garden Club approved it at its January 2021 Executive Committee meeting.

This situation has developed over time, with the gradual growth of trees and will continue to pose an increasing problem for the gardens unless effective action is taken (See Appendix A). The actions proposed here are based on information from affected gardeners, observation of gardens and trees in border areas, analysis of tree heights and sunlight angles that affect the sunlight that reaches the gardens, and assessment of the options for effectively increasing available light. Our proposal entails removing about 125 taller trees to assure adequate sunlight for the community gardens, while retaining shorter trees and shrubs as part of the establishment of "soft edges" for the community gardens. The specific areas and approximate numbers of trees to be removed are shown below in Figures 1, 3, and 4 for the Hamilton Gardens, Henry's Hollow, and Gardenway Gardens respectively. This proposal also calls for the removal of invasive species and planting of "forest garden" species for ecological restoration and conservation of border areas.

FPAB and GCGC acknowledge feelings of distress and loss that this will involve cutting down so many trees. The recommendations contained in this plan were reached reluctantly and only after a prolonged and earnest effort to find solutions for the shading problems that would minimize impacts on the Forest Preserve, and that would ultimately enhance the preserve while also sustaining the Community Gardens. FPAB accepts the impact this has on the Preserve because of the importance of urban agriculture in Greenbelt's history and the value the gardens continue to have for Greenbelt residents today. We aim to be good stewards of the land adjacent to the gardens by converting it into what is known as "forest gardens." Forest gardens are made up of shorter native trees which do not shade the gardens at their mature height and provide fruit, seeds and fiber, as well as habitat for wildlife.

This proposal aligns both with the *Forest Preserve Stewardship Guidelines* and Chapter 12, Article VIII of the City Ordinance in its focus on the environmentally sound stewardship of the boundary areas around the gardens, the removal of invasive species and the planting of "forest garden" species to establish border areas as "soft edges."

## General Basis for Recommended Actions

The primary problem facing the community gardens is that trees in the surrounding forest have grown taller, which limits the amount of sunlight reaching many of the garden plots. An additional concern is that black walnut trees are growing in close proximity to several plots. Black walnuts naturally release chemicals into the soil that limit the growth of other plants. This prevents gardeners from making full use of areas next to these trees. Invasive species in the areas bordering the gardens also spread into the gardens, making gardening more difficult, as further discussed below. See Appendix A for maps of the estimated amount of shade on the gardens plots in 2014.

### Sunlight

As a rule of thumb, the gardeners need about eight hours of sunlight during the growing season from early April to the end of August. In particular, eight hours of sunlight ("full sun") is necessary for "fruiting" vegetables such as tomatoes, peppers, cucumbers, corn, beans, and squash. For plots to have enough sunlight there must be clear sky above a 60°angle looking south and above 30° looking east/west. The need for sunlight places a limit on how high trees can be based on how far they are located away from the gardens. The following tables indicate tree height and distance from the garden plot to attain 8 hours of sunlight in an ideal setting.

| Looking south: | | Looking east or west you need more clear sky: | |
|---|---|---|---|
| Distance (ft.) | Max Tree Height (ft.) | Distance (ft.) | Max Tree Height (ft.) |
| 8 | 13.8 | 8 | 4.6 |
| 16 | 27.7 | 16 | 9.2 |
| 24 | 41.6 | 24 | 13.9 |
| 32 | 55.4 * | 32 | 18.5 * |
| 40 | 69.3 * | 40 | 23.1 * |

*Used only for a few extreme cases.

Trees that are above the maximum height for a given distance will shade the gardens. While the tables give a general idea of the effects of trees on the gardens, they were not used to determine exactly which trees we propose to remove around the gardens. We do not feel that it is appropriate to trim or remove every tree that grows above the maximum height. Rather the tables help identify trees that may be candidates for management. Trees that are above the maximum height should only be cut if doing so will clearly provide a significant benefit to the gardens.

The garden-by-garden management recommendations later in this document identify which trees we propose to remove or limb up. Please review it in its entirety. The Invasive Plants and Forest Gardens/Food Forests sections also discuss proposed arrangements for future management of the garden border areas.

The tall trees right at the edge of the existing 8-foot buffer will have to be felled or drastically trimmed to get more light to the garden plots that are right next to the buffer. Felling and limbing up trees on the 8-foot buffer is the easiest first step.

The trees whose removal would lead to significantly greater sunlight in the long term are on the southern edges of Gardenway and Henry's Hollow, the southeastern edge of Hamilton Gardens and on the strips that divide the two sections of Henry's Hollow and Gardenway. Fewer changes are needed in the east-west buffers.

## Invasive Plants

The perimeters of the forested areas adjacent to or surrounding each of the Greenbelt Community Gardens are highly colonized by early to late successional plant growth. Due to the encroachment of seedling trees and shrubs and the shade cast from the surrounding woodlots, garden plots on the garden area perimeters have slowly been abandoned as this colonization and encroachment has happened over the decades. (See succession of aerial photographs 1938-present in Appendix A.)

The successional plant growth around the perimeters includes grasses, annual and perennial forbs, and woody plants such as shrubs, trees and vines. Unfortunately, the plant species that have colonized most perimeter areas are largely non-native invasive species. These include, but are not limited to; Japanese Stiltgrass, Garlic Mustard, Canada Thistle, Wineberry, Tree of Heaven, Callery Pear, Mile-a-minute weed, Japanese honeysuckle, English Ivy, Chinese Wisteria and Oriental Bittersweet. Most of these plants are on the Maryland Invasive Species Council Invasive Species of Concern list and some are also on State and Federal Noxious Weed lists.

All of these plants are a significant nuisance to highly managed areas like the Community Gardens where they cost many person hours in labor each year for management and control to prevent significant crop yield loss. However, these non-native invasive species pose an even greater threat to the surrounding forest. They outcompete newly emerging native annual, perennial and woody plant seedlings and prevent their establishment. The climbing vines of certain species will overtop and eventually kill even mature native trees on the forest edge. Finally, all of these non-native species produce seed and or vegetative propagules that will

recolonize even further into the gardens and the surrounding forests to ensure that the cycle never ends.

The best management practice for invasive species control in these boundary edges is to first remove the existing non-native vegetation, then to perform management tactics immediately afterwards to prevent rapid re-establishment of seedlings or root sprouts. (See references in Appendix B for details). For the longer term, the prevention of recolonization of invasive plants is imperative. The best way to accomplish this is to first replant with appropriate native grasses, herbaceous annual and perennial forbs and woody trees and shrubs. Once these have established a foothold, they will have a competitive advantage over the recolonization by many non-natives. As in any land stewardship program, it will be necessary to periodically and selectively remove any non-native plants, especially from the edges of these managed areas to prevent re-establishment. The planting of native smaller growing understory trees, shrubs, herbaceous annual and perennial forbs and grasses will create resilient forest margins that are less prone to invasion and don't outgrow the space as larger trees would otherwise do, creating shading issues for the nearby garden plots.

Due to the scale of remediation and required specialized equipment, the efforts at invasive plant species removal and remediation would necessarily be undertaken by city staff in the first phases, with involvement of gardeners and other volunteers where appropriate and feasible. Assistance from the Greenbelt Community Garden Club (GCGC) and volunteers can be employed with subsequent efforts. Long term management of these perimeter areas could be accomplished by a combination of GCGC and FPAB members, city staff and volunteers.

See Appendix B for further discussion of invasive plant management in the forest buffer.

## Forest Gardens / Food Forests

The concept of Food Forests or Forest Gardens, for both wildlife and human benefit, embraces the idea of considering plant species and the ecological niches they provide, when making decisions on what plants to select in new edge plantings. High consideration is given to native plants that provide the greatest resources of food, pollen, nectar, shelter and nesting habitat.

As described above, an important component of reclamation of an area invaded by non-native plants is to plant desirable native plant species in areas from which non-native plants have been removed. These new plantings discourage recolonization by non-natives through competition for sunlight, water and nutrient resources. Properly planned Forest Gardens/Food Forests will

enhance the re-establishment of a healthy, balanced ecosystem by providing habitat and food for birds, mammals, pollinators and other beneficial arthropods.

With regard to designing the Forest Gardens/Food Forests at the boundaries of the garden areas and their interface with the forest edge, it will be crucial to consider the ultimate height of the planting in those areas so as no additional shade is cast on the garden areas. Therefore, it will be important to select an appropriate mix of species of grasses, herbaceous perennial and annual forbs, shrubs and trees to use to revegetate these areas. It will also be important to plan and design these edges in a way that they slope from shortest and least woody at the edge nearest the gardens to tallest and most woody at the part of the planting where it abuts the forest.

See Appendix C for a detailed list of recommended native plants that provide resources and habitat for wildlife as well as fruit, seeds and fiber for gardeners. Also see Appendix C for sketches and example designs of forest gardens.

It is expected that plant material for these areas may be obtained through a combination of city funds, grants written by city staff and GCGC members, and contributions from local resources. Planting of these areas may be performed by a combination of City staff, GCGC, and volunteers. Long term maintenance of these areas may also be performed by City staff, GCGC members and volunteers.

Well planned, well implemented and established Forest Gardens/Food Forests in areas of the Greenbelt Forest preserve once dominated by non-native invasive species will result in enhancement of the health of the forest we are trying to protect, the gardens that the forest surrounds, and the creatures that benefit from both.

# Management Recommendations by Tract

## Hamilton Gardens

We propose that the city remove ~20 trees on the south edges of garden plots, seen in blue polygons in Figure 1. Eight trees are relatively small black walnuts that shade the southwestern plots of the main section of Hamilton (Figure 2a and Photo 1). Seven trees are black walnuts and other species that shade the southern plot in the main section of Hamilton (Figure 2a and Photo 2). There is also a clump of trees located on or next to the western border between GHI and the Hamilton Gardens; these trees shade the gardens and should be removed. This requires

a more specific determination of the exact location of the trees and the boundaries and may require coordination with GHI. There are also 2-4 trees in the Hamilton homestead area (not pictured) that are beginning to shade gardens in the main section of Hamilton. There are approximately five trees proposed for removal in the small southern section of Hamilton gardens (Figure 2b and Photo 3).

There are two trees in the area proposed to be reclaimed as garden plots, these are immediately to the north of the southeastern patch of Hamilton Gardens and south of the Hamilton Cemetery area. This is the only area that we propose to reclaim as open garden plots. This area is heavily infested with invasive plants - most notably Wisteria vines. These plants are a threat to the adjacent forest, as they could easily spread into uninfected areas. Reclaiming these areas as garden plots will eliminate this threat to the surrounding forest.

To the east of the main sections there is a former plot area that is proposed to be reclaimed and converted to forest garden or orchard (Figure 1, pink outlines). No trees would be removed from the cemetery area. Any removal of invasive species and ecological restoration would be done with due respect for the cemetery.

To the north we propose that all branches that overhang the 8-foot buffer be limbed up (Figure 1, red line).

Total trees to remove: ~25.

## Henry's Hollow

We propose that the city removes the row of trees that divides the two sections of Henry's Hollow (Figure 3, lavender box and text). This row shades a large portion of the west section of the garden area throughout the morning and shades the small eastern row of plots in the afternoon. We estimate that there are ~60 trees in this strip that are shading the gardens. Most of these are young red maples, elms, and other species. This strip of trees has grown in over the past forty years or so. This section would be converted to a food forest by replanting with native fruit-bearing trees and other native plants that can provide fiber or other useful products. This area would be managed by the garden club and would not be divided into plots.

We propose that the city removes all trees taller than 50 feet on the western edge of the large section of Henry's Hollow to a distance of 25' from the garden fence (if within the Forest Preserve, but not on adjoining GHI property) (Figure 3; blue box and text, and Photo 4). The area between Henry's Hollow and the GHI units to the west was once all garden plots. The row

of trees that is closest to the fence appears to be taller than the trees farther into the forest on this side of the plots. Removing the tall trees along the fence will allow more late afternoon sun to reach the plots. After removal this area should be restored with native shrubs, fruit trees and other small native trees that typically do not grow taller than 20' (dogwood, redbud, serviceberry, chokeberry). This area may be too small to actively manage as a forest garden, but it can be considered for that use. Restoration planting in this and other areas will consider drainage and may include minor reshaping to form berms, swales, or other features to appropriately manage rainfall run-off and prevent erosion.

We propose that the city removes one large red maple at the southwest corner of Henry's Hollow (Figure 3; pink circle, and Photo 5). This tree shades a significant portion of the southern plots. Growth of remaining trees in this area will be assessed as part of the next five-year review.

We propose to remove two large trees at the southeast corner of the large section of Henry's Hollow (Figure 3; pink circle, and Photo 6). These trees shade the southern plots during much of the day.

We propose to remove approximately 10-12 trees on the southern end of the eastern strip of plots and approximately 8-10 trees on the eastern edge of those plots (Figure 3; pink boxes, and Photos 7-9). These trees shade the southern plots during most of the day.

## Gardenway

The two sections of the Gardenway community garden plots are oriented nearly exactly on an east-west axis. The sections are separated by a wide strip of trees (60'-80') that runs between them. This strip shades a significant portion of the northern section. The forest on the southern section of plots is also close to the garden and shades many plots. The shading in both sections can be relieved by the removal of ~60 trees.

We propose that the city removes ~18 trees on the southern edge of the southern section of plots (Figure 4, red boxes, and Photos 10 and 11). This includes the willow oak that is adjacent to the fence line in the southeast corner. On the western edge of this section there is one tree that should be removed (Figure 4, orange circle) and two trees with large limbs that shade the plots, which need to be removed (Figure 4, green circles). See Photo 12.

FPAB and garden club members spent a significant amount of time thinking about how to manage the strip of trees between the two plot sections. After reviewing literature and

websites that describe the path of the sun, members calculated the height and distance that trees can be on the southern edge to eliminate shading on the plots to the north. FPAB and club members measured and marked these distances in the strip of trees and measured the heights of many of the trees. We designated two zones each with a different tree height limitation. In the zone that is 8 - 30' from the southern fence of the northern row of plots, tree canopies can reach no higher than 12' (at the northern edge of the zone) to 50' (at the very southern edge of the zone) to avoid shading the garden plots. Given that tree canopies within that zone tend to be either below 12' or above 50' in height, all trees above 50' in the 8 - 30' zone were marked for removal.

In the second zone, which is between 30' - 48' from the southern fence of the northern row of plots, tree canopies can reach no higher than 50' (at the northern edge of the zone) to 75' (at the very southern edge of the zone). Given that tree canopies within that zone tend to be either near 50' or near 75', all trees nearing 75' in height were marked for removal.

With these estimates we counted the number of trees in each zone that must be removed. In the 30' zone there are ~31 trees that are >50' tall. In the 30'-45' zone there are ~9 trees that are >75' tall. We propose to remove these trees. See Photos 13-16 for approximate locations of the trees that are proposed for removal. It should be noted that, in accordance with the forest garden concept, this will leave many shorter trees remaining in this section.

