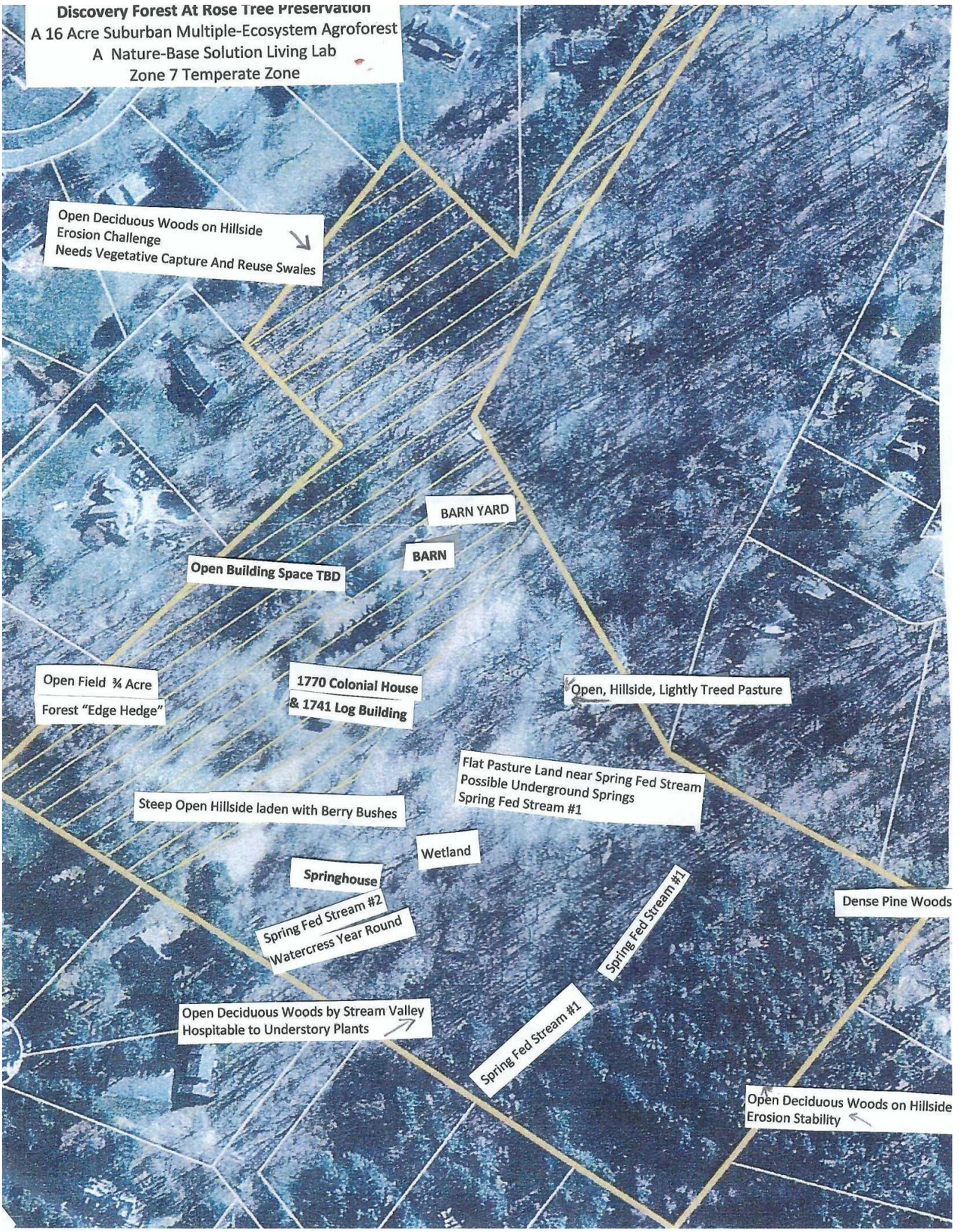
The Discovery Forest Campus Site Analysis

The Discovery Forest Ecosystems Map – 14 Ecosystems & An Aerial Property Parcel Overview



The Discovery Forest Campus

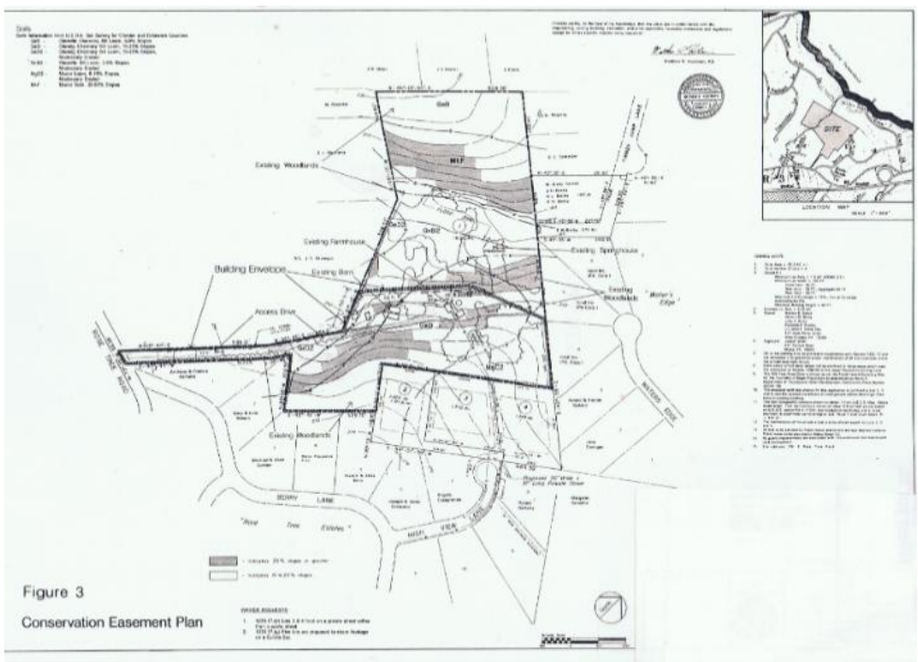
Stewarding A National Branding Enculturation Campaign for Forest Gardens & Facilitating Forest Gardens Projects

These Ecosystems will sequence In-Situ Research for Expanded Knowledge Base & 10 years of Time Lapse Filming

SITE ANALYSIS

Discovery Forest Site Analysis

CONTENTS:



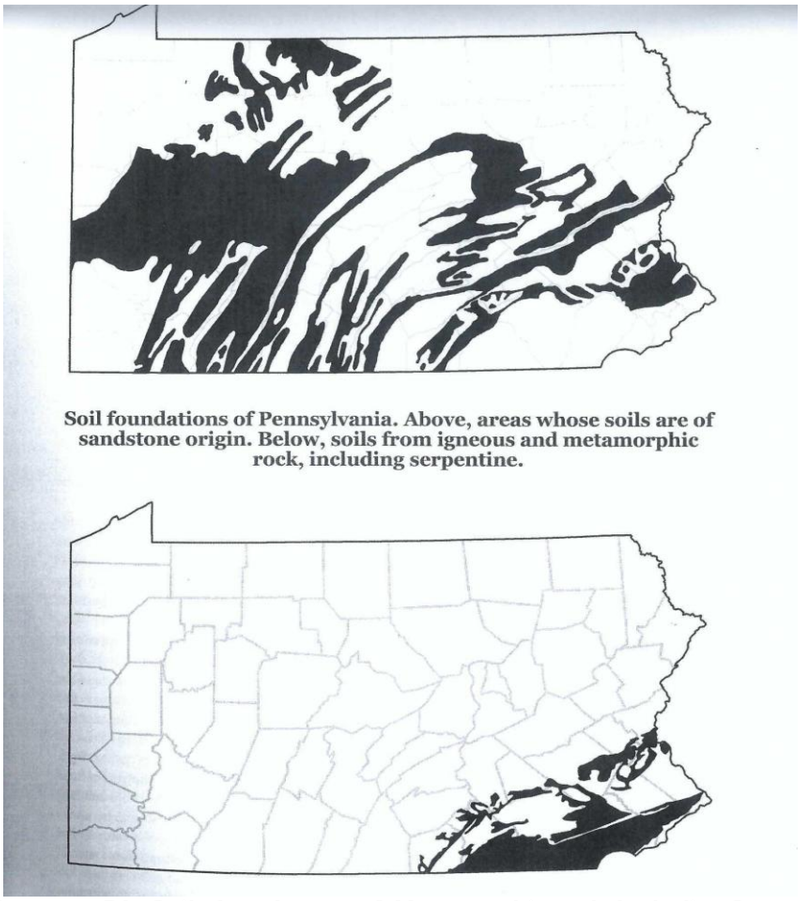
SOILS

Soils Information from USDA Soil Survey
Chester & Delaware Counties, Pa

GeB Glenville Channery Silt Loam 3-8% Slopes
GeD Glensig Channery Silt Loam 15-25% Slopes
GeD2 Glensig Channery Silt Loam 15-25% Slopes Moderately Eroded
GeB2 Glenville Silt Loam 3-8% Slopes Moderately Eroded
MgC2 Manor Loan 8-15% Slopes Moderately Eroded
MhF Manor Soils 35-60% Slopes

Flood Hazard District
Soils with Hydric Inclusions (Glenville Silt Loam)
Steep Slope Greater than 25%
Steep Slope 15 to 25%
Woodlands and Vegetative Cover
High Probability of Archeologic Resources

Southeastern PA: Soils from Igneous & Metamorphic rock, Including Serpentine



Soil foundations of Pennsylvania. Above, areas whose soils are of sandstone origin. Below, soils from igneous and metamorphic rock, including serpentine.

Southeastern PA: Soils from Igneous & Metamorphic rock, Including Serpentine

Soil Types

Glenville Silt Loam

Where they are found: level to sloping upland flats, footslopes or near drainageway heads
Characteristics: mesic to moist, moderately well to somewhat poorly drained, very deep mostly silt loams with moderate permeability, sometimes a fragipan between 15 and 30 inches, and a pH of about 5.8
Composition: 28% sand, 55% silt, 17% clay, 2.4% organic matter in top 12". Formed in residuum and colluvium impacted by soil creep from weathered micaceous schist, gneiss, phyllite and other acidic crystalline rock.
Current Use: Mostly in agricultural use for crops & pasture & large areas are near unban development. Native vegetation is mixed hardwoods, such as Sugar Maple *(Acer Saccharum),* White Ash *(Fraxinus americana*), Yellow Poplar *(Liriodendron tulipifera)* and Red Oak *(Quercus Rubra)*
Taxonomy: fine-loamy, mixed, active, mesic Aquic Fragiudults

Manor Loam

Where they are found: backslopes, shoulders and summits of hills in the Northern Piedmont
Characteristics: mesic to moist, well drained, very deep mostly loams. They can be channery or stony, with a pH of about 5.1
Composition: 43% Sand, 40% silt, 17% clay, with about 1.3% organic matter in top 12" & formed in residuum from micaceous schist
Current Use: Mostly cropland, pasture & urban development; woodlands consist of Black Oak (*Quercus velutina*), Chestnut Oak *(Quercus prinus*), Red Oak *(Quercus rubra),* White Oak *(Quercus Alba),* Hickory *(Carya spp),* Yellow Poplar *(Liriodendron tulipifera*). Red *Maple (Acer Rubrum*), Shortleaf Pine *(Pinus echinata)* & Virginia Pine *(Pinus virginiana).* Also suitable are Black Gum *(Nyssa sylvatica)* and Southern Red Oak *(Quercus falcata)*
Taxonomy: coarse-loamy, micaceous, mesic Typic Dystrudepts

DELAWARE COUNTY ECOLOGICAL ANALYSES

The Discovery Forest Campus is a Multiple Ecosystem Representation of Delaware County Woodlands

The Campus also contains a Palustrine Wetland

A Natural Heritage Inventory of Delaware County, Pennsylvania Biodiversity Study: 6/2011 (Link & Property Specific Excerpts)
https://www.delcopa.gov/planning/pdf/greenspace/Chapter_3_Vol-II_CountywideGreenwayPlan.pdf

~2 COUNTYWIDE GREENWAY PLAN

The Open Space, Recreation, and *Greenway Plan* serves as a guide and resource for countywide, multi-municipal, and municipal open space *planning* efforts.
PDF The Plan *provides the County's 49 municipalities with a framework for the strategic use of public resources* to improve the quality of life for all its residents ...

https://www.delcopa.gov/planning/pdf/greenspace/
Delaware County, Pennsylvania (.gov)
https://delcopa.gov › planning › pubs › delco2035 › Op...

