







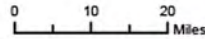
Managing Land in the Piedmont of Virginia

for the Benefit of Birds & Other Wildlife

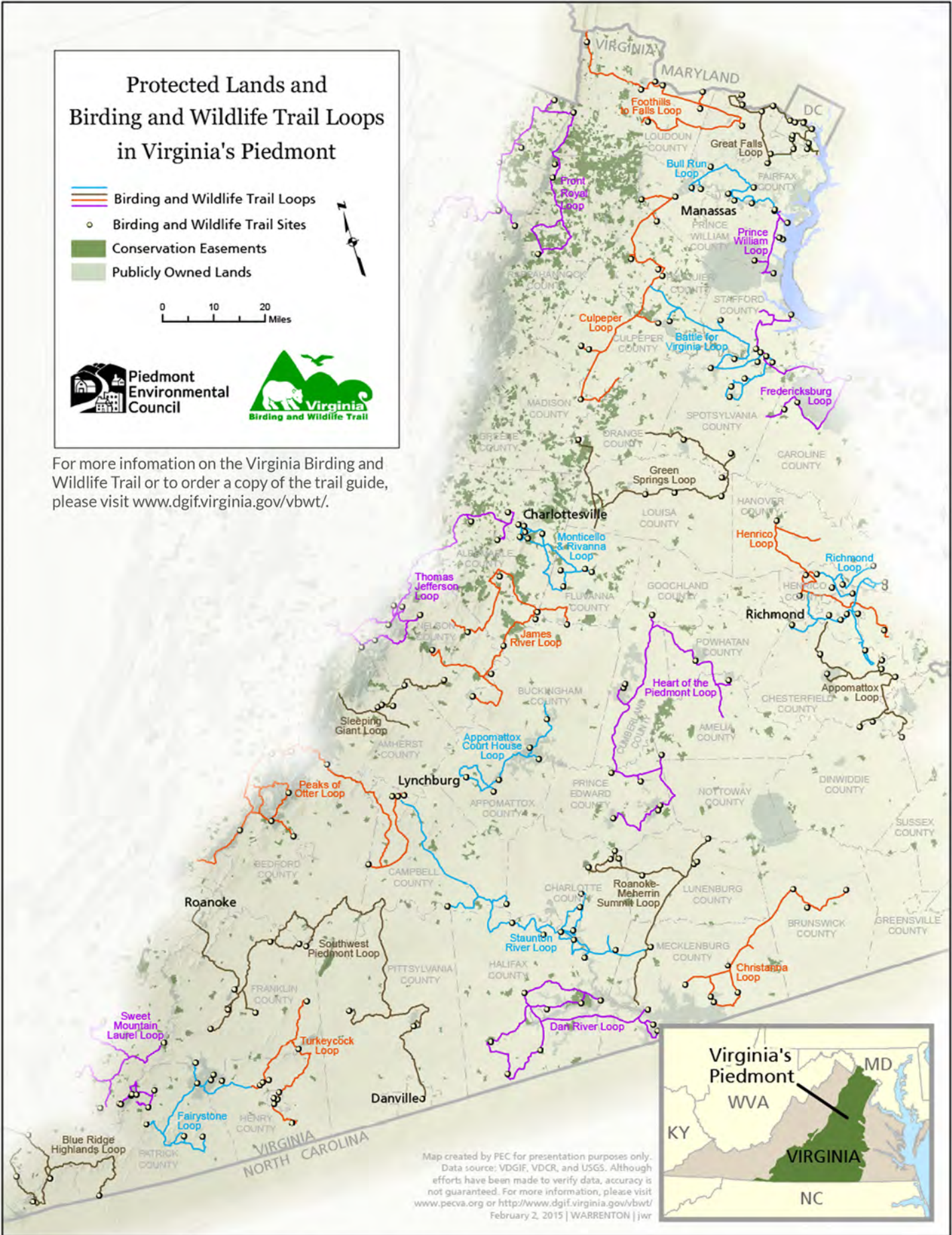


Protected Lands and Birding and Wildlife Trail Loops in Virginia's Piedmont

-  Birding and Wildlife Trail Loops
-  Birding and Wildlife Trail Sites
-  Conservation Easements
-  Publicly Owned Lands

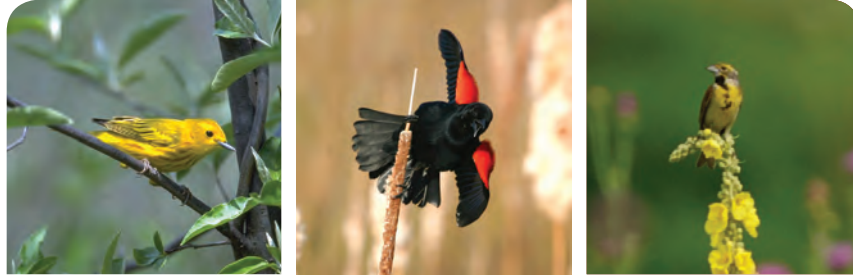


For more information on the Virginia Birding and Wildlife Trail or to order a copy of the trail guide, please visit www.dgif.virginia.gov/vbwt/.



Map created by PEC for presentation purposes only. Data source: VDGI, VDCR, and USGS. Although efforts have been made to verify data, accuracy is not guaranteed. For more information, please visit www.pcv.org or <http://www.dgif.virginia.gov/vbwt/>
February 2, 2015 | WARRENTON | jwr

COVER PHOTOS: View, Katherine Vance; Short-eared Owl, Glen Tepke; Kentucky Warbler, Glen Tepke; Eastern Towhee, Ellen & Tony



Managing Land in the Piedmont of Virginia

for the Benefit of Birds & Other Wildlife

Third Edition, 2016

Authors:

Faren Wolter, The Piedmont Environmental Council*
Stephen Capel, Virginia Department of Game & Inland Fisheries, retired
David Pashley, American Bird Conservancy
Susan Heath, Gulf Coast Bird Observatory

*= at the time of second publication

Revisors:

Celia Vuocolo, The Piedmont Environmental Council
Carolyn Sedgwick, The Piedmont Environmental Council
Sergio Harding, Virginia Department of Game and Inland Fisheries

Suggested Citation:

Vuocolo, C., C. Sedgwick, S. Harding, F. Wolter, S. Capel, D. Pashley, and S. Heath. 2016.
Managing Land in the Piedmont of Virginia for the Benefit of Birds and Other Wildlife:
Third Edition. Warrenton, Virginia. 32 pp.



The Piedmont Environmental Council

The Piedmont Environmental Council (PEC) is a 501(c)(3) nonprofit conservation organization and an accredited, regional land trust. Founded in 1972, PEC uses a comprehensive strategy to promote and protect the Virginia Piedmont's rural economy, natural and historic resources, and scenic views. Accordingly, PEC works with landowners, residents, and local governments to ensure the long-term protection of their communities and quality of life through land conservation and land use planning that directs growth to places which ensure that new development fulfills the vision of local citizens. As communities change, PEC works to foster a sense of history, establish a viable transportation network, create enjoyable neighborhoods, promote strong local economies, and initiate opportunities which allow everyone to enjoy the outdoors.

PEC primarily serves Albemarle, Orange, Madison, Greene, Culpeper, Fauquier, Loudoun, Clarke, and Rappahannock Counties, although assistance is also provided to citizens and organizations with parallel missions in neighboring counties. Consequently, PEC is recognized nationally for leadership in promotion of smart growth principles, land conservation, and related work in rural historic preservation, conservation of working forests and farmland, wildlife habitat, and watershed protection. Please view its website: www.pecva.org.

Virginia Department of Game and Inland Fisheries

As Virginia's wildlife agency, the Virginia Department of Game and Inland Fisheries (VDGIF) works to manage Virginia's wildlife and inland fish to maintain optimum populations of all species to serve the needs of the Commonwealth; to provide opportunity for all to enjoy wildlife, inland fish, boating, and related outdoor recreation and to work diligently to safeguard the rights of the people to hunt, fish and harvest game as provided for in the Constitution of Virginia; to promote safety for persons and property in connection with boating, hunting and fishing; and to provide educational outreach programs and materials that foster an awareness of and appreciation for Virginia's fish and wildlife resources, their habitats, and hunting, fishing, and boating opportunities. VDGIF is responsible for the management of inland fisheries, wildlife, and recreational boating for the Commonwealth of Virginia.

VDGIF is a leader in Virginia in the conservation of birds that are traditionally hunted, such as waterfowl, Wild Turkey, American Woodcock, Northern Bobwhite, and Ruffed Grouse; as well as of nongame avian species, including land birds such as Red-cockaded Woodpecker, Golden Eagle, Peregrine Falcon, Loggerhead Shrike, Golden-winged Warbler and Cerulean Warbler; colonial waterbirds such as terns and herons; and shorebirds such as Piping Plover and American Oystercatcher. Bird conservation by VDGIF includes research and monitoring of bird populations; regulatory review of projects in relation to wildlife resources, including state or federally endangered and threatened species; land acquisition, and habitat management on Virginia's Wildlife Management Areas; and a number of recreational, educational, and outreach programs, including the establishment of the Virginia Birding and Wildlife Trail and sponsorship of Virginia birding festivals. Please view its website: www.dgif.virginia.gov.

American Bird Conservancy

American Bird Conservancy (ABC) is the only 501(c)(3) organization that works solely to conserve native wild birds and their habitats throughout the Americas. ABC acts to safeguard the rarest bird species, restore habitats, and reduce threats, while building capacity in the conservation movement. ABC is the voice for birds, ensuring that they are adequately protected; that sufficient funding is available for bird conservation; and that land is protected and properly managed to maintain viable habitat.

ABC sets the bird conservation agenda by using the best science available to determine the highest priorities and the best solutions, and then communicating these priorities to the conservation community and the public through alliances, partnerships, and networks. ABC counts among its staff some of the foremost experts in bird conservation in the United States, and partners with many others throughout the Americas.

ABC is a membership organization that is consistently awarded a top, four-star rating by the independent group Charity Navigator. Please view its website: www.abcbirds.org.

Acknowledgements

We extend our deep thanks to Bruce and Susan Jones and to Environmental Studies on the Piedmont for providing the funding to design and publish this third edition. Environmental Studies on the Piedmont, the conservation division of The Clifton Institute, focuses on quality outdoor education, research, and habitat restoration that serves as a local and national model for conservation in practice.

