



Upper Mississippi River and  
Great Lakes Region Joint Venture

# Landbird Habitat Conservation Strategy

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## Plan Summary

Bird habitat conservation projects are typically implemented at local scales, but avian ecologists have recognized the need to integrate continental bird priorities into local bird habitat recommendations. A national conservation plan and several ecoregional plans for Partners in Flight (PIF) physiographic areas have identified priorities for landbird conservation. In this strategy we attempt to “step-down” continental and ecoregional landbird priorities to the Joint Venture (JV) region and to smaller manageable scales within the region, providing wildlife managers guidance in designing and managing landscapes with greater value to birds. The strategy goal is to *“Establish efficient habitat conservation to maintain or increase carrying capacity for populations of priority landbird species consistent with continental and JV regional goals.”* We estimated where, what, when and how much habitat is needed to increase and sustain populations of priority landbird species at target levels.

Population estimates and objectives are periodically refined for landbirds, and we recognize population estimates used in this strategy may soon be dated. Nonetheless, science-based recommendations were developed to efficiently and effectively increase landscape carrying capacity through landbird habitat protection, restoration, and enhancement. Information on regional landbird population and habitat trends, presented in concert with population estimates and an evaluation of limiting factors, provide a planning foundation to help assure an adaptive approach to management. In addition, this strategy was developed to complement JV habitat conservation plans for other bird groups including waterfowl, waterbirds, and shorebirds (two terrestrial shorebirds are included in this landbird strategy).

In order to scientifically link population and habitat objectives for this diverse bird group, 24 “JV focal species” were selected for habitat planning by major landscape cover types. We used species that approximate the needs of other less-specialized birds occupying each cover type. Conservation objectives are focused on breeding habitat due to data limitations; migration habitat objectives will be incorporated into future strategy iterations. Planning steps include characterizing and assessing the landscape for JV focal species, modeling occurrence of these species in the JV region, identifying conservation opportunities, and developing landscape-scale recommendations to achieve breeding landbird population objectives. Much of the technical information, including habitat models and decision support maps, appears in JV focal species accounts (Appendix A). Sections on monitoring and program coordination are also provided in the strategy.

Our intent in this JV Landbird Habitat Conservation Strategy is to establish explicit regional objectives and to enhance planning effectiveness by applying available survey data and new technological tools. We establish a scientific process for objective setting and identified assumptions and research needs to improve subsequent iterations of the strategy. This plan is a “living document” that will be refined periodically as knowledge of regional landbird conservation improves and new spatial data becomes available and can be incorporated.

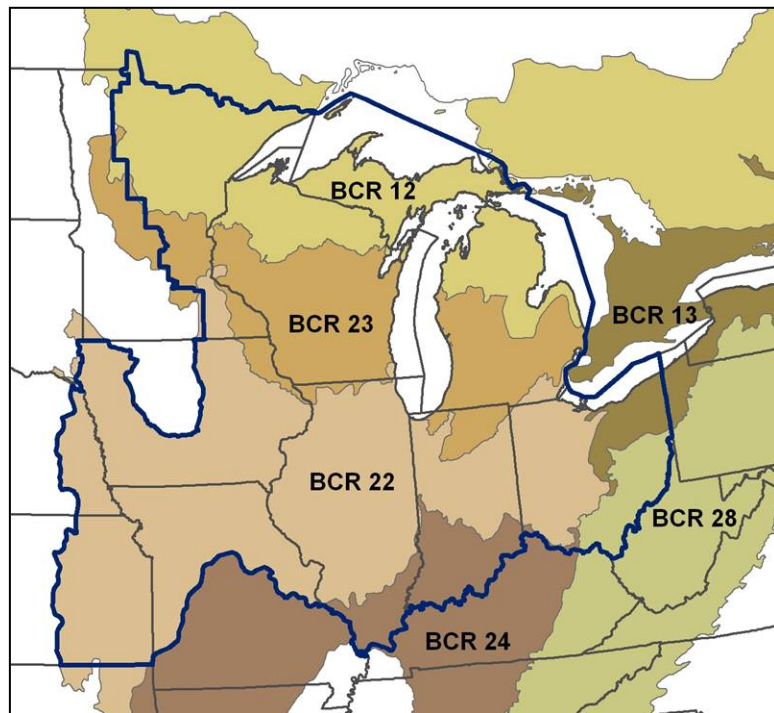
*Acknowledgements:* The following people assisted with development of landbird species accounts (Appendix A): Scott Hull (Ohio Department of Natural Resources); Rochelle Renken, Andy Forbes, and Bobbie Jamison (all Missouri Department of Conservation); and Ryan Recker (Rainwater Basin Joint Venture). Abundance and distribution maps derived from the North American Breeding Bird survey were compiled with assistance from John Nelson (U. S. Geological Survey). Reviewers of the draft landbird document included Andy Paulois (Wisconsin Department of Natural Resources), Diane Granfors (U. S. Fish and Wildlife Service), Yoyi Steele (Wisconsin Department of Natural Resources), Bruce Ehresman and Douglas Harr (Iowa Department of Natural Resources), Brad Jacobs (Missouri Department of Conservation), and Tom Will (U. S. Fish and Wildlife Service). We thank all of these scientists for their valuable comments and insight.



## Background and Context

Approximately 195 species of landbirds regularly breed in the Upper Mississippi River and Great Lakes Joint Venture (JV) region, which includes portions of Bird Conservation Regions (BCRs) 12, 13, 22, 23, 24 and 28 (Figure 1). Ecological diversity abounds in an array of communities including Great Lakes shoreline and islands, boreal forest, mixed northern hardwood forest, oak-hickory deciduous forest, oak savanna, tallgrass prairie, extensive riparian and floodplain forest, and a wide variety of wetland types. The region has high species richness for breeding birds and important stopover sites for migrating landbirds (Ewert and Hamas 1996, Knutson et al. 2001).

Figure 1. Boundaries of the Upper Mississippi River and Great Lakes Joint Venture (JV) region (blue line) and associated Bird Conservation Regions (BCRs) from the North American Bird Conservation Initiative. The JV region largely consists of BCRs 22 (Eastern Tallgrass Prairie), 23 (Prairie Hardwood Transition), and the U.S. portion of 12 (35%, Boreal Hardwood Transition). Portions of BCR 24 (19%, Central Hardwoods), 13 (11%, Lower Great Lakes / St. Lawrence Plain), and 28 (7%, Appalachian Mountains) also are within the JV boundary.



Several landbird species of high conservation concern breed entirely or primarily in the JV Region. For example, the Kirtland's Warbler (see Appendix B for bird scientific names) breeds only in the JV region. At least 50% of the world's population of Golden-winged Warbler (86%), Henslow's Sparrow (65%), and an estimated 25-49% of the world's population of Black-billed Cuckoo (31%), Whip-poor-will (27%), Red-headed Woodpecker (35%), Sedge Wren (33%), Veery (33%), Black-throated Blue Warbler (32%), Dickcissel (30%), Bobolink (29%), and Eastern Meadowlark (26%) breed in the JV region (K. Rosenberg, Cornell Laboratory of Ornithology, unpublished data).

Historically, the landscape of the Upper Mississippi River and Great Lakes region was far less fragmented than it is today and reflected the temporal and spatial variability of natural disturbance regimes. For example, northern mesic forests were dominated by mature forests with more conifers than today (Albert 1995). Large expanses of prairie, oak savanna, jack-pine forest, and spruce-fir forest were characterized by a mosaic of mixed-age stands as a result of

fire and other natural disturbances. Wetland characteristics fluctuated with precipitation cycles, beaver populations, and changes in Great Lakes water levels (Wilcox et al. 2002).

Anthropogenic activity, including development, logging, agriculture, drainage, fire, fire exclusion, introduction of invasive species and pathogens, and other factors have dramatically altered the region's landscape. Exurban use (areas with housing densities of 1 house / 0.4-16 ha) is increasing east of the Mississippi River whereas agricultural land use has generally been declining except in the most intensively farmed areas (Brown et al. 2005). Native vegetation has decreased, structure and composition of plant communities has changed drastically, and the landscape is becoming increasingly fragmented. The consequence of these changes is that the distribution and abundance of many bird species has also been altered (Schulte et al. 2005) and future change is likely; for example shifts in distribution and abundance are expected because of projected change in climate (Price 1995).

Land cover in the northern and very southern portions of the JV region is relatively natural and un-fragmented. The intensively farmed agricultural lands covering much of the west-central part of the region are also un-fragmented (large crop fields) but they are unnatural. Remaining transitional areas are altered and fragmented to varying degrees. Un-fragmented native plant communities harbor a relatively rich diversity of bird habitats, and they act as "source populations" (i.e., where recruitment results in positive population growth and emigration) for many species of birds (Robinson et al. 1995). However, even fragmented portions of the region are important to birds of conservation concern, especially those that are not area-sensitive during the breeding season (Woodward et al. 2001, Burhans and Thompson 2006). Moreover, many areas also serve as stopover sites for migratory landbirds (Ewert and Hamas 1996), and to some degree, as winter habitat. The importance of quality stopover locations for migrating birds is a growing issue, and a format for conservation planning was recently developed (Ewert et al. 2006).

## **Population and Habitat Trends**

Population trends have been quantified for many species based on the North American Breeding Bird Survey (BBS, Table 1) and estimated populations of many landbirds were derived from BBS data by Partners in Flight (Rich et al. 2004, Sauer et al. 2005). In some cases, the data are insufficient to estimate population sizes or trends with much precision, particularly for species that breed north of most BBS routes (Rich et al. 2004). However, additional data are available from sources such as annual censuses of Kirtland's Warbler or other species-specific surveys (e.g., Greater Prairie-Chicken in Illinois).

There are a number of conservation challenges to be considered for virtually all species of conservation concern. One of the most pervasive challenges is habitat loss and fragmentation. Many species, especially those dependent on grasslands, have declined from conversion of native cover and the associated habitat fragmentation across the now agricultural Midwest (Murphy 2003). Habitat fragmentation, while particularly severe for grasslands, has ramifications for all area-sensitive species. Many forest dwelling species have decreased productivity from elevated predation and nest parasitism associated with fragmentation and increased edge.



Table 1. Breeding population trends (% change/year) estimated from Breeding Bird Survey data (Sauer et al. 2005) for JV focal species and other landbirds of continental priority identified in the North American Landbird Conservation Plan (Rich et al. 2004) and located in USFWS Region 3<sup>a</sup>. Species are listed in taxonomic order.

Species <sup>b</sup>	JV focal Species <sup>c</sup>	Trend 1966-2004	p-value <sup>d</sup>	n <sup>e</sup>	Trend 1995-2004	p-value	n
Greater Prairie-Chicken	x	-3.6	0.62	11	-18.4	0.13	6
Upland Sandpiper	x	-0.8	0.43	191	3.1	0.19	90
American Woodcock	x	-2.4	0.76	33	-15.1	0.10	7
Short-eared Owl		5.9	0.00	8	57.3	0.29	3
<b>Whip-poor-will</b>	x	-2.4	0.03	136	-1.9	0.41	52
<b>Chimney Swift</b>	x	-1.8	0.00	529	-3.3	0.00	430
<b>Red-headed Woodpecker</b>	x	-4.1	0.00	468	-4.6	0.00	326
Olive-sided Flycatcher	x	-2.6	0.32	57	-3.8	0.21	18
Willow Flycatcher	x	-0.5	0.31	340	1.0	0.27	247
Bell's Vireo		-4.4	0.22	75	4.0	0.40	34
<b>Veery</b>	x	-1.6	0.00	191	-1.5	0.03	145
Wood Thrush	x	0.3	0.32	451	2.1	0.00	333
Blue-winged Warbler	x	0.7	0.51	142	-2.7	0.10	100
<b>Golden-winged Warbler</b>	x	-1.4	0.04	103	-7.5	0.00	63
Cape May Warbler	x	-3.6	0.20	32	-12.2	0.09	17
Black-throated Blue Warbler	x	8.4	0.36	33	6.8	0.43	15
Kirtland's Warbler	x	na <sup>f</sup>	na	na	na	na	na
Bay-breasted Warbler		5.2	0.72	6	na	na	na
<b>Cerulean Warbler</b>	x	-6.3	0.00	68	-9.2	0.07	33
Prothonotary Warbler	x	1.1	0.18	44	6.6	0.02	32
Worm-eating Warbler		3.8	0.04	35	2.9	0.64	26
Louisiana Waterthrush	x	4.1	0.04	58	-0.2	0.97	32
Kentucky Warbler	x	0.8	0.11	119	-0.5	0.83	92
Connecticut Warbler	x	-0.1	0.97	34	-3.0	0.56	14
Canada Warbler	x	-0.9	0.40	66	-3.6	0.31	35
<b>Yellow-breasted Chat</b>	x	-1.3	0.01	225	0.3	0.71	155
<b>Henslow's Sparrow</b>	x	-7.7	0.00	106	5.7	0.33	41
<b>Dickcissel</b>		-3.0	0.00	382	-0.4	0.63	297
Rusty Blackbird		na	na	na	na	na	na
<b>Eastern Meadowlark</b>	x	-2.5	0.00	527	-2.5	0.00	450

<sup>a</sup>USFWS Region 3 includes the following states: Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin. Boundaries of USFWS Region 3 approximate boundaries of the JV region.

<sup>b</sup>Bold indicates species with significant ( $p \leq 0.05$ ) negative population trends for either time period.

<sup>c</sup>JV focal species selected for planning emphasis; some JV focal species are not considered high continental priority, but represent a unique cover type. Scientific names are provided in Appendix B. American Woodcock and Upland Sandpiper are JV shorebird focal species but addressed in this document as they are largely terrestrial, occupying similar habitat as many priority landbird species.

<sup>d</sup>p-values represent confidence in trend direction with values closer to 0.0 reflecting a stronger trend; for example, values  $<0.05$  reflect  $>95\%$  confidence in trend direction.

<sup>e</sup>n = number of BBS routes used for regional trend average.

<sup>f</sup>na = inadequate survey data to generate a trend estimate.

Habitat-related issues potentially suppressing landbird populations in the JV region include: 1) over-browsing by white-tailed deer (*Odocoileus virginianus*) (Allombert et al.

2005), 2) consequences of invasive species and pathogens (Enserink 2004, Peterson et al. 2004), 3) fire management (Blake 2005), 4) forest management (especially to balance habitat needs for early vs. late succession species; Canterbury et al. 2000), 5) maintenance of large habitat blocks for area-sensitive species to minimize negative effects from edge, 6) refugia shifts and loss during projected climate change (Debinski et al. 2006), 7) nest parasitism (e.g., cowbirds), and 8) predation by species that have adapted well to human-altered landscapes (e.g., raccoons; *Procyon lotor*). Another challenge is to ensure that important migration stopover sites and wintering areas are maintained; populations of some species occurring in the region, such as Olive-sided Flycatcher, Cerulean Warbler, and Rusty Blackbird, may be declining due to factors outside the breeding range (GossCustard et al. 2002, Jones et al. 2004).

## **Biological Foundation**

Landbird conservation in the JV region will focus initially on the breeding season and migration because few landbirds have critical wintering areas in the region (Knutson et al. 2001). Assembling the biological foundation or underpinnings for conservation planning included identification of continental priority species and JV focal species; designation of population goals, current population estimates, and population deficits (goal – current estimate = deficit) for priority species; and identification of factors believed to be limiting focal species population growth. Population restricting factors that can be translated and quantified into landscape cover types and habitat attributes were used to model species-habitat relationships.

## **Planning Framework**

Designing landscapes to meet regional bird conservation objectives is a new science that has been described in a “five element process” (Will et al. 2005). The process involves developing biologically-based, spatially explicit, landscape-oriented habitat objectives for supporting and sustaining bird populations at goal levels. Conservation partners work together to assess current habitat conditions and ownership patterns, evaluate current species distributions and bird-habitat relationships, and determine where on the landscape habitat conservation effort can best be delivered to achieve population objectives. Population and habitat objectives must be explicit to allow measurement of performance and develop a foundation for adaptive management.

Specifically, the five elements include 1) landscape characterization and assessment, 2) bird population response modeling, 3) conservation opportunities assessment, 4) optimal landscape design, and 5) monitoring and evaluation (Will et al. 2005). Elements in this conceptual process were used to develop landbird habitat objectives for this strategy. Population status and goals were identified for all landbird species of continental conservation concern (Rich et al. 2004) occurring in the JV region, but several “JV focal species” are emphasized in planning as representatives of various community types and landbird guilds.

We assess ecological requirements and population trends for JV focal species and use this information to develop conservation strategies in a landscape context. Analysis of digital spatial data and techniques used to generate explicit habitat objectives (i.e., what, where, when, and how much habitat is needed) are described in JV focal species accounts (Appendix A) and

species guild tables (Appendix E and F). Although identification of landscape trends influential to landbird populations is essential to this planning process, our ability to accurately quantify landbird habitat is limited to the classification system used by the digital spatial data available for the region (National Land Cover Data; NLCD 1992). Additional site level information that may be important to landbird species, such as serial stage, percent canopy cover, and vegetation height was not measured by the remote sensing system used. Moreover, accuracy (NLCD, Thogmartin et al. 2004a) and availability (National Wetland Inventory) of critical cover-type data is inconsistent across the JV region and the need to update and improve this information became increasingly obvious during strategy development. Revised NLCD (2001 land cover) became available in early 2007, and these more recent spatial data will be used for plan refinement in the future.

The following list of information needs and tasks was identified during the planning process as key to the success of landbird conservation in the JV region. Whereas this strategy begins the process of addressing these issues, new research findings, monitoring results, and spatial data sets will allow strategy refinement over the next several years.

- 1) Identify and map important breeding (source populations), migration, and winter habitats for species of conservation concern in the JV.
- 2) Use biological models to link population goals with habitat objectives.
- 3) Identify and map areas where habitat should be restored or maintained to meet population objectives.
- 4) Clearly identify the habitat needs of JV focal species at multiple spatial scales (landscape to local) so that site-specific management contributes to species needs across all scales.
- 5) Identify the consequences of specific land management actions on landbirds of conservation concern.
- 6) Consider issues outside the JV region such as events during migration or on the wintering grounds that may affect bird populations of concern, and improve inter-JV collaboration.
- 7) Map critical migration habitat for protection, where isolated forest patches, stretches of Great Lakes shoreline, and north-south riparian corridors are most needed for stopover areas.
- 8) Provide guidance to those implementing the U.S. Farm Bill and other landscape scale land management programs to assure substantive contributions to bird population goals identified in this strategy are achieved (e.g., Conservation Reserve Program and Wetland Reserve Program).
- 9) Identify priority-bird objectives in the State Wildlife Action Plans and integrate with JV objectives.

## **Population Goals**

Landbird species that occur in the JV region in manageable numbers and are considered high conservation concern according to the North American Landbird Conservation Plan were identified and considered a priority for conservation planning. Population goals were derived from population estimates provided by Partners in Flight (Rich et al. 2004; Rosenberg and

Blancher 2005) for these species and others selected as JV focal species for planning. Using population goals and current population estimates, a “population deficit” was calculated for each species by BCR within the JV region (Table 2). In addition, land cover classes commonly used by these species of concern were identified for planning purposes (Table 3)

Table 2. Population estimates, goals, and deficits by Bird Conservation Region (BCR)<sup>a</sup> for landbird species of conservation concern that breed in the Upper Mississippi River and Great Lakes Joint Venture (JV) region. Population deficit calculations are included for BCRs 24, 13, and 28 when >5% of the estimated JV-wide population occurs in that portion of the BCR. Bold names are focal species for JV planning and explained in the strategy.

Species and BCR	Population information		
	Estimate <sup>b</sup>	Goal <sup>c</sup>	Deficit <sup>d</sup>
<b>Greater Prairie-Chicken</b>			
BCR 12	5,800	11,600	5,800
BCR 23	11,000	22,000	11,000
BCR 22	50,000	100,000	50,000
Total	66,800	133,600	66,800
<b>Upland Sandpiper</b>			
BCR 12	630	850	220
BCR 23	3,100	4,100	1,000
BCR 22	30,000	40,000	10,000
BCR 13	100	130	30
BCR 24	40	50	10
Total	33,870	45,130	11,260
<b>American Woodcock</b>			
BCR 12	540,700	615,200	74,500
BCR 23	232,100	310,800	78,700
BCR 22	62,800	100,700	37,900
BCR 13	13,300	24,100	10,800
BCR 24	11,900	19,900	8,000
BCR 28	8,700	18,700	10,000
Total	869,500	1,089,400	219,900
<b>Short-eared Owl</b>			
BCR 12	100	200	100
BCR 22	260	520	260
Total	360	720	360
<b>Whip-poor-will</b>			
BCR 12	72,800	109,000	36,200
BCR 23	35,300	54,000	18,700
BCR 22	118,300	182,100	63,800
BCR 24	47,000	71,000	24,000
BCR 28	12,000	18,000	6,000
Total	285,400	434,100	148,700
<b>Chimney Swift</b>			
BCR 12	91,000	137,000	46,000
BCR 23	440,600	667,400	226,800
BCR 22	2,093,200	3,105,100	1,011,900
BCR 13	180,000	270,000	90,000
BCR 24	343,600	515,400	171,800
BCR 28	270,000	410,000	140,000

Species and BCR	Population information		
	Estimate <sup>b</sup>	Goal <sup>c</sup>	Deficit <sup>d</sup>
Total	3,418,400	5,104,900	1,686,500
<b>Red-headed Woodpecker</b>			
BCR 12	10,900	21,800	10,900
BCR 23	128,500	257,000	128,500
BCR 22	741,900	1,483,800	741,900
BCR 13	9,000	18,000	9,000
BCR 24	76,000	152,000	76,000
BCR 28	2,200	4,400	2,200
Total	968,500	1,937,000	968,500
<b>Olive-sided Flycatcher</b>			
BCR 12	7,050	14,100	7,050
BCR 23	180	360	180
Total	7,230	14,460	7,230
<b>Willow Flycatcher</b>			
BCR 12	15,510	23,815	8,305
BCR 23	147,400	226,700	79,300
BCR 22	141,360	213,600	72,240
BCR 13	46,000	69,000	23,000
BCR 24	10,870	16,760	5,890
BCR 28	42,000	63,000	21,000
Total	403,140	612,875	209,735
<b>Bell's Vireo</b>			
BCR 23	745	1,510	765
BCR 22	58,005	116,010	58,005
BCR 24	1,850	3,700	1,850
Total	60,600	121,220	60,620
<b>Veery</b>			
BCR 12	1,260,000	1,880,000	620,000
BCR 23	206,000	309,000	103,000
Total	1,466,000	2,189,000	723,000
<b>Wood Thrush</b>			
BCR 12	197,000	292,000	95,000
BCR 23	249,400	374,100	124,700
BCR 22	210,130	312,350	102,220
BCR 13	66,000	99,000	33,000
BCR 24	250,000	375,000	125,000
BCR 28	430,000	650,000	220,000
Total	1,402,530	2,102,450	699,920
<b>Blue-winged Warbler</b>			
BCR 12	1,360	2,090	730
BCR 23	33,400	50,700	17,300
BCR 22	4,230	6,300	2,070
BCR 13	7,600	11,000	3,400
BCR 24	7,500	11,300	3,800
BCR 28	41,000	62,000	21,000
Total	95,090	143,390	48,300
<b>Golden-winged Warbler</b>			
BCR 12	125,800	251,600	125,800

Species and BCR	Population information		
	Estimate <sup>b</sup>	Goal <sup>c</sup>	Deficit <sup>d</sup>
BCR 23	21,500	43,000	21,500
BCR 22	170	340	170
BCR 28	50	100	50
Total	147,520	295,040	147,520
<b>Cape May Warbler</b>			
BCR 12	54,000	54,000	0
BCR 23	2,100	2,100	0
Total	56,100	56,100	0
<b>Black-throated Blue Warbler</b>			
BCR 12	60,600	60,600	0
BCR 23	690	690	0
Total	61,290	61,290	0
<b>Kirtland's Warbler</b>			
BCR 12 / Total	2,840	2,000	0
Bay-breasted Warbler			
BCR 12 / Total	4,680	7,080	2,400
<b>Cerulean Warbler</b>			
BCR 12	1,620	3,240	1,620
BCR 23	9,900	19,800	9,900
BCR 22	4,300	8,600	4,300
BCR 13	18,000	36,000	18,000
BCR 24	19,850	39,700	19,850
BCR 28	54,000	108,000	54,000
Total	107,670	215,340	107,670
<b>Prothonotary Warbler</b>			
BCR 23	3,450	5,175	1,725
BCR 22	26,810	40,215	13,405
BCR 24	13,900	20,850	6,950
BCR 28	120	180	60
Total	44,280	66,420	22,140
Worm-eating Warbler			
BCR 23	220	220	0
BCR 22	790	790	0
BCR 24	17,400	17,400	0
BCR 28	16,000	16,000	0
Total	34,410	34,410	0
<b>Louisiana Waterthrush</b>			
BCR 12	60	60	0
BCR 23	800	800	0
BCR 22	4,140	4,140	0
BCR 24	6,500	6,500	0
BCR 28	6,200	6,200	0
Total	17,700	17,700	0
<b>Kentucky Warbler</b>			
BCR 22	20,570	30,885	10,315
BCR 13	60	90	30
BCR 24	61,700	92,550	30,850
BCR 28	34,000	51,000	17,000



Species and BCR	Population information		
	Estimate <sup>b</sup>	Goal <sup>c</sup>	Deficit <sup>d</sup>
Total	116,330	174,525	58,195
<b>Connecticut Warbler</b>			
BCR 12	48,200	73,100	24,900
BCR 23	370	560	190
Total	48,570	73,660	25,090
<b>Canada Warbler</b>			
BCR12	90,000	136,000	46,000
BCR23	1,680	2,480	800
Total	91,680	138,480	46,800
<b>Yellow-breasted Chat</b>			
BCR 23	2,300	2,300	0
BCR 22	89,800	89,800	0
BCR 13	6,400	6,400	0
BCR 24	242,000	242,000	0
BCR 28	150,000	150,000	0
Total	490,500	490,500	0
<b>Henlow's Sparrow</b>			
BCR 12	1,700	3,400	1,700
BCR 23	10,050	20,100	10,050
BCR 22	19,030	38,060	19,030
BCR 13	350	700	350
BCR 24	7,540	15,080	7,540
BCR 28	5,000	10,000	5,000
Total	43,670	87,340	43,670
Dickcissel			
BCR 12	3,990	5,960	1,970
BCR 23	133,000	197,800	64,800
BCR 22	6,563,260	9,940,940	3,377,680
BCR 13	81	120	40
BCR 24	174,000	260,000	86,000
BCR 28	920	1,400	480
Total	6,875,251	10,406,220	3,530,970
Rusty Blackbird			
BCR 12 / Total	130	260	130
<b>Eastern Meadowlark</b>			
BCR 12	57,500	115,000	57,500
BCR 23	254,000	508,000	254,000
BCR 22	1,399,300	2,798,600	1,399,300
BCR 13	30,000	60,000	30,000
BCR 24	114,100	228,200	114,100
BCR 28	36,000	72,000	36,000
Total	1,890,900	3,781,800	1,890,900

<sup>a</sup>Bird Conservation Regions (BCRs): BCR 12 = Boreal Hardwood Transition, 13 = Lower Great Lakes / St. Lawrence Plain, 22 = Eastern Tallgrass Prairie, 23 = Prairie Hardwood Transition, 24 = Central Hardwoods, and 28 = Appalachian Mountains.

<sup>b</sup>Population estimates for each BCR are derived by totaling all state estimates in that BCR from the state Partners in Flight (PIF) landbird reports (Blancher and Rosenberg, unpublished data); except for, American Woodcock, Upland Sandpiper, Cape May Warbler, and Kirtland's Warbler. Estimates for American Woodcock are from the American Woodcock Conservation Plan (Kelly 2006). Estimates for Upland Sandpiper and Cape May Warbler are derived by multiplying the PIF percentage of breeding population to the estimated continental population listed in the North American Shorebird (Brown et al. 2001) and Landbird (Rich et al. 2004) Conservation Plans, respectively. Estimates for BCRs 12, 13, 24, and 28 are also multiplied by the proportion of land area for that BCR in the JV boundary. The population estimate for Kirtland's Warbler is from an annual census conducted for this species (U.S. FWS, unpublished data).

<sup>c</sup>Population goals for each BCR are derived by totaling all state goals in that BCR from the Association of Fish and Wildlife Agencies (AFWA) / PIF state landbird reports, except for American Woodcock, Upland Sandpiper, Cape May Warbler, and Kirtland's Warbler. Goals for American Woodcock are from the American Woodcock Conservation Plan (Kelly 2006). Goals for Upland Sandpiper and Cape May Warbler are derived by multiplying the estimated population for that BCR by the associated continental plan goal. The goal for Kirtland's Warbler is from the Kirtland's Warbler Recovery Plan (Kirtland's Warbler Recovery Team 1985).

<sup>d</sup>Population deficit = population goal - current estimate.

## **Focal Species**

From the list of landbird species occurring in the region, 24 JV focal species were identified for more intensive conservation assessment. We defined a set of focal species that would represent the needs of other less-specialized landbirds occupying primary cover types (Table 3, Appendix A). JV focal species also represent the needs of species that are less sensitive to habitat structure, landscape context, and habitat management than the focal species. To be selected, JV focal species had to have a relatively high level of dependence on the region (Rich et al. 2004) and a relatively well understood life history. The use of JV focal species was a conservation assessment imperative to reduce the number of models developed and applied and yet represent the full suite of species and their habitats. However, the assumption that other species will respond similarly to habitat protection, restoration, and management remains untested and will be evaluated in more detail in later iterations of this plan.

## **Biological Models and Research**

Biological models that combine digital land cover data with population survey data have the potential to translate population objectives into habitat objectives. Characteristics of preferred habitat and landscape features are described for JV focal species in the species accounts (Appendix A). Habitat objectives for these species were calculated using simple models that relate habitat needs to support a specific population level with regional population density estimates. Cover types identified by the National Land Cover Dataset (NLCD 1992) were classified as used or un-used for each species. Un-used cover types were removed from species distribution maps, thus emphasizing priority areas to target when achieving habitat objectives.

Most landbird species use one or more general cover types described by the National Land Cover Data (NLCD 1992) but also have more specific ecological requirements not easily detected using remotely sensed data. Each species has a unique and patchy distribution within a general cover type. Additional information is needed to better define and map the more

Table 3. Land cover classes<sup>a</sup> and sub-categories<sup>b</sup> used by breeding landbirds of conservation concern occurring in the Upper Mississippi River and Great Lakes Joint Venture (JV) region. Bold names are JV focal species which received greater planning emphasis in the landbird strategy.

Species	Deciduous forest	Forested wetland	Mixed forest	Evergreen forest		Shrubland <sup>c</sup>	Bog, muskeg	Herbaceous grassland / pasture, hay		Residential, commercial
				Spruce fir	Jack pine			Grassland	Savanna	
<b>Greater Prairie-Chicken</b>								X		
<b>Upland Sandpiper</b>								X		
<b>American Woodcock</b>						X				
Short-eared Owl								X		
<b>Whip-poor-will</b>	X		X		X					
<b>Chimney Swift</b>	X									X
<b>Red-headed Woodpecker</b>	X								X	
<b>Olive-sided Flycatcher</b>					X		X			
<b>Willow Flycatcher</b>		X				X				
Bell's Vireo						X				
<b>Veery</b>	X	X	X			X				
<b>Wood Thrush</b>	X		X							
<b>Blue-winged Warbler</b>						X				
<b>Golden-winged Warbler</b>		X				X				
<b>Cape May Warbler</b>				X						
<b>Black-throated Blue Warbler</b>	X		X							
<b>Kirtland's Warbler</b>					X					
Bay-breasted Warbler				X						
<b>Cerulean Warbler</b>	X									
<b>Prothonotary Warbler</b>		X								
Worm-eating Warbler	X									
<b>Louisiana Waterthrush</b>	X									
<b>Kentucky Warbler</b>	X									
<b>Connecticut Warbler</b>		X			X	X				
<b>Canada Warbler</b>	X	X	X			X				
<b>Yellow-breasted Chat</b>						X				
<b>Henslow's Sparrow</b>								X		
Dickcissel								X		
Rusty Blackbird							X			
<b>Eastern Meadowlark</b>								X		

<sup>a</sup> Major land cover classes from the 1992 National Land Cover Dataset (NLCD) include: deciduous forest, woody wetland, mixed forest, evergreen forest, herbaceous grassland / pasture / hay, and residential / commercial.

<sup>b</sup> Sub-categories are finer detail cover types that can not be mapped using NLCD.

<sup>c</sup> Shrublands are poorly classified by the 1992 National Land Cover Dataset and were not used for mapping bird habitats.

specific habitat requirements and direct conservation actions to locations that best meet the needs of priority landbirds. Also, the amount of habitat required by a species varies with habitat quality, which can vary from year to year at the same site. Breeding density estimates

are available for many species, and these estimates provide a crude index of the number of individuals a given area of habitat can support.

Despite their limitations, density estimates, published data, and expert opinion regarding habitat requirements for each species can be used to develop biological models that generate habitat objectives for species of concern. This process also identifies critical gaps in knowledge to develop improved biological models in the future. The reliability of these objectives will improve over time as new information becomes available. Spatially explicit biological models that consider interactions between the amount of habitat in a landscape, degree of fragmentation, species-specific responses to area and edge, current and historic rates of change in habitat, and viability of populations (e.g., metapopulation structure, survivorship of adults and juveniles, productivity, emigration and immigration) are needed to determine the best sites for conservation of landbirds.

### **Assumptions and Research Needs**

In this strategy we define a set of JV focal species to represent the diverse habitats occupied by landbirds. We derived population estimates and habitat objectives for each species, based on BBS data and density estimates from the literature. Our purpose was to provide wildlife managers information on what, where, when, and how much habitat is needed to sustain and increase priority landbird populations. The process of deriving population estimates and habitat objectives with minimal data involves use of assumptions. We recognize the approach over-simplifies reality and some assumptions are not true. However, over time assumptions will be tested and other research completed, filling critical information gaps, and resulting in improved methods for estimating populations and habitat needs.

#### *Explicit Planning Assumptions*

- 1) The amount of breeding and migration habitat is limiting populations. We therefore need to protect and restore source habitat for breeding birds and stopover sites for migrating birds to increase population sizes.
- 2) Habitat quality is even across similar habitats and conservation objectives are best achieved through increasing habitat area. The strategy does not define measurable objectives for increasing quality of existing habitats.
- 3) Management actions that benefit JV focal species will benefit other species with similar habitat needs.
- 4) The PIF continental estimates of bird populations and population goals stepped down to the State×BCR level are accurate enough for planning purposes.
- 5) Population density estimates in the literature are representative of the species occupying medium to high quality habitats in the JV region.
- 6) In the absence of data on source and sink populations, we assume that areas with similar ecological features and documented high productivity (annual replacement rate >1) act as source populations. Where this information is lacking, we assume distinct areas with consistently large numbers of breeding pairs (relative to total JV breeding population for species, e.g., >25 pairs) are important areas for protection.

- 7) Stopover sites with large numbers of migrants (relative to total JV migrant population for species) or other sites with similar attributes are the highest priority for protection of migrating birds.
- 8) Habitat for wintering birds will be encompassed by areas protected for breeding and migrating birds.
- 9) Local habitat management actions have the potential to increase regional landbird populations.

