Ecological Inventory: River Mountain - Sweet Root Creek
Everett, PA / Bedford County

Mountains-to-Sea Ecological

Kevin Caldwell, Conservation Biologist

828.551.8225 kevin@mtscological.com

www.MTSecological.com

I. INTRODUCTION & PURPOSE

On May 25-26, 2019 ecological inventories were conducted on the ~142-acre River Mountain property in south-central Bedford County along Sweet Root Creek, north of Chaneysville, PA. The property is an exceptional conservation target with its mosaic of natural resources, as well as sharing ~90% of its border with the 7.374-acre State Gamelands #97, which is itself part of massive complex of protected land block exceeding 150,000 acres. The following summary highlights major findings in regard to conservation, with more details related to River Mountain's education mission to follow. Note that scientific names used only referenced for rare species for ease of reading.

The inventory focused on identification all plant and wildlife species and habitats detectable within a 2-day inventory, with focus on providing educational material to assist future River Mountain educational and management goals. Rare species and habitats, as listed by Pennsylvania Natural Heritage Program (PNHP, 2019), as well as high quality common natural communities, breeding bird species, water resources were primary inventory targets. Management recommendations are included in Section III, noting a detailed management plan would be an additional project beyond the scope of inventory.

II. SUMMARY of FINDINGS

The River Mountain – Sweet Root Creek property is a diverse mixture of native, forest communities (~76 acres), early successional areas (~65 acres), and various and diverse wetlands (~2 acres, overlapping). Wetlands include ~1.7 miles of perennial streams, seeps, wet-meadows, and small farm-pond. The main channel of Sweet Root Creek comprises 46% (4,025 linear feet) of all perennial streams onsite.

A total of 194 plant and wildlife species were observed including 135 plant and 59 wildlife species.

Six native forest & wetland communities detected onsite include Sycamore-Mixed Hardwood Floodplain Forest, Mixed Mesophytic Forest, Dry Oak / Mixed Hardwoods, Dry Oak-Heath Forest, Mixed Forb-Graminoid Wet Meadow, and Golden-Saxifrage/Bittercress Seep (an S2 state "imperiled" seep community). Successional habitats include managed hayfields, bottomland meadows (formerly grazed), and hedgerows.

The majority of forests onsite are excellent (A-quality; 10.5 acres) to very good or good (B/BC-quality, 65 acres) as mature, intact forests. Threats to these forests are primarily extensive deer over-browse and exotic invasive (EI) plant invasion in floodplain & riparian areas, and hedgerows which appears to preclude tree, shrub, and some herb regeneration. Hayfields, bottomland meadow, and hedgerows are not ranked ("NA") though they are still high-quality habitat for open-area species, particularly birds, small mammals, and their predators.

Eight PNPC rare-list plant and wildlife species occur, including five plant and two wildlife species, as designated by the PA Division of Conservation & Natural Resources (DCNR) and PA Biological Survey (PBS). Notable designations are: DCNR Endangered ("E"), PBS Threatened ("T"), and state "imperiled" ("S2") thick-leaved meadowrue (*Thalictrum corieaceum*); Vulnerable ("V") – American ginseng (*Panax quinquefolius);* PBS Rare ("R") and vulnerable ("S3") purple bedstraw (*Galium latifolium);* state "critically imperiled" ("S1") Virginia rose (*Rosa virginiana).* Eastern whip-poor-will is state "vulnerable" ("S3").

Suitable and extensive habitat exists for high numbers of PNHP rare plant and wildlife species, however due to the high number of species (>200) listed in Bedford County, an assessment of habitat suitability onsite has not been performed yet.

A total of 45 breeding bird species were detected including PNHP-listed great blue heron (foraging habitat only; no rookeries occur onsite) and eastern whip-poor-will. An assessment of Partners-in-Flight, Appalachian Joint Ventures, and other federal and NGO program conservation designations for bird species is forthcoming.

Other wildlife typical species include white-tailed deer, black bear (scat and track), American beaver (fresh chew), raccoon, gray squirrel, and eastern coyote. Amphibians and reptiles include the PNHP listed box turtle, gray tree-frog, American toad, green frog, spring peeper, bullfrog, and what may be the rare ornate tree frog detected audibly, but not observed.

One “eDNA” water sample was collected in Sweet Root Creek at the confluence with the “house” tributary within Sweet Root Creek in order to detect DNA of and thus presence of mammals, fish, and aquatic species not detectable within the narrow range. This proprietary technique reads DNA in the water column to detect species that are otherwise difficult. expensive, or impossible to detect such as bats, many of which are in severe decline in the eastern US. Results from DNA analysis should be available in August 2019 and appended to the report.

II.A. PNHP Rare Species

Eight PNHP Rare Species were detected onsite including five plant and three wildlife species (Table 1). Many other rare plant and wildlife species likely occur on the property. State and federal status and rank of note are listed in species descriptions below Table 1. Species are listed from plant to wildlife and then alphabetically by scientific name. Photos are provided for plant species but not wildlife.

Table 1: Rare Plant & Wildlife Species, River Mountain 2019.

Common Name	Scientific Name	Fed Status	State Status	Fed Rank	State Rank	PBS Status
Purple Bedstraw	*Galium latifolium*			G5	S3	PR
American Ginseng	*Panax quinquefolius*		PV	G3	S4	
Virginia Rose	*Rosa virginiana*		TU	G5	S1	
Lettuce Saxifrage	*Saxifraga micranthidifolia*		TU	G5	S4	
Thick-leaved Meadow-rue	*Thalictrum coriaceum*		PE	G4	S2	PT
Eastern Whip-poor-will	*Antrostomus vociferus*			G5	S3B	
Great Blue Heron	*Ardea herodias*			G5	S5B,S4N,S4M	
Eastern Box Turtle	*Terrapene carolina carolina*			G5	S3	

Purple bedstraw (*Galium latifolium,* photo left). Numerous stems were observed in Mixed Mesophytic Forest at the toe-slope of Warrior Mountain and it is estimated that several hundred stems may be found. A coffee family member, it occurs at the north periphery of its US range within southern PA. It is state "vulnerable" (S3) though it is a common species farther south (G5) and is PBS "Rare" (R) species. This species is small, easy to overlook, and easy to confuse with other Galium species onsite. Threats to the species are primarily deer browsing.