We thank Sarah Gannon Nagle for conceptualizing and writing the grant proposals that started the first edition.

We are extremely grateful to the numerous people who have contributed to the various editions of this guide. Each edition has been reviewed by and received contributions from many partners, some of whom have provided feedback for more than one version of the guide. This includes partners from the Virginia Natural Heritage Program, the Virginia Department of Forestry, and the Natural Resources Conservation Service.

We would also like to thank some of the supporting organizations who helped guide the third edition of this publication: Private Lands Wildlife Biologists (jointly employed by the Natural Resources Conservation Service, Virginia Department of Game and Inland Fisheries, and the Conservation Management Institute at Virginia Tech), the American Bird Conservancy, Smithsonian Conservation Biology Institute, and Environmental Studies on the Piedmont, among others.

We also thank Shayan Ghajar (Middleburg Agricultural Research and Extension Center) for sharing his expertise and for his contributions to the 'Grassland' and 'Savanna' sections when he was formerly working with The Piedmont Environmental Council on a grant project; Amy Ewing (Virginia Department of Game and Inland Fisheries) for her contributions to the 'Wetlands' and 'Riparian Areas' section; Jonathan Marquisee and Watsun Randolph (Piedmont Environmental Council) for creating the maps in this publication; and the photographers who generously provided photographs for this guide.

Managing Land in the Piedmont of Virginia for the Benefit of Birds & Other Wildlife

The purpose of this guide is to provide landowners with an introduction to land management concepts and conservation tools that can be used to benefit wildlife and counter some of the threats faced by declining bird species. Although this guide focuses specifically on birds, management that is beneficial to birds often benefits other wildlife that share the same habitats. If you own land in the Virginia Piedmont, whether a large farm or estate, or a small backyard, you can help provide valuable habitat for birds. Simple changes can provide great benefits to birds and other wildlife. For example, allow native vegetation to grow along a fence row, or reduce your lawn footprint by removing turf and planting wildflowers.

While this guide offers general recommendations for habitat management, management decisions may depend on your particular situation. Consider talking to local experts in your area who can help answer property-specific questions. The guide is organized by habitat type, with additional sections on invasive plants, biofuels, resources, and connecting with professionals.

Nearly 130 species of birds breed in the Virginia Piedmont. Data show that populations of many of these species have declined in recent decades. Habitat loss and degradation are the most significant factors causing these declines. Suburban and agricultural development have eliminated much of the region's hardwood forest, and non-native plants and lack of management have impaired much of what remains. Non-native grasses of sub-optimal value to most birds dominate pastures, and early mowing for hay destroys the nests of birds that attempt to breed in tall grass. Farm modernization and increased pesticide use have reduced the value of agricultural lands for birds, in part by eliminating many brushy fence lines, ditches, and road banks that formerly provided valuable habitat for nesting and foraging.



Why are bird population declines and habitat loss important to consider? Birds are an integral part of our ecosystems and thus help maintain the dynamic balance of nature. They are some of our best pest control agents, reducing rodent populations and helping to keep insect populations in check that might otherwise defoliate and damage timber and crops. Birds also serve as one of our most efficient seed dispersers, helping to maintain the vigor of our forests and grasslands and enabling propagation of many woody plant species with direct value to humans. Many bird species act as scavengers, providing services such as waste removal, disease regulation and nutrient cycling. Birds also act as ecosystem engineers, building or excavating nests that are used by a number of small mammals, reptiles and amphibians, and insect species. In addition, birds are aesthetically pleasing, providing beauty of both sight and sound. Birdwatching has become a very popular pastime, generating billions of dollars each year spread across local economies. Perhaps most importantly, birds and other wildlife depend on sound habitat stewardship by those of us who are landowners, and it is our responsibility to assure that future generations have these natural resources to nurture and enjoy. Read on about how you can help.



Agricultural field border, Mike Budd

Agricultural Habitat

Management of agricultural land can have important implications for birds. Not only do some birds make direct use of this habitat, but many other species, both close by and distant, can be affected by agricultural practices.

Several bird species that occur in the Piedmont have been documented to nest directly in crops. A great many other species use the open fields for hunting and foraging and nest in the weedy borders and shrubby edges of cropland. Raptors, including Red-tailed Hawk, American Kestrel, Northern Harrier, Barn Owl, and Great Horned Owl, hunt in crop fields, removing small rodents and insects. In fall and winter, agricultural fields provide food for migrating and wintering sparrows, Northern Bobwhite, and Wild Turkey. Waterfowl and shorebirds frequently feed in flooded portions of crop fields during migration. Depending on their quality, agricultural buffers can be used by a wide variety of shrubland breeding species, including Northern Bobwhite, Common Yellowthroat, and Indigo Bunting, as well as by wintering sparrows.

Maintaining Active Agricultural Production with Considerations for Wildlife

Increasing the availability of cover and food sources on your farm is key to attracting wildlife. Here are three techniques to consider:

Tillage

Conventional tillage practices, including disking or plowing, are detrimental to birds and the surrounding environment. These practices increase potential for soil erosion, which results in siltation of streams and wetlands. This can compromise the biological integrity of these delicate ecosystems, reducing their ability to support wildlife populations.

Consider replacing conventional tillage with a no-till regime or conservation tillage. For either practice, at least 30% of the soil remains covered by plants or plant residue.

- Conservation tillage helps to keep the soil in place, provides habitat for birds, and increases food availability.
- Conservation tillage and no-till leave more waste grain available as food for birds.
- No-till agriculture provides the greatest nesting and foraging opportunities for certain bird species. However, this practice is often accompanied by increased use of pesticides. Pesticides can poison birds directly, reduce their breeding success, and kill the insects that make up a large portion of their diet. Furthermore, they can impact the environment as far away as the Chesapeake Bay through runoff. If you employ no-till agriculture, consider practicing integrated pest management and minimizing the use of pesticides.



From Left to Right:
Common Yellowthroat, Barth Schorre
Indigo Bunting, Kelly Colgan Azar
Killdeer, Amy Johnson



Top Left: American Kestrel, Gary Smyle • Top Center: Agricultural field border, Marc Puckett • Top Right: Red-tailed Hawk, Gary Smyle • Below: Northern Bobwhite, Amy Johnson

Establishing and Maintaining Cover

Birds need cover to avoid predation. Maintaining residue or active growth on fields provides cover and reduces soil erosion and its associated problems. Ideally, ground cover should be present year-round.

- Rotate crops to maintain and improve soil productivity and fertility, reduce soil erosion, control weeds, and manage plant pests by breaking the pest cycle.
- Plant a cover of native grasses, grains, or legumes in unused fields or as a part of crop rotation. This provides many of the same benefits as crop rotation while also creating food and habitat for wildlife. Maintaining plant cover year-round is even better. See a list of native grass species in the 'Grasslands' section.
- In larger fields, planting alternating strips of native grasses or close-growing crops with cultivated crops can provide valuable nesting habitat and cover for wildlife.
- Leaving field and waterway edges unmowed and ungrazed helps prevent runoff and erosion, and provides areas where birds can raise young.

Field Buffers

In the past, the natural hedgerows and weedy areas often found around farmsteads provided both cover and abundant insect food for birds. These buffers were also critical habitat for

native pollinators, which play an important role in crop pollination. Herbicides and the tendency to eliminate brushy areas for aesthetic reasons or to maximize production have resulted in the loss of many of these shrubby habitats. This in turn has negatively impacted wildlife.

- Buffers between crop fields and forests or crop fields and pastures are very beneficial. Installing buffers between individual crop fields can also provide habitat for birds and attract pollinators.
- Buffers between 35 and 300 feet in width provide significant benefits for birds and other wildlife, with wider buffers being better. While much less beneficial to birds, buffers narrower than 35 feet are still helpful in preventing erosion and slowing runoff.
- Buffers should be planted with a variety of native plants of differing heights and sizes that provide food (fruit and nut-bearing tree and shrub species), winter cover (e.g. red cedar and American holly), and nesting opportunities.
- Manage buffers to control the spread of invasive plant species. Management is best accomplished in March or late August, either before or after the nesting season.
- Care should be taken not to create buffers against inhospitable areas like highways, as this creates a death trap for birds.



Northern Bobwhite

The iconic, sharply-whistled 'bob-white!' call may bring back nostalgic memories to those who heard it regularly back when quail were much more numerous in rural Virginia. Since then, changes in the quantity, quality, and distribution of its preferred habitats across the landscape have caused widespread declines in quail populations. While bobwhite quail can be successfully managed in timber stands, in Virginia's Piedmont they are still very much associated with farmland. There they are able to exploit weedy, brushy habitats such as field borders along active agricultural row crops. Consider playing a role in 'bringing back the Bobwhite' by consulting with Private Lands Wildlife Biologists and exploring the various quail-friendly cost-share programs available in the Commonwealth.

who lives here?

Grasslands

Barn Owl, ClipArt.com



Grasslands occurred mostly in the western Piedmont and along river systems in presettlement times. They were maintained there for thousands of years by human manipulation. Even before the European settlers cleared land for pasture and crops, Native Americans had maintained open areas through the use of fire. Fire-maintained grassland composed of giant cane (*Arundinaria gigantea*) used to be common in the Dan, Roanoke, and Bannister River floodplains. Now giant cane is rare in the Piedmont, since most canebrakes were cleared for crop cultivation, or grazed by livestock. Unfortunately, giant cane is difficult to re-establish since it spreads mostly

by rhizomes instead of seeds. Current Piedmont grasslands consist primarily of introduced cool-season grass pasture and hayfields.

Bird population analyses show that grassland birds are declining nationwide. The trend in the Virginia Piedmont is similar, with some breeding species, including Henslow's Sparrow, being nearly extirpated, and common species like Eastern Meadowlark and Grasshopper Sparrow in steep decline. This is largely due to habitat loss and fragmentation. Many bird species that nest exclusively in grasslands require tracts that exceed 20 acres in size in order to nest successfully. Piedmont grasslands are divided among many landowners with different management objectives and practices. This results in relatively small grassland patches that are often too isolated to be of real value to grassland-dependent bird species.

