

Vegetation

The native vegetation of the Upper Perkiomen Creek watershed is characterized as part of the Mixed Oak Forest Region that extends from northern Georgia to southern New England. This forest region was formerly known as Oak-Chestnut, with named for the American Chestnut (*Castanea dentata*) that was the dominant species (and a major sources of lumber for a variety of uses) prior to succumbing to the Chestnut blight introduced to this country in the early 1900's (Braun, 1950). Although the entire region was almost thoroughly cleared of the pre-settlement forests by the late 18th century and most forests have experienced various levels of logging and clearing since that time, the forest types we see today along the ridges, slopes, ravines and stream valleys of the Upper Perkiomen are direct descendants of the original forest cover.

Though a walk through a woodland or along a stream may be peaceful and uneventful, the natural areas of the Upper Perkiomen Valley are the “engine rooms” of the watershed. The rich forests, wetlands, streams and meadows that characterize much of the area are constantly operating natural systems that provide “ecosystem services” to support the lives of people, plants and animals in the watershed. Among its many functions, native vegetation regulates temperatures and wind, provides natural filters for pollution humans release into air, water and soil, cycles water and oxygen to the atmosphere, reduces flooding, erosion and sedimentation impacts in the watershed, creates productive soils, promotes recharge of groundwater, and supports the biological diversity of plants and wildlife.

According to the classification system presented in *Terrestrial and Palustrine Plant Communities of Pennsylvania*, by Jean Fike of the Pennsylvania Natural Diversity Inventory, the region in which the Upper Perkiomen is located supports as many as eight different forest types, two shrub wetland communities and two herbaceous wetland communities. In addition, successional upland communities such as meadows and old fields/thickets represent various stages of regrowth that define abandoned farm fields before they reach the woodland stage. The vegetative communities are described as follows (Fike:

Tuliptree-Beech-Maple Forest

Sugar Maple-Basswood Forest

The slopes and other well-drained areas in the diabase region along Unami, Ridge Valley and Deep Creeks and the north- and east-facing slopes above waterways in the Triassic shale region at the perimeter of the study area support these two similar forest types. Dominant species include:

American beech

Basswood

Red Oak

Fagus grandifolia

Tilia americana

Quercus rubra

Sugar maple	<i>Acer saccharum</i>
Tuliptree	<i>Liriodendron tulipifera</i>
White ash	<i>Fraxinus americana</i>
White oak	<i>Quercus alba</i>

Red Oak-Mixed Hardwood Forest

The more level uplands on Triassic shale tend to support this forest type, often maturing from an early successional stage of nearly solid thickets of Eastern redcedar (*Juniperus virginiana*). Dominant species include:

Mockernut hickory	<i>Carya tomentosa</i>
Red oak	<i>Quercus rubra</i>
Shagbark hickory	<i>Carya ovata</i>
Tuliptree	<i>Liriodendron tulipifera</i>
White oak	<i>Quercus alba</i>

Successional Red Maple Forest

This forest type is typically found in low-lying areas along streams, floodplains and headwaters areas with hydric soils, particularly those that have been logged or abandoned from farming within the last 20 to 30 years. Dominant species include:

Eastern redcedar	<i>Juniperus virginiana</i>
Red maple	<i>Acer rubrum</i>
Tuliptree	<i>Liriodendron tulipifera</i>
White ash	<i>Fraxinus Americana</i>

Bottomland Oak-Hardwood Palustrine Forest

Forested areas along broader floodplains mature to this forest type. Dominant species include:

Black walnut	<i>Juglans nigra</i>
Box elder	<i>Acer negundo</i>
Hop hornbeam	<i>Ostrya virginiana</i>
Pin oak	<i>Quercus palustris</i>
River birch	<i>Betula nigra</i>
Shagbark hickory	<i>Carya ovata</i>
Silver maple	<i>Acer saccharinum</i>
Sycamore	<i>Platanus occidentalis</i>

Silver Maple Flood Plain Forest

Sycamore-River Birch-Box Elder Flood Plain Forest

Flood plains may also support a forest type with greater representation of silver maple or sycamore and river birch.

Conifer Plantations

Planted stands of evergreen species such as Norway spruce (*Picea abies*) and white pine (*Pinus strobes*) can be found in certain parts of the program area. These plantations are not a native forest type, but often date back 50 to 75 years when seedlings were widely distributed.

