

American Woodcock Habitat Management and Development of a Woodcock Habitat Demonstration Area Trail

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Abstract

The American Woodcock (*Scolopax minor*) is a member of the shorebird family that is dependent on early successional forest habitat. Woodcock are distributed throughout the eastern half of North America with their breeding range concentrated in the northern half of the eastern United States and adjacent southern and southeastern Canada (Keppie and Whiting 1994). Since the 1970's, woodcock populations have declined (Straw et al. 1994). In the Northeast, population declines are largely associated with the loss of early successional, young forest habitat due to development, forest fragmentation, and forest aging (Dessecker and McAuley 2001, Trani et al 2001). Habitat loss has also resulted in the decline of populations of other wildlife species dependent on young forest (Dettmers 2003, Fuller and Destefano 2003). In order to restore woodcock populations to pre-decline levels, regional habitat initiatives have been established to create and maintain young forest habitat throughout the woodcock's breeding range. An important component of these regional initiatives includes the creation of demonstration areas where land management practices designed to maintain forest habitats at different stages of succession can be viewed by private landowners. In 2008, The Great Swamp Management Area in Washington County, Rhode Island was designated as a woodcock habitat demonstration area as part of the Atlantic Coast Woodcock Initiative. To educate landowners about the practices used at the Great Swamp Management Area to enhance woodcock habitat, I developed a recreational trail along with a series of interpretive signs. By implementing similar land management practices on their own property, private landowners in the Northeast can play a critical role in the conservation of the American Woodcock and other young forest wildlife in the region.

Introduction

The American Woodcock (*Scolopax minor*), sometimes referred to as the timberdoodle, is a forest-dwelling member of the shorebird family. Unlike many of its shorebird relatives, the woodcock's mottled coloring and short, rounded wings, which provide camouflage and easy maneuverability, make it well suited for life in dense forest vegetation (Straw et al 1994). Distributed throughout eastern North America, woodcock are migratory birds that typically winter south of Maryland and breed further north. While woodcock breeding has been documented in every state in the eastern United States (Straw et al. 1994), their primary breeding range is in the northern half of the eastern U.S. and southeastern Canada.

The American Woodcock is one of the earliest ground-nesting species in the north, often arriving just before the snow has completely melted from the ground (Keppie and Whiting 1994, McAuley et al. 1996). In their northern range, nesting begins in April and extends through June or July (Dessecker and McAuley 2001). Fall migration is most likely prompted by cold fronts, typically beginning in October to early November (Keppie and Whiting 1994). Woodcock migrate through the eastern and central north-south flyways to their primary wintering grounds in the southeastern U.S., where snow cover and ground frost are rare (Keppie and Whiting 1994, Dessecker and McAuley 2001). Woodcock have a long migration period with most birds arriving at wintering grounds by mid-December (Keppie and Whiting 1994).

Because of their unique appearance and unusual courtship displays, woodcock are a favorite among bird watchers and nature enthusiasts. They have also long been a popular game species, with approximately 308,700 woodcock being harvested in the United States during the 2011-2012 hunting season (Cooper and Rau 2012). However, since the 1970's, woodcock

populations have experienced significant declines, which have been largely attributed to habitat loss and degradation (Kelley et al. 2008).

Woodcock are dependent on vegetative communities broadly classified as early successional or young forest habitat. This refers to the transitional stage of forest habitat that occurs when forest vegetation begins to grow back after disturbance events but before it reaches a mature, tree-dominated stage (Swanson et al. 2011). The young forest habitat required by the American Woodcock is less common today than it was prior to European settlement. In the past, young forest habitat was largely created through natural disturbances. Today, due to altered natural disturbance regimes in increasingly human-dominated landscapes, development, and forest fragmentation, young forest habitat has become increasingly rare (Trani et al 2001). As a result of habitat loss, woodcock populations have declined (Cooper and Parker 2010). If active land management practices are implemented and more young forest habitat is created and maintained, then this will improve populations of woodcock along with other wildlife species that inhabit similar young forest habitat.

In this paper I will review existing literature related to the American Woodcock and its habitat needs, and discuss management strategies to conserve woodcock populations in the northeastern United States. I will also provide a guide for the design and creation of the American Woodcock Habitat Demonstration Area Trail in the Great Swamp Management Area, for which I have created a series of interpretive signs. These signs were designed for display along the trail to educate trail users about woodcock habitat requirements and management practices for providing woodcock habitat.

Woodcock Population Trends

Since the 1960's, woodcock populations have been monitored primarily through singing ground surveys located throughout the primary breeding range (Duke 1966, Kelley et al. 2008). Because woodcock are difficult to spot due to their cryptic coloration and the fact that they occupy dense, young forest habitats (Sauer and Bortner 1991, Cooper and Parker 2010), the singing ground survey was developed as a way to monitor regional population trends by making use of the male's conspicuous crepuscular flight displays (Kelley et al. 2008). Data from the singing ground surveys have shown significant long-term population declines (from 1968-2012) of 0.8 percent per year (Cooper and Rau 2012), and have estimated a total loss of 829,000 singing males since the early 1970's (Kelley et al. 2008).

Woodcock populations are also monitored through the national Wing-Collection Survey, in which approximately 10,000 wings sent in by hunters are examined each year (Kelley et al. 2008). Age and sex characteristics are used to estimate the ratio of immature birds to adult females, from which a recruitment index is derived. Results from the Wing-Collection Survey also show long-term population declines, with the 2011 recruitment index for the Eastern Region being estimated at 1.68 immature birds per adult female (Cooper and Rau 2012).

Data from the Wing-Collection Survey is also used by the U.S. Fish and Wildlife Service to regulate annual woodcock harvest (Straw et al. 1994). Based on the theory that hunting mortality is compensatory, the decline of woodcock populations since the 1970's is not believed to have been caused by overharvesting (Dwyer et al. 1983, McAuley et al. 2005). Rather, woodcock population declines are largely associated with the degradation and loss of appropriate habitat through forest succession and urban development (Dwyer et al. 1983, Sauer and Bortner 1991, Straw et al. 1994, McAuley et al. 2005).

The American Woodcock is not the only species that has been affected by the loss of young forest habitat. Declines in a number of bird and mammal species that are closely associated with young forest habitat have been documented as well. For example, data from the North American Breeding Bird Survey revealed that populations of nearly one quarter of shrubland birds in the Northeast have decreased by 50% or more since the mid-1960's; a finding that mirrors the loss of young forest habitat in the region (Dettmers 2003). Some of these species include the Golden-winged Warbler (*Vermivora chrysoptera*), Ruffed Grouse (*Bonasa umbellus*), Eastern Towhee (*Pipilo erythrophthalmus*), Field Sparrow (*Spizella pusilla*), White-throated Sparrow (*Zonotrichia albicollis*), and the American Goldfinch (*Carduelis tristis*) (Dettmers 2003). As many as 20 native terrestrial mammals in the Northeast also show a preference for young forest habitat, and a few of these are obligate users (Fuller and Destefano 2003). One such young forest obligate is the New England cottontail (*Sylvilagus transitionalis*). New England cottontail populations have declined significantly since the 1960's, and the species is now listed by the U.S. Fish and Wildlife Service as a candidate for threatened or endangered status (Litviatis 1993).

