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JOINT VENTURE
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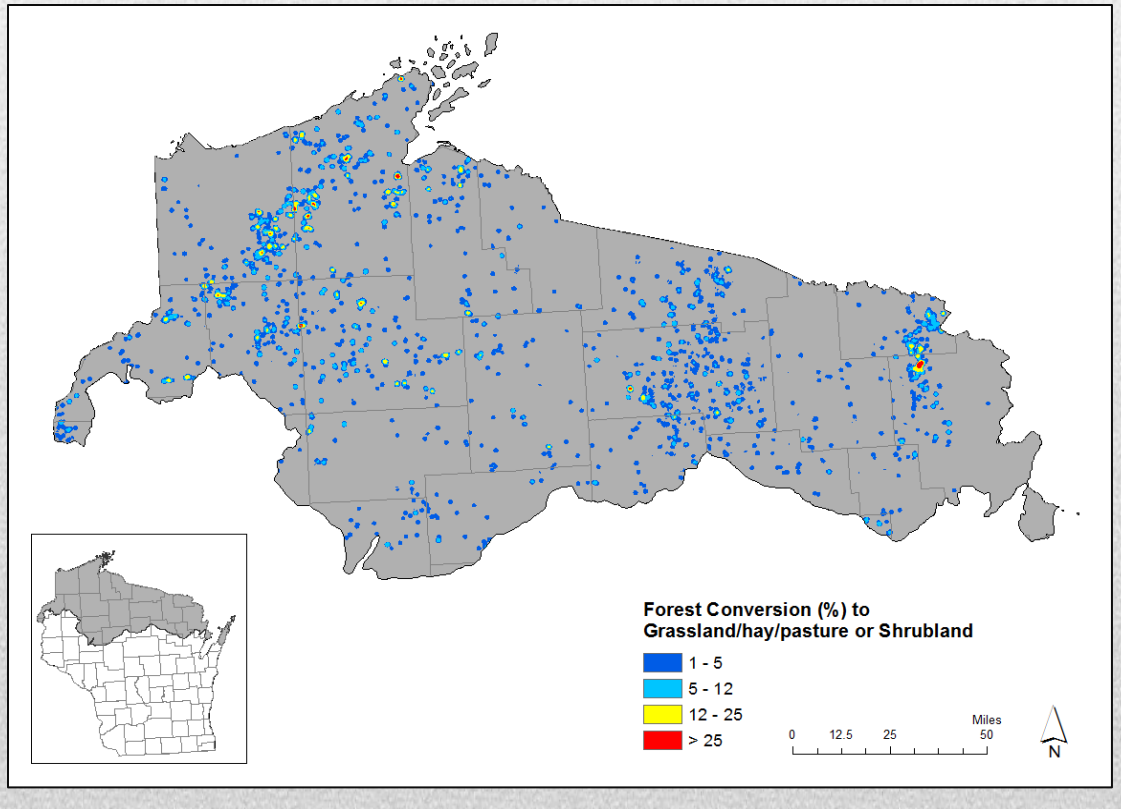
Wisconsin BCR 12 – Assessment Summary

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 Wisconsin BCR 12 (WI-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 WI-12 assessment for more details.**



Primary cover-types

WI-12 consists of extensive forested wetlands (21%), open water (7%), and urban (4%), but its primary cover type is upland forest (55%). Grassland/hay/pasture (+39,600 ac) and shrubland (+13,000 ac) expanded between 2001 and 2006, whereas acreage of upland forest (-58,600 ac) declined. Gain in grassland was largely the result of conversion from upland forest 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 Wisconsin Bird Conservation Region 12. Wetland and open water availability based on recent NWI and WWI, 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	25,688	4,942,503	-0.7
Evergreen forest	120,536	460,848	-1.3
Shrubland	1,118,910	279,245	4.9
Other forest	446,576	1,004,479	-1.7
Grassland	74,100	117,697	50.8
Savanna	65,702	n/a	n/a
Marsh, mudflat, and open water			
Emergent wetland	178,933[a]	185,312	5.3
Woody wetland	21,628[b]	2,232,270	-0.4
Dry mudflat	2,216	547,096[c]	0.4
Open water	47,234	364,574	-0.5

[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:

- Emergent wetland area is greater than current wetland bird habitat objectives, but wetland quality could not be assessed; bogs and other oligotrophic wetlands are nutrient poor and lower value to JV focal species. Expanded protection of high-quality marsh and wet meadow is a priority.
- 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.