### *Research Objectives*

Priority research needs were identified while developing this strategy. JV science partners must test planning assumptions and hypotheses, evaluate decision-support tools, and fill information gaps, with emphasis on JV focal species. Research objectives below are listed in order of importance; however topics within each category are not prioritized. Objectives 1-3 will be largely completed by 2012 and all should be completed by 2015. A brief justification for each objective is provided.

*Research objective 1.* Identify landscape and habitat characteristics (e.g., composition, structure, configuration) associated with high productivity and/or survivorship, including source populations. This information is needed to help ensure viable breeding populations at objective levels set for the region.

- 1) Use site occupancy models as a surrogate for productivity (higher proportion and more consistent use associated with higher productivity).
  - a) Identify and prioritize optimal allocation of habitats/landscapes for JV focal species.
  - b) Evaluate patch size and landscape interactions for moderately altered landscapes and determine if source populations exist (e.g., Allegan, Baraboo, Fort Custer, and Barry Wildlife Areas). Summarize results from ongoing studies at these sites.
  - c) Evaluate effects of connectivity on productivity and survivorship in landscapes with different patch sizes and proportion of natural cover.
  - d) Evaluate habitat characteristics and juxtaposition relative to population dynamics of focal species or suites of species with similar ecology.
- 2) Project future land use of private land owners in focal landscapes where productivity and survivorship is known or thought to be high.
- 3) Collaborate with scientists outside the JV region to better understand breeding and non-breeding habitat needs for species of highest conservation concern (Kirtland's Warbler, Golden-winged Warbler, Henslow's Sparrow, etc.).
- 4) Identify relative survivorship and condition of birds in different post-breeding habitats.
- 5) Examine effects of land-use and environmental change, such as pesticides, invasive plants, and over-browsing by white-tailed deer, on bird food supply and other factors that affect breeding success.
- 6) Identify population dynamics in understudied systems (e.g., boreal-hardwood transition, central mixed-grass prairie, riparian forests, wet meadows, shrub wetlands, savannas, urban-rural interface).
- 7) Contrast Golden-winged Warbler demographics in dynamic systems (early aspen succession) vs. persistent systems (shrub cover).

*Research objective 2.* For migrating birds, identify a network of sites to meet their energetic needs. Document key landscape features at important stopover sites or suites of stopover sites, especially near the Great Lakes and in agricultural and urban settings. This information is needed to ensure sufficient stopover sites to maintain or enhance populations of priority bird groups (JV focal species) in the region.

- 1) Identify primary stopover sites, including relative importance of location, patch size, and patch isolation.
- 2) Apply energetics model to predict relative patch richness, connectivity, and relative importance of sites along migration pathways.
- 3) Establish linkage between breeding, wintering, and migration routes.
- 4) Evaluate altitude of migration relative to shoreline and other factors, specifically relationship to towers and wind turbines.
- 5) Examine effects of land-use and environmental change, such as pesticides, invasive plants, and over-browsing by deer, on food supply and physiological condition of migrants in different landscapes.

*Research objective 3.* Refine breeding density estimates across the JV region and improve models used to calculate habitat objectives. JV focal species whose estimated habitat requirements exceed the estimated habitat available should be completed first. This information is necessary to determine the location and amount of habitat needed to meet population objectives.

- 1) Analyze literature and Breeding Bird Survey (BBS) data to derive population densities used in species-specific JV models.
- 2) Develop Habitat Suitability Index (HSI) or other models for priority birds (JV focal species) and test models with data.
- 3) Implement studies of density across the region in landscapes with different patch sizes and connectivity.

*Research objective 4.* Improve understanding of habitat requirements, management needs, and landscape attributes for species of high conservation concern (e.g., Kirtland's Warbler). This information is needed to develop site specific management protocols for bird population maintenance and restoration.

*Research objective 5.* Quantify fine scale site characteristics important to JV focal species by providing information for explicit habitat prescriptions and identifying research/monitoring needs for fine scale characteristics that are unknown. This information is needed to develop site specific management protocols for bird population maintenance and restoration.

## **Habitat Goals and Objectives**

Conservation goals and objectives in the JV region are focused largely on breeding habitat, as they can be quantified for JV focal species with existing information and simple models (Appendix A). Migration habitat objectives were not addressed in this plan, but will be



incorporated into future iterations. Attributes of important stopover sites have been identified in the western Lake Erie watershed (Ewert et al. 2006) and the Saginaw Bay region and are being identified in the western Lake Michigan watershed and portions of Lake Superior. Ideally, habitat for source populations should be located and established throughout the region especially those areas thought to be most resilient to threats, including climate change and disease outbreaks. However, identification of source populations is difficult. Further, metapopulation structure, and interactions between source and sink populations are dynamic spatially and temporally yet both source and sink populations may be essential to ensure long-term viability of populations (Hanski et al. 1996, Hanski and Ovaskainen 2000).

Donovan et al. (1995) developed population models where they varied survivorship of adults, fledgling production in the core versus edge of a forest patch (<250 m of the edge), and site fidelity of juveniles. They found that increased fragmentation resulted in rapid loss of populations when productivity was relatively low but effects were greatest on sink populations. When productivity was relatively high in source populations, they showed little decline compared to sink populations. Researchers concluded protection of regional source populations is critical to maintain area-sensitive populations and that productivity parameters contribute more than fragmentation effects on dispersal to maintain populations in a landscape (Donovan et al. 1995).

With and King (2001) modeled species with different sensitivities to edge and found the most edge-sensitive species required landscapes with >40% cover and the range of required cover was 5-90%, depending on edge-sensitivity of a species. They concluded that edge-sensitive species should be managed by maintaining large habitat patches and maximum clumping. Other models suggest that species responses are variable to restoration efforts when their vulnerability threshold for habitat loss is exceeded, with edge-sensitive species being least likely to respond to restoration effort (Schrott et al. 2005). Assessment of changes in population growth rate may also interact with changes in habitat loss. Where habitat loss is rapid, changes in population growth rate may lag, so populations may be more vulnerable than suspected (Schrott et al. 2005).

Collectively, models suggest that protection of relatively intact landscapes, with large habitat patches, are most likely to maintain productivity of avian populations, especially edge-sensitive species (Hanski and Ovaskainen 2000). Empirical data are generally consistent with these models. Relatively intact landscapes are apparently associated with important regional source populations that drive metapopulation dynamics. Areas with relatively little change may also contribute to stability of avian populations (Schulte et al. 2005). Greatest benefits to breeding birds in the JV region will result from conservation of areas with the largest patches in the most intact landscapes.

## **Maintenance and Protection**

Landbird habitat maintenance objectives are identified by state and BCR based on the predicted needs of current populations of JV focal species (Table 2, Appendix A). Focal species guilds are established by major land cover (habitat) class to match land cover categories of available spatial data for the JV region. Those species within each habitat guild

with the greatest area need in each State×BCR polygon are used to establish the habitat maintenance objective for that area of the JV region (Table 4, Appendix E).

This process results in a problem for some species, with estimates of habitat needed to sustain current populations being greater than the estimated amount of habitat (specific cover type) currently available; these JV focal species are Willow Flycatcher, Wood Thrush, and Whip-poor-will. The discrepancy may be caused by 1) incorrect population estimates, 2) inaccurate density information, 3) inaccuracies with the spatial data that estimates were compared to, and 4) the fact that species may not be limited by breeding habitat. Thogmartin et al. (2006) outlined potential problems associated with population estimates based on the Breeding Bird Survey and the technique used by Rosenberg and Blancher (2005). Population estimates for Whip-poor-will, a nocturnal species, could be largely inaccurate due to BBS timing and the associated polynomial equation used to correct timing bias for this species. Willow Flycatcher and Wood Thrush population estimates also could be inaccurate due to spatial arrangement of route locations, road effects, or pair adjustment factors. Inaccurate regional density estimates also can cause error in calculating predicted habitat requirements. Density estimates were taken from the literature and averaged for State×BCR polygons in the JV (Appendix A). In some instances density estimates were from very few studies and likely not representative of the JV region. The 1992 National Land Cover Dataset (NLCD) was used to compare the available habitat for each State×BCR polygon to the habitat maintenance objective. Inaccuracies with this dataset have been outlined by Thogmartin et al. (2004a), which include poor classification and confusion among cover types. Due to these inaccuracies for Willow Flycatcher, Wood Thrush, and Whip-poor-will, other species with similar cover type requirements are used when determining habitat maintenance and protection objectives. However, these three species are still used as JV focal species to target conservation effort.

Four species, including Prothonotary Warbler, Cape May Warbler, Eastern Meadowlark, and Greater Prairie-Chicken, had slightly greater maintenance objectives than available habitat. These species were still used in calculating habitat objectives because discrepancies occurred in few State×BCR polygons or maintenance objectives were only slightly >100% of available habitat. Problems associated with Prothonotary Warbler, Eastern Meadowlark, and Greater Prairie-Chicken are likely associated with inaccuracies of the NLCD. Differences in maintenance objectives for Cape May Warbler may be linked to inaccuracies in the population estimate and density estimate as populations can be highly variable and dependent on spruce budworm outbreaks.

Primary emphasis for conservation of current landbird populations must be maintaining and protecting areas that support population sources, especially in mixed wooded openlands (81,000 km<sup>2</sup> of savanna-like landscape) and grasslands (24,000 km<sup>2</sup>), plus evergreen (6,000 km<sup>2</sup>) and deciduous forest (4,000 km<sup>2</sup>). In addition, an estimated 700 km<sup>2</sup> of forested wetland, 41,000 km<sup>2</sup> of shrubland, and 10,000 km<sup>2</sup> of general forest cover (Table 4) are required by current populations of landbirds in the JV region. Areas of greatest importance were identified for species dependent on grassland / openland (Figure 2), evergreen forest (Figure 3), deciduous forest (Figure 4), and woody wetlands (Figure 5) based on the abundance and distribution of JV focal species. We lacked confidence in the NLCD (1992) shrub land- cover class and did not display information for this relatively dynamic cover type. However,

Table 4. Landbird habitat maintenance and protection objectives (km<sup>2</sup>) by cover type, Bird Conservation Region (BCR), and state to meet carrying capacity needs for current estimated breeding populations in the Upper Mississippi River and Great Lakes Joint Venture (JV) region. Distribution of maintenance effort based on JV focal species<sup>a</sup> BCR population estimates and habitat models (Appendix A). Objectives are presented in square kilometers (1 km<sup>2</sup> = 100 ha or 247 acres).

State	BCR	Forest <sup>b</sup>	Deciduous forest <sup>c</sup>	Evergreen forest <sup>d</sup>	Forested wetland <sup>e</sup>	Shrubland <sup>f</sup>	Grassland <sup>g</sup>	Mixed wooded openland <sup>h</sup>
Iowa	22	0	5	0	0	20	1,375	15,833
	23	0	0	0	0	0	94	783
	Total	0	5	0	0	20	1,469	16,616
Illinois	22	0	62	0	148	2,460	3,625	11,667
	23	0	0	0	0	22	94	258
	24	0	357	0	97	1,780	525	2,833
	Total	0	419	0	245	4,262	4,244	14,758
Indiana	22	0	13	0	3	760	938	2,917
	23	0	5	0	4	210	238	667
	24	0	1,071	0	120	1,400	875	3,500
	Total	0	1,089	0	127	2,370	2,051	7,084
Kansas	22 / Total	0	36	0	16	0	4,600	6,667
Michigan	12	1,867	470	2,000	0	12,350	463	375
	22	0	0	0	0	0	0	283
	23	160	85	0	47	340	688	667
	Total	2,027	555	2,000	47	12,690	1,151	1,325
Minnesota	12	4,933	47	3,000	0	6,320	580	400
	22	0	0	0	0	230	150	750
	23	413	8	150	0	2,000	313	2,667
	Total	5,346	55	3,150	0	8,550	1,043	3,817
Missouri	22 / Total	0	357	0	250	460	5,750	16,667
Nebraska	22 / Total	0	0	0	0	0	51	5,000
Ohio	13	0	209	0	0	2,360	375	750
	22	0	33	0	2	1,100	1,088	2,000
	24	0	40	0	0	140	26	0
	28	0	810	0	2	1,500	450	183
	Total	0	1,092	0	4	5,100	1,939	2,933
Wisconsin	12	1,600	89	400	0	3,230	150	133
	22	0	0	0	0	9	15	42
	23	800	17	60	3	3,960	1,750	5,667
	Total	2,400	106	460	3	7,199	1,915	5,842
All States	12	8,400	606	5,400	0	21,900	1,193	908
	13	0	209	0	0	2,360	375	750
	22	0	506	0	419	5,039	17,592	61,826
	23	1,373	115	210	54	6,532	3,177	10,709
	24	0	1,583	0	217	3,320	1,426	6,333
	28	0	810	0	2	1,500	450	183
	Total	9,773	3,829	5,610	692	40,651	24,213	80,709

<sup>a</sup>JV breeding focal species were grouped by cover type, and objectives for each State×BCR area reflect the species with the greatest need for each cover type in that area (see Appendix E).

<sup>b</sup>Forest category includes deciduous forest, mixed forest, and woody wetlands. JV focal species for this community type were Canada Warbler and Veery (forest generalists).

<sup>c</sup>JV focal species for deciduous forest were Cerulean Warbler, Louisiana Waterthrush, Kentucky Warbler,

and Black-throated Blue Warbler.

<sup>d</sup>The evergreen cover type objective was based on Cape May Warbler and may be greater than current available habitat. See text and Appendix E for details. Other JV focal species considered were Olive-sided Flycatcher, Connecticut Warbler, and Kirtland's Warbler.

<sup>e</sup>The forested wetland cover type objective is based on habitat needs for Prothonotary Warbler. Willow Flycatcher, another woody wetland JV focal species, had objectives greater than estimated habitat available. See text and Appendix E for details.

<sup>f</sup>JV focal species for the shrubland cover type were American Woodcock, Blue-winged Warbler, Yellow-breasted Chat, and Golden-winged Warbler.

<sup>g</sup>The grassland cover type objective may be greater than current available habitat; see text and Appendix E for details. JV focal species for this community type were Greater Prairie-Chicken, Upland Sandpiper, Henslow's Sparrow, and Eastern Meadowlark.

<sup>h</sup>The mixed wooded / openland or savanna cover type objective was based on habitat needs of Red-headed Woodpecker. Areas with a savanna-like structure such as golf courses, parks, and mixed agricultural areas may provide some suitable breeding locations.

decision-support maps (Figure 2-5) developed for other guilds should be used to target conservation effort for species dependent on these communities. More specific habitat requirements and locations to target protection effort for shrubland and other landbird groups can be found in species accounts (Appendix A).

A relatively small portion of the area required to accommodate current populations of some JV focal species is protected through ownership by government agencies or non-government conservation organizations (Thogmartin et al. 2004b). In the future, we will develop a digital data layer of conservation lands with perpetual protection in the JV region. This process has begun for the Great Lakes states with identification of conservation and recreation lands (CARL dataset; Ducks Unlimited 2004). In addition, Important Bird Areas (IBAs) are being identified and mapped in each of the JV states. Land ownership and IBA locations can be coupled with priority bird conservation lands from this strategy to better prioritize a plan for acquisition and conservation easements. Besides government agencies, land trusts and other conservation organizations are actively conserving landbird habitats across the JV region. Although forest management practices have been positively influenced by the Sustainable Forestry Initiative (<http://www.abouthfi.org/about.asp>), there remains a need to find additional ways to maintain habitat for landbird species of concern on working lands, such as agriculture and production forestry (Merenlender et al. 2004, Polasky et al. 2005). Private landowners will also play a pivotal role in landbird habitat conservation. Agencies, NGOs, corporations, and similar entities will not alone or in combination be successful at accomplishing many conservation endeavors without a necessary partnership with private landowners.

## **Restoration and Enhancement**

Landbird habitat restoration and enhancement objectives were based on JV focal species population deficits (Table 2) and associated habitat models (Appendix A). We assumed the most effective means to increase a population was to restore missing habitat (vs. increasing the density of species in habitat currently occupied). Similar to maintenance and protection objectives, JV focal species guilds were established by major land cover class to match the resolution of available spatial data for the JV region. Those species characteristic of each land cover class that had the greatest area deficit for specific State×BCR polygons were

used to establish the habitat restoration and enhancement objective for that area of the JV region (Table 5, Appendix F).

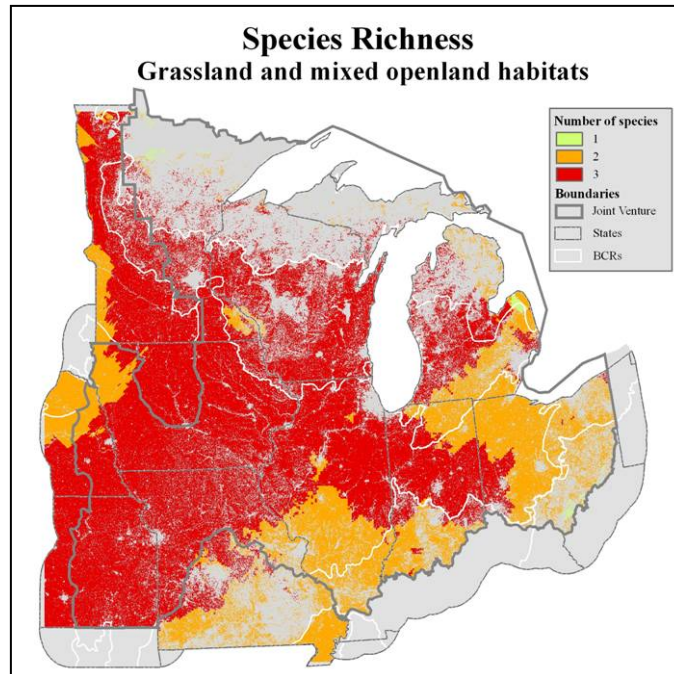
Restoration implies working in human-influenced areas (e.g., agricultural fields, urban/suburban lands, industrial forest), such as converting an annual cover type to a perennial native-plant community optimal for a target bird species or modifying forest management practices that restore or mimic natural processes for a suite of species. Management is generally more economical and effective when restoration efforts aim to restore cover suited for the site (i.e., consider pre-settlement vegetation, current surrounding cover, and critical/irreversible adjustments to landscape hydrology). Likewise, enhancement work must consider landscape capabilities. Properly located enhancement effort that sets back succession, suppresses invasive plants, and provides a missing element to an otherwise suitable landscape typically results in the greatest return on investment.

Based on the pooled needs of JV focal species, area restoration and enhancement objectives are greatest for open grassland landscapes and shrubland forest. Restoration of 105,000 km<sup>2</sup> of grassland (81,000 km<sup>2</sup> wooded openland / savanna and 24,000 km<sup>2</sup> grassland), 16,000 km<sup>2</sup> of shrubland, 350 km<sup>2</sup> of forested wetland, 850 km<sup>2</sup> of evergreen forest, 2,000 km<sup>2</sup> of deciduous forest, and 5,000 km<sup>2</sup> of general forest cover is predicted to establish added landscape carrying capacity to meet the needs of landbird goal populations (eliminate deficits, Table 5). Important breeding forest bird locations have been identified across the region (Figure 3-5) using a combination of land cover classes (NLCD 1992) and JV focal species abundance and distribution data. These decision-support maps and details with specific habitat requirements (area and edge sensitivity) for each forest-dwelling JV focal species (Appendix A) should be used to guide restoration and enhancement.

Potential for greatest net increase in breeding grassland bird habitat exists in the agriculturally dominated portion of the JV region (Figure 2) where extensive native prairie has been converted to cropland. Continued development of wildlife-friendly agriculture programs included in the U.S. Farm Bill can significantly impact landbirds in the region by preserving and restoring native grassland communities. Effective landbird conservation will require collaboration with those implementing federal agriculture programs, and landbird habitat restoration and protection maps should be used to help target Farm Bill conservation efforts. Because habitat enhancement for one species may result in loss of site value for other species, habitat treatments must consider other species potentially using a site. Species of concern from other bird groups can be found in the other JV bird-group strategies.

County-level and site-specific planning will be enhanced with an understanding of area soil characteristics, particularly the location and extent of hydric soils, when landbird and wetland bird habitat decisions are considered together (potential wetland-grassland restoration sites). These data are available for the entire JV region through the U.S. Department of Agriculture at [www.soils.usda.gov/survey](http://www.soils.usda.gov/survey). Proposed landbird habitat restoration and enhancement objectives are “net area” estimates. In other words, any loss of existing habitat during the plan period will have to be added to strategy restoration objectives.

A)



B)

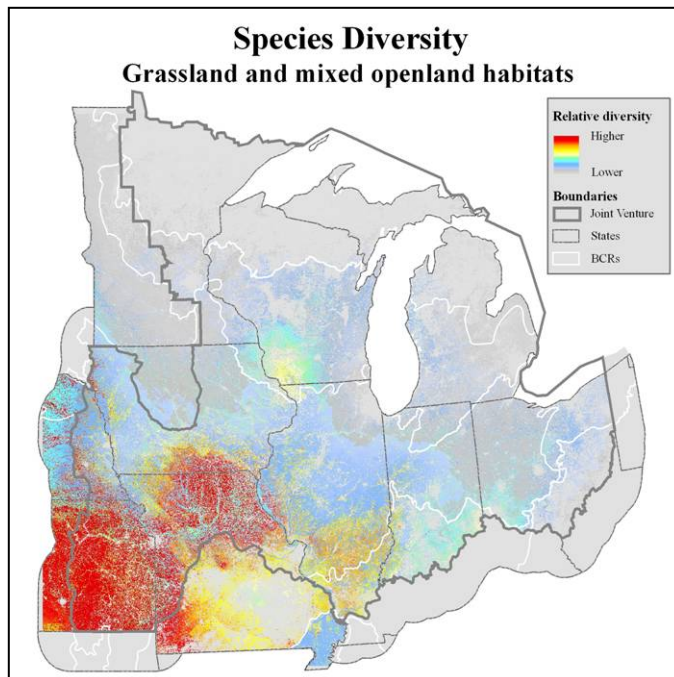
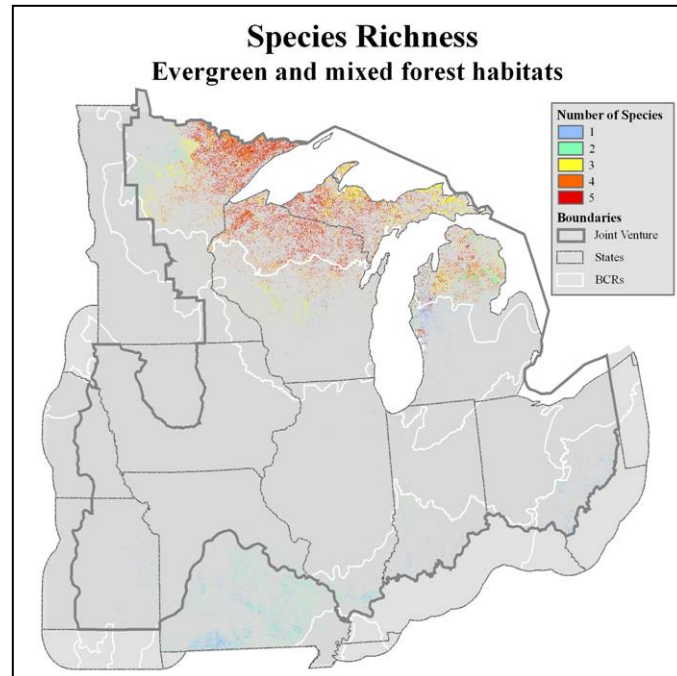


Figure 2. Decision-support maps to target habitat maintenance and restoration for breeding landbirds associated with grassland or mixed openland. These bird habitat maps are Breeding Bird Survey (BBS) point-count interpolations for 3 JV focal species including Red-headed Woodpecker, Eastern Meadowlark, and Upland Sandpiper. Greater Prairie-Chicken and Henslow's Sparrow were not included in the analysis due to lack of sufficient BBS data for these species. Figure A is a measure of JV focal species richness (number of focal species found in the region) and Figure B is focal species diversity (richness and relative abundance) based on the combined interpolation of BBS data for these species. Species ranges may overlap within the region, but some species may not be found in the same location due to specialized habitat requirements. Land-cover spatial data was masked to display only herbaceous grassland and agricultural lands from National Land Cover Data (1992).



A)



B)

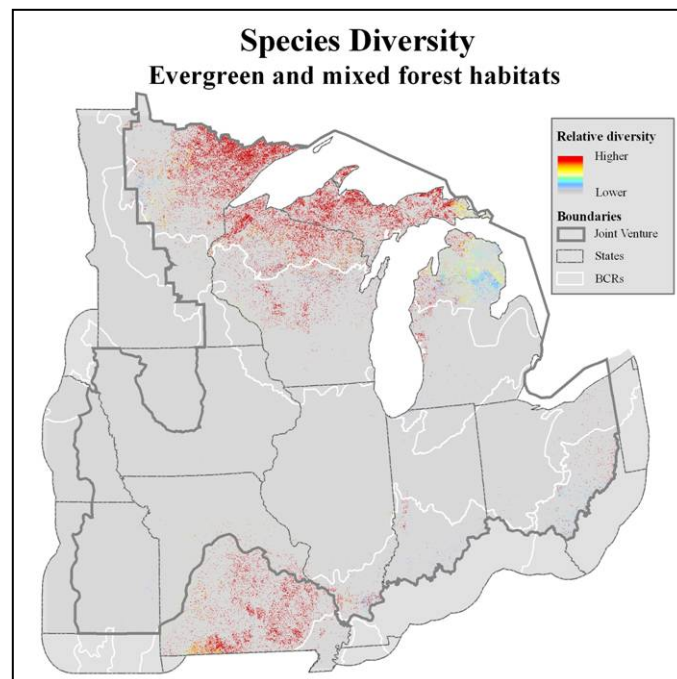
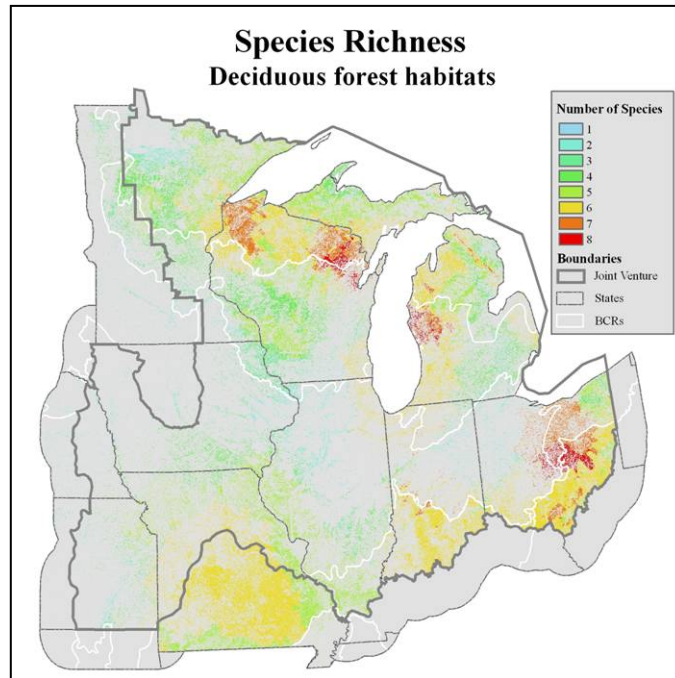


Figure 3. Decision-support maps to target habitat maintenance and restoration for breeding landbirds associated with evergreen and mixed forest. These bird habitat maps are Breeding Bird Survey (BBS) point-count interpolations for 8 JV focal species including Canada Warbler, Olive-sided Flycatcher, Black-throated Blue Warbler, Cape May Warbler, Whip-poor-will, Connecticut Warbler, Wood Thrush, and Veery. Kirtland's Warbler was not included in the analysis due to a lack of sufficient BBS data. Figure A is a measure of JV focal species richness (number of focal species found in the region) and Figure B is focal species diversity (richness and relative abundance) based on the combined interpolation of BBS data for these species. Species ranges may overlap within the region, but some species may not be found in the same location due to specialized habitat requirements. Land-cover spatial data was masked to display only evergreen and mixed forest from National Land Cover Data (1992).

A)



B)

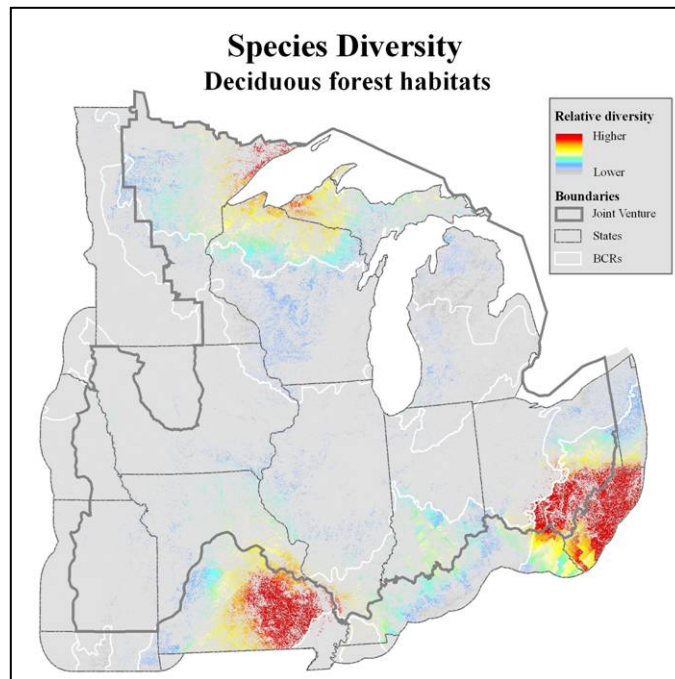
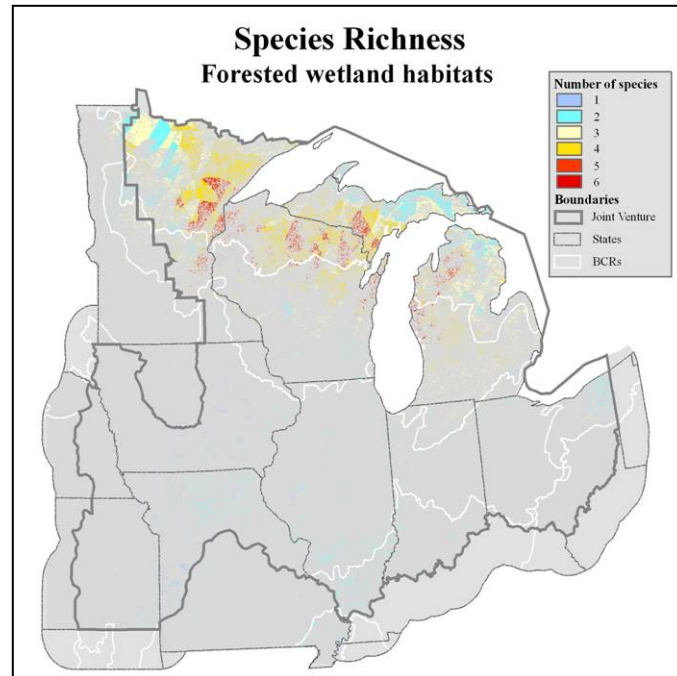


Figure 4. Decision-support maps to target habitat maintenance and restoration for breeding landbirds associated with deciduous forest. These bird habitat maps are Breeding Bird Survey (BBS) point-count interpolations for 9 JV focal species including Wood Thrush, Veery, Black-throated Blue Warbler, Canada Warbler, Red-headed Woodpecker, Whip-poor-will, Cerulean Warbler, Louisiana Waterthrush, and Kentucky Warbler. Chimney Swift was not included in the analysis because it is largely associated with urban areas. Figure A is a measure of JV focal species richness (number of focal species found in the region) and Figure B is focal species diversity (richness and relative abundance) based on the combined interpolation of BBS data for these species. Species ranges may overlap within the region, but some species may not be found in the same location due to specialized habitat requirements. Land-cover spatial data was masked to display only deciduous forest from National Land Cover Data (1992).

A)



B)

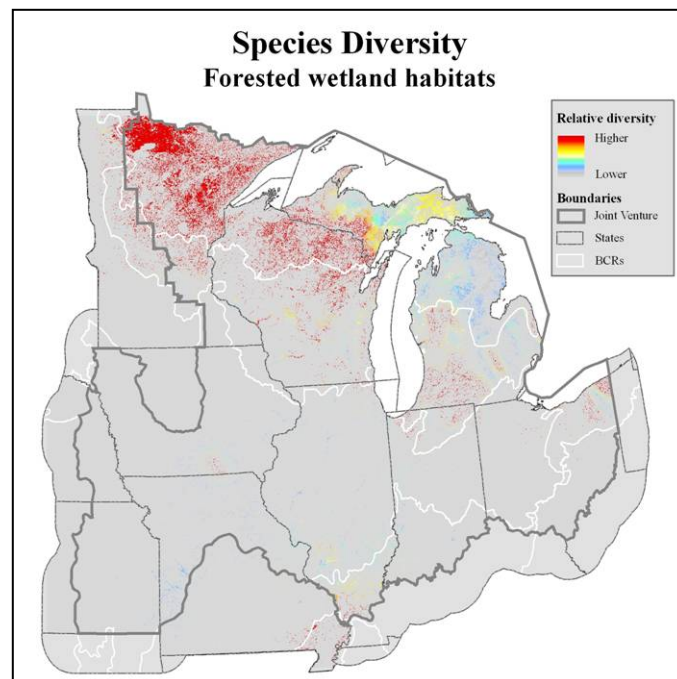


Figure 5. Decision-support maps to target habitat maintenance and restoration for breeding landbirds associated with forested wetlands. These bird habitat maps are Breeding Bird Survey (BBS) point-count interpolations for 6 JV focal species including Canada Warbler, Golden-winged Warbler, Willow Flycatcher, Prothonotary Warbler, Connecticut Warbler, and Veery. Figure A is a measure of JV focal species richness (number of focal species found in the region) and Figure B is focal species diversity (richness and relative abundance) based on the combined interpolation of BBS data for these species. Species ranges may overlap within the region, but some species may not be found in the same location due to specialized habitat requirements. Land-cover spatial data was masked to display only woody wetlands from National Land Cover Data (1992).

Table 5. Landbird habitat restoration and enhancement objectives (km<sup>2</sup>) by cover type, Bird Conservation Region (BCR), and state to reach carrying capacity goals for estimated breeding populations in the Upper Mississippi River and Great Lakes Joint Venture (JV) region. Distribution of restoration effort based on JV focal species<sup>a</sup> BCR population estimates and habitat models (Appendix A). Objectives are presented in square kilometers (1 km<sup>2</sup> = 100 ha or 247 acres).

