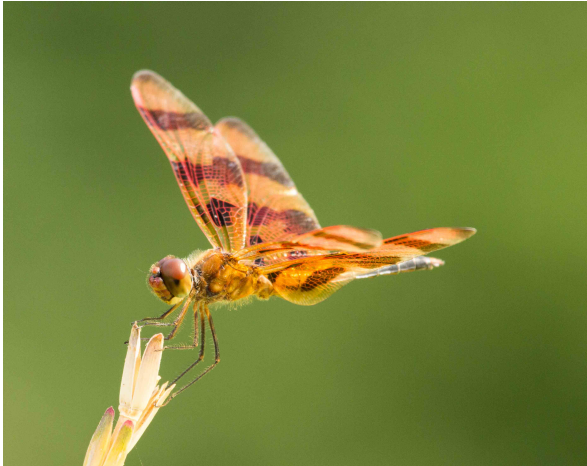
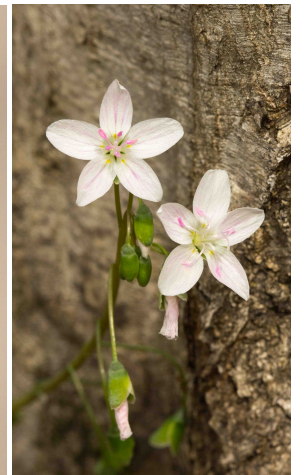
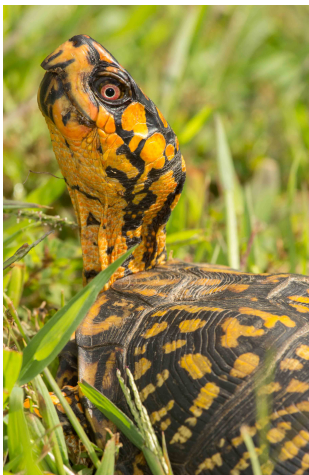




Albemarle County
Biodiversity Action Plan - Appendices
June 2018



ALBEMARLE COUNTY BIODIVERSITY ACTION PLAN

APPENDICES

June 2018

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APPENDIX A: ALBEMARLE COUNTY NATURAL PLANT COMMUNITIES

Compiled by Devin Floyd using comparative observations from Albemarle County collected during Albemarle County Natural Heritage Committee, Center for Urban Habitats, and Blue Ridge Discovery Center expeditions and surveys, and in concert with dozens of sample plots and classifications confirmed by the Division of Natural Heritage, Virginia Department of Conservation and Recreation (Fleming and Patterson 2013).

NOTE: Many of the plant community types listed below occur as local variants of regional types, and therefore specificity is omitted from the common name for those types until further research can be accomplished on the ground in Albemarle County. Three community types that have been extirpated are enjoying a comeback, at least in part, in some areas of the county. These are included below (prairies and savannas) because of their biodiversity conservation value and vital role in informing pollinator conservation and native landscape restoration on the Piedmont landscape. A riverine aquatic bed community group is included due to its presence in the Rivanna River, despite the fact that it is under studied. The community classifications and local variety in this group are currently undefined.

I. Terrestrial System (Upland habitats)

A. High-Elevation Forests, Grasslands, and Rock Outcrops

1. Central Appalachian Northern Hardwood Forest
2. Central Appalachian Northern Red Oak Forest
3. High-Elevation Outcrop Barren

B. Low-Elevation Mesic Forests

1. Appalachian Rich Cove Forest
2. Central Appalachian Rich Cove Forest
3. Inner Piedmont / Lower Blue Ridge Basic Mesic Forest
4. Central Appalachian / Piedmont Basic Mesic Forest
5. Central Appalachian Acidic Cove Forest (White Pine - Hemlock - Mixed Hardwoods Type)
6. Central Appalachian Acidic Cove Forest (Hemlock - Chestnut Oak Type)
7. Piedmont Mesic Mixed Hardwood Forest
8. Appalachian Hemlock - Northern Hardwood Forest
9. Piedmont Hemlock - Hardwood Forest

C. Low-Elevation Dry and Dry-Mesic Forests

1. Northern Hardpan Basic Oak - Hickory Forest
2. Southern Piedmont Basic Oak - Hickory Forest
3. Inner Piedmont / Lower Blue Ridge Basic Oak - Hickory Forest
4. Piedmont Acidic Oak - Hickory Forest
5. Central Appalachian Acidic Oak - Hickory Forest
6. Central Appalachian Dry-Mesic Chestnut Oak - Northern Red Oak Forest
7. Central Appalachian Montane Oak - Hickory Forest (Rich Type)
8. Central Appalachian Montane Oak - Hickory Forest (Acidic Type)
9. Piedmont / Central Appalachian Mixed Oak / Heath Forest
10. Central Appalachian / Inner Piedmont Chestnut Oak Forest
11. Northern Appalachian Chestnut Oak Forest
12. Central Appalachian Xeric Chestnut Oak - Northern Red Oak / Heath Forest
13. Central Appalachian / Piedmont White Pine - Oak Forest
14. Northern Coastal Plain / Piedmont Oak - Beech / Heath Forest
15. Southern Piedmont Hardpan Forest
16. Central Appalachian Acidic Boulderfield Woodland
17. Central Appalachian / Piedmont Low-Elevation Rich Boulderfield Forest

D. Low-Elevation Woodlands, Barrens and Rock Outcrops

1. Central Appalachian Pine - Oak / Heath Woodland
2. Southern Appalachian Pine - Oak / Heath Woodland
3. Central Appalachian Xeric Chestnut Oak - Virginia Pine Woodland
4. Central Appalachian Basic Ash - Hickory Woodland
5. Piedmont Ultramafic Woodland
6. Piedmont Mafic Barren
7. Acidic Oak-Hickory Woodland / Savanna (Remnant/Anthropogenic)
8. Basic Oak-Hickory Woodland / Savanna (Remnant/Anthropogenic)
9. Piedmont Prairie (Remnant/Anthropogenic)
10. Central Appalachian / Piedmont Acidic Cliff

II. Palustrine System (Non-tidal wetlands)

A. Alluvial Floodplain Communities

1. Water-Lily Floodplain Pool / Pond
2. Southern Piedmont / Inner Coastal Plain Floodplain Levee Forest
3. Piedmont Oxbow Shrub Swamp
4. Piedmont Oxbow Marsh
5. Piedmont Floodplain Swamp

6. Piedmont Small-Stream Floodplain Forest
7. Smooth Alder Impoundment Swamp
8. Piedmont / Central Appalachian River Birch - Sycamore Forest
9. Piedmont / Central Appalachian Silver Maple Forest
10. Piedmont / Central Appalachian Rich Floodplain Forest
11. Piedmont / Central Appalachian High Terrace Floodplain Forest
12. Piedmont / Central Appalachian Floodplain Swamp

B. Non-Alluvial Wetlands of the Mountains

1. Central Appalachian Basic Seepage Swamp
2. Central Appalachian Low-Elevation Acidic Seepage Swamp

C. Non-Alluvial Wetlands of the Piedmont

1. Piedmont / Northern Coastal Plain Basic Seepage Swamp
2. Piedmont Upland Depression Swamp
3. Northern Piedmont Acidic Upland Depression Swamp

III. Riverine System (Freshwater river channels)

A. Riverine Aquatic Beds

1. *N/A: Plant community type not determined/inventoried in Central Virginia, despite its likely presence. Albemarle County occurrence probable.*

APPENDIX B: BIODIVERSITY GOALS, OBJECTIVES, STRATEGIES FROM THE ALBEMARLE COUNTY COMPREHENSIVE PLAN (ADOPTED JUNE 10, 2015)

Natural Resources Chapter

Goal: Albemarle’s ecosystems and natural resources will be thoughtfully protected and managed in both the Rural and Development Areas to safeguard the quality of life of present and future generations.

Objective 4: Protect the biological diversity and ecological integrity of the County in both the Rural Area and Development Areas.

Strategy 4a: Develop an Action Plan for Biodiversity to protect significant areas of biological importance in the County.

Strategy 4b: Regularly repeat the land use/land-cover data-gathering process (as begun in 2009) for the purpose of monitoring landscape changes.

Strategy 4c: Collaborate with federal, State, and regional partners, who have geographic information on biological resources, to help build a biodiversity inventory.

Strategy 4d: Assess the need for hiring a County staff member with expertise in conservation biology and/or training existing County staff in principles of conservation biology to assist in development of the Action Plan and coordination with other County actions.

Strategy 4e: Encourage the use of native plants in landscaping to protect and provide habitat for native biodiversity, to save water, and to connect landowners to the local ecosystem.

Strategy 4f: Increase the community’s awareness of the importance of biodiversity to encourage protection of biological resources.

Strategy 4g: Provide information to potential land subdividers on the importance of protecting habitat when creating lots for development.

Strategy 4h: Preserve existing vegetation in areas shown as Parks and Green Systems on Development Area Master Plans.

Rural Area Chapter

Objective 2: Protect and preserve natural resources, which include mountains, hills, valleys, rivers, streams, groundwater, and continuous and unfragmented land for agriculture, forestry, biodiversity and natural resource protection.

Strategy 2d: Continue to promote conservation easements to provide a financially attractive way for landowners to protect family farms in Albemarle County and their unique open space resources, to provide an opportunity for landowners to voluntarily sell a conservation easement to a public agency to be held in trust for perpetuity, and to preserve important features of the Rural Area for all.

Strategy 2e: Strengthen the Acquisition of Conservation Easements (ACE) Program by providing a stable dedicated funding source and staff resources for administering the program.

Strategy 2f: Continue to provide staff support to the Public Recreational Facility Authority (PRFA).

Strategy 2g: Assess how a program for the transfer of development rights might be designed to redirect development potential from sections of the Rural Area with high-value natural and cultural resources to locations outside the Rural Area.

Strategy 2i: Encourage connectivity of conservation land wherever feasible.

APPENDIX C: IMPORTANT SITES FOR ALBEMARLE BIODIVERSITY

High Priority Important Sites

As discussed in the “Landscape Analysis” section of the report, the Natural Heritage Committee (NHC) identified 24 Important Sites as high priority for conservation during the next five years. The NHC will serve as an advocate for thirteen of the sites while Albemarle County should address conservation needs for nine of the sites. The table below lists the High Priority sites.

High Priority Important Sites	Advocate for the Site
Avon Swamp	County
Bald Eagle Nest - North Fork Rivanna - Bentivar **	County
Bald Eagle Nest - Rivanna River - Shadwell/Tufton	Natural Heritage Committee
Cactus Rock Barren	Natural Heritage Committee
Dudley Mountain Barren Complex **	County
Key West Floodplain	County
Montalto Prickly Pear Barren	Natural Heritage Committee
Monticello Mountain Bluffs	Natural Heritage Committee
North Fork Rivanna Proffit Road **	County
Old Mills Complex	County
Red Hill Wetland Area	Natural Heritage Committee
Rivanna Bluffs below Buck Island Creek	County and Natural Heritage Committee
Salamander Crossings	County
South Fork Rivanna Dam, Area 1	County
South Ragged Mountains Barren/Ravine Complex **	County
Southern Albemarle Mountains **, including the five sites occurring within it: <ul style="list-style-type: none"> • Brush Mountain Rock Face ** • Brush Mountain Trail Barren Complex ** • Bungletown ** • Chalk Rock ** • Fan Mountains ** 	Natural Heritage Committee
Sugar Hollow	County and Natural Heritage Committee
Tufton Flatrock Communities	Natural Heritage Committee
Wooded River Bluffs	Natural Heritage Committee

** Denotes sites that overlap geographically with another site.

Old Mills Complex: A Case Study in the Need to Conserve an Important Site

Contributed by Devin Floyd.

This area, located along the eastern edge of the Rivanna River, east of Charlottesville, occupies a variety of landforms on west to southwest facing aspects. The majority of the terrain is steep with frequent rock outcrops and scree slopes. These steep rocky slopes reach down to the river's edge in places, bringing mafic rock outcrop plant communities into direct contact with riverine systems. In other places the steep slopes reach a high floodplain that stretches to the river's edge. The steep slopes offer mafic vegetative assemblages over thin rocky soils, a rare ecological resource in the region. The alluvial floodplains offer deep and well-drained base-rich soils, thus presenting Piedmont Rich Floodplain/Cove Forest types, of which there are only a few examples in the Piedmont Ecoregion portion of the county.

One may consider the entirety of this stretch of terrain, from the Riverbend Condominiums south to I-64, an ecological resource of great value, and at great risk. The corridor is complex due to historic land use and river flood events. Roads, paths, trails, canals, modern and historic flood terraces, clearcuts, selective thinning, and hilltop commercial development have rendered it a mosaic of interweaving cultural resources and exotic invasive species vectors. The land is dotted with remnants of the cultural and ecological past. It is also actively rich with the potential of the ecological future.

Valuable historic resources aside, the corridor holds many remarkable point-specific biological resources. This may be in part due to the steep and rocky nature of the terrain, and the protection that offers some of the floodplain areas. Barrens, outcrop woodlands, and rich forests, all of which rank very high on local, regional, and national conservation priority lists, dot the landscape. Within those are rare and uncommon species and assemblages of species. Interestingly, these communities have some degree of resilience. Despite the very intrusive nature of historic land use (including 18th century clearing, canals, an impoundment created by the Woolen Mills dam, sediment build up on floodplains, trails, roads, and the modern influx of invasive species), the landscape holds some of the region's best biological resources. Many of the resources are not yet fully studied and/or understood. It is likely that many species still await discovery in the corridor. In short, the value of the Old Mills Complex corridor is high, and due to the growing threat of development (not the least of which is an expanded and formalized trail renovation that will dramatically increase human traffic at the site), careful measures should be taken to ensure the site's conservation, in balance with the access that is desired.

There are three critical conservation points along the corridor worthy of discussion. The first exists in the rich forests about halfway south through the area of concern, below the Carriage Hill Condos. Multiple improvised trails and high volume storm washes bisect this unusual forest type. This creates high levels of erosion and increased invasive species introductions. The trails are used by a variety of adult groups, some of which have been observed combining alcohol with a race - running, climbing, and otherwise scrambling through all parts of the forest off the trails, and traversing the most critical points on rock outcrops (impacting species there directly). Currently the county Parks and Recreation Department has no plan (nor the means) to monitor the trail system and surrounding lands for illegal activity or the irresponsible use of the public trail. The trail offers a direct transect through critical habitats, from which one may venture freely (i.e., trespass) up slope or down at hundreds of locations. In effect, the trail functions as an open invitation to explore (and impact) the biological resources in the

corridor - unmonitored, and without any clear guidance or communication about the critical nature of the biome. Dogs run freely, off leash, most of the time. The odor of fecal matter is nearly always present. Mountain bikes race at high speeds in a couple locations, due to the steep nature of the trail at those points.

The second critical point is where the existing public trail slices directly through the metabasalt barrens and woodlands below the Heritage Inn and Assisted Living property. Trails were installed prior to and without the consideration of plant community classifications and conservation, and without regard to the existence of rare species. The only county record for fragrant sumac (*Rhus aromatic*) grows in the trail and at its margins. Some of this colony was likely removed during the construction of the trail.

In the future there should be greater awareness and oversight of activities by county staff and representatives, to prevent harmful impacts to important resources. A potential action is eliminating the trail all-together from the middle and toe slopes, from the entire section of trail extending from northwest of the Carriage Hill Condos and southward to the point just south of the State Farms Insurance Operation Center. Through this stretch, the Old Mills Trail could be an upland, viewshed-focused segment of trail that rejoins the floodplain near the Woolen Mills dam site. The gentle slope from hilltop to floodplain at that location makes it an ideal candidate for trail relocation. Relocating the trails requires securing agreements with property owners, which can be challenging. If successful, the corridor could be designated a biological conservation area. If trails cannot be excluded, trail use should be limited to foot traffic only, with the exclusion of pets and vehicles/toys with wheels.

The third critical point is the extremely steep, erosion-prone, and unsustainable trail point near the Woolen Mill dam. It is so steep that most people actually have to walk their bikes up and/or down, and foot navigation is risky during certain conditions. This mucky climb leaps up the slope, across contours, and interrupts a large rock outcrop seepage habitat in so doing. Regrettably, this is an extremely poor example of trail design.