The decline in grassland bird populations is also driven by habitat degradation and conversion. This occurs via development, the introduction of non-native cool-season grasses, or through natural succession to shrubland and forest if grasslands are not actively maintained. Native grass meadows provide food, nesting sites, and appropriate ground cover structure for grassland

birds. The grasses in these native ecosystems tend to grow in bunches, allowing for movement on the ground for species such as Northern Bobwhite, while also providing overhead cover from predators and inclement weather because of their height and rigid structure. Introduced cool-season grasses provide inferior habitat for wildlife due to their lack of ground-level gaps (which facilitate movement) and overhead cover. Native warm-season grasses grow taller and have more rigidity to their structure than do cool-season grasses, resulting in more substantial shelter for wintering birds.

Creating and Maintaining Grassland Habitat

Size and configuration—Before you begin to manage or create a grassland on your property, first consider the size of your project area and its proximity to other ecological communities.

- Due to their breeding area requirements, certain grassland birds species will not use parcels smaller than 20 acres. If your tract is less than 20 acres in size, consider coordinating with adjacent landowners if some or all of their land can be co-managed to exceed that

Eastern Meadowlark, Matthew Paulson



threshold, or manage your smaller tract as a shrubland (refer to 'Shrublands' section).

- While not ideal, small fields (< 100 acres) can still provide breeding habitat for Bobolinks, Eastern Meadowlarks, Northern Bobwhite, and Savannah Sparrows. Larger tracts (>100 acres) support Grasshopper Sparrows and create the potential for re-establishment of Upland Sandpipers and Henslow's Sparrows. Northern Harriers, Short-eared Owls and other raptors may also use the fields for hunting in the winter.
- Circular or square tracts are better than rectangular or elongated tracts for grassland birds because they minimize the edge to area ratio, which reduces predation and therefore increases reproductive success.
- If managing primarily for pollinators, even small or irregularly-shaped tracts of native grasses and forbs can provide useful habitat.
- Placing roads and infrastructure near the edges of fields—rather than in the center—can help minimize fragmentation.

Optimum species composition

The most beneficial grassland plant species for wildlife are native grasses and forbs. Though no one mix will fit every scenario, Private Lands Wildlife Biologists, wildlife biologists, Virginia Cooperative Extension agents, or others familiar with native warm-season meadow establishment will be able to design a mix suited to your goals and the site's potential.

- Avoid seeding new meadows with exotic sod-forming grass and lawn grasses such as Kentucky bluegrass, orchardgrass, and tall fescue, which are all cool-season species.
 - These grasses are not beneficial to birds and require intensive on-going care, like fertilizer and herbicide applications that are costly and harmful to wildlife.
- Native warm-season bunch grasses do not require fertilizer to be highly productive, unlike introduced warm-season grasses such as bermuda or zoysia.
- These grasses provide dependable forage production during the summer for livestock when exotic cool-season species have slowed in growth.
- Daily weight gains for cattle range from two to four times higher on native grass species than on fescue in the warmer months, with fewer inputs and higher drought and heat tolerance.
- If grazing or hay production is one of your primary goals, your ideal seed mix will be more heavily weighted towards native grasses such as big and little bluestem, indiagrass, eastern gamagrass, switchgrass, or any of a number of other native species shown to be high-quality forage.

- Seeding rates will be lower if you are planting specifically for wildlife. This is especially true in meadows managed for birds, since looser stand structure can provide for easier ground movement.
- For native grass hayfields, a mixture of big and little bluestem and indiagrass will mature later in the hay season than other native species, allowing for later cutting dates (in the third or fourth week of June).
- Add native forbs to meadows to attract insects, birds and



Loggerhead Shrike

Reminiscent of a mockingbird with a black mask, the Shrike is nicknamed the 'Butcher Bird' for its habit of impaling prey on thorny shrubs and barbed wire. Like a raptor packed into a songbird's body, the Shrike hunts insects, small mammals, reptiles, and occasionally birds. Once widespread, Shrikes are now fairly rare in Virginia, although the causes of their decline are poorly understood. They are most often found in grazed pastures with scattered shrubs. Have a Shrike on your property? Consider reporting it to the VA Department of Game and Inland Fisheries (804-367-1000 or dgifweb@dgif.virginia.gov) to help with current conservation efforts.

who lives here?

Loggerhead Shrike, Dick Rowe



Native Grasses and Wildflowers, Bruce Jones

other wildlife. Insects are a vital source of protein for birds during the breeding season, and many insects act as pollinators.

- The loss of milkweeds is one of the top factors contributing to the recent decline of the iconic monarch butterfly. Milkweeds are the host plants for monarch caterpillars. Consider planting native milkweeds in grasslands, shrublands, or even your garden to help improve the outlook for monarch populations.

Management

Without management, grasslands will naturally transition to shrubland and eventually forest through the process known as succession. In Virginia, maintaining land as grassland requires periodic disturbance such as grazing, fire, or disking. These disturbances make it difficult for woody plants to encroach on the grassland, while maintaining the heterogenous stand structure most beneficial to grassland birds, pollinators, and other wildlife.

Ideal grassland habitat for wildlife should mimic pre-colonial conditions, which consisted of patches of grassland of different heights and stages: patches of tall grass provide nesting sites and cover, burned areas allow for better wildlife movement, and areas dominated by forbs produce desirable seeds for forage. If creating a variety of habitats is not feasible, maintaining just one of these habitats will still benefit wildlife and improve grassland health.

Grazing:

- Avoid year-round, uncontrolled grazing. Doing so degrades habitat for many wildlife species.
- Rotational grazing, in which some fields are moderately grazed and others are left idle, is the best practice for maximizing forage productivity and soil health. This is also a preferred method for controlling grass height to benefit birds nesting in introduced, cool-season grasses.
- Season-long grazing of native warm-season grasses at moderate stocking rates can help maintain the ideal grass height for nesting bird species.
- Stocking the pasture with the right number of cattle (usually about two per acre during the warmer months) will result in a grazing pattern that keeps the height of the grasses below 36 inches but above 8 inches, which is above the growing points that the grasses need for regeneration. This height range favors a number of grassland bird species.

Hay production:

While haying is not always compatible with wildlife conservation, it can remain financially viable while benefitting wildlife if certain practices are followed.

- Indiangrass and big and little bluestem are ideal species for native hayfields; they are later to mature than other native grass species and therefore will not need cutting during initial nesting times that are critical for grassland bird populations.



Upland Sandpiper, Gary Smyle

- Unlike cool-season hay meadows, native hayfields only need to be cut once per year, so they are cheaper to maintain. They should be cut above 8 inches to protect the growing points of the grasses.
- Timing of cutting is crucial for wildlife management. If nesting grassland birds are a priority, the best time to cut is early spring (March or early April), followed by late summer or early fall (August-September). Avoid cutting from mid-April through the end of July when most birds are using grasslands for nesting and brood rearing. Note that maximum hay production and bird conservation are incompatible, especially with cool season grasses such as fescue and timothy.

Prescribed fire:

Virginia's Piedmont plant communities developed in concert with burning by humans. Native Americans used fire for millennia to accomplish a number of land management goals, including the creation of wildlife habitat. Consequently, prescribed fire has myriad benefits for creating and maintaining wildlife habitat in Virginia's grasslands.

- Fire reduces woody species and maintains diverse early successional habitat, keeping the landscape open and dominated by grasses and forbs. Fire also increases the nutritive value of forage species, clears dead leaves and grass litter (allowing easy passage for ground-nesting birds), puts nutrients back into the soil, and suppresses competition from invasive species.

- Burn in the early spring (early April), before grasses green up but when trees are generally no longer dormant. If this is not possible, burn in the fall (October-November). Fall burns benefit grasslands but result in removal of good habitat for wintering sparrows and raptors.
- Prescribed burns should be planned and carried out by a certified burn manager. Consult the Virginia Department of Forestry for current Virginia fire laws, and make contact with local authorities; refer to the 'Resources' section of this guide to find organizations and agencies that can help you connect with a prescribed burn contractor.

Disking and mowing:

If none of the above is an option, consider using a combination of disking and mowing to maintain grassland for wildlife.

- Light disking in alternating strips or disking a different portion of your property each year can be useful for creating a mosaic of different stages of grassland habitat. This will also reduce turfgrass species and allow beneficial early successional species already present in your soil seed bank to germinate.
- Be aware that disking will disturb the dormant seed bed and could cause a flush of invasive plant growth. Consult your local wildlife biologist for management recommendations if exotic species begin to colonize your disked fields.
- Mowing or bush hogging once a year is effective for controlling grass height and reducing woody species encroachment. Consult with your local wildlife biologist or Private Lands Wildlife Biologist for more information on mowing times, as the timing will depend on your plant community composition and the wildlife species you are targeting for habitat creation. Mowing a field from the inside out will give wildlife an opportunity to escape.
- As with haying, mowing height should not be lower than 8 inches.

Shrublands



Bottom: Field Sparrow, Bill Hubick • Top: Prairie Warbler, USFWS

Shrubland consists of areas of scattered woody plants (less than roughly ten feet tall) interspersed with open patches of grasses and forbs. Shrublands are also referred to as early-successional habitat--open habitat that is undergoing ecological succession as it matures to forest. Examples of such habitats include regenerating clearcuts, hedgerows, thickets, powerline rights-of-way, restored strip mines, and old fields that have been abandoned and allowed to grow up into vegetation.

"Shrubland birds are among the higher conservation priorities for the Piedmont as identified by the Virginia Department of Game and Inland Fisheries in the Virginia Wildlife Action Plan."

In many cases the transitional area between grassland and forest consists of shrubby, edge habitat.

Shrubland habitats may appear unkempt, so they are frequently cleared or allowed to grow into forest, most often through neglect. The loss of this type of habitat has adversely impacted birds that are dependent on shrublands for nesting, brood rearing, feeding, and escaping predation. As a result, shrubland birds are among the higher conservation priorities for the Piedmont as identified by the Virginia Department of Game and Inland Fisheries in the Virginia Wildlife Action Plan. Among these species are Northern Bobwhite, American Woodcock, Eastern Towhee, Field Sparrow, Yellow-breasted Chat, Eastern Whip-poor-will, Brown Thrasher, and Gray Catbird. Another species, Prairie Warbler, occurs in higher relative abundance in Piedmont shrublands than in any other part of their range. Shrubby areas also provide highly valuable stop-over habitat for a large variety of neotropical songbirds, like warblers, during spring and fall migration, and wintering habitat for several species of sparrows.