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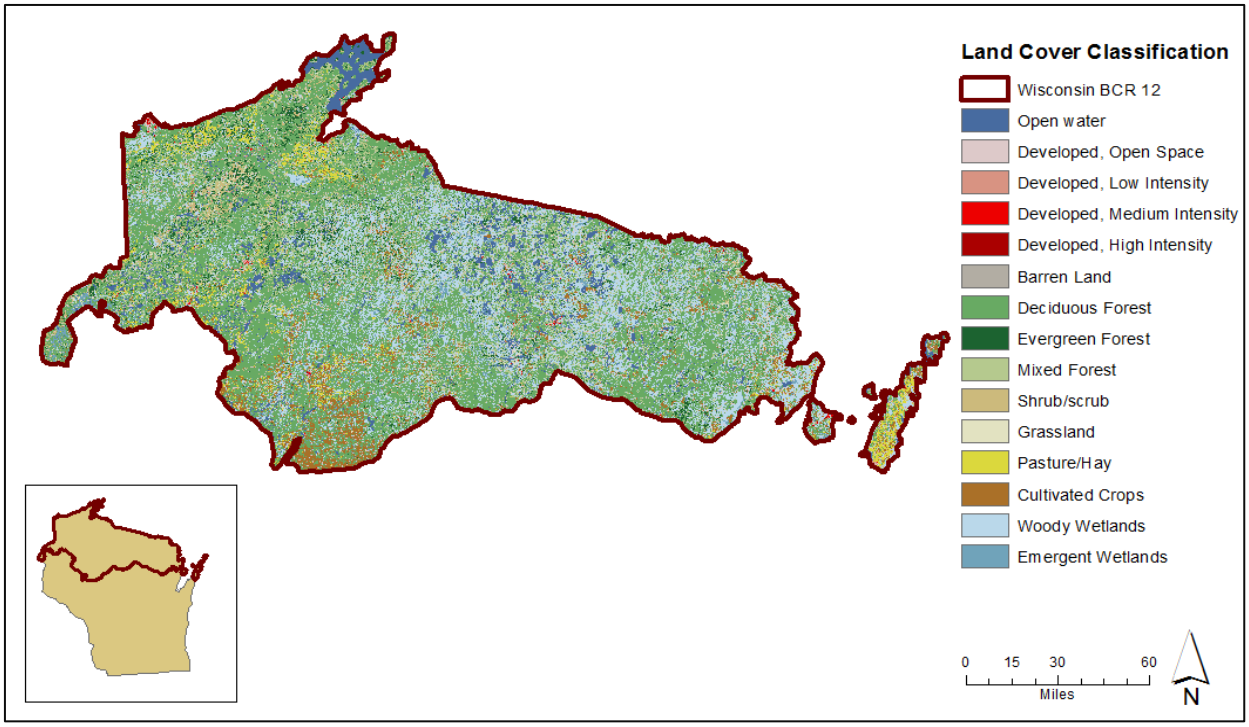
State by BCR Assessment