American ginseng (*Panax quinquefolius,* photo right*).* Ginseng was once a common and even dominant plant species until the late 1700's when wholesale stripping of the species from eastern US and Canadian forests for the Chinese medicinal herb trade eliminated 99% of its population. Currently, it draws $900-1,100 per pound (approximately 40 dried roots) on the medicinal herb market. Though it is listed as "S4" (apparently secure) in PA it is state "vulnerable" (PV) and globally "vulnerable" (G3) this species is dramatically downplayed and ignored for formal protection due to pressure from the medicinal herb market. To be clear – this species remains at less than 1% of its original pre-colonization numbers, and it is incredibly rare and vulnerable to extirpation from deer browsing and poachers. Efforts to propagate and protect the species should be engaged throughout suitable habitats onsite.

Virginia Rose *(Rosa virginiana)* – only two stems of this native rose were observed (non-flowering) on the upper slopes of Warrior Mountain in Chestnut Oak Forest. It is associated with mountain laurel and hillside blueberry plants where little other vegetation occurs. It can be distinguished from the invasive multiflora rose by having straight vs. curved thorns, as well as its very dry habitat where multiflora rose does not occur. It is among the rarest species in the state as a "critically imperiled" species (S1). Its "TU" state status means current Endangered / Threatened status is undetermined.

Lettuce Saxifrage (aka Branch Lettuce) *(Saxifraga micranthidifolia)* – only a few stems of this Saxifrage family member (related to alumroot, golden saxifrage (onsite in seeps) and foamflower) were observed along banks, low wet areas, and mucky areas of Sweet Root Creek. This species is favored by deer for browse, so it might be over-grazed in this area. Likewise – it is a favored spring herb in mountain regions where it is served with lettuce or "killed" with bacon grease for a delicious wilted salad. Like Virginia rose, its current T&E status is undetermined, and it is considered "apparently secure" (S4) in PA and "secure"

across its N. American range where it is an Appalachian “endemic” species occurring primarily or only within the Appalachian Mountains.

Thick-leaved meadowrue (*Thalictrum coriaceum)* – perhaps 50 stems of this rich-site Buttercup-family herb were observed at the edge of stream embankments of Sweet Root Creek and Mixed Mesophytic Forest at the toe-slope of Warrior Mountain. It is relatively easily seen from the stream, and it has a bushier habit and thicker leaves than other similar meadowrues. It is PA state endangered (E) and “imperiled” in the state (S2) though it is “apparently secure” (G4) across its greater northern American range. PA Endangered species are those:

> “in imminent danger of extinction or extirpation throughout their range in Pennsylvania if the deleterious factors affecting them continue to operate. These are: 1) species whose numbers have already been reduced to a critically low level or whose habitat has been so drastically reduced or degraded that immediate action is required to prevent their extirpation from the Commonwealth; or 2) species whose extreme rarity or peripherality places them in potential danger of precipitous declines or sudden extirpation throughout their range in Pennsylvania; or 3) species that have been classified as "Pennsylvania Extirpated", but which are subsequently found to exist in Pennsylvania as long as the above conditions 1 or 2 are met; or 4) species determined to be "Endangered" pursuant to the Endangered Species Act of 1973, Public Law 93 205 (87 Stat. 884), as amended.

Eastern whip-poor-will (*Antrostomus vociferus)* was detected both nights and mornings of the survey and unless PNHP is delayed entering data, this would be new Bedford County record. At least two males were detected on both nights and mornings of survey, and others likely exist further south onsite in open woods. Curiously, deer over-browsing makes for better ground-level habitat for this species which nests directly on the ground without building it a nest. This species is declining throughout its range and is the focus of surveys in many eastern states in the past 10 years. Though considered globally “secure”, it is “vulnerable” (S3) in the state.

Great Blue Heron *(Ardea herodias)* was observed fishing in the pond and along Sweet Root Creek. It does not have a breeding rookery onsite and it is likely a juvenile non-breeding bird in the region. This species is globally secure “G5” and is likely listed due to the state wildlife action plan (WAP) drawing attention to the species as they their expand populations. Though this or other herons cannot breed in this region, the property serves as important and extensive forage and cover for these species as they recover lost habitat regionally.

Eastern Box Turtle (*Terrapene carolina carolina)* – three turtles were observed within the survey and many others likely occur onsite. Perhaps most interesting about box turtles is their ability to live more than 100 years, and age can be determined by counting rings on any of 13 “scutes” or plates on their shell. Box turtles have permanent, overlapping (non-aggressive) home territories of 2-3 acres, so theoretically numerous box turtles likely occupy the property. They have become listed within the past 10 years due to population decline estimates of 50-75% depending on region and they are considered “vulnerable” in the state (S3) though they are still considered globally “secure” (G5). Still, they were recently listed as “vulnerable” by the International Union for Conservation of Nature (IUCN). Maintaining warm, sunny open areas for nesting, such as mowed lawns, gravel areas, and hayfield or meadows with some open soil will help facilitate their increase.

II.B. General Landscape Conditions and PNHP Natural Communities
A total of 194 plant and wildlife species were observed including 135 plant and 59 wildlife species. Numbers of species per form are (noting many other species likely exist onsite)

- Trees – 25 Shrubs – 11 Vines – 6 Herbs - 85 Ferns – 8
- Birds - 45 Mammals – 7 Amphibians – 5 Reptiles – 2

Although timbering has occurred throughout all forests historically, forests are quite mature and diversifying with moderate levels of downed (fallen) woody debris (DWD) and increasing levels of standing woody debris (SWD) which is largely absent in younger stands regionally. Tree cores were not collected however, most forested stands have not been timbered on a large scale in approximately 70-80 years, and many large diameter trees remnant from previous timbering remain throughout forested zones. Stumps are largely absent except for a few select more recent cuts near borders. Hundreds of mature and very old, large diameter trees occur throughout, most notably sycamores to nearly 60” diameter by Sweet Root Creek, 32-40” white oak / northern red oak / sugar maples, and Canada hemlocks that have not succumbed to the hemlock woolly adelgid (HWA).