OPEN SPACE, RECREATION, GREENWAY PLAN
Delaware County, Pennsylvania (.gov)
https://delcopa.gov › OSRGP › ExecutiveSummary

~3 The Pennsylvania Biological Survey (PABS)

is a nonprofit, all-volunteer organization whose purpose is to increase knowledge of, and foster the perpetuation of, the natural biological diversity of the Commonwealth of Pennsylvania. Among other tasks, the Survey is responsible for determining the status (endangered, threatened, etc.) of wild species of animals, plants and other organisms in the state (click HERE to see how that's done). Its over 150 members (including more than 70 PhDs) are scientists from throughout Pennsylvania, representatives of state and federal agencies concerned with natural resource management, representatives of Pennsylvania's major natural history museums and scientific institutions, and other interested and knowledgeable individuals. PABS is governed by a Steering Committee that functions through technical and standing committees focusing on species groups or program areas. To learn more, click on the links at left.
https://www.pabiologicalsurvey.org/

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THE NATURAL LANDS TRUST BASELINE DOCUMENTATION (1993): Partial Inventory of Trees and Understory Plants

Many invasives will need to be removed: It may be helpful to catch the selection/removal process w. Educational or Time Lapse photography

Section 1
Inventory of Existing Environmental Conditions

The conservation easement on the Bixby Farm property is located along a small, unnamed tributary of Crum Creek on the north side of Rose Tree Road in Upper Providence Township, Delaware County, Pennsylvania. The Property is adjacent to the floodplain of Crum Creek and is midway between two reservoirs of Philadelphia Suburban Water Company, the Springton (or Geist) Reservoir and Crum Creek Reservoir.

A field inspection of the easement area was made by the Natural Lands Trust on August 19, 1993.

Natural features in the easement area are mapped in Figure 2 and are generally described in the following sections of this "Baseline Documentation Report." Information was obtained from the site visit and from a variety of published sources.

An aerial photograph of the easement area and adjacent lands (taken in March, 1990) is attached as Exhibit D to the Conservation Easement Document (see Appendix C). On-site photographs taken during field inspections are included as Exhibit C to the Conservation Easement Document (see Appendix C).

1.1 Topography, Surface Drainage, Geology and Soils

The Bixby Farm is located entirely in the watershed of Crum Creek. It consists of nearly level to very steeply sloping lands rising directly above the floodplain of an unnamed tributary entering Crum Creek on the southwest side. The elevation on the easement area rises from a low of approximately 140' MSL where the tributary leaves the property to a high of approximately 280' MSL in the southwest corner and western end of the property.

The property could be considered a cross section of a "U" shaped valley with a fairly level floodplain along the unnamed stream, very steep valley sides and relatively level ridge tops on either side of the valley. More than half of the property has slopes greater than 15%, and approximately twenty percent of the property exceeds 25% slope. A swale drains northward across the property from the southern corner, across the entry drive, and into the unnamed stream. The unnamed stream originates approximately 500 feet west of the property and is augmented by the overflow from the springhouse. The tributary enters Crum Creek approximately 600 feet to the east of the property.

The property is underlain by the Wissahickon Formation made up of oligoclase and

the familiar mica schist, widely found in the Philadelphia region.

Soils are typical of those derived from Wissahickon Schist and include soils which are commonly found together in Chester and Delaware Counties. Soils belonging to the Manor and Glenelg Series underlie the valley sides and the ridge tops of the property. Glenville soils are found along the drainages and, in particular, the floodplain of the small, unnamed tributary stream (USDA, 1959)(see figure 2). These soils series are summarized below:

Manor Loam (MgC2) and Manor Soils (MkF) are deep, well-drained upland soils. On this property, they occur on the ridge tops and the steeply sloping valley sides, including the steepest slopes on the property, those on the northwestern valley side where grades exceed 25%. These slopes are moderately eroded. Due to their steepness and susceptibility to erosion, these soils limit most uses. The Manor loam (MgC2) is classified a "Farmland of Statewide Importance" by the Soil Conservation Service.

Glenelg Channery Silt Loams (GeB, GeD, GeD2) are moderately deep, well-drained soils. GeB soils are considered "prime farmland" by the Soil Conservation Service and occur predominantly on the relatively level northwest ridge top. The GeD soil is found on the steep, southeastern valley side around the original house site.

Glenville Silt Loam (GnB2) occurs only along the unnamed tributary stream and a wide swale on the southeastern valley side. It is a deep, moderately well to somewhat poorly drained soil, and is classified as "prime agricultural." This soil has hydric (or wetland) inclusions in depressions and along drainageways and is therefore restricted in its use.

1.2 Vegetation Cover Types

The Bixby Farm property is a mix of woodlands, meadows, and landscaped areas typical of the Piedmont of Southeast Pennsylvania. The vegetative communities of the property can be categorized into seven general groups, based on terrain and dominant species: deciduous woods, pine woods, stream corridor, sloping meadow and pasture, ornamental yard, orchard/vegetable garden, and entrance driveway strip.

With the exception of a few large specimens, most of the woodland is of even age, estimated to be 50 to 70 years. The pine woods provide unique habitat for owls and other species which make use of the winter cover. The woodlands along the stream and on the steep valley walls contribute to the hydrologic balance by slowing surface run-off and permitting the infiltration of rainfall and stormwater, thereby reducing erosion and siltation. The shade of the canopy helps to maintain cool water temperatures in the stream, an important factor to the health of many aquatic

species. Climatic extremes are also moderated by mature woodlands. The photosynthetic process consumes carbon dioxide and the canopy's shade prevents heat absorption by the surface.

Parts of the property reflect the long history of human use. The steep meadows are mowed annually, and a small pasture is grazed by two horses. Though the meadow is choked by oriental bittersweet, a number of wildflowers can be found. The former vegetable garden and a small orchard are both overgrown as a result of years without use. The ornamental landscape immediately surrounding the house demonstrates the previous owners', the Bixby family, interest in horticulture with many specimen trees and interesting garden plants. However, as the most disturbed section of the property, the yard contains the largest concentration of problem vines and weeds. The entrance drive is located in a heavily wooded strip that extends beyond the property boundary. This area contains a larger number of non-native species than the other wooded areas of the property.

The absence of certain plants is notable. Few seedling trees are growing in the herbaceous layer. Japanese honeysuckle and Norway maple are not dominant on the property. Plants normally visible earlier in the growing season were not visible at the time of this survey in August. Spring ephemerals such as mayapple, lesser celandine, and bleeding heart were present but dormant.

The vegetative areas are mapped in Figure 2, the Natural Features Map. A list of the species occurring in each area is as follows:

("Disturbed" as used in this document means that the natural community has been altered by human influence such as the inclusion of non-native plants. A disturbed area can remain a significant habitat for plants and wildlife.)

Area A: Deciduous Woods
Age: 50 - 70 years
Quality: Fair (not mature, fallen trees on edge near stream)
Disturbed/Undisturbed: Disturbed
Characteristics: Southeast-facing steep slope

Herbacious Layer: somewhat disturbed

a.	Christmas fern	*Polystichum acrostichiodes*
b.	Japanese stiltgrass	*Microstegium vimineum*
c.	Jack-in-the-pulpit	*Arisaema triphyllum*
d.	Cinnamon fern	*Osmunda cimmamomea*
e.	Japanese honeysuckle	*Lonicera japonica*
f.	Barren strawberry	*Waldsteinia fragrioides*

g.	Enchanter's nightshade	*Circaea quadrisulcata*

Shrub Layer: dominated by spicebush

a.	Spicebush	*Lindera benzoin*
b.	Blackberry	*Rubus* sp.
c.	Privet	*Ligustrum* sp.
d.	Boxwood	*Buxus sempervirens*
e.	Blackhaw viburnum	*Viburnum prunifolium*
f.	Arrowwood viburnum	*Viburnum dentatum*
g.	Barberry	*Berberis thunbergii*

Understory Layer: nearly absent

a.	American holly (1)	*Ilex opaca*

Canopy Layer: even-age native species, dominated by tulip trees

a.	Tulip tree	*Liriodendron tulipifera*
b.	Ash	*Fraxinus* sp.
c.	Red maple	*Acer rubrum*
d.	Sourwood	*Nyssa sylvatica*

Vines which Transcend Layers:

a.	Oriental bittersweet	*Celastrus orbiculatus*
b.	Poison ivy	*Toxicodendron radicans*

<u>Area B: Pine Woods</u>
Age: 50 - 70 years
Quality: Fair
Disturbed/Undisturbed: Somewhat disturbed
Characteristics: Southeast facing slope and crest of hill

Herbacious Layer:

a.	Garlic mustard	*Allaria offinialis*
b.	Japanese stiltgrass	*Microstegium vimineum*
c.	Virginia creeper	*Parthenocissus quinquefolia*
d.	Jumpseed	*Polygonum virginianum*
e.	Poison ivy	*Toxicodendron radicans*

Shrub Layer: More open than Deciduous Woods

a.	Spicebush	*Lindera benzoin*
b.	Blackhaw viburnum	*Viburnum prunifolium*

Understory Layer: Absent in places

a.	Crabapple	*Malus* sp.
b.	Eastern redcedar	*Juniperus virginiana*

Canopy Layer:

a.	Eastern white pine	*Pinus strobus*
b.	Sassafras	*Sassafras albidinum*
c.	Ash	*Fraxinus* sp.