Wisconsin 12 – Boreal Hardwood Transition

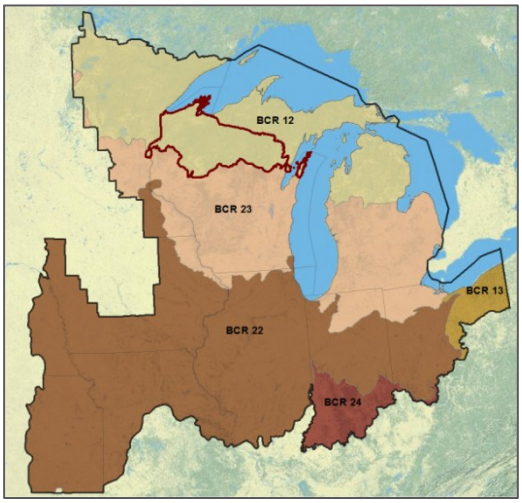
This document was developed to serve as a "stepped-down" version of the 2007 Joint Venture (JV) Implementation Plan with focus on Wisconsin BCR 12, the Boreal Hardwood Transition portion of Wisconsin. It includes lists of bird species used for JV regional planning (i.e., focal species) that represent land cover types, or bird habitat associations, important to bird guilds occurring in WI-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 WI-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 WI-12 (species within guild may be more common than focal species, see 2007 JV Plan).

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

	Year		% change	Acres
Cover Type	2001	2006	from 2001	gained/lost
Open Water	778,713	774,759	-0.5	-3,954
Urban	478,929	479,850	0.2	921
Barren	4,824	6,691	38.7	1,867
Upland Forest	6,488,407	6,429,942	-0.9	-58,465
Shrub/Scrub	266,304	279,245	4.9	12,940
Grassland/Hay/Pasture	396,526	436,024	10.0	39,499
Grassland	78,033	117,697	50.8	39,664
Row Crops	544,202	546,202	0.4	2,000
Wetlands	2,725,753	2,730,945	0.2	5,192
Emergent Wetlands	297,641	313,307	5.3	15,667
Woody Wetlands	2,428,112	2,417,637	-0.4	-10,475
Total	11,702,789	11,702,789		

WI-12 is dominated by upland forest and forested wetlands with abundant open water lakes and interspersed cities and towns (Table 1).[1] Despite losses of 58,500 acres of upland forest and 10,500 acres of woody wetlands 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 (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 of these new openlands may have resulted from activities such as logging or expanded agricultural (i.e., misclassified wheat or hay/pasture as grassland). Forest loss is concerning for some JV focal species, but potential increases in grassland, shrub, and marsh represent gains for other species. Land cover types that were largely stable in area between 2001 and 2006 were urban and row crop.

[1] To evaluate landscape change, we compared satellite imagery (NLCD) of WI-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.