Forest quality ranges from excellent near Warrior Ridge in the eastern-most, upper elevations in Dry Oak-Heath Forest, to very good on Mixed Mesophytic Forest comprising mid to lower slopes, Sycamore-Mixed Hardwood Floodplain Forest is in good (BC) condition, having the most impacts and threats at present.

Forest vegetation onsite is dominated by deciduous trees except in bottomlands where hemlock and white pine co-dominate. Scattered white pines comprise <5% of the canopy on west-facing Warrior Mountain slopes. Forest community quality is reduced primarily by 1) extreme levels of deer browse, which almost entirely excludes native plant regeneration and 2) EI colonies of Japanese barberry, multiflora rose, privet, Morrow’s honeysuckle, autumn olive, garlic mustard and Japanese stiltgrass.

PNHP Natural Communities: Natural communities are permanent alliances of dominant plant species in canopy, understory, and ground-level (herb and shrub) locations that are consistent across an eco-region. They have evolved over eons based on parent material (and thus soil), pH, aspect (N,S,E,W), slope, elevation, water retention, natural disturbances, and exposure. Classification is obscured and made difficult in some cases by human modification and land usage since colonization.

Of nine natural terrestrial communities onsite, six are native, naturally occurring communities. Bottomland meadow and hayfields, hedgerows / shrubland, and the pond are man-made systems, though they are still important for many native plant and wildlife species. Natural communities are listed below in alphabetical order by type and broken out by acreage and quality. See Figure (next page) for map of rare species and natural community locations.

Table 2: Natural Communities and Acreage by Quality, River Mountain 2019

Origin	Community Type	Community Quality					Total Acreage
		A	B	BC	C	NA	
Native	Dry Oak / Mixed Hardwoods, S5		24.9		7.8		**32.7**
Native	Dry Oak-Heath Forest, S5	10.5					**10.5**
Native	**Golden Saxifrage/Bittercress Spring Run (S3)**		**<1**				**<1**
Native	Mixed Forb-Graminoid Wet Meadow, S5		<1				**<1**
Native	Mixed Mesophytic Forest, S4		14.2				**14.2**
Native	Sycamore-Mixed Hardwood Floodplain Forest, S4			18.9			**18.9**
Man-made	Bottomland Meadow					23.3	**23.3**
Man-made	Hayfield					24.7	**24.7**
Man-made	Hedgerows / Shrubland					12	**12**
Man-made	Pond					0.5	**0.5**
Man-made	*(Structural / Mowed)*					5.1	**5.1**
	Grand Total Acres	10.5	39.1	18.9	7.8	65.6	**~142**

Rare natural communities are those listed by NatureServe (the national consortium of state heritage programs) as G1-G3, or PNHP as S1-S3 with numbers indicating “critically imperiled” (S1, G1), “imperiled” (S2,G2), and “vulnerable” (S3, G3). These, as well as high-quality common natural communities, are critical conservation targets onsite and regionally. S4 and S5 communities are classified as “apparently secure” (S4) to “secure” (S5) in the state, though good to excellent quality examples of these areas are of conservation concern.

For conservation purposes, only native habitats are discussed in detail below. Though meadows, hayfields, hedgerows-shrublands, and pond habitats are still critical for amphibians, small-mammals, and birds that cannot breed in forest interior areas and require open areas, they will be discussed in the final report.

Natural Community Descriptions

The following natural community descriptions are organized in order of native to man-made, alphabetical order, and from canopy, understory/shrub, and herb coverage.

Dry Oak / Mixed Hardwoods

On gentle, east-facing slopes of the northern, west-central, and southern boundary regions, this relatively “basic” (near 7.0 pH soil) forest occurs and comprises the highest acreage of any forest onsite. White oak from 18-28’ diameters dominates the canopy, with associated and similar sized sugar maple, shagbark and, northern red oak, sugar maple, white ash, and black walnut. Understory

trees include sparse 4-10” diameter stems of canopy trees and scattered Japanese barberry in low numbers, indicating that deer browse is extreme. However, the northern-most locations of this community harbors dense Japanese barberry colonies due to gentler terrain.

Herb cover varies from sparse to moderate with common species being mayapple, Milksick, wild licorice, white wood-aster, northern shorthusk, and Jack-in-the-pulpit, plume Solomon's-seal, ebony spleenwort, rattlesnake weed, and Pennsylvania sedge. **Eastern whip-poor-will** (PA “vulnerable”, S3) is breeding onsite within this forest type.

Dry Oak – Heath Forest

This forest community is more aptly a Chestnut Oak Forest, with near total canopy dominance by chestnut oak trees from of average 12” diameter and larger stems to 28” over ~12.5 acres. It occurs between 1,300-1,500 feet elevation on steep, west-facing slopes. Associated canopy trees are black oak and white pine, with small diameter understory northern red oak and sugar maple. It is the driest forest community onsite being located at the upper-most elevations of Warrior Mountain abutting state gamelands. A wide variety of understory trees and shrubs occurs here including striped maple, witch-hazel, stunted Canada hemlock, red maple, serviceberry, hophornbeam, hillside blueberry, deerberry, hell-fetter, a few mountain laurel stems, and the rare **Virginia rose.**

The herb zone is a mosaic of moss-covered soil and small-cobble rock lacking herb cover, or conversely it is moderately dominated by herbs such as hairy Solomon’s seal, pussytoes, rue anemone, poverty grass, longleaf houstonia, bear-corn, and fibrous-root sedge.

Golden Saxifrage / Pennsylvania Bittercress Spring Run

An easier reference for these seeps is “Low Elevation Seep” as each seep varies slightly from the given PNHP name, but each includes golden saxifrage and bittercress. PNHP classifies these seeps as “vulnerable” (S3) in the state. At least three locations of this small (<1-acre total) low, wetland habitat were observed. They are dominated by mineral and muck substrate where groundwater emerges from adjacent slopes and flows across low ground rather than a formal stream channel, but they ultimately intersect adjacent streams.

Trees are not rooted within seeps as they fall over too rapidly due to soft substrate. Rather, seeps are dominated by herbs (as noted in the name) as well as the rare **branch lettuce**, Virginia bugleweed, lady fern, white turtlehead, southern lady fern, jewelweed, Spanish needles, and interrupted fern.