Woodcock Habitat Requirements and Young Forest in the Northeast

The young forest habitat required by the American Woodcock and other wildlife species is transient by nature and, over time, develops into mature forest through natural succession. As such, repeated disturbances are needed to maintain this habitat type (Trani et al. 2001). Both natural and anthropogenic disturbances can play a role in the creation of young forest habitat. Natural disturbances can include wildfire, windstorms, hurricanes, beaver activity, or insect epidemics. These create "stand-replacement" events in which all or most of the dominant trees are killed (Swanson et al. 2011). In the Northeast, anthropogenic creation of young forest habitat

dates back to pre-European settlement, when Native Americans frequently burned forested areas to open village sites and facilitate hunting and agricultural activity (Trani et al. 2001, Foster and Aber 2004). With European settlement came more extensive forest clearing, as much of the landscape was converted for agriculture.

In New England the conversion from forestland to agriculture peaked in the mid-1800's (Brooks 2003, Foster and Aber 2004). However, due to social and economic factors (Foster and Aber 2004), New England farmers were soon unable to compete with the more productive farms of the Midwest (Litviatis 1993). This led to a period of widespread farm abandonment in the late 19th and early 20th centuries (Brooks 2003), during which time much of the region became dominated by young forest habitat as forest regenerated on the abandoned farmlands (Degraaf and Yamasaki 2003, Lorimer and White 2003).

The extent of young forest habitat peaked in the Northeast in the 1960's and 1970's (Trani et al. 2001). Then began a long period of decline as the regenerating forests matured and altered natural disturbance regimes, development, and forest fragmentation limited the creation of new young forest habitat (Trani et al. 2001). As a result, the young forest habitat used by the American Woodcock is now less common in several areas of the northeastern U.S. than it was even prior to European settlement (Brooks 2003, Degraaf and Yamasaki 2003).

Throughout spring, summer, and fall in the Northeast, woodcock will make use of a variety of vegetation types representing forests and forest openings at different stages of early development (Dessecker and McAuley 2001). Upon their annual return to the breeding grounds, woodcock require a patchwork of vegetated habitats to meet their breeding, nesting, feeding, and roosting needs. These habitats range from open fields, recent clear cuts, and natural forest openings to forest up to 30 years of age. Landscapes consisting of a mosaic of these habitat types

are ideal for woodcock populations. The ways in which woodcock use these habitats for different activities are described below.

Singing Grounds

During spring, male woodcock need forest openings called singing grounds to perform their courtship displays in order to attract females (Dessecker and McAuley 2001). The male woodcock's courtship display begins on the ground with a series of short *peent* calls (Owen et al. 1977). He then flies upward in a large spiral above his singing ground. During this flight the woodcock's wings make a distinct twittering sound. The male will reach a height of about 90 meters before descending to the ground in a zigzag motion (Keppie and Whiting 1994). This ritual occurs each night at dusk, beginning about 18 minutes after sunset on relatively clear nights and about 9 minutes after sunset on nights with heavier cloud cover (Duke 1966). The courtship display typically continues for 30 minutes to one hour (Owen et al. 1977).

Woodcock will use old fields, natural forest clearings, blueberry barrens, pastures, and forest clear cuts as singing grounds (Owen et al. 1977, Keppie and Whiting 1994, Dessecker and McAuley 2001). The vegetative composition of singing grounds varies (Dessecker and McAuley 2001). Indeed, singing grounds are more similar in habitat structure than plant species composition (Gutzwiller et al. 1983). The size of the opening that woodcock will use as a singing ground also varies. Microsites used for displaying average 70 m² in size, but sites as small as 5 m² are sometimes used as well (Keppie and Whiting 1994). The necessary size of a singing ground is often dependent on the height of surrounding trees (Keppie and Whiting 1994). The quality of adjacent habitat for providing nesting and brooding sites for females is also an important factor in the use of singing grounds (Dessecker and McAuley 2001).

Nesting Coverts

During the breeding season, the daytime activities of female woodcock are focused on nesting. Hen woodcock's nest on the ground, laying their eggs in a shallow depression on top of dry leaf litter (Keppie and Whiting 1994). They will nest in a variety of vegetation types, from young to mixed-age forest (Dessecker and McAuley 2001), but show a preference for second growth hardwood stands 5-10 years of age (McAuley et al. 1996). Most nests are located within a few meters of brushy field edges (Owen et al. 1977) and in close proximity (about 100 meters) to singing grounds (Keppie and Whiting 1994). Woodcock tend to choose nesting sites in areas with high densities of saplings (1,400-1,500 stems/ha) and shrub stems (13,500-49,250 stems/ha) (Dessecker and McAuley 2001) as these provide ample concealment. Females require dry ground for nesting and may prefer to nest in aspen (*Populus* spp.) stands, as aspens are commonly found on well drained soils (McAuley et al. 1996). The aspen's cloning ability also provides the necessary stem density, making for ideal woodcock nesting habitat in the early spring (McAuley et al. 1996).

Female woodcock typically lay four eggs which are incubated for an average of 21 days before hatching (Owen et al. 1977). The young are precocial and leave the nest within hours of hatching (Keppie and Whiting 1994). Woodcock chicks grow rapidly, reaching full size at about 30 days and becoming independent shortly thereafter (Owen et al. 1977, Keppie and Whiting 1994). Nesting habitat and brood rearing habitat are similar, and in many cases identical (Owen et al. 1977). Good brood rearing habitat is characterized by dense, woody mid-stories (saplings and shrubs) which provide the young with protection from avian predators, and reduced ground cover which allows for easy foraging (Straw et al. 1986).

Diurnal Feeding Coverts

Feeding grounds are an important component of woodcock diurnal habitat. Throughout the year, male woodcock focus much of their daytime activity on finding food (Dunford and Owen 1973). Invertebrates, primarily earthworms (*Aporrectodea tuberculata* and *Dendrobaeria octaedra*), make up 80% of the woodcock's diet (Rabe et al. 1983, Keppie and Whiting 1994). The woodcock's long, flexible bill is specialized for probing and extracting earthworms and other macro invertebrates from soil (Keppie and Whiting 1994). Woodcock may use soil color when choosing foraging sites, as soil color is indicative of conditions, such as moisture, that influence earthworm abundance (Rabe et al. 1983). Earthworm abundance may be an important determinant of woodcock diurnal habitat (Hudgins et al. 1985, Straw et al. 1994), and can be influenced by vegetative composition, soil characteristics, hydrology, and land-use history (Straw et al. 1994).

Woodcock prefer second growth hardwood stands (less than 30 years of age) as diurnal feeding coverts (Dunford and Owen 1973, Straw et al. 1994), but can also be found in stands of mature forest with a dense understory (Straw et al. 1994). In second growth hardwood stands, leaf litter from mid-story vegetation provides nutrients for soils, and the canopy helps to reduce temperature and evaporation, keeping soils moist (Straw et al. 1986). Diurnal feeding coverts can vary widely in plant species composition, but alder (*Alnus rugosa*), aspen, and red maple (*Acer rubrum*) are common (Dunford and Owen 1973, Straw et al. 1994).