Descriptions of Important Sites

The following list of 53 sites represent locations of special natural plant communities, unusual habitats, or species rare to scarce in Albemarle County. An initial list of Important Sites was developed in 2004 by the county's Biodiversity Work Group (Albemarle County Biodiversity Work Group 2004). The county's Natural Heritage Committee (NHC) has maintained and revised the list in the ensuing years. The list of sites is based on the cumulative knowledge of the county of current and previous members and supporters of the Biodiversity Work Group and NHC. A comprehensive survey of the county to identify these types of species, plant communities, and habitats has not been conducted.

Brief Descriptions of the 53 Important Sites Acreage figures are approximate.
Avon Swamp. 8 acres. Adjacent to Biscuit Run. The state rare purple fringeless orchid (<i>Platanthera peramoena</i>) is present. Also large colonies of netted chain fern (<i>Woodwardia areolate</i>), hummocks with interrupted fern (<i>Osmunda claytoniana</i>). The county rare spotted turtle (<i>Clemmys guttata</i>) has been documented here.
Bald Eagle Nest - Hardware River - Bellair Farm. 126 acres. Nest in old white pine (<i>Pinus strobus</i>).
Bald Eagle Nest - Lickinghole Creek Reservoir. 126 acres. Nest in small white pine (<i>Pinus strobus</i>).
Bald Eagle Nest - Mechums River. 126 acres.
Bald Eagle Nest - North Fork Rivanna – Bentivar. ** 126 acres. Nest in large sycamore tree (<i>Platanus occidentalis</i>).
Bald Eagle Nest – Rivanna River - Glenmore. 126 acres. Nest on south side of Rivanna River opposite Glenmore.
Bald Eagle Nest - Rivanna River - Shadwell/Tufton. 126 acres. Nest on south side of Rivanna River in power line right-of-way.
Beaver Creek Pond (formerly named Henleys Pond). 89 acres. The lake and surrounding land are prime bird habitat in all seasons.
Beaver Creek Reservoir. 1,166 acres. Reservoir and surrounding land is prime bird habitat in all seasons.
Brush Mountain Rock Face. ** 8.5 acres. Brush Mountain Rock Face is an outstanding example of a south-facing, open granite-slope plant community located 3.1 miles northeast of Faber. The only known station for Appalachian sandwort (<i>Minuartia glabra</i>) is found here. A small colony of wooly lip-fern (<i>Cheilanthes tomentosa</i>), one of only two known county sites is found nearby.
Brush Mountain Trail Barren Complex. ** 205 acres. A grouping of five rock outcrops with characteristics that point to “Piedmont Mafic Barren,” in various states of preservation.
Bucks Elbow. 71 acres. Bucks Elbow Mountain has greenstone cliffs and open rock faces on the southeast side which support two colonies of tall cinquefoil (<i>Potentilla arguta</i>). This plant is rare in Virginia where it is on the edge of its known range and this site is the only one known in Albemarle County. This is also the location of the only known county occurrence of the pine snake (<i>Pituophis melanoleucus</i>).
Bungletown. ** 2 acres. Bungletown, at the east foot of the Fan Mountains, contains one of only two known native occurrences of great laurel (<i>Rhododendron maximum</i>) in the county. It is found in a small colony in the woods on the upper Sheepneck Branch.
Buzzard Rock. ** 38 acres. “Buzzard Rock,” on the east side of Dudley Mountain, is the site of an outstanding open granite rock-face plant community (lithophytes). Other parts of Dudley mountain are interesting both for plant communities and birds. Hairy lip-fern (<i>Cheilanthes lanosa</i>), Rock selaginella (<i>Selaginella rupestris</i>), and Appalachian phacelia (<i>Phacelia dubia</i>) occur here.
Cactus Rock Barren. 9 acres. Prickly pear cactus (<i>Opuntia phemaranthus</i>), <i>Krigia</i> , <i>Grimmia</i> , etc. are present.
Campbell Wetlands 1-2. 57 acres. Near Campbell, in a wooded area northwest of the railroad, is the only county occurrence of the beautiful Jacob’s Ladder (<i>Polemonium reptans</i>), found along with many spring ephemerals.

<p>About 0.7 mile northeast of Campbell is a small marsh containing marsh marigold (<i>Caltha palustris</i>), spatterdock (<i>Nuphar luteum</i>), and stool sedge (<i>Carex stricta</i>). The only known occurrence in the county of Short's sedge (<i>Carex shortiana</i>) is also in this area. Priority site identified in NHC 2007 report.</p>
<p>Chalk Rock. ** 2 acres. Chalk Rock is an exemplary open rock plant community on the south end of Chalk Mountain, 2.75 miles north of Coveseville. The lovely orchid crested coralroot (<i>Hexalectris spicata</i>) and the wooly lip-fern (<i>Cheilanthes tomentosa</i>) occur nearby; both are known from only one other station in the county.</p>
<p>Cove Garden Wetland. 34 acres. This is a small swamp bordered by a marshy area located off Route 633, 1.1 miles southwest of South Garden. Poison sumac (<i>Rhus vernix</i>) (one of only two known stations in the county), swamp fetter-bush (<i>Leucothoe racemosa</i>) (only known county station), Canada May-flower—a mountain species (<i>Maianthemum canadense</i>), and the rare in the county orchid, purple fringeless orchid (<i>Platanthera peramoena</i>) are all found here. Priority site identified in NHC 2007 report.</p>
<p>Doyles/Moormans River Confluence. 14 acres. The Doyles River/Moormans River confluence and adjacent floodplain and wetland areas are excellent bird habitat. In winter, swamp sparrows (<i>Melospiza georgiana</i>) and tree sparrows (<i>Spizella arborea</i>), common snipe (<i>Gallinago gallinago</i>); in summer, willow flycatchers (<i>Empidonax traillii</i>).</p>
<p>Dudley Mountain Barren Complex. ** 789 acres. Biome including plant communities on southeast and northwest slopes that are notable for Albemarle. The barrens are scattered along the southeast aspect upper slopes. The northwest facing ravines are noted for their rich assemblage of flora (including the eastern-most documentation of striped maple, <i>Acer pennsylvanicum</i>).</p>
<p>Fan Mountains 1-2. ** 731 acres. The Fan Mountains are a rich, mostly wooded region with many ravines and stream valleys. This is one of two known sites in the county (also at Preddy Creek Park) for climbing fern (<i>Lygodium palmatum</i>). The area is rich in ferns including log-fern (<i>Dryopteris celsa</i>), Goldies fern (<i>Dryopteris goldiana</i>) and glade fern (<i>Diplazium pycnocarpon</i>), the unusual closed gentian (<i>Gentiana clausa</i>), is also found here.</p>
<p>Green Mountain 1-2. (Formerly named "Green Mountain near Estouteville") 29 acres. Green Mountain, a low (about 750 feet high) ridge in southern Albemarle, has a number of interesting sites. Near the Estouteville estate, two stations are found for smooth gooseberry (<i>Ribes rotundifolium</i>), the only records in the county east of the Blue Ridge. Also found nearby is a colony of log-fern (<i>Dryopteris celsa</i>).</p>
<p>Hardware River Bluffs. 11 acres. Among a number of north to northeast facing bluffs along the Hardware river, one of the most interesting is located 2 miles south of Carter's Bridge. This wooded bluff has eastern hemlock (<i>Tsuga canadensis</i>), pitch pine (<i>Pinus rigida</i>), table-mountain pine (<i>Pinus pungens</i>), and the scarce in the Piedmont shrub sweet fern (<i>Comptonia peregrina</i>).</p>
<p>Hybrid Fern <i>Dryopteris x bootii</i> Site. 23 acres. A rare in Albemarle fern hybrid, <i>Dryopteris x bootii</i> is found here.</p>
<p>Jefferson Mill. 3 acres. A north-facing, wooded Kalmia bluff on the Hardware River 0.7 mile above the Jefferson Mill. Turkey beard (<i>Xerophyllum asphodeloides</i>) is found here.</p>
<p>Key West Floodplain. 87 acres. Another site along the North Fork Rivanna lies between Red Bud Creek and the north end of the bluffs at the Key West subdivision. This is a good spring wildflower area and is another site for dwarf larkspur (<i>Delphinium tricornis</i>). Priority site identified in NHC 2007 report.</p>

<p>Lake Albemarle. 393 acres. The lake and the surrounding land is prime bird habitat in all seasons.</p>
<p>McCullough Site. 55 acres. The McCullough site is an area of south-facing hardwoods bluffs on the James River running about 0.5 miles upstream from a point 3.2 miles west of Warren. Two colonies of chinquapin oak (<i>Quercus muhlenbergii</i>), the only two stations in the county, are found within a half-mile of each other on the river here.</p>
<p>Montalto Prickly Pear Barren. 1 acre. Small site contains a strong colony of the native genotype of eastern prickly pear (<i>Opuntia humifusa</i>).</p>
<p>Monticello Mountain Bluffs. 23 acres. This site is the rich, wooded, north facing bluff of Monticello Mountain on the Rivanna River. In addition to the forested area, a rich spring display of wildflowers includes yellow root (<i>Xanthorhiza simplicissima</i>), bluebells (<i>Mertensia virginica</i>), and bladder-nut (<i>Staphylea trifoliata</i>). The unusual sedge <i>Carex albursina</i> is also found here.</p>
<p>Moormans River Bluffs 1-2. 7 acres. North facing bluffs along the Moormans River west of Ridge Road. In a seep under the eastern hemlocks (<i>Tsuga canadensis</i>), the wild northern white violet (<i>Viola mackloskeyi</i>) is found. The beautiful purple flowering raspberry (<i>Rubus odoratus</i>) is found downstream from the bluffs.</p>
<p>Mount Alto Bluffs. 15 acres. Mount Alto bluff, a north-facing pine-hardwoods-heath association on the Rockfish River 3 miles southeast of Schuyler. Catawba rhododendron (<i>Rhododendron catawbiense</i>), turkey beard (<i>Xerophyllum asphodeloides</i>), leatherwood (<i>Dirca palustris</i>), slender groundpine (<i>Lycopodium tristachyum</i>), table-mountain pine (<i>Pinus pungens</i>), pitch-pine (<i>Pinus rigida</i>), and barren strawberry (<i>Waldsteinia fragarioides</i>) (found at only one other station in the county) all occur at this site.</p>
<p>North Fork Cunningham Creek. 36 acres. East of Woodridge several branches of the North Fork Cunningham Creek provide sites for several Albemarle plant rarities. This is the only known county station for bunch-flower (<i>Veratrum virginicum</i>) and golden-club (<i>Orontium aquaticum</i>). The very scarce orchid, green adder's mouth (<i>Malaxis unifolia</i>) also occurs here.</p>
<p>North Fork Rivanna Flood Plain and Piney Mountain. 71 acres. This area near the GE Fanuc Facility, north of Chris Greene Lake and south of Piney Mountain, includes flood plain of the North Fork Rivanna River and associated slopes. Prothonotary warblers (<i>Protonotaria citrea</i>), very rare in Albemarle County, found singing as if on territory during nesting season. The unusual hairy wood sedge, <i>Carex hirtifolia</i>, is found near the river. Lizard's tail (<i>Saururus cernuus</i>) is also found here.</p>
<p>North Fork Rivanna Proffit Road. ** 229 acres. Probably the most outstanding wildflower site in Albemarle County is the 1.85-mile long, northwest facing wooded bluff and floodplain along the North Fork Rivanna below the Route 649 bridge. The display of spring ephemerals here is fantastic. Several colonies of toad trillium (<i>Trillium sessile</i>) (one of very few occurrences in the county) and dwarf larkspur (<i>Delphinium tricorne</i>) (one of only three county occurrences) are found here. Three very scarce ferns, Bradley's spleenwort (<i>Asplenium bradleyi</i>) (only known county station), pinnatifid spleenwort (<i>Asplenium pinnatifidum</i>), and Trudell's spleenwort (<i>Asplenium x trudellii</i>) occur here on quartzite cliffs upslope. This is also an important area for birds. Priority site identified in NHC 2007 report.</p>
<p>Old Mills Complex 1-2. (Site 1 formerly named "Woolen Mills", Site 2 formerly named "Old Mills Trail Basic Outcrop Woodland Complex.") 5 acres. Site 1 is across the Rivanna River from the old Woolen Mills on a rock outcrop. In the woods is a colony of fragrant sumac (<i>Rhus aromatica</i>), the only known occurrence in the county.</p>

<p>Hairy lip fern (<i>Cheilanthes lanosa</i>) is also found here. A rich floodplain forest occupies much of the site, with a diversity of trees to be found.</p>
<p>Paper Birch Complex. 104 acres. A stand of paper birch (<i>Betula papyrifera</i>), which typically occurs far north of Virginia, is located in Shenandoah National Park.</p>
<p>Power Line at 618 Northeast of Woodridge. 11 acres. Powerline and adjacent areas south of Route 618 near the Albemarle-Fluvanna boundary. Many interesting wet soil plants including <i>Lobelia (georgiana lobelia)</i> (only county record) and southern wild raisin (<i>Viburnum nudum</i>).</p>
<p>Preddy Creek Wetlands. 200 acres. A long stretch of discontinuous riparian “wetland” forest, rather unusual in Albemarle County. Runs about 2 miles in length, from Three Forks southwest to Gilbert, and continuing to Turkey Run. Slightly northeast of this wetland is a small colony of shingle oak (<i>Quercus imbricaria</i>) for which this is one of only two known extant occurrences (also found at Preddy Creek Park). Priority site identified in NHC 2007 report.</p>
<p>Ragged Mountains and Reservoir. ** 3,825 acres. The Ragged Mountain area, including Hickory Hill and the Charlottesville (Ragged Mountain) Reservoir, provide a large mostly wooded area, which supports a great diversity of migrant and nesting birds. Wood frogs, wood otter, and prothonotary warblers have been found in this region. Two ferns scarce in Albemarle County, glade fern (<i>Diplazium pycnocarpon</i>) and log-fern (<i>Dryopteris celsa</i>) are found in these mountains. Perhaps the only county occurrence of grass-leaved arrowhead (<i>Sagittaria graminea</i>) is also found here.</p>
<p>Red Hill Wetland Area. 171 acres. Site includes Turk’s cap lily (<i>Lilium superbum</i>), purple fringeless orchid (<i>Platanthera peramoena</i>), tall purple aster, and other significant plants. More documentation needed.</p>
<p>Rivanna Bluffs below Buck Island Creek. 58 acres. Below the mouth of Buck Island Creek and northeast of Route 53, a steep northwest facing bluff on the Rivanna River provides an exemplary example of a Piedmont hemlock bluff. Turkey beard (<i>Xerophyllum asphodeloides</i>), the ferns, Pinnatifid spleenwort (<i>Asplenium pinnatifidum</i>) and Trudell’s spleenwort (<i>Asplenium trudellii</i>), the scarce in the Virginia, Piedmont clubmoss, slender ground pine (<i>Lycopodium tristachyum</i>), and lyreleaf rockcress (<i>Arabis lyrata</i>), which makes possibly its only Albemarle appearance here. The only known apparently native loblolly pine (<i>Pinus taeda</i>), a 34” DBH, approximately 135 year-old tree, is located in an adjacent ravine. Some of the pitch pines (<i>Pinus rigida</i>) in the same area seem to have loblolly genes. Priority site identified in NHC 2007 report.</p>
<p>Rock Island. 4 acres. Rock Island is a small wooded island in the James River 0.9 miles downstream from Warren. One of the few county stations for twin-leaf (<i>Jeffersonia dyphylla</i>) is found here, and north-facing cliffs support the county’s only known station for hairy heuchera (<i>Heuchera villosa</i>).</p>
<p>Salamander Crossings 1-3. 22 acres. Spotted salamander (<i>Ambystoma maculatum</i>) and other amphibians cross Polo Grounds and Rio Mills Roads in late winter/early spring, from wooded areas north of the roads to breed in seasonally wet areas in the Rivanna River floodplain. This may be the only confirmed breeding site for marbled salamanders (<i>Ambystoma opacum</i>) in the Virginia Piedmont.</p>
<p>Scotland Farm Area. 62 acres. Scotland Farm Pond and several other farm ponds in the same general area are probably the best sites in the county for water and shore birds.</p>
<p>South Fork Rivanna Dam Area 1-2. 14 acres. Two areas adjacent to the South Fork Rivanna River Dam are of interest. An abandoned quarry north of the dam is the site of two fern allies rare in Albemarle County, southern bog clubmoss (<i>Lycopodiella appressa</i>) and northern bog clubmoss (<i>Lycopodiella inundata</i>), with the possibility of</p>