State	BCR	Forest <sup>b</sup>	Deciduous forest <sup>c</sup>	Evergreen forest <sup>d</sup>	Forested wetland <sup>e</sup>	Shrubland <sup>f</sup>	Grassland <sup>g</sup>	Mixed wooded openland <sup>h</sup>
Iowa	22	0	3	0	0	8	1,375	15,833
	23	0	0	0	0	0	94	783
	Total	0	3	0	0	8	1,469	16,616
Illinois	22	0	31	0	74	3	3,625	11,667
	23	0	0	0	0	20	94	258
	24	0	179	0	48	14	525	2,833
	Total	0	210	0	122	37	4,244	14,758
Indiana	22	0	13	0	1	1,080	938	2,917
	23	0	5	0	2	300	238	667
	24	0	536	0	60	2,060	875	3,500
	Total	0	554	0	63	3,440	2,051	7,084
Kansas	22 / Total	0	18	0	8	0	4,600	6,667
Michigan	12	933	4	176	0	1,420	463	375
	22	0	0	0	0	140	0	283
	23	80	85	0	23	2,730	688	667
	Total	1,013	89	176	23	4,290	1,151	1,325
Minnesota	12	2,400	0	565	0	840	580	400
	22	0	0	0	0	0	150	750
	23	207	8	7	0	570	313	2,667
	Total	2,607	8	572	0	1,410	1,043	3,817
Missouri	22 / Total	0	179	0	125	16	5,750	16,667
Nebraska	22 / Total	0	0	0	0	0	51	5,000
Ohio	13	0	209	0	0	780	375	750
	22	0	33	0	1	1,610	1,088	2,000
	24	0	20	0	0	16	26	0
	28	0	628	0	1	420	450	183
	Total	0	890	0	2	2,826	1,939	2,933
Wisconsin	12	800	15	88	0	1,300	150	133
	22	0	0	0	0	4	15	42
	23	400	17	14	1	2,500	1,750	5,667
	Total	1,200	32	102	1	3,804	1,915	5,842
All States	12	4,133	19	829	0	3,560	1,193	908
	13	0	209	0	0	780	375	750
	22	0	277	0	209	2,861	17,592	61,826
	23	687	115	21	26	6,120	3,177	10,709
	24	0	735	0	108	2,090	1,426	6,333
	28	0	628	0	1	420	450	183
	Total	4,820	1,983	850	344	15,831	24,213	80,709

<sup>a</sup>JV breeding focal species were grouped by cover type, and objectives for each State×BCR area reflect the species with the greatest need for each cover type within that area (see Appendix F).

<sup>b</sup>Forest category includes deciduous forest, mixed forest, and woody wetlands. JV focal species for this community type were Canada Warbler and Veery (forest generalists).

<sup>c</sup>JV focal species for the deciduous forest guild were Cerulean Warbler, Louisiana Waterthrush, Kentucky Warbler, and Black-throated Blue Warbler.

<sup>d</sup>JV focal species for the evergreen forest guild were Olive-sided Flycatcher, Connecticut Warbler, Cape May Warbler, and Kirtland's Warbler.

<sup>e</sup>The woody wetland guild objective is based on habitat needs for Prothonotary Warbler. Willow Flycatcher, another woody wetland focal species, had habitat requirements greater than available for the region. See text

and Appendix F for details.

<sup>f</sup>JV focal species for the shrubland cover type were Blue-winged Warbler, Yellow-breasted Chat, and Golden-winged Warbler.

<sup>g</sup>JV focal species for the grassland cover type were Greater Prairie-Chicken, Henslow's Sparrow, and Eastern Meadowlark.

<sup>h</sup>The mixed wooded / openland or savanna objective was based on habitat needs of Red-headed Woodpecker. Areas with a savanna like structure such as golf courses, parks, and agricultural areas may provide some suitable breeding locations.

## Conservation Strategies

Several strategies have been identified to provide land managers with ideas and guidelines to maintaining and increasing priority landbird populations in the JV region. They include the following:

- 1) Follow available “best practices” guidelines for land managers (public and private lands). For example, selective cutting treatments appear to have little effect on productivity of forest-breeding landbirds in either fragmented or extensively forested landscapes (Robinson and Robinson 1999, Duguay et al. 2001).
- 2) Promote landbird planning and conservation across ownerships, states, JV regions, and international boundaries.
- 3) Focus on land supporting viable populations of JV focal species in relatively unfragmented landscapes >10,000 ha and with fewer threats (e.g., low deer density or potential to reduce deer density, few pathogens or invasive species, low probability of being degraded or divided by current owner; Appendix D).
- 4) Emphasize conservation on landscapes >70% intact (undeveloped) and contain core sites with source populations of JV focal species. Landscapes with <70% cover should also be conserved if focal species habitat needs are met, especially if there are few or no landscapes meeting the 70% criteria. In landscapes with <70% natural cover, retain or increase size of forest and grassland tracts, especially in central parts of the JV region, to enhance viability of breeding populations (Pashley et al. 2000).
- 5) Improve monitoring for species whose main breeding range is north of the Breeding Bird Survey coverage area (Rich et al. 2004).
- 6) Create coordinated conservation programs in countries where birds winter and migrate, including identification, protection and management of key sites (Rich et al. 2004).
- 7) Identify and/or maintain critical breeding areas for Golden-winged Warbler, Cerulean Warbler, and Henslow's Sparrow, and other species where this JV is particularly important to breeding populations (>50% of the breeding population; Pashley et al. 2000).
- 8) Focus on stopover sites where they appear especially needed, along Great Lakes shorelines and islands and isolated habitat patches in urban and agricultural landscapes; these areas will likely be different than sites important for breeding birds and require different conservation strategies (Ewert et al. 2006). Conservation strategies needed to maintain a network of stopover sites in the JV region include:
  - a) Protect natural or restored vegetation near the Great Lakes shoreline, especially <0.4 km from shore, and in highly fragmented stretches of shoreline (e.g., Lake Erie, Lake St. Clair, southern Lake Michigan, southern Lake Huron) and sites >4 km from any other natural shoreline vegetation (Ewert et al. 2006).

- b) On Great Lakes shorelines, create vegetation patches (they can be <1 ha) on municipal lands or small private parcels and acquire or seek long-term management agreements with landowners to secure these areas.
- c) Develop strategies to protect the most isolated natural or restored vegetation patches in agricultural or urban landscapes (those >4 km from another patch). Identify and map locations of these patches and initiate work in these landscapes (e.g., programs comparable to the USDA Conservation Reserve Program).
- d) Work with local organizations to plant native plant species that are heavily used by migrating landbirds, especially where stopover sites in the JV are scarce. Ensure restorations create structurally and species-diverse cover.

## **Monitoring and Adaptive Management**

Monitoring landbird populations and associated landscapes is required to determine conservation status, detect population trends, assess health of habitats, and evaluate whether environmental changes and management actions are working as predicted. Several specific monitoring priorities were identified while developing this strategy, with emphasis on JV focal species:

- 1) Estimate population size, track changes in abundance and distribution, and improve monitoring of patch (core habitat area) or subpopulation persistence, extinction, and colonization.
- 2) Record land use change in targeted conservation areas, track bird population change in relation to habitat change, and evaluate response to habitat restoration, protection and enhancement.
- 3) Incorporate detectability considerations in existing surveys, standardize monitoring protocols, and address biases.
- 4) Develop taxa-specific (e.g., raptors) monitoring initiatives for species inadequately inventoried by the BBS, and establish protocols to measure abundance and distribution of priority species (JV focal species) during migration.

Three major types of monitoring address different management objectives. “Context monitoring” (sometimes called surveillance monitoring) inventories ecosystem components at multiple spatial scales without reference to the influences of management (Holthausen et al. 2005). This type of monitoring addresses status and trend objectives; the major context monitoring program for landbirds is the BBS. Unlike other bird taxa, most landbirds are adequately monitored at large spatial scales by the BBS (Dunn et al. 2005).

“Targeted monitoring” assesses the condition and response to management of focal species and habitats (Holthausen et al. 2005). This type of monitoring addresses specific management objectives to effect a change in both habitats and species’ populations. Targeted monitoring is conducted in an adaptive management framework that involves agreement on management objectives and questions, decision-making about management actions, monitoring to assess the outcomes of management actions (Williams 2003, Hahn et al. 2004), and re-assessment of management objectives and uncertainties.



“Cause and effect monitoring” investigates the mechanisms that underlie habitat and species responses to management or disturbance (Holthausen et al. 2005). Manipulative experiments, behavioral studies, and demographic studies are examples of cause and effect monitoring. Surveys that assess environmental or other factors believed to affect bird populations offer an opportunity to test hypotheses about population limitation and regulation. Abundance surveys and monitoring programs used to estimate vital rates (e.g., survival and productivity surveys) can be used to assess habitat quality (Knutson et al. 2006). When coordinated with monitoring of natural and management-induced habitat changes, these surveys can also inform management decisions and provide important insights into the mechanisms underlying changes in bird demographics.

## **Current Regional Monitoring and Needs**

Landbirds as a group have benefited from a number of large scale monitoring programs, including the North American Breeding Bird Survey (BBS), the Christmas Bird Count (CBC), and Monitoring Avian Productivity and Survivorship surveys. Most states have also completed or are in the process of developing Breeding Bird Atlases, and these efforts typically follow a sound sampling protocol. In addition, many national forests, wildlife refuges, and national parks conduct bird monitoring; state agencies also collect useful information even though data are often difficult to access. Finally, hundreds of graduate students have conducted cause and effect research in the JV region over the last several decades, adding to our information base. Four general but important issues have been described for bird monitoring (Kushlan et al. 2002).

*Centralized data storage and access.* Bird conservation scientists must have easy access to digital survey data, and efforts are underway. Recently, a national Bird Point Count database (<http://www.pwrc.usgs.gov/point/>) was developed to archive point count data for surveys like the BBS and CBC. These programs and others can be accessed from the NBII Bird Conservation Node ([http://birdcon.nbii.gov/monitoring\\_links.html](http://birdcon.nbii.gov/monitoring_links.html)). In addition, Cornell Laboratory of Ornithology has launched an E-bird database to record bird sightings in an effort to take advantage of the large number of recreational bird watchers that track their bird sightings (<http://www.ebird.org/content/>). The National Audubon Society is working to identify a network of sites that provide critical habitat for birds through their Important Bird Areas Program (<http://www.audubon.org/bird/iba/>).

*Standard methodologies.* Large-scale monitoring programs use techniques that allow population and habitat data collected in different locations and across multiple geographic or temporal scales to be pooled and compared. The ability to sample at large scales using various methods and still meet trend detection goals is essential. Developing and testing monitoring methods and then evaluating their precision and power to detect trends are crucial for effective conservation. The National Park Service (NPS) and the U.S. Geological Survey (USGS) are developing a national protocol for standard methodology and database website to allow various agencies to share information. NPS has a prototype available for their Inventory and Monitoring Program (<http://science.nature.nps.gov/im/monitor/protocoldb.cfm>).

*Monitoring precision goal.* The World Conservation Union uses a criterion of detecting >50% change over 10 years or 3 generations for purposes of categorizing species at risk of population declines or extinction (World Conservation Union 2005). We suggest this as a minimum detection criterion for monitoring status and trends of populations. Most of the JV focal species have population objectives of  $\geq 50\%$  increase (Appendix A).

*Filling information gaps.* With a data repository and standard methodologies in place, bird conservation partners can better identify gaps in current population survey efforts and coordinate an integrated network of statistically valid, long-term landbird population monitoring programs throughout the region and the continent (Bart et al. 2004, Dunn et al. 2005) to assess the effectiveness of conservation actions.

In addition to tracking changes in population size and land cover area, there is a need to 1) quantify fragmentation (e.g., within 5 km<sup>2</sup> blocks) to identify areas of the JV region best suited as source populations of area-sensitive species, 2) identify areas within the JV region with relatively high enrollment in the Conservation Reserve Program and other government-sponsored programs that provide persistent cover for birds, and 3) identify rapidly developing areas, perhaps especially Great Lakes coastal areas, as these areas may require immediate conservation actions.

## **Monitoring Responsibilities**

Following a history of substantial habitat conservation accomplishments, JV partners are gradually expanding monitoring efforts and embracing the concept of adaptive planning. JV staff, Technical Committee, and state agency science partners are working toward establishing and improving regional monitoring strategies that complement and support continental survey efforts. Targeted and cause and effect monitoring are especially important to measure JV performance and improve biological models. In some cases, specialized surveys will be needed to determine status and trends of species poorly monitored by the BBS (Dunn et al. 2005). The JV should continue developing partnerships to complete regional monitoring priorities and also to support maintenance of adequate resources for Federal migratory bird management agencies.

As the agencies with trust responsibility for management and conservation of migratory birds, it is incumbent on the U.S. FWS, Canadian Wildlife Service (CWS), and Secretaria de medio ambiente y recursos naturales – Semarnat – Mexico (SEMARNAT) to document resource requirements for meeting population and habitat objectives stated in continental and regional bird conservation plans. Federal management agencies, in conjunction with other landbird stakeholders, should seek to develop and implement effective programs for context monitoring of all landbirds. They must also manage data to provide open Internet access to standardized, well-documented, spatially-referenced databases. Finally, Federal migratory bird management agencies should provide technical expertise and operational support for development of regional monitoring strategies as resources permit.

## Measuring Performance

The current measure of existing cover types across the JV region is the National Land Cover Database (NLCD 1992), which was recently revised and made available in early 2007. Landbird habitat availability may crudely be measured through changes in land use and land cover detected on national digital databases like the NLCD. Most of these changes will reflect large shifts in land use such as urbanization and changes in agricultural cropping or intensive forestry due to policy change or economics. The NLCD cannot detect more subtle changes in habitat quantity and quality that are likely to result from local scale management actions. These will need to be addressed through targeted monitoring. JV members must also explore partnering with the U.S. Department of Agriculture (USDA) to gain access to their U.S. Forest Service (USFS) Forest Inventory and Analysis data for forest structure. In addition, the Natural Resources Conservation Service (NRCS) maintains Natural Resources Inventory data on grassland / cropland structure. These data would fill a much needed gap in structural and compositional information, as well as being timelier than NLCD revisions. Other sophisticated techniques are also becoming available for elevation and vegetative-structure analysis (e.g., LiDAR)

Change in population trends for most species at a landscape scale will be measured via the BBS, whereas sub-regional measures of performance can be completed using the BBS combined with targeted monitoring. In addition, population survival and reproduction studies (cause and effect monitoring) are needed to assess performance of conservation actions.

## Adaptive Management

Adaptive management is the use of cyclic planning, implementation, and evaluation to improve management performance. Adaptive Resource Management (ARM) provides an explicit framework that ensures monitoring data are relevant and useful in making management decisions (Lancia et al. 1996). Moreover, it provides a means to improve future decision-making through an iterative cycle of biological prediction and testing (Williams 2003). Although adaptive management does not need to be complex, it does require discipline. Critical preconditions for successful ARM include stakeholder consensus about objectives and a commitment to manage adaptively.

ARM can increase JV effectiveness and efficiency by improving capacity in all three iterative steps: planning, implementation, and evaluation. Planning, at all levels, is based on a set of assumptions, often embodied in implicit or explicit models like those used in the landbird species accounts (Appendix A). These models predict how landbirds should respond to habitat changes and management actions. For example, implementation of prescribed breeding habitat restoration objectives should eliminate breeding population deficits as determined through monitoring. Adaptive management may be feasible at multiple spatial scales for landbirds because of the existence of well-established monitoring programs. Application of ARM concepts will be a priority in the implementation and refinement of this strategy.

## **Timetable and Coordination**

This JV Landbird Habitat Conservation Strategy is a component of a broad JV all-bird conservation plan scheduled to be implemented from 2007 – 2022. Although the general all-bird plan has a 15-year time horizon, the bird-group strategies will be updated more frequently in keeping with adaptive management processes. Moreover, completion of identified research and testing of habitat models and associated assumptions will result in improved knowledge and allow refinement of the taxonomic strategies. Habitat objectives and monitoring recommendations will also be completed during the 15-year plan period, but refinements to both may periodically occur based on new knowledge. Using the habitat objectives and targeted guidelines provided in this plan, partners should continue to increase conservation efficiency and effectiveness for landbirds as well as other bird groups.

Strategy development and refinement will continue to be the responsibility of the JV Technical Committee and strategy approval and implementation remain the responsibility of JV Management Board and their associated conservation organizations and partnerships. Information sharing and tracking of accomplishments will be coordinated through the JV Central Office (Minneapolis, MN) whereas GIS data layers, habitat model development, and collaboration with research and science partners will be the responsibility of the JV Science Office (East Lansing, MI).

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**Appendix A. Landbird species accounts with population and cover type information used for habitat planning in the Upper Mississippi River and Great Lakes Joint Venture (JV) region; two terrestrial shorebirds, Upland Sandpiper and American Woodcock, are also included. These JV focal species were used to develop breeding habitat conservation objectives for primary landscape cover types. Population goals and estimates are measured in individual birds. The equation below can be used to calculate average annual change required to reach population goals over specific time periods (see Monitoring and Performance in species accounts).**

<b>Species English name (primary author / compiler)</b>	<b>Last revised</b>
Greater Prairie-Chicken (Greg Soulliere)	August 2006
Upland Sandpiper (Brad Potter)	August 2006
American Woodcock (Brad Potter)	August 2006
Whip-poor-will (John Castrale)	August 2006
Chimney Swift (Scott Hull)	August 2006
Red-headed Woodpecker (Rochelle Renken)	August 2006
Olive-sided Flycatcher (Dave Ewert)	August 2006
Willow Flycatcher (Andy Forbes)	August 2006
Veery (Scott Hull)	August 2006
Wood Thrush (Bobbie Jamison)	August 2006
Blue-winged Warbler (Brad Potter)	August 2006
Golden-winged Warbler (Dave Ewert)	August 2006
Cape May Warbler (Dave Ewert)	August 2006
Black-throated Blue Warbler (Dave Ewert)	August 2006
Kirtland's Warbler (Dave Ewert)	August 2006
Cerulean Warbler (Dave Ewert / Brad Potter)	August 2006
Prothonotary Warbler (John Castrale)	August 2006
Louisiana Waterthrush (John Castrale)	August 2006
Kentucky Warbler (John Castrale)	August 2006
Connecticut Warbler (Dave Ewert)	August 2006
Canada Warbler (Melinda Knutson)	August 2006
Yellow-breasted Chat (John Castrale)	August 2006
Henslow's Sparrow (Dave Ewert)	August 2006
Eastern Meadowlark (Greg Soulliere / Ryan Recker)	August 2006

### Calculating Population Growth

$$FP = CP (1 + r)^t$$

$$r = \sqrt[t]{FP/CP} - 1$$

*FP = Future population (goal)*

*CP = Current population*

*r = rate of increase (growth / year)*

*t = time periods (years)*

## Greater Prairie-Chicken (*Tympanuchus cupido*)

### Species Account for Habitat Planning

#### Joint Venture population deficit based on PIF Continental and State Plans

Population goal	133,600
Current estimate	66,800
Deficit	66,800

#### Breeding habitat requirements

**Community types:** Grasslands with limited forest cover.

Large (10 km<sup>2</sup>) open complexes of medium and tall grassland, pasture / hay, and cropland are most used; also found where native prairie has intermixed oak woodland, oak-savanna, and riparian “oak-fingers.” Remaining populations are largely restricted to prairie intermixed with cropland. Plateaus with matted grass (>0.5 ha in size) are required for leks (display and breeding areas); occasionally found in agricultural fields. Historic peaks in populations likely occurred during transition from native prairie to cropland (25-69% cropland during the peak); populations declined to extinction in much of the region where cropland completely replaced the prairie landscape.

**Timing:** Lek attendance peaks in early to mid April, but males may occupy territories as early as January and as late as June. Males arrive on leks prior to sunrise (light intensity between 0 and 600 foot-candles) where they remain for 3–4 hours. About 95% of males may be on leks during normal display periods.

**Area / distance:** Densities of males and/or leks are frequently used to evaluate the status of populations. Estimates of male density reveal considerable annual and regional variation; 0 to >10 males/100 ha is common in open prairie landscapes within the region. Sustained flights >10 km possible between islands of suitable habitat. Territories at leks consist of a core area in which other males are rarely encountered and a boundary area in which aggressive interactions with other males are common; average territory size / male on lek is 518 m<sup>2</sup>. Areas of ≥2,000 ha (>67% grass, 0-33% grain cropland, <5% forest cover) within larger, relatively open landscapes should be considered optimal. Up to 10 leks may be found in an optimal area of 2,000 ha, with an average of 9 males / lek and about 1 female / male.

**Limiting factors:** Large areas of native-grass prairie or surrogate grasslands.

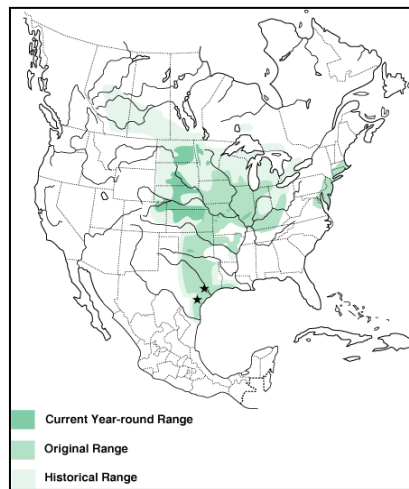
#### Wintering habitat requirements

**Community types:** Same as breeding habitat; species non-migratory.

#### Population monitoring

**Current survey effort:** 1) N.A. Breeding Bird Survey (BBS), but routes are widely dispersed in species range and survey completed after peak breeding activity, 2) lek inventories by state agencies and intermittent surveys associated with research projects.

**Recommended monitoring:** Systematic surveys with adequate precision to detect population change (±20%).



Species range map: Cornell Lab of Ornithology

### Research to assist planning

Current and ongoing projects: The Habitat and Population Evaluation Team (HAPET) in Fergus Falls MN is modeling habitat availability in the prairie portion of Minnesota and North Dakota, and a habitat model was recently completed for Wisconsin.

Research needs: Effective monitoring to measure population change, and determine most efficient habitat actions to increase populations.

### Habitat model results

Objective: Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and Bird Conservation Region (BCR) population estimates and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative concentration (birds/km <sup>2</sup> ) <sup>a</sup>	Density (birds/km <sup>2</sup> ) <sup>b</sup>	Habitat objectives (km <sup>2</sup> ) <sup>c</sup>	
			Estimate	Deficit			Protection	Restoration
MN	12	87,301	5,800	5,800	0.07	10	580	580
KS	22	65,988	46,000	46,000	0.70	10	4,600	4,600
MO	22	82,886	3,800	3,800	0.05	10	380	380
IL <sup>d</sup>	22	44,701	200	200	0.00	10	20	20
WI <sup>e</sup>	23	97,299	11,000	11,000	0.11	10	1,100	1,100
JV total		378,175	66,800	66,800			6,680	6,680

<sup>a</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). The calculation can be used to compare relative importance of State×BCR areas for this species.

<sup>b</sup>Reported density in quality habitat based on scientific literature.

<sup>c</sup>Protection objectives are calculated using population estimates / density in quality habitat, and restoration objectives are population deficits / density in quality habitat.

<sup>d</sup>Population estimate from state breeding bird atlas.

<sup>e</sup>PIF population estimate greater than expert opinion; Wisconsin population may be closer to 200-500 birds (A. Paulios, Wisconsin Department of Natural Resources, personal communication).

### Recommendations

Habitat actions: Protect existing habitat area and quality, and add (restore/enhance) 6,680 km<sup>2</sup> of habitat (see requirements above) at multiple open-land sites within primary current and logical areas of historic range. Large native grasslands may be restored and/or existing degraded sites may be managed to restore required native plant and open-land characteristics (see references for management techniques). Most management effort has been directed toward improvement of habitat. Effective strategies have included manipulation of grazing pressure, control of burning, provision of thick vegetation for protective cover, and establishment of preserves.

Monitoring and performance: BBS data is believed to be inadequate to monitor this species; however long-term BBS trends for the Greater Prairie-Chicken reflect other intermittent survey findings. Eliminating the population deficit requires a 100% population increase or an average annual increase of 5% over a 15 year period.

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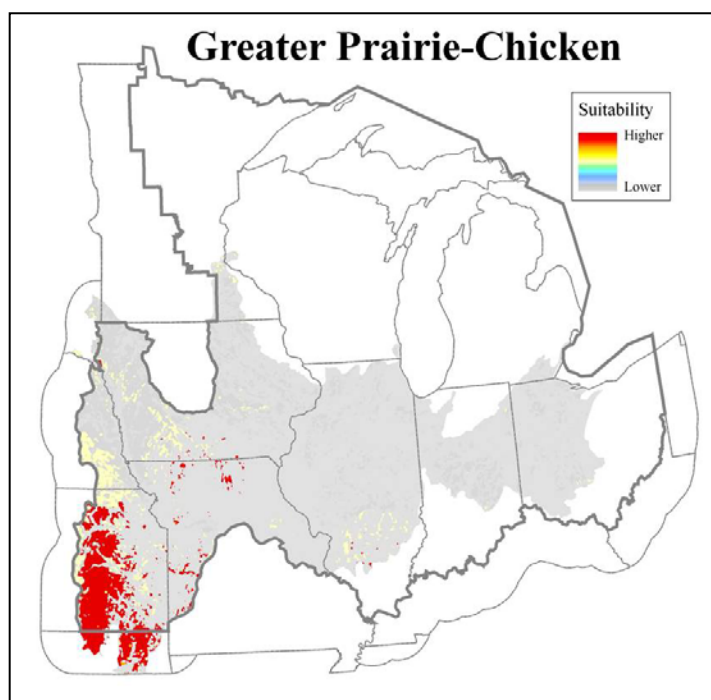
## Landscape Suitability Index (LSI)

Landscape suitability scores for Greater Prairie-Chicken in BCR 22 using cover type proportions<sup>a</sup> based on the 1992 National Land Cover Dataset (NLCD). LSI scores closer to 1.0 represent greater suitability for Greater Prairie-Chicken.

Output options	LSI score
Areas 2,800 ha with >67% grass, <33% cropland, and <5% forest	1.0
Areas 2,800 ha with >67% grass	0.7
Areas 2,800 ha with >33% grass, 33-67% cropland, and <5% forest	0.5
Areas 2,800 ha with >10% grass and <5% forest	0.1

<sup>a</sup>Cover type proportions were calculated by the Missouri Resource Assessment Partnership based on a 3 km radius from each cell (2,826 ha).

*Caution: This is a landscape-scale cover type based model developed using species literature and expert opinion for BCR 22 only. It does not reflect site specific attributes (e.g., suitable nesting substrate) and landscape suitability scores do not reflect abundances at all locations.*



## Upland Sandpiper (*Bartramia longicauda*)

### Species Account for Habitat Planning

#### Joint Venture population deficit based on BBS, expert opinion, and United States Shorebird Conservation Plan

Breeding population goal	45,000
Population estimate	33,000
Deficit	12,000

#### Breeding habitat requirements

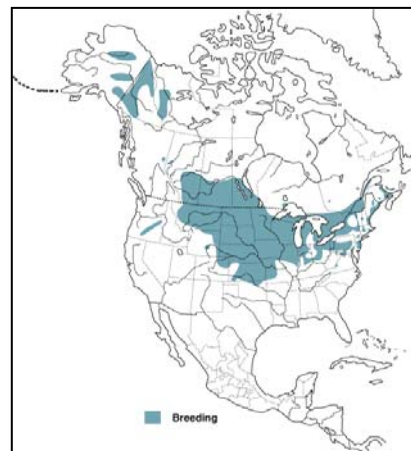
Community types: Primarily open grassland including native prairie, dry meadows, pastures, hayfields, short-grass savanna; also found in large clearcuts or open barrens on sandy soils and minimally in cultivated fields. Preferred sites contain low to moderate forb cover, minimal woody cover, moderate grass cover, moderate to high litter cover, and little to no bare ground.

Landscapes surrounding nesting sites are typically level with little tall vegetation. In some locations highway rights-of-way and airports contain the only suitable cover for breeding.

Timing: Mid-April to early August (egg laying May-June; incubation 21-28 days; young fledge in 30-34 days).

Area / distance: Loosely colonial while breeding, with densities up to 10 pairs/km<sup>2</sup> (1 pair/10 ha). Prefers grasslands >100 ha in size, infrequently found in grasslands <50 ha. Vegetation 8-40 cm in height is preferred for nesting.

Limiting factors: Large areas of short, medium, and tall grass in close proximity to each other for nesting, brooding, and foraging. Habitat loss due to fragmentation by urbanization and cultivation along with natural forest succession are the most serious threats. Invasive species such as spotted knapweed are a threat because they may be too tall and thick for nesting.



Species range map: Cornell Lab of Ornithology

#### Population monitoring

Current survey effort: 1) N.A. Breeding Bird Survey (BBS), and 2) intermittent surveys – states and wildlife refuges.

Recommended monitoring: BBS considered adequate at this time. Need migration monitoring and monitoring on wintering areas in South America

#### Research to assist planning

Current and ongoing projects: Research in southwest Wisconsin is examining impacts of tree removal on grassland birds, including Upland Sandpipers.

Research needs: Need more information on demographics, particularly how many fledglings reach flight stage and proportion of 1 year olds that breed. Information is needed on numbers being harvested in South America. Currently there is little knowledge of the impacts of pesticides and herbicides. Further information is needed on migration habitat use and availability, plus an assessment of wintering habitat.

### Biological model results

Objective: Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Calculation:  $H = (d/2) * h$      $600 = (12,000/2) * 0.1$

H = minimum new habitat area required to eliminate deficit (km<sup>2</sup>)

d = regional population deficit (Upland sandpipers)

h = habitat area used / pair (km<sup>2</sup>)

Breakdown: Habitat objectives were stepped-down into State×BCR polygons based on the required habitat for the current population (protection) or the deficit (restoration) multiplied by the proportion of the population in each State×BCR polygon based on interpolated BBS data.

State	BCR	Habitat objectives (km <sup>2</sup> )	
		Protection	Restoration
IA	22	145	53
IA	23	4	1
IL	22	26	9
IL	23	2	1
IN	22	8	3
IN	24	2	1
KS	22	1,093	398
MI	12	41	15
MI	23	30	11
MN	12	18	7
MN	22	2	1
MN	23	7	3
MO	22	169	62
NE	22	37	13
OH	22	1	0
WI	12	20	7
WI	23	45	16
JV total		1,650	601

### Recommendations

Habitat actions: Maintain current grassland/openland area and improve vegetation structure on grasslands potentially suitable for upland sandpipers. Restore, enhance, or create 600 km<sup>2</sup> of grassland of appropriate size (>100 ha or > 50 ha within landscapes having existing openings) within current breeding range (see maps). Carter (1998) provides information on management of grasslands for Upland Sandpipers.

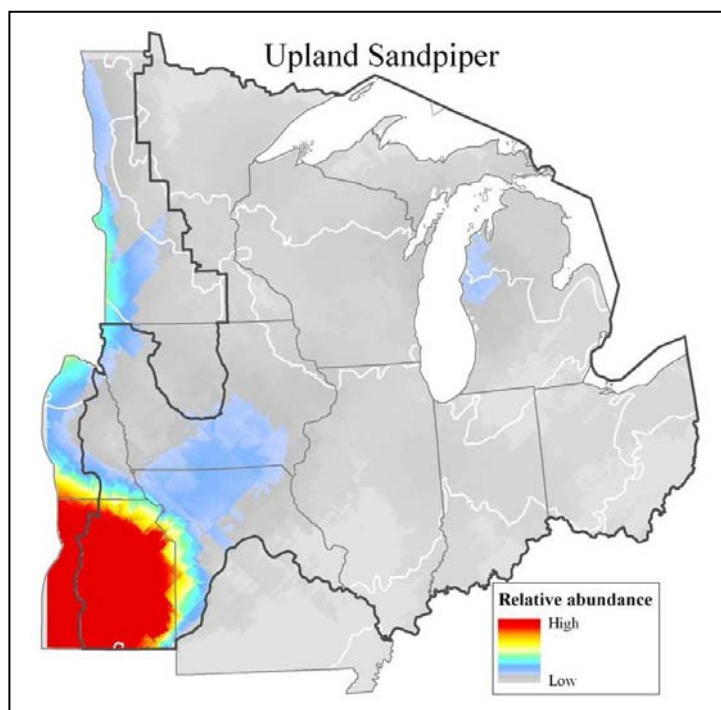
Monitoring and performance: BBS population monitoring is considered adequate for this region. For more accurate population trends, an annual census of known breeding locations can be conducted. Eliminating the current population deficit requires a 41% population increase. Therefore, conservation efforts should result in a 41% increase in the BBS index or an average annual increase of 2.3% for a 15 year period.

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## Relative abundance and distribution

Source: Interpolated from the N. A. Breeding Bird Survey (BBS) counts. Counts are the total number of Upland Sandpipers identified during the road-side survey, 1995-2004.



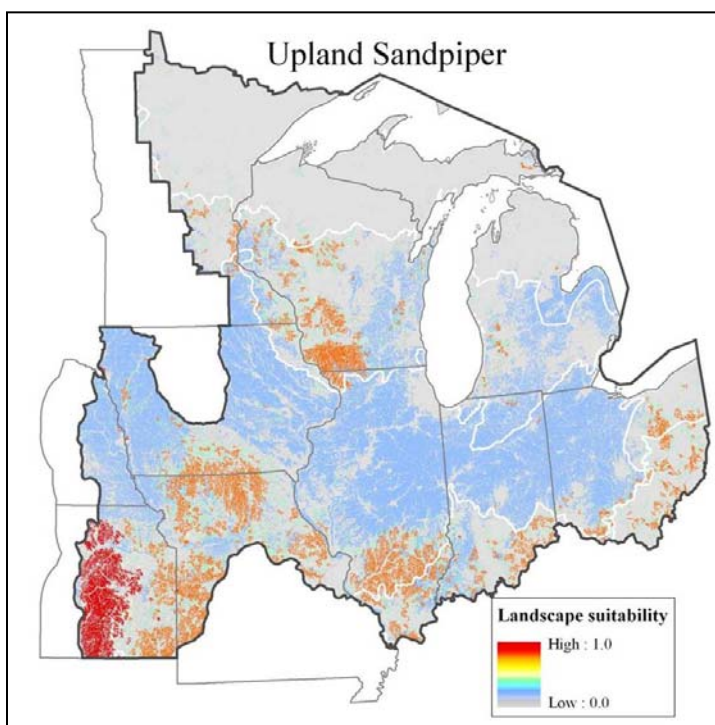
### Landscape Suitability Index (LSI)

Landscape suitability scores for cover types used by Upland Sandpipers (modified from Houston 2001) using the 1992 National Land Cover Dataset (NLCD). LSI scores closer to 1.0 represent greater suitability for Upland Sandpipers. Barrens and large forest clearcuts, which provide habitat particularly in BCR 12, are not represented on the LSI map due to lack of GIS coverage and the dynamic nature of these communities. A new NLCD (available in early 2007) may have better open-land representation.

Output options	LSI score
Grassland / herbaceous >200 ha	1.0
Pasture / hay >200 ha	0.8
Grassland >50 ha and <200 ha	0.5
Pasture / hay >50 ha and <200 ha	0.4
Cultivated land <sup>a</sup> >200 ha	0.2
Grassland >20 ha and <50 ha	0.1
Cultivated land >50 ha and < 200ha	0.1
Pasture / hay >20 ha and <50 ha	0.08
Cultivated land >20 ha and <50 ha	0.02

<sup>a</sup>Cultivated land is a combination of row crops and small grains.