Roosting Fields

At dusk during summer through winter, woodcock often leave their diurnal feeding coverts and fly to nearby forest openings such as fields, pastures, bogs, and recent clear cuts to roost (Dunford and Owen 1973, Keppie and Whiting 1994, Straw et al. 1994). Many of these

roosting sites are also used as singing grounds during spring (Keppie and Whiting 1994). Mature females will sometimes move to different forested areas at dusk, while juvenile females and males typically use fields and other forest openings (Straw et al. 1994). Studies have shown that woodcock spend a large portion of time feeding at roosting sites on their wintering grounds (Stribling and Doerr 1985, Keppie and Whiting 1994, Krementz et al. 1995), but this has not been observed at roosting fields in the woodcocks breeding range. Dunford and Owen (1973) observed that woodcock showed little activity after arriving at roosting sites and likely stayed in a single spot throughout the night. It is speculated that while roosting fields in their breeding range provide little food, they simultaneously provide safety from nocturnal predators (Dunford and Owen 1973).

Singing grounds, nesting cover, diurnal habitat, and roosting fields represent four different ways in which woodcock make use of young forest habitat. Today, in the woodcocks breeding areas of the Northeast, young forest habitat is created through timber harvesting and occasional large storms (Trani et al. 2001). However, the ability of natural disturbances to create young forest habitat on the smaller and more even-aged tracts of forest contained in our present day landscape is limited (Trani et al. 2001, Degraaf and Yamasaki 2003). As a whole, 16% of the total land in the Northeast is comprised of young forest (Trani et al. 2001), but the proportion of young forest habitat differs between states. For example, about 25% of the timberland in Maine is classified as young forest whereas young forest only accounts for about 6% or less of the timberland in Rhode Island, Massachusetts, and Connecticut (Trani et al. 2001). However, implementing active forest management practices can increase young forest in the Northeast and improve woodcock habitat.

Woodcock Habitat Management

In 2001, in order to document the loss of young forest habitat over the previous 30 years and to recommend habitat management measures to stop and reverse declining woodcock population trends, the Association of Fish and Wildlife Agencies formed the Woodcock Task Force (Kelley et al. 2008). The Woodcock Task Force developed the American Woodcock Conservation Plan with the specific objectives of stopping the decline of woodcock populations and young forest habitat by 2012, and increasing population growth and young forest habitat by 2022 (Kelley et al. 2008). The overall goal of the American Woodcock Conservation Plan is to return woodcock densities to levels of the early 1970's in order to provide for the continued use of woodcock populations as a resource (Kelley et al 2008).

In order to meet the goals of the Woodcock Conservation Plan, approximately 8.6 million hectares of new woodcock habitat must be created (Kelley et al. 2008). Significant portions of former woodcock habitat have been converted to land uses that make them unavailable for future habitat management, but the American Woodcock Conservation Plan estimates the amount of young forest habitat that must be created in each Bird Conservation Region to restore woodcock populations to former densities (Kelley et al. 2008). Bird Conservation Region 30, covering the coastal areas of the New England and Mid-Atlantic states, saw an estimated loss of 64,000 singing males between 1970 and 2004 (Kelley et al. 2008). Restoring woodcock population densities to those of the 1970's would require the creation of 890,000 hectares of new habitat (Kelley et al. 2008). Meeting woodcock population density goals in Bird Conservation Region 30 will require that each state, on average, manage 31% of their remaining forested land as young forest habitat (Kelley et al. 2008). Bird Conservation Region 14 (The Atlantic Northern Forest), which covers the majority of northern New England, lost an estimated 92,473 singing

males between 1970 and 2005. Based on this deficit, 1,926,325 of the region's 25,691,737 hectares of forestland (about 7%) have to be conserved as young forest to restore woodcock population densities (Kelley et al. 2008).

As a way to meet the habitat conservation goals laid out by the American Woodcock Conservation Plan, the Wildlife Management Institute and its partnering agencies, created four regional habitat initiatives throughout the woodcock's primary breeding range (Wildlife Management Institute 2010). These habitat initiatives are based on the Bird Conservation Regions outlined in the conservation plan and cover an area from Atlantic Canada to the Great Lakes (Wildlife Management Institute 2010). To implement the conservation plan, each of these four regions has developed a "Best Management Practices" manual that explains strategies for creating and restoring young forest habitat. The regional habitat initiatives also call for the establishment of habitat demonstration areas to showcase current habitat management practices (Wildlife Management Institute 2010). At the landscape scale, woodcock habitat management requires management units of 200 to 400 hectares, each of which would support approximately 500 birds (Kelley et al. 2008). However, beneficial management measures can be implemented by small landowners as well.

Effective woodcock habitat management requires the consideration of the various habitat types required by the woodcock and the placement of each of these components in relation to the others. It is also important to properly identify areas that are suitable for woodcock habitat management. Management units should be centered on broad-leaf deciduous forests or deciduous shrub-scrub wetlands where soils are moist (Kelley et al. 2008). The majority of each unit should be dedicated to generating woodcock diurnal feeding coverts (Williamson 2010). Practices for creating the necessary components of a woodcock habitat mosaic are discussed below.

Singing Grounds

Creating openings in forested areas for woodcock to use as singing grounds can be achieved through clear cutting forest or maintaining herbaceous openings such as old fields. In some cases, openings can also be created by the selective cutting of larger trees (Sepik et al. 1994). The length of time that a singing ground will remain useful varies, but averages about 2 years in hardwood stands before new sprout growth makes the area less attractive to woodcock (Sepik et al. 1994, Kelley et al. 2008). Sprout growth can be eliminated by clear cutting in the summer, and by continuing to cut for 3 to 4 years (Sepik et al. 1994). The useful life of a singing ground can also be extended by removing vegetation annually with a bulldozer (Hale and Gregg 1976).

Ideal singing grounds are located in close proximity to good nesting and brood-rearing habitat, and in some landscapes are less than 100 meters from diurnal feeding coverts (Straw et al. 1994). Singing grounds can range in size from less than 0.4 hectares to over 40 hectares (Sepik et al. 1994). Where surrounding trees are taller than 7.6 meters (25 ft), clearings should be at least 0.2 hectares (Sepik et al. 1994). In areas where the surrounding vegetation is less than 7.6 meters, clearings as small as 0.1 hectares may be used as singing grounds (Sepik et al. 1994). However, creating larger clearings benefits a greater number of species as vegetation begins to grow back. For example, clearings of at least 0.6 hectares will provide adequate habitat for most shrubland birds whereas the New England cottontail requires patches of approximately 10 hectares (Buffum 2011).

Nesting and Diurnal Feeding Coverts

Woodcock most often nest in young, second growth hardwood stands that regenerate after clear cutting (Williamson 2010). While maintaining clear cut areas may require annual management, allowing the vegetation to naturally regenerate will provide good nesting cover for 15 to 25 years (Williamson 2010). Maintaining several successional stages of vegetation will provide habitat for nesting and brood rearing (McAuley et al. 1996). Areas as small as 0.4 hectares can be used for nesting, but it is recommended that 2 hectare units be created for managing nesting habitat (Williamson 2010).

