UPPER MISSISSIPPI RIVER & GREAT LAKES REGION
JOINT VENTURE
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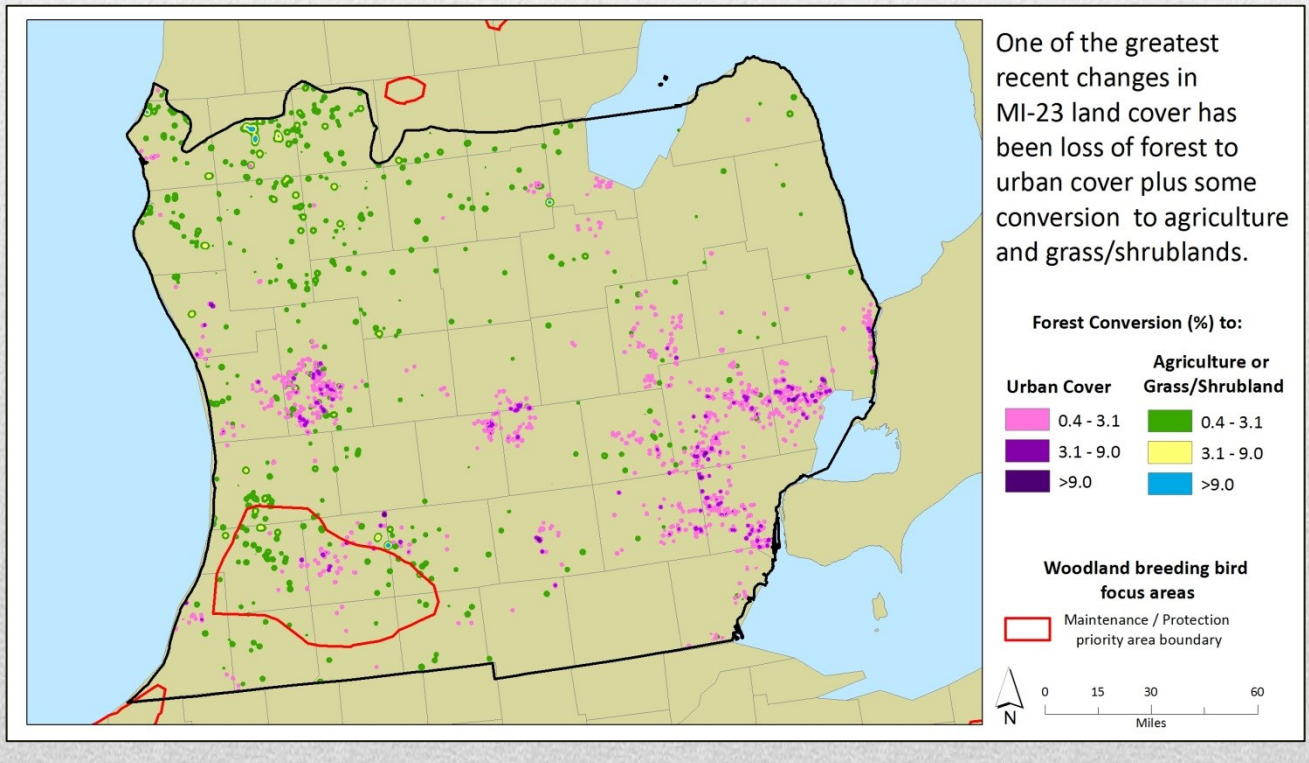
Michigan BCR 23 - Assessment Summary

Bird conservation Joint Ventures (JVs) were established to help achieve continental bird population goals by designing and managing landscapes with high value to birds at regional, state, and local scales. JVs develop Implementation Plans where "focal species" are used to represent guilds and biological models are employed to translate population objectives into habitat objectives. This summary includes highlights from a JV assessment of bird habitat objectives and land use trends in the Michigan BCR 23 (MI-23) "State x Bird Conservation Region." Objectives in the 2007 JV Implementation Plan were developed using spatial data from 2001, and JV partners have reported significant conservation accomplishments since objectives were established. However, trends in landscape cover types suggest mixed results in maintaining and increasing those land covers associated with key bird habitats. We provide general landscape trends based on the National Land Cover Database (2001 to 2006), comparisons between JV bird habitat objectives and cover type availability, and broad implications of those land-cover trends to bird habitat conservation. **Please see the complete MI-23 assessment for more details**.



Primary cover-types

MI-23 contains extensive upland forest (20%), urban (16%), and emergent and forested wetland (11%), but its primary cover type is row crop (34%). Urban land (+31,000 ac) increased between 2001 and 2006, whereas total area of deciduous and evergreen upland forest (-17,000 ac) and row crop (-12,000 ac) declined (Table 1). Shrubland increased by 2.1% primarily due to conversion from forest cover.

Comparison (acres) of Joint Venture bird habitat objectives (maintenance and restoration combined, from 2007 JV Plan) and estimated cover type availability (NLCD 2006) and trend (NLCD 2001 to 2006) in Michigan Bird Conservation Region 23. Wetland and open water availability bsed on NWI, not NLCD. Note: Bird "conservation objectives" represent quality habitats (high recruitment/high survival) needed for JV focal species whereas "cover type availability" reflects cover types on the landscape, but not necessarily quality habitats.

Habitat/cover types	Conservation objective	Cover type availability	Short-term land cover trend (%)
Marsh, mudflat, and open water			
Emergent wetland	231,062[a]	424,529	0.0
Woody wetland	57,386[b]	1,506,921	-0.2
Dry mudflat	44,260	6,249,631[c]	-0.2
Open water	58,122	778,270	0.3
Woodland and openland			
Deciduous forest	41,990	3,232,723	-0.4
Evergreen forest	*na*	291,048	-0.7
Shrubland	792,870	107,918	2.1
Other forest	6,916	163,976	-0.7
Grassland	339,872	376,774	-0.4
Savanna	469,300	n/a	n/a

[a] Includes habitat objectives for several focal species combined: shallow semi-permanent marsh, wet meadow/open water, wet mudflat/ moist soil plants, shallow water depth (<2 in), and moderate water depth (2-8 in) subcategories.