Creating and Maintaining Shrubland Habitats

Size and configuration—Early-successional bird species can thrive in shrubby habitat regardless of size or configuration. This provides a great opportunity to restore and manage small, unused areas of 20 acres or less as bird habitat. Maintaining land parcels larger than 20 acres as shrubland can be difficult. Old fields between 20 and 100 acres might best be managed for birds as grassland, while those larger than 100 acres could be allowed to grow into forest. However, these management recommendations are both landscape and context dependent. For example, if a patch of land that is smaller than 20 acres is adjacent to a large forest tract, it may be more beneficial for wildlife to convert it to forest, thus creating a larger area of intact forest. On the other hand, there are some forest birds whose young use nearby shrubby habitats shortly after coming off the nest. Before making a final decision, consult a wildlife management professional.

Establishment and Management



Creating shrubland habitat from forest requires aggressive management, which may include stump removal, planting, mowing, and herbicide application for a few years to allow the appropriate vegetation to become established. Converting a grassy area into shrubland habitat is easier, and typically involves tree and shrub planting, and weed control. Once created, shrublands require management to prevent them from succeeding into forest.

- Establish hedgerows at the edge of fields when possible, as these are key areas for birds.
- Hedgerows should be as wide as possible; benefits greatly increase at widths of 35 feet or more.
- A diverse mix of native, fruit, or nut-bearing shrubs and small trees is optimal for supporting a unique assemblage of shrubland-adapted birds. Visit the 'Resources' section for suggested references on plant species selection.
- Maintenance of existing shrublands requires periodic disturbance such as burning, mowing, grazing, selective removal of trees, and where necessary, herbicide use. Invasive plant species can gain a foothold in shrublands very easily; assessing your shrubland for invasive plant

encroachment on a yearly basis is important.

- No maintenance should occur from mid-April through August when birds are nesting and raising young.
- Burning should be done in the early spring (early April) when trees are generally no longer dormant. If this is not possible, burn in the fall (October-November).
- Prescribed burns should be planned and carried out by a certified burn manager. Consult the Virginia Department of Forestry for current Virginia fire laws, and make contact with local authorities; refer to the 'Resources' section of this guide to find organizations and agencies that can help you connect with a prescribed burn contractor.
- Timing the management of established shrublands depends greatly on size, species composition, invasive prevalence, and the current state of succession. Small patches that consist primarily of forbs, grasses, and shrubs will need to be managed every 2-4 years. Established shrubland habitats usually only need management about every 5 years.



Yellow-breasted Chat

As the largest member of the wood-warbler family in the United States, the Chat does not look like a warbler and certainly does not sound like one; the aptly-named Chat appears to be having a long, loud conversation with itself. The Chat is associated with dense, shrubby habitats, which makes it easier to detect by ear than by eye, despite its white spectacles and bright, lemon-yellow throat and breast. Look for breeding Chats in your area between May and July; they spend the winter months in Mexico and Central America. Although still fairly common, over 60% of the Chat's population in Virginia has been lost since the mid-1960s, most likely due to loss of habitat.

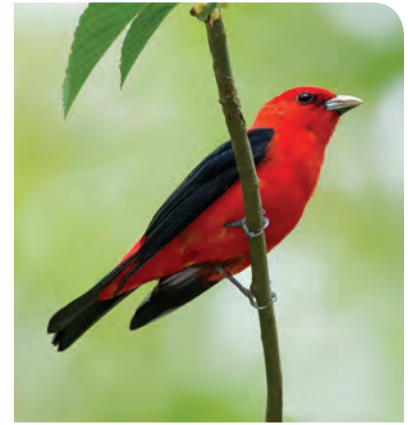
who lives here?

Forests

The Virginia Piedmont supports deciduous hardwood forests, coniferous forests, and mixed conifer-hardwood forests. Oak, maple, and hickory species are predominant in Piedmont hardwood forests. Tulip poplar, beech, red maple, and sweetgum are also present in the overstory. Loblolly and Virginia pine are the primary species in pine forests, along with smaller numbers of shortleaf, white, and pitch pine.

Although European settlers cleared a large extent of Virginia forest, the amount of forest began increasing in the 1940s following broad declines in agricultural production. Then in the early 1990s, Virginia's forests began declining once again due to urbanization and development.

Bird populations in forests increase in density and diversity as the forest gets older, reaching a maximum in forests exceeding 100 years of age. Older forests also tend to support more dead trees or snags, which are important habitat components for many cavity nesting birds and for the approximately eight bat species that breed in the Virginia Piedmont. Woodpeckers excavate cavities for nesting and roosting in dead and decaying snags, which can eventually be used by secondary cavity nesters such as Wood Duck, Prothonotary Warbler, and Great Crested Flycatcher; none of these species is able to excavate its own nest cavities.



Left: Black-and-white Warbler, Richard Crook
Right: Scarlet Tanager, Kelly Colgan Azar

The hardwood forests of the mid-Atlantic Piedmont are the heart of the breeding range for species including but not limited to the Wood Thrush, Scarlet Tanager, Acadian Flycatcher, and Eastern Wood-Pewee. Other species found in Piedmont hardwood forests include the Kentucky Warbler, Worm-eating Warbler, Barred Owl, Red-headed Woodpecker, and Cooper's Hawk. Open pine forests can support Brown-headed Nuthatch, Whip-poor-will, and Prairie Warbler.

Creating and Maintaining Forested Habitats

Size and configuration—Many forest interior bird species require large forest tracts for successful breeding, even though their individual territories may be relatively small. This is because predation rates on bird eggs and young are much higher closer to forest edges. Larger tracts have a

higher proportion of interior habitat. Smaller tracts, however, have larger amounts of edge relative to interior habitat. Unfortunately, most of the forested land on private property in Virginia consists of highly fragmented small- or medium-sized tracts.

While bigger is usually better, reforesting smaller tracts can be valuable for stop-over habitat for migrating birds and also for connecting forest patches. Minimizing edge in smaller forested tracts helps to reduce predation; tracts that are circular or square in shape are preferable over long and narrow tracts. When an option, consider expanding existing forest tracts, particularly if it increases the amount of forest interior (defined as occurring deeper than 330 feet from the forest edge). Locate new roads and utility lines around the forest and maintain a closed canopy over existing roads.

Restoration



Left: Barred Owl, Trish Hartmann
Right: Pileated Woodpecker, Bruce Jones

- Consult with a forester in order to determine which type of forest your land supported historically and/or what type of forest best fits into the surrounding landscape. Be sure to establish a forest type that can be supported by the soil and climate in your area.
- Ask the forester to produce a diverse plant list so you can attract different species of wildlife.
- Deer can decimate newly planted seedlings, so fence out deer from new plantings or consider using tree shelters.

Management

- Livestock should be fenced out of forest stands.
- Monitor regenerating forests for invasive species, which can take over in as little as a year if not controlled.
- Forests with more structural complexity support a greater variety of bird species.
- Promote native ground cover and understory plants to ensure the best habitat structure for birds. A forest that has

varying layers of vegetation (herbaceous layer, shrub layer, sapling layer, and canopy) will provide habitat for the greatest diversity of bird species.

- Creating coarse, woody debris piles in a forest provides habitat for some birds as well as small mammals, amphibians, and reptiles. Dead trees, limbs, and litter on the forest floor also provide cover and a source of invertebrate food.
- Standing dead trees provide foraging sites for woodpeckers and natural cavities for nesting. Aim for at least four standing dead trees per acre.

Special Considerations— Hardwood Forests

- Thin young stands every three to ten years to remove weak, poor quality, or suppressed trees. This allows more growing space for the remaining healthy trees and sunlight penetration that benefits mid- and understory plants.
- Periodic thinning also helps reduce the risk of insect infestations, disease, and



Wood Thrush

A cousin of the familiar American Robin, the Wood Thrush lights up forests and woodlots with its mysterious, ethereal song. It forages on the ground, probing for insects and spiders among the leaf litter. Although it is still fairly common in the Virginia Piedmont, Wood Thrush populations continue to decline in the Commonwealth and across its broader breeding range. These declines may be driven by habitat loss and fragmentation on its breeding grounds in the eastern U.S. or on its wintering grounds in southern Mexico and Central America.

who
lives
here?

Wood Thrush, Kelly Colgan Azar



Left: Yellow-throated Warbler, Big Dipper 2
Right: Red-eyed Vireo, Kelly Colgan Azar

catastrophic fires.

- Thinning that preserves mast-producing trees and seed-producing shrubs helps sustain songbirds, deer, black bear, Wild Turkey, and small mammals through the winter months.
- Girdling a tree allows the tree to die while standing. A shallow cut is made into the cambium, around the entire circumference of the tree. Girdle some large but malformed or damaged trees to create snags for nesting and perching. Try to select trees that already have some decay to accelerate cavity formation.

Special Considerations— Pine Forests

- Loblolly and shortleaf pine stands are planted at an initial density of 400-450 trees per acre (TPA) for timber production. Consider planting at 300-350 TPA for improved wildlife value. This will increase the amount of sunlight that can penetrate through to the forest floor. Increased sunlight promotes plant growth, thus enhancing insect activity and resulting in a greater number of bird species.
- To enhance wildlife values further, consider shortleaf pine instead of loblolly. Shortleaf was native to many parts of the Piedmont that have since been planted in loblolly pine.
- Add a few outer rows or clumps of shrubs to enhance the array of birds using the area.
- Young pine stands are often densely stocked, sometimes exceeding 2,000 TPA. These stands will benefit from a precommercial thin down to 10 foot x 10 foot spacing. Young pine stands can be outcompeted by hardwood species. If your goal is to maintain a pine stand, use prescribed burns or selective herbicide treatments targeted specifically at hardwoods. Take care to not eliminate ground

cover and understory plants.