Vines which Transcend Layers:

a.	Grapevine	*Vitis* sp.
b.	Oriental bittersweet	*Celastrus orbiculatus*

Area C: Stream Corridor
Age: Individual trees of 50 - 100 years
Quality: Good
Disturbed/Undisturbed: Somewhat disturbed
Characteristics: Narrow stream and open woods, between forest and meadow

Herbacious Layer:

a.	False nettle	*Bohemeria cylindrica*
b.	Garlic mustard	*Allaria offinialis*
c.	Japanese stiltgrass	*Microstegium vimineum*
d.	Hay-scented fern	*Dennstaedtia puctilobula*
e.	Sensitive fern	*Onoclea sensibilis*
f.	Tear-thumb/Mile-a-minute plant	*Polygonum perfoliatum*
g.	Watercress	*Nasturtium officinale*

Shrub Layer:

a.	Spicebush	*Lindera benzoin*
b.	Black cherry	*Prunus serotina*

Understory Layer:

a.	Tulip tree	*Liriodendron tulipifera*

Canopy Layer:

a.	Sycamore	*Platanus occidentalis*
b.	Red maple	*Acer rubrum*
c.	Hickory	*Carya* sp.
d.	Black walnut	*Juglans nigra*
e.	White oak (1, massive)	*Quercus alba*
f.	Red oak (1)	*Quercus rubra*
g.	Silver maple	*Acer saccharinum*

Vines which Transcend Layers:

a.	Oriental bittersweet	*Celastrus orbiculatus*

Area D: Sloping Meadow and Pasture
Age: Mowed every year
Quality: Fair to poor
Disturbed/Undisturbed: Disturbed
Characteristics: Steep northwest-facing hillside; some trees spaced throughout

Herbacious Layer: Dominated by bittersweet; pasture closely cropped except for ironweed and abundant broad dock

a.	New York ironweed	*Veronia noveboracensis*
b.	Oriental bittersweet	*Celastrus orbiculatus*
c.	Tear-thumb	*Polygonum perfoliatum*
d.	Downy wood-mint	*Blephilia ciliata*
e.	False nettle	*Bohemeria cylindrica*
f.	Japanese stiltgrass	*Microstegium vimineum*
g.	Sensitive fern	*Onoclea sensibilis*
h.	Rough-stemmed goldenrod	*Solidago rugosa*
i.	Lance-leaved goldenrod	*Solidago graminifolia*
j.	Common milkweed	*Asclepias syriaca*
k.	Seedbox	*Ludwigia alternifolia*
l.	Sneezeweed	*Helenium autumnale*
m.	White vervain	*Verbena urticifolia*
n.	Wild onion	*Allium* sp.
o.	Broad dock	*Rumex obtusifolius*

p.	Bugleweed/horehound	*Lycopus virginicus*
q.	Bedstraw bellflower	*Campanula aparinoides*
r.	Asiatic dayflower	*Commelina communis*

Shrub Layer:

a.	Blackberry	*Rubus* sp.
b.	Multiflora rose	*Rosa multiflora*

Understory Layer: not applicable

Canopy Layer: scattered trees or groups of trees

a.	Apple	*Malus* sp.
b.	Black walnut	*Juglans nigra*
c.	Red maple	*Acer rubrum*
d.	Ash	*Fraxinus* sp.
e.	Tulip tree	*Liriodendron tulipifera*
f.	Bur oak	*Quercus macrocarpa*
g.	Paper-bark birch	*Betula paperifera*
h.	Pitch pine	*Pinus rigida*

Area E: The Ornamental Yard
Age: 40 years
Quality: Fair
Disturbed/Undisturbed: Disturbed, by definition
Characterstics: High quality plantings obscured by vines; small meadow and white pine woods buffers property to the south

Herbacious Layer: Turf, groundcovers, some meadow plants seeded in

a.	English ivy	*Hedera helix*
b.	Japanese pachysandra	*Pachysandra terminalis*
c.	Hay-scented fern	*Dennstaedtia punctilobula*
d.	Maidenhair fern	*Adiantum pedatum*
e.	Sensitive fern	*Onoclea sensibilis*
f.	Ostrich fern	*Metteuccia pensylvanica*
g.	Periwinkle	*Vinca minor*
h.	Japanese stiltgrass	*Microstegium vimineum*
i.	Jumpseed	*Polygonum virginianum*
j.	White snakeroot	*Eupatorium rugosum*
k.	Garlic mustard	*Allaria officinalis*

l.	Foxtail	*Setaria* spp.

Shrub Layer: shows signs of deer damage

a.	Trumpet creeper	*Campsis radicans*
b.	Burning-bush	*Euonymus alata*
c.	Rhododendrons	*Rhododendron* spp.
d.	Japanese pieris	*Pieris japonica*
e.	Forsythia	*Forsythia* sp.
f.	Yew	*Taxus* spp.
g.	Boxwood	*Buxus sempervirens*
h.	Pokeweed	*Phytolacca americana*

Understory Layer:

a.	Apple	*Malus* sp.
b.	American dogwood	*Cornus florida*

Canopy Layer:

a.	Crimson King Norway maple	*Acer platanoides* 'Crimson King'
b.	Eastern white pine	*Pius strobus*
c.	Red maple	*Acer rubrum*
d.	Red oak	*Quercus rubra*
e.	Silver maple	*Acer saccharinum*
f.	Ash	*Fraxinus* sp.
g.	Blue atlas cedar	*Cedrus atlantica* 'Glauca'
h.	Black walnut	*Juglans nigra*
i.	White oak	*Quercus alba*
j.	Saucer magnolia	*Magnolia* x *soulangiana*
k.	American beech	*Fagus grandifolia*
l.	Eastern cottonwood	*Populus deltoides*
m.	Colorado blue spruce	*Picea pungens* var. *Glauca*
n.	Larch	*Larix decidua*

Vines which Transcend Layers:

a.	Oriental bittersweet	*Celastrus orbiculatus*
b.	Grapevine	*Vitis* sp.
c.	Tear-thumb	*Polygonum perfoliatum*
d.	Poison ivy	*Toxicodendron radicans*

Area F: Orchard/Vegetable Garden
Age: Indeterminate
Quality: Fair (not cultivated)
Disturbed/Undisturbed: Disturbed, by definition
Characteristics: Fallow field and fruit trees

Herbacious Layer: mostly grasses

a.	Red top	*Agrostis gigantea*
b.	Butter-and-eggs	*Linnaria vulgaris*
c.	Crown vetch	*Coronilla varia*
d.	Tear-thumb	*Polygonum perfoliatum*
e.	Japanese honeysuckle	*Lonicera japonica*

Shrub Layer:

a.	Multiflora rose	*Rosa multiflora*
b.	Blackberry	*Rubus* sp.

Understory Layer: Not applicable

Canopy Layer:

a.	Apple	*Malus* sp.
b.	Peach	*Prunus* sp.

Area G: Entrance Driveway Strip
Age: 40 years
Quality: Fair; Greater number of aggressive trees than other woods
Disturbed/Undisturbed: Disturbed
Characteristics: Woods give way to residential lots on one side

Herbacious Layer:

a.	Jumpseed	*Polygonum virginianum*
b.	Christmas fern	*Polystichum acrostichioides*
c.	Japanese stiltgrass	*Microstegium vimineum*
d.	Barren strawberry	*Waldsteinia fragrioides*
e.	Jack-in-the-pulpit	*Arisaema triphyllum*
f.	Garlic mustard	*Allaria officinalis*

Shrub Layer:

a.	Blackberry	*Rubus* sp.
b.	Spicebush	*Lindera benzoin*
c.	Multiflora rose	*Rosa multiflora*
d.	Barberry	*Berberis thunbergii*

Understory Layer:

a.	Eastern redcedar	*Juniperus virginiana*
b.	Mulberry	*Morus alba*
c.	American dogwood	*Cornus florida*
d.	Sassafras	*Sassafras albidinum*
e.	Slippery elm	*Ulmus rubra*

Canopy Layer:

a.	Norway maple	*Acer platanoides*
b.	Boxelder	*Acer negundo*
c.	Ash	*Fraxinus* sp.
d.	Eastern white pine	*Pinus strobus*
e.	Tulip tree	*Liriodendron tulipifera*

Vines which Transcend Layers:

a.	Grapevine	*Vitis* sp.
b.	Poison ivy	*Toxicodendron radicans*
c.	Oriental bittersweet	*Celastrus orbiculatus*

Wild Life and Human Life

The Wildlife Today and the Former Inhabitants of this Peaceful, Spring-Fed Valley

This Ecosystem is a very happy, thriving home to various animals and insects and all which that implies. There is a **Wetland**, which attracts nesting **amphibians**, as well as an unusually diverse spread of **owl** & **woodpecker species.** There are **deer**, of course, who use this mainly as a pass through, as there is fresh, clean water here. The Delaware County Conservation organization has given **the water** a clean bill of health as it has the requisite "clean bugs" under the rocks and there is fortuitous **watercress** growing in one of spring-fed streams, often a sign of water purity. Many invasive "volunteer plants" can be removed for new/old plants.
It will be useful to film The Removal of Invasives and the magic of What Happens Next.

In the flat lands near the stream valley, there are very few vegetation "volunteers" compared to other areas on this parcel, which may mean that there are underground springs very near the surface, which might be coaxed into **a pond….** Having a pond might be an extremely advantageous research opportunity…
Every year since I arrived in 1993, there has been a nesting **Fox** Family with newborn kits in the Spring.
Their "song" portends such great optimism and joy, especially when chorused with the sounds of many different types of **owls** and the daytime cries of the **hawks**. If you look way up in the sky, there are twilight displays of **bats** swarming in the early evening, and during the day, the **Red Shouldered and Red Tailed Hawks** are seen. There are **chipmunks** and **squirrels, raccoons, foxes** and **toads** and some **amphibious creatures.** There are occasional sightings of adult **snapping turtles** and only once have I spotted a **skunk**. Some years there are **woodchucks** and **rabbits**; some years, not.
The Eagle has been documented and confirmed by the Pa Game Commission Warden.

At night, if it's not too cloudy, there is a very entertaining magical canopy of stars.
The Discovery Forest Center has a modest "Museum" of found objects, like turtle shells, deer antlers, bird nests and plant findings

First Lenape Peoples and Quaker First Peoples

The confluence of the spring fed stream valley, with its protection from the wind attracted both the **Lenni Lenape** people and the **early Quaker settlers** who arrived and built here, in this peaceful, gentle place in the mid-1700s. The original stone house is built on the side of a high promontory, which is the traditional building site tradition of the Quakers. Their hearts were full of the intentions of "The Holy Experiment" of co-creation of living.

Both the Quaker **Friends** and the Lenape **Grandfathers** were highly skilled, emotionally intelligent World **Thought Leaders of Global Citizenship**. I'll speak more later about the Blending of the Hearts and Minds of both of these unusually congenial people in the "First Peoples" pod and about how they shared this land and its medicine and food folklore and experience as they welcomed the Quaker newcomers who were seeking a "Holy Experiment" in living… more about that later…
As regards the sharing of the land and the resources, folkways and food, the Lenape and The Quakers had more in common than they had apart and were friendly and affectionate with each other. Much of their interaction and affection is recorded and documented in fulsome writings…

But more specifics about their peaceful cohabitation relationships later in
"First, Present and Future Peoples" and "Penn's Woods: Our Holy Experiment c. 1682 – 2082"
….

It's highly interesting to note that the Lenni Lenape people were not entirely migratory as they were inclined toward village life and had villages and gardens of their own in the nearby Crum Creek Reservoir area and often foraged the forests for game and plant food from their villages. It is clear that the two peoples spent a lot of time together and that the Lenape people shared much with the Newcomers to this Land.

For your consideration: While thinking about the Higher Mind Thought Leadership of People like these who had the capacity to highly value Global World Citizenship: It is much easier to create consistent positive efforts toward creating a Wondrous Melting Pot while in the presence of an unquestioned abundance of survival resources such as Agroforestry provided here… and will again.

As Regards the Discovery Forest Site and what was grown or found here:
The Native American Ethnobotany information from the agroforestry records are incomplete but may be able to be expanded with information from the nearby Bartram's Gardens forest plants database from the early 1700s. It makes sense that the existing Ethnobotany list (from the early 1700s, no small feat) is incomplete; One has only to notice the omission of "Paw Paws" that were often noted as a woodland delicacy.
However**,** a study of the existing 1700s foods, medicines and ceremonial plants on the Ethnobotany Pages of the Lenape People yielded a very fortunate, very intriguing fact, if true: The staple forest "crop" of the Lenape people was not maize (which was rather small in those days, {about 1" in diameter and 3" – 4"long}), but rather, **APIOS, the Native American Potato, or Ground Nut**.
What started me on this inquiry about early plant life on this property, was in better understanding the versatility and durability of the Potato as a staple crop in early Pa Indigenous life, as in many cultures, but, what impressed me was also its assured safety from roaming deer. The vine's potato chain is buried in the ground at the root of trees, and it's twining berry, at about 8-10 ft is edible and has properties that positively assist diabetes. The berry is too high for the deer to reach but it likely does wonderful things for pollinators, birds, and insects. The Potatoes are buried in the ground at the base of the tree; again, difficult for browsing deer to discover…. Not only does Apios contribute to the ecosystem as a nitrogen producer; it keeps our Carbon absorbing, Oxygen producing Trees! It also harvests twice a year: Berries in Spring, Potatoes in Fall.