*Caution: This is a landscape-scale cover type based model developed using species literature and expert opinion. It does not reflect site specific attributes (e.g., suitable nesting substrate) and landscape suitability scores do not reflect abundances at all locations.*





**American Woodcock (*Scolopax minor*)**  
Species Account for Habitat Planning

**Joint Venture population deficit based on  
American Woodcock Management Plan**

Population goal (singing males)	1,070,000
Current estimate (singing males)	860,000
Deficit (singing males)	212,000

**Breeding habitat requirements**

Community types: A variety of early-succession forest cover within close proximity. Male woodcock courtship displays occur on singing grounds which are typically forest “clearcuts,” natural openings, roads, pastures, cultivated fields, and agricultural fields reverting to grasses and brush. Young growth hardwood stands near singing grounds are used for nesting and brood rearing. Stem densities of nesting areas vary between 14,600-49,000 stems/ha.

Timing: Nesting occurs mid- to late-April, hatching in early- to mid-May, and young leave nest within hours.

Area / distance requirements: Singing grounds are typically >0.2 ha and near nesting areas. Nocturnal use areas consist of 3-5 ha openings within larger diurnal habitat. Ideal management would provide various aged early-succession forests stands on 200-400 ha tracts within 1-3 km of each other.

Limiting factors: Loss of early succession forest from maturation, declines in farm abandonment, drainage and conversion of bottomland hardwoods to agriculture and pine plantations, fire suppression, and urbanization.

**Migration habitat requirements**

Required community types: Little is known about migration habitat requirements or behavior. It is likely that similar habitat to breeding; early-succession forests are preferred.

Timing: February - April and September - November

Limiting factors: Loss of early succession forest and moist shrublands.

**Population monitoring**

Current survey effort: N.A. Breeding Bird Survey and Woodcock Singing Ground Survey

Recommended monitoring: Woodcock Singing Ground Survey

**Research to assist planning**

Current and ongoing projects: None identified in the JV region.

Research needs: Better understanding of habitat use during migration.

**Habitat model results**

Objective: To eliminate population deficit over a 15-year period through efficient and effective habitat management.



Species range map: Cornell Lab of Ornithology

**Calculation:** Habitat objectives developed by the Woodcock Task Force and presented in the American Woodcock Conservation Plan (Kelley 2006) were used for associated areas of the JV region. Objectives are based on restoring American Woodcock historic densities (1970s) with the current land base (See Kelley 2006 for details on objective calculations).

State	BCR	Habitat objectives (km <sup>2</sup> )	
		Protection	Restoration
IL	22	2,460	0
IL	23	22	20
IL	24	1,780	0
IN	22	760	1,080
IN	23	210	300
IN	24	1,200	2,060
MI	12	12,350	1,420
MI	22	0	140
MI	23	230	2,730
MN	12	6,320	300
MN	22	230	60
MN	23	2,000	570
OH	13	2,360	780
OH	22	1,100	1,610
OH	24	50	0
WI	12	3,230	1,300
WI	23	3,960	2,500
JV total		38,262	14,870

### Recommendations

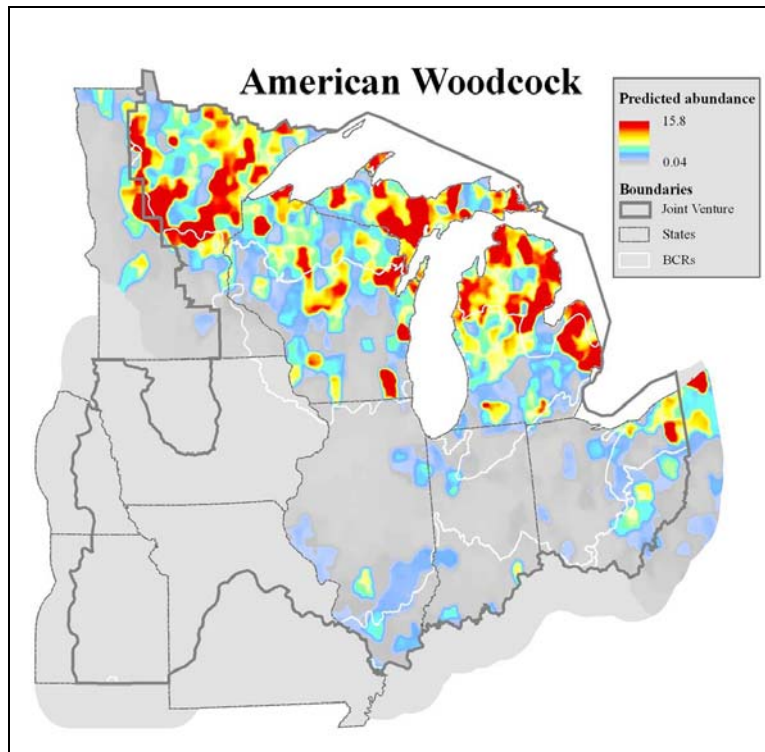
Maintain and protect current land area of early-succession forest and restore/enhance 14,870 km<sup>2</sup> of required breeding habitat. Reaching objectives should result in a halt of Woodcock population declines by 2012 and a positive population growth by 2022.

### References

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**Relative Abundance and distribution**

Predicted abundance and distribution of breeding American Woodcock based on North American Woodcock Singing Ground Survey counts, habitat, year effects, and observer effects (Thogmartin 2007). The western portion of the JV (e.g., Iowa, Missouri, southwestern Minnesota) is outside of the North American Woodcock Singing Ground Survey, but the species is rare to absent in much of this area.



**Whip-poor-will (*Caprimulgus vociferus*)**  
Species Account for Habitat Planning

**Joint Venture population deficit based on PIF  
Continental and State Plans**

Population goal	434,100
Current estimate	285,400
Deficit	148,700

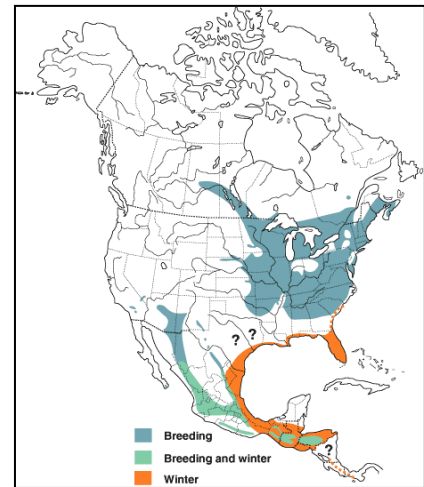
**Breeding habitat requirements**

Community types: Forest and open woodland, perhaps preferring even-aged pole-stage stands. Breeding habitat is usually in upland deciduous and mixed forests adjacent to large clearings. However, forest composition is not as important as the degree of openness in the understory. This species favors even-aged early succession habitats from regeneration to pole-stage stands and are mostly absent in mature stands with extensive, closed canopies.

Timing: April to August (egg-laying in late-April to early-July; second broods initiated about a month after the first brood; incubation is 19-21 days).

Area / distance: Minimum forest plot size needed for breeding is unknown, but small, isolated woodlots in agricultural areas provide Whip-poor-will habitat. Territory size reported to be 2.8-11.1 ha. Densities reported are 12.3 / km<sup>2</sup> (Kansas) and 5.3-6.7 / km<sup>2</sup> (Illinois).

Limiting factors: Habitat loss and degradation due to agriculture and development, forest maturation, lack of forest openings, and grazing have been blamed for local population declines. Ground nests are vulnerable to native and domestic predators.



Species range map: Cornell Lab of Ornithology

**Migration habitat requirements**

Community types: Likely forested areas similar to breeding habitat, poorly known due to difficulty locating birds.

Timing: April – May and September - October

Limiting factors: None identified for JV region.

**Population monitoring**

Current survey effort: 1) N.A. Breeding Bird Survey (BBS), 2) State Breeding Bird Atlas, and 3) intermittent roadside surveys targeting Whip-poor-wills.

Recommended monitoring: The BBS may be inadequate to assess Whip-poor-wills. The State Breeding Bird Atlas projects provide fair to good information on breeding distribution. Surveys conducted at night, dawn or dusk may better assess the distribution and population status.

**Research to assist planning**

Current and ongoing projects: None identified for JV region.

Research needs: Better information to assess population sizes, population trends, and causes of population changes; breeding bird habitat needs, minimum area requirements, and landscape

configurations optimal for breeding; foraging needs and energetics; adult and juvenile survival, dispersal, and demographics; migration corridors, stopover sites, and habitat needs during migration and on wintering grounds; and impacts of forest management practices.

### Habitat model results

**Objective:** Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and Bird Conservation Region (BCR) population estimates and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative concentration (birds/km <sup>2</sup> ) <sup>a</sup>	Density (birds/km <sup>2</sup> ) <sup>b</sup>	Habitat objectives (km <sup>2</sup> ) <sup>c</sup>	
			Estimate	Deficit			Protection	Restoration
MI	12	87,786	52,000	26,000	0.59	8.90	5,843	2,921
MN	12	87,301	8,800	4,200	0.10	8.90	989	472
WI	12	46,114	12,000	6,000	0.26	8.90	1,348	674
IA	22	108,344	14,000	7,000	0.13	8.90	1,573	787
IL	22	123,473	18,000	9,000	0.15	5.50	3,273	1,636
IN	22	44,701	4,100	2,100	0.09	8.90	461	236
KS	22	65,988	3,900	2,000	0.06	12.30	317	163
MO	22	82,886	77,000	43,000	0.93	8.90	8,652	4,831
NE	22	21,979	1,300	700	0.06	8.90	146	79
IA	23	7,312	1,400	2,100	0.19	8.90	157	236
MI	23	58,597	3,000	1,500	0.05	8.90	337	169
MN	23	49,845	6,900	3,100	0.14	8.90	775	348
WI	23	97,299	24,000	12,000	0.25	8.90	2,697	1,348
IL	24	18,710	18,000	9,000	0.96	5.50	3,273	1,636
IN	24	35,774	29,000	15,000	0.81	8.90	3,258	1,685
OH	28	30,912	12,000	6,000	0.39	8.90	1,348	674
JV total		967,021	285,400	148,700			34,447	17,896

<sup>a</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). This calculation can be used to compare the relative importance of State×BCR areas for this species.

<sup>b</sup>Reported density in quality habitat based on scientific literature.

<sup>c</sup>Protection objectives are the estimates / density in quality habitat, and restoration objectives are the deficits / density in quality habitat.

### Recommendations

**Habitat actions:** Protect existing habitat area, and add (restore / enhance) 27,000 km<sup>2</sup> of habitat (see requirements above) at multiple sites within current breeding range. Encourage sustainable timber management practices to provide successional habitats for breeding and foraging.

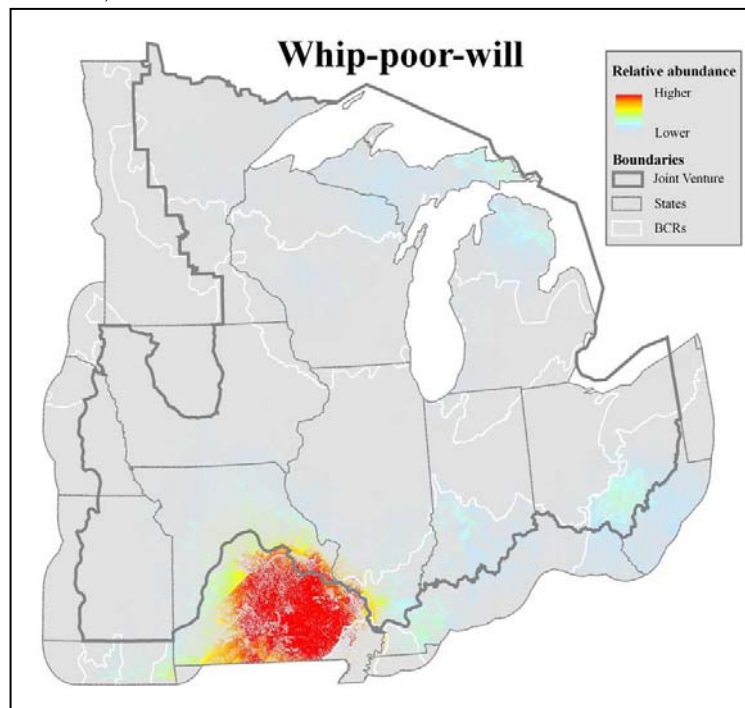
**Monitoring and performance:** Eliminating the current population deficit requires a 50% population increase. Management actions should result in a 50% increase in BBS index or an average of 3% annually over a 15 year period.

## References

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- Bushman, E.S. and G.D. Therres. 1988. Habitat management guidelines for forest interior birds of coastal Maryland. Maryland Department of Natural Resources, Wildlife Technical Publication 88-1.
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## Relative abundance and distribution

Source: Map shading represents relative abundance and distribution interpolated from BBS counts (1995-2004). Mapped areas include cover types typically used by breeding Whip-poor-wills (deciduous forest, evergreen forest, and mixed forest, NLCD 1992); all other cover types were removed (un-shaded).



## Chimney Swift (*Chaetura pelagica*)

### Species Account for Habitat Planning

#### Joint Venture population deficit based on PIF Continental and State Plans

Population goal	5,104,900
Current estimate	3,418,400
Deficit	1,686,500

#### Breeding habitat requirements

Community types: A variety of habitats across its breeding range with the largest concentrations in urban and suburban areas. In remote areas, species typically uses hollow trees, tree cavities, or caves.

Timing: May – July (egg laying May - July; incubation 16-21 days; young fledge 19 days).

Area / distance: Densities average 19.6 birds / km<sup>2</sup>.

Limiting factors: Most likely not habitat based. Changes in urban nest site availability (i.e., fewer chimneys) may be causing distribution and population changes. Mortality is often associated with factors related to chimneys (e.g., fire). Prolonged periods of cool and wet weather during the breeding season may depress insect abundance and survival of adults and their young.



Species range map: Cornell Lab of Ornithology

#### Migration habitat requirements

Community types: Chimneys in urban areas can be important during migration; flocks often roost in chimneys.

Timing: April – late-May and August – October.

Limiting factors: See above.

#### Population monitoring

Current survey effort: N.A. Breeding Bird Survey (BBS).

Recommended monitoring: The BBS may not be the most effective tool for surveying this species because routes are typically not placed in urban areas. There is a need for additional survey data to supplement the BBS. Trapping and banding Chimney Swifts at traditional roost sites during fall migration might provide a crude means to track population trends.

#### Research to assist planning

Current and ongoing projects: None identified for JV region.

Research needs: Information on use of rural areas and natural habitats. Particular concerns are the effects of forest fragmentation and loss of old-growth and very mature forests to nesting Chimney Swifts.

## Habitat model results

**Objective:** Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and Bird Conservation Region (BCR) population estimates and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative concentration (birds/km <sup>2</sup> ) <sup>a</sup>	Density (birds/km <sup>2</sup> ) <sup>b</sup>	Habitat objectives (km <sup>2</sup> ) <sup>c</sup>	
			Estimate	Deficit			Protection	Restoration
MI	12	87,786	52,000	26,000	0.59	19.6	2,653	1,327
MN	12	87,301	11,000	6,000	0.13	19.6	561	306
WI	12	46,114	28,000	14,000	0.61	19.6	1,429	714
OH	13	21,933	180,000	90,000	8.21	19.6	9,184	4,592
IA	22	108,344	330,000	170,000	3.05	19.6	16,837	8,673
IL	22	123,473	660,000	330,000	5.35	19.6	33,673	16,837
IN	22	44,701	200,000	100,000	4.47	19.6	10,204	5,102
KS	22	65,988	220,000	110,000	3.33	19.6	11,224	5,612
MN	22	10,587	8,800	4,200	0.83	19.6	449	214
MO	22	82,886	250,000	130,000	3.02	19.6	12,755	6,633
NE	22	21,979	93,000	47,000	4.23	19.6	4,745	2,398
OH	22	52,190	330,000	120,000	6.32	19.6	16,837	6,122
WI	22	1,475	1,400	700	0.95	19.6	71	36
IA	23	7,312	5,600	2,800	0.77	19.6	286	143
IL	23	3,278	16,000	8,000	4.88	19.6	816	408
IN	23	13,059	30,000	15,000	2.30	19.6	1,531	765
MI	23	58,597	71,000	39,000	1.21	19.6	3,622	1,990
MN	23	49,845	88,000	42,000	1.77	19.6	4,490	2,143
WI	23	97,299	230,000	120,000	2.36	19.6	11,735	6,122
IL	24	18,710	120,000	60,000	6.41	19.6	6,122	3,061
IN	24	35,774	220,000	110,000	6.15	19.6	11,224	5,612
OH	24	1,919	3,600	1,800	1.88	19.6	184	92
OH	28	30,912	270,000	140,000	8.73	19.6	13,776	7,143
JV total		1,071,463	3,418,400	1,686,500		19.6	174,408	86,046

<sup>a</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). This calculation can be used to compare the relative importance of State×BCR areas for this species.

<sup>b</sup>Reported density in quality habitat based on scientific literature.

<sup>c</sup>Protection objectives are the estimates / density in quality habitat, and restoration objectives are the deficits / density in quality habitat.

## Recommendations

**Habitat actions:** More demographic data is required to determine best conservation approaches.

**Monitoring and performance:** Eliminating the current population deficit requires a 50% population increase or an average annual increase of 3% over a 15 year period.

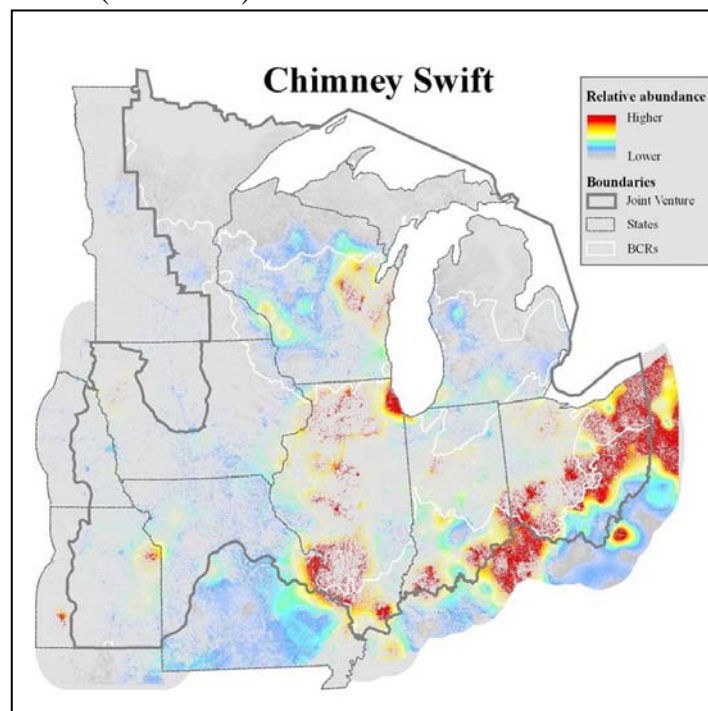


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## Relative abundance and distribution

Source: Map shading represents relative abundance and distribution interpolated from BBS counts (1995-2004). Mapped areas include cover types typically used by breeding Chimney Swifts (low intensity residential, high intensity residential, commercial / industrial / transportation, deciduous forest, evergreen forest, and mixed forest, NLCD 1992) ; all other cover types were removed (un-shaded).



**Red-headed Woodpecker (*Melanerpes erythrocephalus*)**  
Species Account for Habitat Planning

**Joint Venture population deficit based on PIF  
Continental and State Plans**

Population goal	1,937,000
Current estimate	968,500
Deficit	968,500

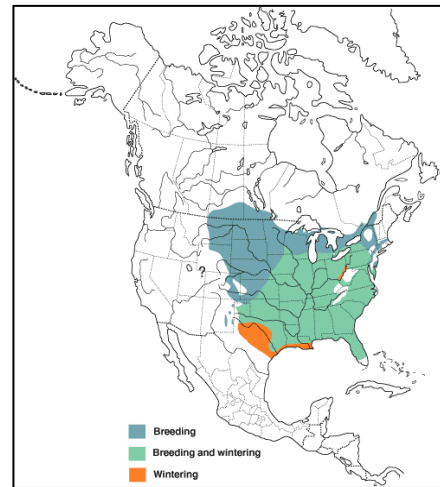
**Breeding habitat requirements**

Community types: Most common in oak savannas and prairie-forest transition areas; also found in bottomland hardwood forests. Nests most often in cavities of dead trees, but species also will use cavities in living trees. Cavities typically 2-24 m above ground.

Timing: May to July (egg laying May – June; incubation 12-14 days; young fledge 24-31 days).

Area / distance: Occur in forest fragments as small as 0.9 ha but are more consistently found in tracts >1.5 ha. Densities average 12 birds/km<sup>2</sup>, with maximum densities reaching 60 birds/km<sup>2</sup>.

Limiting factors: Suitable nesting sites, fire suppression, and invasive shrubs.



Species range map: Cornell Lab of Ornithology

**Migration and wintering habitat requirements**

Community types: Occurrence and abundance in winter appears to be greatly influenced by mast availability. Forested bottomlands and patches of forest within bottomlands with mast producing tree species appear to provide wintering and stopover sites during migration.

Timing: Not truly migratory. Often shift distribution during fall and winter to locations with greatest amount of mast.

Limiting factors: May be limited by winter acorn availability and will abandon areas with mast failure. Loss of bottomland forest may limit habitat availability of wintering Red-headed Woodpeckers.

**Population monitoring**

Current survey effort: 1) N.A. Breeding Bird Survey (BBS), 2) Christmas Bird Counts (CBC), and 3) surveys conducted with savanna restoration projects.

Recommended monitoring: Current monitoring appears adequate.

**Research to assist planning**

Current and ongoing projects: None identified for JV region.

Research needs: Although, existing research indicates that Red-headed Woodpeckers benefit from savanna and woodland restoration (Wilson et al. 1995, Davis et al. 2000), it is not known at what extent clearing of woody vegetation from prairies and savannas would be detrimental (Brad Jacobs, Missouri Department of Conservation, personal communication). This threshold should be identified. Better information is needed to evaluate characteristics of trees used for

nesting, including the size, species, bark condition and state of decay of the nest site (*in* Brown 1999).

### Habitat model results

**Objective:** Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and Bird Conservation Region (BCR) population estimates and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative concentration (birds/km <sup>2</sup> ) <sup>a</sup>	Density (birds/km <sup>2</sup> ) <sup>b</sup>	Habitat objectives (km <sup>2</sup> ) <sup>c</sup>	
			Estimate	Deficit			Protection	Restoration
MI	12	87,786	4,500	4,500	0.05	12	375	375
MN	12	87,301	4,800	4,800	0.05	12	400	400
WI	12	46,114	1,600	1,600	0.03	12	133	133
OH	13	21,933	9,000	9,000	0.41	12	750	750
IA	22	108,344	190,000	190,000	1.75	12	15,833	15,833
IL	22	123,473	140,000	140,000	1.13	12	11,667	11,667
IN	22	44,701	35,000	35,000	0.78	12	2,917	2,917
KS	22	65,988	80,000	80,000	1.21	12	6,667	6,667
MI	22	4,242	3,400	3,400	0.80	12	283	283
MN	22	10,587	9,000	9,000	0.85	12	750	750
MO	22	82,886	200,000	200,000	2.41	12	16,667	16,667
NE	22	21,979	60,000	60,000	2.73	12	5,000	5,000
OH	22	52,190	24,000	24,000	0.46	12	2,000	2,000
WI	22	1,475	500	500	0.34	12	42	42
IA	23	7,312	9,400	9,400	1.29	12	783	783
IL	23	3,278	3,100	3,100	0.95	12	258	258
IN	23	13,059	8,000	8,000	0.61	12	667	667
MI	23	58,597	8,000	8,000	0.14	12	667	667
MN	23	49,845	32,000	32,000	0.64	12	2,667	2,667
WI	23	97,299	68,000	68,000	0.70	12	5,667	5,667
IL	24	18,710	34,000	34,000	1.82	12	2,833	2,833
IN	24	35,774	42,000	42,000	1.17	12	3,500	3,500
OH	28	30,912	2,200	2,200	0.07	12	183	183
JV total		1,073,785	968,500	968,500			80,708	80,708

<sup>a</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). This calculation can be used to compare the relative importance of State×BCR areas for this species.

<sup>b</sup>Reported density in quality habitat based on scientific literature.

<sup>c</sup>Protection objectives are the estimates / density in quality habitat, and restoration objectives are the deficits / density in quality habitat.

### Recommendations

**Habitat actions:** Protect existing habitat area and quality, and add (restore / enhance) 81,000 km<sup>2</sup> of habitat (see requirements above) at multiple sites within current breeding range.

Maintaining a savanna landscape through periodic fire and healthy mast producing trees is

important. Restoration of floodplain forests to promote a diversity of oaks would benefit species during migration and winter.

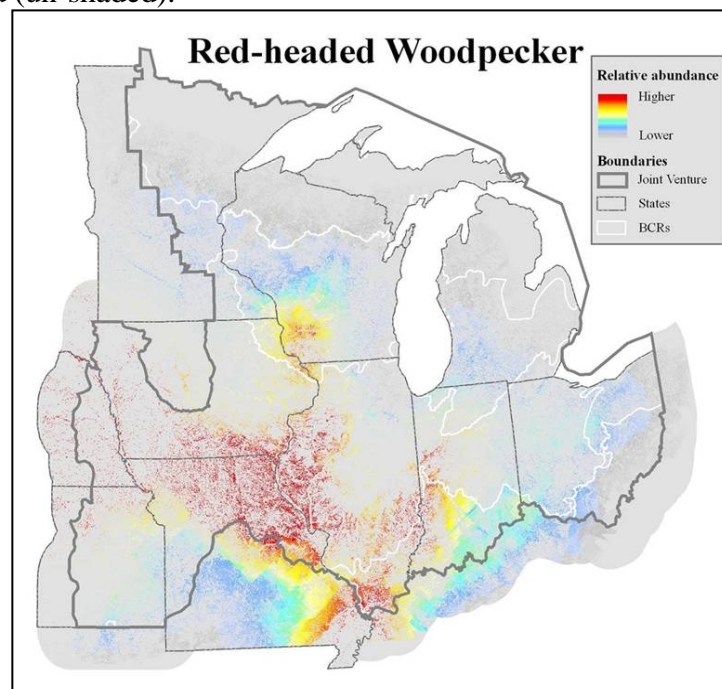
**Monitoring and performance:** Eliminating the current population deficit requires a 100% population increase or an average annual increase of 5% over a 15 year period.

## References

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## Relative abundance and distribution

**Source:** Map shading represents relative abundance and distribution interpolated from BBS counts (1995-2004). Mapped areas include cover types typically used by breeding Red-headed Woodpeckers (transitional forested upland and deciduous forest, NLCD 1992); all other cover types were removed (un-shaded).



**Olive-sided Flycatcher (*Contopus cooperi*)**  
Species Account for Habitat Planning

**Joint Venture population deficit based on PIF  
Continental and State Plans**

Population goal	14,460
Current estimate	7,230
Deficit	7,230

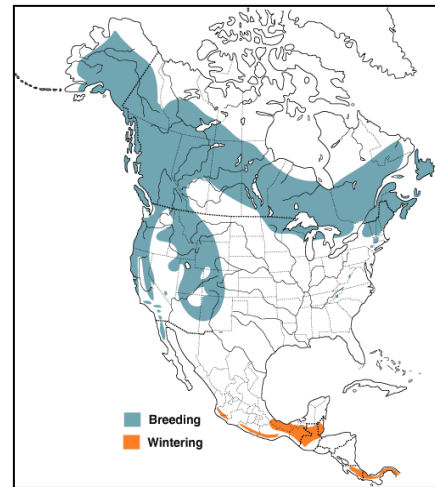
**Breeding habitat requirements**

Community types: Conifer forest including muskeg, and jack pine; breeds primarily in openings that contain snags. Often found along edges of waterways, harvested forest units, and burn sites. Nest typically 1.5-34 m high near the tip of a horizontal branch.

Timing: May to July (egg laying May – June; incubation 15-19 days; young fledge 15-20 days).

Area / distance: Territories are large, typically ranging from 10-15 ha, largest 45 ha. Territories are rarely adjacent to each other and usually separated by unfavorable habitat. Densities range from 4-13 birds/km<sup>2</sup>, with an average of 8.5 birds/km<sup>2</sup>.

Limiting factors: Loss of quantity and quality of breeding habitat due to fire suppression, deforestation, and conversion.



Species range map: Cornell Lab of Ornithology

**Migration habitat requirements**

Community types: Species uses a wide range of cover but is typically found near tall snags.

Timing: May - June and July – September.

Limiting factors: Loss of migration or wintering habitat may limit population growth.

**Population monitoring**

Current survey effort: 1) N.A. Breeding Bird Survey (BBS).

Recommended monitoring: The BBS may be inadequate due to the patchy distribution of the species. Species-specific monitoring may be needed to better describe population trends. Ideally, this would be done during Breeding Bird Atlas work.

**Research to assist planning**

Current and ongoing projects: None identified for JV region.

Research needs: Demographic work is needed, specifically productivity on the breeding grounds. Species may be limited on wintering areas and identification of habitat and habitat trends must be completed to determine if decline is due to breeding or wintering areas.

### Habitat model results

**Objective:** Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and Bird Conservation Region (BCR) population estimates and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative concentration (birds/km <sup>2</sup> ) <sup>a</sup>	Density (birds/km <sup>2</sup> ) <sup>b</sup>	Habitat objectives (km <sup>2</sup> ) <sup>c</sup>	
			Estimate	Deficit			Protection	Restoration
MI	12	87,786	1,500	1,500	0.02	8.5	176	176
MN	12	87,301	4,800	4,800	0.05	8.5	565	565
WI	12	46,114	750	750	0.02	8.5	88	88
MN	23	49,845	60	60	0.00	8.5	7	7
WI	23	97,299	120	120	0.00	8.5	14	14
JV total		368,345	7,230	7,230			851	851

<sup>a</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). This calculation can be used to compare the relative importance of State×BCR areas for this species.

<sup>b</sup>Reported density in quality habitat based on scientific literature.

<sup>c</sup>Protection objectives are the estimates / density in quality habitat, and restoration objectives are the deficits / density in quality habitat.

### Recommendations

**Habitat actions:** Protect existing habitat area and quality, and add (restore / enhance) 851 km<sup>2</sup> of habitat (see requirements above) at multiple sites within current range. Forest management should focus on leaving gaps and snags to provide key habitat components.

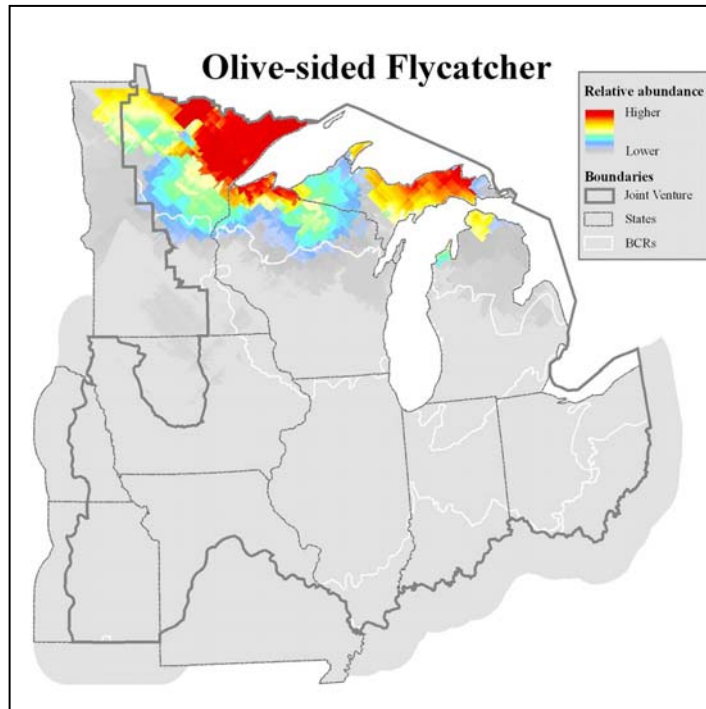
**Monitoring and performance:** Eliminating the current population deficit requires a 100% population increase or an average annual increase of 5% over a 15 year period.

### References

- Altman, B., and R. Sallabanks. 2000. Olive-sided Flycatcher (*Contopus cooperi*). In The Birds of North America, No. 502 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Brewer, R., G.A. McPeck and R.J. Adams, Jr. 1991. The atlas of breeding birds of Michigan. Michigan State University Press, East Lansing.

**Relative abundance and distribution**

Source: Map shading represents relative abundance and distribution interpolated from BBS counts (1995-2004). Cover types typically used by Olive-sided Flycatchers were not identifiable using existing regional spatial data (NLCD 1992), thus some areas within the shaded boundary are unimportant to species.





**Willow Flycatcher (*Empidonax traillii*)**  
Species Account for Habitat Planning

**Joint Venture population deficit based on PIF  
Continental and State Plans**

Population goal	612,875
Current estimate	403,140
Deficit	209,735

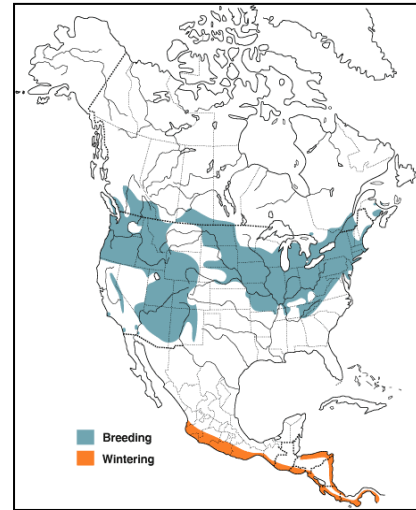
**Breeding habitat requirements**

Community types: Moist, shrubby areas, often with standing or running water, and along wet and/or shrubby woodlands, forest edges and openings. Species is often associated with clumps of willow (*Salix* spp.) although a variety of other shrub species are also used. Nest placed in the crotch of a branch of a shrub or tree approximately 1-2 m above the ground.

Timing: Mid-May to July (egg laying June to July; incubation 12-14 days; young fledge 14-15 days).

Area / distance: The mean territory size is approximately 1-1.5 ha. Densities range from 7-11 territories / km<sup>2</sup>, with an average of 8.5 territories / km<sup>2</sup>.

Limiting factors: Loss and degradation of riparian and isolated wetlands. Cattle grazing in riparian zones can damage otherwise suitable habitat. This species is also vulnerable to parasitism by Brown-headed Cowbird.



Species range map: Cornell Lab of Ornithology

**Migration habitat requirements**

Community types: Similar to breeding habitat; found in riparian woodlands, shrublands, and shrub patches in agricultural landscapes. Species seems to prefer willow-dominated habitats.

Timing: Mid-May – June and August – September.

Limiting factors: Loss of habitat, especially wet shrublands.

**Population monitoring**

Current survey effort: 1) N.A. Breeding Bird Survey (BBS).

Recommended monitoring: Expanding the BBS to include more routes and site-specific monitoring would yield better population status data.

**Research to assist planning**

Current and ongoing projects: None identified for JV region.

Research needs: None identified for JV region.



