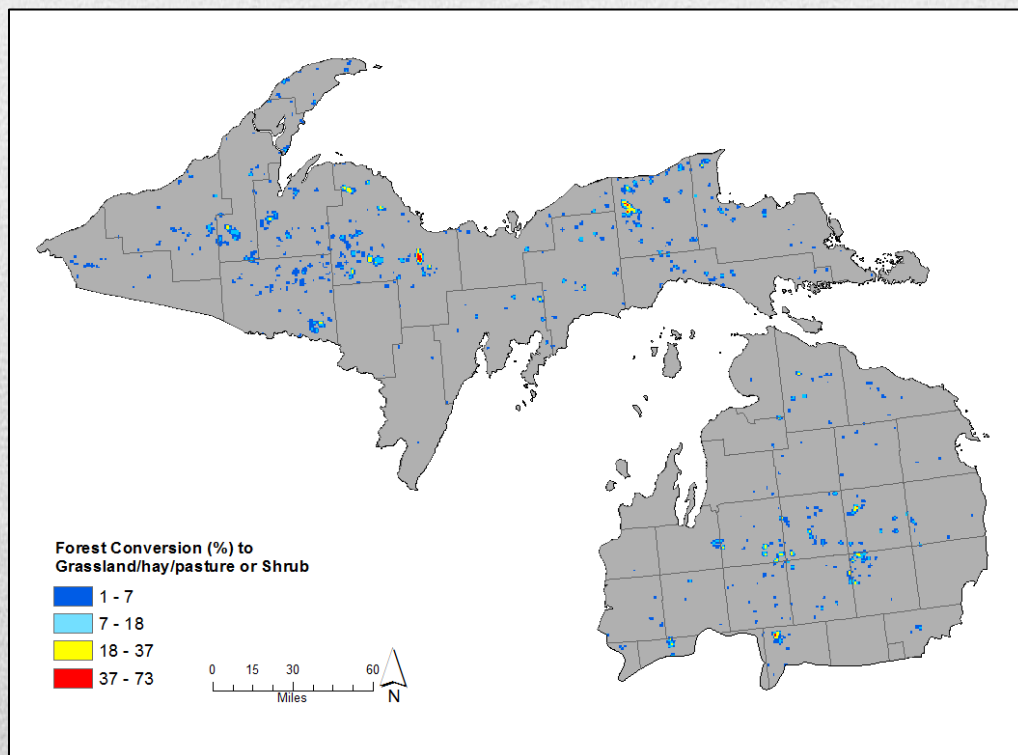




Michigan BCR 12 – Assessment Summary

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 landscape trends in the Michigan BCR 12 (MI-12) “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 land-cover trends to bird habitat conservation. **Please see the complete MI-12 assessment for more details.**



Primary cover-types

MI-12 consists of extensive forested and emergent wetlands (25%), grassland/hay/pasture (8%), and open water (8%), but its primary cover type is upland forest (48%). Grassland/hay/pasture increased (+63,800 ac) between 2001 and 2006, as well as shrub/scrub (+35,500 ac), whereas acreage of upland forest (-111,500 ac) and woody wetland (-11,000 ac) declined. Loss of forest came largely from conversion to grassland, shrub/scrub, and emergent wetland based on NLCD spatial data.

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 12. Wetland and open water availability based on recent NWI, not NLCD. **Note: Bird "conservation objectives" represent quality habitats (high recruitment/high survival) for JV focal species whereas "cover type availability" reflects landscape cover types but not necessarily quality habitats.**

Habitat/cover types	Conservation objective	Cover type availability	Short-term land cover trend (%)
Woodland and openland			
Deciduous forest	117,078	6,317,746	-0.6
Evergreen forest	537,472	2,046,254	-2.7
Shrubland	3,401,190	324,896	12.6
Other forest	0	1,376,923	-1.4
Grassland	228,722	1,077,766	6.4
Savanna	185,250	n/a	n/a
Marsh, mudflat, and open water			
Emergent wetland	243,893 ^a	228,263	2.2
Woody wetland	46,712 ^b	4,283,713	-0.2
Dry mudflat	4,187	707,839 ^c	0.6
Open water	75,809	1,539,539	0.1

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

^b Includes habitats 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

Woodland:

- Despite recent losses, forest area is immense and exceeds JV objectives established for breeding landbirds. Practices that reduce forest fragmentation, effects of fire suppression, and expansion of invasive species will help assure higher quality habitat for edge-sensitive forest birds plus maintain native tree species composition and structure.
- The area of available shrubland appears substantially lower than habitat objectives for shrubland birds and restoration of this cover type remains a priority. JV partner collaboration with foresters and the timber industry can result in strategic cutting operations providing a commercial means to create shrub and young-growth forest while being mindful of fragmentation concerns.