<p>a hybrid of these. The unusual bladderwort (<i>Utricularia gibba</i>) is found at the second Albemarle station. Near the base of the dam, the uncommon Walter's St. Johns- wort (<i>Triadenum walteri</i>), grass-leaved arrow-head (<i>Sagittaria graminea</i>), and indigo (<i>Amorpha fruticosa</i>) is found. (Site 2 north of the dam is likely destroyed due to the resumption of quarrying.)</p>
<p>South Ragged Mountains Barren/Ravine Complex. ** 939 acres. At least three good Piedmont mafic barrens occur in this site, including what is probably the largest example in the county. Several base-rich deep ravines with high probability of rare/uncommon flora and fauna are also found here. County first records of little brown skink (<i>Scincella lateralis</i>) and Appalachian azure butterfly (<i>Celastrina neglectamajor</i>) have been documented here. The site overlaps spatially with Ragged Mountains and Reservoir site.</p>
<p>Southern Albemarle Mountains. ** 21,588 acres. This large area encompasses the Mill Mountain-Castle Rock-Moses Mountain-Hearde Mountain-Boaz Mountain group--a mostly wooded, mountainous region. Five other Important Sites occur within this landscape-scale site. Some rich, wooded, north-facing slopes and ravines harbor Goldies fern (<i>Dryopteris goldiana</i>), small-flowered bunch-flower (<i>Veratrum parviflorum</i>), purple flowering raspberry (<i>Rubus odoratus</i>), Dutchman's pipe (<i>Aristolochia macrophylla</i>), and the two orchids spotted coralroot (<i>Corallorhiza maculata</i>) and Spring coralroot (<i>Corallorhiza wisteriana</i>). The very small and rare daisy-leaved grape-fern (<i>Botrychium matricariaefolium</i>) is found here as the only known station in the county east of the Blue Ridge. In addition to this wealth of flora, this region has a large diversity of nesting wood warblers including: northern parula (<i>Parula americana</i>), worm-eating warbler (<i>Helmitheros vermivora</i>), black-throated green warbler (<i>Dendroica virens</i>), cerulean warbler (<i>Dendroica cerulea</i>), Kentucky warbler (<i>Oporornis formosus</i>), and possibly blue-winged warbler (<i>Vermivora pinus</i>). The only nesting occurrence east of the Blue Ridge for the beautiful rose-breasted grosbeak (<i>Pheucticus ludovicianus</i>) is in these mountains. The only county occurrence of the diploid species of the gray tree frog (<i>Hyla crysoscelis</i>) is suspected in this area. There has been confirmed breeding of Allegheny woodrats (<i>Neotoma magister</i>) in this area. Priority site identified in NHC 2007 report.</p>
<p>Sugar Hollow. (formerly named "Sugar Hollow Reservoir") 105 acres. Located in Shenandoah NP. Old forest near Sugar Hollow Reservoir. Good birding habitat for species including Kentucky warblers (<i>Geothlypis formosa</i>).</p>
<p>Tufton Flatrock Communities. 25 acres. Southeast flatrock has well preserved <i>Phemeranthus</i>, <i>Grimmia</i>.</p>
<p>Turkey Run. 16 acres. A Piedmont-rare great blue heron (<i>Ardea herodias</i>) rookery is located here.</p>
<p>Warren Floodplain. (formerly named "Warren Floodplain at Donegal Farm") 35 acres. Donegal Farm and Hatton Grange at Warren provide a floodplain site on the James River. This site includes a three-quarter mile long wet meadow with marshy strips. Excellent habitat for wintering birds, with large numbers of song sparrows (<i>Melospiza melodia</i>) and swamp sparrows (<i>Melospiza georgiana</i>), The wet areas with many grasses and sedges are an outstanding site for common yellowthroat (<i>Geothlypis trichas</i>) and prothonotary warblers (<i>Protonotaria citrea</i>) in the summer.</p>
<p>Wooded River Bluffs 1-6. 237 acres. The wooded bluffs along the Moormans, Mechums, and Rivanna Rivers constitute important habitat for birds and for flowering plants. Site 1 is also known as the "Great Rhododendron" site. Bungalowtown contains the only other known native occurrence of <i>Rhododendron maximum</i> in the county.</p>

** Denotes sites that overlap geographically with another site.

APPENDIX D: ALBEMARLE COUNTY NATURAL HERITAGE RESOURCES

Prepared by Virginia Department of Conservation and Recreation – Division of Natural Heritage, July 2017.

Natural heritage resources as defined by the Virginia Department of Conservation and Recreation – Division of Natural Heritage (DCR) are the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations such as caves and karst features. Albemarle County is currently home to forty-six distinct types of natural heritage resources with eighty-three total occurrences throughout the county (Table I: Natural Heritage Resources). In addition, DCR has identified forty-four terrestrial and aquatic conservation sites as areas necessary for their survival.

DCR identifies and protects natural heritage resources statewide and maintains a comprehensive database of all documented occurrences of natural heritage resources in Virginia. DCR has developed conservation sites that contain known populations of natural heritage resources and include adjacent or surrounding habitat vital for their protection. Conservation sites do not represent protected lands. They are recommended for protection and stewardship because of the natural heritage resources and habitat they support, but are not currently under any official protection designation. Conservation sites are polygons built around one or more rare plant, animal, or natural community designed to include the element and, where possible, its associated habitat, and buffer or other adjacent land thought necessary for the element’s conservation. Conservation sites can be used to screen development projects for potential impacts to natural heritage resources, aid local and regional planning, identify targets for acquisitions and easements and guide priorities for restoration activities.

An example of a conservation site in Albemarle County is Dudley Mountain Conservation Site. In addition to multiple rare species and habitat types found here, the site/ecosystem are critically important because of the geographic location. Conservation sites are given a biodiversity significance ranking based on the rarity, quality, and number of element occurrences they contain; on a scale of 1-5, 1 being most significant. Dudley Mountain Conservation Site has been given a biodiversity significance ranking of B1, which represents a site of outstanding significance. The natural heritage resource associated with this conservation site is:

Piedmont Mafic Barren

G1/S1/NL/NL



Dudley Mountain Piedmont Mafic Barren

The Northern Piedmont Mafic Barren is known only from scattered mafic outcrops in the northern and western Virginia Piedmont, restricted to exposed outcrops of diabase, metabasalt, amphibolite, and other mafic rocks. There are only nine known occurrences of this community rangewide, most of them less than one acre in size, and totaling less than 20 acres rangewide. This small patch community occurs as a mosaic of lichen, moss mats, and herbs with scattered, stunted trees. The massive outcrops supporting this community type effectively limit the normal establishment and development of trees. White ash (*Fraxinus americana*) and Eastern red cedar (*Juniperus virginiana*) are the most typical woody plants. Characteristic herbaceous species include prickly-pear cactus (*Opuntia humifusa*), little bluestem (*Schizachyrium scoparium*), poverty oat grass (*Danthonia spicata*), Pennsylvania sedge (*Carex pensylvanica*), hairy lip fern (*Cheilanthes lanosa*), round-leaf fameflower (*Phemeranthus teretifolius*), slender knotweed (*Polygonum tenue*), and dwarf dandelion (*Krigia virginica*). (NatureServe 2010).

This community has probably always been rare; some loss of acreage has occurred due to road construction, and several sites have been degraded by invasion of weedy species from nearby disturbed areas. This community is highly threatened by quarrying and road construction (NatureServe, 2010).

An example of a stream conservation unit in Albemarle County is Mechums River – Rocky Run SCU ----- Stream Conservation Unit is located downstream from the project site. Stream Conservation Units (SCUs) identify stream reaches that contain aquatic natural heritage resources, including 2 miles upstream and 1 mile downstream of documented occurrences, and all tributaries within this reach. SCUs are also given a biodiversity significance ranking based on the rarity, quality, and number of element occurrences they contain. The Mechums River – Rocky Run SCU has been given a biodiversity ranking of B2, which represents a site of very high significance. Natural heritage resources associated with this site are:

Lasmigona subviridis
Pleurobema collina

Green floater
James spinymussel

G3/S2/NL/LT
G1/S1/LE/LE



Green floater

The Green floater, a rare freshwater mussel, ranges from New York to North Carolina in the Atlantic Slope drainages, as well as the New and Kanawha River systems in Virginia and West Virginia (NatureServe, 2009). In Virginia, there are records from the New, Roanoke, Chowan, James, York, Rappahannock, and Potomac River drainages. Throughout its range, the Green floater appears to prefer the pools and eddies with gravel and sand bottoms of smaller rivers and creeks, smaller channels of large rivers (Ortman 1919) or small to medium-sized streams (Riddick 1973). Please note that this species has been listed as state threatened by the Virginia Department of Game and Inland Fisheries (VDGIF).

Considered good indicators of the health of aquatic ecosystems, freshwater mussels are dependent on good water quality, good physical habitat conditions, and an environment that will support populations of host fish species (Williams, et al. 1993). Because mussels are sedentary organisms, they are sensitive to water quality degradation related to increased sedimentation and pollution. They are also sensitive to habitat destruction through dam construction, channelization, and dredging, and the invasion of exotic mollusk species.



James spiny mussel

The James spiny mussel is a freshwater mussel endemic to Virginia and is known from the James and Roanoke River watersheds. It occurs in a variety of substrata, ranging from sand and silt mixtures to gravel and sand mixed with rubble, and in a variety of flow regimes (Clarke and Neves 1984, Hove and Neves 1994). It is now restricted to small headwater streams of this watershed (Neves 1991).

Threats to the James spiny mussel include competition with the exotic clam (*Corbicula fluminea*), erosion and sedimentation from logging, road construction, and livestock grazing, sewage effluent, and water quality degradation (Neves 1991). Please note that this species is currently classified as endangered by the United States Fish and Wildlife Service (USFWS) and the Virginia Department of Game and Inland Fisheries (VDGIF).

Potential Threats to Natural Heritage Resources

The single greatest threat to this area and its mussel species is the degradation of water quality from sediment and pollution from residential development, logging, road construction, livestock grazing and sewage effluent. In addition disturbance of the local hydrology by land disturbance, dam construction and stream channelization can change or eliminate habitat. Fragmentation of forests from roads, logging and recreational use and the introduction of invasives, both flora and fauna, can have a direct effect on the survival of many native plants as well.

Threats to the Terrestrial Natural Communities are incompatible development, and recreational activities, invasive species; incompatible agricultural or forestry practices.

Definitions of Abbreviations Used on Natural Heritage Resource Lists of the Virginia Department of Conservation and Recreation

Natural Heritage State Ranks

The following ranks are used by the Virginia Department of Conservation and Recreation to set protection priorities for natural heritage resources. Natural Heritage Resources, or "NHR's," are rare plant and animal species, rare and exemplary natural communities, and significant geologic features. The criterion for ranking NHR's is the number of populations or occurrences, i.e. the number of known distinct localities; the number of individuals in existence at each locality or, if a highly mobile organism (e.g., sea turtles, many birds, and butterflies), the total number of individuals; the quality of the occurrences, the number of protected occurrences; and threats.

S1 - Critically imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state. Typically 5 or fewer populations or occurrences, or very few remaining individuals (<1000).

S2 - Imperiled in the state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state. Typically 6 to 20 populations or occurrences or few remaining individuals (1,000 to 3,000).

S3 - Vulnerable in the state either because rare and uncommon, or found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Typically having 21 to 100 populations or occurrences (1,000 to 3,000 individuals).

S4 - Apparently secure; Uncommon but not rare, and usually widespread in the state. Possible cause of long-term concern. Usually having >100 populations or occurrences and more than 10,000 individuals.

S5 - Secure; Common, widespread and abundant in the state. Essentially ineradicable under present conditions, typically having considerably more than 100 populations or occurrences and more than 10,000 individuals.

S#B - Breeding status of an animal within the state

S#N - Non-breeding status of animal within the state. Usually applied to winter resident species.

S#? - Inexact or uncertain numeric rank.

SH - Possibly extirpated (Historical). Historically known from the state, but not verified for an extended period, usually > 15 years; this rank is used primarily when inventory has been attempted recently.

S#S# - Range rank; A numeric range rank, (e.g. S2S3) is used to indicate the range of uncertainty about the exact status of the element. Ranges cannot skip more than one rank.

SU - Unrankable; Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

SNR - Unranked; state rank not yet assessed.

SX - Presumed extirpated from the state. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

SNA - A conservation status rank is not applicable because the element is not a suitable target for conservation activities.

Natural Heritage Global Ranks are similar, but refer to a species' rarity throughout its total range. Global ranks are denoted with a "G" followed by a character. Note GX means the element is presumed extinct throughout its range. A "Q" in a rank indicates that a taxonomic question concerning that species exists. Ranks for subspecies are denoted with a "T". The global and state ranks combined (e.g. G2/S1) give an instant grasp of a species' known rarity. These ranks should not be interpreted as legal designations.

FEDERAL LEGAL STATUS

The Division of Natural Heritage uses the standard abbreviations for Federal endangerment developed by the U.S. Fish and Wildlife Service, Division of Endangered Species and Habitat Conservation.

LE - Listed Endangered

LT - Listed Threatened

PE - Proposed Endangered

PT - Proposed Threatened

C - Candidate (formerly C1 - Candidate category 1)

E(S/A) - treat as endangered because of similarity of appearance

T(S/A) - treat as threatened because of similarity of appearance

SOC - Species of Concern species that merit special concern (not a regulatory category)

NL – no federal legal status

STATE LEGAL STATUS IN VIRGINIA

The Division of Natural Heritage uses similar abbreviations for State endangerment.

LE - Listed Endangered

PE - Proposed Endangered

SC - Special Concern - animals that merit special concern according to VDGIF (not a regulatory category)

LT - Listed Threatened

PT - Proposed Threatened

C - Candidate

NL - no state legal status

For information on the laws pertaining to threatened or endangered species, please contact:

U.S. Fish and Wildlife Service for all FEDERALLY listed species;

Department of Agriculture and Consumer Services, Plant Protection Bureau for STATE listed plants and insects

Department of Game and Inland Fisheries for all other STATE listed animals

Conservation Sites Ranking

Rank is a rating of the significance of the conservation site based on presence and number of natural heritage resources; on a scale of 1-5, 1 being most significant. Sites are also coded to reflect the presence/absence of federally/state listed species:

Conservation Site Ranks

- B1 – Outstanding significance
- B2 – Very High significance
- B3 – High significance
- B4 – Moderate significance
- B5 – Of general Biodiversity significance

Legal Status of Site

- FL – Federally listed species present
- SL – State listed species present
- NL – No listed species present

List of Natural Heritage Resource Sites in Albemarle County

(compiled by the Natural Heritage Committee, Albemarle County)

Site Name	Biodiversity Rank	Legal status	Type of Site
BALLINGER CREEK SCU	B4	NL	SCU
BISCUIT RUN	B3	NL	Conservation Site
BOWLER CREEK SCU	B3	NL	SCU
BRUSH MOUNTAIN	B1	NL	Conservation Site
BUCKS ELBOW	B2	NL	Conservation Site
CRIMORA LAKE OVERLOOK	B3	NL	Conservation Site
DUDLEY MOUNTAIN	B1	NL	Conservation Site
ELK RUN SCU	B2	FL	SCU
GLADDEN FIELDS	B5	NL	Conservation Site
HARDWARE RIVER SCU	B2	FL	SCU
HORSEHEAD OVERLOOK	B3	NL	Conservation Site
IVY CREEK - LOFT MOUNTAIN	B2	NL	Conservation Site
IVY CREEK - MONTVUE SCU	B2	FL	SCU
IVY CREEK - WEST LEIGH SCU	B2	FL	SCU
JAMES RIVER AT SCOTTSVILLE SCU	B4	SL	SCU
JONES RUN	B3	NL	Conservation Site
JUMPING BRANCH SCU	B3	NL	SCU
KEY WEST	B4	NL	Conservation Site
LICKINGHOLE CREEK SCU	B3	NL	SCU
LYNCH RIVER SCU	B3	NL	SCU
MECHUMS RIVER - ROCKY RUN SCU	B2	FL	SCU
MECHUMS RIVER - STOCKTON CREEK SCU	B2	FL	SCU
MILL MOUNTAIN	B2	NL	Conservation Site
MOORES CREEK SCU	B3	NL	SCU
MOORMANS RIVER - DOYLES RIVER SCU	B2	FL	SCU
MURPHY CREEK SCU	B3	NL	SCU
NORTH FORK MOORMANS RIVER SCU	B3	NL	SCU
NORTH FORK RIVANNA RIVER - SWIFT CREEK SCU	B2	FL	SCU
POND RIDGE	B5	NL	Conservation Site

PREDDY CREEK SCU	B2	NL	SCU
ROCKFISH RIVER SCU	B3	NL	SCU
ROCKY CREEK SCU	B2	FL	SCU
ROCKYTOP OVERLOOK	B5	NL	Conservation Site
RT 708/NORTH AND SOUTH FORK HARDWARE RIVER SCU	B3	NL	SCU
RT. 53 RIVANNA BLUFF	B3	NL	Conservation Site
SOUTH FORK HARDWARE RIVER SCU	B3	NL	SCU
SOUTH FORK MOORMAN'S RIVER	B2	NL	Conservation Site
STOCKTON CREEK ABOVE RT. 250 SCU	B2	NL	SCU
TOTIER CREEK AT RT 626 SCU	B3	NL	SCU
TOTIER CREEK SCU	B3	NL	SCU
TRAYFOOT MOUNTAIN - HALL MOUNTAIN	B3	NL	Conservation Site
UNNAMED TRIBUTARY RIVANNA RIVER - ABOVE RT. 20 SCU	B4	NL	SCU
WHITESIDE BRANCH SCU	B2	NL	SCU

APPENDIX E: GIS DATA AND ANALYSES

Publicly Available Data

Geographic information systems (GIS) and data now play central roles in conservation planning. Useful data are available from the United States, Virginia and Albemarle County governments as well as private sources. Some of these data are described below.