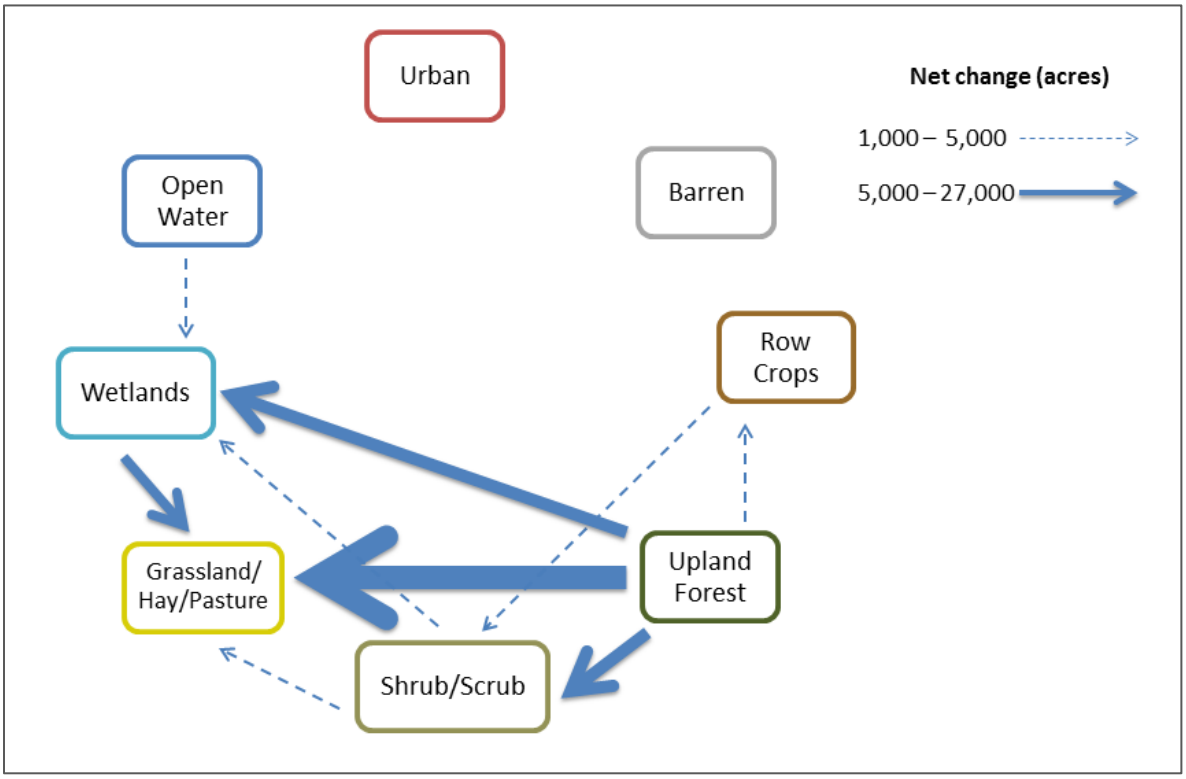


Figure 1. Net change of general land cover types (>1,000 acres converted) in Wisconsin BCR 12 between 2001 and 2006 (NLCD). Arrows point in the direction of change between two cover types and line thickness increases in proportion to amount of net change. "Wetlands" include woody and emergent herbaceous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

Table 2. Conversion (acres) of primary land cover types in Wisconsin 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) coverted to other cover types by 2006 (horizontal axis). For example, between 2001 and 2006, an estimated 4,493 acres of open water converted to wetland and 2,019 acres of wetland converted to open water, for a net change among these two cover types of +2,474 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	771,413	7	151	716	663	1,064	206	4,493
	Urban	0	478,925	0	1	0	1	0	1
	Barren	51	0	4,758	3	9	1	0	3
	Upland Forest	994	282	607	6,424,113	17,773	27,373	3,177	14,087
	Shrub/Scrub	94	16	33	4,488	255,295	4,449	361	1,569
	Grassland/Hay/Pasture	100	264	196	495	3,346	390,815	353	957
	Row Crops	88	163	417	89	2,013	165	540,357	910
	Wetlands	2,019	192	530	37	147	12,157	1,747	2,708,924