Finally, there is on small elm tree on the western edge of the northern section and one elm in the fence line. Both should be removed. The northern and eastern edges of the garden plots should be limbed up where there are overhanging branches.

## Future Stewardship of Garden Boundaries

This section discusses future management of border areas. It incorporates concepts, issues, and suggestions that arose in formulation of this plan and in the Forest Preserve Stewardship Guidelines. However, these topics have not been as thoroughly discussed as those in previous sections. Therefore, additional consideration and adjustment of these proposed arrangements may be useful.

The garden fences, as shown on current maps and remote imagery or as further specified in this plan, will define the permanent boundaries for the community gardens, subject to any future changes approved by the City Council.

The Garden Club will share in responsibility for continuing stewardship of the boundary areas beyond the mowed area, particularly in the first 25 feet from the garden fences and any areas affected by tree removal. Canopy growth will need to be controlled from time to time to limit shading and assure continued sunlight for gardens, managing the boundary areas as sloping "soft edges."

- The City will continue mowing a border of about 8 feet around the garden fences. The city will be responsible for removing tree limbs above the mown area, to the extent this is not done by the Garden Club.

- On a recurring five year basis, the garden club will assess shading of the gardens using the principles outlined in this proposal. Trees which prevent a 60° clear sky to the south or a 30° clear sky to the east or west will be considered for trimming or felling, if doing so would result in a significant improvement in sunlight to the gardens.

- Once the garden club has determined trees they would like to manage, this proposal will be passed to the FPAB for review. The FPAB will then pass the original proposal and any FPAB comments to the City Council for consideration. The Garden Club and the FPAB are encouraged to come to a consensus on the proposed actions, but this is not required.

- Management of border areas will be reviewed at five-year intervals by FPAB and the Garden Club. In addition to any proposed tree maintenance, they will review any other measures needed for continuing implementation of this plan. Any major revisions to this plan may be proposed to City Council for approval.

- The garden club may also remove any invasive species in the forest garden areas, as well as any invasive species within 25 feet of the gardens. Activities for control of invasive species will be done with involvement and supervision of people with suitable skills and experience in the identification and management of invasive species. In accordance with the relevant sections of the Forest Preserve Stewardship Guidelines regarding invasive species, the Garden Club would also be eligible to take part in management of invasive species and ecological restoration in areas further from the gardens.

- In the unlikely case that the gardens would cease to exist, the garden plots would remain a part of the Forest Preserve but would no longer be considered a "specially managed area."


Figure 1. Proposed tree removal and maintenance to alleviate shading at the edges of Hamilton Gardens and to restore several garden plot areas that have been abandoned since the Forest Preserve was created.

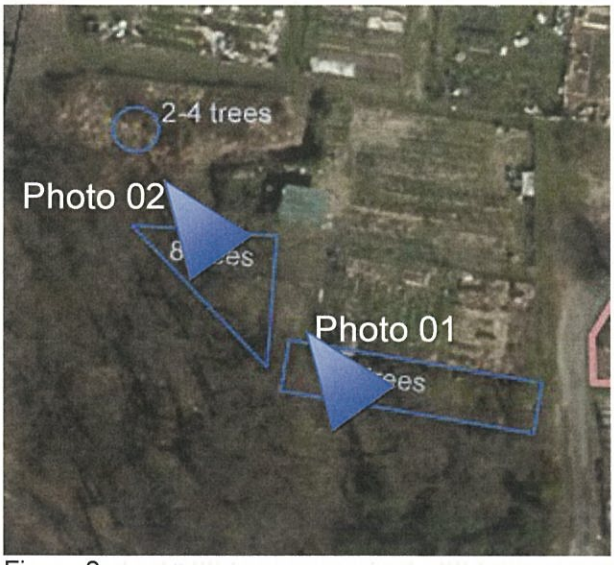



Figure 2a.


Figure 2b.

Figure 2. Two aerial images showing the location and approximate direction of Photos 1-3, which are below. The blue triangles show the approximate view of the photographs below.

Photo 1. The approximate locations of 7 trees proposed for removal.

Photo 2. The approximate locations of 8 trees proposed for removal.

Photo 3. Approximate locations of 5 trees proposed for removal on the south side of the small section of Hamilton gardens.

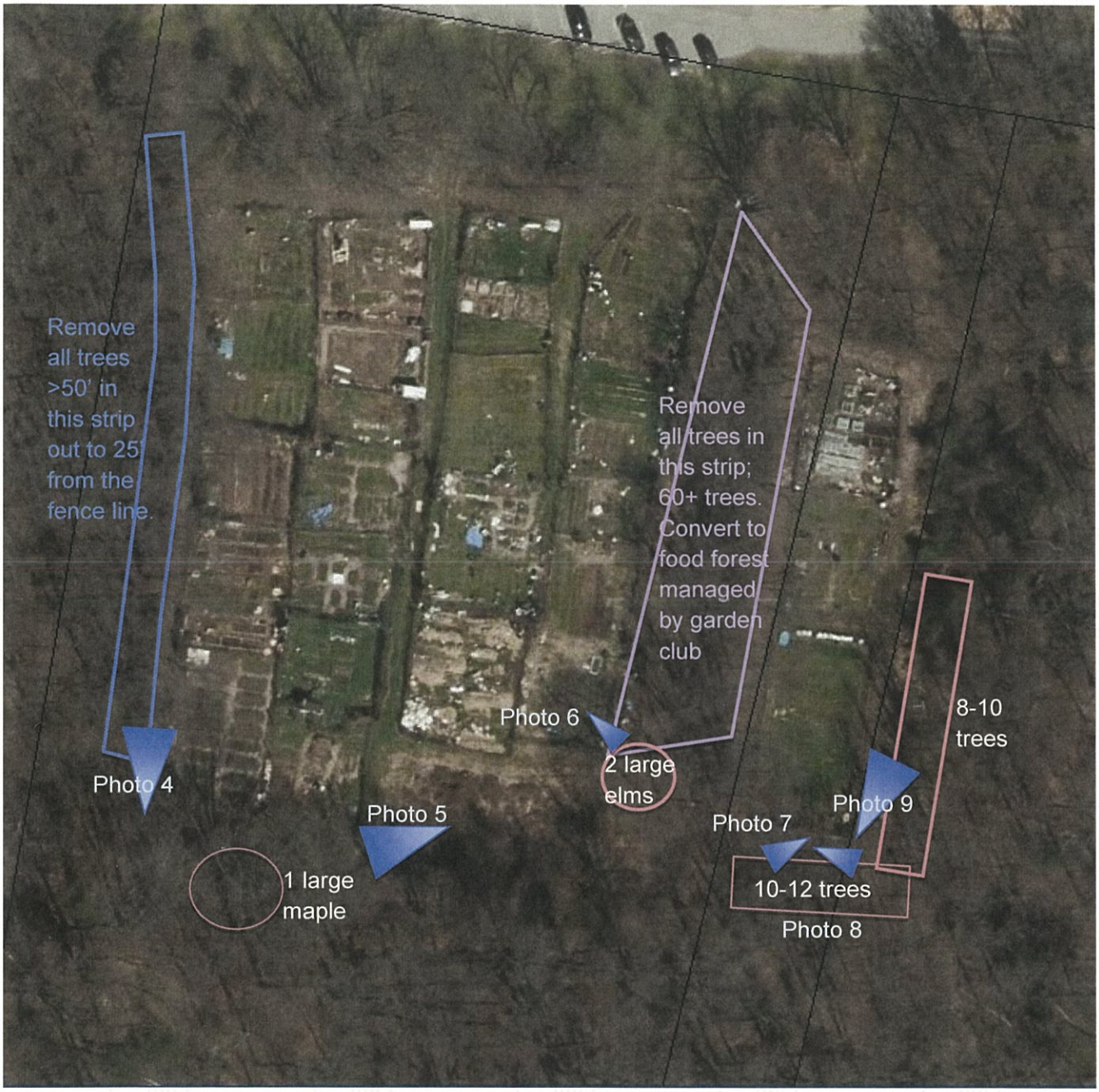



Figure 3. Proposed actions to alleviate shading of the garden plots in Henrys' Hollow.

Photo 4. West border of Henry's Hollow showing the strip of trees proposed for removal. All trees >50' tall and less than 25' from the fence are proposed for removal.

Photo 5. The large maple at the southern end of Henry's Hollow that is proposed for removal.

Photo 6. Two large trees at the SE corner of the large section of Henry's Hollow that are proposed for removal.

Photo 7. Six of the 10-12 trees proposed for removal at the southern end of the east part of Henry's Hollow.

Photo 8. 4-6 trees proposed for removal at the southern end of the east part of Henry's Hollow.

Photo 9. Eight to ten trees proposed for removal on the eastern border of the eastern part of Henry's Hollow.


Figure 4. Proposed actions to manage shading of the two Gardenway community garden plot sections. Blue triangles indicate the approximate view of the photos that are labeled. Photos are below.

Photo 10. Trees on the southwest corner and southern edge of the southern section of plots at Gardenway. Approximately 10 trees are marked and proposed for removal.

Photo 11. Trees along the southern edge and southeast corner of the southern section of plots at Gardenway. Approximately 8 trees are marked and proposed for removal, including the large willow oak next to the fence.

Photo 12. Three trees along the western edge of the southern Gardenway plot section.

Photo 13. Approximately 15 trees that are proposed for removal along the southern edge of the northern section of plots at Gardenway.

Photo 14. Trees in the strip between Gardenway sections. These trees are labelled in Photo 13.

Photo 15. Trees in the strip between Gardenway sections. These trees are labelled in Photo 13 and 16.

Photo 16. Trees in the strip between Gardenway sections that are proposed for removal.

# Appendix A: Shade Maps and Shading Analyses

Part 1 The Greenbelt Community Garden Club Shading Analysis from 2014
Part 2 Historic Aerials of the Garden Areas
Part 3 Shading Analysis using Solar Pathfinder

## The Greenbelt Community Garden Club Shading Analysis from 2014

- Key for Maps of Gardens
- Gardenway
- Hamilton Place
- Henry's Hollow

We have included maps showing the parts of the gardens that are most affected by shade. The general rule is that most traditional garden plants such as tomatoes, peppers and squash require at least 6 hours of direct sunlight per day.

- Gardenway 9 AM
- Gardenway 11 AM
- Gardenway 4 PM
- Hamilton Place 10 AM
- Hamilton Place Noon
- Henry's Hollow 9 AM
- Henry's Hollow Noon

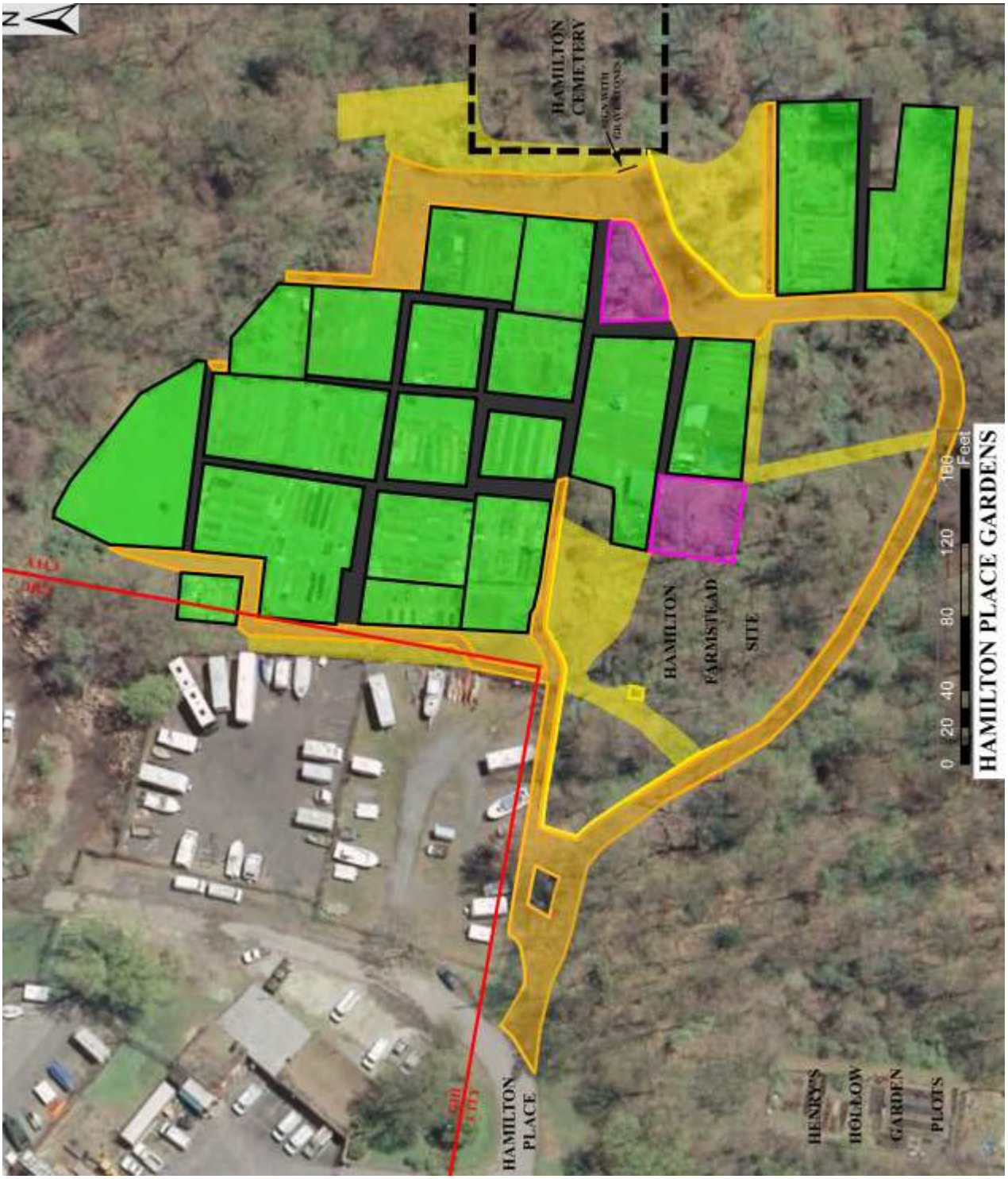
**Key for Maps of Gardens**


The base map is 2011 aerial photography downloaded from PGAtlas. Garden features and property lines are based on this aerial photograph along with 1984 Topo/Parcel maps prepared for GHI by Oyster, Imus, & Petzold, Inc. (available at ghi.coop/image-type/topo-parcel-sheet) and field measurements taken in 2012-2014 by J. Stabler, B. Fischler, and other volunteers.