- Thinning benefits wildlife and is also economically beneficial, resulting in increased growth in diameter and volume of timber.
- To significantly increase bird diversity, 15 to 20 year old stands should be thinned to 150 to 175 TPA. This allows at least 50% of the ground to have sunlight at noon.
- A second thinning should be considered as the pine canopy again closes, typically at about ten years after the first thinning. Thin to 85-100 TPA for a stand of large pines that is attractive to wildlife and financially profitable. Thin as early as economically feasible.
- Conduct a burn of the entire thinned stand roughly a year post-thin. After this initial burn, at least one third of the acreage should be burned every year to control hardwood establishment.
- Prescribed burning removes excess logging debris that could be a fire hazard, and stimulates herbaceous growth, which provides excellent habitat for turkey poults and quail chicks.
- Herbaceous growth responds best to burning in early spring. If this is not possible, burn in the fall after birds have nested.
- Burning requires skill, planning, and experience. Safety and compliance with burn laws is critical. A certified burn manager and the Virginia Department of Forestry (DOF) should be consulted before any burn is considered. Local authorities should be notified of any prescribed burn activities. Virginia fire laws can be found on the DOF website. The 'Resources' section contains references that can direct you to contractors who carry out prescribed burns in Virginia.

Savannas: A Special Case

Vast acreages of pre-colonial Virginia were once covered by savanna, a fire-dependent ecosystem that blended a sparse forest overstory with an open prairie-like understory. These savannas were maintained by frequent surface fires, originating both from lightning and from intentional burning by Native Americans. A host of species such as the Brown-headed Nuthatch, Bachman's Sparrow, and southeastern fox squirrel have a strong association with pine savannas. Some forest birds, such as the Red-headed Woodpecker, and early-successional birds, such as Prairie Warbler, also do particularly well in savannas.

While the most well-known Virginia savannas were the 1 million acres of longleaf pine in southeastern Virginia (mostly southeast of Petersburg), the earliest historical accounts also describe extensive savannas along the western Piedmont into the Blue Ridge foothills and along the major Piedmont river corridors. These savannas were a composite of

fire-tolerant oak, pine, and hickory species. Today, so few oak savannas remain that they have been listed as one of the most endangered ecosystems in North America; pine savannas have experienced a similar decline. In both cases, this is largely a result of the exclusion of fire from these ecosystems, altered forestry management practices, and colonial-era deforestation that supplied burgeoning U.S. timber industries.

Savannas may be managed for both habitat creation and timber production goals. For example, a loblolly plantation thinned after 16 years to 150-175 trees per acre will thrive with a regular prescribed fire regime, producing both useful timber and early successional habitat that birds such as bobwhite prefer.

Savanna Establishment/Restoration

- Undertaking savanna establishment or restoration involves a commitment to the regular use of prescribed burning, typically every two

or three years. The goal is a scattered stand of trees with a grassy/herbaceous groundcover. This habitat structure provides trees for nesting and perching, and an open and diverse herbaceous layer for foraging and nesting. It also provides continuous, light vegetative fuel which supports frequent fire which, in turn, is capable of controlling woody species invasion.

- While savanna creation/restoration can begin with planting trees in field settings, it is more quickly and easily accomplished by thinning in established forest stands. Pine thinning (see 'Special Considerations - Pine Forests' in the 'Forests' section) will produce a savanna stand with an open canopy. However, reducing the TPA even further will produce better ground cover. A third thinning will most likely be required to maintain more than 50% sunlight on the forest floor.
- Creating and maintaining



Left: Brown-headed Nuthatch, Bill Hubick
Center: Prairie Warbler, Bill Hubick
Right: Red-headed Woodpecker, Greg Lavaty



Left: Prescribed burning, David Stephens, Bugwood.org
 Right: Oak savanna, Amelia Wildlife Management Area, Marc Puckett

herbaceous ground cover requires regular burning. The initial post-thin burn is usually the most difficult, as you have to contend with logging slash (the woody debris leftover after thinning).

- In order to promote a diversity of herbaceous plants and to better control unwanted hardwood species, it is recommended that every other prescribed burn be carried out in the growing season (April-August), while all other burns can occur during the dormant season (January-March). Varying the burn season can be beneficial for promoting plant species diversity and wildlife habitat.
- Growing season burns are much more effective at controlling woody plants. However, burning during the growing season can be more challenging than during the dormant season, and can be dangerous for breeding wildlife. Talk to a burn manager and a biologist to assess the need for and logistics of a growing season burn before undertaking it. It may require additional precautions.
- Herbaceous ground cover is critical to a fully functioning savanna. The ground layer may be slow to establish, but prescribed burning will usually yield a surprising array of native plants that have been either lying dormant under the shade of a well-stocked forest,

or which rapidly colonize an area that has been thinned and burned. Again, prescribed burning requires expertise, planning, and suitable weather. Consult with the Virginia Department of Forestry prior to burning.

- Sometimes a diverse ground cover does not materialize, in which case it may be necessary to augment the developing savanna by seeding the native plants appropriate for your site and management goals. Consider grasses such as wild rye, indiagrass, little bluestem, broomsedge, and bottlebrush grass, as well as wildflowers such as partridge pea, wild senna, goat's rue, beggar lice, black-eyed susan, narrow-leaf mountain mint, and grass-leaf blazing star.
- Landowners may want to consider forest types other than loblolly pine as likely settings for savanna restoration. Historically, shortleaf pine and oak/hickory dominated hardwood savannas are likely to have been the preeminent community types within large areas of the Piedmont. If restored, they could yield high wildlife habitat values and benefits for landowners.
- The Virginia Department of Game and Inland Fisheries has an ongoing experiment at the Amelia Wildlife Management Area to determine the most efficient method of restoring

hardwood savanna. In Halifax County, the Virginia DCR is restoring shortleaf pine and hardwood savannas at the Difficult Creek Natural Area Preserve.



Eastern Whip-poor-will

Perfectly camouflaged against the forest floor or on a horizontal tree limb during the daytime, the Whip-poor-will is known for its loud, incessant, territorial call given on bright moonlight nights during the summer. Whip-poor-wills breed in the leaf litter of hardwood/mixed pine-hardwood forests with open understories, such as savannas. They forage on insects at dusk, dawn, and by the light of the moon. They spend the winter south of Virginia along the Atlantic and Gulf Coasts and into Mexico and Central America. Conversion of habitat to pasture and crops, urbanization, and fire suppression leading to dense understories are contributing to the bird's decline.

who lives here?

Eastern Whip-poor-will, Dick Rowe

Wetlands & Riparian

A variety of habitats in the Virginia Piedmont are associated with water. These include vegetated areas along river and stream banks (also known as riparian areas), natural wetlands, and wetlands and other habitats associated with human-created water features such as agricultural waterways and farm ponds. Among the many wetland types are marshes with emergent vegetation such as cattails, grasses, and reeds; forested wetlands (also known as swamps); seeps and springs; wet meadows; and seasonal wetlands known as vernal pools. Wetlands can also form as a result

of beaver activity. In addition to providing specialized wildlife habitat, wetlands perform valuable ecological functions like slowing flood waters, reducing erosion, and filtering sediments. Vegetated riparian areas likewise provide habitat for birds and other wildlife, while also slowing sedimentation, regulating water temperature, and contributing to the food base that supports wildlife species.

The ecological importance of wetland habitats is underappreciated and wetlands are sometimes viewed as wasted or useless areas. Consequently, wetlands are often converted to other land uses, which make them one of the habitats most vulnerable to loss. According to the Environmental Protection Agency, approximately 40% of Virginia's wetlands have been lost since the late 1700s. Vegetated riparian areas have also suffered from conversion to other land uses. Many non-game migratory bird species that are threatened or declining depend on inland freshwater habitats for at least part of their life cycle. These include a number of warblers associated with forested riparian areas, such as Northern Parula, Kentucky Warbler, and Louisiana Waterthrush; this last species has a large portion of its breeding population in the Virginia Piedmont. Bird species associated with Piedmont wetland habitat include Green Heron, Great Blue Heron, Prothonotary Warbler, King Rail, Least Bittern, and Pied-billed Grebe. Migrating shorebirds, wintering and breeding waterfowl, and other breeding rails and wading birds also benefit from well-managed wetlands.

Because of their value and their declining status, wetlands are protected by state and federal laws, which need to be considered when managing these sensitive habitats. When modifying a wetland, you must contact the Virginia Department of Environmental Quality (www.deq.virginia.gov) and the Army Corps of Engineers (www.usace.army.mil) for permitting information.

Creating and Maintaining Wetlands and Riparian Areas

The sections that follow include specific management recommendations pertaining to particular habitat types.



Bottom: Northern Parula, Dick Rowe • Top: Green Heron, Amy Johnson



However, there are general guiding principles that management of all these habitats have in common:

- Maintain a buffer of native vegetation. A buffer is a vegetated strip abutting a water feature which helps protect that waterbody from impacts from adjacent land uses. Using or maintaining native vegetation that is adapted to the local landscape and climate is ideal. Doing so allows the use of fewer fertilizers and pesticides, and helps maintain natural ecosystem function.
- Prevent the introduction and spread of non-native, invasive plant species, and work to control them where they are already established. Invasive plants out-compete native vegetation, can spread widely, and can be difficult to control once established. They also often form monocultures which reduce native plant diversity and, as a result, the diversity of wildlife. Monitoring for non-native invasives along streams and rivers is particularly important in order to avoid the spread of seeds further downstream.

- Limit or avoid the use of pesticides and other chemicals in the vicinity of wetlands or water bodies. Avoid storing chemicals near water.
- Exclude livestock from areas in and around water whenever possible in order to decrease contamination, prevent soil erosion, and protect overall water quality.

Riparian Areas

Establishing a riparian buffer of woody vegetation is one of the best ways to protect water quality, while also providing additional wildlife habitat. Riparian buffers protect adjacent waters from sedimentation, the most prevalent form of stream pollution, by slowing the runoff from fields and other lands, and allowing sediments to deposit in uplands before reaching a river or stream. Riparian vegetation also shades streams, and thus maintains cooler water temperatures which benefit fish and other aquatic life that are the basis of the aquatic food web. Leaves and small twigs that fall from surrounding vegetation into streams and rivers are also critical to the maintenance of aquatic food webs, as they are consumed by many invertebrate species.