Buttonbush Wetland

Alder-Ninebark Wetland

Shrubby wetland communities in the study area are known to support the following species:

Alder	<i>Alnus spp.</i>
Arrowwood	<i>Viburnum dentatum</i>
Buttonbush	<i>Cephalanthus occidentalis</i>
Elderberry	<i>Sambucus canadensis</i>
Red-osier dogwood	<i>Cornus amomum</i>
Silky dogwood	<i>Cornus racemosa</i>
Spicebush	<i>Lindera benzoin</i>
Swamp Rose	<i>Rosa palustris</i>
Willow	<i>Salix spp.</i>
Winterberry holly	<i>Ilex verticillata</i>

Tussock Sedge Marsh

Mixed forb Marsh

Openings in shrubby wetlands, and broader wet meadow areas support these communities, including species such as tussock sedge, sweet flag iris, sensitive fern and skunk cabbage. In some areas, tussock sedge marsh is overtaken by the red maple that indicates a shift toward the Successional Red Maple Forest type.

The woodlands in the Upper Perkiomen support distinctive plant communities and contain over a dozen canopy tree species including red, white, black and chestnut oak, sugar maple, black birch, white ash and tulip poplar.

Planning Implications

The US Forest Service urged protection of large contiguous forests (defined as areas of more than 5,000 acres) as part of the New York – New Jersey Highlands Regional Study in 1990. If the Highlands province is extended into Pennsylvania, additional funds for voluntary protection of forestlands may be available from a special set aside from Pennsylvania’s Land and Water Conservation Fund. Pennsylvania may also consider the Highlands province as a Forest Legacy project site, which would again mean that funding would be available for forested tracts of land to be protected.

The US Forest Service Highlands study also addresses the issue of timber management and production, noting that the timber resources of the region may be underutilized.

The Forest Legacy Program also endorses sustainable forestry, promoting selective cutting with good environmental best management practices. Selective harvesting can occur without causing too much harm to forest and aquatic systems; however, local controls need to ensure that over-harvesting and clear-cuts are avoided, especially within riparian zones and on the steepest slopes, which have the most erodible soils.

At the end of the last ice age (Pleistocene), the area forests probably consisted primarily of spruce, pine, birch and alder, which gave way to chestnut-oak forests as the climate warmed. Indians likely burned the forest periodically, while subsequently early European settlers cleared and plowed many forests and introduced new species, both intentionally (e.g. Norway maples) and unintentionally (e.g. chestnut blight). While chestnut, elm and hemlock have declined locally due to disease, and oaks, beech and hickories are now probably *underrepresented* due to high-grade lumbering, ash, maple, sycamore and tulip poplar are probably more common than they once were in the landscape.

Any future restoration activities involving forests and/or riparian buffers should consider *emphasizing* the underrepresented native species to reinstate biological balance. This will also ensure that appropriate seed-sources are reintroduced to the region, which will in turn provide for long-term viability and balance of the common plant communities.

A final note about *local provenance* is applicable at this point: Efforts should be made to ensure that, where possible, any plants used for restoration (or even for horticultural use – at least by the local institutions if not by residences) should be obtained from local growers. Much discussion in the ecological and native plant communities in recent years has promoted the concept of purchasing plants grown within, ideally, less than 50 miles of the planting site – and certainly no more than 100 miles – to promote a strong, diverse gene pool reflecting long-term adaptation to local conditions.

Invasive Exotic Plant Species

The combination of thin, low-nutrient diabase and gneiss soils, extensive forest cover and lack of soils disturbance, and the prevalence of north-facing slopes along the ridges, hillsides and ravines of the Upper Perkiomen has greatly limited the spread of invasive exotic vegetation so commonly found throughout southeastern Pennsylvania. However, in disturbed areas, such as successional oldfields and abandoned pastures, along woodland edges and hedgerows, forest gaps or clear-cuts, a slate of invasive exotic plants may be evident, intermixed with ruderal (i.e. opportunistic) natives such as cherry, red cedar, dogwood, crab apple, maple and tulip poplar. Invasive exotic plant species of particular concern in the area typically include, but are not limited to:

- Trees such as: Norway & sycamore maples; ailanthus;
- Shrubs including: Multiflora rose; blackberry; wineberry; Russian and autumn olive; tartarian and amur honeysuckle; Japanese knotweed; Japanese barberry; winged euonymus (a.k.a. burning bush)
- Vines such as: Japanese honeysuckle; Oriental bittersweet; akebia vine; Japanese hops; porcelain-berry; mile-a-minute vine;
- Grasses including: Japanese stiltgrass; miscanthus; pennisetum; reed canary grass.
- Herbaceous plants including: Garlic mustard, lesser celandine, dame's rocket, purple loostrife

This list represents only some of the most infamous species. More extensive lists are available through the Pennsylvania Department of Conservation and Natural Resources, which also consider potentially harmful species that are still being evaluated locally for detrimental impacts. The major concern with these invasive species is their ability to outcompete and dominate native plants, thereby reducing plant species diversity and providing degraded habitat and food sources for native wildlife.