Openland:

- Grassland area recently expanded based on NLCD spatial data and exceeds JV objectives established for breeding grassland birds; area of savanna (mixed wooded openland) and trend in this cover type could not be determined with these spatial data.
- Isolated grasslands prone to reforestation should be allowed to succeed to shrubland and forest, potentially reducing forest fragmentation and addressing shrubland bird habitat objectives.

Marsh, mudflat, and open water:

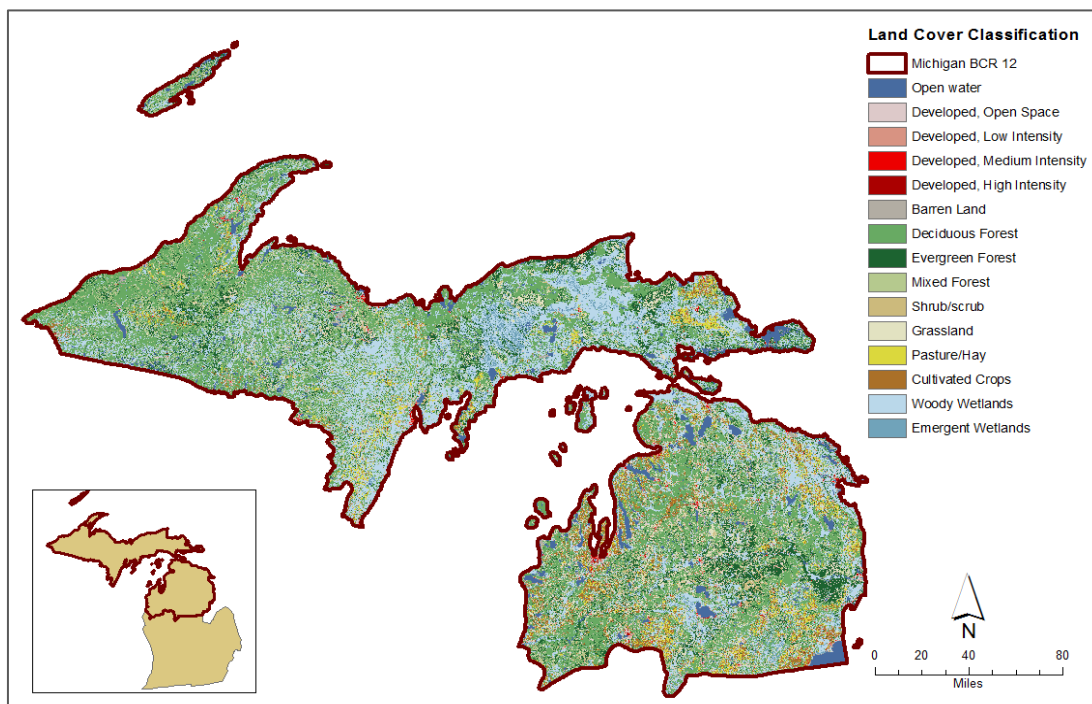
- Area of available marsh exceeds wetland bird habitat objectives, and wetland cover types were relatively stable between 2001 and 2006. However, oligotrophic wetlands are nutrient poor and lower value to JV focal species; expanded protection of high-quality marsh and wet meadow is a priority.
- Functioning riverine, deltaic, and coastal wetlands should retain connectivity to adjacent rivers/lakes to assure nutrient and energy exchange important to productivity and plant and wildlife diversity.
- Management of invasive species may be necessary at some locations, preferable with spot treatments before invasive stands dominate previously healthy wetlands.
- Areas of open water and dry mudflat appear adequate to meet habitat objectives for JV focal species, although the quality of these potential wetland-bird habitats could not be assessed using available data.

