

Shepherd's Reach Forest Stewardship Plan

Prepared for: [REDACTED] Wilson

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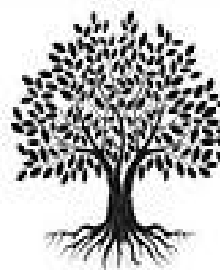
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Acreage: **87 acres**

Date: July 2022

Prepared by: Ryan Pirault - ryan.pirault@gmail.com

Grant Depoy - depoymail@gmail.com



Holistic
Forestry

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Acknowledgements

First and foremost we want to give thanks to the flora, fauna and soil that make the work that we enjoy so much possible.

Second a hearty thank you is sent to Regenerative Earth Design LLC for connecting the Wilsons with us.

Third, we would like to extend a very gracious thank you to the Wilsons for allowing us the space to conceptualize a plan and conversation that will hopefully be carried on through many generations to come.

Introduction

Project Summary

This Holistic Forest Stewardship Plan commenced with a site analysis and surveying in the second week of April 2022, after an initial consultation. Observations and analysis concerned the following: *abiotic and biotic factors, physical, biological and cultural attributes, landform, built environment, energy sources, present and historical land use features, activity nodes and corridors, critical habitat foundations, soil composition, vegetation composition and cover, successional pattern and plant productivity, wildlife corridors, water resources, climatological factors, the waste stream.* After this initial assessment of landscape dynamics and landowner goals and values, the comprehensive planning and design process of this personalized ecological system commenced.

Landowner Goals & Objectives

- Increase biodiversity of native flora and fauna
- Promote and conserve critical wildlife habitats
- Manage resources sustainably in perpetuity
- Increase yield of edible and medicinal forages
- Reduce soil and streambank erosion of Sleepy Creek
- Increase wood turtle habitat in Turtle Terrace
- Sustainably raise pigs in the forest
- Cultivate a forest with old-growth characteristics

Site Analysis

Location

Parcel ID: [REDACTED]

Property Boundary: [REDACTED]

Address: [REDACTED]

Legal Description: [REDACTED]

Latitude/Longitude: [REDACTED]

Access

[REDACTED] This property can be accessed from Berkeley Springs, West Virginia by heading Southeast on WV-9 E/Martinsburg Rd for .8 miles before turning right (South) onto New Hope Rd and continuing for 3.3 miles. Continue onto Spohrs Rd/Virginia Line-Potomac Rd for .1 mile, before turning right onto Mountain Run rd. After .4 miles on Mountain Run rd, continue straight onto Shade Lane for 1.2 miles. The road will fork to a dead end on the right, and to Country Rd Ln on the left. The property extends along the northern side of Country Rd Ln, and to the left of the Shade Lane dead end. The property can be accessed from either road. A large drive extends from Country Rd Lane that circulates the entire property.

Landscape

This property consists of 87 acres surrounded by a creek on 3 sides. Most of the land is open lawn or pasture. The forest exists along the creek and other areas of drainage that lead to the creek. Approximately 47 acres is open lawn, pasture, or infrastructure, and roughly 40 acres is forested. *See satellite imagery below.*



Built Environment

The newly constructed primary dwelling is labeled on map above as “Homesite”. Directly adjacent to the primary dwelling is a detached three car garage as well as a detached mobile chicken coop. Taking the road from the primary dwelling toward “Turtle Terrace” there is an equipment shed to the left of the road. In between the primary dwelling and the “Secret Garden” there are twenty bee hives surrounded by electrified fencing. There is a potential future homesite labeled “ Future Homesite?” on the map above.

Climate

According to the Köppen climate classification system, Morgan County has a **Humid Continental Climate (Dfa)**, typified by four distinct seasons and large seasonal temperature differences, with warm to hot (and often humid) summers and freezing cold (sometimes severely cold in the northern areas) winters. Precipitation is usually distributed throughout the year but often has dry seasons. A climate and precipitation graph with month-to-month averages is included in the appendix. The property lies within the **plant hardiness zone 6a-6b**. As our climate’s trajectory unfolds, outlying climatic occurrences and weather events may become more common.

Soils & Fertility

The general composition of soils on this property are deep loams and silt loams, commonly used for agriculture, and historically forested. An existing NRCS document is available with more details regarding approximate boundaries of soil profiles and their descriptions: *Wilson - Soil Report USA*.

In order to obtain precise soil analyses, collect samples and contact International Ag Labs: <https://aglabs.com/services-international-ag-labs/soiltesting.html>

Ecoregion Classification

Shepherd's Reach lies within the level IV ecoregion, *Northern Shale Valley (67b)*, contained within the level III Ecoregion, *Ridge and Valley (67)*. (LEVEL III AND IV ECOREGIONS OF DELAWARE, MARYLAND, PENNSYLVANIA, VIRGINIA, AND WEST VIRGINIA by Alan J. Woods, James M. Omernik, Douglas D. Brown).

https://trainingcenter.fws.gov/courses/csp/csp3200/resources/documents/epa_region_3_eco_desc.pdf

The **Level III Ecoregion, Ridge and Valley (67)** is a northeast-southwest trending, relatively low-lying, but diverse ecoregion sandwiched between generally higher, more rugged mountainous regions with greater forest cover. As a result of extreme folding and faulting events, the region's roughly parallel ridges and valleys have a variety of widths, heights, and geologic materials, including limestone, dolomite, shale, siltstone, sandstone, chert, mudstone, and marble. Springs and caves are relatively numerous. Present-day forests cover about 50% of the region. The ecoregion has a diversity of aquatic habitats and species of fish.

The **Level IV Ecoregion, Northern Shale Valley (67b)** has a low elevation and consists of rolling valleys and low hills. The bedrock of this region is a mix of sedimentary rocks, including shale, fine-grained sandstone and the finer siltstone. The soils here tend to have low permeability and erode easily. Thus, ephemeral streams with concentrated flow paths are a common occurrence. On average, this region has acidic soils with low fertility. Shale barrens are a common occurrence in this region. The Northern Shale Valleys are interspersed with the agriculturally more fertile, low-lying *Northern Limestone/Dolomite Valleys*, and the higher *Northern Sandstone Ridges*. In a few areas they also border the *Northern Dissected Ridges and Knobs*. At the northeastern end of this region, at the limit of glaciation, this region is replaced by the *Northern Glaciated Shale and Slate Valleys*, essentially the same substrate but shaped by glaciation.

Hydrology

West Virginia has 32 watersheds divided according to hydrologic unit codes (HUC) that contribute to the Chesapeake Bay and the Gulf of Mexico. This property lies within the *Berkeley Watershed*, which drains into the Potomac River, and then into the Chesapeake Bay southeast of Washington D.C. It is crucial to maintain areas of lush vegetation along waterways in order to filter and conserve critical water resources and habitats. Water retention is critical in ecological design, and efforts should be made to slow down water infiltration via methods of water capture such as rain catchment cisterns, ponds, and dense vegetation. Areas of dense vegetation mediate the flux of groundwater, acting as a sponge to slow the infiltration and loss of water. Historic records indicate that this area does flood semi-frequently, (usually every 10-30 years). An existing USFW document is available with more details regarding approximate boundaries of wetland profiles: *Wilson - Wetland Screening*.

Land-Use History

Shepherd's Reach had been used for timber harvesting and private outdoor recreation for the past half century. Acquired in 2017 by the Wilson's, a home was erected and finished in 2018. All 86 acres is home to abundant game such as turkeys, deers and black bears.

Regional History

Humans have been in the surrounding region of Shepherd's Reach for over 12,000 years. West Virginia's earliest found human artifacts include stone hunting tools utilized by the ancient Clovis peoples who hunted for large game and fished along valleys and riverways. Between 2000 BCE and 1000 BCE, humans in the area transitioned from a dominantly nomadic hunter-gatherer culture, toward systems of long-term settlement and agricultural production. The most recent Native American groups were the Monongahelans, who settled in the area between 900 CE and 1635 CE, and the Shawnee tribe, who settled in the area between 1650 CE and 1750 CE. Until recently, the prevailing narrative of the historic North American indigenous peoples has been that they affected the landscape's development minimally. Chemical analyses of stalagmites in West Virginia reveal growth patterns which suggest that the indigenous peoples were regularly burning trees in order to manage their land. Intentionally clearing and burning forests created space for their agricultural development and enhanced the conditions for native nut-bearing trees to flourish.

Region, location	Presettlement forest composition
Eastern West Virginia Ridges	White oak (35%), chestnut (15%), chestnut oak (13%), black oak (12%)
Eastern West Virginia Valleys	White oak (23%), maple (22%), pine (15%), basswood (10%)

Figure 5. This table shows the dominance of hardwood species prior to European settlement. (Butler et al. 2015)

When European settlers entered the area, they brought new attitudes and land management practices with them, most of which did not consider the long term health and succession of the forests. In the late 1700s and early 1800s, logging operations were dangerous and timely, using teams of hand-saws and horses to extract small quantities of timber. The industrial revolution led to the innovation of the bandsaw, which was first constructed in 1881, and greatly increased the market for these destructive practices. By 1909 there were 83 band mills and 1,441 other lumbering establishments operating in the state of West Virginia. Red Spruce was the most valuable timber in the state, cleared from mountain tops and plateaus in order to build homes, barns, fences, and forts. Between 1870 and 1920, an estimated 30 billion board feet of timber were removed from West Virginia's forests, leaving nearly all of the state in clearcut conditions. This pattern of management led to severe and accumulating environmental degradation: soil erosion, stream and river sedimentation, flooding, out-of-control fires, and denuded landscapes.

