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MANAGEMENT PLAN
FOR
AMERICAN WOODCOCK
IN PENNSYLVANIA
2008-2017

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Prepared by

William Palmer
Wildlife Biologist

Bureau of Wildlife Management
Pennsylvania Game Commission
2001 Elmerton Ave.
Harrisburg, PA 17110-9797

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EXECUTIVE SUMMARY

The American woodcock (*Scolopax minor*) is a popular game bird, both with hunters and birdwatchers, throughout eastern North America. The U.S. Fish and Wildlife Service (USFWS) manages woodcock on the basis of Eastern and Central Regions. The woodcock population has declined significantly in both regions since 1968, when surveys began. Loss and degradation of early successional forest habitat is thought to be the main factor causing these declines. The draft national American Woodcock Conservation Plan (2008) documents changes in woodcock densities and habitat that occurred from the early 1970s to present. Population density deficits were calculated and specific habitat acreage goals for erasing these deficits were developed. The historical abundance of woodcock in Pennsylvania (PA) parallels that of the Eastern Region. Intensive logging, farm abandonment and wildfires that created woodcock habitat in the first half of the 20th century are relatively rare today. As urbanization continues to eliminate and fragment forest cover, and our forests become older, the early successional habitat available to woodcock for breeding, feeding and cover, continues to decrease.

The USFWS, Partners in Flight, and the North American Bird Conservation Initiative have ranked the woodcock as a highest conservation priority within the U.S. It is also identified as a priority species in PA's Comprehensive Wildlife Conservation Strategy.

This plan supports the draft American Woodcock Conservation Plan of The Association of Fish and Wildlife Agencies' Woodcock Task Force. Using the process of that plan, knowledge of population deficits was used to determine breeding habitat goals for PA. Woodcock habitat is defined as small diameter (seedling/sapling) and non-stocked forest inventory categories, on moist fertile soils. PA has lost an estimated 40,098 singing male woodcock since the early 1970s, a 43% decline. This number of birds corresponds to a population density deficit of 40,903 males. Using a density allows for differences in manageable acreage between time periods. This density deficit was used to calculate a breeding habitat objective, to return woodcock densities to former levels. The resulting habitat objective is to create an additional 1,174,719 acres (7.3 % of current total forest land) of early successional forest habitat on suitable soils in PA by 2022. This translates to 783,150 acres by 2017, the time fame of this plan. This habitat, as measured by the U.S. Forest Service (USFS) Forest Inventory Analysis system, would result in positive woodcock population growth as measured by the Singing-ground Survey.

This plan includes strategies to obtain stated objectives for PA within the framework of the national woodcock conservation plan. This plan is also intended to be used for other planning purposes, e.g., state game lands plans. The plan contains information on woodcock biology, habitat needs, populations, and recreation, both historical and present. Literature references, figures, tables, and appendices are included. Increasing woodcock populations and habitats is a significant challenge, and will require coordinated planning, research, and management efforts between state and federal agencies, flyway councils, nongovernmental organizations and sportsmen's groups.

SECTION I. MANAGEMENT GOAL, OBJECTIVES, AND STRATEGIES

GOAL: *To return woodcock populations in PA to densities which provide improved hunting and viewing opportunities.*

Two objectives are identified to accomplish this goal, with a set of strategies and a time frame for completion (Appendix 1) provided for each objective.

1. Population Objective: Achieve a positive population growth of 26,700 breeding male woodcock by 2017.

Strategies – Accurate measurements of woodcock numbers are needed to measure changes in populations. Knowing the effects of hunting on the population is necessary to insure the population is not overharvested. Strategies need to be addressed on both flyway and state levels because the migratory woodcock is managed under federal guidelines on a regional basis.

1.1 Monitor statewide woodcock populations annually.
1.2 Monitor woodcock population responses annually on select habitat demonstration areas.
1.3 Monitor woodcock recruitment via wing-collection survey.
1.4 Estimate statewide woodcock hunter numbers and harvests.
1.5 Determine woodcock harvest rates, harvest derivations, and survival rates, in cooperation with other states in the Eastern Management Region.
1.6 Determine woodcock hunter preferences, knowledge, and satisfaction regarding population levels as well as seasons and bag limits.
1.7 Develop harvest strategies for the Eastern Region, in cooperation with other states.

2. Habitat Objective: Create 783,150 acres of early successional forest habitat by 2017.

Strategies – Habitat management, specifically creating early successional forests types on suitable soils, has been shown to increase populations of woodcock. Our state objective includes promoting management of early successional forests on both private and public lands. Woodcock habitat should be created using management units of 500 to 1,000 acres within 1 to 2 miles of each other.

2.1 Monitor statewide early successional forest trends.
2.2 Identify important woodcock breeding and migration habitats for developing priority lists/targets for protection and management.
2.3 Protect critical woodcock habitat from development through purchase or easements.
2.4 Create 6,790 additional acres of woodcock habitat on State Game Lands annually (statewide 10-year target of 67,900 acres).
2.5 Create 14,425 additional acres of woodcock habitat on other public lands annually (statewide 10-year target of 144,250 acres), by establishing formal agreements

and meeting annually with other public land management agencies to focus habitat enhancement/creation initiatives for woodcock.

2.6 Create 57,100 additional acres of woodcock habitat on private lands annually (statewide 10-year target of 571,000 acres), by promoting partnerships with existing programs (e.g., Woodcock Habitat Initiative on State Lands, Partners in Flight, Partners for Fish & Wildlife, Audubon's Important Bird Areas, etc.)

2.7 Establish 12 demonstration areas on public lands that illustrate habitat management practices for woodcock by 2010.

2.8 Develop technical assistance or management guides on woodcock habitat management for distribution to public and private landowners and managers, via websites, news releases, and workshops.

2.9 Conduct 6 workshops annually on woodcock habitat management.

2.10 Continue research to develop new or enhance habitat management techniques to benefit woodcock.

2.11 Identify costs for conducting noncommercial habitat management for woodcock, necessary to meet annual statewide habitat management objective.

2.12 Secure funding to assist landowners with noncommercial forest treatments and habitat development to benefit woodcock.

2.13 Identify landowner preferences, attitudes, and other factors that may be preventing them from implementing habitat practices to benefit woodcock.

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SECTION II. BACKGROUND

In 1997, under the auspices of the International Association of Fish and Wildlife Agencies (IAFWA), the Woodcock Task Force was formed to address woodcock habitat and its management. The task force submitted their report (Woehr 1999) at the March 1999 IAFWA meeting to the Migratory Shore and Upland Game Bird (MSUGB) Subcommittee of the Migratory Wildlife Committee. The report covered the current status of American woodcock habitat, potential trends in habitat, breeding bird surveys as an indicator of habitat trends, and population status of other early successional birds compared with that of mature forest birds. Recommendations were made for habitat issue priorities and how federal and state agencies could work both independently and cooperatively to address habitat and related woodcock population issues.

In December 2001, another Woodcock Task Force was formed (again under auspices of IAFWA) to develop a plan to coordinate woodcock habitat needs with federal, state, provincial, non-government organizations, and private land managers in the U.S. and Canada. The Task Force was also charged to coordinate woodcock management needs with groups working on waterfowl, shorebirds, waterbirds, Partners in Flight (PIF), or other bird management plans/joint ventures/initiatives. This task force was to report to each meeting of the MSUGB Working Group. In 2002, the Task Force reported guidelines for development of a Woodcock Conservation Plan based upon Bird Conservation Regions (BCR; Fig. 1), as identified in the North American Bird Conservation Initiative (USFWS 2000). The draft national American Woodcock Conservation Plan (2008) has habitat acreage goals for each BCR, which often is a composite of portions of multiple states. Our plan is a step-down from the national plan and is a composite of the 3 BCRs in PA (Fig. 2).

Woodcock are identified as a priority species in other planning efforts covering PA; these plans include the PA Wildlife Action Plan (PA Game Commission (PGC), PA Fish and Boat Commission), PIF North American Landbird Conservation Physiographic Area Plans, U.S. Shorebird Conservation Plan, and the Atlantic Coast Joint Venture BCR 13 Plan. The Nature Conservancy has prioritized woodcock as a focal species of management concern. The woodcock is on the National Audubon Society Watchlist, identified as a species of concern.

Taxonomic Description

The American woodcock (*Scolopax minor*) is a migratory game bird, native to eastern North America. Woodcock are members of the shorebird family, but live in the forested uplands. Woodcock weights vary by sex (females are larger than males), age, and time of year, being highest just before fall migration when juvenile weights approximate those of adults (Straw et al. 1994). In Maine during late October, females

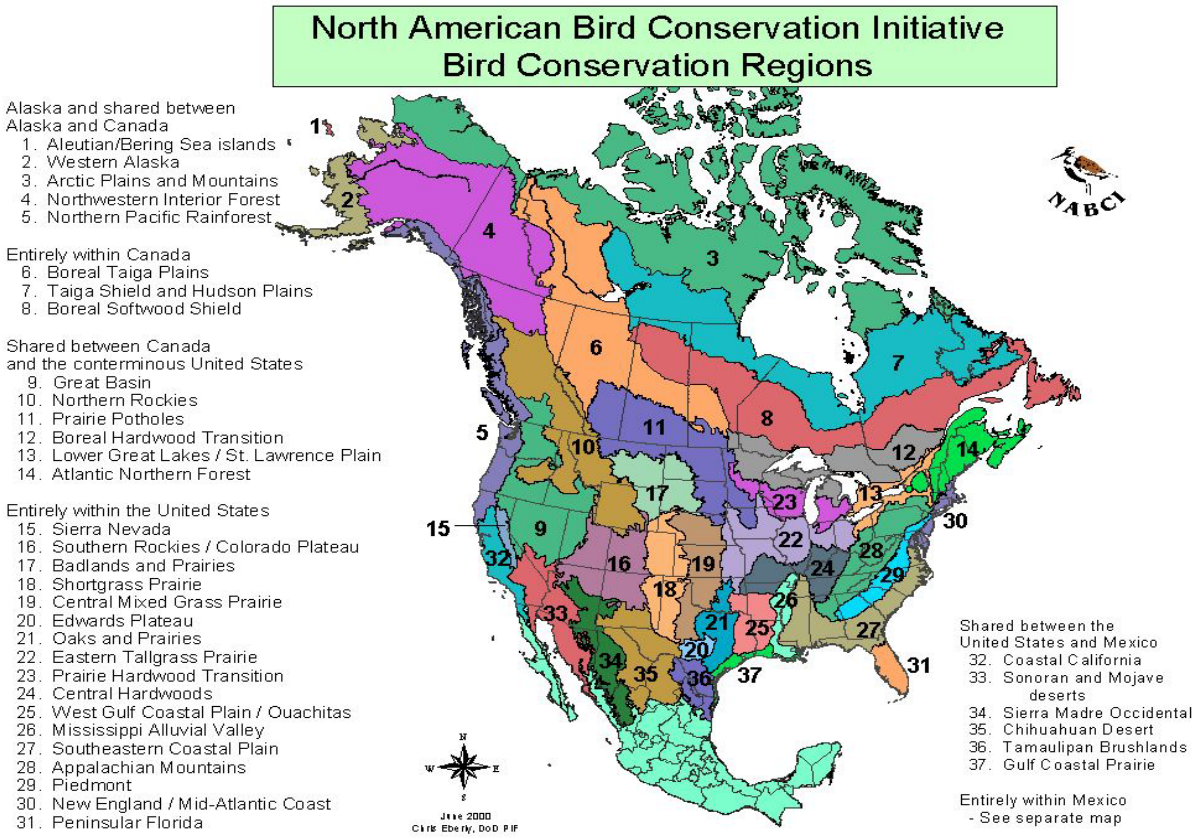

Fig. 1. Bird Conservation Regions in North America (USFWS 2000).