## Habitat model results

**Objective:** Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and Bird Conservation Region (BCR) population estimates and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative concentration (birds/km <sup>2</sup> ) <sup>a</sup>	Density (birds/km <sup>2</sup> ) <sup>b</sup>	Habitat objectives (km <sup>2</sup> ) <sup>c</sup>	
			Estimate	Deficit			Protection	Restoration
MI	12	87,786	11,000	6,000	0.13	18	611	333
MN	12	87,301	3,900	2,000	0.04	18	217	111
WI	12	46,114	610	305	0.01	18	34	17
OH	13	21,933	46,000	23,000	2.10	18	2,556	1,278
IA	22	108,344	33,000	17,000	0.30	18	1,833	944
IL	22	123,473	29,000	15,000	0.23	18	1,611	833
IN	22	44,701	27,000	14,000	0.60	18	1,500	778
KS	22	65,988	1,500	800	0.02	18	83	44
MI	22	4,242	3,400	1,700	0.80	18	189	94
MN	22	10,587	1,800	900	0.17	18	100	50
MO	22	82,886	3,300	1,700	0.04	18	183	94
NE	22	21,979	760	340	0.03	18	42	19
OH	22	52,190	40,000	20,000	0.77	18	2,222	1,111
WI	22	1,475	1,600	800	1.08	18	89	44
IA	23	7,312	2,900	1,500	0.40	18	161	83
IL	23	3,278	1,300	700	0.40	18	72	39
IN	23	13,059	16,000	8,000	1.23	18	889	444
MI	23	58,597	51,000	26,000	0.87	18	2,833	1,444
MN	23	49,845	6,200	3,100	0.12	18	344	172
WI	23	97,299	70,000	40,000	0.72	18	3,889	2,222
IL	24	18,710	790	400	0.04	18	44	22
IN	24	35,774	9,700	5,300	0.27	18	539	294
OH	24	1,919	380	190	0.20	18	21	11
OH	28	30,912	42,000	21,000	1.36	18	2,333	1,167
JV total			403,140	209,735			22,397	11,652

<sup>a</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). This calculation can be used to compare the relative importance of State×BCR areas for this species.

<sup>b</sup>Reported density in quality habitat based on scientific literature.

<sup>c</sup>Protection objectives are the estimates / density in quality habitat, and restoration objectives are the deficits / density in quality habitat.

## Recommendations

**Habitat actions:** Protect existing habitat area and quality, and add (restore / enhance) 12,000 km<sup>2</sup> of habitat (see requirements above) at multiple sites within current breeding range.

**Monitoring and performance:** Eliminating the current population deficit requires a 50% population increase. Management actions should result in a 50% increase or an average annual increase of 3% over a 15 year period.

### Additional background

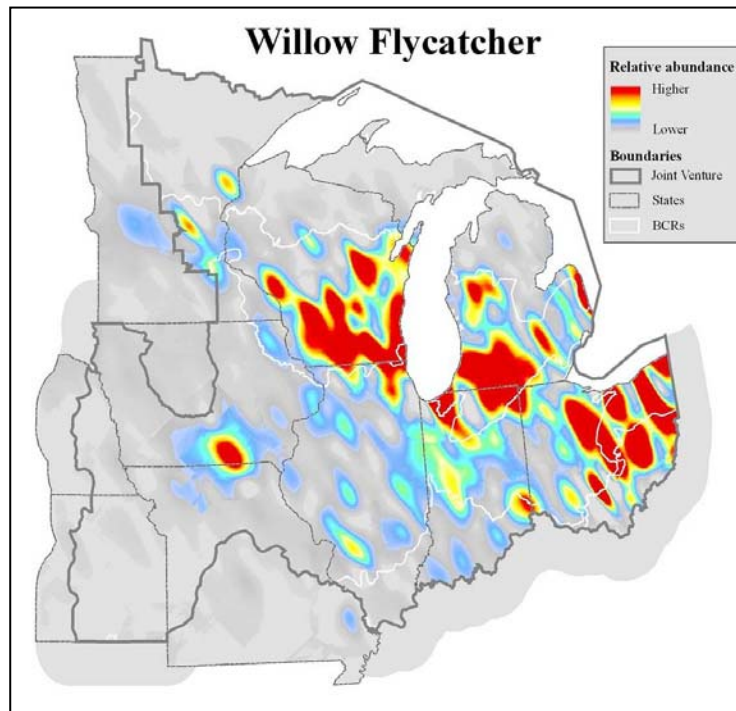
The Missouri Comprehensive Wildlife Strategy, Audubon Missouri Important Bird Areas, The Nature Conservancy's ecoregion portfolio sites and other partners with wetland focus areas identified in each state of the Joint Venture region that may provide habitat for Willow Flycatchers. Many other data layers are available that will be useful in local-scale planning, including aerial photography, infrared imagery and other similar data.

### References

- Brewer, R., G.A. McPeck and R.J. Adams, Jr. 1991. The atlas of breeding birds of Michigan. Michigan State University Press, East Lansing.
- Sedgwick, J. A. 2000. Willow Flycatcher (*Empidonax traillii*). In The Birds of North America, No. 533 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

### Relative abundance and distribution

Source: Map shading represents relative abundance and distribution interpolated from BBS counts (1995-2004). Cover types typically used by Willow Flycatchers were not identifiable using existing regional spatial data (NLCD 1992), thus some areas (e.g., urban) within the shaded boundary are unimportant to species.



**Veery (*Catharus fuscescens*)**  
Species Account for Habitat Planning

**Joint Venture population deficit based on PIF  
Continental and State Plans**

Population goal	2,189,000
Current estimate	1,466,000
Deficit	723,000

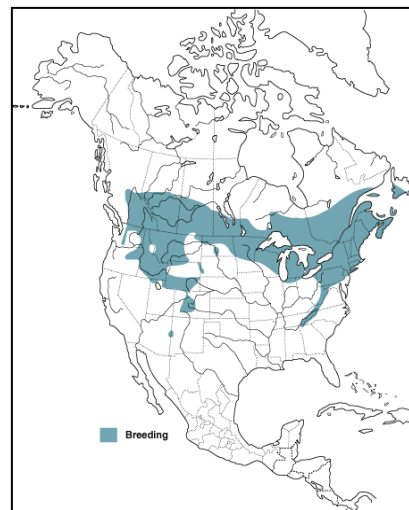
**Breeding habitat requirements**

Community types: Considered a forest habitat generalist and is most often associated with moist deciduous forests and riparian areas that have a dense understory. Densities appear to be highest in early successional forests and populations tend to decline as forests mature and as the density of understory vegetation decreases. Nests are located on the ground or <1.5 m above the ground, typically located at the base of a bush or small deciduous tree.

Timing: Mid-May – July (egg laying mid-May – late-June; incubation 10-14 days; young fledge at 14 days).

Area / distance: Area sensitive; found primarily in forest patches >100 ha and there is only a 50% probability of occurrence in patches <20 ha. Territory size ranges from 0.1 to several hectares. Densities range from 100-200 birds / km<sup>2</sup>, with an average of 150 birds / km<sup>2</sup>.

Limiting factors: Habitat fragmentation and loss of young growth forest likely contributes to long-term population declines. Forest fragmentation also increases likelihood of Brown-headed Cowbird parasitism in some regions.



Species range map: Cornell Lab of Ornithology

**Migration habitat requirements**

Community types: Found in dense forest understory vegetation of all forest types during migration.

Timing: Late-April – early-May and late-August – early-September.

Limiting factors: Habitat loss on the wintering grounds is a concern.

**Population monitoring**

Current survey effort: 1) N.A. Breeding Bird Survey (BBS).

Recommended monitoring: The BBS is considered adequate although may not accurately assess all areas of the region.

**Research to assist planning**

Current and ongoing projects: None identified for JV region.

Research needs: Evaluate the impacts of habitat loss, fragmentation and succession on demographics. Density information in varying cover types would help improve population-habitat models. The locations where Veerys overwinter also are largely unknown.

## Habitat model results

**Objective:** Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and Bird Conservation Region (BCR) population estimates and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative concentration (birds/km <sup>2</sup> ) <sup>a</sup>	Density (birds/km <sup>2</sup> ) <sup>b</sup>	Habitat objectives (km <sup>2</sup> ) <sup>c</sup>	
			Estimate	Deficit			Protection	Restoration
MI	12	87,786	280,000	140,000	3.19	150	1,867	933
MN	12	87,301	740,000	360,000	8.48	150	4,933	2,400
WI	12	46,114	240,000	120,000	5.20	150	1,600	800
MI	23	58,597	24,000	12,000	0.41	150	160	80
MN	23	49,845	62,000	31,000	1.24	150	413	207
WI	23	97,299	120,000	60,000	1.23	150	800	400
JV total			1,466,000	723,000			9,773	4,820

<sup>a</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). This calculation can be used to compare the relative importance of state / BCR areas for this species.

<sup>b</sup>Reported density for this species in quality habitat based on scientific literature.

<sup>c</sup>Protection objectives are the estimates / density in quality habitat, and restoration objectives are the deficits / density in quality habitat.

## Recommendations

**Habitat actions:** Protect existing habitat area, and add (restore / enhance) 4,800 km<sup>2</sup> of habitat (see requirements above) at multiple sites within current breeding range. Forest blocks >100 ha with a dense understory is optimal for breeding Veerys (see references for management recommendations).

**Monitoring and performance:** Eliminating the current population deficit requires a 50% population increase. Management actions should result in a 50% increase in BBS index or an average of 3% annually over a 15 year period.

## Additional background

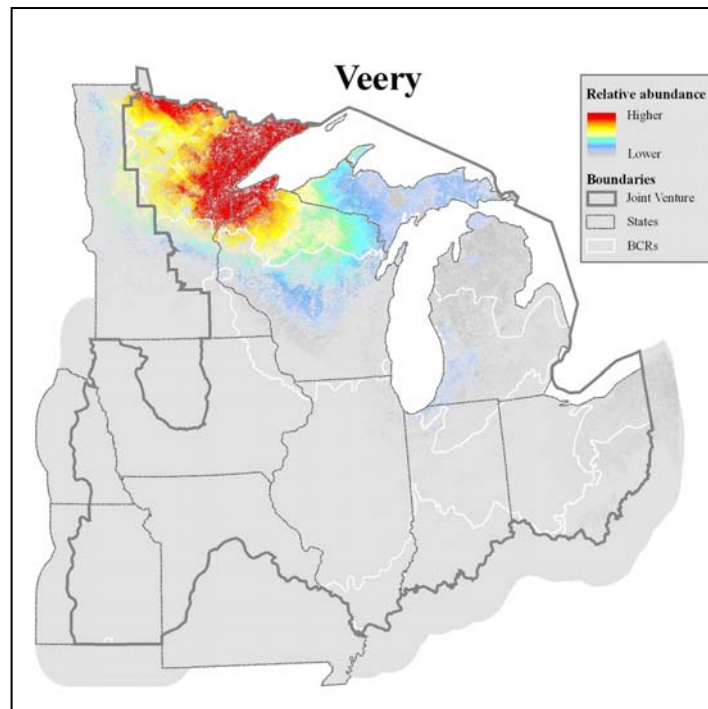
Sites within The Nature Conservancy's Great Lakes ecoregion with >25 pairs (The Nature Conservancy 1999) include: Michigan (Houghton Lake marshes, Reese's Swamp, Allegan State Game Area, Galien River/Warren Woods, Barry State Game Area, Fort Custer/Kalamazoo River, Baraga Plains, Floodwood outwash [Upper Peninsula], McCormick tract, Menominee River, Porcupine Mountains, Brule River, Fence River, Michigamme Highlands) Ohio (Oak Openings, Chagrin River, Cuyahoga River, Grand River State Wildlife Area, Ravenna Arsenal), Wisconsin (Kakagon/Bad River, Penokees, St. Peter's Dome, Baraboo Hills, Glacial Lake Wisconsin West, Kettle Moraine North, Kettle Moraine South, Lower Chippewa, Lower Wisconsin, Upper Mississippi Refuge/Trempealeau, Cathrine Lake, Headwaters Wilderness, and Moose River Forested Wetlands).

## References

- Bevier, L., A. F. Poole, and W. Moskoff. (2004). Veery (*Catharus fuscescens*). The Birds of North America Online. (A. Poole, Ed.) Ithaca: Cornell Laboratory of Ornithology; Retrieved from The Birds of North American Online database: <http://bna.birds.cornell.edu/BNA/account/Veery/>.
- Brewer, R., G.A. McPeck and R.J. Adams, Jr. 1991. The atlas of breeding birds of Michigan. Michigan State University Press, East Lansing.
- Peck, G.K. and R.D. James. 1987. Breeding birds of Ontario: nidology and distribution. Volume 2. Royal Ontario Museum, Toronto.

## Relative abundance and distribution

Source: Map shading represents relative abundance and distribution interpolated from BBS counts (1995-2004). Mapped areas include cover types typically used by breeding Veeries (deciduous forest, mixed forest, and woody wetlands, NLCD 1992); all other cover types were removed (un-shaded).



**Wood Thrush (*Hylochicla mustelina*)**  
Species Account for Habitat Planning

**Joint Venture population deficit based on PIF  
Continental and State Plans**

Population goal	2,102,450
Current estimate	1,402,530
Deficit	699,920

**Breeding habitat requirements**

Community types: Edges and interior portions of mature mesic deciduous or mixed forests with a well developed understory. Optimal habitat consists of bottomland hardwood forest. Nest located in a crotch or saddle (<6m above the ground) on a horizontal branch with a fork and often located on the distal portion, rarely against the trunk.

Timing: May to July (egg laying May to June; incubation 11-13 days; young fledge in 12-15 days).

Area / distance: Juveniles move up to 4.7 km from nest sites to find dense undergrowth. Approximately 3 ha are required to support a pair of Wood Thrushes. This does not account for post-breeding areas where birds molt and prepare for fall migration. Daily survival rates of eggs and young are less in edge (< 200 m from edge of the forest) than the interior in fragmented landscapes (<50% forested) but not in intact landscapes (>75% forested). Productivity is higher in 15 ha woodlots compared to those <2.1 ha. Densities range from 20-400 birds / km<sup>2</sup>, with an average 100 birds / km<sup>2</sup>.

Limiting factors: Degradation and fragmentation of breeding habitat. Reproductive success in fragmented areas has been affected by predation and parasitism by Brown-headed Cowbird.



Species range map: Cornell Lab of Ornithology

**Migration habitat requirements**

Community types: Little known, but thought to consist of deciduous forest and woodland areas, sometimes thickets and scrub. Scrub may be used more often in fall, when fruit is relatively abundant.

Timing: Late April – May and Mid-August – October.

Limiting factors: Habitat loss on migratory routes.

**Population monitoring**

Current survey effort: 1) N.A. Breeding Bird Survey (BBS).

Recommended monitoring: The BBS may be insufficient as Wood Thrushes prefer the interior of forest. Species-specific surveys would provide a better estimate of population trend.

**Research to assist planning**

Current and ongoing projects: Nesting success in urban, agricultural, and silvicultural landscapes in Ohio.

Research needs: None identified in JV region.

## Habitat model results

**Objective:** Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and Bird Conservation Region (BCR) population estimates and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative concentration (birds/km <sup>2</sup> ) <sup>a</sup>	Density (birds/km <sup>2</sup> ) <sup>b</sup>	Habitat objectives (km <sup>2</sup> ) <sup>c</sup>	
			Estimate	Deficit			Protection	Restoration
MI	12	87,786	83,000	37,000	0.95	100	830	370
MN	12	87,301	51,000	26,000	0.58	100	510	260
WI	12	46,114	63,000	32,000	1.37	100	630	320
OH	13	21,933	66,000	33,000	3.01	100	660	330
IA	22	108,344	14,000	7,000	0.13	100	140	70
IL	22	123,473	34,000	17,000	0.28	100	340	170
IN	22	44,701	47,000	24,000	1.05	100	470	240
KS	22	65,988	2,100	1,100	0.03	100	21	11
MI	22	4,242	9,300	4,700	2.19	100	93	47
MN	22	10,587	630	320	0.06	100	6	3
MO	22	82,886	23,000	12,000	0.28	100	230	120
NE	22	21,979	3,500	1,800	0.16	100	35	18
OH	22	52,190	76,000	34,000	1.46	100	760	340
WI	22	1,475	600	300	0.41	100	6	3
IA	23	7,312	600	300	0.08	100	6	3
IL	23	3,278	4,800	2,400	1.46	100	48	24
IN	23	13,059	22,000	11,000	1.68	100	220	110
MI	23	58,597	100,000	50,000	1.71	100	1,000	500
MN	23	49,845	22,000	11,000	0.44	100	220	110
WI	23	97,299	100,000	50,000	1.03	100	1,000	500
IL	24	18,710	58,000	29,000	3.10	100	580	290
IN	24	35,774	180,000	90,000	5.03	100	1,800	900
OH	24	1,919	12,000	6,000	6.25	100	120	60
OH	28	30,912	430,000	220,000	13.91	100	4,300	2,200
JV total			1,402,530	699,920			14,025	6,999

<sup>a</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). This calculation can be used to compare the relative importance of state / BCR areas for this species.

<sup>b</sup>Reported density for this species in quality habitat based on scientific literature.

<sup>c</sup>Protection objectives are the estimates / density in quality habitat, and restoration objectives are the deficits / density in quality habitat.

## Recommendations

**Habitat actions:** Protect existing habitat area and quality, and add (restore / enhance) 7,000 km<sup>2</sup> of habitat (see requirements above) at multiple sites within current breeding range.

Connecting existing forest to achieve large habitat blocks with minimal edge is desirable.

**Monitoring and performance:** Eliminating the current population deficit requires a 50% population increase or an average annual increase of 3% over a 15 year period.

### Additional background

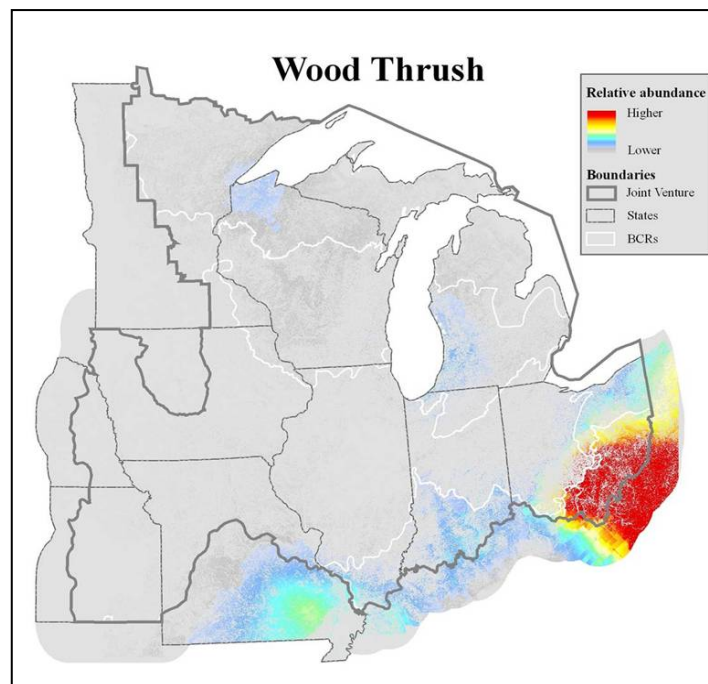
In northern Indiana, the density of Wood Thrush nests ranges from 9.9-32.1 / km<sup>2</sup> (mean = 6.5 ha / nest) which would result in a requirement of 3,250 ha to support 500 pairs. This assumes all forest habitat is used, which is unlikely. Furthermore, juvenile Wood Thrushes move up to 4.7 km to dense undergrowth post-breeding (Sanders et al. 1998) so the area requirements noted here may be conservative. Robinson (1995) and Trine (1998) concluded that forest tracts >1000 ha in Illinois are population sinks in most years. This was confirmed by Fauth (2000) in northern Indiana.

### References

- Fauth, P.T. 2000. Reproductive success of Wood Thrushes in forest fragments in northern Indiana. *Auk* 117:194-204.
- Robinson, S.K. and J. P. Hoover. 1995. Effects of landscape fragmentation on migrant songbirds: implications for floodplain restoration. Final report on Project P-001-W of the Illinois Natural History Survey.
- Roth, R. R., M. S. Johnson, and T. J. Underwood. 1996. Wood Thrush (*Hylocichla mustelina*). In *The Birds of North America*, No. 246 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.
- Trine, C. 1998. Wood Thrush population sinks and implications for the scale of regional conservation strategies. *Conservation Biology* 12:576-585.

### Relative abundance and distribution

Source: Map shading represents relative abundance and distribution interpolated from BBS counts (1995-2004). Mapped areas include cover types typically used by breeding Wood Thrush (deciduous forest and mixed forest, NLCD 1992); all other cover types in the species range were removed (un-shaded).





**Blue-winged Warbler (*Vermivora pinus*)**  
Species Account for Habitat Planning

**Joint Venture population deficit based on PIF  
Continental and State Plans**

Population goal	143,390
Current estimate	95,090
Deficit	48,300

**Breeding habitat requirements**

Community types: Breeds in early- to mid-successional shrub or thickets. Prefers shrub layer that is dense with a canopy <7 m high. Often found near power line rights-of-way, roads, or edges of clearcuts. Nests are located 20 m inside to 30 m outside forest edge. Usually nest on or near the ground (<30 cm high) well concealed by leafy material.

Timing: May – July (egg laying late-May – June; incubation 10-12 days; young fledge 8-10 days).

Area / distance: Not considered area sensitive. Territory size varies from 0.3-5 ha (average 1.1 ha). Average density in optimal habitat is 50 birds / km<sup>2</sup>.

Limiting factors: Conversion and degradation of habitat by anthropogenic uses and succession of abandoned farmland.



Species range map: Cornell Lab of Ornithology

**Migration habitat requirements**

Community types: Similar to breeding habitat; dense thickets or shrubs.

Timing: May – June and August – September.

Limiting factors: See limiting factors above.

**Population monitoring**

Current survey effort: 1) N.A. Breeding Bird Survey (BBS).

Recommended monitoring: The BBS is considered adequate to assess population status.

**Research to assist planning**

Current and ongoing projects: Research on edge and area-sensitivity in Ohio.

Research needs: An evaluation of the interactions of Blue-winged Warblers with Golden-winged warblers.

## Habitat model results

**Objective:** Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and Bird Conservation Region (BCR) population estimates and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative concentration (birds/km <sup>2</sup> ) <sup>a</sup>	Density (birds/km <sup>2</sup> ) <sup>b</sup>	Habitat objectives (km <sup>2</sup> ) <sup>c</sup>	
			Estimate	Deficit			Protection	Restoration
MI	12 <sup>d</sup>	87,786	1300	700	0.01	50	26	14
WI	12 <sup>d</sup>	46,114	60	30	0.00	50	1	1
OH	13	21,933	7600	3400	0.35	50	152	68
IA	22	108,344	1000	400	0.01	50	20	8
IL	22	123,473	300	150	0.00	50	6	3
MO	22	82,886	1600	800	0.02	50	32	16
OH	22	52,190	900	500	0.02	50	18	10
WI	22	1,475	430	220	0.29	50	9	4
IN	23	13,059	800	500	0.06	50	16	10
MI	23	58,597	17000	9000	0.29	50	340	180
MN	23	49,845	3600	1800	0.07	50	72	36
WI	23	97,299	12,000	6,000	0.12	50	240	120
IL	24	18,710	1,400	700	0.07	50	28	14
IN	24	35,774	4,600	2,300	0.13	50	92	46
OH	24	1,919	1,500	800	0.78	50	30	16
OH	28	30,912	41,000	21,000	1.33	50	820	420
JV total			95,090	48,300			1,902	966

<sup>a</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). This calculation can be used to compare the relative importance of state×BCR areas for this species.

<sup>b</sup>Reported density for this species in quality habitat based on scientific literature.

<sup>c</sup>Protection objectives are the estimates / density in quality habitat, and restoration objectives are the deficits / density in quality habitat.

<sup>d</sup>Habitat objectives should be shifted to BCRs 23 and 24 due to antagonistic behavior between Blue-winged Warblers and Golden-winged Warblers.

## Recommendations

**Habitat actions:** Protect existing habitat area and quality, and add (restore / enhance) 1,000 km<sup>2</sup> of habitat (see requirements above) in current breeding range. Species needs early succession habitats and associated forest management; selective cutting is not beneficial to this species.

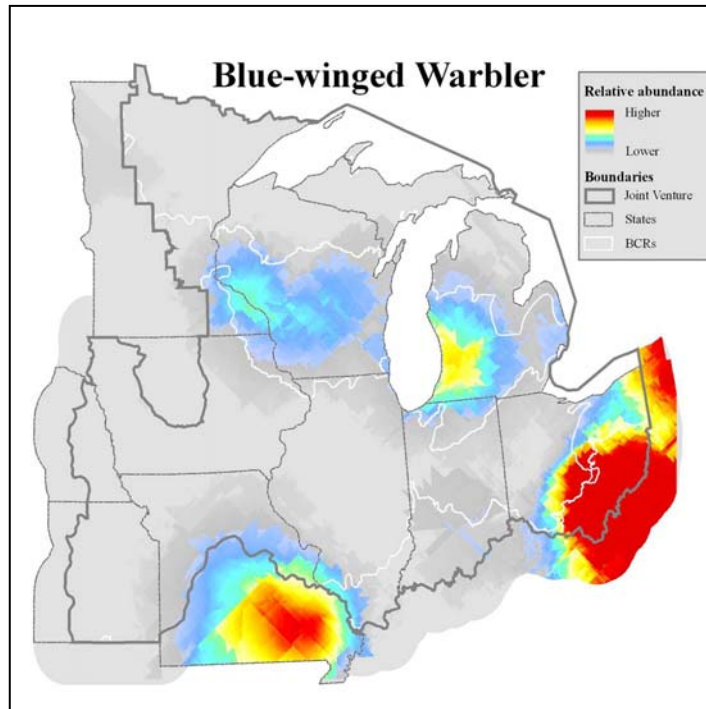
**Monitoring and performance:** Eliminating the current population deficit requires a 50% population increase or an average annual increase of 3% over a 15 year period.

## References

Gill, F. B., R. A. Canterbury, and J. L. Confer. 2001. Blue-winged Warbler (*Vermivora pinus*). In The Birds of North America, No. 584 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

**Relative abundance and distribution**

Source: Map shading represents relative abundance and distribution interpolated from BBS counts (1995-2004). Cover types used by breeding Blue-winged Warblers were not identifiable using existing regional spatial data (NLCD 1992), thus some areas (e.g., urban) within the shaded boundary are unimportant to species.



**Golden-winged Warbler (*Vermivora chrysoptera*)**  
Species Account for Habitat Planning

**Joint Venture population deficit based on PIF  
Continental and State Plans**

Population goal	295,040
Current estimate	147,520
Deficit	147,520

**Breeding habitat requirements**

Community types: Breeds in shrub habitats, most often in early succession aspen stands, alder thickets, and mixed lowland shrubs. Uses edge areas formed by clear cuts, trails, and power line rights-of-way. Nest usually on the ground, often at the base of a cluster of leafy plant material. Nests sometimes built in a tussock of grass or sedge. Most

nests include a taller, thicker stem in the supporting basal material, which adults grasp when arriving at the nest. Sites are often located along shaded forest-field edges; interior nest usually <10m from a field edge.

Timing: Arrive in May to June, with nests initiated soon after arrival. Incubation last 10-11 days and young fledge in 8-9 days.

Area / distance: Median densities of Golden-winged Warblers reach 100/km<sup>2</sup> in optimal habitat.

Limiting factors: Loss of early succession shrub, parasitism by Brown-headed Cowbirds, and competition and hybridization with Blue-winged Warblers.

**Migration habitat requirements**

Community types: There is little information on stopover sites of Golden-winged Warblers that can be applied for management purposes.

Timing: May - June and August - September

Limiting factors: None identified for JV region.

**Population monitoring**

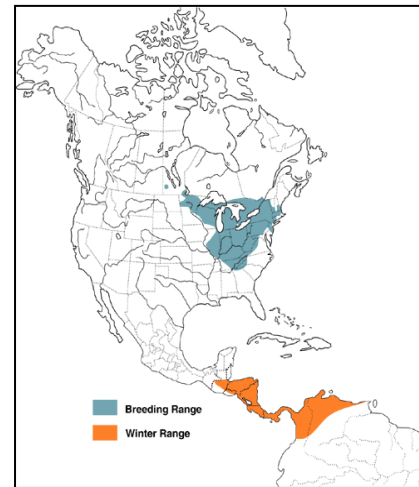
Current survey effort: 1) N.A. Breeding Bird Survey (BBS) and 2) intermittent surveys conducted during research projects.

Recommended monitoring: The BBS is adequate, but improvements that include more routes in species' range are desirable.

**Research to assist planning**

Current and ongoing projects: Following a 2005 workshop for this species, several projects have been initiated, including some in this JV region.

Research needs: The Golden-winged Warbler working group has prepared a list of research needs for this species.



Species range map: Cornell Lab of Ornithology

## Habitat model results

**Objective:** Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and Bird Conservation Region (BCR) population estimates and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative concentration (birds/km <sup>2</sup> ) <sup>a</sup>	Density (birds/km <sup>2</sup> ) <sup>b</sup>	Habitat objectives (km <sup>2</sup> ) <sup>c</sup>	
			Estimate	Deficit			Protection	Restoration
MI	12	87,786	9,800	9,800	0.11	100	98	98
MN	12	87,301	84,000	84,000	0.96	100	840	840
WI	12	46,114	32,000	32,000	0.69	100	320	320
IL	22 <sup>d</sup>	123,473	170	170	0.00	100	2	2
MI	23	58,597	900	900	0.02	100	9	9
MN	23	49,845	4,600	4,600	0.09	100	46	46
WI	23	97,299	16,000	16,000	0.16	100	160	160
OH	28	30,912	50	50	0.00	100	1	1
JV total		581,327	147,520	147,520			1,475	1,475

<sup>a</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). This calculation can be used to compare the relative importance of State×BCR areas for this species.

<sup>b</sup>Reported density in quality habitat based on scientific literature.

<sup>c</sup>Protection objectives are the estimates / density in quality habitat, and restoration objectives are the deficits / density in quality habitat.

<sup>d</sup>Habitat objectives should be shifted to BCRs 12 due to antagonistic behavior between Golden-winged Warblers and Blue-winged Warblers.

## Recommendations

**Habitat actions:** Protect existing habitat area and quality, and add (restore / enhance) 1,475 km<sup>2</sup> of habitat (see requirements above) at multiple sites within current and historic range. Created areas of edge and early succession habitat need to be considerate of other species of concern.

**Monitoring and performance:** Eliminating the current population deficit requires a 100% population increase. Management actions should result in a 100% increase or an average annual increase of 5% over a 15 year period.

## Additional background

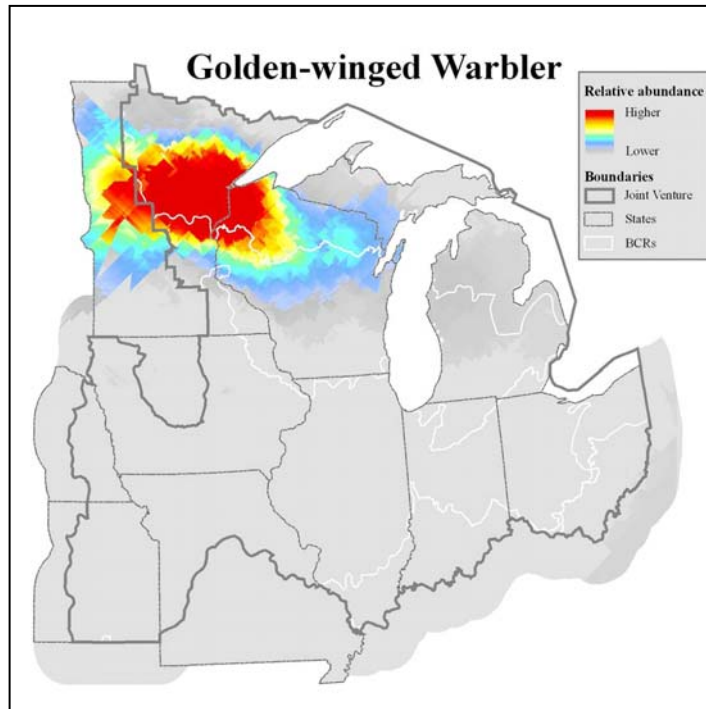
Sites identified in the Great Lakes ecoregion of The Nature Conservancy within the Joint Venture with breeding populations >25 include: Indian River, Gratiot-Saginaw State Game Area, Hope (Midland County), Michigan; and Kakagon/Bad River, Peshtigo/Oconto, St. Peter's Dome, and St. Louis estuary/Pokegama Swamp Wisconsin; and Lester-Amity, Minnesota (The Nature Conservancy 1999); maps of these sites are available from the Midwestern Resource Office of The Nature Conservancy.

## References

Confer, John L. 1992. Golden-winged Warbler. *In* The Birds of North America, No. 20 (A. Poole, P. Stettenheim, and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, DC: The American Ornithologists' Union.

**Relative abundance and distribution**

Source: Map shading represents relative abundance and distribution interpolated from BBS counts (1995-2004). Cover types used by breeding Golden-winged warblers were not identifiable using existing regional spatial data (NLCD 1992), thus some areas (e.g., urban) within the shaded boundary are unimportant to species.



**Cape May Warbler (*Dendroica tigrina*)**  
Species Account for Habitat Planning

**Joint Venture population deficit based on PIF  
Continental and State Plans**

Population goal	56,100
Current estimate	56,100
Deficit	0

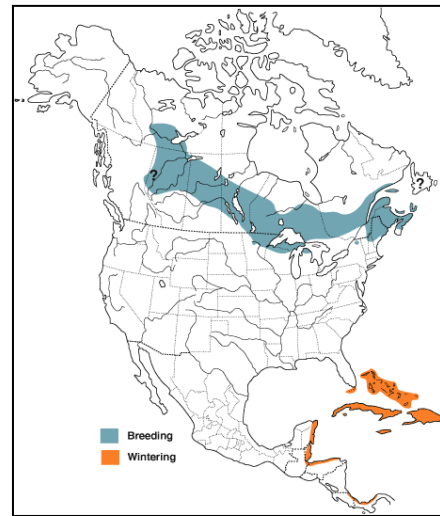
**Breeding habitat requirements**

Community types: Spruce-fir forests at least 50 years old with >15 m tall trees containing a well developed crown and minimal understory. Species typically occurs in forests where there has been little recent disturbance. Populations fluctuate with changes in populations of the spruce budworm. Nests are concealed near the trunk at the top of a conifer. Nest height varies from 10-18 m above ground.

Timing: May – July (eggs laid in June; no information available for timing of incubation and young to fledging)

Area / distance: Densities vary ranging from 1-296 birds / km<sup>2</sup>, with an average of 10 birds / km<sup>2</sup>.

Limiting factors: Availability of mature spruce stands that support spruce budworm populations.



Species range map: Cornell Lab of Ornithology

**Migration habitat requirements**

Community types: Occur in many forest types during migration but prefer conifers; species also found in shrubby areas, residential areas, gardens, and weedy patches.

Timing: May – June and mid-August – early October.

Limiting factors: None identified for JV region.

**Population monitoring**

Current survey effort: 1) N.A. Breeding Bird Surveys (BBS).

Recommended monitoring: The BBS is considered inadequate given the northern distribution and low amplitude songs, which are difficult to detect. Improvements in BBS and boreal surveys are needed to better monitor population change.

**Research to assist planning**

Current and ongoing projects: None identified for JV region.