Only small pockets of West Virginia's forests escaped these destructive logging practices, and Uptop's forest was no exception. The logging industry has sustained itself as a driving economic force in the state, shaped by the global demand for lumber, local landowner values, and national-regional policies. Logging standards have improved through the years, though practices such as Diameter-Limit Cutting (*which indiscriminately harvests all trees above a certain diameter*) perpetuate the declining quality of our forest resources by overlooking the intricacies of age-class, species, and gap dynamics. In 2006, only 5 percent of nonindustrial private forest landowners in West Virginia sought forest management advice from a professional. This leads to regional normalization of forest management protocols that are dominated by the perspective of loggers with special-interests. The forests in the North-East Central Hardwoods region of West Virginia were once primarily uneven-aged mixed hardwoods and became even-aged oak/hickory forests in response to human disturbances during the industrial revolution. Now the forest is headed toward red maple and sugar maple as the dominating species.

Saint Patrick's day March, 1936 brought historic rains and flooded the entire Berkeley Springs region. This flood is well documented and stands tall in historical records but is not the only record setting flood of the past century in this region. Records show the possibility for a major flood event once every ten to thirty years since the late 1800's. Flooding in this region is mainly due to surface runoff but can sometimes be snow and ice melt. Since flood records are only available from the late 1800's on, a scope of flooding in this region is limited. Since logging efforts can coincide with more frequent and damaging floods, one can assume there may be some correlation to the historic and devastating floods since this time period.

Ecoregion Considerations

In order for land managers to act effectively as stewards of the ecosystem, it is essential that they have an awareness of the ecological concerns shared regionally and beyond. This section of the report introduces priority stewardship goals for land managers in West Virginia, as well as threats posed by the changing environment.

Endangered and Threatened Species

West Virginia has no legislation regarding the state's threatened and endangered species. Only federally listed species are listed in the state. This includes native species of bats, mussels, isopods, and salamanders. There are 6 plant listings and 23 animal listings. The listings can be found at: <https://www.wvdnr.gov/wildlife/endangered.shtm>

Invasive and Threatening Species

The following species pose a threat to the establishment of West Virginia's native plant communities by outcompeting local species and creating blankets of uniformity: [Japanese stiltgrass](#), [Japanese honeysuckle](#), [Amur/Bush honeysuckle](#), [Autumn/Russian Olive](#), [Japanese barberry](#), and [multiflora rose](#).

[Hay-scented Fern](#) and [Poison Ivy](#) are present as native-invasive species. Many plant diseases and pests infest native forests. [Hemlock woolly adelgid](#), [emerald ash borer](#), [gypsy moth](#), and [spotted lantern fly](#) may be found in the area. These invasive species compound on top of other insects, fungi, and bacterial infestations that are native and reduce overall plant health.

Oak Regeneration

The establishment and regeneration of native Oak forests are desirable regionally because of their historic presence in stand cover prior to European settlement. Oak trees are capable of enduring a relatively wide range of environmental conditions and provide an abundance of ecosystem services. Concerns regarding regeneration have been reported across West Virginia by natural resource professionals. Their concerns include deer, forest management practices, invasive and interfering vegetation, composition & density of regeneration, forest health, fragmentation, attitudes or perceptions of the public related to forestry or forest management practices, mineral development, and wildfire.

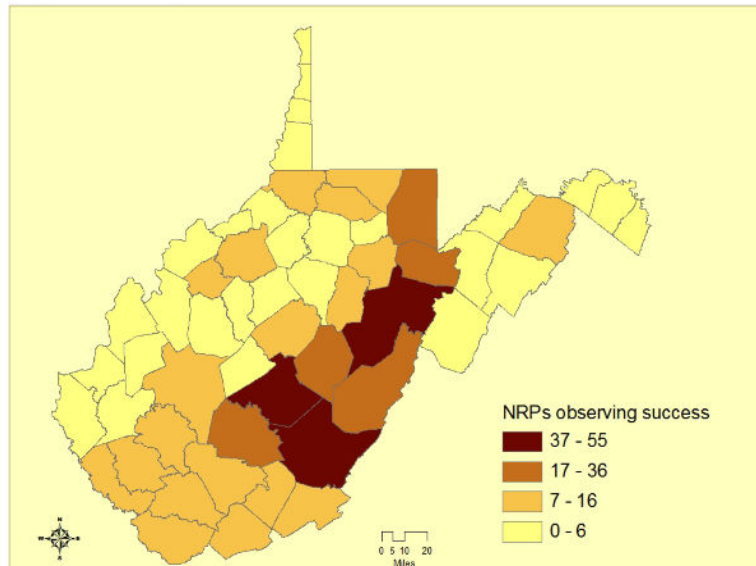


Figure 11. Number of Natural Resource Professionals (NRPs) observing successful regeneration in each county (Voss 2012).

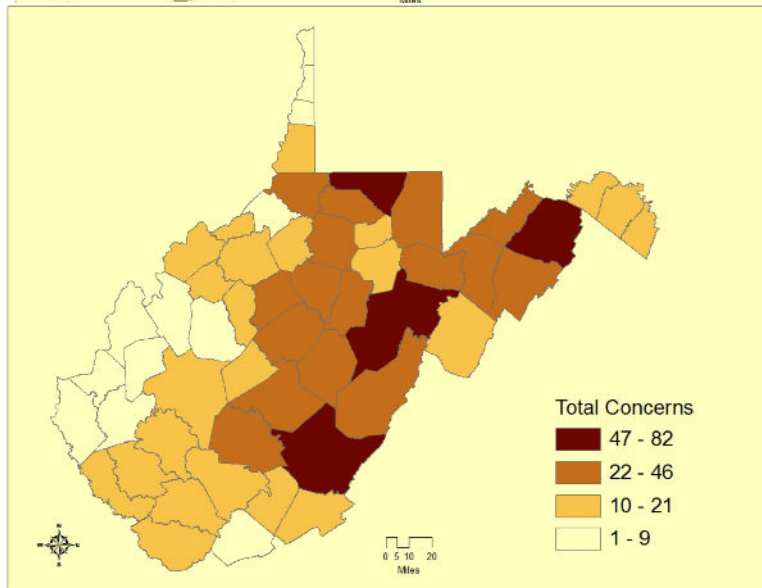


Figure 12. Number of regeneration concerns per county. The mean was 22 concerns (Voss 2012).

The number of concerns exceed the reports of success because the tree species that thrive after disturbances such as selective cutting and clearcutting are tulip poplar, black cherry, and maple. Many forest stands in West Virginia have multi-stemmed cherry trees that are a result of sprouts that originate from stumps of trees that had been cut years prior.

Oaks are shade intolerant species, which means that they struggle to grow in heavily shaded understory conditions, and grow slower than many other native trees. Species such as maple, which are shade tolerant have become dominant due to the regime of fire suppression in the 1900s through to the present. Without fire interrupting shade tolerant growth, non fire-adapted species proliferated. Oaks do particularly well when fire top-kills stems and leaves of young seedlings and saplings. When oaks are

top-killed, they send nutrients and minerals to be stored in their root system, which keeps them growing. The energy-packed root system encourages the oak to grow with vigor into the canopy in the next growing season where openings in the canopy allow for their establishment over decimated shade tolerant species. Other small-diameter, fire-intolerant species (i.e. maple and beech) often die during low-burning ground fires. The fire cooks the tree's cambium, which damages the cells that divide and encourage growth. These species regenerate in abundance and survive well in closed canopy conditions as advanced regeneration.

Future Climate Trends

Global human industrialization has raised questions to foresters that have never been answered before. Although it is unclear what conditions the future climate will yield on the scale of personal property, cross-institutional collaboration can prepare landowners for such unpredictability. Interdisciplinary research teams have utilized historic climatic trends and physical earth processes in order to develop *General Circulation Models (GCMs)*, which simulate human-influenced low-carbon emissions to high-carbon emissions scenarios. GCMs are useful to project future climate trends; however, they are only to be used as guides to inform planning initiatives (Butler et al. 2015). The following climatic conditions are projected to occur in varying intensities:

- 1) Longer Growing Season** - first and last frost dates are projected to change
- 2) Shorter Winters** - the time period needed for some tree seeds to **cold scarify** (preparation phase for germination) is projected to reduce and indeterminate frost may occur; potentially cold shocking spring flowers and effectively reducing seed crops more often
- 3) Potential for Summer Drought** - drought stresses plants that prefer rich and moist growing conditions and can impact trees that are already stressed from other conditions (pests, disease, etc)
- 4) CO₂ Fertilization** - forest growth is projected to increase due to higher levels of carbon in the atmosphere; at least until growth-reducing stressors prevail
- 5) Changes in Suitable Habitat** - as living conditions for trees change, habitat structure and land features are projected to shift depending on site characteristics
- 6) Extreme Events** - storms are projected to be more powerful; drought and flooding are projected to increase
- 7) Wildfire Risk** - increased risk of drought, invasive pests and disease, and heat stress are projected to promote potential for wildfires to increase in abundance and periodicity

8) Forest Pests and Diseases - changes in first and last frost dates may allow pest populations to grow, increasing chances of tree mortality across larger areas

9) Invasive Plants - Invasive plant species are projected to increase in abundance across the landscape, stressing native plant populations and discouraging landscape-level biodiversity

Stewardship Considerations

The Holistic Forestry Approach

This comprehensive design science approach to forestry aims to mediate the needs and values of land users and forest ecology by considering natural laws and ecological design principles. In order to make stewardship decisions that reflect the forest as a whole system nested within the whole of the earth, rigorous observation is necessary. Through consistent and involved observation, apparent “design problems” will reveal their own solutions. By observing the functional relationships within the forest ecosystem rather than its individual elements, subtle connections will be noticed over time, and context-specific opportunities for advancing synergy between humans and the environment will be revealed to the steward.