At the same time, there is also a general overabundance of native ruderal species that prefer 'edge' or disturbed environments in the region. Human impacts in the past few centuries have created many more of these habitat types than there were in pre-colonial times through fragmentation. This imbalance can be address through public awareness and discouraging over-abundant, aggressive native species in favor of underrepresented native species. For example, fox grape is an over-abundant native species in the area that thrives in disturbed edge habitat conditions. Although it provides good wildlife food, its extent should be monitored carefully. If it becomes overabundant, it should be carefully controlled - but not necessarily eradicated. If there are local concerns about loss of food and cover sources for wildlife as invasives are removed, encouraging natural regeneration or planting native shrubs that produce high-lipid berries and nuts (e.g. viburnums, hazel) – is a good alternative.

Planning Implications

While the health of the local forests in the Upper Perkiomen is relatively good, local conservationists must be vigilant. Invasive exotic plant species spread typically by bird droppings (for berry-or seed reproducing species) or wind. Since most invasives were introduced by man, either by accident or purposefully, their distribution is typically highest around urban areas, with concentric rings of decreasing density moving into the countryside. In this area, if the seed-source for many of these species is not yet evident – they will probably be arriving soon.

It is no longer sufficient to conveniently assume that nature is maintaining a self-perpetuating balance. With the invasion of aggressive non-native species, many native plant populations can be severely impacted. Highly disturbed forests can loose their

naturally high biodiversity in the face of these alien invasions – and surprisingly quickly.

It is recommended that local conservation groups undertake annual monitoring of the natural habitats throughout the Upper Perkiomen, particularly those that house rare plant species and in protected parks and nature preserves. At the first signs of invasion by exotics, volunteers should be solicited to manually remove the invasive plants, paying particular attention to removing all roots and seed-heads to avoid resprouting or new germination. If necessary, a skilled, qualified and certified professional can be hired to spot-spray herbicide (typically in the late summer with Roundup,) to control patches of invasive exotic plants that don't respond to manual removal. A public education campaign should be initiated to inform local landowners of the issue and concerns. Natural Lands Trust's Fulshaw Craeg Preserve provides a valuable local demonstration site to learn techniques for management of invasive species.

As a compliment to the native plant species local provenance ordinance proposed above (under the Vegetation Communities section), the local townships should also consider implementing an Invasive Exotic Plant ordinance to ensure that future plantings do not use known invasive species. Again, institutions and corporations could be *required* to adhere to the guidelines, while residential landowners might be *encouraged*, perhaps through property tax rebate incentives, to follow the recommendations. Numerous counties and municipalities in southeast Pennsylvania have such ordinances that could serve as models.

Wildlife

The Upper Perkiomen includes a broad network of forest-interior habitat, forested stream corridors and wetlands, and herbaceous and shrub wetlands and meadows that supports a relatively high diversity of native wildlife species. Owing to the relative lack of forest fragmentation and habitat disturbance in the valley, a number of wildlife species are present that are not commonly found in the more heavily agricultural or developed landscapes of southeast Pennsylvania. Mammal species such as gray fox, forest-nesting birds including scarlet tanager and pileated woodpecker, and reptiles such as Northern Copperhead are all indicative of the ecological integrity of the Unami area.

The distinction between wildlife species that are *habitat specialists* and those that are *habitat generalists* is important to consider in prioritizing natural areas for protection. *Habitat specialists* depend on specific habitat types (e.g. grasslands, forest-interior, cold-water streams), whereas *habitat generalists* are more adaptable to a variety of human-influenced environments. *Habitat generalists* such as gray squirrels, white-tailed deer and blue jays are more often likely to be commonly found in the suburban landscapes of residential areas, woodland edges and woodlots, and small fields that are becoming more ubiquitous throughout the region. *Habitat specialists* such as bald eagles, wood frogs and luna moths rely on larger, undisturbed blocks of interconnected natural areas – the very kind of networks that are being replaced by suburban landscapes favoring *habitat generalists*.