Creating a Riparian Buffer

- Riparian buffers should be at least 100 feet wide on each side of a river or stream in order to filter runoff, ensure flood protection, and provide habitat for birds and other wildlife. If this is not possible, strive to maintain a buffer of at least 35 feet so as to retain some degree of these benefits.
- If fescue or other competitive ground covers are present, it is recommended that they be removed prior to tree planting to reduce competition for resources. If using herbicides, be sure to use those specifically made for use near aquatic environments.
- After planting trees, seeding the ground with a complementary native ground cover or with understory shrubs helps to increase the buffer's wildlife value and prevent erosion.
- The goal for a successful riparian buffer is to have 70% canopy closure in 10 years. In order to accomplish this, plant trees within the buffer at 400 trees/acre, unless there is a good native seed source to



compensate for sapling mortality. Be sure to select native tree species that are appropriate for the site conditions. The Virginia Department of Forestry or Virginia Department of Game and Inland Fisheries staff can help you plan out the species mix for your buffer.

Managing a Riparian Buffer

- Control invasive plant species within the buffer. Invasive plant leaves and debris are not readily consumed by the invertebrates in aquatic environments. Invasives often outcompete native vegetation and offer little value to other wildlife species.
- Mowing is incompatible with the establishment of woody or forested riparian buffers. However, if mowing is necessary, it should take place between mid-November and mid-March.
- Protecting new seedlings with tree shelters is recommended. Without tree shelters, there is a 70% chance of mortality; with tree shelters, that figure decreases to 30%. Four foot shelters are preferred over two foot shelters, and have been shown to increase tree survivorship by 10%. The Virginia Department of Forestry can provide guidance on tree shelter installation, maintenance, and eventual removal.

- Note that tree shelters can cause mortality in birds that become trapped in shelters and have no way to escape. Consult with a professional for recommendations on how to reduce bird mortality.
- Fence riparian buffers to keep out livestock, which can cause stream bank erosion, consume vegetation, and degrade water quality.

Wetlands

Wetlands are fragile ecosystems that offer many benefits to both wildlife and humans. Protection and preservation of wetlands is of primary importance, and is best accomplished by avoiding disturbance. However, there are many options for enhancing and even restoring these ecologically-rich areas. Because wetland management is complex and specific to the type of wetland involved, it is best to consult with a professional before attempting any work. Biologists with the following organizations can be of help: the Virginia Department of Game and Inland Fisheries, The Nature Conservancy, the Virginia Natural Heritage Program, the Natural Resources Conservation Service, Ducks Unlimited, or an environmental consulting firm that specializes in wetland protection and restoration. While addressing the various types of wetlands is beyond the scope of this guide, recommendations are given for vernal pools as they are unique but also widespread.

Vernal Pools

Vernal pools are a type of wetland that consist of depressions in the soil that hold water for part of the year. They can be found in both open areas and woodlands. In Virginia they typically fill with water during the fall and winter, hold water through the spring, and dry up in the summer. Sources of water in vernal pools can include rainfall, melting snow, seasonal flooding, and rising groundwater. Because they are not connected to more permanent sources of water

such as streams, vernal pools do not hold breeding fish populations. The absence of predatory fish makes vernal pools important breeding sites for a variety of frogs, salamanders, and fairy shrimp.

- Because of their seasonal nature and because they can be relatively small, vernal pools may be difficult to identify and easy to overlook. This makes them vulnerable to being filled, drained, and polluted, or to the surrounding habitat being cleared. Vernal pools can be identified by documenting the presence of particular species that rely on them exclusively for breeding. Biologists with



Belted Kingfisher

Unmistakable through its harsh rattling call, the Kingfisher is also conspicuous in flight and easily identified by its large bill and blocky, crested head. The only Kingfisher found east of the Mississippi, this species is named for the rusty 'belt' that distinguishes the female from the male. Primarily a fish-eater, the Kingfisher can be found year-round across the Commonwealth along rivers, streams, lakes and ponds. It nests in burrows that it excavates where it can find suitable vertical earth exposures, including riverbanks, ditches, road cuts, landfills and sand pits. The causes of its decline are unknown, but the Virginia population seems to be faring better in the past dozen years.

who lives here?

The Nature Conservancy, the Department of Conservation and Recreation's Natural Heritage Program, and Virginia Department of Game and Inland Fisheries can help with vernal pool identification. Once a vernal pool has been identified, protecting it from year-round disturbance is critical in order to ensure its value to breeding amphibians and to other wildlife.

- Maintenance of a vegetated buffer around vernal pools is critical to their persistence. Surrounding vegetation protects vernal pools much like riparian buffers protect more permanent bodies of water. In addition, the amphibians breeding in vernal pools live out most of their annual life cycle in the surrounding uplands; these uplands are as necessary for their survival as vernal pools are for their ability to breed.

Farm ponds

- When digging ponds, create a shallow gradient that provides both vegetated borders and open mudflats. This will benefit waterfowl, rails, herons, and shorebirds.
- Avoid surrounding ponds with lawn grass and instead focus on native vegetation. Prevent livestock from grazing in these areas.

- Farm pond buffers should be at least 50 feet wide. They should include vegetation that decreases in height as one transitions from upland areas to the pond itself. This will provide the broadest benefits to birds. If this size buffer is not possible, strive for a buffer of at least 20 feet.

Agricultural waterways

- Allow agricultural waterways to grow grassy strips. This will limit transportation of sediment and agricultural runoff (fertilizers and pesticides) to surrounding lakes and streams. These strips should be as wide as possible, but a minimum of 35 feet in width. Strips that are at least 150 feet wide can provide habitat for some bird species.
- Maintain grassy strips by mowing or disking occasionally, but do not graze them, as this will eliminate their ability to slow water flow.
- Grassy strips should not be disturbed from April to August when most birds are nesting.
- Many herbicides and insecticides are toxic to aquatic life. In addition to maintaining buffer strips, avoid applying insecticides within 20 feet of the water's edge. If using herbicides, be sure to use those specifically made for use near aquatic environments.

Freshwater wetland, Briery Creek Wildlife Management Area, Dwight Dyke





Yard, flickr.com

Backyard & Suburban Habitat

Although the Piedmont is generally viewed as a pastoral landscape, suburban and urban development are increasing. Suburban areas tend to emphasize lawns and non-native ornamental plants, which have limited value as avian habitat. However, if managed properly, suburban backyards can offer benefits to many species. By adding native plants, curtailing pesticide use, and reducing the lawn footprint, developed areas can provide important food and nesting sites for many birds and pollinators.

Creating bird habitat in your yard

- If you have the ability to plan the structures in your lot, place them so that you can maximize the size of natural habitat blocks.
- Plant native plants! Native plants are the building blocks of ecosystems. By using natives, you can re-establish food webs in your own backyard. Insects are critical food for young birds, and native plants are important hosts for these insect populations.
- Avoid creating a manicured, park-like yard that provides habitat for only a few of the more common wildlife species.
- Creating a native hedgerow or thicket is a great way to attract a greater diversity of birds. Intersperse and mix native

shrubs, hedges, and thickets in your yard to create habitat islands and corridors.

- Select a variety of native shrub and tree species in order to provide both cover and food sources year round. Be sure to include a native evergreen like winterberry holly, for example, that provides an important food source for birds during the winter months.
- If your yard abuts forest, consider “softening the edge” of where your woodlot meets your yard. Transitional habitat is crucial to many bird species. Plant a variety of native tree and shrub species of successional height along your forest edge to increase habitat.
- Place water sources in the form of bird baths or small pools around your yard, but remember to empty and refill these every two days to discourage mosquitoes and the spread of mosquito-borne diseases such as West Nile virus.
- If your yard includes a stream, allow the vegetation to grow up around the edges or plant the banks with native vegetation rather than mowing.
- Minimize the use of fertilizers and pesticides that can harm wetlands and streams as far away as the Chesapeake Bay. Using native plants that are best adapted to growing in local conditions will minimize the need for these chemicals.

- Leave dead trees and snags in your yard as long as they are not a safety risk. The dead and decaying wood provides nesting cavities and



House Wren

Highly energetic and with a bubbly, ebullient song, the aptly-named House Wren is equally at home in suburban yards as it is in rural settings, if habitat conditions are right. Habitat includes open, shrubby areas in proximity to trees or woodlots. The House Wren will readily nest inside nest boxes and sheltered crevices in and around buildings, as well as in natural tree cavities. In the summer they are most common in the northern Virginia Piedmont and near the Blue Ridge Mountains; in the winter they are rare in the region. Perhaps because of their ability to exploit partially-developed habitats and tolerate human activity, House Wrens are faring better in Virginia than the other featured species.

who lives here?

House Wren, Ken Schneider



From Top to Bottom:
 Red-bellied Woodpecker, Bill Hubick
 Blue Jay, Laura Erickson, Binoculars.com
 Eastern Bluebird, James Ownby
 American Goldfinch, JD

attracts insects that provide food.

- Create a brush pile that will provide cover for birds and attract insects, or consider putting up nest boxes to attract breeding birds like wrens, chickadees, and bluebirds.

Additional things that you can do for birds and other wildlife

- If you choose to put out bird feeders in the winter, fill them with quality seeds like black-oil sunflower and white proso millet. Remember to clean feeders regularly to prevent disease.
- During the summer, suspended fruit will attract orioles, catbirds, and other fruit-loving birds. Beware that summer and fall bird feeders of any type may attract bears and other mammals.
- Birds can die as a result of flying into glass windows that reflect surrounding vegetation or that are otherwise not visible to them. A number of products are available to reduce bird collisions with glass, including screens, netting, films, tape, paint, decals, and stickers. Closing curtains or blinds and moving houseplants away from windows may also help. If you keep a feeder close to your house, moving it within 1.5 feet of a window can reduce the impact of collisions. Otherwise, keep bird feeders far from buildings to reduce the risk of collision.
- Keep your cat(s) indoors. Free-roaming cats are responsible for a vast number of bird deaths each year, and also kill many species of small mammals. Keeping your cat indoors can increase its lifespan by protecting it from outside hazards.
- Plant native plants that specifically attract hummingbirds. Deep set, conical shaped flowers like native azaleas, trumpet honeysuckle, cardinal flower, and bee balm are pollinated by the Ruby-throated Hummingbird's long beak and

tongue. Hummingbirds are also attracted to feeders.

