



Chapter 4

Maryland's Key Wildlife Habitats





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Introduction

The 2015 SWAP identifies 610 animal species considered to be Species of Greatest Conservation Need (SGCN). This includes all state- and federally listed Threatened or Endangered species, rare species, endemic species, declining species, and responsibility species for which Maryland harbors a significant portion of the overall population (Chapter 3). The distribution and abundance of SGCN and other Maryland wildlife species are directly related to the condition, extent, and location of their habitats. While some species can be found in a variety of habitats, many are less adaptive and are restricted to one or relatively few habitats. This is especially true for the rarest and most vulnerable wildlife species. These specific habitats often exhibit a restricted distribution in Maryland. This distribution is influenced by the diversity of Maryland's six major physiographic provinces: Lower Coastal Plain, Upper Coastal Plain, Piedmont, Blue Ridge, Ridge and Valley, and Appalachian Plateau (Figure 2.2). Maryland's latitude also supports an overlap of habitat ranges and harbors species that typically occur in more northern latitudes and those that occupy the southeastern United States. Aquatic habitats similarly exhibit a wide range, from saline Atlantic Ocean and coastal bays, to brackish Chesapeake Bay estuary, to freshwater streams, rivers, and ponds. This adds to Maryland's wildlife and habitat diversity, but also influences the somewhat limited distribution of certain wildlife species and their habitats (Lawrence 1984; Lawrence & Gross 1984; Fergus 2003). Because of the strong tie between species and habitats, it is critical to identify those habitats that support SGCN in order to conserve them. For purposes of the 2015 SWAP revision, habitats that support SGCN are referred to as "key wildlife habitats." For a SGCN and key wildlife habitat cross reference table, please see Appendix 4a.

These key wildlife habitats can be further divided into finer scale vegetative associations. Natural communities can be defined as "a combination of native plants and animals repeatedly occurring together in a particular natural environment that has experienced minimal human-caused disturbance or has recovered from that disturbance," (NatureServe 2015). For a complete list of state natural communities please see Appendix 4b. The restricted or vulnerable associations that support the unique assemblages of plant and animal species are referred to as "rare natural communities." Maryland Department of Natural Resources (MD DNR) Natural Heritage Program (NHP) tracks rare natural communities, as well as rare plant and animal species, throughout the state. A natural community can be considered to be rare for a number of reasons. It might represent a habitat on the northern or southern extent of its range, or be declining or vulnerable due to anthropogenic threats or natural causes.

This chapter focuses on Maryland's key wildlife habitats. The best available current information regarding the description, condition and distribution of key wildlife habitats (directly addressing **Element #2**) is provided and then linked with the associated SGCN found in those habitats (addressing **Element #1**). County distributions, along with examples of public lands to visit, and state rare natural communities are listed with each key wildlife habitat. Appendix 4c cross-references key wildlife habitats with the counties in which each habitat type may be found. Signature state rare plants, which are native plants in Maryland that help to determine and define key wildlife habitat types, are also listed for select key wildlife habitats. Scientific names for SGCN are included in Appendices 1a and 1b. Scientific names for other species are included in the text of the chapter.



What are Key Wildlife Habitats?

In general, the term “habitat” is described as the physical and biological environment that provides the necessary food, shelter, and other needs of a particular animal, plant, or other organism. Key wildlife habitats are no different in concept with the exception that the species dependent upon those habitats are considered Species of Greatest Conservation Need (SGCN). While SGCN may occupy many habitats, the ones attributed as ‘key’ for that species are considered important for the presence and persistence of that species in Maryland. Likewise, key wildlife habitats serve as critical foundations and support networks not only for SGCN but for all species in Maryland. Together, key wildlife habitats represent a patchwork mosaic of habitats in which the spectrum of Maryland’s natural diversity can be understood, identified, and mapped. Because vegetation typically reflects biological and ecological patterns across the landscape, key wildlife habitats are structured as ecological cover types based primarily on vegetation. They are organized into a simple classification scheme which is scalable, allowing for compatibility with other ecological classifications. At the local level, this classification scheme is closely related to [Maryland NHP’s natural community classification](#). This classification is a relatively fine-scaled classification system that uses an ecologically based hierarchy and grouping of vegetation associations from the U.S. National Vegetation System (Federal Geographic Data Committee 2008) as the foundation.

Many key wildlife habitats have a direct ecological relationship with and are equivalent to certain levels in the Maryland natural community classification (e.g., Basic Mesic Forest, Shale Barren). Others may represent habitats slightly broader in scope that are the result of collapsing several natural community types into one key wildlife habitat. Nevertheless, this relationship to finer-scaled classifications may be useful in driving local land management decisions or identifying rare natural communities, although it is not very practical in facilitating regional approaches to wildlife conservation. Recognizing the need for regional context, Maryland’s key wildlife habitats are equivalent to and directly compatible with NatureServe’s ecological systems which form the basic classification scale of the [Northeastern Terrestrial Wildlife Habitat Classification System \(NETWHCS\)](#) (Gawler 2008). With a similar need for regional consistency among aquatic habitat descriptions and mapping, the [Northeastern Aquatic Habitat Classification System \(NEAHCS\)](#) was developed (Olivero & Anderson 2008). For cross-references between the 2015 SWAP classified key wildlife habitats and the 2005 Wildlife Diversity Conservation Plan, see Appendix 4d.

The NETWHCS and NEAHCS were developed specifically to address the need for a consistent habitat classification and map throughout the northeastern states in order to effectively implement State Wildlife Action Plans. The collaborative effort to have regional consistency in mapping and classifying habitat systems should help protect wildlife and their habitats throughout the Northeast. The NETWHCS is designed on a flexible framework that works on two levels based on NatureServe’s ecological systems and a set of structural modifiers that incorporate the variation of vegetation structure, successional stage, and other characteristics that are relevant to wildlife use (Appendix 4e). This combination of ecological systems with structural modifiers is a powerful tool for assessing wildlife habitat throughout the northeast region.



NatureServe’s ecological systems are defined as “reoccurring groups of biological communities that are found in similar environments and are influenced by similar dynamic ecological processes, such as fire or flooding.” These systems provide a classification unit that is “readily mappable, often from remote imagery, and readily identifiable by conservation and resource managers in the field,” (Comer et al. 2003). Much like Maryland’s key wildlife habitats, they are defined by biogeography, landscape scale, disturbance regime, and dominant cover type. Examples of NatureServe’s ecological systems that occur in Maryland include Central Appalachian Dry Oak-Pine Forest, Appalachian Shale Barren, Northern Atlantic Coastal Plain, and Fresh and Oligohaline Tidal Marsh. In Maryland’s key wildlife habitat classification they are equivalent to and simply referred to as “Montane-Piedmont Oak-Pine Forest,” “Shale Barren,” and “Tidal Freshwater Marsh and Shrubland” key wildlife habitats, respectively.

As with the NETWHCS, the NEAHCS was developed to unify state habitat classifications and to better assess aquatic biodiversity patterns across the region (Olivero & Anderson 2008). The NEAHCS utilized GIS modeled data on variables known to influence stream and river habitats at various spatial scales including stream slope, size, elevation, climate, and geology. These same variables were among those used to define Maryland’s nine stream and river key wildlife habitats identified for the 2015 SWAP revision. Although the regional aquatic habitat classifications were not adopted for use in the 2015 SWAP revision, this regional classification system is useful to place Maryland’s stream and river key wildlife habitats into a regional context. Maryland’s stream and river key wildlife habitats are cross-referenced to the NEAHCS in this plan to better facilitate aquatic conservation at broader spatial scales (Appendix 4f).

The NEAHCS did not include estuarine and ocean waters, and, although efforts have been initiated (Weaver et al. 2013), there currently is no equivalent comprehensive regional classification system for these tidal systems. However, the Atlantic Coastal Fish Habitat Partnership, formed in 2007, identified and prioritized regional estuarine and ocean water habitat types important to many fish and invertebrate species (Atlantic Coastal Fish Habitat Partnership 2009). The five Bay and Ocean key wildlife habitats included in the 2015 SWAP revision were adapted from habitats identified from this regional effort.

Finally, conservation of uncommon and rare natural communities can also serve as protective umbrellas for conserving lesser-known wildlife species. This is particularly true for the thousands of invertebrate species that are poorly understood and unstudied (See Appendix 3h, Category D). Identification and protection of these rare natural communities within key wildlife habitats can be an effective, more holistic approach to conservation by saving all the pieces, as part of “intelligent tinkering” espoused by Aldo Leopold in *A Sand County Almanac* (Leopold 1949). Since then, a large body of literature has been developed that supports this coarse-filter, community approach that evolved into “systems ecology.”

A total of 59 key wildlife habitats have been identified for the 2015 SWAP revision (Table 4.1). Together they represent a diverse portfolio of ecological systems, each bound by a similar physiography, geology, hydrology, climate, soil composition, flora, or other significant characteristics.



Table 4.1 Maryland's 59 Key Wildlife Habitats

KEY WILDLIFE HABITAT	PHYSIOGRAPHIC PROVINCE OF OCCURRENCE					
	AP	RV	BR	PD	UCP	LCP
Terrestrial Habitats						
High Elevation Ridge Forest	X					
Hemlock-Northern Hardwood Forest	X	X	X	X		
Terrestrial Habitats						
Cove Forest	X	X	X			
Montane - Piedmont Oak-Pine Forest	X	X	X	X		
Oak-Hickory Forest	X	X	X	X		
Basic Mesic Forest			X	X	X	X
Mesic Mixed Hardwood Forest			X	X	X	X
Coastal Plain Oak-Pine Forest					X	X
Coastal Plain Pitch Pine Forest					X	
Maritime Forest and Shrubland						X
Serpentine Barren				X		
Shale Barren		X				
Acidic Glade and Barren	X	X	X	X		
Basic Glade and Barren		X	X	X		
Cliff and Rock Outcrop	X	X	X	X		
Coastal Bluff					X	X
Coastal Beach					X	X
Maritime Dune and Grassland						X
Wetland Habitats						
Montane - Piedmont Floodplain	X	X	X	X		
Coastal Plain Floodplain					X	X
Montane Bog and Fen	X	X				
Montane - Piedmont Acidic Seepage Swamp	X	X	X			
Montane - Piedmont Basic Seepage Swamp	X	X	X			
Piedmont Seepage Wetland				X		
Piedmont Upland Depression Swamp				X		
Coastal Plain Flatwood and Depression Swamp					X	X
Coastal Plain Seepage Swamp					X	X
Coastal Plain Seepage Bog and Fen					X	X
Delmarva Bay						X
Maritime Swamp						X
Vernal Pool	X	X	X	X	X	X
Spring	X	X	X	X	X	X
Tidal Forest					X	X
Tidal Freshwater Marsh and Shrubland					X	X
Tidal Brackish Marsh and Shrubland					X	X
Tidal Salt Marsh and Shrubland					X	X
Intertidal Mudflat and Sand Flat					X	X
Aquatic Habitats						
Coldwater Stream	X	X	X	X		
Limestone Stream		X	X			
Highland Stream	X	X	X			



KEY WILDLIFE HABITAT	PHYSIOGRAPHIC PROVINCE OF OCCURRENCE					
	AP	RV	BR	PD	UCP	LCP
Piedmont Stream				X		
Coastal Plain Stream					X	X
Blackwater Stream					X	X
Highland River	X	X	X			
Aquatic Habitats	AP	RV	BR	PD	UCP	LCP
Piedmont River				X		
Coastal Plain River					X	X
Shellfish Bed					X	X
Hard Bottom (Living and Non-living)					X	X
Submerged Aquatic Vegetation					X	X
Macroalgae						X
Pelagic - Open Water					X	X
Subterranean Habitats						
Cave and Karst	X	X	X	X		
Other Habitats						
Managed Montane Conifer Forest	X	X	X	X	X	X
Managed Successional Forest	X	X	X	X	X	X
Managed Grassland	X	X	X	X	X	X
Roadside and Utility Right-of-way	X	X	X	X	X	X
Artificial Impoundment and Artificial Wetland	X	X	X	X	X	X
Artificial Structure - Buildings and Other Structures	X	X	X	X	X	X
Artificial Structure - Mine and Tunnel	X	X	X	X		

Key: AP=Appalachian Plateau; RV=Ridge and Valley; BR = Blue Ridge; PD=Piedmont; UCP= Upper Coastal Plain and LCP= Lower Coastal Plain

Key Wildlife Habitat Classification

Maryland’s key wildlife habitats are nested within a hierarchical classification system split into five broad divisions: 1) Upland Habitats, 2) Wetland Habitats, 3) Aquatic Habitats, 4) Subterranean Habitats, and 5) Other Habitats (Table 4.1). These upper level divisions are generally thought of as systems (*sensu* Cowardin et al. 1979) and are based primarily on gross hydrologic regime. For purposes of organization, four of the five divisions are further divided into finer groups based on similarities of hydrology (e.g., Tidal Wetlands), physiognomic structure (e.g., Forests), geomorphology (e.g., Coastal Beaches and Dunes), or other characteristics. It is at this group level in which all naturally occurring key wildlife habitats are nested throughout the classification. Though these groupings are particularly useful in organizing the classification of key wildlife habitats, they do not serve to relate key wildlife habitats physiographically, topographically, or in ways that these habitats might otherwise co-occur together on the landscape.

Upland habitats are considered to be all terrestrial, non-wetland habitats that typically have dry to mesic well-drained soils. The 18 different upland habitats are divided into three groups: forests; glades, barrens, and cliffs; and coastal beaches and dunes. Wetland habitats are often the interface between upland and aquatic habitats. They include all non-tidal and tidal wetland habitats dominated by woody plants, herbaceous emergent plants, and floating aquatic plants. These 19 wetland habitats are divided into three groups: floodplain wetlands, groundwater



wetlands, and tidal wetlands. Aquatic habitats represent our streams and rivers and a variety of other water-based and submerged habitats important in the estuarine and marine environments. The 14 different aquatic habitats are further divided into two groups: streams and rivers, and bay and ocean. Subterranean habitats include cave habitats and significant associated karst features.

Finally, the fifth broad habitat category is entitled “other habitats.” These are certain human-made habitats, such as mines, abandoned railroad tunnels, and impoundments, which resemble and provide some function as natural wildlife habitats because of their structure, hydrology, vegetative composition or other characteristics. This category includes habitats created as unintended outcomes, as well as habitats that are specifically designed and built to serve as wildlife habitat, such as restored wetlands, artificial reefs, and warm season grass plantings. Although all seven “other habitats” have microclimates or other features that render them as important surrogate habitats for SGCN, their importance for maintaining wildlife populations varies on a case-by-case basis from suitable habitat to critical. For example, chimney swifts lost the great majority of their original nesting and roosting habitat long ago, as colonizing Europeans and growing populations vastly reduced the number of large, hollow trees. The primary habitats remaining to them are structures (chimneys) created and maintained by people. On the other hand, it is important to remember that not every mine, impoundment, or other man-made structure in the “other habitats” category will support Species of Greatest Conservation Need or will provide a benefit equivalent to natural habitats.

Mapping Maryland’s Key Wildlife Habitats

Once the list of key wildlife habitats was compiled, the need for a more comprehensive wildlife information system and, more specifically, for geographic information system (GIS) map data addressing the distribution of the key wildlife habitats was determined. The current scientific inventory and geospatial databases were not sufficient to produce accurate distribution maps for all of the SGCN, their associated key wildlife habitats, or vegetative associations identified during the SWAP update process. Since coarse-level habitat information and accurate habitat distribution models are critical as a range indicator for some of the SGCN lacking adequate distribution and abundance data, the field inventories and analysis required to create these products remain a priority.

Distribution maps of Maryland’s key wildlife habitats are included in this chapter, within each habitat section, for 57 of the 59 habitats. Although some location information is available, insufficient Maryland range data exist to create meaningful distribution maps for two habitats: Basic Mesic Forests and Macroalgae. GIS data layers have been developed for the purpose of generating a graphical representation of the general distribution of the key wildlife habitats at a statewide scale. Because of this scale, many of the smaller habitat patches have been buffered to increase their visibility on the map, especially for habitats that are not densely distributed. However, the smallest patches may still be too small to be seen at this scale. Also, some key wildlife habitats, such as springs and vernal pools, are displayed as points rather than as polygons as a way to handle this issue. Many maps represent known and potential habitat, especially those of the more common and widely distributed habitats. However, some of these common habitats, such as Roadsides and Utility Rights-of-Way, are so abundant that the map only depicts those known to be occupied by SGCN animals or rare plants.



These maps were compiled using numerous existing data sources, such as U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory data; USGS National Hydrography Dataset, National Land Cover Data and Geographic Names Information System; USDA Soil Conservation Service generalized soils data and Cropland data; Federal Emergency Management Agency Q3 Floodplain data; MD Department of Planning's Land Use/Land Cover data; University of Maryland Center for Environmental Science Appalachian Lab deep mines dataset; MD DNR Maryland Biological Stream Survey/Versar Inc. streams data (MBSS100k); and other MD DNR data developed by various sources, including Maryland Geological Survey, MD DNR Resource Assessment Service, and MD DNR Natural Heritage Program. The Northeast Terrestrial Habitat Map, developed by The Nature Conservancy (2011) was also a major source of data. For a complete listing of map data sources, please see the 'Map Sources' supplementary document. The accuracy of MD DNR's key wildlife habitat GIS data layers varies greatly, ranging from field-verified locations to predictive models, and many will need additional ground-truthing and other quality control measures and refinements before they should be considered accurate enough to use for most other purposes, especially at a local level. Even the maps that display known point location data are to some extent incomplete; therefore, these maps only should be viewed as generalized range maps, rather than depicting the full and complete distribution of habitats.

In addition to displaying the general location of key wildlife habitats in Maryland, these maps can be used as a tool to help direct distribution and abundance surveys of SGCN and associated vegetative communities within these habitats. The maps may also support the development of conservation strategies for specific key wildlife habitats on state and private lands designed to benefit all wildlife. Further mapping of "ecological landscapes" and natural communities will identify and delineate land areas with similar topography, bedrock type, soils, surface hydrology, vegetation, and land use. This will allow improved analyses and prediction of the distribution of species and habitats of greatest conservation need within their ecological context and provide an important tool to assist in the conservation of unique habitats within the framework of natural biological systems.

Structural Conditions of Key Wildlife Habitats

The relationship of Species of Greatest Conservation Need (SGCN) to key wildlife habitats is a complex one in which a combination of environmental conditions must exist in order to provide the necessities of life that allow individuals of a species to survive and reproduce. Healthy and viable wildlife populations seek out and use particular habitat types (e.g., cover types), structural conditions (e.g., stand attributes), and habitat elements (e.g., finer-scaled site-specific attributes). Together, these conditions form the core of the wildlife habitat concept and are used here to illustrate the multidimensional relationships of wildlife and habitat.

The structural condition of a key wildlife habitat is a vital component of a species' overall habitat. Structural conditions for vegetated upland and wetland habitats are known to vary through time in a predictable way as they follow plant successional series in a given habitat. These seral stages are temporal phases of plant community development towards its climax and are classified based on age, structure of plant species, and evidence of natural or human-caused disturbance. All seral stages serve a purpose and are important to maintain in the landscape. Forests in particular support a wide variety of species depending on the structural condition or



seral stage present at a given time. For example, old growth forests are extremely important for a wide diversity of SGCN and are the rarest of forest seral stages in Maryland. This rarity, not only in Maryland, but the majority of the U.S., is the reason behind highlighting this seral stage in the hopes that more forest acreage in varying forest types will be allowed to reach old growth status through sound forest stewardship on public and private lands. Natural processes, such as fire, floods, storm damage, tree senescence, and beaver activity, can re-set the clock on a mature forest community to an earlier seral stage on a large or small scale, providing suitable habitat for a different set of species until the forest once again reaches maturity. Human activities can also create changes in natural forest communities that can mimic the impacts of natural disturbances to some extent, as described below. As with the “Other Habitats” category of key wildlife habitats, some but not all human-created early successional habitat may resemble and provide some function as surrogate habitats for species of greatest conservation need. Below are examples of the primary forest structural conditions that are important to many Species of Greatest Conservation Need.

Early Successional Forest Habitats: Early successional forests are upland areas dominated by shrubs and small trees (< 8 m tall). This habitat occurs statewide in five broad settings:

1. **Recently logged forests.** Early successional habitat begins to develop within one year of a timber harvest and may persist for 10-20 years or more depending, in part, on pre-harvest forest conditions, soil type, size and type of regeneration cut (e.g., clearcutting, single-tree selection, shelterwood), and post-harvest silviculture treatments (e.g., seedling plantings vs. natural regeneration, thinnings). Habitat suitability for most early successional species of conservation concern tends to peak 2-10 years following harvest. Many such species are no longer present once tree canopy closure is attained.
2. **Succeeding non-forested land.** Examples include former cropland, pasture, old fields, and reclaimed strip mines that are reverting to a forested state via natural succession or plantings. Early successional habitat may persist for 10-20 years or longer depending, in part, on the size of the opening, surrounding habitat conditions, prior land use, site conditions, and the degree of woody plant browsing by deer and other mammals.
3. **Temporary natural forest openings.** Natural forest canopy openings result from a variety of natural disturbances including windthrow, ice storms, fire, beavers, tree senescence, insect outbreaks, and pathogens. Canopy openings can range in size from small (< 0.4 ha) scattered light gaps to extensive (> 100 ha) blowdown areas. Large tracts (10-100 ha or larger) of early successional habitat may develop following severe ice storms, tornados and hurricanes. In riparian areas, beavers and floods may create sizeable openings. Although not native to North America, moderate to severe gypsy moth (*Lymantria dispar*) outbreaks can also result in large areas of early successional habitat. The duration of these temporary openings varies from a few years in scattered light gaps to several decades or more in large, catastrophic disturbances and extensive beaver- impounded areas. While some early successional species occur in small light gaps, habitat suitability



for many early successional species tends to be greater in larger (> 2 ha) openings. Generally, the size and frequency of natural canopy openings increases with forest age although other factors (e.g., forest type, elevation, and slope) are also important. Extensive tracts of mature to old growth forest can be an important source of early successional forest via temporary natural forest openings.

4. **Shrub-dominated natural communities.** Shrubs and small trees perpetually dominate a number of natural community types and ecotones. These conditions may occur within shale barrens, sandstone glades, dry oak-pine forests, maritime forests and shrublands and along extensive, ridgetop rock outcrops. Some early successional species of conservation concern also occur in non-tidal and tidal shrub wetlands, and shrubby ecotones within Delmarva bays, Appalachian Plateau “bogs” and upper tidal marsh fringes. These are described later within their respective key wildlife habitat sections.
5. **Forest edges.** Forest edges are usually abrupt, narrow (usually 1-10 m wide), linear ecotones between a forested and non-forested habitat (e.g., cropland, road, transmission line right-of-way, backyard) or between two dissimilar forest age classes (e.g., a mature forest and a recent clearcut). These conditions can provide early successional forest habitat for some of the more generalist wildlife species, especially if a “soft” edge or gradual transition between the two adjoining habitats is present. However, species of greatest conservation need that require early successional forests and shrublands are often not found along forest edges because they require larger habitat patches than the narrow band of shrubs along the narrow forest edge ecotone. Also, these ecotones suffer greatly from excessive deer herbivory to the extent that a “browse line” is often evident along forest edges. In addition to deer herbivory, these areas suffer from increased rates of predation and nest parasitism from brown-headed cowbirds (*Molothrus ater*), rendering them unsuitable for shrubland breeders. Some shrubland species, such as yellow-breasted chat, are area-sensitive and require larger habitat patches for increased nesting success. Both forest interior breeding bird specialists and shrubland breeding birds avoid forest edges (Rodewald & Vitz 2005).

Old Growth Forests: Prior to European settlement, forests throughout much of the eastern United States could hardly be considered free from anthropogenic disturbance (Denevan 1992). Much of the landscape was already impacted by Native Americans who had been clearing land for various purposes since the last ice age. However, the influence of Native Americans pales in comparison to the land conversion that followed European settlement. Clearing land for agricultural crops and pastures led to significant changes in the



Old growth forest (Ed Thompson, MD DNR)



landscape punctuated by dramatic forest loss. It is estimated that 90% of Maryland was forested prior to European settlement but was subsequently reduced to about 35% total cover (Buckley & Grove 2001). This direct loss of forest acreage and fragmentation had a profound effect on forested systems and the species that depended upon them. It resulted in a decline in overall forest health and biological diversity. In fact, evidence suggests that the composition and structure of pre-settlement eastern forests of the late 1700s and early 1800s was very different from that of today's forests (Gilliam 2014). The majority of forests that exist today throughout the eastern United States are young, successional forests of second or even third growth (Figure 4.1). They lack much of the structural complexity that is characteristic of more diverse, older forests. It is this complexity that lends to greater biological diversity in forested systems and emphasizes the value of protecting old growth forests.

Old growth forests historically occurred throughout Maryland, representing a broad range of forest types. Today, only scattered remnants remain in the state (see Figure 4.2) and elsewhere in the northeastern United States. In addition, old growth forest stands have only been identified to date for a small number of Maryland forest types (Figure 4.3). These remnant patches were most likely left behind on sites that were not easily accessible or where surveying errors led to uncertainty about forest ownership (McCarthy 1995). In 2007, MD DNR led an effort to map and characterize extant old growth forest on public lands throughout the state (*The Maryland Old Growth Forest Inventory*). For this effort, the following definition was applied:

“An old growth forest is a minimum of 2 ha (5 acres) in size with a preponderance of old trees, of which the oldest trees exceed at least half of the projected maximum attainable age for that species and that exhibits most of the following characteristics:

1. Shade tolerant species are present in all age/size classes.
2. There are randomly distributed canopy gaps.
3. There is a high degree of structural diversity characterized by multiple growth layers (canopy, understory trees, shrub, herbaceous, ground layers) that reflect a broad spectrum of ages.
4. There is an accumulation of dead wood of varying sizes and stages of decomposition, standing and down, accompanied by decadence in live dominant trees.

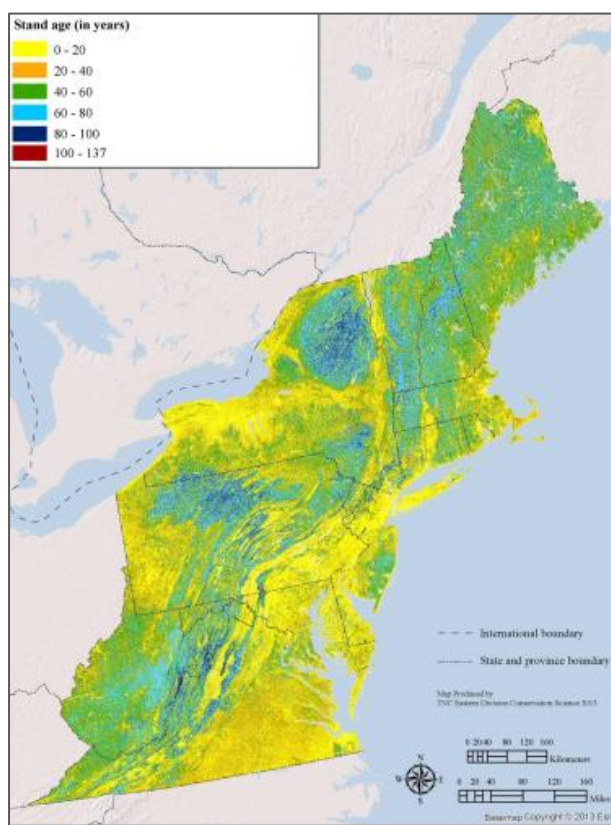


Figure 4.1 Stand age in years in the Northeastern United States. Source: Anderson et al. 2013.



“Pit and mound topography can be observed, if the soil conditions permit it,” (MD DNR 2007). Old growth has been generally defined as forests in existence since pre-settlement times and lacking any significant, direct Euro-American disturbance. Other terms used to reference old growth forest include primeval, climax, virgin, and ancient forest. The ages of old growth forest sites in Maryland documented according to the definition above typically exceeded 250-300 years old.

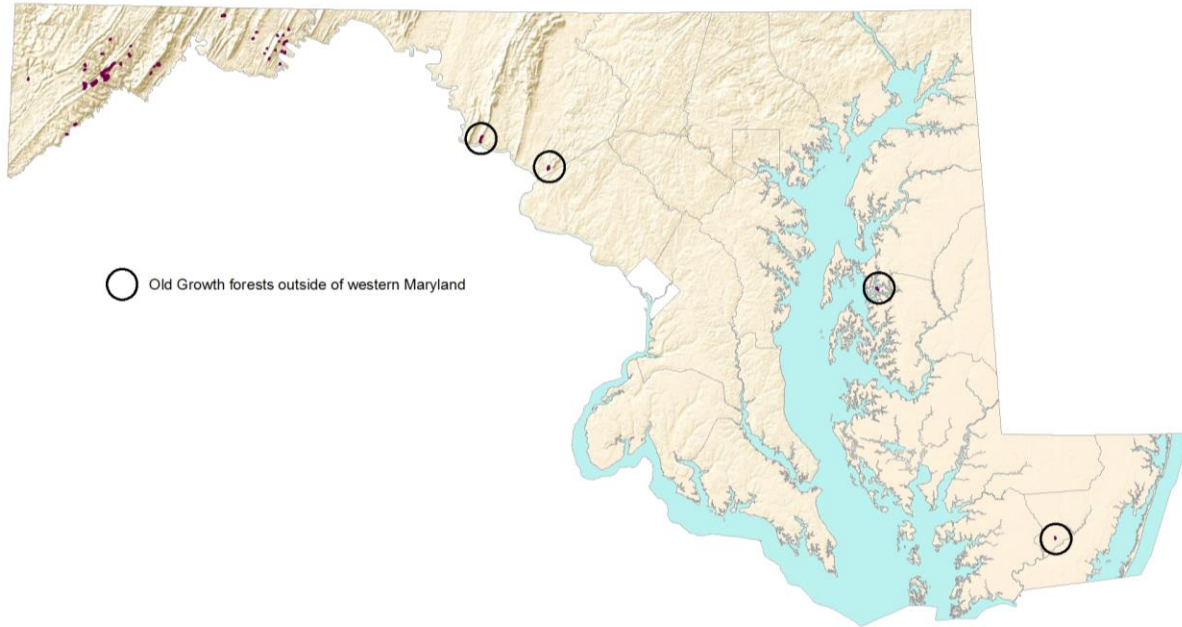


Figure 4.2 Old growth forests on public land in Maryland. Source: MD DNR.

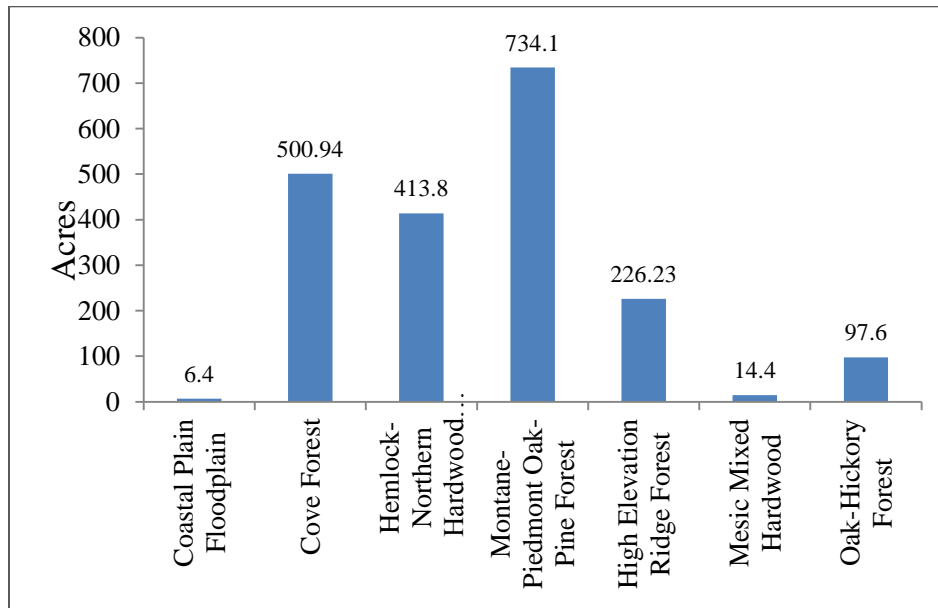


Figure 4.3 Acreage of old growth forest documented in Maryland on public lands by key wildlife habitat. Source: MD DNR.



Upland Habitats

Forests

High Elevation Ridge Forest

The High Elevation Ridge Forest key wildlife habitat is characterized by rocky forests and woodlands that developed on Maryland's highest mountain ridges at or above 2,500 feet, such as those found on Backbone, Big Savage, Negro, Meadow, and Dans Mountains. These areas are some of the most inhospitable habitats in Maryland because they are situated on very exposed sites that are frequently subjected to high winds throughout the year and ice storms during the winter months. Trees are often stunted, have wind-pruned branches, and generally have a much different appearance than trees downslope at lower elevations.



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Overall species diversity is low with chestnut oak (*Quercus montana*) most prominent in the canopy. Other canopy species may include northern red oak (*Quercus rubra*), white oak (*Quercus alba*), bear oak (*Quercus ilicifolia*), yellow birch (*Betula alleghaniensis*), black cherry (*Prunus serotina*), sugar maple (*Acer saccharum*), and occasionally red spruce (*Picea rubens*). Shrubs may include thickets of young bear oak, mountain-laurel (*Kalmia latifolia*), and huckleberries (*Gaylussacia* spp.). These habitats are prone to gypsy moth infestations which can cause significant tree mortality in oak-dominated forests. Prior to the chestnut blight of the 1940s, American chestnut (*Castanea dentata*) was a major component of this habitat. In 2007, the Maryland Department of Natural Resources identified approximately 226 acres of High Elevation Ridge Forests as old growth forests on state lands.

County Distribution: Allegany, Garrett

Places to Visit: Potomac-Garrett State Forest, Savage River State Forest, Dans Mountain Wildlife Management Area



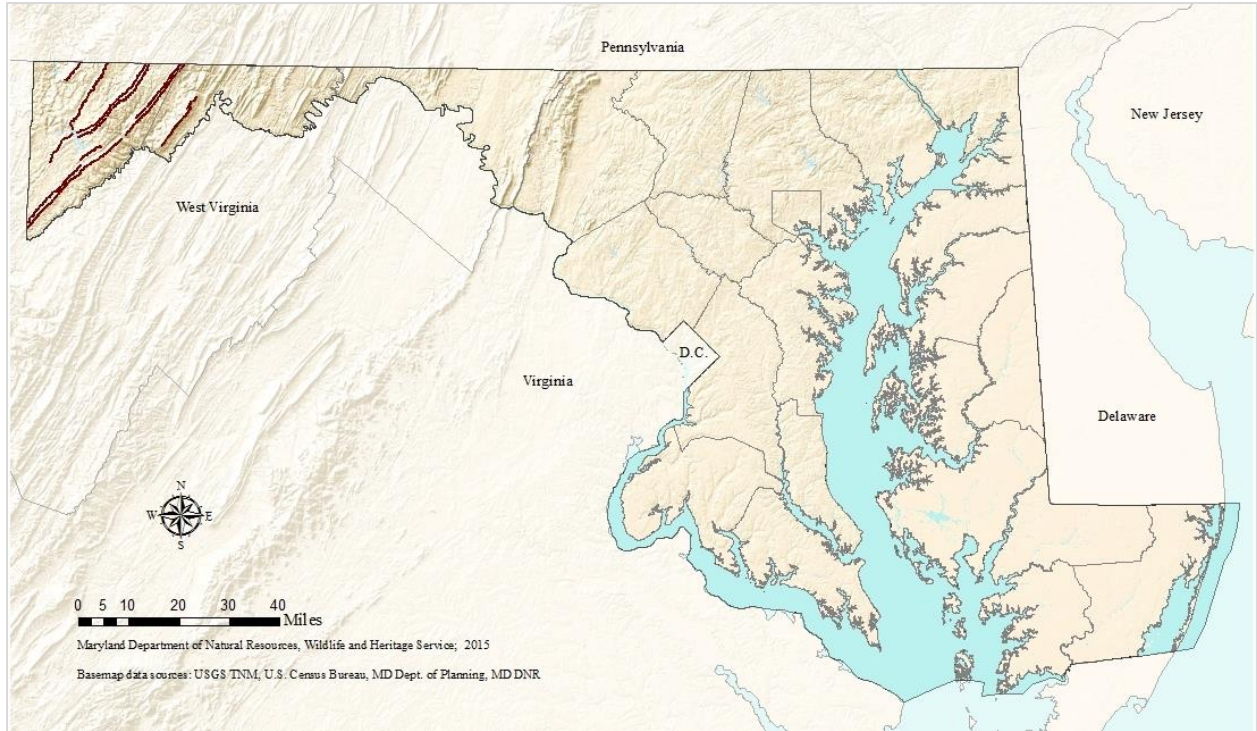


Figure 4.4 Location of High Elevation Ridge Forests in Maryland. Source: MD DNR.

Species of Greatest Conservation Need Associated with High Elevation Ridge Forests:

Mammals	Birds	Reptiles
Allegheny woodrat	Acadian flycatcher	Eastern box turtle
Appalachian cottontail	Black-and-white warbler	Timber rattlesnake
Big brown bat	Black-throated blue warbler	Amphibians
Bobcat	Black-throated green warbler	Jefferson salamander
Eastern red bat	Broad-winged hawk	Wehrle’s salamander
Eastern small-footed myotis	Brown creeper	Insects (Beetles)
Eastern spotted skunk	Canada warbler	Cow path tiger beetle
Hoary bat	Dark-eyed junco	Northern barrens tiger beetle
Indiana myotis	Eastern whip-poor-will	Insects (Bees, Wasps & Ants)
Least weasel	Golden eagle	Sanderson’s bumble bee
Little brown myotis	Golden-winged warbler	Insects (Butterflies & Moths)
Long-tailed shrew	Magnolia warbler	American chestnut nepticulid moth
North American porcupine	Mourning warbler	Gray comma
Northern long-eared bat	Ovenbird	Phleophagan chestnut nepticulid moth
Silver-haired bat	Ruffed grouse	Invertebrates (Snails)
Smoky shrew	Scarlet tanager	Angular disc
Tricolored bat	Winter wren	Rust glyph
	Wood thrush	
	Worm-eating warbler	
	Yellow-bellied sapsucker	



Hemlock-Northern Hardwood Forest

The Hemlock – Northern Hardwood Forest key wildlife habitat is characterized by cool, mesic forests of low mountain slopes and valleys in Maryland. This key wildlife habitat is most abundant at higher elevations on the Appalachian Plateau but also occurs in pockets along north-facing mountain slopes of the Ridge and Valley and Blue Ridge. The composition of Hemlock – Northern Hardwood Forests in Maryland varies with site conditions and was heavily influenced by destructive fires and extensive logging of eastern hemlock (*Tsuga canadensis*), red spruce (*Picea rubens*), white pine (*Pinus strobus*), and hardwoods in the early 1900s. Currently, there are only 413 acres of Hemlock – Northern Hardwood Forests considered as old growth forest on state lands in western Maryland. Today’s stands are typically dominated by northern hardwoods such as sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), black cherry (*Prunus serotina*), and yellow birch (*Betula alleghaniensis*) with mixtures of eastern hemlock. Other tree associates may include



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northern red oak (*Quercus rubra*), white oak (*Quercus alba*), white pine, sweet birch (*Betula lenta*), red spruce, white ash (*Fraxinus americana*), basswood (*Tilia americana*), and red maple (*Acer rubrum*). The understory of Hemlock-Northern Hardwood Forests may include species such as striped maple (*Acer pensylvanicum*), witch-hazel (*Hamamelis virginiana*), maple-leaf viburnum (*Viburnum acerifolium*), and dense patches of great laurel (*Rhododendron maximum*) and mountain-laurel (*Kalmia latifolia*). It is not uncommon to discover the herbaceous layers in some stands entirely dominated by patches of hay-scented fern (*Dennstaedtia punctilobula*) or New York fern (*Thelypteris noveboracensis*). Other characteristic herbs include Indian cucumber-root (*Medeola virginiana*), whorled aster (*Oclemena acuminata*), Canada mayflower (*Maianthemum canadense*), bellworts (*Uvularia* spp.), violets (*Viola* spp.), and wood-ferns (*Dryopteris* spp.). This key wildlife habitat is related in part to small outlying stands of eastern hemlock that occur along north-facing river bluffs and ravines in the Piedmont and Coastal Plain. Although these communities are dominated by eastern hemlock, they lack a number of species restricted to higher elevations in Maryland.

County Distribution: Allegany, Baltimore*, Caroline*, Carroll*, Cecil*, Frederick, Garrett, Harford*, Howard*, Kent*, Montgomery*, Talbot*, Washington

(*This key wildlife habitat accommodates disjunct and isolated stands of Eastern hemlock that occur in portions of the Piedmont and Coastal Plain.)

Places to Visit: Savage River State Forest, Swallows Falls State Park



Signature State Rare Plants: Northern oak fern (*Gymnocarpium dryopteris*), American fly honeysuckle (*Lonicera canadensis*), rosy twisted-stalk (*Streptopus lanceolatus*), Clinton lily (*Clintonia borealis*), Canada yew (*Taxus canadensis*)

State Rare Natural Community: Eastern Hemlock-Hardwood Forest, Northern Hardwood Forest

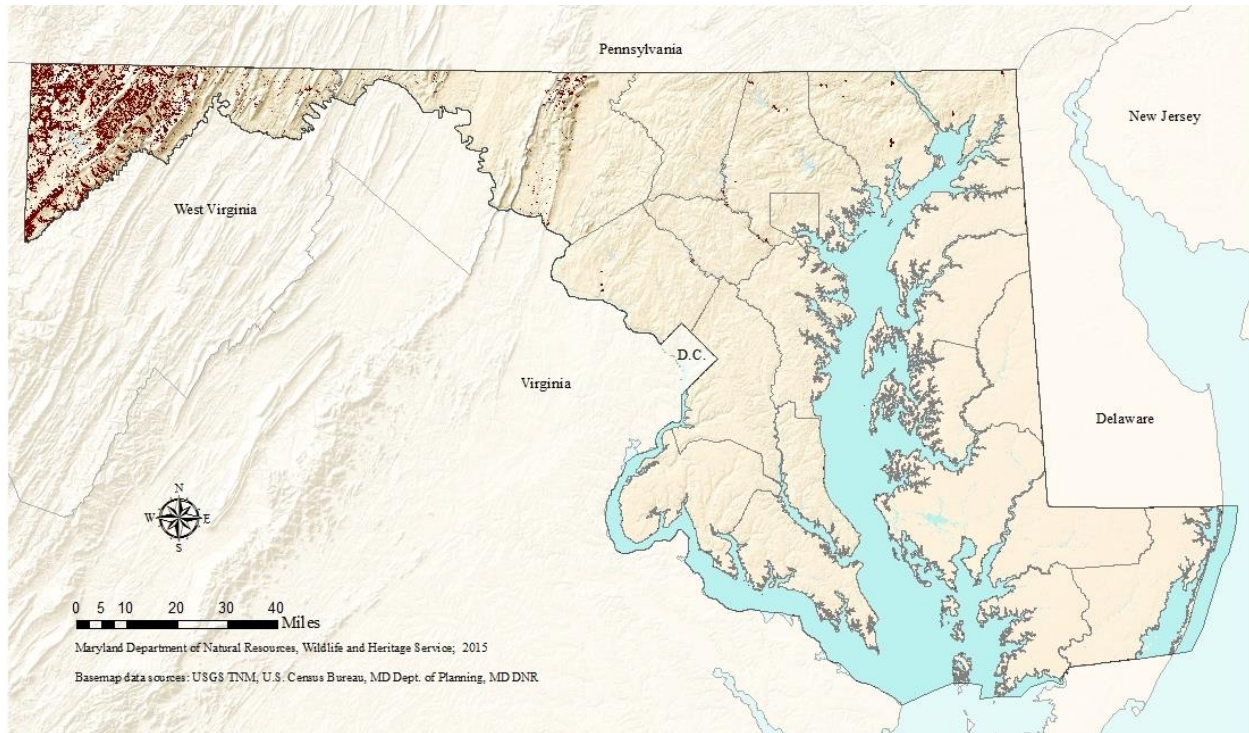


Figure 4.5 Location of Hemlock-Northern Hardwood Forests in Maryland. Sources: MD DNR, Delaware Department of Natural Resources and Environmental Control.

Species of Greatest Conservation Need Associated with Hemlock-Northern Hardwood Forests:

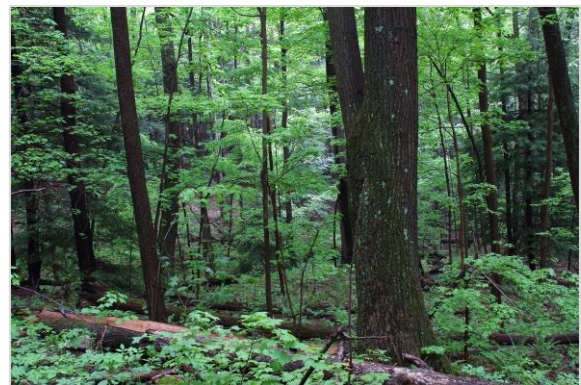
Mammals	Birds	Reptiles
Allegheny woodrat	Acadian flycatcher	Eastern box turtle
American mink	American redstart	Smooth greensnake
Appalachian cottontail	American woodcock	Timber rattlesnake
Big brown bat	Bald eagle	Wood turtle
Bobcat	Black-and-white warbler	Amphibians
Eastern red bat	Blackburnian warbler	Green salamander
Eastern small-footed myotis	Black-throated blue warbler	Jefferson salamander
Eastern spotted skunk	Black-throated green warbler	Mountain chorus frog
Hoary bat	Broad-winged hawk	Valley and Ridge salamander
Indiana myotis	Brown creeper	Wehrle's salamander
Least weasel	Canada warbler	Insects (Bees, Wasps & Ants)
Little brown myotis	Dark-eyed junco	Sanderson's bumble bee
Long-tailed shrew	Eastern whip-poor-will	



Mammals cont.	Birds cont.	Insects (Butterflies & Moths)
North American porcupine Northern long-eared bat Silver-haired bat Smoky shrew Southern bog lemming Southern pygmy shrew Southern rock vole Southern water shrew Tricolored bat Virginia northern flying squirrel	Golden eagle Golden-crowned kinglet Golden-winged warbler Hooded warbler Kentucky warbler Least flycatcher Magnolia warbler Mourning warbler Northern goshawk Northern parula Northern saw-whet owl Ovenbird Pine siskin Red-breasted nuthatch Ruffed grouse Scarlet tanager Sharp-shinned hawk Swainson's thrush Veery Winter wren Wood thrush Worm-eating warbler Yellow-bellied sapsucker	Appalachian blue Compton tortoiseshell Early hairstreak Gray comma Olympia marble Pepper and salt skipper Three-horned moth West Virginia white
		Invertebrates (Snails) Angular disc Bear creek slitmouth Rust glyph Spruce knob threetooth

Cove Forest

The Cove Forest key wildlife habitat is characterized by diverse, mesic forests of mountain slopes occupying sheltered landforms such as coves, ravines, and concave lower slopes. These landforms provide shade, protection from high winds, and lend to very moist soil conditions. Both rich and acidic Cove Forests are represented in this key wildlife habitat and are differentiated by soil fertility, species richness, and species composition. Rich Cove Forests contain deep, fertile soils weathered from a variety of substrates that have high levels of calcium, magnesium, and manganese. Soils are typically moderately alkaline and support very diverse and lush herbaceous layers. Unfortunately, this also makes rich cove forests highly susceptible to invasion of non-native plant species. Rich Cove Forests contain some of the highest diversity of plant species in the state. Stands are commonly dominated by sugar maple (*Acer saccharum*), basswood (*Tilia americana*), white ash (*Fraxinus americana*),



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white oak (*Quercus alba*), and northern red oak (*Quercus rubra*). Other characteristic tree species include cucumber magnolia (*Magnolia acuminata*), shagbark hickory (*Carya ovata*), butternut (*Juglans cinerea*), tulip-poplar (*Liriodendron tulipifera*), black locust (*Robinia pseudoacacia*), witch-hazel (*Hamamelis virginiana*), eastern hop-hornbeam (*Ostrya virginiana*), striped maple (*Acer pensylvanicum*), and sweet birch (*Betula lenta*). The herbaceous layer typically includes species such as Jack-in-the-pulpit (*Arisaema triphyllum*), white snakeroot (*Ageratina altissima*), aniseroot (*Osmorhiza longistylis*), wood nettle (*Laportea canadensis*), enchanter's nightshade (*Circaea lutetiana* ssp. *canadensis*), Virginia waterleaf (*Hydrophyllum virginianum*), wild ginger (*Asarum canadense*), American ginseng (*Panax quinquefolius*), wild columbine (*Aquilegia canadensis*), yellow mandarin (*Prosartes lanuginosa*), blue cohosh (*Caulophyllum thalictroides*), foamflower (*Tiarella cordifolia*), wood-ferns (*Dryopteris* spp.), trilliums (*Trillium* spp.), and bellworts (*Uvularia* spp.).

Acidic Cove Forests occur on substrates underlain by acidic bedrock such as sandstone or quartzite. A mixture of eastern hemlock, white pine (*Pinus strobus*), and hardwoods such as yellow birch, northern red oak (*Quercus rubra*), white oak (*Quercus alba*) and dense patches of great laurel (*Rhododendron maximum*) or mountain-laurel (*Kalmia latifolia*) differentiate these forests from rich Cove Forests. Other characteristic woody species include witch-hazel (*Hamamelis virginiana*), spicebush (*Lindera benzoin*), wild hydrangea (*Hydrangea arborescens*), and maple-leaf viburnum (*Viburnum acerifolium*). Herbaceous species are limited by dense shade and poor soils, and are much sparser and less diverse than in rich cove forests. The herbaceous layer includes species suited to acidic soils such as white wood aster (*Eurybia divaricata*), Christmas fern (*Polystichum acrostichoides*), hay-scented fern (*Dennstaedtia punctilobula*), wild yam (*Dioscorea* spp.), Canada mayflower (*Maianthemum canadense*), rattlesnake fern (*Botrychium virginianum*), and Solomon's plume (*Maianthemum racemosum* ssp. *racemosum*). In general, the Cove Forest key wildlife habitat is transitional to the Hemlock – Northern Hardwood Forest key wildlife habitat. There are currently only 500 acres of Cove Forest in Maryland identified as old growth forests on state lands. Cove Forests range-wide are threatened by logging and invasion of shade-tolerant non-native weeds such as garlic mustard (*Alliaria petiolata*). Furthermore, acidic Cove Forests dominated by eastern hemlock are threatened by the hemlock woolly adelgid (*Adelges tsugae*), a non-native and destructive insect from Asia.

County Distribution: Allegany, Frederick, Garrett, Washington

Places to Visit: Savage River State Forest, Potomac-Garrett State Forest

State Rare Natural Communities: Acidic Cove Forest, Rich Cove Forest



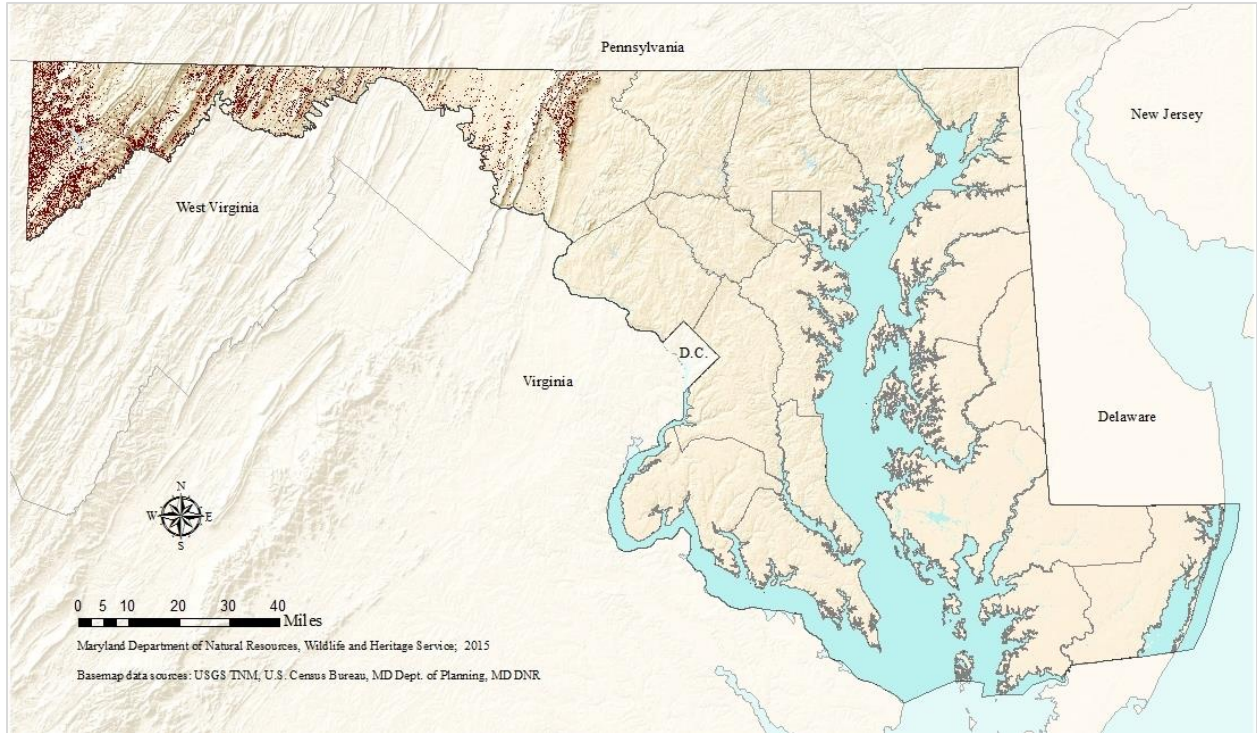


Figure 4.6 Location of Cove Forests in Maryland. Sources: MD DNR, Nature Serve’s Terrestrial Ecological Systems of the U.S.