State by BCR Assessment

Michigan 12 – Boreal Hardwood Transition

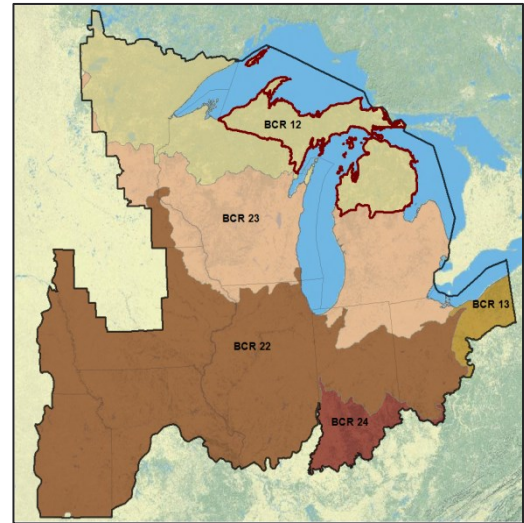
This document was developed to serve as a “stepped-down” version of the 2007 [Joint Venture \(JV\) Implementation](#) Plan with focus on Michigan BCR 12, the Boreal Hardwood Transition portion of Michigan. It includes lists of bird species used for JV regional planning (i.e., focal species) that represent land cover types, or bird habitat associations, important to bird guilds occurring in MI-12. 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 high 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 protected, primary modes of recent cover type conversion, and general management implications for MI-12 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-12 (species within guild may be more common than focal species, see 2007 JV Plan).

Waterfowl	Shorebird	Landbird
Tundra Swan	American Golden-Plover	Whip-poor-will
Wood Duck	Piping Plover	Chimney Swift
American Black Duck	Killdeer	Red-headed Woodpecker
Mallard	Upland Sandpiper	Olive-sided Flycatcher
Blue-winged Teal	Sanderling	Willow Flycatcher
Canvasback	Dunlin	Veery
Lesser Scaup	Short-billed Dowitcher	Wood Thrush
Waterbird	Wilson's Snipe	Blue-winged Warbler
Black-crowned Night-Heron	American Woodcock	Golden-winged Warbler
Yellow Rail	Wilson's Phalarope	Cape May Warbler
King Rail		Black-throated Blue Warbler
Black Tern		Kirtland's Warbler
Common Tern		Cerulean Warbler
		Connecticut Warbler
		Canada Warbler
		Henslow's Sparrow
		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-12). 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 bird 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-12 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, 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-12 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 12 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.**

Cover Type	Year		% change from 2001	Acres gained/lost
	2001	2006		
Open Water	1,537,353	1,539,539	0.1	2,186
Urban	1,000,114	1,005,371	0.5	5,257
Barren	123,381	123,301	-0.1	-80
Upland Forest	9,876,154	9,764,625	-1.1	-111,529
Shrub/Scrub	289,222	325,734	12.6	36,512
Grassland/Hay/Pasture	1,544,171	1,608,007	4.1	63,836
Grassland	1,015,782	1,080,872	6.4	65,090
Row Crops	703,704	707,839	0.6	4,136
Wetlands	5,069,601	5,069,283	0.0	-318
Emergent Wetlands	482,956	493,566	2.2	10,609
Woody Wetlands	4,586,644	4,575,717	-0.2	-10,927
Total	20,143,700	20,143,700		

MI-12 has a diverse landscape with large amounts of forested wetland, grassland/hay/pasture, open water, and small cities and towns, but its primary cover type is upland forest (Table 1).¹ Despite losses of 111,500 acres of upland forest and 11,000 acres of woody wetland between 2001 and 2006, forest remains by far the most significant land cover in the region. Loss of forest came largely from apparent conversion to grassland, shrub/scrub, and emergent wetland as these cover types all increased in area (Figure 1, Table 2). Mapped grassland and shrub gains occurred across the region based on spatial data (Figure 2); degree of conversion to “grassland” seems unrealistic and many new openlands may have resulted from activities such as logging, prescribed and wild fires, or expanded agricultural (i.e., misclassified wheat or hay/pasture as grassland). While

¹ To evaluate landscape change, we compared satellite imagery (NLCD) of MI-12 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.

forest loss is concerning for some JV focal species, increases in grassland, shrub, and marsh represent habitat gains for other species. Land cover types that were largely stable in area between 2001 and 2006 were open water, urban, and barren, which consists largely of sand/beach and rocky open areas.