**Gardenway**


GHI
CITY
GHI
CITY
GHI
CITY
CITY
NPS
GARDENWAY GARDENS
0 20 40 80 120 160
Feet
N

**Hamilton Place**

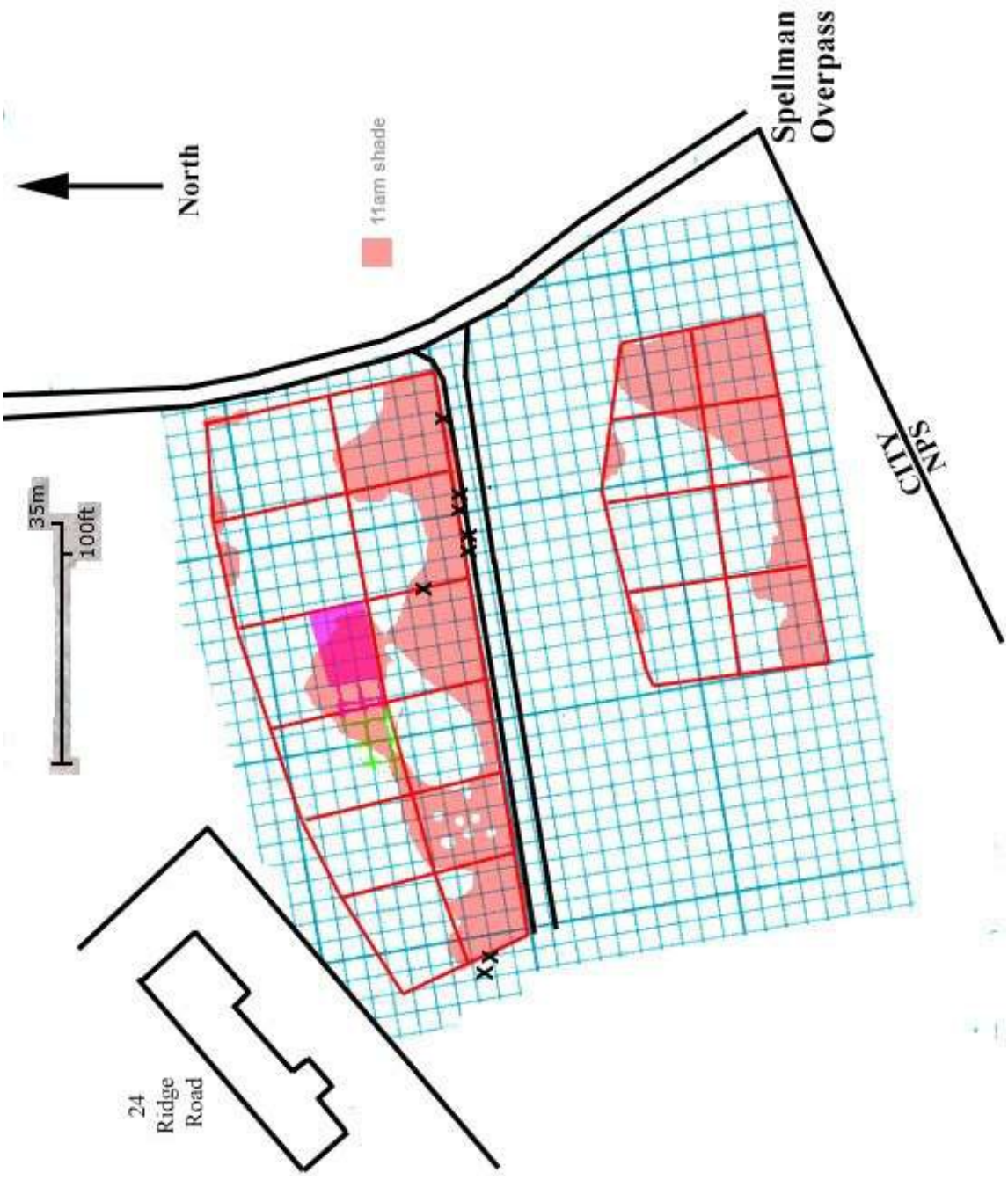


**Henry's Hollow**


HENRY'S HOLLOW GARDENS

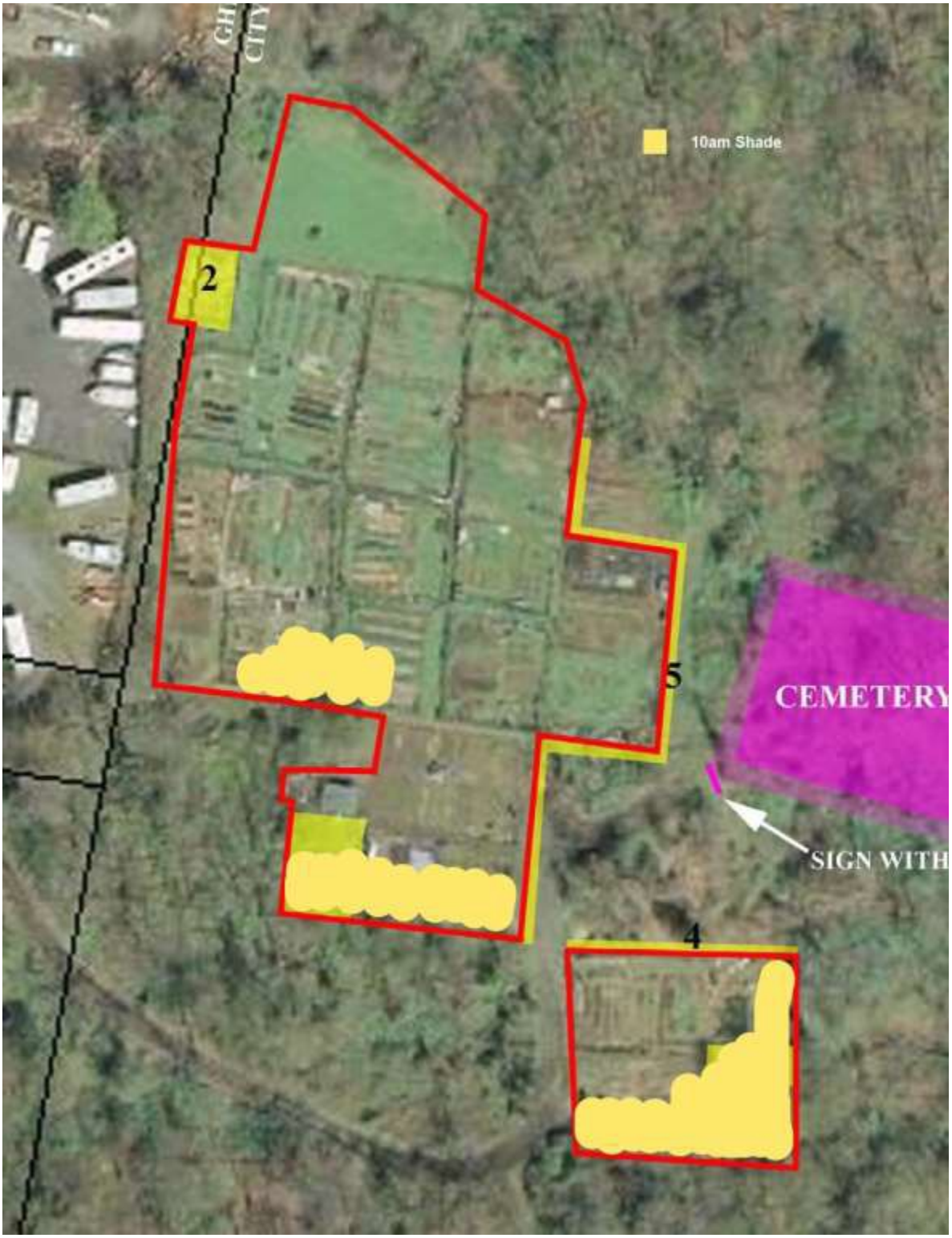
**Gardenway Map showing shade at 9 AM in Yellow**

**Gardenway Map showing shade at 11 AM in Light Pink**

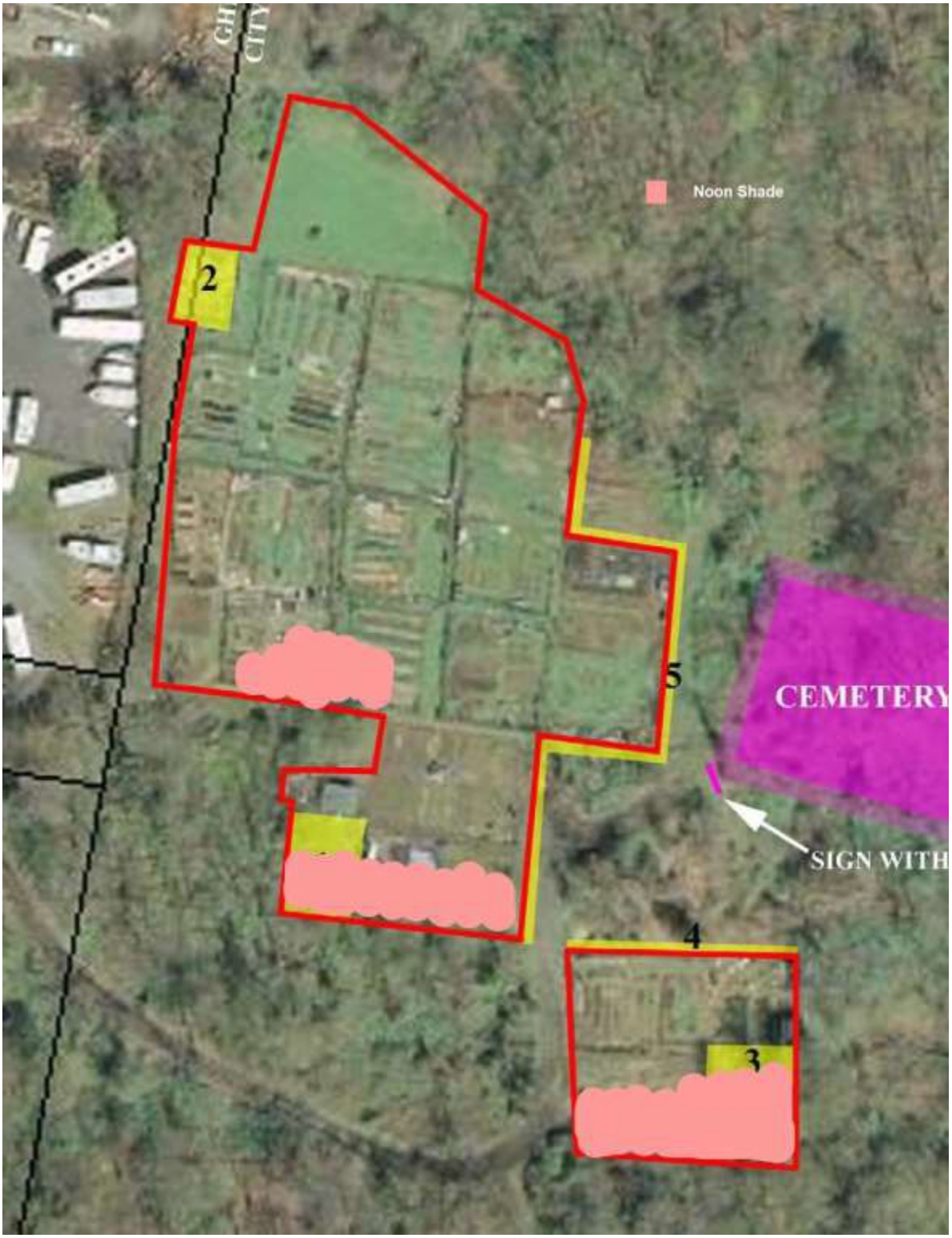


**Gardenway Map showing shade at 4 PM in Blue**

**Hamilton Place Map showing shade at 10 AM in Yellow**



**Hamilton Place Map showing shade at Noon in Pink**

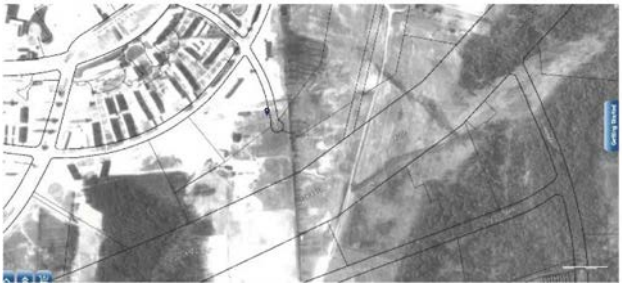


**Henry's Hollow Map showing shade at 9 AM in Yellow**

**Henry's Hollow Map showing shade at Noon in Pink**

# Historic Aerials of the Garden Areas

Photos below show how the garden areas have diminished over time and how trees and buildings have replaced gardens.



*Gardenway 1938*

*Gardenway 1965*


*Gardenway 1980*

*Gardenway 2020*


*Hamilton Place and Henry's Hollow 1938*

*Hamilton Place and Henry's Hollow 19*


*Hamilton Place and Henry's Hollow 1980*

*Hamilton Place and Henry's Hollow 2020*

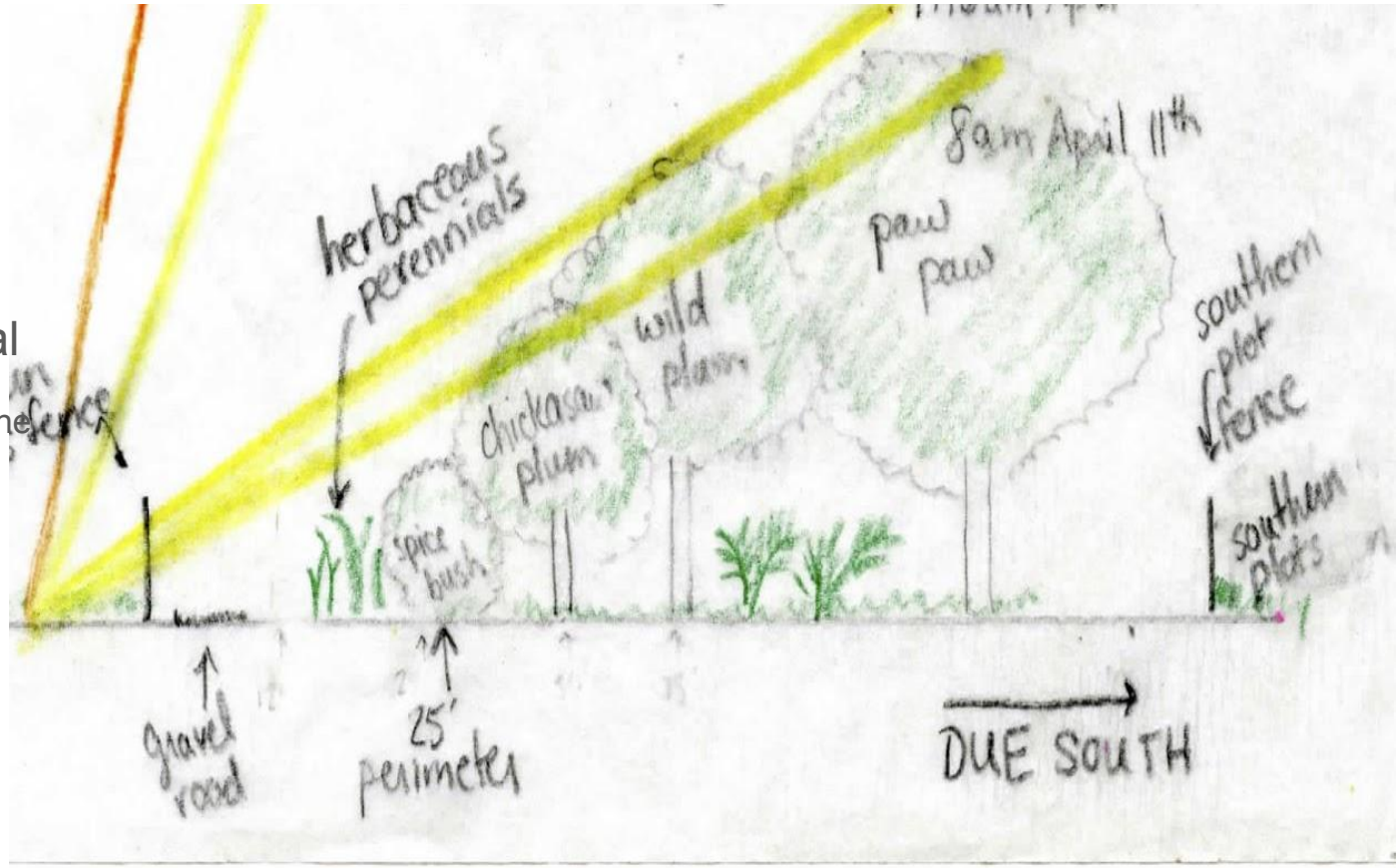
## Shading Analysis using Solar Pathfinder