Ecological Restoration

The goal of ecological restoration is to establish resilient ecosystems which reflect the historic flora and fauna relationships of a given locale. The goal is not to recreate a carbon-copy of the historic ecosystem, but rather to develop practical and regenerative systems for the current context. This is achieved by first extensively researching site-specific records of presettlement conditions, followed by the applying of appropriate technologies to the given context, in order to create the conditions necessary for desired vegetation to reproduce - all with minimal detriment to the existing ecology. Possible interventions could include the introduction of lost species or lost functions (such as fire and grazing), or the manipulation of landform and hydrology.

Restoration Modalities

After considering the historic ecological context, we may derive a series of *restoration modalities*, which determine the overall management approach. These are defined most generally by **canopy coverage** and **soil moisture content**.

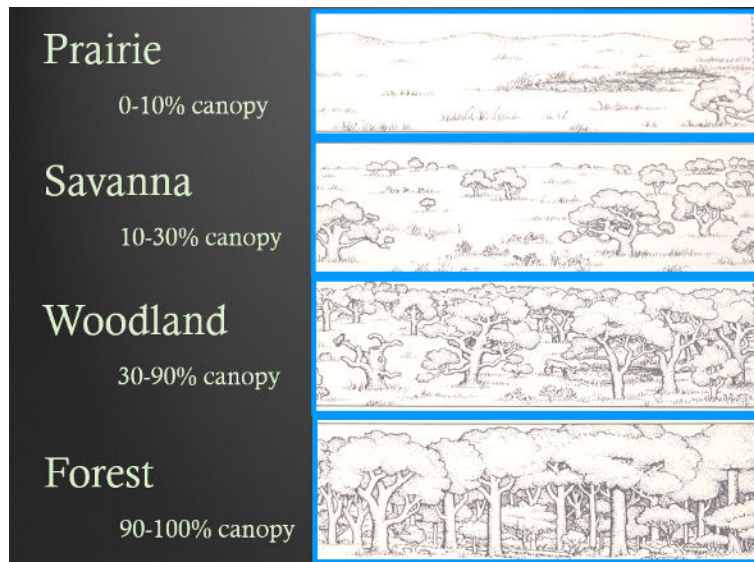


Fig. 1

The spectrum of canopy coverage includes: *prairie, savanna, woodland, and forest*. Each of these cover types are associated with unique species compositions, wildlife habitats, and natural disturbance regimes.

In addition to the spectrum of canopy coverage, we will consider the spectrum of soil moisture: *dry, dry-mesic, mesic, mesic-wet, and wet*. The seasonal moisture content of the soil will also affect the species composition, wildlife habitat, and natural disturbance regime of the site. It is determined by soil texture, climate conditions, underlying geology, and historical events.

Restoration-based Forestry

Old-growth forests accounted for a majority of North American forestland before modern settlement. These forests take at least 200 years to develop naturally, and may take longer in many circumstances. Most forests today are in relatively young stages of development, approximately 100 years or less in maturity. Further, most forests have been selectively cultivated for highly productive timber species or they have been completely severed from their native seed banks and historical disturbance regimes.

When considering a restorative management approach, it is necessary to encourage the characteristic features of old-growth forests in order for the establishment of rare and endemic forest species to occur. The primary characteristics include large rotting logs, standing dead snags, diverse tree species and age classes, complex canopy gap dynamics, and microclimates. Based on the context, management may be approached more or less intensively in order to achieve similar results across different timeframes.

- **“Passive” & “Active” management** offer a spectrum of intensity regarding human intervention. It is recommended that in pursuing any form of active management, that an experienced forester is involved onsite in order to accurately measure and evaluate site conditions.

- **Passive management** involves minimal human intervention and may take upwards of a century to fully develop the characteristic structure of an old-growth forest. Activities may include planning, surveying, monitoring, designating and protecting legacy trees, and responding to natural disturbances such as tornadoes, floods, and fires.
- **Active management** engages human intervention regularly and seeks to accelerate the successional development of old-growth characteristics. Activities may include planning, surveying, monitoring, thinning, girdling, felling, tree planting, timber extraction, designating and protecting legacy trees, prescribed burning or grazing, fertilization, mulching, and more.

Agroforestry

Agroforestry is the integration of agriculture and forestry practices. The cultivation of woody perennials offers a myriad of ecosystem services which benefit the farm ecosystem. This includes raising soil fertility through nutrient cycling, reducing soil erosion, mediating fluxes in groundwater, creating microclimates, and more. Agroforestry supports farm processes while offering additional crops of timber, fruit, nut, fodder, and medicines. The United States Department of Agriculture (USDA) recognizes 5 essential agroforestry activities:

- **Windbreaks & Hedgerows** - *Lines of trees & shrubs to block wind, access, or view*
- **Riparian Forest Buffers** - *Trees & shrubs along waterways*
- **Silvopasture** - *Trees & shrubs used to create structural diversity in pastures*
- **Alley Cropping** - *Lines of trees & shrubs on rotation with annual crops*
- **Forest Farming** - *Foraging or cultivating the understory in a forest setting*

In addition to these 5 federally recognized agroforestry practices, opportunistic food forestry and forest grazing practices may serve landowner values.

Food Forestry - Take an opportunistic approach to managing all woody perennials in fields and forests, in order to increase overall food and medicine resource security. Instead of removing all undesired trees, consider grafting on compatible cultivars that may provide edible crops or biofuels. Honey locust can be grafted onto with non-thorny varieties to spare your tires. Bradford/Callery Pear trees can be grafted onto with edible cultivars. If a disturbance causes a gap in the forest canopy, consider planting fruit or nut cultivars. A plethora of edible wild plants, including mushrooms, ramps, wild ginger, etc. may be promoted throughout forests by spreading seeds.

Forest Grazing - Researchers of ecological succession have determined that large-scale forest grazing events were critical in the development of historic native forest ecologies. Over a vast period of

time, forest plant guilds adapted to the rhythm of high-impact grazing events from large herds of bison, elk, and others, in addition to the browsing-pressure of megafauna. Forest grazing mimics historic patterns of natural disturbance while diversifying the diets of farm animals. With involved management, forest grazing can offer an efficient means to managing your forest and livestock.

Forest Survey

This section presents observations and analyses from the initial forest survey conducted by Ryan Pirault of LivityWorks, LLC. Management units were designated by the landowners. Survey results are included for each distinct management unit in the following order: *Jesus Glade*, *Fernville*, *Turkey Beach*, *Turtle Terrace*, and *Secret Garden*.

Jesus Glade // Forest Survey

Stand Area: 3 acres.

Soils: PHILO SERIES SILT LOAM. The site index for white oak is 85.

Stand Age Class: Uneven-aged Stand.

Forest Cover Type: Oak / Hickory. The predominant species on the site are Oak and Hickory, with associated species of Tulip-Poplar, Silver Maple, Sycamore, and River Birch.

Plants of Concern: Multiflora rose and Japanese barberry are two plants that are cause for concern. They are growing primarily along the creek. Consider thinning or removing them in order for more species to inhabit the stand. There were no endangered or rare species observed.

Understory Conditions: Overall advanced regeneration is low with <10% of the trees at sapling size. The tree regeneration present was predominantly Poplar and Maple in the wooded areas, with associated regeneration of hickory. In the grassy understory and along the forest edge, oak regeneration is observed. American Hornbeam is common in the understory and could stand to be thinned. The understory contains other native and nonnative plants that provide enriching ecosystem services.

Identified species include the following:

- American Hornbeam - *Carpinus caroliniana*
- Yellow Trout Lily - *Erythronium americanum*
- Yarrow - *Achillea millefolium*
- Virginia bluebell - *Mertensia virginica*

Jesus Glade Stand Summary

This area is on the southern facing side of the property. Overall this area is sparsely wooded and is primarily a recreational area. Existing trees have ample room between them and the soil is mostly covered with grass that is easily mowed. To the eastern end, woods are slightly denser and have a forest floor mixed with woodland botanicals and few invasives. Bordered by Sleepy Creek, there is an old road that is now submerged which leads to the other side of the creek but now also acts as a boat ramp. Jesus Glade is an area of the property that brings back fond memories of Ramsey's youth tending the golf course he grew up on.