The largest blocks land containing the broadest networks of forest, wetland and stream habitat are those with the greatest potential habitat value for wildlife conservation. The deep woods, wooded stream corridors and wetlands along the headwaters ridges, the Unami Creek and Ridge Valley Creek, and Deep Creek, and many of the natural stream segments and wetlands in the watershed are all ecologically valuable habitat networks tracts of land for supporting native wildlife. More intensively used agricultural and developed areas of the watershed are somewhat less important for supporting all but the most common species of wildlife. Agricultural and developed areas that maintain connected networks of natural habitat have greater wildlife value. **(see Figure 8: Habitat Networks)**

Aquatic Species (fish, invertebrates)

The major streams, tributary streams, wetlands and ponds that constitute the aquatic ecosystems of the Upper Perkiomen Creek watershed provide food and habitat conditions suitable for a rich diversity of aquatic life. These include an array of benthic macroinvertebrates (insects and larvae found in stream beds) such as caddisfly nymphs, stonefly nymphs, and mayfly nymphs. Freshwater mussels, snails and crayfish also fall into this category. These species form the base of the food web in stream ecosystems,

and are important indicators of stream health or degradation. The diversity of aquatic life includes fish such as dace, darters, minnows, suckers, brown trout and native brook trout.

The best habitats for supporting aquatic species are (obviously) streams, ponds and wetlands, but also associated forest areas which provide important filtration and recharge benefits to maintain the critically important quality and quantity of water on which aquatic organisms depend. Freshwater stream ecosystems evolved in a forested condition, and their richness and viability are inherently connected to the presence of healthy streamside and upland woodland networks. Developed areas and agricultural land are less important for these species unless they retain significant natural buffers along streams and wetlands.

Bird Species

Given the size, diversity and quality of habitats in the Upper Perkiomen Creek valley, the total number of overwintering, migratory and breeding bird species utilizing the area is expected to be high, particularly with forest dwelling and edge dwelling species. The watersheds of the Delaware River basin are important stopover points in the Atlantic Flyway, the major migratory corridor for birds along the east coast of North America. In addition to migratory functions, local habitats support breeding grounds and overwintering areas for numerous bird species. The deep woods habitats and wooded riparian corridors of the ridges and valleys in the watershed attract numerous species of woodland warblers and other habitat specialists such as woodpeckers, owls and small hawks and wood ducks. Even shrubbier successional old field habitats attract less-common edge species such as American woodcock, yellow-breasted chat, and indigo bunting. One of the added benefits of reservoirs in the watershed is the habitat diversity they add for bird species. Large bodies of open water attract a variety of waterfowl, particularly in winter, along with the large resident Canada goose population that is a source of concern for water quality and human health. Shorelines, wetlands and mudflats along the perimeter of the reservoirs provide habitat for a variety of wading birds and other species.

These woodland/stream/wetland/river habitat networks are critical for supporting bird species diversity in the Upper Perkiomen Valley. Lower density developed residential areas and agricultural lands with hedgerows, woodlands and stream corridors and less intensively maintained hayfields have significant habitat value for birds. Intensively farmed agricultural lands and developments dominated by lawns and paved areas and the historic villages of the area are generally less important for most bird species, owing to the lack of food and cover opportunities for many of the habitat specialists that make up the list for the area.

Herpetofauna (Reptiles and Amphibians)

The same habitat networks that support aquatic and bird species diversity are also critical for the reptiles and amphibians of the Upper Perkiomen Valley – but riparian and wetland habitats are most important. Amphibians such as frogs (at least 7 species), toads and salamanders (at least 5 species) are perfect examples of habitat specialists, often reproducing in small vernal pools and shallow wetlands during the spring breeding season, then dispersing to streamside and upland woodlands and wet meadow areas. Reptiles including turtles (at least 5 species) and snakes (at least 6 species) are also found more commonly in natural areas rather than residential or agricultural landscapes. Stream, pond, wetland and river habitats offer the most value for these species, with the majority of woodlands in the area ranking as moderately important. Large woodlands adjoining forested wetlands and streams are important habitats. Agricultural and residential landscapes are less important habitats for reptiles and amphibians due to the lack of food, cover and breeding sites.

