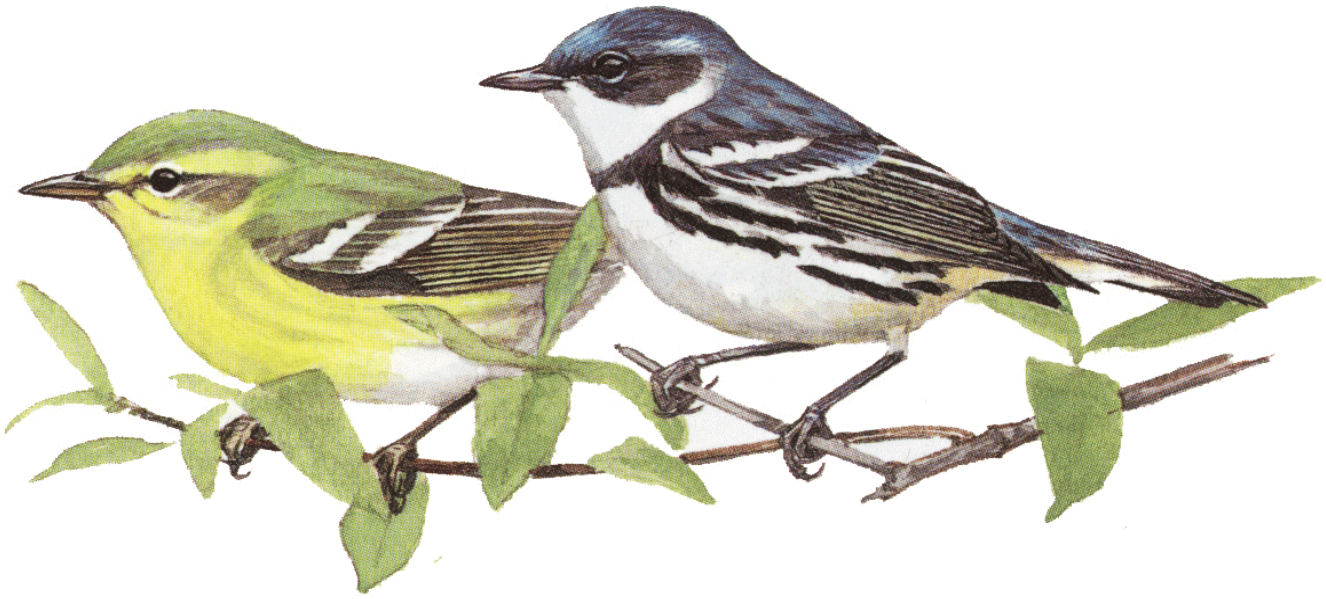
Partners in Flight
Bird Conservation Plan

Ohio Hills

(Physiographic Area 22)



American Bird Conservancy

Partners In Flight
Landbird Conservation Plan:

Physiographic Area 22:
Ohio Hills

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EXECUTIVE SUMMARY

Area - 7,993,400 ha
Description - Landforms within the Ohio Hills consist primarily of dissected, unglaciated plateaus ranging in elevation from 150 m to 450 m, with some valleys as low as 100 m and some mountainous areas reaching 1,100 m. A majority of the planning unit was dominated historically by oak-hickory forests; today these cover roughly 4.3 million ha (10.7 million ac), or 54% of the physiographic area. Numerous patches of northern hardwood forest occur on north-facing hillsides, particularly near the edges of the Allegheny Mountains in West Virginia and Allegheny Plateau in Ohio. Historically, oak-hickory and oak-pine regeneration was dependent on fire, and recent policies of fires suppression in the southern Appalachians has had major (primarily negative) effects on native forest composition and structure. Human populations are relatively sparse through most the physiographic area and are largely confined to the larger valleys; Pittsburgh, PA and Morgantown, WV are the largest cities. Roughly 40% of the physiographic area is in agricultural production or urban development, mostly in the northern half. Timber extraction has been a major activity throughout the history of this region, and it continues to be important on both public (10% of area) and privately owned forest lands. Extraction of minerals, oil and gas, and coal are also important land uses throughout this region, with a new wave of mining underway in the form of highly destructive mountaintop removal.

Priority bird species and habitats

Mature deciduous forest -
Cerulean Warbler – Nearly 50% of global population breeds here; declining significantly, as in much of range. Favors very large oaks on ridgetops and riparian bottomlands.
Louisiana Waterthrush – Sensitive to declining stream quality and loss of riparian forest buffers.
Worm-eating Warbler – Large but stable population; favors mature oak-hickory forest with dense understory on steep hillsides.
Acadian Flycatcher -- Favors streamsides and other wet areas with shrubby understory
Kentucky Warbler – Favors dense shrubby understory at wetter, low-elevation sites.
Wood Thrush – This is one of very few areas where populations of this species have been stable.

Objective: Roughly 2.1 million ha of mature deciduous forest is required to support the entire habitat-species suite (e.g. 619,000 Wood Thrush pairs); 310,000 ha must be suitable to support 245,000 pairs of Cerulean Warblers; 78,000 ha must be suitable to support 32,000 pairs of Worm-eating Warblers. In addition, roughly 27,500 km of forested streams are required to maintain 20,000 pairs of Louisiana Waterthrush.

Early succession shrub -
Bewick's Wren -- Appalachian subspecies. Possibly extinct in most of it's range; status assessment urgently needed.
Golden-winged Warbler – Important and precipitously declining population; persists at higher elevations, especially on reclaimed mine sites.
Prairie Warbler – This Watch List species is still common but declining; uses a variety of open, shrubby habitats.
Field Sparrow – Declining in most of range; most numerous member of habitat suite.

Objective: Roughly 250,000 ha of shrub-scrub habitat is required to support the entire habitat-species suite (e.g. about 370,000 pairs of Field Sparrows and 76,400 pairs of Prairie Warblers), with 8,000 ha managed to support 3,200 pairs of Golden-winged Warblers.

Grasslands -

Henslow's Sparrow – Largest population in Northeast; mostly on reclaimed mine sites in Pennsylvania.

Objective: Roughly 3,000 ha of pasture and reclaimed mine need to managed to support 2,600 pairs of Henslow's Sparrow, with an additional 30,000 ha of grassland habitat to support the entire habitat-species suite of grassland birds.

Conservation recommendations and needs

The Ohio Hills supports a high concentration of high priority and declining species. Two disturbance-dependent species are of exceptional importance here. Concern for one, the Appalachian subspecies of Bewick's Wren, may be coming too late, as most indications are that this bird is nearly extinct. The second, Golden-winged Warbler, is relatively common in this region but has declined precipitously (about 10% per year) over the last 30 years. Management to rectify this situation by repeatedly setting back forest succession over large areas is neither inexpensive nor necessarily politically popular. Silviculture may be less likely to create sustained suitable conditions than farm or strip mine abandonment.

The number of high priority birds in mature deciduous forest in the Ohio Hills makes this a very important habitat type. In contrast with nearby physiographic areas, populations of most forest birds in the Ohio Hills are large and relatively stable. Maintaining stable populations of priority species such as Louisiana Waterthrush and Worm-eating Warbler may require comprehensive forest management planning, but would assure a continued source for many species in the Appalachian region. A new and important concern is the impact of spreading chip mills on forest age, structure, and composition, particularly in West Virginia.

The Cerulean Warbler is a very important exception to the generality regarding stability of forest birds in this physiographic area. In this, the core of Cerulean Warbler range, where the bird has been and continues to be most abundant, populations have been rapidly dropping. This may be a result of a forest that increasingly lacks old trees and a diversity of structure, but this is not at all certain. Proposed mining operations using the mountaintop-removal method could pose a critical threat to existing Cerulean Warbler habitat, both on ridgetops where mining would take place and in bottomlands and valleys where removed earth would be deposited.

The Ohio Hills is one of the few strongholds throughout the range of Henslow's Sparrow, and is the only physiographic area in the Northeast in which the species is not declining. Henslow's Sparrows are most common in the northern part of this area (OH,PA) in either hayfields or reclaimed surface mines planted in warm-season and other native grasses. It is ironic that the strip mines that once devastated vast areas of forest are of incredible value to birds once abandoned, but are of least value if allowed to grow back into forest. If maintained as grass, they

support Henslow's Sparrow, and if kept in early successional shrubs they support Golden-winged Warblers, but there is no single condition that will support both birds.

Specific conservation recommendations in this physiographic area include:

- Identify any extant populations of Appalachian Bewick's Wren, ascertain habitat needs and assure strict protection.
- Determine range of suitable habitats and identify present breeding sites for Golden-winged Warbler in this region.
- Identify present-day concentrations of Cerulean Warbler within the region; determine protection status and specific threats at these sites;
- Maintain a balance of forest-age structures, including adequate amounts of mid-successional as well as late-successional forest.
- Assess effects of mountaintop-removal mining and continued forestry practices on regional populations of high-priority forest birds.
- Identify most important sites for Henslow's Sparrow and determine range of suitable habitat conditions; manage sites to maintain suitable conditions if necessary.

INTRODUCTION

Continental and local declines in numerous bird populations have led to concern for the future of migratory and resident landbirds. Reasons for declines are complex. Habitat loss, degradation, and fragmentation on breeding and wintering grounds and along migratory routes have been implicated for many species. Additional factors may include reproductive problems associated with brood parasitism and nest predation. Scientists and the concerned public agreed that a coordinated, cooperative, conservation initiative focusing on nongame landbirds was needed to address the problem of declining species. In 1990, Partners in Flight (PIF) was conceived as a voluntary, international coalition of government agencies, conservation organizations, academic institutions, private industry, and other citizens dedicated to reversing the downward trends of declining species and "keeping common birds common."

PIF functions to direct resources for the conservation of landbirds and their habitats through cooperative efforts in the areas of monitoring, research, management, and education, both nationally and internationally. The foundation for PIF's long-term strategy for bird conservation is a series of scientifically based Landbird Conservation Plans, of which this document is one. The geographical context of these plans are physiographic areas, modified from original strata devised by the Breeding Bird Survey (Robbins et al. 1986). Twelve physiographic areas overlap the northeastern United States (USFWS Region-5). Although priorities and biological objectives are identified at the physiographic area level, implementation of PIF objectives will take place at different scales, including individual states, federal agency regions, and joint ventures.

A. Goal

The goal of each PIF Bird Conservation Plan is to ensure long-term maintenance of healthy populations of native landbirds. This document was prepared to facilitate that goal by

stimulating a proactive approach to landbird conservation. The conservation plan primary addresses nongame landbirds, which have been vastly underrepresented in conservation efforts, and many of which are exhibiting significant declines that may be arrested or reversed if appropriate management actions are taken. The PIF approach differs from many existing federal and state-level listing processes in that it (1) is voluntary and nonregulatory, (2) focuses proactively on relatively common species in areas where conservation actions can be most effective, rather than the frequent local emphasis on rare and peripheral populations.

B. Process

PIF Landbird Conservation Planning emphasizes effective and efficient management through a four-step process designed to identify and achieve necessary actions for bird conservation:

(1) identify species and habitats most in need of conservation;
(2) describe desired conditions for these habitats based on knowledge of species life history and habitat requirements;
(3) develop biological objectives that can be used as management targets or goals to achieve desired conditions;
(4) recommend conservation actions that can be implemented by various entities at multiple scales to achieve biological objectives.

Throughout the planning process and during the implementation phase, this strategy emphasizes partnerships and actions over large geographic scales. Information and recommendations in the plans are based on sound science and consensus among interested groups and knowledgeable individuals. Specific methods used to complete this process are described within the plan or in its appendices. Additional details on PIF history, structure, and methodology can be found in Finch and Stangel (1993) and Bonney et al. (2000).

C. Implementation

This landbird conservation strategy is one of many recent efforts to address conservation of natural resources and ecosystems in the Northeast. It is intended to supplement and support other planning and conservation processes (e.g. The Nature Conservancy Ecoregion Plans, USFWS Ecosystem Plans, Atlantic Coast Joint Venture, Important Bird Areas initiatives) by describing a conservation strategy for nongame landbirds that are often not addressed or only incidentally addressed in other plans.

PIF strategies for landbird conservation are one of several existing and developing planning efforts for bird conservation. PIF Bird Conservation Plans are intended to complement other initiatives such as the North American Waterfowl Management Plan, United States Shorebird Conservation Plan, and North American Colonial Waterbird Plan. Ongoing efforts to integrate with these initiatives during objective setting and implementation will help ensure that healthy populations of native bird species continue to exist, and that all of our native ecosystems have complete and functional avifaunal communities. In particular, the emerging North American Bird Conservation Initiative (NABCI) will provide a geographical and political framework for achieving these ambitious goals across Canada, Mexico, and The United States.

SECTION 1: THE PLANNING UNIT

A. Physical Features

The Ohio Hills physiographic area (Fig. 1) encompasses much of southwestern Pennsylvania, western West Virginia, and southeastern Ohio, with a total area under consideration of roughly 79,934 square kilometers. An extension of hills across central West Virginia separates the higher Allegheny Mountains to the north from the northern Cumberland Plateau to the south. Landforms within the planning unit consist primarily of dissected, unglaciated plateaus ranging in elevation from 150 m to 450 m, with some valleys as low as 100 m and some mountainous areas reaching 1,100 m. This phyisographic area includes the headwaters of the Ohio River and numerous major drainages, including the Scioto, Hocking and Muskingum Rivers in Ohio, the Kenawha River in West Virginia, and the Monogahela and Youghiogeny Rivers in Pennsylvania.

Within the planning unit are 14 Ecological Units (Keys et al. 1995), encompassing all of the Southern Unglaciated Allegheny Plateau and portions of the Allegheny Mountain, Interior Low Plateau Highland Rim, and Northern Cumberland Plateau sections (Appendix 1). Average annual precipitation ranges from roughly 90 cm to 125 cm. Growing season ranges from 138 days in Pennsylvania to 195 days in southern Ohio (climate data from Keys et. al. 1995).

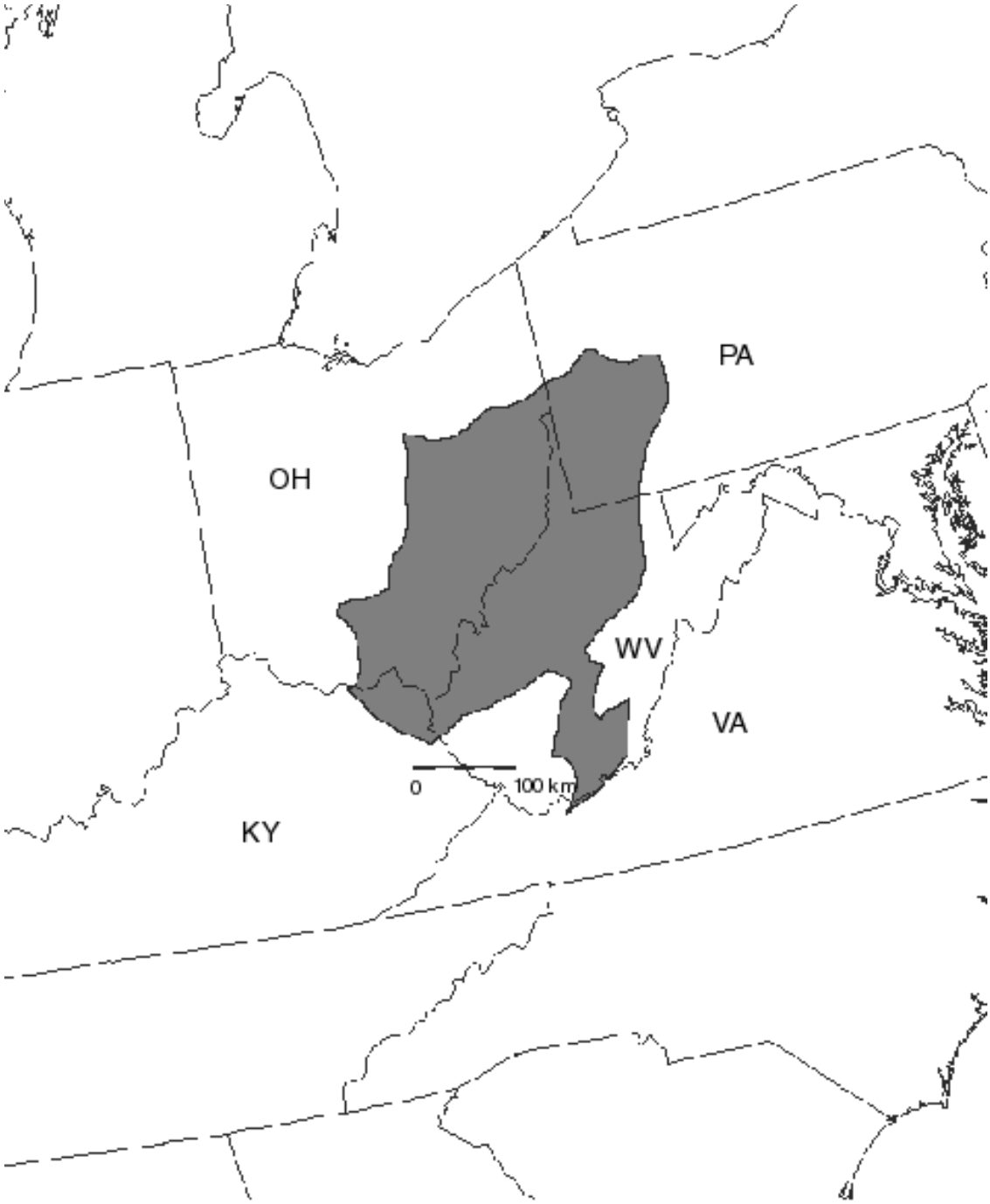
B. Potential Vegetation:

A majority of the planning unit was dominated historically by oak-hickory and oak-chestnut forests (Appendix 1). Today these forest types cover roughly 4.3 million ha (10.7 million ac), or 54% of the physiographic area (Fig. 2, Table 1.1). Numerous patches of northern hardwood forest occur on north-facing hillsides, particularly near the edges of the Allegheny Mountains in West Virginia and Allegheny Plateau in Ohio. Oak-pine forest types (2% of area) occur primarily in a belt to the east of the Ohio River, but also scattered across the southern portion of the physiographic area.