From east to west of the area soil types are mixed. Soil tends to have a bit more clay in the grassy areas, a bit more loam in the more densely wooded area and more sand towards the creek.

Along the creek there are invasive rose and barberry bushes which are easily managed by mowing once every other month Spring through Fall. On the exterior of the eastern wooded area the forest is lined with dogwoods and rosebuds. On the western side, in the area with mowed grass, there is a substantial white oak against the creek.

Fernville // Forest Survey

Stand Area: 16 acres

Stand Age Class: Uneven-aged Stand

Forest Cover Type: Poplar/Maple. The predominant species on the site are Tulip Poplar and Maple, with associated species of Oak, Shagbark Hickory, Sycamore, River Birch, Dogwood, Black Locust, White Pine, Black Cherry, Eastern Redbud, and Tree-of-Heaven.

Soils: POPE SERIES SANDY LOAM. The site index for white oak is 80. The soil on site was observed as mostly silt loam with soil becoming increasingly sandy towards the creek.

Plants of Concern: Multiflora rose and Japanese barberry are two plants that are present, growing primarily along the creek. They are conventionally considered “invasive” because they are exotic in origin and often inhabit disturbed areas including forest edges, roadways, and high-impact forestry interventions. These plants should be monitored and removed if they begin overcrowding desirable native species and habitat. No rare or endangered plants were observed. There were no endangered or rare species observed.

Understory Conditions: The tree regeneration present was predominantly poplar and maple, though many oak seedlings were growing as well. American Hornbeam is common in the understory, and could stand to be thinned. The understory contains other native and nonnative plants that provide enriching ecosystem services. Several plots in this stand had deer trails running throughout them with signs of browsing. Identified species include the following:

- American Hornbeam - *Carpinus caroliniana*
- Yellow Trout Lily - *Erythronium americanum*
- Yarrow - *Achillea millefolium*
- Virginia bluebell - *Mertensia virginica*
- Spicebush - *Lindera benzoin*
- Black Cohosh - *Actaea racemosa*
- Mayapple - *Podophyllum peltatum*
- Bloodroot - *Sanguinaria canadensis*
- Cinquefoil - *Potentilla*
- Multiflora Rose - *Rosa multiflora*
- Barberry - *Berberis vulgaris*
- Spring beauty - *Claytonia virginica*

Fernville Stand Summary

Fernville is the largest forest management unit of Shepherd's Reach. Fernville is tulip poplar dominant with roughly 80% of the trees being tulip poplars. This stand is considered overstocked, with a lot of poplar and maple advanced regeneration. Medium to large poplars, maples, and associated trees could stand to be thinned. Logging roads, tree size and stand density indicate that this stand was logged somewhere between 20-50 years ago. There are a few trees adjacent to the creek that are of greater age; They were likely not logged due to poor structure or for streambank retention.

Fernville is flat topographically with woodland botanicals and invasives as ground cover. Fernville has a large portion of area covered with ferns, hence the name. Some ferns are edible and medicinal, and should be researched for utility purposes. Ferns will proliferate in areas with low phosphorus, and they may respond vigorously to burns. There are other woodland botanicals which is a good sign and signals healthy soils and forest habitat. Dogwoods, redbud and spicebush form an understory layer. There are also small oak trees which may be telling of the previous dominance within this forest. Along the creek there are washouts which signal temporary water levels during high rain events. Also along the creek lies the largest tree on Shepherd's Reach. This area is home to a great diversity of wildlife. Upon site analysis, a handful of wood turtles were found in this area as well as a nesting fox.

Turkey Beach // Forest Survey

Stand Area: 4.25 acres

Stand Age Class: Uneven-aged Stand.

Forest Cover Type: Poplar/Maple. The predominant species on the site are Tulip Poplar and Maple, with associated species of Oak, Shagbark Hickory, Sycamore, River Birch, Dogwood, Black Locust, White Pine, Black Cherry, Eastern Redbud, and Tree-of-Heaven.

Soils: POPE SERIES SANDY LOAM. The site index for white oak is 80.

Plants of Concern: Multiflora roses are present and conventionally considered “invasive” because they are exotic in origin and often inhabit disturbed areas including forest edges, roadways, and high-impact forestry operations. These plants should be monitored and removed if they begin overcrowding desirable native species and habitat. No rare or endangered plants were observed.

Understory Conditions: The tree regeneration present was predominantly (... The understory contains other native and nonnative plants that provide enriching ecosystem services. Several plots in this stand had deer trails running throughout them with signs of browsing. Identified species include the following:

- American Hornbeam - *Carpinus caroliniana*
- Yellow Trout Lily - *Erythronium americanum*
- Yarrow - *Achillea millefolium*
- Virginia bluebell - *Mertensia virginica*
- Spicebush - *Lindera benzoin*
- Black Cohosh - *Actaea racemosa*
- Mayapple - *Podophyllum peltatum*
- Bloodroot - *Sanguinaria canadensis*
- Cinquefoil - *Potentilla*
- Multiflora Rose - *Rosa multiflora*
- Barberry - *Berberis vulgaris*
- Spring beauty - *Claytonia virginica*
- Cedar - *Juniperus virginiana*
- Box elder - *Acer negundo*
- Sassafras - *Sassafras albidum*

Turkey Beach Stand Summary

Existing plant species and canopy structure are similar to Fernville but higher diversity in a more compact area. Spicebush, barberry, bluebells, dogwood and redbud flowering and are main bee forage. Bluebells are abundant towards Sleepy Creek. Main creek erosion is in this area. Washouts have boxelders and may be an indicator that boxelder is a good erosion control. Toward the creek the forest feels older, bigger trees, possibly just because trees weren't ready at time of logging or were twisted.

Turtle Terrace // Forest Survey

Stand Area: 1.5 acres

Stand Age Class: Uneven-aged Stand

Forest Cover Type: Birch/Maple. The predominant species on the site are River Birch and Maple, with associated species of Sycamore, Poplar, Hickory, and Cedar.

Soils: POPE SERIES SANDY LOAM. The site index for white oak is 80.

Plants of Concern: Multiflora rose and Autumn Olive are conventionally considered “invasive” because they are exotic in origin and often inhabit disturbed areas including forest edges, roadways, and high-impact forestry interventions. These plants should be monitored and removed if they begin overcrowding desirable native species and habitat. No rare or endangered plants were observed.

Understory Conditions: Overall advanced regeneration is low with <10% of the trees at sapling size. The tree regeneration present was predominantly River Birch and Maple. The understory contains other native and nonnative plants that provide enriching ecosystem services. Identified species include the following:

- Dogwood - *Cornus florida*
- American Hornbeam - *Carpinus caroliniana*

Turtle Terrace Stand Summary

This stand is essentially a 100' wide riparian buffer along the creek. It is dominated by birch trees, followed by maple, poplar, and cedar. It is full of multiflora rose and autumn olive. The edge closest to the road is lined with autumn olive.

Secret Garden // Forest Survey

Stand Area: 3.75 acres

Stand Age Class: Uneven-aged Stand

Forest Cover Type: Oak/Hickory. The predominant species on the site are Oak and Hickory, with associated species of Sassafras, White Pine, Virginia Pine, and Sycamore.

Soils: ERNEST SERIES SILT LOAM. The site index for white oak is 70.

Plants of Concern: Multiflora rose and Tree-of-Heaven are present and conventionally considered “invasive” because they are exotic in origin and often inhabit disturbed areas including forest edges, roadways, and high-impact forestry operations. These plants should be monitored and removed if they begin overcrowding desirable native species and habitat. No rare or endangered plants were observed.

Understory Conditions: The tree regeneration present was predominantly oak and poplar. Associated regeneration includes maple and hickory. The understory contains other native and nonnative plants that provide enriching ecosystem services. Several plots in this stand had deer trails running throughout them with signs of browsing. Identified species include the following:

- Apple - *Malus*
- Mayapple - *Podophyllum peltatum*
- Hickory - *Carya*
- Box elder - *Acer negundo*
- Tree of Heaven - *Ailanthus altissima*
- Devil's walking stick - *Aralia spinosa*
- Greenbrier - *Smilax*

Secret Garden Stand Summary

This area has a forest floor made from oak leaves, although the mature standing oaks are sparse. Still, this area is oak dominant but the forest is young. There are oaks growing but also tulip poplars that are competing for dominance. Understory consists of devil's walking sticks and multi flora rose. This area is heavily browsed by deer. One apple tree was located in this location. Clayish soils along the border, loamy by creek. Creek area has little undergrowth consisting of barberry and autumn olive. Along the creek is overrun with stiltgrass.

Stewardship Action Plan

Stewardship Action Plan Summary

Below is an overview of a timeline for management activities. The following section provides a breakdown of each site's management approach by compartment, with specific details regarding the implementation of management prescriptions.

- **Year 0:**

- Designate legacy trees, assess opportunities for enrichment plantings (gaps in the canopy), assess site hazards, and areas of high erosion. Before beginning to implement management decisions, study this document and the landscape through rigorous observation and note-taking.