The 70-year peaceful co-habitation of the Quakers and Lenape must have included sharing that important staple food that must have helped the new immigrants to survive their first winters in the New World.
The wondrous contribution of Apios is that it could be kept over the winter and is as versatile as the Irish Potato: it can be over-wintered, turned into flour and cooked in so many ways.
It's not too far a stretch to imagine that the Lenape shared this secret with the early Colonists so that they could survive the winter and that there was further sharing of Folkways and Resources from there…
Might Apios stand as a symbol of the Harmony between the two peoples of this spring valley?

Imaginative Query; Might Apios become a staple agroforestry crop for the United States now and be shared with other Deciduous Forest Lands worldwide….????
Potatoes have been a staple and a sustainer for so many people around the world. The "Irish" Potato, which was a major sustainer of life in Ireland actually was shipped from South America by Sir Walter Raleigh…. The "Potato" sustained the Mayan People and the Irish people… and, since it over-winters so well and can be made into flour, it has always helped people to over-winter before the spring bounty begins. The birds love the fruit and seeds, it builds the soil, is shade friendly and is so difficult for wildlife to "borrow" it. Perhaps Apios could become a major agroforestry crop worldwide, producing very abundant, versatile food, while we get to keep our trees for all the right reasons….

There is evidence that Apios has been successfully reverse-engineered for very large tubers, shade tolerance and improved flavor and is currently under research at Louisiana University and other research centers.
The book, Native American Ethnobotany by Daniel E. Moerman got me started on this and got me started wondering about all the foods, folklore, survival skills and traditions the Lenape and the Quakers shared from their Villages and Gardens as the Lenape villages were in documented peaceful cohabitation with many Quaker Dwellings in this land for over 70 years.

An examination of all of the vegetation that grew in this Stream Valley may yield a window into the pathways toward the Creation of Abundance that once were and can be again, while we keep our Carbon and Nitrogen Positive and Oxygen Producing Trees. It once was true and now can be re-created with all the advantages of accrued knowledge and with a faithful return to Regenerative Agroforestry Values.
The Discovery Forest Site may have the necessary variety of Ecosystems to sustain a meaningful research living laboratory to discover all that Agroforestry can give us again.

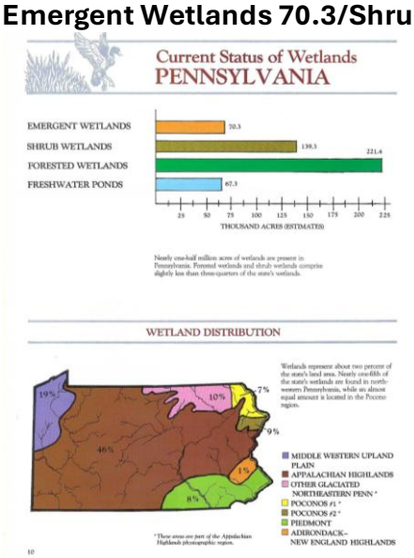
The Wetlands of this Site:

The wetlands were likely a major attraction for foraging and the spring-fed streams attracted game. Also, the very shallow nature of the spring fed streams not only made water available: the shallowness of the streams made them safe play areas for small children.

Mid-Atlantic Wetlands in Pennsylvania

A Disappearing Natural Treasure by Ralph W. Tiner Jr. June 1987
Cooperative Publication: US Fish and Wildlife Service and The US Environmental Protection Agency
"We have already lost over half of our nation's wetlands since America was first settled." *(Currently 2% of PA)*

Emergent Wetlands 70.3/Shrub Wetlands 130.3/Forested Wetlands 221.4/Freshwater Ponds 67.3



Green Section is "Piedmont": 8% of PA Wetlands Discovery Forest may be able to re-assert the productive value of Wetland Agroforestry in the production of food while maintaining habitat and water quality…
This is a start to discovering The Characteristics and Plants of The DISCOVERY FOREST Wetland Area located near the Spring Flow
Terrestrial and Palustrine Plant Communities of Pennsylvania

Herbaceous Wetland Categories of Plant Companion Environments: to be examined with the PNDI Field Survey Research

The Importance of Wetlands for Carbon Sequestration

Preserving and restoring wetlands is crucial for maintaining their carbon sequestration potential and mitigating climate change. In a wetland, more carbon dioxide is removed from the atmosphere and incorporated into vegetation and soil than in either a forest or an upland prairie.

A study by The Conservation Fund found that wetlands store **81 to 216 metric tons of carbon per acre**, depending on their type and location.

Preserving and restoring wetlands is crucial for maintaining their carbon sequestration potential and mitigating climate change. Wetlands are highly effective carbon sinks, storing a disproportionate amount of the Earth's soil carbon, and can sequester carbon dioxide from the atmosphere, mitigating climate change. They do this by accumulating organic matter in their soils, which are often waterlogged and dark, slowing decomposition.

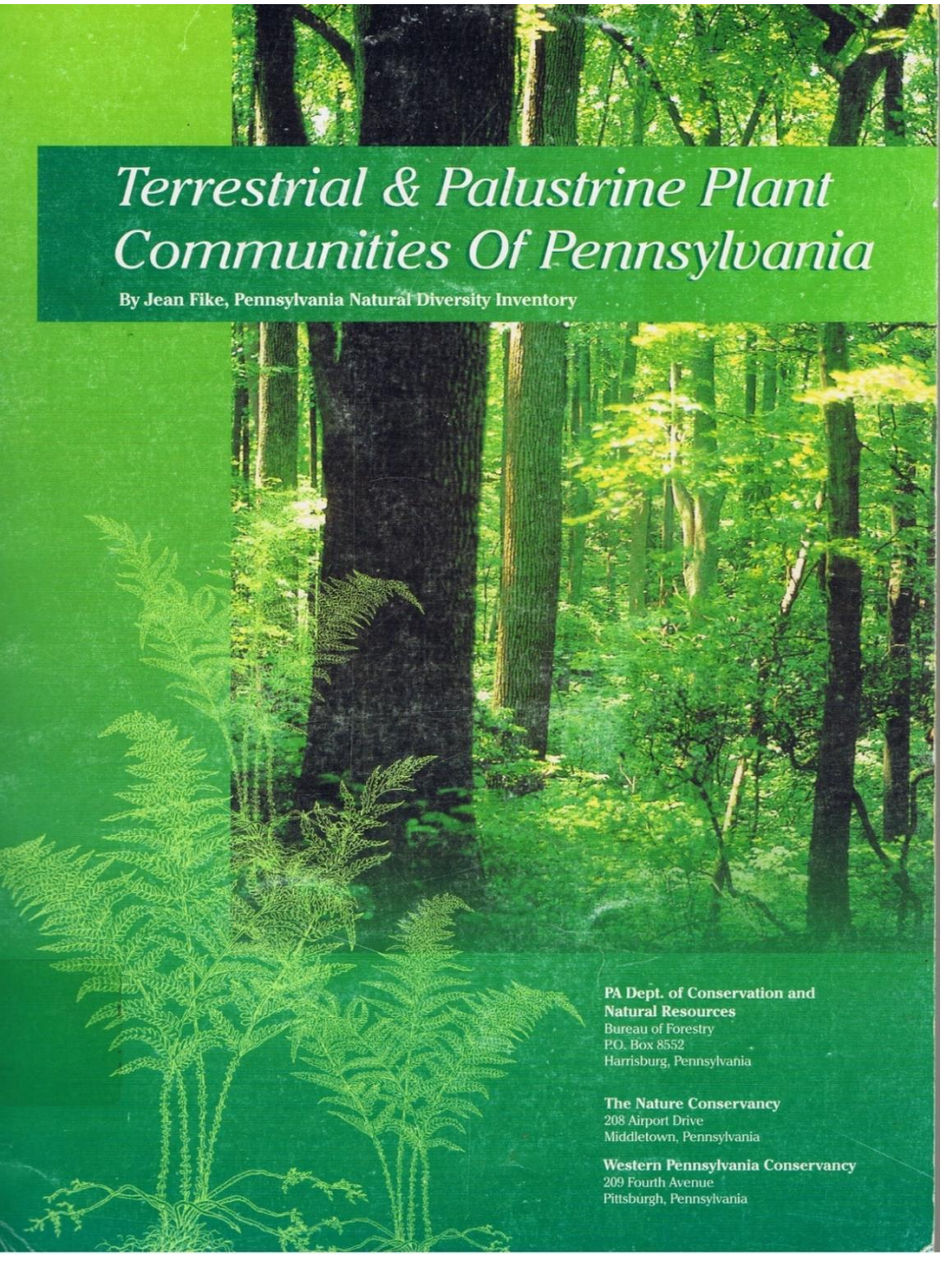
High Carbon Storage

Wetlands, despite covering a small percentage of the Earth's land surface, store a significant portion of global soil carbon, estimated at 20-30%. All wetlands sequester carbon from the atmosphere through plant photosynthesis and by acting as sediment traps for runoff. Carbon is held in the living vegetation as well as in litter, peats, organic soils, and sediments that have built up, in some instances, over thousands of years.The waterlogged and dark conditions in wetlands slow down the decomposition of organic matter, allowing carbon to accumulate in the soil. Wetlands capture and store atmospheric carbon dioxide (CO_2) in the form of plant biomass, which is then buried in the soil.

Plants in wetlands absorb CO_2 through photosynthesis, converting it into organic matter that is stored in the plants and eventually in the soil.

THE IMPORTANCE OF KEEPING WETLANDS AS GROCERY STORES:

Destruction, drainage, and encroachment of wetlands can lead to the release of stored carbon, contributing to increased greenhouse gas emissions. Watercress is beautifully bucolic and has unusually high nutritional value; our wetland springs have aggressive watercress growth.



This appears to be the *type* of Wetland that is in the Valley at Discovery Forest. It will be highly valuable to determine High Nutrition Edible Plants that will thrive in these Canopy Conditions so that we can KEEP THESE WETLANDS AS PRODUCTIVE CITIZENS

This may be an appropriate start at wetland plant analysis:
Golden Saxifrage – Pennsylvania bitter-cress spring run
This community occurs in and immediately adjacent to springs. Springs are points of concentrated groundwater flow reaching the surface. Water flow is relatively constant, and temperatures at the source are generally between 9 and 15 degrees Celsius: pH varies between 6.0 and 8.0 at the ground surface.
A spring run is characterized by a concentrated flow of groundwater reaching the surface.
Seeps are also groundwater-fed, but are characterized by diffuse flow
Common in the entire Pennsylvania state

Most characteristic species:
Chrysosplenium americanum (golden saxifrage)
Cardamine pennsylvanica (Pennsylvania bitter cress)
Nasturtium officinale (watercress)

Other species:
Saxifraga miranthidifolia (lettuce saxifrage
C rotundifolia (mountain watercress)
C. Bulbosa (bitter cress)
Equisetum spp. (horsetails)

Important Community Members
Bryophytes are an especially important element of this community type: more species info would be useful.