Species of Greatest Conservation Need Associated with Cove Forests:

Mammals	Birds	Reptiles
Allegheny woodrat	Acadian flycatcher	Eastern box turtle
American mink	American redstart	Timber rattlesnake
Appalachian cottontail	American woodcock	Wood turtle
Big brown bat	Black-and-white warbler	Amphibians
Bobcat	Blackburnian warbler	Green salamander
Eastern red bat	Black-throated blue warbler	Jefferson salamander
Eastern small-footed myotis	Black-throated green warbler	Mountain chorus frog
Eastern spotted skunk	Blue-winged warbler	Upland chorus frog
Hoary bat	Broad-winged hawk	Valley and Ridge salamander
Indiana myotis	Brown creeper	Wehrle’s salamander
Least weasel	Canada warbler	Insects (Bees, Wasps & Ants)
Little brown myotis	Cerulean warbler	Sanderson’s bumble bee
Long-tailed shrew	Dark-eyed junco	Insects (Butterflies & Moths)
North American porcupine	Eastern whip-poor-will	American chestnut nepticulid moth
Northern long-eared bat	Golden eagle	Appalachian blue
Silver-haired bat	Golden-winged warbler	Compton tortoiseshell
Smoky shrew	Hooded warbler	Early hairstreak
Southern bog lemming	Kentucky warbler	Gray comma
Southern pygmy shrew	Least flycatcher	Hickory hairstreak



Mammals cont.	Birds cont.	Insects (Butterflies & Moths) cont.
Southern water shrew Tricolored bat	Northern parula Northern saw-whet owl Ovenbird Prairie warbler Ruffed grouse Scarlet tanager Sharp-shinned hawk Veery Winter wren Wood thrush Worm-eating warbler Yellow-bellied sapsucker Yellow-throated vireo	Marbled underwing Northern crescent Phleophagan chestnut nepticulid moth Three-horned moth West Virginia white
		Invertebrates (Snails)
		Bear creek slitmouth Rust glyph

Montane-Piedmont Oak-Pine Forest

The Montane-Piedmont Oak-Pine Forest key wildlife habitat consists of dry oak and oak-pine dominated forests of low (< 2,500 feet) mountain slopes, ridge crests, and rolling piedmont hills. This key wildlife habitat develops over a variety of acidic substrates including shale and sandstone in the mountains and metamorphic and igneous rocks in the Piedmont. These rocky forests commonly include chestnut oak (*Quercus montana*), white oak (*Quercus alba*), scarlet oak (*Quercus coccinea*), bear oak (*Quercus ilicifolia*), black oak (*Quercus velutina*), black gum (*Nyssa sylvatica*), and white pine (*Pinus strobus*) in variable mixtures. Some stands may be entirely dominated by chestnut oak whereas others may support abundant white pine. The presence of Virginia pine (*Pinus virginiana*) and successional hardwoods such as red maple (*Acer rubrum*) in this key wildlife habitat indicates disturbance. Tall shrubs of mountain-laurel (*Kalmia latifolia*), wild azalea (*Rhododendron periclymenoides*), and maple-leaf viburnum (*Viburnum acerifolium*) are typical as are dense patches of low heaths such as early lowbush blueberry (*Vaccinium pallidum*), black huckleberry (*Gaylussacia baccata*), and deerberry (*Vaccinium stamineum*). The herbaceous layer of these forests is generally sparse but may include poverty-oat grass (*Danthonia spicata*), wavy hairgrass (*Deschampsia flexuosa* var. *flexuosa*), and Pennsylvania sedge (*Carex pensylvanica*). In 2007, the Maryland Department of Natural Resources identified approximately 734 acres of Montane-Piedmont Oak-Pine Forest as old growth forests on state lands.



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County Distribution: Allegany, Baltimore, Carroll, Cecil, Frederick, Garrett, Harford, Howard, Montgomery, Washington

Places to Visit: Green Ridge State Forest, Savage River State Forest, South Mountain State Park, Dans Mountain Wildlife Management Area

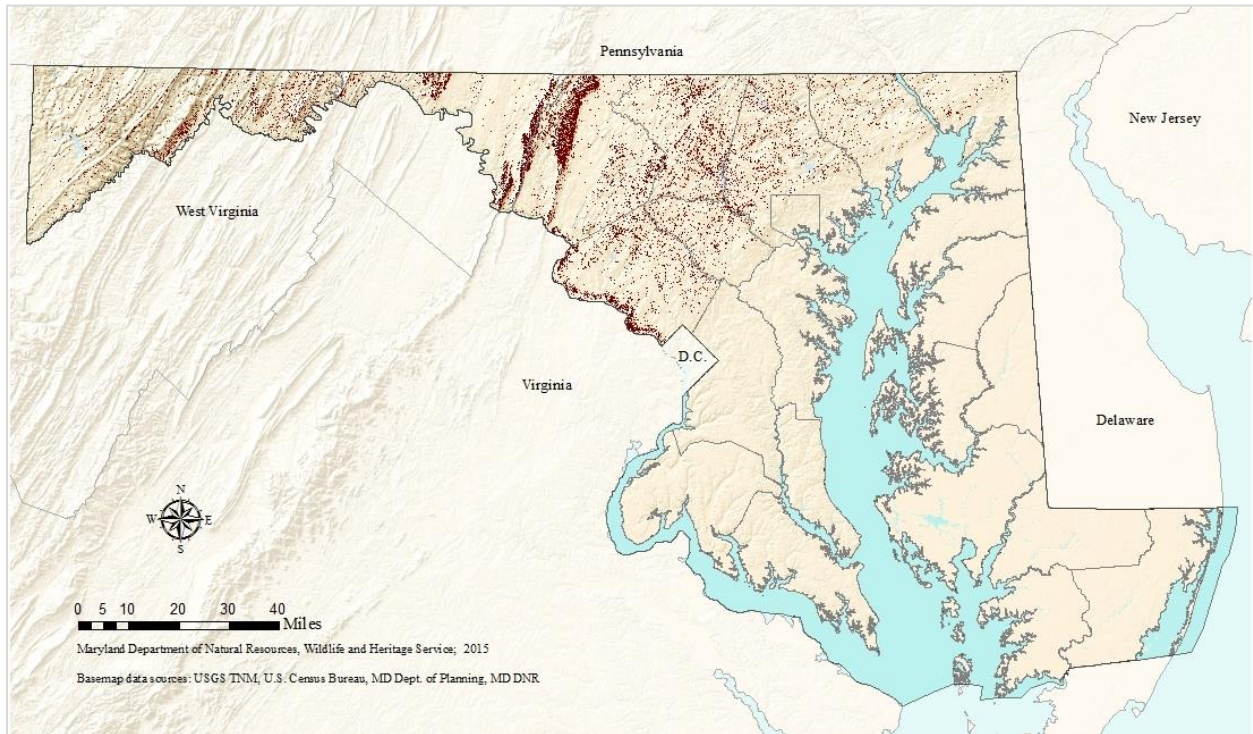


Figure 4.7 Location of Montane-Piedmont Oak-Pine Forests in Maryland. Sources: NatureServe’s Terrestrial Ecological Systems of the U.S.

Species of Greatest Conservation Need Associated with Montane-Piedmont Oak-Pine Forests:

Mammals	Birds cont.	Insects (Beetles)
Allegheny woodrat	Golden eagle	Cow path tiger beetle
American mink	Golden-winged warbler	Northern barrens tiger beetle
Appalachian cottontail	Northern bobwhite	One-spotted tiger beetle
Big brown bat	Northern saw-whet owl	Splendid tiger beetle
Bobcat	Ovenbird	Insects (Bees, Wasps & Ants)
Eastern red bat	Prairie warbler	Rusty-patch bumble bee
Eastern small-footed myotis	Red-headed woodpecker	Sanderson’s bumble bee
Eastern spotted skunk	Ruffed grouse	A mining bee (<i>Andrena braccata</i>)
Evening bat	Scarlet tanager	A mining bee (<i>Andrena fulvipennis</i>)
Hoary bat	Sharp-shinned hawk	Insects (Butterflies & Moths)
Indiana myotis	Wood thrush	American chestnut nepticulid moth
Least weasel	Worm-eating warbler	Cobweb skipper
Little brown myotis	Yellow-breasted chat	Edwards' hairstreak
North American porcupine	Yellow-throated vireo	Frosted elfin



Mammals cont.	Reptiles	Insects (Butterflies & Moths) cont.
Northern long-eared bat Seminole bat Silver-haired bat Tricolored bat	Eastern box turtle Eastern six-lined racerunner Northern coal skink Red cornsnake Smooth greensnake Timber rattlesnake Wood turtle	Giant swallowtail Leonard’s skipper Mottled duskywing Northern metalmark Olympia marble Phleophagan chestnut nepticulid moth Silvery blue
Birds	Amphibians	
Acadian flycatcher American woodcock Bald eagle Black-and-white warbler Broad-winged hawk Brown creeper Eastern whip-poor-will	Jefferson salamander Mountain chorus frog Upland chorus frog Valley and Ridge salamander	

Oak-Hickory Forest

The Oak-Hickory Forest key wildlife habitat is the most common forest type throughout Maryland and much of the northeastern U.S. In Maryland, these forests historically covered thousands of acres throughout the rolling Piedmont and mountains of the Ridge and Valley, Blue Ridge, and Appalachian Plateau. They occupy a wide variety of low- to mid-elevation upland settings of intermediate soil moisture and fertility. Soils are predominantly acidic, however, localized areas of basic substrates such as mafic igneous and metamorphic rocks (e.g., metabasalt, amphibolite, and gabbro) support a higher diversity of plants and are considered rare natural communities in the State. Soil moisture is dependent upon local site conditions but can vary from mesic to dry. Characteristic of this key wildlife habitat is a well-developed, closed canopy of oaks such as white oak (*Quercus alba*), northern red oak (*Quercus rubra*), scarlet oak (*Quercus coccinea*), black oak (*Quercus velutina*), and occasionally chestnut oak (*Quercus montana*). American chestnut (*Castanea dentata*) was likely prominent in the canopy of oak-hickory forests prior to the chestnut blight of the 1940s. Hickories are diagnostic and often abundant as understory trees but may also reach into the canopy. Hickory species commonly encountered include pignut hickory (*Carya glabra*), mockernut hickory (*Carya alba*), shagbark hickory (*Carya ovata*), and bitternut hickory (*Carya cordiformis*). White ash (*Fraxinus americana*), eastern hop hornbeam (*Ostrya virginiana*), common hackberry (*Celtis occidentalis*), and eastern redbud (*Cercis canadensis*) are characteristic of stands over basic substrates. With a long history of human habitation, logging, and agricultural conversion, many stands today are early to mid-successional and may be dominated or codominated by tulip-poplar (*Liriodendron tulipifera*), sugar maple (*Acer saccharum*), white pine (*Pinus strobus*), and Virginia pine (*Pinus*



Richard Wiegand, MD DNR



virginiana). Only 104 acres of Oak-Hickory Forest have been identified by the Maryland Department of Natural Resources as old growth on state lands.

The shrub layer of Oak-Hickory Forests frequently includes dense patches of deciduous ericads such as early lowbush blueberry (*Vaccinium pallidum*) and deerberry (*Vaccinium stamineum*), and scattered individuals of maple-leaf viburnum (*Viburnum acerifolium*), witch-hazel (*Hamamelis virginiana*), and flowering dogwood (*Cornus florida*). Historically, flowering dogwood was probably much more abundant, but today's stands are vulnerable to dogwood anthracnose (*Discula destructiva*), a fungal pathogen responsible for high mortality in dogwoods. The herbaceous layer of Oak-Hickory Forests is generally patchy with the highest species diversity in stands over basic substrates. Unfortunately, excessive deer browse in these habitats has resulted in poor tree regeneration, and in some cases favored invasion of non-native weeds such as garlic mustard (*Alliaria petiolata*), Japanese stiltgrass (*Microstegium vimineum*), Japanese honeysuckle (*Lonicera japonica*), and flat-stemmed bluegrass (*Poa compressa*). Native plants of basic Oak-Hickory Forests may include cut-leaf toothwort (*Cardamine concatenata*), spring-beauty (*Claytonia* spp.), rue-anemone (*Thalictrum thalictroides*), white wood aster (*Eurybia divaricata*), bottlebrush grass (*Elymus hystrix* var. *hystrix*), blue-stemmed goldenrod (*Solidago caesia*), elm-leaf goldenrod (*Solidago ulmifolia* var. *ulmifolia*), and Bosc's panic grass (*Dichanthelium boscii*). Native plants of acidic Oak-Hickory Forests generally include species such as Indian cucumber-root (*Medeola virginiana*), Solomon's-seal (*Polygonatum biflorum*), rattlesnake-weed (*Hieracium venosum*), plantain-leaved pussytoes (*Antennaria plantaginifolia*), Pennsylvania sedge (*Carex pensylvanica*), and poverty oat-grass (*Danthonia spicata*).

County Distribution: Allegany, Baltimore, Carroll, Cecil, Frederick, Garrett, Harford, Howard, Montgomery, Washington

Places to Visit: Green Ridge State Forest, Monocacy Natural Resource Management Area, Patapsco Valley State Park, C&O Canal National Historical Park

Signature State Rare Plants: Cliff stonecrop (*Sedum glaucophyllum*), stiff-hair sunflower (*Helianthus hirsutus*)

State Rare Natural Community: Basic Oak-Hickory Forest



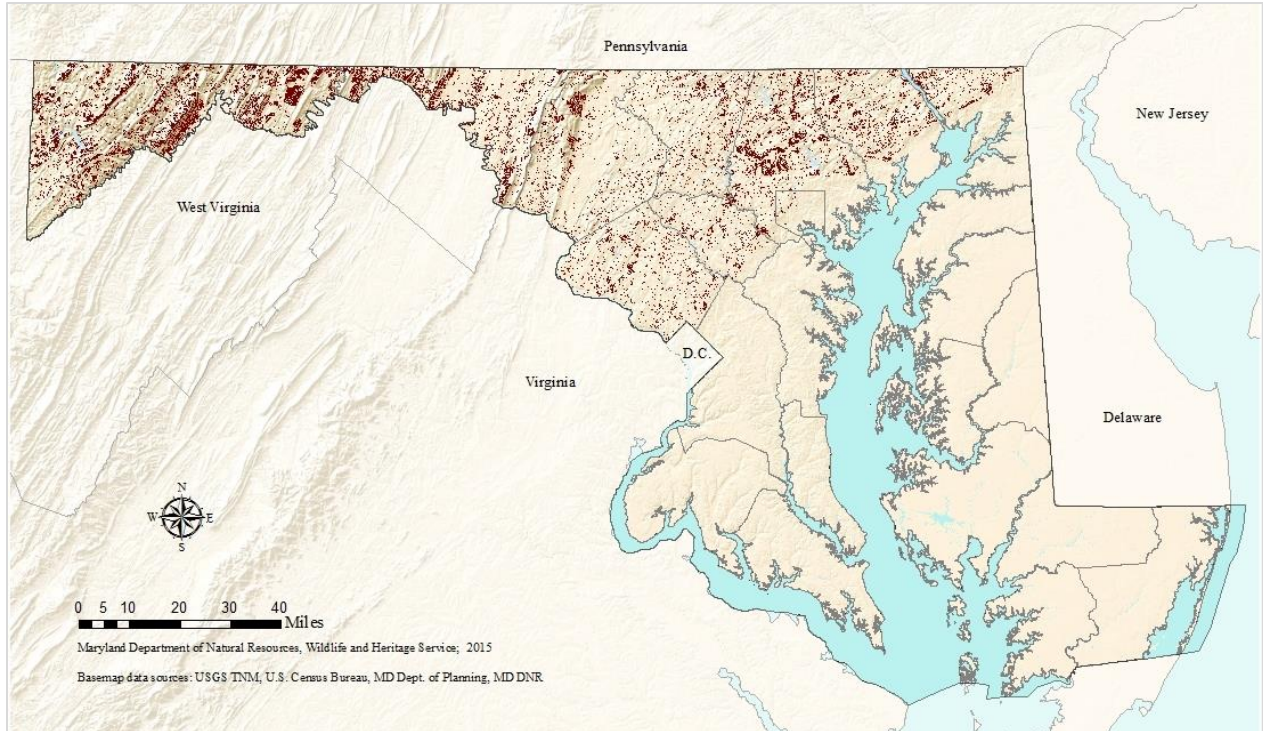


Figure 4.8 Location of Oak-Hickory Forests in Maryland. Source: The Nature Conservancy’s (TNC) Northeastern Terrestrial Wildlife Habitat Classification System (NETWHCS).

Species of Greatest Conservation Need Associated with Oak-Hickory Forests:

Mammals	Birds	Reptiles
Allegheny woodrat	Acadian flycatcher	Bog turtle
American mink	American redstart	Eastern box turtle
Big brown bat	American woodcock	Eastern kingsnake
Bobcat	Bald eagle	Red cornsnake
Eastern red bat	Black-and-white warbler	Smooth greensnake
Eastern small-footed myotis	Blackburnian warbler	Spotted turtle
Eastern spotted skunk	Black-throated blue warbler	Timber rattlesnake
Evening bat	Black-throated green warbler	Wood turtle
Hoary bat	Blue-winged warbler	Amphibians
Indiana myotis	Broad-winged hawk	Green salamander
Least weasel	Brown creeper	Jefferson salamander
Little brown myotis	Canada warbler	Mountain chorus frog
North American porcupine	Cerulean warbler	Upland chorus frog
Northern long-eared bat	Dark-eyed junco	Valley and Ridge salamander
Seminole bat	Eastern whip-poor-will	Insects (Beetles)
Silver-haired bat	Golden eagle	Six-banded longhorn beetle
Smoky shrew	Golden-winged warbler	Insects (Bees, Wasps & Ants)
Southeastern shrew	Hooded warbler	Rusty-patch bumble bee
Southern bog lemming	Kentucky warbler	Sanderson's bumble bee



Mammals cont.	Birds cont.	Insects (Butterflies & Moths)
Southern pygmy shrew Tricolored bat	Least flycatcher Mourning warbler Northern bobwhite Northern parula Ovenbird Prairie warbler Red-headed woodpecker Ruffed grouse Scarlet tanager Sharp-shinned hawk Veery Wood thrush Worm-eating warbler Yellow-bellied sapsucker Yellow-breasted chat Yellow-throated vireo	American chestnut nepticulid moth Appalachian blue Compton tortoiseshell Early hairstreak Gray comma Hickory hairstreak Marbled underwing Northern crescent Northern metalmark Pepper and salt skipper Phleophagan chestnut nepticulid moth Three-horned moth West Virginia white
		Invertebrates (Snails)
		Bear creek slitmouth Rust glyph

Basic Mesic Forest

The Basic Mesic Forest key wildlife habitat is characterized by rich, moist forests of the Coastal Plain, Piedmont, and low mountain regions that develop over calcareous substrates or mafic bedrock that when weathered produce basic soils high in calcium and magnesium. Basic Mesic Forests are typically found on north and east facing slopes, in ravines, or occasionally upon high floodplain terraces that are well-drained. On the Coastal Plain, these forests are associated with tertiary-aged shell deposits common in ravines and slopes bordering streams and rivers. In the Piedmont, Basic Mesic Forests are associated with mafic substrates such as amphibolite or diabase while in the mountains they tend to be derived from limestone, calcareous shales, or greenstone material. While these forests may differ in the substrate from which they develop, they share a number of similar species. Several tree species are characteristic and stands commonly include tulip-poplar (*Liriodendron tulipifera*), American beech (*Fagus grandifolia*), black walnut (*Juglans nigra*), northern red oak (*Quercus rubra*), chinkapin oak (*Quercus muhlenbergii*), bitternut hickory (*Carya cordiformis*), white ash (*Fraxinus americana*), eastern redbud (*Cercis canadensis var. canadensis*), eastern hop hornbeam (*Ostrya virginiana*),



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and sugar maple (*Acer barbatum*) in the mountains. The shrub and herbaceous layers are typically lush and dense with numerous species of ferns and leafy forbs such as may-apple (*Podophyllum peltatum*), black cohosh (*Caulophyllum thalictroides*), and twinleaf (*Jeffersonia diphylla*). Basic Mesic Forests are similar to Cove Forests, but they are differentiated by the number of species restricted to lower elevations in Maryland. Insufficient data exist to create meaningful distribution maps for Basic Mesic Forests.

County Distribution: Anne Arundel, Baltimore, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester, Frederick, Harford, Howard, Kent, Montgomery, Prince George’s, Queen Anne’s, St. Mary’s, Talbot, Worcester [Although some location information is available, insufficient Maryland location data exist to create a meaningful distribution map for Basic Mesic Forests.]

Places to Visit: Mattawoman NEA

Signature State Rare Plants: Tall larkspur (*Delphinium exaltatum*), Virginia heartleaf (*Hexastylis virginica*), Eastern leatherwood (*Dirca palustris*), golden-seal (*Hydrastis canadensis*), Goldie’s fern (*Dryopteris goldiana*), large-leaf waterleaf (*Hydrophyllum macrophyllum*)

Species of Greatest Conservation Need Associated with Basic Mesic Forests:

Mammals	Birds cont.	Amphibians
Allegheny woodrat	Brown creeper	Barking treefrog
American mink	Cerulean warbler	Eastern narrow-mouthed toad
Big brown bat	Eastern whip-poor-will	Eastern tiger salamander
Bobcat	Hooded warbler	Jefferson salamander
Delmarva fox squirrel	Kentucky warbler	Upland chorus frog
Eastern red bat	Northern bobwhite	Insects (Beetles)
Eastern small-footed myotis	Northern parula	Six-banded longhorn beetle
Evening bat	Ovenbird	Insects (Bees, Wasps & Ants)
Hoary bat	Prairie warbler	Rusty-patch bumble bee
Indiana myotis	Red-headed woodpecker	Insects (Butterflies & Moths)
Little brown myotis	Scarlet tanager	American chestnut nepticulid moth
Northern long-eared bat	Sharp-shinned hawk	Appalachian blue
Seminole bat	Veery	Carolina satyr
Silver-haired bat	Wood thrush	Giant swallowtail
Smoky shrew	Worm-eating warbler	Marbled underwing
Southeastern myotis	Yellow-breasted chat	Phleophagan chestnut nepticulid moth
Southeastern shrew	Yellow-throated vireo	A noctuid moth (<i>Hadena ectypa</i>)
Southern bog lemming	Reptiles	Invertebrates (Snails)
Southern pygmy shrew	Bog turtle	Cherrystone drop
Tricolored bat	Coastal Plain milksnake	Maryland glyph
Birds	Common ribbonsnake	Natural Bridge supercoil
Acadian flycatcher	Eastern box turtle	Rust glyph
American redstart	Eastern kingsnake	
American woodcock	Mole kingsnake	



Birds cont.	Reptiles cont.
Bald eagle	Northern pinesnake
Bicknell's thrush	Northern scarletsnake
Black-and-white warbler	Spotted turtle
Blue-winged warbler	Timber rattlesnake
Broad-winged hawk	Wood turtle

Mesic Mixed Hardwood Forest

The Mesic Mixed Hardwood Forest key wildlife habitat develops over acidic, nutrient poor soils of the Coastal Plain and Piedmont in a variety of moist landscape settings including ravines, lower slopes, undulating uplands, and flatwoods. These forests are characterized by mixed canopies of tulip-poplar (*Liriodendron tulipifera*), American beech (*Fagus grandifolia*), white oak (*Quercus alba*), northern red oak (*Quercus rubra*), mockernut hickory (*Carya alba*), pignut hickory (*Carya glabra*) and



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understories of flowering dogwood (*Cornus florida*), pawpaw (*Asimina triloba*), American strawberry-bush (*Duchesnea indica*), and American hop-hornbeam (*Ostrya virginiana*). Many of the oaks and other associated trees of these forests vary by region. For example, loblolly pine (*Pinus taeda*) and American holly (*Ilex opaca* var. *opaca*) are occasionally prominent in Coastal Plain Mesic Mixed Hardwood Forests, but are absent in Piedmont stands. The infertile soils of these forests rarely support lush layers of herbaceous vegetation like those in basic mesic forests; however, ferns such as Christmas fern (*Polystichum acrostichoides*) and New York fern (*Thelypteris noveboracensis*) may be locally abundant in patches. Other plants common to this key wildlife habitat include pink lady's-slipper (*Cypripedium acaule*), false Solomon's-seal, perfoliate bellwort (*Uvularia perfoliata*), Indian cucumber-root (*Medeola virginiana*), cranefly orchid, and spotted wintergreen (*Chimaphila maculata*). Although Mesic Mixed Hardwood Forests are widespread throughout the Coastal Plain and Piedmont of Maryland, their size and condition have been much reduced by logging, agriculture, and development. Only 14 acres have been identified by the Maryland Department of Natural Resources as old growth on state lands.

County Distribution: Anne Arundel, Baltimore, Calvert, Caroline, Carroll, Cecil, Charles, Dorchester, Frederick, Harford, Howard, Kent, Montgomery, Prince George's, Queen Anne's, Somerset, St. Mary's, Talbot, Wicomico, Worcester

Places to Visit: Mattawoman NEA, Wye Island Natural Resources Management Area-Schoolhouse Woods, Patuxent Research Refuge

Signature State Rare Plants: Virginia least trillium (*Trillium pusillum* var. *virginianum*)



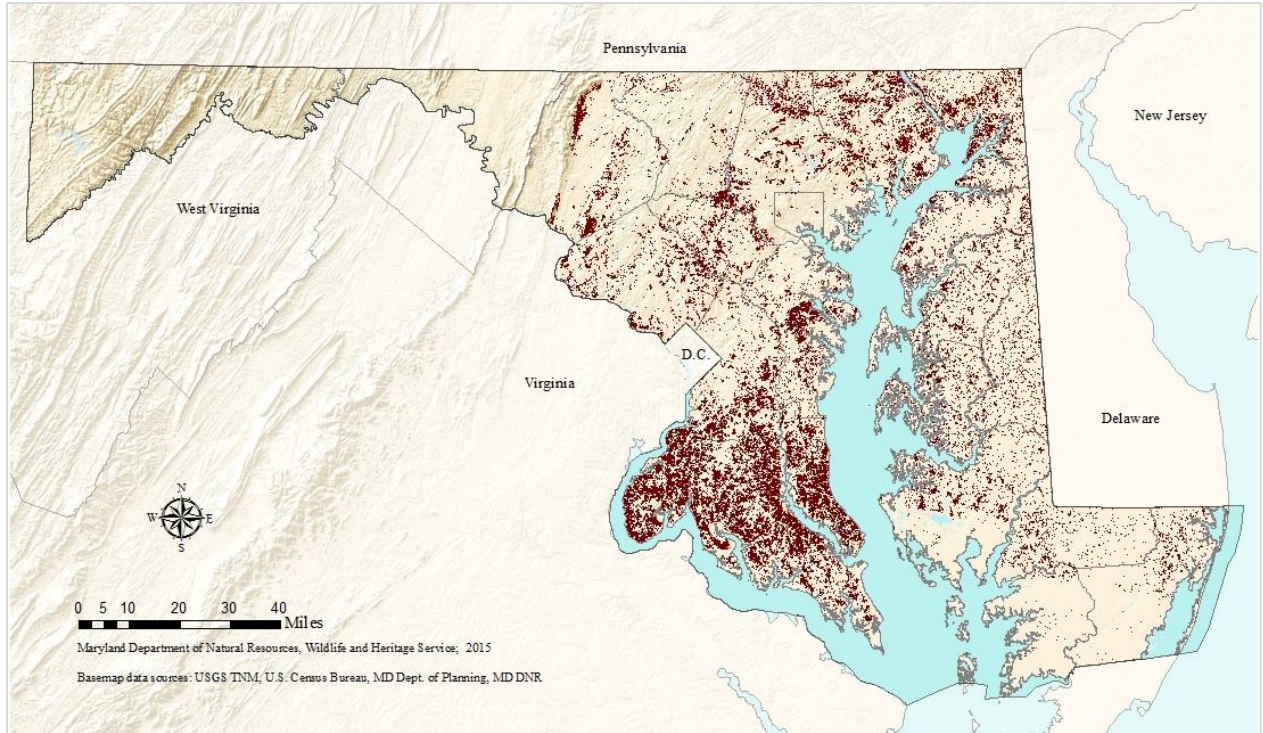


Figure 4.9 Location of Mesic Mixed Hardwood Forests in Maryland. Source: MD DNR.

Species of Greatest Conservation Need Associated with Mesic Mixed Hardwood Forests:

Mammals	Birds	Reptiles
Allegheny woodrat	Acadian flycatcher	Bog turtle
American mink	American redstart	Coastal Plain milksnake
Big brown bat	American woodcock	Common ribbonsnake
Bobcat	Bald eagle	Eastern box turtle
Delmarva fox squirrel	Bicknell's thrush	Eastern kingsnake
Eastern red bat	Black-and-white warbler	Mole kingsnake
Evening bat	Blue-winged warbler	Northern pinesnake
Hoary bat	Broad-winged hawk	Northern scarletsnake
Indiana myotis	Brown creeper	Spotted turtle
Little brown myotis	Cerulean warbler	Timber rattlesnake
Northern long-eared bat	Chuck-will's-widow	Wood turtle
Seminole bat	Eastern whip-poor-will	Amphibians
Silver-haired bat	Great blue heron	Barking treefrog
Smoky shrew	Great egret	Carpenter frog
Southeastern myotis	Hooded warbler	Eastern narrow-mouthed toad
Southeastern shrew	Kentucky warbler	Eastern tiger salamander
Southern bog lemming	Northern bobwhite	Jefferson salamander
Southern pygmy shrew	Northern parula	Upland chorus frog
Tricolored bat	Ovenbird	Insects (Beetles)
	Prairie warbler	Six-banded longhorn beetle



	Birds cont.	Insects (Butterflies & Moths)
	Red-headed woodpecker Scarlet tanager Sharp-shinned hawk Veery Wood thrush Worm-eating warbler Yellow-breasted chat Yellow-throated vireo	A noctuid moth (<i>Hadena ectypa</i>) American chestnut nepticulid moth Appalachian blue Carolina satyr Marbled underwing Pepper and salt skipper Phleophagan chestnut nepticulid moth

Coastal Plain Oak-Pine Forest

The Coastal Plain Oak-Pine Forest key wildlife habitat is generally characterized by dry, fire-prone forests and woodlands that develop over sandy and gravelly soils of the Coastal Plain. Several different natural communities are represented in this key wildlife habitat and are largely differentiated by landscape setting, substrate, and soil moisture, which can range from extremely dry to dry-mesic. The landscape settings vary from steep ravine slopes, north-facing bluffs, terraces, ancient inland dunes and ridges to calcareous river-fronting bluffs. Oaks are dominant and widespread throughout this key wildlife habitat, but may vary in cover as the landscape settings change and other species intergrade into the tree canopy.



Chris Frye, MD DNR

Signature canopy oaks include white oak (*Quercus alba*), southern red oak (*Quercus falcata*), northern red oak (*Quercus rubra*), and chestnut oak (*Quercus montana*). Other canopy species may include black oak (*Quercus velutina*), scarlet oak (*Quercus coccinea*), sassafras (*Sassafras albidum*), and black gum (*Nyssa sylvatica*). Red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), Virginia pine (*Pinus virginiana*) and loblolly pine (*Pinus taeda*) are also frequent in the canopy and may be locally abundant, but they usually indicate past disturbance and fire suppression. American beech (*Fagus grandifolia*) is prominent on submesic sites such as steep ravine slopes or north-facing bluffs. Hickories are typically a component of the understory as are dense shrub colonies of heaths such as huckleberries (*Gaylussacia* spp.) and blueberries (*Vaccinium* spp.). Herbaceous plants are generally not well-developed and usually sparse throughout the deeply leaf-littered forest floor.

Two rare natural communities associated with this key wildlife habitat are ancient Inland Sand Dune and Ridge Woodland and Coastal Plain Dry Calcareous Forest and Woodland. Inland sand dunes and ridges developed during the late Pleistocene when strong northwest prevailing winds transported sands across the Coastal Plain, eventually mounding up into prominent dunes and ridges flanking the east sides of rivers such as the Choptank, Nanticoke, Wicomico, and



Pocomoke. These areas now support dry oak-pine forests and woodlands of southern red oak (*Quercus falcata*), white oak (*Quercus alba*), blackjack oak (*Quercus marilandica*), post oak (*Quercus stellata*), shortleaf pine (*Pinus echinata*), pitch pine (*Pinus rigida*), sassafras (*Sassafras albidum*), sand hickory (*Carya pallida*), and flowering dogwood (*Cornus florida*). The shrub and herbaceous layers vary from patches of huckleberries (*Gaylussacia* spp.) or early lowbush blueberry (*Vaccinium pallidum*) to sparse sandy openings covered with graminoids (*Graminoid* spp.) or reindeer lichens (*Cladonia* spp.). Though numerous, inland dunes and ridges are considered rare natural communities in Maryland because they exhibit a unique flora adapted to these harsh and dry environments. In addition, many historical stands have been replaced or degraded by development, agriculture and commercial forestlands. Another rare natural community type within the Coastal Plain Oak-Pine Forest key wildlife habitat is the Coastal Plain Dry Calcareous Forest and Woodland. These extremely rare, natural communities exist as small wooded patches of river-fronting bluffs and slopes on the Coastal Plain that have developed over either tertiary-aged shell deposits or Native American oyster shell middens. They exhibit a unique flora rich in species uncommon to the Coastal Plain due to a combination of dry sandy soil and abundant calcium. Typically dry calcareous forests and woodlands contain chinkapin oak (*Quercus muhlenbergii*), white ash (*Fraxinus americana*), hackberry (*Celtis occidentalis*), eastern hop hornbeam (*Ostrya virginiana*), and Eastern redbud (*Cercis canadensis* var. *canadensis*). Unlike most communities in this key wildlife habitat, the understory and herbaceous layers are diverse and may include species such as blackhaw (*Viburnum rufidulum*), Robin's plantain (*Erigeron pulchellus* var. *pulchellus*), Bosc's panic grass (*Dichanthelium boscii*), tickweed, white snakeroot (*Ageratina altissima*), columbine (*Aquilegia canadensis*), and slender wild rye (*Elymus villosus*). Examples of this community have been documented along the Chesapeake Bay and river-fronting slopes and bluffs of the Chester, Sassafras, Wye, Great Bohemia, Transquaking and Piscataway River tributaries.

County Distribution: Anne Arundel, Baltimore, Calvert, Caroline, Cecil, Charles, Dorchester, Harford, Kent, Prince George's, Queen Anne's, Somerset, St. Mary's, Talbot, Wicomico, Worcester

Places to Visit: Idylwild Wildlife Management Area, Pocomoke State Forest

Signature State Rare Plants: Cream tick-trefoil (*Desmodium ochroleucum*), sweet pinesap (*Monotropsis odorata*), American ginseng (*Panax quinquefolius*), spiked hoary-pea (*Tephrosia spicata*), sundial lupine (*Lupinus perennis*), rough dropseed (*Sporobolus clandestinus*)

State Rare Natural Communities: Inland Sand Dune and Ridge Woodland, Coastal Plain Dry Calcareous Forest and Woodland



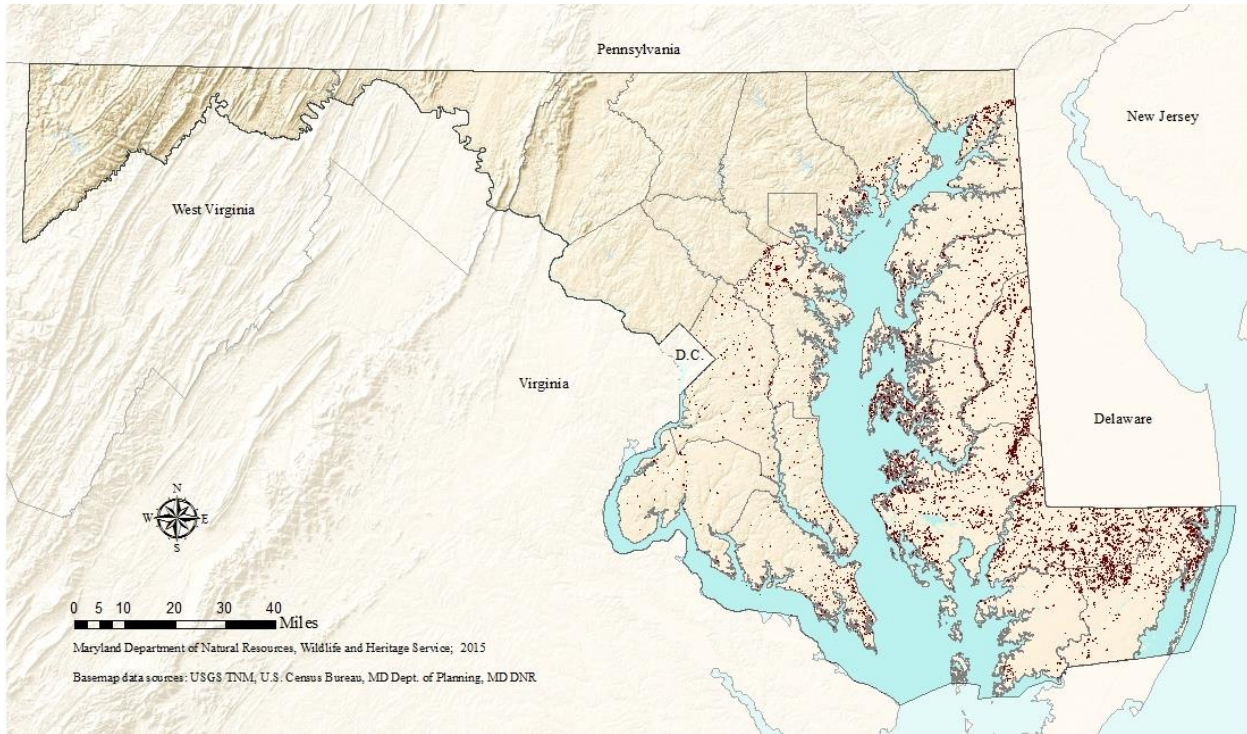


Figure 4.10 Location of Coastal Plain Oak-Pine Forests in Maryland. Source: MD DNR.

Species of Greatest Conservation Need Associated with Coastal Plain Oak-Pine Forests:

Mammals	Birds cont.	Amphibians
American mink Big brown bat Bobcat Delmarva fox squirrel Eastern harvest mouse Eastern red bat Evening bat Hoary bat Least shrew Little brown myotis Seminole bat Silver-haired bat Southeastern myotis Tricolored bat	Chuck-will's-widow Common nighthawk Eastern whip-poor-will Northern bobwhite Ovenbird Prairie warbler Red-headed woodpecker Scarlet tanager Wood thrush Worm-eating warbler Yellow-breasted chat	Carpenter frog Eastern narrow-mouthed toad Eastern tiger salamander
		Insects (Beetles)
		Eastern pinebarrens tiger beetle Festive tiger beetle Northern barrens tiger beetle One-spotted tiger beetle Splendid tiger beetle A tenebrionid beetle (<i>Helops cisteloides</i>) A tenebrionid beetle (<i>Schoenicus puberulus</i>)
	Reptiles	Insects (Bees, Wasps & Ants)
	Coastal Plain milksnake Eastern box turtle Eastern kingsnake Eastern six-lined racerunner Mole kingsnake Northern pinesnake Northern scarletsnake Red cornsnake	Rusty-patch bumble bee
		Insects (Butterflies & Moths)
Birds Acadian flycatcher American woodcock Bicknell's thrush Black-and-white warbler Broad-winged hawk		Cobweb skipper Frosted elfin Leonard's skipper Pine barrens zanclognatha Northern barrens tiger beetle One-spotted tiger beetle



	Reptiles cont.	Insects (Butterflies & Moths) cont.
	Spotted turtle	Splendid tiger beetle A noctuid moth (<i>Zale curema</i>)

Coastal Plain Pitch Pine Forest

The Coastal Plain Pitch Pine Forest key wildlife habitat is characterized by dry, mixed forests and woodlands of Maryland’s inner Coastal Plain, extending from Cecil County south to Prince George’s County. This key wildlife habitat is best developed over flat to gently rolling uplands with deep, sandy loams and sandy clay-loams of the Patuxent Formation. These soils are very acidic with exceedingly low base cation and base saturation levels, indicating extreme infertility. In Maryland, these forests are considered as a southern extension of the New Jersey Pine Barrens, where pitch pine (*Pinus rigida*) is a dominant and characteristic species. Because pitch pine has numerous fire adaptations allowing it to regenerate in burned areas, it is considered a fire- dependent ecosystem by many. It supports vegetation capable of various fire-adaptation strategies allowing for natural regeneration while persisting in settings susceptible to ignition, combustion, and fire spread. Though mean fire return intervals in portions of the New Jersey Pine Barrens occurred at much higher frequencies because of drier fuels and higher evaporation rates, it is likely that fire intervals in Maryland’s pitch pine forest occurred every 40-60 years. It is believed by many that this fire return interval would allow pitch pine to persist while also allowing for continued oak regeneration. Many aspects of Maryland’s flora found in this region of Maryland also suggest a phytogeographical relationship to natural communities of the New Jersey Pine Barrens.



Jason Harrison, MD DNR

The tree canopies of Coastal Plain Pitch Pine Forests are mixed with pitch pine and several other species such as scarlet oak (*Quercus coccinea*), southern red oak (*Quercus falcata*), white oak (*Quercus alba*), black oak (*Quercus velutina*), blackjack oak (*Quercus marilandica*), dwarf chestnut oak (*Quercus montana*), black gum (*Nyssa sylvatica*), and sassafras (*Sassafras albidum*). Virginia pine (*Pinus virginiana*), red maple (*Acer rubrum*), and sweetgum (*Liquidambar styraciflua*) are successional in this key wildlife habitat and often indicate disturbance such as logging or agricultural conversion. Inflammable shrubs of dangleberry (*Gaylussacia frondosa*), black huckleberry (*Gaylussacia baccata*), early lowbush blueberry (*Vaccinium pallidum*), hairy highbush blueberry (*Vaccinium fuscatum*), and deerberry (*Vaccinium stamineum*) can be abundant, sometimes forming a continuous layer. Herbs are noticeably sparse in this key wildlife habitat and may include pink lady’s-slipper (*Cypripedium acaule*), Indian-pipe (*Monotropa uniflora*), spotted wintergreen (*Chimaphila maculata*), and partridge-berry (*Mitchella repens*).

County Distribution: Anne Arundel, Cecil, Prince George’s



Places to Visit: Elk Neck State Forest, Patuxent Research Refuge

State Rare Natural Community: Coastal Plain Pine-Oak Woodland

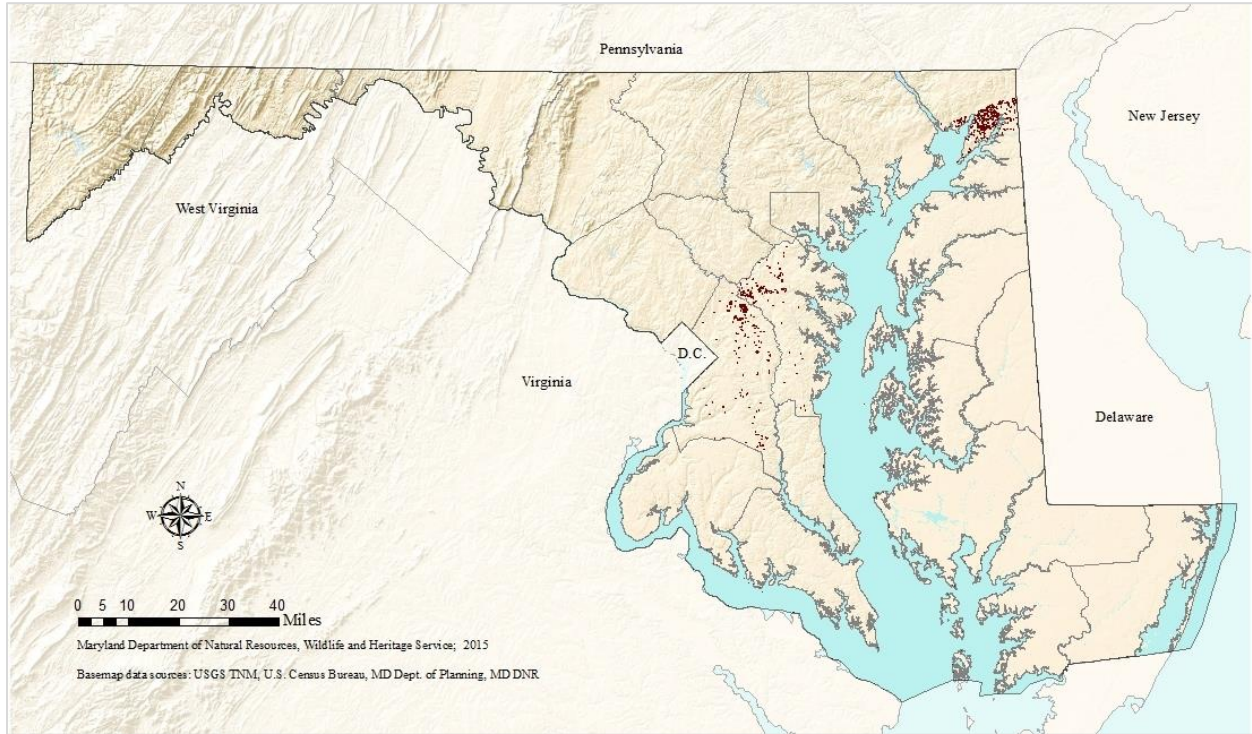


Figure 4.11 Location of Coastal Plain Pitch Pine Forests in Maryland. Sources: MD DNR, Nature Serve’s Terrestrial Ecological Systems of the U.S., USFWS

Species of Greatest Conservation Need Associated with Coastal Plain Pitch Pine Forests:

Mammals	Birds	Reptiles
Big brown bat	Acadian flycatcher	Coastal Plain milksnake
Bobcat	American woodcock	Eastern box turtle
Eastern harvest mouse	Bicknell's thrush	Eastern kingsnake
Eastern red bat	Black-and-white warbler	Eastern six-lined racerunner
Evening bat	Broad-winged hawk	Mole kingsnake
Hoary bat	Chuck-will's-widow	Northern pinesnake
Least shrew	Eastern whip-poor-will	Northern scarletsnake
Seminole bat	Northern bobwhite	Red cornsnake
Silver-haired bat	Ovenbird	Insects (Beetles)
Southeastern myotis	Prairie warbler	Cow path tiger beetle
Tricolored bat	Red-headed woodpecker	Festive tiger beetle
	Scarlet tanager	Northern barrens tiger beetle
	Sharp-shinned hawk	One-spotted tiger beetle
	Wood thrush	Splendid tiger beetle
	Worm-eating warbler	



	Birds cont.	Insects (Bees, Wasps & Ants)
	Yellow-breasted chat	Rusty-patch bumble bee
		Insects (Butterflies & Moths)
		Cobweb skipper Frosted elfin Leonard’s skipper Pine barrens zanclognatha A noctuid moth (<i>Zale curema</i>)

Maritime Forest and Shrubland

The Maritime Forest and Shrubland key wildlife habitat includes forests and shrublands whose structure and composition are influenced by proximity to marine environments. In Maryland, they are best developed in sheltered dune systems and flats of barrier islands of the Atlantic Coast and islands of the lower Chesapeake Bay. The distribution and vegetation of these habitats is largely controlled by marine influences such as salt spray and deep sand deposits. Forests that develop are primarily dominated by loblolly pine (*Pinus taeda*) with mixtures of black cherry (*Prunus serotina*), sassafras (*Sassafras albidum*), southern red oak (*Quercus falcata*), willow oak (*Quercus phellos*), red maple (*Acer rubrum*), American holly (*Ilex opaca var. opaca*), and bayberry (*Morella spp.*). While marine influences are the primary contributing factor in vegetation structure and distribution, soil moisture and drainage also play a critical role in shaping these habitats. Open woodlands of stunted loblolly pine may develop on rapidly-drained back dunes, away from the primary dune, where the effects of salt spray are minimized. In addition, shrublands or “scrub” vegetation develop on inland edges of back dunes and leeward dune slopes where they are moderately protected from ocean salt spray. The vegetation is best characterized as “scrubby” in appearance, typically including stunted trees and low growing, dwarfed shrub species such as sand heather (*Hudsonia tomentosa*), bayberry (*Morella spp.*), and



Peter Stango, MD DNR



Jason Harrison, MD DNR



high-tide bush (*Baccharis halimifolia*). Vines are often abundant and include poison-ivy (*Toxicodendron radicans*), muscadine grape (*Vitis rotundifolia*), Virginia creeper (*Parthenocissus quinquefolia*), and common greenbrier (*Smilax rotundifolia*). Herbaceous species are sparse; however, frequent canopy gaps support many species that are recruited from adjacent maritime grassland communities, such as beach panic grass (*Panicum amarum* ssp. *amarulum*) and slender spikegrass (*Chasmanthium laxum*). These habitats are threatened by coastal development and by natural and anthropogenic disturbances that destroy the protective primary dune system. Because these habitats have a restricted geographic range (Delaware to North Carolina) and narrow habitat requirements, all natural communities within Maritime Forests and Shrublands are considered globally uncommon to rare.

County Distribution: Dorchester, Somerset, Wicomico, Worcester

Places to Visit: Assateague Island National Seashore

State Rare Natural Communities: Maritime Forest, Maritime Dune Scrub, Maritime Dune Woodland

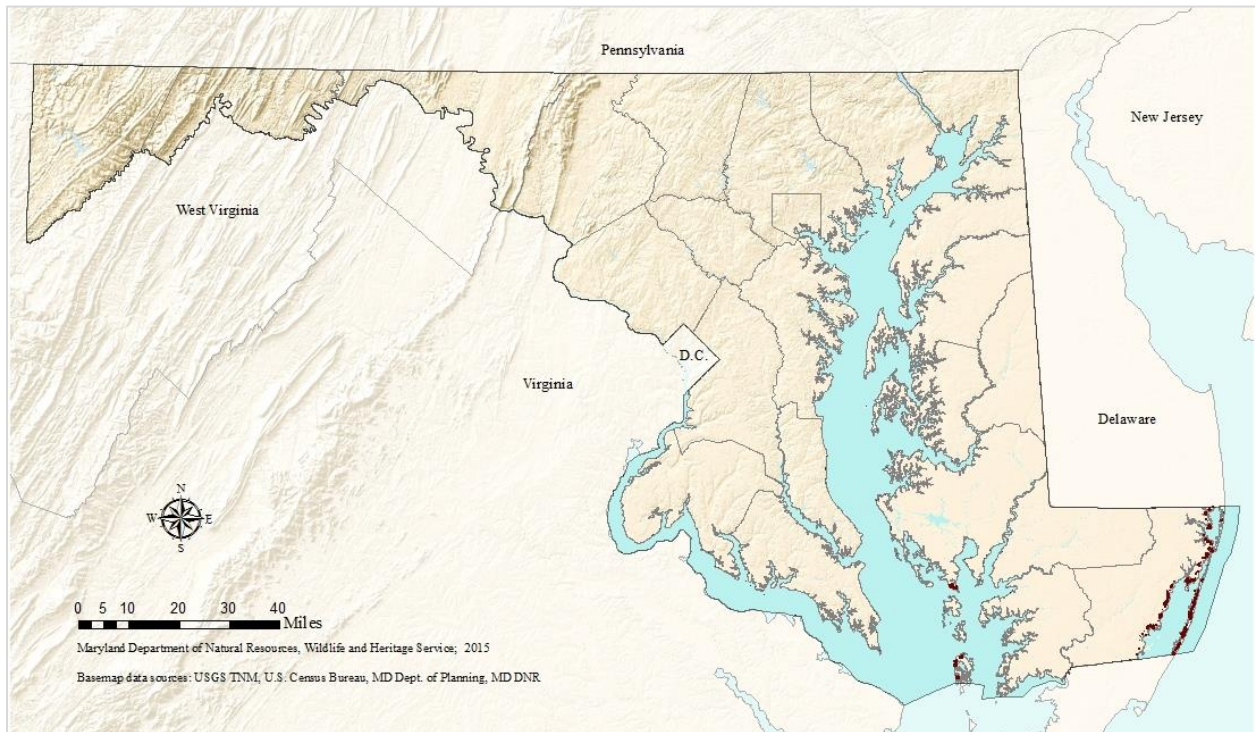


Figure 4.12 Location of Maritime Forests and Shrublands in Maryland. Sources: MD DNR, NETWHCS, USFWS.



Species of Greatest Conservation Need Associated with Maritime Forests and Shrublands:

Mammals	Birds	Birds cont.
Big brown bat	American woodcock	Long-eared owl
Delmarva fox squirrel	Bald eagle	Northern bobwhite
Eastern red bat	Black-crowned night-heron	Northern saw-whet owl
Hoary bat	Boat-tailed grackle	Ovenbird
Least shrew	Chuck-will's-widow	Prairie warbler
Seminole bat	Common nighthawk	Red-cockaded woodpecker
Silver-haired bat	Glossy ibis	Snowy egret
Southeastern myotis	Great blue heron	Tricolored heron
Tricolored bat	Great egret	Yellow-breasted chat
	Little blue heron	Yellow-crowned night-heron

Glades, Barrens, and Cliffs

Serpentine Barren

The Serpentine Barren Key Wildlife Habitat includes habitats that have developed on shallow soils over ultramafic bedrock of serpentine. The plant communities associated with them are structurally intermediate between forests and open canopy uplands, often consisting of sparse woodlands, shrublands, and grass-savannas. Most of these habitats are kept from succeeding to closed forests by periodic fire, drought-stress, edaphic factors, and unstable substrates. Serpentine soils derive from ultramafic rocks, which occur in a discontinuous band east of the Appalachian Mountains from Canada to Alabama.



Wesley Knapp, MD DNR

Serpentine Barrens are best developed in the Piedmont of southeastern Pennsylvania and northern Maryland. One of the four remaining serpentine areas in Maryland, the Soldiers Delight Natural Area near Baltimore is the largest in eastern North America, encompassing 2,000 acres of woodlands and grassland savannas, and is among the most species-rich in the world. Serpentine is a mineral that forms dry, nutrient-poor soil deadly to plants not specially adapted to its unusual chemistry. In folklore, the name "serpentine" is attributed to the soil's resemblance to a mottled greenish-brown snake dwelling on similar soils in northern Italy. The greenish soil color comes from fragments of the underlying bedrock containing magnesium silicate. Toxic to plants, as much as one-third of the bedrock may be made of magnesium. The soil can be very dark in color, depending on its iron, chromite, and magnesium content. High levels of magnesium in the soil block a plant's ability to take in soil nutrients, especially calcium. Because they are shallow and low in organic material and clay, serpentine soils also cannot hold water or nutrients well. Serpentine soils often have pockets of naturally occurring heavy metals toxic to



plants, such as chromium, cobalt, and nickel. Also, these soils are normally acidic near the surface, but less so in deeper layers. As wind and water erode the soil, non-acidic layers are exposed, creating varied habitat for plants. Plants characteristic of serpentine barrens include little bluestem (*Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*), serpentine aster (*Aster depauperatus*), and roundleaf fameflower (*Phemeranthus teretifolius*). Woodlands bordering grassland savannas consist of blackjack oak (*Quercus marilandica*) and post oak (*Quercus stellata*) but are commonly invaded by species such as common greenbrier (*Smilax rotundifolia*), Eastern red cedar (*Juniperus virginiana*), and Virginia pine (*Pinus virginiana*) when fire-suppressed.