# Shading Analysis

## Sunshine and Soft Edges for the Greenbelt Community Gardens

Analysis of tree canopy shading and potential impacts of the Detailed Garden Boundary Proposal

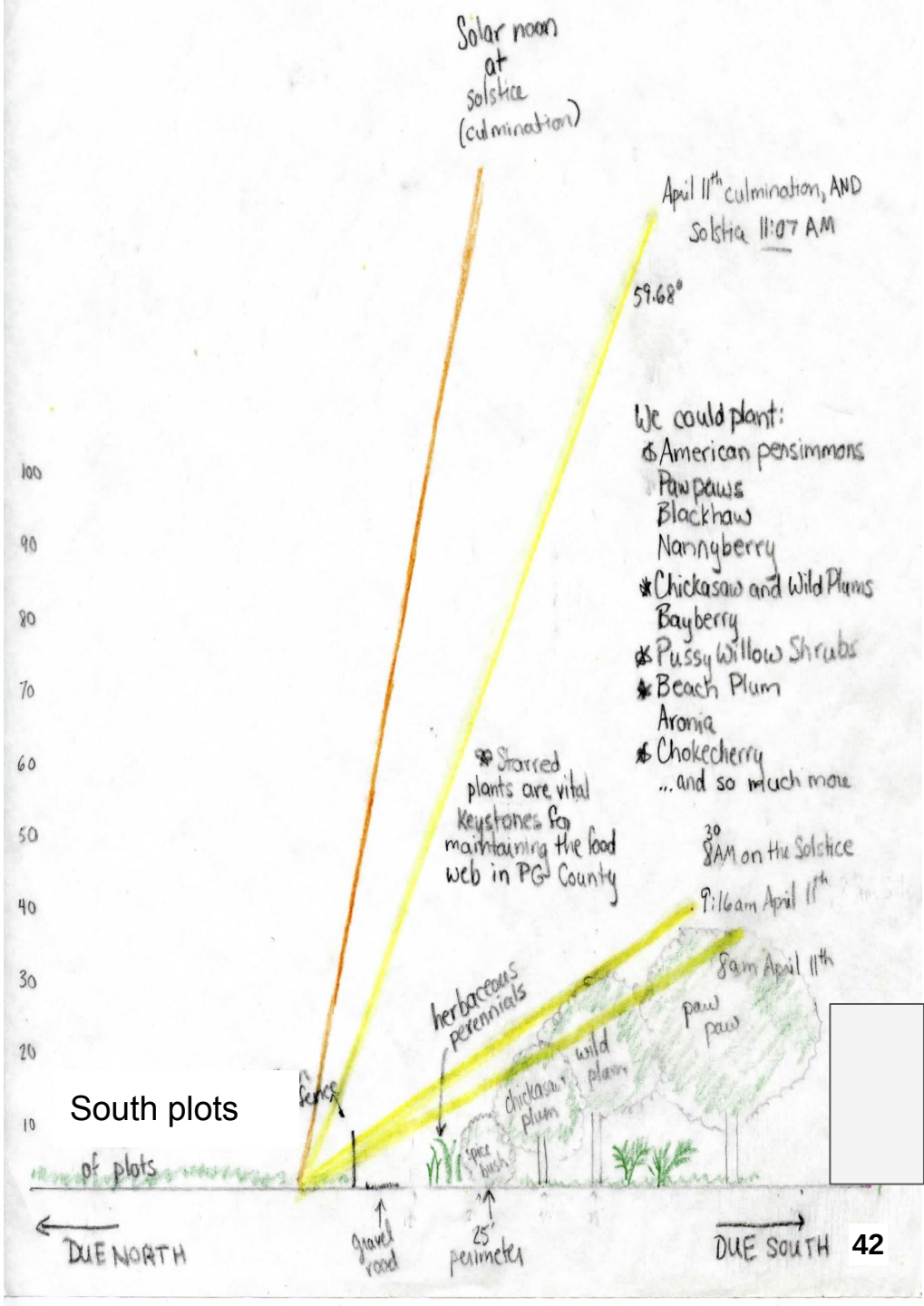
Prepared as an input for the planning of Community Garden borders in the Greenbelt City Forest Preserve



# A forest garden of native trees prevents shade and benefits the forest

One possible solution to shading of garden plots is to remove trees that shade the southern row of gardens and replace them with a diversity of short-statured native trees, shrubs, and herbaceous plants that will never cause shade problems, such as:

- Spice bush
- Chickasaw plums
- Wild plums
- Pawpaws



# Solar Pathfinder

A tool to objectively assess hours of direct sunlight at a given location throughout the 365 day year.

Use during winter months reveals increased hours of sun that could be gained by removing certain trees or branches.

“The Solar Pathfinder™ uses a highly polished, transparent, convex plastic dome to give a panoramic view of the entire site. All the trees, buildings or other obstacles to the sun are plainly visible as reflections on the surface of the dome. The sunpath diagram can be seen through the transparent dome at the same time”.

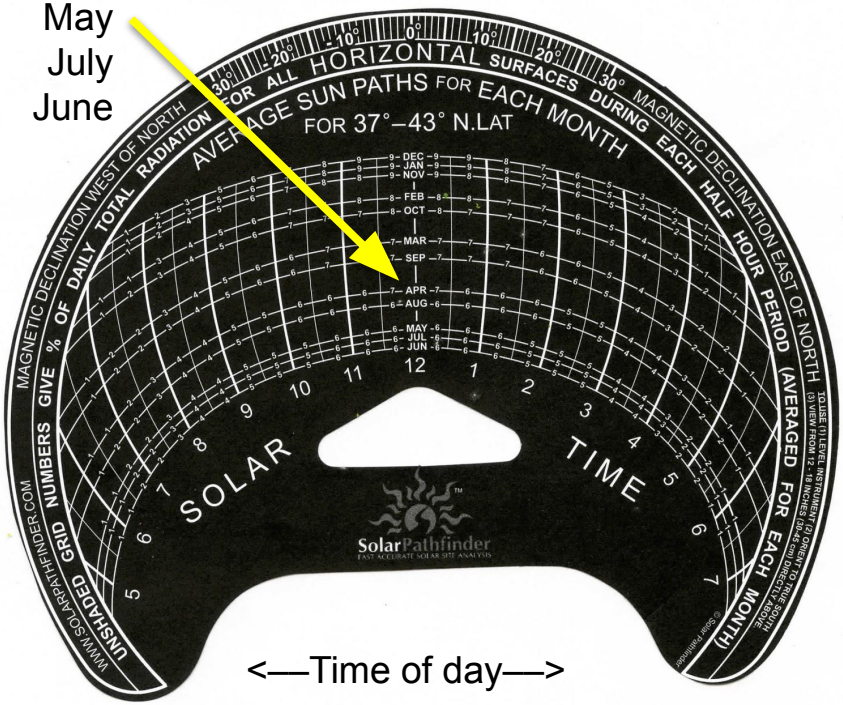
https://www.solarpathfinder.com

# How much sun?

- measure available sunshine throughout the year
- assess impact of proposed removal and limbing up of trees

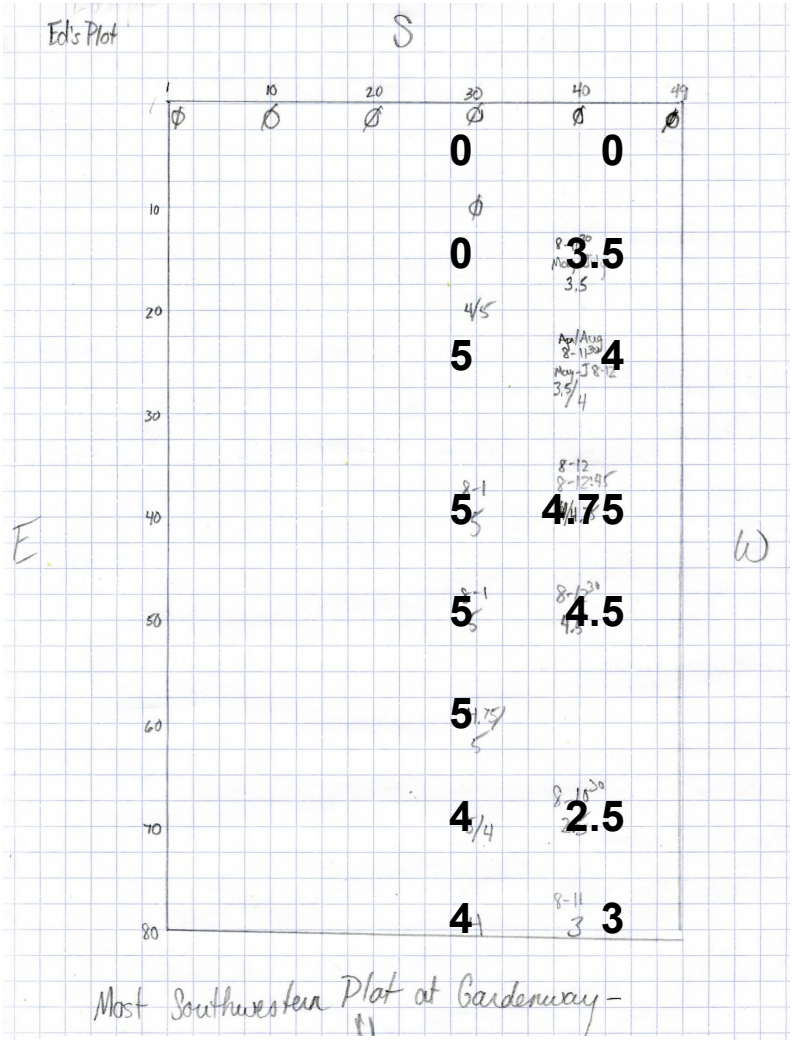
This location will receive sun only from 7am - 11am April - August