- **Year 1-3:**

- **Jesus Glade:** Establish a native woodland understory. Assess mast production.
- **Fernville:** Convert a portion of Fernville into silvopasture for the pig operation. Utilize rotational grazing, thinnings, and plant silvopasture grasses. Learn the behaviors and impact of pigs as a landscape disturbance.
- **Fernville/Turkey Beach:** Plant desired erosion control trees and understory shrubs along washouts and edges of forest prone to erosion.
- **Secret Garden:** Conduct liberation thinnings of oak and hickory trees. Remove excess trees from the understory (poplar, maple, eastern hophornbeam, muscledwood). Assess mast production. Consider enrichment planting if canopy gaps are apparent.
- **All Compartments:** Perform liberation thinnings, selectively harvesting some marginal timber trees (poplar, cherry, maple). Harvest slash from thinnings to create habitat piles, compost piles, and for fuelwood. Plant desired fruit, nuts, fuel, or wildlife trees in early spring or mid-late fall.

- **Years 3-5:**

- **Jesus Glade:** After the woodland understory establishment, begin a regular burn schedule for grasses on 3-4 year cycles. Perform thinnings and enrichment plantings where beneficial.
- **Fernville:** Scale pig operation and begin to designate permanent paddocks for rotational grazing. Integrate plantings of annual root crops or grains into silvopasture for pig nutrition. Perform thinnings and enrichment plantings where beneficial.
- **Fernville/Turkey Beach:** Monitor erosion control plants and scale plantings if desired.
- **Secret Garden:** Begin burning on 6-10 year cycles. Utilize mast production.
- **All Compartments:** Perform liberation thinnings, selectively harvesting some marginal timber trees (poplar, cherry, maple). Harvest slash from thinnings to create habitat piles, compost piles, and for fuelwood. Create a native plant nursery for expanding polycultures.

- **Years 5-10:**

- **Jesus Glade:** Maintain a regular burn schedule for grasses on 3-4 year cycles.
- **Fernville:** Increase the mast production and diversity of stand through enrichment plantings, thinnings, and selective harvests.
- **Fernville/Turkey Beach:** Monitor erosion control trees and shrubs.
- **Secret Garden:** Maintain burns on a 6-10 year cycle. Utilize mast production.
- **All Compartments:** Perform liberation thinnings, selectively harvesting some marginal timber trees (poplar, cherry, maple). Harvest slash from thinnings to create habitat piles, compost piles, and for fuelwood. Maintain native plant nursery.

- **Years 10+ :**

- **Jesus Glade:** Maintain a regular burn schedule for grasses on 3-4 year cycles.
- **Fernville :** Increase the mast production and diversity of stand through enrichment plantings, thinnings, and selective harvests. If harvesting timber, utilize the silvicultural methods: selective harvest or group selection harvest with reserves, with follow-up

plantings. Harvest mature poplar and associated species, and plant a diversity of native species.

- **Fernville/Turkey Beach:** Monitor erosion control trees and shrubs. Scale plantings when desired.
- **Secret Garden:** Maintain burns on a 6-10 year cycle. Utilize mast production.
- **All Compartments: Have an ecological forester revisit the site every 10 years to renew management prescriptions.** Aim for more passive restoration-based management throughout all stands. Perform thinnings and harvests where it's ecologically-sound. Harvest slash from thinnings to create habitat piles, compost piles, and for fuelwood. Maintain native plant nursery. Care for & harvest tree crops. Utilize fire, grazing, and mechanical/hand removal to manage understory regeneration. Promote species that provide many functions for utility and ecology.

Jesus Glade // Stewardship Action Plan

Management Suggestions:

Restore and maintain Jesus Glade as an Oak-Hickory woodland for ecology, recreation, and aesthetics. Establish and maintain a canopy coverage of 30-60% with an understory of native grasses and forbes. Create and maintain a dense riparian buffer extending 75-100' out from the creek. Take a passive management approach to the large open-grown trees that compose the park-like setting of Jesus Glade. Allow some dead trees to remain standing, and allow large downed logs to rot in place. Cultivate a diversity of native woodland plants all throughout the compartment. This compartment would be a nice area to run hogs through in the late fall during their finishing period, because of high mast production.

- **Canopy Management:** Timber harvesting is not a priority for this compartment. Poplar and other associated species will be selectively harvested from this stand when opportunities arise due to thinnings. Perform **liberation thinnings** throughout the stand by removing trees that are competing with oaks and hickories. Exempt legacy trees from harvests and thinnings. Maintain several seed sources (10+ per acre) of mature oak, hickory, and other desirable overstory trees. When thinning, consider girdling some trees instead of felling. Aim for 5 standing dead trees per acre. This maintains structural diversity and wildlife habitat.
- **Understory Management:** Perform thinnings of multiflora rose and japanese barberry if they begin to monopolize an area. Plant other native shrubs to compete. Establish a native woodland ground layer in woodland areas. To maintain the groundcover, mow, burn, or graze to prevent woody perennials from encroaching. See *Appendix* for establishment, maintenance, and recommended suppliers and seed mixes.
- **Slash Management:** Slash created from thinnings is a resource to be utilized. Create piles of slash as wildlife habitat for snakes and rodents. It is okay to leave some slash throughout the landscape, though consider that it will increase the fuel-load during prescribed burns. Slash can be shredded, chipped, or composted, and spread across the compartment as a fertilizing mulch. Slash can also be burned, used to create natural fencing, and more. Wildlife can use slash piles of any size, though research suggests that building piles that are 10 to 12 feet across at the base and about 6 feet tall are most effective. To make one, place large poles (at least 4 inches in diameter) on the ground in 4 to 6 perpendicular (crisscross) layers. Larger materials go into the lowest layers that form the base and help provide tunnels for smaller creatures to escape predators. Add finer material on top – at least 18 inches deep which might require 6 to 10 layers of branches

and boughs. Smaller material such as branches and boughs can provide ground nesting birds with forage, cover, and even nest sites. Aim for 2 to 3 piles per acre, about 100 feet apart.

- **Riparian Management:** Within 50 feet of the creek, do not remove canopy trees except by girdling when necessary. This area will be managed passively. Maintain a good quantity of coarse woody debris and native vegetation in this area to stabilize the streambanks and create shade. Native stream ecology thrives when these conditions are maintained. Do not allow autumn olive to monopolize the streambank edge - research has shown that it produces large quantities of nitrogen which can be detrimental to stream biota.
- **Wildlife Management:** When constructing slash piles for habitat, placement is important to consider. Implementing slash piles within 50-100' of the streambank will encourage amphibians to inhabit the pile. Rodents and insects will also utilize the slash pile.
- **Burning, Grazing, & Mowing:** Burns for Oak-Hickory woodlands historically experienced fire disturbances on irregular 3-4 year cycles. After establishing the native woodland understory, begin burning on 3-4 year cycles. Grazing and mowing can also be used to reduce the encroachment of undesired woody perennials. Protect any desirable vegetation. Always consult a burn professional before conducting operations.

Fernville // Stewardship Action Plan

Management Suggestions

Fernville will use a restoration-based forestry approach to sustain a forest-raised pork operation, provide for occasional timber harvests and other agroforestry ventures, and will integrate with the local ecology. The approach will be multifaceted. Some areas will utilize a combination of thinnings and grazing techniques in order to develop a silvopasture-woodland system for the pigs. Areas that are not utilized primarily for pigs will maintain a more diverse forest structure. Pigs may graze these areas on less frequent occasions. As the pig operation grows and takes shape, its scale will determine how much of the forest will be converted to silvopasture. More silvopasture can be established via tree plantings in the pasture adjacent to Fernville. Across the entirety of this forest compartment, mast and fruit producing trees such as hickory, oak, pecan, walnut, beech, persimmon, etc should be encouraged. This stand will offer opportunities to harvest timber during thinnings or selective harvests. The creation and maintenance of old-growth characteristics are compatible with other management objectives and should be applied all throughout the compartment. Create and maintain a lush riparian buffer 100-200' out from the edge of the creek. This stand provides opportunities for fuelwood harvest.

- **Canopy Management:** In this compartment, **selective harvests** and **group selection harvests with reserves** will occur over time. Initially, poplar, maple, cherry, and other associated species will be selectively harvested from this stand when opportunities arise due to thinnings. Targeting these species will lower their dominance in the stand and promote the oak, hickory, and silvopasture trees. Thinnings will occur due to the establishment of silvopasture and from **liberation thinnings**. Perform liberation thinnings throughout the stand by removing trees that are competing with oaks and hickories. Exempt legacy trees from harvests and thinnings. Maintain several seed sources (5-10 trees per acre) of mature oak, hickory, and other desirable overstory trees. When thinning, consider girdling some trees instead of felling. Aim for 5 standing dead trees per acre, though identify and designate any hazards. This maintains structural diversity and wildlife habitat. If significant gaps are created in the stand due to group selection harvesting or natural disturbances, perform an **enrichment planting**. During enrichment plantings, aim to diversify the forest's species composition while favoring nut and fruit bearing trees.
- **Slash Management:** Slash created from thinnings is a resource to be utilized. Create piles of slash as wildlife habitat for snakes and rodents. It is okay to leave some slash throughout the landscape, though consider that it will increase the fuel-load during prescribed burns. Slash can be shredded, chipped, or composted, and spread across the compartment as a fertilizing mulch.