averaged 215 g with males at 174 g (Mendall and Aldous 1943, Owen and Krohn 1973). Plumage is a mottling of browns, blacks and buffs, a camouflage pattern for blending in with leaves on the forest floor. Short rounded wings allow flight in thick cover. The outermost primary feathers produce a twittering sound when the bird is flushed and during the male's courtship display. The eyes sit far back on the head, enabling the bird to see virtually 360^0. One of the most distinctive features of the woodcock is its bill, 60-75 mm in length (Mendall and Aldous 1943). It has a prehensile tip that can be opened while the bird probes for food in deep soil. The underside of the mandible and tongue are roughened and enhance grasp on the woodcock's main diet of earthworms and other soil invertebrates. Age of woodcock chicks up to 15 days can be estimated by bill length (Ammann 1982). Bill length is a reliable measurement for distinguishing gender of fully-grown birds. Other measurements for sexing grown birds include wing length (Artmann and Schroeder 1976) and width of primaries 8-10 (Greeley 1953). Unlike most birds, woodcock have no crop or gizzard for storing and grinding food. Their diet of soft earthworms and invertebrates apparently makes a gizzard unnecessary, and the relatively long digestive tract provides the required digestion of foods. Short legs are positioned far back on the body so that it walks with a front-back bobbing gait. The woodcock is a unique bird and it has many local names that describe its appearance and habits, including: bog sucker, big eyes, swamp quail**,** wood snipe, brush snipe, swamp bat, and Labrador twister. The most common nickname is timberdoodle. A more complete list is recorded by Pettingill (1936).

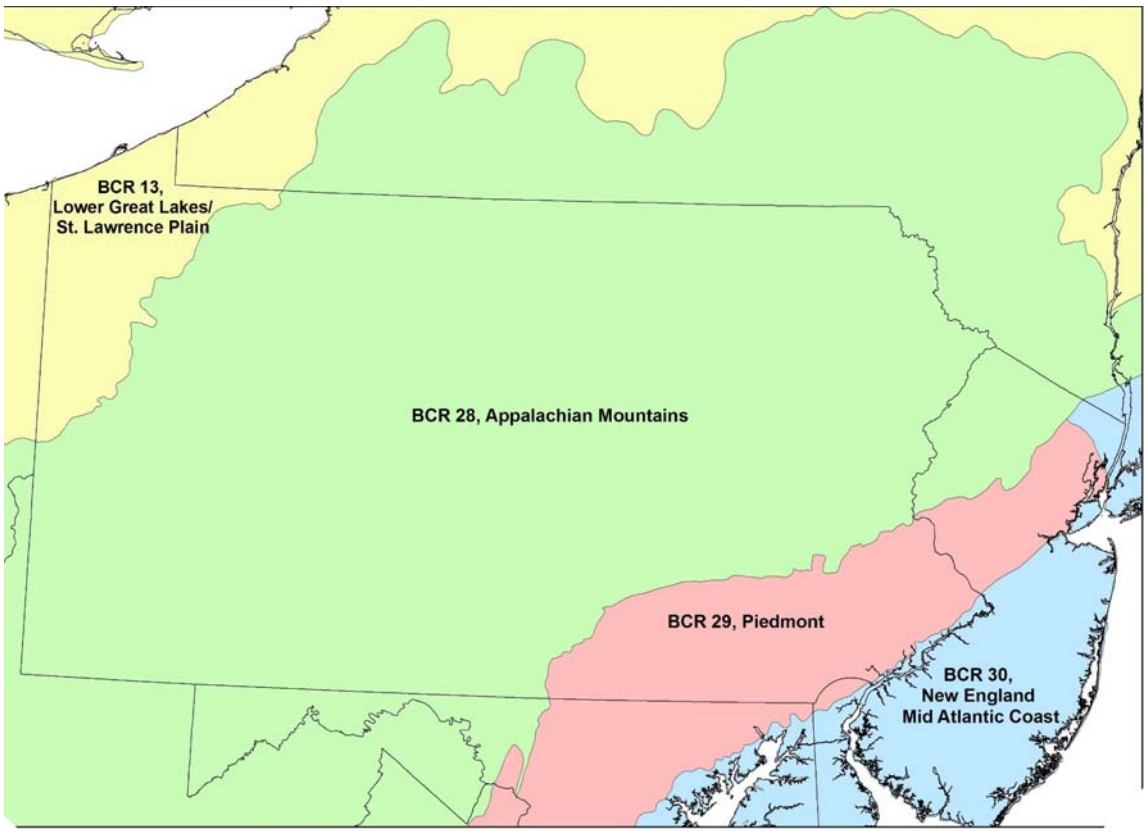

Figure 2. Bird Conservation Regions in PA (USFWS 2000).

History and Distribution

The first fossil bone fragment of an American woodcock was discovered in Eichelberger cave near Belleview, Florida (Brodkorb 1956). Dr. Brodkorb judged that the age of the bone dated to the middle Pleistocene (781,00-126,000 years ago). Pleistocene woodcock remains have been found at additional sites, one in Florida and one in Virginia, since 1957 (Wetmore 1962, Ligon 1963). Woodcock lived in America prior to the last two ice invasions, possibly more than 1,000,000 years ago (Sheldon 1967). The modern bird probably evolved during the late Tertiary period (38-1.6 million years ago), as did many other present-day species of birds (Lanyon 1963).

The woodcock range has most likely not changed for hundreds of years. The earliest records go back about 200 years and reports mostly agree with current woodcock locations (Sheldon 1967). American woodcock occur throughout eastern North America. They breed primarily in the northeastern U.S. and Canada, and winter in the southeastern U.S. (Fig. 3). Breeding is documented as far north as 50^0N, from Newfoundland in the northeast to the Manitoba-Saskatchewan border in the northwest (Straw et al. 1994). The western limit of breeding range follows Robbins et al. (1966). Breeding surveys (Sauer and Bortner 1991) are not conducted in Kentucky, North Carolina and states to their south because of low breeding densities in southern states. Wintering range extends from eastern Texas into southeastern Kansas, then across southern portions of Missouri, Illinois, Indiana, Ohio, PA and New Jersey, south through the northern two-thirds of Florida.

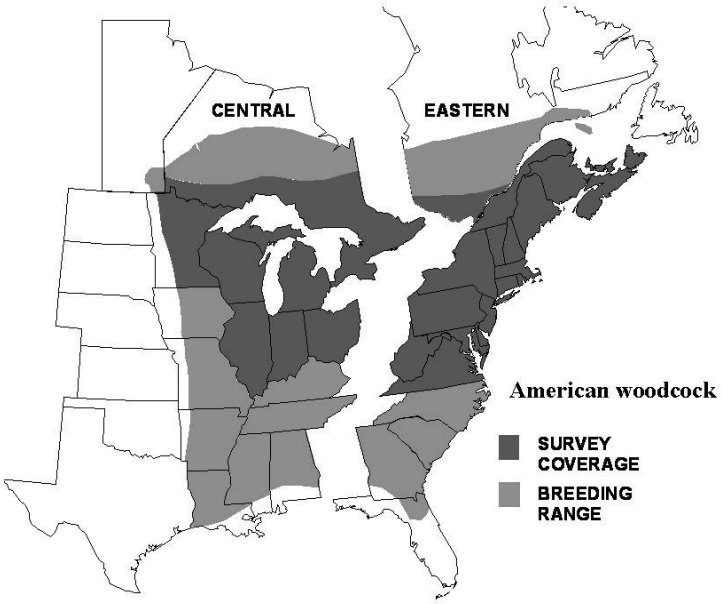

Figure 3. Woodcock management regions, breeding range, and Singing-ground Survey (SGS) coverage (Straw et al. 1994).

In PA, breeding woodcock are found throughout the state, although distribution and abundance are not uniform (Liscinsky 1972). Based on singing-ground survey (SGS) counts over the period 1970-88, estimated densities range from low (0-0.1 woodcock per route) in the Piedmont region of the state to relatively high (4-10) in the extreme northwestern part of the state (Sauer and Bortner 1991, Fig. 4). Migrating woodcock may be encountered throughout the state in spring and fall. Woodcock winter in southern and southeastern counties during mild winters. While the woodcock has a wide geographical range in North America, they are restricted primarily to young forests, with scattered openings and on moist, fertile soils that support an abundance of earthworms. Moderately-drained, fine-textured soils hold more earthworms (Owen and Galbraith 1989).

The status of woodcock prior to the American Revolution is largely unknown (Sheldon 1967). In 1783, the first American publication on game bird shooting, *The Sportsman's Companion*, described woodcock hunting methods of the late 18th century. A decade or two before the Civil War, shooting records of sportsmen and market hunters indicated an abundance of birds "unknown to modern hunters" (Sheldon 1967). By the turn of the century, long open seasons and market hunting appeared to take their toll, as woodcock population declines seemed to parallel those of deer and other wildlife. Laws to protect woodcock were enacted during the latter part of the nineteenth and early years of the twentieth centuries. Enforcement of these laws was so ineffectual that the bird

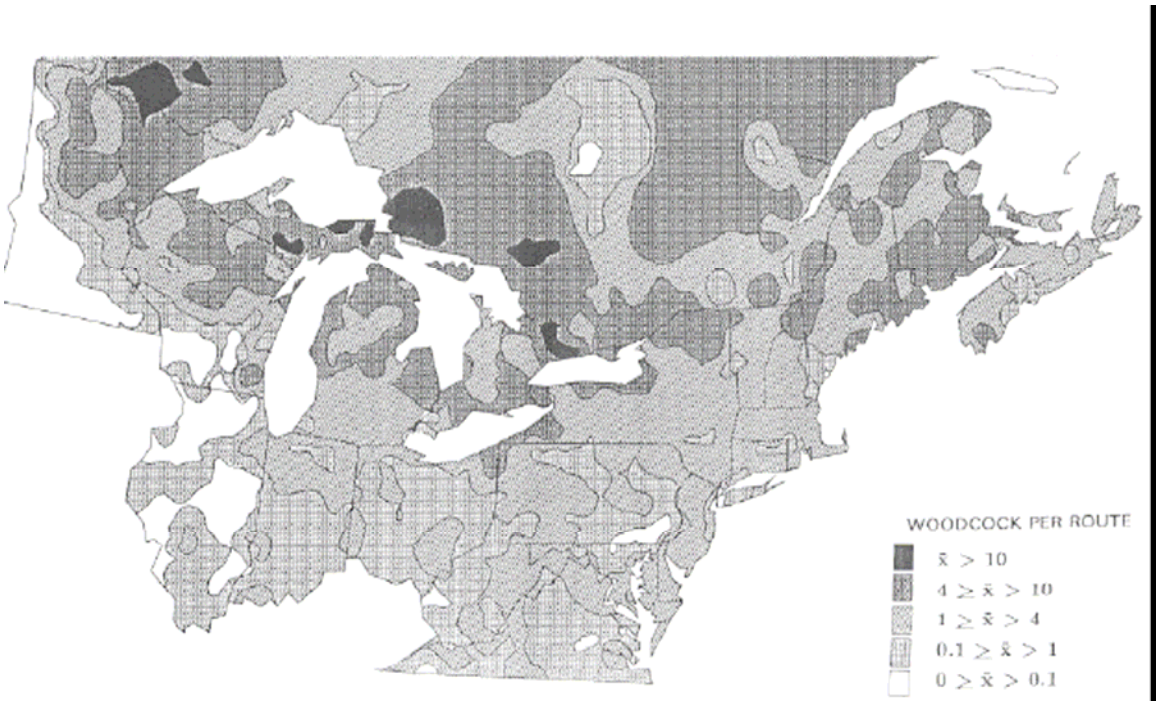

Figure 4. Estimated relative density of American woodcock throughout the range of the SGS, estimated from average counts over the period 1970-88, on SGS routes (Sauer and Bortner 1991).