April
August
May
July
June

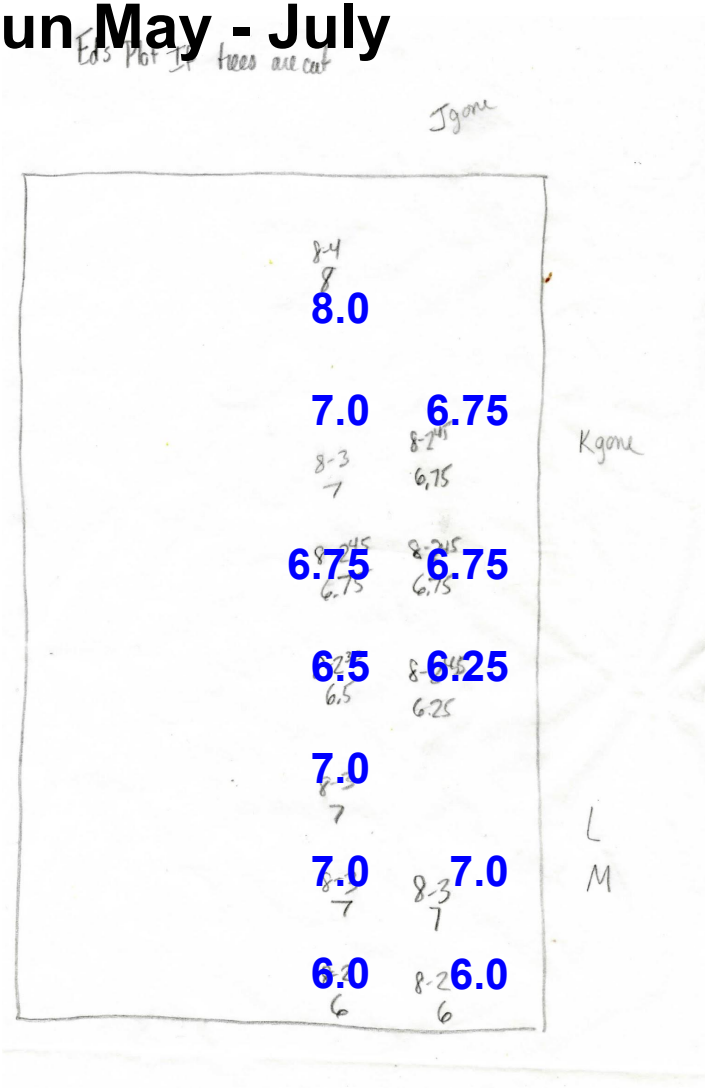



<—Time of day—>

# Solar Pathfinder data for the southwestern plot in Gardenway: Hours of sun May - July

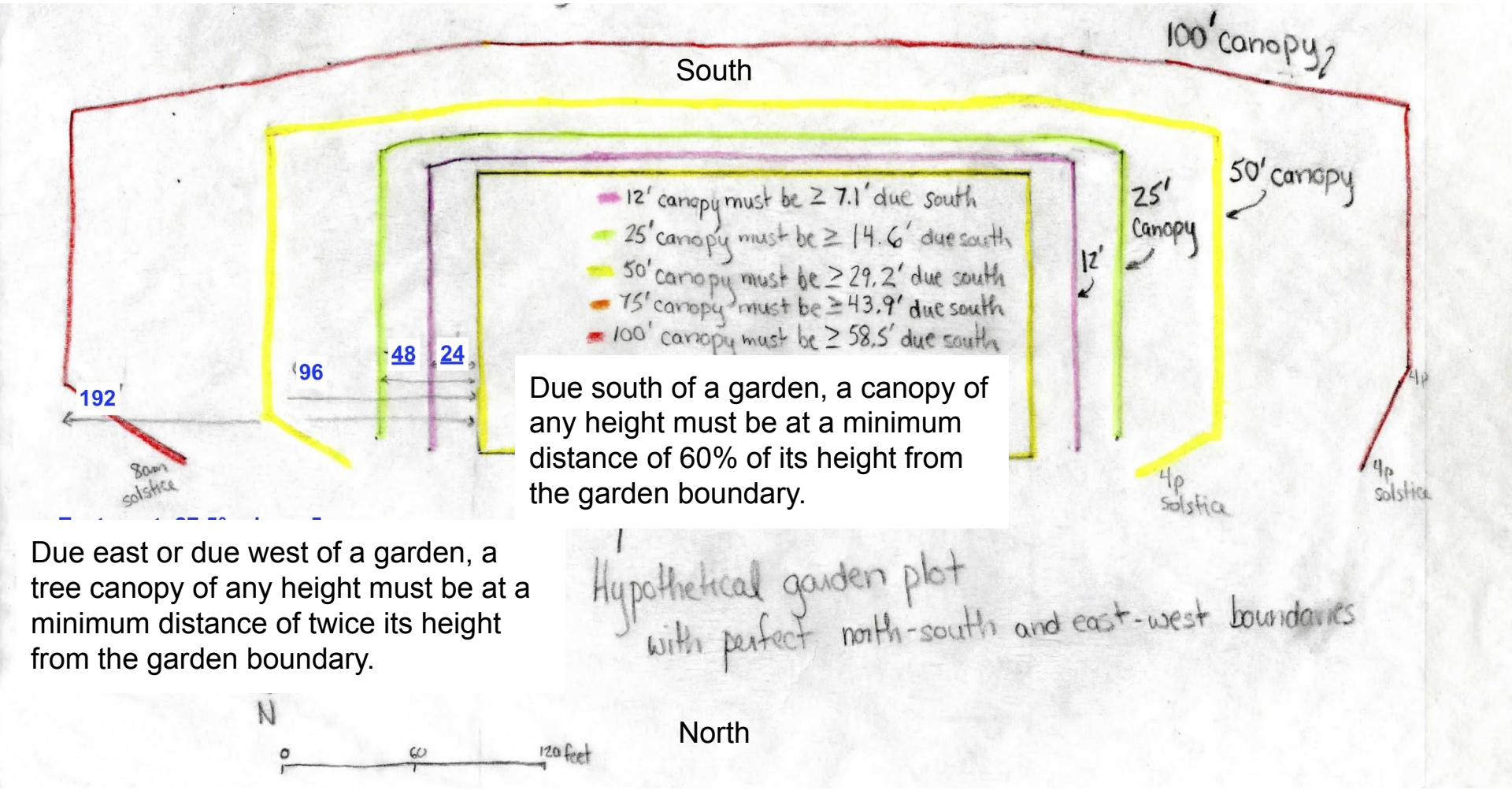



Very little vegetable cultivation can be done with current limited hours of sunshine




Cutting 2 trees & limbing up 2 more would dramatically increase hours of sunshine, making this a productive vegetable garden

# Hypothetical boundaries for 8 hours of sunshine April 11-Aug 31




To control canopy shading and assure enough sunshine for fruiting vegetables such as tomatoes, beans, squash, etc., soft edges to east and west would need to rise gradually, at about a 30° angle. Southern edges can rise more steeply, at about a 60° angle.

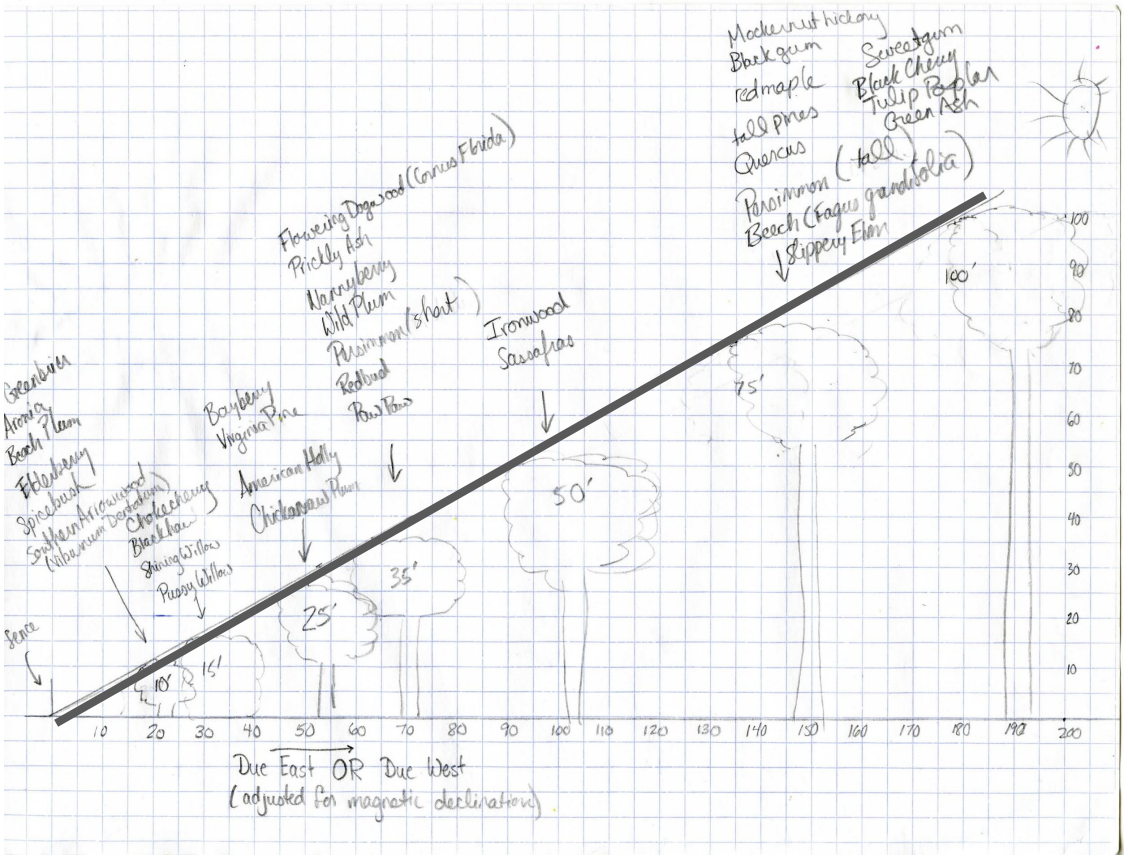
# Distance that tree canopies of varying heights must be from garden plots to avoid shading

| Canopy Height (ft) | Distance due south* from garden boundary (ft) | Distance due east or due west* from garden boundary (ft) |
|---|---|---|
| 15 | 9 | 27 |
| 25 | 15 | 45 |
| 35 | 21 | 62 |
| 45 | 26 | 80 |
| 55 | 32 | 98 |
| 65 | 38 | 116 |
| 75 | 44 | 133 |
| 85 | 50 | 151 |
| 95 | 56 | 169 |

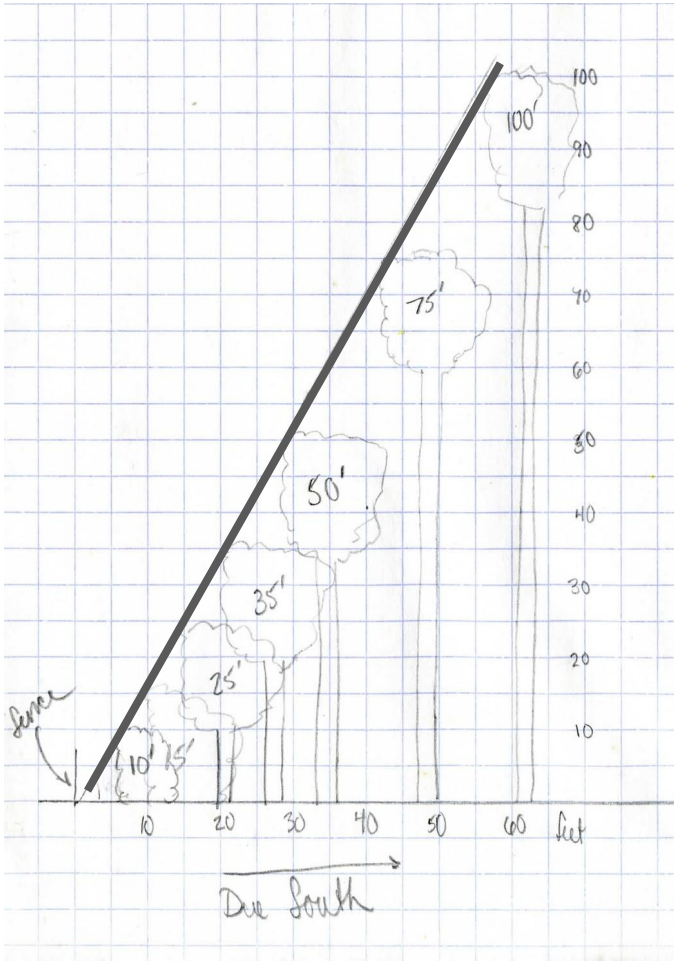
* All directions depend on appropriate adjustment for magnetic declination at this longitude of -10.1 degrees.

Note that these distances are easily calculated. A canopy of any height must be located at a distance 60% of its height due south of a garden boundary in order to avoid shading the garden. A canopy of any height must be located at a distance 1.8 times (or, rounding up, twice) its height due east or due west of a garden boundary in order to avoid shading the garden.

# Trees that shade can be replaced with shorter native trees




Profile for forest garden on east or west side




south side

## Appendix B: Invasive Species at the Forest Preserve Edges

Invasive plants significantly compromise the health of native trees and other plants in the Forest Preserve ecosystem.

Trees are stressed and eventually killed when invasive vines like Oriental bittersweet, English ivy, porcelain berry, and Japanese honeysuckle are allowed to climb and smother them. Invasive shrubs and grasses such as Amur honeysuckle, Privet species, multiflora rose, wavyleaf basketgrass, and Japanese stiltgrass crowd out native trees, shrubs, and herbaceous plants, and provide inferior nutrition and habitat to beneficial insects, birds, and mammals.

The presence of the invasive tree-of-heaven, which is a preferred host of the spotted lanternfly, now poses a threat to the health of the entire forest ecosystem due to the potential destructive effects of spotted lanternfly infestations. Removing tree-of-heaven prior to the arrival of the spotted lanternfly in this area is recommended to protect the health of forests in this region.[6]

- The decline of healthy native eastern forest ecosystems are a significant contributor to the precipitous decline in North American song bird populations. Many other valued wild animals are also insectivores, or rely upon a diet of animals that consume insects.

Bird populations depend upon insects that feed on native wildflowers, and upon berries and cover produced by native plants. Ninety-six percent of North American terrestrial birds rear their young on insects and arthropods. One pair of chickadees, for example, requires 6,240 – 9,120 caterpillars to rear one clutch of babies.[7] When native plants are overwhelmed and killed by invasive vines and displaced by exotic trees and shrubs, insect populations and other food sources decline, leading to the precipitous decline in songbird populations.[8]

For example, hedgerows invaded by invasive plants including privet, burning bush, porcelain berry, Oriental bittersweet, and bush honeysuckles in Maryland, Delaware, and Virginia have been shown to host five times fewer caterpillar species, and 22 times fewer caterpillars, than hedgerows consisting solely of native plants. That's 91% fewer caterpillars, with a loss of 96% of the caterpillars by weight![9] Birds feeding from non-native hedgerows therefore are forced to do 22 times more foraging work to feed themselves and their babies – and since this is impossible, the bird population shrinks to the tremendously diminished carrying capacity of the land from which they feed.[10]

In addition to loss of caterpillar production, invasive plants that produce berries compromise birds'

6 "Spotted Lanternfly Frequently Asked Questions" by H. Leach, PennState Extension, accessed October 21, 2020, https://extension.psu.edu/spotted-lanternfly-frequently-asked-questions.

7 Doug Tallamy, Urban Forestry 13: The Role of Urban Forests in Biodiversity Restoration, The National Academy of Sciences/National Research Council, presentation delivered February 2013, accessed November 18, 2020, https://www.youtube.com/watch?v=Ljqo3MNhDWE.

8 "Spotted Lanternfly Frequently Asked Questions" by H. Leach, PennState Extension, accessed October 21, 2020, https://extension.psu.edu/spotted-lanternfly-frequently-asked-questions.

9 Doug Tallamy, Nature's Best Hope, p. 111.

10 Doug Tallamy, Urban Forestry 13: The Role of Urban Forests in Biodiversity Restoration, The National Academy of Sciences/National Research Council, presentation delivered February 2013, accessed November 18, 2020, https://www.youtube.com/watch?v=Ljqo3MNhDWE.

capacity to survive the winter. Birds require fall berries for the fats they need during the cold months, whether they migrate south or overwinter in place. But berries produced by invasive plants such as bush and Japanese honeysuckle, multiflora rose, and common buckthorn contain less than 1% fat. In contrast, many native plants produce berries with nearly 50% fat content, such as Virginia creeper, wax myrtle, arrowwood viburnum, spicebush, poison ivy, and gray dogwood.[11]

Since 1970, bird populations have declined in North America by nearly 30%, with a 14% decline in migrating birds seen in the eastern U.S in the past decade. Nearly two-thirds of bird species that breed in eastern forests are in decline, with a 17% overall loss in these bird populations since 1970 (Rosenberg et al., 2019).

In addition to birds, many other creatures rely upon insects as a crucial food source. Spiders, frogs, toads, salamanders, lizards, freshwater fish, bats, foxes, skunks, opossums, and bears are insectivores.[12]

- The beauty of the forest is lessened when invasive vines, Japanese stiltgrass, and wavyleaf basketgrass smother or displace native plants, including spring ephemeral wildflowers.[13]

In addition to altering the current beauty of the forest, dense stands of Japanese stiltgrass and other invasives form such dense, low shade on the forest floor that they prevent the germination and growth of tree seeds. A Japanese stiltgrass monoculture on a forest floor will eventually convert that forested area to an open, unforested Japanese stiltgrass meadow, as mature trees die and are not replaced by saplings.

- Gardeners rely on native pollinators and other beneficial insects for vegetable production. As wild native plants are lost to invasive plants in the forest edges surrounding the Community Gardens, beneficial insects decline and disappear.[14]

"Most insects can develop and reproduce only on the plants with which they share an evolutionary history."[15] Ninety percent of insect herbivores are plant specialists, meaning that they can survive only by eating plants in three or fewer families. As Doug Tallamy, a respected researcher at University of Delaware, explains,

"If we build our urban forests out of a hodgepodge of plants from someplace else, we're going to lose 90% of the insect herbivores that are the basis of the food webs that could be maintained in those settings."[16]

- Removing invasive plants from edge areas and replacing them with native species can protect the forest ecosystem far beyond the edge areas.

---

11 Doug Tallamy, Nature's Best Hope, p. 117.

12 Doug Tallamy, Urban Forestry 13: The Role of Urban Forests in Biodiversity Restoration, The National Academy of Sciences/National Research Council, presentation delivered February 2013, accessed November 18, 2020, https://www.youtube.com/watch?v=Ljqo3MNhDWE.