The U.S. government has long provided satellite and aerial images that reveal much about locations of natural resources and changes in land use over time. The National Land Cover Database (developed by the Multi-Resolution Land Characteristics Consortium) provides satellite-image-derived land cover GIS data for various years, including 1992, 2001, 2006 and 2011. The federal government also provides census data useful in assessing development-related risks to natural resources as well as GIS data with wetland and other natural resource locations.

Series of black and white aerial images of Albemarle County taken between 1937 and 1996 are available through the University of Virginia Library system.

In recent years, the Virginia Geographic Information Network, a division of the Virginia Information Technologies Agency, has overseen collections of high resolution color aerial images that cover all of Virginia. Land use layers based on the 2009¹ and 2013² images are available to the Natural Heritage Committee. These layers are invaluable for identifying large forested areas and should become useful in understanding land use changes pertinent to natural resource management.

The Virginia Department of Mines, Minerals and Energy provides information on locations of geological formations in Albemarle County useful in predicting locations of plant communities.

Albemarle County has assembled downloadable GIS layers from various sources. These include roads, streams, buildings, parcel boundaries and elevation data. These data have diverse uses in conservation planning.

Local biologists have digitized observations on field maps of distinguished naturalist C.E. “Mo” Stevens. These data include approximately 500 observations on locations of noteworthy plants in Albemarle County and adjoining localities.

¹ The 2009 land use/land cover data were developed by Worldview Solutions, Inc. with funding from local partners: the Counties of Albemarle and Fluvanna, The Nature Conservancy of Virginia, StreamWatch, and the Rivanna River Basin Commission, with The Nature Conservancy providing project management and coordination

² The 2013 land cover data were produced by Worldview Solutions, Inc. as part of a statewide land cover mapping effort coordinated by the Virginia Geographic Information Network (VGIN) and its partners. The Land Cover product leverages the Commonwealth's investment in the VBMP digital orthophotography and is focused on creating a consistent, statewide 1 meter digital land classification.

In 2004, the Albemarle County Biodiversity Work Group identified thirty-eight county locations, referred to as Important Sites, containing important identified biological resources and a map of large forest blocks.

The Virginia Department of Conservation and Recreation has produced a tool, Virginia Conservation Vision, with a set of GIS layers that map its judgments of conservation priorities. This was known previously as the Virginia Conservation Lands Needs Assessment.

The Virginia Department of Game and Inland Fisheries has developed the Virginia Wildlife Action Plan aimed at conserving imperiled or declining native animal populations (Virginia Department of Game and Inland Fisheries 2015). The initial version of the plan appeared in 2005. A second plan was released in 2015. The current plan includes sub-plans for regional subdivisions of Virginia.

The Nature Conservancy has developed methods to rank landscapes for permeability to movement and resilience in the face of climate change and other disturbances. Analyses of Virginia landscapes for permeability and resilience based on these methods are available (Anderson, et al. 2016).

Kane et al. (2013) have modeled shifts in suitable ranges of twenty Virginia species that would result from projected climate changes.

The Blue Ridge Partnership for Regional Invasive Species Management (Blue Ridge PRISM) has reviewed impacts of local invasive species and developed a list of twelve species as conservation priority targets.

As part of a Green Infrastructure Community Planning effort, the Green Infrastructure Center (GIC) collaborated with the Natural Heritage Committee in a county landscape analysis (Firehock 2012, Albemarle County 2017). The analysis produced data showing large forest blocks, connecting corridors between forest blocks, and a classification of the entire county landscape using geologic and topographic variables. GIC also produced a map with locations of a variety of conservation and open space resources. Below is more detailed description of the analysis.

Large Forest Blocks in Albemarle County

The largest and most important habitat areas in the mid-Atlantic region are known as habitat cores. Habitat cores are areas of interior habitat (e.g., forests, wetlands) that are at least 100 acres in size. This definition is based upon guidance from the Virginia Department of Conservation and Recreation-Division of Natural Heritage, which recommends 100 acres as a minimum size to support most interior forest bird species, and is recommended for the Chesapeake Bay Critical Area (Jones et al. 2000). By supporting these avian species, a host of other species such as black bears, spotted salamanders, and native plants will also benefit.

In Albemarle County, forest represents the most common and widespread type of habitat, including the largest contiguous areas of habitat. As discussed in the “Landscape Analysis” section of this report, large forested areas (forest blocks, not including pine plantations) in Albemarle County were identified during a project conducted by the nonprofit Green Infrastructure Center for the county (Firehock 2012, Albemarle County 2017). The mapping effort used 2009 land cover data as the basis for identifying forest blocks. The analysis was supplemented with county data regarding the location of buildings and roads to account for more recently development features that fragment the natural landscape.

Each forest block consists of two parts: a central area of undisturbed wildlife habitat (interior forest) and the surrounding edge area that absorbs impacts (such as erosion, wind, human intrusion, and invasive species) from outside the forest block. This edge habitat serves as a buffer, protecting the interior forest from encroachment.

Edge habitat was defined as the outer 300 feet of forest, and interior forest was defined as forested areas lying 300 feet or more from the forest edge (i.e. 300 feet away from a fragmenting feature such as a building or road, or any non-forested land). The project identified large forest blocks and small forest blocks. Large forest blocks contain 100 acres or more of interior forest while small forest blocks contain 10 to 99 acres of interior forest (Map 1).

Forests are valuable as habitat for wildlife. In general, the larger an intact forested area, the more likely it is to support a greater diversity of habitat types and species, larger populations of those species, and remain resilient in the face of disturbances (Forman and Godron 1986, Tilman and Lehman 1997, Wilson and MacArthur 1967, Harris 1984, Fahrig 2003, Brock and Atkinson 2013). Albemarle County has an impressive forested landscape. Based on the 2009 land cover data, tree cover (not including tree farms) makes up approximately 67 percent of the county's land cover (Map 1).

In addition to its importance as wildlife habitat, forests provide a number of important ecosystem services, including air purification, providing oxygen to the atmosphere, and carbon sequestration. Of particular note is the role of forests in the water cycle. Trees evapotranspire large quantities of water into the atmosphere while slowing surface runoff and providing better infiltration of rain into the ground. Since most of the county's rural residents depend on groundwater for household uses, groundwater recharge is critical. Forests also store stormwater and release it slowly, thereby reducing flooding and mitigating the effects of drought on stream flows.

Forest is the most effective land cover type for reducing runoff pollutants. While the tree canopy breaks the energy of rain drops, the duff layer of the forest floor acts as a sponge, soaking up water, reducing the velocity of overland runoff, and breaking down pollutants.

To preserve their ecological value, forest blocks should be kept intact whenever possible. Human disturbances, such as roads and buildings, create effects that degrade ecological integrity, in effect fragmenting the landscape into smaller, disconnected pieces. Since fragmented landscapes do not function as well as intact landscapes, many of the benefits that they provide are lost. Habitat fragmentation is widely considered to be one of the top threats to wildlife and biodiversity as well as a key driver in species extinction (Sorrell 1997, Haddad et al. 2015).

When development or disturbance occurs that fragments forest blocks, the amount of edge habitat increases. While some edge habitat can be beneficial as a buffer to the forest interior, excessive edge habitat provides an ideal space for invasive and non-native species of plants and animals. Many wildlife species, including birds such as the cerulean warbler (*Setophaga cerulean*) and the scarlet tanager (*Piranga olivacea*), rely on interior forest for their habitat.

Ranking Large Forest Blocks and Important Sites

The following describes how the 179 large forest blocks (i.e., area containing 100 acres or more of interior forest) and 53 Important Sites were assessed and ranked for their importance in conserving

biological diversity in Albemarle County, both now and into the future. Two factors were used in assessing overall conservation value: biological value and resilience to climate change.

Large forest blocks were ranked on a scale of 1 to 10 for each factor. A composite score was also created by combining the biological value score and the resilience to climate change score. Biological value accounts for 90% of the composite score and resilience to climate change accounts for 10%.

$$\text{Composite Score} = (\text{Biological Score} * 0.9) + (\text{Resilience Score} * 0.1)$$

Thus, Composite scores range from 0 to 10 in value. The higher the score, the greater the relative value of the site or forest block and the greater the priority to protect or conserve it.

Biological Value of Large Forest Blocks

As described in the main body of the report, four factors were considered in determining the biological value of forest blocks: the amount of interior forest, proximity to other forested areas, shape/compactness of the forest block, and geographic overlap with Important Sites and locations identified by the Virginia Department of Conservation and Recreation–Division of Natural Heritage (DCR-NH) as important biologically (see Appendix D for discussion of DCR-NH data). Biological scores range from 0 to 10 points, and are assigned as follows:

- Amount of interior forest – 0 to 5 points
 - The Jenks natural breaks optimization method was used to categorize forest blocks based on the amount of forest interior (in acres) each contained. Ten categories were created, with points assigned accordingly from 0 to 5.
- Proximity to other forested areas – 0 to 2.5 points
 - A proximity index (PI) was calculated for each forest block, based on the number, size, and distance of other large and small (i.e., area containing 10 to 99 acres of interior forest) forest blocks within one mile of the forest block. Distances between forested areas were measured edge-to-edge. The Jenks natural breaks optimization method was used to categorize large forest blocks based on the values of the PI. Ten categories were created, with points assigned accordingly from 0 to 2.5.
- Shape/compactness of the forest block – 0 to 1.5 points
 - A compactness value for each forest block was calculated, based on how closely the shape of the forest block resembles a circle. The Jenks natural breaks optimization method was used to categorize forest blocks based on the compactness values. Ten categories were created, with points assigned accordingly from 0 to 1.5.
- Forest block overlaps with Important Sites and DCR-NH locations – 0 to 1 point
 - One overlap – 0.2 points
 - Two overlaps – 0.4 points
 - Three overlaps – 0.6 points
 - Four overlaps – 0.8 points
 - More than four overlaps - 1 point

Biological Value of Important Sites

Values range from 0 to 10. The scores were assigned by the Natural Heritage Committee (NHC) based on knowledge of the sites and best professional judgment. Sites received a minimum value of 1 unless the site had been destroyed or disturbed beyond its ability to recover.

Points are added for:

- The number and abundance of rare or unusual species present at the site, as well as their health/condition
- Site overlaps a DCR-NH element
 - Conservation Site
 - Stream Conservation Unit (SCU), adjacency to SCU is considered as overlap
 - General location of a species or other element occurrence
- Site overlaps a large forest block
- Site was one of seven “Priority” sites identified by the NHC in a 2007 report

Other considerations:

- Potential presence of conditions or elements if they were not considered in the basic biological-ecological value of the site. These conditions or elements include possible wetlands (as indicated by NWI, presence of hydric soils), steep slopes near streams and rivers, and wooded riparian buffers.

Resilience to Climate Change of Large Forest Blocks and Important Sites

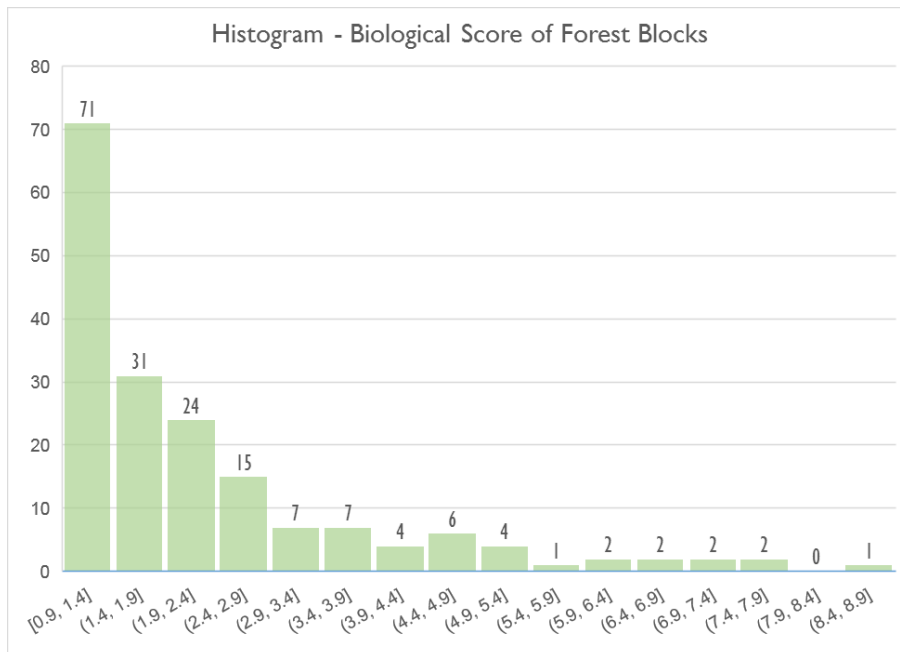
The same method was used to assess resilience to climate change for both forest blocks and Important Sites. Values range from 0 to 10 points, and were assigned as follows using data developed with GIS:

- Size of the site - 0 to 4 points
 - First quintile of sites – 0 points
 - Second quintile of sites – 1 point
 - Third quintile of sites – 2 points
 - Fourth quintile of sites – 3 points
 - Fifth quintile of sites – 4 points
- Local landscape characteristics - 0 to 3 points
 - Northeast aspect of site
 - Less than 50% of the site has northeast (NE) aspect – 0 points (*37.8% is the mean value for all 54 Important Sites, definition of NE aspect represents 34.7% of total aspect: 125 degrees of the total 360 degrees*)
 - 50% or more of the site has NE aspect – 1 point
 - Number of landscape classes per acre on the site (*1.7 is the mean value for all 54 Important Sites*)
 - First tertile of sites – 0 points
 - Second tertile of sites – 1 point
 - Third tertile of sites – 2 points

- Regional resilience based on TNC data for Resilient Sites (Anderson et al. 2016) - 0 to 3 points
 - None of the site is rated Above or Far Above Average for resilience – 0 points
 - Up to 33.3% of the site is rated Above or Far Above Average for resilience – 1 point
 - 33.4% to 66.6% of the site is rated Above or Far Above Average for resilience – 2 points
 - 66.7% or more of the site is rated Above or Far Above Average for resilience – 3 points

		Minimum	Maximum	Mean	Median	Standard Deviation	(units)	
Scores	Biological	0.9	8.8	2.3	1.7	1.6	n/a	
	Resilience	1.0	8.0	4.3	4.0	1.6	n/a	
	Composite	0.9	8.6	2.5	2.0	1.5	n/a	
Metrics	Biological	Amount of Interior Forest	100.3	17890.1	759.9	263.8	1681.7	Acres
		Proximity Index	2,018	43,574,004	1,801,908	258,659	4,711,914	n/a
		Shape Compactness	1.3	13.8	3.8	3.1	2.3	n/a
		Imp't Sites/DCR	0.0	8.0	0.7	0.0	1.1	number of sites
	Resilience	Size	193.1	21719.2	1075.3	448.3	2070.2	Acres
		NE Aspect in the Forest Block	1.3	68.3	30.1	31.7	12.6	% of forest block
		Landscape Classes per Acre	0.02	0.85	0.14	0.13	0.10	# Landscape classes
		Regional Resilience	0.0	100.0	54.2	60.0	35.2	% of forest block

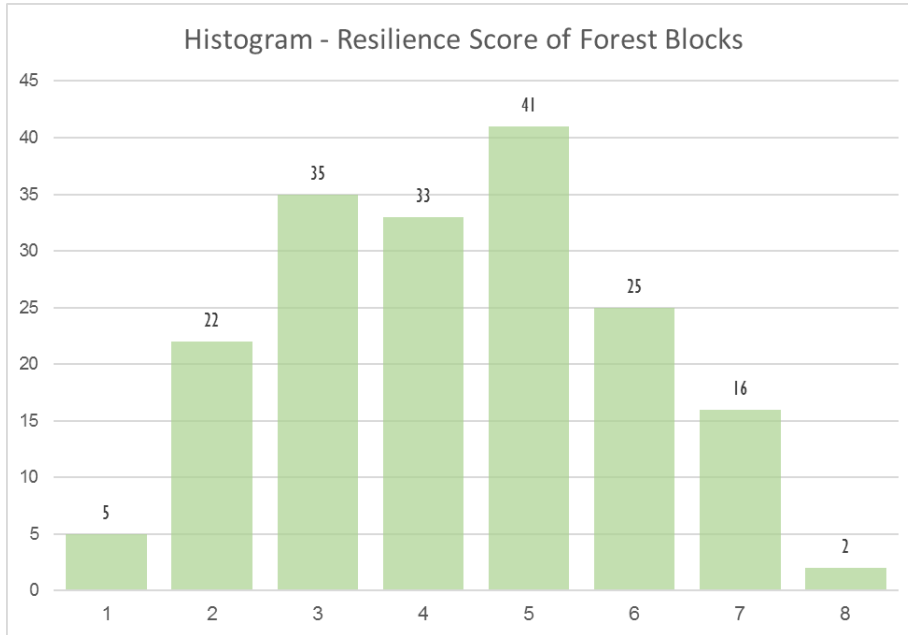
This table presents summary statistics for the Biological, Resilience, and Composite scores of large forest blocks, as well as the individual metrics that are used to compute the Biological and Resilience scores.