Table 1.1. Natural vegetation cover-types in the Ohio Hills physiographic area. Forest types are taken from USFS FIA data; nonforest types are from USGS data. See Fig. 2 for map of current vegetation cover types.

Vegetation type	Area (ha)	Area (ac)	% of area
Oak-hickory forest	4,313,600	10,658,906	54.0
Maple-beech-birch forest	234,400	579,202	2.9
Oak-pine forest	165,400	408,703	2.1
White-red-jack pine forest	15,400	38,053	0.19
Spruce-fir forest	500	1,236	0.01

Additional forest alliances that are not classified by USFS FIA data include hemlock-hardwood ravine forest, red maple-ash floodplain swamp, and sycamore-box-elder floodplain forest. Nonforest alliances include pitch pine-scrub oak barrens.



The Ohio Hills, physiographic area 22, covering 7,993,400 ha (19,751,691 ac) across Ohio, Kentucky, Virginia, West Virginia, and Pennsylvania.

Funding for the preparation of this map was provided by the National Fish and Wildlife Foundation, through a challenge grant to The Nature Conservancy, Wings of the Americas program. Matching funds for this grant were donated by Canon U.S.A., Inc.

Fig. 1.

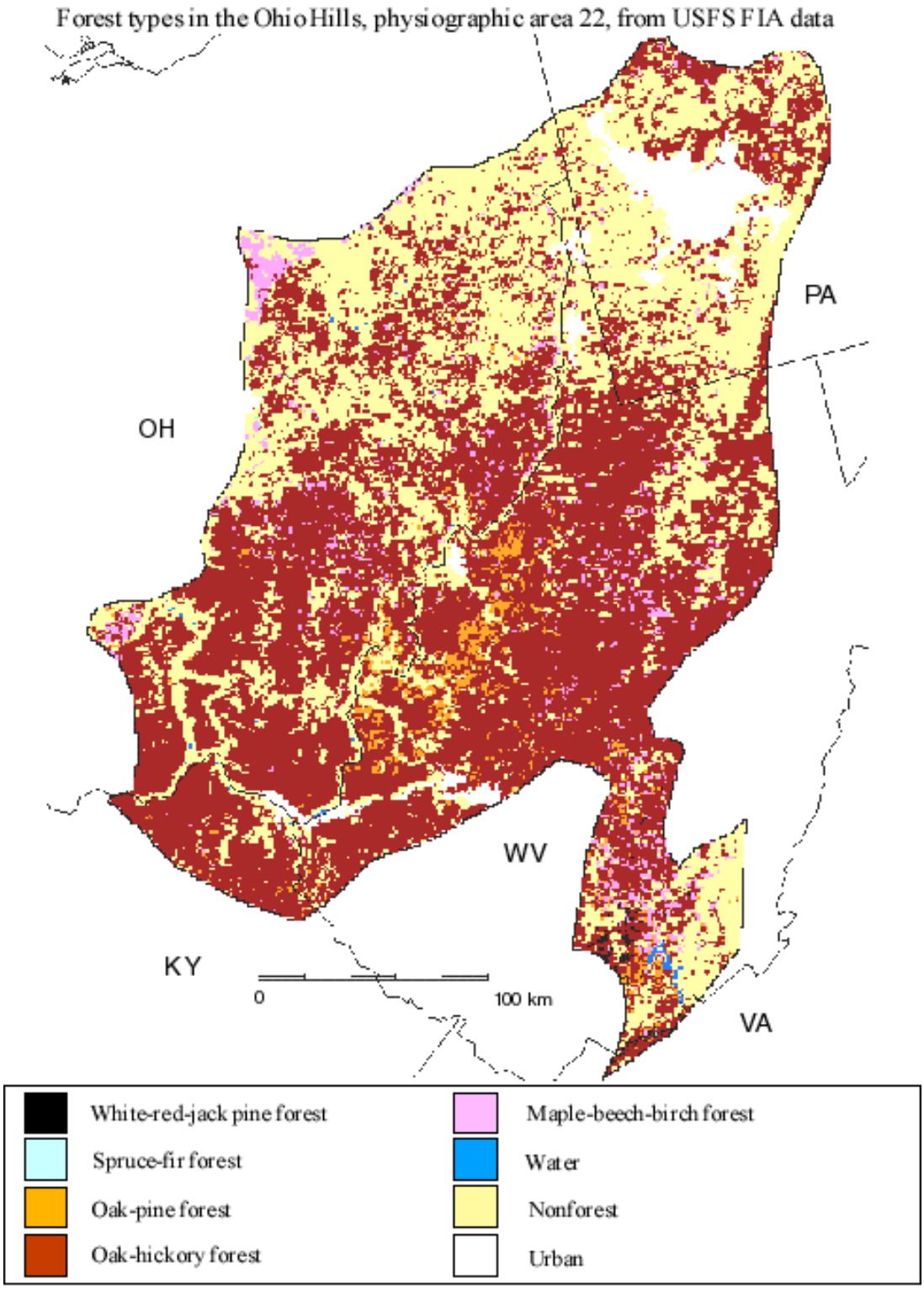


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Fig. 2.

C. Natural disturbances:

Historically, oak-hickory and oak-pine forests were strongly influenced by fire. In particular regeneration of oaks and certain pines is dependent on fire. Recent policies of fires suppression in the Ohio Hills, like much of the southern and middle Appalachians, has had major (primarily negative) effects on native forest composition and structure (Sutherland and Hutchinson 2003). Gap-phase dynamics, or the opening of forest canopy from tree-falls or wind-throws, was also very important. An estimated 17% to 24% of old-growth, mesic-forest canopy in this region was maintained in a natural gap state (USFS 1996a -- **these figures have been contested but we haven't looked into this**…). Other largescale disturbance factors affecting natural communities include wind and ice storms. Biotic influences included extinct mammals (elk, bison) and birds (Passenger Pigeon), as well as major effects of beavers in maintaining wetland systems. More recently and into the near future, disturbances from invading forest pests/disease, such as gypsy moth, dogwood anthracnose, beech bark disease, butternut canker, and hemlock woolly adelgid, have the potential to cause significant changes to the composition and structure of existing forests.

D. History and land use:

The following excerpt from Sutherland and Hutchinson (2003) provides an excellent historic perspective, particularly for eastern Ohio and western Pennsylvania:

"Ohio was occupied by hunter-gatherers during the Paleo-Indian (ca. 17000 to 10500 BP) and Archaic (ca. 10500 to 3000 BP) Periods (Bush et al. 1995). More evidence of occupation exists for the Woodland Period (ca. 3000 to 400 BP). Although southeastern Ohio was almost entirely forested at the onset of Euro-American settlement (ca. 1800; Gordon 1969), written accounts of the landscape prior to 1800 describe more open conditions in some areas. In 1751, Christopher Gist described the landscape near present-day Lancaster, Ohio: 'All the way from Licking Creek to this place is fine rich level land with large meadows, fine clover bottoms and spacious plains covered with wild rye' (Darlington 1893). In several accounts, forests were described as open and park-like. In 1765, George Croghan frequently described 'clear Woods' in eastern Ohio. Thaddeus Harris, traveling from Marietta, Ohio, to Wheeling, West Virginia, in 1802, wrote, 'There is but little underwood; but on the sides of the creeks and near the river, the papaw, spicebush, or wild pimento and the dogberry grow in the greatest abundance' (Thwaites 1904).

Descriptions of open areas and park-like forests in the Eastern United States, in addition to direct accounts of Native Americans using fire, have led ecologists and historians to conclude that the use of fire as a land management tool was widespread and had significant effects on the structure and composition of the landscape (Day 1953; Williams 1989; Whitney 1994). However, this conclusion is not universally accepted (e.g., Russell 1983), or may not be applicable to all forest types in the region (McCarthy et al. 2001). Several accounts provide direct evidence of Native Americans using fire in the Ohio Valley. Joseph Barker ([1790] 1958), described burning near Marietta, Ohio (85 km east of AR and WR study areas), 'The Indians, by burning the Woods every Year, kept down the undergrowth and made good pasture for the deer and good hunting for himself.' Traveling west from Pittsburgh, Pennsylvania, David McClure ([1772] 1899) noted that, 'the woods were clear from underbrush, the oaks and black walnut do not grow very compact, and there is scarcely anything to incommode a traveler in riding, almost in any

direction, in the woods of the Ohio. The Indians have been in the practice of burning over the ground, that they may have the advantage of seeing game at a distance among the trees.'"

European settlement of southeastern Ohio largely occurred between 1800 and 1830. The charcoal iron industry was the primary cause of forest clearing during most of the rest of that century (1830-1890). Sixty-nine iron furnaces had been established in southeastern Ohio and northeastern Kentucky by 1875. Eighty to 250 ha of forest were harvested annually to supply charcoal for a typical furnace, and secondary forests were harvested again at intervals of 20 to 30 years (Stout 1933). While the discovery of richer iron ores around Lake Superior led to the decline of the charcoal iron industry in this region during the end of the 1800s, it was also noted that timber resources had been largely depleted from this area, "It may be safely stated, that at present eight-ninths of this available timber land of the southern Ohio iron manufacturing districts has been cleared." (Lord 1884).

Since the late 1800s, the forests of this region have undergone secondary succession, with periodic timber extraction from these areas continuing to be a factor throughout the region. Timber harvest continues to be important, particularly on privately owned forest lands. Most of the commercial forestry has been for hardwood species, although pine has also been an important resource in some areas. Timber harvest, along with accompanying policies of fire suppression, has altered the tree species composition and age structure of the forests.

Extraction of minerals, oil and gas, and coal are also important land uses throughout this region. For example, the Bureau of Land Management, which manages oil and gas leases on all federally owned lands, reports that as of 2001 about 20,000 acres of oil and gas leases existed on the Wayne National Forest in Ohio. Over 1,200 individual wells are thought to exist on these leased lands. While individual wells have relatively limited direct impacts, indirect impacts from access roads and cumulative impacts from the large total number of wells need to be considered when evaluating the overall effects of oil and gas extraction. Considerable coal resources also exist within this physiographic area, with surface strip mining, underground mining, and mountaintop removal mining methods all being used to extract coal within this physiographic area. As of 2001, the Office of Surface Mining reported that about 108,000 acres are permitted for coal mining in Ohio, the majority of which is within the Ohio Hills. Almost 290,000 acres in West Virginia and 416,000 acres in Pennsylvania were permitted state-wide for coal mining, although much smaller percentages of those states mining lands (compared to Ohio) are within the Ohio Hills area. Surface strip mining and mountaintop removal mining result in major alterations of existing habitats, with the post-mining reclaimed lands in a different cover type than what was originally present.

While utilization of timber resources has the primary focus of land uses in the southern half of this physiographic area in European settlement, this portion of the planning unit has also sustained a low level of agricultural practices, particularly along river valleys and stream bottoms where corn and tobacco have been staple row crops. Dairies, sheep farms, and horse farms have also dotted the rolling hills of this area since soon after the first large influx of settlers in the late 1700s and early 1800s. However, it has been in the northern half of this physiographic area where agriculture has been the more dominant land use since European settlement. Corn and wheat were dominant row crops, with the number of acres in production peaking around 1900 (Jones 1956). Although exact numbers have not been located, a minimum of roughly 70% of the

land in the northern portion of this physiographic area was cleared for agricultural purposes during its maximum extent in the early 1900s. Today, roughly 40% of the physiographic area is in agricultural production or urban development, mostly in the northern half (Table 1.2, Fig. 2).

Nearly 10% of the land area is in public ownership (Table 1.2, Fig. 3). The largest acreage is on the Wayne National Forest in southeastern Ohio, with additional large tracts of state forest land in Pennsylvania, Ohio and West Virginia. State lands in the Youghioghenny River drainage of PA have been identified as an Important Bird Area.

Current human populations are relatively sparse through most of the physiographic area and are largely confined to the larger valleys. Pittsburgh, PA and Morgantown, WV are the largest cities; suburban and second-home development is rapidly encroaching from these urban centers.

Table 1.2. Current land-use and ownership patterns in the Ohio Hills physiographic area.

Land classification	Area (ha)	Area (ac)	% of area
Forested land	4,729,695	11,687,076	59.2
Public ownership	751,900	1,857,945	9.4
State Forest Preserve	108,000	266,068	1.4
National Forest	588,800	1,482,106	7.5
National Park & Rec. Area	4,200	10,378	0.1
.....Wilderness/ wild & scenic r.	39,800	98,346	0.5
Private industrial			
Private non-industrial			
Agricultural land	2,936,200	7,255,350	36.7
Urban/ developed	303,200	749,207	3.8
Other nonforest lands			
Wetlands			

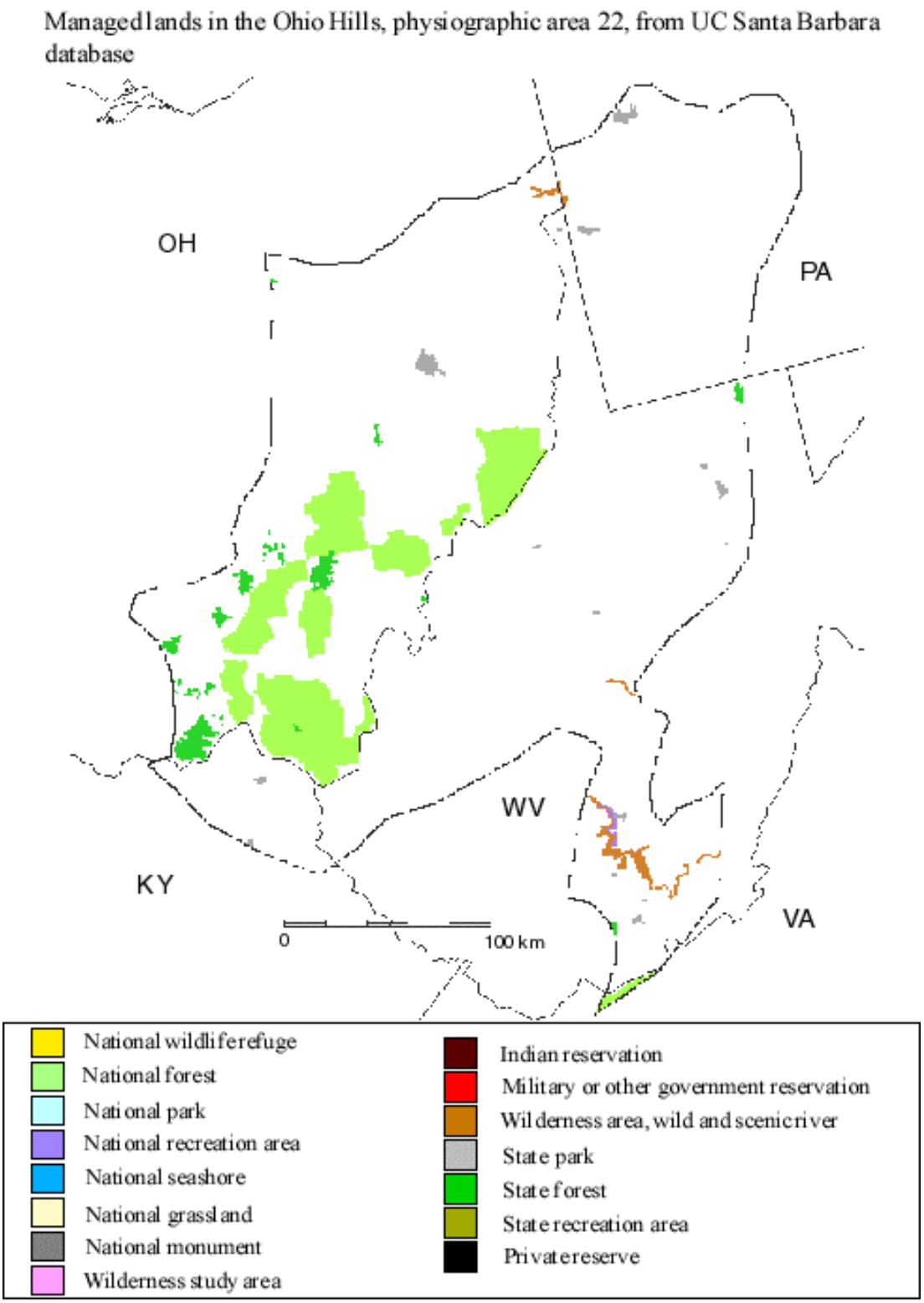

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Fig. 3.