County Distribution: Baltimore, Cecil, Harford, Montgomery

Places to Visit: Soldiers Delight Natural Area, Robert E. Lee Park

Signature State Rare Plants: Sandplain gerardia (*Agalinis acuta*), Torrey’s mountainmint (*Pycnanthemum torreyi*), serpentine aster (*Symphotrichum depauperatum*), Richardson’s sedge (*Carex richardsonii*), tufted hairgrass (*Deschampsia cespitosa*), northern dropseed (*Sporobolus heterolepis*), Scribner’s witchgrass (*Dichanthelium oligosanthes var. scribnerianum*), roundleaf fameflower (*Phemeranthus teretifolius*)

State Rare Natural Community: Serpentine Barren

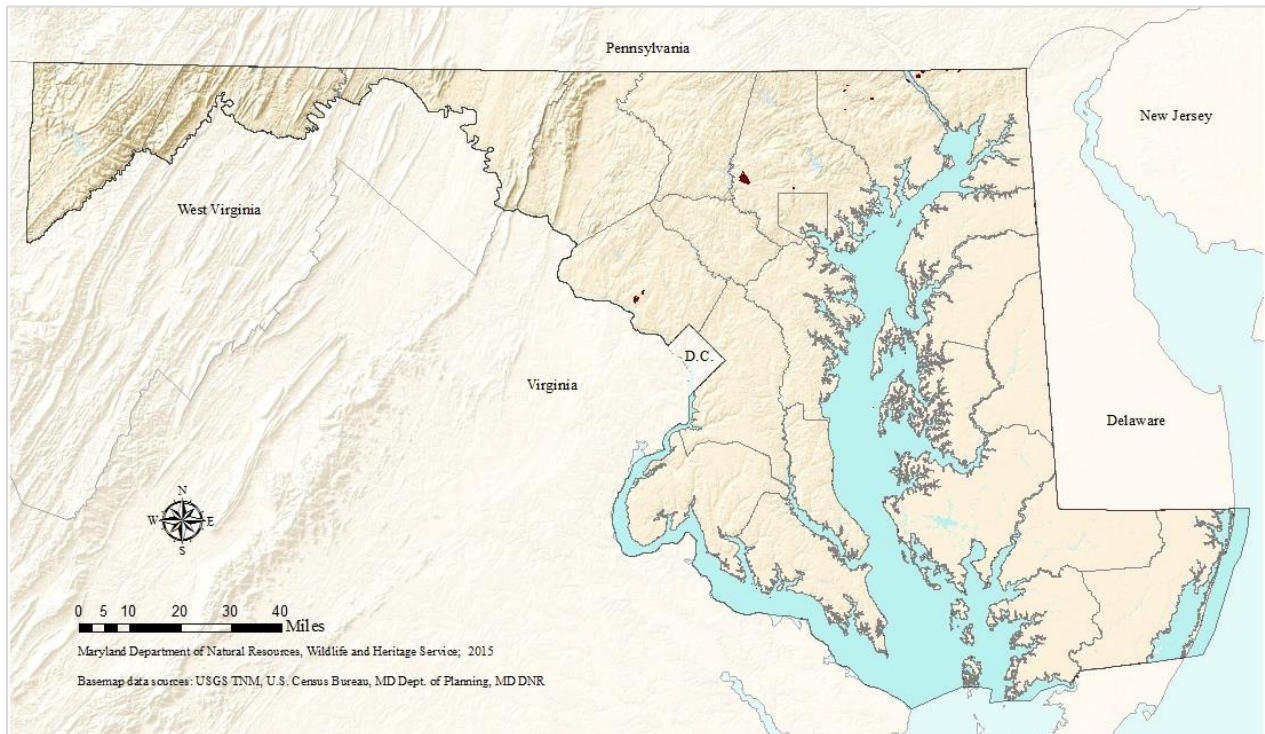


Figure 4.13 Location of Serpentine Barrens in Maryland. Source: MD DNR.



Species of Greatest Conservation Need Associated with Serpentine Barrens:

Mammals	Birds	Insects (Butterflies & Moths)
Big brown bat	Eastern whip-poor-will	Cobweb skipper
Bobcat	Ovenbird	Delaware skipper
Eastern red bat	Prairie warbler	Edwards' hairstreak
Hoary bat	Insects (Beetles)	Indian skipper
Least shrew	Cow path tiger beetle	Leonard's skipper
Little brown myotis	Splendid tiger beetle	Mottled duskywing
Seminole bat		Northern hairstreak
Silver-haired bat		Pine barrens zanclognatha
Tricolored bat		A geometrid moth (<i>Cyclophora nanaria</i>)
		A noctuid moth (<i>Zale curema</i>)
		Other Insects
		Eastern sedge barrens planthopper

Shale Barren

The Shale Barren key wildlife habitat consists of sparse woodlands with scattered herbaceous openings on rock outcrops of acidic and calcareous shales in the Ridge and Valley physiographic province of Maryland. They are best developed on steep, dry slopes with south to west-facing exposures, where surface temperatures are seasonally extremely high. In addition, shales are highly friable and many steep slopes contain loose and unstable channery derived from the continual undercutting of bedrock by streams. This mechanical erosion from



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constant downslope movement of loose fissile shale, combined with very little soil development, very low soil moisture, rapid water drainage, lack of shading vegetation, and longer daily/annual exposure to the sun (due to southerly aspect), results in harsh growing conditions and drought stress. Only species well adapted to these drought stresses thrive in such habitats. These conditions favor the development of open woodlands containing stunted trees of chestnut oak (*Quercus montana*), Virginia pine (*Pinus virginiana*), Eastern red cedar (*Juniperus virginiana*), and pignut hickory (*Carya glabra*). Other characteristic trees include white ash (*Fraxinus americana*), post oak (*Quercus stellata*), black oak (*Quercus velutina*), red oak, table-mountain pine, white pine (*Pinus strobus*), and shagbark hickory (*Carya ovata*). Shrubs common to shale barrens include shadbush (*Amelanchier* spp.), black huckleberry (*Gaylussacia baccata*), deerberry (*Vaccinium stamineum*), and bear oak (*Quercus ilicifolia*). Herbaceous openings are sparsely vegetated and often scattered within a woodland matrix. Such openings contain many endemic or near-endemic Shale Barren species such as shale-barren pussytoes (*Antennaria virginica*), shale-barren ragwort (*Packera antennariifolia*), shale-barren evening primrose



(*Oenothera argillicola*), low bindweed (*Calystegia spithamea*), and Kate’s mountain-clover (*Trifolium virginicum*). Also characteristic are species such as Pennsylvania sedge (*Carex pennsylvanica*), tufted hairgrass (*Deschampsia flexuosa*), common dittany (*Cunila organoides*), rattlesnake-weed (*Hieracium venosum*), poverty oat-grass (*Danthonia spicata*), little bluestem (*Schizachyrium scoparium*), moss-pink (*Phlox subulata*), bird’s-foot violet (*Viola pedata*) and reindeer lichens (*Cladonia* spp.).

County Distribution: Allegany, Washington

Places to Visit: Green Ridge State Forest

Signature State Rare Plants: Kate’s mountain clover (*Trifolium virginicum*), shale barren evening-primrose (*Oenothera argillicola*), smooth sunflower (*Helianthus laevigatus*), yellow ladies’-tresses (*Spiranthes ochroleuca*), stiff-hair sunflower (*Helianthus hirsutus*), bearberry (*Arctostaphylos uva-ursi*), narrowleaf bluecurls (*Trichostema setaceum*)

State Rare Natural Community: Shale Barren

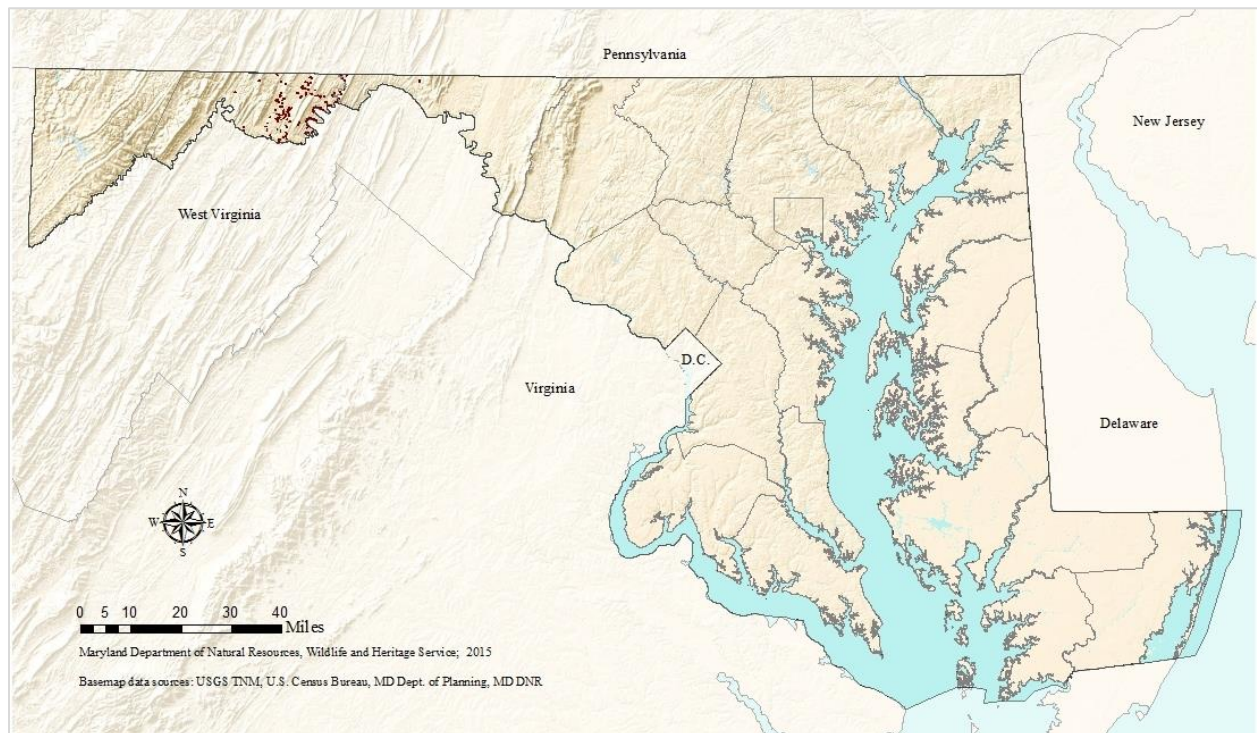


Figure 4.14 Location of Shale Barrens in Maryland. Source: MD DNR.



Species of Greatest Conservation Need Associated with Shale Barrens:

Mammals	Birds	Insects (Butterflies & Moths)
Allegheny woodrat	Eastern whip-poor-will	Cobweb skipper
Appalachian cottontail	Ovenbird	Delaware skipper
Big brown bat	Prairie warbler	Edwards' hairstreak
Bobcat	Ruffed grouse	Giant swallowtail
Eastern red bat	Reptiles	Indian skipper
Eastern small-footed myotis	Eastern six-lined racerunner	Leonard's skipper
Hoary bat	Northern coal skink	Mottled duskywing
Indiana myotis	Red cornsnake	Northern crescent
Least shrew	Timber rattlesnake	Northern hairstreak
Little brown myotis	Amphibians	Northern metalmark
Northern long-eared bat	Valley and Ridge salamander	Olympia marble
Silver-haired bat	Insects (Beetles)	Silvery blue
Tricolored bat	Cow path tiger beetle	Southern grizzled skipper
	One-spotted tiger beetle	

Acidic Glade and Barren

The Acidic Glade and Barren key wildlife habitat is characterized by glades and rocky woodlands over acidic substrates of the Piedmont and mountain regions in Maryland. Piedmont examples are typically associated with small rock outcrops and bouldery slopes of schist, granite, or quartzite. Some examples such as Sandstone Glades are considered rare in Maryland. Sandstone Glades are associated with Pottsville sandstone are most prominent on the Appalachian Plateau at 2,700-2,800 feet, whereas examples in the Ridge and Valley occur at lower elevations of 800-1,000 feet over Oriskany sandstone. The vegetation of these habitats is variable depending on the region but most can be generally characterized as a mosaic of stunted woodlands with scrubby thickets, scattered herbaceous plants, and considerable exposed bedrock. Plant growth is typically confined to crevices or depressions where organic material has accumulated over time. Acidic glades and barrens exhibit very harsh growing conditions resulting from very little soil development, low moisture retention, rapid runoff, and sun exposure. When combined, these conditions make these habitats extremely drought prone. Woody scrub usually consists of scattered, stunted trees of chestnut oak (*Quercus montana*), bear oak (*Quercus ilicifolia*), black gum (*Nyssa sylvatica*), pitch pine (*Pinus rigida*), sweet birch (*Betula lenta*) and shrub thickets of black huckleberry (*Gaylussacia* spp.), early lowbush blueberry (*Vaccinium pallidum*), late low blueberry (*Vaccinium angustifolium*), mountain-laurel



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(*Kalmia latifolia*), and glaucous greenbrier (*Smilax glauca*). Openings in the woody scrub are interspersed, and, if the right conditions are present, they typically support herbaceous species such as wintergreen (*Gaultheria procumbens*), little bluestem (*Schizachyrium scoparium*), broomsedge (*Andropogon virginicus*), Pennsylvania sedge (*Carex pennsylvanica*), and oat-grasses (*Danthonia* spp.). Reindeer lichens (*Cladonia* spp.) may be especially abundant.

County Distribution: Allegany, Baltimore, Carroll, Cecil, Frederick, Garrett, Harford, Howard, Montgomery, Washington

Places to Visit: Cunningham Falls State Park, Dans Mountain Wildlife Management Area, Savage River State Forest, South Mountain State Park

Signature State Rare Plants: Running serviceberry (*Amelanchier spicata*), pale corydalis (*Capnoides sempervirens*)

State Rare Natural Communities: Sandstone Glade

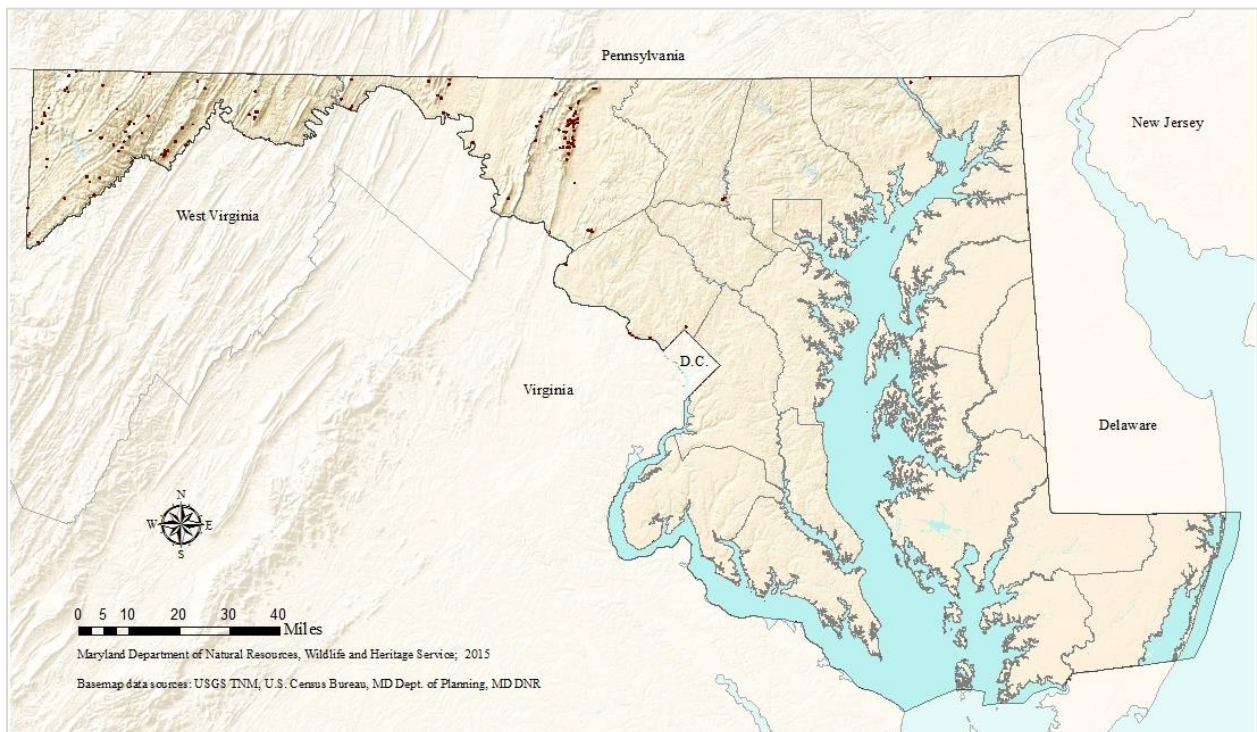


Figure 4.15 Location of Acidic Glades and Barrens in Maryland. Source: MD DNR, Terrestrial Ecological Systems of the United States.



Species of Greatest Conservation Need Associated with Acidic Glades and Barrens:

Mammals	Birds	Insects (Butterflies & Moths)
Allegheny woodrat	Eastern whip-poor-will	Cobweb skipper
Appalachian cottontail	Ovenbird	Edwards' hairstreak
Big brown bat	Prairie warbler	Frosted elfin
Bobcat	Ruffed grouse	Indian skipper
Eastern red bat	Reptiles	Northern crescent
Eastern small-footed myotis	Smooth greensnake	Northern metalmark
Eastern spotted skunk	Timber rattlesnake	Pine barrens zanclognatha
Hoary bat	Insects (Beetles)	A geometrid moth (<i>Cyclophora nanaria</i>)
Indiana myotis	Cow path tiger beetle	A noctuid moth (<i>Zale curema</i>)
Least shrew		
Little brown myotis		
Northern long-eared bat		
Silver-haired bat		
Tricolored bat		

Basic Glade and Barren

The Basic Glade and Barren key wildlife habitat consists of glades and woodlands that develop over limestone and mafic (i.e., greenstone, amphibolite, diabase, gabbro) rock in the western Piedmont and mountains of Maryland. These habitats usually occupy small outcrops and steep talus slopes with very thin, dry soils. The soils can range from moderately acid to basic, but are extremely base-rich and fertile. Drought stress influences the vegetation structure of these areas resulting in a patchy mosaic of woodlands, interspersed with open grassy areas called “glades.” Stunted open woodlands of chinkapin oak (*Quercus muhlenbergii*), white ash (*Fraxinus americana*), eastern red cedar (*Juniperus virginiana*), common hackberry (*Celtis occidentalis*), eastern hop-hornbeam (*Ostrya virginiana*), pasture rose (*Rosa carolina* var. *carolina*), northern prickly-ash (*Zanthoxylum americanum*), and fragrant sumac (*Rhus aromatica*) are common in limestone regions. Glades over limestone are dominated by side-oats grama (*Bouteloua curtipendula* var. *curtipendula*), bottlebrush grass (*Elymus hystrix* var. *hystrix*), mountain oat-grass (*Danthonia compressa*), woodland sunflower (*Helianthus divaricatus*), hoary puccoon (*Lithospermum canescens*), and flowering spurge (*Euphorbia corollata*). Basic Glades and Barrens over mafic bedrock includes similar species that are tolerant of dry, shallow soils such as chestnut oak (*Quercus montana*), Virginia pine (*Pinus*



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virginiana), pignut hickory (*Carya glabra*), and little bluestem (*Schizachyrium scoparium*). These small-patch habitats are prone to invasion by non-native plant species and are considered rare in Maryland.

County Distribution: Allegany, Baltimore, Carroll, Frederick, Garrett, Montgomery, Washington

Places to Visit: C&O Canal National Historical Park, Roundtop Hill Natural Area

Signature State Rare Plants: Mountain Parsley (*Taenidia montana*), Snow Trillium (*Trillium nivale*), Appalachian Sandwort (*Minuartia glabra*), Hairy parviflorum (*Lithospermum parviflorum*), Side-oats Grama (*Bouteloua curtipendula* var. *curtipendula*)

State Rare Natural Communities: Limestone Glade, Basic Outcrop Barren, Boulderfield Forest and Woodland

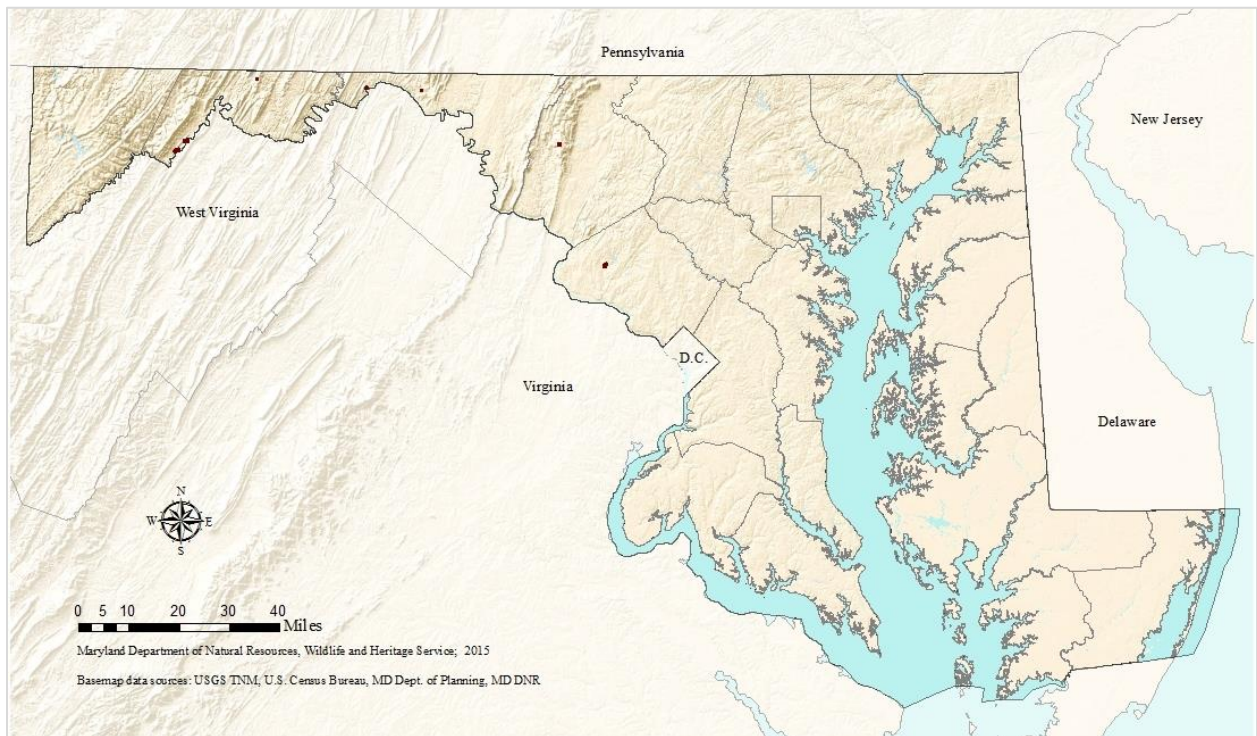


Figure 4.16 Location of Basic Glades and Barrens in Maryland. Source: MD DNR.

Species of Greatest Conservation Need Associated with Basic Glades and Barrens:

Mammals	Birds	Insects (Butterflies & Moths)
Allegheny woodrat	Eastern whip-poor-will	Cobweb skipper
Big brown bat	Ovenbird	Edwards' hairstreak
Bobcat	Prairie warbler	Giant swallowtail
Eastern red bat	Reptiles	Indian skipper
Eastern small-footed myotis	Smooth greensnake	Northern crescent
Hoary bat	Timber rattlesnake	Northern metalmark



Mammals cont.	Insects (Beetles)	Insects (Butterflies & Moths) cont.
Indiana myotis Least shrew Little brown myotis Northern long-eared bat Silver-haired bat Tricolored bat	Cow path tiger beetle	Pine barrens zanclognatha Silvery blue Southern grizzled skipper A geometrid moth (<i>Cyclophora nanaria</i>) A noctuid moth (<i>Zale curema</i>)
		Invertebrates (Snails)
		Cherrystone drop Maryland glyph Natural Bridge supercoil

Cliff and Rock Outcrop

The Cliff and Rock Outcrop key wildlife habitat includes tall (from 3 to over 50 m high), steep to vertical expanses of bare to sparsely vegetated bedrock and/or soil. The differences between the two are subtle: cliffs are generally considered tall, sheer vertical walls of rock or soil, while outcrops consist of steep to vertical, exposed rock formations with well-developed fissures and crevices. Both are most numerous and prominent in the Appalachian Plateau and Ridge and Valley physiographic regions, although significant examples also occur in the Piedmont. On the Appalachian Plateau, this habitat is



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typified by extensive (in places, > 0.5 km long), Pottsville sandstone outcrops along the upper slopes and ridges (600-1,000 m) of the state's highest mountains, including Dans, Big Savage, Meadow, and Backbone Mountains. In the Ridge and Valley, large sandstone ridgetop outcrops also occur in the Tuscarora Formation on Haystack, Wills and Evitts Mountains, and in the Bear Pond Mountains; the Purslane Formation on Sideling Hill and Town Hill; and in the Oriskany Formation on numerous ridges such as Fort Hill, Roundtop Hill and Warrior Mountain. Further east, between Hagerstown and Frederick, the Weverton Quartzite Formation forms major outcrops along the crests of South and Catoclin Mountains. Many of these outcrops include massive cliff and boulder faces with numerous, deep fissures. The outcrop base is often surrounded by extensive, open talus that grades into the Boulderfield Forests and Woodlands natural community. Cool, windswept conditions along with frequent ice storms and heavy snows, greatly limit soil development and, thus, the type and extent of plant communities present. Vegetation in and around outcrops also varies depending on the physiographic region, elevation, slope, aspect, geological formation and other factors. On the steepest, most exposed sections, vegetation is absent except for patches of lichens and mosses growing on rock surfaces.



On less exposed areas, scattered, sometimes dense patches of shrubs such as mountain-laurel (*Kalmia latifolia*), great rhododendron (*Rhododendron maximum*), huckleberries (*Gaylussacia* spp.), and blueberries (*Vaccinium* spp.), as well as occasional stunted trees of chestnut oak (*Quercus montana*), pitch pine (*Pinus rigida*), American mountain ash (*Sorbus americana*), table-mountain pine (*Pinus pungens*), or eastern hemlock (*Tsuga canadensis*) can be found growing there. The surrounding vegetation, which influences the types of outcrop fauna present, can range from High Elevation Ridge Forests and Hemlock-Northern Hardwood Forests to Montane-Piedmont Oak-Pine Forests. Prior to the introduction of chestnut blight in the early-mid 1900s, American chestnut (*Castanea dentata*) was a frequent to dominant tree species in many of the forests surrounding ridgetop outcrops.

At lower elevations in western Maryland, large outcrops and cliffs also occur along many of the larger streams and rivers. In Garrett County, for example, Pottsville sandstone outcrops overlook sections of the Youghiogheny River and North Branch of the Potomac River. A variety of formations outcrop along the main stem of the Potomac. One of the more spectacular examples is the Weverton Quartzite Formation which forms tall, sheer cliffs near Harpers Ferry and Point of Rocks. Shale and limestone outcrops and ledges also occur along the Potomac in Allegany, Washington, and Frederick counties. Cliffs and Rock Outcrops are much less common in the Piedmont and most are relatively small. The largest occur along the Susquehanna River, on Sugarloaf Mountain, and in the Great Falls region of the Potomac River.

County Distribution: Allegany, Baltimore, Carroll, Cecil, Frederick, Garrett, Harford, Howard, Montgomery, Washington

Places to Visit: Catoctin Mountain Park, C&O Canal National Historical Park, Rocks State Park, South Mountain State Park

Signature State Rare Plants: Nantucket shadbush (*Amelanchier nantucketensis*), lobed spleenwort (*Asplenium pinnatifidum*), cliff stonecrop (*Sedum glaucophyllum*), American arborvitae (*Thuja occidentalis*), Michaux's stichwort (*Minuartia michauxii*)

State Rare Natural Communities: Basic Cliff, Riverside Outcrop Barren, Boulderfield Forest and Woodland



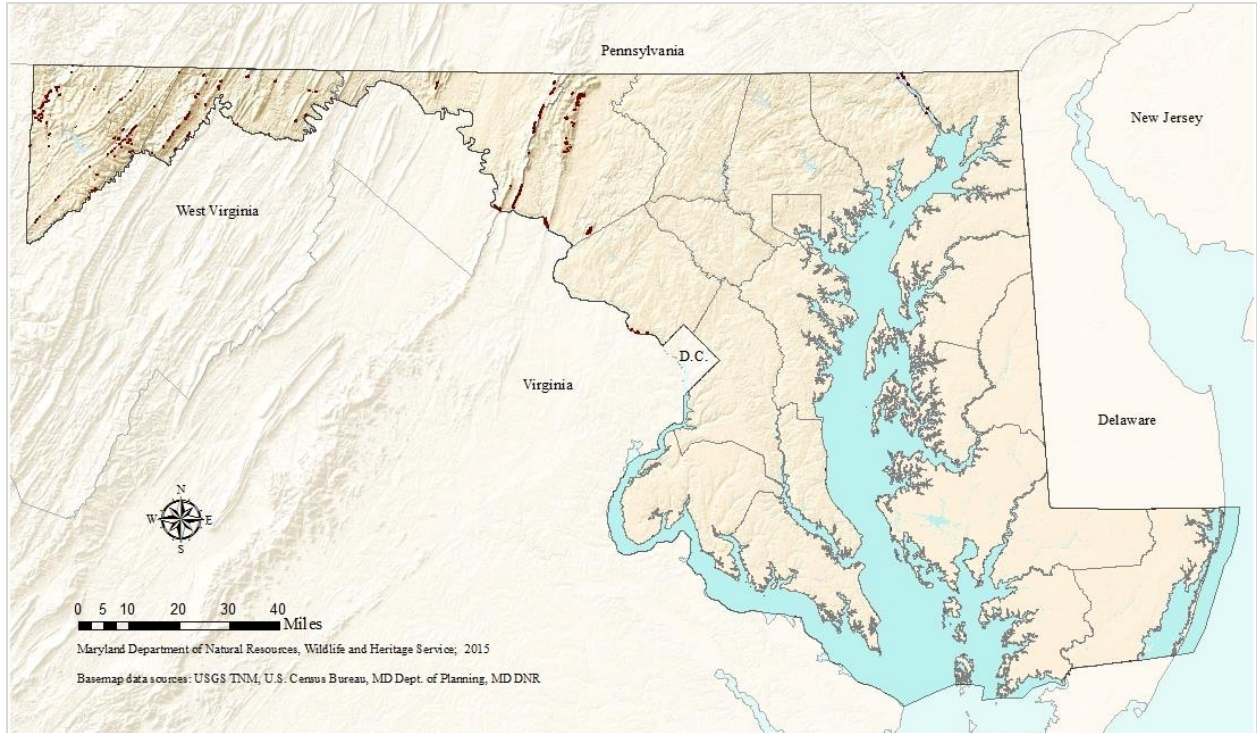


Figure 4.17 Location of Cliff and Rock Outcrops in Maryland. Sources: MD DNR, NETWHCS.

Species of Greatest Conservation Need Associated with Cliff and Rock Outcrops:

Mammals	Birds
Allegheny woodrat	American peregrine falcon
Appalachian cottontail	Dark-eyed junco
Big brown bat	Golden eagle
Bobcat	Winter wren
Eastern small-footed myotis	Reptiles
Eastern spotted skunk	Eastern six-lined racerunner
Indiana myotis	Red cornsnake
Least weasel	Smooth greensnake
Little brown myotis	Timber rattlesnake
Long-tailed shrew	Amphibians
North American porcupine	Green salamander
Northern long-eared bat	Wehrle's salamander
Silver-haired bat	Insects (Beetles)
Smoky shrew	Cow path tiger beetle
Tricolored bat	



Coastal Bluff

The Coastal Bluff key wildlife habitat is defined as a steep shoreline slope formed in loose sediments of clay, sand, and gravel often just above the high tide line. By comparison, cliffs or slopes in bedrock (ledge) surfaces are not classified as bluffs and are not subject to significant erosion over a century or more. In addition, beaches and dunes do not form bluffs, except along the seaward dune edge as a result of erosion. On the Coastal Plain, this habitat type is limited to tall (5-40 m), steep to vertical bluffs of Miocene origin along the shorelines of the mid- and upper Chesapeake Bay and large tidal rivers. Calvert Cliffs in Calvert County and Grove Point at the mouth of the Sassafras River typify this habitat type. Vegetation is usually absent to sparse due to naturally high erosion rates resulting from a combination of shoreline wave action, groundwater percolation, and the weathering effects of wind and precipitation, especially during major storm events (e.g., hurricanes, nor'easters). A sparse early successional community may become temporarily established on less steep or exposed bluff faces. Vegetation composition varies, but small trees such as black locust (*Robinia pseudoacacia*) and sassafras (*Sassafras albidum*) are among the more frequent tree species present. Smaller (3-8 m tall) bluffs also occur along large inland rivers, such as the Potomac and the Monocacy. In some cases, sand and gravel mining operations create bluff-like conditions around the edges or in the open pits that are used by certain SGCN, primarily bank swallows.



Jared Parks, Eastern Shore Land Conservancy

Chesapeake Bay and large tidal rivers. Calvert Cliffs in Calvert County and Grove Point at the mouth of the Sassafras River typify this habitat type. Vegetation is usually absent to sparse due to naturally high erosion rates resulting from a combination of shoreline wave action, groundwater percolation, and the weathering effects of wind and precipitation, especially during major storm events (e.g., hurricanes, nor'easters). A sparse early successional community may become temporarily established on less steep or exposed bluff faces. Vegetation composition varies, but small trees such as black locust (*Robinia pseudoacacia*) and sassafras (*Sassafras albidum*) are among the more frequent tree species present. Smaller (3-8 m tall) bluffs also occur along large inland rivers, such as the Potomac and the Monocacy. In some cases, sand and gravel mining operations create bluff-like conditions around the edges or in the open pits that are used by certain SGCN, primarily bank swallows.

County Distribution: Anne Arundel, Baltimore, Calvert, Cecil, Charles, Frederick*, Harford, Kent, Montgomery*, Prince George's, Queen Anne's, St. Mary's, Talbot

(*This key wildlife habitat accommodates "disjunct" and isolated areas that occur in portions of the Piedmont.)

Places to Visit: Calvert Cliffs State Park, Sassafras Natural Resources Management Area



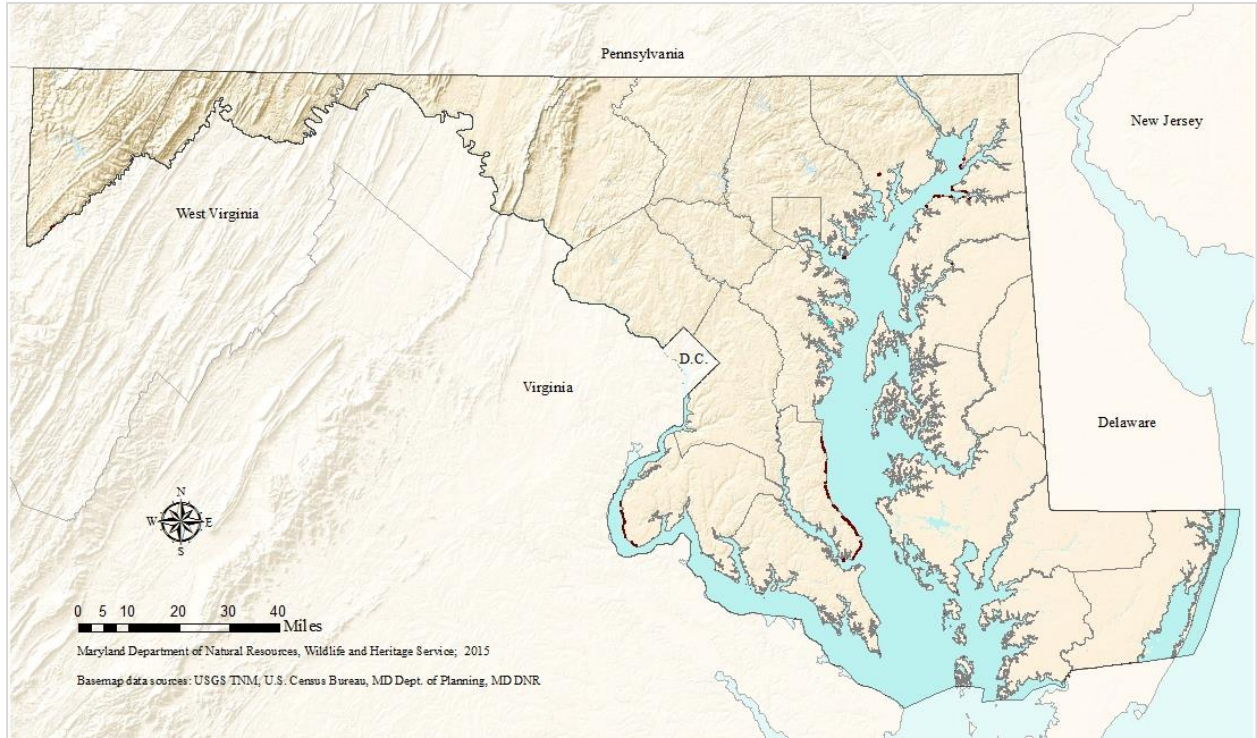


Figure 4.18 Location of Coastal Bluffs in Maryland. Source: MD DNR.

Species of Greatest Conservation Need Associated with Coastal Bluffs:

Birds	Insects (Beetles)
Bank Swallow	Puritan tiger beetle Splendid tiger beetle

Coastal Beaches and Dunes

Coastal Beach

The Coastal Beach key wildlife habitat is represented by ocean shores and flats behind breached foredunes of the Atlantic Coast, as well as along some of the shoreline habitat of the Coastal Bays, Chesapeake Bay, and lower reaches of major rivers. Situated between the mean high tide limit and foredunes, coastal beaches along the Atlantic Ocean are subjected to extreme conditions associated with marine environments, such as salt spray, high winds, flooding, and shifting sands. These habitats are generally kept moist due to constant salt spray and rainwater. Substrates are composed of unconsolidated sands and shells, which are constantly being shifted by winds and floods of storm surges and spring high tides. This dynamic disturbance regime severely limits vegetation to salt tolerant, succulent annuals such as American sea rocket and glassworts. In



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addition, broad overwash flats may develop behind primary dunes when breaching occurs during storm surges. Dune construction along the Atlantic coast has greatly reduced the extent of these habitats by increasing ocean-side beach erosion and eliminating the natural disturbance regime that creates and maintains overwash flats. Beaches of shorelines away from the ocean are subject to many of the same conditions, except for a minimized or insignificant amount of salt spray, depending on its location. These beaches are also frequently reduced to small, isolated areas. Certain erosion control structures, such as bulkheads and placement of riprap revetments along shorelines, have greatly reduced the extent of this habitat by disrupting natural erosion and longshore or littoral drift of sand.

County Distribution: Anne Arundel, Baltimore, Calvert, Caroline, Cecil, Charles, Dorchester, Harford, Kent, Prince George’s, Queen Anne’s, Talbot, Somerset, St. Mary’s, Wicomico, Worcester

Places to Visit: Assateague Island National Seashore, Calvert Cliffs State Park, Flag Ponds Nature Park

Signature State Rare Plants: Seabeach amaranth (*Amaranthus pumilus*), seaside knotweed (*Polygonum glaucum*), beach plum (*Prunus maritima*), narrowleaf willow (*Salix exigua*)

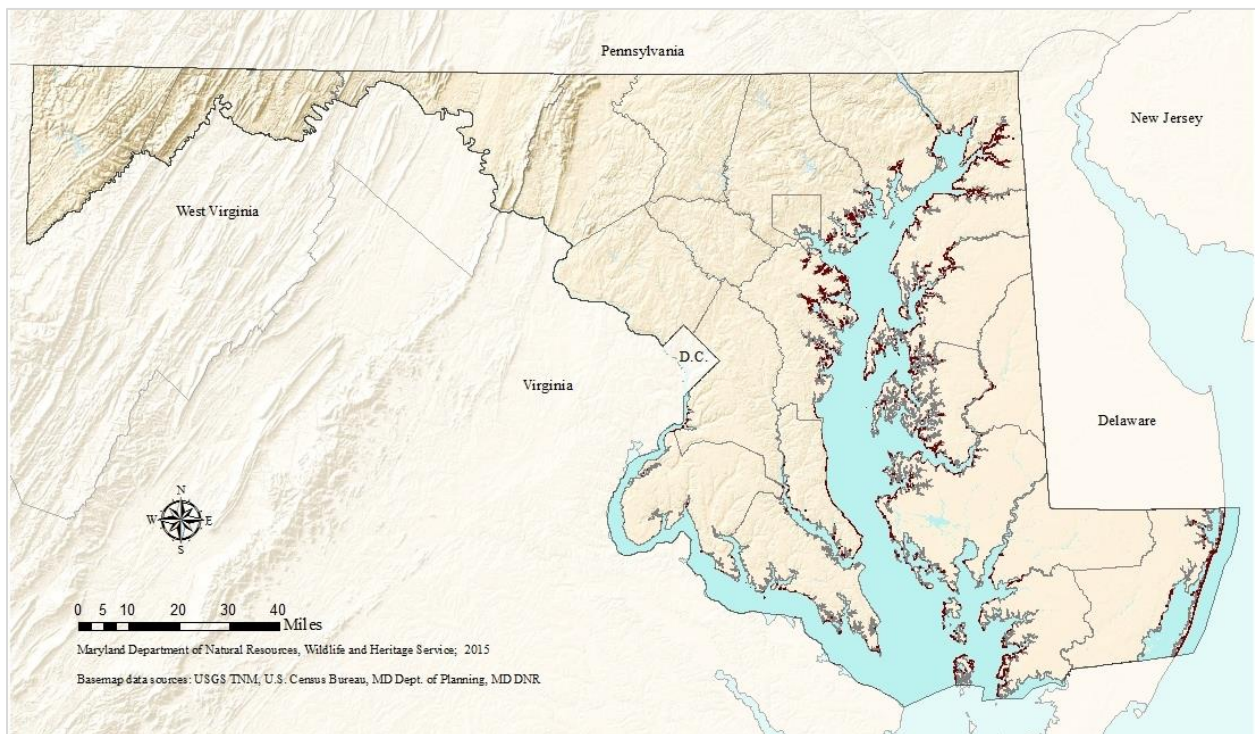


Figure 4.19 Location of Coastal Beaches in Maryland. Sources: MD DNR, NPS, USGS.



Species of Greatest Conservation Need Associated with Coastal Beaches:

Birds	Birds cont.	Reptiles
American oystercatcher	Lesser yellowlegs	Eastern six-lined racerunner
Black skimmer	Piping plover	Loggerhead seaturtle
Black-bellied plover	Red knot	Northern diamond-backed terrapin
Brant	Roseate tern	Insects (Beetles)
Brown pelican	Royal tern	Northeastern beach tiger beetle
Common tern	Ruddy turnstone	White tiger beetle
Dunlin	Sanderling	Arthropods
Forster's tern	Sandwich tern	Horseshoe crab
Greater yellowlegs	Semipalmated sandpiper	
Gull-billed tern	Spotted sandpiper	
Laughing gull	Whimbrel	
Least tern	Willet	
	Wilson's plover	

Maritime Dune and Grassland

The Maritime Dune and Grassland key wildlife habitat is characterized by dune systems of the Atlantic Ocean and to a lesser extent the Chesapeake Bay. These habitats are dominated by grasses and dwarf shrubs well adapted to extreme gradients of soil moisture and salt spray. Sand movement is also an important factor in shaping dune communities. Active dunes, where sand movement is greatest tend to support grasses such as American beachgrass (*Ammophila breviligulata*), beach panic grass (*Panicum amarum* ssp. *amarulum*), and bitter seabeach grass (*Panicum amarum* ssp. *amarum*), whereas stabilized dunes



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support low growing shrubs such as beach heather. Steep, ocean-fronting dunes are usually colonized by linear, nearly monospecific stands of American beachgrass. The crest and back slopes of primary dunes have a slightly more diverse plant assemblage that may include sea oats, bitter seabeach grass, beach panic grass, seaside goldenrod, seaside spurge, and dune sandbur. A series of smaller secondary dunes spread inward from the primary dune. These dunes are somewhat protected from salt spray and often dominated by beach panic grass. Small, seasonally flooded grasslands in low swales between secondary dunes are commonly referred to as “interdunal swales”. Interdunal swales are characterized by perched water tables and shallow seasonal flooding by rainfall. Although they are predominantly freshwater wetlands, periodic saltwater intrusion may occur in some swales during storm surges. Fluctuations in water levels and salinity vary between swales and greatly influence species composition. As water levels



drawdown late in the growing season, interdunal swales support a variety of grasses, sedges, rushes, and forbs. Maritime dune systems are threatened by development and coastal erosion.

County Distribution: Worcester

Places to Visit: Assateague Island National Seashore

State Rare Natural Communities: Maritime Dune Grassland, Interdunal Swale

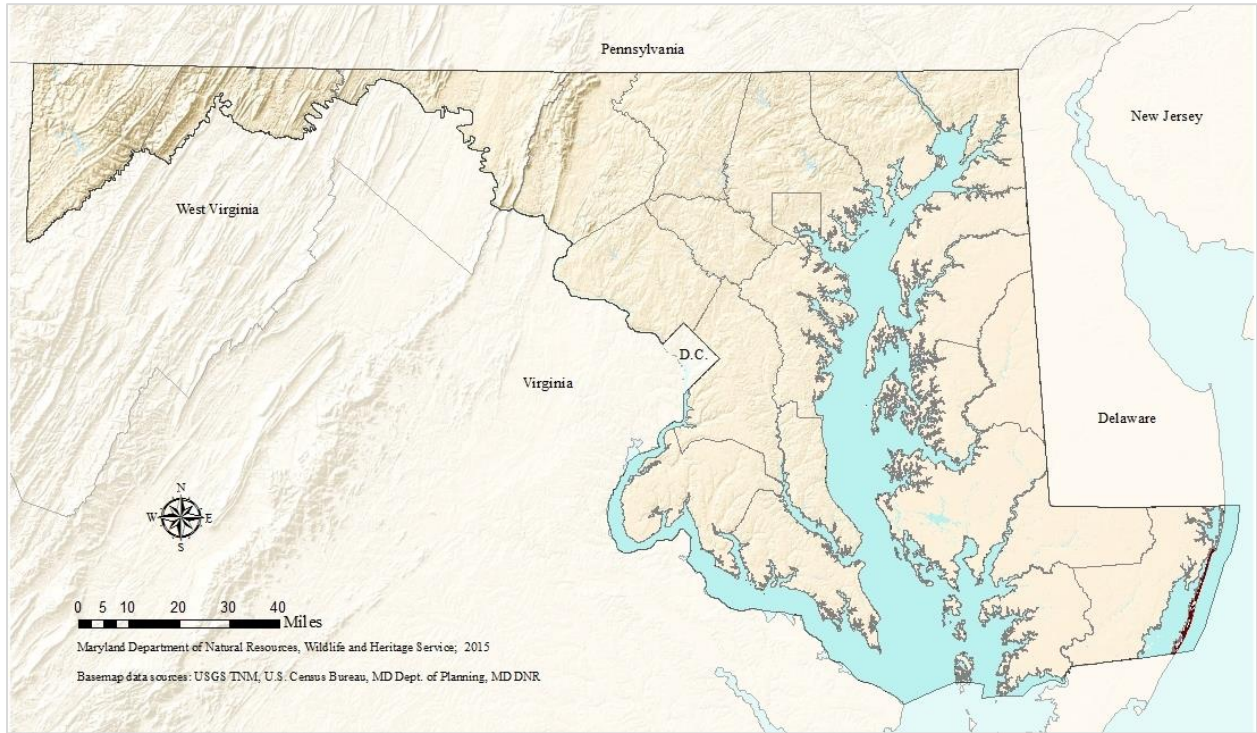


Figure 4.20 Location of Maritime Dunes and Grasslands in Maryland. Sources: MD DNR, NPS.

Species of Greatest Conservation Need Associated with Maritime Dunes and Grasslands:

Mammals	Birds cont.	Reptiles
Big brown bat	Greater yellowlegs	Northern diamond-backed terrapin
Eastern red bat	Gull-billed tern	Insects (Beetles)
Hoary bat	Laughing gull	Bethany Beach firefly
Least shrew	Least tern	Ghost tiger beetle
Seminole bat	Lesser yellowlegs	Insects (Butterflies & Moths)
Silver-haired bat	Northern bobwhite	Monarch
Tricolored bat	Northern harrier	
Birds	Piping plover	
American oystercatcher	Roseate tern	
Black skimmer	Royal tern	
Boat-tailed grackle	Sandwich tern	
Common nighthawk	Short-eared owl	



Birds cont.	
Common tern	Whimbrel
Forster's tern	Willet
	Wilson's plover

Wetland Habitats

Floodplain Wetlands

Montane-Piedmont Floodplain

The Montane-Piedmont Floodplain key wildlife habitat encompasses a wide variety of floodplain habitats along small streams and large river systems in the Piedmont and mountain regions of Maryland. These habitats are very diverse with species distributions influenced by geology, soil properties, and flooding regimes. Temporarily and intermittently flooded bottomland forests are prominent along many of the rivers and are frequently characterized by species such as sycamore (*Platanus occidentalis*), silver maple (*Platanus occidentalis*), black walnut (*Juglans nigra*), river birch (*Betula nigra*), boxelder (*Acer negundo*), pawpaw (*Asimina triloba*), and American elm (*Ulmus americana*). Distinct alluvial landforms such as gravel bars, levees, terraces, old oxbows, and sloughs are usually present at varying scales along larger rivers. Young, flood-scoured woodlands sometimes occur along shoreline areas and islands, especially in high-gradient rocky sections and along flood-deposited sand and gravel bars. Such areas are frequently dominated by dense, nearly pure stands of small (2-8 m tall) sycamore (*Platanus occidentalis*), boxelder (*Acer negundo*), river birch, and green ash (*Fraxinus pennsylvanica*) trees. Frequently embedded within floodplain forests are floodwater pools and seasonally flooded backswamps and sloughs dominated by red maple (*Acer rubrum*), silver maple, sweetgum (*Liquidambar styraciflua*), and hydrophytic oaks such as pin oak (*Quercus palustris*) and swamp white oak (*Quercus bicolor*). These backwater areas usually exhibit distinctive hummock-and-hollow microtopography with maximum flood depths of 50-70 cm. along smaller, higher gradient streams, where the floodplain is narrower and alluvial landforms develop at much smaller scales, mesophytic species may occur. Commonly encountered is a mixture of bottomland and mesophytic species which include tulip-poplar (*Liriodendron tulipifera*), sugar maple (*Acer saccharum*), basswood (*Tilia americana*), American



Richard Wiegand, MD DNR



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beech (*Fagus grandifolia*), and white pine (*Pinus strobus*). At higher elevations, eastern hemlock (*Tsuga canadensis*), black cherry (*Prunus serotina*), yellow birch, and dense thickets of great laurel (*Rhododendron maximum*) are usually prominent.

County Distribution: Allegany, Baltimore, Carroll, Cecil, Frederick, Garrett, Harford, Howard, Montgomery, Washington

Places to Visit: C&O National Historical Park, Gunpowder Falls State Park, Patapsco Valley State Park, Susquehanna State Park

Signature State Rare Plants: Harperella (*Harperella nodosa*), Virginia mallow (*Sida hermaphrodita*), valerian (*Valeriana pauciflora*), Blue Monkshood (*Aconitum uncinatum*), Snowy Campion (*Silene nivea*), winged loosestrife (*Lythrum alatum*), blue wild indigo (*Baptisia australis*)

State Rare Natural Communities: River Scour Woodland, Riverside Prairie



Figure 4.21 Location of Montane-Piedmont Floodplains in Maryland. Sources: MD DNR, FEMA.



Species of Greatest Conservation Need Associated with Montane-Piedmont Floodplains:

Mammals	Birds cont.	Amphibians
American mink	Golden-crowned kinglet	Jefferson salamander
Big brown bat	Golden-winged warbler	Valley and Ridge salamander
Bobcat	Great blue heron	Insects (Beetles)
Eastern red bat	Great egret	Appalachian tiger beetle
Evening bat	Greater yellowlegs	Insects (Butterflies & Moths)
Hoary bat	Hooded warbler	Atlantis fritillary
Indiana myotis	Kentucky warbler	Baltimore checkerspot
Least shrew	Lesser yellowlegs	Black dash
Least weasel	Louisiana waterthrush	Delaware skipper
Little brown myotis	Magnolia warbler	Giant swallowtail
Northern long-eared bat	Northern parula	Harris's Checkerspot
Seminole bat	Northern waterthrush	Long dash
Silver-haired bat	Ovenbird	Marbled underwing
Southeastern shrew	Prothonotary warbler	Mulberry wing
Southern bog lemming	Red-headed woodpecker	Northern crescent
Southern pygmy shrew	Ruffed grouse	Pepper and salt skipper
Southern water shrew	Rusty blackbird	Silver-bordered fritillary
Tricolored bat	Scarlet tanager	West Virginia white
	Spotted sandpiper	Insects (Dragonflies and Damselflies)
Birds	Veery	Bar-winged skimmer
Acadian flycatcher	Willow flycatcher	Beaverpond baskettail
Alder flycatcher	Winter wren	Black-tipped darner
American black duck	Wood thrush	Canada darner
American redstart	Worm-eating warbler	Comet darner
American woodcock	Yellow-breasted chat	Golden-winged skimmer
Bald eagle	Yellow-crowned night-heron	Green-striped darner
Bank swallow	Yellow-throated vireo	Harlequin darner
Black-and-white warbler	Reptiles	Robust baskettail
Blackburnian warbler	Bog turtle	Ski-tailed emerald
Black-crowned night-heron	Common ribbonsnake	Stripe-winged baskettail
Black-throated blue warbler	Eastern box turtle	Taper-tailed darner
Black-throated green warbler	Eastern spiny softshell	White-faced meadowhawk
Blue-winged warbler	Northern map turtle	
Broad-winged hawk	Smooth greensnake	
Brown creeper	Spotted turtle	
Canada warbler	Timber rattlesnake	
Cerulean warbler	Wood turtle	
Common merganser		



Coastal Plain Floodplain

The Coastal Plain Floodplain key wildlife habitat is characterized by a variety of flooded habitats that border Coastal Plain streams and rivers. These floodplain habitats are influenced by temporary or seasonal overbank flooding, groundwater seepage, and beaver activity. The vegetation of Coastal Plain Floodplains is both structurally and compositionally diverse, and often occurs as a mosaic of forests, woodlands, shrublands, and herbaceous communities. Species composition varies widely with stream order, soil type, and flooding regime. Floodplain forests of small intermittent streams and braided streams may support combinations of sycamore (*Platanus occidentalis*), green ash (*Fraxinus pennsylvanica*), red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), black gum (*Nyssa sylvatica*), river birch (*Betula nigra*), swamp chestnut oak (*Quercus michauxii*), and willow oak (*Quercus phellos*). Diverse understories are often present and characterized by mixtures of American hornbeam (*Carpinus caroliniana*), pawpaw (*Asimina triloba*), American elm (*Ulmus americana*), American holly (*Ilex opaca* var. *opaca*), spicebush (*Lindera benzoin*) and herbs of Jack-in-the-pulpit (*Arisaema triphyllum*), false nettle (*Boehmeria cylindrical*), poison-ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), wood reedgrass (*Cinna arundinacea*), and various sedges. Similarly, floodplain forests of larger Coastal Plain Rivers with well-drained terraces or natural levees will often support species such as tulip-poplar (*Liriodendron tulipifera*), beech (*Fagus grandifolia*), and box elder (*Acer negundo*). Poorly drained floodplains, backswamps, and depressions of small Coastal Plain streams and rivers may support seasonally flooded swamps dominated by green ash, red maple (*Acer rubrum*), and plants tolerant of fluctuating water levels such as lizard's-tail. Bald Cypress Swamps and Atlantic White Cedar Swamps are rare natural communities that are also associated with poorly drained settings in seasonally flooded floodplains. Both are associated with slow-moving Blackwater Streams such as those in the Pocomoke and Nanticoke River watersheds. Only 6 acres have been identified by the Maryland Department of Natural Resources as old growth on state lands.