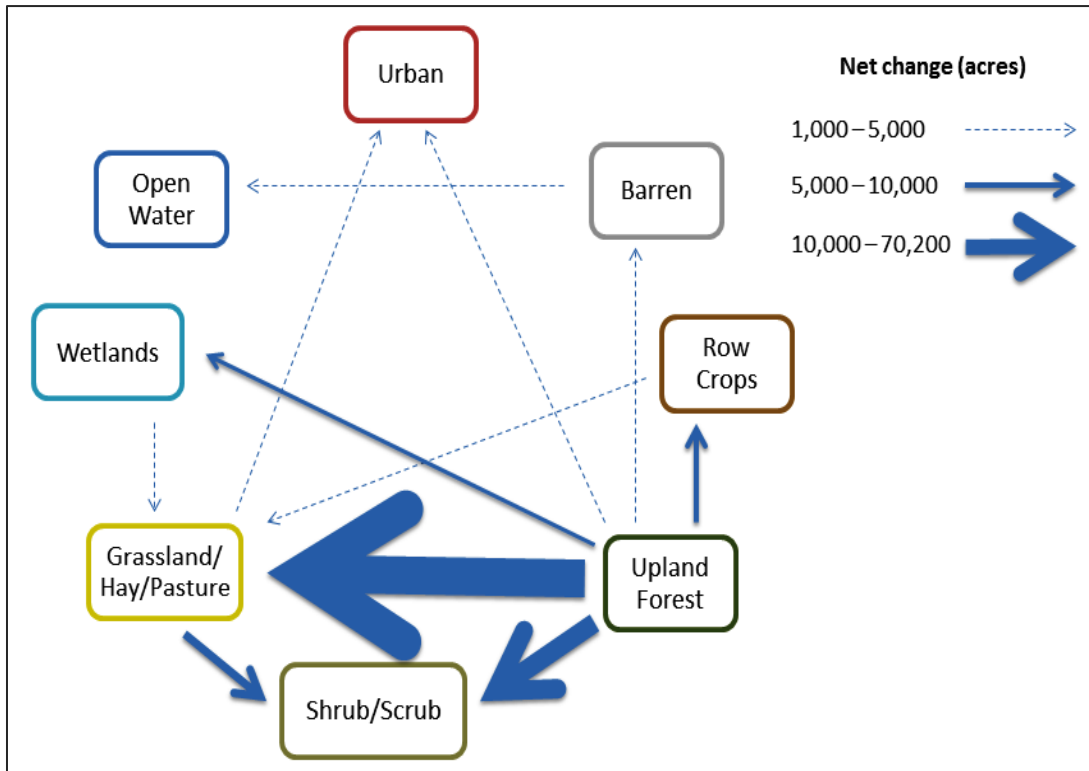


Figure 1. Net change of general land cover types (>1,000 acres converted) in Michigan BCR 12 between 2001 and 2006 (NLCD). Arrows point in the direction of change between two cover types and line thickness increases in proportion to amount of net change. “Wetlands” include woody and emergent herbaceous wetland, whereas “upland forest” represents upland (non-wetland) forest cover.

Table 2. Conversion (acres) of primary land cover types in Michigan BCR 12 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) converted to other cover types by 2006 (horizontal axis). For example, between 2001 and 2006, 2,949 acres of open water converted to wetland and 3,492 acres of wetland converted to open water, for a net change among these two cover types of -543 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	Forest	Shrub/Scrub	Grassland/Hay/Pasture	Row Crops	Wetlands
2001	Open Water	1,532,356	22	970	138	120	761	37	2,949
	Urban	0	1,000,084	1	0	9	12	4	3
	Barren	2,927	204	117,565	259	82	706	604	1,034
	Forest	440	2,159	1,727	9,754,443	30,342	74,569	6,917	5,558
	Shrub/Scrub	83	152	93	3,896	280,377	3,637	335	650
	Grassland/Hay/Pasture	167	1,593	1,119	4,519	13,252	1,515,532	2,076	5,914
	Row Crops	75	890	763	954	409	3,116	696,937	561
	Wetlands	3,492	269	1,063	415	1,143	9,674	929	5,052,615