SECTION 2: PRIORITY BIRD SPECIES

A. General avifauna

Roughly 174 bird species (Appendix 2) have been documented as breeding within the Ohio Hills physiographic area (Peterson 1980, various breeding bird atlases). Of the nongame landbirds (121 species), the majority are migratory; these include 74 Neotropical migratory species. The landbird avifauna is typical of the southern Appalachian region. An analysis of all Neotropical migratory species in the Northeast U.S. (Rosenberg and Wells 1995) found the composition of breeding species in this area to be most similar to the Mid-Atlantic Ridge and Valley and Piedmont physiographic areas. This area ranked extremely high in terms of immediate conservation concern, based on high concentrations of high-priority and declining species (Rosenberg and Wells 1995, 2000).

For a relatively small physiographic area, the Ohio Hills supports exceptionally high proportions of the world population for many species, including the highest proportion of any physiographic area for Cerulean Warbler, Blue-winged Warbler, Acadian Flycatcher, Worm-eating Warbler, and Louisiana Waterthrush. (Appendix 2). In addition, over 10% of all Yellow-throated Warblers, Scarlet Tanagers, and Kentucky Warblers are estimated to occur here, and over 5% of the population for seven additional species. This is one of only five physiographic areas that supported the endangered Appalachian race of Bewick's Wren.

Our primary measure of population trend at present is the Breeding Bird Survey (BBS), which provides data on roughly 103 of the 149 species breeding within Physiographic Area 22 (N = 60 routes). For many species in this region, however, especially those with patchy distributions, BBS coverage is poor, and reported trends often lack statistical significance. Nevertheless, a significant declining trend for a species on existing BBS routes may be reason enough to examine the population trend more closely, and to initiate measures to halt or reverse this trend.

Of the species sampled by BBS, 29 have declined significantly ($P < 0.10$) since 1966, and 6 additional species have declined since1980 (Appendix 2). Of the 35 declining species, 24 are associated with grassland and other early successional habitats, including urban areas. These include 13 of the 15 species showing the steepest declines (> 3 % per yr). The only mature forest species to show a particularly steep declining trend (> 5%) in this area is Hairy Woodpecker. Several common forest species show smaller, but significant, declines (e.g. Great Crested Flycatcher, Acadian Flycatcher, Scarlet Tanager -- the latter two only since 1980). Other declining forest species are associated with either forest edges or openings (e.g. Eastern Wood-Pewee, Yellow-shafted Flicker, Yellow-billed Cuckoo). This is one of very few physiographic areas where both Wood Thrush and Henslow's Sparrow do *NOT* show a declining population trend.

In contrast, 41 species exhibit significantly increasing population trends; 14 of these show significant trends only since 1980 (Appendix 2). A majority of these fall in two categories, either species associated with regenerating or mature hardwood forests, or species that have adapted particularly well to human activities or development. More forest species (16) are increasing in this region than are declining (9), including several regionally important species such as Worm-

eating Warbler, Hooded Warbler, Yellow-throated Vireo, Ovenbird, and American Redstart that have all increased dramatically since 1980.

B. Priority species pool

From among the breeding avifauna, a pool of species may be derived that represents priorities for conservation action within the physiographic area (Table 2.1). Note that a species may be considered a priority for several reasons, including global threats to the species, high concern for regional or local populations, or responsibility for conserving large or important populations of the species. The different reasons for priority status are represented by categories or tiers in the table below. Our primary means of identifying priority species is through the PIF species assessment process (Hunter et al. 1993, Carter et al. 2000) using scores generated by the Rocky Mountain Bird Observatory. This system assesses species on the basis of seven measures of conservation vulnerability. These include four global measures (i.e., they do not change from area to area), as well as threats to breeding populations (TB), area importance (AI), and population trend (PT), which are specific to each physiographic area. Categories of priority status are determined by examining combinations of parameter scores, as well as the total rank score, which is a measure of overall conservation priority. This process of species assessment has been standardized across all physiographic areas of North America. Scores for all breeding species in the Ohio Hills area may be found at: <http://www.rmbo.org/pif/pifdb.html>.

Note: The parameter scores for all physiographic areas in the Northeast were updated in August 2003 to reflect and be consistent with methods used in the *PIF North American Landbird Conservation Plan* (Rich et al. 2004). The priority species pool presented below reflects these updated scores and a revised set of entry levels (i.e., Tiers). If you note changes in the priority species pool or individual scores from a previous version of this plan or those found at <http://www.rmbo.org/pif/pifdb.html>, they are likely due to the process of updating scores and entry levels to reflect the North American Plan.

There are six entry levels into the priority species pool, as follows:

Tier I. *High Continental Priority.* -- Species on the *PIF Continental Watch List* (Rich et al. 2004), which are typically of conservation concern throughout their range. These are species showing high vulnerability in a number of factors, expressed as any combination of high global parameter scores, with AI $\geq$ 2 (so that species without manageable populations in the region are omitted). High level conservation attention warranted.

Tier IA. *High Continental Concern + High Regional Responsibility*. Species for which this region shares in major conservation responsibility; i.e., conservation in this region is critical to the overall health of this species. These species are on the *PIF Continental Watch List* with AI of 3 – 5 for this region, or a high percent population (above threshold in IIB).

Tier IB. *High Continental Concern + Low Regional Responsibility*. Species for which this region can contribute to rangewide conservation objectives where the species occurs. Species on the *PIF Continental Watch List* with AI of 2 for this region.

Tier II. *High Regional Priority*. Species that are of moderate continental priority (not on *Continental Watch List)*, but are important to consider for conservation within a region because of various combinations of high parameter scores, as defined below; total of 7 parameter scores = ≥ 19.

Tier IIA. *High Regional Concern*. Species that are experiencing declines in the core of their range and that require immediate conservation action to reverse or stabilize trends. These are species with a combination of high area importance and declining (or unknown) population trend; total of 7 parameters ≥ 19, with AI + PT ≥ 8.

Tier IIB. *High Regional Responsibility*. Species for which this region shares in the responsibility for long-term conservation, even if they are not currently declining or threatened. These are species of moderate overall priority with a disproportionately high percentage of their total population in the region; total of 7 parameters ≥ 19, with AI = 5 or % population > threshold (see Appendix 3).

Tier IIC. *High Regional Threats*. Species of moderate overall priority that are uncommon in a region and whose remaining populations are threatened, usually because of extreme threats to sensitive habitats. These are species with high breeding threats scores within the region (or in combination with high nonbreeding threats outside the region); total of 7 parameters ≥ 19 with TB + TN > 6, or local TB or TN = 5.

Tier III. *Additional Federally Listed*. Species listed under the U.S. Endangered Species Act receive conservation attention wherever they occur.

Tier IV. *Additional State Listed*. - Species on state or provincial endangered, threatened, or special concern lists that did not meet any of above criteria. These often represent locally rare or peripheral populations.

Tier V. *Additional Stewardship Responsibility*. Representative or characteristic species for which the region supports a disproportionately high percentage of the world population (see Appendix), but which did not meet any of the above criteria. Includes moderate- and low-scoring species for which the region has long-term stewardship responsibility, even if these species are not of immediate conservation concern.

Tier VI. *Local concern* - species of justifiable local concern or interest. May represent a geographically variable population or be representative of a specific habitat or conservation concern.

Table 2.1. Priority breeding-species pool for Area 22. PIF regional and global scores from the PIF Species Assessment Database housed at Rocky Mountain Bird Observatory (Carter et al., 2000). Unless otherwise stated, percent of population calculated from percent of range area, weighted by BBS relative abundance (see Rosenberg and Wells 2000). See text for definition and interpretation of entry levels. AI = Area Importance; PT = Population Trend. Species with AI = 1 are not included in this table as such a score indicates a peripheral population without manageable numbers in this area. Local status categories include species with breeding populations only (B) or species with at least part of the population found in the area year-round

(R). Species that are federally or state listed are noted on the Priority Species Pool by country and/or state using the following codes: E = Endangered, T = Threatened, SC = Special Concern.

Entry Level	Species	Combined Score	% of pop.	AI	PT	Local Status
IA. *High Continental Concern + High Regional Responsibility*						
	Cerulean Warbler	28	43.7	5	5	B
	Henslow's Sparrow	26	6.3	4	2	B
	Swainson's Warbler	26	2.5	3	3	B
	Prairie Warbler	25	6.0	5	5	B
	Kentucky Warbler	25	8.4	5	4	B
	Worm-eating Warbler	24	8.2	4	3	B
	Blue-winged Warbler	23	25.0	5	2	B
	American Woodcock	23	1.6	3	5	R
	Wood Thrush	21	8.6	5	2	B
	Short-eared Owl (PA-E)	21	< 1	3	3	R
	Willow Flycatcher	18	< 1	3	3	B
IB. *High Continental Concern + Low Regional Responsibility*						
	Golden-winged Warbler (OH-E)	26	1.3	2	5	B
	Prothonotary Warbler	22	< 1	2	3	B
	Upland Sandpiper (PA-T)	21	< 1	2	3	B
	King Rail (PA,OH-E)	21	< 1	2	3	B
	American Black Duck	20	< 1	2	3	R
	Red-headed Woodpecker	19	< 1	2	3	R
IIA. *High Regional Concern*						
	Louisiana Waterthrush	25	10.7	5	4	B
	Acadian Flycatcher	23	14.7	5	4	B
	Bewick's Wren (OH-E)	23	< 1	4	5	R
	Field Sparrow	21	4.6	5	5	R
	Yellow-breasted Chat	20	3.5	4	5	B
	Black-billed Cuckoo	20	1.9	4	4	B
	Eastern Towhee	20	4.5	5	4	R
	Indigo Bunting	19	3.9	5	4	B
IIB. *High Regional Responsibility*						
	Scarlet Tanager	21	10.2	5	2	B
	Yellow-throated Vireo	20	7.7	5	2	B
	Hooded Warbler	20	5.6	4	2	B
	Yellow-throated Warbler	19	10.8	4	1	B
	Chimney Swift	19	3.6	5	2	B
IIC. *High Regional Threats*						
	Sedge Wren (PA-T)	20	< 1	2	3	B
	Grasshopper Sparrow	19	< 1	2	5	B

IV. *Additional State Listed*					
Northern Bobwhite (PA-SC)	19	< 1	2	5	R
American Bittern (PA-E)	18	< 1	2	3	B
Least Bittern (PA,OH-E)	18	< 1	2	3	B
Northern Harrier (OH-E; PA-SC)	17	< 1	2	3	R
Barn Owl (PA-SC)	16	< 1	2	3	R
Lark Sparrow (OH-E)	16	< 1	2	3	B
Yellow-bellied Sapsucker (OH-E)	15	< 1	2	3	R
Osprey (OH-E; PA-T)	15	< 1	3	3	B

Thirteen species on the PIF continental Watch List have manageable populations within this planning unit (Table 2.1); these are considered to be of high overall concern throughout their range. Four additional species considered to be high priorities by other bird conservation initiatives (American Woodcock, Upland Sandpiper, King Rail, American Black Duck) meet the same PIF watch list criteria. Of these 17 species, 11 have populations large enough for this area to be considered significant to their overall conservation, whereas 6 species have smaller, more patchily distributed populations. Of these species, Cerulean Warbler received the highest score in this planning unit with Henslow's Sparrow, Golden-winged Warbler, and Swainson's Warbler all receiving the next-highest score. The critically endangered Appalachian race of Bewick's Wren could be considered of highest concern, if it still exists in the region. The overall score presented for this subspecies reflects the score for the entire species, not the Appalachian race. Also among the species of highest global importance are Prairie, Kentucky, Worm-eating, and Blue-winged warblers, and Wood Thrush. The highest priority species are birds of mature forest, shrubland, and grassland habitats, and a majority of these represent species in the core of their range, where globally important populations need to be conserved. In particular, nearly half of the world population of Cerulean Warblers is estimated to breed in this physiographic area, and this population has declined significantly since 1966. Swainson's Warbler and Prothonotary Warbler are somewhat peripheral species; The Swainson's Warblers of this area represent the upland population, which is tied to rhododendron thickets, while Prothonotary Warblers are simply absent from much of the higher elevations of the central and southern Appalachian Mountains but are locally distributed along the Ohio River and some of its major tributaries throughout this planning area. While this physiographic area did not historically support a large Henslow's Sparrow population, reclaimed mine lines are currently providing significant amounts of habitat in this planning unit for a special of high continental concern, making for an interesting contrast between historic and current conditions.

Fifteen additional species are considered to be of high regional importance. The 8 species in Tier IIA show a combination of high area importance and declining populations in this physiographic area. These birds are primarily common species of early-successional and disturbance-maintained habitats. In Tier IIB, Scarlet Tanager, Yellow-throated Vireo, Hooded Warbler, Yellow-throated Warbler, and Chimney Swift have disproportionately large breeding populations in the area, but these species all have stable or increasing trends in this physiographic area; these are species for which the region shares responsibility for long-term planning to maintain healthy

populations of these species in the core of their ranges. Tier IIC contains 2 additional species that are threatened within the physiographic area and have small breeding populations in the planning unit. These 2 species highlight the need to protect sensitive and threatened grasslands.

Eight additional species are listed as endangered, threatened, or special interest in Pennsylvania or Ohio and are listed under Tier IV. Nearly all of these are rare or peripheral species in the physiographic area and are mostly raptors or species of grasslands and wetlands. This list highlights the continued concern for these highly threatened habitats. The overall priority pool of 40 species (23% of the breeding avifauna) is dominated by common forest- and shrub-breeding species, many of which have large and important populations in this area. Considering all priority categories, the species of highest conservation concern include Appalachian Bewick's Wren, Cerulean Warbler, Henslow's Sparrow, Golden-winged Warbler, and a suite of additional deciduous forest breeders. These species represent focal species that help define conservation actions in their respective habitats (see Section 4).

SECTION 3: BIRD CONSERVATION ISSUES AND OPPORTUNITIES

A. Early vs. late-successional habitats and species -- historical baselines

Because most of the northeastern U.S. has undergone major changes in forest cover during the past two centuries, the relative importance placed on early- versus late-successional species and their habitats today depends in large part on the historical baseline chosen for comparison. This issue, which permeates bird-conservation planning throughout the Northeast, must be resolved before priority species and habitats are determined. As elsewhere in the region, species with relatively large proportions of their total population in the planning unit (or those with high AI scores) are mostly associated with mature forest habitats. In contrast, early successional species are less represented here than elsewhere in the Northeast, and the vast majority of these show declining population trends.

To some extent, deciding on the "value" of early-successional bird populations is subjective; for example, the fact that two species with significant declining trends in the region are Brown-headed Cowbird and House Sparrow is hardly reason for concern. Other species such as Golden-winged Warbler, however, rank high in regional importance and is dependent on successional or disturbed habitats. Similarly, the Appalachian Bewick's Wren is a species of global concern that occurred in naturally disturbed sites in this area.

This plan recognizes the importance of mature-forest species in long-term conservation planning for the northeastern U.S., but calls for a balance of maintaining naturally disturbed habitats as well as some early successional stages within the managed forest landscape. In addition, areas that are currently in agricultural production could be managed to benefit high-priority grassland species, thus maintaining the overall diversity of the avifauna.

B. Regional economics of commercial timber production

Clearly, any successful landbird conservation plan in this region must reconcile the needs of long-term, sustainable timber production and the habitat needs of high-priority bird species. Loss of the economic sustainability of commercial forestry could result in conversion of forest habitats to urban development or other less bird-friendly landscapes. In general, over a century of timber harvesting in this region has not resulted in the significant loss of species or populations of forest birds. Avifaunal changes have mostly been in the form of changes in local composition and relative abundances, as the mix of successional stages and tree-species composition shifted across the landscape.

The primary goal of this bird conservation plan is to ensure the long-term maintenance of all important forest types in the future landscape mosaic. This must be achieved through careful forest-planning on both private and public lands, with the goals of economic gains and sustainability balanced with the needs of birds and other wildlife. This balance will likely differ in areas of different land ownership. By taking a landscape perspective, we can take advantage of the opportunities in each area, such that the cumulative result will be to maintain healthy bird populations into the future.