[b] Includes habitat objectives for multiple focal species combined: marsh with associated shrub/forest and forested wetlands.

[c] Area of row crop, which can provide some value to dry mudflat bird species.

Management Implications

Marsh, mudflat, and open water:

- The current areas of open water and mudflat appear adequate to meet habitat objectives for JV focal species and deep marsh is nearly adequate. However, the quality (high survival and reproduction) of these potential bird-habitats could not be assessed using available data and most are unprotected; “dry mudflat” availability is simply the area of row crop, which may provide some value in spring.
- Invasive plants (e.g., *Phragmites australis*) and human disturbance can reduce habitat quality for wetland birds, especially in many coastal marsh and open water areas.
- Partners should continue to expand protection of marsh and wet meadow providing quality bird habitat while seeking and implementing effective control of invasive plants.

Woodland:

- Forest cover is abundant but forest fragmentation results in lower productivity of some breeding focal species. Birds dependent on mature forests have a substantial habitat base, whereas shrub and early-growth forest birds have been in population declines reflective of habitat shortfalls.
- Timber cutting can provide a large-scale means to restore young forest and shrub, but it should be carefully planned to prevent habitat degradation for area- and edge-sensitive forest birds.

Openland:

- Grassland area appears adequate to meet breeding grassland bird objectives, but savanna (mixed wooded openland) could not be determined with NLCD spatial data.
- Future grassland abundance will be largely related to private land management (e.g., CRP), and recent high commodity prices will likely result in conversion of grassland to row crops.
- Row crop, forest, and urban cover dominate the MI-23 landscape, and current JV population and habitat objectives for grassland / openland birds may not be achievable with current economic conditions.

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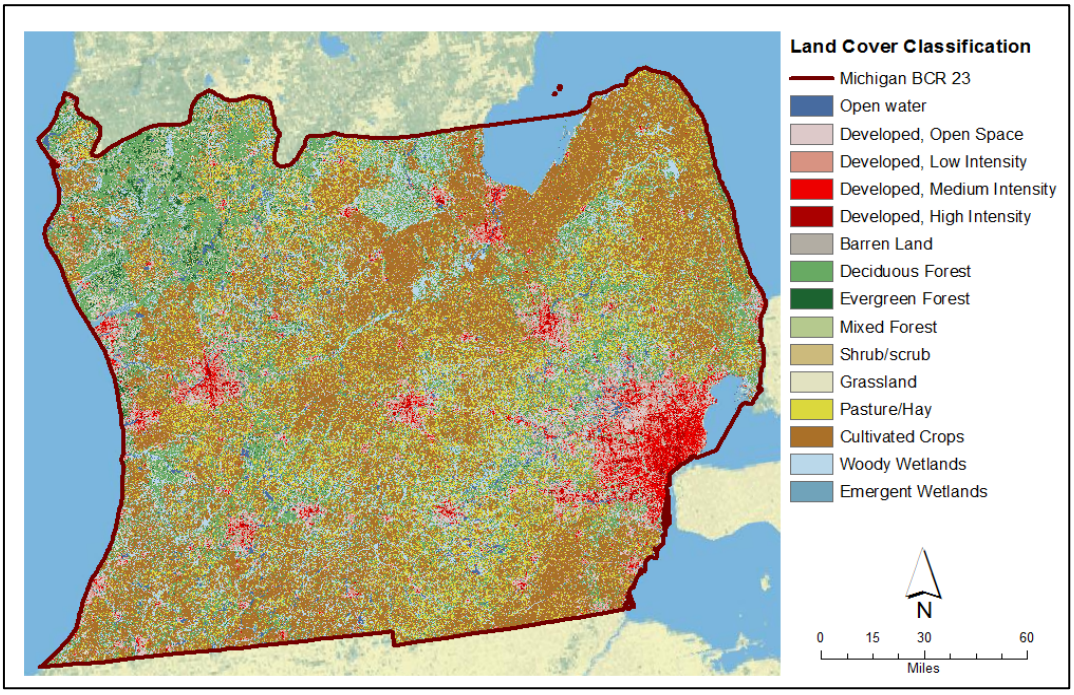
State by BCR Assessment

Michigan 23 – Prairie Hardwood Transition

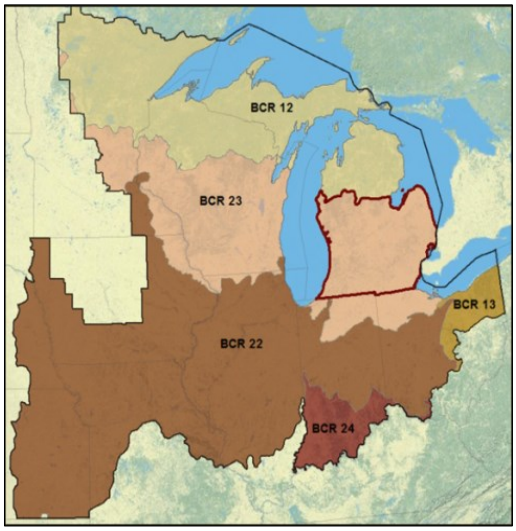
This document was developed to serve as a "stepped-down" version of the 2007 Joint Venture (JV) Implementation Plan with focus on Michigan BCR 23, the Prairie Hardwood Transition portion of Michigan. It includes lists of bird species used for JV regional planning (i.e., focal species) that represent land cover types, or bird habitat associations, important to bird guilds occurring in MI-23. Bird habitat (cover type) objectives are presented for maintenance/protection and restoration/enhancement based on the 2007 JV Plan.