gained little protection until the Lacey Act of 1900 prohibited interstate shipment of illegally killed game. With improved enforcement of more restrictive state laws, spring and summer shooting of woodcock decreased. The Migratory Bird Treaty Act placed woodcock hunting under federal regulation in 1918 and ended market hunting. By 1920, woodcock could be shot legally only in the fall and numbers have been sufficient since that time to permit regulated hunting. Limited surveys during the period of 1940-1965 did not show any changes in continental woodcock numbers (Sheldon 1967). Woodcock seemed to respond to protection in the early decades of the 20th Century. Meanwhile, habitat loss and degradation (decreased quality) was under way. Large losses of habitat, particularly forested wetlands in wintering areas, occurred during the mid-1950s to the mid-1970s (Haynes et al. 1988). Since the late 1960s woodcock breeding populations have been in long-term decline (Kelley et al. 2007). PA's resident breeding woodcock population trend has declined (-3.4% per year) along with the continental population, albeit at almost twice the rate of the Eastern region (-2.0% per year) as a whole.

Life History

Spring Migration

Woodcock begin to migrate in late January or February from wintering grounds in southern states. They are among the earliest migrants and arrive in PA from February through early April. By mid-April, only resident birds remain.

Courtship and Breeding

Before and during migration and after reaching their breeding areas, males perform their courtship rituals. Females arrive at breeding areas at the same time as the males. Woodcock courtship and breeding activity takes place at "singing grounds". The singing grounds are openings in areas of trees and/or shrubs, usually near dense young forest stands providing food and cover (Mendall and Aldous 1943, Liscinsky 1972). The courtship display occurs at dawn and dusk. The male begins on the ground with vocalization of a nasal *peent* followed by an upward spiral flight, peaking at 30 to 100 m, then descent to the flight departure point. During the courtship flight, the outer primary wing feathers produce a twittering sound and a melodic chirping is vocalized. These flights last around a minute and are repeated about a dozen times, for a display period of an hour or less (Mendall and Aldous 1943). Females attracted to these displays may visit as many as 3 males per evening and >1 female may visit a male during the crepuscular period (McAuley et al. 1993).

Nesting

Woodcock in PA have a rather long nesting season. Hatching has been observed from April 5 to June 14, with the peak occurring during the last week of April in central PA (Liscinsky 1972). Nest site requirements are few and they use a variety of habitats. Most nests are found in young, second growth hardwoods (Mendall and Aldous 1943, Sheldon 1967). In central PA, nests are often at the base of a tree or shrub (Coon et al. 1982). Usually 4 eggs are laid in a cup shaped depression lined with leaves. Incubation is between 19 and 22 days (Liscinsky 1972). Incubating hens have strong nest affinity and can sometimes be touched while on the nest.

Summer

By early summer, woodcock chicks are fully independent. During summer, most woodcock begin to move to nocturnal roosts at dusk and return to their diurnal cover at dawn (Straw et al. 1994). The roost is usually an opening, like a field or singing ground, but may be another forested site similar to the diurnal cover. Use of openings versus forested sites as roosting areas varies by age and sex. Percentage of individuals using fields varies by age and gender but peaks in mid summer and declines through late summer and early fall (Sepik and Derleth 1993).

Fall Migration

Cold temperatures that freeze the ground, or snow cover, makes feeding on earthworms difficult and forces woodcock to head south. Resident birds do not "move out" prior to migrants arriving from north of PA and locally banded birds were recovered throughout the hunting season (Liscinsky 1972). Another PA study showed migration occurring between November 18 and December 8 (Coon et al. 1976). More recently, woodcock in northwestern PA migrated between October 23 and November 27, 1998 and between October 24 and December 11, 1999 (PGC unpublished data). In mild winters, there have been reports of woodcock remaining in southern PA.

SECTION III. WOODCOCK POPULATIONS

Population Demographics

Females have high nest site fidelity (Dwyer and Nichols. 1982). Mean clutch size is about 4 eggs. Nest success is high, with estimates from 43 to 67% (Mendall and Aldous 1943, Liscinsky 1972, Gregg 1984, McAuley et al. 1990), and woodcock readily renest after losing a clutch or brood. Therefore, even with a small clutch size, woodcock have a fairly high reproductive potential.

Survival from hatch to fledging is dependent primarily on weather (McAuley, unpublished data). In PA, Liscinsky (1972) estimated 9% loss between hatching and brood counts, with another 15% lost by hunting season. Additional information on population status is obtained through the Wing-collection Survey (Kelley et al. 2007) where cooperating hunters send woodcock wings to the USFWS. Age and sex ratios in the harvest are determined by examining plumage characteristics, thus providing an index to recruitment. In the Eastern Region woodcock management unit the 2006 recruitment index was 1.5 immatures per adult female. The long-term (1963-2005) index for the region is 1.7. In PA for 2006, the recruitment index of 1.3 was slightly lower than the 1.4 in 2004 and below the long-term PA average of 1.5. Survival of adults during courtship and nesting also is weather dependent. Persistent snow in spring can prevent feeding and lead to high mortality (Dwyer et al. 1988).

Most estimates of annual survival of woodcock have been based on analyses of band recoveries (Sheldon 1956, Martin et al. 1969, Krohn et al. 1974, Dwyer and Nichols 1982, Dwyer et al. 1988). Krementz and Bruggink (2000) estimated survival of adult woodcock in the Eastern Region to be 0.343 for males and 0.522 for females. Because of the difficulty of banding adequate numbers of birds and because the cost of banding adequate samples of woodcock is prohibitive, these estimates are imprecise. Based on radio telemetry studies, period survival rates were calculated for summer through early fall (0.923) in Maine (Derleth and Sepik 1990), during winter (0.647) in areas of the southern U.S. (Krementz et al. 1994), and in spring (0.789) in Maine (Longcore et al. 1996). Longcore et al. (1996) used these period estimates of woodcock survival from telemetry studies during spring, summer, early fall, and winter, then approximated survival during migration to estimate annual survival of adult males at 0.471. Longcore used a fall survival estimate of 0.853 from an un-hunted site (Moosehorn National Wildlife Refuge, Derleth and Sepik 1990) for the hunting and fall migration period. Subsequent work by McAuley et al. (2005) used radio telemetry to determine survival at sites (some hunted and some unhunted) in New Hampshire, Maine, PA, and Vermont during fall up to migration. Substituting their estimate of 0.700, with sexes and ages combined, for this period, resulted in an annual survival rate of 0.290. The two sites in PA used for this study had survival rates of 0.668 for an unhunted area and 0.746 for a hunted area, values not significantly different and falling on either side of the pooled point estimate for all sites.

Population Management

Because the woodcock is a migratory bird, the USFWS has regulatory authority over its management. Woodcock are managed on the basis of Eastern and Central regions or populations as recommended by Owen et al. (1977, Fig 5). These regional boundaries conform to the boundary between the Atlantic and Mississippi waterfowl flyways. The USFWS sets the frameworks of harvest regulations for all migratory game birds, including woodcock.

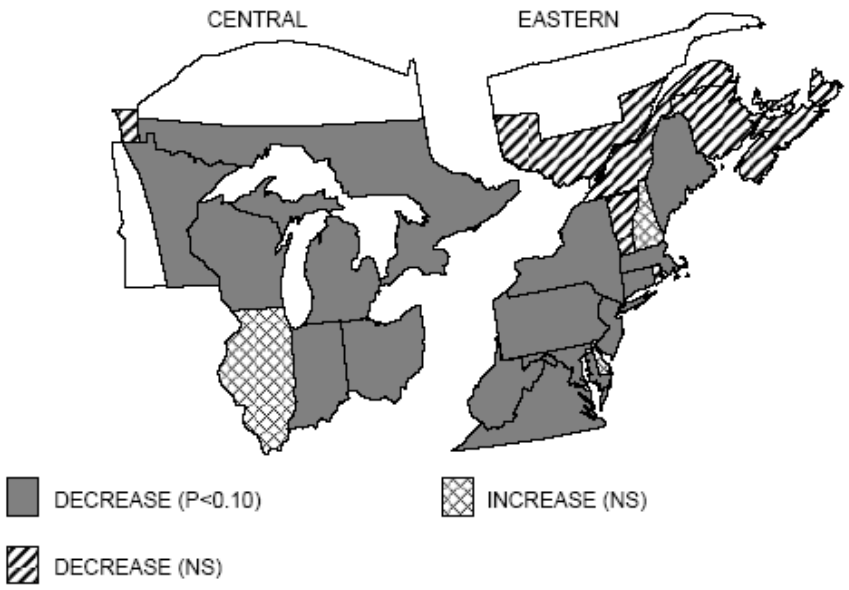

Figure 5. Long-term trends in the number of American woodcock heard on the SGS, 1968-2007 (Owen et al. 1977).

Monitoring

The USFWS annually coordinates a SGS (Kelley et al. 2007) to monitor woodcock breeding populations within each state and province in the central and eastern portions of the woodcock's breeding range (Fig. 3). The SGS was developed to exploit the conspicuous courtship display of the male woodcock. Early studies demonstrated that counts of singing males provide indices to woodcock populations and could be used to monitor annual changes (Mendall and Aldous 1943, Goudy 1960, Duke 1966, and Whitcomb 1974). This survey determines a population index by counting the number of singing males in the spring along randomly selected routes throughout the breeding range. Further population monitoring in PA includes several study areas in Crawford and Erie Counties. We have been conducting SGSs, from 1997 to the present, at SGLs 314, 101, 69 and the Erie National Wildlife Refuge. From 2001 through 2006, SGSs were run at Bald Eagle State Park (BESP) in Centre County. This effort was part of a cooperative project between several agencies and organizations and is described under the habitat section of the management history. The most recent population-monitoring endeavor in

PA was begun in 2002, in and around the Delaware State Forest in northeastern PA. This work is part of an idea for an early successional ecosystem management project targeting American woodcock, initiated by the Department of Conservation and Natural Resources (DCNR) Bureau of Forestry (BOF) (T. Ladner, personal communication). Additional cooperators include the PGC, private landowners, USFWS, and the Ruffed Grouse Society (RGS).

Trends

There have been significant long-term (1968-07) woodcock declines of 2.0 % per year in the Eastern Region and 1.8% per year in the Central Region (Kelley et al. 2007; Fig. 6). The historical abundance of woodcock in PA parallels that of the Eastern Region. PA's woodcock population has declined significantly since 1968 by an average annual rate of about 3.4% (Table 1). In the Eastern Region, the 2007 breeding population index was 1.34 singing-males per route; the 2007 index for PA was 0.91 males per route. SGSs conducted over the past decade on selected local, managed sites in northwestern (game lands and national wildlife refuge) and central (BESP) PA reflect relatively stable populations, with an average of 8 males per route; this shows the potential in managed habitat on good sites.