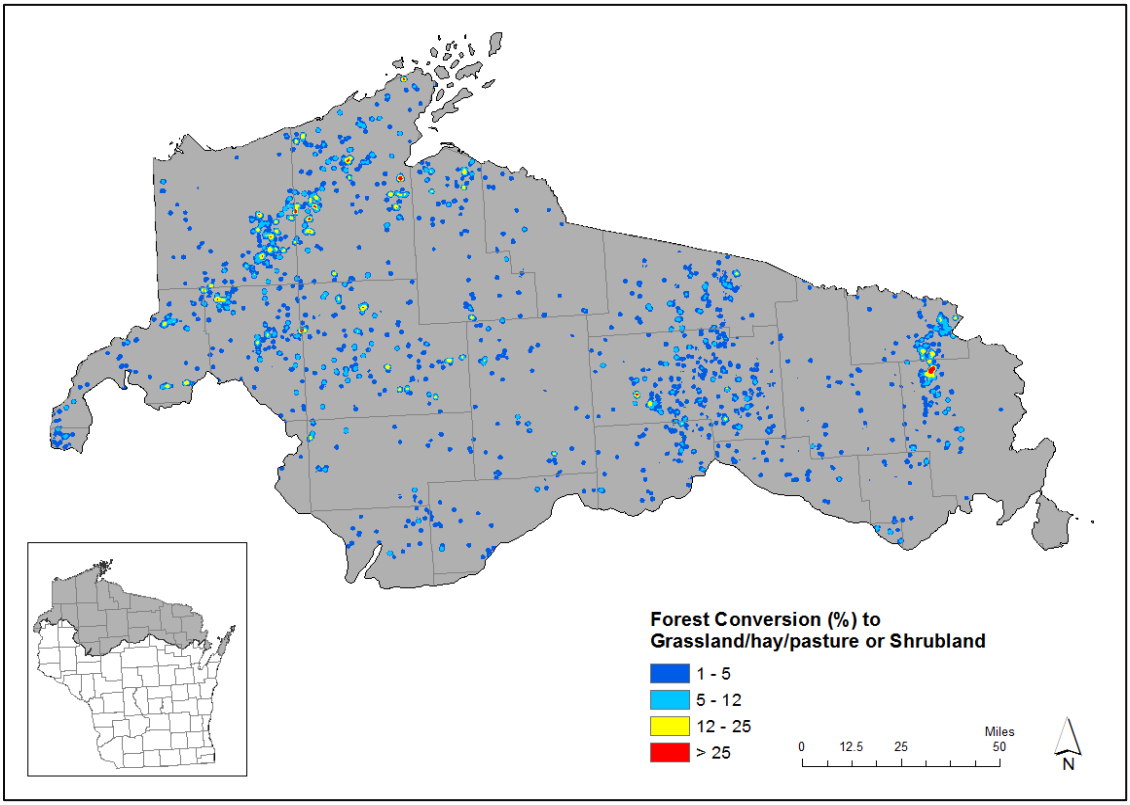


Figure 2. Conversion (percent total area converted within 1 km circular radius) from forest (upland forest and woody wetlands) to grass/hay/pasture and shrubland cover in Wisconsin BCR 12, 2001 to 2006 (NLCD).

Bird Habitat Objectives and Cover Type Availability

JV bird-habitat conservation objectives fall under two categories: "maintain and protect" (hereafter maintenance) and "restore and enhance" (hereafter restoration). Maintenance objectives reflect estimated area of habitat needed to 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 only for 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 area of cover types potentially providing bird habitat was estimated using the National Wetland Inventory and Wisconsin Wetlands 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 WI-12 protected land configuration and ownership composition (Figure 3). In December 2013, 265,000 acres were enrolled in the Conservation Reserve Program (CRP) in Wisconsin with roughly 119,000 acres scheduled to expire by 2018. We were unable to partition total Wisconsin CRP acreage to the WI-12 portion of the state or assess the land cover composition of CRP lands due to privacy protections in the U.S. Farm Bill.