Invertebrates (Terrestrial)

Invertebrates are perhaps the most diverse yet least understood and appreciated of the wildlife taxa groups. The myriad of ants, beetles, worms, and larvae that live in the forest leaf litter and upper soil layers in the region are the “decomposers” that play a crucial role in maintaining healthy ecosystems and stream quality. The more charismatic butterflies, moths, dragonflies, damselflies, and the less popular bees, wasps, flies and mosquitoes play crucial roles as pollinators and/or decomposers, and are often *plant specific* in their habitat requirements, in addition to being habitat specific. They also form a critical layer in the food web for the vast majority of other wildlife species. Invertebrates are most dependent on forested habitats for their survival, due to the combination of high plant diversity and accumulation of organic matter they provide. Agricultural and residential landscapes are less beneficial, however, the use of native plants in gardens, landscaping, wildflower meadows and even stormwater management basins can add significant habitat and food for insects, including butterflies.

Mammals

The habitat networks of the Upper Perkiomen may support as many as 50 different species of mammals. Some of these are more common habitat generalists or woodland edge species found in many backyards. Species such as white-tailed deer, gray squirrel, groundhog, white-footed mouse, raccoon, opossum, moles, shrews, and eastern cottontail rabbit fall into this category.

White-tailed deer in particular are a concern, as their population has boomed in recent decades to many times its natural density. The natural density of deer populations in Pennsylvania averages roughly 5 deer per square mile. Today, in much of southeastern Pennsylvania, there are more than 20 deer per square mile. This change is due to a combination of factors, including the ability of deer to adapt to human environments

and the resulting loss and fragmentation of natural habitats, the long absence of historic top predators such as gray wolf and mountain lion, and the cultural shift away from hunting as rural populations become more suburbanized. There are at least three major impacts of white-tailed deer overpopulation in the Upper Perkiomen – the overbrowsing of the forest understory and loss of plant diversity and future canopy trees; the loss of farm crops; and the hazard of collisions between deer and automobiles.

The potential list of less common and more habitat specific species in the area includes several types of weasels (including mink – which have been confirmed along the Unami Creek), gray fox, up to 10 species of bats, eastern coyote and red squirrel. Several larger mammal species that are indicators of large, healthy habitat networks may pass through the area, or could be attracted in the future. These include bobcat, black bear, beaver and Eastern wood rat -- an important, declining native rodent that may be present in this area. As with so many other forms of wildlife, the interconnected woodland/stream/wetland/river networks are critically important for mammals. Agricultural and residential landscapes tend to support the more generalist species, and have secondary value for mammals. The buffering and linking value of farmland adjoining woodlands is certainly an important factor in maintaining the diversity of mammals in the Upper Perkiomen.

Planning Implications

Habitat destruction, fragmentation and disturbance are the primary causes of loss of flora and fauna diversity across the region, and in the Upper Perkiomen landscape. However, studies show that the introduction or invasion of exotic species now has the second largest impact in reducing species diversity across the nation. Deer browse is also a concern for plant species diversity and the wildlife diversity that depends on native vegetation. Locally, gypsy moth invasions are a good example of invasive exotic wildlife, but there are many others – the newest of which are the growing concerns about Asian longhorn beetle and Asian and European earthworm impacts in natural woodlands, although no sustainable solutions to these problems have yet been developed.

As with many other areas in the region, some wildlife species are bouncing back from human impacts – such as white-tailed deer, wild turkey, Canada goose and red fox – while others continue to decline. Typically invertebrates, amphibians and reptiles continue to be disproportionately impacted by our modern world, while other vertebrates, and mammals in particular, seem better able to adapt. Species of all taxon groups that have difficulty adapting to disturbance, or those that *require* specific disturbance regimes or that are area-sensitive and affected by habitat fragmentation, continue to decline in the region. Many bird species – neotropical migrants and grassland species in particular, are showing marked population declines on the east-coast. Many amphibians and reptiles suffer as wetlands, vernal pools and other surface waters are ‘improved’ for higher-value land use or compromised by pollution. While

water habitats may be essential for breeding, there is a growing realization that many of these species also need an undisturbed upland habitat buffer adjacent to their breeding habitats for foraging and hibernation in non-breeding season.

It is, of course, very difficult to obtain accurate wildlife survey information - and even when we do obtain it, we must acknowledge that it is always over-representative of charismatic megafauna (i.e. deer, great-blue heron) and under-representative of the lower orders of faunal life forms.