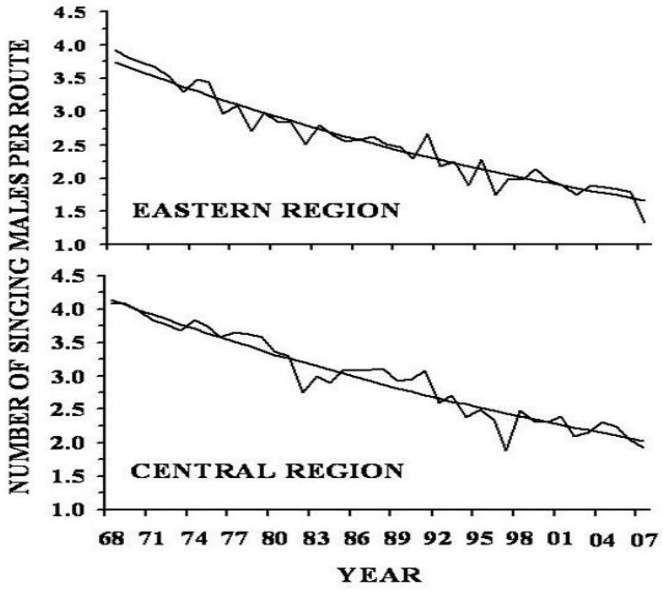

Figure 6. Long-term trends (smooth line) and annual indices of woodcock heard on the SGS 1968-2007 (Kelley et al. 2007).

Table 1. Breeding population indices for American woodcock from the SGS in PA, 1968-2007 (Kelley et al. 2007).

Year	Index	Year	Index	Year	Index
1968	3.20	1982	1.63	1996	1.15
1969	3.02	1983	1.86	1997	1.26
1970	3.33	1984	1.98	1998	1.39
1971	2.83	1985	1.57	1999	1.10
1972	2.59	1986	1.75	2000	0.72
1973	2.88	1987	1.73	2001	0.96
1974	2.09	1988	1.72	2002	1.01
1975	2.35	1989	1.26	2003	1.03
1976	2.31	1990	1.70	2004	0.95
1977	2.28	1991	1.89	2005	1.07
1978	1.86	1992	1.41	2006	0.84
1979	2.12	1993	1.46	2007	0.91
1980	1.93	1994	0.78		
1981	1.95	1995	1.44		

Threats

In addition to the most serious threat of habitat loss and degradation, other factors influencing woodcock populations must be considered.

Although hunting can be a major source of mortality on some sites, it is not thought to be causing woodcock population declines in the northeast under current regulatory frameworks (McAuley et al. 2005). Except for the hunted site in PA, natural predation was the major source of mortality in this northeast study. Natural predation is not considered a threat to populations because it was and is a constant in the evolvement of woodcock. While hunting impacted fall survival of woodcock in the western great lakes region (Oppelt et al. 2006), the effect on populations was not determined. There is still uncertainty due to unknown hunting factors, including seasons, bag limits, and harvest rates. While telemetry studies can estimate harvest rates for the period of time that woodcock remain on a study area, banding is needed to estimate harvest rates over the entire season. The extent and intensity required to band sufficient numbers of birds for improved survival rate estimates, a coordinated effort involving many states, has been cost prohibitive in the past.

Past banding of woodcock has been an effective technique to monitor migration, distribution and other aspects of life history. Researchers in the U.S. began using bird dogs to locate broods for banding in the 1930s. The PGC banded woodcock, mostly chicks, from 1952-1990, with approximately 1,500 total. The PGC terminated this program because without the participation of most other states, and transitioning the efforts to adult banding, harvest and survival rates cannot be estimated. The Michigan Department of Natural Resources continues to band (primarily chicks); they have banded

over 10,000 woodcock with their long-term volunteer spring program, ongoing since the 1960s.

The threat of contaminants on woodcock populations is another relatively unknown area. Acid deposition is a threat that can affect habitat; the effect on soil pH is a factor not only in forest regeneration but also on the supply of earthworms (Esher et al. 1993). Lead contamination is thought to be widespread in eastern Canada (Scheuhammer et al. 1999). Woodcock accumulate pesticides (Clark and McLane 1974) and pesticides can also impact the availability of food sources, such as earthworms.

There is little evidence of woodcock mortality from disease or parasitism. Chances of finding birds dead due to these causes are slight. An exception was in December 1989, when an estimated 1,000 woodcock were found dead in Cape May, New Jersey, and Cape Charles, Virginia (Docherty et al. 1994). A reovirus was identified as associated with this die-off, where emaciation was a consistent necropsy finding. A survey in 1990-92 indicated that this virus was not present in detectable levels in either breeding or wintering woodcock populations.

Impact with man-made structures is a mortality factor for birds migrating nocturnally at low altitudes. Woodcock have been found following collisions with tall office buildings, possibly attracted or disoriented by the city lights. According to the Federal Communication Commission 2000 Antenna Structure Registry, the number of lighted towers is over 74,000. Construction of towers is growing and will likely result in larger numbers of birds killed in collisions (Evans and Manville 2000).

Harvests and Hunter Success

Approximately 300,000 woodcock were harvested in the U.S. during the 2006-07 hunting season (Kelley et al. 2007). With a take of 18,371 birds, PA ranked first for harvest among states in the Eastern Region and fifth among all states (Appendix 2). Woodcock harvest totals are influenced by hunter numbers, and while hunter numbers are lower than in the early 1990s, they have remained relatively stable over the past decade (Librandi-Mumma and Boyd 2007). Hunter success, indexed as woodcock per day or woodcock per season, is difficult to measure because of many changes in seasons and bag limits over time (Appendix 3). Also, during these time periods, PA had imposed season and bag limits more restrictive than the federal frameworks (Appendix 4).

In addition to the above surveys, PA uses a system of cooperating hunters who keep a record of hours afield and bird flushes (Lang 1994, Palmer 2007) to provide an index to woodcock hunter success; it is recognized that this index is influenced by woodcock migrations as well as resident woodcock population levels. The average flushing rate for the 2005-2006 hunting season was 1.55 per hour, compared to 1.57 in 1994, 1.27 in 1984, and 1.73 in 1965. Flushing rates are influenced not only by migration, but also by changes in season and bag. In 1985, the USFWS reduced the season length from 65 to 45 days, and simultaneously reduced the daily bag from 5 birds to 3. In 1997, the season length was further reduced to 30 days. Since the adoption of the reduced hunting season framework, evaluations of the impact of the change remains problematic with respect to the effects of hunting on populations for the management unit (McAuley et al. 2005). PA

reduced its daily bag limit from 5 birds to 3 in 1983. PA's more recent changes in season length were in 1984 (from 6 weeks to 3), in 1991 (from 3 weeks to 2) and in 2001, when the season was increased from 2 weeks to 4. This last season change was in response to results from the survival rate study in the northeast, which included 2 sites in PA. The USFWS has no accurate estimates of harvest rate or annual survival and the wing-collection data do not often agree with state harvest surveys (USFWS 1990).

Population Goals

The major causes of long-term decline in woodcock populations are thought to be degradation and loss of suitable habitat on both the breeding and wintering grounds (Dessecker and McAuley 2001, Dwyer et al. 1983, Owen et al. 1977, Straw et al. 1994). The Woodcock Task Force of the Association of Fish and Wildlife Agencies was formed to document losses of woodcock habitat that have occurred during the past 3 decades, and to develop habitat management recommendations that are needed to halt and, ultimately, reverse population declines. The Task Force recognized that significant acreages of former woodcock habitat have reverted to land uses that make them unavailable to new management efforts. Therefore, they did not entertain an approach to developing objectives that involved striving for a return to absolute population *sizes* observed during the early 1970s. Instead, they adopted a framework for returning woodcock *densities* to former levels. Our state population targets are a simple step-down process from the draft 2008 American Woodcock Conservation Plan of The Woodcock Task Force.

A deficit approach was used to obtain population and subsequent habitat objectives. Average woodcock populations (singing males only) were estimated for the periods 1970-75 and 2000-2004 for each BCR. This was done by determining the average number of singing males for each time period. Estimates from singing males per route were then converted to singing males per acre since it was known how many acres each survey route sampled. Individual counties were assigned a density category based on which density contour the majority of its land area fell within. The total number of singing males in each county was determined by multiplying the density estimate by the total land base acreage (not simply acres of woodcock habitat) in the county. The population estimate for the state was determined by summing population estimates from the three individual BCR sections of the state. The *effective density* of singing males in each time period was determined by dividing the number of singing males by the number of manageable acres found in all BCRs during that time period. Manageable acres was defined as all timberland as determined by the USFS Forest Inventory (FIA). FIA is a system for inventorying and monitoring PA's forest resources (McWilliams et al. 2004).

By subtracting the current effective density from the historic effective density, a woodcock *density deficit* was derived. The *population deficit* is the number of singing males that need to be added to achieve the effective density observed during 1970-75. The population deficit was calculated for the sum of the 3 BCRs in PA by multiplying the density deficit by the current number of manageable acres. Then these totals were summed. PA has lost 40,098 singing male woodcock since the early 1970s (Table 2). When adjusted for manageable habitat acreage, this corresponds to a population density deficit of 40,903 males. These deficits were used to calculate breeding habitat objectives,

to return woodcock *densities* to former levels. Woodcock population changes will be measured by the SGS.

Table 2. Calculation of population deficits and habitat goals for American woodcock in PA.

	Historical[1]		Current[2]
Total land area (acres)	29,475,347		29,475,347
Manageable acres	16,002,190		16,141,502
Population of singing males	92,439		52,341
Population deficit (singing males)[3]		40,098	
Habitat goal (acres)[4]		1,174,719	

[1]Historical time period refers to ca. 1970-1975.
[2]Current time period refers to ca. 1998-2002.
[3]The population deficit is not the simple difference in males per time period but considers the density of males on manageable acres for each time period.
[4]The habitat goal is calculated as the population deficit multiplied by 28.7 aces.

SECTION IV. WOODCOCK HABITAT

Land Use Trends

Loss and degradation of habitat is a major problem for woodcock management in PA and throughout the eastern region of the U.S. Woodcock habitat is ephemeral and patchy in distribution. Habitat creation and maintenance depends on periodic forest disturbance to provide dense stands of early successional cover. An overall decrease in young forests (Ferguson 1968, Considine and Powell 1980, McWilliams et al. 2004; Fig. 7) has been attributed to a variety of conditions (USFWS 1990, 1996), including changing land management objectives and techniques, decline in farm field abandonment, advancing natural plant succession, increased urbanization and industrialization, increased suppression of wildfire and pests, and changing attitudes of landowners. Public misconceptions about forest management have promoted the belief that wildlife inhabiting mature forests are imperiled. In many cases, the exact opposite is true. For example, in the Northeast U.S., most interior forest bird species have increasing population trends, whereas almost half of all species using early successional/shrub habitats are declining (Sauer et al. 2005). The American Bird Conservancy has listed early successional habitats in eastern deciduous forests as one of the 20 most threatened bird habitats.