13 "Spotted Lanternfly Frequently Asked Questions" by H. Leach, PennState Extension, accessed October 21, 2020, https://extension.psu.edu/spotted-lanternfly-frequently-asked-questions.

14 "Introduction to Invasive Plants," University of Maryland Extension, accessed October 21, 2020, https://extension.umd.edu/hgic/topics/introduction-invasive-plants.

15 Ehrlich & Raven (1964), as cited by Doug Tallamy, Urban Forestry 13: The Role of Urban Forests in Biodiversity Restoration, The National Academy of Sciences/National Research Council, presentation delivered February 2013, accessed November 18, 2020, https://www.youtube.com/watch?v=Ljqo3MNhDWE.

16 Doug Tallamy, Urban Forestry 13: The Role of Urban Forests in Biodiversity Restoration, The National Academy of Sciences/National Research Council, presentation delivered February 2013, accessed November 18, 2020, https://www.youtube.com/watch?v=Ljqo3MNhDWE.

Invasive plants tend to enter the forest ecosystem from forest edges. Replacing invasive exotic plants with native plants at the forest edges benefits both the native plants and insects, birds, and other animals at those forest edges and far into the forest, as habitat is preserved and protected from incursion by invasive plants.

The health of the Greenbelt Forest Preserve ecosystem is compromised by many invasive species, and particularly so in the forest tracts surrounding the Community Gardens. Some of the invasive plants that are most prevalent and problematic in the 25' buffers surrounding the three Community Garden areas are listed below. Discussion of selected plants is presented in depth.

## Section 1. Invasive Trees

### Tree-of-Heaven (Ailanthus altissima) and the Spotted Lanterfly

### Tree-of-Heaven and Spotted Lanternfly: Threats to the forest ecosystem

Tree-of-Heaven is a fast growing tree native to China with a mature height of 100 feet and a diameter of six feet.[17] Tree-of-Heaven spreads by root suckering and seed distribution, and forms clonal groves that can spread over large areas.[18] It provides little value for wildlife, and prevents growth of native trees or shrubs from growing by producing a natural herbicide that is toxic to many other plants.[19]

In addition to out-competing native trees and herbaceous plants, tree-of-heaven is the preferred host for the spotted lanternfly. The lanternfly is an invasive insect native to Asia that is expected to pose a major threat to Maryland forests if it spreads throughout the state.

Hardwood forests are expected to be at high risk of damage by the spotted lanternfly.[20] "Once established in an area, SLF has the potential to dramatically affect forest ecosystems, agricultural production, and cultural resources," writes Dorothy Borowy of the National Park Service.[21]

The spotted lanternfly has been found in Cecil, Harford, and Washington Counties in Maryland, as well as in Pennsylvania, New Jersey, Virginia, and West Virginia.[22] The Maryland Department of Agriculture issued a quarantine in October 2019 for all materials that may contain the lanternfly in Cecil and Harford Counties.[23]

The adult lanternfly prefers a tree-of-heaven host, but can also feed on and damage over 70 other trees, plants

17 "Spotted Lanternfly Management for Residents," PennState Extension, last modified August 4, 2020, https://extension.psu.edu/spotted-lanternfly-management-for-residents.

18 "Invasive Species of Concern in Maryland: Terrestrial Plants," The Maryland Invasive Species Council, accessed October 21, 2020, http://mdinvasives.org/archive/species/terrestrial_plants/Tree_of_Heaven.html.

19 "Tree-of-Heaven is Really Stinking Tree-from-Hell," The Maryland Invasive Species Council, last updated September 1, 2007, http://www.mdinvasivesp.org/iotm/sept-2007/.

20 Samantha Hogan, "Foresters prepare public for arrival of spotted lanternfly," The Frederick News-Post, December 12, 2018, https://www.fredericknewspost.com/news/environment/foresters-prepare-public-for-arrival-of-spotted-lanternfly/article_fdbac4ab-054d-57fd-825f-f28a6597e9f4.html.

21 "Spotted Lanternfly 101," National Park Service, accessed October 21, 2020, https://www.nps.gov/articles/spotted-lanternfly-101.htm.

22 "Spotted Lanternfly," University of Maryland Extension, accessed October 21, 2020, https://extension.umd.edu/hgic/topics/spotted-lanternfly.

23 Lillian Reed, "Two Maryland counties under quarantine amid spotted lanternfly invasion," Baltimore Sun, October 29, 2019, https://www.baltimoresun.com/news/environment/bs-md-spotted-lanterfly-20191028-20191028-sfyiwny42zfepbn6ays77qypc4-story.html.

and crops including:[24]

- apple/crabapple, beech, birch, cherry, dogwood, linden, peach, sassafras, sycamore, black walnut, willow, maple, plum, poplar, pine, hickory, and oak trees
- blueberry and serviceberry shrubs
- grapevines
- basil, cucumber, and horseradish plants

The lanternfly poses "potentially devastating effects" on the agricultural and lumber industries in Maryland.[25] The nymphs and adults suck fluids from stems and leaves, resulting in stunted growth, reduced yields, and even death of plants. Serious damage in trees includes oozing sap, wilting and curling of leaves, and dieback.[26] The lanternfly secretes honeydew as it feeds, attracting ants, wasps, and other insects. The honeydew provides necessary conditions for growth of sooty mold, which blackens plants and prevents photosynthesis. The increased stress of honeydew and sooty mold on trees, along with feeding by lanternflies, is causing mature trees in forests to die, including young trees that are unable to withstand the stresses to regenerate the forests.[27]

In southeastern Pennsylvania, where spotted lanternfly is well established, lanternfly infestations are killing sapling trees, sumac, grapevines, and tree-of-heaven. Canopy dieback and declines in the health of forests, particularly in the lanternflies' preferred trees including black walnut and maple, are being observed. Sooty mold is killing groundcover plants, particularly below infested trees.[28]

"In counties infested and quarantined for this bug, residents have reported hundreds that affect their quality of life and ability to enjoy the outdoors during the spring and summer months. They will cover trees, swarm in the air and their honeydew can coat decks and outside toys."[29]

Countering the Threats posed by Tree-of-Heaven and the approach of the Spotted Lanternfly

The U.S. Department of Agriculture (USDA) and the PennState Extension Service recommends that tree-of-heaven be removed to avoid attracting the spotted lanternfly.[30],[31] The Maryland Department of Agriculture is working with the USDA to suppress lanternfly infestations in Cecil and Harford Counties by treating tree-of-heaven hosts with herbicides and insecticides.[32]

Removing tree-of-heaven is difficult, as it spreads aggressively by root suckers once a trunk has been cut or

---

24 "Spotted Lanternfly Treatments Begin in Cecil and Harford Counties," Maryland Department of Agriculture, accessed October 21, 2020, https://news.maryland.gov/mda/press-release/2019/09/09/spotted-lanternfly-treatments-begin-in-cecil-and-harford-counties/.

25 Ibid.

26 Natasha Matteliano, "Spotted Lanternfly Poses Risks," The Post-Journal, September 22, 2020, https://www.post-journal.com/news/local-news/2020/09/spotted-lanternfly-poses-risks/,

27 Tim Weigle, "Spotted Lanternfly: Understanding its Ecology and the Threat," Cornell Cooperative Extension webinar filmed October 17, 2019. Posted October 2019. https://www.youtube.com/watch?v=qlYWS7arsPE.

28 From https://extension.psu.edu/spotted-lanternfly-frequently-asked-questions, retrieved 10/21/20

29 Natasha Matteliano, "Spotted Lanternfly Poses Risks," The Post-Journal, September 22, 2020, https://www.post-journal.com/news/local-news/2020/09/spotted-lanternfly-poses-risks/,

30 "Businesses Can Help Stop the Spotted Lanternfly," U.S. Department of Agriculture Animal and Plant Health Inspection Service, accessed October 21, 2020, https://www.aphis.usda.gov/aphis/resources/pests-diseases/hungry-pests/slfbiz/slf-business-page.

31 "Spotted Lanternfly Management for Residents," PennState Extension, last modified August 4, 2020, https://extension.psu.edu/spotted-lanternfly-management-for-residents.

32 "Spotted Lanternfly Treatments Begin in Cecil and Harford Counties," Maryland Department of Agriculture, accessed October 21, 2020, https://news.maryland.gov/mda/press-release/2019/09/09/spotted-lanternfly-treatments-begin-in-cecil-and-harford-counties/.

girdled. The roots will send up hundreds of root suckers that can grow up to 6' per year. When a tree-of-heaven is cut, the stump will re-sprout, growing at a rate of 10-15 feet per year. To decrease the vigor of sprouts and suckers, tree-of-heaven should be cut in June and early July, to minimize the reservoir of stored energy in the roots. The trees should be cut down while they are young. Ideally, sprouts and suckers would be cut once per week for the next 2-3 years to eliminate the trees.[33]

Section 2. Invasive Shrubs

Amur honeysuckle (Lonicera maackii)

Amur honeysuckle bushes create dense thickets that exclude native plants and increase populations of lone star ticks.34 Amur honeysuckle is allelopathic, meaning that it secretes chemicals that inhibit the growth of other plants. It was declared a Tier 1 invasive plant in Maryland in 2018.

Amur honeysuckle flowers in early spring before many native shrubs. Seeds are dispersed over long distances by birds and deer.

Plants including native Trumpet honeysuckle (Lonicera sempervirens) and black chokeberry (Aronia melanocarpa) provide pollinators, birds, and other animals with sustenance, filling similar ecological niches as Amur honeysuckle.

Burning bush/winged euonymous (Euonymous alatus)

Japanese barberry (Berberis thunbergii)

Multiflora Rose (Rosa multiflora)

Multiflora rose was widely planted in eastern states by the 1930's, having been advocated for erosion control, wildlife habitat, and hedgerows by the USDA Soil Conservation Service. Virtually no predators feed on this plant. Leaves emerge earlier than on most native plants, and fall later in the fall. Multiflora rose forms impenetrable thickets, excluding native plant species.

Individual plants can produce up to 500,000 seeds annually. Seeds deposited in the soil bank stay viable for 10 – 20 years. Seeds are dispersed by birds over long distances, although most fall close to the parent plant.[35]

Multiflora rose flowers in May – June, and fruits in August. Fruits persist into the winter months. Multiflora rose provides food for song birds and cover for rabbits and birds. The hips are particularly enjoyed by cedar waxwings and American robins. Leaves and hips are consumed by chipmunks, white tailed deer, opossums, and mice.[36]

Multiflora rose can be replaced with shrubs such as common elderberry and black chokeberry, which are much

33 Philip Pannill, "Tree of Heaven Control," Maryland Department of Natural Resources – Forest Service, last updated October 2000, http://mdinvasives.org/archive/species/uploadpdf/Tree_of_Heaven_Control_Pannill.pdf.

34 "Exotic Bush Honeysuckles," University of Maryland Extension, accessed October 25, 2020, https://extension.umd.edu/hgic/topics/exotic-bush-honeysuckles.

35 Bruce Wenning, "Multiflora Rose: An Exotic Invasive Plant Fact Sheet,"Ecological Landscape Alliance, last updated July 2012, https://www.ecolandscaping.org/07/landscape-challenges/invasive-plants/multiflora-rose-an-exotic-invasive-plant-fact-sheet.

36 Gregory Munger,, "Rosa multiflora," Fire Effects Information System, [U.S. Department of Agriculture, last updated 2002, https://www.fs.fed.us/database/feis/plants/shrub/rosmul/all.html.

more prolific sources of flowers for pollinators and food for song birds and other animals. Common elderberry (Sambucus canadensis) flowers in May-June, and produces huge clusters of berries in August. Many birds enjoy elderberries, including cedar waxwings[37] and American robins.[38] Black chokeberry (Aronia melanocarpa) flowers in spring and produces fruit in mid to late summer. Fruits can persist into the winter and serve as a food source for birds and other animals.[39]

Privet (Ligustrum species)

Wineberry (Rubus phoenicolasius)

Section 3. Invasive Vines

Invasive vines block light needed by native wildflowers and other plants. When wildflowers are lost, insects are lost. Without insects, bird populations decline.

English ivy (Hedera helix)

"Dense foliage blocks sunlight and restricts growth of other plants. Heavy vines cause damage and death to mature trees by loosening the bark and holding moisture against the trunk, making a good environment for fungal disease and decay. Heavy vines can take trees down in wind, snow, and icy conditions. English ivy also serves as reservoir for bacterial leaf scorch, a disease in maples, oaks, and elms." (https://extension.umd.edu/hgic/topics/english-ivy)

Ground ivy (Glechoma hederacea)

Japanese honeysuckle (Lonicera japonica)

Mile-a-minute Vine (Polygonum perfoliatum)

Mile-a-minute vine can grow 25' per season, and rapidly smothers native plants. Mile-a-minute vines kill insects by ensnaring them them in prickles.[40]

Oriental bittersweet (Celastrus orbiculatus)

Oriental bittersweet vines strangle, smother, and pull down trees. It is a potential host for the spotted lanternfly, and should be removed to withdraw support for the lanternfly.[41] Oriental bittersweet has orange berries all along the branch. Roots will sucker.

Porcelain berry (Ampelopsis brevipedunculata)

Porcelain berry vine climbs and smothers shrubs and trees.

37 M. Stevens, "Plant Guide for Common Elderberry," USDA Natural Resources Conservation Service, 2001, accessed October 25, 2020, https://plants.usda.gov/plantguide/pdf/cs_sanic4.pdf.
38 "American Robin (Turdus migratorius)," Maryland Department of Natural Resources, accessed October 25, 2020, https://dnr.maryland.gov/wildlife/Pages/plants_wildlife/American_Robin.aspx.
39 "Black chokeberry," University of Minnesot Extension, accessed October 25, 2020, https://extension.umn.edu/trees-and-shrubs/black-chokeberry.
40 Ibid.
41 "Spotted Lanternfly Management for Residents," PennState Extension, last modified August 4, 2020, https://extension.psu.edu/spotted-lanternfly-management-for-residents.

Sweet autumn clematis (Clematis terniflora)

Vinca/Periwinkle (Vinca minor)

Wisteria (Wisteria sinensis, W. floribunda)

Wintercreeper (Euonymous fortunei)

Section 4. Invasive herbaceous plants

Garlic mustard (Alliaria petiolata, A. officinalis)

Ground ivy (Glechoma hederacea)

Japanese stiltgrass (Microstegium vimineum)
Hand pull or cut in late summer, prior to fall seed production.

Lesser celandine (Ranunculus ficaria)

Mugwort (Artemisia vulgaris)

Wavyleaf Basketgrass (Oplismenus undulatifolius)

## Appendix C: Forest Gardens in the forest buffer

A native forest garden is a carefully designed ecosystem of perennial plants that provides food, fiber, fertilizer, medicinal plants, and more while hosting thriving native pollinators and other beneficial insects, as well as providing habitat and sustenance for birds and mammals. Forest gardens are planted in polycultures, meaning that a large diversity of plants (including trees, shrubs, vines, and herbaceous plants) are grouped together in ways that fill all available ecosystem niches. Each plant is selected to fill multiple functions that contribute to the health of the whole ecosystem.