C. Urban and recreational development

Urban/suburban areas cover a relatively small portion of this planning unit. Perhaps the greatest threat from urbanization is the loss of agricultural land through abandonment and development. Loss of shrubland habitats is a major factor where development takes place in areas that were previously left fallow. Subdivision of pastureland and large farms is particularly detrimental to area-sensitive grassland species, such as Upland Sandpiper and Henslow's Sparrow.

Forests along riparian corridors in this region are typically the first forested areas to be impacted by human activity, as development tends to happen along streambeds and floodplains first. However, as populations grow and development begins to reach onto ridges, forest fragmentation becomes more of an issue. Landscape context should be monitored in areas with rapid human development. Although urban habitats are often thought of as non-habitat for most birds, municipal parks and even wooded neighborhoods can provide suitable stopover habitat that is critically needed by migrating landbirds in largely deforested valleys.

D. Mining

The mining methods of mountaintop removal/valley filling being practiced in the southern WV portions of this planning unit represent an immediate threat to many forest-breeding birds. These methods typically remove forest cover over large extents (1000s of acres), directly eliminating large amounts of forest habitat as well as increasing fragmentation and edge effects. They also directly affects two primary habitats used by many priority species in this physiographic area -- mature deciduous forest on Appalachian ridge tops, and mature mixed-mesophytic forest along headwater streams (coves). The total cumulative forest loss from mining activities is likely to substantial and to have negative impacts on many forest-dependent birds in this area. In addition, current methods of reclamation following mountaintop removal mining/valley fill activities result in poor quality early-successional habitats of non-native grasses and shrubs that are likely to

remain in these early successional conditions for hundreds of years due to the soil compaction during the mining and reclamation process and the resulting length of time it will take tree species to re-colonize these areas. Better methods for mine reclamation need to be developed that will result in higher quality habitat. Every effort should be made to develop techniques for restoring mature, native hardwood forests to all mined sites within time frames approximating natural successional processes.

E. Forest health

At present, one of the most important disturbance factors affecting forested habitats in this region is the prevalence and spread of native and exotic insect pests and disease. Beginning with American chestnut blight, a series of such elements threaten the integrity and health of Appalachian forest ecosystems. These include gypsy moth, which stresses oak and other hardwood forests, southern pine beetle, dogwood anthracnose, hemlock woolly adelgid, and beech bark disease. In addition, oak decline is a condition that further threatens dominant oak forests. Threats from these factors are particularly insidious, because in most cases, no effective control agents are currently known (SAA 1996, USFS 1996).

Along with forest pest and disease issues, over-browsing by deer has the potential to affect forest bird populations. Deer exclosure studies have shown that high deer populations can cause a reduction in the density and diversity of understory wood plants. However, these changes can be reversed by reductions in deer densities. The response by birds to reduced deer populations is an overall increase in bird populations, especially for ground-nesting and intermediate canopy species, as vegetation structure and abundance increases (McShea and Rappole 2000).

G. Bird conservation opportunities and solutions

Several factors contribute to an optimistic assessment of future bird conservation planning in this region: (1) most priority bird species are still abundant and widespread, exemplifying the PIF objective of "keeping common birds common;" (2) a major economic basis of the region is in commercial forestry and recreation, so it is unlikely that habitats for forest birds will be severely threatened in the near future; (3) an unprecedented level of dedication and cooperation exists among land-management agencies, private landowners, and conservation advocacy groups.

Roughly 9% of the planning unit (752,000 ha) consists of federal or state-owned lands. A majority of these are on the Wayne National Forest and state-owned forest lands in OH and the New River Gorge national scenic river in WV. These large public lands represent core areas where implementation of conservation objectives for high-priority bird species may be incorporated into other planning efforts.

State agencies and NGO’s provide a number of specific programs for implementing bird conservation objectives in the Ohio Hills:

Important Bird Areas Program

Identification of Important Bird Areas (IBA) within the Pennsylvania portions of this planning unit has recently been carried out by National Audubon Society's Pennsylvania (Crossley 1999)

state offices. Identified IBAs include XX sites in the Pennnsylvania portion of the planning area (Appendix 5). Conservation planning for these Important Bird Areas has begun and includes implementation of PIF plan objectives for high-priority landbirds. Specific sites will be referred to in greater detail under appropriate habitat sections below. Preliminary identification of IBAs within Ohio and West Virginia has occurred but official designations have not yet been made.

How the Important Bird Area program fits into the Partners in Flight bird conservation planning and implementation process has not been fully resolved. The IBA program is not only targeted at protecting sites that are important to PIF priority species, but also protects areas that are important migratory habitat for many species, support large numbers of particular species during the breeding or wintering seasons, provide habitat for birds listed as endangered, threatened or species of concern by state or federal agencies, sites that hold unique habitat types with characteristic bird life or sites that provide extraordinary opportunities for research or monitoring.

Pennsylvania Natural Area Program

This program, a part of the Pennsylvania Bureau of State Parks, attempts to maintain certain areas within the state park system at a higher level of ecological integrity. A "natural area" is an area within a state park of unique scenic, geologic or ecological value which will be maintained in a natural condition by allowing physical and biological processes to operate, usually without direct human intervention. These areas are set aside to provide locations for scientific observation of natural systems, to protect examples of typical and unique plant and animal communities and to protect outstanding examples of natural interest and beauty. In areas of high recreational activity and in otherwise hostile or degraded landscapes these areas may provide significant benefits for priority birds by improving habitat quality and reducing disturbance.

Ducks Unlimited Wetland Programs

Ducks Unlimited is actively working on wetland restoration and protection throughout the Pennsylvania portion of the planning unit. In 1985, Ducks Unlimited initiated the MARSH (Matching Aid to Restore States Habitat) program to protect and enhance waterfowl habitat at the state level. The program is funded on a 7.5% reimbursement based on the state's chapter income. To date, the MARSH program has generated $1,526,558 for cost share on waterfowl projects in Pennsylvania. The Pennsylvania Game Commission, U.S. Fish and Wildlife Service and other co- operators have contributed an additional $4,817,834 to the future of waterfowl. Thus far, 377 projects have been completed, restoring and protecting more than 18,276 acres of wetland habitat in the state.

SECTION 4: PRIORITY HABITATS AND SUITES OF SPECIES

When species in the priority pool (Table 2.1) are sorted by habitat, the highest priority habitats and associated species can be identified (Table 4.1). These represent the habitats that are either in need of critical conservation attention or are critical for long-term planning to conserve regionally important bird populations. The highest priority species do not form a cohesive

habitat group, but rather divide among five different forest, early successional, and wetland habitats. Steep population declines, a large proportion of its breeding population, and high threats to breeding habitat due to mountaintop removal/valley fill mining in parts of this planning unit make Cerulean Warbler the species of greatest concern within this physiographic area. By association, upland deciduous forest ranks first in regional priority habitats. Appalachian Bewick's Wren, which likely is already extirpated from this physiographic area, and Golden-winged Warbler are also species of high concern and by association, the disturbance-maintained habitats of shrublands and early successional forests rank second in regional priority. Other habitats may be loosely ranked according to the highest-scoring species in the habitat suites. Within each habitat-species suite, certain species that represent particular limiting requirements (e.g., area sensitivity, snags) are considered focal species for setting population-habitat objectives and determining conservation actions.

Table 4.1. Priority habitat-species suites for Area 22. TB (threats breeding), AI (area importance), PT (population trend), and total PIF scores from RMBO prioritization database (Carter et al. 2000). The focal species for each habitat are in bold type. Species are sorted according to action level and then total score. Scale of Concern indicates whether a species is of continental (C) or regional (R) concern. State-listed species are not included in this analysis because they may not be of concern in all states within a region.

Habitat	Common Name	Scale of Concern	Action Level [a]	Combined Score	TB	AI	PT
Mature deciduous-riparian forest							
	Cerulean Warbler	C	MA, MO	28	3	5	5
	Kentucky Warbler	C	MA	25	3	5	4
	Louisiana Waterthrush	R	MA	25	3	5	4
	Worm-eating Warbler	C	MA	24	3	4	3
	Red-headed Woodpecker	C	MA, MO	19	4	2	3
	Swainson's Warbler	C	PR, MO	26	3	3	3
	Acadian Flycatcher	R	PR	23	2	5	4
	Prothonotary Warbler	C	PR, MO	22	3	2	3
	Wood Thrush	C	PR	21	2	5	2
	Scarlet Tanager	R	PR	21	2	5	2
	Black-billed Cuckoo	R	PR	20	2	4	4
	Yellow-throated Vireo	R	PR	20	2	5	2
	Hooded Warbler	R	PR	20	2	4	2
	Yellow-throated Warbler	R	PR	19	3	4	1
	Chimney Swift	R	PR, MO	19	3	5	2
Shrub-early successional							
	Golden-winged Warbler	C	IM, MO	26	4	2	5
	Bewick's Wren	R	IM, MO	23	5	4	5
	Prairie Warbler	C	MA	25	3	5	5
	American Woodcock	C	MA	23	3	3	5
	Field Sparrow	R	MA	21	3	5	5
	Yellow-breasted Chat	R	MA	20	3	4	5
	Eastern Towhee	R	MA	20	3	5	4

Willow Flycatcher	C	MA	18	2	3	3
Blue-winged Warbler	C	PR	23	2	5	2
Indigo Bunting	R	PR	19	2	5	4
Riparian/bottomland forest						
Cerulean Warbler	C	MA, MO	28	3	5	5
Louisiana Waterthrush	R	MA	25	3	5	4
Acadian Flycatcher	R	PR	23	2	5	4
Prothonotary Warbler	C	PR, MO	22	3	2	3
Yellow-throated Warbler	R	PR	19	3	4	1
Grassland						
Henslow's Sparrow	C	IM, MO	26	4	4	2
Short-eared Owl	C	MA, MO	21	4	3	3
Upland Sandpiper	C	MA, MO	21	4	2	3
Sedge Wren	R	MA, MO	20	4	2	3
Grasshopper Sparrow	R	MA	19	4	2	5
Freshwater marsh						
King Rail	C	MA, MO	21	4	2	3
American Black Duck	C	PR	20	3	2	3

[a] Action levels: IM = immediate management or policy needed to prevent regional extirpation; MA = management or other actions needed to reverse or stabilize declining populations or reduce threats (TB + PT ≥ 7 or =6 if continental action level=MA); PR = long-term planning to ensure stable populations (TB + PT < 7); MO = additional monitoring needed to better understand status or population trends.

A. Mature deciduous forest

Importance and conservation status: The deciduous forests of the middle and southern Appalachians are among the most diverse forests in North America. The majority of these forests are dominated by oaks, with important distinctions in species composition (including mixing with pines) that are dependent on gradients of moisture and elevation. Forests broadly classified as oak-hickory cover 4.3 million acres, or 54% of the physiographic area (Fig. 2). The largest tracts are in the southern half of the physiographic area on the western slopes of the Allegheny Mountains and Ohio river drainage.

A primary distinction is made between oak-hickory forests and mixed-mesophytic, or cove-hardwood, forest communities. Cove hardwood forests occur at low-to-middle elevations on mesic sites, in stream valleys and ravines, and on north- and east-facing slopes (USFS 1996). These are typically tall, diverse forests with well-developed and diverse small-tree, shrub, and herbaceous layers. This forest type also includes bottomland-hardwood communities, including forests dominated by sycamore, box-elder, elms, maples, ash, or sweetgum.

A variety of other oak-hickory forest types dominate at higher elevations and more xeric sites. A gradation of types exist from mesic-oak to xeric-oak to mixed pine-oak forests. Forests classified as oak-pine forests cover roughly 400,000 acres, or 2% of the physiographic area (Fig. 2).

From a bird-conservation perspective, the importance of this habitat type is great, because of the number of associated bird species with high priority scores in the planning unit. In general, these species are relatively abundant throughout the region, and many of these species show stable population trends in the Ohio Hills. Setting habitat and population objectives is therefore not as straightforward as in rare or patchy habitat types. Conservation planning should focus on extensive tracts of representative forest types, and should address the microhabitat needs of species showing regional or local declines.

recent and future trends in timber harvest.... strip mining....

Associated priority species: CERULEAN WARBLER, LOUISIANA WATERTHRUSH, WORM-EATING WARBLER, Swainson's Warbler, Eastern Wood-Pewee, Kentucky Warbler, Wood Thrush, Acadian Flycatcher, Scarlet Tanager, etc. The total suite of 19 priority species in this habitat represents a cross section of the diverse forest breeding bird community.

The highest priority species in this suite occupy the full range of mature deciduous forest types (Table 4.3) and represent optimal conditions of canopy structure (Cerulean Warbler), understory structure (Swainson's, Worm-eating, Kentucky warblers), and specialized conditions along streams (Louisiana Waterthrush). Although mixed-mesophytic forests are considered most productive and most threatened, only Swainson's Warbler is primarily dependent on this forest type within this physiographic area. Many species of upland forests also occur in riparian-bottomland habitats, which are considered separately below.

Table 4.2. Habitat associations and requirements for priority species of mature deciduous forest habitats in the Ohio Hills physiographic area. Based on Buckelew and Hall (1994), and working groups of WV, VA, and MD PIF. Forest-types: MM = mixed mesophytic; BH = bottomland hardwood; O-H = oak-hickory; O-P = mixed oak-pine.

Species	Forest type				Habitat needs
	MM	BH	O-H	O-P	
Cerulean Warbler	X	X	X		late succession (>60 yr); tall complex canopy; interior
Swainson's Warbler	X	?	?	?	mid-late succession; rhododendron thickets
Louisiana Waterthrush	X	X	X		late succession (>60 yr); rocky, flowing streams, interior
Worm-eating Warbler	X		X	X	mid-late succession (>30 yr); dense shrub understory; interior; ground-nesting
Kentucky Warbler	X	X	X	?	mid-late succession (>30 yr); dense understory; interior

Eastern Wood-Pewee	X	X	X	X	mid-late succession (>30 yr); forest openings, snags
Wood Thrush	X	X	X	X	mid-late succession (>30 yr); well-developed deciduous understory
Acadian Flycatcher	X	X	X	X	late succession (>60 yr); well-developed understory; streamsides
Yellow-throated Vireo	X	X	X		late succession (>60 yr); low elevation; tall canopy
Hooded Warbler	X	X	X	X	mid-late succession (>30 yr); dense understory; interior
Black-billed Cuckoo	X		X		
Scarlet Tanager	X		X	X	closed canopy
Great Crested Flycatcher	X	X	X	X	mid-late succession (>30 yr); open canopy; snags; cavity-nester
Yellow-billed Cuckoo		X	X		mid-late succession (>30 yr); dense, tangled understory
Black-and-white Warbler	X		X	X	closed canopy, sparse ground cover; ground-nester

CERULEAN WARBLER

Status: The Cerulean Warbler is declining over much of its breeding range despite the fact that its range has expanded, particularly in the Northeast. It had the greatest decline of any North American warbler between 1966 and 1982 and this decline may be continuing (Degraaf and Rappole 1995). Cerulean Warbler is found throughout the physiographic area, which may be considered the present center of abundance for the species. Even so, in the last 30 years, the Cerulean Warbler population in this physiographic area has declined at a rate of 2.5 % per year for an overall loss of about 90% of the pre-BBS population estimate. This species is currently listed as a species of concern in 13 states, threatened in two states and endangered in one state.

Breeding Habitat Characterization: Cerulean Warbler is found throughout this physiographic area below 2500 ft. elevation and often at relatively high breeding densities. Populations occupy mature oak forests on dry ridge tops, mixed-mesophytic forests on slopes, and tall bottomland forests of sycamore, cottonwood, or maples. The common feature of these habitats appears to be mature trees, a tall and uneven emergent canopy layer, and large tracts of land. The size of trees is of primary importance whereas the type of tree is secondary (Hamel 2000 from CEWAP). According to the Cerulean Warbler Atlas Project (1996-1998), the birds may seek out the most mature forest conditions available in the region. This species is sensitive to forest loss and fragmentation because of its large area requirements making the conservation of mature forests within its range a high management priority. A complex canopy structure with some emergent/super-emergent trees and possibly including small canopy gaps appear to be important characteristics of the mature forests inhabited by this species.

LOUISIANA WATERTHRUSH

Status: The Louisiana Waterthrush is believed to have relatively stable population levels in Canada and the US with local declines in some areas due to habitat loss and degradation (Brown et al. 1999). Currently, the breading range is expanding northward into northeastern states including New York, Vermont, and Connecticut most likely because of the recent reforestation of these areas (Brown et al. 1999). Although this species has not had a significant decline in numbers over the years, it is still an important priority species because of its association with riparian woodlands – a very unique and increasingly threatened habitat type.

Breeding Habitat Characterization: The preferred habitat for the Louisiana Waterthrush consists of moist forest, woodland, and ravines along streams. They can sometimes also be found in swamp forests and mature deciduous forests in floodplains. Preferable habitat is large tracts of land (probably greater than 100 ha) with little undergrowth near flowing waters of streams (Brown et al. 1999). The key component of the Louisiana Waterthrush's breeding habitat is rapidly, clean flowing water (BFL cornell). They are not usually found in areas of high fragmentation or areas where water quality is negatively affected by urban or agricultural landuse (Brown et al. 1999).