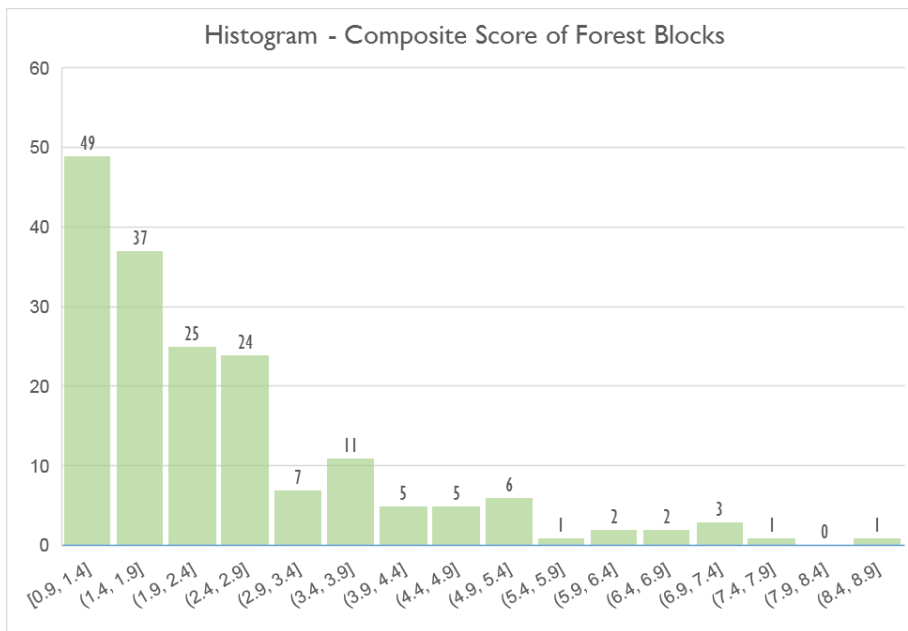
This histogram represents the Biological Scores of the large forest blocks. Forest blocks need to score very well in the individual ranking metrics to have a high Biological Score. This is particularly the case

with their interior acres ranking, which is why most blocks have a score at the lower end of the spectrum. Only a select few forest blocks have higher scores.

In each of the three histograms displayed, the brackets used along the bottom axis indicate whether a number is included or not in that particular range – “[” is inclusive and “(” is not inclusive. For example, the bracket (2.9, 3.4] includes values greater than 2.9 and less than or equal to 3.4.



This histogram represents the Resilience to Climate Change Score.



This histogram represents the Composite Scores of the large forest blocks. The distribution is similar to the Biological Scores, since that contributes 90 percent of the composite score. However, the Resilience Score is able to move a forest block’s Composite Score up or down slightly.

Habitat Connectivity within the Three Conservation Focus Areas

A connectivity analysis was performed using GIS to assess the degree to which existing large forest blocks are connected to other large forest blocks. 'Connectivity' is defined here as the extent to which large forest blocks are connected by natural (forested) land cover. In other words, what type of land cover must be traversed to travel between two forest blocks? Two forest blocks with mostly forested land separating them would be considered more connected than two forest blocks with barriers like major roads and human-modified landscapes between them. Likewise, two forest blocks that are close to each other would be considered more connected than two forest blocks that are more distant from each other, all other things being equal.

The 2009 land cover data formed the basis for the connectivity analysis, and was modified using road, railroad, and buildings/driveways data to account for these barriers to movement. These inputs were used to create a raster dataset that represents the general resistance across the county landscape (plus a five mile buffer outside the county) for the movement of plants and animals. This is based on the assumption that movement is easier where development is less intense. Thus natural forest is more amenable to movement than a hayfield and a hayfield is more amenable to movement than a shopping center. While there are some species that can thrive in an urban environment, this is a general model that bases its assumptions on the needs of the majority of native species.

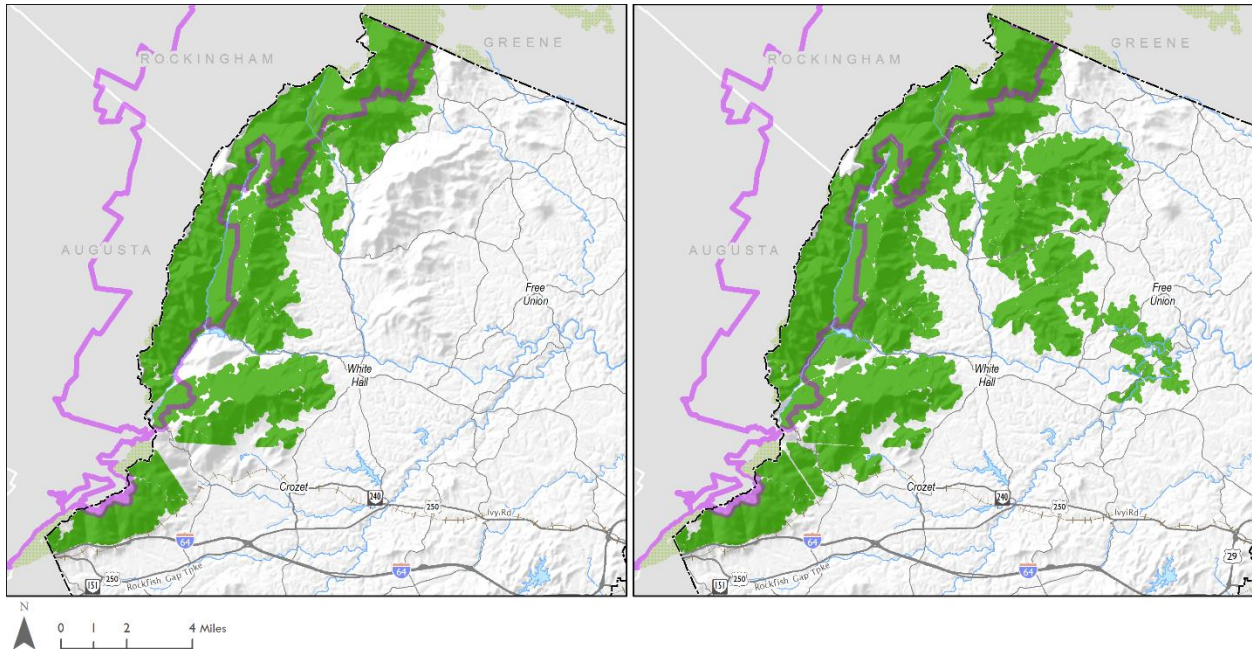
The impedance raster served as the primary input into the Linkage Mapper tool, which is a GIS tool designed to support regional wildlife habitat connectivity analyses (<http://www.circuitscape.org/linkagemapper>). Linkage Mapper produces a series of links depicting the 'least cost path' between forest blocks. In other words, they depict the 'path of least resistance' between forest blocks based on land cover and barriers. Each path was attributed with additional information including the length of the path, the cumulative cost of traversing the underlying land cover, if it crosses a road, and more. This dataset was used as guidance for a qualitative process of identifying forest blocks with a high degree of connectivity to the focus areas. In each focus area, an initial set of forest blocks was selected as a starting point:

- Northwest Albemarle: forest blocks that are either fully or partially within the Shenandoah National Park
- Southern Albemarle Mountains: forest blocks intersecting the Southern Albemarle Mountains Important Site
- Rivanna Corridor: forest blocks intersecting the Rivanna River or its 100-year floodplain.

After the initial set of forest blocks was selected for each focus area, an analysis was conducted to find clusters of forest blocks, starting with these initial sets, that are in close proximity and connected with mostly natural land cover with few barriers. The least cost path dataset produced by Linkage Mapper was used to identify forest blocks that were either within 200 feet of any forest block in the initial set, or had a *cost-weighted distance to path length ratio* of less than or equal to 87.5 on a link connected to a forest block in the initial set. The cost weighted distance to path length ratio uses land cover and barriers between the forest blocks to estimate the 'difficulty' of traversing the path between them, and relates it to the overall linear distance of that path. 87.5 was chosen as the threshold for the analysis

since it represents the top 25 percent of the links identified by Linkage Mapper (i.e. 25 percent of links had better (lower) relative scores, meaning they have more estimated habitat connectivity potential).

These criteria were used to find forest blocks with high connectivity potential to the initial set of forest blocks. This process was then repeated iteratively until no additional forest blocks met the criteria. Finally, the criteria were applied to the small forest blocks. The large and small forest blocks that were identified with this analysis are shown on Maps 8 and 9. Map 10 depicts the large and small forest blocks that intersect the 100-year floodplain of the Rivanna River.



The map at left shows the initial set of forest blocks (green) for the Northwest Albemarle Focus Area. These forest blocks were identified by finding the large forest blocks that intersect the boundary of Shenandoah National Park (purple). The image at right shows the final set of forest blocks (large and small) that were identified after performing the connectivity analysis. This is the set of forest blocks depicted on Map 8.

Landscape Classification in Albemarle County

Summary

In late 2015 and early 2016, the Albemarle County Natural Heritage Committee, with technical support from the nonprofit Green Infrastructure Center, created a methodology for classifying the different types of landscapes in the county. The factors included in the methodology are based on the physical setting of a given site, such as geology, slope, and elevation. Several advantages of a system such as this are:

1. The ability to relatively quickly generate countywide maps using readily obtainable data.
2. Ensures a consistent, objective approach to mapping the county.

The primary disadvantage of a system such as this is that it does not identify actual plant communities (but may suggest where they may be found). Mapping plant communities for an area the size of Albemarle County is a time and resource intensive process, but if this were to be done in the future, the results could be incorporated into this system to form a more complete classification.

The variables chosen (listed below) are based on relevance to conditions specific to Albemarle County (e.g. the decision to use 800 feet elevation as the over/under breakpoint in the elevation variable). Each of these six variables has between two and four possible values. The value ranges include all of Albemarle County, meaning there are no gaps in the mapping (i.e. all locations in the county have an elevation either greater than 800 feet, or less than or equal to 800 feet). When combined, there are 384 unique combinations possible, with 325 of these actually occurring in Albemarle County.

To construct the map of the different unique combinations, each variable was first represented as a raster dataset using a 10 meter cell size, resulting in six rasters. These six raster were used as an input into the “Combine” geoprocessing tool in ArcGIS to generate a single raster that represents the combination of the six variables for any given location in the county.

Why are these unique combinations important? Species diversity is highly correlated with geophysical diversity (Anderson and Ferree 2010, Lawler et al. 2015). Given the uncertainty in both our knowledge of species locations, as well as their response to future scenarios (e.g. climate change), conserving a diverse portfolio of settings (habitat types) is one means of protecting biodiversity in the county.

Variables Used for Landscape Classification

Geologic Chemistry Groups – Cation Exchange Capacity and Base Saturation Levels

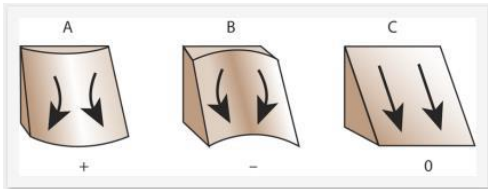
- Low level
- Mid level
- High level
- Ultramafic

Aspect

- North and East (290 – 55 degrees)
- East and South (56 – 195 degrees)
- South and West (196 – 289 degrees)

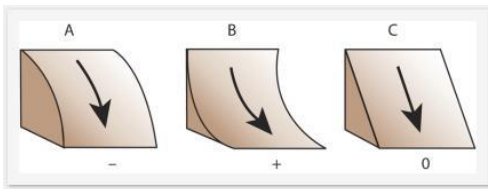
Planform Slope

- Convex (e.g. spur)
- Concave (e.g. ravine)



Profile Slope

- Convex (e.g. ridgeline)
- Concave (e.g. toe of slope)



Elevation

- 0 – 800 ft
- >800 ft

Slope

- 0 – 10% (~5.74 degrees)
- 10 – 20% (~11.5 degrees)
- 20 – 60% (~30 degrees)
- >60%

APPENDIX F: GOALS AND RECOMMENDATIONS – A CONSOLIDATED LIST

Characters in square brackets after each recommendation indicate the parties potentially or likely involved in implementing the action. Codes are: “N”: County natural resources staff, Natural Heritage Committee members, and volunteers; “C”: other county staff or decision-makers; “\$”: staff funded by grant or other outside sources; “P”: partner organization; “R”: general county residents.

From the Landscape Analysis section, page 18.

GOAL 1: Recognize the importance of the three conservation focus areas. Prioritize conservation of the land and resources within them and, where possible, connections among them.

RECOMMENDATIONS:

1. Develop strategies to conserve and protect lands in the conservation focus areas. [N,C,P]
2. Use existing conservation tools (e.g. conservation easements) to protect lands in the conservation focus areas, where possible. [C,P]
3. Take appropriate actions to conserve and protect the high priority Important Sites identified in Appendix C. [N,C,P]
4. Use existing conservation tools and develop strategies to protect lands that can serve as habitat corridors or connections among important habitat areas. [N,C,P]
5. Incorporate knowledge about the conservation value of the three conservation focus areas in land use planning and decision-making. [N,C]
6. Educate and inform landowners about the conservation value and importance of conserving Important Sites, with special focus on the high priority sites. [N]
7. Educate and inform the public about the conservation value and importance of conserving lands in the three conservation focus areas. [N,C,P]

From the Protection of Open Space Habitat Areas section, page 28.

GOAL 2: Promote conservation easements for areas of important biological resources or physical landscape conditions.

RECOMMENDATIONS:

1. Promote the County’s ACE and PRFA conservation easement programs. Promote and support conservation easement programs of other organizations. [N,C,P]
2. Revise ACE and PRFA easement-acceptance criteria to reflect biodiversity values and conservation needs. Incorporate data from this report and the NHC in assessing biodiversity values. [N,C]
3. Ensure that all easements held by the county include terms that protect specifically identified biodiversity and other natural resources identified on the property. [N,C]

GOAL 3: Conduct outreach and educate the public and landowners on the importance of preserving habitat areas and managing land wisely. Provide more opportunities and incentives for landowners to conserve biodiversity and other resources.