Unlike flora, it is difficult to know where wildlife is located at any given time – since these species move around over both the short and long term. Seasonal migrations are particularly difficult to provide for in conservation planning, especially when the migrations are of large geographic extent, particularly international. Neotropical migratory birds are perhaps the best example of this scale. *Successful land preservation efforts to support viable wildlife populations therefore needs to focus more on providing a suitable regional habitat network, rather than just focusing on site-specific parcels where species have been seen and are presumed to reside. Local land use ordinances must also consider the importance of wildlife habitats in guiding development. In addition, more detailed surveys of local fauna are needed to better assess the health or crises facing wildlife communities in the area.*

Management strategies for overabundant species such as white-tailed deer and Canada goose should be considered in areas where impacts are most evident.

To do a better job of protecting the most ecologically valuable natural areas, we need a better understanding of how wildlife are using those areas. Where do we find the greatest concentrations of amphibians such as frogs and salamanders -- are they found around the vernal pools and the seeps and springs along small rivulets in the area? Are top-predator mammals such as coyote or bobcat found in the area? Do mink utilize the stream corridors? Where are the greatest concentrations of forest-nesting warblers and bats in the area? These are extremely important questions for honing-in on the “hotspots” of biodiversity in the Upper Perkiomen.

So far, these questions have only been addressed based on educated assumptions, and the limited surveys of the Montgomery County Natural Areas Inventory. The best way to answer questions about patterns of wildlife occurrence and diversity is to enlist the assistance of ornithologists, zoologists, herpetologists, etymologists and other wildlife experts in conducting field surveys of the area. Local bird clubs and local sportsmen’s clubs are also good sources of information regarding wildlife and local habitats. A wildlife inventory initiative for the Upper Perkiomen could help to establish baseline data on species diversity and habitat use.

Natural Areas Inventories

The four counties within the Upper Perkiomen watershed have participated in the Natural Areas Inventory program sponsored by the Pennsylvania Science Office of the Nature Conservancy and funded in part through the Pennsylvania Department of Conservation and Natural Resources. The purpose of these Inventories is to assess the biological importance of various natural areas throughout each county, and to confirm historic or new records of state or federally listed rare, threatened or endangered plant or wildlife species. In most counties, these Inventories represent the most complete compilation of data on native flora and fauna available, yet they are typically not done in a great level of detail and should be considered a foundation for much needed detailed surveys.

Montgomery County

The Montgomery County Natural Areas Inventory of 1995, prepared by the Pennsylvania Science Office of The Nature Conservancy, lists an unusually rich array of six (6) Priority 1 Sites of Statewide Significance and one (1) Priority 2 Site of Local Significance within the Upper Perkiomen as priorities for biodiversity conservation. The Upper Perkiomen Valley supports the highest concentration of Natural Areas Inventory priority sites in all of Montgomery County. These include:

Priority 1 Sites:

The Ridge Valley Site: this site includes the meadows at NLT's Fulshaw Craeg Preserve and some adjacent meadows on the PECO Energy property. Two plant species of special concern (SP556 and SP562) and a diversity of meadow wildflowers and grasses are noted for the site. Succession and invasion of exotic plant species were noted as potential threats to this plant community. The "Potato Patch" boulder field is also included as a locally-significant geologic feature.

The Sumneytown South Slopes: this site includes wooded slopes of sugar maple, oak and hop-hornbeam along Unami Creek, in which a rare plant is found. The forested buffer along the creek and lack of disturbance are noted. Exotic invasive vegetation such as garlic mustard and stilt grass are present. These, along with potential gaps in the forest canopy, are noted as potential threats to the rare plant population, pointing to the need for management.

Upper Ridge Road: this site includes two subpopulations of a wildflower species of special concern growing in open meadow areas. "A management plan defining an annual mowing regime could help to secure the long-term viability of this species here. Herbicides would be

detrimental to the plants.” The site is partially on property of the Hart Boy Scout Camp.

Unami Creek Site: this site includes a sedge of special concern and a threatened species of rush along Unami Creek, partially within the Hart Boy Scout Camp. The boulders along Unami Creek are also noted as a locally-significant geologic feature.

Boutcher Road Site: this site includes wet meadows and shrubland along a PECO Energy corridor, and supports two species of special concern. Herbicide use and succession are noted as concerns.