Spatial data were not available to assess each bird habitat type identified in the JV Plan, but recent trends in broad land cover categories believed to be important to JV focal species are provided. Land cover trend analyses are based on quantities (acres) calculated from the 2001 and 2006 National Land Cover Database (NLCD). Although area estimates do not translate into quality bird habitats, significant increases or decreases in specific cover types likely result in similar population trends for species associated with those cover types. Also included in this assessment are the amount and location of land currently under protection, primary modes of recent cover type conversion, and general management implications for MI-23 bird conservation partners.



JV focal species were selected to facilitate planning and monitoring when developing the 2007 Implementation Plan. Population and habitat objectives for landbirds and waterbirds included the breeding period only, whereas objectives generated for waterfowl and shorebirds also included the non-breeding period (migration/winter). The following JV focal species represent bird guilds requiring specific cover types found in MI-23 (species within guild may be more common than focal species, see 2007 JV Plan).

Landbird	Shorebird	Waterbird
Whip-poor-will	American Golden-Plover	Black-crowned Night-Heron
Chimney Swift	Piping Plover	Yellow Rail
Red-headed Woodpecker	Killdeer	King Rail
Willow Flycatcher	Upland Sandpiper	Black Tern
Veery	Sanderling	Common Tern
Wood Thrush	Dunlin	**Waterfowl**
Blue-winged Warbler	Short-billed Dowitcher	Tundra Swan
Golden-winged Warbler	Wilson's Snipe	Wood Duck
Cerulean Warbler	American Woodcock	American Black Duck
Prothonotary Warbler	Wilson's Phalarope	Mallard
Louisiana Waterthrush		Blue-winged Teal
Canada Warbler		Canvasback
Henslow's Sparrow		Lesser Scaup
Eastern Meadowlark		



Bird Conservation Regions (BCR's) in the Upper Mississippi River and Great Lakes JV region.

Introduction

A primary goal of bird habitat Joint Ventures is to achieve continental bird population targets by designing landscapes with greater value to birds and employing conservation actions at regional, state, and smaller scales. To contribute to this goal, the UMRGLR JV developed an all-bird Implementation Plan in 2007, which included explicit regional bird population and habitat conservation objectives. These objectives were created by sequentially stepping-down continental population goals to the JV region, Bird Conservation Regions (BCRs), and the intersections of states and BCRs (e.g., MI-23). This "top-down" planning process relied on accurate population estimates and biological models to determine the amount of high quality habitat area needed to achieve bird population goals. A key assumption of the planning process was that population goals could be achieved with current and potential bird habitat cover types available on the landscape. JV planners also assumed existing quality habitats would remain available through time, but given the dynamic nature of some landscapes, this is not always the case.

Compared to the 2007 JV Implementation Plan, this complementary document includes updated and refined information to help guide MI-23 managers in decision making for bird habitat conservation. Its primary purpose was to use existing spatial data to evaluate the suitability of established focal species habitat objectives by comparing them with the area of cover type associated with that species (i.e., capacity of the landscape to support the objectives). Spatial data used in this analysis were the National Land Cover Database (NLCD) and National Wetland Inventory (NWI); however, these data are imperfect. Classification accuracy is 80-85% but lower for some cover types such as grassland, shrubland, and pasture/hay. In addition, these spatial data do not necessarily identify "high quality" bird habitats, where focal species abundance, survival and reproduction are relatively high. Despite these inadequacies, NLCD and NWI are useful for indicating current land use and patterns of change, and they are sufficient to identify gross disparities between the JV's bird habitat objectives and available land covers. Updated cover type information, coupled with new bird research and monitoring data and JV partner priorities, will be used to improve future versions of the JV Implementation Plan.

Land Cover Change

Bird habitat objectives and decision-support maps in the 2007 JV Plan were developed using population information and 2001 NLCD. Although NLCD categories were often more general than JV habitat categories, NLCD (supplemented with NWI) provided a source of spatial data for the whole JV region. However, smaller-scale landscape conditions, trends in land cover, or how these conditions might correspond with JV objectives were not considered. Landscapes are not static, which inevitably has a strong bearing on the attainability of bird habitat objectives. As such, this assessment aims to provide a better understanding of land cover conditions in MI-23 and to illustrate how the landscape has changed since development of the 2007 JV Plan. Periodic assessment of landscape conditions allows us to identify land cover trajectories and provides a means to continually reevaluate the feasibility of achieving bird population and habitat objectives. Furthermore, knowledge of whether we are gaining or losing priority bird habitats and where on the landscape this change is occurring provides managers an additional tool to assist in focusing on-the-ground conservation efforts.

Table 1. General land cover types (acres) and percent change between 2001 and 2006 in Michigan BCR 23 based on NLCD. Note: The correct classification rate of NLCD is 80 to 85%; misclassification often occurs between pasture and grassland categories and forested wetlands and upland forest categories.

	Year			Acres
Cover Type	2001	2006	% change	gained/lost
Open Water	669,163	671,104	0.3	1,940
Urban	2,883,756	2,915,145	1.1	31,389
Barren	70,763	71,926	1.6	1,162
Upland Forest	3,712,176	3,695,172	-0.5	-17,004
Shrub/Scrub	105,897	108,096	2.1	2,199
Grassland/Hay/Pasture	2,626,508	2,621,814	-0.2	-4,694
Grassland	378,130	376,774	-0.4	-1,355
Row Crops	6,271,865	6,259,849	-0.2	-12,016
Wetlands	2,079,861	2,076,884	-0.1	-2,977
Emergent Wetlands	159,962	159,903	0.0	-59
Woody Wetlands	1,919,899	1,916,981	-0.2	-2,918
Total	18,419,988	18,419,988		

MI-23 is heavily forested in places, with large amounts of open water and urban, but its primary cover type is row crop agriculture (Table 1).[1] Row crop cover declined slightly between 2001 and 2006, accounting for a 12,000 acre loss. Likewise, upland and wetland forest area declined by nearly 20,000 acres. Conversely, urban cover increased by 31,400 acres, roughly the combined footprint of Lansing and East Lansing. Gains in urban cover came primarily from land previously in agricultural and forest (Figure 1, Table 2) and represents permanent habitat loss for some JV focal species. Most forest conversion to urban cover occurred adjacent to metropolitan areas; however, measureable forest cover was also lost in an area prioritized for forest bird habitat maintenance and protection in southwestern MI-23 (Figure 2). Land cover types that were largely stable in area between 2001 and 2006 were emergent wetland, open water, grassland/shrub, and barren, consisting largely of sand/beach and rocky open areas.