Richard Wiegand, MD DNR

Floodplain pools, beaver ponds, and other open water habitats are also characteristic of Coastal Plain Floodplains. These habitats are subjected to irregular disturbances that change water levels, such as the breaching of beaver dams and storm events. These habitats are highly variable in size, structure, and species composition. They often support a variety of floating aquatic, emergent, and woody vegetation. Species common to these habitats include white water-lily (*Nymphaea odorata*), spatterdock (*Nuphar advena*), pondweeds (*Potamogeton* spp.), duckweeds (*Lemna* spp.), bladderworts (*Utricularia* spp.), rice cutgrass (*Leersia oryzoides*), common woodrush (*Luzula multiflora*), smartweeds (*Polygonum* spp.), pickerelweed (*Pontederia cordata*), arrow-arum (*Peltandra virginica*), three-way sedge (*Dulichium arundinaceum*), broad-leaved cattail (*Typha latifolia*), American bur-reed (*Sparganium americanum*), swamp loosestrife (*Decodon verticillatus*), and common buttonbush (*Cephalanthus occidentalis*).



County Distribution: Anne Arundel, Baltimore, Calvert, Caroline, Cecil, Charles, Dorchester, Kent, Prince George's, Queen Anne's, St. Mary's, Somerset, Talbot, Wicomico, Worcester

Places to Visit: Merkle Wildlife Sanctuary, Idylwild Wildlife Management Area, Pocomoke State Forest

Signature State Rare Plants: Flat-stem Spikerush (*Eleocharis compressa*), water-plantain spearwort (*Ranunculus ambigens*), catchfly cutgrass (*Leersia lenticularis*), veined skullcap (*Scutellaria nervosa*), red turtlehead (*Chelone obliqua*)

State Rare Natural Communities: Bald Cypress Swamp, Atlantic White Cedar Swamp

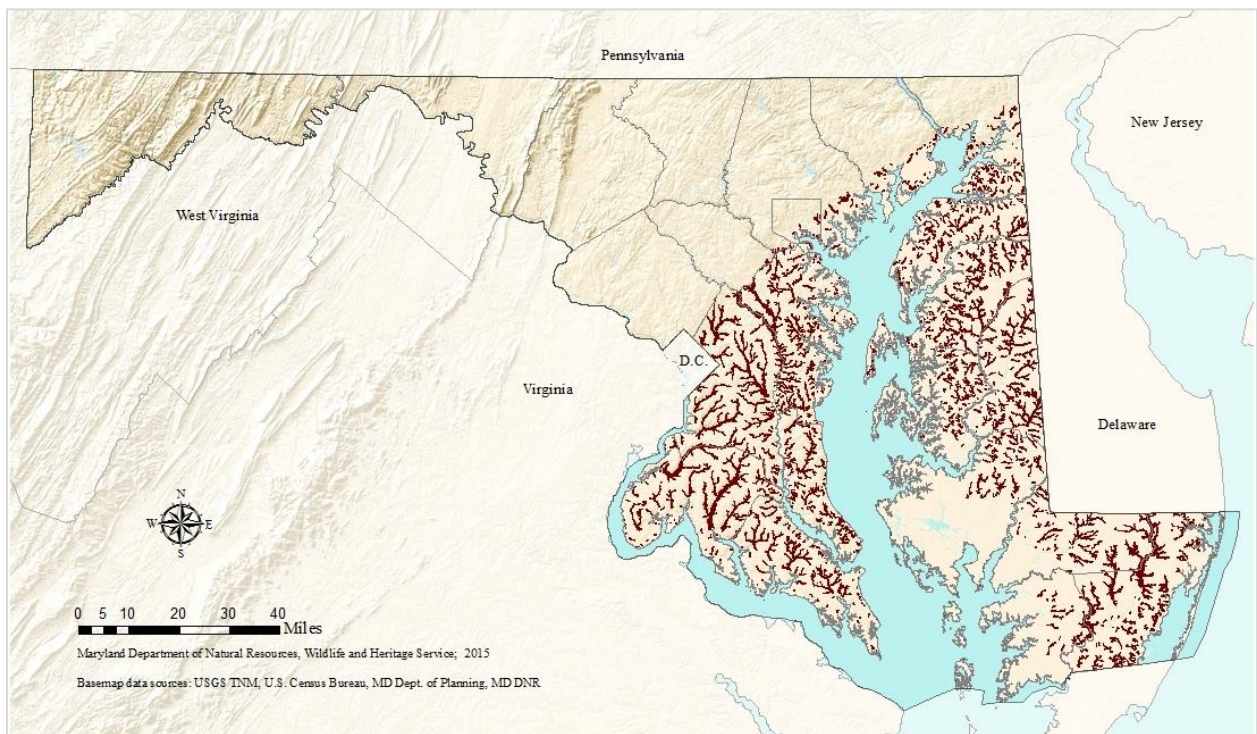


Figure 4.22 Location of Coastal Plain Floodplains in Maryland. Sources: MD DNR, FEMA.



Species of Greatest Conservation Need Associated with Coastal Plain Floodplains:

Mammals	Birds cont.	Insects (Butterflies & Moths)
American mink Big brown bat Bobcat Delmarva fox squirrel Eastern red bat Evening bat Hoary bat Least shrew Seminole bat Silver-haired bat Southeastern myotis Southeastern shrew Southeastern star-nosed mole Southern bog lemming Southern pygmy shrew Tricolored bat	Hooded warbler Kentucky warbler Lesser yellowlegs Louisiana waterthrush Northern parula Ovenbird Prothonotary warbler Red-headed woodpecker Rusty blackbird Scarlet tanager Spotted sandpiper Swainson's warbler Veery Wayne's black-throated green warbler Willow flycatcher Wood thrush Worm-eating warbler Yellow-breasted chat Yellow-crowned night-heron Yellow-throated vireo	Bronze copper Carolina satyr Chermock's mulberry wing Cypress sphinx moth Dion skipper Great purple hairstreak Hessel's hairstreak King's hairstreak Marbled underwing Palamedes swallowtail Precious underwing A noctuid moth (<i>Meropleon titan</i>)
		Insects (Dragonflies and Damselflies)
		Bar-winged skimmer Duckweed firetail Elfin skimmer Fine-lined emerald Four-spotted pennant
		Dragonflies and Damselflies cont.
		Furtive forktail Golden-winged skimmer Harlequin darner Martha's pennant Robust baskettail Stripe-winged baskettail Taper-tailed darner White-faced meadowhawk
		Other Insects
		Pitcher-plant mosquito
		Crustaceans
		Digger crayfish An amphipod (<i>Crangonyx stagnicolous</i>)
		Invertebrates (Snails)
		Chesapeake ambersnail Coastal-plain ambersnail Cylindrically-ornate wood snail Snowhill ambersnail
Birds		
Acadian flycatcher American black duck American redstart American woodcock Bald eagle Bank swallow Bicknell's thrush Black-and-white warbler Black-crowned night-heron Blue-winged warbler Broad-winged hawk Brown creeper Chuck-will's-widow Great blue heron Great egret Greater yellowlegs	Reptiles	
	Coastal Plain milksnake Common ribbonsnake Eastern box turtle Eastern kingsnake Mole kingsnake Northern map turtle Plain-bellied watersnake Rainbow snake Spotted turtle	
	Amphibians	
	Eastern mud salamander Eastern narrow-mouthed toad	



Groundwater Wetlands

Montane Bog and Fen

The Montane Bog and Fen key wildlife habitat is represented by open Acidic Seepage Wetlands supporting a patchwork of saturated shrub and herbaceous vegetation. The term “bog” is actually a technical misnomer, and in strict usage applies only to peatlands that are rainwater fed (i.e., ombrotrophic). We have adopted it here for consistency since this term is so widely used throughout much of the region to describe open, acidic seepage wetlands. In Maryland, bogs and fens are groundwater-fed (i.e., minerotrophic) and best developed on seepage slopes, along headwater streams, oxbows of streams, margins of beaver ponds, established millponds, and sandpits. Soils vary from mineral to deep peat, are extremely acidic and nutrient poor, and often support a variety of *Sphagnum* mosses. Bogs on the Appalachian Plateau are uncommon habitats often occurring in openings on seepage slopes and along streams bordered by forests of red spruce (*Picea rubens*), eastern hemlock (*Tsuga canadensis*), white pine (*Pinus strobus*), larch (*Larix* spp.), red maple (*Acer rubrum*), and black gum (*Nyssa sylvatica*). The openings contain a diverse flora often including Virginia cotton-grass (*Eriophorum virginicum*), rose pogonia (*Pogonia ophioglossoides*), round-leaf sundew (*Drosera rotundifolia* var. *rotundifolia*), cranberry (*Vaccinium* spp.), and a variety of ferns, rushes, and sedges. Dense mats of sphagnum and haircap mosses are also characteristic of many Montane Bogs and Fens. Shrubs common to these habitats include speckled alder (*Alnus incana* ssp. *rugosa*), narrow-leaved meadowsweet (*Spiraea alba*), mountain holly (*Ilex montana*), and black chokeberry (*Aronia melanocarpa*). The density of shrubs is variable among sites and can range from being scattered to dense impenetrable thickets. Many disturbed examples of these wetlands are dominated by alder or silky dogwood (*Cornus amomum*).



Peter Stango, MD DNR

County Distribution: Allegany, Garrett

Places to Visit: Mt. Nebo Wildlife Management Area, Cranesville Swamp (The Nature Conservancy), Finzel Swamp (The Nature Conservancy)

Signature State Rare Plants: Bog Jacob’s ladder (*Polemonium vanbruntiae*), horned bladderwort (*Utricularia cornuta*), slender cottongrass (*Eriophorum gracile*), American larch (*Larix laricina*), bog buckbean (*Menyanthes trifoliata*), Fernald’s mannagrass (*Torreyochloa pallida* var. *fernaldii*), lake-bank sedge (*Carex lacustris*), Buxbaum’s sedge (*Carex buxbaumii*), small cranberry (*Vaccinium oxycoccos*)

State Rare Natural Community: Montane Peatland



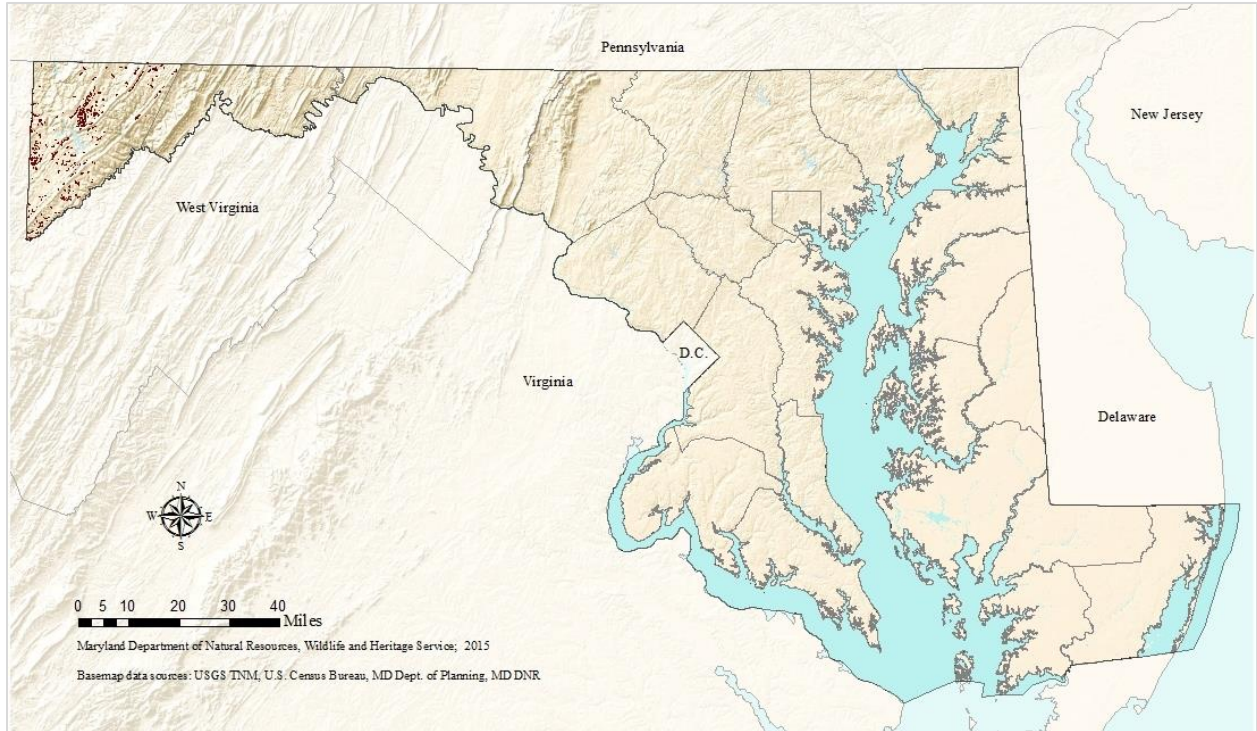


Figure 4.23 Location of Montane Bogs and Fens in Maryland. Sources: MD DNR, USFWS.

Species of Greatest Conservation Need Associated with Montane Bogs and Fens:

Mammals	Birds cont.	Insects (Dragonflies and Damselflies)
American mink	Northern parula	Amber-winged spreadwing
Big brown bat	Northern saw-whet owl	American emerald
Bobcat	Northern waterthrush	Bar-winged skimmer
Eastern red bat	Olive-sided flycatcher	Beaverpond baskettail
Hoary bat	Ovenbird	Black-tipped darner
Indiana myotis	Pine siskin	Brush-tipped emerald
Least shrew	Red-breasted nuthatch	Dragonflies and Damselflies cont.
Little brown myotis	Ruffed grouse	Canada darner
North American porcupine	Rusty blackbird	Chalk-fronted skimmer
Northern long-eared bat	Scarlet tanager	Comet darner
Silver-haired bat	Sedge wren	Crimson-ringed whiteface
Smoky shrew	Sora	Dot-tailed whiteface
Southern bog lemming	Spotted sandpiper	Dusky clubtail
Southern pygmy shrew	Swainson's thrush	Frosted whiteface
Southern water shrew	Veery	Golden-winged skimmer
Tricolored bat	Willow flycatcher	Green-striped darner
Virginia northern flying squirrel	Winter wren	Harlequin darner
	Wood thrush	Hudsonian whiteface
	Worm-eating warbler	Northern bluet
	Yellow-bellied sapsucker	Rainbow bluet



Birds	Amphibians	Dragonflies and Damselflies cont.
Acadian flycatcher	Mountain chorus frog	Ski-tailed emerald
Alder flycatcher	Reptiles	Spotted spreadwing
American bittern	Eastern box turtle	Spring blue darner
American black duck	Mountain earthsnake	Sweetflag spreadwing
American redstart	Northern coal skink	Tule bluet
American woodcock	Smooth greensnake	Dragonflies and Damselflies cont.
Black-and-white warbler	Spotted turtle	White-faced meadowhawk
Blackburnian warbler	Timber rattlesnake	Yellow-sided skimmer
Black-throated blue warbler	Insects (Butterflies & Moths)	Invertebrates (Snails)
Black-throated green warbler	Atlantis fritillary	Spruce knob threetooth
Blue-winged warbler	Baltimore checkerspot	Striped whitelip
Brown creeper	Black dash	
Canada warbler	Bog copper	
Dark-eyed junco	Harris's checkerspot	
Golden-crowned kinglet	Hoary elfin	
Golden-winged warbler	Long dash	
Hooded warbler	Monarch	
Kentucky warbler	Mulberry wing	
Lesser yellowlegs	Pepper and salt skipper	
Louisiana waterthrush	Pink-edged sulphur	
Magnolia warbler	Silver-bordered fritillary	
Nashville warbler	Two-spotted skipper	
Northern harrier	A noctuid moth (<i>Melanapamea mixta</i>)	

Montane-Piedmont Acidic Seepage Swamp

The Montane-Piedmont Acidic Seepage Swamp key wildlife habitat of the Piedmont and mountain regions is characterized by gently sloping seepage swamps of small headwaters, large spring seeps, ravine bottoms, and toe-slopes. Seepage swamps develop where groundwater is forced to the surface along an impermeable clay or rock layer due to hydrostatic pressure resulting from gravity or artesian flow. They often have a diffuse drainage pattern of braided channels and rivulets that typically remain saturated throughout the year due to perennial groundwater seepage. The soils are acidic and derived from the weathering of sandstone, quartzite, and granitic bedrock. In this case, the hydrology and acidic soils of seepage swamps in the Piedmont and mountain regions combine to support a very distinctive flora. Acidic Seepage Swamps are structurally forests and woodlands with canopies ranging from closed to semi-open canopy. Canopy trees commonly include red maple (*Acer rubrum*), tulip-poplar (*Liriodendron tulipifera*), black gum (*Nyssa sylvatica*), and yellow birch (*Betula alleghaniensis*), red spruce (*Picea rubens*), eastern hemlock (*Tsuga canadensis*) at higher elevations. Small openings of shrubs and herbs are typical in areas of windfall or beaver activity. Shrubs vary depending on the region and elevation but common species may include winterberry (*Ilex verticillata*), swamp azalea (*Rhododendron viscosum*), highbush blueberry (*Vaccinium corymbosum*), great-laurel



(*Rhododendron maximum*), mountain-laurel (*Kalmia latifolia*), speckled alder (*Alnus incana* spp. *rugosa*), and southern arrow-wood (*Viburnum dentatum*). The forest floor is comprised of sphagnum moss covered hummocks and mucky hollows frequently dominated by skunk cabbage (*Symplocarpus foetidus*), American false-hellebore (*Veratrum viride*), and cinnamon fern (*Osmunda cinnamomea*). Other common associates may include long sedge (*Carex folliculata*), gray bog sedge (*Carex canescens*), three-seed sedge (*Carex trisperma* var. *trisperma*), white-edged sedge (*Carex debilis*), marsh-marigold (*Caltha palustris*), and various orchids, buttercups, and asters.

County Distribution: Allegany, Baltimore, Carroll, Cecil, Frederick, Garrett, Harford, Howard, Montgomery, Washington

Places to Visit: Cranesville Swamp (The Nature Conservancy), Finzel Swamp (The Nature Conservancy), Mt. Nebo Wildlife Management Area, Savage River State Forest, Sugarloaf Mountain

Signature State Rare Plants: Nannyberry (*Viburnum lentago*), Clinton lily (*Clintonia borealis*)

State Rare Natural Communities: High Elevation Seepage Swamp, Montane-Piedmont Acidic Seepage Swamp



Richard Orr



Jessica McPherson



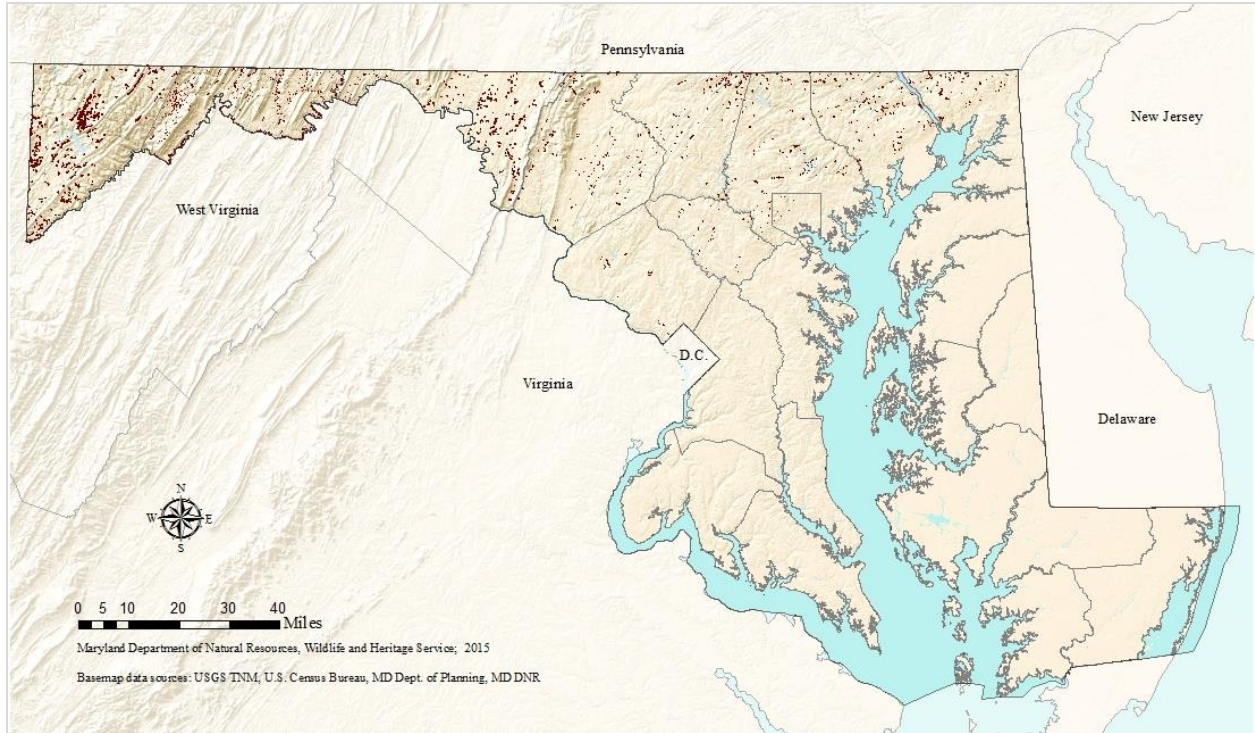


Figure 4.24 Location of Montane-Piedmont Acidic Seepage Swamps in Maryland. Sources: MD DNR, NETWHCS, Terrestrial Ecological System for the U.S., USFWS.

Species of Greatest Conservation Need Associated with Montane-Piedmont Acidic Seepage Swamps:

Mammals	Birds	Reptiles
American mink	Acadian flycatcher	Common ribbonsnake
Big brown bat	American redstart	Eastern box turtle
Bobcat	American woodcock	Smooth greensnake
Eastern red bat	Black-and-white warbler	Spotted turtle
Evening bat	Blackburnian warbler	Mountain chorus frog
Hoary bat	Black-throated blue warbler	Upland chorus frog
Indiana myotis	Black-throated green warbler	Insects (Butterflies & Moths)
Little brown myotis	Blue-winged warbler	Baltimore checkerspot
Northern long-eared bat	Canada warbler	Black dash
Seminole bat	Dark-eyed junco	Indian skipper
Silver-haired bat	Golden-winged warbler	Long dash
Southern bog lemming	Hooded warbler	Mulberry wing
Southern rock vole	Kentucky warbler	Pepper and salt skipper
Tricolored bat	Louisiana waterthrush	Insects (Dragonflies and Damselflies)
	Magnolia warbler	Arrowhead spiketail
	Northern parula	Brown spiketail
	Northern waterthrush	Delta-spotted spiketail
	Ovenbird	



	Birds cont.	Dragonflies and Damselflies cont.
	Prothonotary warbler Ruffed grouse Scarlet tanager Veery Willow flycatcher Winter wren Wood thrush	Gray petaltail Petite emerald Seepage dancer Sphagnum sprite Tiger spiketail

Montane-Piedmont Basic Seepage Swamp

The Montane-Piedmont Basic Seepage Swamp key wildlife habitat is characterized by saturated deciduous forests of gently sloping stream headwaters, large spring seeps, and lateral areas in ravines and stream bottoms where groundwater emerges at the base of slopes. Habitats are underlain by metabasalt (greenstone), base-rich granite, calcareous shale, and limestone, and usually have considerable cover of bouldery, cobbly, and gravelly alluvium; braided seeps and stream channels; moss (*Sphagnum* spp.) covered hummocks; and muck-filled depressions. Soils range from strongly acidic to circumneutral, with moderately high calcium and magnesium levels.



Jason Harrison, MD DNR

County Distribution: Allegany, Baltimore, Carroll, Cecil, Frederick, Garrett, Harford, Howard, Montgomery, Washington

Places to Visit: Catoctin Mountain Park, Gunpowder Falls State Park, Patapsco Valley State Park

Signature State Rare Plants: Glade spurge/Darlington’s spurge (*Euphorbia purpurea*), queen-of-the-prairie (*Filipendula rubra*), swamp lousewort (*Pedicularis lanceolata*)

State Rare Natural Community: Montane-Piedmont Basic Seepage Swamp



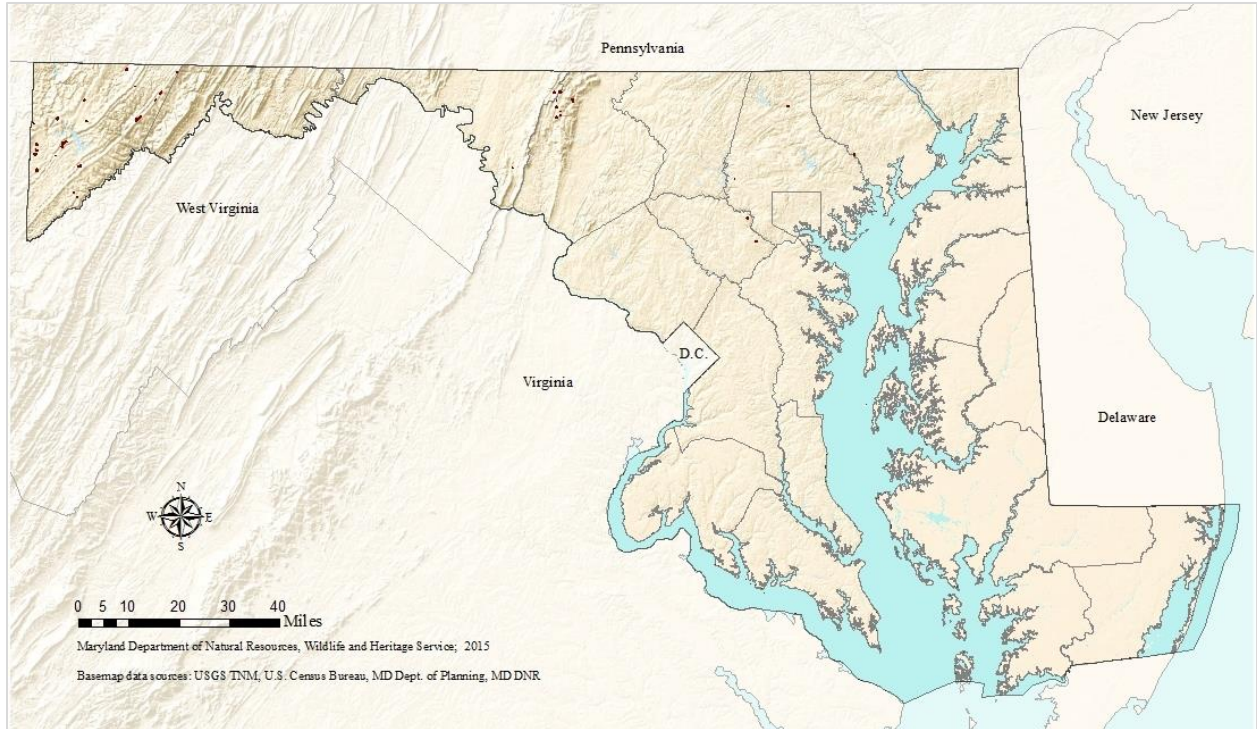


Figure 4.25 Location of Montane-Piedmont Basic Seepage Swamps in Maryland. Sources: MD DNR, USFWS.

Species of Greatest Conservation Need Associated with Montane-Piedmont Basic Seepage Swamps:

Mammals	Birds	Reptiles
American mink	Acadian flycatcher	Common ribbonsnake
Big brown bat	American redstart	Eastern box turtle
Bobcat	American woodcock	Smooth greensnake
Eastern red bat	Black-and-white warbler	Spotted turtle
Evening bat	Black-throated blue warbler	Amphibians
Hoary bat	Black-throated green warbler	Mountain chorus frog
Indiana myotis	Blue-winged warbler	Northern red salamander
Little brown myotis	Canada warbler	Upland chorus frog
Northern long-eared bat	Dark-eyed junco	Insects (Butterflies & Moths)
Seminole bat	Golden-winged warbler	Baltimore checkerspot
Silver-haired bat	Hooded warbler	Black dash
Southern bog lemming	Kentucky warbler	Indian skipper
Southern rock vole	Louisiana waterthrush	Long dash
Tricolored bat	Northern parula	Mulberry wing
	Northern waterthrush	Pepper and salt skipper
	Ovenbird	Insects (Dragonflies and Damselflies)
	Prothonotary warbler	Arrowhead spiketail
	Ruffed grouse	Brown spiketail
	Scarlet tanager	Delta-spotted spiketail



	Birds cont.	Dragonflies and Damselflies cont.
	Veery Willow flycatcher Winter wren Wood thrush	Gray petaltail Petite emerald Seepage dancer Sphagnum sprite Tiger spiketail

Piedmont Seepage Wetland

The Piedmont Seepage Wetland key wildlife habitat encompasses open, graminoid-dominated meadows and shrub swamps scattered throughout low stream valleys of the Piedmont. They are common features at the toeslopes of rolling hills and margins of floodplains where groundwater seepage can be found throughout much of the year. The water table is usually at or near the surface throughout much of the growing season causing most habitats to remain saturated, but conditions may vary yearly from site to site. The substrates of Piedmont Seepage Wetlands are primarily comprised of mineral soils with mucky, organic surficial layers. The vegetation structure varies from graminoid-dominated meadows of tussock sedge (*Carex stricta*), common rush (*Juncus effusus*), wood reedgrass (*Cinna arundinacea*), and rice cutgrass (*Leersia oryzoides*) to a patchwork of shrub swamps dominated by alder (*Alnus* spp.), meadowsweet (*Spiraea* spp.), southern arrow-wood (*Viburnum dentatum*), buttonbush (*Cephalanthus occidentalis*), spicebush (*Lindera benzoin*), marsh rose (*Rosa palustris*), and black willow (*Salix nigra*). Other common species include jewelweed (*Impatiens* spp.), skunk cabbage (*Symplocarpus foetidus*), sensitive fern (*Onoclea sensibilis*), wood reedgrass (*Cinna arundinacea*), woolgrass (*Scirpus cyperinus*), Joe pye-weed (*Eupatorium dubium*), American golden saxifrage (*Chrysosplenium americanum*), sallow sedge (*Carex lurida*), tearthumbs (*Polygonum* spp.), and marsh fern (*Thelypteris palustris* var. *pubescens*). In addition, purple loosestrife (*Lythrum salicaria*), common reed (*Phragmites australis*), Japanese stilt-grass (*Microstegium vimineum*), and reed canary grass (*Phalaris arundinacea*) are frequently reported non-native invasive plants in these habitats. Though trees are relatively unimportant in these habitats, woody plant succession of red maple (*Acer rubrum*) is a common problem that usually indicates a cessation of grazing or other forms of disturbance.



Bonnie Ott

County Distribution: Baltimore, Carroll, Cecil, Frederick, Harford, Howard, Montgomery
Places to Visit: Fair Hill Natural Resource Management Area, Rocks State Park, Eden Mill Nature Center, Gunpowder Falls State Park, Little Bennett Regional Park

Signature State Rare Plants: Canada burnet (*Sanguisorba canadensis*)

State Rare Natural Community: Montane - Piedmont Wet Meadow/Fen



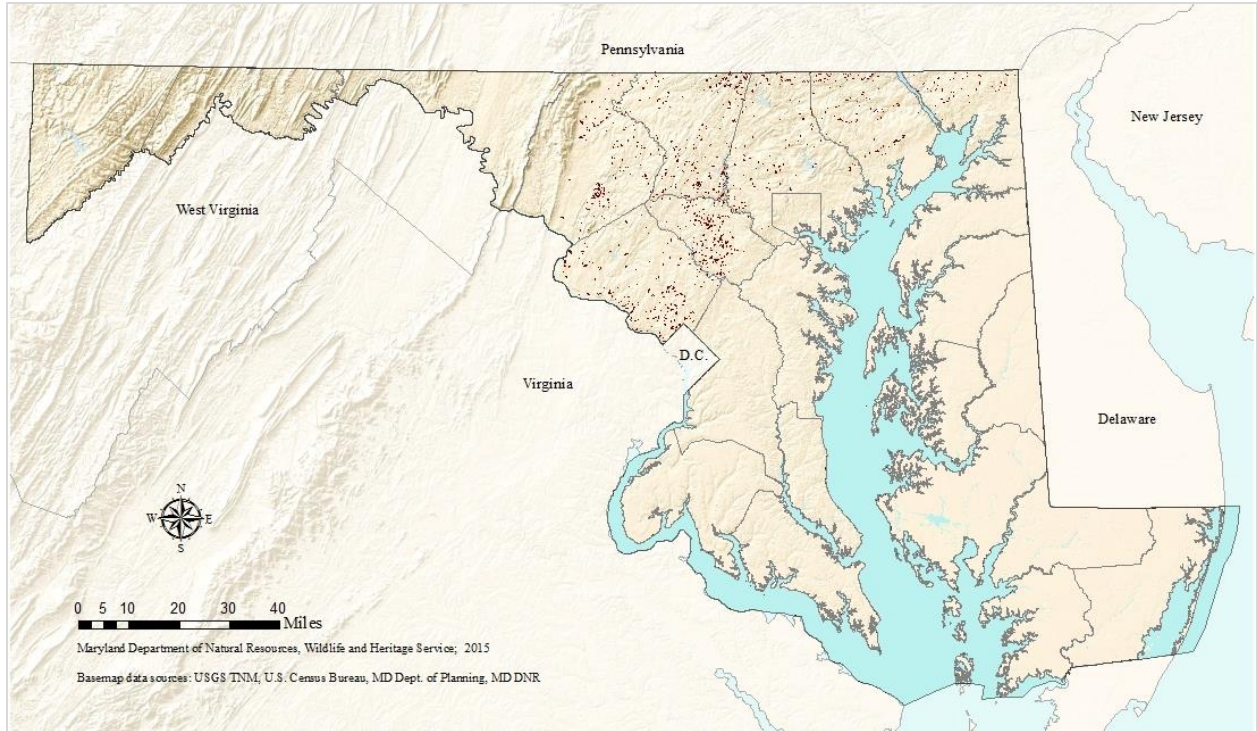


Figure 4.26 Location of Piedmont Seepage Wetlands in Maryland. Sources: MD DNR, NETWHCS.

Species of Greatest Conservation Need Associated with Piedmont Seepage Wetlands:

Mammals	Birds	Insects (Butterflies & Moths)
American mink	Acadian flycatcher	Baltimore checkerspot
Big brown bat	American redstart	Black dash
Bobcat	American woodcock	Bronze copper
Eastern red bat	Blue-winged warbler	Indian skipper
Evening bat	Willow flycatcher	Long dash
Hoary bat		Monarch
Indiana myotis	Reptiles	Mulberry wing
Little brown myotis	Bog turtle	
Northern long-eared bat	Common ribbonsnake	Insects (Dragonflies and Damselflies)
Seminole bat	Eastern box turtle	Arrowhead spiketail
Silver-haired bat	Spotted turtle	Brown spiketail
Southeastern shrew	Amphibians	Gray petaltail
Southern bog lemming	Northern red salamander	Petite emerald
Southern pygmy shrew	Upland chorus frog	Seepage dancer
Tricolored bat		Sphagnum sprite
		Tiger spiketail
		Yellow-sided skimmer



Piedmont Upland Depression Swamp

The Piedmont Upland Depression Swamp key wildlife habitat includes seasonally flooded forested wetlands characterized by shallow bedrock or clay hardpans that impede soil drainage. This results in standing water throughout the early part of the growing season, followed by a period of drawdown. The hydroperiods are variable between swamps and largely depend on rainfall and drought cycles. The forested canopy structure of Upland Depression Swamps ranges from open to closed and is primarily oak dominated with other hardwoods less frequent. Common tree species include willow oak (*Quercus phellos*), pin oak (*Quercus palustris*), swamp chestnut oak (*Quercus michauxii*), swamp white oak (*Quercus bicolor*), green ash (*Fraxinus pennsylvanica*), red maple (*Acer rubrum*), and black gum (*Nyssa sylvatica*). In the understory, shrubs and vines are common but variable, often including an abundance of common greenbrier. The herbaceous layer is often sparse and may include species of sedges, manna-grasses, and rushes. Slightly elevated hummocks of *Sphagnum* mosses frequently form large patches. Piedmont Upland Depression Swamps are isolated wetlands subject to major disturbances such as logging, draining, and development. In Maryland, many finer-scale plant communities associated with Piedmont Upland Depression Swamps are considered rare.



Jason Harrison, MD DNR

County Distribution: Baltimore, Carroll, Cecil, Frederick, Harford, Howard, Montgomery

Places to Visit: C&O Canal National Historical Park, Hoyles Mill Conservation Park

State Rare Natural Community: Upland Depression Swamp



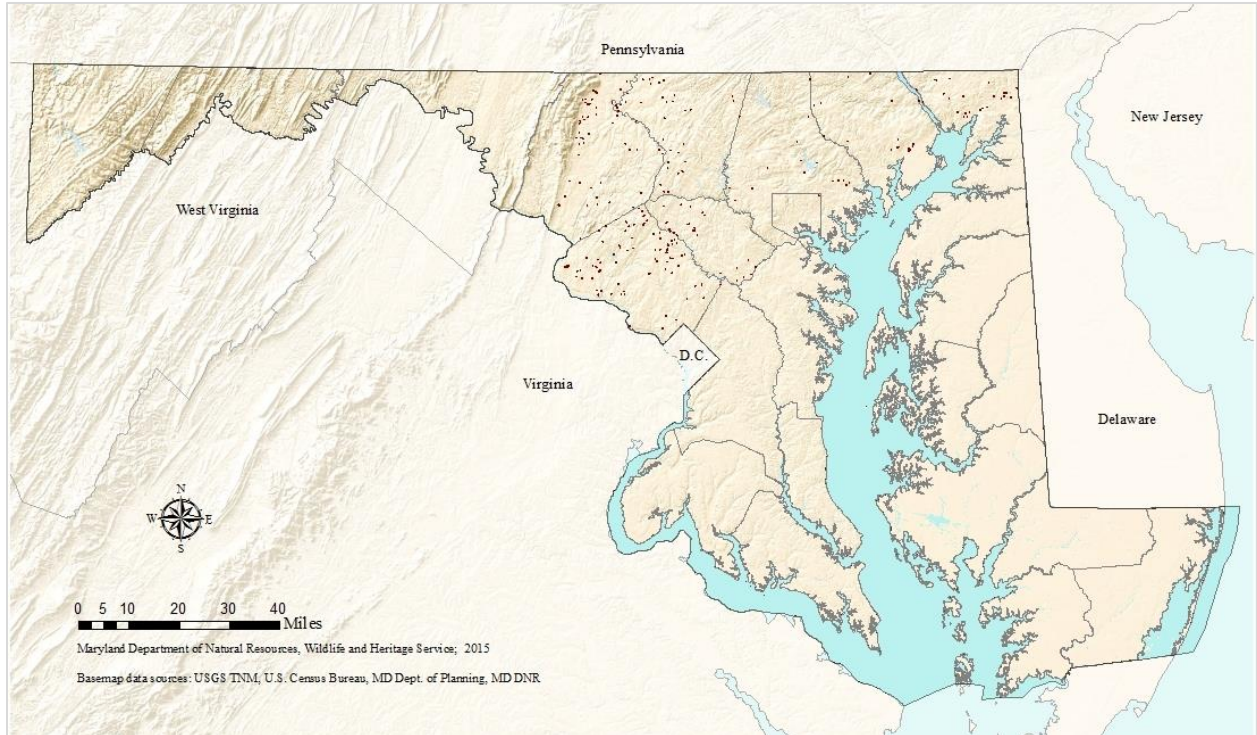


Figure 4.27 Location of Piedmont Upland Depression Swamps in Maryland. Source: MD DNR.

Species of Greatest Conservation Need Associated with Piedmont Upland Depression Swamps:

Mammals	Birds	Reptiles
American mink	Acadian flycatcher	Common ribbonsnake
Big brown bat	American redstart	Spotted turtle
Bobcat	American woodcock	Amphibians
Eastern red bat	Black-and-white warbler	Upland chorus frog
Evening bat	Blue-winged warbler	Insects (Dragonflies and Damselflies)
Hoary bat	Hooded warbler	Bar-winged skimmer
Indiana myotis	Kentucky warbler	Harlequin darter
Little brown myotis	Louisiana waterthrush	White-faced meadowhawk
Northern long-eared bat	Northern parula	
Seminole bat	Ovenbird	
Silver-haired bat	Prothonotary warbler	
Southeastern shrew	Scarlet tanager	
Southern bog lemming	Veery	
Southern pygmy shrew	Willow flycatcher	
Tricolored bat	Wood thrush	
	Worm-eating warbler	
	Yellow-throated vireo	



Coastal Plain Flatwood and Depression Swamp

The Coastal Plain Flatwood and Depression Swamp key wildlife habitat includes seasonally flooded flatwoods and depressions of the Coastal Plain. These habitats develop on flat terraces and shallow depressions with seasonally perched water tables. This results in standing water throughout the early part of the growing season followed by a period of drawdown. Hydroperiods are variable between swamps and largely dependent on rainfall and drought cycles. The forested canopy structure of flatwoods and depression swamps range from open to closed with composition ranging from hardwood dominated to a



Scott Smith, MD DNR

mixtures of hardwoods and pines. Swamps dominated by oak species such as willow oak (*Quercus phellos*), pin oak (*Quercus palustris*), swamp chestnut oak (*Quercus michauxii*), and cherrybark oak (*Quercus pagoda*) are generally considered as higher quality because much of today's remaining stands are characterized by successional hardwoods such as red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), black gum (*Nyssa sylvatica*), and American holly (*Ilex opaca* var. *opaca*). Loblolly pine (*Pinus taeda*) is a prominent component of many flatwoods on the lower Coastal Plain. Other species commonly encountered in these habitats include green ash (*Fraxinus pennsylvanica*), overcup oak (*Quercus lyrata*), and swamp tupelo (*Nyssa biflora*). State rare natural communities within this key wildlife habitat include depressions with mixtures of Atlantic white cedar (*Chamaecyparis thyoides*), swamp tupelo, pond pine (*Pinus serotina*), and sweetbay magnolia (*Magnolia virginiana*). In the understory, shrubs and vines are common but variable, often including an abundance of common greenbrier (*Smilax rotundifolia*). The herbaceous layer is often sparse and may include species of sedges, manna-grasses, and rushes. Slightly elevated hummocks of sphagnum mosses frequently form large patches. Coastal Plain Flatwoods and Depression Swamps have been greatly reduced in extent in Maryland through ditching, draining, logging, and conversion to agriculture and pine plantations.

County Distribution: Anne Arundel, Baltimore, Calvert, Caroline, Cecil, Charles, Dorchester, Harford, Kent, Prince George's, Queen Anne's, Somerset, St. Mary's, Talbot, Wicomico, Worcester

Places to Visit: Blackwater National Wildlife Refuge, LeCompte Wildlife Management Area, Millington Wildlife Management Area, Third Haven Woods (The Nature Conservancy)

Signature State Rare Plants: Three-angle spikerush (*Eleocharis tricostata*), southern waxy sedge (*Carex glaucescens*), white-bracted boneset (*Eupatorium leucolepis*)



State Rare Natural Communities: Coastal Plain Non-Riverine Hardwood Swamps, Atlantic White Cedar Swamp, Upland Depression Swamp

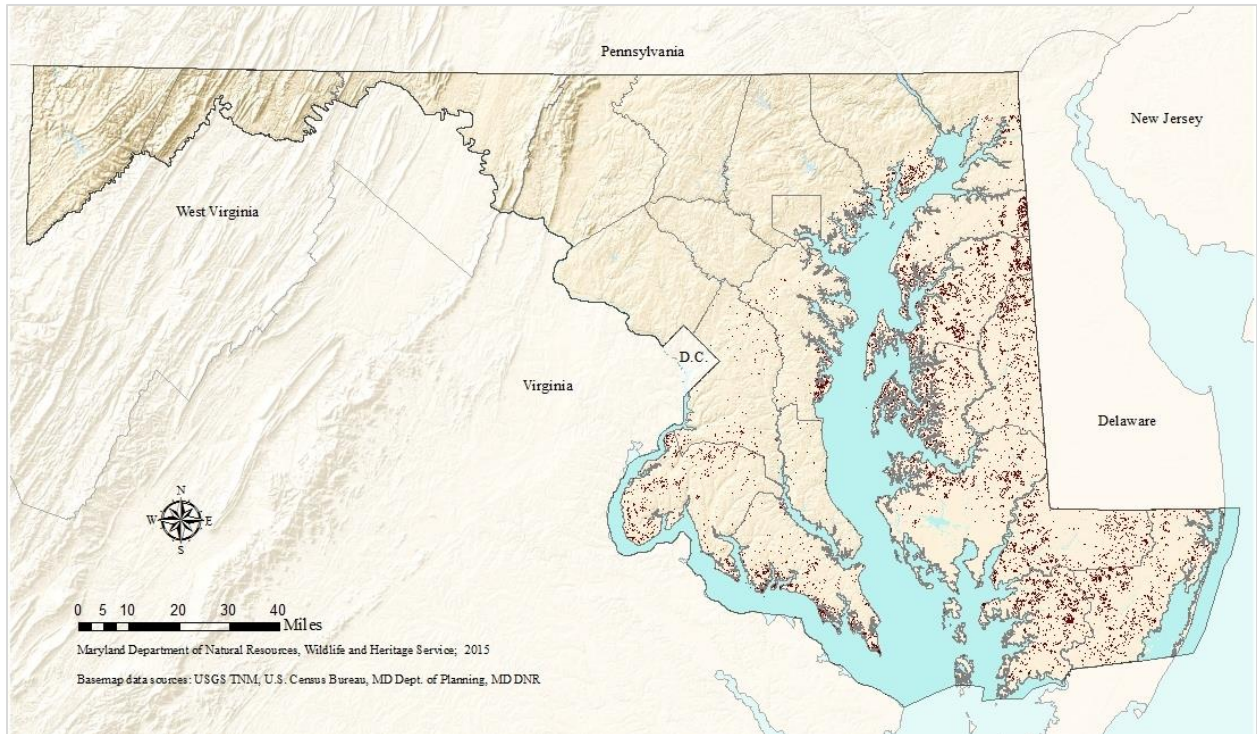


Figure 4.28 Location of Coastal Plain Flatwoods and Depression Swamps in Maryland. Source: MD DNR.

Species of Greatest Conservation Need Associated with Coastal Plain Flatwoods and Depression Swamps:

Mammals	Birds	Reptiles
American mink	Acadian flycatcher	Coastal Plain milksnake
Big brown bat	American redstart	Common ribbonsnake
Bobcat	American woodcock	Eastern box turtle
Delmarva fox squirrel	Bicknell's thrush	Eastern kingsnake
Eastern red bat	Black-and-white warbler	Mole kingsnake
Evening bat	Broad-winged hawk	Northern scarletsnake
Hoary bat	Chuck-will's-widow	Plain-bellied watersnake
Seminole bat	Eastern whip-poor-will	Rainbow snake
Silver-haired bat	Great blue heron	Amphibians
Southeastern myotis	Great egret	Barking treefrog
Southeastern shrew	Hooded warbler	Carpenter frog
Southeastern star-nosed mole	Kentucky warbler	Eastern narrow-mouthed toad
Southern bog lemming	Louisiana waterthrush	Eastern tiger salamander
Southern pygmy shrew	Northern bobwhite	Insects (Butterflies & Moths)
Tricolored bat	Northern parula	Hessel's hairstreak
	Ovenbird	



	Birds cont.	Dragonflies and Damselflies
	Prothonotary warbler	Bar-winged skimmer
	Red-cockaded woodpecker	Harlequin darner
	Red-headed woodpecker	Taper-tailed darner
	Scarlet tanager	White-faced meadowhawk
	Wood thrush	Invertebrates (Crayfish)
Worm-eating warbler	Digger crayfish	
Yellow-throated vireo	An amphipod (<i>Cragonyx stagnicolous</i>)	
	Invertebrates (Snails)	
		Cylindrically-ornate wood snail

Coastal Plain Seepage Swamp

The Coastal Plain Seepage Swamp key wildlife habitat is characterized by gently sloping forests of small headwaters, ravine bottoms, and toe-slopes where groundwater is discharged at ground surface and carried away as stream flow. Often the groundwater seepage is perennial and characterized by diffuse drainage and braided channels with sand, gravel, or peaty substrates. Soils are typically moderately to strongly acidic and nutrient-poor; however, basic seepage swamps may develop in ravines that have downcut into tertiary-aged shell marl deposits. Coastal Plain Seepage Swamps are associated with mostly closed to semi-open canopies of red maple (*Acer rubrum*), black gum (*Nyssa sylvatica*), tulip-poplar (*Liriodendron tulipifera*), sweetbay magnolia (*Magnolia virginiana*), green ash (*Fraxinus pennsylvanica*), white ash (*Fraxinus americana*), and pitch pine (*Pinus rigida*). The shrub and herbaceous layers in many Coastal Plain Seepage Swamps are diverse and recognized by dense patches of skunk cabbage (*Symplocarpus foetidus*) and colonies of ferns such as cinnamon fern (*Osmunda cinnamomea*), marsh fern (*Thelypteris palustris* var. *pubescens*), royal fern (*Osmunda regalis* var. *spectabilis*), New York fern (*Thelypteris noveboracensis*), and netted chain fern (*Woodwardia areolata*). Other notable plants include jewelweed (*Impatiens* spp.), small green wood orchid (*Platanthera clavellata*), Virginia bugleweed (*Lycopus virginicus*), Jack-in-the-pulpit (*Arisaema triphyllum*), false nettle (*Boehmeria cylindrical*), and numerous sedges. In addition, hummocks of peat mosses can be quite abundant and diagnostic to Coastal Plain Seepage Swamps of acidic substrates. The shrub layer may include winterberry (*Ilex verticillata*), sweet pepper-bush (*Clethra alnifolia*), swamp azalea (*Rhododendron viscosum*), spicebush (*Lindera benzoin*), possum-haw (*Viburnum nudum*), highbush blueberry (*Vaccinium corymbosum*), and vines of poison-ivy (*Toxicodendron radicans*), greenbrier (*Smilax* spp.), and Virginia creeper (*Parthenocissus quinquefolia*). Coastal Plain Seepage Swamps are naturally small-patched habitats vulnerable to hydrological disturbances, beaver activity, logging, and surface runoff.



Richard Wiegand, MD DNR



County Distribution: Anne Arundel, Baltimore, Calvert, Caroline, Cecil, Charles, Dorchester, Harford, Kent, Prince George’s, Queen Anne’s, Somerset, St. Mary’s, Talbot, Wicomico, Worcester

Places to Visit: Elk Neck State Forest, Tuckahoe State Park, Pocomoke State Forest

Signature State Rare Plants: Swamp pink (*Helonias bullata*), dwarf huckleberry (*Gaylussacia dumosa*)

State Rare Natural Community: Coastal Plain-Piedmont Acidic Seepage Swamp

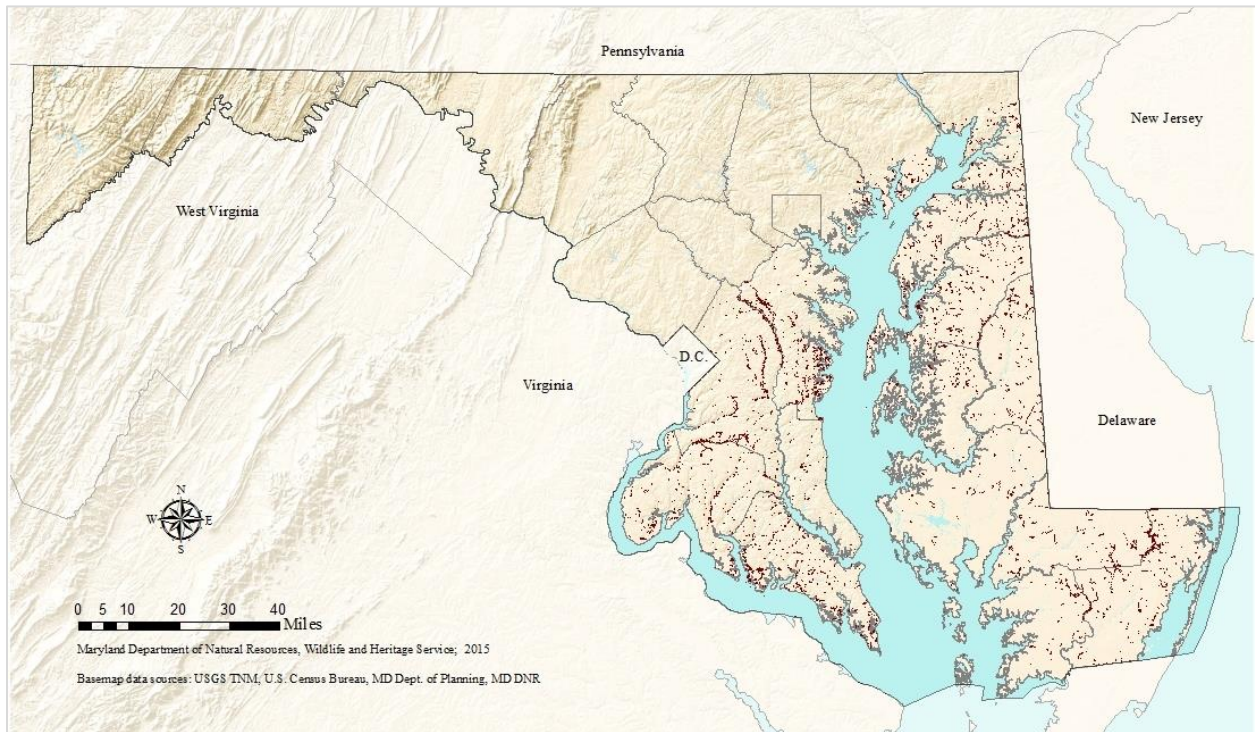


Figure 4.29 Location of Coastal Plain Seepage Swamps in Maryland. Sources: MD DNR, USFWS.