Research needs: Demographic studies in both fragmented and unfragmented landscapes, dispersal, site fidelity, and demography related to spruce budworm cycles, habitat selection and survivorship on the wintering grounds.

## Habitat model results

**Objective:** Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and Bird Conservation Region (BCR) population estimates and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative concentration (birds/km <sup>2</sup> ) <sup>a</sup>	Density (birds/km <sup>2</sup> ) <sup>b</sup>	Habitat objectives (km <sup>2</sup> ) <sup>c</sup>	
			Estimate	Deficit			Protection	Restoration
MI	12	87,786	20,000	0	0.23	10	2,000	0
MN	12	87,301	30,000	0	0.34	10	3,000	0
WI	12	46,114	4,000	0	0.09	10	400	0
MN	23	49,845	1,500	0	0.03	10	150	0
WI	23	97,299	600	0	0.01	10	60	0
JV total			56,100	0			5,610	0

<sup>a</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). This calculation can be used to compare the relative importance of state / BCR areas for this species.

<sup>b</sup>Reported density for this species in quality habitat based on scientific literature.

<sup>c</sup>Protection objectives are the estimates / density in quality habitat, and restoration objectives are the deficits / density in quality habitat.

## Recommendations

**Habitat actions:** Protect current habitat area and quality. There are no restoration and enhancement objectives. Mature spruce should be targeted for protection and retained in forest management planning.

**Monitoring and performance:** The population is at goal level, and it should continue to be monitored to track trends.

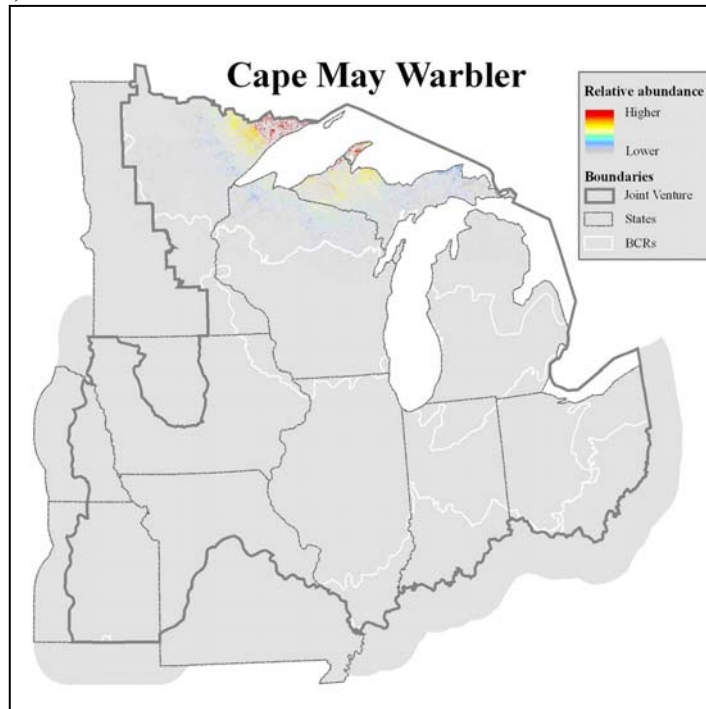
## References

- Askins, R.A. 2000. Restoring North America's birds. Yale University Press, New Haven, Connecticut.
- Baltz, M. E., and S. C. Latta. 1998. Cape May Warbler (*Dendroica tigrina*). In The Birds of North America, No. 332 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.



**Relative abundance and distribution**

Source: Map shading represents relative abundance and distribution interpolated from BBS counts (1995-2004). Mapped areas include cover types typically used by breeding Cape May Warblers (evergreen forest, NLCD 1992); all other cover types in the species range were removed (un-shaded).



**Black-throated Blue Warbler (*Dendroica caerulescens*)**  
Species Account for Habitat Planning

**Joint Venture population deficit based on PIF  
Continental and State Plans**

Population goal	61,290
Current estimate	61,290
Deficit	0

**Breeding habitat requirements**

Community types: Northern hardwood and mixed hardwood forests with a well developed understory. Species responds well to low intensity forest harvest (selective cutting), which opens the canopy allowing development of a thick understory. Nests are located low to the ground (<1.5 m high) in the crotch of a branch in a dense shrub.

Timing: Late May – July (egg laying Late-May – June; incubation 12-13 days; young fledge 8-10 days).

Area / distance: Densities of breeding Black-throated Blue Warblers in New Hampshire northern hardwoods range from 80-90 pairs/km<sup>2</sup> to 2-3 pairs/km<sup>2</sup>, with lowest densities being in areas with low shrub densities. Densities of 10-20 pairs/km<sup>2</sup> occur in conifer forests of Quebec. In Michigan's eastern Upper Peninsula territory sizes averaged 2.5 ha in areas heavily browsed by deer and 2.0 ha in areas less browsed by deer. High productivity in both low and heavy browse areas suggests that the population is a source population.

Limiting factors: Overbrowsing by dense populations of white-tailed deer may have an impact in some local areas.

**Migration habitat requirements**

Community types: Forest edges and riparian woodlands. Also uses well vegetated gardens and parks.

Timing: Late-April – May and mid-August - October

Limiting factors: None identified.

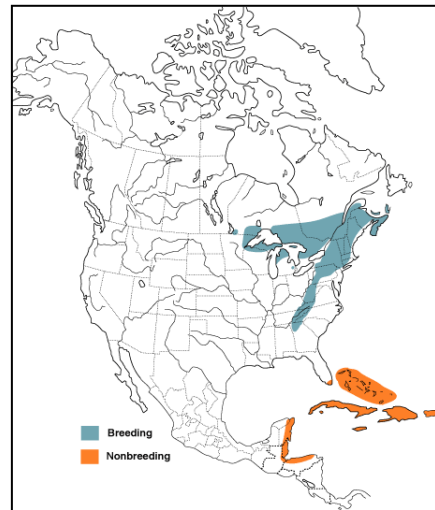
**Population monitoring**

Current survey effort: 1) N.A. Breeding Bird Survey (BBS).

Recommended monitoring: The BBS is considered inadequate for the species and species-specific survey may be needed to accurately assess the population.

**Research to assist planning**

Current and ongoing projects: The breeding distribution of this species was modeled, based on cover type and climate, in the JV region (Venier et al. 2004); maps of occurrence based on breeding bird atlas data are compared with those developed by modeling occurrence based on climate and vegetation type and impacts of deer browsing in the eastern Upper Peninsula of Michigan.



Species range map: Cornell Lab of Ornithology

Research needs: Impact on reproductive success of over-browsing by locally high white-tailed deer populations.

### Habitat model results

Objective: Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and Bird Conservation Region (BCR) population estimates and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative concentration (birds/km <sup>2</sup> ) <sup>a</sup>	Density (birds/km <sup>2</sup> ) <sup>b</sup>	Habitat objectives (km <sup>2</sup> ) <sup>c</sup>	
			Estimate	Deficit			Protection	Restoration
MI	12	87,786	47,000	0	0.54	100	470	0
MN	12	87,301	4,700	0	0.05	100	47	0
WI	12	46,114	8,900	0	0.19	100	89	0
MI	23	58,597	540	0	0.01	100	5	0
WI	23	97,299	150	0	0.00	100	2	0
JV total			61,290	0			613	0

<sup>a</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). This calculation can be used to compare the relative importance of State×BCR areas for this species.

<sup>b</sup>Reported density in quality habitat based on scientific literature.

<sup>c</sup>Protection objectives are the estimates / density in quality habitat, and restoration objectives are the deficits / density in quality habitat.

### Recommendations

Habitat actions: Protect current habitat area and quality. There are no restoration or enhancement objectives although forest management should focus maintaining a suitable understory for black-throated blue warblers.

Monitoring and performance: The population is at goal level, and it should continue to be monitored to track trends.

### Additional background

Sites identified in the Great Lakes ecoregion of The Nature Conservancy with breeding populations >25 include: Hiawatha National Forest, Porcupine Mountains, Sleeping Bear Dunes and nearby areas, High Island (Lake Michigan), and Tahquamenon Falls State Park, Michigan; Apostle Islands, and St. Peter's Dome, Wisconsin; and Tettegouche, and Sawtooth regions, Minnesota (The Nature Conservancy 1999); maps of these sites are available from the Midwestern Resource Office of The Nature Conservancy.

### References

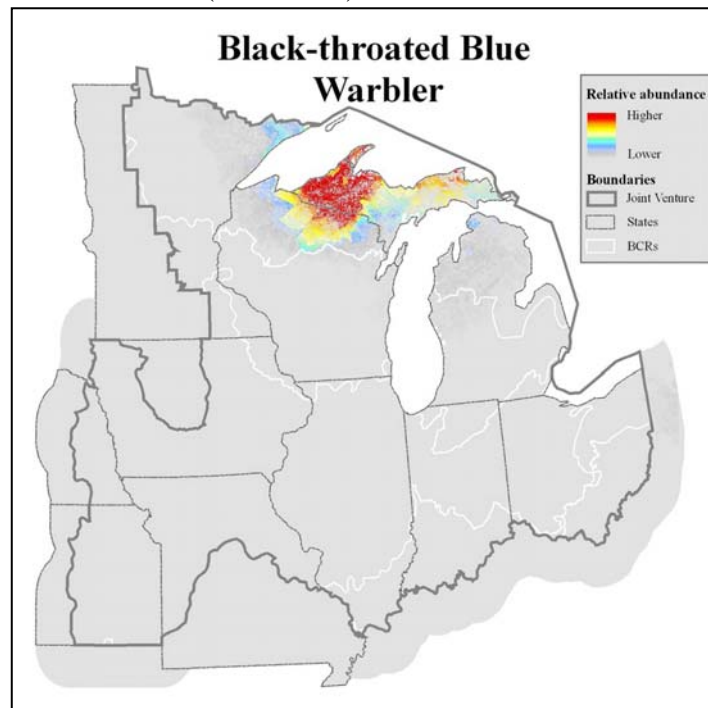
- Hall, K.R. 2002. An assessment of habitat quality of heavily-and less-browsed Michigan forests for a shrub-nesting songbird. PhD Dissertation, University of Michigan, Ann Arbor.
- Holmes, R.T., N. L. Rodenhouse and T. S. Sillett. 2005. Black-throated Blue Warbler (*Dendroica caerulescens*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Laboratory of Ornithology; Retrieved from The Birds of North American

Online database: [http://bna.birds.cornell.edu/BNA/account/Black-throated\\_Blue\\_Warbler/](http://bna.birds.cornell.edu/BNA/account/Black-throated_Blue_Warbler/)

Venier, L.A., J. Pearce, J.E. McKee, D.W. McKenney, and G. J. Niemi. 2004. Climate and satellite-derived land cover for predicting breeding bird distribution in the Great Lakes basin. *Journal of Biogeography* 31:315-331.

### **Relative abundance and distribution**

Source: Map shading represents relative abundance and distribution interpolated from BBS counts (1995-2004). Mapped areas include cover types typically used by breeding Black-throated Blue Warblers (deciduous forest and mixed forest, NLCD 1992); all other cover types in the species range were removed (un-shaded).



**Kirtland's Warbler (*Dendrocia kirtlandii*)**  
Species Account for Habitat Planning

**Joint Venture population deficit based on  
Kirtland's Warbler Recovery Plan**

Population goal	1,000 singing males
Current estimate	1,420 singing males
Deficit	0

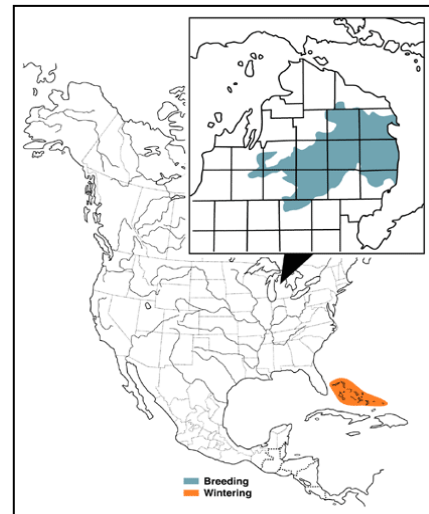
**Breeding habitat requirements**

Community types: Almost entirely restricted to large (>30 ha) young jack pine stands with gaps. Natural habitat structure was maintained through fire and is replicated through planting. Species uses jack pine stands 6 years after fire or planting up to year 20 years. Nest on the ground concealed by grass with the surrounding ground littered with pine needles and oak leaves.

Timing: Mid-May to July (egg laying May – June; incubation 13-15 days; young fledge 8-10 days).

Area / distance: Territory size varies with habitat composition (0.6-10 ha, average 8.4 ha).

Limiting factors: Availability of young jack pine communities and parasitism by Brown-headed Cowbirds.



Species range map: Cornell Lab of Ornithology

**Migration habitat requirements**

Community types: There are too few sightings to determine if Kirtland's Warblers have specific habitat requirements during migration. Winter habitat of the Kirtland's Warbler is currently being investigated in the Bahamas.

Timing: May and August - October

Limiting factors: A few Kirtland's Warblers have been killed at lighthouses and towers during migration but limiting factors are not well understood.

**Population monitoring**

Current survey effort: Kirtland's Warblers are counted annually on the breeding grounds in Michigan; ad hoc searches occur in Wisconsin and Ontario. Demographic studies have been conducted.

Recommended monitoring: Current survey effort appears adequate.

**Research to assist planning**

Current and ongoing projects: Several sites on The Bahamas are being monitored. Perhaps the greatest need is to determine if Cowbird parasitism remains a limiting factor now that Kirtland's Warbler populations have increased.

Research needs: Research needs are periodically reviewed and updated by the Kirtland's Warbler Recovery Team.

### Habitat model results

Objective: Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

### Recommendations

Habitat actions: Approximately 770 km<sup>2</sup> of jack pine forest have been dedicated in several Kirtland Warbler management areas. These lands are primarily under the jurisdiction of the U.S. Forest Service, Michigan Department of Natural Resources, and U.S. Fish and Wildlife Service. Management is currently well coordinated among the agencies so the requisite amount of jack pine acreage with appropriate structure needed to meet the recovery goal is met. Assuming that approximately 770 km<sup>2</sup> are dedicated to Kirtland's Warbler management, and that cowbird control continues, the Kirtland's Warbler breeding habitat should be sufficient to meet population objectives. Some climate change models suggest that jack pine may not persist in the northern Lower Peninsula of Michigan. If so, provisions for creating more habitat in the Upper Peninsula and perhaps in Ontario may be needed.

Monitoring and performance: The population is at goal level. Kirtland's Warbler populations will continue to be monitored by the management team.

### References

- Byelich, J., G. W. Irvine, N. I. Johnson, and H. Mayfield. 1985. Kirtland's Warbler recovery plan. Kirtland's Warbler Recovery Team. U.S. Fish and Wildlife Service.
- Mayfield, Harold F. 1992. Kirtland's Warbler. *In* The Birds of North America, No. 19 (A. Poole, P. Stettenheim, and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, DC: The American Ornithologists' Union.

### Abundance and distribution

Kirtland's Warbler management areas owned and managed by the Michigan Department of Natural Resources, the U. S. Forest Service, and the U. S. Fish and Wildlife Service.



**Cerulean Warbler (*Dendroica cerulea*)**  
Species Account for Habitat Planning

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**Joint Venture population deficit based on PIF  
Continental and State Plans**

Population goal	215,340
Current estimate	107,670
Deficit	107,670

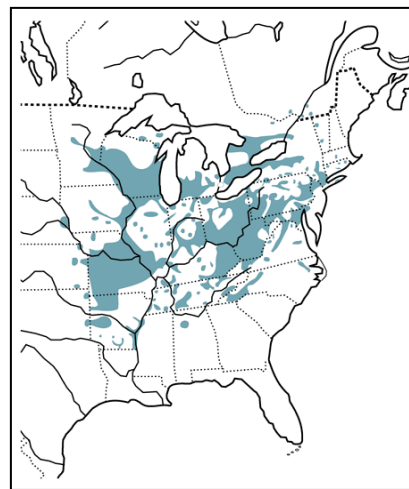
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**Breeding habitat requirements**

Community types: Large tracts of mature deciduous forest with an understory containing 85% canopy cover and some forest gaps. Distribution of Cerulean Warblers is often patchy, even within favored forest-types. The surrounding area should be at least 50% forested and forested landscapes up to 10,000 ha may be needed.

Timing: Late May to early July (egg laying May-July; incubation 11-12 days; young fledge in 10-11 days).

Area / distance: Territories are approximately 1 ha (range 0.4-2.5 ha). Densities range from 7-580 birds/km<sup>2</sup>, with an average of 86 birds/km<sup>2</sup>.



Species range map: Cornell Lab of Ornithology

**Migration habitat requirements**

Community types: Various forest, woodland, second growth, and scrub. Uses the forest canopy often near forest gaps and edges.

Timing: Late April – May and July – August.

Limiting factors: None identified for JV region.

**Population monitoring**

Current survey effort: 1) N.A. Breeding bird surveys, and 2) counts conducted intermittently by states and during research projects.

Recommended monitoring: Surveys should be conducted at select breeding sites to assess population trends. Demographic studies may be needed to identify limiting factors in populations that are declining.

**Research to assist planning**

Current and ongoing projects: Breeding densities, habitat associations, and reproductive success is being studied in Ohio. The breeding ecology is being studied on state and federal lands in Indiana and nest studies are being conducted at Big Oaks National Wildlife Refuge. Priority research projects have been identified by the Cerulean Warbler working group.

Research needs: More data is needed to describe population structure, demography, productivity, and habitat use, and how use varies in landscapes with differing degrees of fragmentation.

## Habitat model results

**Objective:** Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and Bird Conservation Region (BCR) population estimates and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative bird concentration (birds/km <sup>2</sup> ) <sup>a</sup>	Density (birds/km <sup>2</sup> ) <sup>b</sup>	Habitat objectives (km <sup>2</sup> ) <sup>c</sup>	
			Estimate	Deficit			Protection	Restoration
MI	12	87,786	320	320	0.00	86	4	4
WI	12	46,114	1,300	1,300	0.03	86	15	15
OH	13	21,933	18,000	18,000	0.82	86	209	209
IL	22	123,473	400	400	0.00	86	5	5
IN	22	44,701	1,100	1,100	0.02	86	13	13
OH	22	52,190	2,800	2,800	0.05	86	33	33
IN	23	13,059	400	400	0.03	86	5	5
MI	23	58,597	7,300	7,300	0.12	86	85	85
MN	23	49,845	700	700	0.01	86	8	8
WI	23	97,299	1,500	1,500	0.02	86	17	17
IN	24	35,774	19,000	19,000	0.53	86	221	221
OH	24	1,919	850	850	0.44	86	10	10
OH	28	30,912	54,000	54,000	1.75	86	628	628
JV total		663,603	107,670	107,670			1,252	1,252

<sup>a</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). This calculation can be used to compare the relative importance of State×BCR areas for this species.

<sup>b</sup>Reported density in quality habitat based on scientific literature.

<sup>c</sup>Protection objectives are the estimates / density in quality habitat, and restoration objectives are the deficits / density in quality habitat.

## Recommendations

**Habitat actions:** Protect existing habitat area and quality, and add (restore / enhance) 1,252 km<sup>2</sup> of habitat (see requirements above) at multiple sites within current and historical range. Forest management should focus on maintaining large blocks of habitat with minimal edge (see references for management techniques).

**Monitoring and performance:** Eliminating the current population deficit requires a 100% population increase or an average annual increase of 5% over a 15 year period.

## Additional background

Sites identified in the Great Lakes ecoregion of The Nature Conservancy with breeding populations >25 include: Allegan State Game Area and Galien River/Warren Woods, Michigan; Lower Wisconsin, Lower Wolf, Lower Chippewa, and Straight Lake, Wisconsin. (The Nature Conservancy 1999); maps of these sites are available from the Midwestern Resource Office of The Nature Conservancy. Knutson et al. (2001) suggest that at least the following areas may also have potential to provide sufficient habitat for Cerulean Warblers: Yellow River State Forest (Iowa), Wyalusing State Park and South Kettle Moraine (Wisconsin), and Allegan State Game Area, Fort Custer, and Waterloo Recreation Areas (Michigan).

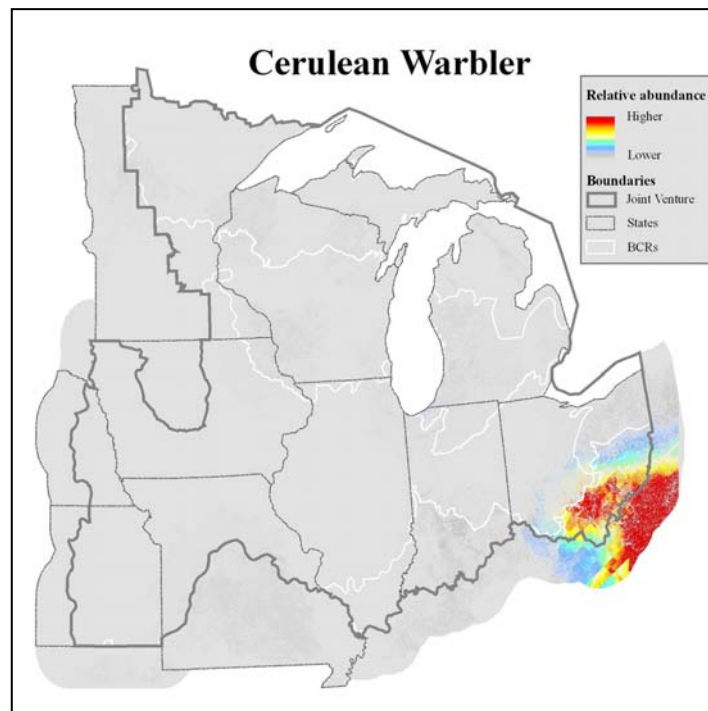


## References

- Hamel, P. B. 2000. Cerulean Warbler (*Dendroica cerulea*). In *The Birds of North America*, No. 511 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Knutson, M. G., G. Butcher, J. Fitzgerald, and J. Shieldcastle. 2001. Partners in Flight Bird Conservation Plan for The Upper Great Lakes Plain (Physiographic Area 16). U.S. Geological Survey Upper Midwest Environmental Sciences Center and Partners in Flight.

## Relative abundance and distribution

Source: Map shading represents relative abundance and distribution interpolated from BBS counts (1995-2004). Mapped areas include cover types typically used by breeding Cerulean Warblers (deciduous forest, NLCD 1992); all other cover types in the species range were removed (un-shaded).



**Prothonotary Warbler (*Protonotaria citrea*)**  
Species Account for Habitat Planning

**Joint Venture population deficit based on PIF  
Continental and State Plans**

Population goal	66,420
Current estimate	44,280
Deficit	22,140

**Breeding habitat requirements**

Community types: Breeds exclusively in forested wetlands with standing water, including bald cypress swamps, floodplain forests, backwaters of rivers, and wooded margins of lakes and reservoirs. Other habitat features include low elevation, little topographic relief, sparse understory and ground cover, and 50-75% canopy cover with a height of 12-40 m. Species generally has a narrow (<50 m wide) linear distribution along wooded river corridors.

Timing: April to July (egg laying mid-April – mid-May; incubation 12-14 days; young fledge 10-11 days).

Area / distance: Appears to be area-sensitive, being largely absent from forests <100 ha and avoiding (<30 m wide) forest strips along waterways. Territories range in size from 0.5-1.5 ha. Foraging areas average 3.7-5.4 ha. Densities range from 8-120 birds/km<sup>2</sup>, with an average of 64 birds/km<sup>2</sup>.

Limiting factors: Loss and degradation of forested wetlands through logging and conversion to other uses. Predation, competition, and loss of nest sites due to flooding. Frequency of nest parasitism by Brown-headed Cowbirds is reported to be 11-27%.

**Migration habitat requirements**

Community types: Primarily found near water in coastal areas, inland waterways, and marshes.

Timing: April – May and July – September.

Limiting factors: Destruction of mangrove forests on the wintering grounds, especially northern South America.

**Population monitoring**

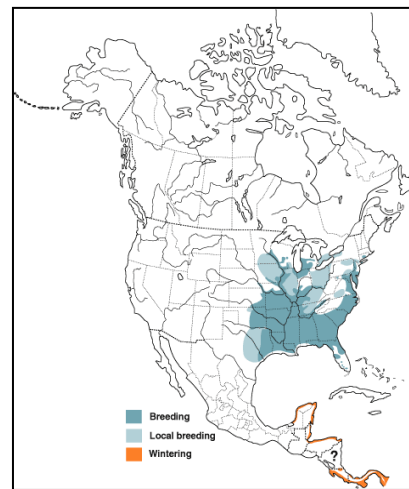
Current survey effort: 1) N.A. Breeding Bird Survey (BBS).

Recommended monitoring: The BBS may be inadequate as survey routes under-sample floodplain forest and forested wetlands.

**Research to assist planning**

Current and ongoing projects: Populations are being monitored at Muscatatuck Bottoms and Patoka National Wildlife Refuge.

Research needs: Better information is needed to assess numbers, trends, and causes for population changes. Migration corridors and stopover locations need to be identified.



Species range map: Cornell Lab of Ornithology

Demographic information for populations, especially those using natural cavities and impacts of habitat loss on wintering grounds.

### Habitat model results

**Objective:** Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and Bird Conservation Region (BCR) population estimates and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative concentration (birds/km <sup>2</sup> ) <sup>a</sup>	Density (birds/km <sup>2</sup> ) <sup>b</sup>	Habitat objectives (km <sup>2</sup> ) <sup>c</sup>	
			Estimate	Deficit			Protection	Restoration
IL	22	123,473	9,500	4,750	0.08	64	148	74
IN	22	44,701	170	85	0.00	64	3	1
KS	22	65,988	1,000	500	0.02	64	16	8
MO	22	82,886	16,000	8,000	0.19	64	250	125
OH	22	52,190	140	70	0.00	64	2	1
IN	23	13,059	270	135	0.02	64	4	2
MI	23	58,597	3,000	1,500	0.05	64	47	23
WI	23	97,299	180	90	0.00	64	3	1
IL	24	18,710	6,200	3,100	0.33	64	97	48
IN	24	35,774	7,700	3,850	0.22	64	120	60
OH	28	30,912	120	60	0.00	64	2	1
JV total		623,590	44,280	22,140			692	346

<sup>a</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). This calculation can be used to compare the relative importance of State×BCR areas for this species.

<sup>b</sup>Reported density in quality habitat based on scientific literature.

<sup>c</sup>Protection objectives are the estimates / density in quality habitat, and restoration objectives are the deficits / density in quality habitat.

### Recommendations

**Habitat actions:** Protect and maintain existing habitat area and quality, and add (restore / enhance) 322 km<sup>2</sup> of quality breeding habitat (see requirements above) within current and historic breeding range. Connect and reduce fragmentation of current forested wetlands by creating large blocks (>100 ha). Obtaining permanent conservation easements through the Wetland Reserve Program (WRP) would be a mechanism for protecting floodplain forests with the appropriate hydrology.

**Monitoring and performance:** Eliminating the current population deficit requires a 50% population increase or an average annual increase of 3% over a 15 year period.

### Additional background

Populations are more numerous in the floodplain forests of the Mississippi and Ohio Rivers and their larger tributaries. Sites identified in the Great Lakes ecoregion of The Nature Conservancy with breeding populations >25 include: Paw Paw River, Allegan State Game Area, Galien River/Warren Woods, and Maple River, Michigan; Lower Wisconsin, Lower Chippewa, St. Croix, Lower Wolf, Wisconsin; and Western Lake Erie marshes and Chagrin River, Ohio (The Nature Conservancy 1999); maps of these sites are available from the

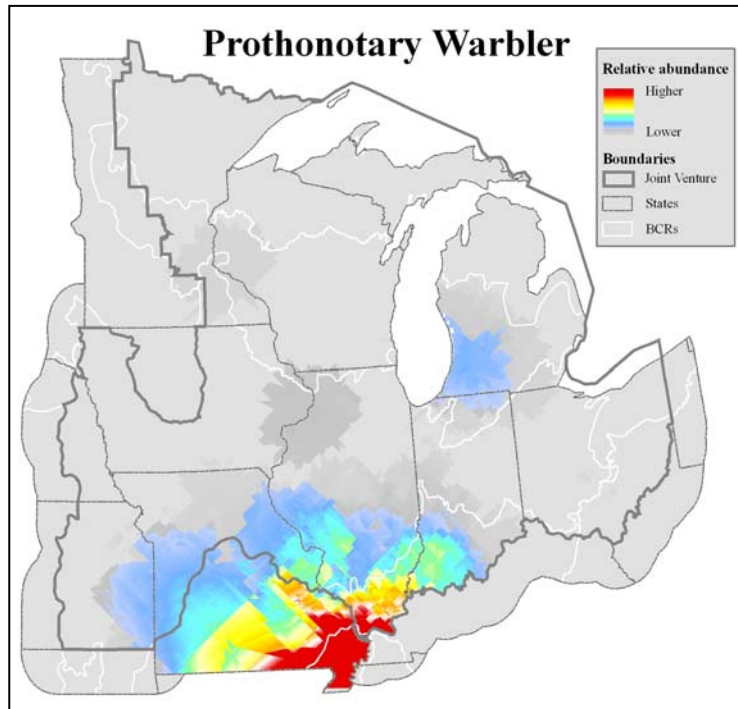
Midwestern Resource Office of The Nature Conservancy. Appears to be area-sensitive, being largely absent from forests <100 ha and avoiding (<30 m wide) forest strips along waterways (Kahl et al. 1985, Brush 1994). Average territory size in Michigan (Walkinshaw 1953) is about 1.5 ha but in southern Illinois and Tennessee territories averaged 0.5 ha (Petit 1989). Foraging areas have been reported to average 3.7-5.4 ha in Alabama (Reynolds 1997). Buffers of approximately 90 m (300 feet) wide around each side of the stream are recommended; territories might, on average have 120 m of frontage along a river. In Iowa, nesting success was 82% in relatively large (>84 ha) unfragmented forest compared to <50% in a relatively smaller, fragmented forest corridor (Brush 1994).

## References

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- Walkinshaw, L.H. 1953. Life-history of the Prothonotary Warbler. *Wilson Bulletin* 65:152-168.

**Relative abundance and distribution**

Source: Map shading represents relative abundance and distribution interpolated from BBS counts (1995-2004). Cover types used by breeding Prothonotary warblers were not identifiable using existing regional spatial data (NLCD 1992), thus some areas within the shaded boundary are unimportant to species.



**Louisiana Waterthrush (*Seiurus motacilla*)**  
Species Account for Habitat Planning

**Joint Venture population deficit based on PIF  
Continental and State Plans**

Population goal	17,700
Current estimate	17,700
Deficit	0

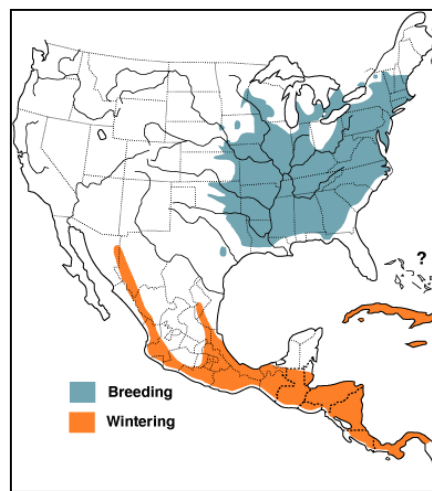
**Breeding habitat requirements**

Community types: Breeds most commonly along gravel-bottomed streams flowing through deciduous forest and less commonly in floodplain forests and cypress swamps. It nests on the ground adjacent to streams in the roots of fallen trees, in small hollows or cavities of stream banks, and under fallen logs.

Timing: May to July (egg laying May – June; incubation 12-14 days; young fledge 9-10 days).

Area / distance: Considered area sensitive with minimum forest blocks of >100 ha. Territories are linear along streams with reported distances ranging from 188-1,200 m long and averages of 358-930 m. The mean length of stream required/pair is 930 meters in southern Illinois. Buffers should be at least 100 m wide either side of the stream and mature forest that shades streams is preferred. Additional buffer widths may be needed to protect surface and ground water flow into streams. Densities range from 2-6 birds / km of stream, with an average density of 4 birds / km.

Limiting factors: Suitable habitat consisting of forested perennial or permanent streams with good spring flows and high aquatic insect abundance. Ground nests subject to high predation and nest parasitism.



Species range map: Cornell Lab of Ornithology

**Migration habitat requirements**

Community types: Similar to breeding habitat although migrants will also occur in parks, gardens, and other habitats.

Timing: Late-March – early-May and July - August

Limiting factors: Suitable forested wetlands with high aquatic insect diversity.

**Population monitoring**

Current survey effort: 1) N.A. Breeding Birds Survey (BBS).

Recommended monitoring: The BBS is considered inadequate due to avoidance of streams by roadside routes and peak singing activity earlier in the breeding season. Suggested stream side surveys during the early part of the breeding season when males are more vocal.

**Research to assist planning**

Current and ongoing projects: None identified for JV region.

Research needs: Habitat, behavioral, and population ecology studies are needed for the wintering range. Survival, dispersal, and other demographic information are desirable as well

as identification of source populations. More information is also needed on the minimum riparian buffer widths needed for nesting.

### Habitat model results

**Objective:** Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and Bird Conservation Region (BCR) population estimates and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative concentration (birds/km <sup>2</sup> ) <sup>a</sup>	Density (birds/km) <sup>b</sup>	Habitat objectives (km) <sup>c</sup>	
			Estimate	Deficit			Protection	Restoration
WI	12	46,114	60	0	0.00	4	15	0
IA	22	108,344	250	0	0.00	4	63	0
IL	22	123,473	400	0	0.00	4	100	0
IN	22	44,701	90	0	0.00	4	23	0
KS	22	65,988	880	0	0.01	4	220	0
MO	22	82,886	2,300	0	0.03	4	575	0
OH	22	52,190	220	0	0.00	4	55	0
MI	23	58,597	800	0	0.01	4	200	0
IL	24	18,710	1,800	0	0.10	4	450	0
IN	24	35,774	3,600	0	0.10	4	900	0
OH	24	1,919	1,100	0	0.57	4	275	0
OH	28	30,912	6,200	0	0.20	4	1,550	0
JV total		669,609	17,700	0			4,425	0

<sup>a</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). This calculation can be used to compare the relative importance of State×BCR areas for this species.

<sup>b</sup>Reported density in quality habitat based on scientific literature.

<sup>c</sup>Protection objectives are the estimates / density in quality habitat, and restoration objectives are the deficits / density in quality habitat.

### Recommendations

**Habitat actions:** Protect current habitat area and quality; continue to protect areas surrounding streams and maintain water quality. There are no restoration and enhancement objectives.