[1] To evaluate landscape change, we compared satellite imagery (NLCD) of MI-23 between 2001 and 2006. We used ArcGIS to determine whether a given pixel (30 x 30 m resolution) changed from one cover type to another. We collapsed cover types into eight distinct categories; open water, urban, barren, upland forest, shrub/scrub, grassland/hay/pasture, row crops, and wetlands. Although coarse, these broad cover types provide a good indication of landscape composition and a means for prioritizing finer scale analysis.

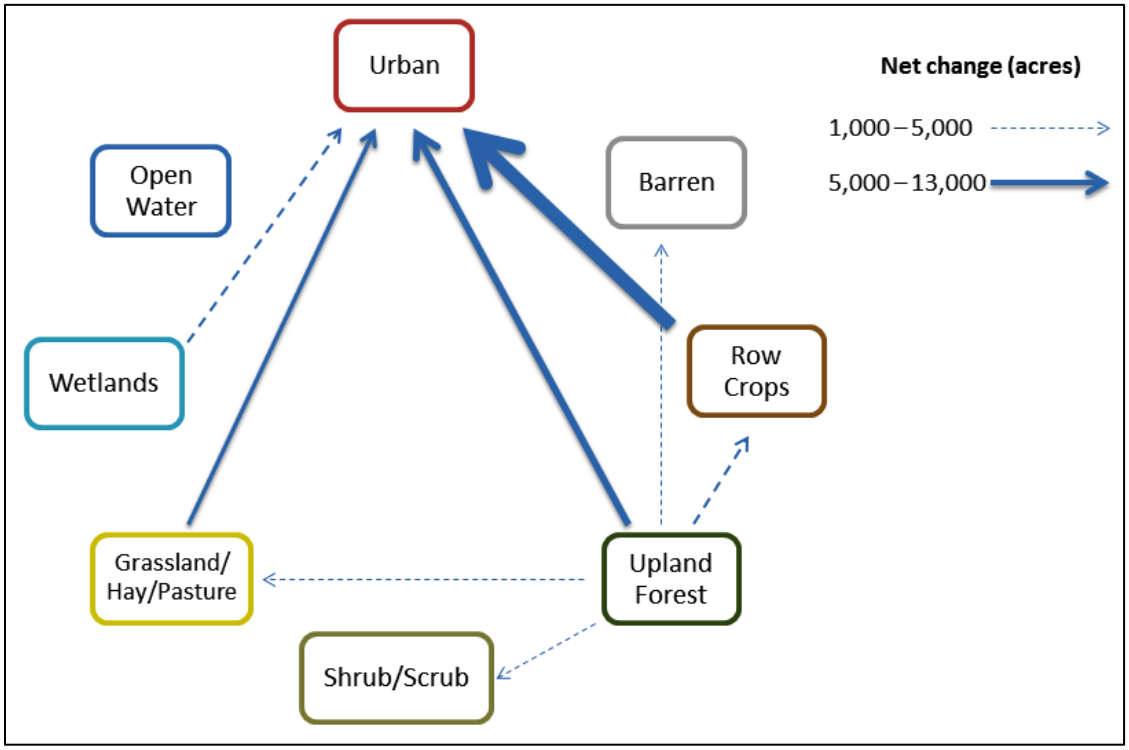


Figure 1. Net change of general land cover types (>1,000 acres converted) in Michigan BCR 23 between 2001 and 2006 (NLCD). Arrows point in the direction of change between two cover types and line thickness increases in proportion to amount of net change. "Wetlands" include woody and emergent herbaceous wetland, whereas "upland forest" represents upland (non-wetland) forest cover.

Table 2. Conversion (acres) of primary land cover types in Michigan BCR 23 between 2001 and 2006. Grey cells represent the acreage in which no change occurred, whereas remaining cells represent the area of 2001 cover types (vertical axis) coverted to other cover types by 2006 (horizontal axis). For example, between 2001 and 2006, 685 acres of open water converted to wetland and 924 acres of wetland converted to open water, for a net change among these two cover types of -239 wetland acres (also see Figure 1). Note: The correct classification rate of NLCD is 80 to 85%; misclassification often occurs between pasture and grassland categories and forested wetland and upland forest categories.

Land Cover Type		2006							
		Open Water	Urban	Barren	Upland Forest	Shrub/Scrub	Grassland/ Hay/Pasture	Row Crops	Wetlands
2001	Open Water	666,966	123	68	2	1	21	203	685
	Urban	0	2,879,037	4	0	0	1	0	0
	Barren	522	598	64,957	32	5	1,599	2,541	394
	Upland Forest	256	8,713	1,819	3,687,729	1,403	2,463	3,411	314
	Shrub/Scrub	31	195	46	24	105,124	109	149	45
	Grassland/Hay/Pasture	273	5,366	1,420	487	918	2,612,484	781	486
	Row Crops	1,034	13,391	3,120	789	194	609	6,241,323	1,150
	Wetlands	924	2,955	375	68	275	244	1,208	2,070,414