Crosswalking:
(mapping equivalent, identical, or similar information across two or more distinct data sets)
Smith's "Spring Community' and "Spring Run Community"
TNC"s *Chrysosplenium Americanum-Nasturtium officinale* Herbaceous Alliance

Nutritional Value of Wetland Watercress: a Superfood
It is one of the oldest known leaf vegetables consumed by humans. It is considered a "super food".
According to ADNI, **watercress is the healthiest vegetable**. In the USA, Whole Foods Market runs the ANDI (aggregate nutrient density index) which measures the amount of nutrients (carbohydrates, fats, proteins, vitamins and minerals) in a food related to the amount of energy (calories).
Watercress is also **rich in vitamin C, which supports your immune system, helps you heal from injuries, and supports healthy collagen production**. Watercress is full of beta-carotene and other carotenoids, which are known for being potent antioxidants. **Watercress (nasturtium officinale) is a superfood**; we already know that watercress is rich in vitamins, containing over 50 vital vitamins and minerals. Gram for gram contains more calcium than milk, more folate than bananas, more Vitamin C than oranges and more Vitamin E than broccoli

Nutritional Value of Bittercress:
Being in the brassica family bittercress has many health benefits. It contains glucosinolates which are known to **help remove carcinogens from the body**. It also contains vitamin C, beta-carotene, antioxidants, calcium, magnesium and Vitamin C and possibly lutein which is known to help reduce vision problems including cataracts.

FURTHER PALESTRINE PLANT COMMUNITY RESEARCH SOURCES:

Terrestrial & Palustrine Plant Communities of Pennsylvania (Fike 1999) is the most current community classification system for Pennsylvania's palustrine and terrestrial plant communities. This report was developed by the Pennsylvania Natural Heritage Program to update and refine Smith's 1991 report Classification of Natural Communities in Pennsylvania (draft), the first effort dedicated specifically to the classification of natural communities in the state. Work is ongoing to improve the current classification system and therefore, future editions may define new community types or alter currently defined types. Aquatic communities (lakes, streams, and rivers), communities where vegetation is absent or not a definitive characteristic (caves, scree slopes), and communities resulting from extensive human disturbance (old agricultural fields, manmade wetlands, etc.), are not addressed in this classification. Until more extensive work can be completed to define these types of communities and incorporate them into a single statewide framework, the County Natural Heritage Inventory reports will provisionally refer to features of ecological interest that fall outside the Fike 1999 system using categories described in Smith 1991. More information on community classification in Pennsylvania is available at http://www.naturalheritage.state.pa.us/

Plant Communities of Pennsylvania
Pennsylvania Natural Heritage Program
https://www.naturalheritage.state.pa.us › communities
Explore wetland and riparian **plant communities of Pennsylvania** with our fact sheets and **Palustrine** Community Key. ... **Terrestrial** Communities. Learn about the ...

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[Terrestrial & Palustrine Plant Communities of Pennsylvania ...](https://www.naturalheritage.state.pa.us)
https://www.naturalheritage.state.pa.us › community
This is a **rare plant community** in Pennsylvania that has an unusual array of species and is habitat for both rare and common species of plants and animals that ...

Terrestrial & Palustrine Plant Communities of Pennsylvania
Conservation Tools
https://conservationtools.org › library_items › 527-Ter...
An in-depth breakdown of **plant communities** found in **Pennsylvania** specific to particular physiographic regions. Average rating. Your rating.

Palustrine Plant Community Key for Pennsylvania
dep.state.pa.us
https://files.dep.state.pa.us › WaterObstruction

Terrestrial and Palustrine Plant Communities of Pennsylvania.
Nuclear Regulatory Commission (.gov)
https://www.nrc.gov › docs
The objective of this document is to classify and describe the **terrestrial and palustrine** (wetland) **plant communities of Pennsylvania**. A plant community is an ...
85 pages

Terrestrial & Palustrine Plant Communities of Pennsylvania ...
PA.GOV (.gov)
http://elibrary.dcnr.pa.gov › PDFProvider

Plant **communities are groups of plants sharing a common environment that interact with each other, animal populations, and the physical environment**.
Plant Communities - PA DCNR
https://www.dcnr.pa.gov › PlantCommunities › Pages
Pennsylvania currently has **127 documented** plant communities, including 78 wetland and 49 terrestrial community types. These community types can be organized or ...

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A NATURAL HERITAGE INVENTORY OF DELAWARE COUNTY, PENNSYLVANIA June 2011

The Link for the entire study is here AND excerpts from the study that apply to the immediate area of the subject property location appear below:

Submitted to: Delaware County Planning Department 201 West Front Street, Media, Pennsylvania 19063 610-891-4000
Prepared by: Pennsylvania Natural Heritage Program Western Pennsylvania Conservancy 208 Airport Dr. Middletown, Pennsylvania 17057

https://www.naturalheritage.state.pa.us/CNAI_PDFs/Delaware_CNHI_Update_2011_WEB.pdf

http://www.naturalheritage.state.pa.us/CNAI_Download.aspx

Excerpts from the study that apply to the immediate area of the Subject Property (appear below(
p. 158 "**Crum Creek Floodplain**" p 158 Upper Providence Township in Delaware County
p. 312 **"Species and Communities of Concern"** p 312

A NATURAL HERITAGE INVENTORY OF DELAWARE COUNTY, PENNSYLVANIA June 2011
A Biodiversity Study (Articulations from the report that apply specifically to the Property Location are excerpted and presented in full further down)

The Study Focus:
This **County Natural Heritage Inventory** is designed to provide information about the biodiversity of Delaware County. The introduction of the report has an overview of the process behind this inventory as well as an overview of the natural history of Delaware County. A section on natural history includes information about the common plants, animals, and communities that one would expect in the County followed by a section on inventory methodology. Results are presented at the broad landscape view, then moving into finer scale Natural Heritage Areas followed by conclusions and general recommendations.

The Delaware County Natural Heritage Inventory Update is a document compiled and written by the Pennsylvania Natural Heritage Program (PNHP) of the Western Pennsylvania Conservancy (WPC). It builds on the original Natural Areas Inventory of Delaware County completed in 1992 by the Pennsylvania Science Office of The Nature Conservancy. This document contains information on the locations of rare, threatened, and endangered species and of the highest quality natural areas in the county; it is not an inventory of all open space. It is intended as a conservation tool and should in no way be treated or

used as a field guide. Accompanying each site description are general management recommendations that would help to ensure the protection and continued existence of these natural communities, rare plants, and animals. The recommendations are based on the biological needs of these elements (communities and species). The recommendations are strictly those of WPC and do not necessarily reflect the policies of the state or the policies of the county or townships for which the report was prepared

Submitted to: Delaware County Planning Department 201 West Front Street, Media, Pennsylvania 19063 610-891-4000
Prepared by: Pennsylvania Natural Heritage Program Western Pennsylvania Conservancy 208 Airport Dr. Middletown, Pennsylvania 17057

For the Original Document:

https://www.naturalheritage.state.pa.us/CNAI_PDFs/Delaware_CNHI_Update_2011_WEB.pdf

http://www.naturalheritage.state.pa.us/CNAI_Download.aspx

Articulations that apply specifically to the Property Location:

p. 158 Crum Creek Floodplain p 158 of the Study: Focus on Property Location: Upper Providence Township
p. 312 Species and Communities of Concern

General Biodiversity Findings that may apply to the subject property:
Wetlands

Fifty-six percent of Pennsylvania's wetlands have been lost or substantially degraded by filling, draining, or conversion to ponds (Dahl 1990). According to the Pennsylvania Department of Environmental Protection (DEP), sixty percent of those Pennsylvania lakes that have thus far been assessed for biological health are listed as impaired. Of 83,000 miles of streams in Pennsylvania, almost 70,000 miles has been assessed for water quality. From this, nearly 11,000 miles have been designated as impaired due to abandoned mine discharges, acid precipitation, and agricultural and urban runoff (PA DEP 2004). The species that depend on these habitats are correspondingly under threat: 58 percent of threatened or endangered plant species are wetland or aquatic species; 13 percent of Pennsylvania's 200 native fish species have been lost, while an additional 23 percent are imperiled. Among freshwater mussels, one of the most globally imperiled groups of organisms_

General Biodiversity Findings that may apply to the subject property:
Forests

Delaware County Natural Heritage Inventory – Introduction / 28 Pennsylvania's 67 native species are extirpated (meaning locally extinct) and another 22 are imperiled (Goodrich et al. 2003). Prior to European settlement, over ninety percent of Pennsylvania's land area was forested. Today, sixty percent of the state is still forested, but much of this forest is fragmented by roads, utility rights-of-way, agriculture, and development. Only forty-two percent is interior forest habitat; meaning that some of the species that depend upon interior forest habitat are in decline

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General Biodiversity Findings that apply to the subject property:
County Overview

History The lands of Delaware County have hosted European settlements since the early 1600's, and Native American tribes long before then. Pennsylvania came into existence with William Penn's charter in 1681. Delaware County was split from the existing Chester County on September 26, 1789. Covering a little over 191 square miles, Delaware County is the third-smallest county in Pennsylvania, but one of the most populated with over 550,000 citizens per the 2000 census. Because of its small size and high population, Delaware County is the second-most densely populated county in the Commonwealth, behind only Philadelphia.

When the first Europeans stood at the edge of Penn's Woods, they encountered a wilderness so vast, deep and impenetrable that it instilled in many of them a sense of dread. Little by little the wilderness of Delaware County was transformed, first to agricultural then to suburban and urban uses. The existing land use patterns within the County have been largely influenced and shaped by the region's natural features such as the location of arable soils, steep slopes, deep valleys, wetlands, and waterways. Like most of southeastern Pennsylvania, very little of Delaware County's landscape has been left in a "natural" state.

Delaware County can be divided into three distinct regions: agricultural, suburban, and industrial, based on the prevalent land use in each region. The gradual settling of the County was at first oriented towards farming of the easily accessible tidal marshes. These marshes were gradually drained, filled, and developed to become the industrial waterfront associated with the city of Chester. The primeval forests were gradually replaced by ever expanding farmland that provided food and resources to the burgeoning population centers of Philadelphia and Wilmington. Existing forested areas and wood lots in the County are second, third, or even fourth growth trees from the time the virgin forests were first cut. Most of the relatively flat, fertile land in the western part of the County was converted to agricultural production long ago. Farms often represent many generations of cultural heritage and some farms contain a natural component or are adjacent to a natural area (Goodrich et al. 2003). In addition to habitat fragmentation, forest pests, acid precipitation (which causes nutrient leaching and stunted growth), overbrowsing by deer and invasive species also threaten forest ecosystem health.

General Biodiversity Findings that may apply to the subject property:

The Wetland Area of the Subject Property

Terrestrial & Palustrine Plant Communities of Pennsylvania (Fike 1999) is the most current community classification system for Pennsylvania's palustrine and terrestrial plant communities. This report was developed by the Pennsylvania Natural Heritage Program to update and refine Smith's 1991 report Classification of Natural Communities in Pennsylvania (draft), the first effort dedicated specifically to the classification of natural communities in the state. Work is ongoing to improve the current classification system and therefore, future editions may define new community types or alter currently defined types. Aquatic communities (lakes, streams, and rivers), communities where vegetation is absent or not a definitive characteristic (caves, scree slopes), and communities resulting from extensive human disturbance (old agricultural fields, manmade wetlands, etc.), are not addressed in this classification. Until more extensive work can be completed to define these types of communities and incorporate them into a single statewide framework, the County Natural Heritage Inventory reports will provisionally refer to features of ecological interest that fall outside the Fike 1999 system using categories described in Smith 1991. More information on community classification in Pennsylvania is available at http://www.naturalheritage.state.pa.us/

The Spring-Fed Stream under The Spring House (with the Watercress year round)
Terrestrial & Palustrine Plant Communities of Pennsylvania (Fike 1999) is the most current community classification system for Pennsylvania's palustrine and terrestrial plant communities.

Golden Saxifrage – Pennsylvania Bitter-Cress Spring Run
This community type occurs in and immediately adjacent to springs. Springs are points of concentrated groundwater flow reaching the surface. Water flow is relatively constant, and temperatures at the source are generally between 9 and 15 degrees C; pH varies between 6.0 and 8.0 at the ground surface.
Chrysosplenium Americanum (golden saxifrage), *Cardamine Pennsylvanica* (Pennsylvania Watercress), and the introduced *Nasturtium officinale* (watercress) are by far the most characteristic species.
Other species include *Saxifraga micranthidifola* (lettuce saxifrage), *C. Rotundifolia* (mountain watercress), *C. Bulbosa* (bitter cress) and *Equisetum SPP*. (horsetails).
Bryophytes are an especially important element of this community type; more species information is needed.