Green Lane Marsh/New Goshenhoppen Meadows: The northwest end of Green Lane Reservoir supports a graminoid marsh with breeding habitat for rare wildlife species, and is frequented by a diversity of birds and other animals. New Goshenhoppen Meadows adjoin the Perkiomen Creek just upstream from the Green Lane Reservoir, and also support rare wildlife species and uncommon grassland nesting birds such as savannah sparrow, meadowlark and bobolink. The wet meadows contain a diversity of sedges and native wildflowers with good butterfly habitat.

Priority 2 Sites:

Whites Mill Swamp: this site is a forested wetland and shrub swamp along Ridge Valley Creek near the intersection of Whites Mill and Reller Roads. It is considered “one of the largest areas of this type in the county” and contains several shallow man-made or enlarged ponds with abundant aquatic vegetation. Birds, dragonflies, and damselfly communities are all rich at this site.

In addition, the Inventory lists a number of Locally Significant natural areas based on their size, diversity of wildlife and plant life, water quality protection, and recreation potential.

Whites Mill Meadow is a seasonally wet meadow along Ridge Valley Creek that includes an abundance of native plants such as Indian grass, big bluestem, little bluestem, goldenrods, asters, ironweed and others including eastern redcedar. This site is listed as having High importance.

Macoby Creek Ravine is a site containing a large population of a state-listed rare plant species. Sugar maple, flowering dogwood and a variety of wildflowers are noted at this site adjacent to the quarry.

Deep Creek Reservoir is a site of a small population of a Pennsylvania rare plant species along a woodland edge within the Upper Perkiomen Valley County Park. A Pennsylvania threatened aquatic plant is also found along the shoreline of the reservoir.

Deep Creek Woods is a site with a poor population of a rare plant documented in 1989.

Knight Road Bluffs is a site hosting a small population of a state-listed endangered plant on shale slopes within Green Lane Reservoir Park.

Deep Creek Marsh is a wetland site with a rare sedge population. Other sedges, grasses, mountain mint and agrimony are noted as part of this plant community.

Church Road Floodplain is a locally significant floodplain forest with species such as silver maple, ash, and spicebush, with an adjoining upland woods supporting sugar maple, beech and hemlock along the Perkiomen Creek. This site adjoins the New Goshenhoppen Meadows.

Mill Hill Woods is a large contiguous tract of woodland on the diabase ridge known as Mill Hill just north of Pennsburg in Upper Hanover and Lower Milford Townships. There may be seepage wetlands and at least 2 plant species of special concern at this site. At 700 feet above sea level, Mill Hill is the highest point in Montgomery County.

Henning Road Woods is a well developed mixed hardwood forest community on the steep diabase slopes above Deep Creek. At least 13 species of trees occur at this site, including red maple, oaks, ash, beech, hickory, flowering dogwood, sassafras, and paw paw. The shrub and herbaceous layers are well defined.

Bucks County

The Bucks County Natural Areas Inventory of 1999, prepared by the Morris Arboretum, lists an unusually rich array of five (5) Priority 1 Sites of Statewide Significance and one (1) Priority 2 Site of Local Significance within the Upper Perkiomen as priorities for biodiversity conservation. The Unami Creek Valleys supports one of the highest concentrations of Natural Areas Inventory priority sites in all of Montgomery County.

These include:

Ridge Valley Creek (Priority 1)

“In the section west of Ridge Valley Road the creek flows through a broad flat valley where sediment accumulation has occurred forming extensive areas of swampy floodplain forest and marsh. Headwaters areas in the vicinity of Forest Road and Mountain View Road contain sphagnum shrub swamps, and unusual feature in the diabase region.” The stream valley supports a diversity of native forest and wetland communities, including: an herbaceous wetland type (bluejoint-reed canary grass

emergent wetland); two shrub wetland types (highbush blueberry-meadow sweet wetland and buttonbush wetland); vernal ponds; four forest types (red maple-mixed shrub palustrine wetland, bottomland oak-hardwood palustrine forest, red oak-mixed hardwood forest, tuliptree-beech-maple forest). Five state-listed plant species are also identified in this area, including: eastern floater; Oake's pondweed (PA Endangered); Pineland pimpernel (PA Endangered); Scarlet Indian paintbrush (PA Threatened); and swamp doghobble (PA Threatened).