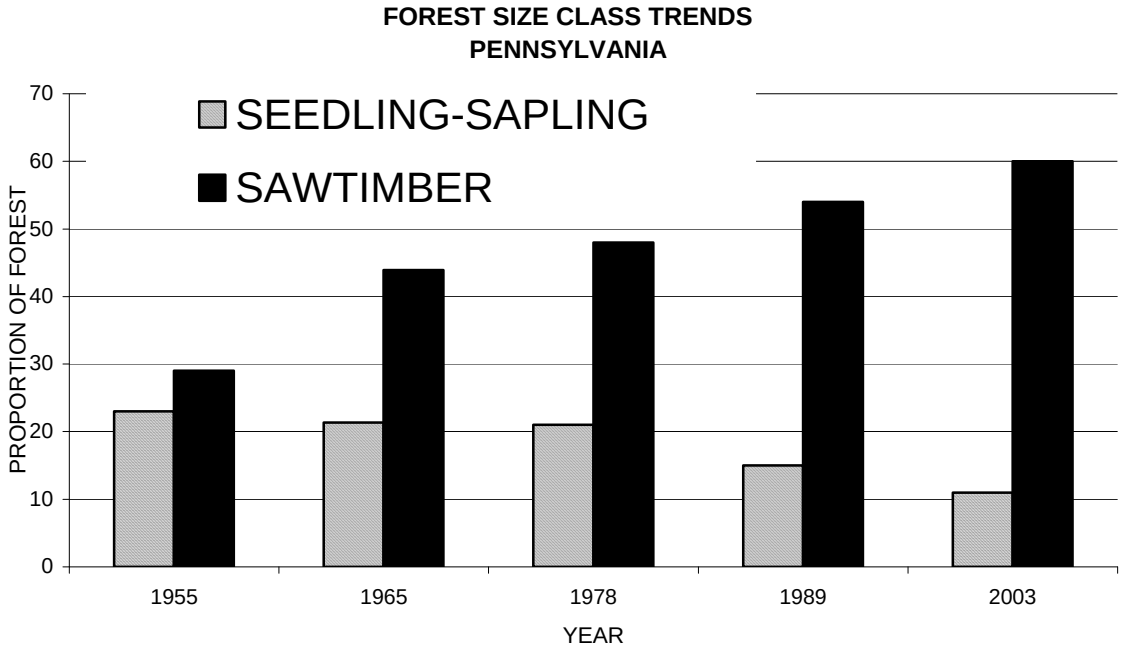

Figure 7. Trends in proportions of forested lands in PA by size class, 1965-2003 (Ferguson 1968, Considine and Powell 1980, McWilliams et al. 2004).

Habitat Relationships

Woodcock can be reliably described as early successional habitat specialists (Fig 8). Their preferred habitat is often referred to as scrub-shrub or seedling/sapling, suggesting relatively low growing, dense, woody cover. Abandoned agricultural lands and regenerating hardwood forests provide the bulk of woodcock habitat in PA. Rarely are woodcock found in a mature forest with a dense canopy. Woodcock habitats are widespread across PA. The birds may be found wherever early successional forest habitats mixed with openings on fertile soils exist. This mosaic of early successional forest habitats on suitable soils provides the habitat needs of woodcock, including breeding, migrating, and wintering birds (in extreme southern PA). The amount, distribution, and quality of these habitats determine population densities. Northwestern PA contains the largest proportion of high-quality woodcock habitat in the state and the highest densities of breeding woodcock.

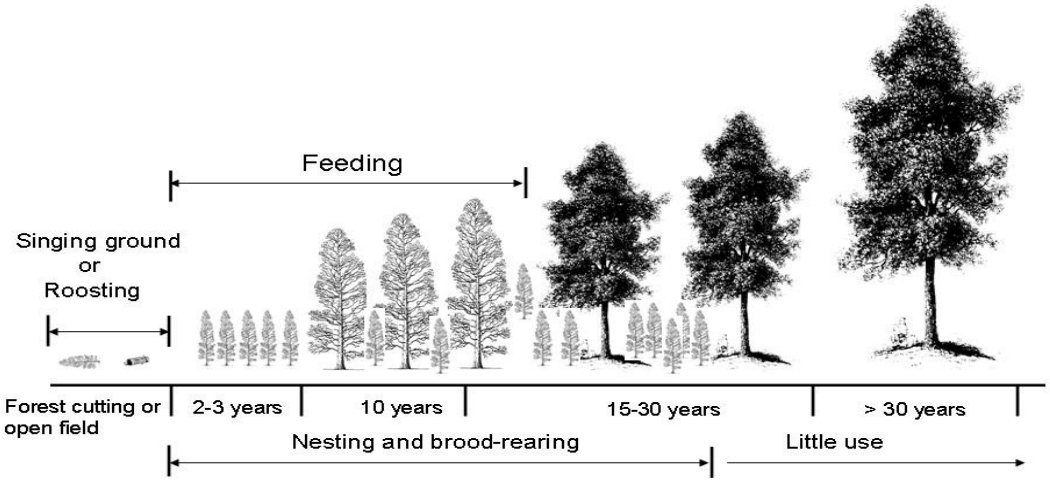

Figure 8. Key habitat components required by woodcock in relation to forest succession.

Woodcock require a mix of early successional habitats, including small, scattered openings and dense stands of shrubs and young trees (Liscinsky 1972). Use of this mix of habitats varies with activity, time of day, and season. Openings varying in size from a fraction of an acre to several acres are used as singing grounds (courtship display) in the spring and by some woodcock for nighttime roosting during summer (Mendall and Aldous 1943, Sheldon 1967, Sepik and Derleth 1993, Dessecker and McAuley 2001). While woodcock nest in a variety of habitats, including young to mixed-age stands, they prefer young hardwood stands (Mendall and Aldous 1943). Moist, fertile soils are required to support an abundance of earthworms and other soil invertebrates, the primary food sources for woodcock. Soils of a sandy, droughty nature are generally not suitable. The soils must have organic matter, replaceable calcium, and low acidity. Earthworm populations may be dramatically variable within very short distances. Woodcock are

commonly found in damp thickets, riparian zones, brushy edges and forest clearings. Woodcock use of coniferous stands is minimal, except during periods of drought when moist soils under the shade of dense conifers may offer a supply of earthworms (Sepik et al. 1983, PGC unpublished data). Burned areas or farmlands reverting to woodlands often provide favorable habitat (Brauning 1992).

Breeding Habitat (Singing Grounds)

Woodcock courtship activities typically begin in March in PA when birds return from the wintering grounds. Males perform courtship displays in openings called "singing grounds". These include natural openings found in forest clearcuts and reverting farmlands, roads, pastures, and cultivated fields. The size of singing grounds varies widely with no preference for any particular size opening (Mendall and Aldous 1943). In central PA, openings ranged from 0.1-13.9 acres, with more frequent use of shrubby sites (Gutzwiller and Wakely 1982); they suggested that more consistent use of smaller sites was due to favored vegetative structure (e.g., shrubby). Use of openings depends in part on the quality of adjacent cover for broods and nesting, because females likely choose males that display near the better nest sites. Singing grounds are often less than 100 m from diurnal cover (Straw et al. 1994).

Nesting and Brood Rearing Habitat

Females nest in a wide variety of cover types and sites but tend to favor young, open second growth hardwoods (Liscinsky 1972), often within 150 m of a singing ground. Females usually do not move broods far from the nest site. Nests and broods are found in mixed-age forests. Critical components of brood cover include low numbers of larger (older, more mature) trees and basal area, with high stem densities of hardwood saplings or shrubs on areas with a good supply of earthworms (Rabe and Prince 1982, Parris 1986, Dessecker and McAuley 2001).

Diurnal Habitat

Diurnal cover is characterized by dense stands of early successional forest, which can be young hardwood trees and/or shrubs, on soils with an abundant supply of earthworms (Hudgins et al. 1985). Habitat requirements from a structural standpoint are fairly general and acceptable plant species composition varies widely at diurnal habitat sites. Woodcock are not restricted to specific plant assemblages (Keppie and Whiting 1994). Even though a broad range of plant species is used, several species-groups are important indicators of potential woodcock habitat because they are typically early successional and/or have growth forms that provide proper habitat structure. Stands of hawthorne (*Crataegus* spp.), alder (*Alnus* spp.), aspen (*Populus* spp.), and dogwood (*Cornus* spp.) are frequently indicators of good woodcock habitat (Straw et al. 1994). Birds may sometimes use more mature forest if there is a dense woody understory/midstory of saplings and large shrubs.

Nocturnal Habitat

By early summer, woodcock chicks are fully independent. During summer, most woodcock begin to move to nocturnal roosts at dusk and return to their diurnal cover at dawn (Straw et al. 1994). The roost is usually an opening, like a field or singing ground, but also may be another forested site similar to the diurnal cover. Use of openings versus forested sites as roosting areas varies by age and sex. Percentage of individuals using fields varies by age and gender, but peaks in mid summer and declines through late summer and early fall, with differences in the sex ratio of captured juveniles attributed to sex-specific differences in habitat use (Sepik and Derleth 1993).

Migratory Habitat

Little is known about the habitat requirements of woodcock during migrations. Diurnal migratory "stopover" habitat in PA is similar to breeding habitat, but migrants may also use areas not inhabited by resident birds (Liscinsky 1972). Woodcock seem to be slightly more flexible in their use of habitat during migration. While adequate breeding habitat for woodcock is often emphasized, high quality and well-distributed habitats are also crucial for migration. Opportunities for woodcock to stop and "refuel" are vital for surviving the perils of migration. Northwestern PA and Presque Isle are important to woodcock migration as staging areas after crossing Lake Erie from Ontario. At times, high densities of woodcock may be found in relatively small patches of suitable habitat during the spring and fall migration periods.

Wintering Habitat

While the majority of woodcock winter to the south of PA, some birds will winter in southern and southeastern counties during mild winters. While both diurnal and nocturnal habitats of wintering woodcock are similar to those of breeding birds, there is a wider variation in use (Krementz and Jackson 1999). The serious threats to woodcock of habitat loss and degradation (Owen et al. 1977, Dwyer et al. 1983, Krementz and Jackson 1999) are exacerbated on PA's winter range due to intense urbanization and associated development in southeastern counties.

Public Lands Habitat

In 2002 the PGC began surveying public land managers in PA (W. Palmer, unpublished data) to catalog known woodcock habitat on public lands. Managers included were those for state forests; state parks; fish and boat properties; national wildlife refuges; national forest; national park service sites; army corps of engineers holdings; and state game lands. Either the senior land manager or a staff person familiar with woodcock provided estimates of woodcock habitat (including location, acreage, woodcock presence, breeding activity, active habitat management) for their respective land areas. Questionnaires returned represented 3,778,000 acres, 86% of the total public land acres (Table 3). National wildlife refuges had the highest proportion (20%) of their holdings in woodcock habitat, followed by Fish and Boat Commission with 19%. While only 1.7% of game lands acreage was identified as woodcock habitat, it represented the highest estimated

total acres (24,072) of woodcock habitat, followed by state parks with 11,490 acres. Statewide total known public woodcock habitat was projected at 60,565 acres and constituted just 1.4% of public land upland acres. This expert data compilation included maps and/or coordinates for most of the 225 sites identified. Many of these locations should be candidate sites for habitat enhancement (along with creation of new habitat) included in the national plan objectives. The PGC also has recently begun a process to quantify woodcock habitat through GIS modeling of soils and cover types. With such a small proportion of PA's public lands in existing woodcock habitat, it should be a high priority for stewardship.