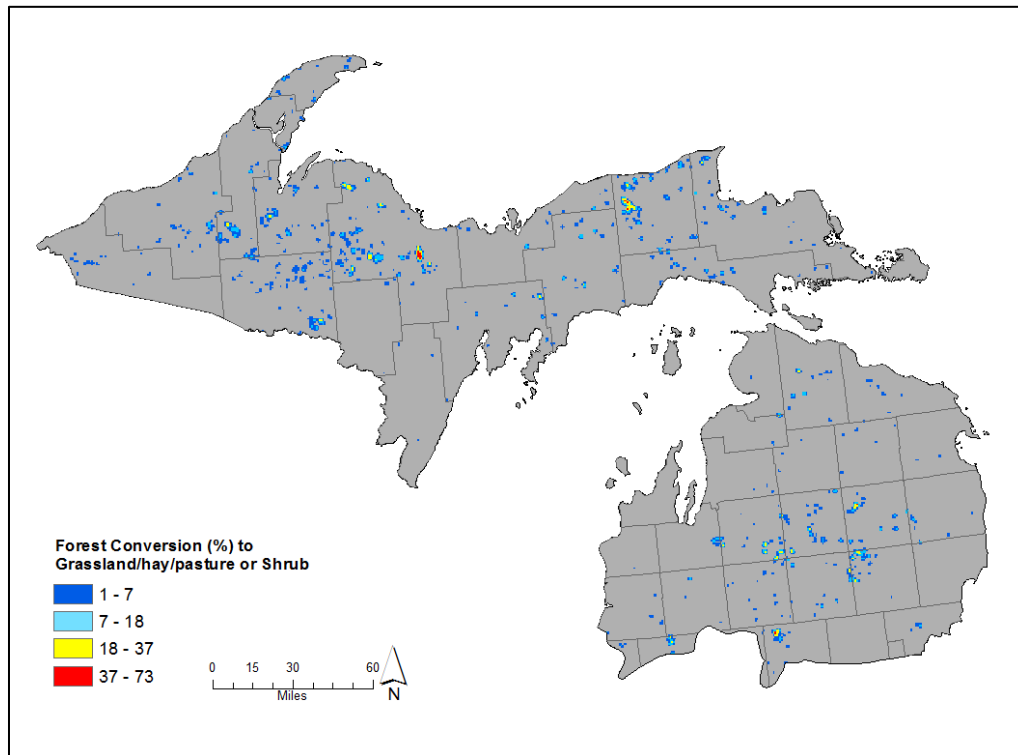


Figure 2. Conversion (percent total area converted within 1 km circular radius) from forest cover (upland forest and woody wetlands) to grassland, hay/pasture, or shrubland cover in Michigan BCR 12, 2001 to 2006 (NLCD).

Bird Habitat Objectives and Cover Type Availability

JV bird-habitat conservation objectives fall under two categories: “maintain and protect” (hereafter maintenance) and “restoration and enhancement” (hereafter restoration). Maintenance objectives reflect estimated area of habitat needed to main 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.

The southern boundary of MI-12 was adjusted slightly following completion of the 2007 JV Implementation Plan, however objectives in this assessment are the same as in the 2007 JV Plan (i.e., MI-12 bird habitat objectives did not change with boundary adjustment). The area of cover types potentially providing bird habitat was estimated using the National Wetland Inventory for wetlands and National Land Cover Database (NLCD 2006) for upland / openland. 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-12 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-12 portion of the state or assess the land cover composition of CRP lands due to privacy protections in the U.S. Farm Bill.