Related types: A spring run is characterized by a concentrated flow of groundwater reaching the surface. Seeps are also groundwater-fed but are characterized by diffuse flow.
Range: The entire State
Selected References: PNDI Field Surveys
Crosswalk: Smith's "Spring Community" and "Spring Run Community", TNC's *Chrysosplenium Americanum – Nasturtium officianale* Herbaceous Alliance

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General Biodiversity Findings from the report that may apply to the subject property:

Crum Creek Reservoir P 158 of the Study

Crum Creek Floodplain and Reservoir Delaware County, PA Natural Heritage Inventory Delaware County Natural Heritage Inventory 2011 – Crum Creek Floodplain and Reservoir /153 Crum Creek Floodplain and Reservoir – Notable significance PNDI Rank2 Legal Status2 Species of Concern: Taxa1 Global State State (Proposed) Last Seen Quality2 Netted chainfern (Woodwardia areolata) P G5 S2 N (PT) 1998 E Sensitive species of concern3 --- --- --- --- 2008 BC 1 A = Amphibian; B = Bird; C = Community; F = Fish; L = Lepidopteran; O = Odonate; P = Plant; M = Mammal; R= Reptile, U = Unionoid (Mussel) 2 Please refer to Appendix III for an explanation of PNHP ranks and legal status 3 This species is not named by request of the jurisdictional agency overseeing its protection

Location: This area includes the floodplain of Crum Creek from the dam breast of the Crum Reservoir upstream to the outflow of the Springton Reservoir dam and Trout Run from its headwaters to its confluence with Crum Creek. o Municipalities: o Marple Township o Nether Providence Township o Springfield Township o Upper Providence Township o USGS Quadrangles: o Lansdowne Quadrangle o Media Quadrangle o Watersheds: o Crum Creek o 1992 Delaware County Natural Areas Inventory reference: o "SA604" (Lansdowne Quadrangle) o 1998 Delaware County Natural Areas Inventory Update reference: o "SA520- Lower Crum Reservoir"- (Lansdowne Quadrangle) Description: A mosaic of upland forest, forested wetlands, open wetlands, spring seeps, successional old fields and an open water reservoir are set within a residential context along the floodplain of Crum Creek. Much of the 100 foot riparian buffer on either side of Crum Creek from the dam breast of the Crum Reservoir upstream to the outflow of Springton Reservoir is forested, while outside of that boundary, suburban residences and infrastructure crowd the creek floodplain. Occasional small wetlands occur along the creek floodplain where it widens and the water slows.

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p. 312 Species of Concern Considerations:

o Netted chainfern is a plant that typically inhabits swamps, seepages, wet woods, boggy wetlands and along margins of streamlets. The viability of populations of netted chainfern and its habitat may be enhanced by establishing buffers around wetlands, controlling invasive species and protecting the natural hydrology surrounding wetlands. A survey in late fall 2009 did not relocate this population, but it may still occur along portions of the creek's floodplain and adjacent wetlands. A resurvey earlier in the season may be more likely to detect this population. o A sensitive species of concern, which is not named at the request of the jurisdictional agency overseeing its protection, requires specific plant communities within a matrix of open canopied habitats. Restoration of the marshy habitats historically associated with the Crum Creek floodplain will help to provide expanded habitat opportunities for this species of concern.

Crum Creek Floodplain and Reservoir /154 Forest Cover / Natural Communities:

The plant community types depicted are approximations delineated from 2005 aerial photography interpretation and were followed up with minimal selective ground-truthing. Community types follow "Terrestrial & Palustrine Plant Communities of Pennsylvania" (Fike 1999) where appropriate, and otherwise describe general land cover types (*). o Terrestrial (upland) communities: o Dry oak – mixed hardwood forest o Tuliptree – beech – maple forest o modified successional forest* o Palustrine (wetland) communities: o Sycamore – (river birch) – box elder floodplain forest Ownership: o The linear riparian corridor of these creeks and tributaries has a very fragmented ownership, with many small parcels abutting the creeks. Fragmentation of ownership of larger landscapes can make consistent conservation action more difficult, but not impossible to achieve.

Habitat Disturbances:

o Historic: o Most of the original forest cover of the area had been removed and converted to agricultural or other uses over the past several centuries, leaving little of the original vegetation in place. Aerial photographs from 1937 show small scattered forested woodlots within a landscape dominated by active agriculture. o The Crum Creek Reservoir had been constructed by the time of the 1937 air photos, disrupting the natural hydrology of the waterway. o Current: o Rapid development has occurred on the periphery of the core habitat area, fragmenting the landscape with additional buildings, roads and infrastructure and increasing the amount of impervious surface and edge habitat in the immediate watershed. o Stormwater runoff from the highly developed surrounding communities flows into the creek system with little opportunity to be slowed or filtered. This results in increased downstream flooding and erosion and is a potentially significant non-point source of pollution. Runoff from these sources has significantly higher levels of sediment, nutrients, pesticides, herbicides and other pollutants than runoff filtered through natural vegetation. o Exotic Species – The edge habitat provided by reverting agricultural fields and residential development creates conditions favorable for many introduced species of plants. o Control options for invasive plants range from mechanical to chemical. High priority for invasive species control at this site should be targeted towards removing small populations of newly established invasive plants in the most weed-free areas of the Natural Heritage Area. Invasive species control efforts should try to maintain weed-free areas first, and then concentrate on removing invasive species in lightly infested areas, continually pushing back the line of invasion. Invasive species removal should be conducted in coordination with native species replacement to avoid denuding the understory vegetation. This needs to be a continual and sustained process of monitoring and control efforts. o The relatively low volume and diversity of understory herbs and shrubs in forested habitats may be attributable to an oversized deer herd. Over browsing by white-tailed deer is a serious threat to the overall understory plant diversity. An overabundance of deer can create the effect of park-like forests in which the understory and vertical stratification is greatly reduced. Removal of understory species eliminates habitat for some nesting songbirds as well as increasing competition between deer and other wildlife due to reduced food sources. Deer have strong, species-specific feeding preferences. The most highly preferred species are the first to decline or disappear when deer numbers are high. Furthermore, deer have Delaware County Natural Heritage Inventory 2011 –

Crum Creek Floodplain and Reservoir

There are many prolific seed dispersers for many of the most invasive nonnative species. The result is greatly impoverished native species diversity, failure of native tree regeneration, and the rapid proliferation of invasive species. It is likely their selective feeding habits and effective seed dispersal make the spread of invasives much faster than would be the case without deer, even where herds are only moderately oversized. Conservation Actions: o Overall: o Conserve and expand the forested riparian buffers of Crum Creek and its tributaries. Establish at least a 100 foot buffer of woody vegetation along the creek to help reduce erosion, sedimentation, and pollution. Additionally, best management practices (BMPs) that focus on limiting the introduction of non-point sources of pollution into surface and groundwater should be applied to the surrounding area. o Habitat modification by beavers could help to improve the integrity of this Natural Heritage Area, by reestablishing the matrix of open and canopied wetland complexes. If beavers expand into this system, a few should be allowed to modify and restore some of the open habitats that previously existed at this site. Beaver numbers are on the rise in Pennsylvania, and it is very possible that they could be documented here in the near future. o Within the Core Habitat: o Avoid fragmenting the existing forested areas with additional buildings or infrastructure. Avoid logging in this area except as it relates to invasive species removal. The forest cover should be allowed to achieve and maintain old-growth characteristics. Leave fallen trees in place to help provide habitat, soil nutrients, humus. and tilth. Trees that have fallen over approved trails can be cut through as necessary. o Restore and protect the hydrology of the landscape. Avoid altering the hydrology of Crum Creek, its tributaries, springs, and wetlands. This may require that road crossing improvements involve bridge systems that would preserve the wide sluggish waters associated with marshes and slow flowing waterways. o Forested and open wetlands each require special consideration to maintain their unique attributes. Existing wet meadows should not be modified (i.e. dammed, planted in trees, or farmed), as this will deprive the open wetlands adapted species of suitable habitat. Light grazing with pastoral animals can be an effective tool to maintain these soggy meadows in their preferred condition. Once the

open habitat within the historic floodplain has been restored, light grazing, often considered compatible with high financial yield organic meat and dairy production, could be an effective tool to maintaining the habitat for all wet meadow species. o

Could a Pond be created from the Underground Springs in the Valley Flatlands?
Research for Forest Gardens Pond Plants would expand the knowledge base.

Completely aside: There is an open question about whether there are undiscovered underground springs in the flat land near the stream valley that might be uncovered and persuaded to become a **pond**. It could be not only a well-tended pond but also could provide research into Aquatic Agroforestry food production, a Time Lapse capture of the process of testing, exposing and accessing water on a property that appears to have no water access, and the benefits of the wildlife biodiversity conditions captured on Time Lapse Photography: How a Pond affects Biodiversity and Wildlife Populations and Migration. These explorations are currently purely speculative....

As existing farm ponds deteriorate and are in need of maintenance, the creation and/or removal of such ponds should be explored as they affect the total ecological health of Forest Gardens, in order to recreate the natural hydrologic flows of the landscape. Because the species of concern noted from this site relies in part on open canopied habitats, programs that support establishment of riparian buffers with trees, such as CREP, should be avoided in areas close to open wetlands. Instead, these programs may be better suited beyond the historic floodplain of the drainages delineated within in this Natural Heritage Area. o
The stormwater runoff from development and agriculture should be considered a potential source of significant contamination for the creek and its floodplain habitat. Runoff from these sources have significantly higher levels of sediment, nutrients, pesticides, herbicides and other pollutants than runoff filtered through a natural habitat.

The Steep Forested Hillsides and their potential erosion capacity merit careful study and experimentation.
Stormwater management measures such as the creation of detention basins or vegetated swales should be implemented to decrease the unfiltered flow into the creek. o Remove invasive species of plants. o Reduce the deer density in the area. Uncommon species of native plants are particularly susceptible to deer herbivory. Delaware County Natural Heritage Inventory 2011 – Crum Creek Floodplain and Reservoir /156 of Potential Restoration Activities: Streams through forested areas should be considered high priority for conservation in the habitat. The forested riparian corridor helps to regulate the temperature of the stream and creates streamside conditions that contribute to improved water quality and aquatic habitat. Streams through non-forested areas should be restored with native trees and shrubs appropriate to the habitat. o Careful determination is needed to avoid planting trees in floodplains that contain herbaceous wetland habitats. These habitats should be maintained in their current open condition, with tree plantings to occur at the periphery of natural wetland openings. o Riparian Buffers: o An ideal vegetated stream buffer should be at least 100 meters (328 feet) in width from the edge of the 100-year floodplain. o An intermediate vegetated stream buffer should be at least 100 feet in width from the edge of the 100-year floodplain. o A minimum vegetated buffer should be at least 35 feet in width from the edge of the 100-year floodplain. o Remove invasive species of plants. The creek floodplain and edge habitats associated with agricultural fields are particularly susceptible to weedy plant invasion and will require a sustained and targeted approach to invasive management. Aggressive invasive species along the powerline rights-of-way can have a significant impact on the available habitat for the species of concern. Control of invasive species in the area will require extensive and continual effort. Focus non-chemical control efforts on selected areas surrounding species of concern. o Target pioneer populations of invasive plants for immediate and continued removal. It is much easier and more effective to keep a place invasive-free than to try and repair a heavily infested habitat. o Invasive species management needs to be coordinated by individuals familiar with the rare species as well as the invasive species present. o Continual invasive species monitoring and control will be necessary.