Diurnal feeding coverts can be created by cutting vegetation in patches or strips at regular intervals. After clear cutting, sprout growth in regenerating hardwood stands will provide the necessary stem density for woodcock diurnal feeding coverts. New patches or strips should be clear cut next to older strips every 4 to 5 years, resulting in a mosaic of younger, albeit uneven-aged, forest (Sepik et al. 1994). When possible, patches or strips should be cut adjacent to or across available moisture gradients, as the difference in soil moisture will result in variation in vegetation growth rates and density (Sepik et al. 1994). Furthermore, woodcock will nest on the drier soils, while the moist areas may support more abundant food resources (Sepik et al. 1994).

Regenerating forest can provide suitable nesting and feeding coverts for up to 30 years; beyond 30 years tree species mature and shrub species begin to be replaced by grasses (Sepik et al. 1994). Without a densely vegetated understory, forests past 30 years of age will be of little use to woodcock (Kelley et al. 2008). To improve habitat for American Woodcock, it is recommended that landowners maintain at least 25% of their land at an early successional stage (McAuley et al. 1996). When managing woodcock habitat in mature forest, this can be achieved by clear cutting 30 meter wide strips on a 40 year rotation (McAuley et al 1996).

Roosting Fields

Woodcock prefer to roost at night in forest openings of at least 1.2 hectares, often using agricultural fields, pastures, or recently harvested woodlands (Sepik et al. 1994). In heavily forested areas where natural openings are scarce, roosting fields can be created by clear cutting (Williamson 2010). After clear cuts are made, openings can be maintained by burning every 2 years to eliminate invading woody vegetation (Sepik et al. 1994). Pastures and hayfields can be maintained for use as roosting sites through regular agricultural practices (Sepik et al. 1994), but in fields that are not farmed, strips from 2 to 2.5 meters wide can be mowed in the early summer to manage vegetation growth (Williamson 2010). When creating roosting fields, it is recommended that a 30 meter border around the site be allowed to regenerate into dense, sapling-sized deciduous trees or shrubs to create nearby nesting habitat (Williamson 2010). Within a woodcock habitat mosaic, one roosting field should be managed for every 40.5 hectares of habitat (Sepik et al. 1994, Williamson 2010), and roosting sites should be positioned within 2 km of feeding areas (Sepik et al. 1994).

While it is recommended that multiple woodcock habitat mosaics be positioned within 1.6 to 3.2 km of each other at demonstration areas (Williamson 2010), it should be recognized that smaller land owners can also play an important role in woodcock habitat management. Landowners can inventory their land and neighboring land to determine what components of a woodcock habitat mosaic they can provide. In areas appropriate for woodcock habitat management, the combined efforts of neighboring landowners can be beneficial, as cumulative small-scale efforts can contribute to the landscape goal of increasing woodcock habitat (Williamson 2010). Woodcock demonstration areas serve as a way to display habitat

management practices and provide private landowners with habitat management information, thereby encouraging the creation and maintenance of young forest habitat throughout the woodcock's breeding range.

Trail Development

The Atlantic Coast Woodcock Initiative is the regional habitat initiative of Bird Conservation Region 30. While best management practices for this region are currently being developed, a number of demonstration areas have already been established (Wildlife Management Institute 2010). One such area is the Great Swamp Management Area in Washington County, Rhode Island. The Great Swamp Management Area is a 1,406 hectare property with approximately 1,502 hectares of forested wetlands (Wildlife Management Institute 2010). A section of the area is managed to create woodcock habitat through a variety of techniques, including mowing and clear cutting. Other Rhode Island species of greatest conservation need, including the Blue-winged Warbler, Eastern Towhee, Indigo Bunting, Field Sparrow, Whip-poor-Will, and New England Cottontail may benefit from these management practices as well.

One of the goals of the regional habitat initiatives is to use demonstration areas to provide landowners and managers a view of current woodcock habitat management practices. Private landowners in Bird Conservation Region 30 have the potential to play a large role in woodcock conservation since 80% of the forestland in this region is privately owned (Kelley et al 2008). Rhode Island is no exception, as private landowners own the majority of forestland in the state (Buffum 2011). To help facilitate the viewing of the management practices at the Great Swamp Management Area, I laid out a recreational trail that passes through each of the various habitats created for and used by American Woodcock. I also designed seven interpretive signs to be

displayed at strategic points along the trail. These signs provide an understanding of how woodcock use a patchwork of habitat types for various activities during the spring, summer, and fall, and highlight management practices that can be implemented by private landowners. The signs also incorporate findings from ongoing research on woodcock habitat management at the Great Swamp Management Area conducted by biologists from the University of Rhode Island and the Rhode Island Department of Environmental Management's Division of Fish and Wildlife.

In designing the American Woodcock Habitat Demonstration Area Trail, a couple of factors were taken into consideration. First, I wanted a trail that was easily accessed by visitors. Second, I wanted the interpretive signs along the trail to follow a logical flow that clearly identifies singing grounds, nesting cover, feeding grounds, and roosting fields. The initial trail layout was done on a printed map of the management area demarcating each of the existing clear cut areas by year. I then walked through the management area following the trail as drawn and recorded the path with a hand-held GPS unit. To finalize the trail layout, I walked the trail once more using the track recorded with the GPS unit. During this walk-through I recorded GPS locations of where each sign and trail marker is to be placed and marked the trail with orange flagging so that it can be easily cleared. The GPS data was uploaded into ArcGIS and used to make an accurate map of the trail showing the location of each of the trailside displays (Appendix A). The final trail is an approximately 2 km loop bringing visitors through areas clear cut in 1995, 2007, and 2012; past sections of more mature second growth forest; and through open fields. This loop typifies the range of vegetative communities that make up the woodcock habitat mosaic at the Great Swamp Management Area. The interpretive signs and trail map are available at: <http://www.edc.uri.edu/mesm/docs/majorpapers/em/>

Options for Sign Installation

A total of seven 2 foot tall by 3 foot wide interpretive signs for the American Woodcock Habitat Demonstration Area Trail were designed as posters using Microsoft Powerpoint. These posters can be easily printed at stores that offer commercial printing services. Printing the signs as posters and then constructing the display structure will be the least expensive way to create and install the interpretive signs. For example, all seven posters can be printed in full color and laminated at any nearby FedEx Kinkos store for a total of \$395.47.

The price of materials for constructing the interpretive sign displays will vary depending on the type of structure built and the quality of the materials used. If the signs are printed as posters they will need to be housed in a weather proof structure. I would suggest using bulletin displays with a small roof structure to prevent rain and snow from falling directly on the display surface, and a plastic viewing window to help keep the signs from weathering. A bulletin display will also allow for the signs to easily be replaced if they become damaged or if the content of the signs needs to be updated.

To build a bulletin display will require lumber for the legs of the stand, plywood and plastic covering to encase the poster, and plywood and wooden beams for a small roof structure. Lumber will also be needed for trail markers. The list of necessary materials will include:

- 4 in x 4 in x 8 ft lumber (for trail markers)
- 6 in x 6 in x 8 ft lumber (used for legs)
- $\frac{3}{4}$ in 2 ft x 4 ft plywood (sign backing and roof)
- 2 in x 4 in x 12 ft lumber (roof beams)
- 48 in x 36 in Lexan polycarbonate sheet (Lexan is highly durable and easily cut)

Table 1 compares prices and materials from Home Depot, Liberty Cedar in West Kingston, Rhode Island, and Arnold Lumber also in West Kingston, Rhode Island.