Mixed Forb-Graminoid Wet Meadow

More easily referred to as “wet meadows” – these are common regionally, though they are usually small natural communities dominated by full-sun wetland herbaceous vegetation. Most were forested wetlands prior to clearing for agriculture. They are typically ponded or saturated early in the growing season but are usually dry by mid/late summer.

Vegetation is lush and diverse, and dominated by grasses (graminoid) and broad-leaf herb (forb) species. Typical species are needlerush, wool-grass, bugleweed, smartweeds, numerous sedges, boneset, royal fern, St. John's-wort, sensitive fern, cinnamon fern, Spanish needles, and spike-rush. A single black willow stands out from the largest, northern-most example southeast of the primary homesite.

Mixed Mesophytic Forest

This unique forest community dominates west and northwest facing mid-to-lower slopes of Warrior Mountain between 1,200-1,300 feet. It is defined by a wide variety of moisture-tending canopy species with sugar maple and northern red oak co-dominating the canopy. Associated trees are shagbark hickory, American beech, tulip-poplar, basswood, white ash, white oak, slippery elm, cucumber tree, black cherry, and black locust. A few stray Canada hemlock and white pine are dotted throughout, but at much smaller diameters than in floodplain forest below. Shrubs and tree-regeneration are sparse due to intensive deer browse and the shrub zone is "open" meaning long-range views are had year-round. Common shrub species are witch-hazel, wild hydrangea, spicebush, striped maple, roundleaf greenbrier, and scattered Japanese barberry.

Herbs are diverse and moderately lush to lush including bluestem goldenrod, broad beech-fern, Pennsylvania knotweed, Christmas fern, toothwort, mayapple, white wood aster, windflower, rue-anemone, rattlesnake fern, dittany, Hayscented fern, woodland Joe-Pye, wild yam, tall rattlesnake-root, Solomon's seal, Jack-in-the-pulpit, St. Johns-wort, and groundnut. Several rare species were observed including **American ginseng**, **purple licorice** (which occurs over a large area), and the state Endangered **thick-leaved meadow-rue**.

Sycamore-Mixed Hardwood Floodplain Forest

This bottomland forest bordering and buffering Sweet Root Creek does not entirely match PNHP forest classifications, as this area is co-dominated by both sycamore and Canada hemlock (~25% cover each) - each species defining separate but similar communities in the formal classification. Other similar classifications are Hemlock -Mixed Mesophytic Forest (which lacks sycamore) and Hemlock-Mixed Hardwoods (which is a wetland forest). The formal PNHP Sycamore-Mixed Hardwood classification lacks hemlock, but all other species in all strata are most similar so this classification has been selected.

Aside from sycamore and hemlock, associated tree species are similar to Mixed Mesophytic Forest, including high numbers of sugar maple, northern red oak, American beech, white ash, and shagbark hickory. Green ash, black cherry, black birch, pignut hickory, black locust, and black walnut, slippery elm, white pine, and ironwood are scattered. Tree regeneration is sparse. Shrubs, where Japanese barberry and multiflora rose are not dominant, include Virginia creeper, roundleaf greenbrier, spicebush, and wild hydrangea.

Herbs are more dense and lush than in Mixed Mesophytic Forest, including species that require greater soil moisture such as white turtlehead, false nettle, wood nettle, royal fern, bristly buttercup, jewelweed, enchanter's nightshade, bluets, bog violet, swamp candles, great lobelia, Pennsylvania knotweed, monkeyflower, deertongue grass, and vast areas of Japanese stiltgrass. The rare **branch lettuce** was observed in two locations along Sweet Root Creek, though it likely occurs in other locations as well along stream margins.

Man-made / Anthropogenic Communities:

The following communities were only briefly surveyed, and briefly summarized below. They harbor many non-native "naturalized" and/or EI species and structural conditions that occur largely by suppressing natural dynamics and yet they also contain high number of plant species, though largely non-native ones. Still, these areas are important for conservation – particularly bottomland meadows and hayfields which are sizable and contain conservation value for grassland birds, and as matrix open areas which house the smaller wet meadow communities.

Bottomland Meadow / Hayfields

Bottomland meadows would have most likely been a mixture of Sycamore-Mixed Hardwoods and Mixed Mesophytic forest, while hayfields would have been Dry Oak / Mixed Hardwoods for the majority of their history until cleared following colonization. These communities are dominated by grasses including timothy, orchard grass, fescue, redtop, perennial rye and many other grasses. and wide variety of naturalized European herbs such as clovers, plantains, and native goldenrods. Bottomland meadows are dotted with Japanese barberry, a species which can be removed relatively easily. Shrubby hedgerows edge, bisect, and border each of these habitats.