WORM-EATING WARBLER

Status: The Worm-eating Warbler is vulnerable to population declines because of its dependence on large tracts of forest for nesting and as a result of significant losses of over-wintering tropical broadleaf forest habitat (Petit et al. 1993 cited in Patton and Hanners 1996). The BBS data show a stable population trend in eastern North America since 1966. The Northeast regions are home to the largest proportion of Worm-eating Warblers. In this physiographic region, BBS data show the Worm-eating Warbler having a non-significant decline over the past 35 years. The population in this area appears to be stable today, despite possible earlier declines.

Breeding Habitat Characterization: The primary breeding habitat requirements for Worm-eating Warblers consist of mature deciduous forest with understory patches of dense shrubs like mountain laurel and a topography of moderate to steep slopes (Patton and Hanners 1996). However, they can also be found in young and medium-aged stands (Bushman and Therres 1988 in Patton and Hanners 1996). They are also found near streams or swamps surrounded by shrubs and deciduous woods (Degraaf and Rappole 1995). Worm-eating Warblers probably require large tracts of forest for successful reproduction (Patton and Hanners 1996). Most research suggest that viable populations occur in forest tracts of 300 ha or more (Patton and Hanners 1996). Possible management strategies, therefore, requires identification, maintenance and restoration of large tracts of land that offer potential to be population sources.

Another rather specialized species in this area is the Swainson's Warbler. It is very sparsely distributed in this physiographic area; it occurred in only 4 atlas blocks in West Virginia. Their abundance over the last 30 years has been uncertain, but today there are only about 2,000 birds in this region. This is part of the upland population, which inhabits dense rhododendron or mountain laural thickets in the understory of mature forest. Brown and Dickson (1994) provide two primary habitat descriptions for this Appalachian mountain population. One is the

rhododendron-mountain laurel-eastern hemlock-American holly community type. The second is mature cove hardwood forest with understories of spicebush and greenbrier.

Habitat and population objectives: Based on extrapolations from BBS relative abundances (see Appendix 3), VERY ROUGH estimates of population size for priority species in this habitat suite can be derived (Table 4.3). These crude estimates are most useful in illustrating the relative population sizes of various species, and perhaps giving order-of-magnitude figures for setting population objectives for this planning unit.

Table 4.3. Population estimates and targets (in number of pairs) for priority species of mature deciduous forest habitats in the Ohio Hills physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported within Physiographic Area 22 (from Rosenberg and Wells 1995 [appendix 4], using Peterjohn and Rice 1991, Brauning 1992, Buckelew and Hall 1994).

Species	BBS population	% lost since 1966	Population Target	% Atlas blocks PA	WV	OH
Cerulean Warbler	122,600	> 50%	245,200	43	67	89
Louisiana Waterthrush	14,000	15-50%	20,000	24	62	82
Red-headed Woodpecker	1,600	uncertain	1,760			
Great Crested Flycatcher	27,700	> 50%	55,400	61	33	97
Swainson's Warbler	2,500	uncertain	2,800	0	4	0
Kentucky Warbler	105,000	15-50%	147,000	47	75	99
Worm-eating Warbler	29,400	uncertain	32,400	4	44	39
Acadian Flycatcher	336,000	15-50%	470,000	62	88	100
Wood Thrush	618,900	stable	618,900	96	97	100
Yellow-throated Vireo	130,900	stable	130,900	35	66	98
Black-billed Cuckoo	11,900	15-50%	16,700	33	30	38
Hooded Warbler	100,500	increasing?	100,500	54	69	71
Scarlet Tanager	122,400	increasing?	122,400	93	89	100
Canada Warbler	515	uncertain	565	3	1	1
Chimney Swift	268,500	stable	268,500	87	82	99
Sharp-shinned Hawk	2,060	uncertain	2,270			
Winter Wren	??	uncertain	??			
Magnolia Warbler	1,440	uncertain	1,580	6	0	1

For species that have declined significantly during the BBS period, a population target may be set to approximate pre-BBS population levels; an annual decline of 2.4% per year corresponds with a 50% loss over 30 years. For species suffering a 50% or greater loss since 1966 (PT=5), this plan calls for roughly a doubling of present-day populations as a practical objective. For species suffering a 15-50% loss since 1966 (PT=4), this plan calls for increasing the current population by 1.4. For species showing stable or unknown trends, population targets are roughly rounded up from current population estimates by a factor of 1.1. Note that the relative abundances used for these estimates are averages across all BBS routes in the physiographic area using data from 1990-1998. For more details on methods used for calculating populations and targets, (see Appendix 3).

OBJECTIVE 1. Stabilize or reverse declining population trend for Cerulean Warbler; maintain a long-term population of 245,000 breeding pairs (5.9 birds per BBS route).

OBJECTIVE 2. Maintain a stable population of 20,000 Louisiana Waterthrush pairs throughout the physiographic area and distributed among a large number of watersheds within well-forested landscapes.

OBJECTIVE 3. Maintain a stable population of 32,000+ pairs of Worm-eating Warblers throughout the physiographic area (0.8-1.0 birds per BBS route).

Based on published average density estimates of 3 pairs of Wood Thrush per 10 ha (Roth et al. 1996), an estimated 2.1 million ha of mature deciduous forest is required to support the entire habitat-species suite (e.g. 619,000 Wood Thrush pairs); 310,000 ha must be suitable to support 245,000 pairs of Cerulean Warblers; 78,000 ha must be suitable to support 32,000 pairs of Worm-eating Warblers. In addition, roughly 27,500 km of forested streams are required to maintain 20,000 pairs of Louisiana Waterthrush.

Implementation strategy: Implementing the broad objectives for this habitat-species suite will require a comprehensive forest management plan for the entire Ohio Hills region (and adjacent physios) that acknowledges the long-term importance of maintaining large source populations of priority forest birds. Elements of such a plan that are most relevant to the high-priority birds include:

- maintaining a balance of forest-age structures, including adequate amounts of mid-successional as well as late-successional forest
- ensuring long-term tree-species composition; i.e. prevent loss of particular species, through disease or selective harvest
- ensuring adequate structural diversity, especially regarding canopy and understory components (shrubs, treefalls); monitor effects of natural disturbances (e.g. wind storms) as well as insect outbreaks, deer browsing, and forestry practices
- set maximum allowable levels of forest fragmentation due to forestry practices or planned development; e.g. do not allow any 10,000 km^2 landscape to fall below 70% forest cover within the southern half of this physiographic area

Specific implementation strategy for the highest-priority species, Cerulean Warbler, includes:

- identify important populations and sites on public land; determine habitat needs and implement policy to protect or enhance populations;
- identify important populations and sites on private land; prioritize and target sites for easement, acquisition, or voluntary implementation of habitat protection or enhancement;
- monitor long-term use and suitability of key sites in relation to land use trends.
- determine best forest management practices for Cerulean Warblers to enhance populations.

Management guidelines:

Landscape Level

Maryland Partners in Flight provides an excellent publication on habitat management guidelines for forest and other landbirds (Maryland PIF1997). Maintaining the largest possible forest tracts are of primary importance, ideally at least 7,500 acres (3000 ha) for conservation. Construction and other activity and disturbance should be concentrated on the periphery to prevent fragmentation and edge effects and maintain the largest possible areas of suitable habitat for species that are area-sensitive.

Maryland PIF emphasizes the importance of maximizing the amount of contiguous forest "interior" (forest area more than 100m from the forest edge) within each forest tract. Management and acquisition efforts should be targeted at less isolated forest patches and should promote the reforestation of gaps between forest patches. Increasing forest connectivity is likely to benefit the dispersal ability and habitat quality for many forest interior birds.

In addition to these general guidelines, Rosenberg et al. (1999b) provide minimum patch size requirements in regionally specific landscapes with different amounts of forest cover. Although these minimum areas were derived from data on Scarlet Tanagers, they most likely apply to a suite of forest-breeding species. In the Appalachian region, area requirements are relaxed in landscape blocks (1,000 ha) that are ≥ 50% forested; tanagers and other forest birds will occur in nearly any size patch. In landscape blocks that are 30% forested, however, a minimum patch size of 60 ha is required to support breeding tanagers, and in a block that is only 20% forested, no single patch may be larger enough to attract this species. Given the general differences in landcover proportions between landscapes in the northern (less forested, more agricultural) and southern (more forested, less agricultural) portions of this physiographic area, these guidelines for different types of landscapes are very applicable to the Ohio Hills area.

Publicly owned land such as national and state forests contain many of the remaining large patches of contiguous forest in the Ohio Hills. Management of these areas should emphasize the types of forest present (plant species composition, successional age, vegetation structure, habitat heterogeneity), patterns of habitat across the landscape (patch configuration and shape, patch size, distance between patches, amount of non-forest edge, juxtaposition of habitats), and forest cover (historical, current and potential future). Consideration of non-forest land should also be a part of a forest management plan targeted at conservation of forest species. Petit et al. (1995) suggest a sample management plan to help in assessment. Consideration of minimum area requirements for targeted population levels of forest birds as well as the habitat needs of disturbance-dependent species should be included.

Franzreb et al. (2000) suggest a perspective for forest management in different landscape patterns. Even-aged management may only be consistent with goals for conservation of forest birds in highly forested landscapes, such as the southern portions of the Ohio Hills. Even-aged harvests are more extreme forms of local disturbance and may have a severe impact upon habitat suitability of surrounding forest in more agriculturally dominated regions. But even in more forested areas, attempts should be made to aggregate harvest areas and optimize cut shape and area to minimize forest fragmentation.

Ownership Level

Private land owners can play an important role in forest bird conservation within the context of their land ownerships and management objectives (Wigley and Sweeney 1993). Many of the priority bird species in this habitat suite are tolerant of moderate disturbance, and some such as Wood Thrush and Eastern Wood-Pewee may be dependent on some forms of disturbance to create forest openings and promote a dense understory. Various timber harvesting techniques on a small scale may be beneficial to these species. An assessment of the species occupying a particular forest tract should be conducted before initiating a management action.

Locally, Maryland PIF (1997) suggest avoiding even the loss of small forests (<25 acres or 10 ha), especially along streams and riparian corridors where forests are scarce. These sites are important, perhaps critical, to the survival of migrating birds in many habitat suites. Removal of small woods that would improve the quality of grassland habitat in less forested landscapes may be a consideration for land managers, however.

Older forests often have higher densities of standing dead trees, or "snags". Snags are a necessity for cavity nesting birds such as woodpeckers, which excavate their nests in them, as well as for secondary cavity nesters, which occupy these vacant holes afterward. Many species require snags for roosting and for feeding because dead trees are often host to a number of boring insects and grubs (Maryland PIF 1997).

Other forest management recommendations include promoting a diverse forest understory by controlling deer numbers through exclosures and hunting. Controlled burns can also promote forest regeneration and provide snags and other habitat characteristics that are important for fire- or gap-dependent native forest vegetation and some bird species.

Resources:

The proceedings of several major conferences and groups have been published and offer major insights into the management of Neotropical migratory birds, and especially forest species (Martin and Finch 1995, Finch and Stangel 1993, Hagan and Johnson 1992). DeGraff and Rudis (1986) and DeGraff et al. (1992) are specific to the Northeast. Also read Maryland PIF (1997) for more specific recommendations tailored to different types of land use categories including timber harvest areas and private woodlots.

Species-specific management recommendations are available online through the Nature Conservancy's Wings of the Americas website. They provide links to additional species management information available from the Northern Prairie Wildlife Research Center of the U.S. Geological Survey, Biological Resources Division, the Army Corps of Engineers, Waterways Experiment station, and the Wilderness Society's (TWS) Migratory Bird Initiative. They also reference the appropriate publication number for the Birds of North America seriess and provide links or contact information maintained by Partners in Flight to species accounts developed by the US Fish and Wildlife Service.

Wings Info Resources / Species Information and Management Abstracts:
http://www.tnc.org/wings/wingresource/birddata.htm

Research and monitoring needs:
- identify present-day concentrations of Cerulean Warbler within the region; determine protection status and specific threats at these sites; develop better understanding of site conditions that attract these birds in this physiographic area.
- determine specific habitat needs (and causes of declines) for Cerulean Warbler, Louisiana Waterthrush, Eastern Wood-Pewee, and Kentucky Warbler.
- better understanding of landscape-level effects of land-use practices on forest bird populations
- better understanding of role of stand age and stand structure on habitat quality and ultimately survival and reproductive success of priority species.
- assess the effects of various logging practices (especially selection and shelterwood cuts) on occurrence, breeding density, and nesting success of the priority species in this habitat suite.
- better methods for monitoring species that use patchily distributed components of the forest, such as treefall gaps, small wetlands, snags.
- design and conduct targeted monitoring program to track population trends of forest interior species and raptors that are not well-covered by BBS in this physiographic area.
- monitor reproductive success of this suite of species at different locations throughout region to better understand where forest fragmentation causes problems and where it does not.
- determine relative importance and use of other habitat types during the post-fledging period prior to migration.
- catalog the number, size and arrangement of conservation lands within the planning unit.

***Outreach*:** An estimated 80% of forest land in the eastern United States is privately owned. Outreach should be targeted at owners of private woodlots and large timber companies to manage (or not manage) their land for the benefit priority forest birds. Proactive management on private lands would benefit conservation efforts and landowner interests.

B. Early successional-shrub/scrub

Importance and conservation status: This general habitat grouping includes a variety of specific ecological communities, including oak-pine barrens, naturally occurring disturbance such as landslides, beaver-created wetland systems, as well as abandoned pastureland, early regenerating clearcuts, power-line right-of-ways, and reclaimed strip mines. As such, it is difficult to generalize about the conservation status of these habitats.

Naturally occurring shrub communities should be given high priority for conservation, because these likely represent ancestral habitats that supported original populations of bird species dependent on this habitat type. Examples are pitch pine-scrub oak barrens associated with ridgetops, beaver impoundments in headwater streams and valley bottoms, and areas regenerating from fires or other natural disturbances. A majority of these natural communities occur at higher elevations and potentially support the highest-priority bird species in this suite.

Regenerating clearcuts and reclaimed surface mines provide habitats that mimic natural shrub communities in structure and may be important to native shrub-nesting birds. These habitats are usually ephemeral, lasting generally five to ten years after disturbance, and they occur in a wider variety of forest types and at lower elevations. In addition to providing habitat for native priority species, these areas support additional early successional species that may formerly have been rare in this forested region.

Associated priority species: APPALACHIAN BEWICK'S WREN, GOLDEN-WINGED WARBLER, PRAIRIE WARBLER, etc.

APPALACHIAN BEWICK'S WREN
Status: The status of this high priority species in this area is uncertain. The West Virginia Breeding Bird Atlas recorded this species at two localities within the physiographic area between 1984 and 1989, and at two additional localities just to the west of the area (Buckelew and Hall 1994). This wren has declined precipitously in that state during the past 50 years; by the 1970s it was restricted to "dry valleys of the Ridge and Valley Region" (Hall 1983). The Appalachian population of Bewick's Wren ranged historically from southwestern Pennsylvania, Ohio, and Kentucky south to Georgia and Alabama. Today, this population has all but vanished. Only 20 pairs have been found in Maryland, Virginia and West Virginia during this decade (MD DNR). Currently, the only remaining stronghold of the Eastern Bewick's Wren is in the central hardwoods area of southern Indiana and Illinios, western Kentucky, central Tennessee, and central and southern Missouri into northern Arkansas (UNSABCI 2000).

Breeding Habitat Characterization: Before the decline of the Eastern population of the Bewick's Wren, this species was well known for being adapted to human disturbance; it was often found nesting in old cars, junkyards, and outbuildings. The known breeding habitat of this species today varies from thickets, openings in woodlands to overgrown farmlands or pastures. In the eastern portion of its breeding range, it is found mostly above elevations of 4,000 feet in brushy habitat, heath balds, rocky outcrops, and around rural residences. It is listed by Gaines and Morris (1996) as a species of early successional pine-oak, oak-hickory, and northern hardwood forests. A critical need is to identify the main causes for such drastic population declines and then to identify any extant populations of this species, ascertain their habitat needs, and assure their strict protection by controlling threats

GOLDEN-WINGED WARBLER
Status: A limited populations of this species currently exists in the WV and PA portions of this physiographic area, and the species has shown a precipitous long term decline (-10.8% per yr) over the last 35 years in the Ohio Hills. Besides loss of early successional habitats, this species is susceptible to displacement by and hybridization with the closely related Blue-winged Warbler. Declines of Golden-Winged Warblers may also be due to the loss of wintering habitat due to deforestation and/or nest parasitism by the brown-headed cowbird (Confer1992). Nevertheless, a critical need is to determine what specific habitat conditions favor Golden-winged Warblers or promote long-term coexistence with little or no hybridization.