Discovery Forest may be able to significantly contribute to the next iteration of a focused study and active experimentation captured with Time Lase Photography with intentional, crafted Living Laboratory Research for Nature Based "Solutions" can all be folded into 2yr/5yr/10 yr. plan within these Ecosystems and also capture useful time lapse visuals for specific projects involving step forest slopes, a pond, wetlands and spring-fed streams as well as highly detailed comparative studies of he effect of Canopy thickness on the production of food throughout the 4 seasons.

BIODIVERSITY IMPLICATIONS

The following is an informal list of local and migratory birds in the immediate area. A knowledgeable ornithologist may be able to infer substantive information about what kinds of foods are available to the bird population and what kinds of companion animals and life forms are implied by their presence.

By the dozen (or regular flocks)
Blue Jay
House Finch

More Rare
Wood Thrush
Brown-Headed Cowbird

Gold Finch
Song Sparrow
Dark-eyed Tunco
Fox Sparrow
Black-capped Chickadee
Tufted Titmouse
Downy Woodpecker
White-Breasted Nuthatch
Red-Bellied Woodpecker
Northern Flicker
House Sparrow
House Wren
American Crow
Mourning Dove
Robin
Vesper Sparrow

Ovenbird
Eastern Towhee
Gray Catbird
Wood Thrush
Least Flycatcher

Common

This is a List of the Plants that were thought to be part of the life of Lenni-Lenape People who lived here pre-1775

Native American Ethnobotany by Daniel E. Moerman

(am in the process of obtaining a better copy of this)

An Encyclopedic Resource of Indigenous Plants & their importance in all aspects of daily life: Medicinal, Ceremonial, Insecticides, Religious Symbolism, Food… This listing page highlights the "Delaware" First Peoples, presumably from before the 1750s, when the Lenape People had voluntarily migrated West. The Delaware (Oklahoma) listing is from the post-migratory time to the mid-West. This plant listing of the 17th and 18th Century is invaluable. The **17th and 18th Century Biodiversity of Plants from the Past** may be able to live here again: Their research and further forest food species may be able to be significantly augmented by the 1728 Botanical Records of *very* nearby Bartram's Gardens. John & Son gathered native woodland plants from the deep wilderness from Montreal to lower Florida with the help of Indigenous Guides, who likely also furnished a lifetime's wealth of Botanical Wisdom. They kept meticulous records with Latin botanical names, which can be further traced by the European Export Customer Lists and to the detailed Botanical & Cultivation Records of Thomas Jefferson & other founding fathers. A notable food item on this list is "Apios", "The Native American Potato", a versatile, essential food that offset scarce winter food resources. There are over 250 Varieties and extensive study is underway at Louisiana U. Perhaps Discovery Forest can further the research….

Stable Gear: *Ulmus americana, U. thomasii, Urtica dioica*
Tools: *Ulmus americana, U. rubra, U. thomasii, Yucca glauca*
Toys & Games: *Amelanchier alnifolia, Artemisia* sp., *Betula papyrifera, Opuntia humifusa, Physalis lanceolata, Populus deltoides, Prunus americana, Quercus macrocarpa, Sambucus canadensis, Scirpus acutus, Thalictrum dasycarpum, Ulmus americana, U. rubra, Urtica dioica, Viburnum opulus*

Delaware

Drug

Abortifacient: *Acorus calamus, Mitchella repens*
Analgesic: *Cornus canadensis, Symplocarpus foetidus*
Anthelmintic: *Eryngium aquaticum, Juglans nigra, Prunus persica*
Antidiarrheal: *Prunus serotina, Rubus allegheniensis, Solidago juncea*
Antiemetic: *Cercis canadensis, Prunus persica*
Antirheumatic (External): *Aesculus glabra, Asclepias tuberosa, Cirsium vulgare, Gaultheria procumbens, Goodyera pubescens, Iris versicolor, Mitchella repens, Phytolacca americana, Tsuga canadensis, Verbascum thapsus*
Antirheumatic (Internal): *Arctium minus*
Blood Medicine: *Ambrosia artemisiifolia, Arctium minus, Chimaphila umbellata, Comptonia peregrina, Gelsemium sempervirens, Gentianopsis crinita, Gleditsia triacanthos, Myrica* sp., *Phytolacca americana, Rumex crispus, R. obtusifolius, Sambucus canadensis, Sassafras albidum*
Cathartic: *Maianthemum stellatum, Pimpinella anisum*
Cold Remedy: *Acorus calamus, Platanus occidentalis, Quercus velutina, Ulmus americana*
Cough Medicine: *Acorus calamus, Gleditsia triacanthos, Petasites frigidus, Prunus serotina, Quercus alba, Q. rubra, Ulmus americana, Verbascum thapsus*
Dermatological Aid: *Baptisia tinctoria, Celastrus scandens, Chimaphila umbellata, Comptonia peregrina, Datura stramonium, Juglans nigra, Monarda punctata, Phytolacca americana, Rhus copallinum, Sambucus canadensis*
Disinfectant: *Quercus alba*
Ear Medicine: *Aesculus glabra, Humulus lupulus*
Febrifuge: *Cercis canadensis, Eupatorium perfoliatum, Monarda punctata, Prunella vulgaris, Solidago juncea*
Gastrointestinal Aid: *Acorus calamus, Angelica atropurpurea, Cardamine diphylla, Gentianopsis crinita, Hedeoma pulegioides, Inula helenium, Juglans nigra, Maianthemum stellatum, Pimpinella anisum, Quercus palustris, Sanguinaria canadensis, Scutellaria galericulata*
Gland Medicine: *Phytolacca americana*
Gynecological Aid: *Asclepias tuberosa, Baptisia tinctoria, Goodyera pubescens, Leonurus cardiaca, Maianthemum stellatum, Plantago major, Quercus alba*
Heart Medicine: *Zanthoxylum americanum*
Hemorrhoid Remedy: *Datura stramonium*
Kidney Aid: *Achillea millefolium, Gaultheria procumbens, Hydrangea arborescens, Iris versicolor, Myrica* sp., *Typha latifolia*
Laxative: *Podophyllum peltatum, Scutellaria galericulata, Taraxacum officinale*
Liver Aid: *Achillea millefolium, Celastrus scandens, Iris versicolor, Rumex crispus, R. obtusifolius, Sambucus canadensis*
Misc. Disease Remedy: *Asclepias* sp., *Daucus carota, Lobelia cardinalis, Symplocarpus foetidus*
Narcotic: *Crotalaria sagittalis*
Oral Aid: *Rhus copallinum*
Panacea: *Lophophora williamsii*
Pediatric Aid: *Chrysopsis mariana, Nepeta cataria, Prunus persica, Sambucus canadensis*
Poison: *Aesculus glabra*
Pulmonary Aid: *Asclepias tuberosa, Chimaphila umbellata, Comptonia peregrina, Goodyera pubescens, Petasites frigidus, Symplocarpus foetidus, Verbascum thapsus*
Reproductive Aid: *Salix humilis, Viburnum prunifolium, Vitis rupestris*
Respiratory Aid: *Petasites frigidus, Verbascum thapsus*
Sedative: *Chrysopsis mariana, Humulus lupulus*
Stimulant: *Arctium minus, Humulus lupulus, Phytolacca americana*
Strengthener: *Populus deltoides, Sanguinaria canadensis, Vitis rupestris*
Throat Aid: *Helianthemum canadense, Platanus occidentalis, Quercus alba, Q. rubra, Q. velutina*
Tonic: *Aristolochia serpentaria, Chrysopsis mariana, Cimicifuga racemosa, Cornus florida, Gaultheria procumbens, Inula helenium, Panax quinquefolius, Podophyllum peltatum, Prunus serotina*
Toothache Remedy: *Humulus lupulus*
Tuberculosis Remedy: *Lophophora williamsii*
Unspecified: *Panax quinquefolius, Plantago major, Toxicodendron pubescens*
Urinary Aid: *Chimaphila umbellata, Comptonia peregrina*
Venereal Aid: *Cardamine diphylla, Chimaphila umbellata, Comptonia peregrina, Crotalaria sagittalis, Echinacea purpurea, Iris versicolor, Rhus copallinum, R. hirta, Salix humilis, Stachys palustris*

Food

Bread & Cake: *Apios americana, Zea mays*
Dried Food: *Zea mays*
Porridge: *Zea mays*
Soup: *Zea mays*
Staple: *Zea mays*
Unspecified: *Agaricus campestris, Apios americana, Rumex acetosella, Zea mays*
Winter Use Food: *Apios americana*

Other

Ceremonial Items: *Sanguinaria canadensis, Zea mays*
Insecticide: *Juglans nigra*