RECOMMENDATIONS:

1. Investigate changes to the Land Use Valuation program to encourage conservation. Consider reducing the minimum acreage requirement for Open Space use to 5 acres, from the current 20 acre minimum. [N,C]
2. Contact the landowners of Important Sites throughout Albemarle County to educate and inform them of the biodiversity resources on and near their property. Develop relationships and encourage conservation of the land. [N]
3. Conduct landowner workshops and other events aimed at educating target audiences and the general public and promoting conservation. [N,C,P]
4. Serve as an information source and clearinghouse for landowners. Promote conservation efforts on the part landowners and the general public. [N]

GOAL 4: Promote management of county-owned and other public lands in a manner that conserves and enhances biodiversity and other natural resources.

RECOMMENDATIONS:

1. Identify opportunities for habitat restoration or improved land management of school grounds and other county-owned property. [N,C,P]
2. Acquire lands appropriate for natural areas in the county park system. (The William S. D. Woods Natural Heritage Area is an excellent example.) [N,C,P]
3. Continue emphasizing management that conserves and enhances biodiversity at county parks. [N,C]

From the Minimizing Habitat Fragmentation/Maintaining Connectivity section, page 30.

GOAL 5: Minimize or reduce habitat fragmentation county-wide and maintain habitat connectivity.

RECOMMENDATIONS:

1. Target areas containing large forest blocks and promote their protection through conservation easements and other habitat protection tools. [N,C,P]
2. Target areas of forested and other habitat corridors connecting large forest blocks and promote their protection. [N,C,P]
3. Promote protection of forested and other habitat corridors with road and waterway crossings favorable to animal movements and prioritize these corridors for conservation. [N,C,P,\$]
4. Investigate a Route 29 underpass in southern Albemarle County to better connect eastern and western portions of the Southern Albemarle Mountains Important Site, a conservation priority area. [N,C,P,\$]
5. Gather information and knowledge for future action plans: [N]
 - a) Map rivers and streams interrupted by dams.
 - b) Develop a database of dispersal mechanisms of key species at Important Sites.

From the Limiting Biological Effects of Parcel Subdivisions section, page 32.

GOAL 6: Improve policies for subdivision of properties to help prevent habitat fragmentation and maintain parcels of sufficient size for agriculture and forestry.

RECOMMENDATIONS:

1. Unless parcels are clustered (as in the following recommendation, for example), establish a minimum length-to-width ratio for newly subdivided parcels, to discourage “barcoding.” [C]
2. Encourage Rural Preservation Developments with small building lots of two acres or less and the remainder of the land preserved as open space. [C]

GOAL 7: Reduce the impact of rural roads and other fragmenting features on habitat.

RECOMMENDATIONS:

1. Identify locations where the fragmenting effects of roads can be reduced or eliminated. Develop means for wildlife to pass safely under roads at strategic locations. Identify areas where reduced vehicle speed, traffic signs, or other steps will reduce wildlife mortality. Intersections of roads and riparian corridors are of particular importance. [N,C,P]
2. Paving of gravel roads in rural areas should be discouraged, particularly where paving would promote development or fragment forest blocks and habitat corridors. [N,C,P]
3. Where possible, prevent new public roads and other infrastructure from bisecting forest blocks and habitat corridors. [N,C,P]
4. Conduct a survey of all public roads in the county to identify opportunities for improving stream habitat and aquatic connectivity where roads cross streams. [N,C,P]
5. Promote the use of open arch and other open bottom structures for road crossings of streams. [N,C,P]

From the Invasive Species section, page 35.

GOAL 8: Manage invasive species to limit their spread.

RECOMMENDATIONS:

1. Continue a partnership with Blue Ridge PRISM. [N,P]
 - a. Educate the public regarding invasive species.
 - b. Implement methods of controlling the “Terrible Twelve” species (see Appendix G).
2. Support control of invasive species in and near biologically important areas and on county-owned properties. [N,C,P,R]
3. Develop county-wide data sets on invasive species occurrences. [N,P,\$]
 - a. Participate in EDDMapS invasive observation recordings.
 - b. Partner with VDOF, Blue Ridge PRISM, or others as opportunities arise in developing county-wide data on invasive species occurrences.
 - c. Investigate tools to use in documenting occurrences of invasive species in Albemarle. The Mid-Atlantic Early Detection Network (MAEDN) is one such tool.
4. Periodically examine invasive species biocontrol possibilities. [N]
5. Require the use of locally native plants for landscaping on county-owned land or projects. Recommend the use of locally native plants on projects on private land that require county approval. [N,C,R]

6. Educate and promote the use of locally native plants for gardening and landscaping on private lands. [N,C,R]
7. Working with other organizations, conduct workshops on the control of invasive species. [N,C,P]

From the Climate Change section, page 38.

GOAL 9: Develop strategies for biodiversity conservation during climate change.

RECOMMENDATIONS:

1. Acknowledge the key role of Shenandoah National Park in county climate change adaptation strategies. [N]
2. Maintain, improve, and promote biological connections to Shenandoah National Park and among other important large habitat areas identified in this report. [N,C,P]
3. Identify and protect potential climate change refugia. [N,C,P,\$]
4. Reduce climate-change stresses due to human activities (e.g. provide shade to denuded stream banks with tree buffers). [N,C,R]
5. Educate the public generally about climate change. Develop information pertinent to Albemarle County. [N,C,P]
6. Monitor: [N, C]
 - a. Climate change projections.
 - b. Species range shifts (local projections, observed shifts).
 - c. Disease agents.
 - d. Anticipated impacts on agricultural and forestal industries, local water supplies.
7. Conduct a county-wide climate change preparedness assessment, as outlined in Strategy 8a of the Comprehensive Plan. Biodiversity and natural resources should be a key component of the assessment. [N,C]
8. Use the ACE program and other applicable state or regional programs to acquire open space properties that can function as movement corridors connecting land in the county to Shenandoah National Park or as climate change refugia. [N,P]

From the Forests section, page 40.

GOAL 10: Identify, restore, and protect large forested areas.

RECOMMENDATIONS:

1. Investigate and support regional efforts to preserve large natural areas in the Piedmont with a minimal human presence. [C,P]
2. Implement burning regimes aimed at promoting biodiversity for forests on county properties. [C,P]

GOAL 11: Maintain feasibility of deer hunting by humans as a means of promoting forest regeneration.

RECOMMENDATIONS:

1. Work with VDGIF to identify areas of high deer population and as a key partner in developing strategies for management. [N,C,P]
2. Investigate methods of controlling local deer populations, such as periodic “deer culling” with sharp shooters on county owned properties. [C,P]

3. Propose creation of a Wildlife Management Area in Albemarle County in the Virginia Outdoors Plan. [N,C,P]
4. Do not develop policies that would discourage or restrict hunting in rural areas of Albemarle County. [C,P]

From the Outcrops, Bluffs and other Xeric Habitats section, page 41.

GOAL 12: Identify and protect xeric habitats.

RECOMMENDATIONS:

1. Identify areas with potential xeric habitats using GIS data analyses. [N,C,\$,P]
2. Review and update guidelines for Resource Extraction Areas. Limit new permits to areas that do not contain key habitats. [C]
3. Ensure that park trails avoid these xeric habitat areas except where measures like boardwalks and fences are provided to protect them, or where access is provided specifically for educational reasons. [C]
4. Protect steep bluffs along rivers through easements or other tools. [N,C,P]
5. Educate the public about these sensitive habitats and how to conserve them. [N]

From the Relict Piedmont Prairies, Meadows and Grasslands section, page 42.

GOAL 13: Identify, restore, and protect prairie and savanna habitat.

RECOMMENDATIONS:

1. Identify existing biodiverse prairies and savannas. [N]
2. Promote grassland conservation programs such as those offered by NRCS and other organizations. [N,C,P]
3. Advise landowners of herbicide no-spray zone programs offered by Virginia Department of Transportation (VDOT) and utility companies. [N,C]
4. Implement burning or mowing regimes aimed at promoting biodiversity for areas maintained as grasslands on county properties. [C,P]

From the Rivers, Streams and Riparian Areas section, page 44.

GOAL 14: Improve county stream and river buffers to improve aquatic ecosystem health, water quality, and riparian habitat quality.

RECOMMENDATIONS:

1. Upon completing a review of current stream buffer rules, the county should strengthen stream buffer requirements. [N,C]
2. Inform and educate landowners about the county's buffer regulations. Ensure that landowners who convert land from agriculture or forestry to a different land use are informed. [N,C]
3. Educate the public on the value of stream buffers. Promote and support existing cost-share programs for buffers and livestock exclusion from streams. Promote locally native riparian plantings on non-agricultural lands through VCAP and other programs. [N,C,P]

From the Wetlands section, page 46.

GOAL 15: Identify, restore, and protect wetlands.

RECOMMENDATIONS:

1. Educate landowners regarding cost share programs to create wetland buffers and exclude livestock from them. [N,P]
2. Work with partner organizations to help landowners locate lost wetlands, encourage and facilitate their restoration, and understand ecological benefits of restoration. [N,P]
3. Investigate the county's authority and ability to protect wetlands, particularly those that are not contiguous to stream buffers. [N,P]

From the Developed Areas section, page 47.

GOAL 16: Protect and restore urban streams.

RECOMMENDATIONS:

1. Establish protection standards for urban streams. [C,P]
 - a. Where appropriate, consider buffers less than 100 feet wide and relative to the size of the stream.
 - b. Consider waivers if the solution preserves a visible surface stream and improves water quality.
2. Develop density bonuses, tax credits, or other incentives for preserving and restoring streams. [C]
3. Develop design standards to encourage preserving and/or recreating gradual grading to the stream. [C,P]
4. Develop policies that encourage protection of existing natural streams and wetlands rather than the construction of stormwater facilities. [C,P]

GOAL 17: Protect the Rivanna River and adjacent ecosystems.

RECOMMENDATIONS:

1. Allow Nutrient Banks and Wetland Mitigation banks as by-right uses adjoining the Rivanna River. [C,P]
2. Investigate and identify other land uses for riverfront parcels that protect and enhance water quality. [N,C]
3. Investigate the possibility of a Transfer of Development Rights (TDR) program for areas near the Rivanna River. [N,C]

GOAL 18: Clean up and reuse potentially contaminated sites with bioremediation and natural habitat restoration.

RECOMMENDATIONS:

1. Identify contaminated sites with restoration potential and invest in restoring them. [C,P]
2. Seek grant funding to assist with restoration and potential redevelopment of contaminated sites, and encourage inclusion of wildlife habitat as part of cleanup plans. [C,P]
3. When practical, encourage establishing native wildflower meadows as approved and encouraged practice while sites are waiting to be redeveloped. [C,P]
4. Explore redevelopment incentives which can include wildlife habitat as part of the design standard. [N,C,P]

GOAL 19: Promote the use of locally native plants in developed areas.

RECOMMENDATIONS:

1. Review and/or develop list(s) of approved plants for the different types of projects that require county approval (e.g., site plans, stormwater management facilities, stream buffers). The lists should emphasize the use of locally native plants. [C]
2. Use a minimum of 80% locally native species (as discussed in the Comprehensive Plan, page 4.22, under Strategy 4e) in all county projects and projects reviewed by county staff. [C]
3. Recommend locally site-appropriate native species that occur together naturally and locally as approved plantings for all projects. Identify or develop the data source(s) to use. [N,C]
4. Provide assistance through the county's Office of Economic Development to help promote local nurseries and their marketing of locally native plants. [C]
5. Consider making native plant nurseries a by-right use of land in rural areas. [C]
6. Participate as a partner in the Virginia Native Plants Marketing Partnership through DEQ. [C]

From the Education section, page 50.

GOAL 20: Educate the public on the importance of biodiversity and ways to protect it.

RECOMMENDATIONS:

1. Review and update existing education materials found on the Natural Heritage web page of the county's website. [N]
2. Create and assemble documents from other sources and develop mechanisms for the dispersal of information on biodiversity education topics such as: [N,P]
 - a. Values of biodiversity
 - b. Conservation concepts
 - c. Important local biological resources
 - d. Emerging threats (invasive species, climate change, etc.)
 - e. Land management for biodiversity
 - f. Landscaping with locally native plants
3. Sponsor workshops on land management practices that promote biodiversity. [N,P]
4. Create and distribute an informational flyer, to be mailed with tax bills, that provides simple landowner tips that promote biodiversity, best stewardship practices, and includes a link to the county's Natural Heritage web page. [N,C]
5. Create signage, use QR codes, and/or make brochures available at county parks to educate about the importance of biodiversity and to instill a greater appreciation for our native forests and the natural world. [N,C]
6. Create and disperse a welcome package for new landowners with information about best practices for enhancing biodiversity on their property and opportunities for placing property in a conservation easement. [N,C]
7. Create signage on county land where locally native plants have been used in landscaping as a way to educate the public. [N,C]
8. Create videos on landscaping techniques that preserve and enhance biodiversity and on conservation easement opportunities. [N,C,\$,P]
9. Create more demonstration landscapes using locally native plants on county land. [N,C, \$,P]
10. Create partnerships with local plant nurseries to disperse educational materials about invasive plant species, locally native species, and the creation of meadow landscapes. [N,C,P]
11. Create informational materials and provide workshops for developers on practices that preserve and protect biodiversity. [N,C,\$,P]

12. Sponsor a Conservation Cafe with the goal of promoting conversations and collaboration between county staff, elected officials, and conservation groups. [N,C,\$,P]
13. Designate an official plant and/or animal on a yearly basis to raise awareness about local habitats and the biodiversity found within them. [N,C]

From the Indicators of the State of County Biodiversity section, page 52.

GOAL 21: Develop indicators and monitor data that reflect the state of biodiversity in Albemarle County.

RECOMMENDATIONS:

1. Develop landscape protection indicators based on: [N,C]
 - a. Open space areas under long term protection.
 - i. Public lands with conservation value (e.g., county parks).
 - ii. Permanent conservation easements, including the level of biodiversity protection the easements provide.
 - b. Percentage of large forest blocks, Important Sites, and other significant conservation areas under conservation easements.
 - c. Ag/forestral district and open space agreement areas, including changes over time.
 - d. Percentage of stream lengths with forested buffers (Increase in vegetated stream buffers is Item 8 under Indicators of Progress for Natural Resources in the Comprehensive Plan, page 13.12).
2. Develop indicators of threats to biodiversity from development based on: [N,C,P]
 - a. Population growth, focusing on the proportion in developed areas compared to rural areas.
 - b. Demand for open space recreational opportunities.
 - c. Construction of new roads.
 - d. Construction of utility corridors.
3. Monitor data and develop indicators of conditions that reflect the state of biodiversity, either directly or indirectly. [N,C,P]
 - a. Develop indices or measurements of habitat fragmentation for the county.
 - b. Monitor and quantify changes in land use/land cover over time (Strategy 4b in Comp Plan, page 4.21).
 - c. Develop methods to quantify the ecosystem services generated by the county's landscape, with a focus on water quality and air quality. This should include monitoring the number of impaired waterways and total number of impairments on waterways in Albemarle County (Items 1 and 2 under Indicators of Progress for Natural Resources in the Comprehensive Plan, page 13.12).
 - d. Develop methods to quantify and describe the presence of invasive species, and track changes over time.
 - e. Monitor the number of highway underpasses created or improved in order to facilitate wildlife movement, and the number road-stream crossings that are upgraded or improved to facilitate movement of aquatic species.

APPENDIX G: “TERRIBLE TWELVE” INVASIVE PLANT SPECIES IDENTIFIED BY BLUE RIDGE PRISM (CURRENT THROUGH APRIL, 2018)

- Autumn Olive (*Elaeagnus umbellata*)
- Garlic Mustard (*Alliaria petiolata*)
- Japanese Honeysuckle (*Lonicera japonica*)
- Japanese Stiltgrass (*Microstegium vimenum*)
- Kudzu (*Pueria montana* var. *lobata*)
- Mile-A-Minute (*Persicaria perfoliata*), formerly *Polygonum perfoliatum*)
- Multiflora Rose (*Rosa multiflora*)
- Oriental Bittersweet (*Celastrus orbiculatus*)
- Porcelainberry (*Ampelopsis brevipedunculata*)
- Privet (*Ligustrum sinense*)
- Tree of Heaven (*Ailanthus altissima*)
- Wavyleaf Grass (*Oplismenus undulatifolius*), formerly *Oplismenus hirtellus* spp. *undulatifolius*)

APPENDIX H: ALBEMARLE COUNTY STREAM BUFFER REGULATIONS

In 1998, Albemarle County enacted a Water Protection Ordinance (WPO). The Chesapeake Bay Preservation Act (CBPA) enables localities to develop regulations to help protect water quality. Some CBPA requirements are mandatory in the Tidewater region of Virginia, but are voluntary in other areas of the state. Albemarle County was the first locality west of the Tidewater region to voluntarily enact portions of the CBPA.