Slash can also be burned, used to create natural fencing, and more. Wildlife can use slash piles of any size, though research suggests that building piles that are 10 to 12 feet across at the base and about 6 feet tall are most effective. To make one, place large poles (at least 4 inches in diameter) on the ground in 4 to 6 perpendicular (crisscross) layers. Larger materials go into the lowest layers that form the base and help provide tunnels for smaller creatures to escape predators. Add finer material on top – at least 18 inches deep which might require 6 to 10 layers of branches and boughs. Smaller material such as branches and boughs can provide ground nesting birds with forage, cover, and even nest sites. Aim for 2 to 3 piles per acre, about 100 feet apart.

- **Edge Management:** Where forest borders woodland, the transitional edge will be less dramatic than where forest borders field. Ideally, the dominant canopy of the forest will step down from large trees to smaller, to shrubs. Edges are often monopolized by species such as multiflora rose, blackberry, and autumn olive. Control this vegetation through a combination of mechanical and hand removal, grazing, and fire - then diversify the edge by planting native shrubs through direct seeding or planting. After establishment, maintain with burns and grazing.
- **Riparian Management:** Within **200'** of the creek, do not remove canopy trees except by girdling when necessary. A wide riparian buffer will off-set runoff from the pig operation. This area will be managed passively. Perform **enrichment plantings** of native erosion control species within washouts and within 100' of the creek when desired. Maintain a good quantity of coarse woody debris and native vegetation in this area to stabilize the streambanks and create shade. Native stream ecology thrives when these conditions are maintained. Do not allow autumn olive to monopolize the streambank edge - research has shown that it produces large quantities of nitrogen which can be detrimental to stream biota.
- **Silvopasture Management:** When the silvopasture has been implemented, it will resemble a woodland in structure. This silvopasture will be established by conducting an initial thinning of the forest to a canopy coverage of 30-50%. The goal is to maintain a canopy structure that allows enough sunlight through for grass to grow. This will be accomplished by executing an initial thinning that aims to create an average spacing of 15-20' between existing trees and followed up by more thinnings as the canopy closes up over time. The core of management will depend on the integration of silvopasture plant guilds and the rotational grazing of pigs. See the *Appendix* for more information on managing silvopasture ground layers.

Establishment

- Begin by thinning out alleys for electric fencing. Utilize logging roads where possible. Assess the site for hazards before moving pigs in.

- Enter the herd into the paddock and monitor closely over time. Environmental conditions such as weather and pre-existing vegetation may determine how long the pigs will stay in one area before needing to be moved. If pigs are kept in one paddock too long, they may begin to destroy larger mature trees. In this phase of establishment, aim to significantly disturb the understory layer of shrubs and smaller trees, but not the medium to large sized trees.
- 1-2 days before moving your pigs to the next paddock, broadcast the *Silvopasture Ground Layer Seed Mix*. They will work the seeds into the soil. See the *appendix* for resources.
- Selectively harvest and thin trees in the recently grazed paddock, to the appropriate density for silvopasture. Prioritize the cultivation of desirable silvopasture tree species and seed sources into the canopy.

Management

- Over time, semi-permanent or permanent fencing may be implemented in the silvopasture paddocks. Scale the number and size of paddocks according to the number of pigs being grazed. Implement a design that considers ease of access for equipment to move fencing, trailers, waterers, feeders, etc.
 - Precise stocking rates and densities can be calculated based on forage production and pig consumption, though these numbers are highly contextual and difficult to estimate in forest environments. The best way to grow your hog operation is to start small and build a larger herd as a site-specific approach is developed.
 - Maintain a silvopasture canopy by thinning or pruning trees where too much shade is being created. Maintain nut and fruit producing native trees in the overstory.
 - Adaptive management requires that the steward closely monitors the unfolding plant community dynamics. You must observe the life cycles of your plants and notice the tendencies of certain plants to dominate others, in order to precisely time supplemental inter-seedings, plantings, burns, or grazing operations.
- **Livestock Management:** Start small and scale to what is manageable. Begin with a farrow-to-finish operation in order to get familiarized with pig management and rotational grazing methods. You will need solar power fencing (solar charger, grounding rod, high tensile wire, polybraid square fencing, posts, insulators, gate handles), waterers, feeding troughs,

shelter, and medicines. Feed pigs with grain that considers ecoregional sufficiency - prioritize using natural and local feed sources. Supplement feed with all compatible farm scraps. Pigs have optimal growth when they have access to grass and woods, to browse and graze. In early stages of silvopasture establishment, extend paddocks into grassy areas if possible. See *appendix* resources for images of woodland pig operations.

- In the spring, around March-April, farrows are weaned and purposed as “feeder pigs,” at approximately 8wks and 60lbs live weight.
 - The feeder pig farrows are kept in a secure paddock and trained to electric fence until they are large enough for the silvopasture electric fence system of 1 or 2 high tensile wires.
 - This often occurs in early summer, when farrows are approximately 12-15wks and 80lbs live weight. The farrows are introduced and rotated throughout the silvopasture system until they are ready to be finished. During this phase, pigs may be recruited to different areas of the farm for their landscape disturbance pattern. This might be for understory thinnings or forest grazing prescriptions.
 - In the fall, around October-November, move to finish the farrows. Rotate them to your paddocks with high mast production from trees such as oak and hickory. This will initially be Jesus Glade or Secret Garden, until Fernville has been cultivated for high mast production. They will be finished at around 6-8mos and 250-300lbs live weight.
- **Burning & Grazing:** In forested areas that will not be converted to silvopasture, a disturbance regime will benefit ecology. Historically, fires occurred irregularly on 2-10 year cycles in these forests, and averaged around 5-6 year periods without fire. To control existing undesired shrubbery and seedlings, you may begin a more frequent disturbance schedule on irregular 3-4 year cycles. Monitor the site and use a combination of burning with grazing to control the encroachment of unwanted regeneration and forest edge encroachment. Monitor and conduct fires in response to vigor of plants. Burns for Oak-Hickory forest are most effective with conditions of November-December. Always consult a burn professional before conducting operations.

Management Suggestions

Use a more passive form of restoration-based forestry to manage Turkey Beach as a diverse uneven-aged forest. Manage this site for the development of old-growth characteristics. This includes large downed logs, standing snags, large legacy trees, and diverse species composition. This area will have 4 distinguished strata, including a dominant canopy layer, sub-canopy layer, shrub layer, and ground cover of forbes. Designate and protect legacy trees, and promote diversity in species composition and wildlife habitat. This stand provides opportunities for fuelwood harvest.

- **Canopy Management:** Timber harvesting is not a priority for this compartment. Poplar and other associated species will be selectively harvested from this stand when opportunities arise due to thinnings. Perform **liberation thinnings** throughout the stand by removing trees that are competing with desirable canopy species. Exempt legacy trees from harvests and thinnings. Maintain several seed sources (10+ per acre) of mature oak, hickory, and other desirable overstory trees. When thinning, consider girdling some trees instead of felling. Aim for 5 standing dead trees per acre. This maintains structural diversity and wildlife habitat. You may also perform a species composition **enrichment planting** if key tree species are reaching critically low numbers. Implement tree-release thinnings where desired regeneration occurs.
- **Slash Management:** Slash created from thinnings is a resource to be utilized. Create piles of slash as wildlife habitat for snakes and rodents. It is okay to leave some slash throughout the landscape, though consider that it will increase the fuel-load during prescribed burns. Slash can be shredded, chipped, or composted, and spread across the compartment as a fertilizing mulch. Slash can also be burned, used to create natural fencing, and more. Wildlife can use slash piles of any size, though research suggests that building piles that are 10 to 12 feet across at the base and about 6 feet tall are most effective. To make one, place large poles (at least 4 inches in diameter) on the ground in 4 to 6 perpendicular (crisscross) layers. Larger materials go into the lowest layers that form the base and help provide tunnels for smaller creatures to escape predators. Add finer material on top – at least 18 inches deep which might require 6 to 10 layers of branches and boughs. Smaller material such as branches and boughs can provide ground nesting birds with forage, cover, and even nest sites. Aim for 2 to 3 piles per acre, about 100 feet apart.
- **Riparian Management:** Within 100' of the creek, do not remove canopy trees except by girdling when necessary. This area will be managed passively. Perform **enrichment plantings** of native erosion control species within washouts and within 100' of the creek when desired. Maintain a good quantity of coarse woody debris and native vegetation in this area to stabilize

the streambanks and create shade. Native stream ecology thrives when these conditions are maintained. Do not allow autumn olive to monopolize the streambank edge - research has shown that it produces large quantities of nitrogen which can be detrimental to stream biota.

- **Wildlife Management:** When constructing slash piles for habitat, placement is important to consider. Implementing slash piles within 50-100' of the streambank will encourage amphibians to inhabit the pile. Rodents and insects will also utilize the slash pile.
- **Edge Management:** Where forest borders woodland, the transitional edge will be less dramatic than where forest borders field. Ideally, the dominant canopy of the forest will step down from large trees to smaller, to shrubs. Edges are often monopolized by species such as multiflora rose, blackberry, and autumn olive. Control this vegetation through a combination of mechanical and hand removal, grazing, and fire - then diversify the edge by planting native shrubs through direct seeding or planting. After establishment, maintain with burns and grazing.
- **Burning and Grazing:** Historically, fires occurred irregularly on 2-10 year cycles in these forests, averaging 5-6 year periods without fire. Monitor the site and use a combination of burning with grazing to control the encroachment of unwanted regeneration and forest edge encroachment. Burns for Oak-Hickory forest are most effective with conditions of November-December. Grazing can be used as an alternative to burning, but must be managed for precise impact and followed up with mechanical or hand thinnings.