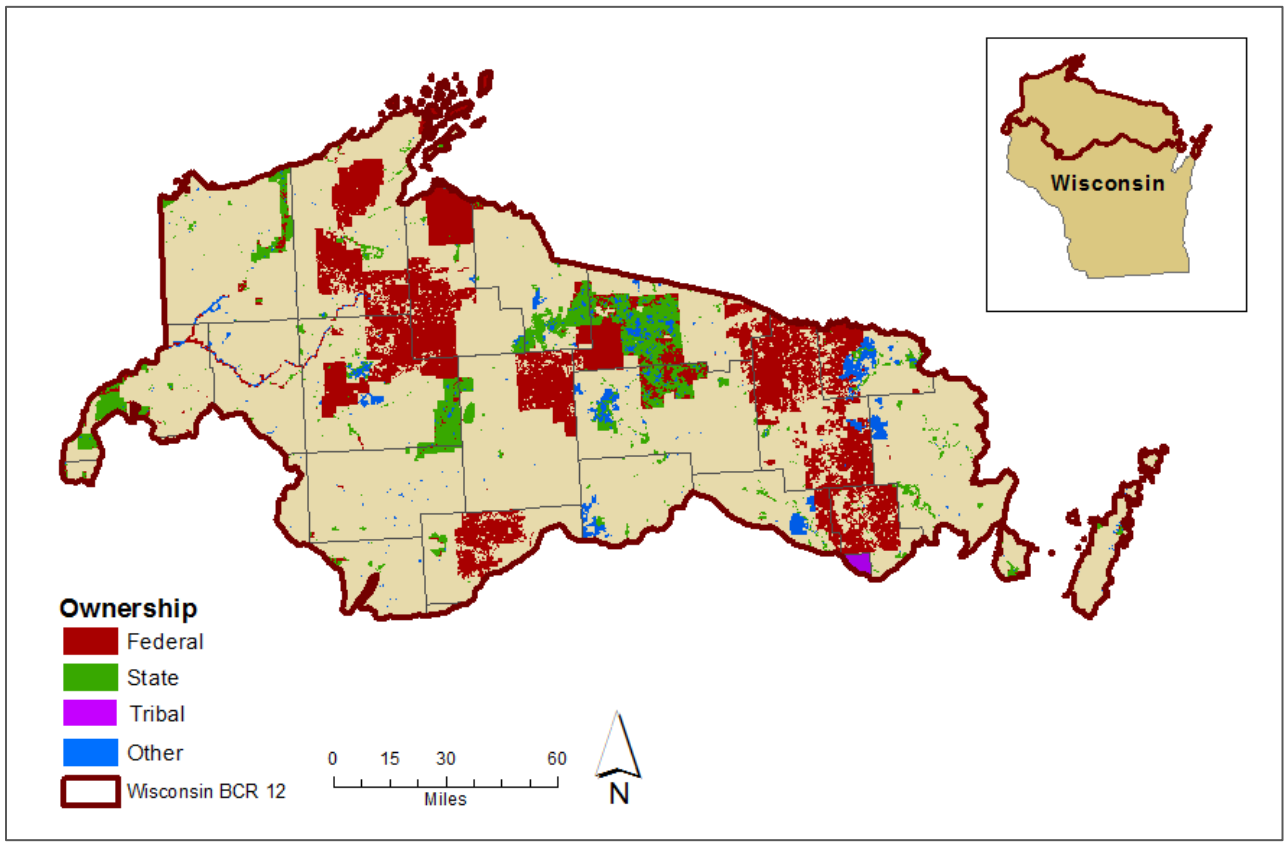


Figure 3. Location of federal, state, or other conservation lands in Wisconsin Bird Conservation Region 12. "Other" ownership category includes private land with temporary and permanent easements, conservancy land, and county, township, and city owned land. Based on conservation land spatial data, total land area conserved (excluding CRP) is 3,641,423 acres, including 2,823,355 acres of woodland/grassland and 403,029 acres of marsh wetland, open water, 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 about 1.3 million acres (Table 3). This area, plus an additional 589,000 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 1,852,000–acre upland bird habitat objective represents 16% of the total area of WI-12, and the primary cover types needed to meet JV objectives for landbirds are shrub and upland forest woodlands.

Landbird cover types and focal species	
Deciduous forest	Whip-poor-will, Wood Thrush, Black-throated Blue Warbler, Cerulean Warbler, Louisiana Waterthrush
Evergreen forest	Olive-sided Flycatcher, Cape May Warbler, Connecticut 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, evergreen forest, shrubland, and other mixed forest were all driven by the needs of breeding landbirds. WI-12 encompasses about 8.2 million acres of woodland and an estimated 2.8 million acres are protected based on available spatial data (Table 3). The region contains abundant forests and is well above JV objective levels for forest bird habitat; however, this cover type saw the

greatest decline in area between 2001 and 2006 accounting for an estimated 59,000-acre loss. In addition to decline in quantity, forest conversion can result in reduced habitat value of remaining woodlands, as fragmentation of large contiguous forest blocks can limit habitat quality for edge-sensitive breeding forest birds.