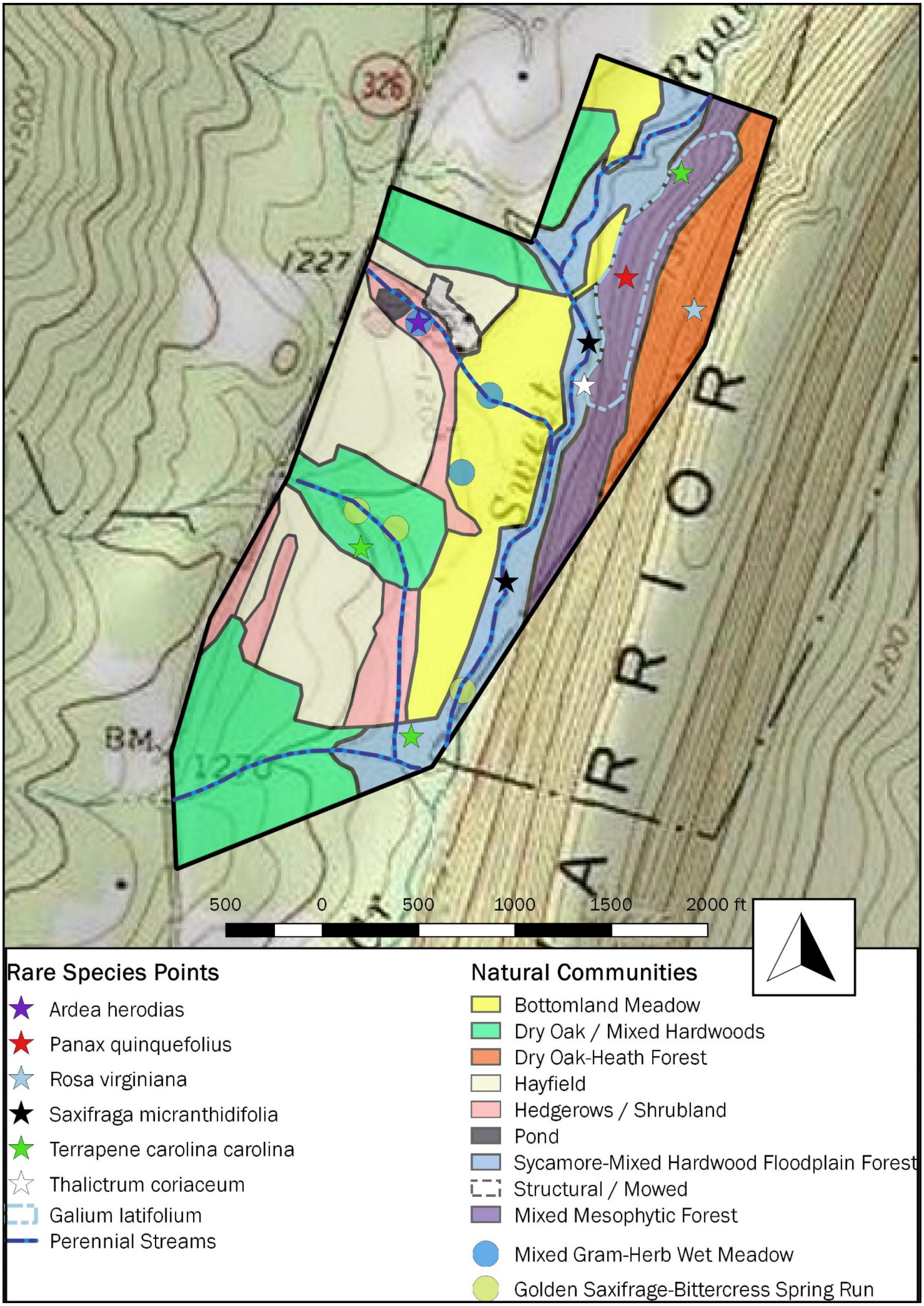
Hedgerows / Shrubland

This habitat structure is less a natural community that a structure preferred by many bird and small mammal species and their predators. It consists of a wide array of tree, shrub, vine, and herb species preferring full sun conditions and EI species dominance provides dense thicket conditions preferred by many bird species. Typical species are white ash, black cherry, black walnut, red maple, and many others over dense thickets of multiflora rose, Morrow's honeysuckle, oriental bittersweet, and multi-flora rose.

Pond

Though not a naturally occur water such as beaver impoundment, the pond at the western boundary serves as a key breeding, forage, escape cover and wintering site for many species. Wood duck and the PA rare-listed great blue heron were observed here. Turtles and egg-laying sites for amphibians is very good here as well, with species like green frog and bullfrog being common. Black willow, black alder, needle-rush, cattail, and numerous sedge and wetland-dependent herb species thrive around the perimeter.

See Figure 1 below for rare species, natural community, and wetland resource locations.


1227
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Rare Species Points
Ardea herodias
Panax quinquefolius
Rosa virginiana
Saxifraga micranthidifolia
Terrapene carolina carolina
Thalictrum coriaceum
Galium latifolium
Perennial Streams
Natural Communities
Bottomland Meadow
Dry Oak / Mixed Hardwoods
Dry Oak-Heath Forest
Hayfield
Hedgerows / Shrubland
Pond
Sycamore-Mixed Hardwood Floodplain Forest
Structural / Mowed
Mixed Mesophytic Forest
Mixed Gram-Herb Wet Meadow
Golden Saxifrage-Bittercress Spring Run

Breeding Bird Species Summary:
Bird surveys were focused on detection of likely breeding birds which are key indicators of habitat quality and structure.

Forest Bird Species: Among bird species onsite, the majority of species requiring forest interior conditions are neotropical migratory species which typically live in tropical and sub-tropical regions most of the year but migrate to North America in spring specifically to breed. Many of these species are in decline, and will continue to suffer future declines, because their wintering (home) and breeding habitats have been damaged and lost in the past 150 years. Many of these species prefer stream-side (riparian) zones.

Typical forest interior neotropical migratory species (13) include Acadian flycatcher, black-and-white warbler, broad-winged hawk, chimney swift, the PA listed **whip-poor-will**, eastern wood-pewee, Louisiana Waterthrush, ovenbird, scarlet tanager, veery, wood thrush, yellow-billed cuckoo, and yellow-throated vireo. Several resident woodpeckers are also forest-based, but they are regional / elevational migrants and/or resident species.

Typical forest-based resident and regional migratory birds include all woodpeckers, belted kingfisher, blue jay, brown thrasher, eastern kingbird, and white breasted nuthatch.

Open Area Species: A small number of species (5) are fully based within open bottomland and upland hayfields (including individual trees and hedgerows) including Baltimore oriole, red-winged blackbird, song-sparrow, field sparrow, and swamp sparrow. Suitable habitat exists for many rare, unusual, and unobserved species like eastern meadowlark, bobwhite quail, bobolink, horned lark, grasshopper sparrow, upland sandpiper, Savannah sparrow, Henslow's sparrow, vesper sparrow, yellow-breasted chat, eastern bluebird, and many others if open areas are maintained over time.

Edge / Hedgerow / Generalist / Structural-based Species: The majority of birds detected (28) prefer a mosaic of habitat structure that includes forested, edge, hedgerow, stream and pond habitats, and open areas. These include all species not listed above including **great-blue heron** (foraging; non-breeding record).

III. MANAGEMENT RECOMMEDATIONS

The following management recommendations are listed in relatively order from immediate / near-term projects that should be considered and/or initiated immediately to mid-to-long-term projects that might be initiated soon, but which will require ongoing sustained effort over time.