Though the WPO has been revised several times since 1998, it has always included some level of protection for stream buffers. A buffer is simply an area of vegetation adjacent to a stream or river (and to ponds or wetlands in close proximity to them). Buffers have a significant impact on the health of streams while providing other benefits as well (e.g., wildlife habitat, open space). As stated in the WPO, buffers are “for purposes of retarding runoff, preventing erosion, filtering nonpoint source pollution from runoff, moderating stream temperature, and providing for the ecological integrity of stream corridors and networks.”

Stream buffer regulations come into effect when land disturbing activity occurs that is regulated at the state or federal level (e.g., VA Stormwater Management Program, VA Erosion and Sediment Control Program, floodplains). Some activities are exempt from stream buffer regulations (e.g., agriculture, silviculture, public water and sewer facilities).

General rules for stream buffers in Albemarle County are:

- In the Rural Area, a 100 foot stream buffer is required on rivers, perennial streams, intermittent streams, and contiguous wetlands.
- In Development Areas, a 100 foot stream buffer is required on rivers, perennial streams (but not intermittent streams), and contiguous wetlands.
- Along public drinking water reservoirs, 200 foot buffers are required.
- The preferred vegetative cover is “a native riparian forest with ground cover, shrub, and tree canopy layers.”

APPENDIX I: EDUCATION

Goals for Biodiversity Education (revised from the Albemarle County Biodiversity Work Group Report, 2004)

A biodiversity education program should strive to achieve the following goals:

- To establish a comprehensive framework for biodiversity education that is linked to the achievement of biodiversity protection goals as listed in the Comprehensive Plan.
- To conduct and support a variety of education programs that develops understanding of biodiversity, ecosystem services (services like pollination and clean water that healthy natural systems can provide) and the importance of their preservation for individuals and the community.
- To develop citizen understanding of biodiversity protection issues.
- To explain county policy on biodiversity.
- To convey stewardship techniques to owners and managers of private and public lands to enable them to manage for biodiversity on their lands.

Biodiversity Education Topics (adapted from Albemarle County Biodiversity Work Group Report, 2004)

There are many specific topics that relate to biodiversity. Some of the major topics include:

- Defining biodiversity through a local-native lens and explaining its importance.
- Essential steps in protecting and restoring biodiversity, connections with ecosystem concepts, and conservation of ecosystems and watersheds.
- Species, community, and natural history information and experiences through a local-native lens.
- County (and other) government roles in biodiversity protection and restoration.
- What people in a rural setting can do to protect and restore biodiversity.
- What people in a neighborhood setting can do to protect and restore biodiversity.
- Essential steps to eradicate and prevent the spread of invasive plants and to promote the use of local-native plant communities in landscaping.

Biodiversity Education Audiences (from Albemarle County Biodiversity Work Group Report, 2004)

There are also several potential audiences for biodiversity outreach and education efforts. Some of these audiences include:

- Elected and appointed county leaders
- County staff
- Neighborhood residents / small lot owners
- Rural area residents / large lot owners
- Public land managers (Parks and Recreation, Schools, Rivanna Water and Sewer Authority, University of Virginia)

- Farmland preservation advocates
- Open-space easement holders and promoters
- Developers, contractors, builders, and realtors
- Pre-school youth
- Primary school youth
- Secondary school youth
- College students

Existing Biodiversity Education Efforts (revised and updated from Albemarle County Biodiversity Work Group Report, 2004)

There are several entities providing biodiversity-related education in the community. Efforts should be made to collaborate to enhance educational opportunities. Some of these providers include:

- K-12 Schools - The K-12 system has a number of standards of learning (SOL) that provide information to students about issues in biodiversity across a variety of subjects. There should be strong curricular and structural linkages between the K-12 curriculum and the county's biodiversity program. Western Albemarle High School has an Environmental Studies Academy. Private schools have biodiversity related education efforts as well.
- Nature Camps for kids - Living Earth Camp, ARC Natural History Camp
- Piedmont Virginia Community College (PVCC) - PVCC provides course work focusing on a great variety of aspects of biodiversity education, including general interest courses such as Natural History, Spring and Fall Wildflowers, Astronomy, Forestry, Horticulture, and Ornithology. These courses provide community members with information about biodiversity and actions needed to protect our biodiversity. There are also opportunities for other courses to be offered in the broad area of biodiversity.
- The University of Virginia (UVA) - UVA provides numerous opportunities for study in Environmental Science, both at the undergraduate and graduate level, and courses for local residents. The university has the potential of being a very valuable biodiversity education resource for our community.
- Ivy Creek Foundation (ICF) - The ICF, through partnerships with Albemarle County and the City of Charlottesville, maintains Ivy Creek Natural Area. The organization provides guided tours of the Ivy Creek Natural Area to elementary-age children. ICF also hosts guest speakers, nature walks, and meetings of local organizations that provide many natural history education opportunities to both adults and youth. ICF is called out from the broader list of NGOs because of its unique partnership with the county and city and its roles in managing public land and education.
- Non-Governmental Organizations that contribute to biodiversity education as part of their missions - There are several organizations that provide biodiversity education, scientific work, advocacy, or access. Among these groups are the Rivanna Master Naturalists, The Nature Conservancy, Blue Ridge PRISM, Monticello Bird Club, Virginia Native Plant Society, Rivanna Conservation Alliance, Rivanna Trails Foundation, Piedmont Environmental Council, Charlottesville Area Tree Stewards, Piedmont Landscape Association, and numerous garden clubs.
- A particularly large group in this realm is Local Naturalists - A number of individual local naturalists have collected incredible amounts of information on biodiversity in Albemarle County. They have shared their knowledge both in educational settings and by providing data to

county officials.

- Hybrid organizations such as Center for Urban Habitats (CUH, a Limited Liability Corporation with a non-profit education arm) have significant community impact from the standpoint of biodiversity education in Albemarle County. CUH not only inventories and tracks flora, fauna, and ecosystems on private and public lands, but it offers a unique education approach to the property owners in order to fulfill its mission of “biodiversity education and conservation in the Piedmont”. It also creates and distributes biodiversity and natural history publications and resources in a direct effort to enrich the knowledge of the general public around native plants, animals, and ecosystems.
- For-profit corporations that further the mission of the Albemarle County Natural Heritage Committee are those that have a purpose focused environmental education, land conservation, and biodiversity assessment and renewal. Many of them, in fact, are mission-driven, and they accomplish education by the very nature of their business. In addition to Center for Urban Habitats, companies such as Wild Ginger Field Services, Ecosystem Services, Virginia Forestry and Wildlife Group, and Agriculture Solutions of Albemarle are doing a great deal of work that contributes to the growing body of knowledge in our region pertaining to natural resource management, education, and conservation.

APPENDIX J: AN ANNOTATED CHECKLIST OF THE MAMMALS OF ALBEMARLE COUNTY, VIRGINIA

Adapted from Dan Bieker, May 2017.

Definitions of Rank and Status

County Status:

Very Common: likely in large numbers in proper habitat/season.

Common: present most of the time or in small numbers in proper habitat/season.

Uncommon: occurs in small numbers in limited habitat.

Rare: occurs irregularly in small numbers

“S” - State Rank (VA Natural Heritage Rank and Status Definitions):

S5 - Very common; demonstrably secure under present conditions.

S4 - Common; usually >100 populations or occurrences, but may be fewer with many large populations; may be restricted to only a portion of the state; usually not susceptible to immediate threats.

S3 - Rare to uncommon; usually between 20 and 100 populations or occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.

S2 - Very rare; usually between 5 and 20 populations or occurrences; or with many individuals in fewer occurrences; often susceptible to becoming extirpated.

S1 - Extremely rare; usually 5 or fewer populations or occurrences in the state; or may be a few remaining individuals; often especially vulnerable to extirpation.

SA - Accidental in the state.

S#B - Breeding status of an organism within the state.

SH - Historically known from the state, but not verified for an extended period, usually >15 years; this rank is used primarily when an inventory has been attempted recently.

S#N - Non-breeding status within the state. Usually applied to winter resident species.

SU - Status uncertain, often because of low search effort or cryptic nature of the element.

SX - Apparently extirpated from the state.

SZ - Long distance migrant whose occurrences during migration are too irregular, transitory, and/or dispersed to be reliably identified, mapped and protected.

“N” - National Rank: Similar to state rank, but refers to a species' rarity (in most instances) throughout the 48 contiguous United States.

“G” - Global Rank: Similar to state rank, but refers to a species’ rarity throughout its total range. Note that GA and GN are not used and GX means “apparently extinct.”

2015 Virginia Wildlife Action Plan - Species of Greatest Conservation Need Rankings

Tier I: Critical Conservation Need - Faces an extremely high risk of extinction or extirpation. Populations of these species are at critically low levels, face immediate threat(s), or occur within an extremely limited range. Intense and immediate management action is needed.

Tier II: Very High Conservation Need - Has a risk of extinction or extirpation. Populations of these species are at very low levels, face real threat(s), or occur within a very limited distribution. Immediate management is needed for stabilization and recovery.

Tier III: High Conservation Need - Extinction or extirpation is possible. Populations of these species are in decline, have declined to low levels, or are restricted in range. Management action is needed to stabilize or increase populations.

Tier IV: Moderate Conservation Need - The species may be rare in parts of its range, particularly on the periphery. Populations of these species have demonstrated a declining trend or a declining trend is suspected which, if continued, is likely to qualify this species for a higher tier in the foreseeable future. Long-term planning is necessary to stabilize or increase populations.

List of Mammals

Pouched Mammals (Marsupials – Order: Didelphimorphia)

Opossums (Family: Didelphidae)

- **Virginia Opossum** (*Didelphis virginiana*) G5 N4 S5 County: common
Habitat: Wide variety; prefers wooded lowlands interspersed with pastures, fields, brushy fencerows. Often forages near rivers, lakes, streams.
Status: Common throughout county.

Shrews and Moles (Order: Soricomorpha)

Shrews (Family: Soricidae)

- **Masked Shrew** (*Sorex cinereus*) G5 N5 S5 County: uncertain
Habitat: Wide variety of habitats; prefers moist, mixed woods with moss-covered rocks

and decaying logs. Also found in grassy fields, swamps, dry upland fields.

Status: This species is found in the mountains of western VA; it can be common in good habitat and is possible in the mountainous areas of western Albemarle.

- **Southeastern Shrew** (*Sorex longirostris*) G5 N5 S5 County: likely uncommon

Habitat: Prefers moist woods or fields, also brushy thickets, young forest with dense honeysuckle and herbaceous ground cover.

Status: Usually found below 1500 feet; studies in VA indicate this species to be widely scattered but common in certain localities; likely found in county east of the Blue Ridge.

- **Smoky Shrew** (*Sorex fumeus*) G5 N5 S5 County: uncertain

Habitat: Cool, moist mountain forests with deep leaf litter. Prefers hemlock, spruce and damp deciduous forests; also found in swamps/bogs with moss-covered rocks and logs.

Status: Possibly occurs in the mountains of western Albemarle. Can be abundant in good habitat, but likely scarce in the county.

- **Pygmy Shrew** (*Sorex hoyi*) G5 N5 S4 County: likely uncommon

Habitat: Prefers well-drained sites in deciduous woodlands with minimal understory; slopes or tops of ridges above streams; most often found in deep leaf litter or decaying logs.

Status: Occurs statewide but densities are difficult to determine. Likely uncommon in the county.

- **Least Shrew** (*Cryptotis parva*) G5 N5 S5 County: common

Habitat: Prefers open, grassy fields.

Status: Common throughout county in suitable habitat.

- **Northern Short-tailed Shrew** (*Blarina brevicauda*) G5 N5 S5 County: very common

Habitat: Wide variety; prefers thick leaf litter of moist woodlands. Often found also in fields, thickets, and is the most likely shrew to enter buildings.

Status: Very common throughout county.

Moles (Family: Talpidae)

- **Eastern Mole** (*Scalopus aquaticus*) G5 N5 S5 County: very common

Habitat: Almost any area with well-drained loam or sandy soil. Fields, lawns, gardens, deciduous and coniferous forests.

Status: Very common throughout county, except in areas of heavy clay soils.

- **Hairy-tailed Mole** (*Parascalops breweri*) G5 N5 S5 County: uncommon

Habitat: Well-drained soils above 2500 feet. Prefers forested areas with thick vegetation; also found in cultivated fields, grassy areas, and rhododendron thickets.

Status: Found in western (and possibly southern) portions of the county in suitable habitat.

- **Star-nosed Mole** (*Condylura cristata*) G5 N5 S4 County: likely rare

Habitat: Wet meadows, marshes, and low, wet areas near streams and lakes.

Status: Rare in county due to minimal habitat.

Bats (Order: Chiroptera)

Vespertilionid Bats (Family: Vespertilionidae)

- **Little Brown Myotis** (*Myotis lucifugus*) G3 N3 S2 **Tier 1** County: rare
Habitat: Colonial; inhabits caves and mines in winter. Summer: buildings, hollow trees, under loose bark, cliffs, bridges, etc. Maternity colonies most often are in man-made structures. In rapid decline due to white nose (fungal) syndrome.
Status: Formerly common throughout county in warm months; will travel long distances to roost in caves during winter. Very sensitive to organochlorine insecticides and other pollutants. Status unknown, but likely rare.
- **Northern Myotis** (*Myotis septentrionalis*) G1 N2 S3 **Tier 1** County: likely rare
(Federal listing: threatened; State: proposed threatened)
Habitat: Caves, mines, buildings, under loose bark, hollow trees, etc. Will roost singly in cracks and crevices; will also mix with other bats in caves. Rapid decline attributed to white nose syndrome and habitat loss.
Status: Uncommon throughout VA; likely rare, if at all, in county. Global status: critically imperiled
- **Indiana Bat** (*Myotis sodalis*) G2 N2 S1 **Tier 1** County: unlikely
(federally and state endangered)
Habitat: Most often in caves; also mines, buildings, hollow trees, under loose bark, etc.
Status: State and federally endangered. Albemarle is on the eastern edge of this species' range and has little suitable habitat, so while possible, it is unlikely to occur here.
- **Small-footed Myotis** (*Myotis leibii*) G3 N3 S2 **Tier 1** County: unlikely
Habitat: Most often found in caves in forested areas; also in mines, under bridges, and sometimes in buildings.
Status: Albemarle is on the eastern edge of this species' range; in VA it has only been recorded in a few locations in the western mountains (one record is from the piedmont of Maryland). Likely rare or absent from county.
- **Silver-haired Bat** (*Lasiorycteris noctivagans*) G3 N5 S4 **Tier 1V proposed**
County: uncommon
Habitat: Usually solitary; prefers to roost near water in hollow trees or under bark of old trees. Migratory – most individuals breed in northern US and migrate southward in the fall. High mortality from wind turbines.
Status: Uncommon in county; most likely to be found during cooler months.
- **Eastern Pipistrelle** (*Perimyotis subflavus*) G2 N3 S2 **Tier 1** County: rare
(Tricolored Bat) State listing: proposed endangered
Habitat: Hibernates in caves and rock crevices. Maternity colonies in warmer months are usually in buildings or hollow trees. Rapid decline from white-nose syndrome. Also

highly susceptible to wind turbine mortality.

Status: Rare; more likely in western part of county, and during warmer months.

- **Big Brown Bat** (*Eptesicus fuscus*) G5 N5 S5 County: uncommon
Habitat: Wide habitat preferences; prefers buildings, caves, hollow trees. Most often seeks buildings for winter roosts and maternity colonies.
Status: Widespread though uncommon throughout county.

- **Evening Bat** (*Nycticeius humeralis*) G5 N5 S4 County: uncertain
Habitat: Hollow trees, bark crevices, buildings, bridges; prefers woodland areas. Does not inhabit caves. Migratory, although specifics are poorly understood.
Status: Albemarle is on the western edge of this species' range. It prefers low elevation and is possible in the county, most likely in the eastern portion.