The objective for shrubland (1.1 million acres) exceeds the apparent availability of shrubland on the landscape (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.

Table 3. Upland bird habitat maintenance and restoration objectives (acres) by primary woodland and openland cover types and the amount of each currently on the landscape in Wisconsin BCR 12. Objectives are from the 2007 JV Implementation Plan and represent 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 and Wisconsin 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	21,983	3,705	4,942,503	891,888	259,814	434,569	1,586,271
Evergreen forest	98,800	21,736	460,848	142,649	28,427	44,291	215,367
Forested wetland	0	0	1,515,092	285,705	101,526	114,946	502,177
Shrub/scrub	797,810	321,100	279,245	55,238	18,427	33,023	106,688
Other forest	274,417	172,159	1,004,479	215,214	72,953	88,656	376,823
Openland							
Grassland	37,050	37,050	117,697	7,267	10,838	9,219	27,324
Pasture/Hay[b]	--	--	318,327	3,524	1,408	3,773	8,705
Savanna	32,851	32,851	na[c]	na	na	na	na
Total	1,262,911	588,601	8,638,191	1,601,485	493,393	728,477	2,823,355

[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 cover type could not be estimated due to resolution limitations of spatial data.

Openland.—The grassland-bird guild used for planning requires an estimated 74,100 acres of high quality habitat, and the region contains an estimated 117,700 acres of grassland plus 318,300 acres of pasture/hay (Table 3). Grassland area appears adequate to meet JV objectives, plus hay/pasture can provide some grassland bird habitat depending on management (i.e., timing of hay mowing, stocking density of pastures). Similar to forests, fragmentation of large grasslands can be detrimental to edge-sensitive breeding grassland birds.

Savanna (mixed wooded openland) objectives of 65,700 acres (Table 3) are based on estimated habitat requirements of breeding savanna birds (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. In addition, the savanna area objective will be reduced substantially in future JV planning based on new information.

Marsh, Mudflat, and Open Water

Wetland and open water cover types and focal species	
Deep water marsh	Tundra Swan, American Black Duck
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 wetland bird populations is about 203,400 acres (Table 4)[2]. This area, plus an additional 46,800 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 WI-12. The overall 250,200-acre wetland bird habitat objective represents about 2% of the total area in WI-12, with shallow marsh and extensive open water being the primary cover types needed to meet JV objectives for wetland birds.

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 900,000 acres of available marsh cover types in WI-12, and most were marsh/shrub wetlands (Table 4). In addition, about 30% of all marsh wetlands in the region were protected based on available spatial data. Conservation objectives for marsh cover types were driven primarily by the needs of breeding waterfowl. Habitat objectives for the non-breeding period included marsh and extensive open water (Table 4) and were based on the habitat needs of migrating and wintering waterfowl.

Marsh communities are relatively abundant in WI-12 based on NWI and WWI (Table 4); however, we were unable to determine the quality of these areas for wetland birds based on spatial data. The JV Plan calls for high quality wetland-bird habitat totaling 169,800 acres of shallow marsh / hemi marsh (includes roughly 66,300 acres for wet meadow with open water) and 6,200 acres of deep-water marsh, similar to the estimated marsh area available (Table 4). Objectives for marsh with associated shrub/forest (21,600 acres) are well below the 717,200 acres of this cover type available in WI-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. Riverine wetlands, "wild rice lakes," and active beaver pond wetlands are relatively productive and wet meadows, especially along Great Lakes coast, are unique communities, typically with high plant and bird diversity. Conversely, bogs and other oligotrophic wetlands have limited value for waterfowl.