Butter Creek (Priority 2)

"Most of the creek valley is forested...the lower part is characterized by a broad flat stream valley with mucky shrub and sedge-dominated marshes that spread out from the creek on both sides providing habitat for birds, reptiles and amphibians." The Natural Areas Inventory notes one notable wetland type (tussock sedge marsh), three forest types (red maple-mixed shrub palustrine wetland, tuliptree-beech-maple forest, and red oak-mixed hardwood forest), and a state-listed plant species (Eastern floater).

Unami Creek from Upper Ridge Road to the County Line (Priority 2)

"This site is a continuation of the Unami Hills area of Montgomery County which was identified as a major priority for preservation in the Montgomery County Natural Areas Inventory." The forested slopes, diabase outcrops, small streams and seeps, floodplain forests and backwater channels are all listed as important natural features. Four forest types are listed (sugar maple-basswood; red oak-mixed hardwood; tuliptree-beech-maple; and bottomland oak-hardwood palustrine forest). Three state-listed aquatic species are also noted (Allegheney River skimmer; Eastern floater; and Pineland pimpernel – PA Endangered).

Hazelbach Creek (Priority 3)

The Natural Areas Inventory notes that "The Hazelbach Creek corridor is typical of diabase streams, with extensive wooded, shrubby and herbaceous wetlands forming a mosaic of habitats which includes amphibian and reptile habitat." Tussock sedge marsh, red maple-mixed shrub palustrine woodland, and bottomland oak-mixed hardwood forest are all noted in the area.

Unami Creek in the vicinity of Allentown Road (Priority 3).

This site is noted for its forested floodplain and wooded slopes, and aquatic species. "A 1997 survey of fish documented high native fish diversity (15 species) in this section of Unami Creek."

The Inventory notes that the continuous expanse of the Unami forest in both Bucks and Montgomery Counties provides habitat for birds such as Barred owls and Pileated woodpeckers that require large expanses of forest.

Lehigh County

The Natural Areas Inventory of Lehigh and Northampton Counties identified four sites within the Upper Perkiomen watershed. These include:

Indian Creek Floodplain in Upper Milford Township

Hosensack Marsh

This site is listed as a high priority (Priority 1) site in Lehigh County, one of the highest-ranking wetlands in the Upper Perkiomen watershed. The marsh is noted for its combination of marsh and shrub swamp habitat, supporting a good example of an animal species of special concern.

Lower Milford Marsh (Lower Milford Township)

This site supports a “Basin Graminoid-Forb Fen Natural Community” along the floodplain of Hosensack Creek. The northern section of this wetland includes seeps and springs, marsh, and then a forested swamp. The southern portion gradually becomes marshy and is densely vegetated by grasses and sedges. Tree species noted in the Inventory include black walnut, willow, and ash, with herbaceous plants including sweetflag iris, sensitive fern and skunk cabbage. Several species of special concern are suspected at this site, both plants and wildlife.

Mill Hill (Lower Milford Township and Upper Hanover Township)

This wooded diabase ridge in the Hosensack Creek subwatershed supports an extensive forested area with possible plant species of special concern. Beech, tulip poplar, sugar maple, basswood, ash, hickory, and oak are dominant species on lower slopes. Herbaceous plants are diverse, with numerous species of woodland wildflowers and ferns. The upper slopes are dominated by chestnut oak, sweet birch, tulip poplar and red oak, with witchhazel, dogwood, choke-cherry and maple-leaved viburnum common in the shrub layer. A rich herbaceous plant community is present in the upper slopes. Mill Hill is noted for its diversity of forested and stream habitats. Upper Hanover Township has acquired the majority of the Montgomery County portion of the site as a protected area.

Big Beech Woods (Lower Milford Township)

This site is a southeast-facing slope along Hosensack Creek with a maturing second-growth forest of beech, tulip poplar, sugar maple, hickory, oak and birch. Some of the trees are measured at over 2 feet in diameter. Hemlock is also present in the understory, along with a diversity of shrubs and a rich herbaceous layer. The Inventory also notes

the importance of protecting this woodland to support the quality of the Hosensack Marsh.

Berks County

The Natural Areas Inventory of Berks County did not identify any high priority sites within the Upper Perkiomen watershed. However, Berks County Conservancy, in the West Branch Perkiomen Creek Preliminary Assessment noted that portions of District and Hereford Townships mark the nesting locations of a bird species imperiled at the state level due to rarity. Per the 1991 Pennsylvania Natural Diversity Inventory (PNDI), there are not any plants of concern in the West Branch Watershed.