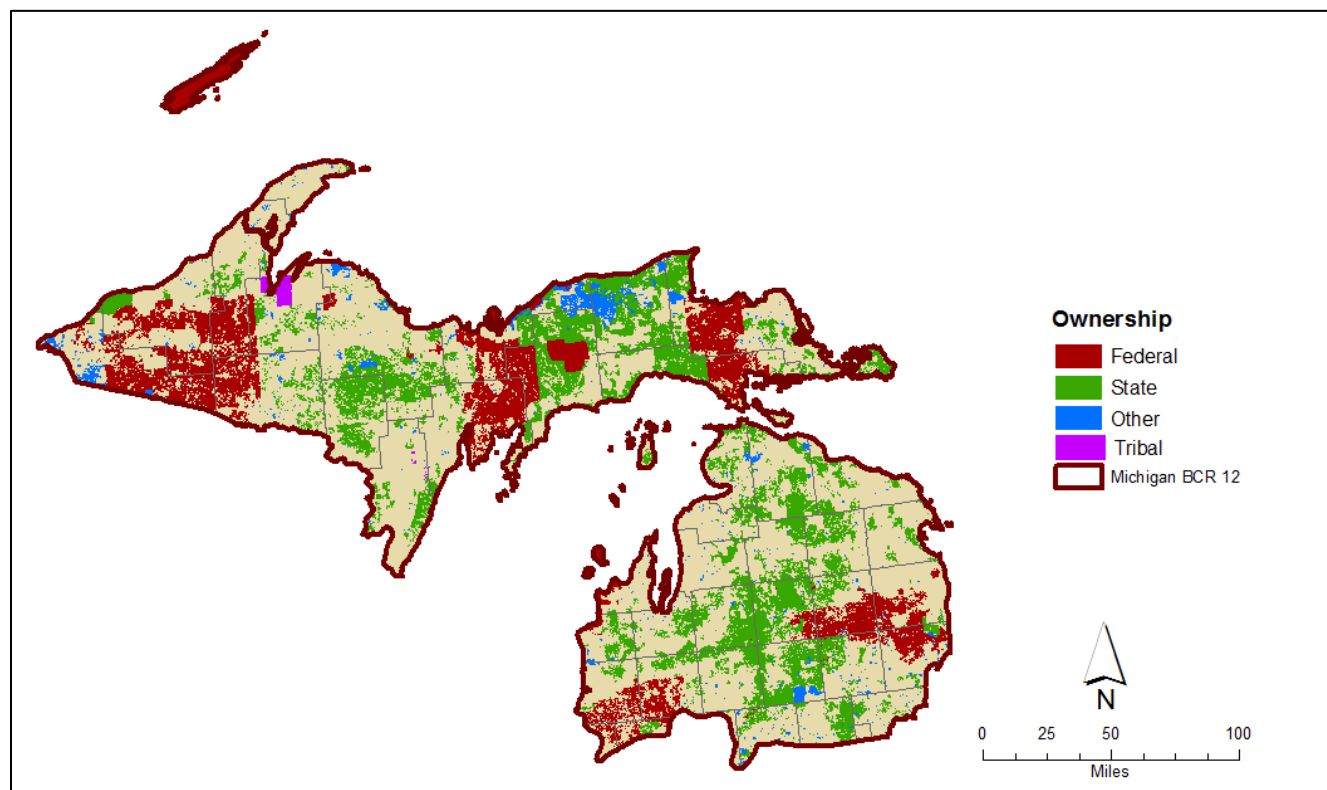


Figure 3. Location of federal, state or other conservation lands in Michigan Bird Conservation Region 12. “Other” ownership category includes private land with temporary and permanent easements, conservancy land, and county, township, and city owned land. Based on conservation land spatial data, total land area conserved (excluding CRP lands) is about 7,596,500 acres, including 6,245,200 woodland/grassland acres and 726,800 acres of open water, marsh wetland, and agriculture.

Woodland and Openland

The estimated amount of woodland and openland needed in a high quality habitat condition to maintain current landbird populations is 3,868,000 acres (Table 3). This area, plus an additional 602,000 acres of restored, high quality upland cover types, is predicted to achieve a landscape design adequate (i.e., provide carrying capacity) to meet JV goal populations for breeding woodland and openland birds. The overall 4,470,000-acre upland bird habitat objective represents 22% of the total area of MI-12 and less than what is currently under federal, state, or other protection (Table 3). Based on the 2007 JV Plan, the majority of habitat area needed to meet landbird objectives is shrubland.

Landbird cover types and focal species	
Deciduous forest	Whip-poor-will, Wood Thrush, Black-throated Blue Warbler, Cerulean Warbler
Forest generalist	Chimney Swift, Veery, Canada 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-12 encompasses about 13,386,000 acres of woodland and an estimated 5,870,000 acres are protected (Table 3). Although MI-12 contains abundant forest cover, forest fragmentation is a concern because it can limit habitat quality for some breeding forest birds. For

example, 117,100 acres of mature deciduous forest in large tracts (>5,000 contiguous acres) is required to meet the “high-quality” habitat objectives for JV focal species using this cover type. However, <1% of deciduous and mixed forest blocks in MI-12 meet these criteria important for species sensitive to fragmentation; most were state or federally owned lands with surrounding forested private lands.

Objectives for shrubland (3,401,200 acres) are substantially higher than the estimated area of shrub/scrub in the region (Table 3). However, 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.—The grassland-bird guild used for planning requires an estimated 229,000 acres of high quality habitat, and the region contains an estimated 1,078,000 acres of grassland plus 527,000 acres of pasture/hay (Table 3). Grassland area appears adequate to meet JV objectives, but fragmentation of large grasslands can be detrimental to breeding grassland birds. Savanna (mixed wooded openland) objectives (185,300 acres; Table 3) are based on the breeding habitat requirements of birds occupying savanna (e.g., Red headed Woodpecker). This cover type is not mapped by NLCD so it is difficult to assess the landscape’s capacity for supporting current and future populations of savanna birds.