Table 3. Woodcock habitat on public lands in PA, 2002-2006 (W. Palmer, PGC, unpublished data)

	Sample			Woodcock Habitat				
Public Land	Number	Returns (%)	Acres	Present	Acres	% Of Sample Acres	Total System Acres	Estimated Woodcock Habitat
[1]SGL	28	23 (82%)	1,110,659	23 (100%)	19,097	1.72	1,400,000	24,072
[2]SP	117	75 (64%)	177,977	56 (75%)	7,967	4.48	256,672	11,490
[3]SF	20	18 (90%)	1,868,600	18 (100%)	7,054	0.38	2,082,700	7,862
[4]COE	23	14 (61%)	63,391	14 (100%)	5,214	8.23	68,868	5,664
[5]ANF	1	1 (100%)	506,000	1 (100%)	5,000	0.99	506,000	5,000
[6]NPS	12	12 (100%)	39,399	10 (83%)	2,430	6.17	39,399	2,430
[7]FBC	14	7 (50%)	2,326	7 (100%)	432	18.57	11,017	2,046
[8]NWR	2	2 (100%)	9,900	2 (100%)	2,000	20.20	9,900	2,000
TOTAL	217	152 (70%)	3,778,252	131 (86%)	49,194	1.30	4,374,556	60,565

[1]SGL=State Game Lands Groups
[2]SP=State Parks
[3]SF=State Forests
[4]COE=U.S. Army Corps of Engineers
[5]ANF=Allegheny National Forest
[6]NPS=National Park Service
[7]FBC=Fish and Boat Commission
[8]NWR=National Wildlife Refuge

The PA Woodcock Habitat Initiative on State Lands (PA WHISL) database was developed by the RGS through a public/private partnership. These records were developed using geographic information systems (GIS). This modeling process identified 3,100 acres of public land sites across state forestland, game lands, and national forest in PA, including 28 locations over 21 counties as potential sites for the creation and/or restoration of woodcock habitat. Between PA WHISL, the above survey of land managers, and emerging GIS technologies (Klute 1999, Thogmartin et al. 2007) we can identify public land areas for managing woodcock habitat.

Private Lands Habitat

We have little specific information on locations of woodcock habitat for private lands, other than approximately 30 woodcock SGS routes conducted annually. The same GIS technologies referred to for public lands can be utilized for focusing on specific sites for

habitat management on private lands. Since the majority (79%) of forestlands in PA are private (Widmann 1995), a majority of woodcock habitat is in private ownership. Approximately 95% of this private forestland is in non-industrial ownership. Privately-owned forest tracts show a trend of more-rapidly changing ownerships along with decreasing sizes by ownership (Birch 1996). As the size of forest tracts decrease, so does the probability of timber harvests (Birch and Stelter 1993). Private owners of both forestland and farmland have the most acreage not stocked (potential woodcock habitat) with timber. We may expect public land mangers to manage habitats for species of concern, but it will be a challenge to implement management practices for woodcock habitat on private lands. But to be successful (to meet goals), the vast majority of management will necessarily occur on private lands. Potential partners and funding sources for private lands habitat projects are listed later under the Partners subsection.

Habitat Management Needs

Woodcock and other species that depend on early-succession will continue to decline without programs to create young forest. The need is to protect and manage habitats that will increase woodcock populations and restore an appropriate mix of young and old forest. Because woodcock require different habitats for different purposes, habitat management considerations must include the juxtaposition of various covers. Singing grounds clearings (1/4-1/2 acre in size) for males should be placed within 1/2 mile of feeding cover and near suitable covers for nesting and rearing broods (Sepik et al. 1981). Because woodcock feed primarily on earthworms and other soil invertebrates, site factors such as soil moisture and fertility, slope, and aspect must be considered. Habitat management in valleys and lower slopes is more beneficial than management on dry upper and middle slopes (Liscinsky 1972). Therefore, it is important to develop searchable soil databases to incorporate into GIS for selection of habitat management areas. Nocturnal roosting areas (e.g. old fields or recent clearcuts) should be located within 0.5 miles of feeding cover. Active forest management programs in mixed hardwood forests can supply all of these components. Short rotation cuttings (e.g., no more than 20-30 years) will insure that forested habitats maintain woodcock use and prevent a local population decline. Riparian areas unquestionably warrant special consideration during the planning and implementation of active forest management. Small-diameter forest and shrubland habitats in riparian areas are critical to woodcock and other wildlife and should be incorporated as a component of riparian area management. The potential negative soil impacts of management activities on riparian and other moist areas can be mitigated by the use of light-on-the-land harvest equipment and timing activities to coincide with frozen-ground conditions where applicable. Control of invasive plants (e.g., rose, olive, honey suckle) on moist sites is another possible factor in managing habitats on these areas.

The North American plan calls for woodcock habitat management to utilize units of 500-1,000 acres to ensure a landscape-level approach. Within these units, treatments should be centered on broad-leafed deciduous or deciduous shrub/scrub wetlands. Even-age forest treatments of $\geq$3 acres will stimulate sprouting of shade-intolerant species, such as aspen, to create ideal woodcock habitat. To facilitate interchange of birds, several units should be developed within 1-2 miles of one another. In following the national woodcock conservation plan, habitat management should focus primarily on forest types that are

potentially valuable woodcock habitat, but that currently contain no woodcock due to forest succession. This constitutes creation of *new* habitat because it concentrates on areas that once contained woodcock but no longer do. Management of habitats that currently contain woodcock will obviously be important, but could be better described as habitat enhancement rather than habitat creation. Finally, the acreages of early successional forest habitat created must be sufficient to affect woodcock populations.

Accomplishing habitat management for woodcock on a statewide basis will require not only participation by all public land managers, but development of a major private lands initiative, incorporating both existing and new programs. Technical assistance and funding to both public land managers and private landowners will need to be achieved. Private lands initiatives should include existing incentives for landowners to conduct forest habitat management for woodcock and other wildlife species that associate with young forest stands. A coalition of partnerships will be necessary to provide the extensive outreach to landowners needed to ultimately result in implementation of effective habitat management.

Habitat Goals

Using the process of the 2008 draft, knowledge of population deficits (see SECTION III) was used to determine breeding habitat goals. Woodcock habitat was defined as small diameter (seedling/sapling) and non-stocked forest inventory categories (Cushwa et al. 1977; Gutzwiller et al. 1982). A habitat multiplier was used to determine how many acres of new habitat would be needed to add one singing male to the population. The habitat multiplier is the acreage of early successional habitat for the 1970-75 period divided by the number of singing males found in the state during the same period. The acreage goal was calculated by multiplying the population deficit by the habitat multiplier specific to PA. Based on the objective of returning woodcock densities to those of the early 1970s (draft American Woodcock Conservation Plan 2008), the need is to create an additional 1,174,719 acres (7.3 % of current total PA forest land) of early successional forest habitat on suitable soils in PA by 2022 (Table 2); for the time frame of our state plan (2017), the need is to create 783,150 additional acres or 5% of current PA forested land. This is in addition to treatments necessary to maintain the current 11.8 % (McWilliams et al. 2004) of PA's forests that are in the early successional stage. The annual average additional treatments would be 78,315 acres. This represents creation of new habitat because it focuses on areas that once contained woodcock, but no longer do. Converting non-forested habitats to those that would support woodcock could also create new habitat; e.g., allowing agricultural fields to revert to forest. FIA data will be used to track changes in early successional forest acres.

Management of habitats that currently contain woodcock should be part of the conservation effort, but these efforts could be better described as habitat enhancement rather than habitat creation. No information was available on how to quantitatively predict woodcock response to enhancement and therefore it was not included in goal calculations. Known woodcock habitat on public land must be the highest priority for management of existing sites. Recommended techniques for managing woodcock breeding habitat are provided by Sepik et al. (1981).

The national woodcock plan identifies BCRs as the basic habitat management unit. BCRs often include portions of several states. With the BCR as the base unit, the national plan recognizes that management objectives may not be met proportionally within each individual state portion of that BCR. Likewise with PA's woodcock plan, even though the habitat goal was determined by summing the specific BCRs, the goal is for the state as one management unit. We recognize that, realistically, we cannot meet habitat objectives in BCR 29 (Piedmont in southeastern PA) because of permanent habitat loss to development (highways and buildings). However, we can meet statewide objectives in both the national and state plans because of the habitat potential in BCRs 13 and 28 that include the rest of PA. Using models to map predicted abundance will allow us to focus management and monitoring on areas with habitat features important to woodcock (Thogmartin et al. 2007).

Cooperative Partnerships

In addition to landowners being informed, there need to be sources of technical assistance available to them, including financial incentives to manage for woodcock habitat (Table 4). The North American Bird Conservation Initiative planning is a large-scale international effort for bird conservation. Current funding is largely through grants for wetlands protection, which should provide great utility for woodcock conservation since early successional habitats near wetlands can be ideal environments for woodcock.

There are already some existing programs at the state and federal level attempting to provide landowners with the technical assistance and funding to improve woodcock habitat. The RGS Coverts (private landowner) program is active in NH, CT, MA, MD, NY, VA, PA, WV, OH, WI and VT. The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service provides technical and financial cost-share assistance to private landowners through various programs; their Wildlife Habitat Incentive Program (WHIP), Forestry Incentives Program (FIP), Forest Stewardship Program, and Wetland Reserve Program (WRP) funds could be used to benefit woodcock. Woodcock Limited of PA's Private Land Opportunity for Woodcock (PLOW) is a program to assist at the state level.

The Farm Service Agency in USDA has the Conservation Reserve Enhancement Program (CREP). The USFWS's Partners for Fish and Wildlife Program has prioritized early successional habitat. USFWS also has the Landowner Incentive Program (LIP), the Private Stewardship Grants Program, and the State Wildlife Grants Program (which includes the Private Lands Assistance Program, funding 6 PGC biologists). In PA, we also have the Forest Stewardship and Tree Farm Programs.

The Wildlife Management Institute (WMI) began the Northern Forest Woodcock Initiative in 2005, with a cooperative agreement between WMI and the Northeastern Association of Fish and Wildlife Agencies. They have organized technical assistance, outreach and funding opportunities for woodcock and other early successional habitat species in BCR 14. Twenty-three partners have agreed to cooperate on the objective of this initiative, which is to implement the Woodcock Conservation Plan in New England and New York. In 2008, the Appalachian Mountain Woodcock Initiative was started to

Table 4. Summary of potential funding sources for priority habitat conservation and research projects in PA.

Program	Description	Website
North American Wetlands Conservation Act	A federal grant program for the acquisition, restoration, and enhancement of wetlands and associated uplands	http://www.fws.gov/birdhabitat/Grants/NAWCA/
Neotropical Migratory Bird Conservation Act	A federal grant program for the conservation of neotropical migratory birds in the U.S., Latin America, and the Caribbean	http://www.fws.gov/birdhabitat/Grants/NMBCA/
National Coastal Wetlands Conservation Grants Program	A federal grant program for the acquisition and restoration of coastal habitats (includes Great Lakes) and associated uplands.	http://www.fws.gov/coastal/CoastalGrants/
State Wildlife Grants	A federal grant program for the development and implementation of programs for the benefit of wildlife and their habitats.	http://wsfrprograms.fws.gov/Subpages/GrantPrograms/SWG/SWG.htm
Landowner Incentive Program	A federal grant program that provides for habitat protection and restoration on private lands for federally listed, proposed, candidate, or other at-risk species.	http://wsfrprograms.fws.gov/Subpages/GrantPrograms/LIP/LIP.htm
Coastal Estuarine and Land Protection Act	A federal grant program to protect important coastal and estuarine areas with significant conservation, recreation, ecological, historical, and aesthetic values threatened by development or conversion.	http://coastalmanagement.noaa.gov/pdf/CELCPfinal02guidelines.pdf
Partners for Fish and Wildlife Program	A USFWS program to help provide financial and technical assistance to private landowners for restoration of wetlands and other important habitats.	http://www.fws.gov/partners/
Conservation Reserve Enhancement Program	A federal grant program for farmers to put sensitive lands out of production, including wetland and riparian habitat for wildlife	http://www.fsa.usda.gov/FSA/

coordinate initiation of the draft American Woodcock Conservation Plan in BCR 28, including part of PA. RGS and Woodcock Limited of PA (WL) will be cooperating in this habitat initiative.