- Select native plants that act as host species for butterflies. For example, *Antennaria neglecta*, or pussy toes, is the host plant for the American Painted Lady butterfly. To learn more about butterfly conservation and host plants, visit the Xerces Society's website.
- Native bees, like blue orchard mason bees, bumblebees, and leaf cutter bees, are important pollinators, so consider installing a native bee house in your yard. Most native bees are not colonial like non-native honeybees. Some species create solitary nests in tube-like structures such as dead reeds, standing stems, and hollow tree branches. You can create a simple nesting structure for them by bundling a handful of bamboo shoots together and placing them in a safe spot in your yard, or by simply leaving dead standing flower stems. There are also more elaborate and stand-alone bee houses available for sale on the internet and at home and garden stores. For bumblebees and other native bees that nest in the ground, leave bare spots of earth in your flower beds and garden for nesting opportunities.

Improving your neighborhood for birds

- Participate in or help organize park and stream restoration projects in your neighborhood, and encourage the use of native vegetation in landscaping projects.
- Help schools to transform part of their land into bird habitat. It will require less maintenance than closely cropped grass, which saves money and helps reduce greenhouse gas emissions, while also providing a unique learning opportunity for young students.
- Contact your local Virginia Native Plant Society Chapter to learn about potential projects and networking opportunities.



Purple Loosestrife, pixabay.com

Invasive Exotics

"It is much easier to control a few rogue plants than to fight them after they have become established."



Bottom: Johnsongrass, Chris Evans, River to River, CWMA, Bugwood.org • Top: Garlic mustard, Wisconsin DNR



While some non-native species are aesthetically pleasing, many introduced species can cause considerable harm to natural ecosystems. Most of our popular garden plants are exotic, yet not invasive, which makes them relatively harmless. However, invasive exotics can escape the garden and quickly spread throughout your property as they out-compete native vegetation.

Invasive exotic plant infestations on your property should be addressed on a yearly basis. If allowed to gain a foothold, they can displace desirable native plant species in as little as a two to three years. Non-native invasive plant infestations can ultimately disrupt ecosystem processes and decrease biodiversity. Invasive plants thrive in areas of frequent disturbance like roadsides, field borders, and forest openings. If you are undertaking a management project, you will need to include an invasive plant control plan along with your other management strategies.

There are nearly 100 plant species that the Virginia

Natural Heritage program recognizes as alien invasive plants in Virginia. For a more thorough discussion and a listing of invasive species, visit the Virginia Natural Heritage Program website.

It is much easier to control a few rogue plants than to fight them after they have become established. Familiarize yourself with some of the more common invasive species, be vigilant about checking for their presence on your land, and quickly move to control invasive species when you find them. Almost all invasive plants have a recommended control method, and a specific time of year when the control should occur. The most common methods of control are pulling, burning, cutting, and herbicide use, and sometimes a combination of two more of these methods is needed. Selective herbicides are usually better choices than broad-spectrum varieties. Your county Cooperative Extension agent or the Virginia Department of Forestry can assist with information on control of specific pests.



Exotics in Agricultural Fields

- Each crop field has its own unique “seed bank” that has accumulated over the years. Minimizing tillage brings fewer seeds to the surface. Look for invasives in adjacent field borders, fence lines, and pastures before starting a new planting.
- Johnsongrass grows in dense clumps and can become easily established along the edges of crop fields. Preventing seed dispersal by eliminating the plant before it goes to seed and stopping the spread of rhizomes is key to controlling infestations.
- *Ailanthus altissima*, or Tree of Heaven, is another field invader. This tree alters the soil chemistry, which prevents other plants from growing. Its woody shoots are often found on the edges of fields, so killing the *Ailanthus* in these transitional areas before initiating any planting will make future maintenance a lot easier. Tree of Heaven reproduces by prolific seeding, and also root suckering and re-sprouting, which can accelerate if a parent tree is cut down but not treated with herbicide. Treating Tree of Heaven with an herbicide stem injection in the summer-fall or basal spraying in February- April has been shown to be the most effective means of control.
- Most woody invasive shrubs can be controlled by cutting the shrub at the stump and “painting” on a selective herbicide. Painting the herbicide directly onto the stump minimizes the risk of spraying other plants.
- Mowing can knock back invasive plants for a growing season. However, it is not a very effective means of control because it keeps the root system intact.
- Spot spraying, burning, pulling, and mowing invasive grasses and legumes are all fairly effective if used on the correct species or in conjunction with each other. Once you have identified the invasive, research the best methods to control it.
- Exotic thistles can be particularly troublesome in newly established grasslands since they are difficult to remove and spread easily. Their seeds are dispersed by wind, so check for thistle presence in neighboring fields before initiating new plantings.

Exotics in Grasslands

- Virginia’s grasslands are host to numerous alien plant species. Autumn olive, *Sericea lespedeza*, perilla mint, multiflora rose, exotic thistles, Japanese barberry, Johnsongrass, and Tree of Heaven are just a few.
- While bermudagrass may offer some value for grazing, it spreads easily and is difficult to get rid of once established.

Exotics in Shrublands

- Shrubby areas are very susceptible to take over by invasive species. Seeds of invasive species generally establish quickly in shrubby areas that are undergoing succession. Furthermore, young invasive plants often outcompete young natives for space. The regular disturbance required to maintain shrublands sometimes encourages the spread of invasive species.
- Hedgerow maintenance is particularly important because edge habitat is very prone to take over by invasive species like kudzu, multiflora rose, oriental bittersweet, Japanese honeysuckle, English ivy, and autumn olive.

Exotics in Forests

- Invasive plants can take hold in forests because landowners often do not routinely evaluate forest condition. Monitor forests annually for presence of invasive exotics. Pay particular attention to the forest floor for signs of invasives, including Japanese stiltgrass and garlic mustard. These plants are easily hand pulled, but are prolific seeders, so removing



From Top to Bottom: Canada thistle, Wisconsin DNR • Autumn olive, IPANE (Invasive Plant Atlas of New England) • Japanese stiltgrass, Wisconsin DNR

them before they go to seed is the key to controlling them.

- Vines like kudzu and bittersweet can cause serious damage to forests by infesting and eventually collapsing entire trees. Kudzu infestations are extremely aggressive and usually require the assistance of a management professional. Other invasive vines like the non-native honeysuckle and bittersweet are most successfully controlled by using selective herbicides in the fall when other plants have gone dormant. The cut and paint method or a foliar application seem to work the best.
- Understory plants can be displaced by invading shrubs such as Japanese barberry, multiflora rose, Japanese honeysuckle, and exotic bush honeysuckles.
- Wavy leaf basket grass is a new forest invader. It resembles Japanese stiltgrass in appearance and behavior, and often grows right beside it. The plant was first discovered in the U.S. in 1996 in Maryland and has since been identified in a few places in Virginia. Since this is a new invasive species, swift identification and eradication are imperative; the public is urged to report sightings to the Virginia Department of Conservation and Recreation (DCR).

Exotics in Wetlands

- Purple loosestrife may be a beautiful plant, but it can be extremely aggressive in aquatic environments, and can form dense stands. Traditional means have not proven successful in controlling large infestations. Leaf-feeder beetles, however, have been

"Invasive plants can take hold in forests because landowners often do not routinely evaluate forest condition."

successfully used as a bio-control agent since the 1990s to manage purple loosestrife populations. Contact DCR for assistance if you think you have an infestation.

- Check boats and trailers carefully if they have been used in waters suspected of housing populations of Hydrilla or European water chestnut. These aquatic invaders can create thick mats on the surface of the water and shade out other important submerged native vegetation. They can also slow water flow and clog water pumping stations. Cleaning your boat or trailer of any vegetation will help ensure that these plants will not spread to a new water body.
- Phragmites is usually found in Tidewater wetlands, but it may occur in the eastern Piedmont. It is often found in roadside ditches along highways. Be careful of any disturbance in wet areas, as you may encourage expansion of phragmites stands. Phragmites is extremely difficult to control once it becomes established, so early detection is key.



Logging slash, Marc Puckett

Biofuels and Wildlife

Biofuels include an array of fuels derived from renewable resources such as crops, grasses, and trees. At present, the vast majority of biofuels in the United States are derived from corn. In Virginia, there has been an increasing interest in producing biofuels from native feedstocks, such as wood and native grasses. Woody biomass has been especially prominent in the Virginia biofuels market during the past decade, with operations ranging from wood pellet plants to the use of sawdust to heat university buildings.

Our knowledge of the potential impacts of biofuel production on birds and other wildlife is imperfect. However, we know that benefits to wildlife are greater when using native perennial biofuel crops over annual, non-native crops. Native plants require fewer inputs (fertilizers and pesticides) and have lower production costs. They also benefit wildlife if planted as diverse mixtures of grasses and forbs in open field settings, or trees and shrubs in forested settings. From both an ecological and a wildlife perspective, the use of non-native species and of monocultures (whether grass or woody) should be avoided where possible.



From Left to Right: Soybeans, Howard F. Schwartz, Bugwood.org • Sunflowers, stock.xchng • Little bluestem, Meadowbrook Nursery

- In keeping with the above, corn and soybean biofuel production is the most detrimental to wildlife; row crops are intensively managed monocultures that support relatively few species, and these acres have been converted from either idle or less intensive land uses which offered greater value to wildlife. If opting for row crops, refer to recommendations in the 'Agricultural Habitat' section for wildlife-friendly approaches to managing production.
- From a wildlife perspective, a preferred biofuels option is the use of native grasses; refer to the 'Grasslands' section of this guide for recommendations.
- Woody feedstocks offer an additional alternative. They can consist of slash from logging operations, poor quality trees or high-graded stands from past logging activities, invasive species that have been removed, or quick growing trees that have been purposefully planted. With careful planning and a selective harvest, you may be able to restore a degraded hardwood stand and gain a biofuel harvest at the same time. Forest management recommendations can be found in the 'Forests' section of this guide.
- Whole tree chipping harvests offer an array of opportunities to establish improved timber stands or to begin a scrub-shrub habitat. For shrubland management guidance, refer to the 'Shrubland' section of this guide.



Resources for Landowners

There are many resources available for landowners who are interested in managing their land for wildlife. Several government agencies and non-profit organizations provide habitat planning and management advice at no cost, though they are not usually directly involved with on-the-ground implementation. Private consultants are able to carry out on-the-ground work and may also provide planning and management assistance.