Many books have been written about forest gardening, and a selection is listed in the References section.

Thriving local examples of well-maintained forest gardens can be seen on a large scale at Forested in Bowie and on a small scale at Hyattsville's Emerson Street Forest Garden.

Rather than offering a manicured landscape, a native forest garden is composed of a selection of the diversity of native plants that might have otherwise been present in the absence of invasive exotic plants, a soil seed bank that had not been disrupted by hundreds of years of farming, and the current overpopulation of white tailed deer.

In order to demonstrate the forest garden concept, proposed plantings along a portion of the perimeters of the Gardenway Community Gardens are presented below. This forest garden design is offered as an example of the types of plantings that are proposed within the 25' buffers of all the Community Garden perimeters. The proposed forest garden design necessarily uses only a subset of the native trees, shrubs, vines, and herbaceous plants that could be useful in the various microclimates of the Community Garden buffers. A more inclusive list of useful native plants is included in Appendix III.

Example Forest Garden of the Gardenway Community Garden Buffers

The Gardenway section of the Community Gardens consists of two areas of plots divided by a forested strip of trees that have grown in a previously gardened area. The plan presented here is for the southern row of plots, which is surrounded on all four sides by forest.

The proposed guilds, groups of plants, for forest garden plantings to surround the Gardenway gardens are composed of trees, shrubs, forbs, and flowers that will provide sustenance to native pollinators, other beneficial insects, birds, other wildlife, and human visitors. These guilds are designed to beneficially occupy all of the ecological niches in the 25' buffers, holding the space previously occupied by harmful invasive plants.

The sketch on the following page details the plan. It is presented to scale. For ease of understanding, most of the current standing trees are not detailed in the sketch. The following native shade-tolerant plants are proposed to replace the current invasives, as detailed in the sketch:

Trees:

- Paw Paw
- Chickasaw Plum Shrubs:
- Common elderberry
- Black chokeberry
- Clove currant
- New Jersey Tea

Groundcovers:

- Partridgeberry
- Honewort
- Toothwort
- Green and Gold

Flowers, bunchgrasses, and ferns:

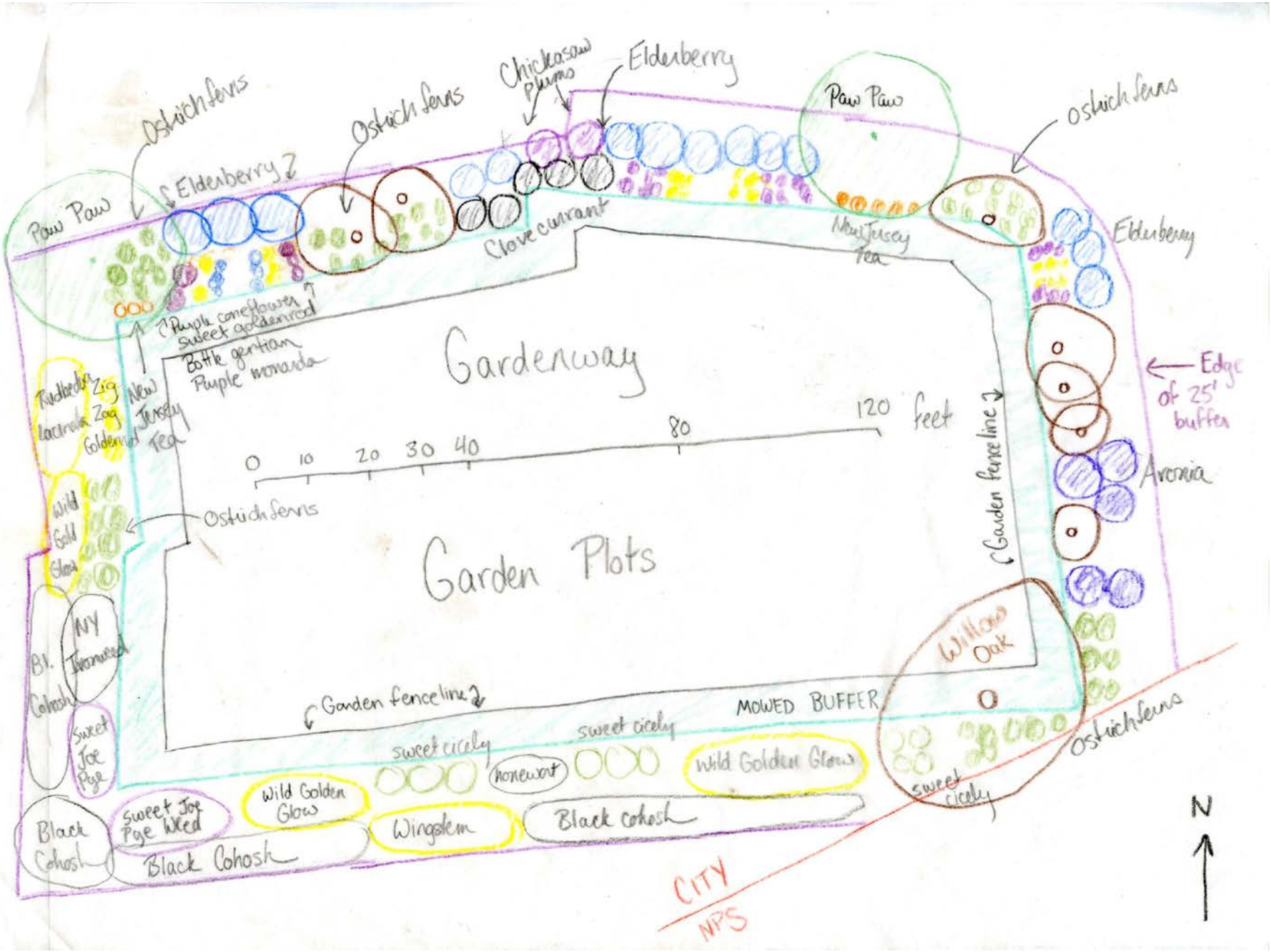
- Purple coneflower
- Sweet goldenrod
- Bottle gentian
- Spotted Beebalm and Wild Beebalm
- Zig Zag Goldenrod
- Wild Golden Glow
- Wingstem
- Black Cohosh
- Sweet Joe Pye Weed
- Boneset
- New York Ironweed
- Ostrich ferns
- Sweet cicely

The forest garden plantings will be maintained with the health of the forest ecosystem – rather than culturally derived aesthetic sensibilities – as a paramount guide. This means, for example, that bunchgrasses and flower stalks will remain standing throughout the winters in order to provide overwintering habitat for beneficial insects.

The forest garden guilds are deliberately designed to simultaneously support the thriving of the soil, insects, plants, mycorrhizal fungi, and animals that we recognize as comprising the forest ecosystem, as well as the human animals who tend these forest edges. We recognize that, as Robin Wall Kimmerer writes, “all flourishing is mutual.”* When Greenbelt residents directly benefit from tending the forest edges that provide sustenance and medicine to us as well as our more than human relatives, the thriving of the native plants that comprise these edges will be better assured.

---

- Robin Wall Kimmerer, Braiding Sweetgrass, p. 21.


Ostrich ferns
Chickasaw plums
Elderberry
Paw Paw
Ostrich ferns
Ostrich ferns
Elderberry 2
Paw Paw
Clove currant
New Jersey Tea
Elderberry
Purple coneflower
Sweet goldenrod
Bottle gentian
Purple monarda
Gardenway
Edge of 25' buffer
Rudbeckia Zig Zag Goldenrod
New Jersey Tea
0 10 20 30 40 80 120 feet
Aronia
Wild Gold Glow
Ostrich ferns
Garden Plots
Garden fence line
Garden fence line
Willow Oak
NY Ironweed
Bl. Cohosh
Sweet Joe Pye
MOWED BUFFER
Ostrich ferns
sweet cicely
sweet cicely
honewort
Wild Golden Glow
sweet cicely
Black Cohosh
Sweet Joe Pye Weed
Wild Golden Glow
Wingstem
Black cohosh
Black Cohosh
Black Cohosh
CITY
NPS
N

Native Plants Appropriate to Greenbelt Forest Gardening

This is a partial list of the many plants that are native to the state of Maryland which could be useful in restoring the ecological health of the forest edges surrounding the Community Gardens.

Please note that the appropriate choice of plants for any particular location on the garden perimeters depends on myriad factors, including matching the site's sun and shading, soil moisture and acidity, and other characteristics to the plants that will thrive in those conditions.

Plant choice also depends upon the site's location with respect to garden plots. For example, a tall tree like shagbark hickory would be an inappropriate choice for planting east, south, or west of garden plots, where it would shade more and more of the plots as it grew. But given shagbark hickory's narrow canopy and reliable future nut production, it might be an excellent choice for a location 20' north of a garden plot, where it will never become a source of garden shade.

This appendix ends with lists of commercially available seed mixes for establishing pollinator plant borders in appropriate areas following removal of invasive plants.

0-0.5' plants

| Latin Name | Common Name | Height | Light requirements |
|---|---|---|---|
| Allium tricoccum | Ramps | 6-8” | Partial Sun/Shade |
| Arctostaphylos uva-ursi | Bearberry | 6” | Sun/Partial Sun |
| Cardamine diphylla/Dentaria diphylla | Toothwort/Crinkleroot | 6” | Partial Sun/Shade |
| Chrysogonum virginianum | Green and Gold | 3” | Sun/ Partial Sun |
| Fragaria virginiana | Wild Strawberry | 6” | Sun/ Partial Sun |
| Gaultheria hispidula | Creeping Snowberry | 3-6” | Partial Sun /Shade |
| Gaultheria procumbens | Eastern Teaberry | 4-6” | Partial Sun /Shade |
| Linnaea borealis | Twinflower | 6-8” | Partial Sun /Shade |
| Mitchella repens | Partridgeberry | 1” | Partial Sun /Shade |
| Sedum | wild stonecrop | 0.1 – 0.5' | Partial Sun /Shade |
| ternatum | Foamflower | 4” | Partial Sun /Shade |
| Tiarella | Bog Cranberry | 4” | Sun |
| cordifolia | Common Blue Violet | 6” | Sun/ Partial Sun |
| Vaccinium | Barren Strawberry | 4” | Sun/ Partial Sun |

0.5' – 3' plants

| | | | |
|---|---|---|---|
| Achillea millefolium | Common Yarrow | 8-36” | Sun/ Partial Sun |
| Adiantum pedatum | northern maidenhair | 1 – 2' | Partial Sun /Shade |
| Allium canadense | Wild Garlic | 1' | Sun/ Partial Sun |
| Allium cernuum | Nodding Wild Onion | 1' | Sun/ Partial Sun |
| Amelanchier stolonifera | Running Serviceberry | 2-3' | Sun |
| Antennaria plantaginifolia | Plantain-leaf Pussytoes | 2” foliage | Sun/ Partial Sun |
| Aralia nudicaulis | Wild Sarsaparilla | 1-2' | Partial Sun |
| Asarum canadense | Wild ginger | 4-8” | Partial Sun /Shade |

0.5' – 3' plants, continued

| | | | |
|---|---|---|---|
| Athyrium filix-femina | Common Ladyfern | 1.5-3' | PS/Shade |
| Carex aquatilis | Water Sedge | 6-40” | Sun |
| Catha palustris | Marsh Marigold | 2' | sun/ps/sh |
| Chamaecrista fasciculata | Partridge Pea | 1-3' | Sun/PS |
| Conoclinium coelestinum | Blue mistflower/ Wild ageratum | 3' | Sun/PS |
| Cryptotaenia canadensis | Honewort | 2' | PS/Shade |
| Desmodium canadense | Tick Trefoil | 3' | PS/Shade |
| Dryopteris marginalis | marginal woodfern | 1 – 3' | Ps/Sh |
| Elymus virginicus | Virginia wildrye | 3' | sun/ps/shade |
| Gaylussacia baccata | Black Huckleberry | 3' | Sun/PS |
| Gentiana andrewsii | Bottle gentian | 2' | Sun/PS |
| Helenium autumnale | Sneezeweed | 2' | Sun |
| Hierochloe hirta | Northern Sweetgrass | 2.5' | PS/Shade |
| Hierochloe odorata | Sweetgrass | 1' | PS/Shade |
| Hydrophyllum virginianum | Virginia Waterleaf | 2' | PS/Shade |
| Iris cristata | Dwarf Crested Iris | 0.5 – 1' | PS |
| Lobelia cardinalis | Cardinal Flower | 2-4' | Sun/PS |
| Lobelia siphilitica | Great Blue Lobelia | 1-4' | sun/ps/shade |
| Lupinus perennis | Lupine | 2' | Sun |
| Mentha arvensis | Native Mint | 2' | Sun/PS |
| Onoclea sensibilis | Sensitive Fern | 2' | sun/ps/sh |
| Opuntia humifusa | Prickly Pear | 1' | Sun |
| Osmorhiza claytonii | Sweet Cicely | 2' | PS/Shade |
| Packera aurea | Golden Groundsel/Golden Ragwort | 6′ | PS/Shade |
| Penstemon hirsutus | Hairy Beardtongue | 1-2' | sun/ps/sh |
| Physalis longifolia | Longleaf Ground Cherry | 2' | Sun/PS |
| Podophyllum peltatum | Mayapple | 1' | PS/Shade |
| Polystichum acrostichoides | Christmas Fern | 1 – 2' | Ps Sh |
| Pycnanthemum virginianum | Mountain Mint | 18” | Sun/PS |
| Solidago flexicaulis | Zig Zag Goldenrod | 3' | PS/Shade |
| Solidago odora | Sweet Goldenrod | 3' | Sun/PS |
| Solidago patula | Swamp Goldenrod | 3' | sun/ps/sh |
| Solidago sempervirens | Seaside Goldenrod | 6' | Sun |
| Taenidia integerrima | Yellow Pimpernel | 3' | sun/ps/sh |
| Tradescantia virginiana | Virginia spiderwort | 1-3' | sun/ps/sh |
| Vaccinium angustifolium | Lowbush Blueberry | 18” | Sun |
| Vaccinium pallidum | Hillside Blueberry/Lowbush blueberry | 1.5-2' | sun/ps/shade |
| Zizia aurea | Golden Alexanders | 18” | Sun/PS |