Table 1. Comparison of sign construction and trail marker materials and prices from Home Depot, Liberty Cedar, and Arnold Lumber.

	Home Depot	Liberty Cedar	Arnold Lumber
4" x 4" x 8'	Pressure treated pine \$6.75	Knotty-grade cedar \$22.80	Pressure treated lumber \$13.21
6" x 6" x 8'	Pressure treated pine \$19.97	Knotty-grade cedar \$79.20	Pressure treated lumber \$20.24
¾" x 2' x 4'	Plywood \$23.47 (for two)	---	Plywood \$13.13 (each)
2" x 4" x 12'	Spruce-pine-fir \$4.95	Knotty-grade cedar \$15.60	Spruce lumber \$5.34
Lexan	48" x 36" (enough to cover two signs) \$67.97	---	---

Printing the signs as posters and constructing bulletin display structures with the materials listed above, I estimate a minimum total cost for 7 displays and 8 trail markers to be about \$1,260 if materials for the bulletin displays are purchased from Home Depot (Table 2).

Table 2. Materials used and total price for sign construction and trail markers.

Material	Quantity	Price
Posters	7	\$395.47
4" x 4" x 8' lumber	4	\$27.00
6" x 6" x 8' lumber	14	\$279.58
¾" x 2' x 4' plywood	7 sets of 2	\$164.29
2" x 4" x 12' lumber	24	\$118.80
48" x 36" Lexan	4	\$271.88
	Total	\$1,257.02

Using a professional graphics company is another option for the design and installation of the interpretive signs. Companies such as Wilderness Graphics, Envirosigns, and Pannier Graphics specialize in the design, editing, and fabrication of interpretive signs and trailside displays. Wilderness Graphics is often used by the Trustum Pond National Wildlife Refuge for the design of their interpretive signs. Wilderness Graphics offers fiberglass embedded, high-pressure laminate, or Alumicolor signs. All three options are highly durable and UV resistant material. Their 2 foot by 3 foot custom made interpretive signs range from \$1,290 to \$1,845 each. Wilderness Graphics also offers a variety of options for trail-side framing and mounting. Trailhead kiosks (upright displays with a roof structure) that display two 2' x 3' interpretive signs can be purchased for \$2,500. Upright trailside mounts for displaying interpretive signs range from \$450 to \$750 depending on the material used. These displays are designed so that the interpretive panel can simply slide into the frame. The frames do not have acrylic sheets to protect the signs and are meant to house signs that are already weatherproof. Using a professional graphics company for the design and installation of the interpretive signs for the American Woodcock Habitat Demonstration Area Trail, I estimate a minimum total cost for the project (not including shipping of materials) to be about \$12,180 (Table 3).

Table 3. Materials and prices for interpretive signs and displays from Wilderness Graphics.

Item	Quantity	Price
2' x 3' custom made fiberglass signs	7	\$9,030
Upright, pressure-treated sign mounts	7	\$3,150
	Total	\$12,180

Conclusion

The American Woodcock is a unique shorebird. In its breeding range in the Northeast, it has also provided countless hours of recreation to both consumptive and non-consumptive users over the past several decades. However, as our landscape has become more developed and young forest increasingly rare, woodcock populations have experienced significant declines. It is the goal of the U.S. Fish and Wildlife Service to manage woodcock populations to meet the demands of both consumptive and non-consumptive users (Cooper and Parker 2010). This goal can be achieved through managing public and private lands in a manner that encourages the creation and maintenance of young forest habitat. Because of its dependence on young forest habitat, the American Woodcock can be seen as an umbrella species for numerous other species of wildlife that also rely on young forest habitat. By managing our lands in order to conserve woodcock populations, we also provide habitat for over 36 bird species (Dettmers 2003) and as many as 20 mammal species (Fuller and DeStefano 2003). The creation of woodcock demonstration areas serves as a way to educate landowners about land management practices that benefit the American Woodcock. As such, the American Woodcock Habitat Demonstration Area Trail and the interpretive signs I developed for the Great Swamp Management Area represent a further step toward the conservation of biodiversity in the Northeast.

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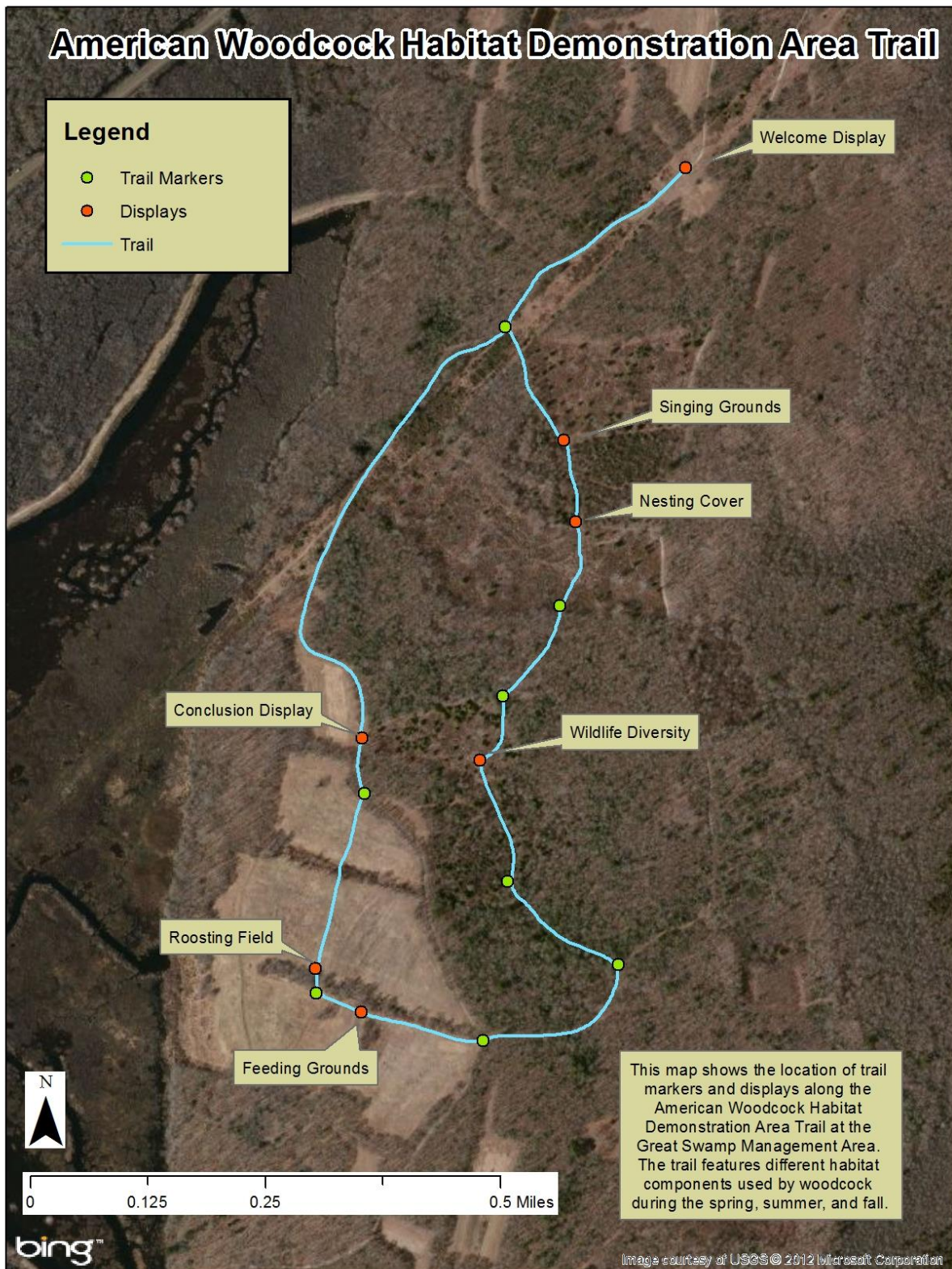
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Appendix A