Here in PA, the PGC has already been partnering for woodcock. At Bald Eagle State Park (DCNR-BSP), we participated in developing a project plan for native plant restoration, with woodcock as the featured wildlife species for the long-term habitat management. Cooperators on this project include USFWS, DCNR-Bureau of Parks, RGS, U.S. Army Corps of Engineers, and DCNR-Bureau of Forestry. We continue to seek additional funding partners for this project. At Montour Preserve, we assisted WL with initiating a woodcock management plan.

SECTION V. RECREATIONAL SIGNIFICANCE AND PUBLIC INTEREST

Hunting

The American woodcock is a popular game bird throughout eastern North America. During the 2006-07 hunting season, approximately 490,000 hunter days were expended in the U.S. (Kelley et al. 2007). This 2007 report estimated 10,140 active woodcock hunters in PA, ranking first in the Eastern Management Unit and fifth nationally, representing 36,563 days afield. PA's Game Take Survey (Librandi-Mumma and Boyd 2007) estimate for the 2006 season was 11,978 woodcock hunters, with 69,440 days in the field. Both surveys have relatively large confidence intervals for estimates so differences are not significant and trends are the same. The federal estimates allow state-to-state comparisons.

Viewing

Many Pennsylvanians derive pleasure from watching woodcock. Viewing the male woodcock's courtship display after sunset is a popular spring pastime in many areas. Park naturalists and others schedule nature walks to take advantage of these displays; however, estimates of total woodcock viewers are not available. At one location, Bald Eagle State Park, the Woodcock Festival has drawn 100-130 participants in each of the past 3 years (M. Banker, personal communication).

Status

The Nature Conservancy has identified the woodcock as a local species of management concern. The U.S. Shorebird Conservation Plan has designated the woodcock as a species of high concern. The PIF Physiographic area plan includes woodcock in PA. Woodcock is a maintenance priority species in PA's Wildlife Action Plan. Other documents listing woodcock as a species of concern include the North Atlantic Regional Shorebird Plan and the Atlantic Coast Joint Venture BCR 13 Plan. Habitats and their management are listed as concerns related to woodcock and the USFWS also recognizes the need to manage woodland habitat to benefit this upland shorebird. The America Bird Conservancy has listed the Eastern Deciduous Early Successional Forests as one of the 20 most endangered habitats in the U.S.

Education/Outreach

In PA the majority of timberland is under private ownership. Therefore, state and federal resource agencies will need to enlist the help of individual and commercial private forestland owners in order to achieve habitat management goals.

Outreach will play a critical role in PA as woodcock and the entire early successional bird suite (Table 5) are associated with greater population and habitat declines than any

other species suite (grassland suite is in similar predicament). Managers, environmentalists, and the public need to be educated that shrublands and early successional habitats are important for woodcock and need to be protected or managed, and that these habitats provide critical diversity to not only PA but to the Northeast. A program to develop demonstration sites throughout the states and provinces would be beneficial in helping to educate the public and provide habitat guidance to those interested in managing for woodcock and other early successional birds. Incorporating educational modules on early successional habitat and associated birds, including woodcock, into existing environmental educational curricula would be a valuable investment for future forestland owners.

Table 5. Comprehensive Wildlife Conservation Strategy-priority bird species associated with early successional forest that share woodcock habitat in PA

Species	Specific Habitat Requirements
Alder Flycatcher *Empidonax alnorum*	Wet shrubby habitats, including brushy swamps, alder bogs, edges of beaver ponds, and wet meadows with woody vegetation
American Woodcock *Scolopax minor*	Mix of habitats, including small, scattered openings and dense stands of shrubs and young trees
Blue-Winged Warbler *Vermivora pinus*	Early-mid successional forests and thickets with openings; areas marked by patches of herbs, shrubs, and trees and often located near a forest edge
Brown Thrasher *Toxostoma rufum*	Brushy mosaic habitats ("odd areas" -hedgerows, multiflora rose thickets, overgrown fields and pastures, and forest edges); prefer large (>0.5 hectares) overgrown fields with open foraging areas, thick brushy nesting areas, abundant song perches
Golden-Winged Warbler *Vermivora chrysoptera*	Mosaic of herbaceous patches and shrubby thickets located along a forest edge, often at higher elevations; increasingly found in higher elevation bogs and forested wetlands
Kentucky Warbler *Oporornis formosus*	Lowland deciduous forests with well developed ground cover and a dense brushy or vine understory, often near streams
Prairie Warbler *Dendroica discolor*	Brushy second growth, dry scrub, low pine-juniper, mangroves, pine barrens, burned-over areas, and sprout-lands
Whip-poor-will *Caprimulgus vociferus*	Early to mid successional and open, forested habitats near clearings
Willow Flycatcher *Empidonax traillii*	Low-elevation shrub swamp, wet meadow, and brushy habitats along streams and the edges of ponds and marshes; sometimes dry upland sites
Yellow-Breasted Chat *Icteria virens*	Low, dense shrub habitats with an open or partially open tree canopy in regenerating clearcuts, forest edges, abandoned farmland, burned forest, and shrubby margins

SECTION V. LITERATURE CITED

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APPENDIX 1. IMPLEMENTATION SCHEDULE FOR WOODCOCK MANAGEMENT PLAN FOR PA, 2008-2017.

	By End of Year										
Objectives and Strategies	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Responsible Bureau or Region**
Population Objective											
Strategy:											
1.1 Monitor statewide woodcock populations annually.	●	●	●	●	●	●	●	●	●	●	BWM/ Regions
1.2 Monitor woodcock population responses annually on select habitat demonstration areas.	●	●	●	●	●	●	●	●	●	●	BWM/ Regions
1.3 Monitor woodcock recruitment via wing-collection survey.	●	●	●	●	●	●	●	●	●	●	BWM
1.4 Estimate statewide woodcock hunter numbers and harvests.	●	●	●	●	●	●	●	●	●	●	BWM
1.5 Determine woodcock harvest rates, harvest derivations, and survival rates, in cooperation with other states in the Eastern Management Region.							●	●	●	●	BWM
1.6 Determine woodcock hunter preferences, knowledge, and satisfaction regarding population levels as well as seasons and bag limits.			●					●			BWM
1.7 Develop harvest strategies for the Eastern Region, in cooperation with other states.	●	●	●	●	●	●					BWM
Habitat Objective											
Strategy:											
2.1 Monitor statewide early successional forest trends.	●	●	●	●	●	●	●	●	●	●	BWM
2.2 Identify important woodcock breeding and migration habitats for developing priority lists/targets for protection and	●	●	●	●	●	●	●	●	●	●	BWHM/ BWM/ Regions

management.											

APPENDIX 1. (Cont.)

	By End of Year										
Objectives and Strategies	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Responsible Bureau or Region**
Habitat Objective											
Strategy:											
2.3 Protect critical woodcock habitat from development through purchase or easements.		•	•	•	•	•	•	•	•	•	BWHM / Regions
2.4 Create 6,790 additional acres of woodcock habitat on State Game Lands annually (statewide 10-year target of 67,900 acres).	•	•	•	•	•	•	•	•	•	•	BWHM / Regions
2.5 Create 14,425 additional acres of woodcock habitat on other public lands annually (statewide 10-year target of 144,250 acres), by establishing formal agreements and meeting annually with other public land management agencies to focus habitat enhancement/creation initiatives for woodcock.	•	•	•	•	•	•	•	•	•	•	Exec Office / BWM
2.6 Create 57,100 additional acres of woodcock habitat on private lands annually (statewide 10-year target of 571,000 acres), by promoting partnerships with existing programs (e.g., Woodcock Habitat Initiative on State Lands, Partners in Flight, Partners for Fish & Wildlife, Audubon's Important Bird Areas, etc.)	•	•	•	•	•	•	•	•	•	•	BWM / BWHM / Regions
2.7 Establish 12 demonstration areas on public lands that illustrate habitat management practices for woodcock by 2010.		•									BWHM / Regions / BWM

APPENDIX 1. (Cont.)

Objectives and Strategies	By End of Year 2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Responsible Bureau or Region
Habitat Objective											
Strategy:											
2.8 Develop technical assistance or management guides on woodcock habitat management for distribution to public and private landowners and managers, via websites, news releases, and workshops.			•	•	•						BWM / BWHM
2.9 Conduct 6 workshops annually on woodcock habitat management.		•	•	•	•	•	•	•	•	•	BWM / Regions
2.10 Continue research to develop new or enhance habitat management techniques to benefit woodcock.			•	•	•	•					BWM / BWHM
2.11 Identify costs for conducting noncommercial habitat management for woodcock, necessary to meet annual statewide habitat management objective.			•	•	•	•	•	•	•	•	BWHM / BWM
2.12 Secure funding to assist landowners with noncommercial forest treatments and habitat development to benefit woodcock.		•	•	•	•	•	•	•	•	•	Exec Office
2.13 Identify landowner preferences, attitudes, and other factors that may be preventing them from implementing habitat practices to benefit woodcock.		•					•				BWM

APPENDIX 2. PRELIMINARY ESTIMATES OF WOODCOCK HARVEST, HUNTER NUMBERS, DAYS AFIELD, AND HUNTER SUCCESS FROM THE 2006-07 HARVEST INFORMATION PROGRAM SURVEY.

	Harvest		Active woodcock hunters		Days afield		Seasonal harvest per hunter	
	Total	± 95% CI	Total	± 95% CI	Total	± 95% CI	Total	± 95% CI
Eastern Region								
CT	3,504	39	1,257	27	5,523	33	2.8	48
DE	274	93	168	101	465	64	1.6	138
FL	194	151	1,075	178	2,150	178	0.2	234
GA	461	105	1,410	172	5,605	173	0.3	201
ME	15,585	31	7,822	23	33,243	34	2.0	39
MD	2,033	117	770	121	1,787	105	2.6	169
MA	3,052	31	1,327	23	5,931	23	2.3	39
NH	5,900	31	1,550	34	6,794	24	3.8	46
NJ	1,417	41	721	47	2,775	56	2.0	62
NY	10,231	30	4,375	23	18,664	29	2.3	38
NC	4,552	126	1,601	118	6,404	120	2.8	172
PA	18,371	63	10,140	33	36,563	38	1.8	71
RI	0		177	134	532	134	0.0	
SC	6,146	96	2,316	88	8,363	111	2.7	131
VT	2,361	32	799	33	3,361	40	3.0	46
VA	3,069	101	1,601	69	5,286	98	1.9	122
WV	884	58	250	52	768	47	3.5	78
Region	78,033	21	na[a]		144,217	18	na	
Central Region								
AL	300	86	150	66	375	84	2.0	108
AR	2,892	146	2,970	110	6,827	143	1.0	182
IL	2,171	160	1,973	87	8,944	115	1.1	182
IN	2,403	69	1,000	58	4,377	75	2.4	90
IA	1,470	77	2,122	54	4,302	59	0.7	94
KS	68	89	299	185	329	168	0.2	205
KY	343	104	131	45	909	86	2.6	113
LA	19,045	68	3,968	65	10,908	66	4.8	94
MI	116,216	27	30,017	14	155,333	17	3.9	30
MN	38,738	41	14,934	24	60,160	31	2.6	47
MS	647	131	1,212	128	3,866	145	0.5	183
MO	411	52	1,530	96	3,771	118	0.3	109
NE	78	93	585	133	667	117	0.1	162
OH	4,060	51	2,249	68	9,764	67	1.8	85
OK	26	141	522	189	568	174	0.0	235
TN	730	115	139	95	799	104	5.3	149
TX	0		0		0			
WI	42,958	25	19,390	22	72,365	25	2.2	33
Region	232,557	17	na		344,262	12	na	
U.S. Total	310,590	14	na		488,479	10	na	

APPENDIX 3. HISTORY OF FRAMEWORK DATES, SEASON LENGTHS, AND DAILY BAG LIMIT FOR HUNTING AMERICAN WOODCOCK IN THE EASTERN REGION, 1918-2007.