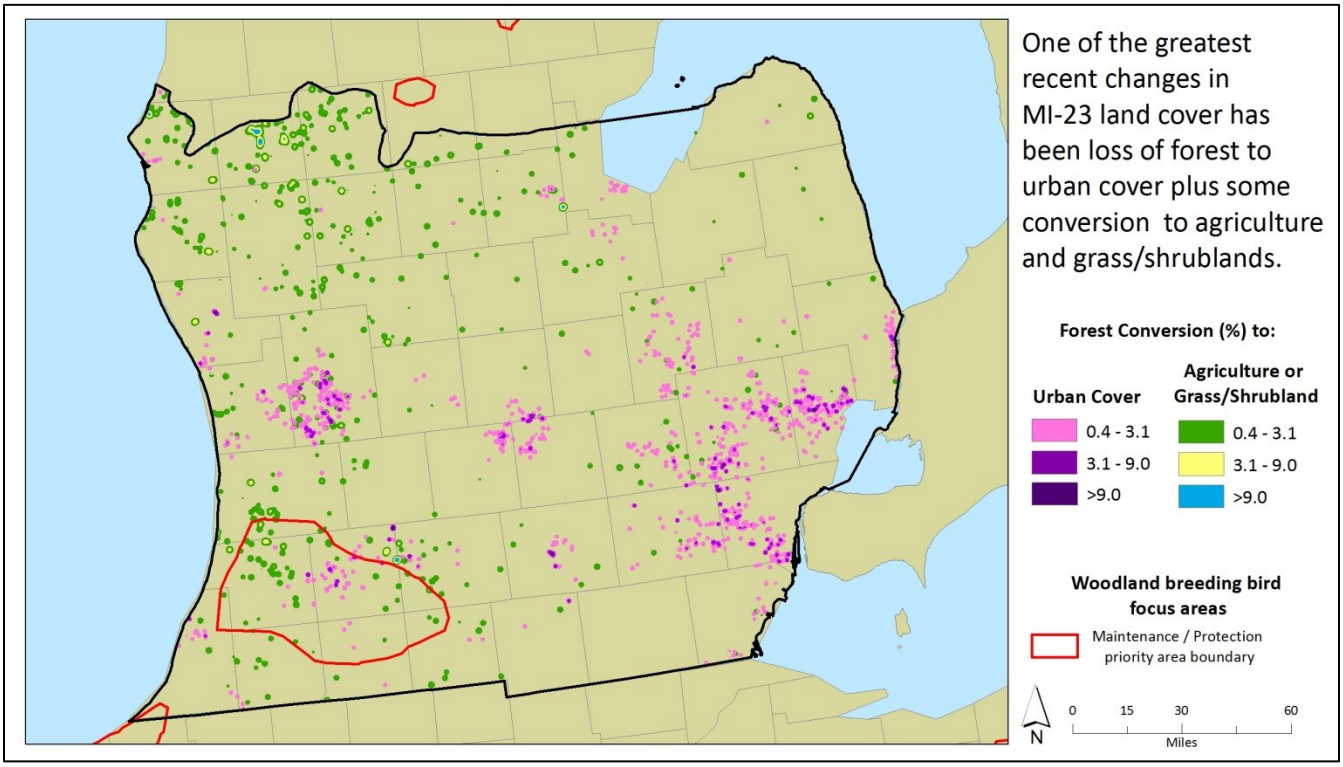


Figure 2. Conversion (percent total area converted within 1 km circular radius) from forest cover (upland forest and woody wetlands) to urban or agriculture and grass/shrubland cover in Michigan BCR 23, 2001 to 2006 (NLCD). Red lines reflect areas with greater habitat maintenance / protection emphasis for woodland breeding birds (Figure 6a, 2007 JV Implementation Plan).

Bird Habitat Objectives and Cover Type Availability

JV bird habitat conservation objectives fall under two categories: "maintain and protect" (hereafter maintenance) and "restore and enhance" (hereafter restoration). Maintenance objectives reflect estimated area of habitat needed of maintain current bird populations, whereas restoration objectives were generated based on population deficits (deficit = population goal - current population) and reflect the amount of new habitat needed to achieve JV population goals. For each category, there are breeding and non-breeding bird habitat objectives. Breeding objectives were established for all four bird groups – waterfowl, waterbirds, shorebirds, and landbirds – whereas non-breeding (migration and wintering) objectives were developed for only shorebirds and waterfowl. Breeding habitat was calculated based on cover-type area needed for successful reproduction and non-breeding habitat was based on food-energy needs critical to survival.

Because the boundaries of BCR 23 were adjusted following completion of the 2007 JV Implementation Plan, objectives presented here represent the total of Michigan BCR 23 and 22 objectives in the 2007 JV Plan. A small portion of Michigan BCR 12 is also now included in BCR 23, but BCR 12 objectives from the 2007 JV Plan were not split into the adjusted BCR 23. The area of cover types potentially providing bird habitat was estimated using the National Wetland Inventory for wetlands and the National Land Cover Database (NLCD 2006) for upland. Location and ownership of public lands was also assessed. Spatial data from the Protected Areas Database (PAD), the Conservation and Recreation Lands Database (CARL), and the National Conservation Easement Database were pooled to display MI-23 protected land configuration and ownership composition (Figure 3). In December 2013, 178,000 acres were enrolled in the Conservation Reserve Program (CRP) in

Michigan with roughly 88,000 acres scheduled to expire by 2018. We were unable to partition total Michigan CRP acreage to the MI-23 portion of the state or assess the land cover composition of CRP lands due to privacy protections in the U.S. Farm Bill.