Welcome to the American Woodcock Habitat Demonstration Area Trail at the Great Swamp Management Area

Although a member of the shorebird family, the American Woodcock (*Scolopax minor*) requires young forest or “early successional” habitat like that provided here at the Great Swamp Management Area. In the past, forest openings that created young forest habitat were produced by natural disturbances such as wind, fire, insect and beaver activity, and also by the activities of Native Americans. Young forest habitat was most abundant in the Northeast during the late 1800’s to mid 1900’s when many European settlers abandoned their farmland and moved to towns and cities. During this period, young forest habitat accounted for as much as 35% of the forested area in the Northeast. The legacy of these former farmlands is evident by the many stone walls now found in our forests.

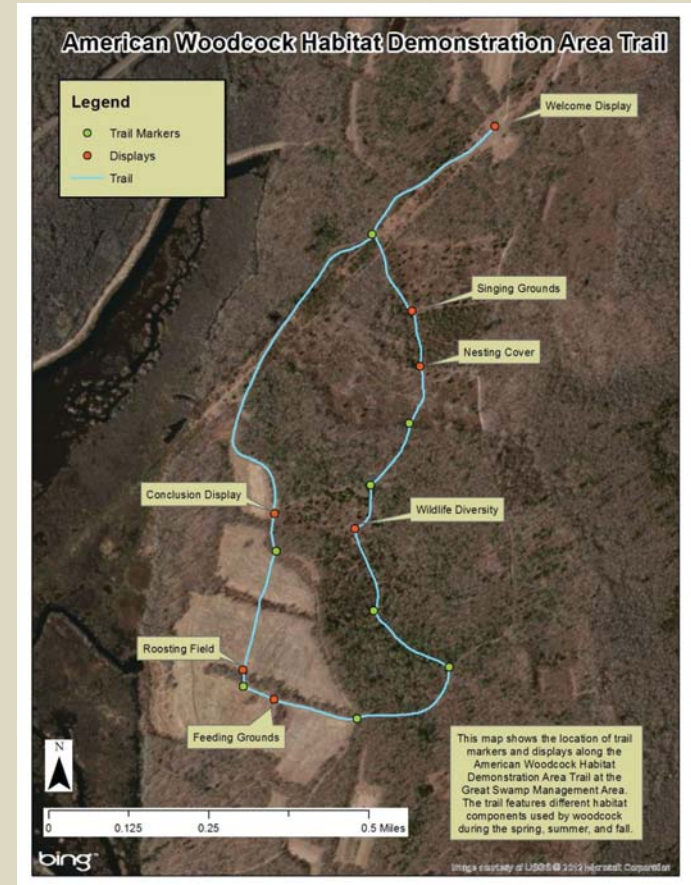
Young forest habitat in Rhode Island has declined quite dramatically since the mid 1900’s because we have reduced the frequency and extent of natural disturbances, cutting of forests in uncommon, and human development has converted most land for other uses. A 2008 land cover study conducted by researchers at the University of Rhode Island found that young forest habitat covered only 3.3% of the total land area in the state. As a result of this loss and degradation of young forest habitat, woodcock populations have declined along with the populations of many other wildlife species that depend on this habitat.



American Woodcock

What can we do about the decline of young forest habitat and the wildlife that depend on it? In short, we need to more actively manage our forests in ways that conserve wildlife populations that require young forest habitat. In 2008, with funding support from the Wildlife Management Institute, a portion of the Great Swamp Management Area was designated as a Woodcock Habitat Demonstration Area by the Division of Fish and Wildlife. The goal was to create young forest habitat and demonstrate its value to wildlife. In general, the site is managed by periodically clear-cutting small patches of forest so that new, young forest returns, and maintaining some herbaceous openings via periodic mowing. Every few years new patches of forest are managed so that over time a patchwork of young forest habitat is maintained.

As you follow this 1.25 mile trail you will pass through forests that are a variety of different ages and provide habitat for a variety of wildlife. Stops along the way will highlight how the area has been managed to improve habitat for the American Woodcock and various other species, and how land owners and managers can implement these practices on their properties.



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Singing Grounds

American Woodcock are hardy, ground-nesting birds. Of all the migratory birds in the northeastern United States, woodcock are among the first to return to the breeding grounds and begin nesting. At Great Swamp, woodcock usually arrive in late-March and throughout April. Soon after their arrival, males seek out forest openings where they perform elaborate flight and ground displays to attract females. This ritual usually occurs each night just after dusk. Interestingly, male woodcock alter the timing of their courtship displays in response to light levels. On clear nights they begin their display about 18 minutes after local sunset. On cloudy nights, when it becomes darker earlier, courtship displays typically begin about 9 minutes after local sunset. The male begins his display by making a nasally call that sounds like a short “*peent*”. He repeats this call from the ground for several minutes before launching himself into the air. He then flies in a wide spiral around his singing ground, reaching a height of about 300 feet. After the short courtship flight, the male returns to the ground, usually to the same spot from which he took off, and begins calling again. The male will continue to alternate between his ground and aerial displays for about an hour after sunset. The male hopes that a female will be attracted by his display and they will mate.



Area immediately after clear cut



Wood from clear cut to be sold as timber

Males may use active or abandoned farm fields, pastures, natural forest openings, or regenerating forest clear cuts (such as the area in front of you) as singing grounds. The size of a clearing that a male will use as a singing ground varies, and is more dependent on the height of the surrounding vegetation and proximity to good nesting areas where females are likely to be. By clear cutting select forest patches, managers and landowners can create ideal woodcock singing grounds. Once these clearings have been made, it does not take long for woodcock to find them. Since beginning efforts to improve woodcock habitat in the Great Swamp Management Area, biologists from the Division of Fish and Wildlife and the University of Rhode Island have documented male woodcock performing courtship displays in clear cuts within a month after the clear cuts were created.

The clear cuts made here at the Great Swamp Management Area range from 5 to 12 acres and typically support 1 to 4 singing males each season, but woodcock can use smaller areas as singing grounds as well. In areas where the surrounding vegetation is less than 25 feet tall, singing grounds as small as 0.25 acres can be created. If the surrounding vegetation is taller, singing grounds should be made at least 0.5 acres. Creating singing grounds through clear-cutting can also be profitable for landowners, as the cut wood can be sold as timber. The money generated from timber sales at the Great Swamp Management Area is used to support additional management activities here and at other management areas around the state.