Species of Greatest Conservation Need Associated with Coastal Plain Seepage Swamps:

Mammals	Birds	Amphibians
American mink	Acadian flycatcher	Carpenter frog
Big brown bat	American redstart	Eastern mud salamander
Bobcat	American woodcock	Northern red salamander
Eastern red bat	Black-and-white warbler	Insects (Butterflies & Moths)
Evening bat	Hooded warbler	Bronze copper
Hoary bat	Kentucky warbler	Chermock's mulberry wing
Seminole bat	Louisiana waterthrush	Dion skipper
Silver-haired bat	Northern parula	Precious underwing
Southeastern myotis	Ovenbird	Insects (Dragonflies and Damselflies)
Southeastern shrew	Prothonotary warbler	Arrowhead spiketail
Southeastern star-nosed mole	Scarlet tanager	Bar-winged skimmer



Mammals cont.	Birds cont.	Dragonflies and Damselflies cont.
Southern bog lemming Southern pygmy shrew Tricolored bat	Wood thrush	Brown spiketail Delta-spotted spiketail Elfin skimmer Fine-lined emerald Gray petaltail Seepage dancer Sphagnum sprite Tiger spiketail Treetop emerald Yellow-sided skimmer
	Reptiles	
	Common ribbonsnake	
	Eastern box turtle	
	Eastern kingsnake	
	Rainbow snake	
	Spotted turtle	
		Crustaceans
		Digger crayfish
		Invertebrates (Snails)
		Cylindrically-ornate wood snail

Coastal Plain Seepage Bog and Fen

The Coastal Plain Seepage Bog and Fen key wildlife habitat is a rare, small-patched habitat associated with seepage toeslopes, small stream bottoms, and the margins of long established millponds and sandpits. They typically develop at the base of sand and gravel terraces near streams where groundwater seepage is abundant and forced to the surface by an impermeable clay lens or aquiclude. The soils are usually peaty or sandy, very acidic, infertile, and often covered by dense mats of mosses (*Sphagnum* spp.) that support a unique flora. The term "bog" as applied to these wetlands, is a technical misnomer, since not all of these habitats are true peatlands and none is an ombrotrophic (i.e., fed by rainwater) system. This term, however, is now so widely used in the southeastern United States as a descriptor for open, acidic seepage wetlands that we have adopted it here for consistency. In Maryland, Coastal Plain Seepage Bogs and Fens exist in a variety of open settings and many are relicts of older, larger systems. Many natural examples have been destroyed by hydrologic alterations (e.g., ditching, draining, and impoundment construction), beaver activity, and a long history of fire suppression across the landscape. Remaining sites that support bog flora persist in artificially maintained habitats such as millponds, powerline rights-of-way, and sandpits where woody plant succession is usually controlled. The vegetation of Coastal Plain Seepage Bogs and Fens is very heterogeneous and patchy with scattered shrubs and graminoid dominated patches. The small openings found along



Wesley Knapp, MD DNR



the margins of slow-moving streams, millponds, and abandoned sandpits often support shrubs such as leatherleaf (*Chamaedaphne calyculata*), big cranberry (*Vaccinium macrocarpon*), sweet pepper-bush (*Clethra alnifolia*), swamp loosestrife (*Decodon verticillatus*), and giant cane (*Arundinaria gigantea*). Hummocks of *Sphagnum* mosses are characteristic and usually support species such as northern pitcher-plant (*Sarracenia* spp.), white beak-sedge (*Rhynchospora alba*), rose pogonia (*Pogonia ophioglossoides*), St. John's-wort (*Hypericum* spp.), and Virginia meadow-beauty (*Rhexia virginica*). Orchids, sundews (*Drosera* spp.), bladderworts (*Utricularia* spp.), and yellow-eyed grasses (*Xyris* spp.) are also common. Near the fall-line, globally rare Magnolia Bogs occur and share many floristic similarities to the New Jersey Pine Barrens region. Unlike true bogs, Magnolia Bogs are not characterized by accumulations of peat or organic soils. Nutrient poor and acidic seepage flow from groundwater often forms mucky depressions and braided channels around hummocks of sphagnum mosses. Historic accounts of Magnolia Bogs describe these areas with sweet bay and various shrubs fringing and forming clumps within a more open center dominated by herbaceous plants. Today, remaining examples exist mostly as open woodlands of black gum (*Nyssa sylvatica*) and sweet bay (*Magnolia virginiana*) with very dense shrubs and very small, scattered herbaceous patches. Shrubs common to these habitats include sweet bay, swamp azalea (*Rhododendron viscosum*), highbush blueberry (*Vaccinium fuscatum*), fetterbush (*Leucothoe racemosa*), dangleberry (*Gaylussacia frondosa*), poison sumac (*Toxicodendron vernix*), and Southern wild raisin (*Viburnum nudum*). Herbaceous openings include species such as cinnamon fern (*Osmunda cinnamomea*), woolly panicgrass (*Dichanthelium acuminatum*), partridge berry (*Mitchella repens*), halberd-leaved greenbrier (*Smilax pseudochina*), wild yam (*Dioscorea* spp.), Indian cucumber-root (*Medeola virginiana*), and primrose-leaved violet (*Viola primulifolia*). Regionally uncommon or rare "bog" species persisting in Magnolia Bogs include bog goldenrod (*Solidago uliginosa* var. *uliginosa*), ten-angled pipewort (*Eriocaulon decangulare*), Long's rush (*Juncus longii*), spoon-leaved sundew (*Drosera intermedia*), red milkweed (*Asclepias rubra*), and sheep-laurel (*Kalmia angustifolia*).

Sea-level Fens are small maritime seepage wetlands that occur above the high tide line at the bases of slopes where abundant groundwater discharges along the upper edges of estuarine bays. The hydrology of these sites is best characterized as saturated, although shallow standing water and small, muck-filled pools are locally present at all sites. Soils are characterized as organic and nutrient-poor. The vegetation exhibits characteristics of both inland seepage bogs and slightly brackish tidal marshes. Stands are generally a physiognomic mosaic of open woodland, scrub, and herbaceous patches. Woody species include red maple (*Acer rubrum*), black gum (*Nyssa sylvatica*), sweet bay (*Magnolia virginiana*), and southern bayberry (*Morella cerifera*). Characteristic herbs include twig rush (*Cladium mariscoides*), beaked spikerush (*Eleocharis rostellata*), white beaksedge (*Rhynchospora alba*), spoon-leaved sundew (*Drosera intermedia*), ten-angled pipewort (*Eriocaulon decangulare*), coinleaf (*Centella erecta*), brown-fruited rush (*Juncus pelocarpus*), and bladderworts (*Utricularia* spp.). Because of their small size and association with tidal salt marshes, Sea-level Fens are included as part of the Tidal Salt Marsh and Shrubland key wildlife habitat.

County Distribution: Anne Arundel, Calvert, Caroline, Cecil, Charles, Dorchester, Prince George's, Somerset, Wicomico, Worcester

Places to Visit: Suitland Bog



Signature State Rare Plants: New Jersey rush (*Juncus caesariensis*), Long’s rush (*Juncus longii*), red milkweed (*Asclepias rubra*), leatherleaf (*Chamaedaphne calyculata*), brown-fruit rush (*Juncus pelocarpus*), northern pitcher plant (*Sarracenia purpurea*)

State Rare Natural Community: Coastal Plain-Piedmont Acidic Seepage Bog/Fen

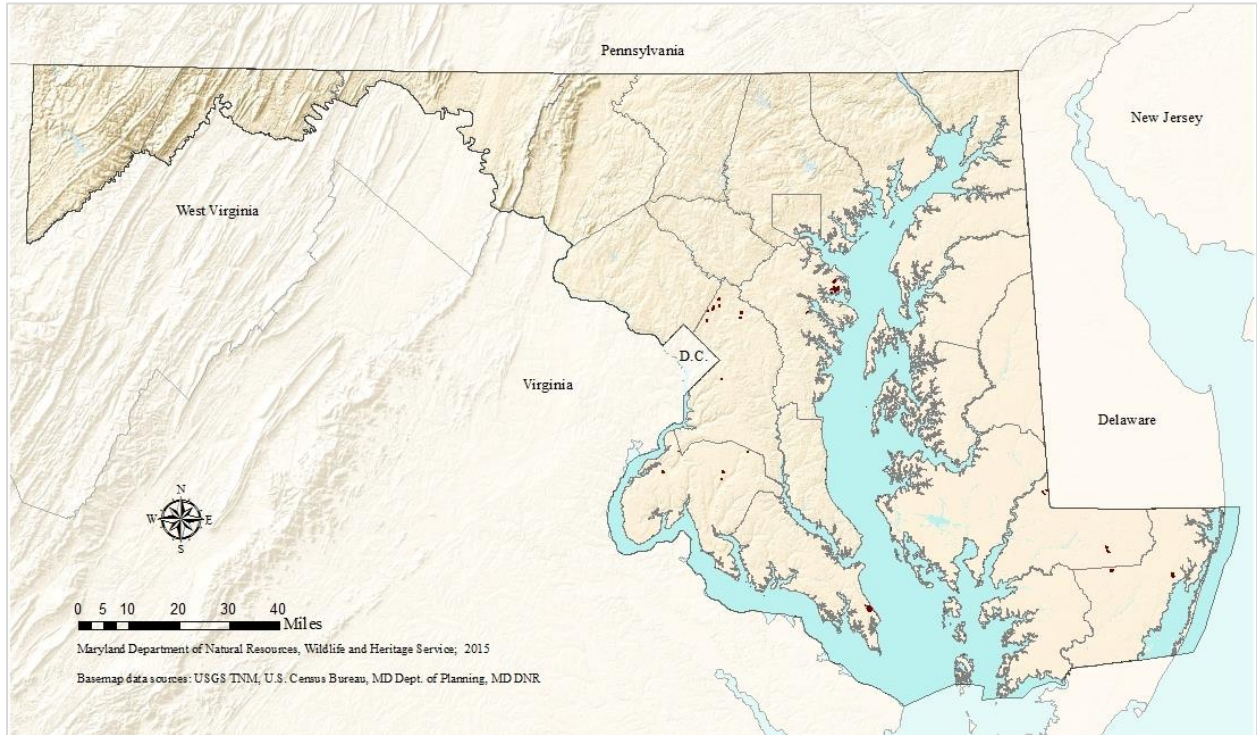


Figure 4.30 Location of Coastal Plain Seepage Bogs and Fens in Maryland. Sources: MD DNR, USFWS.

Species of Greatest Conservation Need Associated with Coastal Plain Seepage Bogs and Fens:

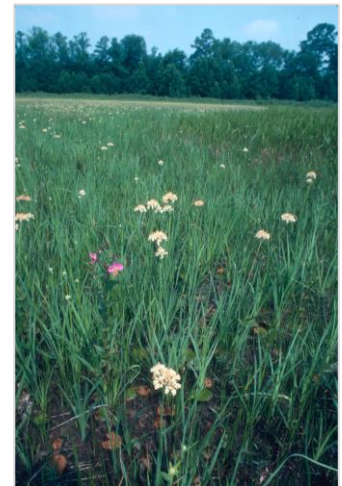
Mammals	Insects (Butterflies & Moths)	Other Insects
American mink	Dion skipper	Pitcher-plant mosquito
Big brown bat	A noctuid moth (<i>Meropleon titan</i>)	Crustaceans
Bobcat	Insects (Dragonflies and Damselflies)	Digger crayfish
Eastern red bat	Amber-winged spreadwing	Invertebrates (Snails)
Hoary bat	Atlantic bluet	Cylindrically-ornate wood snail
Least shrew	Attenuated bluet	
Seminole bat	Bar-winged skimmer	
Silver-haired bat	Black-tipped darner	
Southeastern myotis	Burgundy bluet	
Southeastern shrew	Comet darner	
Southeastern star-nosed mole	Elfin skimmer	



Mammals cont.	Dragonflies and Damselflies cont.	
Southern bog lemming Southern pygmy shrew Tricolored bat	Faded pennant Fine-lined emerald Four-spotted pennant Golden-winged skimmer	
Birds	Green-striped darner Harlequin darner Little blue dragonlet Mantled baskettail Martha's pennant	
Acadian flycatcher American redstart American woodcock Kentucky warbler Prothonotary warbler	Pale bluet Seepage dancer Southern sprite Sphagnum sprite Spotted spreadwing Spring blue darner Sweetflag spreadwing	
Reptiles	Taper-tailed darner Treetop emerald Tule bluet White corporal	
Common ribbonsnake Eastern box turtle Eastern kingsnake Rainbow snake Spotted turtle	White-faced meadowhawk Yellow-sided skimmer	
Amphibians		
Carpenter frog Eastern mud salamander Northern red salamander		

Delmarva Bay

The Delmarva Bay key wildlife habitat is characterized by a shallow, seasonally flooded depression wetland on Maryland’s lower Coastal Plain. Research suggests this habitat developed from ancient interdunal depressions approximately 16,000 years ago when the climate of the Coastal Plain was very cold and windy and supported an extensive sand dune ecosystem. The majority of Delmarva Bays have been shaped by these wind and erosional processes into circular depressions up to one meter in depth with prominent sand rims. A perched water table and seasonal fluctuations in groundwater recharge and precipitation cause these wetlands to be irregularly flooded or seasonally inundated. During very dry seasons, surface water may be absent or limited to the deepest point within the bay. Likewise, during very wet years when rainfall is abundant, bays may retain water throughout the entire growing season. Depth and duration of seasonal inundation are apparently the most important factors influencing plant communities and the degree to which woody species become established. Dry-season fires in adjacent uplands may spread into Bays and may be another factor limiting the invasion of woody species, although fire frequencies throughout



Richard Wiegand, MD DNR



the region have been much reduced in recent decades. The vegetation of Delmarva Bays is closely linked to its hydrologic regime. As water levels draw down or recede during the growing season, plant communities typically develop concentric rings from the outer edge towards the center or deepest point in the bay. Outer rings of a bay may include shrubs of buttonbush (*Cephalanthus occidentalis*), fetterbush (*Leucothoe racemosa*), swamp loosestrife (*Lysimachia terrestris*), and sweet pepper-bush (*Clethra alnifolia*) or nearly monospecific stands of Walter's sedge (*Carex striata*), maidencane (*Panicum hemitomon*), and Virginia chain fern (*Woodwardia virginica*). Interior portions of Bays may include species such as Eaton's panic-grass (*Dichantherium spretum*), warty panicgrass (*Panicum verrucosum*), and Virginia meadow-beauty (*Rhexia virginica*). Many of these species grade into the "draw down pocket" or lowest portion of a bay, which is the last to desiccate during the growing season. Common to this zone are slender fimbry (*Fimbristylis autumnalis*) and flood tolerant shrubs like buttonbush (*Cephalanthus occidentalis*). Many plants and animals considered rare in Maryland are known to occur in Delmarva Bays.

County Distribution: Caroline, Dorchester, Kent, Queen Anne's, Somerset, Talbot, Wicomico, Worcester

Places to Visit: Millington Wildlife Management Area

Signature State Rare Plants: Harper's fimbriatylis (*Fimbristylis perpusilla*), rose coreopsis (*Coreopsis rosea*), creeping St. John's-wort (*Hypericum adpressum*), featherfoil (*Hottonia inflata*), red root (*Lachnanthes caroliniana*), Walter's paspalum (*Paspalum dissectum*), two-formed pink (*Sabatia difformis*), purple bladderwort (*Utricularia purpurea*), fringed yellow-eyed grass (*Xyris fimbriata*)

State Rare Natural Community: Delmarva Bay



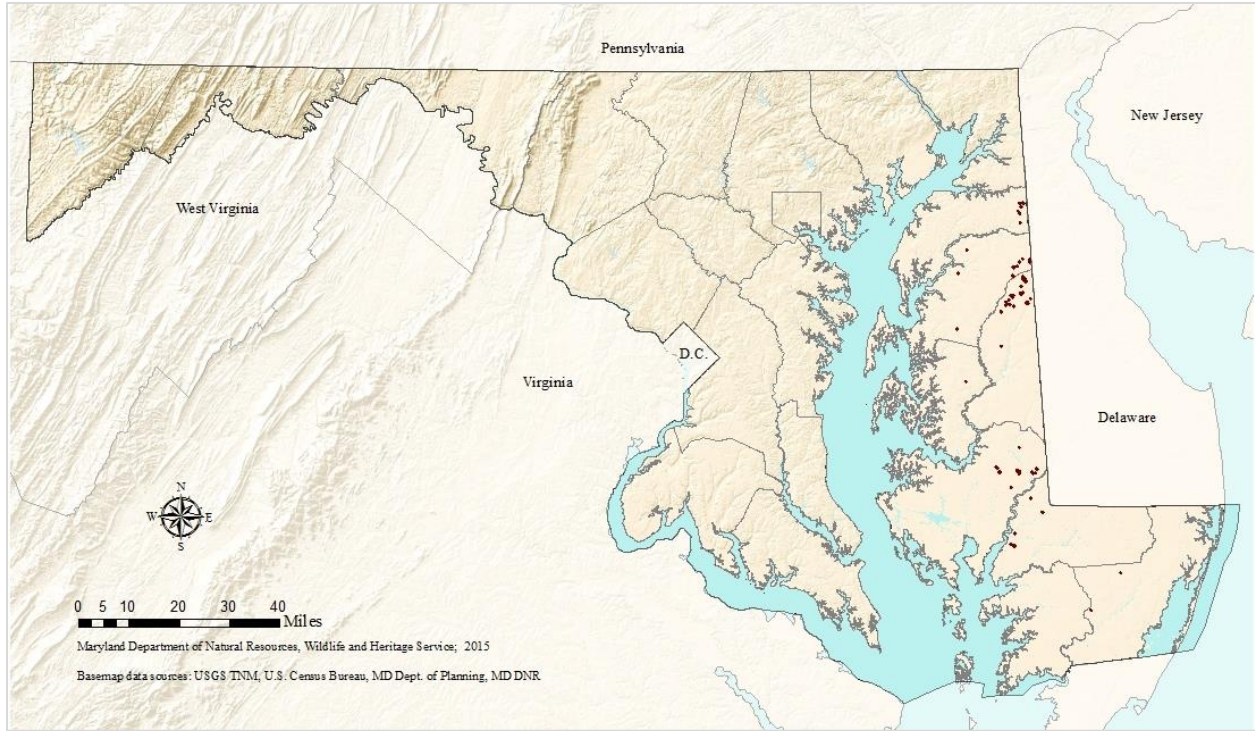


Figure 4.31 Location of Delmarva Bays in Maryland. Sources: MD DNR, USFWS.

Species of Greatest Conservation Need Associated with Delmarva Bays:

Mammals	Birds	Insects (Dragonflies and Damselflies)
American mink	American woodcock	Attenuated bluet
Big brown bat	Reptiles	Bar-winged skimmer
Bobcat	Common ribbonsnake	Comet darner
Eastern red bat	Eastern box turtle	Fine-lined emerald
Hoary bat	Eastern kingsnake	Four-spotted pennant
Least shrew	Spotted turtle	Harlequin darner
Seminole bat	Amphibians	Martha's pennant
Silver-haired bat	Barking treefrog	Sphagnum sprite
Southeastern myotis	Carpenter frog	Spotted spreadwing
Southeastern star-nosed mole	Eastern tiger salamander	Sweetflag spreadwing
Southern bog lemming	Insects (Butterflies & Moths)	Taper-tailed darner
Tricolored bat	A noctuid moth (<i>Meropleon titan</i>)	White-faced meadowhawk
		Crustaceans
		Digger crayfish



Maritime Swamp

The Maritime Swamp key wildlife habitat encompasses saturated and seasonally flooded swamps and shrublands of barrier islands along the Atlantic Coast, and low-lying flats behind tidal marshes just inland from estuarine zones. The structure of these swamps may vary from shrubland to woodland to forest because of differing stand ages and the amount of exposure to harsh maritime conditions, such as salt spray and wind pruning. Shrub swamps of back-dune hollows and inlet heads are frequent on barrier islands where perched water tables and seasonal flooding characterize the hydrology. Though primarily freshwater, these shrub swamps may periodically be subjected to higher salinity levels as a result of storm surges from hurricanes and other storm events. The species composition is variable from stand to stand, but southern bayberry (*Morella cerifera*), highbush blueberry (*Vaccinium fuscatum*), poison-ivy (*Toxicodendron radicans*), royal fern (*Osmunda regalis* var. *spectabilis*), whorled water-pennywort (*Hydrocotyle verticillata*), and marsh fern (*Thelypteris palustris* var. *pubescens*) are common. Saturated and seasonally flooded forests typically develop in protected swales between dunes and flats behind tidal marshes. Hummocks and pockets of standing water are common but variable among stands. Red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), black gum (*Nyssa sylvatica*), willow (*Salix* spp.), swamp tupelo (*Nyssa biflora*), and sweetbay magnolia (*Magnolia virginiana*) are common trees. The shrub layers are often dense with southern bayberry, highbush blueberry (*Vaccinium fuscatum*), poison-ivy (*Toxicodendron radicans*), and greenbrier (*Smilax* spp.). Back-dune depressions of barrier islands and low-lying flats bordering tidal marsh of estuaries further inland are characterized by a dominance of loblolly pine (*Pinus taeda*) and a saturated hydrology. These fringing pine forests are nearly level and may contain areas of standing water. Some common associates include southern bayberry, greenbrier, cinnamon fern (*Osmunda cinnamomea*), royal fern, switchgrass (*Panicum virgatum*), and whorled marsh-pennywort. In Maryland, Maritime Swamps are of conservation significance because of a limited distribution along the Atlantic Coast and a high vulnerability to coastal development, sea level rise, and stochastic storm events.



Jason Harrison, MD DNR

County Distribution: Dorchester, Somerset, Wicomico, Worcester

Places to Visit: Assateague Island National Seashore, Blackwater National Wildlife Refuge

State Rare Natural Communities: Maritime Shrub Swamp, Maritime Wet Pine Forest



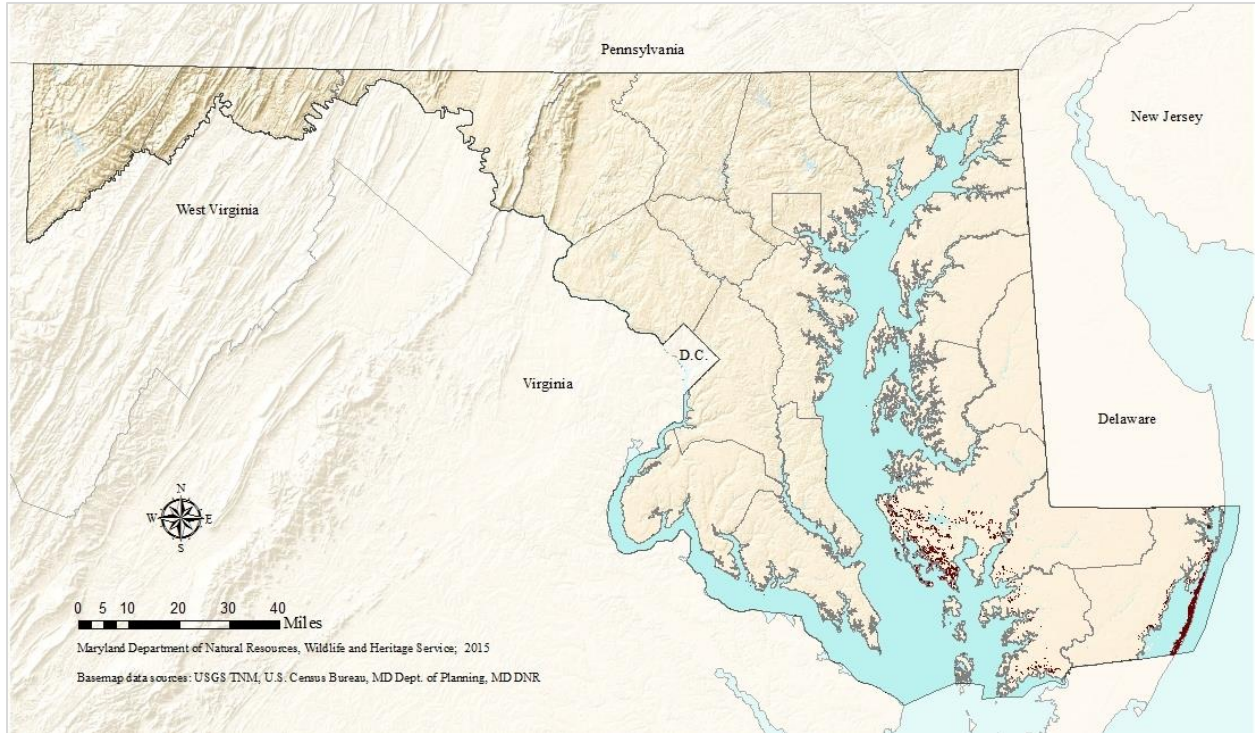


Figure 4.32 Location of Maritime Swamps in Maryland. Sources: MD DNR, NETWHCS, USFWS.

Species of Greatest Conservation Need Associated with Maritime Swamps:

Mammals	Birds	Reptiles
American mink Big brown bat Bobcat Eastern red bat Hoary bat Seminole bat Silver-haired bat Southeastern myotis	American black duck American woodcock Black-crowned night-heron Glossy ibis Great blue heron Great egret Little blue heron Northern bobwhite	Common ribbonsnake Eastern box turtle Plain-bellied watersnake Spotted turtle
		Amphibian
		Carpenter frog
		Insects (Butterflies and Moths)
		Palamedes swallowtail
Mammals cont.	Birds cont.	
Southeastern star-nosed mole Tricolored bat	Snowy egret Tricolored heron Yellow-breasted chat Yellow-crowned night-heron	

Vernal Pool

The Vernal Pool key wildlife habitat is defined as small (~0.1-2 ha), non-tidal palustrine forested wetlands. They exhibit a well-defined, discrete basin and lack a permanent, above-ground outlet. The basin overlies a clay hardpan or some other impermeable soil or rock layer that impedes drainage. As the water table rises in fall and winter, the basin fills forming a shallow pool. By spring, the pool typically reaches maximum depth (~0.5-2.5 m) following snowmelt and the onset of spring rains. By mid- to late summer, the pool usually dries up completely, although



some surface water may persist in relatively deep basins, especially in years with above average precipitation. This periodic seasonal drying prevents fish populations from becoming established, an important biotic feature of Vernal Pools. Many species have evolved to use these temporary, fish-free wetlands. Some are obligate vernal pool species, so-called because they require a Vernal Pool to complete all or part of their life cycle. Vernal Pools occur throughout the state as scattered, isolated habitats. They are most numerous on the Lower Coastal Plain, especially on the mid to upper Eastern Shore, and uncommon west of the Fall Line. They are typically situated in low areas or depressions in a forest, but they can also occur in floodplain forests as isolated floodwaters, among backwaters of old beaver impoundments, old sinkholes, or as perched spring- or seep-fed basins along mountain slope benches, or at the base of slopes. Vernal Pools may persist in cleared areas such as cropland, pastures, and clearcuts, but usually in a highly degraded ecological state. Because Vernal Pools occur throughout the state in a variety of forest types and settings, the vegetation in and around these habitats varies considerably. However, many Vernal Pools exhibit similar vegetative structure. For example, Pools tend to have a semi-open to closed forest canopy around them and the degree of canopy closure generally decreases with increasing pool size. The basin substrate consists of dense mats of submerged leaf litter and scattered, coarse woody debris. Herbaceous vegetation is usually absent to sparse in and around the basin, although small mossy patches frequently occur along the basin edge. A dense shrub layer may occur along the shoreline or in small patches within the basin, especially on the Coastal Plain, but many Pools also lack a well-developed shrub layer.



James McCann, MD DNR

County Distribution: Statewide

Places to Visit: Seth Demonstration Forest

State Rare Natural Community: Vernal Pool



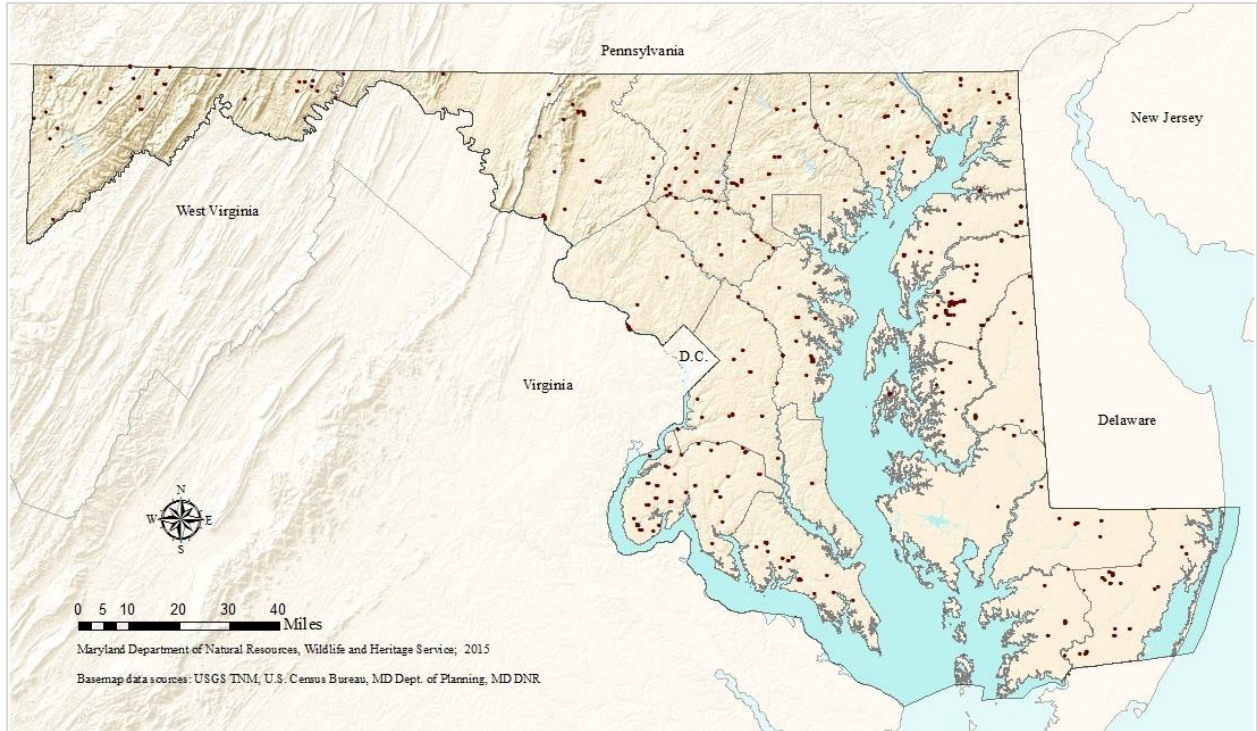


Figure 4.33 Location of Vernal Pools in Maryland. Source: MD DNR.

Species of Greatest Conservation Need Associated with Vernal Pools:

Mammals	Reptiles	Insects (Dragonflies and Damselflies)
American mink	Eastern box turtle	Amber-winged spreadwing
Big brown bat	Eastern kingsnake	Attenuated bluet
Eastern red bat	Rainbow snake	Bar-winged skimmer
Eastern small-footed myotis	Spotted turtle	Comet darner
Evening bat	Amphibians	Harlequin darner
Hoary bat	Carpenter frog	Sphagnum sprite
Indiana myotis	Eastern narrow-mouthed toad	Spotted spreadwing
Little brown myotis	Eastern tiger salamander	Sweetflag spreadwing
Northern long-eared bat	Jefferson salamander	Taper-tailed darner
Seminole bat	Mountain chorus frog	White-faced meadowhawk
Silver-haired bat	Upland chorus frog	Crustaceans
Southeastern myotis	Insects (Beetles)	Digger crayfish
Southeastern star-nosed mole	Seth forest water scavenger beetle	
Tricolored bat		



Spring

The Spring key wildlife habitat is a concentrated discharge of groundwater at a small (usually $< 1 \text{ m}^2$), distinct site or opening in the ground. Springs are uncommon, isolated features and most occur west of the Fall Line. They provide critical habitat for highly rare aquatic snails and subterranean invertebrates, salamanders, crayfish and other invertebrates. Because some Springs discharge directly into streams or wetlands, they also play a vital role in maintaining the ecological integrity of these habitats which, in turn, may harbor species of conservation concern (e.g., pearl dace, brook trout, rare dragonflies and damselflies). Springs emit groundwater due to hydrostatic pressure resulting from gravity or artesian flow, although other physical forces may play a role (e.g., buoyant effect of dissolved gases). Several types of Spring key wildlife habitats exist in Maryland including contact, scree, and fault Springs. Perhaps the most common type is fracture or crevice springs. Here, groundwater moves downward due to gravity, flowing through fractures and crevices underneath the ground and emerging as a spring where a major fracture in a rock formation occurs at the earth's surface, usually along a ravine or swale. The flow or discharge rates of Maryland's Springs range from less than one gallon per minute to nearly 10,000 gallons per minute. Springs differ from seeps in that the latter appear on the ground surface as broad, diffuse zones of wetness or percolation rather than distinct discharge sites. Also, seeps and associated wetlands often support distinct plant communities while springs are essentially aquatic and geological features.



MD DNR

County Distribution: Statewide

Places to Visit: Henryton Spring, Annapolis Rock Spring



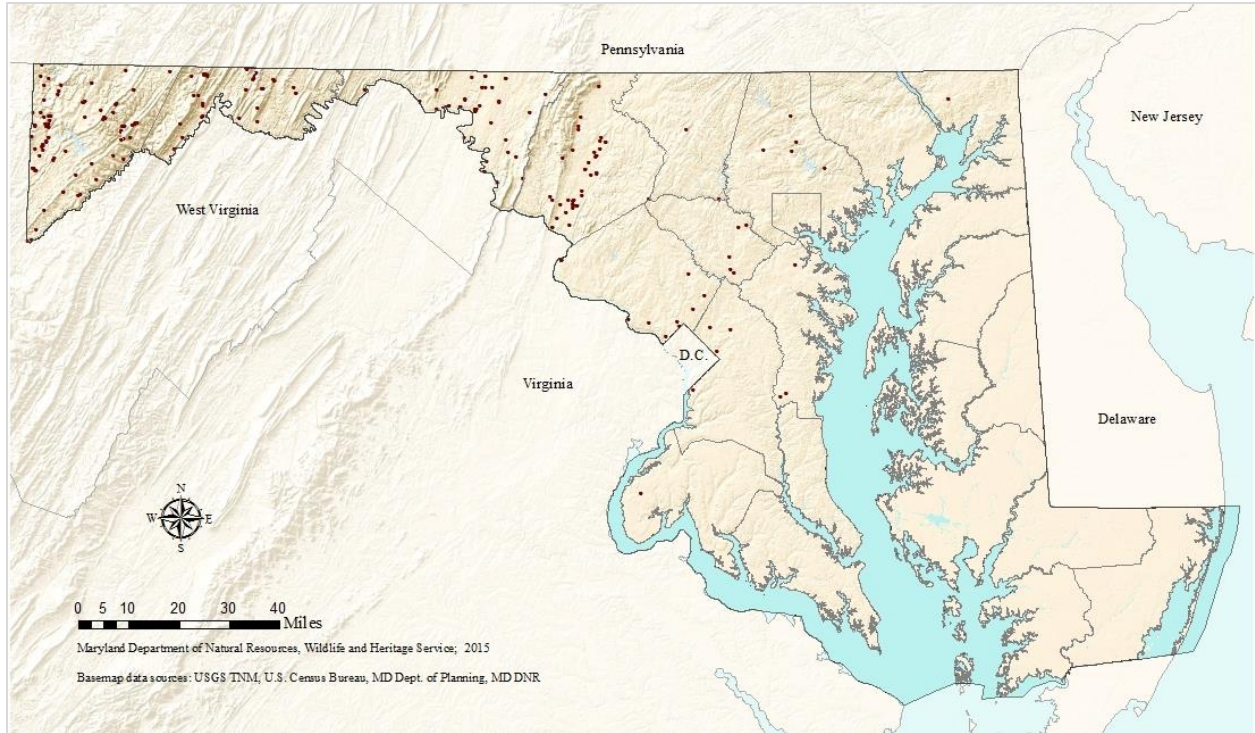


Figure 4.34 Location of Springs in Maryland. Sources: MD DNR, Geographic Names Information System (USGS).

Species of Greatest Conservation Need Associated with Springs:

Reptiles	Crustaceans cont.	Invertebrates (Snails)
Eastern kingsnake	Franz's cave amphipod	Appalachian springsnail
Amphibians	Franz's cave isopod	Blue Ridge springsnail
Mountain chorus frog	Friendly cave amphipod	Invertebrates (Flatworms)
Northern red salamander	Greenbrier cave amphipod	A planarian (<i>Paraplanaria dactyligera</i>)
Northern spring salamander	Maus' cave isopod	A planarian (<i>Phagocata dissimilis sp. nov.</i>)
Seal salamander	Norden's groundwater isopod	A planarian (<i>Phagocata projecta sp. nov.</i>)
Upland chorus frog	Pizzini's amphipod	A planarian (<i>Phagocata virilis</i>)
Insects (Stoneflies, Mayflies, Caddisflies)	Potomac amphipod	A planarian (<i>Procotyla typhlops</i>)
Shenandoah needlefly	Prettyboy groundwater amphipod	A planarian (<i>Sphalloplana buchanani</i>)
Shenandoah sallfly	Price's cave isopod	A planarian (<i>Sphalloplana cava sp. nov.</i>)
Crustaceans	Rappahannock spring amphipod	A planarian (<i>Sphalloplana pricei</i>)
Allegheny cave amphipod	Rock Creek groundwater amphipod	A planarian (<i>Sphalloplana sp 1</i>)
Allegheny spring isopod	Roundtop amphipod	
Barrelville amphipod	Shenandoah Valley cave amphipod	
Biggers' cave amphipod	Tenuis amphipod	



Crustaceans cont.	
Capital Area groundwater amphipod	Tidewater amphipod
Cecil groundwater amphipod	A copepod (<i>Acanthocyclops columbiensis</i>)
Devils Hole cave amphipod	Vandel's cave isopod
Feller's groundwater amphipod	

Tidal Wetlands

Tidal Forest

The Tidal Forest key wildlife habitat includes a variety of tidally-flooded forests that border the upper reaches of Maryland’s Coastal Plain Rivers and tributaries. These habitats are species rich and structurally complex with open canopies and floristically diverse lower strata. In much of our region, these freshwater habitats are dominated by mixtures of hardwoods such as ash, gum, and maple. The Pocomoke River watershed is especially unique in that bald cypress is co-dominant with ash, gum, and maple. Atlantic white cedar is also present in the Nanticoke and Pocomoke River watersheds as small stands or scattered individuals. These communities often develop in narrow ecotones between regularly tidally flooded areas and the upland interface. Both Atlantic white cedar (*Chamaecyparis thyoides*) and bald cypress (*Taxodium distichum*) swamps are considered rare in Maryland because of widespread logging that occurred in the early 1900s.



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The shrub layer in freshwater Tidal Forests is usually dense and diverse, often including species such as northern arrow-wood (*Viburnum recognitum*), winterberry (*Ilex verticillata*), silky dogwood (*Cornus amomum*), swamp azalea (*Rhododendron viscosum*), swamp rose (*Rosa palustris*), fetterbush (*Leucothoe racemosa*), and sweet pepperbush (*Clethra alnifolia*). Climbing vines are common in multiple layers and may include species such as common wild yam (*Dioscorea villosa*), poison-ivy (*Toxicodendron radicans*), common greenbrier (*Smilax rotundifolia*), and Virginia creeper (*Parthenocissus quinquefolia*). Pronounced hummock-and-hollow microtopography is characteristic of tidal forests. Hollows are regularly inundated by tidal water, whereas hummocks are less frequently flooded thus supporting the establishment of trees and numerous herbs. The exceptional species diversity and richness in these habitats can be attributed to the flooding frequency and hummock-and-hollow microtopography. Regularly flooded hollows support many flood-tolerant swamp species, such as jewelweed (*Impatiens capensis*), arrow arum (*Peltandra virginica*), halberd-leaved tearthumb (*Polygonum arifolium*), lizard’s-tail (*Saururus cernuus*), and sedges such as tussock sedge (*Carex stricta*). Elevated above normal high tides, hummocks provide habitat for marsh blue violet (*Viola cucullata*), water hemlock (*Cicuta maculata* var.



maculata), greenfruit clearweed (*Pilea pumila*), false nettle (*Boehmeria cylindrica*), and ferns such as royal fern (*Osmunda regalis* var. *spectabilis*), cinnamon fern (*Osmunda cinnamomea*), and marsh fern (*Thelypteris palustris* var. *pubescens*).

In brackish river systems, small fringing tidal woodlands dominated by loblolly pine (*Pinus taeda*) occur along portions of tidal rivers and creeks, in narrow ecotones between “high salt marshes” and adjacent uplands, and as islands within extensive salt marshes. Examples of these tidal forests can be found in the lower “tidewater” areas of Dorchester, Wicomico, Somerset, Worcester and St. Mary’s counties. These habitats are believed to be an artifact of sea level rise and marsh subsidence which subsequently allows for a higher frequency of tidal encroachment to the surrounding upland, pine-dominated communities. The flood tolerance of loblolly pine is relatively high, but signs of stress have become more apparent as frequency and length of tidal inundation have increased in duration. Indicators of stress may include stunted growth, thinning crowns, and significant tree mortality. These habitats are generally species poor, with loblolly pine (*Pinus taeda*) often forming a monospecific canopy and southern bayberry (*Morella cerifera*) comprising the shrub layer. Indicative of brackish conditions, species diversity in the herbaceous layer is quite low and chiefly comprised of vegetation tolerant of such conditions. Most frequent and dominant of these species include salt meadow cordgrass (*Spartina patens*), switchgrass (*Panicum virgatum*), and salt grass (*Distichlis spicata*).

County Distribution: Anne Arundel, Baltimore, Calvert, Caroline, Cecil, Charles, Dorchester, Harford, Kent, Prince George’s, Queen Anne’s, Somerset, St. Mary’s, Talbot, Wicomico, Worcester

Places to Visit: Blackwater National Wildlife Refuge, Piscataway Park, Pocomoke River State Forest

Signature State Rare Plants: Mitchell’s sedge (*Carex mitchelliana*), gritty hedge-nettle (*Stachys aspera*), long-stalk greenbrier (*Smilax pseudochina*)

State Rare Natural Communities: Tidal Bald Cypress Forest and Woodland, Tidal Hardwood Swamp



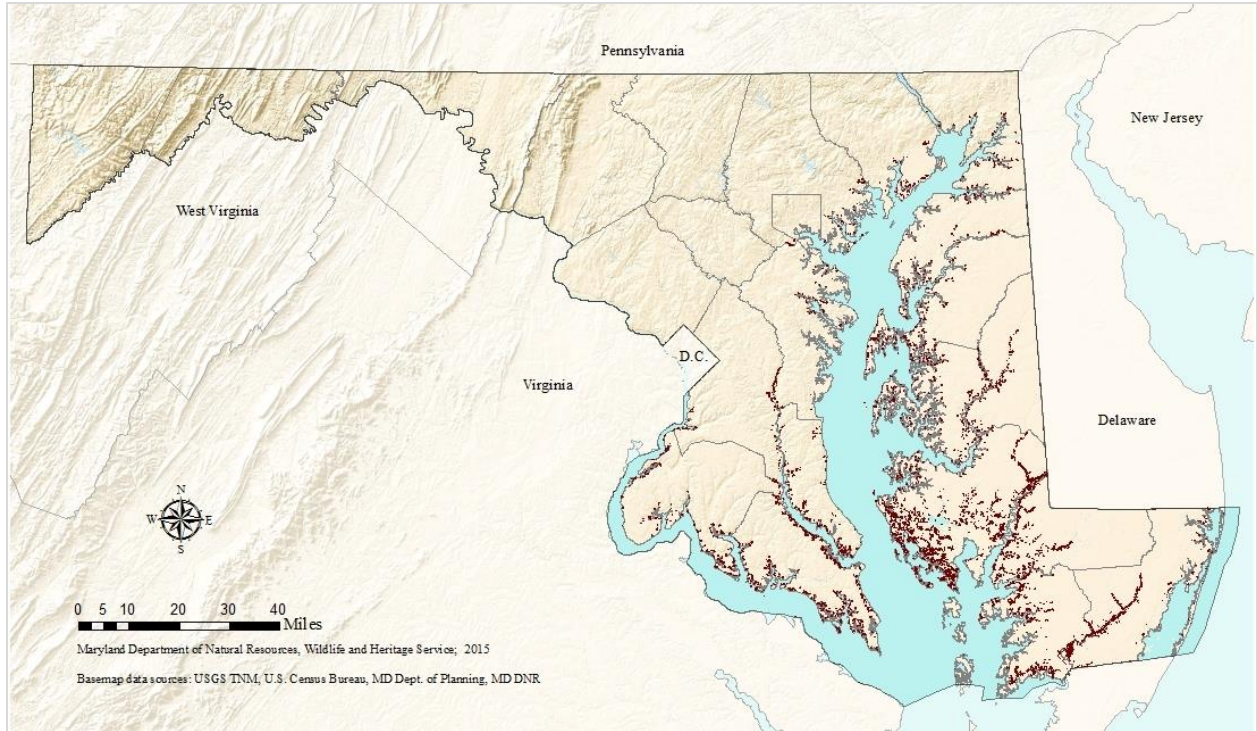


Figure 4.35 Location of Tidal Forests in Maryland. Source: MD DNR.

Species of Greatest Conservation Need Associated with Tidal Forests:

Mammals	Birds cont.	Insects (Butterflies & Moths)
Big brown bat	Red-headed woodpecker	Bronze copper
Bobcat	Rusty blackbird	Carolina satyr
Delmarva fox squirrel	Scarlet tanager	Chermock's mulberry wing
Eastern red bat	Swainson's warbler	Cypress sphinx moth
Hoary bat	Wayne's black-throated green warbler	Dion skipper
Seminole bat	Wood thrush	Great purple hairstreak
Silver-haired bat	Worm-eating warbler	Hessel's hairstreak
Southeastern myotis	Yellow-breasted chat	Marbled underwing
Southeastern star-nosed mole	Yellow-throated vireo	Palamedes swallowtail
Tricolored bat	Reptiles	Insects (Dragonflies and Damselflies)
Birds	Coastal Plain milksnake	Harlequin darner
Acadian flycatcher	Common ribbonsnake	Taper-tailed darner
American redstart	Eastern box turtle	White-faced meadowhawk
American woodcock	Eastern kingsnake	Other Insects
Bald eagle	Mole kingsnake	Pitcher-plant mosquito
Black-and-white warbler	Northern map turtle	Crustaceans
Chuck-will's-widow	Plain-bellied watersnake	An amphipod (<i>Crangonyx stagnicolous</i>)
Great blue heron	Rainbow snake	Invertebrates (Snails)
Great egret	Spotted turtle	Chesapeake ambersnail



Birds cont.	Amphibians	Invertebrates (Snails) cont.
Hooded warbler Kentucky warbler Louisiana waterthrush Northern parula Ovenbird Prairie warbler Prothonotary warbler	Atlantic Coast leopard frog Carpenter frog Eastern mud salamander Eastern narrow-mouthed toad	Coastal-plain ambersnail Snowhill ambersnail

Tidal Freshwater Marsh and Shrubland

The Tidal Freshwater Marsh and Shrubland key wildlife habitat is flooded twice daily by lunar tides. In Maryland, these areas are widely distributed along tidal rivers and shores of the Chesapeake Bay. This habitat occurs in upper sections of tidal rivers and creeks where water is consistently fresh (salinity less than 0.5 ppt). Pulses of higher salinity are common during spring high tides and episodes of low river discharge during drought cycles. In addition, where these marshes begin the transition to saline ones, a zone of slightly brackish conditions (i.e., oligohaline) occurs where salt concentrations may range from 0.5 – 5 ppt.



Jason Harrison, MD DNR

The vegetation of these marshes is very diverse and dominated by aquatics that are emergent at high tide. Typically, there are two distinct zones in a tidal freshwater marsh; a low elevation zone dominated by short, broad-leaf emergents bordering mudflats or open water, and a slightly higher-elevation area dominated by tall graminoids. Plants in the low zone may include spatterdock (*Nuphar advena*), arrow-arum (*Peltandra virginica*), and pickerelweed (*Pontederia cordata*) while higher zones often support species such as wild rice (*Zizania aquatica* var. *aquatic*), jewelweed (*Impatiens* spp.), sweetflag (*Acorus calamus*), dotted smartweed (*Polygonum punctatum*), rice cutgrass (*Leersia oryzoides*), arrowleaf tearthumb (*Polygonum sagittatum*), halberdleaf tearthumb (*Polygonum arifolium*), and beggar-ticks (*Bidens* spp.). This zonation can be attributed to flooding depth, duration, and frequency. Slightly brackish, or oligohaline, marshes frequently support the latter species in addition to species tolerant of brackish conditions such as water-hemp pigweed (*Amaranthus cannabinus*), eastern-rose mallow (*Hibiscus moscheutos* ssp. *moscheutos*), seashore mallow (*Kosteletzkya virginica*), saltmarsh bulrush (*Schoenoplectus robustus*), and extensive stands of big cordgrass (*Spartina cynosuroides*), and narrow-leaved cattail (*Typha angustifolia*). Tidal freshwater shrublands commonly form small, linear patches on floodplains between tidal emergent marshes and Tidal Forests. On narrow or constricted floodplains, discrete shrub-dominated communities occur along ecotones or transitional areas and may not be physiognomically distinct. Stands occupying rather expansive marshes or large estuary meanders on broader floodplains are commonly



fronted or surrounded by emergent marshes forming depositional islands. The vegetation of tidal freshwater shrub wetlands is very diverse and typically contains species characteristic of both tidal marshes and tidal forests. Common are shrubs such as smooth alder (*Alnus serrulata*), winterberry (*Ilex verticillata*), marsh rose (*Rosa palustris*), Northern arrow-wood (*Viburnum recognitum*), southern bayberry (*Morella cerifera*), and silky dogwood (*Cornus amomum*). Pronounced hummock and hollow microtopography is characteristic and contributes to relatively high species richness with most species confined to irregularly flooded hummocks. Hollows are regularly flooded and typically contain only those species tolerant of frequent inundation.

County Distribution: Anne Arundel, Baltimore, Calvert, Caroline, Cecil, Charles, Dorchester, Harford, Kent, Prince George's, Queen Anne's, Somerset, St. Mary's, Talbot, Wicomico, Worcester

Places to Visit: Pocomoke State Forest

Signature State Rare Plants: Sensitive joint-vetch (*Aeschynomene virginica*), seaside alder (*Alnus maritima*), Long's bittercress (*Cardamine longii*), small-fruit beggarticks (*Bidens mitis*), shoreline sedge (*Carex hyalinolepis*), water horsetail (*Equisetum fluviatile*), partridge pea (*Chamaecrista fasciculata* var. *macrosperma*)

State Rare Natural Communities: Tidal Freshwater Marsh and Shrubland, Tidal Oligohaline Marsh and Shrubland

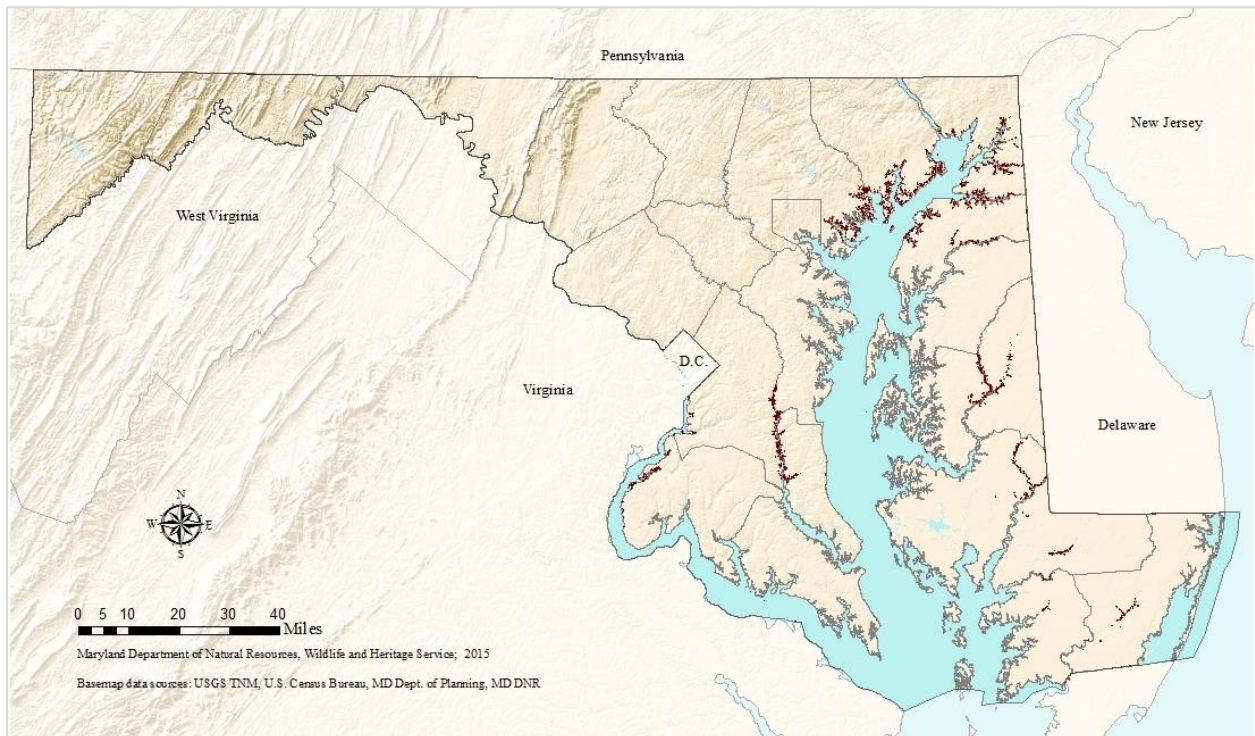


Figure 4.36 Location of Tidal Freshwater Marshes and Shrublands in Maryland. Sources: MD DNR, Nature Serve's Terrestrial Ecological Systems of the U.S.