Table 3. 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 12. 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		Cover type area on landscape	Land cover			
	Maintenance	Restoration		Conservation status (protected)			
				Federal	State	Other	Total
Woodland							
Deciduous forest	116,090	988	6,317,746	990,664	1,215,290	273,390	2,479,344
Evergreen forest	494,000	43,472	2,046,254	603,448	582,352	37,006	1,222,806
Forested wetland	0	0	3,318,961	461,256	932,863	18,503	1,412,622
Shrub/scrub	3,050,450	350,740	324,896	34,105	118,084	8,621	160,810
Other forest	0	0	1,376,923	297,403	258,712	39,040	595,155
Openland							
Grassland	114,361	114,361	1,077,766	80,186	260,866	20,698	361,750
Pasture/hay ^b	--	--	526,598	1,040	3,126	8,535	12,701
Savanna	92,625	92,625	na ^c	na	na	na	na
Total	3,867,526	602,186	14,989,144	2,468,102	3,371,293	405,793	6,245,188

^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.

Marsh, Mudflat, and Open Water

The estimated area of high quality bird habitat needed in marsh wetland, mudflat, and open water to maintain current wetland bird populations is about 290,000 acres (Table 4)². This area, plus an additional 81,000 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-12. JV wetland bird habitat objectives represent about 2% of the total area in MI-12, but 24% of the marsh and shrub wetland cover and 5% of the extensive open water area (Table 4).

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 mudflat	American Golden-Plover Killdeer
Open water	Canvasback, Lesser Scaup
Beach	Piping Plover, Sanderling
Islands with limited vegetation	Common Tern

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 an estimated 1,193,000 acres of available marsh and marsh/shrub wetlands in MI-12, of which 51% are protected (Table 4). Conservation objectives for marsh cover types were driven largely by the needs of breeding waterfowl and waterbirds. Habitat objectives for the non-breeding period include shallow semi-permanent marsh and deep-water marsh, and also open water. These values were generated based on the needs of migrating and wintering waterfowl.

Marsh communities are relatively abundant in MI-12 (Table 4); however, we were unable to determine the quality of these areas for breeding waterfowl and other marsh birds based on spatial data. The JV Plan calls for high quality wetland-bird habitat totaling 222,400 acres of shallow marsh / hemi marsh (includes 52,200 acres for wet meadow with open water) and 15,900 acres of deep-water marsh, similar to the estimated shallow and deep marsh available (Table 4). Objectives for marsh with associated shrub/forest (46,700 acres) are lower than the 964,800 acres of this cover type on the landscape in MI-12. Regarding quality of mapped marshes for waterfowl and other breeding wetland birds, forage and overall productivity can be low, often due to low nutrient levels or high acidity. Whereas riverine and deltaic wetlands and active beaver pond wetlands are relatively productive, bogs and other oligotrophic wetlands have limited value to breeding and migrating waterfowl. Coastal wet meadows are a unique Great Lakes community, typically with high plant and bird diversity, and some remain vulnerable to human actions.

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 9,800 acres of wet mudflat and shallow-water providing high quality shorebird habitat (Table 4). However, assessments of these cover types are difficult using remotely sensed data and are not adequately identified by NWI. These cover types are also 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, which is represented by row crop in NLCD (i.e., agricultural fields in spring provide value to some shorebirds), is greater than objectives in the JV Plan. Protected area of dry mudflat totals 20,600 acres, including an estimated 12,700 acres of state and federal lands apparently in row crop.

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-12 to maintain current populations of birds dependent on dry mudflat is 1,717 acres, as the breeding objective (1,717 ac) is greater than the non-breeding objective (412 ac) (See Table 4).

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 75,800 acres of high quality foraging and resting habitat. Whereas the region has abundant open water locations (Table 4), low forage availability and human disturbance may negatively influence use of some open-water areas by diving ducks. Some species of shorebird and terns depend on beach. Beach objectives total about 430 acres. Beach is abundant in MI-12, especially coastal beach when Great Lakes water levels are below average.

Table 4. 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 12. 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 (with 1 km lakeward buffer from Great Lakes shoreline); 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				Cover type area on landscape	Land cover			
	Maintenance		Restoration			Conservation status (protected)			
	B	N	B	N		Federal	State	Other	Total
Marsh									
Deep-water marsh	2,075	14,830	1,037	0	8,374	1,245	2,696	72	4,013
Shallow semi-permanent marsh ^a	164,458	49,195	57,973	2,601	219,889 ^b	34,548	66,817	667	102,032
Marsh with shrub/ forest	38,927	0	7,785	0	964,752	193,389	350,736	3,754	547,879
Mudflat and Shallows									
Wet mudflat/ shallows ^c	0	3,120	0	2,475	na ^d	na	na	na	na
Dry mudflat ^e	1,717	412	2,470	240	707,839	2,288	10,453	7,841	20,582
Open Water and Beach									
Extensive open water	0	67,144	0	8,665	1,539,539 ^f	120,002	41,739	811	162,552
Beach	210	82	0	217	123,301 ^f	10,705	10,396	2,058	23,159
Total	207,387	134,783	69,265	14,198	3,563,694	362,177	482,837	15,203	860,217

^aBird habitat objectives for "shallow semi-permanent marsh" also include objectives for "wet meadow with areas of open water" in the 2007 JV Plan.