Mudflat and Shallows.—Objectives for wet mudflat, shallow-depth (<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 3,000 acres of wet mudflat and shallow-water providing high quality foraging habitat (Table 4). Assessment of mudflat and shallows 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 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 far greater than objectives in the JV Plan. Protected area of dry mudflat totals 18,000 acres, including an estimated 13,300 acres of state and federal lands are 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 WI-12 to maintain current populations of birds dependent on deep water marsh is 5,639 acres, as the non-breeding objective (5,639 ac) is greater than the breeding objective (1,141 ac) (See Table 3).

Table 4. Wetland bird habitat maintenance and restoration objectives (acres) for marsh, mudflat, and open water and the amount of each cover type currently on the landscape in Wisconsin BCR 12. Objectives are from the 2007 JV Implementation Plan and represent 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 and Wisconsin Wetland Inventory (with 500 m 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				Land cover				
	Maintenance		Restoration		Cover type area on landscape	Conservation status (protected)			
	B	N	B	N		Federal	State	Other	Total
Marsh									
Deep-water marsh	1,141	5,639	571	0	1,777	247	82	99	428
Shallow semi-permanent marsh[a]	142,286	26,511	27,477	921	183,535[b]	14,774	19,254	17,500	51,528
Marsh with shrub/ forest	18,024	0	3,604	0	717,178	122,670	67,003	34,711	224,384
Mudflats and shallows									
Wet mudflat/ shallows[c]	0	1,650	0	1,310	na[d]	na	na	na	na
Dry mudflat[e]	909	220	1,307	128	546,096	7,734	5,609	4,883	18,226
Open water and beach									
Extensive open water	0	34,847	0	12,387	364,574[f]	61,173	23,028	25,086	109,287
Beach	64	44	0	116	6,702[f]	423	116	89	628
Total	162,424	68,911	32,959	14,862	1,820,862	207,021	115,092	82,368	404,481

[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 cover type area 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 land cover 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 sand/gravel/bedrock with little vegetation (NLCD).

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 47,000 acres of high quality foraging and resting habitat. Whereas the region has abundant open water locations (Table 4), low forage availability and human disturbance can negatively influence use of lakes by diving ducks. Some species of shorebirds and terns depend on beach. Beach objectives total about 180 acres. Beach is abundant in WI-12, especially coastal beach when Great Lakes water levels are below average.

Management Implications

Within the JV region, WI-12 is unique for its expansive forest cover and high value to breeding forest birds. In addition, the wooded and wetland shorelines 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 migration and wintering habitat objectives were not developed for landbirds in 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 WI-12. However, this cover type saw the greatest area decline between 2001 and 2006 and forest

fragmentation is a threat to edge- and area-sensitive species. 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 be considered in management planning, especially along Great Lakes shorelines.

Grassland cover appears to have increased substantially between 2001 and 2006 in WI-12 due primarily to conversion from forest cover. While there is justification for grassland/openland bird management in WI-12, current grassland areas are often located in largely forested landscapes. Depending on successional tendency, isolated grasslands prone to reforestation should be allowed to succeed, potentially adding shrub / young forest and reducing local forest fragmentation. A significant area of state and federally owned lands are mapped as grassland (18,000 acres), 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 WI-12 are unique and will require periodic management to maintain characteristics required of openland / savanna birds.

The current areas of WI-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). WI-12 partners should continue expanding protection of marsh and wet meadow providing quality wetland-bird habitat. Functioning riverine, deltaic, and coastal wetlands should retain connectivity to adjacent rivers and lakes to assure water, nutrient, and energy exchange important to long-term productivity and plant and wildlife diversity. Management of invasive plant species may be necessary at some locations, preferably with spot treatments before invasive species dominate previously healthy wetlands. *Phragmites australis*, the most problematic invasive wetland plant in Wisconsin, will require biological control (http://greatlakesphragmites.net/control-options/) at large scales but inventory and treatment of small and newly colonized areas in WI-12 is viable management during bio-control development.

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