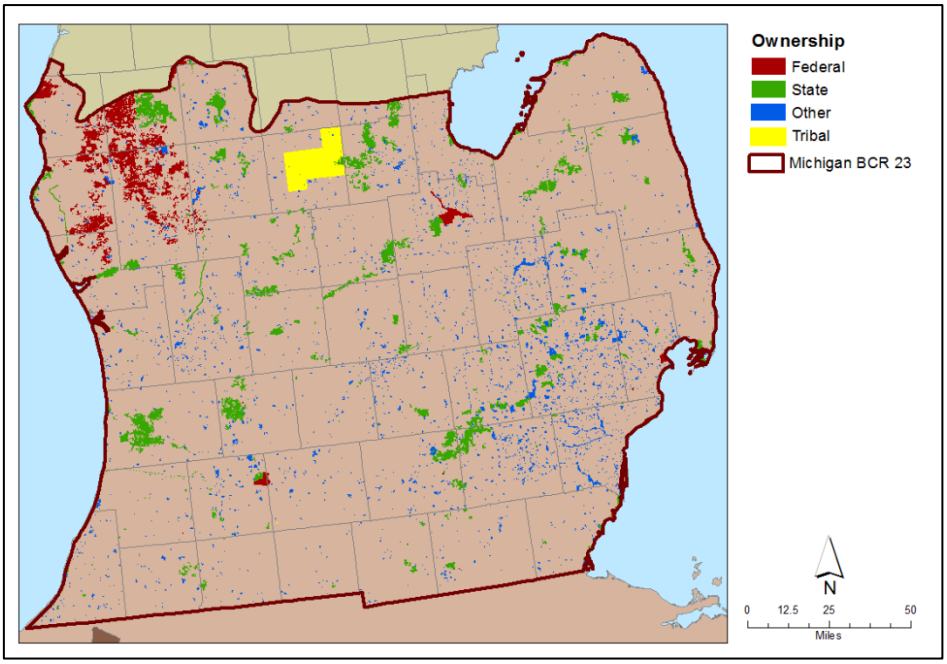


Figure 3. Location of federal, state or other conservation lands in Michigan Bird Conservation Region 23. "Other" ownership category includes private land with temporary and permanent easements, conservancy land, and county, township and city owned land. Total land area conserved (excluding CRP lands) is about 1,469,430 acres, including 911,400 woodland/grassland acres and 310,000 acres of open water, marsh wetland, and row crop.

Marsh, Mudflat, and Open Water

Wetland and open water cover types and focal species	
Deep water marsh	Tundra Swan, American Black Duck, Black Tern
Wet meadow w/ open water	Blue-winged Teal, Yellow Rail
Semi-permanent/hemi-marsh	American Black Duck, Mallard, King Rail
Marsh with shrub/forest	Wood Duck, Black-crowned Night-Heron
Wet mudflat/moist soil plants	Blue-winged Teal, Dunlin, Wilson's Snipe
Shallow water (<5 cm)	Short-billed Dowitcher
Moderate water (5-20 cm)	Wilson's Phalarope
Dry mudlfat	American Golden-Plover, Killdeer
Open water	Canvasback, Lesser Scaup
Beach	Piping Plover, Sanderling
Islands with limited vegetation	Common Tern

The estimated area of high quality bird habitat needed in marsh wetland, mudflat, and open water to maintain current bird populations is about 280,000 acres (Table 3)[2]. This area, plus an additional 94,000 acres of restored, high quality wetland cover types is predicted to achieve a landscape design adequate (i.e., provide carrying capacity) to meet JV goal populations for breeding and non-breeding wetland birds in MI-23. JV wetland bird habitat objectives represent about 2% of the total area, 47% of the marsh and shrub wetland cover, and less than 1% of the total mudflat available in MI-23 when agriculture (e.g., bare crop field in spring) is included in the mudflat category (Table 3).

Marsh.—Habitat objectives were developed for breeding wetland bird groups dependent on four general marsh categories: wet meadow, shallow semi-permanent marsh / hemi-marsh, deep-water marsh, and marsh with associated shrub or forest. There were a total 790,900 acres of available marsh and marsh/shrub wetlands on the landscape and 13% were protected (Table 3). Conservation objectives for marsh cover types were driven by the needs of breeding waterfowl and waterbirds. Habitat objectives for the non-breeding period include

[2] Acreage totals for habitat objectives in this section represent cumulative total of highest values between breeding and non-breeding habitat objectives for each cover type. For example, the estimated area of quality habitat needed in MI-23 to maintain current populations of birds dependent on dry mudflat is 18,157 acres, as the breeding objective (18,157 ac) is greater than the non-breeding objective (373 ac) (See Table 3).

primarily shallow semi-permanent marsh, deep-water marsh, and open water. These values were generated based on the needs of migrating and wintering waterfowl.

Shallow emergent marsh communities are relatively abundant in MI-23 based on NWI (Table 3), however we were unable to determine the quality of these areas for breeding waterfowl and other marsh birds based on the spatial data. The JV Plan calls for high quality wetland-bird habitat totaling 205,700 acres of shallow marsh / hemi marsh (includes 19,000 acres for wet meadow with open water) and 40,000 acres of marsh with associated shrub/forest (Table 3) during the breeding period. Objectives for deep water marsh were higher during the non-breeding period and totaled 15,000 acres. These values are substantially lower than the wetland available (Table 3), however the quality of mapped marsh wetlands is low in some areas, often due to invasive plants (e.g., Phragmites), water quality, or proximity to developed lands and human activity. Coastal wet meadows have been nearly eliminated due to agriculture and development. Remaining fragments of this unique and dynamic Great Lakes plant and bird community remain vulnerable to human actions.

Table 3. Wetland bird habitat maintenance and restoration objectives (acres) for marsh, mudflat, and open water and the estimated amount of each cover type currently on the landscape in Michigan BCR 23. Objectives are from the 2007 JV Implementation Plan and represent estimated area of high quality habitat required to meet the needs of JV focal species and planning guilds during both breeding (B) and non-breeding (N) periods. Cover types were measured using National Wetland Inventory; National Landcover Database (2006) was used for dry mudflat and beach. Conservation status (protected land) and ownership was determined using the Protected Areas Database, Conservation and Recreation Lands Database, and National Conservation Easement Database.