Five year old clear cut



American Woodcock in clearing

Nesting Cover

During a clear cutting event, sections of forest are removed, allowing sunlight to reach down to the ground below. Soon after clear cutting, new vegetation springs up from the remaining stumps and from seeds that have lain dormant just beneath the ground. This early stage of forest growth creates a layer of dense, shorter vegetation that provides ideal nesting cover for female woodcocks and their chicks. Females nest on the ground, laying four light brown, speckled eggs on the leaf litter. The eggs are incubated by the female for about 21 days before hatching. Within an hour after hatching, the young leave the nest. The high stem density of the young growth forest provides woodcock chicks with both camouflage and physical protection from predators. Woodcock chicks grow rapidly and are nearly full size and independent of the female by 25 days of age.



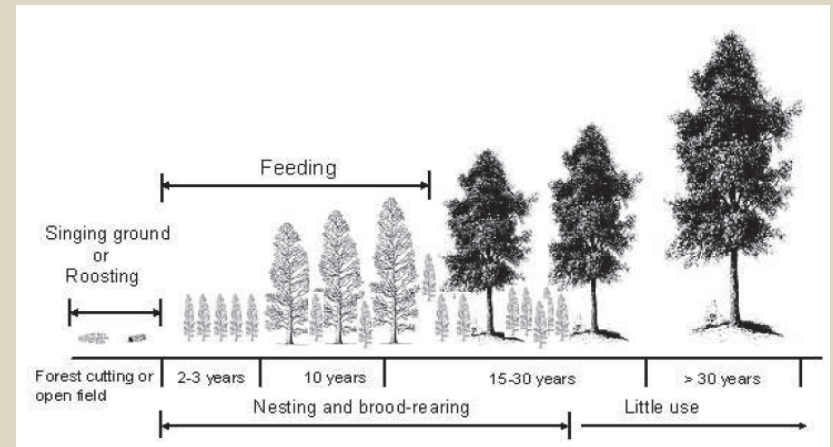
American Woodcock Nest



American Woodcock chick

The forest to your left was clear cut in 1995, while the forest to your right was clear cut in 2007. Once an area is clear cut, it will provide good nesting habitat for about 30 years without any further management. The best way to provide nesting habitat is to manage forest land in a way that creates patches of habitat in various age classes. This can be achieved by clear cutting adjacent strips of land every 4 to 5 years over a 30 year rotation period.

Image from Kelley et al. 2008. American Woodcock Conservation Plan



This graphic shows how woodcock use forest at different stages of development for courtship displays, roosting, feeding, nesting, and brood-rearing.



American Woodcock hen with chicks

Wildlife Diversity

As vegetation begins to grow back after a clear cut, woodcock will continue to use open patches as singing grounds for at least 5 years. The new growth of shrubs and young trees also provides excellent habitat for many other species. Biologists at the University of Rhode Island and Division of Fish and Wildlife have conducted studies showing that there are significantly more bird species found within 55 yards of woodcock singing grounds than at unmanaged forest sites. These species include the Eastern Towhee, Blue-winged Warbler, Indigo Bunting, Field Sparrow, and Whip-poor-will which are all “species of greatest conservation need” in Rhode Island.

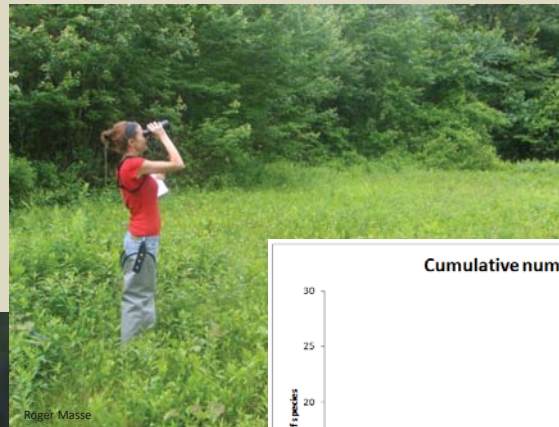
Another species of greatest conservation need is the New England cottontail. Over the past 50 years, their numbers in the Northeast have declined dramatically due to land development and competition from the introduced eastern cottontail. In fact, throughout much of the Northeast, populations of New England cottontail have been almost completely replaced by populations of eastern cottontail. New England cottontails thrive in shrub thickets and young forest habitat. While 1-2 acres of shrubland or young forest generally provides adequate habitat for most bird species, the New England cottontail requires about 25 acres. Since 1995, XX acres of forest have been cleared in the Great Swamp Management Area, adding to the already existing 44 acres of wildlife habitat openings.



New England Cottontail



Yellow Warbler



Roger Masse



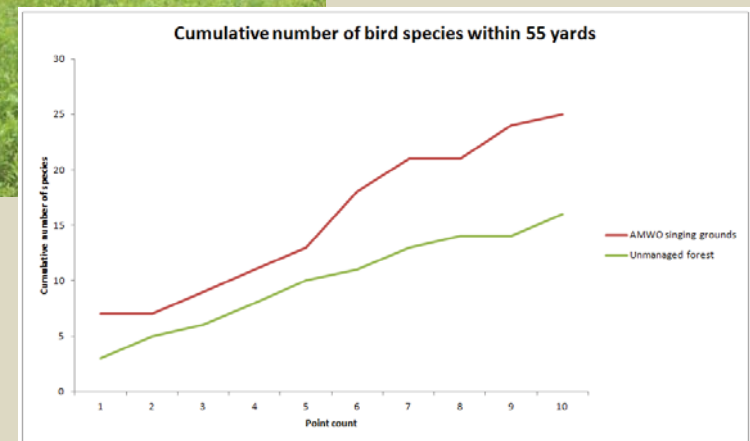
Field Sparrow



Indigo Bunting



Eastern Towhee



This graph shows the total number of bird species detected at woodcock singing grounds versus unmanaged forest areas at ten different sites

Feeding Grounds

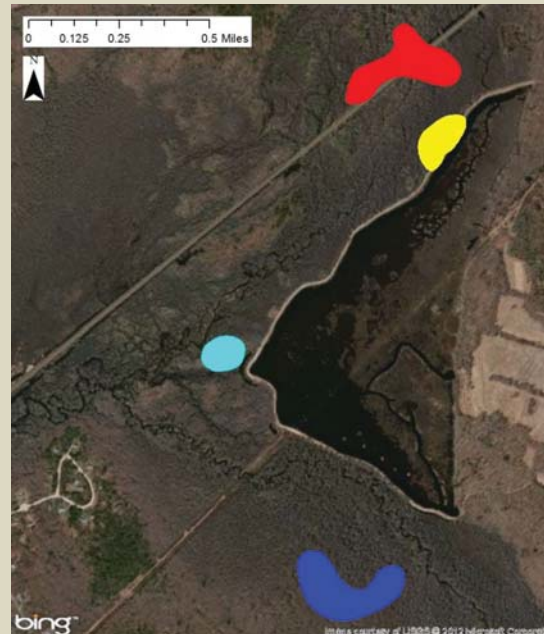
As you look west across the water, you will see the rich floodplain of the Pawcatuck and Usquepaug Rivers. These floodplain forests provide feeding grounds for the American Woodcock, and during summer months, male woodcock spend much of the day feeding and resting in these productive areas. The woodcock uses its long, flexible bill to probe the moist soil in search of earthworms. Amazingly, the flexible tip of the woodcock's bill is capable of opening and grasping earthworms even when it is plunged into the soil. In a single day, a woodcock can eat its weight (about 130-210 grams) in earthworms.