Turtle Terrace // Stewardship Action Plan

Management Suggestions

Turtle Terrace will use a more passive form of restoration-based forest management, and will be utilized primarily for the function of riparian buffering and wildlife habitat. Maintain birch trees in the canopy, and promote other native trees that like mesic soil. It also gives potential for forest farming non-timber forest products. Manage this site for the development of old-growth characteristics. This includes large downed logs, standing snags, large legacy trees, and diverse species composition. This area will have 4 distinguished strata, including a dominant canopy layer, sub-canopy layer, shrub layer, and ground cover of forbes. Because of the width of this stand, edge management will require more attention than other compartments. It will be critical to establish a dense native forest edge and canopy to prevent species such as blackberry, honeysuckle, barberry, multiflora rose, and autumn olive from monopolizing the entire understory of the compartment.

- **Canopy Management:** Timber harvesting is not a priority for this compartment. Thinnings may be considered where undesirable species are monopolizing an area. When conducting thinnings, **girdle** trees instead of felling. This will maintain the root structure of the riparian buffer. Maintain several seed sources (10+ per acre) of mature oak, hickory, and other desirable overstory trees. Aim for 5 standing dead trees per acre. This maintains structural diversity and wildlife habitat. You may also perform a species composition **enrichment planting** if key tree species are reaching critically low numbers.
- **Understory Management:** Perform thinnings of multiflora rose and japanese barberry if they begin to monopolize an area. Plant other native shrubs to compete. Woodland grasses and forbes can be planted as well. Consider a forest farming operation of NTFPs such as mushroom cultivation or ginseng. Promote wildlife habitat.
- **Riparian Management:** Within **100'** of the creek, do not remove canopy trees except by girdling when necessary. This area will be managed passively. Maintain a good quantity of coarse woody debris and native vegetation in this area to stabilize the streambanks and create shade. Native stream ecology thrives when these conditions are maintained. Do not allow autumn olive to monopolize the streambank edge - research has shown that it produces large quantities of nitrogen which can be detrimental to stream biota.
- **Slash Management:** Slash created from thinnings is a resource to be utilized. Create piles of slash as wildlife habitat for snakes and rodents. It is okay to leave some slash throughout the landscape, though consider that it will increase the fuel-load during prescribed burns. Slash can be shredded, chipped, or composted, and spread across the compartment as a fertilizing mulch. Slash can also be burned, used to create natural fencing, and more. Wildlife can use slash piles of any size, though research suggests that building piles that are 10 to 12 feet across at the base and about 6 feet tall are most effective. To make one, place large poles (at least 4 inches in diameter) on the ground in 4 to 6 perpendicular (crisscross) layers. Larger materials go into the lowest layers that form the base and help provide tunnels for smaller creatures to escape predators. Add finer material on top – at least 18 inches deep which might require 6 to 10 layers of branches and boughs. Smaller material such as branches and boughs can provide ground nesting birds with forage, cover, and even nest sites. Aim for 2 to 3 piles per acre, about 100 feet apart.
- **Edge Management:** Because this compartment is only approximately 200' wide, sunlight will penetrate all throughout. This will allow monopolizing edge species to work into the understory and prevent the advanced regeneration of canopy trees. Utilize thinnings, grazing, or

burns to combat these species if they begin to monopolize larger swaths of the forest: autumn olive, honeysuckle, multiflora rose, barberry, and blackberry. To prevent their re-establishment, plant desirable native species that fill the same understory niche. Follow up with more understory disturbances when needed.

Secret Garden // Stewardship Action Plan

Management Suggestions

Secret Garden will be sustained as an Oak-Hickory forest. These forests require disturbance to prevent shade-tolerant species from outcompeting sun loving oaks. Historically, native oak-hickory forests endured fires on 10-12 year cycles irregularly, averaging a 6-year window between large scale disturbances. These forests were also subject to large herds of grazers and browsers, and cultivated by indigenous peoples. This stand offers a great density of mast trees, and may be harvested for acorns and hickory nuts, or utilized as a forest paddock for finishing hogs. This forest could also be maintained as a quiet place for contemplation. Manage this site for the development of old-growth characteristics. This includes large downed logs, standing snags, large legacy trees, and diverse species composition. This area will have 4 distinguished strata, including a dominant canopy layer, sub-canopy layer, shrub layer, and ground cover of forbes. Allow some dead trees to remain standing, and allow large downed logs to rot in place. Cultivate a diversity of native woodland plants all throughout the compartment. This stand provides opportunities for fuelwood harvest.

- **Canopy Management:** Timber harvesting is not a priority for this compartment. Poplar and other associated species will be selectively harvested from this stand when opportunities arise due to thinnings. Perform **liberation thinnings** throughout the stand by removing trees that are competing with desirable canopy species. Exempt legacy trees from harvests and thinnings. Maintain several seed sources (10+ per acre) of mature oak, hickory, and other desirable overstory trees. When thinning, consider girdling some trees instead of felling. Aim for 5 standing dead trees per acre. This maintains structural diversity and wildlife habitat. You may also perform a species composition **enrichment planting** if key tree species are reaching critically low numbers. Implement tree-release thinnings where desired regeneration occurs.
- **Slash Management:** Slash created from thinnings is a resource to be utilized. Create piles of slash as wildlife habitat for snakes and rodents. It is okay to leave some slash throughout the landscape, though consider that it will increase the fuel-load during prescribed burns. Slash can be shredded, chipped, or composted, and spread across the compartment as a fertilizing mulch.

Slash can also be burned, used to create natural fencing, and more. Wildlife can use slash piles of any size, though research suggests that building piles that are 10 to 12 feet across at the base and about 6 feet tall are most effective. To make one, place large poles (at least 4 inches in diameter) on the ground in 4 to 6 perpendicular (crisscross) layers. Larger materials go into the lowest layers that form the base and help provide tunnels for smaller creatures to escape predators. Add finer material on top – at least 18 inches deep which might require 6 to 10 layers of branches and boughs. Smaller material such as branches and boughs can provide ground nesting birds with forage, cover, and even nest sites. Aim for 2 to 3 piles per acre, about 100 feet apart.

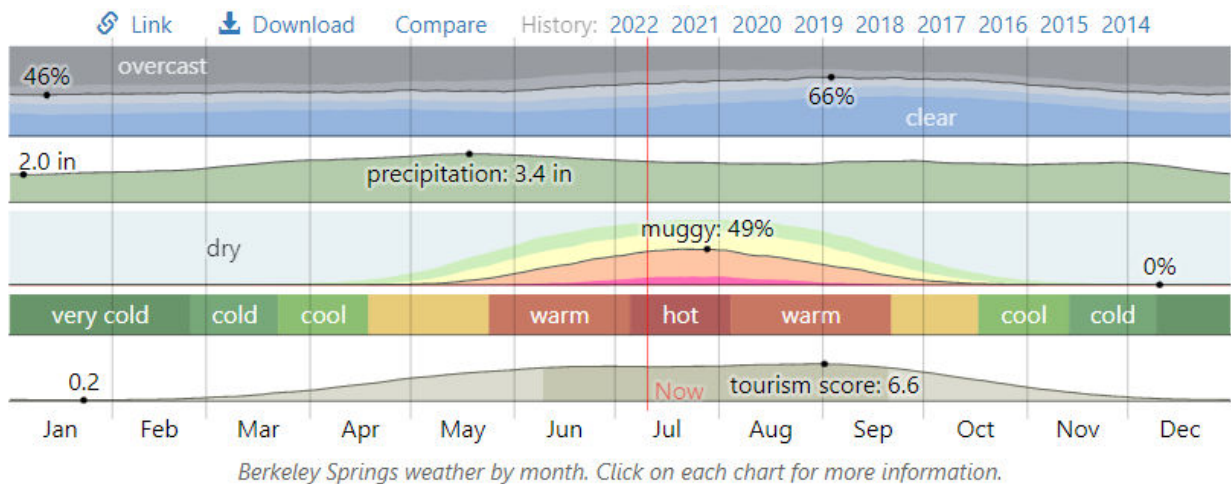
- **Riparian Management:** Within 100' of the creek, do not remove canopy trees except by girdling when necessary. This area will be managed passively. Maintain a good quantity of coarse woody debris and native vegetation in this area to stabilize the streambanks and create shade. Native stream ecology thrives when these conditions are maintained. Do not allow autumn olive to monopolize the streambank edge - research has shown that it produces large quantities of nitrogen which can be detrimental to stream biota.
- **Edge Management:** Ideally, the dominant canopy of the forest will step down from large trees to smaller, to shrubs. Edges are often monopolized by species such as multiflora rose, blackberry, and autumn olive. Control this vegetation through a combination of mechanical and hand removal, grazing, and fire - then diversify the edge by planting native shrubs through direct seeding or planting. After establishment, maintain with burns and grazing.
- **Burning and Grazing:** Historically, fires occurred irregularly on 2-10 year cycles in these forests, averaging 5-6 year periods without fire. Monitor the site and use a combination of burning with grazing to control the encroachment of unwanted regeneration and forest edge encroachment - a solid groundcover of leaf litter makes for a successful burn. Burns for Oak-Hickory forest are most effective with conditions of November-December. Grazing can be used as an alternative to burning, but must be managed for precise impact and followed up with mechanical or hand thinnings. Consider grazing hogs here in the fall during their finishing period. Move them before damage is done to larger hickories and oaks.