Species of Greatest Conservation Need Associated with Tidal Freshwater Marshes and Shrublands:

Mammals	Birds cont.	Reptiles
American mink Big brown bat Bobcat Eastern red bat Hoary bat Least shrew Seminole bat Silver-haired bat Southeastern myotis Tricolored bat	Glossy ibis Great blue heron Great egret Greater yellowlegs King rail Least bittern Least tern Lesser yellowlegs Little blue heron Marsh wren Northern harrier Pied-billed grebe Ruddy duck Ruddy turnstone Rusty blackbird Sanderling Sedge wren Semipalmated sandpiper Short-eared owl Snowy egret Sora Spotted sandpiper Tricolored heron Yellow-crowned night-heron	Eastern kingsnake Northern diamond-backed terrapin Plain-bellied watersnake Rainbow snake Spotted turtle
		Amphibians
		Atlantic Coast leopard frog
		Fishes
		Spotfin killifish
		Insects (Butterflies & Moths)
		Bronze copper Delaware skipper Rare skipper Seaside goldenrod stem borer A noctuid moth (<i>Meropleon titan</i>)
		Insects (Dragonflies and Damselflies)
		Fine-lined emerald Four-spotted pennant
		Invertebrates (Snails)
		Chesapeake ambersnail Coastal-plain ambersnail Snowhill ambersnail
Birds		
American bittern American black duck Bald eagle Barn owl Black rail Black-crowned night-heron Blue-winged teal Boat-tailed grackle Brown pelican Coastal Plain swamp sparrow Dunlin Gadwall		

Tidal Brackish Marsh and Shrubland

The Tidal Brackish Marsh and Shrubland key wildlife habitat is a transitional wetland between tidal freshwater systems and salt marshes. It is the most significant wetland type in Maryland, occurring along the many miles of rivers and shores where the salinity of water ranges from 5 -18 ppt. This wide transition zone is diverse, with species tolerant of both saline and freshwater conditions. The vegetation of this key wildlife habitat is influenced by salinity, elevation, and the depth and duration of tidal flooding. Lower, more regularly flooded zones



Jason Harrison, MD DNR



consist of species such as saltmarsh cordgrass (*Spartina alterniflora*), saltgrass (*Distichlis spicata*), narrow-leaved cattail (*Typha angustifolia*), olney threesquare (*Schoenoplectus americanus*), saltmarsh bulrush (*Schoenoplectus robustus*), and extensive stands of black needlerush (*Juncus roemerianus*). It is believed by many that black needlerush has expanded due to a decrease in natural fires in brackish marshes of the mid-Atlantic. Higher portions of brackish marshes may support saltmeadow cordgrass (*Spartina patens*), sea-lavender (*Limonium carolinianum*), seashore mallow (*Kosteletzkya virginica*), marsh fleabane (*Pluchea camphorate*), glassworts (*Salicornia* spp.), switchgrass (*Panicum virgatum*), and seaside goldenrod (*Solidago sempervirens*). Shrubby ecotones of southern bayberry (*Morella cerifera*), marsh-elder (*Iva frutescens*), and high-tide bush (*Baccharis halimifolia*) are frequent.

County Distribution: Anne Arundel, Baltimore, Calvert, Caroline, Dorchester, Kent, Prince George’s, Queen Anne’s, Somerset, St. Mary’s, Talbot, Wicomico, Worcester

Places to Visit: Blackwater National Wildlife Refuge, Eastern Neck Wildlife Refuge, Fishing Bay Wildlife Management Area

Signature State Rare Plants: Koehne ammannia (*Ammannia latifolia*), shoreline sedge (*Carex hyalinolepis*)

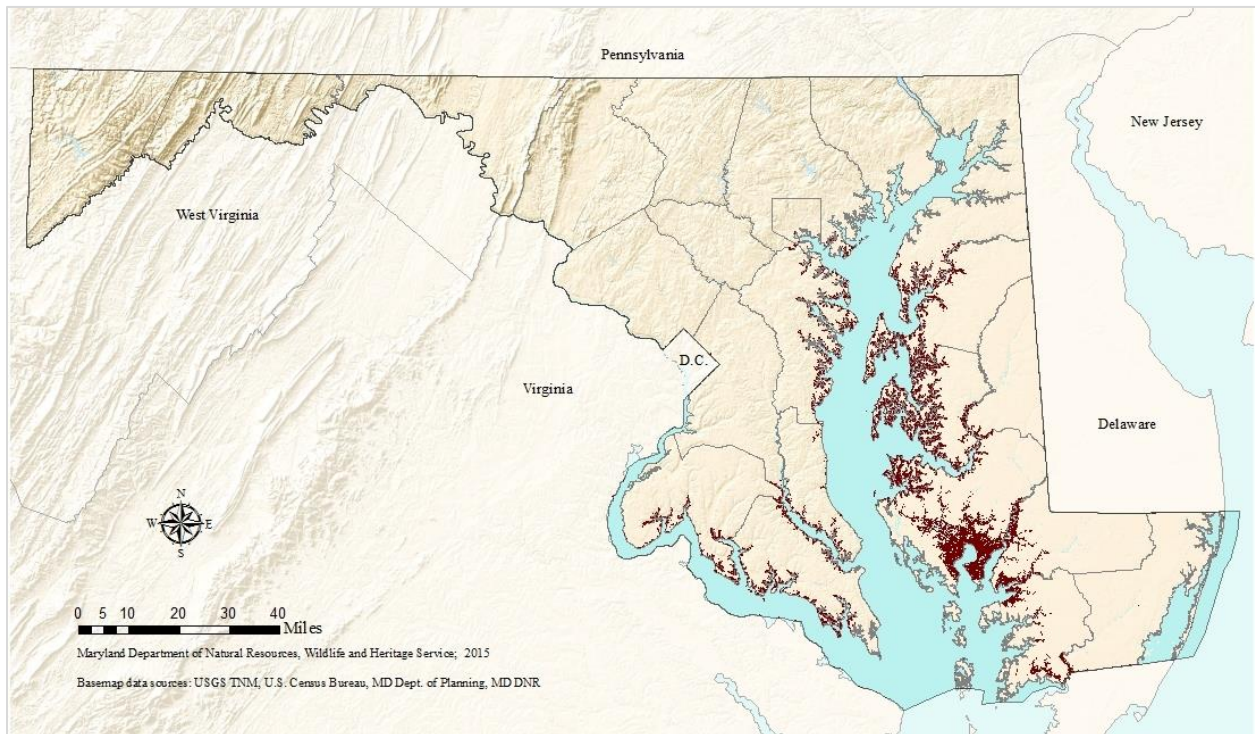


Figure 4.37 Location of Tidal Brackish Marshes and Shrublands in Maryland. Sources: MD DNR, Nature Serve’s Terrestrial Ecological Systems of the U.S.



Species of Greatest Conservation Need Associated with Tidal Brackish Marshes and Shrublands:

Mammals	Birds cont.	Reptiles
American mink Big brown bat Bobcat Eastern red bat Hoary bat Least shrew Seminole bat Silver-haired bat Southeastern myotis Tricolored bat	Great blue heron Great egret Greater yellowlegs Horned grebe King rail Least bittern Least tern Lesser yellowlegs Little blue heron Marsh wren Nelson's sparrow Northern harrier Pied-billed grebe Ruddy duck Ruddy turnstone Saltmarsh sparrow Sanderling Seaside sparrow Sedge wren Semipalmated sandpiper Short-billed dowitcher	Eastern kingsnake Northern diamond-backed terrapin Plain-bellied watersnake
		Amphibians
		Atlantic Coast leopard frog
		Fishes
		Spotfin killifish
		Insects (Butterflies & Moths)
		Bronze copper Delaware skipper Rare skipper Seaside goldenrod stem borer A noctuid moth (<i>Meropleon titan</i>)
Birds		
American bittern American black duck American peregrine falcon Bald eagle Barn owl Black rail Black-crowned night-heron Blue-winged teal Boat-tailed grackle Brown pelican Coastal Plain swamp sparrow Common gallinule Common nighthawk Dunlin Eastern meadowlark Gadwall Glossy ibis Golden eagle	Tricolored heron Whimbrel Willet Yellow-crowned night-heron	

Tidal Salt Marsh and Shrubland

The Tidal Salt Marsh and Shrubland key wildlife habitat includes salt meadows along the coast and lower portions of the Chesapeake Bay that form essentially flat plains of low-statured vegetation with moderate species diversity and distinct zonation between low and high salt marshes. Lower, more regularly flooded salt zones with lower salinity are often dominated by saltmarsh cordgrass (*Spartina alterniflora*) and extensive stands of black needlerush (*Juncus roemerianus*). Shorter-statured salt marshes or salt meadows are dominated by saltgrass (*Distichlis spicata*) and saltmeadow cordgrass (*Spartina patens*) and generally occur on slightly elevated surfaces where tides may be less regular and where soils may concentrate salts. High



salt marsh zones often support a diverse assemblage of plants that may include species such as camphorweed (*Pluchea* spp.), saltmarsh false-foxglove (*Agalinis maritima*), annual saltmarsh aster (*Symphotrichum subulatum*), perennial saltmarsh aster (*Symphotrichum tenuifolium*), sea-oxeye (*Borrichia frutescens*), sea-lavender (*Limonium carolinianum*), glassworts (*Salicornia* spp.), sea rose-pink (*Sabatia stellaris*), salt-marsh false foxglove (*Agalinis maritima*), and narrow-leaved loosestrife (*Lythrum lineare*). The salinity of tidal water is usually 18 - 30 ppt and flooding is less regular because of slightly elevated landscapes. Embedded in salt marshes are shallow, poorly drained depressions called “salt pannes”. Like the adjacent salt marsh, salt pannes are flooded by tidal water, but water does not drain freely into creeks or guts. After a panne has been flooded, the standing water evaporates and the salinity of the soil water greatly increases above the level of sea-water, thus supporting the most salt tolerant perennials and annuals such as saltgrass (*Distichlis spicata*), saltwort, and glassworts. Salt scrub is generally species poor and composed only of plants tolerant of high salinity such as southern bayberry (*Morella cerifera*), high-tide bush (*Baccharis halimifolia*), and marsh-elder (*Iva frutescens*). These communities are found in saline environments throughout the outer Coastal Plain. Although salt scrub does occur in tidal habitats, it more commonly occupies higher, only irregularly-flooded landscape positions in a mosaic with lower, regularly-flooded salt marsh. Salt scrub stands often occur in maritime environments, where they are influenced especially by high winds and salt spray. Sea-level fens are also associated with higher landscape positions in tidal salt marsh and shrubland systems. These small seepage wetlands develop at the upland edge of salt marshes where abundant groundwater discharges at the bases of gentle slopes. The hydrology of these sites is best characterized as saturated, although shallow standing water and small, muck-filled pools are locally present at most sites. The soils are organic and extremely nutrient-poor. Because of freshwater groundwater seepage, the vegetation of these features exhibits characteristics of both inland acidic seepage bogs and oligohaline tidal marshes. Stands are generally a physiognomic mosaic of open woodland, scrub, and herbaceous patches. Sea-level fens are globally rare natural communities threatened by sea-level rise, encroachment of non-native species (e.g., *Phragmites australis*), and excessive nutrient input via agricultural runoff.



Jason Harrison, MD DNR

County Distribution: Dorchester, Somerset, St. Mary’s, Wicomico, Worcester

Places to Visit: Assateague Island National Seashore

Signature State Rare Plants: White spikerush (*Eleocharis albida*), seabeach orach/crested saltbush (*Atriplex mucronata*), narrowleaf seepweed (*Suaeda linearis*)

State Rare Natural Community: Sea-level Fen



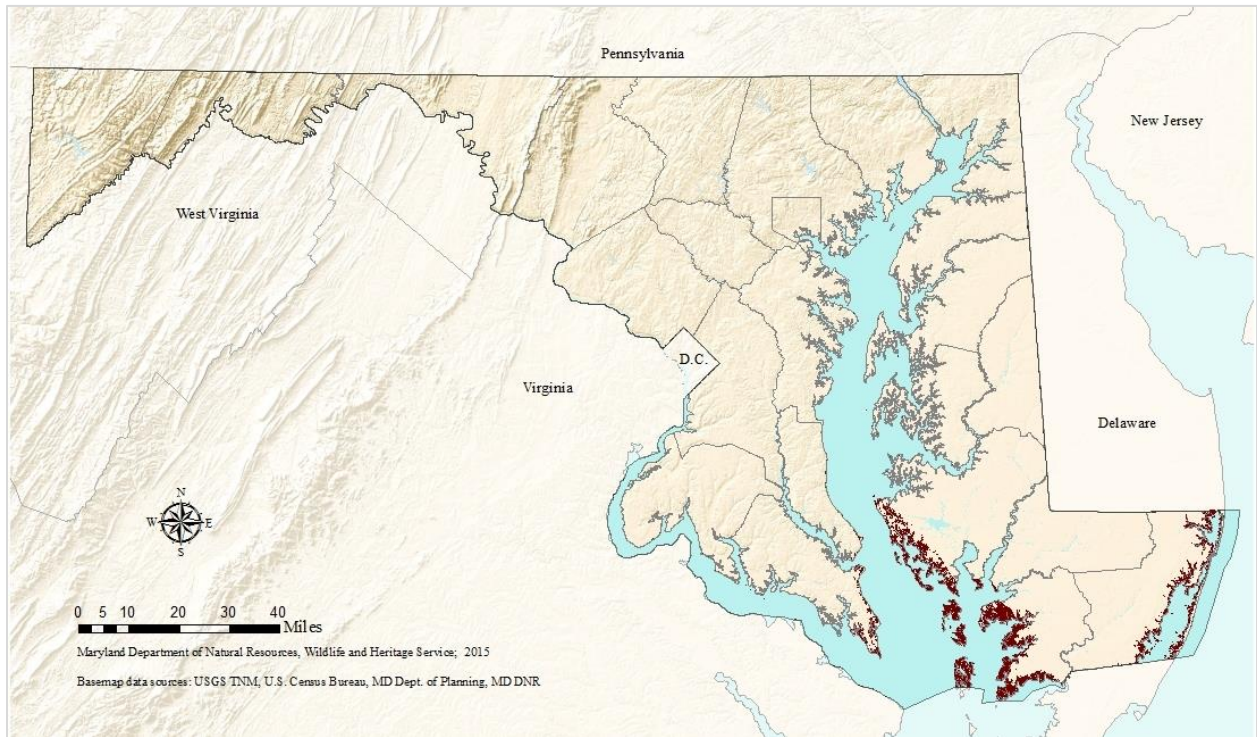


Figure 4.38 Location of Tidal Salt Marshes and Shrublands in Maryland. Sources: MD DNR, Nature Serve’s Terrestrial Ecological Systems of the U.S.

Species of Greatest Conservation Need Associated with Tidal Salt Marshes and Shrublands:

Mammals	Birds cont.	Birds cont.
American mink	Common tern	Ruddy turnstone
Big brown bat	Dunlin	Saltmarsh sparrow
Bobcat	Eastern meadowlark	Sanderling
Eastern red bat	Forster's tern	Sandwich tern
Hoary bat	Gadwall	Seaside sparrow
Least shrew	Glossy ibis	Sedge wren
Seminole bat	Golden eagle	Semipalmated sandpiper
Silver-haired bat	Great blue heron	Short-billed dowitcher
Tricolored bat	Great egret	Short-eared owl
Birds	Greater yellowlegs	Snowy egret
American bittern	Gull-billed tern	Sora
American black duck	Horned grebe	Spotted sandpiper
American oystercatcher	Laughing gull	Tricolored heron
American peregrine falcon	Least bittern	Whimbrel
Bald eagle	Least tern	Willet
Barn owl	Lesser yellowlegs	Yellow-crowned night heron
Black rail	Little blue heron	



Birds cont.		Reptiles
Black skimmer	Marsh wren	Northern diamond-backed terrapin
Black-crowned night-heron	Nelson's sparrow	Fishes
Blue-winged teal	Northern harrier	Spotfin killifish
Boat-tailed grackle	Pied-billed grebe	Insects (Butterflies & Moths)
Brown pelican	Red knot	Delaware skipper
Common gallinule	Royal tern	Rare skipper
Common nighthawk	Ruddy duck	Seaside goldenrod stem borer
		A noctuid moth (<i>Meropleon titan</i>)

Intertidal Mudflat and Sand Flat

The Intertidal Mudflat and Sand Flat key wildlife habitat is characterized by mudflats and sand flats of embayed and riverine areas of the Coastal Plain. They are best developed in shallow protected estuarine bays, pools, and along small tidal creeks and guts. The depth and frequency of tidal flooding is variable depending on the landscape setting, but most flats are exposed twice daily during low tide cycles. Sand flats are often tidally exposed extensions adjacent to areas of Coastal Beach key wildlife habitat. Additional intertidal areas are less frequently exposed during certain lunar cycles that cause extra low tides and especially during extended periods of strong wind. Though not species rich, vascular aquatic species can be abundant and often include species such as eelgrass (*Vallisneria americana*), beaked ditch-grass (*Ruppia maritima*), horned pondweed (*Zannichellia palustris*), and sago pondweed (*Potamogeton pectinatus*). Aquatic algae can be also abundant and may frequently include species of sea-lettuces.



Jason Harrison, MD DNR

County Distribution: Anne Arundel, Baltimore, Calvert, Caroline, Cecil, Charles, Dorchester, Harford, Kent, Prince George’s, Queen Anne’s, Somerset, St. Mary’s, Talbot, Wicomico, Worcester

Places to Visit: Blackwater National Wildlife Refuge, Assateague Island National Seashore, Piscataway Park

Signature State Rare Plants: Parker’s pipewort (*Eriocaulon parkeri*), mudwort (*Limosella australis*), riverbank quillwort (*Isoetes riparia*)

State Rare Natural Community: Intertidal Shore



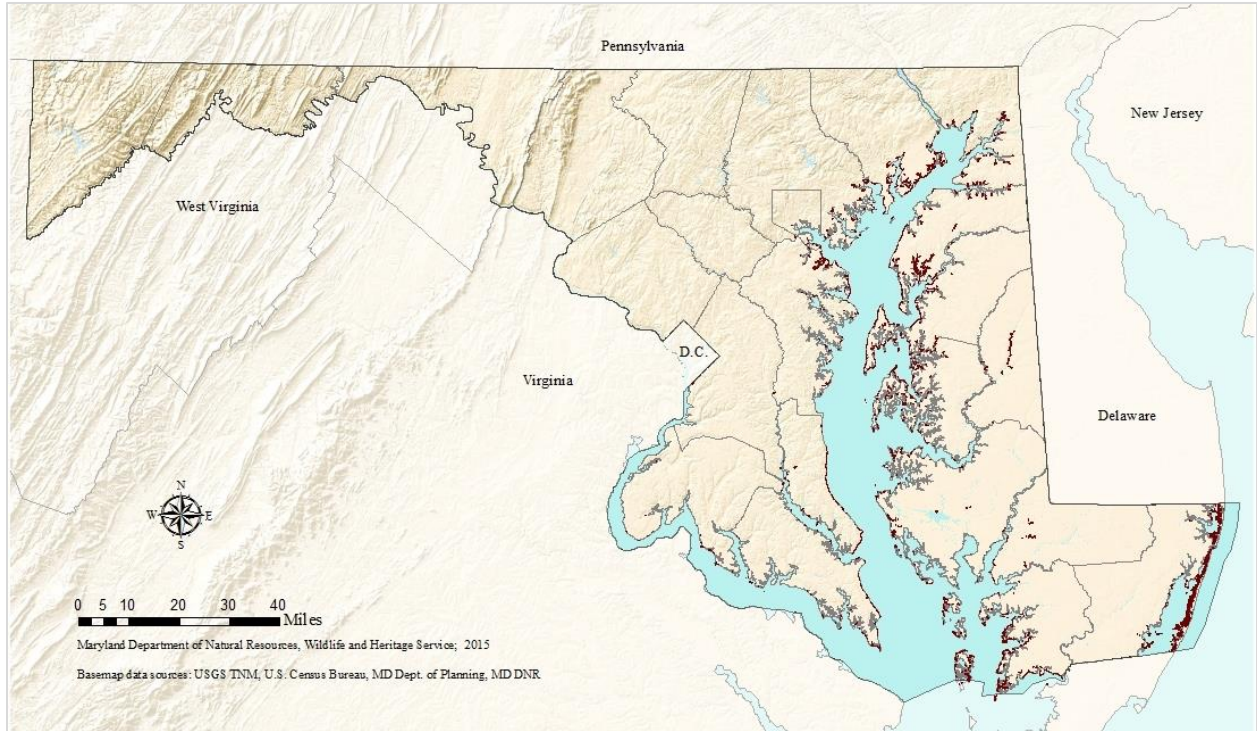


Figure 4.39 Location of Intertidal Mudflats and Sandflats in Maryland. Sources: USFWS, USGS, MD DNR.

Species of Greatest Conservation Need Associated with Intertidal Mudflats and Sandflats:

Birds	Birds cont.	Reptiles
American black duck American oystercatcher American peregrine falcon Bald eagle Black skimmer Black-bellied plover Black-crowned night-heron Blue-winged teal Brant Brown pelican Common tern Dunlin Forster's tern Gadwall Glossy ibis Great blue heron Great egret Greater yellowlegs Gull-billed tern Laughing gull	Least tern Lesser yellowlegs Little blue heron Piping plover Red knot Roseate tern Royal tern Ruddy turnstone Sanderling Sandwich tern Semipalmated sandpiper Short-billed dowitcher Snowy egret Sora Spotted sandpiper Tricolored heron Whimbrel Willet Wilson's plover Yellow-crowned night-heron	Northern diamond-backed terrapin Insects (Beetles) Northeastern beach tiger beetle Arthropods Horseshoe crab

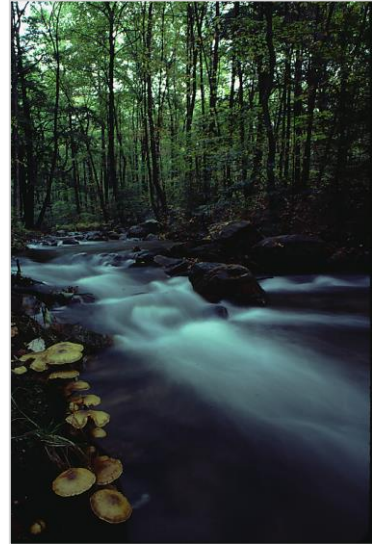


Aquatic Habitats

Streams and Rivers

Coldwater Stream

Coldwater Streams comprise approximately 2,750 miles of Maryland's freshwater streams and are unique in their form, function, and biota. They are most common in the Appalachian Plateau and Ridge and Valley physiographic provinces, particularly in the Youghiogheny and North Branch Potomac drainages, but are also found in the Piedmont physiographic province within the Middle Potomac, Susquehanna, Gunpowder, and Patapsco drainages. Characterized by a maximum daily mean water temperature of less than 20° C and dissolved oxygen levels greater than 5 mg/L, these streams are typically found only in the headwater reaches of a watershed. Most are riffle-dominated, high gradient (>2%) streams with well-shaded riparian canopies allowing for mechanical aeration and regulation of water temperature. Fallen trees and submerged logs play an important role in shaping Coldwater Stream channels, creating pools and slow-water areas beneficial to aquatic species. Logs and leaf litter are also a primary source of organic matter forming the base of the food web in these streams. Beaver activity along Coldwater Streams represents an important form of natural disturbance and creates habitat heterogeneity. Beaver impounded stream sections help reduce sediment and nutrient loads in downstream areas, create shifting mosaics of different forest successional stages, and provide habitat for a variety of wildlife species of greatest conservation need. Compared to downstream and warm water streams, aquatic biodiversity and productivity are low, with few fish and benthic macroinvertebrate species, often occurring in low abundance. Brook trout, Maryland's only native trout species, are found in these streams along with introduced brown and rainbow trout. Common nongame species include mottled and Blue Ridge sculpin, longnose dace, and creek chub. Stoneflies of the genera *Sweltsa* and *Tallaperla* are considered coldwater obligate taxa – found only in these habitats. Mayflies of the genera *Ephemerella*, *Epeorus*, *Stenonema*, and *Paraleptophlebia* and stoneflies often dominate the benthic macroinvertebrate community. In contrast to the low diversity of fish species, Coldwater Streams support the greatest diversity of aquatic and semi-aquatic salamanders in the State, including spring (*Gyrinophilus porphyriticus*), seal, and Allegheny mountain dusky salamanders (*Desmognathus ochrophaeus*).



Richard Wiegand, MD DNR

The quantity and quality of Coldwater Stream habitats have declined as a result of disturbance associated with agriculture and urban development. Although the historical extent of Coldwater Streams in Maryland is not known, this type of stream habitat was likely more widespread. Based on fish and benthic macroinvertebrate community assessments (MBSS 2007-2009), Coldwater Streams in Maryland are on average in fair condition, meaning that many of these streams are at least partially degraded. Seven percent of Coldwater Stream habitats are considered to be severely degraded and no longer support many of the species that make this key wildlife habitat unique. Thirty-six percent are in good condition and 7% of the approximately



2,750 miles of Coldwater Streams are considered “high quality waters” as designated in Maryland’s Anti-degradation regulation (COMAR 26.08.02.04-1).

County Distribution: Allegany, Anne Arundel, Baltimore, Carroll, Cecil, Frederick, Garrett, Harford, Howard, Montgomery, Prince George’s, Washington

Places to Visit: Savage River State Forest, Big Run State Park, Gunpowder Falls State Park

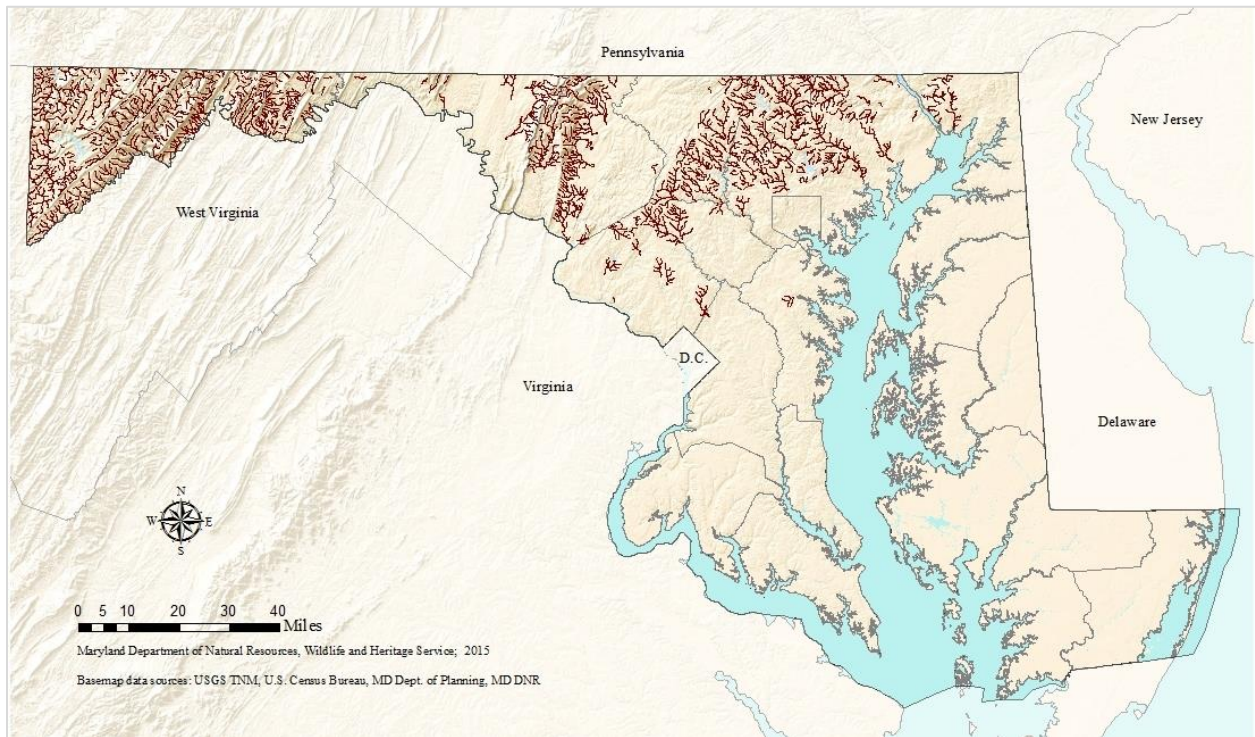


Figure 4.40 Location of Coldwater Streams in Maryland. Sources: Versar, Inc., USGS, MD DNR.

Species of Greatest Conservation Need Associated with Coldwater Streams:

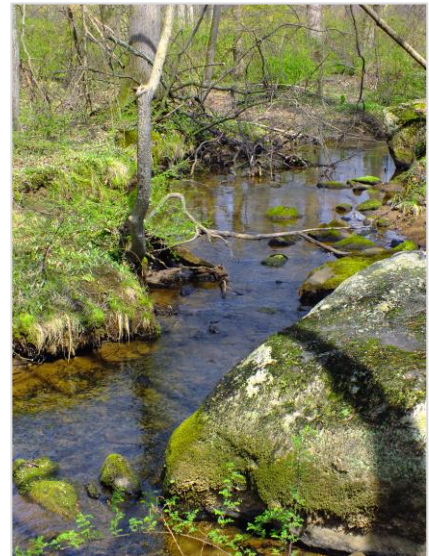
Mammals	Birds	Insects (Dragonflies and Damselflies)
American mink	Louisiana waterthrush	Arrowhead spiketail
Big brown bat	Reptiles	Brown spiketail
Eastern red bat	Common ribbonsnake	Delta-spotted spiketail
Eastern small-footed myotis	Wood turtle	Harpoon clubtail
Evening bat	Amphibians	Mocha emerald
Hoary bat	Eastern hellbender	Northern pygmy clubtail
Indiana myotis	Northern red salamander	Ocellated darter
Little brown myotis	Northern spring salamander	River jewelwing
Northern long-eared bat	Seal salamander	Sable clubtail
Silver-haired bat	Fishes	Ski-tailed emerald
Southern water shrew	Brook trout	Southern pygmy clubtail



Mammals cont.	Fish cont.	Dragonflies and Damselflies cont.
Tricolored bat	Mottled sculpin	Superb jewelwing Tiger spiketail Zebra clubtail
		Insects (Stoneflies, Mayflies, Caddisflies)
		Aracoma sallfly Dusky sallfly Pocahontas sallfly Shenandoah sallfly
		Crustaceans
		Allegheny crayfish Rock crawfish An ostracod (<i>Donnaldsoncythere donnaldsonensis</i>)

Limestone Stream

Limestone Streams are strongly influenced by the underlying geology of the Ridge and Valley physiographic province of Maryland, resulting in systems that are physically and chemically distinct from freestone (non-limestone) streams. Fractures, cracks, and channels are abundant in limestone, making springs and seeps common. This connectivity between groundwater and surface water serves to stabilize pH and water temperature. Submerged logs and tree roots are important features in Limestone Streams that shape stream channels, create pools and other slow-water areas beneficial to aquatic species. Logs and leaf litter form the base of the food web in these streams. Limestone Streams are also biologically unique. Plants, such as watercress (*Rorippa nasturtium-aquaticum*) and waterweed (*Elodea* spp.) are abundant, especially near spring sources and groundwater seeps. Fish and benthic macroinvertebrate communities tend to exhibit low diversity, but maintain high abundance in response to the stable water chemistry. Beaver activity along Limestone Streams represents an important form of natural disturbance and creates habitat heterogeneity. Beaver-impounded stream sections help reduce sediment and nutrient loads in downstream areas, create shifting mosaics of different forest successional stages, and provide habitat for a variety of wildlife species of greatest conservation need. Fish species common in Limestone Streams include checkered sculpin and pearl dace. In contrast to the region’s freestone streams, which are dominated by mayfly and stonefly taxa, the benthic macroinvertebrate communities of Limestone Streams tend to be dominated by crustaceans, like scuds and aquatic sow bugs. An estimated 256 miles of Maryland’s streams are limestone systems.



Wikimedia Commons



The majority of Maryland’s Limestone Streams are located in the Ridge and Valley physiographic province, a predominately agricultural area that is under increasing pressure from suburban development. Agricultural land use practices have altered many of these streams by chemical and physical degradation. Based on fish and benthic macroinvertebrate community assessments (MBSS 2007-2009), the average condition of Limestone Streams in Maryland is fair. Twenty-five percent of Limestone Streams are considered degraded and no longer support many of the species that make these habitats unique.

County Distribution: Frederick, Washington

Places to Visit: Chesapeake and Ohio National Park at Antietam Creek, South Mountain State Park

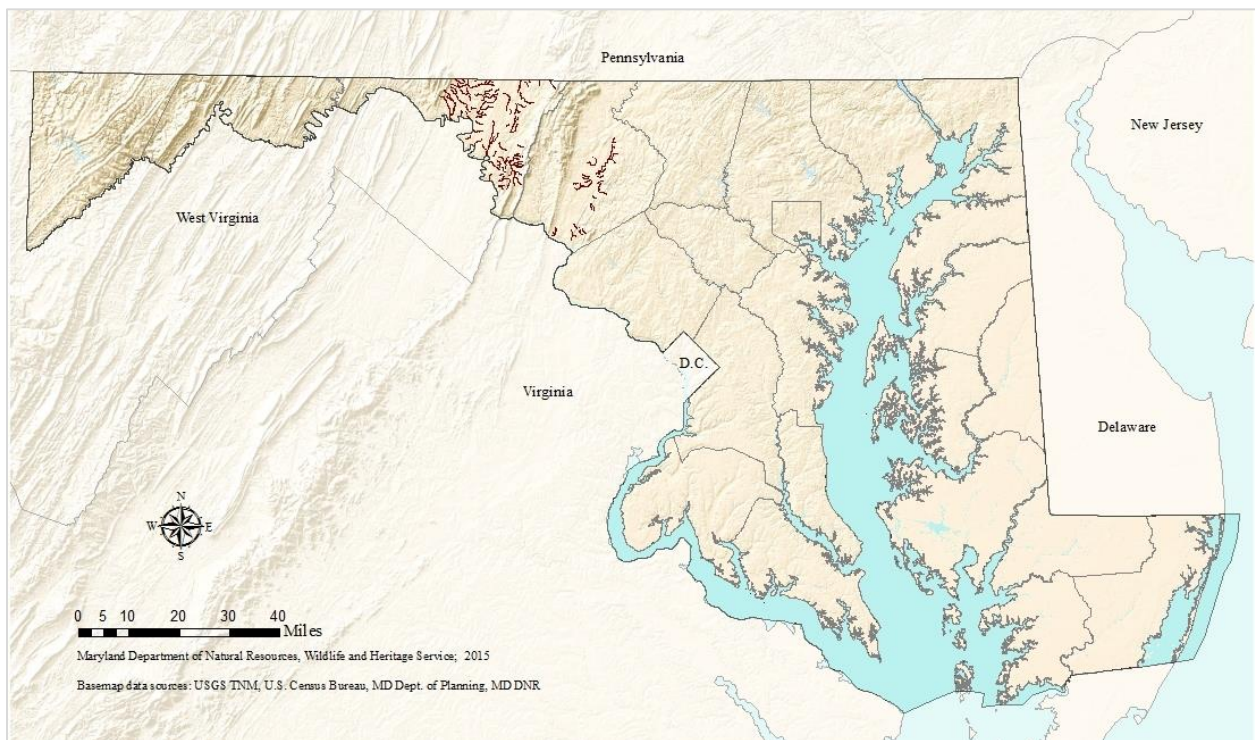


Figure 4.41 Location of Limestone Streams in Maryland. Sources: Versar, Inc., USGS, MD DNR.

Species of Greatest Conservation Need Associated with Limestone Streams:

Mammals	Birds	Insect (Dragonflies and Damselflies)
American mink	Louisiana waterthrush	Mocha emerald
Big brown bat	Reptiles	Insects (Stoneflies, Mayflies, Caddisflies)
Eastern red bat	Common ribbonsnake	Speith's great speckled olive mayfly
Eastern small-footed myotis	Wood turtle	Crustaceans
Evening bat		An ostracod (<i>Donaldsoncythere donaldsonensis</i>)
Hoary bat	Amphibians	Freshwater Mussels
Indiana myotis	Northern red salamander	Brook floater



Mammals cont.	Fishes	Freshwater Mussels cont.
Little brown myotis Northern long-eared bat Silver-haired bat Tri-colored bat	Brook trout Checkered sculpin	Creeper

Highland Stream

Highland Streams flow through several physiographic regions, including the Appalachian Plateau, Ridge and Valley, and Blue Ridge. They are typically high gradient systems (>4 %), ranging in elevation from 140 to 2,800 feet. Substrate is dominated by gravel, cobble, and boulders interspersed with bedrock outcroppings. Many of these streams fall within the rain shadow of the Appalachians, and thus receive the lowest annual rainfall amounts in the state. Consequently, stream flow in the summer is often markedly reduced for many Highland Streams. Beaver activity along Highland Streams represents an important form of natural disturbance and creates habitat heterogeneity. Beaver-impounded stream sections help reduce sediment and nutrient loads in downstream areas, create shifting mosaics of different forest successional stages, and provide habitat for a variety of wildlife species of greatest conservation need. Native fish species found in Highland Streams include mottled sculpin, Potomac sculpin (*Cottus girardi*), silverjaw minnow (*Notropis buccatus*), striped shiner, and fantail darter (*Etheostoma flabellare*). Stoneflies and mayflies often dominate the benthic macroinvertebrate community. Streamside trees and logs play an important role in shaping Highland Stream channels and banks, creating pools and slow-water areas beneficial to aquatic species. Logs and leaf litter are also a primary source of organic matter, forming the base of the food web in these streams. There are approximately 320 miles of highland streams in Maryland.



Paul Kayzak, MD DNR

Based on fish and benthic macroinvertebrate community assessments (MBSS 2007-2009), the average condition of Highland Streams in Maryland is fair, meaning that many of these streams are at least partially degraded. Approximately 47% of Highland Streams are considered severely degraded. Four percent of Highland Streams are in good condition and 3% of the approximately 320 miles of Highland Streams are considered “high quality waters” as designated by Maryland’s Anti-degradation regulation (COMAR 26.08.02.04-1).

County Distribution: Allegany, Frederick, Garrett, Washington

Places to Visit: Green Ridge State Forest



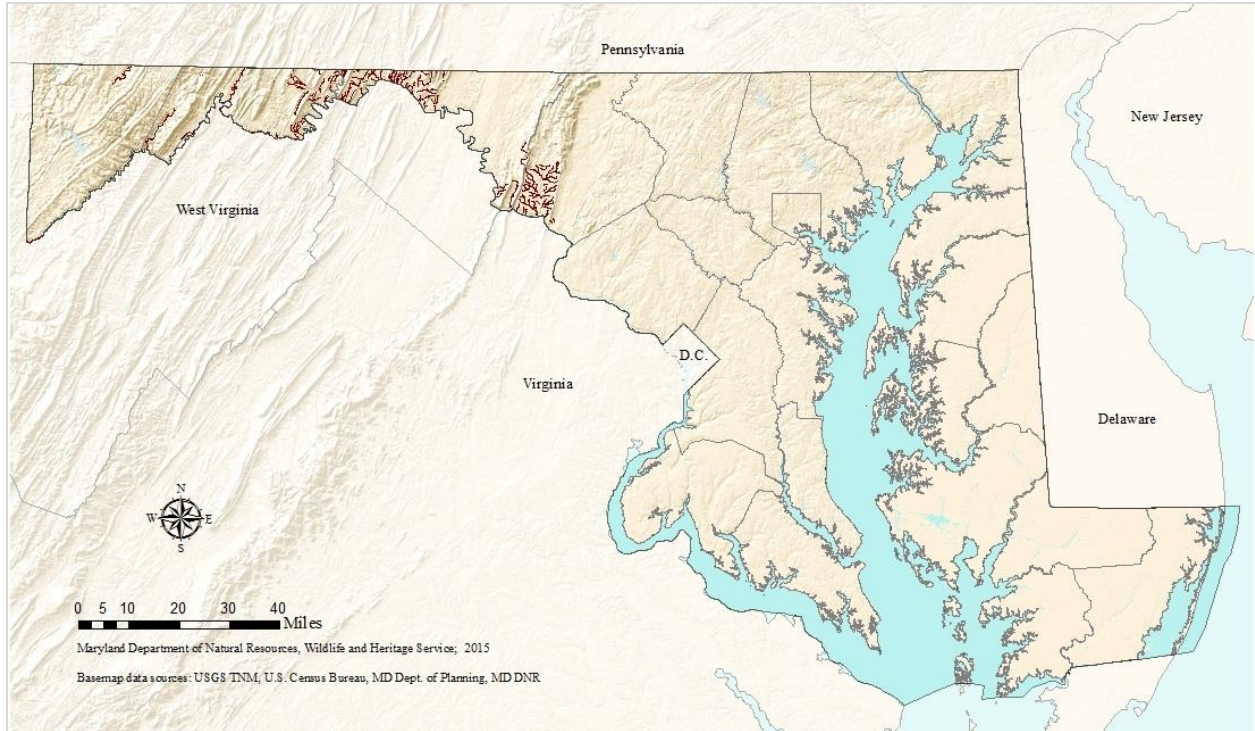


Figure 4.42 Location of Highland Streams in Maryland. Sources: Versar, Inc., USGS, MD DNR.

Species of Greatest Conservation Need Associated with Highland Streams:

Mammals	Fishes	Insects (Stoneflies, Mayflies, Caddisflies)
American mink	Brook trout	Gaspe sallfly
Big brown bat	Comely shiner	Crustaceans
Eastern red bat	Johnny darter	Allegheny crayfish
Eastern small-footed myotis	Longnose sucker	Rock crayfish
Hoary bat	Mottled sculpin	An ostracod (<i>Donnaldsonocythere donnaldsonensis</i>)
Indiana myotis	Stonecat	Freshwater Mussels
Little brown myotis	Striped shiner	Atlantic spike
Northern long-eared bat	Insects (Beetles)	Brook floater
Silver-haired bat	Appalachian tiger beetle	Creeper
Tricolored bat	Insects (Dragonflies and Damselflies)	Eastern lampmussel
Birds	Allegheny river cruiser	Green floater
Louisiana waterthrush	Appalachian jewelwing	Triangle floater
Reptiles	Green-faced clubtail	
Common ribbonsnake	Harpoon clubtail	
Spotted turtle	Laura's clubtail	
Wood turtle	Maine snaketail	
	Mocha emerald	



Amphibians	Dragonflies and Damselflies cont.
Common mudpuppy Eastern hellbender Northern red salamander	Mustached clubtail Northern pygmy clubtail Ocellated darner Rapids clubtail Sable clubtail Ski-tailed emerald Southern pygmy clubtail Spine-crowned clubtail Splendid clubtail Uhler's sundragon Zebra clubtail

Piedmont Stream

Piedmont Streams, located from the western boundary of the Catoctin Mountains in Frederick County to the eastern border at the Fall Line, are among the most biologically productive systems in the State. The physical and chemical nature of Piedmont Streams is governed largely by the varying topography and geology of the Piedmont physiographic province. Streams along the eastern edge share similar physical characteristics with the neighboring Coastal Plain. Here, streams are typically low to moderate in gradient (1-2%) with silt, sand, and gravel substrates. High gradient streams west of the Fall Line are characterized by cobble-boulder substrates with bedrock outcrops. Beaver activity along Piedmont Streams represents an important form of natural disturbance and creates habitat heterogeneity. Beaver-impounded stream sections help reduce sediment and nutrient loads in downstream areas, create shifting mosaics of different forest successional stages, and provide habitat for a variety of wildlife species of greatest conservation need. Fish species commonly found in Piedmont Streams include American eel, tessellated darter (*Etheostoma olmstedi*), blacknose dace (*Rhinichthys atratulus*), Blue Ridge sculpin (*Cottus caeruleomentum*), common shiner (*Luxilus cornutus*), longnose dace (*Rhinichthys cataractae*), and bluntnose minnow (*Pimephales notatus*). Streamside trees, roots, and submerged logs shape the stream channel and banks, creating pools and slow-water areas and important cover habitat for a variety of aquatic species. Logs and leaf litter are also a primary source of organic matter, forming the base of the food web in these streams. River basins with Piedmont Streams draining into Chesapeake Bay include Susquehanna, Elk, Bush, Gunpowder, Patapsco, the upper portion of the Patuxent River, Middle Potomac, and the eastern portion of the Potomac Washington Metro basins. There are approximately 1,800 miles of Piedmont Streams in Maryland.



Jay Kilian, MD DNR



Maryland’s Piedmont physiographic province has been the center of urban and suburban development in the state. Stream degradation associated with urbanization has reduced biodiversity and ecological integrity of many Piedmont Streams draining urban centers. Based on fish and benthic macroinvertebrate community assessments (MBSS 2007-2009), the overall condition of Piedmont Streams on average is fair. Approximately 42% of Piedmont Streams are considered degraded. Only 12% of Piedmont Streams are considered to be in good biological condition. Approximately 54 of 1,800 miles of Piedmont Streams are considered “high quality waters” as designated by Maryland’s Anti-degradation regulation (COMAR 26.08.02.04-1).

County Distribution: Anne Arundel, Baltimore, Carroll, Cecil, Frederick, Harford, Howard, Montgomery, Prince George’s

Places to Visit: Gunpowder State Park, Patapsco Valley State Park, Seneca Creek State Park

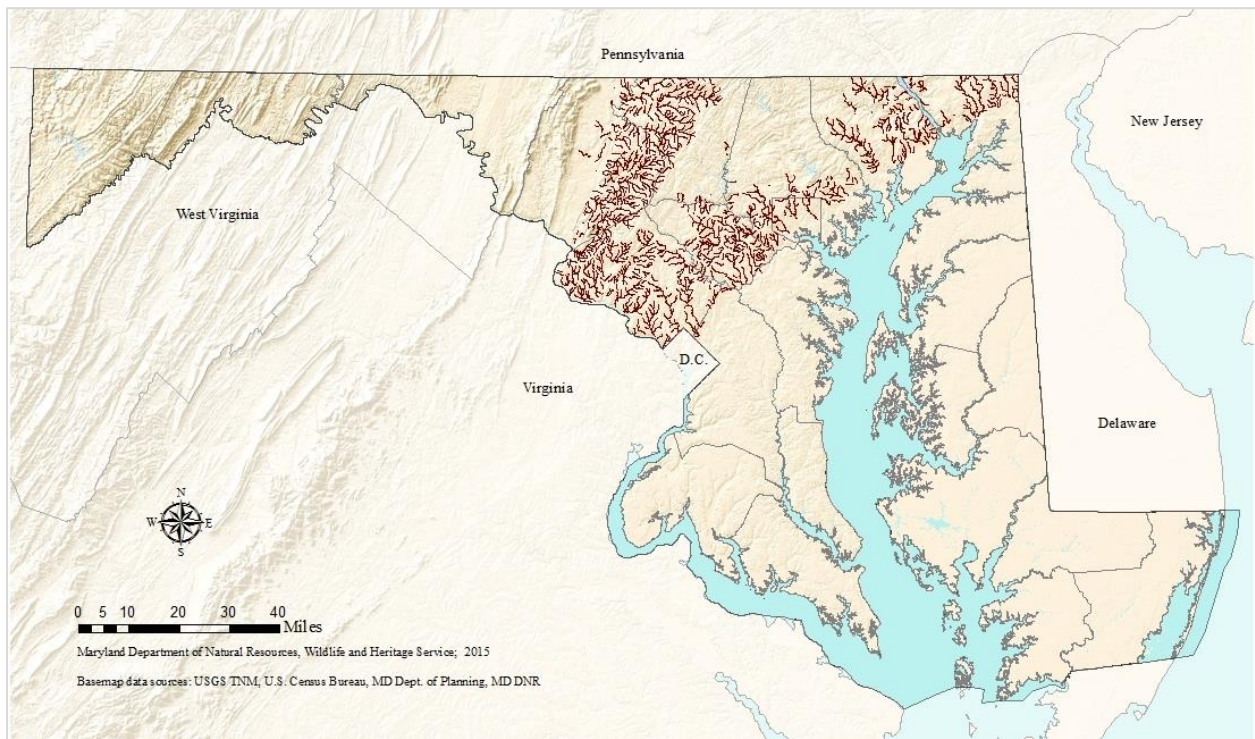


Figure 4.43 Location of Piedmont Streams in Maryland. Sources: Versar, Inc., USGS, MD DNR.

Species of Greatest Conservation Need Associated with Piedmont Streams:

Mammals	Amphibians	Crustaceans	
American mink Big brown bat Eastern red bat Evening bat Hoary bat Indiana myotis Little brown myotis	Northern red salamander	Acuminate crayfish	
	Fishes		
	Bridle shiner	Allegheny crayfish	
	Brook trout	An ostracod (<i>Donnaldsoncythere donnaldsonensis</i>)	
	Chesapeake logperch	Freshwater Mussels	
	Comely shiner	Alewife floater	
	Glassy darter	Atlantic spike	
		Brook floater	



Mammals cont.	Fishes cont.	Freshwater mussels cont.
Northern long-eared bat	Maryland darter	Creeper
Seminole bat	Insects (Dragonflies and Damselflies)	Eastern lampmussel
Silver-haired bat	Appalachian snaketail	Green floater
Tricolored bat	Arrowhead spiketail	Triangle floater
Birds	Brown spiketail	Yellow lance
Louisiana waterthrush	Common sanddragon	
Yellow-crowned night-heron	Laura's clubtail	
Reptiles	Mocha emerald	
Bog turtle	Royal river cruiser	
Common ribbonsnake	Sable clubtail	
Spotted turtle	Southern pygmy clubtail	
Wood turtle	Tiger spiketail	

Coastal Plain Stream

Maryland’s Coastal Plain Streams extend from the Fall Line eastward toward the Atlantic Ocean. These streams are typically low in gradient (<1%) and found at elevations of less than 50 feet above sea level. They represent the lower non-tidal and upper fresh tidal (salinity < 0.5 ppt) sections of larger stream and river systems, and form transition zones between upper non-tidal reaches and increasingly larger, saline tidal sections. Silt, sand, gravel, and small cobble are the dominant substrates. Most Coastal Plain Streams contain only runs, glides and pools; however, gravel riffles are common in those streams draining the rolling hills on the western and upper eastern shore. Streams on the lower eastern shore are extremely sluggish with broad floodplains and braided channels. Since Coastal Plain Streams lack stable substrates such as bedrock and boulders, wood and submerged aquatic vegetation are important channel features. Submerged logs and tree roots slow the flow of nutrients and sediment, provide cover for fishes and stream insects, and control stream bank erosion. Beaver activity along Coastal Plain Streams represents an important form of natural disturbance and creates habitat heterogeneity. Beaver-impounded stream sections help reduce sediment and nutrient loads in downstream areas, create shifting mosaics of different forest successional stages, and provide habitat for a variety of wildlife species of greatest conservation need. Eastern mudminnow (*Umbra pygmaea*), bluespotted sunfish (*Enneacanthus gloriosus*), creek chubsucker (*Erimyzon oblongus*), and least brook lamprey (*Lampetra aepyptera*) are common Coastal Plain Stream fishes. These streams are also important habitat for the American eel (*Anguilla rostrate*) from the juvenile to adult stage. Sandy and gravel substrates of Coastal Plain Streams support a diverse community of freshwater mussels (Unionidae), many of which are listed as In Need of Conservation, Threatened, or Endangered in Maryland. Many of these



MBSS, MD DNR



riverine fish and mussel species are favorite prey items of river otter and muskrat. The Chester, Choptank, Nanticoke/Wicomico, Pocomoke, Lower Potomac, Patapsco, Gunpowder, Elk, Lower Susquehanna, Bush, Potomac Washington Metro, West Chesapeake, and Patuxent River basins all contain Coastal Plain Streams, comprising approximately 2,500 stream miles.

Based on fish and benthic macroinvertebrate community assessments (MBSS 2007-2009), the average condition of Coastal Plain Streams in Maryland is fair, meaning that many of these streams are at least partially degraded. Approximately 38% of Coastal Plain Streams are considered severely degraded. Thirty-four percent of Coastal Plain Streams are considered to be minimally impaired and 6% of the 2,500 miles of Coastal Plain Streams are designated as “high quality waters” by Maryland’s Anti-degradation regulation (COMAR 26.08.02.04-1).