Breeding Habitat Characterization: Golden-winged Warbler occurs primarily in early successional, open deciduous woodlands (formerly oak-hickory, northern hardwood) at middle and high elevations (>3500 ft). This species also uses power line right-of-ways and open pine-

oak woodland on reclaimed mine sites as they seem to prefer areas of dense patches of herbs and shrubs with sparse trees (WVPIF, Canterbury, Confer 1992a, b). It's original habitat in this region, however, may have included high-elevation heath balds and beaver-created wetlands. Several territories will often be clustered close together in the fashion of a loose colony. Patches of 10-15 ha can support up to six pairs, and these may be preferred over smaller or larger habitat patches (Confer 1992a). Nests are often located along field-forest edges very close to the ground, often supported by the base of a cluster of herbaceous plant material (Confer 1992b, Klaus 1999). Golden-winged Warbler habitat is ephemeral and requires periodic disturbance such as logging, burning, and intermittent farming to return it to favorable early successional conditions.

The remaining species in this group occur in high densities in a variety of suitable shrubby habitats and, although declining, are not of immediate conservation concern. Because of their diverse habitat requirements, these species probably do not constitute a "habitat-species suite" per se. Listing them together, however, highlights the need to include early successional habitats in the conservation plan, where doing so is not in conflict with higher-priority forest-bird objectives.

Habitat and population objectives: Based on extrapolations from BBS relative abundances (see Appendix 3), VERY ROUGH estimates of population size for priority species in this habitat suite can be derived (Table 4.4). These crude estimates are most useful in illustrating the relative population sizes of various species, and perhaps giving order-of-magnitude figures for setting population objectives for this planning unit.

Table 4.4. Population estimates and targets (in number of pairs) for priority species of early successional and forest-edge habitats in the Ohio Hills physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported within Physiographic Area 22 (from Rosenberg and Wells 1995 [appendix 4], using Peterjohn and Rice 1991, Brauning 1992, Buckelew and Hall 1994).

Species	BBS population	% lost Since 1966	Population Target	% Atlas blocks PA	WV	OH
Appalachian Bewick's Wren	(extinct?)			0	1	1
Golden-winged Warbler	1,600	> 50%	3,200	12	26	1
Prairie Warbler	38,200	> 50%	76,400	41	64	89
American Woodcock	???					
Field Sparrow	184,000	> 50%	368,000	96	89	100
Yellow-breasted Chat	176,200	> 50%	352,400	51	87	100
Eastern Towhee	256,000	15-50%	358,500	97	97	100
Blue-winged Warbler	50,400	increasing?	50,400	49	59	99
Eastern Phoebe	254,000	15-50%	355,600	89	94	100
Eastern Bluebird	99,300	15-50%	139,000	82	92	99
White-eyed Vireo	237,000	increasing	237,000	43	90	99
Indigo Bunting	548,300	15-50%	767,700	98	97	100

For species that have declined significantly during the BBS period, a population target may be set to approximate pre-BBS population levels; an annual decline of 2.4% per year corresponds with a 50% loss over 30 years. For species suffering a 50% or greater loss since 1966 (PT=5), this plan calls for roughly a doubling of present-day populations as a practical objective. For species

suffering a 15-50% loss since 1966 (PT=4), this plan calls for increasing the current population by 1.4. For species showing stable or unknown trends, population targets are roughly rounded up from current population estimates by a factor of 1.1. Note that the relative abundances used for these estimates are averages across all BBS routes in the physiographic area using data from 1990-1998. For more details on methods used for calculating populations and targets, (see Appendix 3).

OBJECTIVE 1. Identify any extant populations of Appalachian Bewick's Wren, ascertain habitat needs and assure strict protection; strive to secure and maintain a breeding population of > 100 pairs over next 20 years.

OBJECTIVE 2. Reverse declines of Golden-winged Warbler by maintaining known breeding sites in suitable habitat condition and replicating these conditions wherever feasible; strive to maintain long-term population of 3,200 breeding pairs.

OBJECTIVE 3. Reverse declines of Prairie Warbler by improving the amount and condition of suitable early successional habitat across this planning unit; strive to increase the population to 76,400 pairs

Setting habitat objectives for Bewick's Wren (or Golden-winged Warbler) is difficult at present, because of poor estimates of numerical population objectives. Overall objectives for early-successional habitat may be set, however, based on desired populations of the more common species, with the assumption that adequate habitat for those species would also support Golden-wnged Warblers and any wrens that exist. Based on published average densities of roughly 15 pairs of Field Sparrows per 10 ha (Walkinshaw 1978), an estimated 250,000 ha of early successional habitat is required to maintain this species and the full species-habitat suite throughout the physiographic area. Of this area, roughly 8,000 ha (15,000 ac) should be managed or maintained specifically to support 3,200 pairs of Golden-winged Warblers and another 153,000 ha of the total should be maintained in suitable condition to support 76,400 pairs of Prairie Warblers. Configuration or size requirements for habitat blocks for these species remain to be determined.

Implementation strategy:

- determine habitat/area requirements of Golden-winged Warblers; compare natural and managed habitat communities;
- determine acreage of potential powerline right-of-way throughout physiographic area; identify management needs on these lands;
- identify protection status of known populations and sites; identify potential partners for implementation
- identify additional areas for potential Golden-winged Warbler management; assess potential for discouraging continued expansion of Blue-winged Warbler;
- identify additional areas with high populations of Prairie Warbler, Field Sparrow and other priority species; continue to monitor populations.

Research and monitoring needs:

- intensive surveys for Appalachian Bewick's Wren, including all recent, known sites and targeted tape-playback surveys in potential habitat throughout the region

- determine range of suitable habitats and identify present breeding sites for Golden-winged Warbler in this region.
- compare early successional habitats resulting from natural disturbances vs. forestry practices and mine reclamation, with regard to suitability for high-priority species

Outreach:
- inform birding community -- all-out search for Appalachian Bewick's Wren;
- identify potential partners for shrubland management and enhancement (e.g. mining and power companies;
- highlight value of natural shrub communities (e.g. beaver activity) in regional environmental initiatives;
- highlight value of reclaimed strip mines; outreach to companies and the public.

C. Riparian/bottomland forests

Importance and conservation status: Historically, bottomland forests of the Ohio Hills occur in the floodplains of the Ohio River and throughout the narrower floodplains of major tributaries such as the Monongahela, Kanawha, Big Sandy, Scioto, Hocking, and Muskingum Rivers. Many bottomland forest types reach their northernmost range in the Ohio River system and some of these trees (such as cypress and tupelo) do not occur in this area. Floodplain forests in the Ohio Hills planning area can include oak, sweetgum, blackgum, hickory, sycamore, silver maple, and birch forests. Most forested wetlands in the Ohio Hills have been replaced by row crop agriculture or impounded water for hydroelectric power. In the Ohio River floodplain and most of the major tributaries, fragmented forested wetlands occur in relatively small blocks within an agricultural landscape.

Riparian woodlands, which may also be called greenbelts, stream corridors, streamside management zones, or streamside buffers, also occur through the Ohio Hills along the stream bottoms of major and minor tributaries. These riparian habitats may be dominated by tree and shrub species more typical of uplands, such as oak-hickory or beech-maple, or may occur as forested wetlands in narrow floodplains. Riparian habitats are often important habitats for both aquatic and terrestrial fauna, especially in those lands where there is high topographic relief. Riparian vegetation is considered essential for minimizing erosion from upslope areas from entering and seriously changing water quality. The importance of minimizing erosion through maintenance of riparian habitats is perhaps most important in areas being developed for residential or industrial use. However, maintenance of riparian vegetation adjacent to areas mined, farmed, or timbered remains necessary to reduce runoff and erosion, and minimize environmental contamination from applied chemicals. Cerulean Warbler, Acadian Flycatcher, Louisiana Waterthrush, and Yellow-throated Warbler are among the most common birds in riparian habitats within largely forested landscapes.

Associated priority species: CERULEAN WARBLER, LOUISIANA WATERTHRUSH, Acadian Flycatcher, Prothonotary Warbler, Yellow-throated Warbler, Red-shouldered Hawk.

Habitat and population objectives: Based on extrapolations from BBS relative abundances (see Appendix 3), VERY ROUGH estimates of population size for priority species in this habitat suite can be derived (Table 4.4). These crude estimates are most useful in illustrating the relative population sizes of various species, and perhaps giving order-of-magnitude figures for setting population objectives for this planning unit.

Table 4.5. Population estimates and targets (in number of pairs) for priority species of riparian and bottomland forest habitats in the Ohio Hills physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported within Physiographic Area 22 (from Rosenberg and Wells 1995 [appendix 4], using Peterjohn and Rice 1991, Brauning 1992, Buckelew and Hall 1994).

Species	BBS population	% lost since 1966	Population target	% Atlas blocks PA	WV	OH
Cerulean Warbler	122,600	> 50%	245,200	43	67	89
Louisiana Waterthrush	14,000	15-50%	20,000	24	62	82
Acadian Flycatcher	336,000	15-50%	470,000	62	88	100
Prothonotary Warbler	100	uncertain	110	0	3	8
Yellow-throated Warbler	72,700	increase	72,700	9	53	76
Red-shouldered Hawk	3,300	increase	3,300	8	10	8

For species that have declined significantly during the BBS period, a population target may be set to approximate pre-BBS population levels; an annual decline of 2.4% per year corresponds with a 50% loss over 30 years. For species suffering a 50% or greater loss since 1966 (PT=5), this plan calls for roughly a doubling of present-day populations as a practical objective. For species suffering a 15-50% loss since 1966 (PT=4), this plan calls for increasing the current population by 1.4. For species showing stable or unknown trends, population targets are roughly rounded up from current population estimates by a factor of 1.1. Note that the relative abundances used for these estimates are averages across all BBS routes in the physiographic area using data from 1990-1998. For more details on methods used for calculating populations and targets, (see Appendix 3).

OBJECTIVES: population objectives for the focal species are the same as listed in Section 4.A. (Upland deciduous forest) and the habitat objective should be considered as combined objective for both upland and riparian/bottomland forest.

Implemention strategy: Inventory of mature bottomland forests remaining... Identification of sites important to Cerulean Warbler..... How relates to other species in suite??
The following should be included in an implementation strategy:
1. conduct inventory of remaining bottomland forests and promote conservation of these areas
2. promote reforestation of marginal bottomland and riparian farm lands
3. utilize financial incentives, conservation easements, and partnerships through public-private programs like the Farm Bill's Forest Stewardship provisions (U.S.D.A. Forest Service) and Partners for Wildlife (U.S. Fish and Wildlife Service) to stabilize or enhance riparian habitat.
4. Working with the USFWS's Ohio River ecosystem team to identify mechanisms for integrating migratory bird conservation planning and implementation

Management recommendations:
Timber activity near forested riparian areas can negatively impact bird populations in these areas by reducing the overall forest cover and habitat distribution. Some species are easily extirpated from strips of riparian forest if strips are too narrow. Studies designed to ascertain specific recommendations for the suggested width of strips has yielded a variety of results. Some suggest that riparian strips should be at least 60 meters on either side of a river in order to prevent extirpation of more area sensitive species, other suggest more or less. Maintaining riparian forest buffers of at least 100m is probably a good working rule.

Research and monitoring needs:
Research could clarify the following items regarding management of riparian forest zones:
1. optimum vegetative structure
2. desired plant species composition
3. maximum active management advisable within riparian habitats
4. a standard minimum width of riparian habitats necessary to minimize erosion and conserve birds
5. determine to what degree river to upland habitat corridors are valuable to birds

Monitoring efforts should focus on conducting an inventory of remaining bottomland forest sites as well as targeted population monitoring of riparian bird species not covered well by BBS, particularly Prothonotary Warbler. An inventory and subsequent monitoring of bottomland forest sites important to Cerulean Warblers should also be undertaken.

Outreach: xxxxxxxx

D. Grasslands and agricultural land

Importance and conservation status: Natural grasslands were not a major feature of the presettlement landscape of the Ohio Hills, and it is unclear whether other natural openings, such as barrens or floodplains, supported many grassland birds. Today, agricultural land and reclaimed strip mines represent the primary habitat for grassland birds.

With the exception of Henslow's Sparrow, grassland birds are a relatively low priority in this physiographic area, other than maintaining overall bird species diversity in the region. Where land is in active agricultural production, however, efforts to maintain populations of priority bird species will contribute to conservation objectives for these species throughout the Northeast.

Associated priority species: HENSLOW'S SPARROW, Upland Sandpiper, Dickcissel, Northern Harrier, etc..

HENSLOW'S SPARROW
Status: The Ohio Hills represents one of the few strongholds for Henslow's Sparrow and the only northeastern physiographic area in which the species is not declining. This sparrow is vulnerable to extinction throughout its range, and conservation efforts directed at populations in the Ohio Hills (and adjacent Allegheny Plateau) can contribute greatly to the long-term survival of the species.

Breeding Habitat Characterization: The Henslow's Sparrow occupies two distinct habitats in the region, relatively tall, unmowed hayfields, and reclaimed surface mines that are planted with warm-season and other native grasses. In Ohio, its habitat is described as "fallow fields overgrown with weeds, grasses, and a few scattered shrubs and small saplings.... also regularly in extensive grasslands covering reclaimed strip mines and dry hillsides covered with broom-sedge" (Peterjohn 1989). Its original habitat was said to be wet prairies composed of sedges and scattered shrubs, and also the sedge-bulrush margins of swamps (Hyde 1939, Trautman 1940, Walker 1928; cited in Peterjohn and Rice 1991).

The only other priority species with a sizable population is Eastern Bluebird, which has begun to rebound from previous population lows with the widespread efforts to provide nest boxes. This species is now widely distributed throughout the Ohio Hills area. Dickcissel is a peripheral and sporadic breeder in this area. Loggerhead Shrike and Short-eared Owl are listed as endangered in Pennsylvania; the shrike was unreported from this region during the PA BBA, whereas the owl was found breeding at 5 sites, all on reclaimed surface mines (Brauning 1992). The single site located in Ohio (Muskingum Co.) was also at a reclaimed strip mine. Dickcissel has recently expanded its numbers in this region. Upland Sandpiper is probably the most area-sensitive species in the suite and most or all sites supporting this species would also support one or more of the other species.

Habitat and population objectives: Based on extrapolations from BBS relative abundances (see Appendix 3), VERY ROUGH estimates of population size for priority species in this habitat suite can be derived (Table 4.4). These crude estimates are most useful in illustrating the relative population sizes of various species, and perhaps giving order-of-magnitude figures for setting population objectives for this planning unit.

Table 4.6. Population estimates and targets (in number of pairs) for priority species of grassland and agricultural habitats in the Ohio Hills physiographic area. Percent of Atlas blocks based on number of 5-km blocks in which the species was reported within Physiographic Area 22 (from Rosenberg and Wells 1995 [appendix 4], using Peterjohn and Rice 1991, Brauning 1992, Buckelew and Hall 1994).

Species	BBS population	% lost since 1966	Population Target	% Atlas blocks PA	WV	OH
Henslow's Sparrow	2,600	stable?	2,600	19	1	38
Upland Sandpiper	??	??	50	1	0	0
Sedge Wren	??	??	50	< 1	< 1	0
Short-eared Owl	??	??	15	0	0	< 1
Dickcissel	970	uncertain	1,060	1	1	2
Eastern Bluebird	99,300	15-50%	139,000	82	92	99
Northern Harrier	40	uncertain	45	< 1	< 1	< 1
Loggerhead Shrike	??	??	50	0	< 1	< 1
Barn Owl	??	??	15	1	0	< 1

For species that have declined significantly during the BBS period, a population target may be set to approximate pre-BBS population levels; an annual decline of 2.4% per year corresponds with a 50% loss over 30 years. For species suffering a 50% or greater loss since 1966 (PT=5), this

plan calls for roughly a doubling of present-day populations as a practical objective. For species suffering a 15-50% loss since 1966 (PT=4), this plan calls for increasing the current population by 1.4. For species showing stable or unknown trends, population targets are roughly rounded up from current population estimates by a factor of 1.1. Note that the relative abundances used for these estimates are averages across all BBS routes in the physiographic area using data from 1990-1998. For more details on methods used for calculating populations and targets, (see Appendix 3).

OBJECTIVE 1: Maintain stable breeding population of 2,600 pairs of Henslow's Sparrows distributed among 20% of atlas blocks in PA, 40% of blocks in OH, and 5% of blocks in WV.

OBJECTIVE 2: Maintain and enhance large grassland sites in each state to support viable population of 50 pairs of Upland Sandpipers.

OBJECTIVE 3: Locate and protect any extant populations of Loggerhead Shrike; strive to re-establish a regional population of 50 individuals.

Habitat Objective: Manage 3,000 ha (6,300 ac) of pasture and reclaimed mine to support 2,600 pairs of Henslow's Sparrow, with an additional 30,000 ha (75,000 ac) of suitable grassland habitat to support other grassland birds.