Bird habitat categories	Habitat objective				Land cover				
	Maintenance		Restoration		Cover type area on landscape	Conservation status (protected)			
	B	N	B	N		Federal	State	Other	Total
Marsh									
Deep-water marsh	5,068	15,089	2,534	0	13,611	72	1,332	67	1,471
Shallow semi-permanent marsh[a]	156,561	83,125	49,104	2,589	410,918[b]	6,805	43,846	2,454	53,105
Marsh with shrub/ forest	33,412	0	6,684	0	366,400	7,833	35,702	3,912	47,447
Mudflat and shallows									
Wet mudflat/ shallows[c]	0	5,884	0	1,890	na[d]	na	na	na	na
Dry mudflat[e]	18,157	373	26,103	220	6,249,631	7,003	34,946	111,368	153,317
Open water and beach									
Extensive open water	0	50,816	0	7,306	778,270[f]	4,067	33,656	4,218	41,941
Beach	27	62	0	158	71,885[f]	840	10,136	1,695	12,671
Total	213,225	155,349	84,425	12,163	7,890,715	26,620	159,618	123,714	309,952

[a]Bird habitat objectives for "shallow semi-permanent marsh" also include objectives set for "wet meadow with areas of open water" in the 2007 JV Plan.

[b]Cover type area for "shallow semi-permanent marsh" includes emergent marsh within palustrian, lacustrine, and riverine categories in NWI.

[c]Bird habitat objectives for "wet mudflat/shallows" category incorporates objectives for "wet mudflat," "shallow water depth (<2 in)" and "moderate water depth (2-8 in)" open flats in the 2007 JV Plan.

[d]na indicates that bird habitat objectives were not set for a cover type or that a cover type could not be estimated due to resolution limitations of spatial data.

[e]Dry mudflat/agriculture was a bird habitat category used in the 2007 JV Plan and "row crop" (NLCD) is the cover type measured on the landscape.

[f]Cover type area for "extensive open water" represents lacustrine, riverine, and unconsolidated bottom and shore categories (NWI) whereas "beach" is the area of sand/gravel/bedrock with little vegetation (NLCD).

Mudflat and Shallows.—Objectives for wet mudflat, shallow (<2 in), and moderate-depth (2-8 in) open wetland communities were based primarily on the energetic needs of migrating shorebirds. These objectives total about 7,800 acres of wet mudflat and shallow-water providing high quality shorebird habitat (Table 3). However, assessments of these cover types are difficult using remotely sensed data and are not adequately identified by NWI. These cover types are also very dynamic, especially along the Great Lakes shoreline, where conditions can change hourly, daily, and seasonally making one-time static assessments (i.e., NWI) poor estimators of cover type availability. The area of dry mudflat (i.e., row crop) protected totals 153,300 acres, including 42,000 acres of state and federal lands apparently in agriculture.

Open Water and Beach.—Open-water bird habitat objectives are based on the needs of migrating and wintering diving ducks and sea ducks. This group requires an estimated 58,000 acres of high quality foraging and resting habitat. Whereas the region has abundant open water locations (Table 3), low food availability and human disturbance may negatively influence the use of some open-water areas. Some species of shorebirds and terns depend on beach. Beach objectives total about 220 acres. Coastal beach is abundant with current lake levels.

Woodland and Openland

The estimated amount of woodland and openland/grassland needed in a high quality habitat condition to maintain current landbird populations is 528,000 acres (Table 4). This represents 3% of the total area of MI-23 and less than what is currently under federal, state or other protection (Table 4). The majority of habitat area needed to maintain and increase landbird populations are shrubland and savanna (mixed wooded openland).

Landbird cover types and focal species	
Deciduous forest	Whip-poor-will, Wood Thrush, Cerulean Warbler, Louisiana Waterthrush
Forest generalist	Veery, Canada Warbler, Chimney Swift
Forested wetland	Prothonotary Warbler
Shrubland	American Woodcock, Willow Flycatcher, Blue-winged Warbler, Golden-winged Warbler
Grassland	Upland Sandpiper, Henslow's Sparrow, Eastern Meadowlark
Savanna	Red-headed Woodpecker

Woodland.—Objectives developed for deciduous forest, forested wetland, shrubland, and other mixed forest were all driven by the needs of breeding landbirds. MI-23 encompasses about 4,938,000 acres of woodland and 804,000 acres are protected (Table 4). In general, MI-23 has abundant forest cover, but forest fragmentation is a concern because it can limit habitat quality of breeding forest birds. For example, 42,000 acres of mature deciduous forest in large tracts (>5,000 contiguous acres) is required to meet habitat goals for JV focal species using this cover type. However, only 13 areas in MI-23 were identified having tracts large enough for species sensitive to fragmentation; most were state or federally owned lands with surrounding forested private lands.

Objectives for forested wetlands (17,300 acres) and other mixed forest (6,900 acres) were also substantially lower than the area of these forest types in the region (Table 4). However, habitat quality features such as forest tract size and sparse understory are important to breeding success of some forest birds. Shrubland cover types are poorly mapped and estimates based on remote sensing (i.e., NLCD) are not sufficient for assessment. Local managers should consult the USDA Forest Service Forest Inventory and Analysis (FIA) program for county-level measures of this somewhat dynamic cover type.

Openland.—Grassland community types can be poorly mapped by NLCD, making assessment difficult. The grassland-bird guild used for planning requires 340,000 acres of high quality habitat, and the region contains an estimated 377,000 acres of grassland plus 2.2 million acres of pasture/hay (Table 4). Although the amount of grassland appears adequate to meet objectives, changes in agricultural practices (i.e., early hay mowing), reforestation, recent conversion (grassland, pasture, and hay to urban), and fragmentation of large grasslands

have likely been detrimental to breeding grassland birds. Savanna objectives (469,000 acres; Table 4) are based on the breeding habitat requirements of birds occupying savanna (e.g., Red-headed Woodpecker). This cover type is not mapped by NLCD and assessing the landscape's capacity for supporting current and future populations of savanna birds is not possible with these spatial data.