Appendix

Climate Graph

Berkeley Springs, Morgan County, West Virginia

- <https://weatherspark.com/y/20267/Average-Weather-in-Berkeley-Springs-West-Virginia-United-States-Year-Round>



Woodland Ground Cover Establishment

Woodland and silvopasture ground layers consist of native cool-season grasses and forbes. There are dominant native species that are easier to get established, and rare or conservative species that are more difficult to get established, and are seeded after a native turf has been already established. During the establishment phase, focus on integrating dominant native grasses and forbes through interseeding.

Interseeding

Interseeding is a method of establishing native turf in prairie, savanna, and woodland environments without directly removing an existing vegetative cover. It is one of the least invasive techniques of ground cover restoration, as it does not disturb the soil by plowing or tilling. Interseeding involves broadcast seeding by hand or with machine, and may include specialized drill seeding equipment. By the strategic timing of burns, mowing, grazing, and seed-sowing, work can be reduced

and establishment rates are kept high. The success of interseeding lies not only in the timing of operations, but in the design of seed-mixtures and their precise application to certain site-conditions.

Pre-Establishment Procedures

If an existing ground cover is dense enough to cast the ground into deeper shade, you will need to mow or burn before interseeding. This is important so that young native plants will have enough sunlight to get established. Once interseeding begins, you will not be able to burn the site until native turf has become established. This is because burning in the early stages of establishment may retard the root growth of native perennials or destroy the underdeveloped seed bank. For this reason, it is common practice to conduct a burn, interseed immediately after, and then mow or graze during the first 2-3 years of establishment. An initial burn will weaken the dominance patterns of existing vegetation and release nutrients into the soil. You may consider conducting several pre-establishment burns if the area is severely dominated by aggressive, undesired cool-season grasses. If this is the case, you may want to burn 2 or 3 years successively to weaken their vigor before interseeding operations. Without an initial burn to clear the seedbank, undesired vegetation will persist for a longer duration of the restoration process, but over time similar results will be achieved. In this case, mow as close to the ground as you can before drilling and broadcasting seed.

You will need to obtain the seed mixtures by purchasing them from regional nurseries, governmental programs, or via seed-collection. Seed-collection is the most cost-effective method of acquiring native seed, but it is the most labor-intensive.

Establishment

After preparing the planting site, begin seed sowing. Broadcast seed by hand or with equipment. It is recommended to conduct a pre-establishment burn in the fall and seed immediately after. This allows seeds to stratify naturally, and natural disturbances will gently work the seeds into the soil. In areas that flood with high water flow, mow instead of burn. This will maintain some structure to protect seed from being washed away. Consider inoculating the seed mixtures with prairie bacteria to increase survival rates. Broadcast and/or drill-in the seed mixtures to their correlating management areas. Perlite can be mixed with seed to prevent seed-clumping and to add a visual indicator of where seeding has occurred.

The quantity of seeds per acre will be double the conventionally recommended amount, at a minimum. Overseeding can accelerate turf establishment by crowding-out the prior ground cover and compensating for native seed mortality. During the first 2-3 years of establishment, monitor the field and mow strategically to prevent the shading-out of native seedlings. A standard rule-of-thumb is to mow when vegetation reaches a height of 12-18 inches, shortening it to a height of 4-6 inches. It is also

important to mow or graze before undesired and exotic vegetation develops seedheads. You may need to mow 2-3 times each summer-fall season for the first 2-3 years of establishment. Make observations of your restoration progress and respond appropriately to the unfolding vegetation dynamics.

Master Plant List

Suppliers

- <https://riversidenativetrees.com/state/west-virginia/>
- <https://www.prairiemoon.com/>

Native Forest Trees and Shrubs Resources

- <https://plantnative.org/rpl-mdvawv.htm>
- <https://www.wvnps.org/>

Riparian Vegetation

- - Sycamore, Cottonwood, Willow, Elderberry, Persimmon, Pawpaw, Blackgum, Pin Oak, Swamp White Oak, River Birch, Grasses

Bee Plants

- - Sycamore, Cottonwood, Willow, Elderberry, Honey Locust (thornless), Huckleberry, Coralberry, Birch, Bladder Nut, Blueberry, Currants, Gooseberry, Clover, Wildflowers

Silvopasture Trees & Shrubs

- Pecan, Pignut Hickory, Shagbark Hickory, Oak, Hackberry, Persimmon, Honey Locust (thornless), Black Walnut, English Walnut, Black Locust, American Basswood, Blue Ash, Hazel, American Holly, Mulberry, Serviceberry

Silvopasture Ground Covers

- Select native grasses mix from suppliers

Woodland Ground Covers

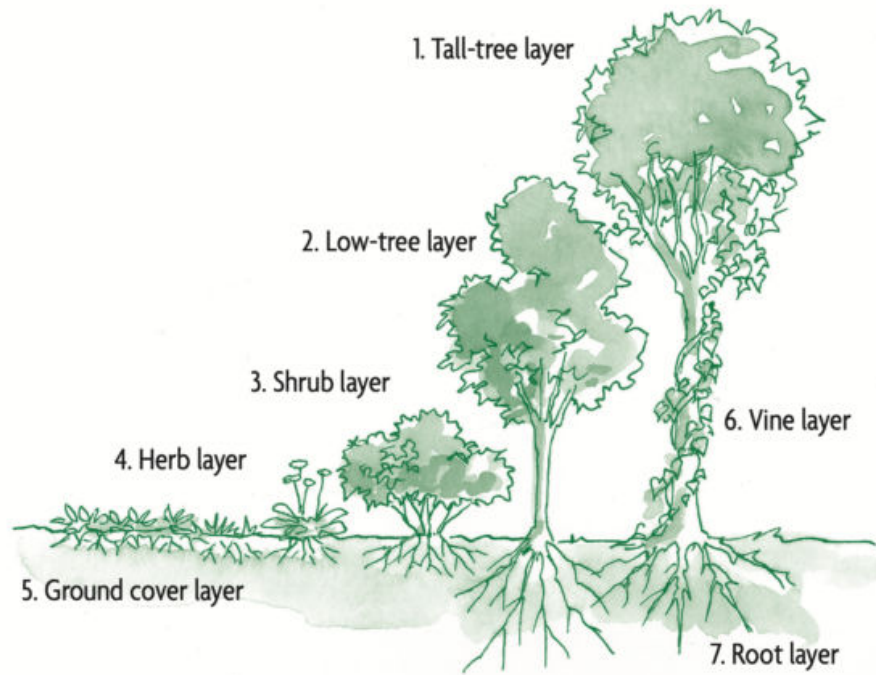
- Select native grass and wildflower mix from suppliers

Forest Grazing & Silvopasture Exhibits





Layers of the Forest (to be planted with multifunctional species)



Desirable Conditions for Oak-Hickory Forest and Silvopasture.

Silvopastures may have fewer trees than appear in the image. Old-growth conditions are not included in image: *large downed logs, large dead trees, large legacy trees, etc*



Desired Conditions for Birch/Maple Forest

Old-growth conditions are not included in image: *large downed logs, large dead trees, large legacy trees, etc*



Suggested Readings

- Restoring Old Growth Characteristics (D'Amato & Catanzaro)
 - https://extension.unh.edu/sites/default/files/migrated_unmanaged_files/Resource000429_Rep451.pdf
- Edible Wild Plants: Eastern/Central North America (Peterson Field Guides)
 - <https://www.amazon.com/Edible-Wild-Plants-Eastern-Peterson/dp/039592622X>
- The Methods of Jean Pain (Brushwood Composting)

- [https://library.uniteddiversity.coop/Permaculture/Another Kind of Garden-The Methods of Jean Pain.pdf](https://library.uniteddiversity.coop/Permaculture/Another_Kind_of_Garden-The_Methods_of_Jean_Pain.pdf)
- **Animal Nutrition and Feed**
 - <https://www.feedipedia.org/content/feeds?category=13591>
- **Silvopasture Handbook (USDA)**
 - <https://www.fs.usda.gov/nac/assets/documents/morepublications/silvopasturehandbook.pdf>
- **History of West Virginia Floods**
 - <https://www.morganmessenger.com/2021/03/17/85-years-since-the-flood-of-36/>
 - <https://www.weather.gov/lwx/1936Flood>
- **Logging the Virgin Forests of WV**
 - <https://mh3wv.org/wp-content/uploads/2021/05/Logging-the-Virgin-Forests-of-West-Virginia-PATC.pdf>
- **CASRI - Central Appalachian Spruce Restoration Initiative**
 - <https://restoredspruce.org/>