- **Eastern Red Bat** (*Lasiurus borealis*) G3 N5 S4 **Tier 1V proposed** County: uncommon
Habitat: Deciduous woods, orchards; preferably near water. Solitary; seldom inhabits caves. Often hangs from tree or shrub branches.
Status: Widespread throughout county; often forages for insects over water or above outdoor lights. Migratory, but may overwinter here.

- **Hoary Bat** (*Lasiurus cinereus*) G3 N5 S3 **Tier 1V** County: rare
Habitat: Prefers coniferous forests, or conifer patches in deciduous forest; often roosts hanging from a branch. Solitary; seldom found in caves. Migratory - breeds in northern US and Canada; winters further south.
Status: Rare in county; most records from western portion.

Rabbits, Hares, Pikas (Order: Lagomorpha)

Rabbits and Hares (Family: Leporidae)

- **Eastern Cottontail** (*Sylvilagus floridanus*) G5 N5 S5 County: very common
Habitat: Primarily in disturbed areas: old fields, thickets, brushy fencerows, woodland edges. Escape cover is the most important element of good habitat.
Status: Widespread and very common throughout county in open, brushy, and cultivated areas.

- **Appalachian Cottontail** (*Sylvilagus obscurus*) G4 N4 S4 **Tier 1V** County: uncertain
Habitat: Prefers higher elevations of the Appalachian Mountains; woods, brush, rhododendron thickets. Found in thicker wooded cover than eastern cottontail.
Status: Albemarle County is on the eastern edge of this species' range. Could possibly be found in western parts of county. Visually it is nearly indistinguishable from eastern cottontail.

Rodents (Order: Rodentia)

Chipmunks, Woodchucks, and Squirrels (Family: Sciuridae)

- **Eastern Chipmunk** (*Tamias striatus*) G5 N5 S5 County: common
Habitat: Deciduous forest, brushy areas with crevices, logs, rock piles for refuge.
Solitary except during breeding season.
Status: Widespread and common throughout county.

- **Woodchuck** (*Marmota monax*) G5 N5 S5 County: common
Habitat: Prefers open areas near woodland edge; grassy fields, meadows, railroad and highway right-of-ways; sometimes under buildings.
Status: Widespread and common throughout county in suitable habitat.

- **Eastern Gray Squirrel** (*Sciurus carolinensis*) G5 N5 S5 County: very common
Habitat: Dense hardwood and mixed hardwood/coniferous forests. Also inhabits woodlots, parks, and urban areas with suitable trees.
Status: Widespread and very common throughout county. Forestry practices such as removal of old trees and establishment of pine stands are detrimental.

- **Eastern Fox Squirrel** (*Sciurus niger vulpinus*) G5 N5 S4 County: rare
Habitat: Prefers mature forest stands of oak, hickory, pine with minimal understory.
Status: Encountered very rarely in the county; usually in western and southern portions.

- **Red Squirrel** (*Tamiasciurus hudsonicus*) G5 N5 S5 County: rare
Habitat: Prefers coniferous woodlands and high-elevation mountainous areas.
Status: Rarely encountered in the county; most likely to occur in western portion.

- **Southern Flying Squirrel** (*Glaucomys volans*) G5 N5 S5 County: common
Habitat: Prefers mature hardwood forests with large trees for nesting/roosting cavities; also mixed hardwood/coniferous forests and residential areas; may occupy buildings and bird houses.
Status: Widespread and common throughout county in suitable habitat. Rarely encountered due to secretive and nocturnal habits.

Beaver (Family: Castoridae)

- **American Beaver** (*Castor canadensis*) G5 N5 S5 County: uncommon
Habitat: Streams, swamps, lakes in wooded areas.
Status: Widespread though uncommon (locally common in some areas) throughout county.

Murid Mice and Rats (Family: Muridae)

- **Eastern Harvest Mouse** (*Reithrodontomys humulis*) G5 N5 S5 County: uncommon
Habitat: Old fields, brushy borders of cultivated fields, broomsedge, short grass with interlaced thickets and tangles.
Status: Not commonly encountered, probably due to loss of preferred habitat to extensive pasture establishment of recent decades.

- **Deer Mouse** (*Peromyscus maniculatus*) G5 N5 S5 County: likely rare
Habitat: prefers cool, moist forests of western and northern VA.
Status: Could possibly be found in the mountains of western portion of county.

- **White-footed Mouse** (*Peromyscus leucopus*) G5 N5 S5 County: very common
Habitat: Hardwood and mixed hardwood/coniferous forest, field edges, thickets, brushy fencerows.
Status: Very common and widespread throughout county. Important prey species for many predators. Prefers nest sites above ground, sometimes in trees or buildings.

- **Golden Mouse** (*Ochrotomys nuttalli nuttalli*) G5 N5 S4 County: likely rare
Habitat: Prefers forested lowlands and floodplains with thick undergrowth, especially vines such as greenbrier and honeysuckle. Arboreal; often climbs vines to get to nest sites in trees.
Status: Possible in lowland areas, most likely in southern and eastern Albemarle.

- **Allegheny Woodrat** (*Neotoma magister*) G3 N3 S3 **Tier 1V** County: rare
Habitat: Deciduous forest, talus slopes, rocky outcrops, crevices, caves in mountainous areas of state. Often inhabits buildings near suitable habitat.
Status: Reported from southern (Covesville, North Garden) and western portions of county. Declining over most of its range in eastern US for unknown reasons.

- **Southern Red-backed Vole** (*Myodes gapperi*) G5 N5 S5 County: uncommon
Habitat: Northern species which extends its range into Appalachian Mountains, generally found above 2500 feet. Prefers cool, damp areas in coniferous forests; also found in deciduous and mixed forests. Fond of moss-covered logs and rocks, rock crevices, shaded slopes.
Status: Likely uncommon in county due to lack of preferred habitat; mountains of southern and western Albemarle are the most likely areas of occurrence.

- **Meadow Vole** (*Microtis pennsylvanicus*) G5 N5 S5 County: very common
Habitat: Prefers open grassy areas, old fields, orchards, low moist areas near streams.
Status: Widespread and very common in Albemarle; important prey species. Densities fluctuate from year to year, but one of the most common small mammals in eastern US.

- **Woodland Vole** (*Microtis pinetorum*) G5 N5 S5 County: common
Habitat: Woodlands, old fields, orchards; prefers moist but well-drained soil or deep humus combined with heavy ground cover.
Status: Widespread and common in county.

- **Southern Bog Lemming** (*Synaptomys cooperi stonei*) G5 N5 S5 County: likely rare
Habitat: Generally occurs west of the Blue Ridge. Variety of habitats including moist meadows, sphagnum bogs, marsh borders, grasslands and weedy fields.
Status: Likely rare in county due to lack of preferred habitat; western mountains of county are the most likely area of occurrence.

- **Common Muskrat** (*Ondatra zibethicus*) G5 N5 S5 County: uncommon
Habitat: Fresh and salt water marshes, swamps, edges of ponds, lakes and streams.

Prefers areas with bulrushes and/or cattails.

Status: Encountered infrequently in Albemarle due to lack of preferred marshy/swampy habitat.

- **Black Rat** (*Rattus rattus*) G5 N: n/a S: n/a County: uncertain
Habitat: Introduced species. Found mainly near coastal areas; usually in buildings.
Status: Uncertain; likely is absent from county, as it is in most of VA. Easily displaced by more aggressive Norway Rat.
- **Norway (Brown) Rat** (*Rattus norvegicus*) G5 N: n/a S: n/a County: common
Habitat: Introduced species. Wide variety of habitats from cities to rural areas; usually associated with human activity. Found in and under buildings, trash heaps, barnyards, fields, ditches, dumpsters, etc. Usually found in lower reaches of structures. Aggressive, prolific breeder, and usually considered a pest.
Status: Widespread and common throughout county.
- **House Mouse** (*Mus musculus*) G5 N: n/a S: n/a County: very common
Habitat: Introduced species. Mostly associated with human activity – homes, barns, restaurants, warehouses, etc.; also common in cultivated and abandoned fields, fencerows, swamps, and other natural habitats. Will inhabit all levels of structures. Prolific breeder, unsanitary, and usually considered a pest.
Status: Widespread and very common throughout county.

Jumping Mice (Family: Zapodidae)

- **Meadow Jumping Mouse** (*Zapus hudsonius*) G5 N5 S5 County: uncommon
Habitat: wet meadows, bogs, abandoned grassy fields, thick vegetation near marshes and streams. Hibernates through winter.
Status: Uncommon in county, though present in desirable habitat. Not often observed due to nocturnal and solitary nature.
- **Woodland Jumping Mouse** (*Napaeozapus insignis*) G5 N5 S5 County: unlikely
Habitat: Prefers spruce/hemlock/mixed hardwood forests, moist coves, mostly in western VA.
Status: Possible in high elevations of western Albemarle.

Porcupine (Family: Erethizonetidae)

- **Porcupine** (*Erethizon dorsatum*) G5 N5 S1 County: extirpated
Habitat: Mixed conifer/hardwood forests.
Status: Primarily a northern species, porcupines once inhabited the southern Appalachians. Closest current populations occur in south-central Pennsylvania and northeastern West VA. The most recent known report close to Albemarle is from Greene County, 2005. Porcupines likely once occupied the woodlands of Albemarle County, and individuals wandering into the county are possible.

Carnivores (Order: Carnivora)

Dogs and Foxes (Family: Canidae)

- **Red Fox** (*Vulpes vulpes*) G5 N5 S5 County: common
Habitat: Open areas and fields interspersed with brush and woodlots. Frequents streams and forest edges.
Status: Common in appropriate habitat in most areas of county.
- **Gray Fox** (*Urocyon cinereoargenteus*) G5 N5 S5 County: common
Habitat: Forest and brushy areas; woodlots. Prefers more wooded terrain than red fox. Often occurs in suburban areas.
Status: Common and widespread throughout county.
- **Coyote** (*Canis latrans*) G5 N5 S5 County: uncommon
Habitat: Open woodlands, forest edges, semi-open farmland, brushy areas. Rapid range expansion over eastern US in recent decades.
Status: Uncommon, though increasing in Albemarle. Heard more often than seen.
- **Gray Wolf** (*Canis lupus*) G5 N4 SX County: extirpated
Habitat: Wide variety of habitats; limited more by availability of prey than landscape requirements. Prefers wilderness habitat with minimal human disturbance.
Status: Gray wolves once inhabited all of Virginia, and undoubtedly roamed and bred in the forests of Albemarle County. They were last recorded in the county in 1850. The last wild wolf reported in Virginia was killed in Tazewell County, 1910.

Bears (Family: Ursidae)

- **Black Bear** (*Ursus americanus*) G5 N5 S4 County: uncommon
Habitat: Heavily wooded forests; lowland swamps. Prefers oak-hickory and mixed hardwood forests, and areas of minimal human habitation. Can range over long distances.
Status: Uncommon, though apparently increasing in Albemarle, mostly in western and southern sections.

Raccoons (Family: Procyonidae)

- **Common Raccoon** (*Procyon lotor*) G5 N5 S5 County: common
Habitat: Stream, river, and lake edges, bottomland, wooded areas. Often takes up residence in barns, attics, and other buildings.
Status: Widespread and common throughout county.

Mustelids - Weasels, Mink and Otter (Family: Mustelidae)

- **Least Weasel** (*Mustela nivalis*) G5 N5 S3 County: rare
 Habitat: Wide variety: woodlands, old fields, brushy fencerows. Northern species whose range extends through Appalachian Mountains.
 Status: Albemarle is on the eastern edge of this species' range. Anecdotal sightings; likely rare in county, though insufficiently studied.

- **Long-tailed Weasel** (*Mustela frenata*) G5 N5 S5 County: uncommon
 Habitat: Farmland, woods, swamps. Fond of brushy fencerows and field edges, and areas near water.
 Status: Uncommon throughout county; seldom encountered due to nocturnal and secretive nature.

- **American Mink** (*Vison vison*) G5 N5 S5 County: uncommon
 Habitat: Banks of streams, rivers, lakes, and in swamps, marshes. Prefers wooded or brushy areas.
 Status: Rarely observed in county, though observation opportunities limited due to habitat and nocturnal nature of species.

- **Northern River Otter** (*Lutra canadensis*) G5 N5 S4 County: rare
 Habitat: Aquatic areas: streams, rivers, lakes, swamps. Requires relatively clean water; prefers areas of minimal human disturbance.
 Status: Has been reported in Rivanna River, Ragged Mountain Reservoir, and other scattered locations in county. Observed rarely, though apparently increasing in past few decades.

Skunks (Family: Mephitidae)

- **Eastern Spotted Skunk** (*Spilogale putorius*) G4 N4 S3 **Tier 1V** County: rare
 Habitat: Found in the mountains of Virginia; prefers open forests with rock piles and rock outcrops. Also found around farms and houses.
 Status: Occurs primarily west of the Blue Ridge. Sightings in Albemarle from western and southern (Red Hill, Heards Mt.) areas.

- **Striped Skunk** (*Mephitis mephitis*) G5 N5 S5 County: common
 Habitat: Prefers upland areas: old fields, farmland, brushy fencerows. Often found near homes and in suburban areas.
 Status: Scattered, though common in most areas of county.

Cats (Family: Felidae)

- **Mountain Lion** (*Puma concolor*) F5 N5 SX County: extirpated (federally and state endangered)
 Habitat: Mountains, hilly woodlands, wilderness areas with minimal human disturbance.
 Status: Credible sightings recorded in recent years from many counties in western Virginia, including Albemarle. It is possible that this species does roam through the county; most likely occurrence would be in mountains of western Albemarle.

- **Bobcat** (*Lynx rufus*) G5 N5 S4 County: rare
Habitat: Occurs mostly in the mountainous areas of Virginia; prefers second-growth deciduous forest, rocky areas, river bottom swamps.
Status: Rarely observed in the county, mostly in western portion. Observation opportunities limited due to species' nocturnal, solitary, and extremely secretive nature.

Hoofed Mammals (Order: Artiodactyla)

Pigs (Family: Suidae)

- **Feral Pig** (*Sus Scrofa*) Introduced; found in most US states County: uncertain
Habitat: Wide variety. Mostly in forested habitats, but can also inhabit swamps and semi-open areas. Destructive; active eradication efforts in place throughout Virginia.
Status: no recent records for Albemarle, but feral pig populations exist in counties immediately to the north and south of county.

Deer and Elk (Family: Cervidae)

- **White-tailed Deer** (*Odocoileus virginianus*) G5 N5 S5 County: very common
Habitat: Woodland, semi-open areas, farmland. Often found in residential areas.
Status: Widespread and very common in most areas of county.
- **Elk** (*Cervus elaphus*) G5 N5 SX County: extirpated
Habitat: Open forests with adjacent meadows and fields.
Status: Elk once inhabited much of the eastern US, and likely occurred throughout Albemarle County. The last native elk recorded in Virginia was killed in 1855. Subsequent reintroductions, especially in last decade, have met with success in southwestern VA.

Bison (Family: Bovidae)

- **American Bison** (*Bos bison*) G4 N4 SX County: extirpated
Habitat: Eastern bison, a variation of the western bison, were well adapted to woodlands; they occurred in small herds and preferred open valleys of the Piedmont, Shenandoah Valley and mountains.
Status: Bison were reportedly plentiful around Charlottesville in the early to mid 1700's. They were gradually driven from the East as settlement progressed; the last records in Virginia are from the late 1700's.

Additional information on these mammals can be found in Hurt and Grossenheider (1980), Linzey (1998), NatureServe (2017), Roble (2016), Virginia Department of Game and Inland Fisheries (2017), Virginia Department of Game and Inland Fisheries (2015), Webster, Parnell and Biggs (1985)

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Cover page design and photographs by Emily Luebke. From left to right,

Top row: curlyheads (*Clematis ochroleuca*), eastern tiger swallowtail (*Papilio glaucus*) on wild azalea (*Rhododendron peryclyminoides*), blue curls (*Trichostema dichotomum*)

Second row: eastern box turtle (*Terrapene carolina carolina*), fire pink (*Silene virginica*), song sparrow (*Melospiza melodia*), spring beauty (*Claytonia virginica*)

Third row: Halloween pennant (*Celithemis eponina*), spotted salamander (*Ambystoma maculatum*), juniper hairstreak (*Callophrys gryneus*) on golden ragwort (*Packera aurea*)