Table 4. Upland bird habitat maintenance and restoration objectives (acres) by primary woodland and openland cover types and the estimated amount of each currently on the landscape in Michigan BCR 23. Objectives are from the 2007 JV Implementation Plan and represent estimated area of high quality habitat required to meet the needs of JV focal species during the breeding period. Cover types were measured using the National Land Cover Database (2006), except forested wetland which was determined using National Wetland Inventory. Conservation status (protected land) and ownership was determined using the Protected Areas Database, Conservation and Recreation Lands Database, and National Conservation Easement Database.

Bird habitat categories	Habitat objective[a]		Land cover				
	Maintenance	Restoration	Cover type area on landscape	Conservation status (protected)			
				Federal	State	Other	Total
Woodland							
Deciduous forest	20,995	20,995	3,234,086	150,645	235,587	108,706	494,938
Evergreen forest	0	0	291,171	68,147	15,642	10,485	94,274
Forested wetland	11,609	5,681	1,140,521	34,098	94,397	19,578	148,073
Shrub/scrub	83,980	708,890	107,918	5,933	12,034	3,684	21,651
Other forest	6,916	0	163,976	24,369	15,363	5,226	44,958
Openland							
Grassland	169,936	169,936	376,774	5,132	20,715	10,885	36,732
Pasture/hay[b]	--	--	2,245,040	857	12,284	57,637	70,778
Savanna	234,650	234,650	na[c]	na	na	na	na
Total	528,086	1,140,152	7,559,486	289,181	406,022	216,201	911,404

[a] Upland bird habitat objectives are for the breeding period only; non-breeding habitat objectives were not calculated for landbirds (see 2007 JV Implementation Plan for more detail).

[b] Bird habitat objectives were not established for this primary NLCD cover type providing openland value.

[c] na indicates that bird habitat objectives were not set for a cover type or that a cover type could not be estimated due to resolution limitations of spatial data.

Management Implications

MI-23 is an extremely diverse bird conservation region in Michigan, both ecologically and socially. Within the JV region, MI-23 is unique for its high value to non-breeding diving ducks (especially southeast MI), breeding marsh birds and colonial waterbirds (especially along Great Lakes coast), and forest birds. The region is important for both breeding and migrating forest birds although non-breeding forest bird habitat objectives were not developed for the 2007 JV Implementation Plan.

In general, the current area of MI-23 open water, marsh, and mudflat cover appears adequate to meet habitat objectives for JV focal species. However, the area of wet mudflat and shallows providing forage to migrating wetland birds could not be determined using existing spatial data. Therefore, where capacity exists, management may be necessary to assure mudflat is available during shorebird migration periods. Spatial data were also inadequate to assess emergent wetland types (hemi-marsh vs. wet meadow), quality (high vs. low

reproduction / survival), and timing of availability (recently wet vs. wet when image was taken). MI-23 partners should continue expanding protection of marsh and wet meadow providing quality wetland bird habitat, while seeking and implementing effective management of invasive plants such as Phragmites and hybrid cattail. *Phragmites australis*, the most problematic invasive wetland plant in MI-23, will require biological control (http://greatlakesphragmites.net/control-options/) at large scales but inventory and treatment of small and newly colonized areas remains valuable during bio-control development. Open water space seems to be adequate for foraging waterfowl, but some locations may have limited value due to human disturbance. Boating activity and potential energy development in the southeast (Lakes St. Clair and Erie) could degrade this continentally significant diving duck migration-staging area and increasingly important wintering area.

Breeding and migrating woodland birds dependent on mature forests currently have a substantial habitat base in MI-23. Modest declines in forest cover occurred in recent years, but primarily outside of areas most important for woodland breeding birds. Shrub and young-growth forest is far below goal in MI-23 and species dependent on this habitat type have been in long-term population decline. JV partner collaboration with foresters and the timber industry can result in strategic timber cutting operations that provide a commercial means to create shrub and young-growth forest. However, managers should carefully consider forest fragmentation trends and patch size as they evaluate cutting locations because large un-fragmented forest tracts are critical to viable populations of some breeding songbirds. Additional concerns include the effects of fire suppression, herbivory, lack of management, and invasive species (buckthorn, emerald ash borer beetle) on forest composition and structure. Practices that restore and maintain diverse native tree composition help assure higher quality habitat for forest-breeding birds and must be considered in future management scenarios. Likewise, composition, structure, and juxtaposition of woodlands are important during migration periods and these corridors should also be part of local scale management planning, especially along Great Lakes shorelines.

Grassland cover types appeared relatively stable between 2001 and 2006. Future abundance in MI-23 will be largely related to private land management activities (e.g., pasture/hay and Conservation Reserve Program). There are opportunities to promote grasslands in a working landscape through methods other than taking land out of agricultural production. For example, the value of pasture and hay cover for grassland birds may be increased through management practices (e.g., timing and or intensity of grazing/mowing) maintaining both ecological and economic benefits. However, current high commodity prices will likely result in conversion of forest, grassland, and shrub to agriculture. Because a significant area of state and federally owned lands are also mapped as cultivated cropland (42,000 acres), managers should seek opportunity to convert areas back to native cover, particularly grassland and wet meadow. Expanding “permanent” openings such as grasslands associated with right-of-ways (e.g., highways, utility corridors) and coastal wet meadows can result in greater management efficiency by providing larger openland areas/unit cost.

A relatively small area of openland in MI-23 is protected by state and federal ownership. These areas require periodic management to maintain characteristics required of grassland / savanna birds. Current JV population and habitat objectives for openland species, those dependent on grassland and savanna, are probably beyond the capacity of MI-23’s agricultural and forest-dominated landscape.

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