Funding opportunities through state water resource, wildlife, forestry departments can likely be advised and directed by region land trusts. The following recommendations do not constitute a management plan, but rather they present a brief list of potential actions that can be identified and fleshed out in a future management plan.

1. Canada Hemlocks: Numerous Canada hemlocks along Sweet Root Creek remain unaffected by the hemlock woolly adelgid (HWA) scale-insect invasion. Hemlocks should be treated immediately with safari and/or imidicloprid (chemical) immediately to protect them from further die off, and to remain a key evergreen riparian area component.

2. Rare Plant and Wildlife Species Protection & Enhancement: This is a more complex discussion requiring some plant propagation experience but competing saplings and shrubs and weedier species can be periodically removed from Virginia rose locations. Ginseng can be propagated onsite or for better success, in greenhouse or protected conditions. Engage in propagation / increase of select other species. Partly includes EI species removal in some locations.

3. Wildlife Hazards:
    a. Remove barbed wire and cattle-fencing property-wide. Fences are a wildlife hazard for movement of deer, bear, and forest owls & hawks.
    b. Remove all metal, glass, and potentially toxic materials at the large dump at the western edge of the “middle wood” east of the powerline crossing.

4. Stream-side Vegetation Buffers:
    a. Leave vegetation buffer on the pond-stream and seepage (south of the current bridge crossing) approximately 3-5 lateral feet. For stream areas visible from the porch or nearby adjacent areas where most stream views occur, cut buffer vegetation height to 18-24” inches.

5. Exotic-Invasive (EI) Species Removal:
    a. EI species should be removed from areas strategically including the smallest, most critical areas first then expanding to larger matrix areas later. Starting points should be the pond-stream (between house and state road) and pond perimeter, which will allow view of the stream and pond areas, within and surrounding seeps, within bottomland meadows, then in forests buffering the main creek and the large central / southern creek channels.

6. Bottomland and Upland Meadow Maintenance:
    a. Maintain bottomland dry and wet meadows (and upland hayfields if desired) through 1-3-year interval bush-hogging. This will prevent takeover of woody species and to maintain and attract new open area breeding bird species. Wet meadows may need to be cut in mid-late summer when they are dry and once birds have fledged chicks from within.
    b. Bush-hog dry (non-wet meadow) areas in late winter, as remnant vegetation will provide habitat for wintering birds and small mammals through winter while mowed / ground-level vegetation will not.

7. Grassland Songbird Protection: Grassland and shrubland breeding songbirds (declining regionally) can be protected through maintaining bottomland meadows as open (see next) and by scheduling first-cut for hayfields to approximately July 1-7 or later annually (though

this may lead to hayfield decline). If hayfields are to be abandoned or yielded, these areas can be converted to a more natural grassland / shrubland structure or reforested.

8. Reforestation: Naturally, bottomland and upland meadows would have been forested. Thus, reforestation of at least upland meadows may be desirable. Forests can absorb and store far more carbon per acre than grasslands. Consideration to this idea should be weighed against the benefits of grassland / shrubland bird population development in these areas.

9. Stream Restoration:
    a. Remove & replace the small bridge and undersized culvert (south of the barn) and replace with span bridge (lacking culvert or a 24 – 36" culvert. Currently, the culvert is elevated above the stream substrate and it blocks passage, migration, and genetic exchange of small fish and aquatic vertebrate. The culvert is also under-sized for high water flows during storm events.
    b. Install a check-dam on the "pond-stream" outflow east of the primary (northern) wet meadow to expand the existing wet meadow habitat size and to increase water volume retention in the greater area.
    c. Opportunities to conduct more extensive and targeted stream restoration opportunities may exist for this property, especially with its connectivity to large state land blocks. Consider discussion with regional land trusts and/or state water resources divisions for more information.

10. Course Woody Debris (CWD) Creation: Standing and fallen dead trees are generally absent from forests onsite, a Create standing and fallen woody debris in bottomland and upland forests by girdling and/or felling approximately 1-4 larger diameter overly abundant tree species.

11. Deer Maintenance & Control: Deer overpopulation is clearly affecting forest composition onsite (and regionally), apparent in the primary lack of seedlings and new or root-sprout saplings, shrubs, and some herb species property-wide. Intensive hunting would likely be required within the property to help reduce the deer population and increase forest seedling diversity and progression. See *https://extension.psu.edu/white-tailed-deer* and http://www.docs.dcnr.pa.gov/cs/groups/public/documents/document/dcnr_20027101.pdf for more detailed discussion on this complex problem and solutions.

12. Bluebird Box Installation: Although eastern bluebirds are not rare, their original next-cavity habitat within woodland / glade (open area) habitats have been largely removed through agriculture and they are mostly dependent on boxes. Boxes can be established on 400-foot intervals (minimum) throughout the property to help restore this now uncommon (but not rare) species. Boxes should not be placed too close to barn or homesite structures to avoid house sparrow (not observed) invasion. Tree swallows and Carolina or House wrens must also be discouraged from nesting in the boxes as well.

Miscellaneous Opportunities

1. Treehouse / Elevated Observation Platforms: Build viewing platforms along creek or slope areas for viewing opportunities may be considered, pending liability. These may be used for individual or group educational opportunities.

2. Maple Syrup Production ("sugaring"): A high number of sugar maple trees occur in easily accessible locations which may be tapped annually for small-scale maple syrup production. Done properly and at the right time, syrup production will not damage the trees.

3. Trail System Opportunities: Many miles of open and forested trail system opportunities exist throughout the tract. It is suggested that trails follow forest / field edges, wet meadow boundaries, along Sweet Root Creek (and secondary large creeks in central and southern regions). Lengthy trail sections may be located on the west-facing slopes of Warrior Mountain that might connect to adjacent game-lands. A notable potential foot-bridge crossing over Sweet Root to unique toe-slope sub-ridge (and then slope) of Warrior Mountain occurs in the southern region where the boundary crosses the stream.