Implementation strategy: Habitat objectives for grassland species in this physiographic area should be met on existing agricultural and reclaimed mine sites by enhancing habitat condition through management, easement, and acquisition of lands considered no longer suitable or profitable for agricultural. Additional acres of grassland should *NOT* be created at the expense of priority forest or shrubland species.

- identify important sites for priority grassland birds throughout the region
- determine protection status, ownership, and land-use projections at all important sites
- implement management policies to maintain optimal habitat conditions for Henslow's Sparrow on all publically owned sites
- partner with mining companies and agricultural trusts to establish habitat-management programs on privately owned sites
- provide and monitor bluebird nest boxes in appropriate open areas – see www.nabluebirdsociety.org for more information on nest box construction and placement.

Management recommendations: In the Northeast, grassland habitat loss and degradation through urbanization, row-crop agricultural techniques, and ecological succession in which encroachment of woody species into grasslands reduce the available breeding habitat are drastically affecting populations of nearly all the priority species in this habitat suite. Fragmentation of habitat into small, widely scattered plots is another serious threat affecting multiple species.

Numerous studies in the Northeast have revealed a positive relationship between grassland area and the diversity and abundance of breeding birds using a grassland (Bollinger and Gavin 1992,

Smith and Smith 1992, Vickery et al. 1994, Norment et al. 1999). These clear results suggest that increasing grassland area is one obvious means of increasing grassland bird populations. Consideration should be given to consolidation of adjacent grassland fields, through the elimination of hedgerows, stone fences, or tree lines, in areas where open land occupies a considerable amount of the surrounding landscape and grassland management can be identified as a reasonable management alternative. Connecting adjoining fields could increase the overall abundance or diversity of grassland birds using an area above what the fields would accommodate separately.

Intact grasslands large enough to support breeding populations of some of the more area-sensitive species and those with larger home ranges are rare in this physiographic area. In general, fields < 10 ha in size should be considered low priorities for grassland maintenance or enhancement activities, while areas > 100 ha should be the highest priorities for such actions. While grasslands as small as 150 acres may be sufficient for more area sensitive species such as Upland Sandpiper, evidence shows that these birds are more likely to persist and reproduce in grasslands of higher acreage. Ideally, grasslands of 250+ ha would provide viable populations of all species in this habitat suite (Carter 1992, Herkert 1994, Jones and Vickery 1997, Tate et al. 1999, Johnson et al. 1999).

Prescribed fire can be an effective tool to prevent woody encroachment in grasslands. Fire alters the structure of grasslands by reducing woody species cover, decreasing litter, and removing dead, aboveground vegetation (DeBano et al. 1998). These effects could reduce vegetation density and overall community height in warm season grasslands, making them more attractive as nesting habitat for grassland birds. However, fire also has been shown to increase productivity of warm season grasses (Howe 1995, DeBano et al. 1998). Prescribed fire could increase height and density of live stems of tall grasses in warm season grass plantings, making them potentially less attractive to grassland breeding birds.

Mowing can also be an effective means of managing grassland habitat, but can also negatively affect grassland birds if done during the wrong time of year. Furthermore, it may not be totally effective in eliminating woody vegetation from shrub-dominated fields. Since many of the high priority grassland birds in this planning unit can raise two broods in a single breeding season, postponing mowing until after September 1 will allow these birds the greatest opportunity to maximize annual reproductive success. At a minimum, mowing should be delayed until late June to allow for young to fledge from first nesting attempts. Bollinger (1995) found that fields with early mowing dates the previous year had lower bird densities than fields with later mowing dates. He suggested that mowing-induced nest destruction was partially responsible for lower breeding densities in the following year. While some studies have shown that abundance of some grassland birds is reduced in the year following mowing (Bollinger 1995, Herkert 1995, Mazur 1996), Norment (1999) found high numbers of grassland birds in fields that had been mowed during late summer or fall of the previous year.

If mowing every two or three years is sufficient to deter woody growth, such a schedule may be more beneficial to grassland birds than annual mowing. Warm season grassland do not need to be mowed as frequently as cool season grassland to control shrub invasion, so a three to four year schedule may be adequate for warm season grasses (Myers and Dickson 1984). Thus, dividing

fields and mowing sections on a rotational basis, where feasible, may be the most appropriate means of using mowing to manage grasslands for bird populations.

The following are more specific recommendations for sustaining high-priority species:

Henslow's Sparrow -- Population declines have been attributed to the loss of grassland breeding habitats, either through urbanization or succession to shrublands and forests, as well as intensive production of row cropping which reduces or eliminates the use of hay fields and grazing land (Smith 2000). Management recommendations from Herkert (1998) in Smith (2000) are:

This species likely requires at least 30 ha of contiguous grassland (Zimmerman 1988, Smith and Smith 1992, Mazur 1996) and prefers grasslands > 100 ha in size (Herkert et al. 1993). Where contiguous management units are not available, efforts should be made to provide a complex of smaller units located near enough to one another to facilitate colonization from adjacent territories in available habitat (Mazur 1996). Disturbance of any kind should be avoided during the breeding season as it will reduce available habitat for at least one breeding season (Herkert et al. 1993, Hanson 1994, Melde and Koford 1996). Implement a rotational disturbance regime to maintain grassland habitat (Zimmerman 1988, Herkert 1994b, Melde and Koford 1996). Birds require a dense and moderately tall (>30cm) grassy vegetation (Smith 1992). Remove woody vegetation when it becomes taller than fully grown herbaceous vegetation (Smith 1992, Herkert et al. 1993, Mazur 1996) or use prescribed fire (Eddleman 1974).

In order to avoid destruction of nests, conduct management treatments before birds arrive in the spring (15 April) or after the young have fledged (15 September) (Smith 1992, Hanson 1994, Mazur 1996). In Missouri, implement conservation haying (one annual cut after mid-July) on a two to three year rotation (Swengel 1996) and provide idle or lightly grazed grasslands. Light grazing was defined as grazing pressure that left > 40% vegetative cover at 25 cm (Skinner 1982, Skinner et al. 1984). Prescribed burns should be conducted in early spring (March to early April) or late fall (October and November) (Herkert et al. 1993). In New York, recommendations are to burn once every five to six years or mow every four to five years (Mazur 1996). These intervals will allow vegetation to recover between disturbances to provide suitable habitat while keeping succession in check.

There appear to be significant differences between nesting habitat preferences in eastern sites and birds nesting in the Midwest. Such differences could correspond to differences in habitat selection by the two recognized subspecies. Therefore, management recommendations for the Ohio Hills should consider whether alternate management activities might be appropriate, particularly with respect to the roles played by fire and grazing, and the requirements for standing dead vegetation and litter depth in the two regions. The role of litter depth in habitat selection has not been well investigated in eastern locations. In Pennsylvania, reclaimed strip-mines support Henslow's Sparrow and management should attempt to maintain these habitats (Smith 2000).

Upland Sandpiper -- Upland Sandpipers breed in extensive, open grasslands, which in the Northeast historically included old hayfields, pastures, wet meadows, sandplain grasslands, and blueberry barrens. They tend to be loosely colonial while breeding and often return to the same nesting fields in successive years (Carter 1992). Nesting territories generally are grouped, with

independent nesting sites but adjacent communal areas for feeding and loafing (Swanson 1996). A variety of vegetation structures are required by this species for breeding. They build their nests in areas of mixed, tall grasses and forbs (but not > 60 cm) and they forage in areas with short grasses (Swanson 1996, Jones and Vickery 1997). They generally do not occupy areas with uniform graminoid or forb cover (Buhnerkempe and Westmeier 1988, Swanson 1996). A variety of native and introduced grasses have been associated with Upland Sandpiper nesting fields, including timothy (*Phleum* spp.), bluegrass (*Poa* spp.), needlegrass (*Stipa* spp.), bluestem (*Andropogon* spp.), quackgrass (*Agropyron* spp.), Junegrass (*Koelera* spp.), and bromegrass (*Bromus* spp.) [Carter 1992].

Vickery et al. (1994) found that in addition to grassland area, the only vegetation parameter that was a significant predictor of Upland Sandpiper abundance in Maine grasslands was patchiness of cover types. The density of this species was subsequently found to be positively associated with bare ground and negatively correlated with tall forbs and tall shrubs (Vickery et al. 1999). In New York, Bollinger (1995) found Upland Sandpiper abundance to be negatively associated with total vegetation cover and vegetation height.

In Wisconsin, mean vegetation characteristics of nesting habitat were 0.5% wood cover, 81% herbaceous cover, 4% bare ground, 15 % litter cover, and 45 cm maximum vegetation height. In Canada, mean characteristics of nesting sites were 75-95% grass cover, 0-5% forb cover, 5-25% litter cover, 5-25% bare ground, and 12 cm average vegetation height (Swanson 1996).

Sedge Wren -- Decline of this species throughout its range has been associated with loss and degradation of wetlands (Ehrlich et al. 1992), caused by suburbanization, intensive agricultural development, and natural succession. Loss of nesting habitat may be the major cause of declines in populations. About 4.75 million acres (1.92 million ha) of palustrine emergent wetlands, which include wet meadows important to nesting, were lost in the U.S. between the mid-1950s and mid-1970s (Tiner 1984). The preferred wetland type, sedge/grass meadows with moist or saturated soils, are the most easily drained and filled type. Habitat loss to urbanization and successional processes have been especially evident in the Northeast. In just ten years (late 1960s-70s) along woodcock survey routes in all northeastern states combined, the availability of abandoned and active fields declined by 23- 25%, whereas the amount of land in young forest increased by 63% and that in urban/industrial uses increased by 33% (Dwyer et al. 1983 from Gibbs et al. 1999).

Research and monitoring needs:

• Determine precise habitat and area needs of Henslow's Sparrow in this region. Research should include demographic factors in order to determine characteristics of sites with potential to support source populations.

• Develop and implement supplemental inventory and monitoring programs to identify important sites for Henslow's Sparrow, Upland Sandpiper, Short-eared Owl, Loggerhead Shrike and other uncommon, patchily distributed grassland species not well monitored by BBS.

• Evaluate the effects of specific farming and management practices, such as timing of haying and grazing intensity, on productivity of grassland birds.

Outreach:
- outreach to birding community to help identify and monitor important grassland sites
- outreach to farming community and NCRS to ensure incentives for proper grassland-bird management
- outreach to mining companies and the public about proper grassland-bird management

E. Freshwater Wetland

Importance and conservation status: This habitat suite represents a continued continental concern for wetland habitats and their potentially vulnerable species. The amount of freshwater wetlands that have been lost or degraded during the last century is large. The greatest threats to most species in this habitat suite are continuing loss and alteration of wetland habitat through draining, dredging, filling, pollution, acid rain, agricultural practices, and siltation. Various contaminants (e.g., pesticides, insecticides, heavy metals, acid deposition, etc.) from agricultural, industrial, and urban/suburban sources can degrade wetland ecosystems and impair reproductive abilities of the birds. The size of wetlands is also an important consideration for some of the priority species in this habitat suite. These species occur more often and at higher abundance in larger wetlands. Loss and degradation of wetland habitat continue to be the primary concerns for the species of this habitat suite, and preservation of existing wetland sites should be the first priority for conservation actions in this habitat type.

Associated priority species: AMERICAN BLACK DUCK, KING RAIL. The species in this suite are considered a priority because of their Watch List status. This habitat suite therefore represents continued nationwide concern for wetland habitats and their potentially vulnerable species.

Habitat and population objectives: due to lack of reliable population estimates for most of the species in this habitat suite, numerical population and habitat-area objectives have not been determined. Protecting all remaining habitat, especially the largest wetlands, should receive high conservation attention. More information on population objectives and management guidelines for American Black Duck can be found in the North American Waterfowl Management Plan.

Implementation strategy/management guidelines:
- Wetlands used as breeding sites for these species should be protected from chemical contamination, siltation, eutrophication, and other forms of pollution/contamination that could directly harm breeding birds or their food supply.
- Preserve all large (> 10 ha) freshwater wetlands from development, draining, and other forms of habitat loss.
- Design a regional management program for these wetland species that continue to be threatened by habitat loss, including increased coordination among managers and biologists to prevent duplication of research efforts and to share current information.
- Hemi-marsh conditions favored by ducks and grebes need to be maintained by periodic reversal of vegetation succession to open up some of the extensive stands of emergent

vegetation, but suitable habitat for nesting needs to maintained in nearby areas during wetland management.

- Creation of new nesting habitat may be needed for some species in this physiographic area. Minor alterations to existing management activities for waterfowl, such as leaving some dense stands of cattail and bulrush for nesting sites and maintaining fairly stable water levels during the nesting season, should benefit many of these species. Complete drying of impoundments during drawdowns should be avoided to prevent the die-off of small fish, amphibians, and dragonflies, which are a major food sources for many of these bird species. Slow drawdowns should benefit bitterns by providing suitable foraging habitat and encouraging dense stands of emergent vegetation for nesting.

Research and monitoring needs:

- Investigate wetland management alternatives that can provide a variety of wetland habitat conditions that are suitable to the various needs of the priority species in this habitat suite.
- A regional monitoring program to provide better abundance and population trend information is needed for the secretive wetland birds. Standard methods for conducting point-counts using tape-recorded vocalization playback have been developed and should be used in monitoring efforts.
- Evaluate habitat requirements, including nest site characteristics, water quality, and minimum wetland area needed during both the breeding and nonbreeding seasons.
- Determine causes of breeding failure and mortality of young and adults.
- Evaluate effects of invasive plants such as *Phragmites* and purple loosestrife.

Outreach:

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APPENDIX 1: ECOLOGICAL UNITS AND VEGETATION ALLIANCES

Appendix 1. Ecological Units and associated vegetation alliances within the Ohio HIlls PIF planning unit (physiographic area 22). Modified from Keys et al. (1995). O-HDF = oak-heath dry forest; SM-CO = sugar maple-chinquapin oak forest. Human use categories: F = forestry, A = agriculture, R = recreation, U = urban, M = mining, D = Development, I = Industrial.

Subunit (state)	Description	Vegetation	Human use
221Ea (PA, WV, OH)	Pittsburgh Low Plateau	O-HDF, SM-CO, hemlock-white pine forest	F, A, M, D
221Eb (WV, KY)	Teays Plateau	O-HDF, red maple-ash floodplain swamp, SM-CO	A, I, D, M
221Ec (WV, OH)	Ohio Valley Lowland	SM-CO, O-HDF, hemlock-hardwood ravine forest	F, A, M
221Ed (OH)	East Hocking Plateau	SM-CO, O-HDF, red maple-black ash seepage swamp	F, A, M
221Ee (OH)	Unglaciated Muskingum Plateau	O-HDF, SM-CO	A, F, R, M
221Ef (OH)	West Hocking Plateau	SM-CO, hemlock-hardwood ravine forest, red maple-ash floodplain swamp	F, A, M
221Eg (OH)	Lower Scioto River Plateau	SM-CO, O-HDF, hemlock-hardwood ravine forest	F, A
221He (KY)	Low Hills Belt	White oak-n. red oak-hickory forest, chestnut oak forest	A
M221Bb (WV)	Western Allegheny Mountains (part)	O-HDF, oak-pine dry forest, sycamore-box elder floodplain forest	F, R, A
M221Bc (WV)	Southern High Allegheny Mountains	N. hardwood forest, ridgetop pitch pine-scrub oak barrens, yellow birch-spruce transitional forest	F, R, M
M221Bd (WV)	Eastern Allegheny Mountain and Valley	O-HDF, oak-pine dry forest, ridgetop pitch pine-scrub oak barrens	F, R, A
M221Be (WV, KY)	Western Allegheny Mountain and Valley	O-HDF, oak-pine dry forest	A, R
222En (KY)	Kinnikonick and Licking Knobs (part)	Chestnut oak-oak-hickory forest, white oak-n. red oak-hickory forest	F
222Eo (KY)	The Cliffs (part)	Chestnut oak-oak-hickory forest, chestnut oak forest	F

APPENDIX 2: AVIFAUNAL ANALYSIS

The 174 bird breeding species within the Ohio Hills physiographic area are listed in Table A2.1. All species have been ranked by the PIF prioritization system (Hunter et al. 2000), and all global and physiographic area scores are presented.

Species of regional importance

Species may also be ranked according to the importance of this planning unit to their total species population. Species with relatively high proportions of their total populations in this region are considered of greatest importance for long-term conservation planning; ie., this region has the greatest responsibility for the long-term maintenance of their populations (Rosenberg and Wells 1995, 2000). The 25 species with >3% of their total population in this planning unit are listed in Table A2.2. Eighteen of these also score an AI of 5 based on high BBS relative abundances; for Cerulean Warbler, Blue-winged Warbler, Acadian Flycatcher, and Scarlet Tanager the relative abundance is the highest recorded in any physiographic area.