County Distribution: Anne Arundel, Baltimore, Calvert, Caroline, Cecil, Charles, Harford, Howard, Kent, Prince George’s, Queen Anne’s, St. Mary’s, Talbot

Places to Visit: Tuckahoe State Park, Millington Wildlife Management Area, Myrtle Grove Wildlife Management Area

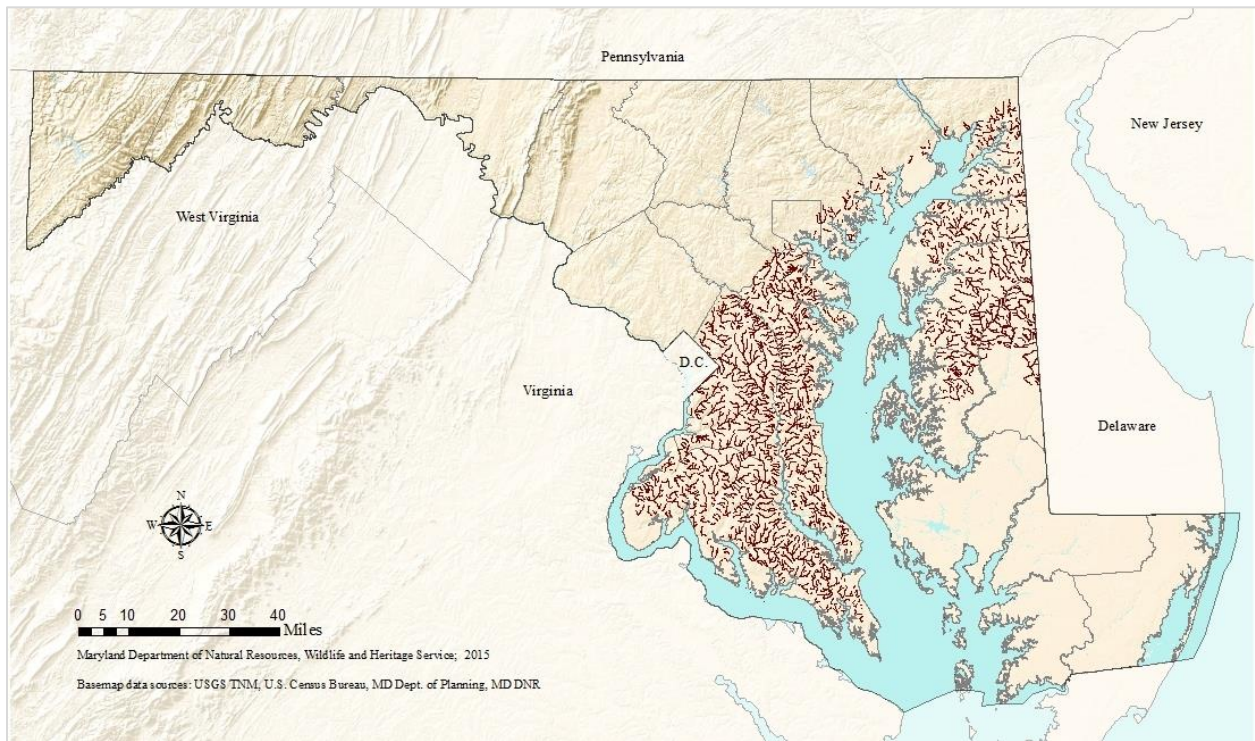


Figure 4.44 Location of Coastal Plain Streams in Maryland. Sources: Versar, Inc., USGS, MD DNR.

Species of Greatest Conservation Need Associated with Coastal Plain Streams:

Mammals	Amphibians	Insects (Dragonflies and Damselflies)
American mink Big brown bat Eastern red bat	Northern red salamander Southern two-lined salamander	Appalachian snaketail Arrowhead spiketail Banded spiketail



Mammals cont.	Fishes	Dragonflies and Damselflies cont.
Hoary bat Little brown myotis Seminole bat Silver-haired bat Southeastern myotis Southeastern star-nosed mole Tricolored bat	American brook lamprey American shad Banded sunfish Blackbanded sunfish Bridle shiner Chesapeake logperch Flier	Blackwater bluet Brown spiketail Common sanddragon Coppery emerald Delta-spotted spiketail Furtive forktail Laura's clubtail Mocha emerald Royal river cruiser Sable clubtail Selys' sunfly Sparkling jewelwing Tiger spiketail Uhler's sundragon
Birds	Glassy darter Hickory shad Ironcolor shiner Maryland darter Mud sunfish Stripeback darter Swamp darter	
Great blue heron Louisiana waterthrush Yellow-crowned night-heron		
Reptiles		
Common ribbonsnake Plain-bellied watersnake Rainbow snake Spotted turtle		Crustaceans Acuminate crayfish Digger crayfish An ostracod (<i>Donnaldsoncythere donnaldsonensis</i>)
		Freshwater Mussels Alewife floater Atlantic spike Creeper Dwarf wedgemussel Eastern lampmussel Eastern pondmussel Northern lance Paper pondshell Tidewater mucket Triangle floater Yellow lampmussel Yellow lance



Blackwater Stream

Blackwater Streams are sluggish, low gradient (<1%) systems located within the Pocomoke and Nanticoke/Wicomico basins of Maryland's Coastal Plain physiographic province. They are characterized by low acidity, generally with pH levels less than 6, and dissolved organic carbon greater than 8 mg/L. In contrast to other streams, dissolved oxygen levels are low (< 5mg/L) due to increased bacterial respiration from the decomposition of organic matter. Substrate consists primarily of silt, sand, and organic matter, with minor and isolated amounts of small gravel. Because of the lack of larger, more stable substrate, instream wood is of



Jay Kilian, MD DNR

critical importance in defining hydrologic features and providing cover for the aquatic biota. Biodiversity in Blackwater Streams is typically low, and limited to only those organisms that are tolerant of the naturally acidic conditions. Beaver activity along Blackwater Streams represents an important form of natural disturbance and creates habitat heterogeneity. Beaver-impounded stream sections help reduce sediment and nutrient loads in downstream areas, create shifting mosaics of different forest successional stages, and provide habitat for a variety of wildlife species of greatest conservation need. Common fishes include eastern mudminnow (*Umbra pygmaea*), pirate perch (*Aphredoderus sayanus*), golden shiner (*Notemigonus crysoleucas*), creek chubsucker (*Erimyzon oblongus*), tadpole madtom (*Noturus gyrinus*), and redbfin pickerel (*Esox americanus*). The benthic macroinvertebrate community is dominated by dragonfly, amphipod, and isopod taxa. There are approximately 1,275 miles of Blackwater Streams in Maryland.

Based on fish and benthic macroinvertebrate community assessments (MBSS 2007-2009), 30 percent of Blackwater Streams remain in good biological condition. Approximately, 64 miles of Blackwater Streams are considered "high quality waters" as designated by Maryland's Anti-degradation regulation (COMAR 26.08.02.04-1). However, approximately half of all Blackwater Streams in Maryland are considered degraded, largely due to intensive agricultural practices, removal of forests, stream channelization, and other stressors.

County Distribution: Anne Arundel, Calvert, Caroline, Charles, Dorchester, Harford, Kent, Prince George's, Queen Anne's, Somerset, St. Mary's, Talbot, Wicomico, Worcester

Places to Visit: Pocomoke State Park, Zekiah Swamp Natural Environmental Area



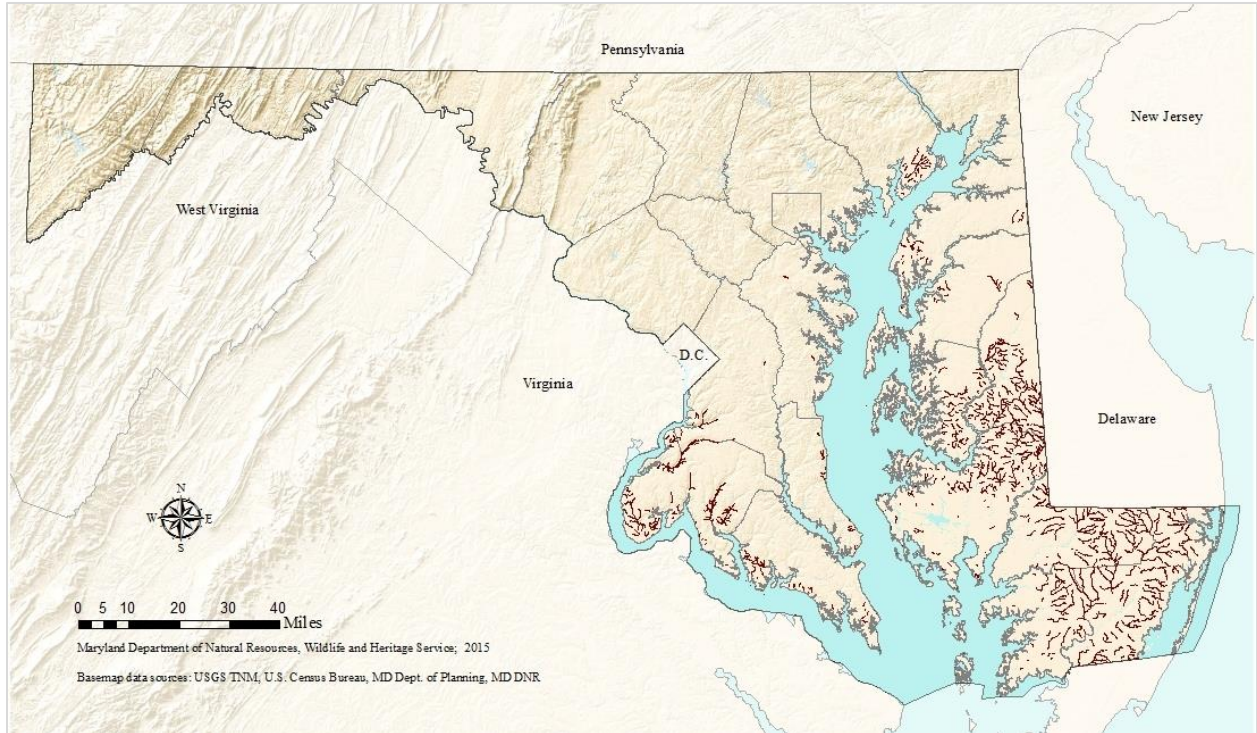


Figure 4.45 Location of Blackwater Streams in Maryland. Sources: Versar, Inc., USGS, MD DNR.

Species of Greatest Conservation Need Associated with Blackwater Streams:

Mammals	Reptiles	Insects (Dragonflies and Damselflies)
American mink	Common ribbonsnake	Blackwater bluet
Big brown bat	Plain-bellied watersnake	Coppery emerald
Eastern red bat	Spotted turtle	Duckweed firetail
Hoary bat	Amphibians	Furtive forktail
Seminole bat	Southern two-lined salamander	Mocha emerald
Silver-haired bat	Fishes	Royal river cruiser
Southeastern myotis	Banded sunfish	Selys' sunfly
Southeastern star-nosed mole	Blackbanded sunfish	Sparkling jewelwing
Tricolored bat	Bridle shiner	Crustaceans
Birds	Flier	Digger crayfish
Great blue heron	Glassy darter	Freshwater Mussels
Louisiana waterthrush	Ironcolor shiner	Alewife floater
	Mud sunfish	Dwarf wedgemussel
	Swamp darter	Eastern lampmussel
		Northern lance



Highland River

Large Highland Rivers in Maryland are located in the western portion of the state in the Youghiogheny and Potomac River basins. Highland Rivers consist of riffle/run and pool habitat sequences with substrate ranging from large boulders to sand and silt. The energy base for these systems includes large woody debris and leaf litter, as well as primary production by periphyton, phytoplankton, and aquatic macrophytes. These large river systems support a diversity of game fish species including smallmouth bass, chain pickerel, and walleye. Several gamefish species (tiger muskellunge (*Esox masquinongy* X *Esox lucius*), northern pike (*Esox lucius*), walleye (*Sander vitreus*), brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*), and cutthroat trout (*Oncorhynchus clarkii*)) are stocked in Highland Rivers. Nongame species common in these systems include redbreast sunfish (*Lepomis auritus*), rock bass (*Ambloplites rupestris*), Potomac sculpin (*Cottus girardi*), northern hogsucker (*Hypentelium nigricans*), and margined madtom (*Noturus insignis*). There are approximately 180 miles of Highland River habitat in Maryland.



James McCann, MD DNR

Degradation and loss of species associated with highland and coldwater tributaries have ultimately affected the downstream conditions of Maryland's Highland River habitats. Highland Rivers serve as receiving waters for effluents from industrial sources and municipal sewage treatment plants. The damming of Highland Rivers for drinking water reservoirs and hydroelectric power generation has altered these habitats considerably, often reducing available habitats for many fish and mussel SGCN.

County Distribution: Allegany, Frederick, Garrett, Washington

Places to Visit: Potomac State Forest, Green Ridge State Forest, Sideling Hill Wildlife Management Area



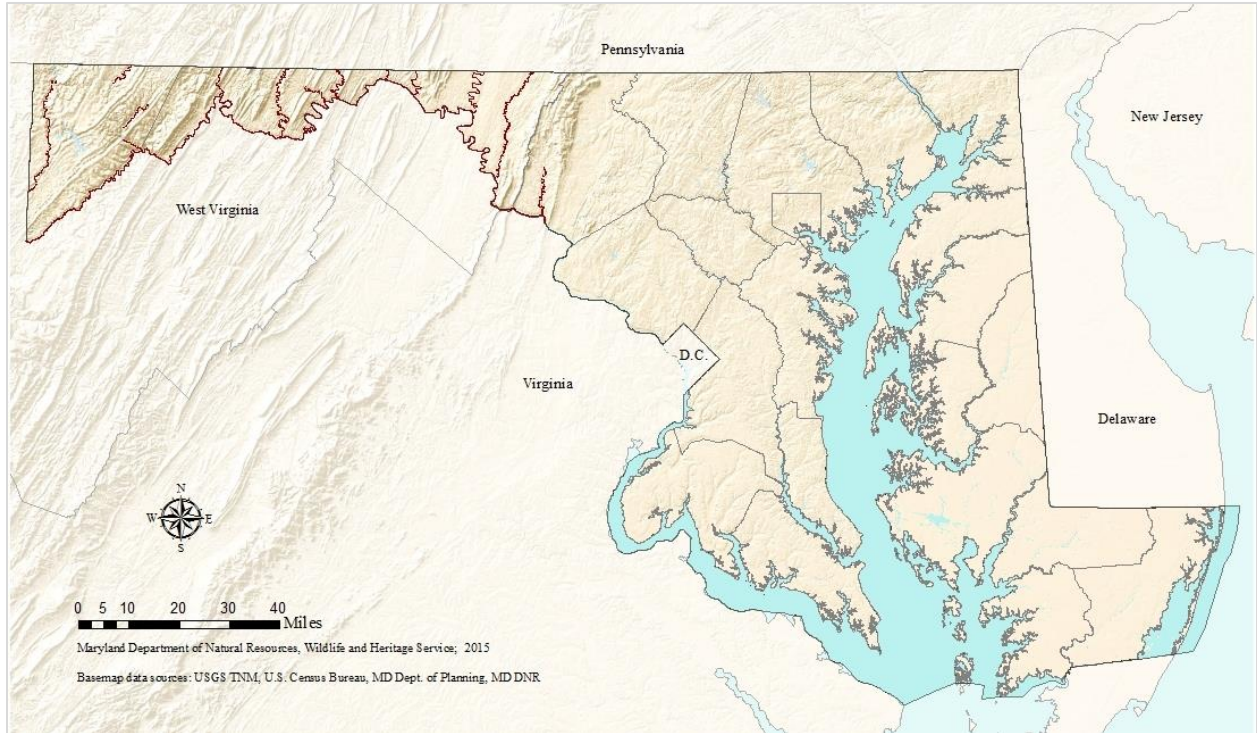


Figure 4.46 Location of Highland Rivers in Maryland. Sources: Versar, Inc., USGS, MD DNR.

Species of Greatest Conservation Need Associated with Highland Rivers:

Mammals	Fishes	Insects (Stoneflies, Mayflies, Caddisflies)
American mink	Comely shiner	Gaspe sallfly
Big brown bat	Johnny darter	Crustaceans
Eastern red bat	Longnose sucker	Allegheny crayfish
Eastern small-footed myotis	Stonecat	Freshwater Mussels
Hoary bat	Striped shiner	Alewife floater
Indiana myotis	Insects (Beetles)	Atlantic spike
Little brown myotis	Appalachian tiger beetle	Brook floater
Northern long-eared bat	Insects (Dragonflies and Damselflies)	Creeper
Silver-haired bat	Allegheny river cruiser	Eastern lampmussel
Tricolored bat	Appalachian jewelwing	Green floater
Birds	Chesapeake snaketail	Paper pondshell
Bald eagle	Eastern ringtail	Triangle floater
Common merganser	Green-faced clubtail	Yellow lampmussel
Great blue heron	Laura's clubtail	
Louisiana waterthrush	Maine snaketail	
Spotted sandpiper	Midland clubtail	
Reptiles	Ocellated darter	
Eastern spiny softshell	Pygmy snaketail	
Spotted turtle	Rapids clubtail	



Reptiles cont.	Dragonflies and Damselflies cont.	
Wood turtle	Royal river cruiser	
Amphibians	Rusty snaketail	
Common mudpuppy	Spine-crowned clubtail	
Eastern hellbender	Splendid clubtail	
	Stygian shadowdragon	

Piedmont River

Large rivers of the Piedmont physiographic province represent transitional habitats between headwater streams and tidal portions of Chesapeake Bay. Physically, Piedmont Rivers consist of large riffle/run and pool sequences with substrate ranging from large boulders to sand and silt. As transition zones between upland habitats and lowlands of the Coastal Plain, Piedmont Rivers are home to a diverse aquatic fauna, often consisting of a mixture of piedmont and lowland species. Chemical, physical, and hydrologic stability typical of large Piedmont Rivers also contribute to high species diversity.



Jay Kilian, MD DNR

Fish species common to Piedmont Rivers include American eel (*Anguilla rostrate*), river chub (*Nocomis micropogon*), spottail shiner (*Notropis hudsonius*), common shiner, white sucker (*Luxilus cornutus*), pumpkinseed (*Lepomis gibbosus*), redbreast sunfish (*Lepomis auritus*), bluegill (*Lepomis macrochirus*), rock bass (*Ambloplites rupestris*), quillback (*Carpionodes cyprinus*), margined madtom (*Noturus insignis*), and channel catfish (*Ictalurus punctatus*). Popular game fishes include smallmouth bass (*Micropterus dolomieu*) and largemouth bass (*Micropterus salmoides*). Piedmont Rivers provide spawning habitat for many migratory fish species of the Chesapeake Bay such as blueback herring (*Alosa aestivalis*), alewife (*Alosa pseudoharengus*), white perch (*Morone americana*), yellow perch (*Perca flavescens*), striped bass (*Morone saxatilis*), and several species of shad. Piedmont Rivers also serve as wintering habitats for migratory waterfowl. Although logs and leaf litter continue to play a large role in the food base of these systems, open tree canopies allow for the growth of periphyton, phytoplankton, and aquatic macrophytes providing additional sources of energy to the food chain. Connectivity between river channels and the adjacent floodplain is important for the movement and exchange of organic matter in these systems. Floodplains also provide refuge for aquatic species during periods of high flows. Piedmont River habitat can be found in portions of the Susquehanna, Gunpowder, and Patapsco Rivers, the upper portion of the Patuxent River, and the eastern portion of the Potomac Washington Metro, and Middle Potomac basins. There are approximately 270 miles of Piedmont River habitat in these basins.

Piedmont Rivers are located in highly urbanized portions of Maryland. Stressors associated with urbanization have had negative effects on these habitats. Combined sewer overflows designed to carry domestic, commercial, and industrial wastewater often deliver untreated sewage to Piedmont Rivers during storm flows. These outflows can reduce the biological health of these



habitats. As with Highland Rivers, Piedmont Rivers have been impounded for drinking water reservoirs and for hydroelectric power generation. Impoundments have reduced the available habitat for several fish and mussel SGCN and also reduced upstream access to spawning grounds by many migratory fishes. The degradation of Piedmont and Coldwater Streams has negatively affected downstream Piedmont Rivers.

County Distribution: Baltimore, Carroll, Cecil, Frederick, Harford, Howard, Montgomery

Places to Visit: Patapsco Valley State Park, Gunpowder Falls State Park, Susquehanna State Park

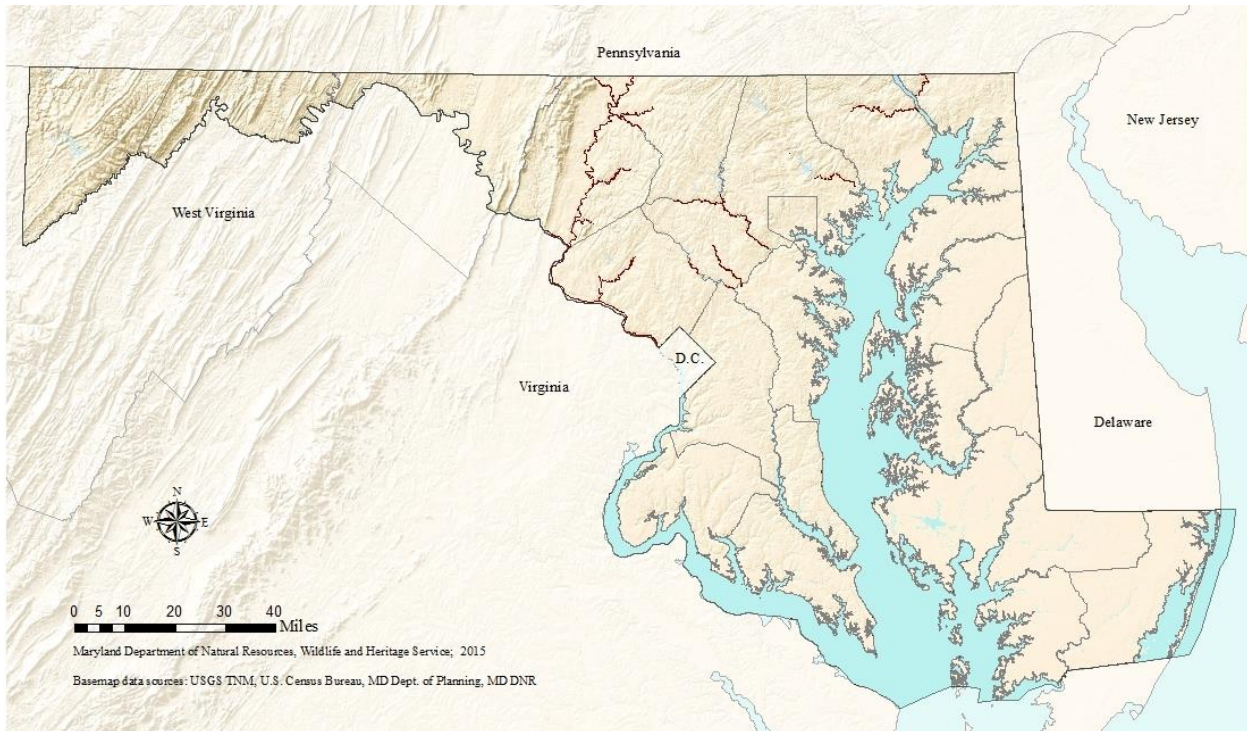


Figure 4.47 Location of Piedmont Rivers in Maryland. Sources: Versar, Inc., USGS, MD DNR.

Species of Greatest Conservation Need Associated with Piedmont Rivers:

Mammals	Reptiles	Insects (Dragonflies and Damselflies)
American mink	Northern map turtle	Allegheny river cruiser
Big brown bat	Spotted turtle	Appalachian snaketail
Eastern red bat	Wood turtle	Chesapeake snaketail
Evening bat	Amphibians	Common sanddragon
Hoary bat	Eastern hellbender	Eastern ringtail
Indiana myotis	Fishes	Green-faced clubtail
Little brown myotis	American shad	Laura's clubtail
Northern long-eared bat	Bridle shiner	Midland clubtail
Seminole bat	Chesapeake logperch	Rapids clubtail
Silver-haired bat	Comely shiner	Riverine clubtail



Mammals cont.	Fishes cont.	Dragonflies and Damselflies cont.
Tricolored bat	Hickory shad	Royal river cruiser
Birds	White catfish	Rusty snaketail
Bald eagle		Sable clubtail
Common merganser		Skillet clubtail
Great blue heron		Smoky rubyspot
Great egret		Spine-crowned clubtail
Horned grebe		Stygian shadowdragon
Louisiana waterthrush		Crustaceans
Pied-billed grebe		Allegheny crayfish
Spotted sandpiper		Freshwater Mussels
Yellow-crowned night-heron		Alewife floater
		Atlantic spike
		Brook floater
		Creeper
		Dwarf wedgemussel
		Eastern lampmussel
		Green floater
		Paper pondshell
		Tidewater mucket
		Triangle floater
		Yellow lampmussel
		Yellow lance

Coastal Plain River

Coastal Plain Rivers are low gradient, slow flowing rivers (typically 5th order and larger) in the Lower and Upper Coastal Plain physiographic provinces. They represent the lower non-tidal and upper fresh tidal (salinity < 0.5 ppt) sections of larger river systems, and form transition zones between upper non-tidal river reaches and increasingly larger, saline tidal sections that eventually flow into and form part of the Chesapeake Bay proper. Coastal Plain Rivers consist of predominantly pool/glide habitat with sand and silt substrates. Large woody debris is an important element in structuring pool habitat and serves as an important source of coarse organic matter



Jason Harrison, MD DNR

to riverine food webs. Open tree canopies allow for the growth of periphyton, phytoplankton, and aquatic macrophytes. These primary producers also form the base of energy flow within these systems. Connectivity between river channels and the adjacent floodplain is important for the movement and exchange of organic matter in Coastal Plain River systems. Floodplains



provide refugia for aquatic species during periods of high flows and for prey species from main channel fish predators. Extensive pool habitat common in Coastal Plain Rivers is home to many large predator fish species typically uncommon in headwater Coastal Plain Streams. Fish species common to Coastal Plain Rivers include American eel (*Anguilla rostrata*), pumpkinseed (*Lepomis gibbosus*), redbreast sunfish (*Lepomis auritus*), bluegill (*Lepomis macrochirus*), shorthead redhorse (*Moxostoma macrolepidotum*), quillback (*Carpionodes cyprinus*), longnose gar (*Lepisosteus osseus*), and warmouth (*Lepomis gulosus*). Popular game fishes in these rivers include largemouth bass (*Micropterus salmoides*), chain pickerel (*Esox niger*), and black crappie (*Pomoxis nigromaculatus*). Coastal Plain Rivers also provide spawning habitat to many migratory fish species of Chesapeake Bay such as blueback herring (*Alosa aestivalis*), alewife (*Alosa pseudoharengus*), white perch (*Morone americana*), yellow perch (*Perca flavescens*), American shad, and hickory shad. Sandy and gravel substrates of Coastal Plain Rivers support a diverse community of freshwater mussels (Unionidae), many of which are listed as In Need of Conservation, Threatened, or Endangered in Maryland. Many of these riverine fish and mussel species are favorite prey items of river otter and muskrat. Coastal Plain Rivers also serve as wintering habitats for migratory waterfowl. Coastal Plain River habitats can be found in portions of the Chester, Choptank, Nanticoke, Lower Potomac, Patapsco, Patuxent, Pocomoke, Potomac Washington Metro, and Wicomico river basins. Coastal Plain River habitat comprises approximately 115 stream miles within these basins.

Degradation and loss of species associated with Coastal Plain and Blackwater Stream tributaries have ultimately affected the downstream conditions of Maryland's Coastal Plain River habitats. Maryland Coastal Plain Rivers are located in predominately agriculturally-focused watersheds. Nutrient enrichment and sedimentation associated with agricultural land use practices have reduced habitat quality and quantity available to many fish and mussel SGCN. Stream blockages have also reduced upstream access to spawning habitats for migratory fishes.

County Distribution: Anne Arundel, Baltimore, Calvert, Caroline, Cecil, Charles, Dorchester, Harford, Kent, Prince George's, Queen Anne's, Somerset, St. Mary's, Talbot, Wicomico, Worcester

Places to Visit: Tuckahoe State Park, Idylwild Wildlife Management Area, Pocomoke State Park



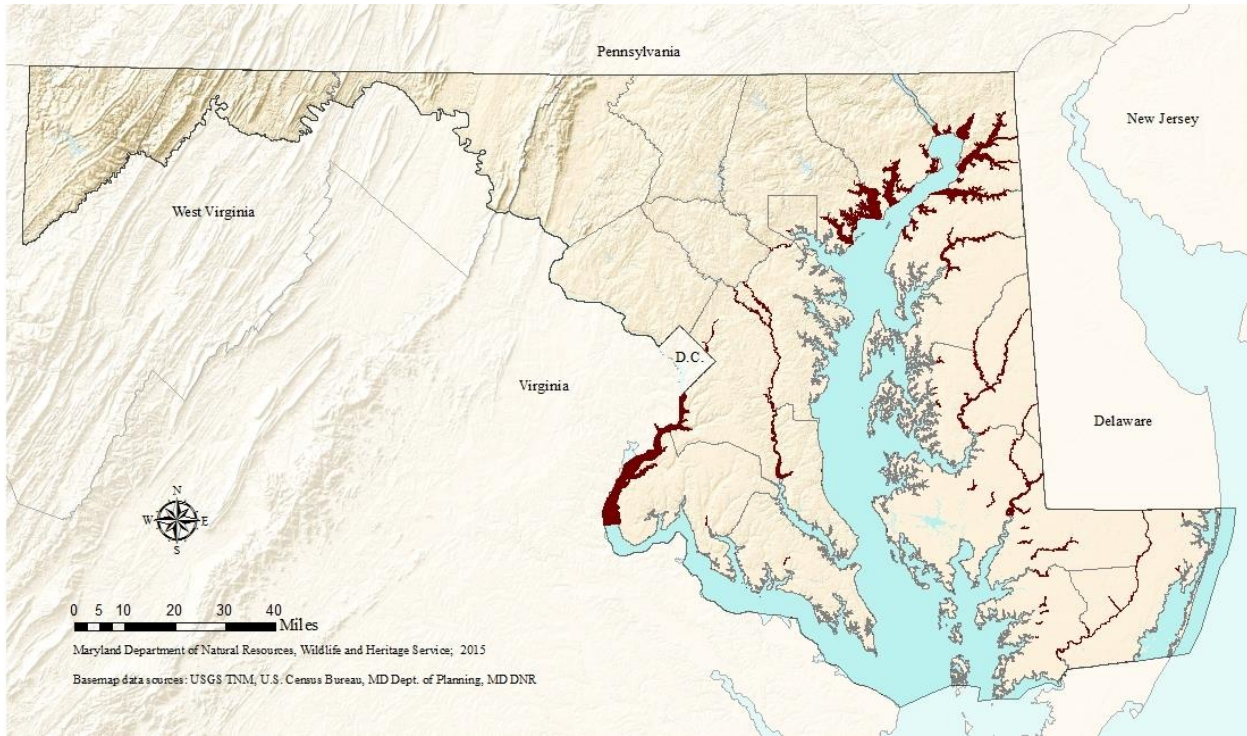


Figure 4.48 Location of Coastal Plain Rivers in Maryland. Sources: Versar, Inc., USGS, MD DNR.

Species of Greatest Conservation Need Associated with Coastal Plain Rivers:

Mammals	Birds cont.	Fishes
American mink Big brown bat Eastern red bat Hoary bat Little brown myotis Seminole bat Silver-haired bat Southeastern myotis Southeastern star-nosed mole Tricolored bat	Great egret Horned grebe Laughing gull Least tern Long-tailed duck Louisiana waterthrush Pied-billed grebe Redhead Red-throated loon Ruddy duck	American shad Atlantic sturgeon Bowfin Bridle shiner Chesapeake logperch Comely shiner Hickory shad Shortnose sturgeon Stripeback darter White catfish
Birds	Spotted sandpiper	Insects (Dragonflies and Damselflies)
American black duck Bald eagle Bank swallow Black scoter Blue-winged teal Canvasback Common loon Common merganser Forster's tern Gadwall Great blue heron	Surf scoter White-winged scoter	Appalachian snaketail Common sanddragon Coppery emerald Furtive forktail Laura's clubtail Piedmont clubtail Royal river cruiser Smoky rubyspot Stygian shadowdragon
	Reptiles	Crustaceans
	Northern diamond-backed terrapin Northern map turtle Plain-bellied watersnake Rainbow snake Spotted turtle	Digger crayfish



		<p>Freshwater Mussels cont.</p> <p>Alewife floater Atlantic spike Creeper Eastern lampmussel Eastern pondmussel Northern lance Paper pondshell Tidewater mucket Triangle floater Yellow lampmussel Yellow lance</p>
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Bay and Ocean

Shellfish Bed

Bivalve mollusks such as oysters, mussels, clams, and scallops aggregate in large numbers to form key wildlife habitats known as Shellfish Beds. The species that comprise Shellfish Beds vary with salinity, depth, and bottom type. Aggregations of clams are important features throughout the Chesapeake Bay. In the low salinity waters of the upper Chesapeake Bay and the Potomac River below Washington, DC, dense beds of the brackish water clam are common in sand and mud substrates. In mid- to high-salinity waters, beds formed by soft, razor, and hard clams become important features. Beds formed by the American oyster (*Crassostrea virginica*), also known as bars or reefs, are iconic features of the Chesapeake region. Historically, these oyster bars were expansive. Today, oyster bars are greatly reduced from historical levels, but continue to be important habitats in the mid- to high-salinity zones of the bay and its tributaries. Shellfish Beds comprised of ribbed mussels are common in the lower Chesapeake Bay and in much of the Coastal Bays of Maryland. These mussels attach using strong byssal threads to hard substrate including other live and dead mussels, forming large aggregations in the shallow, inter-tidal areas along the coastal marshes. In Maryland, blue mussels (*Mytilus edulis*) are rare in near-shore areas, but beds or mats of this species can be found on the sub-tidal seafloor off of the Atlantic coast. Surf clams (*Spisula solidissima*) can be found in low numbers in the Coastal Bays, but become more abundant offshore. In cooler waters in depths greater than 60 feet, sea scallops form dense beds over sand and gravel substrate. Ocean quahogs (*Arctica islandica*) are also abundant in deeper offshore areas.



Jay Fleming, MD DNR

The physical characteristics of Shellfish Beds vary with species. Surf, razor, and hard clams are considered infaunal species in that they form beds within bottom sediments. Buried and exposed



aggregations of live clams and accumulations of dead shells provide important structure and refuge for a variety of invertebrates and finfish. Epifaunal shellfish species, such as oysters and mussels, form dense aggregations that create vertical heterogeneous structure in otherwise featureless soft bottom areas of Maryland's estuaries and Atlantic Ocean. Shellfish Beds provide critical habitat for a wide array of organisms. For example, oyster beds supply hard substrate to which many sessile animals attach. Barnacles, anemones, sea squirts, bryozoans, sponges, and hydroids commonly attach to oyster shells. Sea stars, tube-building worms, snails, scuds, hermit crabs, blue crabs, and spider crabs are just a few of the common inhabitants crawling in and around the cracks and crevices formed in oyster beds. These beds serve as a refuge for small, reclusive fishes like gobies and blennies and attract larger fishes like striped bass (*Morone saxatilis*), red drum (*Sciaenops ocellatus*), sheepshead (*Archosargus probatocephalus*), and black drum (*Pogonias cromis*) among other species, as well as predatory sharks and rays. Some diving ducks that winter in Maryland, such as long-tailed duck and three species of scoters, feed primarily on mussels and clams, while other ducks, like canvasbacks, will augment their diet of submerged aquatic vegetation with shellfish and other animals.

In addition to important habitat, Shellfish Beds provide other ecological services. Shellfish, as filter feeders, assimilate nutrients and carbon as they grow and thus improve water clarity and quality by removing phytoplankton and suspended sediments. In the process, shellfish transfer vital nutrients to the substrate that are then utilized by other benthic species. Shellfish Beds also buffer the erosive impacts of waves and currents in shallow waters.

County Distribution: Anne Arundel, Baltimore, Calvert, Cecil, Charles, Dorchester, Harford, Kent, Queen Anne's, Somerset, St. Mary's, Talbot, Wicomico, Worcester

Places to Visit: Point Lookout State Park, Janes Island State Park, Assateague Island State Park



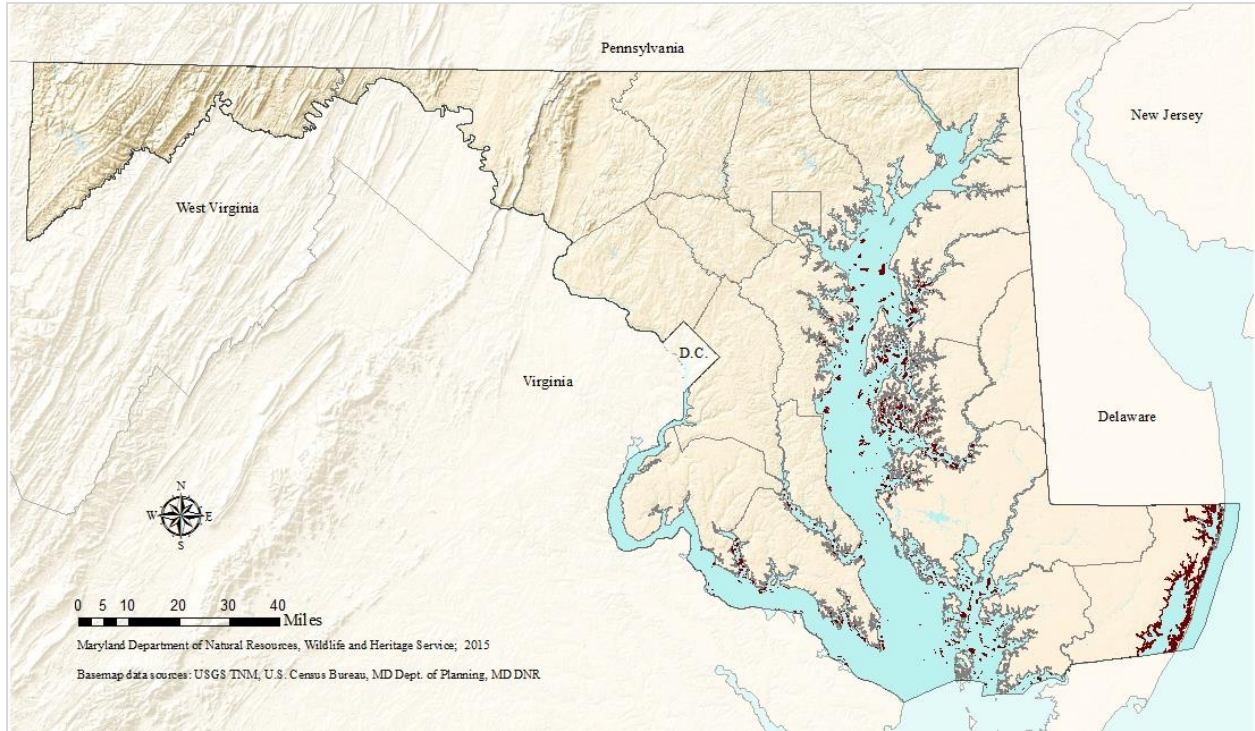


Figure 4.49 Location of Shellfish Beds in Maryland. Source: MD DNR.

Species of Greatest Conservation Need Associated with Shellfish Beds:

Birds	Reptiles
Black scoter Canvasback Common loon Long-tailed duck Surf scoter White-winged scoter	Kemp's ridley seaturtle Loggerhead seaturtle Northern diamond-backed terrapin
	Fishes Atlantic sturgeon Barndoor skate Shortnose sturgeon Smooth skate Thorny skate

Hard Bottom (Living and Non-living)

Large expanses of soft silt, sand, and mud characterize the seafloors of much of Maryland’s estuaries and Atlantic Ocean. In these vast, mostly homogenous areas, Hard Bottom habitat is often sparse and a rare commodity for many species that require firm, stable substrate to complete their lifecycle. Submerged Hard Bottom habitats are formed by aggregations of non-living, coarse materials (e.g., gravel, cobble, boulder) or from the colonization and growth of reef building corals or worm species (e.g., tube worms of the families Sabellidae and Serpulidae). Hard Bottom habitats are found in shallow and deep channel areas of the Chesapeake and Coastal Bays, and in nearshore and deep offshore waters on the Atlantic Coast. In the estuarine and marine environment, hard substrate is quickly colonized by coldwater star corals,



sponges, anemones, sea squirts, and other animals. Limpet nudibranchs, chitons, scuds, worms, and other invertebrates feed among the crevices created by these structure-forming invertebrates and, in turn, attract diverse assemblages of other animals like shrimp, crabs, and sea stars. As is the case with Shellfish Beds, Hard Bottom habitats attract a high diversity of fishes that use these areas as feeding and nursery grounds.



Jane Thomas, UMCES

County Distribution: Anne Arundel, Baltimore, Calvert, Charles, Dorchester, Harford, Kent, Queen Anne’s, Somerset, St. Mary’s, Talbot, Wicomico, Worcester

Places to Visit: Assateague Island State Park

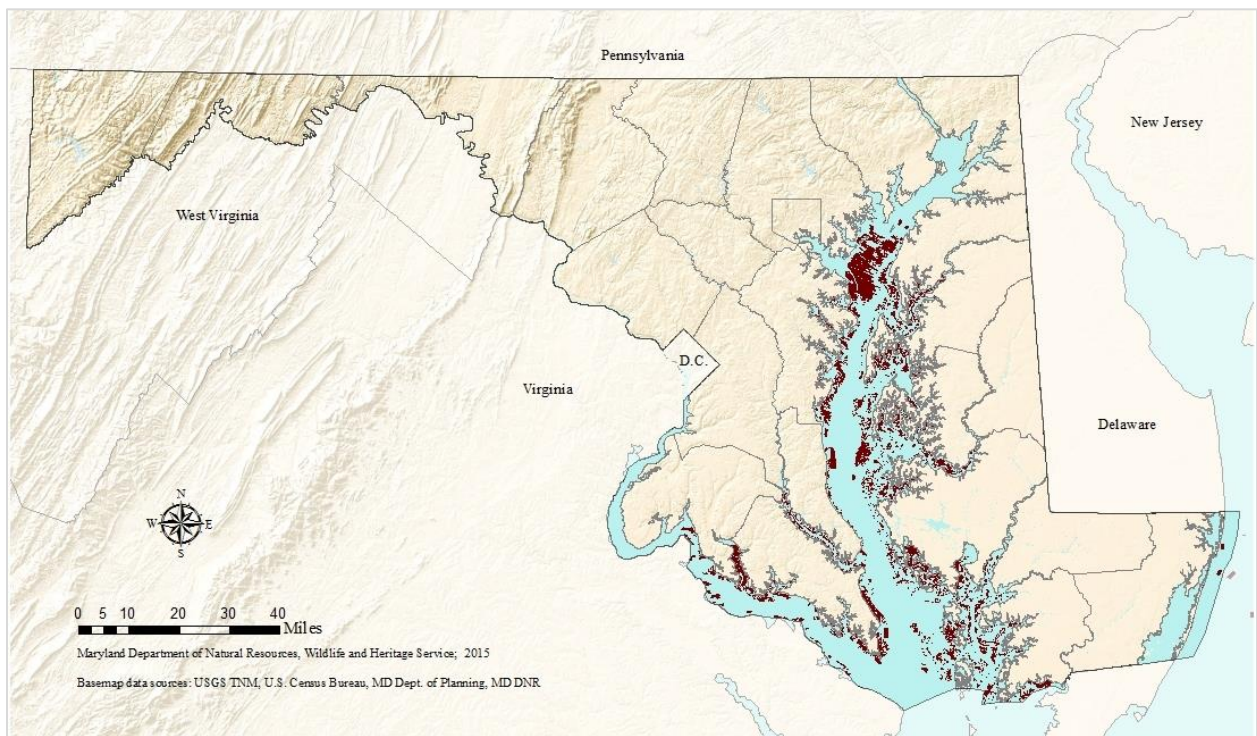


Figure 4.50 Location of Hard Bottom Habitats in Maryland. Sources: MGS, MD DNR, NOAA, Maryland Artificial Reef Initiative.

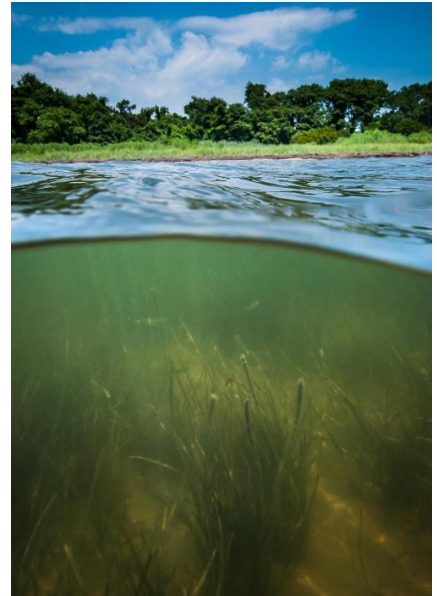


Species of Greatest Conservation Need Associated with Hard Bottom Habitats:

Birds	Reptiles	Fishes
Black scoter	Atlantic hawksbill seaturtle	Atlantic sturgeon
Canvasback	Kemp's ridley seaturtle	Barndoor skate
Common loon	Loggerhead seaturtle	Shortnose sturgeon
Long-tailed duck	Northern diamond-backed terrapin	Smooth skate
Surf scoter		Thorny skate
White-winged scoter		

Submerged Aquatic Vegetation

Submerged aquatic vegetation (SAV) refers to the underwater flowering plants that flourish in the shallow waters of the Chesapeake and Coastal bays and their tidal tributaries. These rooted vascular plants form large beds in waters below the mean low-tide line to depths of around 10 feet. SAV, also known as seagrass, serves a vital ecological role in the estuaries. It absorbs nutrients and increases oxygen concentrations in surrounding waters. Dense SAV beds also slow currents, reduce wave action, stabilize sediments, and reduce shoreline erosion. The vertical structure created by the stems and leaves within these dense beds provide substrate and a rich food supply for isopods and other invertebrates. SAV beds provide critical habitat for blue crabs, especially during the molting process. It provides cover and habitat for a rich diversity of smaller fish and foraging grounds for larger fish. These submerged aquatic plants are also a bountiful food source on which many species of migratory waterfowl depend. Geese, tundra swan (*Cygnus columbianus*), and ducks, such as redhead, canvasback, and ruddy ducks, rely on the grasses, as well as the tubers, as a primary food source.



Eduardo Infantes Oanes

Decaying SAV plant matter is also an important food source for amphipods, shrimp, and other detritivores.

Water clarity, sediment, nutrients, and salinity are some of the environmental factors that influence the distribution and abundance of SAV. Of these, salinity is the most important in determining the aquatic plant species that comprise a SAV bed. Eelgrass (*Vallisneria americana*) and widgeon grass (*Ruppia maritima*) are the dominant species in high salinity (>18ppt) areas of the Chesapeake and Coastal Bays. The diversity of aquatic plant species increases in lower salinity waters. SAV beds in the mesohaline region (5-18 ppt) are dominated by redhead grass, widgeon grass, and horned pondweed. In the tidal fresh and oligohaline portions of the Chesapeake Bay, SAV beds are composed of wild celery (*Vallisneria americana*), sago pondweed (*Potamogeton pectinatus*), naiads, and water stargrass (*Heteranthera dubia*), among other species. Exotic species such as curly pondweed (*Potamogeton crispus*), hydrilla (*Hydrilla verticillata*), and Eurasian water-milfoil (*Myriophyllum spicatum*) are also common. The Susquehanna Flats, where the Susquehanna River meets the Chesapeake Bay, is the largest and most diverse grass bed in Maryland. SAV abundance and distribution declined precipitously



in the 1970s largely due to Hurricane Agnes, increased nutrient loads, and sediment pollution. Maryland's Coastal Bays, in which SAV plays an important role as habitat for blue crab and many fish and shellfish species, have seen drastic changes in SAV populations. After undergoing substantial population increases from 1986 until 2001, SAV population sizes have since declined to pre-1986 levels. These declines are largely attributed to unusually warm summers, high phosphorus levels, and increased boat traffic (Maryland Coastal Bays Program 2015). Due to its sensitivity to poor water quality and sediment pollution, the abundance and distribution of this key wildlife habitat remains an important indicator of the health of Maryland's estuaries. The extent of SAV beds is a common measure used to gauge the success of bay restoration efforts.

County Distribution: Anne Arundel, Baltimore, Calvert, Caroline, Cecil, Charles, Dorchester, Harford, Kent, Queen Anne's, Prince George's, Somerset, St. Mary's, Talbot, Wicomico, Worcester

Places to Visit: Susquehanna Flats Area, Assateague State Park, Janes Island State Park

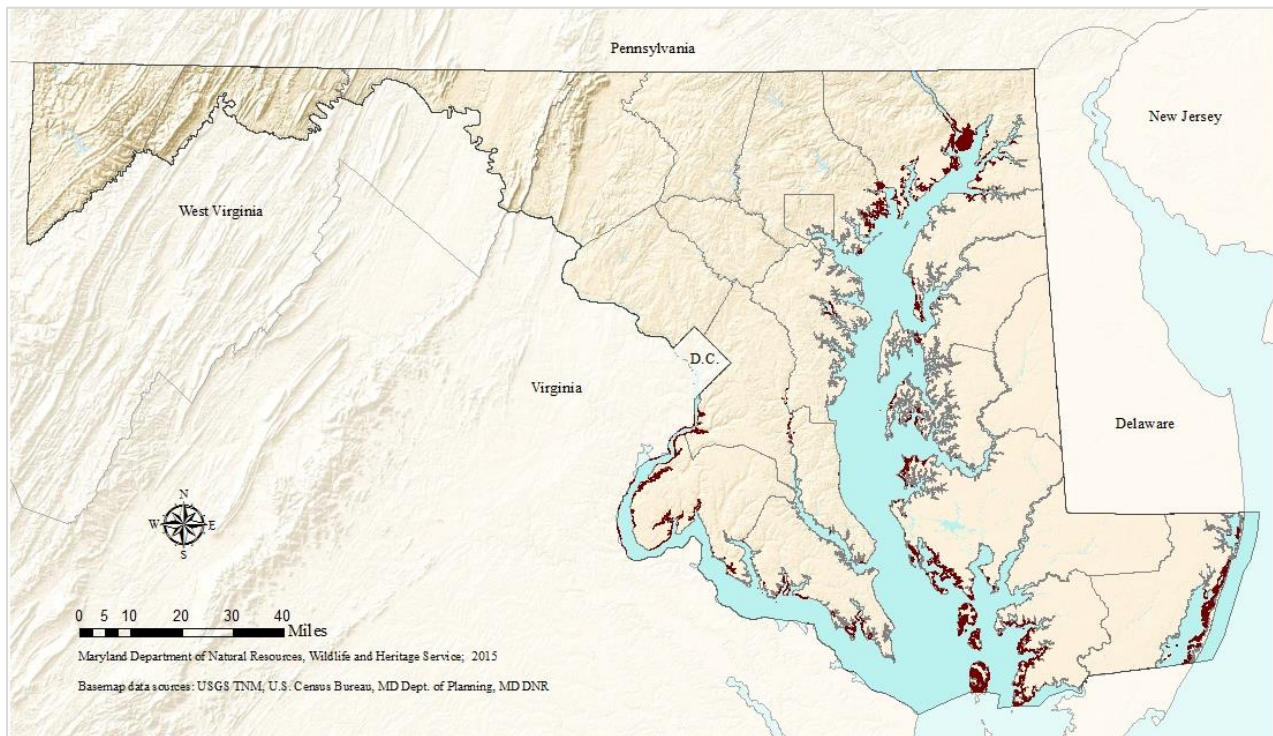


Figure 4.51 Location of Submerged Aquatic Vegetation Areas in Maryland. Sources: Virginia Institute of Marine Science, MD DNR.



Species of Greatest Conservation Need Associated with Submerged Aquatic Vegetation:

Birds	Reptiles
American black duck Brant Canvasback Gadwall Redhead Ruddy duck	Green sea turtle Kemp's ridley sea turtle Loggerhead sea turtle Northern diamond-backed terrapin

Macroalgae

Aggregations of marine brown, red, and green algae (seaweeds) including bladderwrack, Agar's red weed, sea lettuce, and other species form beds that are important habitats in mid to high salinity waters of Maryland's estuaries and Atlantic ocean. Macroalgae can be found drifting or attached to hard bottom substrate in inter- and sub-tidal waters. As with SAV, marine algae contribute significantly to primary productivity and are important in detrital food webs. Macroalgae also provides three-dimensional structure that attracts a diverse array of crustaceans, worms, snails, and other invertebrates that provide a food base for larger animals. In the Coastal Bays, drifting and attached macroalgal beds serve as important nursery habitat for blue crab and other commercially important fisheries, especially where SAV is sparse. In the open ocean, aggregations of *Sargassum* seaweed originating from the Sargasso Sea southeast of Bermuda are brought to Maryland waters by the Gulf Stream current. *Sargassum* mats host a diverse assemblage of invertebrates and fishes including mackerel, dolphinfish (*Coryphaena hippurus*), and cobia (*Rachycentron canadum*) and provide important cover and feeding habitat for juvenile sea turtles. Many species of marine birds are commonly associated with these large seaweed mats. *Sargassum* seaweed often washes ashore on the beaches of Ocean City and Assateague Island following large storms.



Jane Hawkey, UMCES

Although Macroalgae key wildlife habitats are essential and beneficial to aquatic wildlife, excessive growth, or blooms, of marine algae spurred by nutrient run-off can be problematic in Maryland's estuaries. Macroalgae rob SAV of important sunlight and decrease oxygen concentrations in surrounding waters.

County Distribution: Dorchester, Somerset, St. Mary's, Talbot, Wicomico, Worcester [Although some location information is available, insufficient Maryland location data exist to create a meaningful distribution map for areas with Macroalgae.]

Places to Visit: Assateague Island State Park



Species of Greatest Conservation Need Associated with Macroalgae:

Birds	Reptiles
American black duck Audubon’s shearwater Black-legged kittiwake Brant Canvasback Common tern Cory’s shearwater Gadwall Laughing gull Leach’s storm-petrel Red phalarope Redhead Red-necked Phalarope Royal Tern Ruddy duck	Green sea turtle Kemp's ridley sea turtle Loggerhead sea turtle Northern diamond-backed terrapin

Pelagic – Open Water

Pelagic, open water habitats include the waters of the Chesapeake Bay and lower tributaries, Coastal Bay estuaries, and Atlantic Ocean that cover the sub-tidal areas from the low tide line to depths of over 130 feet. These waters are affected by freshwater input, tides, winds, and sub-surface currents that make them dynamic in nature. Extreme changes in temperature, salinity, water clarity, oxygen concentrations, and nutrient availability are commonplace within these waters. Pelagic, open waters play a vital role in the cycling and movement of nutrients from nearshore to offshore areas and at upwellings of deeper water toward the surface. The phytoplankton and zooplankton that live on these nutrients provide important food sources for fish and other aquatic organisms, which become food for seabirds, such as northern gannet and shearwaters, marine mammals, and sea turtles. These waters connect all the other estuarine and marine habitats (e.g., SAV, Shellfish Beds) and support a number of recreational and commercial fisheries. Pelagic, open waters are vital to many migratory fish species including American shad and Atlantic sturgeon that utilize freshwater and marine habitats to complete their life cycle.