IV. PLANT AND WILDLIFE SPECIES LISTING

FORM	COMMON NAME	*SCIENTIFIC NAME*
	PLANT SPECIES	
Tree	American Basswood	*Tilia americana*
Tree	American Beech	*Fagus grandifolia*
Tree	Bitternut Hickory	*Carya cordiformis*
Tree	Black Birch	*Betula lenta*
Tree	Black Locust	*Robinia pseudoacacia*
Tree	Black Oak	*Quercus velutina*
Tree	Black Walnut	*Juglans nigra*
Tree	Canada hemlock	*Tsuga canadensis*
Tree	Cucumber Magnolia	*Magnolia acuminata*
Tree	Green Ash	*Fraxinus pennsylvanica*
Tree	Hophornbeam	*Ostrya virginiana*
Tree	Mockernut Hickory	*Carya alba*
Tree	Northern Red Oak	*Quercus rubra*
Tree	Pignut Hickory	*Carya glabra*
Tree	Red Maple	*Acer rubrum*
Tree	Shagbark Hickory	*Carya ovata*
Tree	Slippery Elm	*Ulmus rubra*
Tree	Striped Maple	*Acer pensylvanicum*
Tree	Sugar Maple	*Acer saccharum*
Tree	Sycamore	*Platanus occidentalis*
Tree	Tulip Poplar	*Liriodendron tulipifera*
Tree	White Ash	*Fraxinus americana*
Tree	White Oak	*Quercus alba*
Tree	White Pine	*Pinus strobus*
Tree	Wild Black Cherry	*Prunus serotina*
Shrub	Autumn Olive	*Elaeagnus umbellata*
Shrub	Chinese Privet	*Ligustrum sinense*

Shrub	Cockspur Hawthorn	*Crataegus crus-galli*
Shrub	Elderberry	*Sambucus canadensis*
Shrub	Hillside Blueberry	*Vaccinium pallidum*
Shrub	Japanese Barberry	*Berberis thunbergii*
Shrub	Mountain Laurel	*Kalmia latifolia*
Shrub	Spicebush	*Lindera benzoin*
Shrub	Squaw Huckleberry	*Vaccinium stamineum*
Shrub	Wild Hydrangea	*Hydrangea arborescens*
Shrub	Witch-hazel	*Hamamelis virginiana*
Vine	Hell-fetter	*Smilax tamnoides*
Vine	Oriental Bittersweet	*Celastrus orbiculatus*
Vine	Rambler Rose	*Rosa multiflora*
Vine	Roundleaf Greenbrier	*Smilax rotundifolia*
Vine	Virginia Creeper	*Parthenocissus quinquefolia*
Vine	Virginia Rose	*Rosa virginiana*
Herb	Appalachian Meadowrue	*Thalictrum coriaceum*
Herb	Autumn Bluegrass	*Poa autumnalis*
Herb	Bear-corn	*Conopholis americana*
Herb	Bearded Shorthusk	*Brachyelytrum erectum*
Herb	Black Cohosh	*Actaea racemosa*
Herb	Black Snakeroot	*Sanicula canadensis*
Herb	Blue Cohosh	*Caulophyllum thalictroides*
Herb	Bluestem Goldenrod	*Solidago caesia*
Herb	Bluets	*Houstonia serpyllifolia*
Herb	Boneset	*Eupatorium perfoliatum*
Herb	Bristly Buttercup	*Ranunculus hispidus*
Herb	Broadleaf Arrowhead	*Sagittaria latifolia*
Herb	Broad-leaf Cattail	*Typha latifolia*
Herb	Broomstraw	*Andropogon virginicus*
Herb	Canada Cinquefoil	*Potentilla canadensis*
Herb	Canada Honewort	*Cryptotaenia canadensis*
Herb	Common St. Johnswort	*Hypericum punctatum*
Herb	Crooked-stem Aster	*Symphyotrichum prenanthoides*

Herb	Deer-tongue Grass	*Dichanthelium clandestinum*
Herb	Dittany	*Cunila origanoides*
Herb	Enchanter's Nightshade	*Circaea lutetiana*
Herb	English Plantain	*Plantago lanceolata*
Herb	False Nettle	*Boehmeria cylindrica*
Herb	Field Garlic	*Allium vineale*
Herb	Fowl Manna-grass	*Glyceria striata*
Herb	Fringed Loosestrife	*Lysimachia ciliata*
Herb	Garlic Mustard	*Alliaria petiolata*
Herb	Ginseng	*Panax quinquefolius*
Herb	Golden Saxifrage	*Chrysosplenium americanum*
Herb	Great Blue Lobelia	*Lobelia siphilitica*
Herb	Ground Ivy	*Glechoma hederacea*
Herb	Hairy Solomon's-seal	*Polygonatum pubescens*
Herb	Hog Peanut	*Amphicarpaea bracteata*
Herb	Indian Tobacco	*Lobelia inflata*
Herb	Jack-in-the-pulpit	*Arisaema triphyllum*
Herb	Japanese Stiltgrass	*Microstegium vimineum*
Herb	Kidney-leaved Buttercup	*Ranunculus abortivus*
Herb	Largeleaf Plantain	*Plantago major*
Herb	Lettuce-leaf Saxifrage	*Micranthes micranthidifolia*
Herb	Little Starwort	*Stellaria graminea*
Herb	Mayapple	*Podophyllum peltatum*
Herb	Monkeyflower	*Mimulus ringens*
Herb	Old-field Cinquefoil	*Potentilla simplex*
Herb	Pennsylvania Bittercress	*Cardamine pensylvanica*
Herb	Pennsylvania Smartweed	*Polygonum pensylvanicum*
Herb	Philadelphia Fleabane	*Erigeron philadelphicus*
Herb	Plantain-leaf Pussytoes	*Antennaria plantaginifolia*
Herb	Purple Bedstraw	*Galium latifolium*
Herb	Purple-stem Aster	*Symphyotrichum puniceum var. puniceum*
Herb	Rattlesnake Hawkweed	*Hieracium venosum*