Table A2.2. Species with high proportions of their total population in Area-22. Percent of population calculated from percent of range area, weighted by BBS relative abundance (see Rosenberg and Wells 2000, Appendix 3). Population trend from BBS data (% change per year from 1966-1999). Area Importance (AI) scores from CBO (Carter et al., 2000).

Species	% of pop.	rel. abun.	No. of BBS routes	Pop. trend	P value	AI
Cerulean Warbler	43.7	2.85 a	50	**-2.5**	0.00	5
Blue-winged Warbler	25.0	3.28 a	56	0.9	ns	5
Acadian Flycatcher	14.7	8.87 a	57	**-0.9**	0.05	5
Worm-eating Warbler	8.2	0.72	26	**-0.8**	0.08	4
Yellow-throated Warbler	10.8	2.15	39	7.3	0.02	4
Louisiana Waterthrush	10.7	0.88	41	-1.9	ns	5
Kentucky Warbler	8.4	3.08	56	-0.9	ns	5
Scarlet Tanager	10.2	7.73	58	1.0	ns	5
Wood Thrush	8.6	20.56	58	0.06	ns	5
Bewick's Wren (Appalachian)	8.9	0.02	6	**-32.3**	0.00	4
Yellow-throated Vireo	7.7	3.25	53	0.06	ns	5
Hooded Warbler	5.6	2.70	49	1.7	ns	4
Henslow's Sparrow	6.3	0.14	15	0.1	ns	4
Gray Catbird	6.3	16.21	58	0.2	ns	5
Prairie Warbler	6.0	2.49	55	**-4.0**	0.00	5
Ruby-throated Hummingbird	4.4	1.43	54	3.1	0.05	5
Eastern Towhee	4.5	15.35	58	-0.8	ns	5
Field Sparrow	4.6	13.51	58	**-3.4**	0.00	5
Indigo Bunting	3.9	31.32	58	**-1.3**	0.00	5
Eastern Wood-pewee	2.9	5.97	58	**-3.4**	0.00	4
Blue-gray Gnatcatcher	3.2	5.65	57	**-1.3**	0.07	4

Tufted Titmouse	3.2	13.74	58	-0.5	ns	5
Yellow-breasted Chat	3.5	9.03	57	**-2.8**	0.00	4
Eastern Phoebe	3.4	6.76	58	-0.8	ns	5
White-breasted Nuthatch	3.1	3.28	55	0.6	ns	5
Chimney Swift	3.6	15.56	58	-0.7	ns	5
White-eyed Vireo	3.2	5.98	57	**1.7**	0.03	4

[a] Relative abundance is the highest recorded for any physiographic area

Species of immediate concern

The assessment of regional importance of bird species did not take into account whether those species were declining within the planning unit or elsewhere. Species of high regional importance, that are also declining, are of greatest concern in terms of short-term conservation action (Rosenberg and Wells in press). Of the 25 species with ≥3% of their total population in the planning unit, 8 species have declined significantly ($P < 0.10$) since 1966 (Table A2.3). All but two of these are early successional species, including the nearly extirpated Appalachian Bewick's Wren (not graphed) and steeply declining Golden-winged Warbler. The two declining forest birds are Cerulean Warbler and Eastern Wood-pewee ; the decline in Cerulean Warblers is significant, but not nearly as steep as in other physiographic areas. Note that this is one of few areas where populations of Wood Thrush and Henslow's Sparrow are stable.

Other declining species may be of local concern, even if they don't rank highly in regional importance. In addition, suites of declining species may signal added regional concern for a habitat type that also supports high-priority species. Of the 35 declining species (Table A2.3), 24 are associated with grassland and other early successional habitats, including urban areas.

Table A2.3. Species showing large or significant population declines within Physiographic Area 22, based on Breeding Bird Survey, 1966-1999 trends (N = 60 routes). Relative abundance is the average for the period 1990-1999. CF = conifer forests; HF = hardwood or mixed forests; ES = early successional; GR = grassland; W = wetland; UR = urban.

Species	Trend (% per year)	N	Significance	Relative abundance	Primary habitat
Appalachian Bewick's Wren	-32.3	6	0.00	0.03	ES
Horned Lark	-16.4	26	0.00	0.59	GR
Red-headed Woodpecker	-16.1 [a]	15	0.01	0.10	HF, GR
Vesper Sparrow	-12.0	28	0.00	0.43	GR
Golden-winged Warbler	-10.5	18	0.00	0.30	ES
Grasshopper Sparrow	-9.5	39	0.00	1.91	GR
Northern Bobwhite	-7.2	37	0.00	3.82	GR, ES
Ring-necked Pheasant	-6.1	19	0.00	0.45	GR
Prairie Warbler	-4.0	55	0.00	3.04	ES
Purple Martin	-3.5	31	0.07	1.68	ES (W)
Eastern Wood-pewee	-3.4	58	0.00	6.90	HF
Brown-headed Cowbird	-3.4	58	0.00	11.75	ES

Field Sparrow	-3.4	58	0.00	11.75	ES
Great Crested Flycatcher	-3.3	53	0.00	1.93	HF
American Goldfinch	-3.1	58	0.00	13.55	ES (UR)
Green Heron	-3.0	47	0.00	0.50	W
House Sparrow	-3.0	57	0.00	28.70	UR
Yellow-breasted Chat**	-2.8	57	0.00	11.49	ES
Yellow-shafted Flicker	-2.7	58	0.00	4.57	HF
Eastern Meadowlark	-2.6	55	0.00	11.65	GR
Barn Swallow	-2.5 [a]	67	0.00	16.63	GR, ES
Warbling Vireo	-2.5	46	0.02	1.67	HF
Cerulean Warbler	-2.5	50	0.00	2.85	HF
Red-winged Blackbird	-2.4	58	0.00	61.30	ES
Black-billed Cuckoo	-2.3	43	ns	0.56	HF
Hairy Woodpecker	-2.3	44	ns	0.37	HF
Brown Thrasher	-1.9	56	0.00	2.83	ES
Common Grackle	-1.9 [a]	67	0.00	41.74	ES (UR)
Scarlet Tanager	-1.7 [a]	69	0.04	9.35	HF
Blue-gray Gnatcatcher	-1.3	57	0.07	5.4	
Indigo Bunting	-1.3	58	0.00	34.33	ES
Eastern Bluebird	-1.2	57	0.04	7.67	ES
Common Yellowthroat	-1.0	58	0.02	18.29	ES
Acadian Flycatcher	-1.0	57	0.05	8.82	HF
Barn Swallow	-0.9	58	0.01	19.00	
Chipping Sparrow	-0.9	58	0.02	21.12	CF, HF
Belted Kingfisher	-0.8	48	ns	0.68	W
Eastern Phoebe	-0.8	58	ns	6.60	ES (UR)
American Crow	-0.8	58	0.04	39.05	HF, UR

[a] Significant declining trend for period 1980-1999 only.

Increasing species

It is informative to also examine the species that are increasing significantly in a physiographic area. In the Ohio Hills, 41 species show increasing population trends (Table A2.4), compared with 35 species that have declined. A majority of these fall in two categories, either species associated with regenerating or mature hardwood forests, or species that have adapted particularly well to human activities or development. More forest species (16) are increasing in this region than are declining (9), including several regionally important species such as Worm-eating Warbler, Hooded Warbler, Yellow-throated Vireo, Ovenbird, and American Redstart that have all increased dramatically since 1980. Unlike in many other physiographic areas, some species associated with natural shrub-scrub habitats are also increasing in Area 22 (e.g. Yellow Warbler, Willow Flycatcher, Blue-winged Warbler, White-eyed Vireo, Gray Catbird, Eastern Towhee).

Table A2.4. Species showing large or significant population increases within Physiographic Area 22, based on Breeding Bird Survey, 1966-1999 trends (N = 69 routes). Relative abundance

is the average for the period 1990-1999. CF = conifer forests; HF = hardwood or mixed forests; ES = early successional; GR = grassland; W = wetland; UR = urban.

Species	Trend (% per year)	N	Significance	Relative abundance	Primary habitat
Canada Goose	30.4	27	0.00	1.80	W (UR)
Wild Turkey	24.3	32	0.02	0.39	HF
Bobolink	19.4	17	0.01	0.51	GR
Tree Swallow	15.6	29	0.00	0.76	W
Rose-breasted Grosbeak	12.0	28	0.00	0.49	HF
Worm-eating Warbler	11.8 a	34	0.01	1.61	HF
Great Blue Heron	11.7	37	0.00	0.71	W
House Finch	10.7	55	0.00	4.77	UR
American Redstart	10.0 a	53	0.00	3.20	HF
Mallard	9.6	33	0.01	0.55	W (UR)
Northern Mockingbird	9.3 a	52	0.00	3.08	ES (UR)
Wood duck	7.5	30	0.02	0.37	W
Yellow-throated Warbler	7.3	39	0.02	1.66	HF
Broad-winged Hawk	7.3	19	0.08	0.13	HF
Red-shouldered Hawk	6.4	17	0.06	0.16	HF, W
Cooper's Hawk	5.9	17	0.09	0.07	HF
Turkey Vulture	5.8	50	0.00	2.65	ES
Carolina Wren	5.0 a	68	0.00	5.93	HF (UR)
N. Rough-winged Swallow	3.9	49	0.00	1.32	W
Mourning dove	3.7	58	0.00	20.90	ES
Cedar Waxwing	3.7	54	0.02	6.66	ES (UR)
Hooded Warbler	3.6 a	56	0.08	3.57	HF
Baltimore Oriole	3.6 a	67	0.01	2.96	HF (UR)
Killdeer	3.3	55	0.00	3.81	GR (W)
Ovenbird	3.3	57	0.01	5.39	HF
Ruby-thr. Hummingbird	3.1	54	0.05	1.16	ES (UR)
Willow Flycatcher	2.9	43	0.01	2.34	ES
Red-tailed Hawk	2.8	50	0.02	0.77	ES
American Kestrel	2.7	45	0.01	0.73	GR, ES
Yellow Warbler	2.6 a	68	0.00	11.31	ES
Tufted titmouse	2.3 a	69	0.00	13.30	HF (UR)
Blue Jay	2.2	58	0.00	7.45	HF (UR)
Red-bellied Woodpecker	2.0	58	0.02	3.41	HF (UR)
Pileated Woodpecker	1.9	53	0.06	1.92	HF
White-eyed Vireo	1.7	57	0.03	5.68	HF (ES)
Yellow-throated Vireo	1.7 a	64	0.06	3.19	HF
Gray Catbird	1.5 a	69	0.04	13.81	ES
Eastern Towhee	1.5 a	69	0.05	14.77	ES
American Robin	1.3	58	0.00	52.83	ES (UR)

House Wren	1.2	52	ns	7.37	ES (UR)
Northern Cardinal	1.1 [a]	69	0.08	26.51	ES (UR)
Red-eyed Vireo	1.0	58	ns	25.2	HF
Blue-winged Warbler	0.9	56	ns	3.17	ES

[a] Significant increasing trend for period 1980-1999 only.

APPENDIX 3: POPULATION ESTIMATES AND ASSUMPTIONS

In this PIF bird conservation plan, several estimates are presented of relative or absolute bird population sizes. Relative population size (percent of global population) is used to illustrate the importance of a given geographic area to priority bird species, whereas estimates of absolute population size are used to set numerical population objectives for habitat-species suites within a physiographic area. Both types of estimates are derived using Relative Abundance values from the Breeding Bird Survey (BBS). These values represent the average number of birds per BBS route, across all routes in a physiographic area, for the period 1990 through 1998 (J.R. Sauer, pers. com.). These same Relative Abundance values are used to calculate Area Importance (AI) scores in the PIF species prioritization database (see Carter et al. 1999). Note that prior to July, 1999 BBS Relative Abundance was calculated differently; so any previously presented or published population estimates using these values will differ from those calculated after July 1999 (J.R. Sauer, pers. com.).

A. Percent of Population

The percent of total or global population (% pop) for a species is calculated according to the methods originally described by Rosenberg and Wells (1999). For species sampled by the BBS, the Relative Abundance value for each physiographic area is multiplied by the size of that area (km^2) and then summed across all the physiographic areas in which the species occurred to yield a total "BBS population." The area-weighted value for each physiographic area is then divided by this total to yield the proportion of the total population in that area. Thus:

$$\% \text{ Pop} = \frac{\text{Relative Abundance (area)}}{\Sigma \text{ (Relative Abundance) (area)}}$$

Estimates of % Pop are relative values and are not dependent on the "correctness" of Relative Abundance values for individual routes; i.e., even if BBS greatly underestimates absolute abundance of "poorly sampled" species, such as nightjars and raptors, Relative Abundance values and % pop estimates should be valid, *as long as the detectability of a species on BBS routes is relatively constant across the range of the species*. These estimates are more questionable for species occupying very patchy habitats (e.g. wetlands) in regions where BBS routes do not adequately sample these habitats.

In cases where additional survey data for groups of species are available (e.g. waterfowl, colonial waterbirds), relative abundance and % pop estimates should be calculated with these data to compare with or replace BBS data. For some species (e.g. Piping Plover), direct censuses of populations exist and should be used to calculate the percentage of the total population in each region. Wherever supplemental data exist, these new estimates should be entered into the PIF prioritization database at Colorado Bird Observatory.

B. Absolute population estimates

In order to set appropriate and justifiable habitat goals within physiographic areas, it is usually necessary to first set numerical population objectives for priority bird species. Population estimates rarely exist, however, for most nongame bird species. For relatively widespread and common species of forest, shrub, and some grassland habitats, the BBS may provide a landscape-level density estimates that can be converted into regional population estimates if the following assumptions are made:
(1) BBS routes constitute a random sample of the landscape;
(2) habitats in question are fairly evenly distributed across the region; and
(3) each bird species has a relatively fixed average detection distance at BBS stops, within which a reasonable estimate of the number of individuals present may be obtained.

Because BBS route locations are selected at random (ref), the first assumption is reasonable. Furthermore, several studies have shown that common habitat types are represented along secondary roads used as BBS routes in roughly the same proportions as in the overall landscape (refs). The third assumption is the most problematic; although most species probably do have a fairly constant average detection distance, selecting that distance is difficult and has a large effect on total population estimates. For example, an entire BBS route composed of 50 stops, each consisting of a 0.25 mi. (400 m)-radius circular count, potentially surveys roughly 25 km^2 of heterogeneous landscape. For a species that is detected routinely only out to 200 m at each stop, the effective area surveyed is reduced to 6.3 km^2; for a species detected only out to a distance of 100 m, the BBS route surveys 1.6 km^2. A simple method of extrapolating avian density from counts of singing males using detection threshold distances was proposed by Emlen and DeJong (1981), who also provided average maximum detection distances for 11 species of common forest birds. These distances ranged from 72 m (Blue-gray Gnatcatcher) to 186 m (Wood Thrush) and averaged 128 m for the 11 species. Emlen and DeJong (1981) further proposed that numbers of singing males be doubled to obtain a total population estimate and that a correction factor be applied to account for variable singing rate (i.e. birds that were missed because they didn't sing during the survey period).

In the absence of additional empirical data on species-specific detection distances and singing frequencies, we may take a simple and conservative approach to estimating regional population sizes from BBS relative abundance data. Species were initially placed in three categories, according to their presumed detection-threshold distances. A majority of forest-breeding songbirds and similar species of scrubby and open habitats were assigned a detection distance of 125 m (close to the average distance for forest birds in Emlen and DeJong's study) -- for these species a BBS route samples an effective area of 2.5 km^2. A second group of species that are detected primarily visually or have unusually far-carrying vocalizations in open habitats were assigned detection distances of 400 m; ie., they are detected out to the limit of each BBS circular stop (e.g. raptors, Upland Sandpiper). For these species the BBS samples roughly 25 km^2. A third group of species is considered to be intermediate and was assigned a detection distance of 200 m (effective sampling area = 6.3 km^2). These include species, such as Bobolink and Eastern Meadowlark, that are detected by a combination of song and visual observations in open habitats.

Population estimates for a physiographic area are then calculated as the average landscape-level density (number of birds per route * effective area sampled by each route) multiplied by the size

(km^2) of the physiographic area. Note that landscape-level densities are not assumed to be similar to species densities in uniform optimum habitats, but rather reflect habitat heterogeneity at larger scales as sampled by BBS routes. Because the great majority of detections on typical BBS routes are of singing or displaying males, the population estimate derived from this method is assumed to represent number of breeding pairs, unless specifically noted otherwise.

Clearly, much additional research and analysis is necessary to (1) test assumptions of this approach, (2) provide refined empirical estimates of detection distances and frequencies that can be applied to density estimation, and (3) to develop independent means of estimating population size in order refine or calibrate estimates derived from BBS data. The crude population estimates provided in this PIF plan are a reasonable starting point, however, that are based on the best information yet available, and that can serve as preliminary population objectives for priority species in each physiographic area. These population objectives can then be translated into habitat objectives, with the goal of assuring the long-term sustainability of priority species in each region. As better population data become available, these should be incorporated into later versions of the PIF conservation plans.