3-6' plants

| | | | |
|---|---|---|---|
| Agastache nepetoides | Yellow Giant Hyssop | 4-6' | Sun/PS |
| Agastache scrophulariifolia | Purple Giant Hyssop | 4-6' | PS |
| Andropogon gerardii | Big Bluestem | 6' | |
| Apocynum cannabinum | Dogbane | 6' | Sun |
| Aronia melanocarpa | Aronia/Black chokeberry | 3-6' | Sun/PS |
| Asclepias incarnata | Swamp milkweed | 3-6' | Sun/PS |
| Asclepias syriaca | Common Milkweed | 3-4' | Sun |
| Asclepias tuberosa | Butterfly milkweed | 3' | Sun |
| Baptisia australis | Wild Indigo | 3-4' | Sun |
| Ceanothus americanus | New Jersey Tea | 3-4' | Sun/PS |
| Cirsium discolor | Field thistle | 6' | Sun/PS |
| Comptonia peregrina | Sweetfern | 3-4' | Sun |
| Coreopsis lanceolata | Lanceleaf coreopsis/ Lanceleaf tickseed | 2' | Sun/PS |
| Echinacea purpurea | Purple coneflower | 4' | Sun/PS |
| Elymus canadensis | Canada wildrye | 2-5' | PS/Shade |
| Elymus glabriflorus | Southeastern wildrye | 4' | Sun/PS |
| Euthamia graminifolia | Flat-top Goldentop/ Flat-topped Goldenr | 3-6' | Sun/PS |
| Eutrochium maculatum | Spotted Joe Pye Weed | 2-6.5' | Sun/PS |
| Heracleum maximum | Cow parsnip | 5-6' | Sun/PS |
| Laportea canadensis | Wood nettle | 4' | PS/Shade |
| Liatris spicata | Marsh blazing star/ Dense blazing star | 4' | Sun |
| Matteuccia struthiopteris | Ostrich Fern | 3-5' | PS/Shade |
| Monarda didyma | Scarlet Beebalm | 3-4' | Sun/PS |
| Monarda fistulosa | Wild Bergamot | 3-4' | Sun/PS |
| Penstemon digitalis | Foxglove Beardtongue | 3' | Sun/PS |
| Polygonatum commutatum | Giant Solomon's Seal | 3-5' | Sun/PS |
| Prunus pumila | Sandcherry | 3-4' | Sun Sun |
| Rubus allegheniensis | Allegheney Blackberry | 3-6' | Sun Sun |
| Rubus idaeus | American Red Raspberry | 3-5' | Sun |
| Rubus occidentalis | Black Raspberry | 3-5' | |
| Senna marilandica | Maryland Senna | 3-6' | |
| Solidago rugosa | Wrinkleleaf Goldenrod/ Rough goldenrod | 4' | Sun |
| Symphyotrichum novae-anglia | New England Aster | 4-6' | Sun/PS |
| Thermopsis villosa | Carolina Bushpea | 3-5' | Sun |
| Urtica gracilis = Urtica dioica | Native Stinging Nettle | 3-5' | Sun/PS |
| Verbesina alternifolia | Wingstem | 8' | PS/Shade |
| Vernonia noveboracensis | New York Ironweed | 3-8' | Sun/PS |

6-12' shrubs and herbaceous plants

| | | | |
|---|---|---|---|
| Actea racemosa | Black Cohosh Coastal | 6-10' | Sun/PS |
| Amelanchier obovalis | Serviceberry | 8-10' | Sun |
| Amorpha fruticosa | False Indigo | 8'x6' | Sun/PS |
| Calycanthus floridus | Eastern Sweetshrub, Carolina allspice | 6-12' | Sun/PS |
| Castanea pumila | Chinkapin | 4-20' | Sun/PS |
| Cimicifuga racemosa | Black Cohosh American | 7' | PS/Shade |
| Corylus americana | Hazel | 6-12' | Sun/PS |
| Elaeagnus commutata | Silverberry | 6-12' | Sun |
| Eutrochium fistulosum | Joe Pye Weed | 6-9' | Sun/PS |
| Eutrochium purpureum | Sweet Joe Pye Weed | 4-7' | PS/Shade |
| Helianthus maximilianii | Maximilian Sunflower | 6-12' | Sun |
| Helianthus tuberosus | Sunchoke, Jerusalem artichoke Rose | 6-12' | Sun |
| Hibiscus moscheutos | mallow | 4-7' | Sun/PS |
| Lindera benzoin | Spicebush Northern | 6-12' | Sun/PS |
| Myrica pensylvanica | Bayberry | 6-8' | Sun |
| Prunus maritima | Beach Plum | 6-8' | Sun |
| Prunus virginiana | Chokecherry | 3' – 19' tall | Sun |
| Ribes odoratum | Buffalo Currant, Clove Currant | 6-10' | Sun/PS |
| Robinia viscosa | Clammy Locust Wild | 6-20' | PS |
| Rudbeckia laciniata | Golden Glow | 7' | sun/ps/sh |
| Salix nigra | Black willow | 10' shrub | Sun/PS |
| Sambucus canadensis | Elderberry | 6-12' | Sun/PS |
| Vaccinium corymbosum | Highbush Blueberry | 6-8' | Sun |

12-25' Trees and Shrubs

| | | | |
|---|---|---|---|
| Alnus serrulata | Hazel alder | 12-20' | Sun |
| Arundinaria gigantea | Giant Cane Bamboo | 10-20' | Sun/PS |
| Chionanthus virginicus | Fringetree | 12-20' | Sun/PS |
| Crataegus crus-galli | Cockspur hawthorn | 20-30' | highSun |
| Myrica cerifera | Wax Myrtle, Bayberry | 10-30' | Sun Sun |
| Prunus americana | American Plum, Wild Plum | 12 – 35' | Sun/PS |
| Prunus augustifolia | Chickasaw Plum | 14-25' | Sun/PS |
| Salix discolor | Pussy willow | 15' | Sun |
| Salix interior | Sandbar willow | 3-20' | Sun/PS |
| Salix lucida | Shining willow | 13' | Sun/PS |
| Viburnum lentago | Nannyberry | 12-35' | Sun/PS |
| Viburnum prunifolium | Blackhaw | 12-15' | Sun |
| Zanthoxylum americanum | Prickly Ash | 12-35' | |

25 – 50' Trees

| | | | |
|---|---|---|---|
| Asimina triloba | Pawpaw | 20-35' | Sun/PS |
| Cercis canadensis | Eastern Redbud | 20-35' | Sun/PS |
| Diospyros virginiana | American Persimmon | 35-75' | Sun |
| Morus rubra | Red Mulberry | 35-50' | Sun |

50 – 100' Trees

| | |
|---|---|
| Carya ovata | Shagbark Hickory |

## Seed mixes for pollinator borders after invasive removal

Please note that unlike the above lists of native Maryland plants, the following lists of commercially available seed mixes have not been scrutinized to be sure that every listed plant is native to our state. For that reason, we will seek approval from Public Works prior to using any of these seed mixes. The source of these seed mixes is Ernst Conservation Seed, Meadville, PA.

Perennial Food & Cover Wetland Mix

Mix Composition:
20.0% Carex vulpinoidea, PA Ecotype (Fox Sedge, PA Ecotype) 20.0%
Elymus virginicus, PA Ecotype (Virginia Wildrye, PA Ecotype) 18.0%
Carex scoparia, PA Ecotype (Blunt Broom Sedge, PA Ecotype) 15.5%
Carex lurida, PA Ecotype (Lurid Sedge, PA Ecotype)
15.0% Panicum clandestinum, Tioga (Deertongue, Tioga) 5.0%
Carex lupulina, PA Ecotype (Hop Sedge, PA Ecotype) 3.0%
Juncus effusus (Soft Rush)
2.0% Leersia oryzoides, PA Ecotype (Rice Cutgrass, PA Ecotype)
1.0% Carex crinita, PA Ecotype (Fringed Sedge, PA Ecotype) 0.5%
Scirpus cyperinus, PA Ecotype (Woolgrass, PA Ecotype)

Seasonally Flooded Wildlife Food Mix

Mix Composition:
21.5% Panicum clandestinum, Tioga (Deertongue, Tioga)
20.0% Elymus virginicus, 'Madison' (Virginia Wildrye, ‘Madison’)
16.6% Andropogon gerardii, 'Niagara' (Big Bluestem, ‘Niagara’)
15.0% Echinochloa crusgalli var. frumentacea (Japanese Millet)
10.0% Carex vulpinoidea, PA Ecotype (Fox Sedge, PA Ecotype)
8.0% Panicum virgatum, 'Cave-In-Rock' (Switchgrass, ‘Cave-In-Rock’)
4.0% Chamaecrista fasciculata, PA Ecotype (Partridge Pea, PA Ecotype)
1.5% Verbena hastata, PA Ecotype (Blue Vervain, PA Ecotype)
1.0% Heliopsis helianthoides, PA Ecotype (Oxeye Sunflower, PA Ecotype) 1.0%
Juncus effusus (Soft Rush)
0.8% Agrostis perennans, Albany Pine Bush-NY Ecotype (Autumn Bentgrass, Albany Pine Bush-NY Ecotype)

0.1% Asclepias incarnata, PA Ecotype (Swamp Milkweed, PA Ecotype)
0.1% Aster novae-angliae, PA Ecotype (New England Aster, PA Ecotype)
0.1% Eupatorium fistulosum, PA Ecotype (Joe Pye Weed, PA Ecotype)
0.1% Eupatorium perfoliatum, PA Ecotype (Boneset, PA Ecotype)
0.1% Monarda fistulosa, Fort Indiantown Gap-PA Ecotype (Wild Bergamot, Fort Indiantown Gap-PA Ecotype)
0.1% Pycnanthemum tenuifolium (Narrowleaf Mountainmint)

Mesic to Dry Native Pollinator Mix w/o Grasses

Mix Composition:
15.0% Echinacea purpurea (Purple Coneflower) 12.0%
Coreopsis lanceolata (Lanceleaf Coreopsis)
12.0% Rudbeckia hirta, Coastal Plain NC Ecotype (Blackeyed Susan, Coastal Plain NC Ecotype)
10.0% Chamaecrista fasciculata, PA Ecotype (Partridge Pea, PA Ecotype)
8.0% Verbena hastata, PA Ecotype (Blue Vervain, PA Ecotype)
6.0% Asclepias incarnata, PA Ecotype (Swamp Milkweed, PA Ecotype)
6.0% Heliopsis helianthoides, PA Ecotype (Oxeye Sunflower, PA Ecotype)
6.0% Tradescantia ohiensis, PA Ecotype (Ohio Spiderwort, PA Ecotype)
5.0% Zizia aurea, PA Ecotype (Golden Alexanders, PA Ecotype)
4.0% Penstemon digitalis, PA Ecotype (Tall White Beardtongue, PA Ecotype)
3.5% Aster novae-angliae, PA Ecotype (New England Aster, PA Ecotype) 2.4%
Senna hebecarpa, VA & WV Ecotype (Wild Senna, VA & WV Ecotype) 2.0%
Pycnanthemum tenuifolium (Narrowleaf Mountainmint)
1.6% Solidago nemoralis, PA Ecotype (Gray Goldenrod, PA Ecotype)
1.5% Aster umbellatus, PA Ecotype (Flat Topped White Aster, PA Ecotype)
1.3% Eupatorium perfoliatum, PA Ecotype (Boneset, PA Ecotype)
1.2% Monarda fistulosa, Fort Indiantown Gap-PA Ecotype (Wild Bergamot, Fort Indiantown Gap-PA Ecotype)
1.0% Baptisia australis, Southern WV Ecotype (Blue False Indigo, Southern WV Ecotype) 1.0%
Geum canadense, PA Ecotype (White Avens, PA Ecotype)
0.5% Asclepias syriaca (Common Milkweed)

Mesic to Dry Native Pollinator Mix (with grasses)

Mix Composition:
30.2% Schizachyrium scoparium, Fort Indiantown Gap-PA Ecotype (Little Bluestem, Fort Indiantown Gap-PA Ecotype)
22.0% Sorghastrum nutans, 'Tomahawk' (Indiangrass, ‘Tomahawk’)
15.0% Elymus virginicus, 'Madison' (Virginia Wildrye, ‘Madison’)
5.0% Echinacea purpurea (Purple Coneflower)
5.0% Panicum clandestinum, Tioga (Deertongue, Tioga)
3.0% Chamaecrista fasciculata, PA Ecotype (Partridge Pea, PA Ecotype)
3.0% Coreopsis lanceolata (Lanceleaf Coreopsis)
3.0% Rudbeckia hirta (Blackeyed Susan)

3.0% Verbena hastata, PA Ecotype (Blue Vervain, PA Ecotype)
2.0% Heliopsis helianthoides, PA Ecotype (Oxeye Sunflower, PA Ecotype)
1.5% Asclepias incarnata, PA Ecotype (Swamp Milkweed, PA Ecotype) 1.0%
Aster novae-angliae, PA Ecotype (New England Aster, PA Ecotype)
1.0% Senna hebecarpa, VA & WV Ecotype (Wild Senna, VA & WV Ecotype) 0.7%
Pycnanthemum tenuifolium (Narrowleaf Mountainmint)
0.7% Solidago nemoralis, PA Ecotype (Gray Goldenrod, PA Ecotype)
0.6% Eupatorium perfoliatum, PA Ecotype (Boneset, PA Ecotype)
0.5% Baptisia australis, Southern WV Ecotype (Blue False Indigo, Southern WV Ecotype) 0.5%
Geum canadense, PA Ecotype (White Avens, PA Ecotype)
0.5% Monarda fistulosa, Fort Indiantown Gap-PA Ecotype (Wild Bergamot, Fort Indiantown Gap-PA Ecotype)
0.5% Tradescantia ohiensis, PA Ecotype (Ohio Spiderwort, PA Ecotype)
0.5% Zizia aurea, PA Ecotype (Golden Alexanders, PA Ecotype)
0.3% Asclepias syriaca (Common Milkweed)
0.3% Penstemon digitalis (Tall White Beardtongue)
0.2% Aster umbellatus, PA Ecotype (Flat Topped White Aster, PA Ecotype)

References

Brown, M.L. & Brown, R.G. (1984). Herbaceous Plants of Maryland. College Park, MD: University of Maryland.

Brown, R.G. & Brown, M.L. (1972). Woody Plants of Maryland. College Park, MD: University of Maryland.

Jacke, D. & Toensmeier, E. (2005). Edible Forest Gardens, vol 1 & II. White River Junction, VT: Chelsea Green.

Kimmerer, R.W. (2013). Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge and the Teachings of Plants. Canada: Milkweed Editions.

Rosenberg, K.V. et al. (2019). "Decline of the North American avifauna." Science, 366(6461):120-124.

Swearingen, J., B. Slattery, K. Reshetiloff, and S. Zwicker. 2010. Plant Invaders of Mid-Atlantic Natural Areas, 4th ed. National Park Service and U.S. Fish and Wildlife Service. Washington, DC. 168pp.

Tallamy, D.W. (2019). Nature's Best Hope. Portland, Oregon: Timber Press.

Weigle, T. (2019) Spotted Lanternfly – Understanding its Ecology and the Threat. New York State Integrated Pest Management Program. Downloaded 10/7/20 from https://www.youtube.com/watch?v=qlYWS7arsPE.

Weiseman, W., Halsey, D., & Ruddock, B. (2014) Integrated Forest Gardening. White River Junction, VT: Chelsea Green.