Herb	Robin's Plantain	*Erigeron pulchellus*
Herb	Rosy Sedge	*Carex rosea*
Herb	Rough Sedge	*Carex scabrata*
Herb	Round-lobed Liverleaf	*Hepatica americana*
Herb	Self-heal	*Prunella vulgaris*
Herb	Slender-leaved Bluets	*Houstonia tenuifolia*
Herb	Smooth Yellow Violet	*Viola eriocarpa*
Herb	Soft Rush	*Juncus effusus*
Herb	Solomon's Plume	*Maianthemum racemosum*
Herb	Solomon's Seal	*Polygonatum biflorum*
Herb	Spanish Needles	*Bidens bipinnata*
Herb	Spotted Jewel-weed	*Impatiens capensis*
Herb	Spreading Sedge	*Carex laxiculmis*
Herb	Sweet Vernal Grass	*Anthoxanthum odoratum*
Herb	Sweet-scented Bedstraw	*Galium triflorum*
Herb	Tall Rattlesnake-root	*Prenanthes altissima*
Herb	Tearthumb	*Polygonum sagittatum*
Herb	Three-way Sedge	*Dulichium arundinaceum*
Herb	Twisted Sedge	*Carex torta*
Herb	Velvet Grass	*Holcus lanatus*
Herb	Virginia Bugleweed	*Lycopus virginicus*
Herb	Virginia Strawberry	*Fragaria virginiana*
Herb	White Snakeroot	*Ageratina altissima*
Herb	White Turtlehead	*Chelone glabra*
Herb	White Vervain	*Verbena urticifolia*
Herb	White Wood Aster	*Eurybia divaricata*
Herb	White-edge Sedge	*Carex debilis*
Herb	Wild Licorice	*Galium circaezans*
Herb	Wild Yam	*Dioscorea villosa*
Herb	Wood Anemone	*Anemone quinquefolia*
Herb	Wood Nettle	*Laportea canadensis*
Herb	Wood Violet	*Viola sororia*
Herb	Wood Violet	*Viola palmata*

Herb	Woodland Joe-Pye	*Eupatorium purpureum*
Herb	Yarrow	*Achillea millefolium*
Fern	Christmas Fern	*Polystichum acrostichoides*
Fern	Evergreen Woodfern	*Dryopteris intermedia*
Fern	Fan Club-moss	*Diphasiastrum digitatum*
Fern	Interrupted Fern	*Osmunda claytoniana*
Fern	Rattlesnake Fern	*Botrypus virginianus*
Fern	Southern Lady Fern	*Athyrium asplenioides*
Fern	Tree Clubmoss	*Lycopodium obscurum*
Fern	Virginia Rockcap Fern	*Polypodium virginianum*
WILDLIFE SPECIES		
Reptile	Common Gartersnake	*Thamnophis sirtalis*
Reptile	Eastern Box Turtle	*Terrapene carolina*
Amphibian	American Bullfrog	*Rana catesbeiana*
Amphibian	American Toad	*Anaxyrus americanus*
Amphibian	Gray Treefrog	*Hyla versicolor*
Amphibian	Green Frog	*Rana clamitans*
Amphibian	Spring Peeper	*Pseudacris crucifer*
Mammal	American Beaver	*Castor canadensis*
Mammal	American Black Bear	*Ursus americanus*
Mammal	Common Raccoon	*Procyon lotor*
Mammal	Coyote	*Canis latrans*
Mammal	Eastern Chipmunk	*Tamias striatus*
Mammal	Eastern Gray Squirrel	*Sciurus carolinensis*
Mammal	Eastern Mole	*Scalopus aquaticus*
Bird	Acadian Flycatcher	*Empidonax virescens*
Bird	American Redstart	*Setophaga ruticilla*
Bird	Baltimore Oriole	*Icterus galbula*
Bird	Barn Swallow	*Hirundo rustica*
Bird	Belted Kingfisher	*Megaceryle alcyon*
Bird	Black-and-white Warbler	*Mniotilta varia*

Bird	Blue Jay	*Cyanocitta cristata*
Bird	Broad-winged Hawk	*Buteo platypterus*
Bird	Brown Thrasher	*Toxostoma rufum*
Bird	Carolina Wren	*Thryothorus ludovicianus*
Bird	Cedar Waxwing	*Bombycilla cedrorum*
Bird	Chimney Swift	*Chaetura pelagica*
Bird	Eastern Kingbird	*Tyrannus tyrannus*
Bird	Eastern Phoebe	*Sayornis phoebe*
Bird	Eastern Towhee	*Pipilo erythrophthalmus*
Bird	Whip-poor-will	*Antrostomus vociferus*
Bird	Eastern Wood-Pewee	*Contopus virens*
Bird	Field Sparrow	*Spizella pusilla*
Bird	Gray Catbird	*Dumetella carolinensis*
Bird	Great Blue Heron	*Ardea herodias*
Bird	Hairy Woodpecker	*Picoides villosus*
Bird	Hooded Warbler	*Setophaga citrina*
Bird	Indigo Bunting	*Passerina cyanea*
Bird	Lesser Goldfinch	*Spinus psaltria*
Bird	Louisiana Waterthrush	*Parkesia motacilla*
Bird	Mourning Dove	*Zenaida macroura*
Bird	Northern Cardinal	*Cardinalis cardinalis*
Bird	Northern Mockingbird	*Mimus polyglottos*
Bird	Ovenbird	*Seiurus aurocapilla*
Bird	Pileated Woodpecker	*Dryocopus pileatus*
Bird	Red-bellied Woodpecker	*Melanerpes carolinus*
Bird	Red-tailed Hawk	*Buteo jamaicensis*
Bird	Red-winged Blackbird	*Agelaius phoeniceus*
Bird	Scarlet Tanager	*Piranga olivacea*
Bird	Song Sparrow	*Melospiza melodia*
Bird	Swamp Sparrow	*Melospiza georgiana*
Bird	Tree Swallow	*Tachycineta bicolor*
Bird	Veery	*Catharus fuscescens*
Bird	White-breasted Nuthatch	*Sitta carolinensis*

Bird	Wild Turkey	*Meleagris gallopavo*
Bird	Wood Duck	*Aix sponsa*
Bird	Wood Thrush	*Hylocichla mustelina*
Bird	Yellow Warbler	*Setophaga petechia*
Bird	Yellow-billed Cuckoo	*Coccyzus americanus*
Bird	Yellow-throated Vireo	*Vireo flavifrons*