^bCover type area for "shallow semi-permanent marsh" includes emergent marsh within palustrine, lacustrine, and riverine categories in NWI.

^cBird 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.

^dna indicates cover type area could not be estimated due to resolution limitations of spatial data.

^eDry mudflat/agriculture was a habitat category used in the 2007 JV Plan and "row crop" (NLCD) is the cover type measured on the landscape.

^fCover type area for "extensive open water" represents lacustrine, riverine, and unconsolidated bottom categories (NWI), whereas "beach" is sand/gravel/bedrock with little vegetation (NLCD).

Management Implications

Within the JV region, MI-12 is unique for its expansive Great Lakes coast, forest coverage, and high value to breeding wetland and forest birds. In addition, the wooded and wetland shores bordering the region connect northern breeding areas and southern wintering areas by providing crucial stopover habitat for millions of migrating birds, particularly forest birds. Although non-breeding landbird habitat objectives were not developed for the 2007 JV Implementation Plan, this emphasis will be addressed in future JV landbird planning efforts.

Breeding and migrating woodland birds dependent on mature forests currently have a substantial habitat base in MI-12. However, this cover type saw the greatest area decline between 2001 and 2006 and forest

fragmentation may limit some breeding bird populations. Shrub and young-growth forest increased in recent years but this cover type remains well below JV goal levels. JV partner collaboration with foresters and the timber industry can result in strategic timber cutting operations providing a commercial means to create shrub and young-growth forest, at least temporarily. However, managers should carefully consider forest fragmentation trends and patch size as they evaluate cutting locations because large un-fragmented forests are critical to viable populations of some breeding songbirds. Managing utility corridors for shrub vegetation and maintaining shrub cover in an irregular pattern, rather than hard edges, can reduce the effects of fragmentation while simultaneously working toward meeting shrubland bird habitat goals.

Additional forest cover 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 species composition and structure, including a healthy conifer component within deciduous stands, will assure higher quality habitat for forest-breeding birds and must be considered in long-term management scenarios. Likewise, composition, structure, and juxtaposition of woodlands are important during migration periods and movement corridors should also be considered in management planning, especially along Great Lakes shorelines.

Grassland cover appears to have increased substantially between 2001 and 2006 in MI-12 due primarily to conversion from forest cover. While there is justification for grassland/openland bird management in MI-12, current grassland areas are often located in largely forested landscapes. Depending on successional tendency, isolated grasslands prone to reforestation may be allowed to succeed, potentially reducing local forest fragmentation. A significant area of state and federally owned lands are mapped as grassland (341,000 acres; a large proportion are likely wet meadow), and where intensive management is required for grassland maintenance managers should consider allowing these lands to revert to shrubland and forest. Spatial data were not available to analyze the area of savanna on the landscape, but mixed wooded openlands in MI-12 are unique and also require periodic management to maintain characteristics required of openland / savanna birds.

The current areas of MI-12 open water and dry mudflat appear 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. The amount of shallow semi-permanent marsh was similar to the established habitat objectives for this cover type, but spatial data were 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-12 partners should continue expanding protection of marsh and wet meadow providing high quality wetland-bird habitat. Functioning riverine, deltaic, and coastal wetlands should retain connectivity to adjacent rivers and lakes to assure nutrient and energy exchange important to long-term productivity and plant and wildlife diversity. Management of invasive plant species may be necessary, preferably with spot treatments before invasive species dominate previously healthy wetlands. *Phragmites australis*, the most problematic invasive wetland plant in Michigan, will require biological control (<http://greatlakesphragmites.net/control-options/>) at large scales but inventory and treatment of small and newly colonized areas within MI-12 remains a viable management option during bio-control development.

Recommended citation: Pierce, R.L, B.M. Kahler, and G.J. Soulliere. 2014. State X BCR Assessment: Michigan 12 – Boreal Hardwood Transition. Upper Mississippi River and Great Lakes Region Joint Venture, U.S. Fish and Wildlife Service, Bloomington, MN, USA.

This assessment document and JV Implementation Plan available at: www.UpperMissGreatLakesJV.org (Last revised 24 September 2014).