Delaware, Oklahoma

Drug

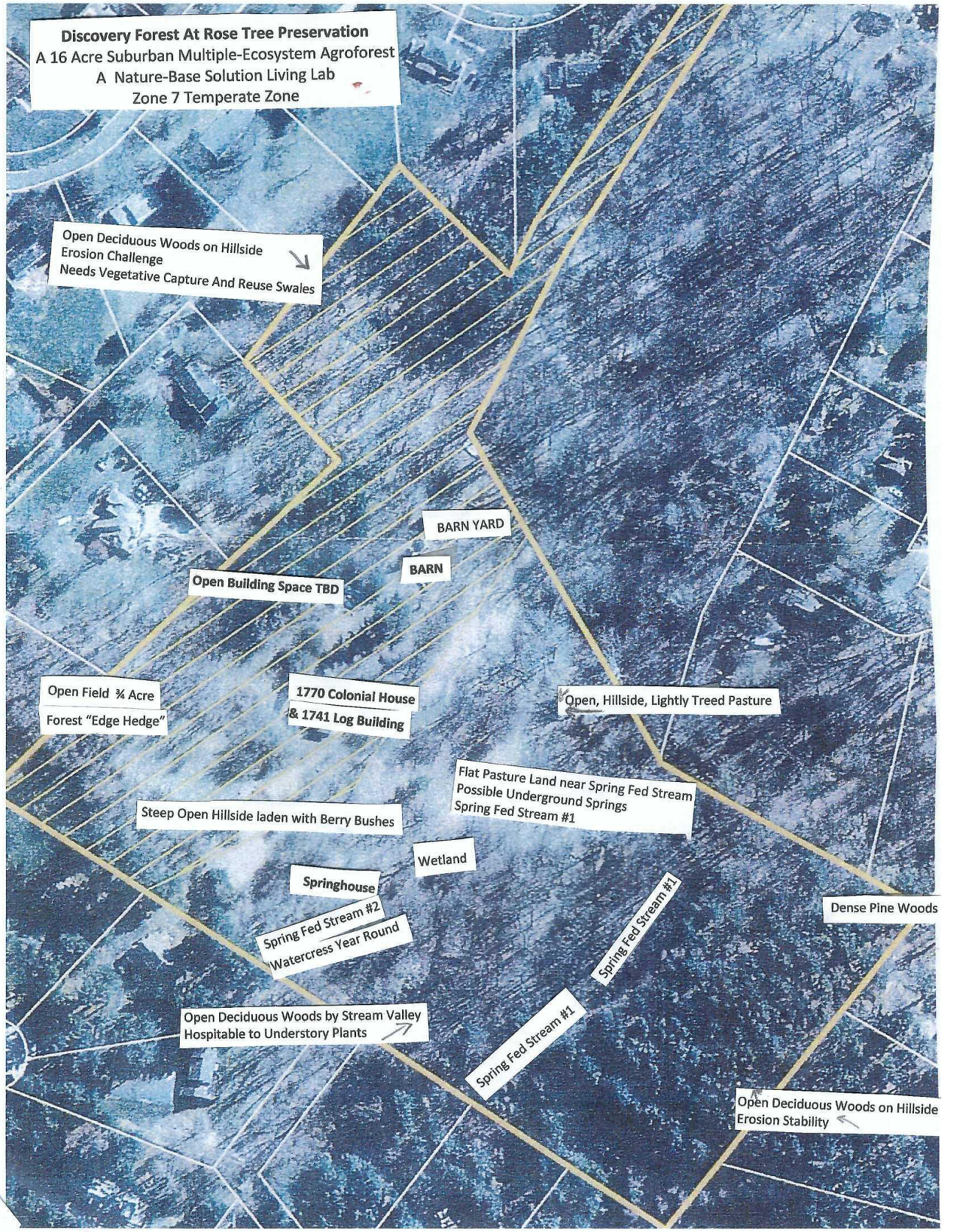
Abortifacient: *Acorus calamus, Mitchella repens*
Analgesic: *Acorus calamus, Cornus canadensis, Hedeoma pulegioides, Helianthemum canadense, Quercus palustris, Symplocarpus foetidus, Verbascum thapsus*
Anthelmintic: *Eryngium aquaticum*
Anticonvulsive: *Asclepias* sp., *Symplocarpus foetidus*
Antidiarrheal: *Prunus serotina, Rubus allegheniensis, R. canadensis, Solidago juncea*
Antiemetic: *Cercis canadensis*
Antirheumatic (External): *Cirsium vulgare, Juniperus virginiana, Mitchella repens, Phytolacca americana, Tsuga canadensis, Verbascum thapsus*
Antirheumatic (Internal): *Arctium minus, Asclepias tuberosa, Gaultheria procumbens, Goodyera pubescens, Iris versicolor, Phytolacca americana*
Blood Medicine: *Ambrosia artemisiifolia, Arctium minus, Chimaphila umbellata, Comptonia peregrina, Gelsemium sempervirens, Gentianopsis crinita, Gleditsia triacanthos, Myrica* sp., *Phytolacca americana, Rumex crispus, R. obtusifolius, Sambucus canadensis, Sassafras albidum*
Cathartic: *Betula alleghaniensis, Frangula caroliniana, Fraxinus americana, Juglans nigra, Maianthemum stellatum, Morus nigra, Pimpinella anisum*
Ceremonial Medicine: *Artemisia frigida, Rhus copallinum*
Cold Remedy: *Acorus calamus, Platanus occidentalis, Quercus velutina, Ulmus americana, Verbascum thapsus*
Cough Medicine: *Acorus calamus, Gleditsia triacanthos, Petasites frigidus, Prunus serotina, Quercus alba, Q. rubra, Symplocarpus foetidus, Ulmus americana, Verbascum thapsus*
Dermatological Aid: *Ambrosia artemisiifolia, Baptisia tinctoria, Chimaphila umbellata, Comptonia peregrina, Datura stramonium, Gelsemium sempervirens, Juglans nigra, Menispermum canadense, Quercus alba, Rhus copallinum, Sambucus canadensis, Solanum dulcamara, Toxicodendron pubescens, Vitis vulpina*

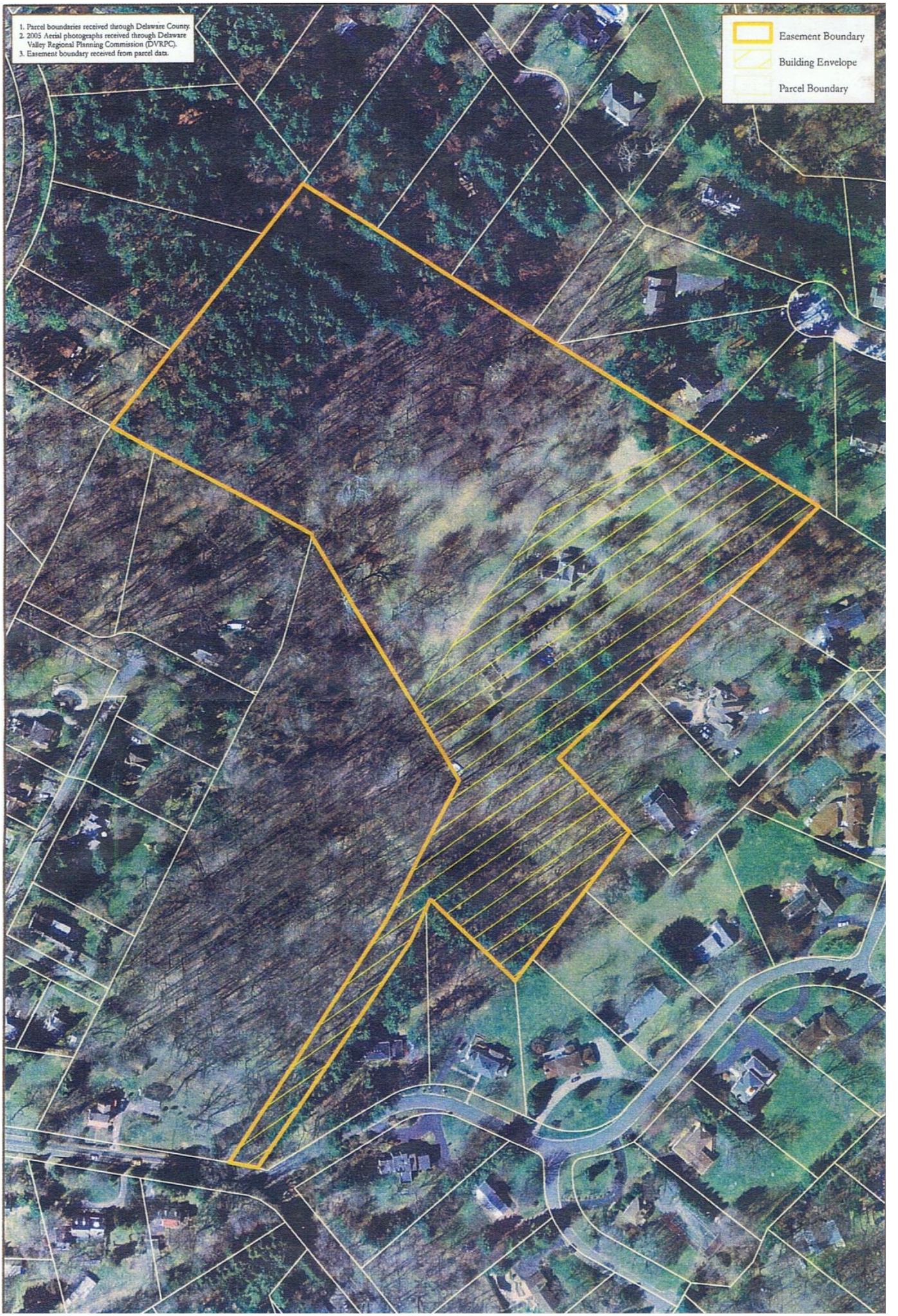
It would be so exciting to attempt to rediscover and revitalize native plants of the (Delaware) Lenni-Lenape First Peoples from the 1600s & 1700s that created the paradise of abundance in this very valley. *Nearby* Bartram's Gardens has 1700s woodland plant data...

petegrina

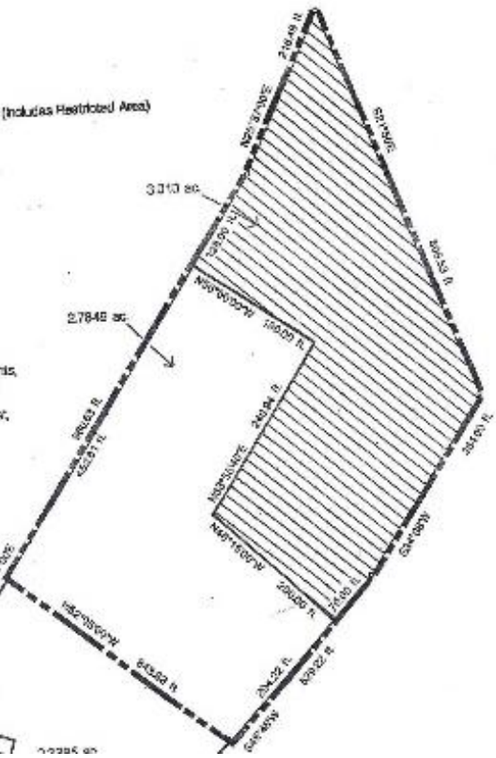
sagittahs, Ecbi,nacea parpu.rea, it is versicolor,

A


Discovery Forest At Rose Tree Preservation
A 16 Acre Suburban Multiple-Ecosystem Agroforest
A Nature-Base Solution Living Lab
Zone 7 Temperate Zone
Open Deciduous Woods on Hillside
Erosion Challenge
Needs Vegetative Capture And Reuse Swales
BARN YARD
BARN
Open Building Space TBD
Open Field ¾ Acre
Forest "Edge Hedge"
1770 Colonial House
& 1741 Log Building
Open, Hillside, Lightly Treed Pasture
Flat Pasture Land near Spring Fed Stream
Possible Underground Springs
Spring Fed Stream #1
Steep Open Hillside laden with Berry Bushes
Wetland
Springhouse
Spring Fed Stream #2
Watercress Year Round
Spring Fed Stream #1
Dense Pine Woods
Open Deciduous Woods by Stream Valley
Hospitable to Understory Plants
Spring Fed Stream #1
Open Deciduous Woods on Hillside
Erosion Stability



This Contiguous 6 Acre Wooded Area that is also under protective easement with The Natural Lands Trust is already spoken for and no acquisition overtures of any kind have been made. Perhaps it could become available at some point to be added to the 16 acre parcel.... It has a fairly open forest floor and is has a gently open old growth canopy on a gentle slope ravine in its center which would be interesting to research for Agroforestry Plantings...

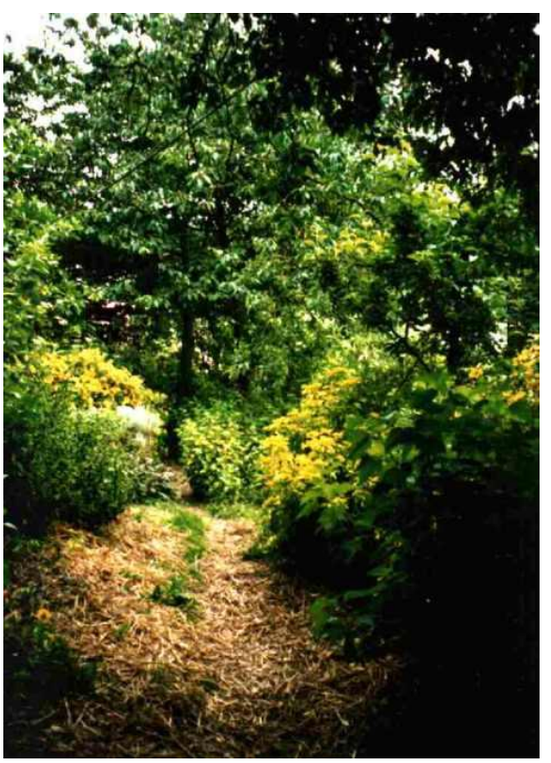


The Discovery Forest Campus Site

The Discovery Forest Ecosystems Map – 14 Ecosystems & An Aerial Property Parcel Overview

Stewarding A National Branding Enculturation Campaign for Forest Gardens & Facilitating Forest Gardens Projects

These Ecosystems will sequence In-Situ Research for Expanded Knowledge Base & 10 years of Time Lapse Filming



Mature Forest Garden Understory
Robert Hart's Forest Garden, Wenlock Edge, Devon, UK

Discovery Forest
The Home of Ancient Forest Garden Futures