Planning Assistance

- Virginia Department of Game and Inland Fisheries (VDGIF) biologists offer wildlife habitat planning and management recommendations to landowners. More information can be found at www.dgif.virginia.gov, or by calling the following offices in the Piedmont: Fredericksburg (540-899-4169), Forest (434-525-7522), and Farmville (434-392-9645).
- The Virginia Department of Forestry (VDOP) employs Area Foresters who provide a wide variety of services at the local level. VDOP also maintains a list of private foresters on its website. Visit www.dof.virginia.gov or call VDOP headquarters in Charlottesville (434-977-6555).
- The Piedmont Environmental Council's Sustainable Habitat program provides residents of the Virginia Piedmont with various resources to help improve biodiversity, water quality, and land health on their property. Staff are available to provide site visits, information on restoration practices, and can connect you to the appropriate service provider for your project. PEC also hosts numerous outreach events on land stewardship and wildlife habitat every year and coordinates many large scale land-restoration projects. Call the PEC main office in Warrenton (540-347-2334) or visit www.pecva.org.
- The Natural Resources Conservation Service (NRCS), a division of the U.S Department of Agriculture, provides conservation planning, technical assistance, and cost-share programs. There are numerous NRCS service centers throughout the state; visit www.nrcs.usda.gov to find the one closest to you.
- Private Lands Wildlife Biologists assist in Virginia's Quail Recovery Initiative and are part of a cooperative effort involving VDGIF, NRCS, and Virginia Tech's Conservation Management Institute. Private Lands Wildlife Biologists can assist you with cost-share programs and provide assistance for landowners interested in managing their land for wildlife. They have a special focus on early successional habitat species like quail, Field Sparrows, and Prairie Warblers, among others. They can be contacted through VDGIF's website.
- A list of Certified Foresters can be found on The Society of American Foresters website, www.eforester.org.
- A list of Certified Wildlife Biologists (CWB) and Associate Wildlife Biologists (AWB) can be found on website of The Wildlife Society, the professional governing organization for wildlife biologists: www.wildlife.org.

Contractors, Vendors, & Consultants

The Piedmont Environmental Council publishes a comprehensive guide called *Go Native Go Local* which provides the residents of the Virginia Piedmont with a listing of businesses that offer products and services that promote native biodiversity. Here you can find foresters, native plant nurseries, landscape designers and architects, wildlife management consultants, and government agencies that offer products and services that can help you get started managing your land for wildlife.

A copy of *Go Native Go Local* can be downloaded for free at www.pecva.org/gonative



Cost-Share Assistance

Identifying programs designed to aid landowners in managing and protecting their property's ecological resources is an important step toward implementing on-the-ground conservation efforts. Programs that include financial incentives for landowners are known as cost-share programs.

Several federal and state financial incentive programs are managed by government agencies, such as:

- Natural Resources Conservation Service
- Virginia Department of Forestry
- Virginia Department of Conservation and Recreation
- Virginia Department of Historic Resources

Landowners can contact these agencies directly to learn more about the latest in financial assistance programs. Practitioners at these agencies may also know of additional opportunities in the Piedmont to help offset project costs.

Useful websites

pecva.org/habitat

This is the Piedmont Environmental Council's website for everything habitat. Learn about PEC's latest initiatives and find information on wildlife, plants, pollinators, water quality, and invasive species. You can also locate sources of conservation funding or schedule a site visit to your property with one of PEC's field staff.

dgif.virginia.gov

The Virginia Department of Game and Inland Fisheries website contains useful information on habitat management for quail and other wildlife; search for 'quail' or 'habitat'.

dof.virginia.gov

The Virginia Department of Forestry's website provides information on basics such as tree planting and care, programs and services, invasive species management, and conservation options for landowners, among other things. The website also offers contact information for your regional VDOF forester.

dcr.virginia.gov

Comprehensive state native plant and invasive plant lists can be found under the Natural Heritage Program section of the Virginia Department of Conservation and Recreation's website.

allaboutbirds.org

All About Birds is the Cornell Lab of Ornithology's user-friendly bird guide with life history, conservation status, and identification information for North American birds.

vnps.org

The Virginia Native Plant Society has up-to-date information on native plant sales in your area, as well as extensive resources on plants native to the Virginia Piedmont.

vaworkinglandscapes.org

Virginia Working Landscapes studies and encourages the sustainable use of Virginia's landscapes for native biodiversity through community engagement and research on the importance of restoring native habitats.

xerces.org

The Xerces Society is a non-profit organization that specializes in invertebrate conservation. The resources section on their website includes pollinator plant lists and information on pollinator conservation.

albemarle.org/nativeplants

This is a database with information on native plants in the Piedmont, their uses, and growing conditions.



Additional Reading

Many of the publications listed below are available as free online electronic documents. Due to the ever changing nature of electronic links, we recommend conducting an internet search on the title of the publication to determine whether it is available electronically.

Field Guides

Godfrey, M.A. 1997. *Southern Gateways Guides Field Guide to the Piedmont: The Natural Habitats of America's Most Lived-in Region, From New York City to Montgomery, Alabama*. University of North Carolina Press, Chapel Hill, North Carolina. 536 pp.

Miller, J.H. 2003. *Nonnative Invasive Plants of Southern Forests: a Field Guide for Identification and Control*. Revised Gen. Tech. Rep. SRS-62. Asheville, NC: USDA Forest Service, Southern Research Station. 93 pp. (Available electronically or request a printed copy by phone (828-257-4830) or email (pubrequest@fs.fed.us) and Ask for GTR-SRS-62)

Virginia Department of Forestry. 2012. *Common Native Trees of Virginia*. Charlottesville, Virginia. 128 pp.

Native Plants

Davis, J.S., R. Glaettli, A. Henley, N. McGoff, L. Murray, B. Truax, W. Cocke, and C. Vuocolo. 2015. *Piedmont Native Plants: A guide for landscapes and gardens*. In press. 127 pp.

Slattery, B.E., K. Reshetiloff, and S.M. Zwicker. 2003. *Native Plants for Wildlife Habitat and Conservation Landscaping: Chesapeake Bay Watershed*. U.S. Fish & Wildlife Service, Chesapeake Bay Field

Office, Annapolis, MD. 82 pp.

Tallamy, D.W. 2007. *Bringing Nature Home: How You Can Sustain Wildlife with Native Plants*. Timber Press, Portland, Oregon. 288 pp.

Habitat Management (general)

Biebighauser, T.R. 2002. *A Guide to Creating Vernal Ponds*. USDA Forest Service, Morehead, Kentucky. 33 pp.

Ducks Unlimited. 2005. *Wetland Habitat Management: a Guide for Landowners*. Great Lakes/ Atlantic Regional Office, Ann Arbor, Michigan. 28 pp.

Harper, C.A., G.E. Bates, M.J. Gudlin, and M.P. Hansbrough. 2004. *A Landowner's Guide to Native Warm-season Grasses in the Mid-South*. University of Tennessee, Extension PB 1746. 25 pp.

May, H.L. 2002. *Managing Forests for Fish and Wildlife*. Fish and Wildlife Habitat Management Leaflet Number 18. Natural Resources Conservation Service. 44 pp.

Oehler, J.D., D.F. Covell, S. Capel, and B. Long. 2006. *Managing Grasslands, Shrublands and Young Forests for Wildlife: A Guide for the Northeast*. The Northeast Upland Habitat Technical Committee.

Massachusetts Division of Fisheries and Wildlife. 148 pp.

Puckett, K.M., P.D. Keyser, H.L. Haney, Jr., C.L. Godfrey, S.F. Warner, and S.W. Capel. 1998. *Managing Pines for Profit and Wildlife*. Wildlife Information Publication No. 98-1. Virginia Department of Game and Inland Fisheries. 16 pp.

Virginia Department of Game and Inland Fisheries. 2014. *Habitat at Home*. 8 pp. (<http://www.dgif.virginia.gov/habitat/wild-in-the-woods/habitat-at-home.pdf>)

Zimmerman, C.B. 2010. *Urban and Suburban Meadows: Bringing Meadows to Big and Small Spaces*. Matrix Media Press. 271 pp.

Reptiles and Amphibians

Bailey, M.A., J.N. Holmes, K.A. Buhlmann, and J.C. Mitchell. 2006. *Habitat Management Guidelines for Amphibians and Reptiles of the Southeastern United States*. Partners in Amphibian and Reptile Conservation Technical Publication HMG-2, Montgomery, Alabama. 88 pp.

Mitchell J.C., A.R. Breisch, and K.A. Buhlman. 2006. *Habitat Management Guidelines for Amphibians and Reptiles of the*

Northeastern United States. Partners in Amphibian and Reptile Conservation Technical Publication HMG-3, Montgomery, Alabama. 108 pp. (to order a free copy, e-mail Andrea Chaloux at amchalou@gw.dec.state.ny.us)

Bats

Taylor, D.A.R. 2006. *Forest Management & Bats*. Bat Conservation International. 13 pp.

Pollinators

Mader, E., M. Shepherd, M. Vaughan, S. Black, and G. LeBuhn. 2011. *Attracting Native Pollinators: The Xerces Society Guide to Protecting North American Bees and Butterflies*. Storey Publishing, North Adams, Massachusetts. 372 pages.

Birds

Rosenberg, K.V., R.W. Rohrbaugh, Jr., S.E. Barker, J.D. Lowe, R.S. Hames, and A.A. Dhondt. 1999. *A Land Manager's Guide to Improving Habitat for Scarlet Tanagers and Other Forest-interior Birds*. The Cornell Lab of Ornithology.

Rosenberg, K.V., R.S. Hames, R.W. Rohrbaugh, Jr., S. Barker Swarthout, J.D. Lowe, and A.A. Dhondt. 2003. *A Land Manager's Guide to Improving Habitat for Forest Thrushes*. The Cornell Lab of Ornithology.



WWW.ABCBIRDS.ORG
540-253-5780 • 888-247-3624



WWW.PECVA.ORG
540-347-2334



WWW.DGIF.VIRGINIA.GOV
804-367-1000



Over Jordan Farm, Rappahannock County, Carolyn Seigwick