**Monitoring and performance:** The population is at goal level and it should continue to be monitored to track trends.

### Additional background

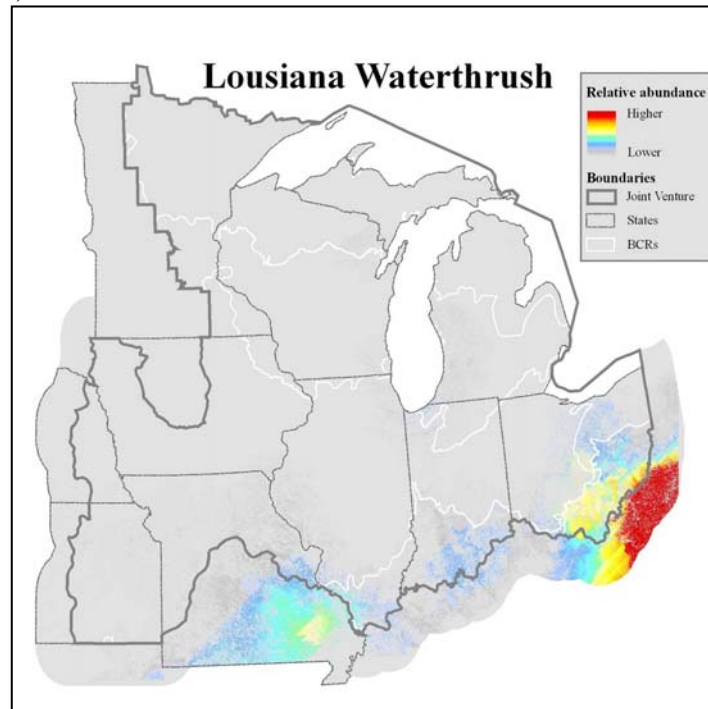
Prosser and Brooks (1998) tested a habitat suitability model in Pennsylvania: optimal cover included large (>350 ha) blocks of forest with >80% forest cover; low, sparse herbaceous cover; first or second order streams with well developed pool and riffle areas, clear water and coarse substrates; and steep banks with a mix of soil, rock, and exposed tree roots. The species breeds north to central Michigan, southern Wisconsin and southern Minnesota, but the best opportunities for increasing populations are in the main part of the Louisiana Waterthrush range in Ohio, Indiana, Illinois and Missouri.

## References

- Bent, A.C. 1953. Life histories of North American wood-warblers. U.S. National Museum Bulletin 203.
- Eaton, S.W. 1958. A life history study of the Louisiana Waterthrush. Wilson Bulletin 70:210-235.
- Mengel, R.M. 1965. The birds of Kentucky. Ornithological Monograph 3.
- Prosser, D.J., and R.P. Brooks. 1998. A verified habitat suitability index for the Louisiana Waterthrush. Journal of Field Ornithology 69:288-298.
- Robinson, W. D. 1995. Louisiana Waterthrush (*Seiurus motacilla*). In The Birds of North America, No. 151 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.

## Relative abundance and distribution

Source: Map shading represents relative abundance and distribution interpolated from BBS counts (1995-2004). Mapped areas include cover types typically used by breeding Louisiana Waterthrush (deciduous forest, NLCD 1992); all other cover types in the species range were removed (un-shaded).





## Kentucky Warbler (*Oporornis formosus*)

### Species Account for Habitat Planning

#### Joint Venture population deficit based on PIF Continental and State Plans

Population goal	174,495
Current estimate	116,330
Deficit	58,165

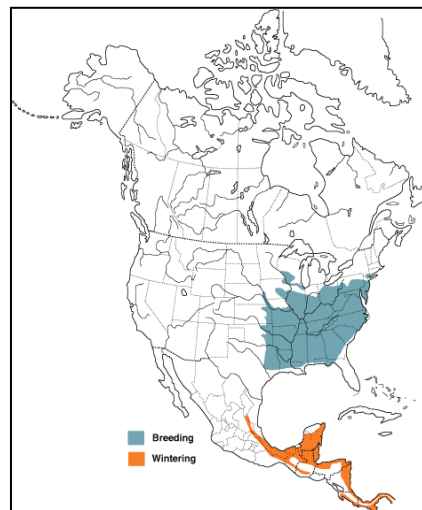
#### Breeding habitat requirements

Community types: Large areas (>500 ha) of deciduous forest ranging from bottomlands and moist ravines to dry uplands. Species can be found in forest stands of various ages but prefers medium-aged mesic stands with dense understory and well-developed ground cover, often near streams. Most nests are located on the ground with few as high as 1 m.

Timing: April to July (egg laying May-July; incubation 11-13 days; young fledge 8-9 days).

Area / distance: Appears to be moderately sensitive to forest fragmentation with occurrences in forest blocks as small as 2.5 ha. However, frequencies and densities are much greater in larger forest blocks and >500 ha may be needed for successful breeding. Territory size ranges from 1.2-3.7 ha. Densities range from 24-72 birds/km<sup>2</sup>, with average densities 42 birds/km<sup>2</sup>.

Limiting factors: Loss and fragmentation of bottomland and upland forests due to logging, conversion to agriculture, and development. Nest parasitism by Brown-headed Cowbirds is high in fragmented areas. Species may be sensitive to over-browsing by deer when ground and shrub layers are lost).



Species range map: Cornell Lab of Ornithology

#### Migration habitat requirements

Community types: Use forest, woodland, scrub and thickets during migration.

Timing: April – mid-May and August - September

Limiting factors: None identified for JV region.

#### Population monitoring

Current survey effort: 1) N.A. Breeding Bird Survey considered adequate.

Recommended monitoring: Additional survey areas within species' range where extensive habitat work has been completed.

#### Research to assist planning

Current and ongoing projects: None identified for JV region.

Research needs: Document minimum area requirements and locations for source populations; determine minimum viable population sizes; determine effects of forest fragmentation and forest management practices on population viability; obtain more complete dispersal, survivorship and other demographic information and migration and wintering habitat needs.

## Habitat model results

**Objective:** Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and Bird Conservation Region (BCR) population estimates and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative concentration (birds/km <sup>2</sup> ) <sup>a</sup>	Density (birds/km <sup>2</sup> ) <sup>b</sup>	Habitat objectives (km <sup>2</sup> ) <sup>c</sup>	
			Estimate	Deficit			Protection	Restoration
OH	13	21,933	60	30	0.00	42	1	1
IA	22	108,344	220	110	0.00	42	5	3
IL	22	123,473	2,600	1,300	0.02	42	62	31
IN	22	44,701	150	75	0.00	42	4	2
KS	22	65,988	1,500	750	0.02	42	36	18
MO	22	82,886	15,000	7,500	0.18	42	357	179
OH	22	52,190	1,100	550	0.02	42	26	13
IL	24	18,710	15,000	7,500	0.80	42	357	179
IN	24	35,774	45,000	22,500	1.26	42	1,071	536
OH	24	1,919	1,700	850	0.89	42	40	20
OH	28	30,912	34,000	17,000	1.10	42	810	405
JV total			116,330	58,165			2,770	1,385

<sup>a</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). This calculation can be used to compare the relative importance of state / BCR areas for this species.

<sup>b</sup>Reported density for this species in quality habitat based on scientific literature.

<sup>c</sup>Protection objectives are the estimates / density in quality habitat, and restoration objectives are the deficits / density in quality habitat.

## Recommendations

**Habitat actions:** Protect existing habitat area and quality, and add (restore / enhance) 1,385 km<sup>2</sup> of habitat (see requirements above) at multiple sites within current and historic range. Efforts should be concentrated in more heavily forested landscapes and in areas where larger (>500 ha) blocks of forest can be achieved. Selective timber management practices can be used to increase the development of shrub and ground vegetation (see references for management techniques).

**Monitoring and performance:** Eliminating the current population deficit requires a 50% population increase or an average annual increase of 3% over a 15 year period.

## Additional background

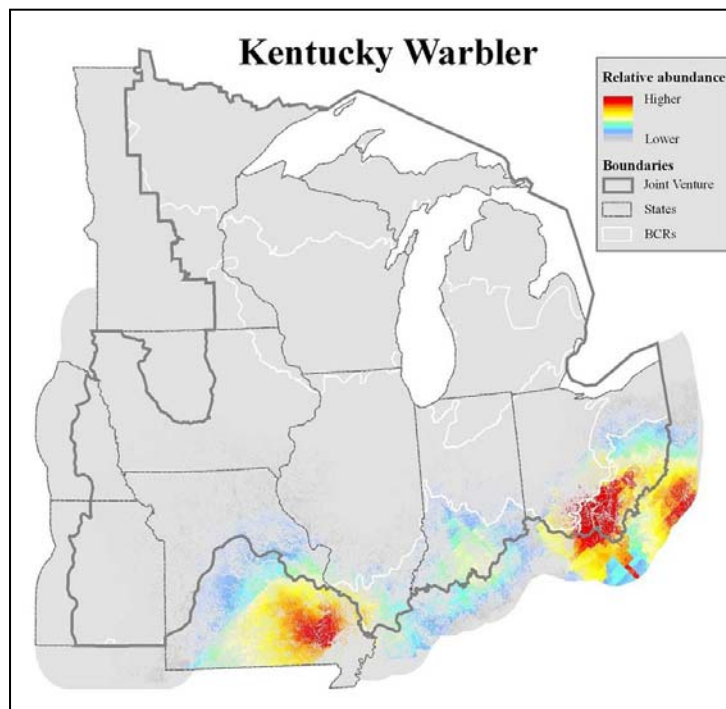
Nest predation was lower in older forests in Illinois compared to even-aged stands and plantations and nest parasitism decreased with distance from a feed lot (Morse and Robinson 1999). Densities have been reported to range from 0.25-2.2 males/10 ha (Whitcomb et al. 1981, Hamel et al. 1982, Gibbs and Faaborg 1990, Wenny et al. 1993, McDonald 1998). Densities of Kentucky Warblers may be larger in large forest fragments (2.2 males/10 ha) than small forest fragments (1.4 males/10 ha) in Virginia but were similar in small (140 ha) and large forest tracts (>500 ha) in Missouri.

## References

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- Hamel, P. B., H.E. LeGrand, Jr., M.R. Lemmartz, and S. A. Gauthreaux, Jr. 1982. Bird-habitat relationships on southeastern forest lands. U.S. Forest Service, General Technical Report SE-22.
- McDonald, M. V. 1998. Kentucky Warbler (*Oporornis formosus*). In *The Birds of North America*, No. 324 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Whitcomb, R. F., C. S. Robbins, J.E. Lynch, M. K. Klimkiewicz, B. L. Whitcomb, and D. Bystrak. 1981. Effects of forest fragmentation on avifauna of the eastern deciduous forest. In *Forest Island Dynamics in Man-dominated Landscapes* (R.L. Burgess and D. M. Sharpe, eds.). Springer-Verlag, New York.
- Wenny, D. G., R. L. Clawson, J. Faaborg, and S.L. Sheriff. 1993. Population density, habitat selection, and minimum area requirements of three forest interior warblers in central Missouri. *Condor* 95:968-979.

## Relative abundance and distribution

Source: Map shading represents relative abundance and distribution interpolated from BBS counts (1995-2004). Mapped areas include cover types typically used by breeding Kentucky Warblers (deciduous forest, NLCD 1992); all other cover types in the species range were removed (un-shaded).



## Connecticut Warbler (*Oporornis agilis*)

### Species Account for Habitat Planning

#### Joint Venture population deficit based on PIF Continental and State Plans

Population goal	73,660
Current estimate	48,570
Deficit	25,090

#### Breeding habitat requirements

Community types: Open woods or semi-open forest with patches of dense understory. This includes poorly drained spruce-tamarack or wet pole-sized forests as well as dry oak-pine forest or jack pine barrens. Nests placed on or near the ground in dense thickets or saplings.

Timing: Mid-May - July (egg laying June – July; incubation length and day to young fledge unknown).

Area / distance: Densities range from 200-1,200 birds / km<sup>2</sup>, with an average of 300 birds / km<sup>2</sup>. In Minnesota, breeding densities reported between 2.9 - 5.6 pairs/ha and in closed spruce forests to average 2.1 pairs/ha. Throughout its breeding range this species is thought to be uncommon, local, and at low densities.

Limiting factors: None identified for JV region.



Species range map: Cornell Lab of Ornithology

#### Migration habitat requirements

Community types: Thickets and dense shrub areas during both spring and fall.

Timing: Mid-May – early June and late-August – early October.

Limiting factors: None identified for JV region.

#### Population monitoring

Current survey effort: 1) N.A. Breeding Bird Survey (BBS).

Recommended monitoring: The BBS may be inadequate given the northern distribution and low route density. Improvements in BBS and boreal surveys are needed to better monitor population change.

#### Research to assist planning

Current and ongoing projects: None identified for JV region.

Research needs: Detailed studies of the general biology of Connecticut Warblers are needed on the breeding grounds, including estimates of breeding densities and productivity throughout its breeding range in the JV region.

#### Habitat model results

Objective: Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and Bird Conservation Region (BCR) population estimates and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative concentration (birds/km <sup>2</sup> ) <sup>a</sup>	Density (birds/km <sup>2</sup> ) <sup>b</sup>	Habitat objectives (km <sup>2</sup> ) <sup>c</sup>	
			Estimate	Deficit			Protection	Restoration
MI	12	87,786	1,400	700	0.02	500	3	1
MN	12	87,301	37,000	19,000	0.42	500	74	38
WI	12	46,114	9,800	5,200	0.21	500	20	10
WI	23	97,299	370	190	0.00	500	1	0
JV total			48,570	25,090			97	50

<sup>a</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). This calculation can be used to compare the relative importance of State×BCR areas for this species.

<sup>b</sup>Reported density in quality habitat based on scientific literature.

<sup>c</sup>Protection objectives are the estimates / density in quality habitat, and restoration objectives are the deficits / density in quality habitat.

### Recommendations

Habitat actions: Protect existing habitat area and quality, and add (restore / enhance) 50 km<sup>2</sup> of habitat (see requirements above) at multiple sites within current breeding range. Management should maintain openings and a dense understory (see references for management techniques).

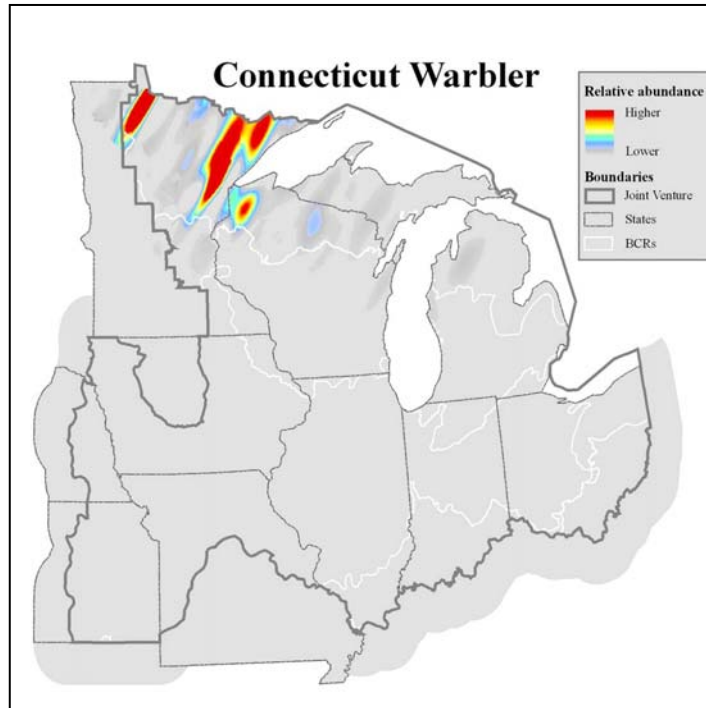
Monitoring and performance: Eliminating the current population deficit requires a 50% population increase. Management actions should result in a 50% increase in BBS index or an average of 3% annually over a 15 year period.

### References

Pitocchelli, J., J. Bouchie, and D. Jones. 1997. Connecticut Warbler (*Oporornis agilis*).  
In The Birds of North America, No. 320 (A. Poole and F. Gill, eds.). The Academy of  
Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union,  
Washington, D.C.

**Relative abundance and distribution**

Source: Map shading represents relative abundance and distribution interpolated from BBS counts (1995-2004). Cover types used by breeding Connecticut warblers were not identifiable using existing regional spatial data (NLCD 1992), thus some areas within the shaded boundary are unimportant to species.



**Canada Warbler (*Wilsonia canadensis*)**  
Species Account for Habitat Planning

**Joint Venture population deficit based on PIF  
Continental and State Plans**

Population goal	138,480
Current estimate	91,680
Deficit	46,800

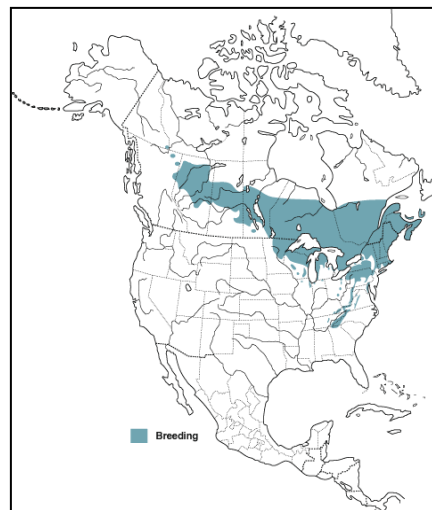
**Breeding habitat requirements**

Community types: Breeding habitat is described as woodland undergrowth, bogs, tall shrubs near streams or swamps and, locally, ravines, moist mixed forests with a well developed understory, wet low lying areas and young, recently cut forests. Most common in moist, mixed coniferous-hardwood forests with a well developed understory, especially near water. Small amounts of vegetation between the ground and 0.5 m above ground with a thick shrub layer seem to be preferred. Abundance is positively correlated with foliage density 0.3-1 m above ground, forest moisture index, tree basal area and forest fragment size.

Timing: May to July (egg laying May – June; incubation 12 days; young fledge 8-10 days).

Area / distance: Reaches highest breeding densities in relatively large tracts (perhaps >400 ha). Densities vary considerably by habitat, from 5-200 birds / km<sup>2</sup>, with an average of 20 birds / km<sup>2</sup>.

Limiting factors: An absence of a dense understory in otherwise suitable habitat may be the most important limiting factor. Habitat may be created by blow-downs and forest management. In fragmented landscapes, small habitat patches (<400 ha) are selected less (only 50% occupancy) than large habitat patches (>3,000 ha).



Species range map: Cornell Lab of Ornithology

**Migration habitat requirements**

Community types: Habitat used by migrating Canada Warblers is only generally described as second-growth woodland, scrub, thickets and floodplain forest.

Timing: May – June and mid-July – late August

Limiting factors: None identified for JV region.

**Population monitoring**

Current survey effort: 1) N.A. Breeding Bird Survey (BBS)

Recommended monitoring: BBS adequate, although an increase in route density within species' range would improve confidence in trend estimate.

**Research to assist planning**

Current and ongoing projects: Point counts being conducted in the Northern Lower Peninsula of Michigan.

Research needs: An assessment and comparison of Canada Warbler densities and productivity in varying habitats.

## Habitat model results

**Objective:** Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and Bird Conservation Region (BCR) population estimates and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative concentration (birds/km <sup>2</sup> ) <sup>a</sup>	Density (birds/km <sup>2</sup> ) <sup>b</sup>	Habitat objectives (km <sup>2</sup> ) <sup>c</sup>	
			Estimate	Deficit			Protection	Restoration
MI	12	87,786	11,000	6,000	0.13	20	550	300
MN	12	87,301	62,000	31,000	0.71	20	3,100	1,550
WI	12	46,114	17,000	9,000	0.37	20	850	450
MI	23	58,597	690	310	0.01	20	35	16
MN	23	49,845	250	130	0.01	20	13	7
WI	23	97,299	740	360	0.01	20	37	18
JV total		426,942	91,680	46,800			4,584	2,340

<sup>a</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). This calculation can be used to compare the relative importance of State×BCR areas for this species.

<sup>b</sup>Reported density in quality habitat based on scientific literature.

<sup>c</sup>Protection objectives are the estimates / density in quality habitat, and restoration objectives are the deficits / density in quality habitat.

## Recommendations

**Habitat actions:** Protect existing habitat area and quality, and add (restore / enhance) 2,340 km<sup>2</sup> of habitat (see requirement above) in current breeding range. A well developed understory is required in areas of restoration (see reference for management techniques).

**Monitoring and performance:** Eliminating the current population deficit requires a 50% population increase or an average annual increase of 3% over a 15 year period.

## Additional background

Canada Warblers reach their highest numbers in northern JV region with fewer than 100 breeding pairs known from Ohio, Indiana and Illinois. Sites identified in the Great Lakes ecoregion of The Nature Conservancy with breeding populations >25 include: Fox Islands (Lake Michigan), Hiawatha National Forest, Tahquamenon Falls State Park, Porcupine Mountains, Menominee River and Baraga Plains, Michigan; Apostle Islands, Kakagon/Bad River, and Peshtigo/Oconto Wisconsin (The Nature Conservancy 1999); maps of these sites are available from the Midwestern Resource Office of The Nature Conservancy.

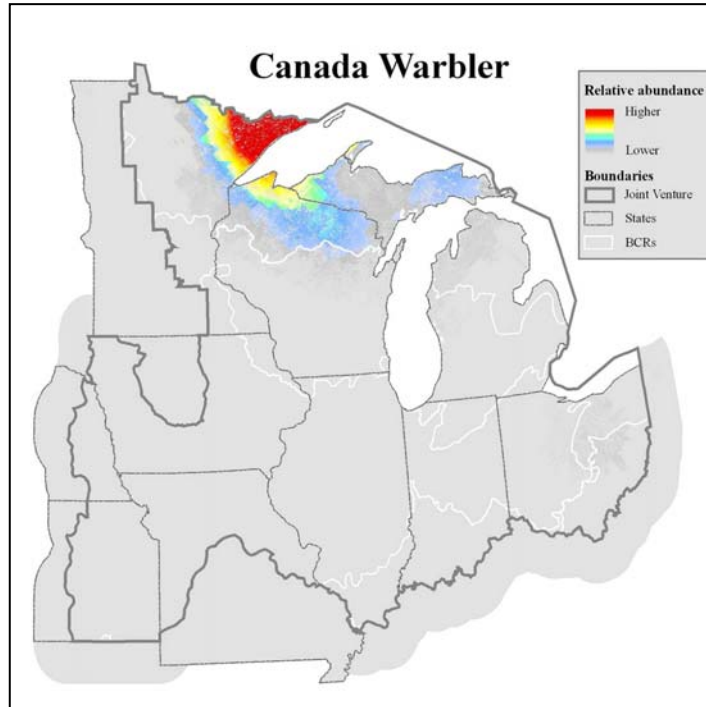
## References

- Conway, C. J. 1999. Canada Warbler (*Wilsonia canadensis*). In *The Birds of North America*, No. 421 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Robbins, C.S., D.K. Dawson, and B.A. Dowell. 1989. Habitat area requirements of breeding forest birds of the middle Atlantic states. *Wildlife Monographs* 103:1-34.



**Relative abundance and distribution**

Source: Map shading represents relative abundance and distribution interpolated from BBS counts (1995-2004). Mapped areas include cover types typically used by breeding Canada warblers (deciduous forest, evergreen forest, mixed forest and woody wetlands; NLCD 1992); all other cover types in the species range were removed (un-shaded).



**Yellow-breasted Chat (*Icteria virens*)**  
Species Account for Habitat Planning

**Joint Venture population deficit based on PIF  
Continental and State Plans**

Population goal	490,500
Current estimate	490,500
Deficit	0

**Breeding habitat requirements**

Community types: Shrubland, fencerows, stream margins, and early successional forest habitats with an abundance of weedy, shrubby cover and scattered trees with a height <4.5 m. Dense thickets of blackberry, multiflora rose, poison ivy, and Japanese honeysuckle are often used for nesting. Larger patches (>5.5 m in diameter) have been shown to decrease predation. Nests are located near ground (<2 m) supported by branches or dead vegetation.

Timing: May to August (egg-laying mid-May - early June, incubation 11-12 days, young fledge 7-10 days).

Area / distance: Rarely detected in shrubby patches <0.4 ha and most frequently in patches >5 ha. Prefers nest sites >20 m from habitat edge. Densities were greater in larger (13-16 ha) patches in southern Ohio and away from forest edges. Reported territory sizes ranged from 0.35-2.4 ha with smaller territories in high density areas. Densities range from 2-256 birds / km<sup>2</sup>, with an average of 100 birds / km<sup>2</sup>.

Limiting factors: Suitable shrubby and early successional habitats are ephemeral so frequent natural and anthropogenic disturbances are needed to create habitat for Yellow-breasted Chats. Predation of nests can be high and nest parasitism rates by Brown-headed Cowbirds range from 5-91%.

**Migration habitat requirements**

Community types: Generally uses similar shrubby cover as during the breeding season although it is occasionally found in suburban habitat.

Timing: April – May and August - September

Limiting factors: None identified for JV region.

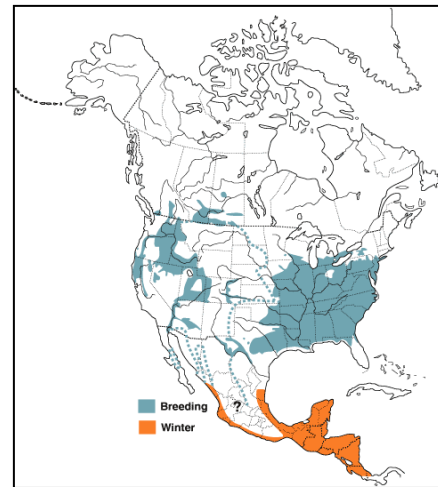
**Population monitoring**

Current survey effort: 1) N.A. Breeding Bird Survey (BBS).

Recommended monitoring: The BBS is considered adequate for the species. A greater number of routes would improve regional population estimates.

**Research to assist planning**

Current and ongoing projects: Edge and area sensitivity, nesting success, and movements are being studied in Ohio.



Species range map: Cornell Lab of Ornithology

**Research needs:** Better information is needed to assess numbers, population trends and causes for population changes. For example, relationships among patch size and landscape attributes with population densities, predation and nest parasitism rates; dispersal, survival, and other demographic parameters; and population responses to land management practices.

### Habitat model results

**Objective:** Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and Bird Conservation Region (BCR) population estimates and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative concentration (birds/km <sup>2</sup> ) <sup>a</sup>	Density (birds/km <sup>2</sup> ) <sup>b</sup>	Habitat objectives (km <sup>2</sup> ) <sup>c</sup>	
			Estimate	Deficit			Protection	Restoration
OH	13	21,933	6,400	0	0.29	100	64	0
IL	22	123,473	22,000	0	0.18	100	220	0
IN	22	44,701	12,000	0	0.27	100	120	0
MO	22	82,886	46,000	0	0.55	100	460	0
OH	22	52,190	9,800	0	0.19	100	98	0
IN	23	13,059	2,300	0	0.18	100	23	0
IL	24	18,710	88,000	0	4.70	100	880	0
IN	24	35,774	140,000	0	3.91	100	1,400	0
OH	24	1,919	14,000	0	7.30	100	140	0
OH	28	30,912	150,000	0	4.85	100	1,500	0
JV total		425,558	490,500	0			4,905	0

<sup>a</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). This calculation can be used to compare the relative importance of State×BCR areas for this species.

<sup>b</sup>Reported density in quality habitat based on scientific literature.

<sup>c</sup>Protection objectives are the estimates / density in quality habitat, and restoration objectives are the deficits / density in quality habitat.

### Recommendations

**Habitat actions:** Protect current habitat area and quality. There are no restoration and enhancement objectives. Clear-cutting and shelterwood cutting that create openings >5 ha will lead to the development of suitable habitat. Selective logging and single or group tree selection cuts do not create openings large enough for chats.

**Monitoring and performance:** The population is at goal level and it should continue to be monitored to track trends.

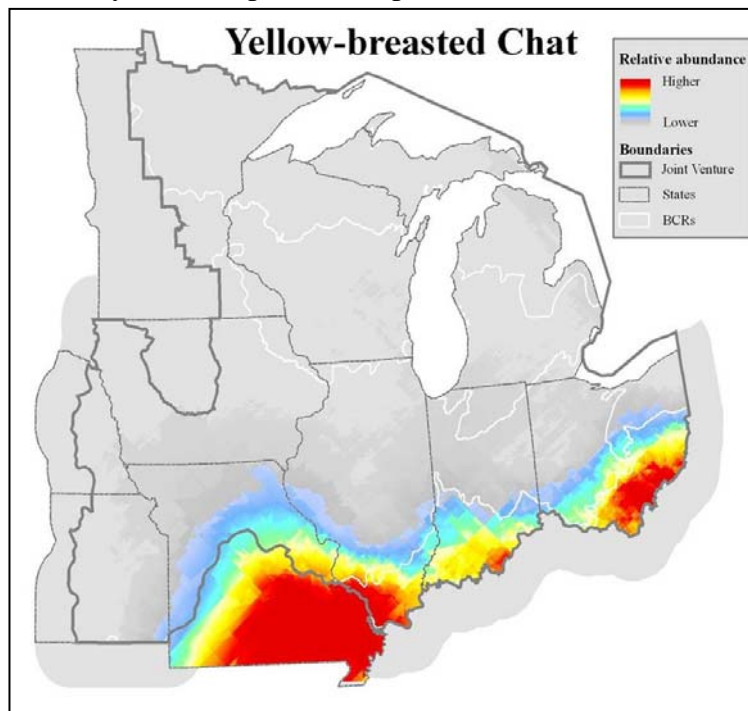
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### Relative abundance and distribution

Source: Map shading represents relative abundance and distribution interpolated from BBS counts (1995-2004). Cover types used by breeding Yellow-breasted Chats were not identifiable using existing regional spatial data (NLCD 1992), thus some areas (e.g., urban) within the shaded boundary are unimportant to species.



**Henslow's Sparrow (*Ammodramus henslowii*)**  
Species Account for Habitat Planning

**Joint Venture population deficit based on PIF  
Continental and State Plans**

Population goal	87,340
Current estimate	43,670
Deficit	43,670

**Breeding habitat requirements**

Community types: Dense stands of herbaceous grasslands >30 cm tall. Further requirements include a well developed litter layer and standing dead vegetation with minimal woody cover. Recently burned grasslands are seldom used but species often occupies grasslands 1 year post-fire with densities increasing through 2 years post-fire. Fires 3-4 years apart are optimal.

Timing: Mid-May to August (egg laying in Mid-May and second nest initiated in July – August; incubation 11 days; young fledge in 9-10 days).

Area / distance: Minimum area of 30 ha of grass required. Densities average 57 breeding pairs/km<sup>2</sup>, with a range of 29-152 pairs/km<sup>2</sup>. It is estimated that 2,500 ha of suitable habitat is needed to sustain 5,000 pairs of Henslow's Sparrows. Estimated density in strip mines in southern Indiana was 0.16/ha (Bajema et al. 2001) and in large prairie fragments densities of 0.22-0.28 males/ha have been found.

Limiting factors: Large areas of native herbaceous grass with little to no woody cover.

**Migration habitat requirements**

Community types: Presumably grassy areas similar to composition of breeding habitat.

Timing: Mid-April – Late-May and September - December

Limiting factors: Large areas of tall dense grasslands.

**Population monitoring**

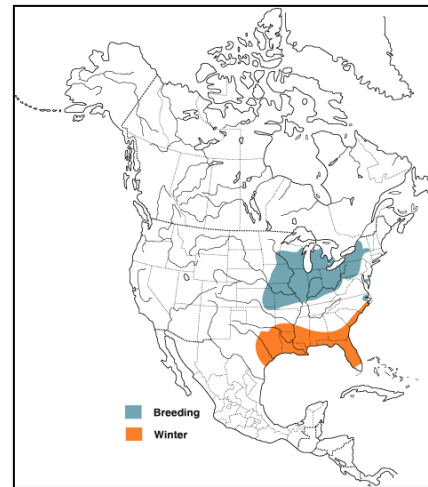
Current survey effort: 1) N. A. Breeding Bird Survey (BBS).

Recommended monitoring: None identified for JV region.

**Research to assist planning**

Current and ongoing projects: A study of grassland birds is being conducted in Michigan, including Henslow's Sparrows. Breeding densities, nesting success and habitat selection is being studied in reclaimed strip mines in Ohio. Annual surveys are being conducted at Big Oaks National Wildlife Refuge. The effects of tree-line removal on grassland birds is being conducted in south west Wisconsin.

Research needs: None identified for JV region.



Species range map: Cornell Lab of Ornithology

## Habitat model results

**Objective:** Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and Bird Conservation Region (BCR) population estimates and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative concentration (birds/km <sup>2</sup> ) <sup>a</sup>	Density (birds/km <sup>2</sup> ) <sup>b</sup>	Habitat objectives (km <sup>2</sup> ) <sup>c</sup>	
			Estimate	Deficit			Protection	Restoration
MI	12	87,786	1,200	1,200	0.01	114	11	11
WI	12	46,114	500	500	0.01	114	4	4
OH	13	21,933	350	350	0.02	114	3	3
IN	22	44,701	230	230	0.01	114	2	2
KS	22	65,988	1,200	1,200	0.02	114	11	11
MO	22	82,886	17,000	17,000	0.21	114	149	149
OH	22	52,190	600	600	0.01	114	5	5
IL	23	3,278	220	220	0.07	114	2	2
IN	23	13,059	1,300	1,300	0.10	114	11	11
MI	23	58,597	3,600	3,600	0.06	114	32	32
MN	23	49,845	330	330	0.01	114	3	3
WI	23	97,299	4,600	4,600	0.05	114	40	40
IL	24	18,710	340	340	0.02	114	3	3
IN	24	35,774	7,000	7,000	0.20	114	61	61
OH	24	1,919	200	200	0.10	114	2	2
OH	28	30,912	5,000	5,000	0.16	114	44	44
JV total		710,991	43,670	43,670			383	383

<sup>a</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). This calculation can be used to compare the relative importance of State×BCR areas for this species.

<sup>b</sup>Reported density in quality habitat based on scientific literature.

<sup>c</sup>Protection objectives are the estimates / density in quality habitat, and restoration objectives are the deficits / density in quality habitat.

## Recommendations

**Habitat actions:** Protect existing habitat area and quality, and add (restore / enhance) 383 km<sup>2</sup> of habitat (see requirements above) at multiple sites within current and historical range. Focus should be on large blocks of grassland >1 km<sup>2</sup> (see references for management techniques).

**Monitoring and performance:** Eliminating the current population deficit requires a 100% population increase or an average annual increase of 5% over a 15 year period.

## Additional background

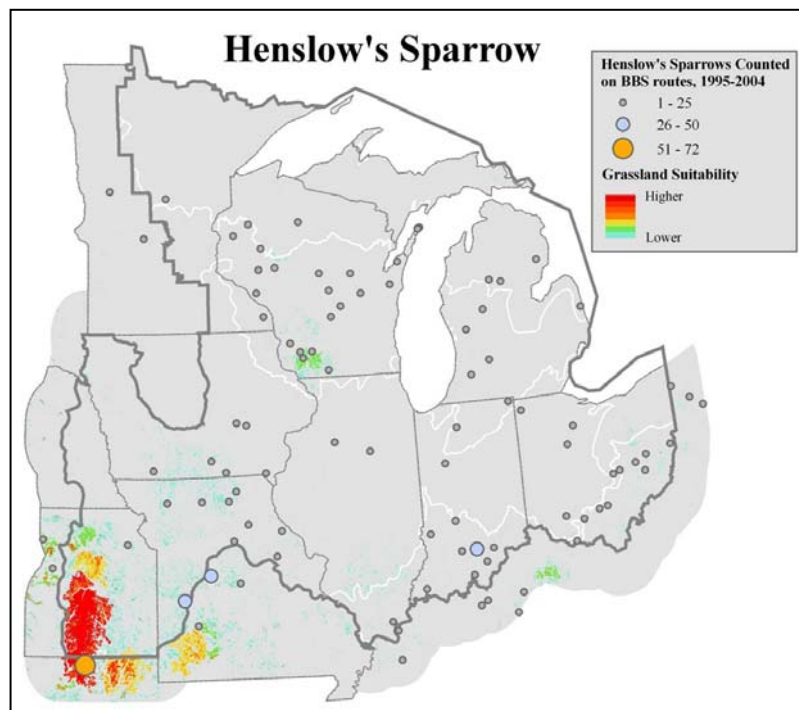
Sites identified in the Great Lakes ecoregion of The Nature Conservancy with breeding populations >25 include: Marion, Michigan (The Nature Conservancy 1999); a map of this site is available from the Midwestern Resource Office of The Nature Conservancy. In addition, Bajema et al. (2001) identified eleven 500 ha areas of suitable habitat for Henslow's Sparrows at 19 strip mines (each mine with >100 ha of grassland) in southern Indiana; areas are estimated to support 2,000 to 4,000 Henslow's Sparrows.