Researchers from the University of Rhode Island and the Division of Fish and Wildlife have used radio transmitters to track the daytime movements of male woodcock with radio transmitters that were captured at singing grounds during spring months. These males travel up to 1 mile from their signing grounds to feed and rest in floodplains and other areas with moist soils, high shrub and sapling densities, and high earthworm densities. Woodcock will also feed in mature forest with understories of shade-tolerant shrubs such as pepperbush (*Clethra alnifolia*) and winterberry (*Ilex verticillata*) where soils remain moist during hot summer months.

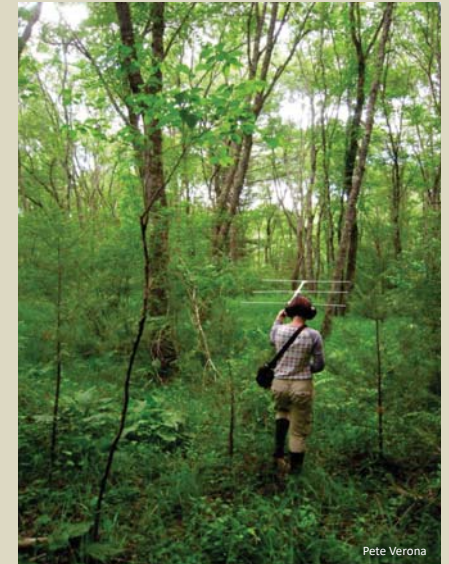


Dense vegetation of woodcock feeding grounds

Maintaining patches of land in different stages of succession can provide both nesting habitat and places for adults to feed. A proven way to create good quality feeding grounds is to clear-cut strips of forest that run near streams or wet areas on the managed land, as the moist soils are likely to support a greater abundance of earthworms. However, because many wetlands are protected, be sure to consult state wetland protection laws before altering habitat along streams or in wetlands.



This map shows the daytime feeding areas of four different male woodcock, as you look west across the impoundment. The areas used by each of the four males are marked in different colors.



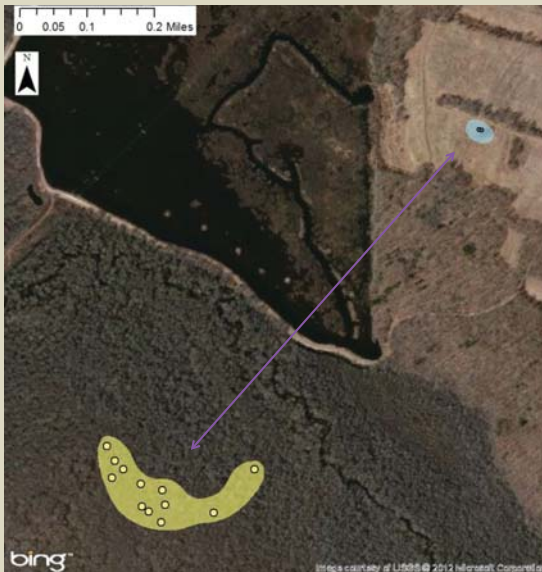
Radio tracking woodcock in the field



American Woodcock with radio transmitter

Roosting Fields

In the summer and early fall, when woodcock are no longer seeking mates but have not yet migrated south, they often fly to forest openings each night to roost. Woodcock will roost in old fields and pastures, blueberry barrens, or newly created clear cuts. While these areas may not be rich in food for the woodcock, they do provide safety from predators. The patchy growth in these habitats provides protection from predators overhead, but is open enough to permit good vision of potential predators approaching on the ground. Research conducted by biologists with the Division of Fish and Wildlife and the University of Rhode Island show evidence that at night woodcock are safer in fields or recent clear cuts than dense forest because mammalian predators are less active in these forest openings. Young of the year will begin moving to these roost sites about 3 weeks after hatching, when they are independent of their mother.



This image shows the movement of an individual male woodcock from its daytime feeding area (in yellow) to its nighttime roosting site (in blue).

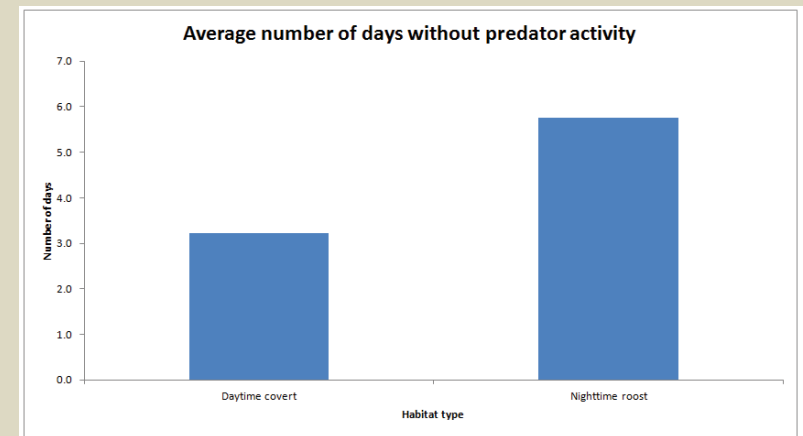


This image shows the roosting sites of four individual males, each marked by a different color.

The field that you are in has been managed to create roosting habitat for woodcock. Each year during July, managers at the Great Swamp Management Area mow a series of 8-20ft wide strips throughout the field and along the field edges. Woodcock roost in the shorter grass that has been mowed, and radio tracking of woodcock has shown that some individuals will consistently return to these mowed areas each night. Managers recommend periodically mowing whole fields and meadows or a series of 20 foot wide strips from mid-July through September to encourage woodcock roosting.



Woodcock roosting field



This chart shows the difference in predator activity between woodcock daytime coverts and nighttime roost sites. Woodcock are safer at nighttime roost sites in forest openings because predators are less active in these areas.

Conclusion

Beginning in October, as the weather turns cold, woodcock start their journey south for the winter. Each spring when they return, they depend on this patchwork of young forest habitat; clearings are needed for singing grounds, dense vegetative cover is required for successful nesting and brood rearing, forested areas with rich and moist soils are ideal for feeding, and open fields provide safe havens at night from predators. From where you stand, you can see managed fields behind you, a regenerating clear cut to your right, and more mature, second growth forest to your left. These varying stages of forest succession are all components of the woodcock habitat mosaic that has been created here at the Great Swamp Management Area.



Feeding Grounds



Roosting Fields



Great Swamp Management Area



Singing Grounds



Nesting Cover

The American Woodcock has long been a popular game species and a favorite among bird watchers and nature-lovers alike. Implementing land management strategies like you see demonstrated here on both public and private lands creates a mosaic of young forest habitat that is key to the conservation of woodcock populations. Due to its dependency on young forest habitat, woodcock can be considered an umbrella species for other wildlife that use this same habitat. By actively creating the habitat patches so important to the American Woodcock, we can play a role in increasing woodcock populations, as well as the populations of over 50 wildlife species that all depend on young forest habitat.