Year (s)	Outside dates	Season length	Daily bag limit
1918-26	Oct. 1-Dec. 31	60	6
1927	Oct. 1-Dec. 31	60	4
1928-39	Oct. 1-Dec. 31	30	4
1940-47	Oct. 1-Jan. 6	15	4
1948-52	Oct. 1-Jan. 20	30	4
1953	Oct. 1-Jan. 20	40	4
1954	Oct. 1-Jan. 10	40	4
1955-57	Oct. 1-Jan. 20	40	4
1958-60	Oct. 1-Jan. 15	40	4
1961-62	Sep. 1-Jan. 15	40	4
1963-64	Sep. 1-Jan. 15	50	5
1965-66	Sep. 1-Jan. 30	50	5
1967-69	Sep. 1-Jan. 31	65	5
1970-71	Sep. 1-Feb. 15	65	5
1972-81	Sep. 1-Feb. 28	65	5
1982	Oct. 5-Feb. 28	65	5
1983-84	Oct. 1-Feb. 28	65	5
1985-96	Oct. 1-Jan. 31	45	3
1997-01	Oct. 6-Jan. 31	30	3
2002-07	Oct. 1-Jan. 31	30	3

APPENDIX 4. HISTORY OF SEASONS AND DAILY BAGS FOR HUNTING AMERICAN WOODCOCK IN PA, 1915-2007 (NO SUNDAY HUNTING).

Year (s)	Start dates	Season length	Daily bag limit
1915-16	Oct. 15	37	10
1917	Oct. 20	31	10
1918- 26	Oct. 1	49	6
1927	Nov. 1	13	4
1928	Oct. 15-Thu, Fri, Sat each week	18	4
1929-36	Oct. 15	25	4
1937-39	Oct. 1	25	4
1940-41	Oct. 16	13	4
1942	Oct. 24	13	4
1943	Oct. 1	13	4
1944	Oct. 14	13	4
1945	Oct. 10	13	4
1948	Oct. 9	25	4
1949	Oct. 10	25	4
1950	Oct. 10	19	4
1951	Oct. 8	25	4
1952	Oct. 15	25	4
1953-56	Early-Oct.	31	4
1957-62	Mid-Oct.	31	4
1963-66	Mid-Oct.	43	4
1967-73	Mid-Oct.	55	4
1974-75	Mid-Oct.	43	4
1976-81	Mid-Oct.	55	4
1982	Mid-Oct.	37	5
1983	Mid-Oct.	37	3
1984-1990	Mid-Oct.	19	3
1991-2000	Late-Oct.	13	3
2001-2007	Mid-Oct.	25	3

APPENDIX 5. SUMMARY OF PUBLIC COMMENTS

The draft of the Management Plan for American Woodcock in Pennsylvania 2008-2017 was made available for public comment from August 18 to September 19, 2008. A news release and posting on the PGC's webpage announced the comment period. The document was available electronically through the webpage or in printed format by request. Comments could be submitted via the webpage, email, or in writing.

We received 32 correspondences. Most replies contained more than one comment. For example, "This plan is sound. I suggest a habitat stamp. Determining woodcock harvest rates is an excellent strategy." was divided into 3 comments.

Seventy unique comments were received. These comments were grouped into the following categories: Support Plan, Do Not Support Plan, Woodcock Hunting, Support Woodcock Stamp/License, Other Funding, Predators, Habitat, and Information/General Comments.

The most numerous individual comment (26) expressed support for the plan, although 2 were opposed. Nineteen comments were of an informational/general nature. Fourteen comments were received on habitat, 7 on hunting, 7 supporting woodcock stamps/licenses, 1 opposed to increased costs and 1 suggested a funding alternative. Three comments dealt with predators. Twenty-four questions were interpreted as not providing commentary on the plan. Several of these questions were specific to individual strategies, but the information requested was already in the plan document. We summarized comments in tabular form below.

The public response to the PA Woodcock Plan clearly shows support, with 81% of the 32 replies expressing an opinion in favor of restoring woodcock populations. We appreciate the input from all who took time to evaluate and to provide commentary.

PUBLIC COMMENTS ON THE PA WOODCOCK MANAGEMENT PLAN			
COMMENTS		**No.**	**Plan Objectives/Strategies**
SUPPORT PLAN		**26**	All
1.	This plan is sound.	1	
2.	I am very excited that there is effort being put forth to increase woodcock populations.	1	
3.	I 100% support anything you can do to create/improve/enhance woodcock numbers thru habitat.	1	
4.	I am very impressed with how well it was written and the effort involved to reach this point, very good job!	1	

COMMENTS (cont.)		No.	Plan Objectives/Strategies
5.	I am glad to see the PGC is actively pursuing a plan to promote the timberdoodle.	1	
6.	I feel that this plan is an excellent attempt to address the challenges (increasing loss of habitat) facing woodcock.	1	
7.	Yes, please do this, the plan looks great.	1	
8.	I am pleased to see that the PGC will be addressing the woodcock decline and thank you for the job you are undertaking.	1	
9.	I am excited to hear about plans to improve habitat.	1	
10.	The plan as written sounds good.	1	
11.	Congratulations and good luck with the plan.	1	
12.	Excellent.	1	
13.	I support this plan.	4	
14.	I am sure this may be a necessary goal to keep a good population.	1	
15.	Congratulations to all of you for your efforts on developing this plan and I am pleased to see something aggressive being done for woodcock and it appears to be a great start.	1	
16.	Very informative and comprehensive.	1	
17.	I am in favor of the plan.	1	
18.	Congratulations on the objective, let's get it done.	1	
19.	I think the plan is well worth the effort.	1	
20.	I can sum up my opinion in one word, Fantastic!	1	
21.	I reviewed the plan and it looked great.	1	
22.	A very thorough and well-written report.	1	
23.	Let me complement the PGC for your outstanding woodcock management plan. Your work will go a long way to improve the situation for woodcock.	1	
DO NOT SUPPORT PLAN		**2**	All
24.	I do not wish to spend state or federal money on a program that will have little or no impact and I would rather have a plan that specifically provides for aggressive programs that will enhance the growth of native trees, shrubs, and plants necessary for woodcock and other upland bird species.	1	
25.	This plan was poorly designed and thought out.	1	

COMMENTS (cont.)		No.	Plan Objectives/Strategies
WOODCOCK HUNTING		**7**	
26.	I would like to see the woodcock season closed.	1	
27.	A several year moratorium might be warranted to help the population increase.	1	
28.	I think the bag limits should be 2 per day and 3 per season.	1	
29.	There should be no woodcock hunting for several years and habitat should be prepared for any increase.	1	
30.	Some demonstration areas should be off limits to hunting to better measure the effects of the management techniques.	1	
31.	Stocking pheasants and the crowds they bring have a negative impact on woodcock populations because the goal of the pheasant hunter is to shoot anything possible.	1	
32.	Determining woodcock harvest rates is an excellent strategy.	1	1.5
SUPPORT WOODCOCK STAMP/LICENSE		**7**	
33.	I suggest a habitat stamp.	1	
34.	I think the plan should address a woodcock stamp for woodcock hunters (except junior hunters).	1	
35.	I am willing to pay more for HIP and a Federal woodcock stamp.	1	
36.	I would support a woodcock habitat stamp ($10 to $20).	1	
37.	I support a habitat stamp.	3	
OTHER FUNDING		**1**	
38.	I hope that the PGC will elicit assistance from the public with completion of any management activities because this free labor force may be a huge benefit during these difficult financial times.	1	2.13
PREDATORS		**3**	
39.	With predators increasing in numbers, we may be too late if we don't curtail the taking (hunting) of woodcock.	1	
40.	A reduction in the hawks, owls and coyotes wouldn't hurt.	1	
41.	I hope you address the problem of increased numbers of fur-bearing predators (avian predators are obviously Federally controlled).	1	

COMMENTS (cont.)		No.	Plan Objectives/Strategies
HABITAT		**14**	
42.	Early successional forested ecosystems must be increased, not only for woodcock, but for many other species as well.	1	2.5, 2.6, 2.7
43.	We must create more of the "younger forests".	1	2.5, 2.6, 2.7
44.	I hope RGS will be invited to participate in planning and completing habitat improvement.	1	2.7
45.	The bottom line is habitat, habitat, habitat.	1	2.4
46.	Too little acreage is being placed in the program.	1	2.5, 2.6, 2.7
47.	Any habitat improvement will also help the other upland species.	1	
48.	Two logical alternatives for management are patch cutting and a healthy beaver population.	1	
49.	Need money for private landowners to do habitat improvement.	1	2.13
50.	This is an opportunity to also benefit many other species, which also rely on this type of habitat.	1	
51.	I truly wonder if the PGC land managers know woodcock habitat.	1	
52.	Protecting habitat from development through purchase or easements is a great idea.	1	2.3
53.	Any management for woodcock will have a profound effect on other avian species as well as small mammals.	1	
54.	Increase the amount of acreage for the target.	2	2.5, 2.6, 2.7
INFORMATION/GENERAL COMMENTS		**19**	
55.	I would like to get personally involved in this project.	1	
56.	I am sure that the plan will eventually lead to another cost to the hunter, like the "migratory bird permit" that started at $0.50 to cover a "study" and is now $3.00.	1	
57.	In the past, management of native small game of the state was vastly ignored in favor of big game.	1	
58.	The ruffed grouse will benefit as well as a result of this program.	1	
59.	You are wasting our time asking for comments when you will just do what Commissioners personal desires are anyway.	1	
60.	This plan will also address the increasing loss of grouse habitat.	1	
61.	I have lived in Erie County for 41 years, hunted 26 of them, and never seen or shot a woodcock.	1	

COMMENTS (cont.)		No.	Plan Objectives/Strategies
62.	We had good woodcock hunting in southern York County in the 1960s and 1970s; so I hope you will include this area in your study.	1	
63.	A thoughtful cost estimate could be produced now and refined as you go.	1	2.12
64.	I hope that BCR #29 is not ruled out for woodcock habitat work.	1	
65.	I suggest getting the Delaware Water Gap (NPS) to participate in plan.	2	2.6
66.	Workshops are a great idea.	1	2.10
67.	We strongly believe that a full-time woodcock biologist is needed in the PGC.	1	
68.	The plan should state the need of an ongoing analysis to insure the plan's habitat implementation.	1	1
69.	I am glad to see that you incorporated the goals from the national plan into the state plan.	2	1 and 2