## References

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## Relative abundance and distribution

Source: Grassland suitability for Henslow's Sparrow is derived from the 1992 National Land Cover Dataset. Larger grassland patches are deemed more suitable to Henslow's Sparrows. Patches smaller than 30 ha and <70% grass cover were removed. Dots represent the total number of Henslow's Sparrows counted on BBS routes, 1995-2004.



**Eastern Meadowlark (*Sturnella magna*)**  
Species Account for Habitat Planning

**Joint Venture population deficit based on PIF  
Continental and State Plans**

Population goal	3,781,800
Current estimate	1,890,090
Deficit	1,890,090

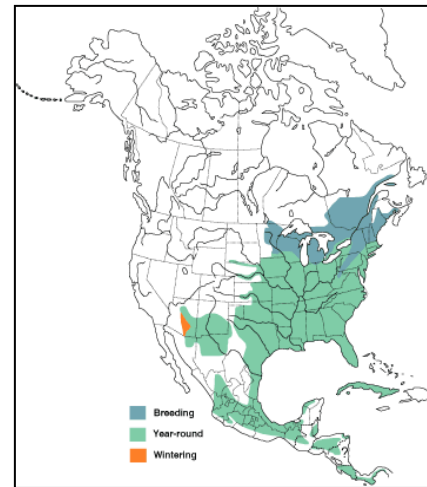
**Breeding habitat requirements**

Community types: Most common in native grasslands, pastures, and savannas, but also in hay and alfalfa fields, weedy borders of croplands, roadsides, orchards, golf courses, reclaimed strip mines, airports, shrubby overgrown fields, or other open areas; tall-grass prairie. Species shows preference for grass with a well developed litter layer and nests in dense vegetation on the ground in a shallow depression.

Timing: April to August (egg laying in April – July; incubation 13-14 days; young fledge in 10-12 days).

Area / distance: Territories range from 1.2-6.1 ha. Breeding densities can average 80 birds / km<sup>2</sup> in quality habitat.

Limiting factors: Loss and degradation of suitable habitat due to intensive agriculture appears to limit species. Early mowing and haying of fields can kill young and adults on nests.



Species range map: Cornell Lab of Ornithology

**Migration and wintering habitat requirements**

Community types: Similar to breeding habitat (see above).

Timing: Limited migration occurs.

Limiting factors: Availability of large grasslands.

**Population monitoring**

Current survey effort: 1) N.A. Breeding Bird Survey (BBS).

Recommended monitoring: The BBS is an adequate survey to track trends although additional survey routes may be needed in species primary range.

**Research to assist planning**

Current and ongoing projects: A study of habitat use, movement patterns, and survival of juvenile Eastern Meadowlarks is being completed. Breeding densities in reclaimed strip mines in Ohio is being conducted. The effects of tree-line removal on grassland birds is being conducted in south west Wisconsin.

Research needs: Effective monitoring to measure population densities as BBS generated densities have not been tested, and evaluate / determine most efficient habitat actions to increase populations.



## Habitat model results

**Objective:** Eliminate regional population deficit over a 15-year period through effective and efficient habitat conservation that is considerate of other species of concern.

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and Bird Conservation Region (BCR) population estimates and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative concentration (birds/km <sup>2</sup> ) <sup>a</sup>	Density (birds/km <sup>2</sup> ) <sup>b</sup>	Habitat objectives (km <sup>2</sup> ) <sup>c</sup>	
			Estimate	Deficit			Protection	Restoration
MI	12	87,786	37,000	37,000	0.42	80	463	463
MN	12	87,301	8,500	8,500	0.10	80	106	106
WI	12	46,114	12,000	12,000	0.26	80	150	150
OH	13	21,933	30,000	30,000	1.37	80	375	375
IA	22	108,344	110,000	110,000	1.02	80	1,375	1,375
IL	22	123,473	290,000	290,000	2.35	80	3,625	3,625
IN	22	44,701	75,000	75,000	1.68	80	938	938
KS	22	65,988	360,000	360,000	5.46	80	4,500	4,500
MN	22	10,587	12,000	12,000	1.13	80	150	150
MO	22	82,886	460,000	460,000	5.55	80	5,750	5,750
NE	22	21,979	4,100	4,100	0.19	80	51	51
OH	22	52,190	87,000	87,000	1.67	80	1,088	1,088
WI	22	1,475	1,200	1,200	0.81	80	15	15
IA	23	7,312	7,500	7,500	1.03	80	94	94
IL	23	3,278	7,500	7,500	2.29	80	94	94
IN	23	13,059	19,000	19,000	1.45	80	238	238
MI	23	58,597	55,000	55,000	0.94	80	688	688
MN	23	49,845	25,000	25,000	0.50	80	313	313
WI	23	97,299	140,000	140,000	1.44	80	1,750	1,750
IL	24	18,710	42,000	42,000	2.24	80	525	525
IN	24	35,774	70,000	70,000	1.96	80	875	875
OH	24	1,919	2,100	2,100	1.09	80	26	26
OH	28	30,912	36,000	36,000	1.16	80	450	450
JV total			1,890,900	1,890,900			23,636	23,636

<sup>a</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). This calculation can be used to compare the relative importance of State×BCR areas for this species.

<sup>b</sup>Reported density in quality habitat based on scientific literature.

<sup>c</sup>Protection objectives are the estimates / density in quality habitat, and restoration objectives are the deficits / density in quality habitat.

## Recommendations

**Habitat actions:** Protect existing habitat area and quality, and add (restore / enhance) 24,000 km<sup>2</sup> of habitat (see requirements above) at multiple sites within current breeding range.

Management should focus on creating large grass complexes for optimal multi-season habitat.

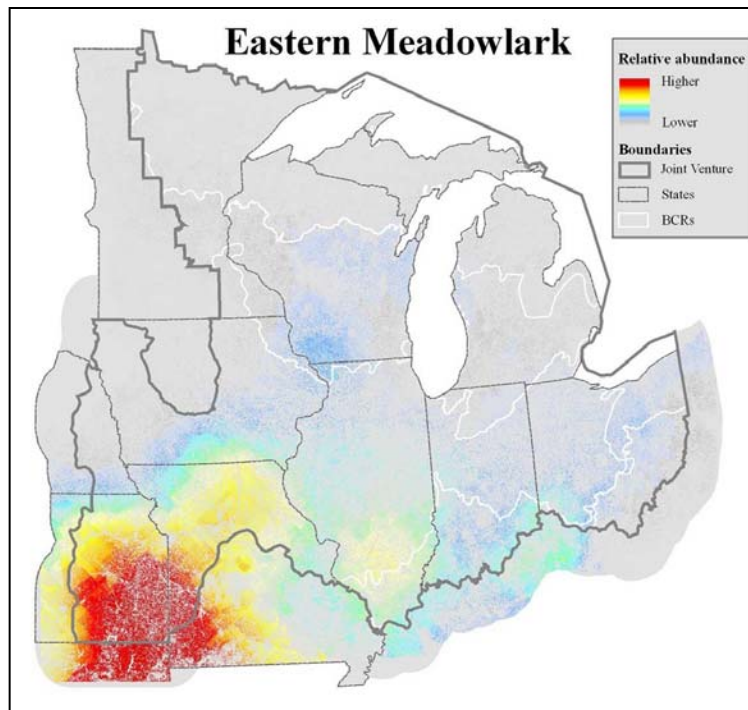
**Monitoring and performance:** Eliminating the current population deficit requires a 100% population increase or an average annual increase of 5% over a 15 year period.

## References

Lanyon, W. E. 1995. Eastern Meadowlark (*Sturnella magna*). In *The Birds of North America*, No. 160 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

## Relative abundance and distribution

Source: Map shading represents relative abundance and distribution interpolated from BBS counts (1995-2004). Mapped areas include cover types typically used by breeding Eastern Meadowlarks (herbaceous grassland and pasture / hay, NLCD 1992); all other cover types in the species range were removed (un-shaded).



**Appendix B. English and scientific names of Joint Venture focal species and other landbirds of continental priority identified in the North American Landbird Conservation Plan (Rich et al. 2004) and occurring in the Upper Mississippi River and Great Lakes Joint Venture region; two terrestrial shorebirds, Upland Sandpiper and American Woodcock, are also included. List is arranged in taxonomic order.**

English name	Scientific name
Greater Prairie-Chicken	<i>Tympanuchus cupido</i>
Upland Sandpiper	<i>Bartramia longicauda</i>
American Woodcock	<i>Scolopax minor</i>
Short-eared Owl	<i>Asio flammeus</i>
Whip-poor-will	<i>Caprimulgus vociferus</i>
Chimney Swift	<i>Chaetura pelagica</i>
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>
Olive-sided Flycatcher	<i>Contopus cooperi</i>
Willow Flycatcher	<i>Empidonax traillii</i>
Bell's Vireo	<i>Vireo bellii</i>
Veery	<i>Catharus fuscescens</i>
Wood Thrush	<i>Hylocichla mustelina</i>
Blue-winged Warbler	<i>Vermivora pinus</i>
Golden-winged Warbler	<i>Vermivora chrysoptera</i>
Cape May Warbler	<i>Dendroica tigrina</i>
Black-throated Blue Warbler	<i>Dendroica caerulescens</i>
Kirtland's Warbler	<i>Dendroica kirtlandii</i>
Bay-breasted Warbler	<i>Dendroica castanea</i>
Cerulean Warbler	<i>Dendroica cerulea</i>
Prothonotary Warbler	<i>Protonotaria citrea</i>
Worm-eating Warbler	<i>Helmitheros vermivora</i>
Louisiana Waterthrush	<i>Seiurus motacilla</i>
Kentucky Warbler	<i>Oporornis formosus</i>
Connecticut Warbler	<i>Oporornis agilis</i>
Canada Warbler	<i>Wilsonia canadensis</i>
Yellow-breasted Chat	<i>Icteria virens</i>
Henslow's Sparrow	<i>Ammodramus henslowii</i>
Dickcissel	<i>Spiza americana</i>
Eastern Meadowlark	<i>Sturnella magna</i>
Rusty Blackbird	<i>Euphagus carolinus</i>

## **Appendix C. Estimating landbird population and habitat objectives for the Upper Mississippi River and Great Lakes Joint Venture region.**

Habitat and population objectives for the strategy were derived from analyses of North American Breeding Bird Survey (BBS) data and population goals defined in the PIF North American Landbird Conservation Plan (Rich et al. 2004) and Partners In Flight plans (Blancher and Rosenberg, Cornell Laboratory of Ornithology, unpublished data). Population goals were simple: maintain populations, increase by 50%, or increase by 100%. Blancher and Rosenberg stepped down continental population estimates to sub-BCR units represented by the intersection of Bird Conservation Regions and states (State×BCR polygons) and population goals were allocated accordingly. Population density estimates were derived from the literature, primarily the Birds of North America accounts (Poole and Gill 1992-2004) and other recent publications. We used median densities that we assumed represented medium to high quality habitats. Population goals were divided by density estimates to obtain habitat area objectives for each State×BCR polygon. Habitat maintenance objectives reflect the area of habitat needed for current populations whereas restoration and enhancement objectives represent the area of habitat needed to alleviate population deficits (population goal – current population = population deficit). See example below.

A primary limitation to this simplistic approach of objective setting is that it does not provide measurable objectives for increasing quality of existing suitable habitats. An alternate approach was considered but required more resources than were available for this version of the strategy. This approach would derive population estimates by modeling species' abundance based on habitat associations across ecoregions and comparing these estimates with other monitoring data and focused field studies (Larson et al. 2004, Thogmartin et al. 2004b, Thogmartin et al. 2006). The resulting predictive maps would then be used to identify potential locations for monitoring and conservation management actions (Hanski and Ovaskainen 2000). The approach is enhanced if accurate land cover maps are available to capture habitat features relevant to focal species at the appropriate spatial scales (Thogmartin et al. 2004a). Maps with this level of resolution are not currently available for the JV region. Habitat quality assessment and more sophisticated modeling approaches will be emphasized in future iterations of this strategy.

### **Example: Canada Warbler**

Objective: Eliminate regional population deficit through effective and efficient habitat conservation that is considerate of other species of concern.

#### **Joint Venture population information based on PIF Continental and State Plans**

Population goal	138,480
Current estimate	91,680
Deficit	46,800

Habitat protection and restoration objectives derived from Partners in Flight (PIF) State and BCR population priorities and objectives.

State	BCR	Land unit area (km <sup>2</sup> )	Population (birds)		Relative concentration (birds/km <sup>2</sup> ) <sup>b</sup>	Density (birds/km <sup>2</sup> ) <sup>c</sup>	Habitat objectives (km <sup>2</sup> ) <sup>d</sup>	
			Estimate	Deficit <sup>a</sup>			Protection	Restoration
MI	12	87,786	11,000	6,000	0.13	20	550	300
MN	12	87,301	62,000	31,000	0.71	20	3,100	1,550
WI	12	46,114	17,000	9,000	0.37	20	850	450
MI	23	58,597	690	310	0.01	20	35	16
MN	23	49,845	250	130	0.01	20	13	7
WI	23	97,299	740	360	0.01	20	37	18
JV total		426,942	91,680	46,800		20	4,584	2,340

<sup>a</sup>Population deficits may not be exactly 0, 50, or 100% due to rounding or slight refinement for individual State×BCR polygons (Blancher and Rosenberg, unpublished data).

<sup>b</sup>Relative concentration reflects estimated species abundance based on random surveys (BBS routes) of this land unit area (population estimate / land area). This calculation can be used to compare the relative importance of State×BCR polygon areas for this species.

<sup>c</sup>Reported average density for this species in quality habitat based on scientific literature.

<sup>d</sup>Protection objectives are the population estimates / density in quality habitat, and restoration objectives are the deficits / density in quality habitat.

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**Appendix D. Threats common to breeding and migrating landbirds in the Upper Mississippi River and Great Lakes Joint Venture Region.**

<b>Category</b>	<b>Threats</b>	<b>Examples and concerns</b>
<b>Habitat conversion and fragmentation</b>	Industrial, residential, and recreational development causing wetland loss or degradation	Housing Industrial development Golf courses Cell Towers Wind farms Roads
	Intensification of agriculture	Conversion of grasslands to row crops Short mowing intervals on haylands
	Changes in forestry practices	Short-rotation plantations Reduction in conifer stands
	Fragmented ownership of formerly large land holdings	Sales of large timber holdings for housing or recreation
	Incompatible natural resource management	Prescribed burn patterns/frequency Vegetative planting/manipulation Flooding and dam maintenance and removal Loss of migrant stop-over habitat
	Loss of shrublands	No economic return on shrublands
<b>Non-consumptive biological resource use</b>	Non-consumptive recreation	Noise and disturbance
	Military maneuvers	Heavy artillery training Heavy equipment movements Aircraft traffic
<b>Pollution</b>	Urban, municipal and industrial pollution	Solid waste Acid rain Oil and gas drilling/mining
	Pesticides and herbicides	Agriculture practices Golf course practices Mosquito control
<b>Biological interactions</b>	Invasive plants and animals (native & exotic)	Expanding ranges Introduced plants Introduced animals Introduced predators Free-ranging cats and dogs Deer (over-browse)
	Disease, pathogens, and parasites	West Nile virus Avian influenza
	Loss of genetic viability	Greater Prairie-Chickens
<b>Modification of natural processes</b>	Climate change	Human influenced Natural processes
	Grazing/mowing patterns	Frequency of mowing High intensity grazing
	Fire regime	Fire suppression
	Hydrologic regimes	Water withdrawal Drains and accelerated drainage Field tiles and stream flash flooding
<b>Education</b>	Lack of species life history knowledge	Inappropriate management due to lack of knowledge
	Social attitudes	Persecution Ignorance Apathy
<b>Unknown</b>	Not yet documented	Not yet documented

**Appendix E. Habitat maintenance/protection objectives for six landbird guilds (representing major cover types) in the Upper Mississippi River and Great Lakes Joint Venture (JV) region. Species with the greatest habitat requirement in the State×BCR polygon within the JV region were used for the guild objective (see text for details).**

*Deciduous Forest – Maintenance and Protection*

State	BCR	Guild objective	Species			
			Black-throated Blue Warbler	Cerulean Warbler	Louisiana Waterthrush	Kentucky Warbler
Iowa	22 <sup>a</sup>	5	0	0	1	5
	23	0	0	0	0	0
	Total	5	0	0	1	5
Illinois	22 <sup>a</sup>	62	0	5	2	62
	23	0	0	0	0	0
	24 <sup>a</sup>	357	0	0	9	357
Indiana	Total	419	0	5	11	419
	22 <sup>a</sup>	13	0	13	0.5	4
	23	5	0	5	0	0
	24 <sup>a</sup>	1,071	0	221	18	1,071
	Total	1,089	0	239	18.5	1,075
Kansas	22 / Total <sup>a</sup>	36	0	0	4	36
Michigan	12	470	470	4	0	0
	22	0	0	0	0	0
	23 <sup>a</sup>	85	5	85	4	0
	Total	555	475	89	4	0
	12	47	47	0	0	0
	22	0	0	0	0	0
Minnesota	23	8	0	8	0	0
	Total	55	47	8	0	0
Missouri	22 / Total <sup>a</sup>	357	0	0	12	357
Nebraska	22 / Total	0	0	0	0	0
Ohio	13	209	0	209	0	1
	22 <sup>a</sup>	33	0	33	1	26
	24 <sup>a</sup>	40	0	10	6	40
	28 <sup>a</sup>	810	0	628	31	810
	Total <sup>a</sup>	1,092	0	880	38	877
Wisconsin	12 <sup>a</sup>	89	89	15	0.3	0
	22	0	0	0	0	0
	23	17	2	17	0	0
	Total	106	91	32	0.3	0
	12 <sup>a</sup>	606	606	19	0	0
	13	209	0	209	0	1
All states	22 <sup>a</sup>	506	0	51	21	490
	23 <sup>a</sup>	115	7	115	4	0
	24 <sup>a</sup>	1,583	0	346	37	1,468
	28 <sup>a</sup>	810	0	628	31	810
	Total	3,829	613	1,368	93	2,769

<sup>a</sup>Guild objective for State×BCR polygon and total contains required habitat for Louisiana Waterthrush a streamside habitat specialist that uses deciduous forest. For example, the Iowa BCR 22 guild objective of 5 km<sup>2</sup> should include 1 km<sup>2</sup> for Louisiana Waterthrush.

<b><i>Evergreen Forest – Maintenance and Protection</i></b>						
State	BCR	Guild objective <sup>a</sup>	Species			
			Olive-sided Flycatcher	Connecticut Warbler	Cape May Warbler	Kirtland's Warbler
Iowa	22	0	0	0	0	0
	23	0	0	0	0	0
	Total	0	0	0	0	0
Illinois	22	0	0	0	0	0
	23	0	0	0	0	0
	24	0	0	0	0	0
	Total	0	0	0	0	0
Indiana	22	0	0	0	0	0
	23	0	0	0	0	0
	24	0	0	0	0	0
	Total	0	0	0	0	0
Kansas	22 / Total	0	0	0	0	0
Michigan	12 <sup>a</sup>	2,000	176	3	2,000	770
	22	0	0	0	0	0
	23	0	0	0	0	0
	Total	2,000	176	3	2,000	770
Minnesota	12	3,000	565	74	3,000	0
	22	0	0	0	0	0
	23	150	7	0	150	0
	Total	3,150	572	74	3,150	0
Missouri	22 / Total	0	0	0	0	0
Nebraska	22 / Total	0	0	0	0	0
Ohio	13	0	0	0	0	0
	22	0	0	0	0	0
	24	0	0	0	0	0
	28	0	0	0	0	0
	Total	0	0	0	0	0
Wisconsin	12	400	88	20	400	0
	22	0	0	0	0	0
	23	60	14	1	60	0
	Total	460	102	21	460	0
All states	12	5,400	829	97	5,400	770
	13	0	0	0	0	0
	22	0	0	0	0	0
	23	210	21	1	210	0
	24	0	0	0	0	0
	28	0	0	0	0	0
	Total	5,610	850	98	5,610	770

<sup>a</sup>Guild objective based on Cape May Warbler may be greater than the current available habitat. See text for details.



<i>Forested Wetland – Maintenance and Protection</i>			
State	BCR	Guild objective <sup>a</sup>	Species
			Prothonotary Warbler
Iowa	22	0	0
	23	0	0
	Total	0	0
Illinois	22	148	148
	23	0	0
	24	97	97
	Total	245	245
Indiana	22	3	3
	23	4	4
	24	120	120
	Total	127	127
Kansas	22 / Total	16	16
Michigan	12	0	0
	22	0	0
	23	47	47
	Total	47	47
Minnesota	12	0	0
	22	0	0
	23	0	0
	Total	0	0
Missouri	22 / Total	250	250
Nebraska	22 / Total	0	0
Ohio	13	0	0
	22	2	2
	24	0	0
	28	2	2
	Total	4	4
Wisconsin	12	0	0
	22	0	0
	23	3	3
	Total	3	3
All states	12	0	0
	13	0	0
	22	419	419
	23	54	54
	24	217	217
	28	2	2
	Total	692	692

<sup>a</sup>Guild objective based on Prothonotary Warbler. Habitat objectives for Willow Flycatcher, another woody wetland focal species, were estimated to be greater than existing habitat available. See text for details.

***Shrubland – Maintenance and Protection***

State	BCR	Guild objective	Species			
			Blue-winged Warbler	Yellow-breasted Chat	Golden-winged Warbler	American Woodcock
Iowa	22	20	20	0	0	0
	23	0	0	0	0	0
	Total	20	20	0	0	0
Illinois	22	2,460	6	220	2	2,460
	23	22	0	0	0	22
	24	1,780	28	880	0	1,780
	Total	4,262	34	1,100	2	4,262
Indiana	22	760	0	120	0	760
	23	210	16	23	0	210
	24	1,400	92	1,400	0	1,200
	Total	2,370	108	1,543	0	2,170
Kansas	22 / Total	0	0	0	0	0
Michigan	12	12,350	26	0	98	12,350
	22	0	0	0	0	0
	23	340	340	0	9	230
	Total	12,690	366	0	107	12,580
Minnesota	12	6,320	0	0	840	6,320
	22	230	0	0	0	230
	23	2,000	72	0	46	2,000
	Total	8,550	72	0	886	8,550
Missouri	22 / Total	460	32	460	0	0
Nebraska	22 / Total	0	0	0	0	0
Ohio	13	2,360	152	64	0	2,360
	22	1,100	18	98	0	1,100
	24	140	30	140	0	50
	28	1,500	820	1,500	1	0
	Total	5,100	1,020	1,802	1	3,510
Wisconsin	12	3,230	1	0	320	3,230
	22	9	9	0	0	0
	23	3,960	240	0	160	3,960
	Total	7,199	250	0	480	7,190
All states	12	21,900	27	0	1,258	21,900
	13	2,360	152	64	0	2,360
	22	5,039	85	898	2	4,550
	23	6,532	668	23	215	6,422
	24	3,320	150	2,420	0	3,030
	28	1,500	820	1,500	1	0
	Total	40,651	1,902	4,905	1,476	38,262

<i>Grassland and Savanna – Maintenance and Protection</i>			Grassland Species				Savanna Species	
State	BCR	Guild Objective	Greater Prairie-Chicken	Henslow's Sparrow	Eastern Meadowlark	Upland Sandpiper	Guild Objective	Red-headed Woodpecker
Iowa	22	1,375	0	0	1,375	145	15,833	15,833
	23	94	0	0	94	4	783	783
	Total	1,469	0	0	1,469	149	16,616	16,616
Illinois	22	3,625	20	0	3,625	26	11,667	11,667
	23	94	0	2	94	2	258	258
	24	525	0	3	525	0	2,833	2,833
	Total	4,244	20	5	4,244	28	14,758	14,758
Indiana	22	938	0	2	938	8	2,917	2,917
	23	238	0	11	238	0	667	667
	24	875	0	61	875	2	3,500	3,500
	Total	2,051	0	74	2,051	10	7,084	7,084
Kansas	22 / Total	4,600	4,600	11	4,500	1,093	6,667	6,667
Michigan	12	463	0	11	463	41	375	375
	22	0	0	0	0	0	283	283
	23	688	0	32	688	30	667	667
	Total	1,151	0	43	1,151	71	1,325	1,325
Minnesota	12	580	580	0	106	18	400	400
	22	150	0	0	150	2	750	750
	23	313	0	3	313	7	2,667	2,667
	Total	1,043	580	3	569	27	3,817	3,817
Missouri	22 / Total	5,750	380	149	5,750	169	16,667	16,667
Nebraska	22 / Total	51	0	0	51	37	5,000	5,000
Ohio	13	375	0	3	375	0	750	750
	22	1,088	0	5	1,088	1	2,000	2,000
	24	26	0	2	26	0	0	0
	28	450	0	44	450	0	183	183
	Total	1,939	0	54	1,939	1	2,933	2,933
Wisconsin	12	150	0	4	150	20	133	133
	22	15	0	0	15	0	42	42
	23	1,750	1,100	40	1,750	45	5,667	5,667
	Total	1,915	1,100	44	1,915	65	5,842	5,842
All states	12	1,193	580	15	719	79	908	908
	13	375	0	3	375	0	750	750
	22	17,592	5,000	167	17,492	1,481	61,826	61,826
	23	3,177	1,100	88	3,177	88	10,709	10,709
	24	1,426	0	66	1,426	2	6,333	6,333
	28	450	0	44	450	0	183	183
	Total	24,213	6,680	383	23,639	1,650	80,709	80,709

**Appendix F. Habitat restoration and enhancement objectives for six landbird guilds (representing major cover types) in the Upper Mississippi River and Great Lakes Joint Venture (JV) region. Species with the greatest habitat requirement in the State×BCR polygon within the JV region were used for the guild objective (see text for details).**

<i>Deciduous Forest - Restoration</i>			Species			
State	BCR	Guild objective	Cerulean Warbler	Louisiana Waterthrush	Kentucky Warbler	Black-throated Blue Warbler
Iowa	22	3	0	0	3	0
	23	0	0	0	0	0
	Total	3	0	0	3	0
Illinois	22	31	5	0	31	0
	23	0	0	0	0	0
	24	179	0	0	179	0
	Total	210	5	0	210	0
Indiana	22	13	13	0	2	0
	23	5	5	0	0	0
	24	536	221	0	536	0
	Total	554	239	0	538	0
Kansas	22 / Total	18	0	0	18	0
Michigan	12	4	4	0	0	0
	22	0	0	0	0	0
	23	85	85	0	0	0
	Total	89	89	0	0	0
Minnesota	12	0	0	0	0	0
	22	0	0	0	0	0
	23	8	8	0	0	0
	Total	8	8	0	0	0
Missouri	22 / Total	179	0	0	179	0
Nebraska	22 / Total	0	0	0	0	0
Ohio	13	209	209	0	1	0
	22	33	33	0	13	0
	24	20	10	0	20	0
	28	628	628	0	405	0
	Total	890	880	0	439	0
Wisconsin	12	15	15	0	0	0
	22	0	0	0	0	0
	23	17	17	0	0	0
	Total	32	32	0	0	0
All states	12	19	19	0	0	0
	13	209	209	0	1	0
	22	277	51	0	246	0
	23	115	115	0	0	0
	24	735	231	0	735	0
	28	628	628	0	405	0
Total		1,983	1,253	0	1,387	0

***Evergreen Forest - Restoration***

State	BCR	Guild objective <sup>a</sup>	Species			
			Olive-sided Flycatcher	Connecticut Warbler	Cape May Warbler	Kirtland's Warbler
Iowa	22	0	0	0	0	0
	23	0	0	0	0	0
	Total	0	0	0	0	0
Illinois	22	0	0	0	0	0
	23	0	0	0	0	0
	24	0	0	0	0	0
	Total	0	0	0	0	0
Indiana	22	0	0	0	0	0
	23	0	0	0	0	0
	24	0	0	0	0	0
	Total	0	0	0	0	0
Kansas	22 / Total	0	0	0	0	0
Michigan	12 <sup>a</sup>	176	176	1	0	0
	22	0	0	0	0	0
	23	0	0	0	0	0
	Total	176	176	1	0	0
Minnesota	12	565	565	38	0	0
	22	0	0	0	0	0
	23	7	7	0	0	0
	Total	572	572	38	0	0
Missouri	22 / Total	0	0	0	0	0
Nebraska	22 / Total	0	0	0	0	0
Ohio	13	0	0	0	0	0
	22	0	0	0	0	0
	24	0	0	0	0	0
	28	0	0	0	0	0
	Total	0	0	0	0	0
Wisconsin	12	88	88	10	0	0
	22	0	0	0	0	0
	23	14	14	0	0	0
	Total	102	102	10	0	0
All states	12	829	829	49	0	0
	13	0	0	0	0	0
	22	0	0	0	0	0
	23	21	21	0	0	0
	24	0	0	0	0	0
	28	0	0	0	0	0
	Total	850	850	49	0	0

<b>Forested Wetland - Restoration</b>			<b>Species</b>	
State	BCR	Guild objective <sup>a</sup>	Prothonotary Warbler	
Iowa	22	0	0	
	23	0	0	
	Total	0	0	
Illinois	22	74	74	
	23	0	0	
	24	48	48	
	Total	122	122	
Indiana	22	1	1	
	23	2	2	
	24	60	60	
	Total	63	63	
Kansas	22 / Total	8	8	
Michigan	12	0	0	
	22	0	0	
	23	23	23	
	Total	23	23	
Minnesota	12	0	0	
	22	0	0	
	23	0	0	
	Total	0	0	
Missouri	22 / Total	125	125	
Nebraska	22 / Total	0	0	
Ohio	13	0	0	
	22	1	1	
	24	0	0	
	28	1	1	
	Total	2	2	
Wisconsin	12	0	0	
	22	0	0	
	23	1	1	
	Total	1	1	
All states	12	0	0	
	13	0	0	
	22	209	209	
	23	26	26	
	24	108	108	
	28	1	1	
Total		344	344	

<sup>a</sup>Guild objective based on Prothonotary Warbler. Habitat objectives for Willow Flycatcher, another woody wetland focal species, were estimated to be greater than existing habitat available. See text for details.

<i>Shrubland - Restoration</i>			Species			
State	BCR	Guild objective	Blue-winged Warbler	Yellow-breasted Chat	Golden-winged Warbler	American Woodcock
Iowa	22	8	8	0	0	0
	23	0	0	0	0	0
	Total	8	8	0	0	0
Illinois	22	3	3	0	2	0
	23	20	0	0	0	20
	24	14	14	0	0	0
	Total	37	17	0	2	20
Indiana	22	1,080	0	0	0	1,080
	23	300	10	0	0	300
	24	2,060	46	0	0	2,060
	Total	3,440	56	0	0	3,440
Kansas	22 / Total	0	0	0	0	0
Michigan	12	1,420	14	0	98	1,420
	22	140	0	0	0	140
	23	2,730	180	0	9	2,730
	Total	4,290	194	0	107	4,290
Minnesota	12	840	0	0	840	300
	22	0	0	0	0	60
	23	570	36	0	46	570
	Total	1,410	36	0	886	930
Missouri	22 / Total	16	16	0	0	0
Nebraska	22 / Total	0	0	0	0	0
Ohio	13	780	68	0	0	780
	22	1,610	10	0	0	1,610
	24	16	16	0	0	0
	28	420	420	0	1	0
	Total	2,826	514	0	1	2,390
Wisconsin	12	1,300	1	0	320	1,300
	22	4	4	0	0	0
	23	2,500	120	0	160	2,500
	Total	3,804	125	0	480	3,800
All states	12	3,560	15	0	1,258	3,020
	13	780	68	0	0	780
	22	2,861	41	0	2	2,890
	23	6,120	346	0	215	6,120
	24	2,090	76	0	0	2,060
	28	420	420	0	1	0
	Total	15,831	966	0	1,476	14,870

<i>Grassland and Savanna - Restoration</i>							Savanna Species	
State	BCR	Guild Objective	Grassland Species				Guild Objective	Red-headed Woodpecker
			Greater Prairie- Chicken	Henslow's Sparrow	Eastern Meadowlark	Upland Sandpiper		
Iowa	22	1,375	0	0	1,375	53	15,833	15,833
	23	94	0	0	94	1	783	783
	Total	1,469	0	0	1,469	54	16,616	16,616
Illinois	22	3,625	20	0	3,625	9	11,667	11,667
	23	94	0	2	94	1	258	258
	24	525	0	3	525	0	2,833	2,833
	Total	4,244	20	5	4,244	10	14,758	14,758
Indiana	22	938	0	2	938	3	2,917	2,917
	23	238	0	11	238	0	667	667
	24	875	0	61	875	1	3,500	3,500
	Total	2,051	0	74	2,051	4	7,084	7,084
Kansas	22 / Total	4,600	4,600	11	4,500	398	6,667	6,667
Michigan	12	463	0	11	463	15	375	375
	22	0	0	0	0	0	283	283
	23	688	0	32	688	11	667	667
	Total	1,151	0	43	1,151	26	1,325	1,325
Minnesota	12	580	580	0	106	7	400	400
	22	150	0	0	150	1	750	750
	23	313	0	3	313	3	2,667	2,667
	Total	1,043	580	3	569	11	3,817	3,817
Missouri	22 / Total	5,750	380	149	5,750	62	16,667	16,667
Nebraska	22 / Total	51	0	0	51	13	5,000	5,000
Ohio	13	375	0	3	375	0	750	750
	22	1,088	0	5	1,088	0	2,000	2,000
	24	26	0	2	26	0	0	0
	28	450	0	44	450	0	183	183
	Total	1,939	0	54	1,939	0	2,933	2,933
Wisconsin	12	150	0	4	150	7	133	133
	22	15	0	0	15	0	42	42
	23	1,750	1,100	40	1,750	16	5,667	5,667
	Total	1,915	1,100	44	1,915	23	5,842	5,842
All states	12	1,193	580	15	719	29	908	908
	13	375	0	3	375	0	750	750
	22	17,592	5,000	167	17,492	539	61,826	61,826
	23	3,177	1,100	88	3,177	32	10,709	10,709
	24	1,426	0	66	1,426	1	6,333	6,333
	28	450	0	44	450	0	183	183
	Total	24,213	6,680	383	23,639	601	80,709	80,709