Jason Harrison, MD DNR

The chemical and physical properties (e.g., temperature, salinity, dissolved oxygen, pH, and suspended sediments) of Pelagic - Open Water key wildlife habitat affect the distribution and



abundance of aquatic species. Excessive nutrient pollution has reduced the quality of Pelagic - Open Water in Maryland's estuaries in recent decades. For example, large expanses of the deep waters of the Chesapeake Bay often become devoid of life-giving oxygen during summer months. In some years, low oxygen can make over a cubic mile of bay waters uninhabitable to most subsurface and benthic aquatic species. Bay restoration efforts to reduce nutrient pollution aims to improve the quality of Pelagic – Open Water to maintain this vital link between all important key estuarine and marine wildlife habitats.

County Distribution: Anne Arundel, Baltimore, Calvert, Caroline, Cecil, Charles, Dorchester, Harford, Kent, Queen Anne's, Prince George's, Somerset, St. Mary's, Talbot, Wicomico, Worcester

Places to Visit: Sandy Point State Park, Point Lookout State Park, Assateague Island State Park, Atlantic Ocean, Chesapeake Bay

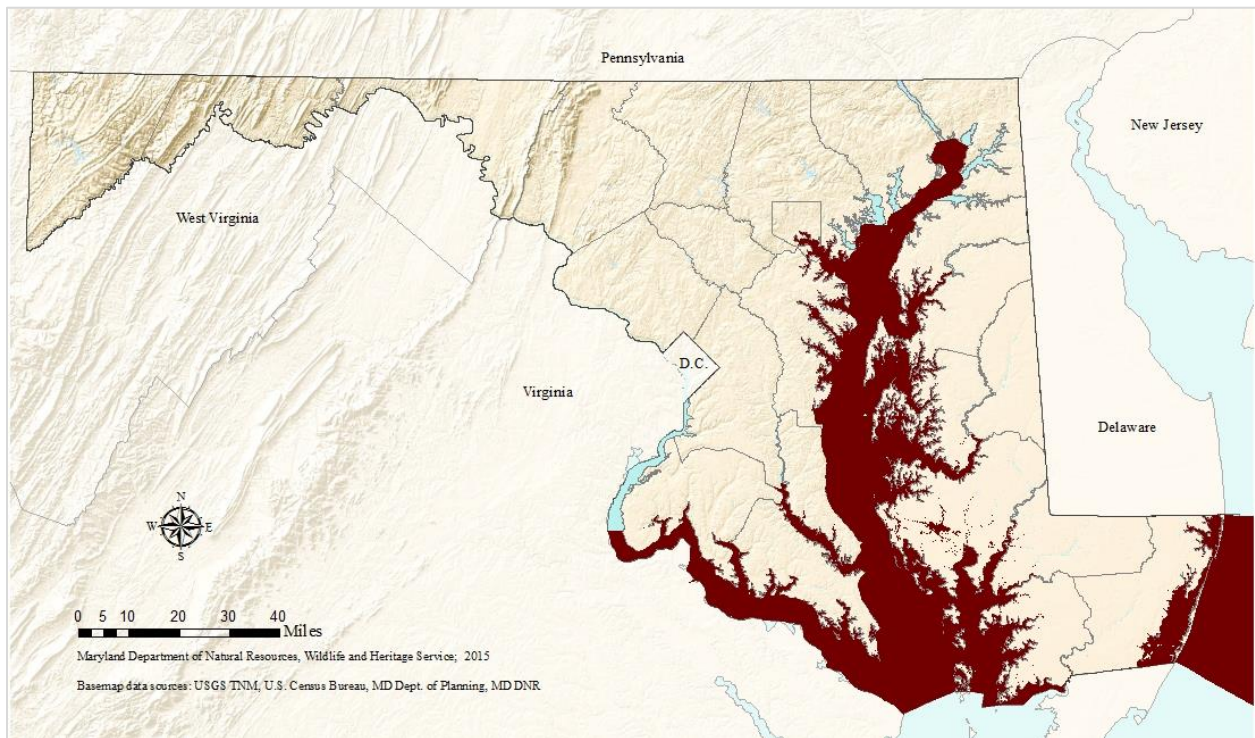


Figure 4.52 Location of Pelagic - Open Water Areas in Maryland. Source: MD DNR.



Species of Greatest Conservation Need Associated with Pelagic - Open Water Areas:

Mammals	Birds cont.	Reptiles
Blue whale	Common tern	Atlantic hawksbill seaturtle
Bottlenose dolphin	Cory's shearwater	Green seaturtle
Cuvier's beaked whale	Forster's tern	Kemp's ridley seaturtle
Fin whale	Gull-billed tern	Leatherback seaturtle
Gervais beaked whale	Horned grebe	Loggerhead seaturtle
Humpback whale	Laughing gull	Fishes
Northern right whale	Leach's storm-petrel	American shad
Sei whale	Least tern	Atlantic sturgeon
Sperm whale	Long-tailed duck	Barndoor skate
True's beaked whale	Northern gannet	Hickory shad
Birds	Pied-billed grebe	Shortnose sturgeon
Audubon's shearwater	Red phalarope	Smooth skate
Bald eagle	Redhead	Thorny skate
Black scoter	Red-necked phalarope	Arthropods
Black skimmer	Red-throated loon	Horseshoe crab
Black-legged kittiwake	Roseate tern	
Brant	Royal tern	
Brown pelican	Ruddy duck	
Canvasback	Sandwich tern	
Common loon	Surf scoter	
Common merganser	White-winged scoter	

Subterranean Habitats

Cave and Karst

Caves are natural, underground cavities or tunnels. They contain unique, fragile environments that support highly specialized animal communities and a variety of rare species. Over 100 caves have been documented in Maryland. Most are located in the Ridge and Valley and Appalachian Plateau physiographic regions, but a few small caves occur in the Piedmont. Caves are most numerous in Washington County followed by Allegany, Garrett, and Frederick Counties. Crabtree Cave in Garrett County is the largest with over 1,200 m of passages. Two general types of caves exist in Maryland: solutional and non-solutional caves. The latter are formed by mechanical processes, occurring as joints or fractures in bedrock. Fissure caves and rock shelters are examples of this cave type. They are less numerous than solutional caves and are usually relatively small, shallow, and lack extensive passageways. They occur in a variety of



Dan Feller, MD DNR



rock formations including the Pottsville Sandstone Formation in Garrett County, Tuscarora Sandstone Formation in Allegany and Washington Counties, and Weverton Quartzite Formation in Frederick County. Solutional caves, however, can be quite deep and extensive and they represent, by far, the largest caves in Maryland. They are formed by the dissolving action of groundwater, which is naturally slightly acidic, with soluble, carbonate rock (usually limestone). Over millennia, these and related processes lead to the development of complex passages or tunnels and various speleothems or “formations” (carbonate deposits on cave surfaces) such as stalagmites, stalactites, helictites and cave “coral”. Some caves also contain subterranean streams, water-filled sinkholes, and springs. Solutional caves and other karst features are most numerous in the Tomstown Limestone Formation in Washington County, which contains massive dolomites and limestones over 300 m thick. Other important cave-bearing formations include the Greenbrier Formation in Garrett County and the Tonoloway, Waynesboro, Beekmantown and Stones River formations in Washington County.

County Distribution: Allegany, Baltimore, Carroll, Frederick, Garrett, Howard, Washington

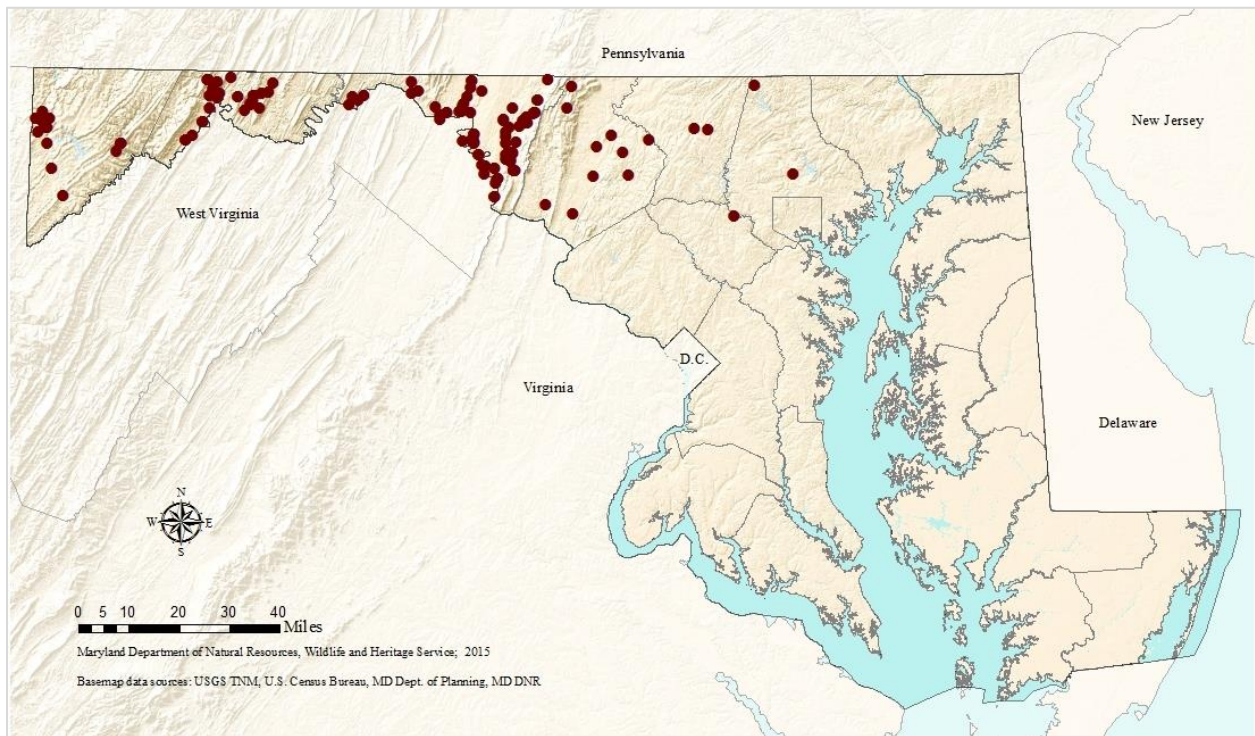


Figure 4.53 Location of Caves and Karsts in Maryland. Source: MD DNR.



Species of Greatest Conservation Need Associated with Caves and Karsts:

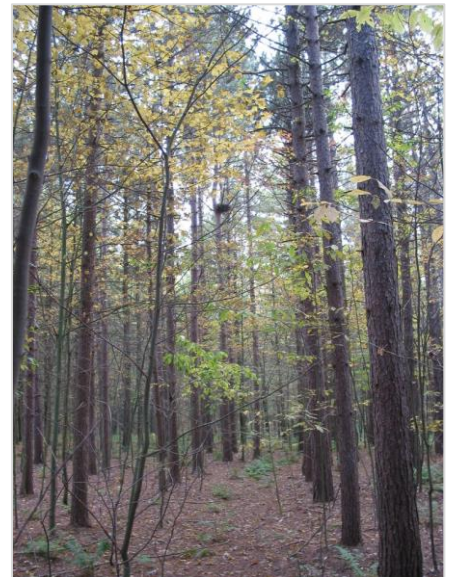
Mammals	Crustaceans	Invertebrates (Snails)
Allegheny woodrat Big brown bat Eastern small-footed myotis Indiana myotis Little brown myotis Northern long-eared bat Silver-haired bat Tricolored bat	Allegheny cave amphipod Barrelville amphipod Biggers' cave amphipod Devils Hole cave amphipod Franz's cave amphipod Franz's cave isopod Friendly cave amphipod Greenbrier cave amphipod Holsinger's cave isopod Maus' cave isopod	Appalachian springsnail Blue Ridge springsnail
Insects (Beetles)		Invertebrates (Flatworms)
A cave beetle (<i>Pseudanophthalmus sp 15</i>)		Hoffmaster's cave planarian A planarian (<i>Sphalloplana buchamani</i>) A planarian (<i>Sphalloplana sp 1</i>)
Other Insects	Pennsylvania cave crangonyctid	
Crabtree cave springtail	Price's cave isopod Roundtop amphipod Shenandoah Valley cave amphipod Vandel's cave isopod Appalachian cave spider Snivelys cave spider	

Other Habitats

Managed Montane Conifer Forest

This habitat consists of pure or nearly pure conifer stands that have been planted, usually as monocultures. Many contain non-native conifers (e.g., Norway spruce [*Picea abies*], black spruce [*Picea glauca*], Scotch pine [*Pinus sylvestris*]), but some include native species such as eastern white pine (*Pinus strobus*). Numerous conifer forest stands in western Maryland were established during the 1930s by Civilian Conservation Corps work crews. Today, these plantings can still be found on DNR lands (e.g., Savage River State Forest, New Germany State Park) and elsewhere as dense, heavily shaded, mature conifer stands. In a region where most natural forests dominated by northern conifers were eliminated by 19th and early 20th century logging, conifer plantations provide surrogate nesting habitat for some sub-boreal and boreal bird species of conservation need that reach the southern periphery of their breeding range in the central and southern Appalachians.

Species such as red-breasted nuthatch and golden-crowned kinglet can be found in other forested habitats, such as Hemlock – Northern Hardwood Forests, but the density and age of conifers in these stands provide optimal conditions for species with northern affinities.



Dave Brinker, MD DNR



County Distribution: Statewide

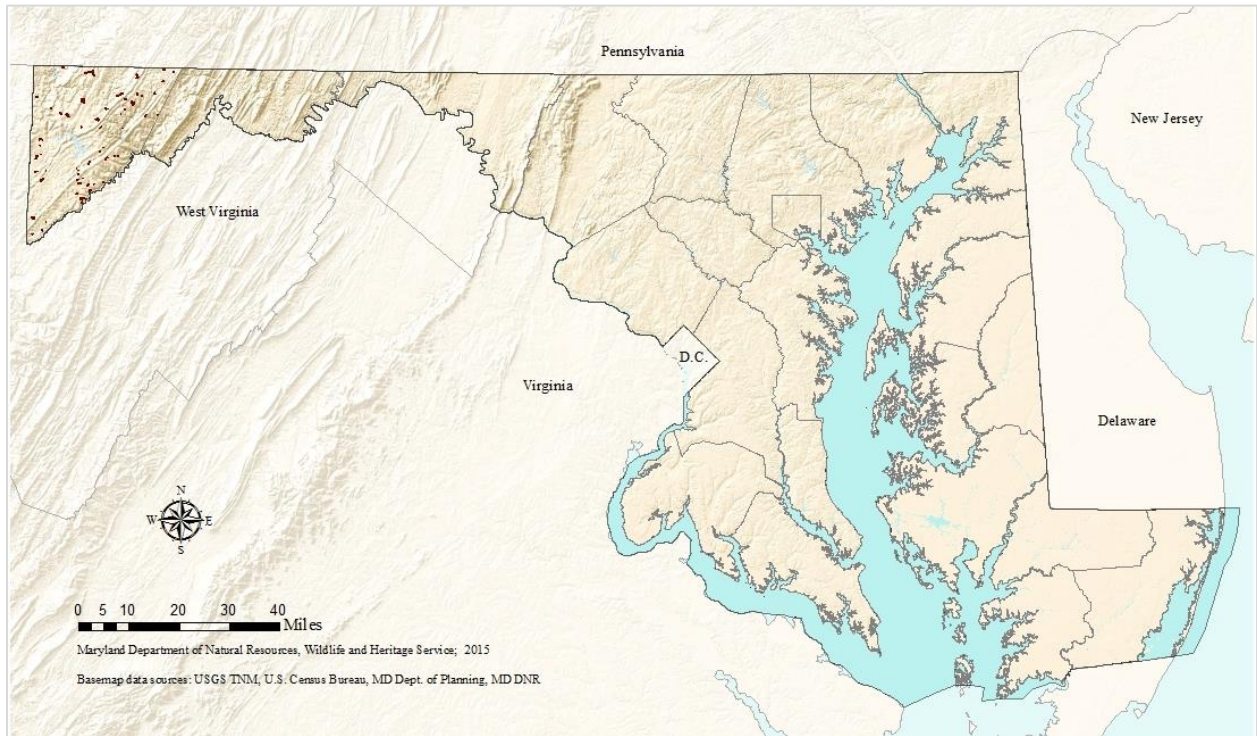


Figure 4.54 Location of Managed Montane Conifer Forests in Maryland. Source: MD DNR.

Species of Greatest Conservation Need Associated with Managed Montane Conifer Forests:

Birds
Blackburnian warbler
Black-throated green warbler
Golden-crowned kinglet
Long-eared owl
Magnolia warbler
Northern goshawk
Pine siskin
Red-breasted nuthatch
Sharp-shinned hawk



Managed Successional Forest

Managed Successional Forests are primarily upland areas, occasionally wetlands, that are in an early successional forest state (i.e., dominated by shrubs and small trees [< 8 m tall]) due to forest management practices, land use change, or some other form of human disturbance. This habitat occurs statewide in three broad settings:

- 1. Recently Logged Forests.** In this setting, early successional forest begins to develop within one year of a timber harvest and may persist for 10-20 years or more depending, in part, on pre-harvest forest conditions, soil type, the size and type of regeneration cut (e.g., clearcutting, single-tree selection, shelterwood), post-harvest silvicultural treatments (e.g., seedling plantings vs. natural regeneration, thinnings), and the degree to which deer herbivory and invasive plant species impede native plant establishment and growth.



James McCann, MD DNR

Habitat suitability for most early successional species of conservation concern tends to peak 5-15 years following harvest. Many species that require early successional forests are no longer present once tree canopy closure is attained.

- 2. Succeeding Non-forested Land.** These are areas that were converted to agriculture or some other non-forested condition and have been recently allowed to succeed or are otherwise managed in a way that has led to the development of early successional forest habitat. Examples include former cropland and pasture, old fields and reclaimed strip mines that are reverting to a forested state via natural succession or plantings. Early successional habitat forest may persist for 10-20 years or longer depending, in part, on prior land use, soil conditions, the size of the opening, surrounding habitat conditions, and the degree to which deer herbivory and invasive plant species impede native plant establishment and growth.
- 3. Forest Edges.** Forest edges are usually abrupt, narrow (usually 1-10 m wide), linear ecotones between a forested and nonforested habitat (e.g., cropland, road, transmission line right-of-way, backyard) or between two dissimilar forest age classes (e.g., a mature forest and a recent clearcut). These conditions can provide early successional forest habitat for some of the early successional wildlife species, especially if a “soft” edge or gradual transition between the two adjoining habitats is present and is wider than is often found along a forest edge. However, species of greatest conservation need that require early successional forests and shrublands are often not found along forest edges because they require larger habitat patches than the narrow band of shrubs along the narrow forest edge ecotone. Also, these ecotones suffer greatly from excessive deer herbivory to the



extent that a “browse line” is often evident along forest edges, rendering them unsuitable for shrubland breeders, as well as from increased rates of predation and nest parasitism from brown-headed cowbirds (*Molothrus ater*). Some shrubland species, such as yellow-breasted chat, are area-sensitive and require larger habitat patches for increased nesting success. Much as forest interior breeding bird specialists avoid forest edges, shrubland breeding birds avoid edges as well (Rodewald and Vitz 2005).

The historical extent of early successional forest in Maryland is uncertain, and the origin, distribution, and characteristics of today’s forms of this habitat are likely to be quite different in many cases. Prior to widespread European colonization, fires set by Native Americans and settlers and, to a lesser degree, lightning strikes, played a major role in creating and sometimes perpetuating forest conditions dominated by shrubs and small trees. Herbivores (e.g., beaver [*Castor canadensis*], bison [*Bison bison*], and elk [*Cervus canadensis*]), topography, edaphic conditions and storm-related events (e.g., floods, ice storms, and tropical storms) also played a significant role. Together, these agents of change maintained a shifting mosaic of early successional habitat embedded within a landscape that was likely dominated by old growth forest and a variety of grassland, shrubland and wetland habitats. The degree to which these factors affected the landscape varied by region and with local conditions (e.g., soil type, forest type, slope, and aspect). According to the United States Department of Agriculture (USDA) and the United States Forest Service (USFS), there were approximately 225,000 acres of small diameter forest lands in Maryland as of 2013. The small diameter forest type can be defined as live trees 1.0 to 4.9 inches (2.5 – 12.5 cm) in diameter and can be considered early successional forest.

County Distribution: Statewide

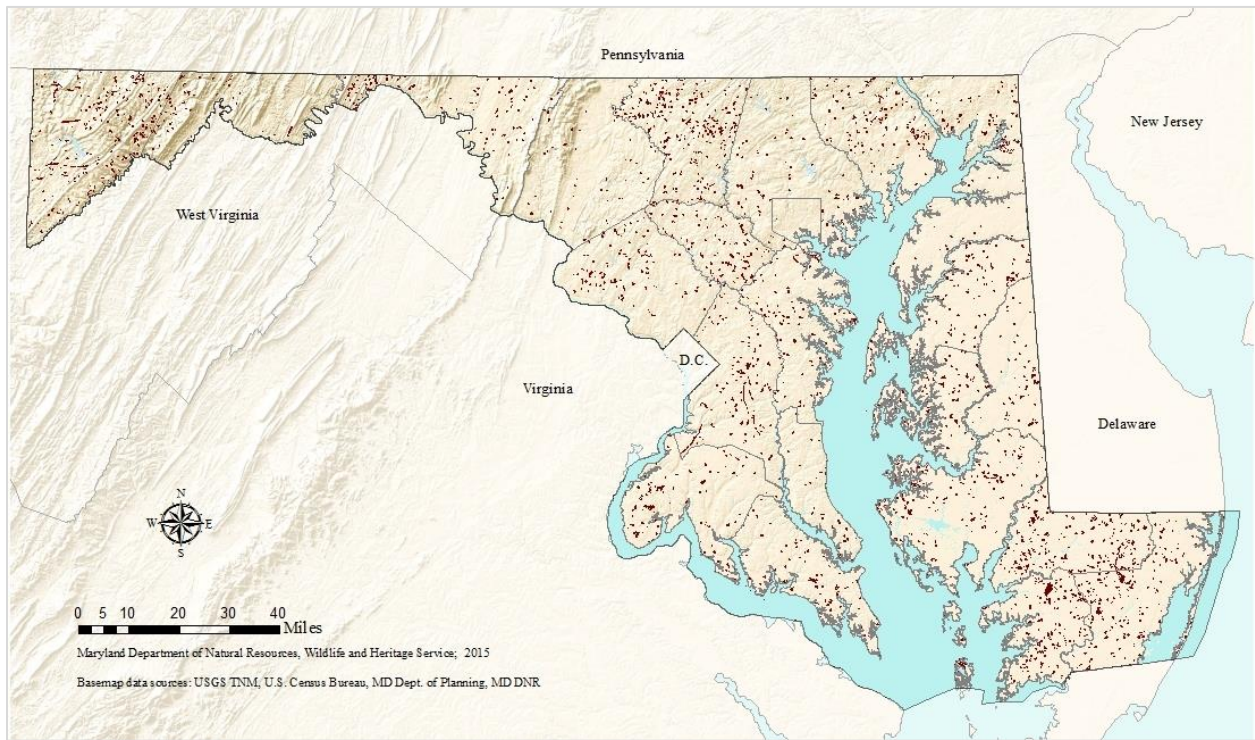


Figure 4.55 Location of Managed Successional Forests in Maryland. Source: Maryland Department of Planning’s Land Use/Land Cover 2010.



Species of Greatest Conservation Need Associated with Managed Successional Forests:

Mammals	Birds	Reptiles
Big brown bat	American woodcock	Eastern box turtle
Bobcat	Blue-winged warbler	Northern pinesnake
Eastern harvest mouse	Common nighthawk	Northern scarletsnake
Eastern red bat	Golden-winged warbler	Plain-bellied watersnake
Evening bat	Least flycatcher	Smooth greensnake
Hoary bat	Mourning warbler	Timber rattlesnake
Indiana myotis	Northern bobwhite	Insects (Butterflies & Moths)
Least shrew	Prairie warbler	
Least weasel	Red-headed woodpecker	
Little brown myotis	Willow flycatcher	
North American porcupine	Yellow-breasted chat	
Northern long-eared bat		
Seminole bat		
Silver-haired bat		
Southeastern myotis		
Southeastern shrew		
Southern bog lemming		
Tricolored bat		

Managed Grassland

Managed Grasslands are anthropogenically created, open, upland areas dominated by grasses and other herbaceous vegetation. The vegetation can vary in height (~0.15-2 m tall), structure, and composition and may include a mix of both native and non-native species. However, those dominated by native species tend to have greater conservation value. Some scattered shrubs and small trees (<8 m tall) may be present, but they are usually limited (<25% cover), patchy, and/or confined to the outer periphery of the opening as a soft forest edge or ecotone. Generally, grassland suitability as habitat for wildlife increases with size and area-to-edge ratio. Grasslands at least 4 ha in size to well over 100 ha are needed to support a number of area-sensitive grassland species of greatest conservation need (e.g., Henslow's sparrow and northern harrier). In addition to grassland size, other patch metrics (e.g., shape, degree of fragmentation) and landscape metrics (e.g., proximity to other grasslands, percentage of grassland and openings in surrounding landscape), as well as vegetation composition, height, and structure, can be important predictors of the presence and abundance of these species.



Bonnie Ott



Historically, parts of Maryland supported large expanses of natural grasslands and savanna-like habitats. Tens of thousands of acres of grassland dotted with blackjack (*Quercus marilandica*) and post (*Quercus stellata*) oaks once stretched across northern Maryland and nearby Pennsylvania. Prior to European settlement, much of Baltimore, Harford, and Carroll counties and adjacent counties in Pennsylvania were covered by this prairie-like grassland intermingled among wooded valleys (Mayre 1920). Also, early 18th and 19th century accounts depict large natural grasslands in the Hagerstown, Middletown, and Frederick valleys (Mayre 1955) and around The Glades area of Garrett County. It is believed that these openings were created and maintained by a combination of soil conditions, large grazing mammals (e.g., woodland bison [*Bison bison*], elk [*Cervus canadensis*]), and periodic fires. These grassland ecosystems have since nearly vanished due to habitat loss resulting from development, agriculture, fire suppression, and the disappearance of large ungulates. The few remaining native grasslands are either wetland key wildlife habitats (e.g., Piedmont Seepage Wetland, Montane-Piedmont Floodplains, Montane Bog and Fen) or are upland key wildlife habitats described as small patch habitats within a larger woodland matrix (e.g., Shale Barren, Basic Glade and Barren). The largest remaining native grassland is the Serpentine Barren woodland complex at Soldiers Delight Natural Environment Area in Baltimore, which has been under restoration for over 15 years.

Most of the state's remaining grassland fauna mostly persists in one or more of the following settings: (1) active pastures and hayfields; (2) fallow fields and grass plantings; (3) mowed edges of airports and military airfields; (4) reclaimed strip mines on the Appalachian Plateau. Managed grasslands occur statewide in these broad settings:

- 1. Active pasture and hayfields.** These active agricultural fields are dominated by a mix of native and non-native herbaceous vegetation. They are managed or maintained primarily through livestock grazing, mowing, haying, and, in some cases, prescribed burns.
- 2. Fallow fields and grass plantings.** This includes former agricultural land and other forms of anthropogenically created open land that is in the earliest stages of natural succession and dominated by a mix of native and non-native herbaceous vegetation. It includes some of the agricultural land management practices used in the USDA Conservation Reserve Program (CRP) and Conservation Reserve Enhancement Program (CREP). Unlike hayfields and pasture, these areas typically receive little or no active management. In the absence of human intervention, they become increasingly dominated by shrubs and small trees and, over time, would succeed to a forested condition. Grassland habitat may persist for approximately 10-20 years depending, in part, on prior land use, soil conditions, the size of the opening, surrounding habitat conditions, and the degree to which deer herbivory and invasive plant species impede woody plant establishment and growth.
- 3. Airfields.** Areas surrounding airfields must be maintained, usually via mowing, in some form of grass-dominated state to prevent woody plant growth and comply with airport safety regulations. Although airfields are typically under a strict mowing regime that limits their habitat suitability for many grassland-associated wildlife, areas along the periphery that are mowed infrequently or seasonally can provide substantial habitat for some species of conservation concern, including grassland nesting birds and migratory species, like upland sandpiper and eastern meadowlark.



- 4. Reclaimed strip mines.** This includes large acreages of reclaimed coal-strip mined lands in the Appalachian Plateau physiographic region that have been planted in grasses, usually fescue, and are now dominated by herbaceous vegetation. Although strip mining destroys or severely degrades natural terrestrial and aquatic ecosystems, these large anthropogenic grasslands now provide essential habitat for Henslow’s sparrow, as well as being significant for other grassland species of greatest conservation need, including American kestrel, bobolink, grasshopper sparrow, and eastern meadowlark.

County Distribution: Statewide

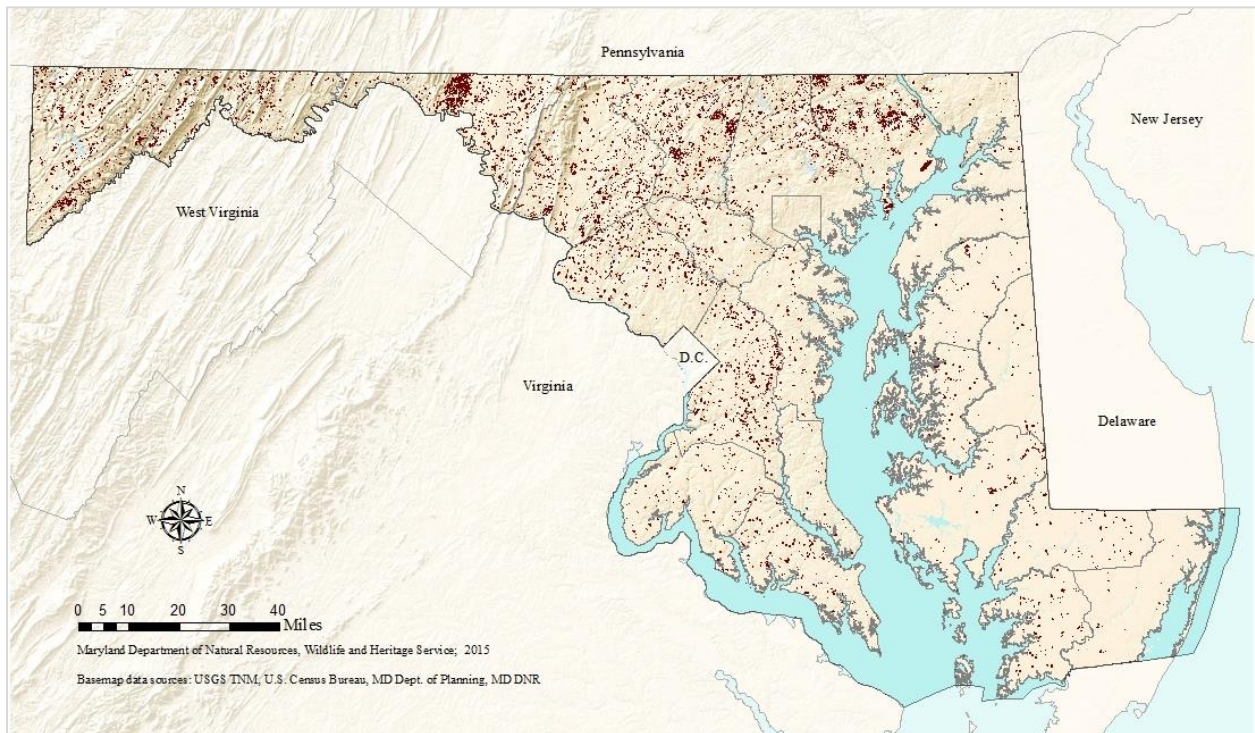


Figure 4.56 Location of Managed Grasslands in Maryland. Source: Maryland Department of Planning’s Land Use/Land Cover 2010.

Species of Greatest Conservation Need Associated with Managed Grasslands:

Mammals	Birds	Reptiles
Big brown bat	American kestrel	Bog turtle
Bobcat	American woodcock	Eastern box turtle
Eastern harvest mouse	Barn owl	Smooth greensnake
Eastern red bat	Bobolink	Insects (Bees, Wasps & Ants)
Evening bat	Common nighthawk	American bumble bee
Hoary bat	Dickcissel	Black and gold bumble bee
Indiana myotis	Eastern meadowlark	Insects (Butterflies & Moths)
Least shrew	Golden eagle	Frosted elfin
Least weasel	Grasshopper sparrow	Indian skipper



Mammals cont.	Birds cont.	Insects (Butterflies & Moths) cont.
Little brown myotis Seminole bat Silver-haired bat Southeastern myotis Tricolored bat	Henslow's sparrow Loggerhead shrike Long-eared owl Northern bobwhite Northern harrier Savannah sparrow Sedge wren Short-eared owl Upland sandpiper Vesper sparrow	Monarch

Roadside and Utility Right-of-Way

These habitats comprise a mixture of managed grasslands and shrub-dominated early successional forest areas that are maintained along roadsides, gas pipelines, and in powerline rights-of-way. Vegetation composition includes both native and non-native species and varies across the region. Depending on site conditions (e.g., soils, geology, slope, aspect, etc.) and how vegetation along the roadside or right-of-way is managed, these areas may, to some degree, mimic the natural disturbances and early successional phases of adjacent natural systems. Because these areas are usually rather narrow, although long, strips of habitat, they are usually not suitable for vertebrates that are area-sensitive and require the interior of large habitat patches for optimal breeding conditions. Therefore, these areas are more valuable as habitat for species, especially invertebrates, which may not require large habitat patches, as migratory or dispersal corridors for birds and other vertebrates, or as additional “linkage” habitat that connects and expands the size of adjacent patches of managed successional forests or grasslands. In highly fragmented or mosaic landscapes, connectivity between habitat patches may be important for the survival of wildlife on a species-specific basis.



Jason Harrison, MD DNR

County Distribution: Statewide

Signature State Rare Plants: Walter’s paspalum (*Paspalum dissectum*), white-bracted boneset (*Eupatorium leucolepis*), spiked hoary-pea (*Tephrosia spicata*), New Jersey rush (*Juncus Caesariensis*), Long’s rush (*Juncus longii*), red milkweed (*Asclepias rubra*), tuberous grass-pink (*Calopogon tuberosus*)



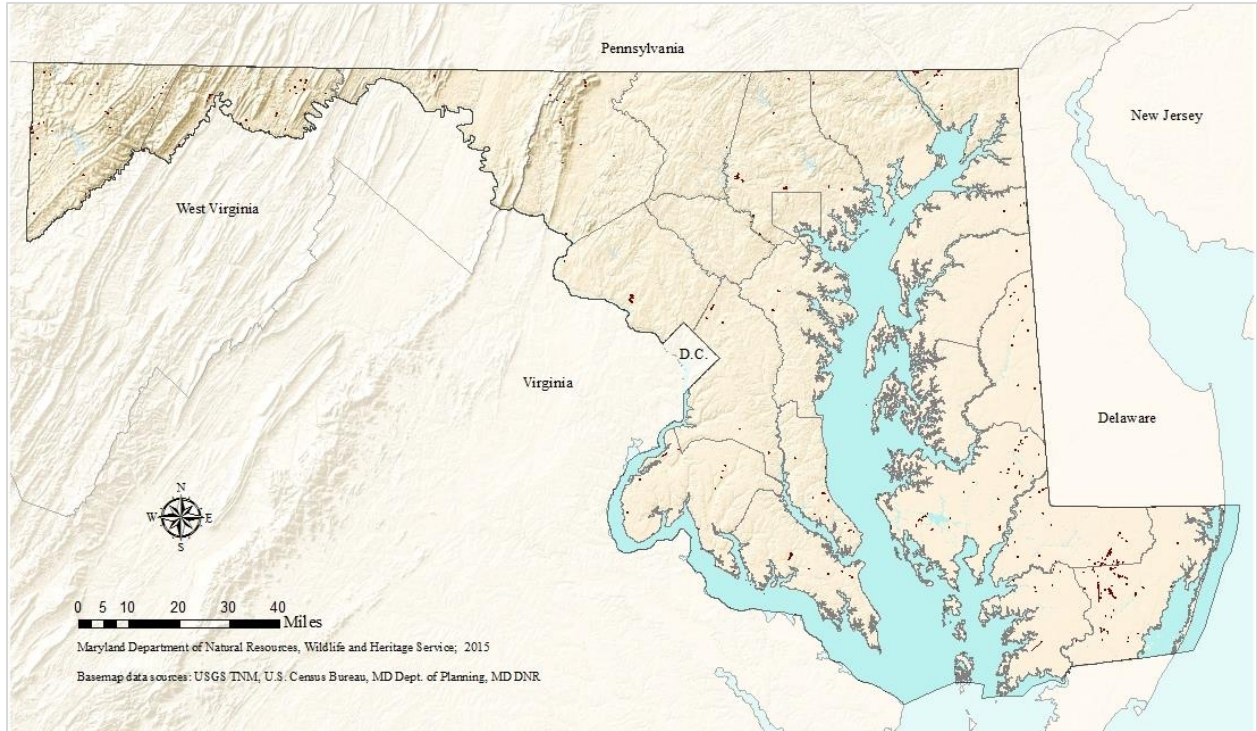


Figure 4.57 Location of Select Roadsides and Utility Rights-of-Way in Maryland (those that support SGCN animals and rare plants). Source: MD DNR.

Species of Greatest Conservation Need Associated with Roadsides and Utility Rights-of-Way:

Mammals	Birds	Insects (Beetles)
Big brown bat	Blue-winged warbler	Cow path tiger beetle
Eastern red bat	Golden-winged warbler	Eastern pinebarrens tiger beetle
Evening bat	Prairie warbler	Festive tiger beetle
Hoary bat	Willow flycatcher	Northern barrens tiger beetle
Indiana myotis	Reptiles	One-spotted tiger beetle
Little brown myotis	Mountain earthsnake	Splendid tiger beetle
Northern long-eared bat	Northern pinesnake	Insects (Butterflies & Moths)
Seminole bat	Smooth greensnake	Cobweb skipper
Silver-haired bat	Amphibians	Frosted elfin
Southeastern myotis	Eastern narrow-mouthed toad	Harris's checkerspot
Tricolored bat	Upland chorus frog	Leonard's skipper
		Monarch
		Mottled duskywing
		Northern metalmark
		Olympia marble
		Silvery blue
		Southern grizzled skipper



Artificial Impoundment and Artificial Wetland

No natural lakes occur in Maryland; the state lies well south of the southern extent of glaciation and lacks other natural lake-forming, geologically-based processes. However, numerous man-made wetlands, ponds, and lakes of varying sizes exist. These habitats are usually the result of water diversion. In many cases, impoundments were created at the expense of natural streams and river systems or natural marshes. Maryland does, however, contain some small natural, open freshwater areas in the form of beaver impoundments, wetland openings (e.g., Delmarva Bays, vernal pools, montane bogs and fens, flooded riverine floodplain openings) and river oxbows. A variety of species of conservation need inhabit such areas and also use some man-made impoundments and wetlands. In a few cases (e.g., black-banded sunfish), where natural aquatic habitats have been destroyed or degraded, Artificial Impoundment key wildlife habitats provide critical refugia. Today, the number and overall extent of the state's natural open water areas and wetlands have been greatly reduced due to various forms of ditching, drainage, degradation, and conversion of wetlands and stream and river habitats. Also, beaver populations in many parts of the state have never fully recovered from pre-1900 declines due to fur trapping pressure; the effects on aquatic ecosystems and associated wildlife have been significant. Unfortunately, the suitability as habitat of many man-made ponds and wetlands, such as stormwater management ponds, is somewhat limited, if not entirely absent, for most SGCN.



Jason Harrison, MD DNR

County Distribution: Statewide

Signature State Rare Plants: Three-angle spikerush (*Eleocharis tricostata*)



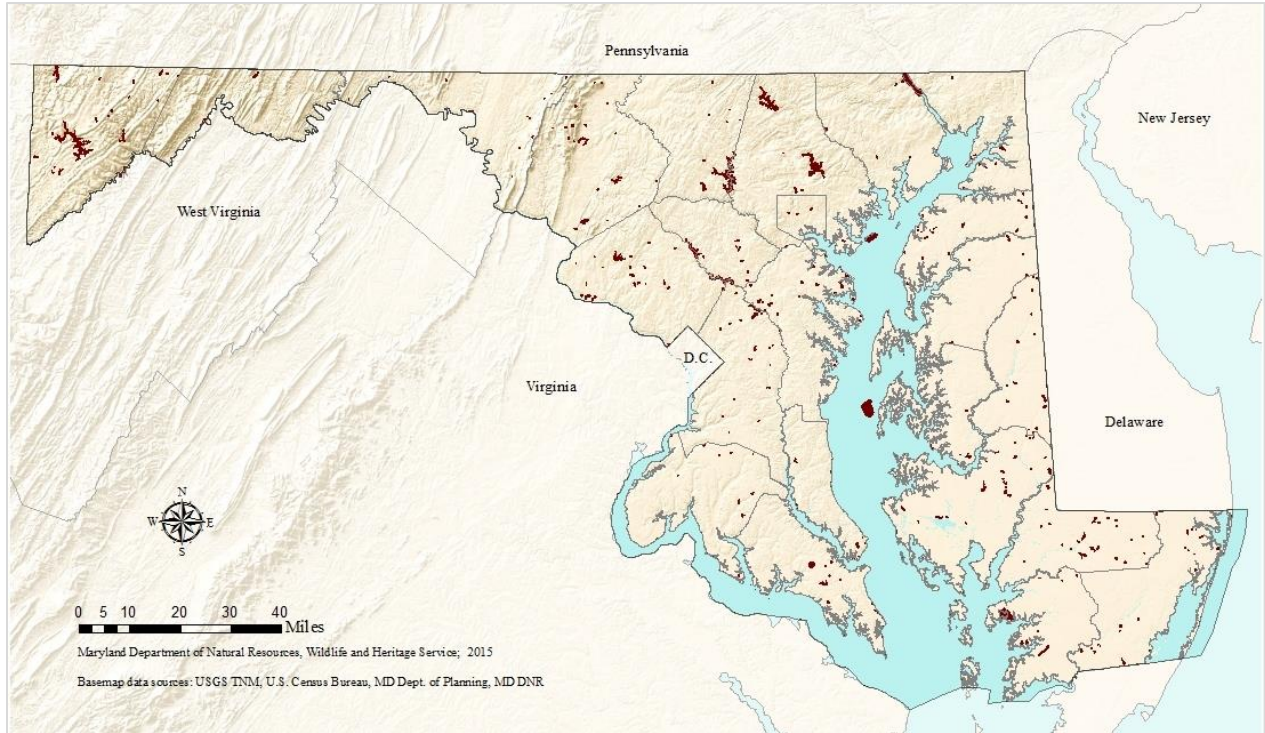


Figure 4.58 Location of Artificial Impoundments and Artificial Wetlands in Maryland. Source: MD DNR.

Species of Greatest Conservation Need Associated with Artificial Impoundments and Artificial Wetlands:

Mammals	Birds	Reptiles
American mink	American bittern	Eastern box turtle
Big brown bat	American black duck	Eastern spiny softshell
Eastern red bat	Bald eagle	Northern diamond-backed terrapin
Evening bat	Black rail	Spotted turtle
Hoary bat	Black scoter	Amphibians
Indiana myotis	Black-bellied plover	Barking treefrog
Little brown myotis	Black-crowned night-heron	Eastern narrow-mouthed toad
Northern long-eared bat	Blue-winged teal	Eastern tiger salamander
Seminole bat	Canvasback	Undetermined siren
Silver-haired bat	Common gallinule	Fishes
Southeastern myotis	Common loon	Blackbanded sunfish
Tricolored bat	Dunlin	Swamp darter
	Gadwall	Insects (Dragonflies and Damselflies)
	Glossy ibis	American emerald
	Golden eagle	Atlantic bluet
	Great blue heron	Black-tipped damer
	Great egret	Burgundy bluet
	Greater yellowlegs	Canada damer
	Least bittern	Chalk-fronted skimmer



	Birds cont.	Dragonflies and Damselflies cont.
	Lesser yellowlegs Little blue heron Long-tailed duck Pied-billed grebe Red knot Red phalarope Redhead Red-necked phalarope Ruddy duck Ruddy turnstone Sanderling Semipalmated sandpiper Short-billed dowitcher Snowy egret Sora Spotted sandpiper Surf scoter Tricolored heron White-winged scoter Willet	Comet darner Dot-tailed whiteface Duckweed firetail Elfin skimmer Faded pennant Frosted whiteface Golden-winged skimmer Green-striped darner Little blue dragonlet Martha's pennant Pale bluet Rainbow bluet Spring blue darner
		Freshwater Mussels
		Creeper Eastern lampmussel Northern lance Paper pondshell

Artificial Structure - Buildings and Other Structures

This habitat includes buildings, bridges and other man-made structures that, in some specific cases, provides important surrogate habitat for a small number of species of greatest conservation need. These species have adapted over time to use Artificial Structures in the absence of sufficient suitable natural features or habitats. Examples include the peregrine falcon’s use of tall buildings and bridges as nest sites in place of undisturbed cliff faces with sufficient prey populations nearby; least tern use of building rooftops with suitable substrates (e.g., loose, light-colored gravel) near tidal waters in place of natural sandy islands and sand bars lacking predators and human disturbance; and little brown bat use of houses and barns as maternity sites to raise their young in place of undisturbed, large, old hollow trees. Some species, such as chimney swifts, have virtually no natural alternatives remaining, while other species can still use natural alternatives, but have a much higher chance for survival or reproductive success using man-made alternatives because of the changed landscape.



Chesapeake Conservancy



In aquatic environments, man-made reefs comprised of concrete, fabricated reef structures, sunken ships/barges, or other materials attract reef-associated species in areas where shellfish beds and other natural reefs have declined or have been lost to siltation. These artificial structures provide attachment substrate for algae, sponges, oysters, and other invertebrates, and serve as shelter, nursery, and feeding habitat for many aquatic species, including some species of greatest conservation need.

County Distribution: Statewide

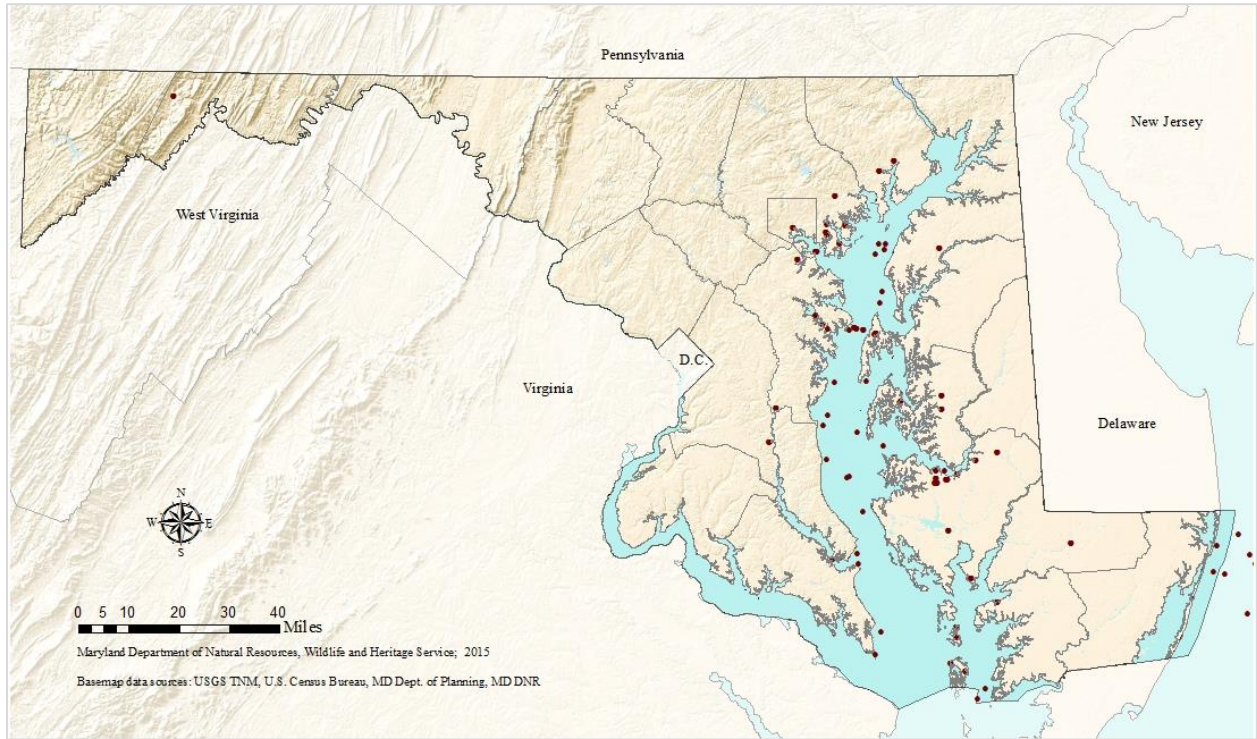


Figure 4.59 Location of Buildings and Other Structures in Maryland. Source: MD DNR.

Species of Greatest Conservation Need Associated with Buildings and Other Structures:

Mammals	Birds	Reptiles
Big brown bat	American peregrine falcon	Atlantic hawksbill seaturtle
Evening bat	Barn owl	Kemp's ridley seaturtle
Indiana myotis	Black scoter	Loggerhead seaturtle
Little brown myotis	Canvasback	Northern diamond-backed terrapin
Northern long-eared bat	Chimney swift	Fishes
Silver-haired bat	Common nighthawk	Atlantic sturgeon
Southeastern myotis	Least tern	Barndoor skate
Tricolored bat	Long-tailed duck	Shortnose sturgeon
	Surf scoter	Smooth skate
	White-winged scoter	Thorny skate



Artificial Structure - Mine and Tunnel

Mines are man-made, underground tunnels from which coal and other mineral resources (e.g., limestone, copper, gold, chromium) are extracted. Most occur on the Appalachian Plateau but some smaller, now inactive mines also occur in the Ridge and Valley and Piedmont regions. Most cave-dwelling species of conservation concern are absent in mines. However, in some cases, abandoned mines and railroad tunnels can provide surrogate, cave-like habitat for a limited number of cave-dwelling species, especially more mobile vertebrates like bats. The habitat suitability of these abandoned mine and railroad tunnels for cave-dwelling animals depends on a variety of factors but especially the level of human disturbance, size and/or depth, passage complexity, rock formation type, temperature, humidity, and the presence or absence of groundwater. Abandoned railroad tunnels are currently the most significant overwintering habitat remaining for a number of rare and declining bat species.



Richard Orr

County Distribution: Statewide

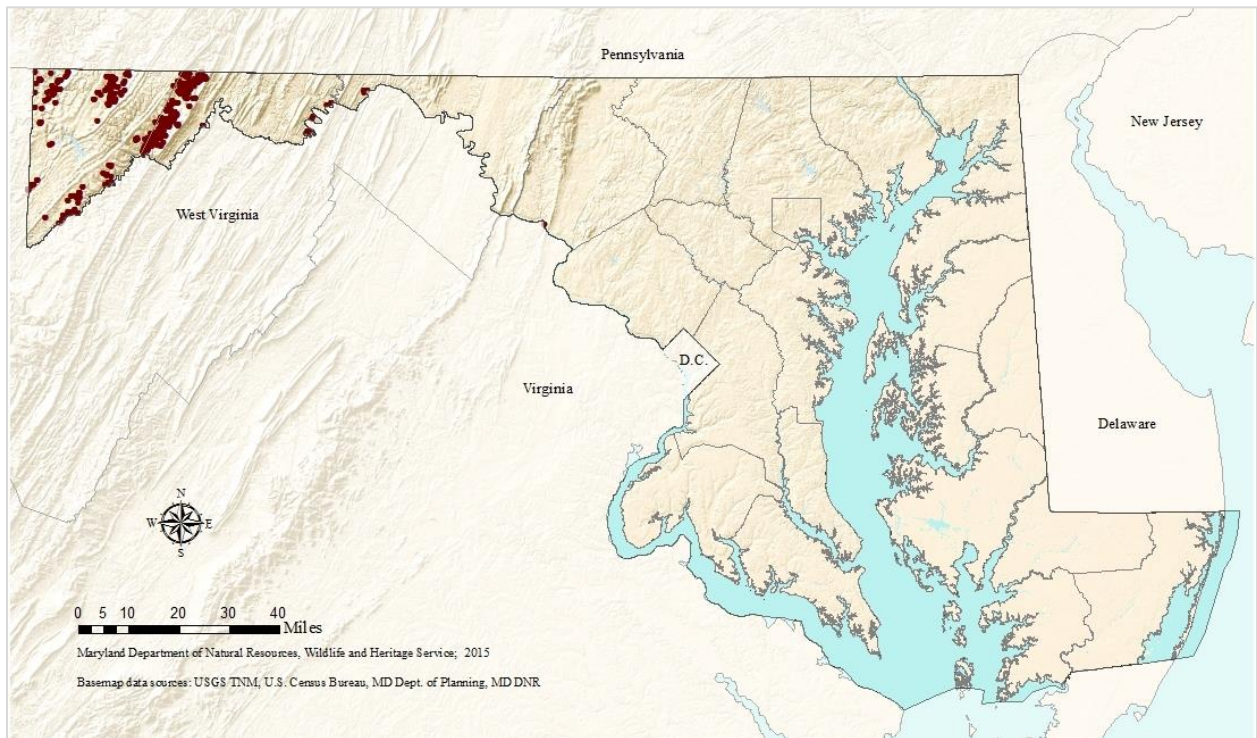


Figure 4.60 Location of Mines and Tunnels in Maryland. MD DNR, Maryland Department of the Environment, USGS.



Species of Greatest Conservation Need Associated with Mines and Tunnels:

Mammals	Crustaceans
Allegheny woodrat	Allegheny cave amphipod
Big brown bat	Franz’s cave amphipod
Eastern small-footed myotis	Franz’s cave isopod
Indiana myotis	Maus’ cave isopod
Little brown myotis	Roundtop isopod
Northern long-eared bat	Vandel’s cave isopod
Silver-haired bat	Invertebrates (Snails)
Tricolored bat	Appalachian springsnail
	Invertebrates (Flatworms)
	Hoffmaster’s cave planarian
	A planarian (<i>Sphalloplana sp 1</i>)

This chapter provides extensive descriptions of the key wildlife habitats that exist in Maryland, including key wildlife habitat distributions and conditions, and SGCN and signature plants that can be found in these habitats. (**Element 2**). The next chapter will discuss threats facing Maryland’s wildlife species and their habitats (**Element 3**).

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