UPPER MISSISSIPPI RIVER & GREAT LAKES REGION
JOINT VENTURE
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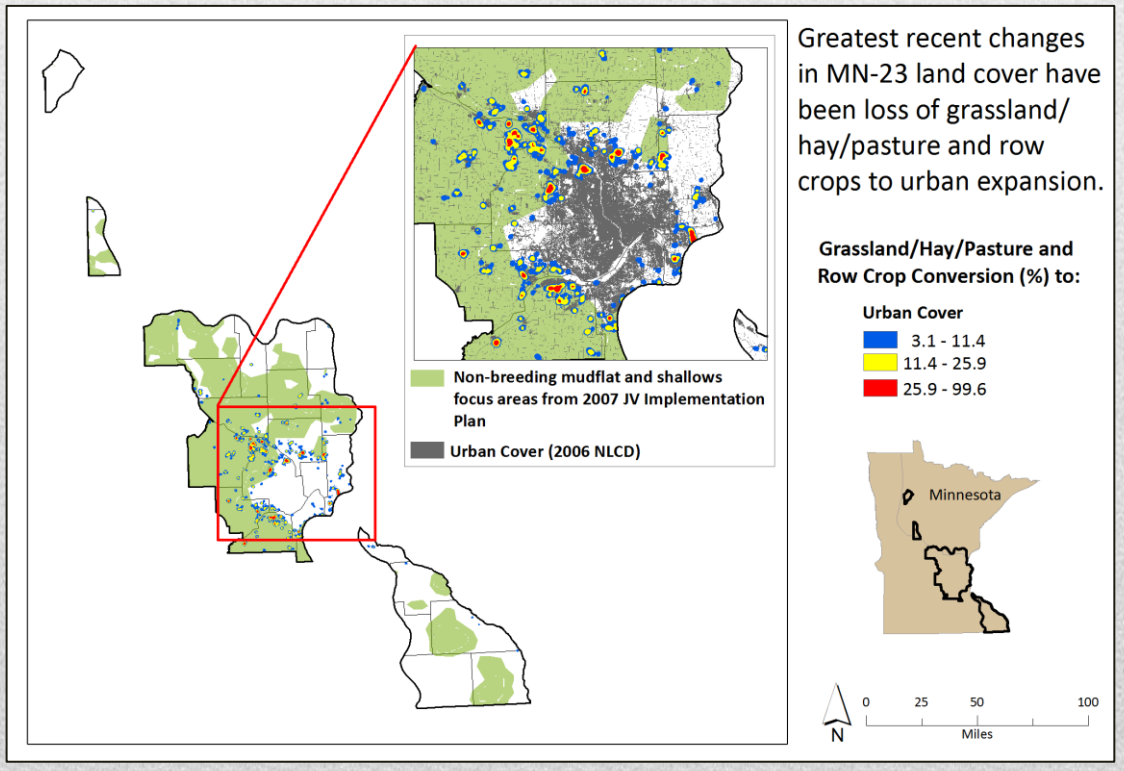
Minnesota BCR 23 – Assessment Summary

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 Minnesota BCR 23 (MN-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 MN-23 assessment for more details**.



Primary cover-types

MN-23 consists of a near-equal mixture of row crops (27%), grassland/hay/pasture (26%), and upland forest (22%). Urban land (+41,000 ac) expanded in recent years, whereas total area of row crop (-21,000 ac), grassland/hay/pasture (-18,000 ac), and upland forest (-9,000 ac) declined. Cover types that remained relatively stable were shrub/scrub and emergent marsh wetlands.

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 Minnesota Bird Conservation Region 23. 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 (%)
Marsh, mudflat, and open water			
Emergent wetland	552,672[a]	566,135	0.0
Woody wetland	43,299[b]	323,733	1.5
Dry mudflat	18,076	1,717,340[c]	-1.2
Open water	15,706	256,003	1.5
Woodland and openland			
Deciduous forest	3,952	1,313,741	-0.6
Evergreen forest	38,779	71,327	-2.2
Shrubland	634,790	69,007	0.7
Other forest	110,409	3,823	-1.2
Grassland	154,622	313,970	-1.2
Savanna	1,317,498	n/a	n/a

[a] Includes habitat objectives for multiple focal species combined: deep water marsh, 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 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:

- Current areas of emergent marsh and marsh with associated shrub/forest appear adequate to meet habitat objectives for JV focal species.
- Despite adequate coverage of emergent marsh, MN-23 partners should continue to expand protection, plus enhance quality of bird habitat, including implementing control of invasive plants (e.g., *Phragmites australis*) and human disturbance where needed.
- Areas of open water and dry mudflat appear adequate to meet habitat objectives for JV focal species. Area of wet mudflat and shallows could not be assessed, nor could the quality of these potential wetland-bird habitats be assessed using available spatial data.

Woodland:

- Despite slight declines, forest cover is greater than needed to meet current JV breeding bird objectives.
- Migration and wintering landbird objectives were not developed for the 2007 JV Plan, but the non-breeding period will be addressed in the future. In the meantime, maintaining forest bird migration corridors, especially along river floodplains should be considered a management priority.
- The area of available shrubland appears substantially lower than habitat objectives for shrubland birds. One approach to restoration of this cover type may be well-planned timber harvest.

Openland:

- Grassland availability appears greater than habitat objectives for breeding grassland birds, but the area of savanna (mixed wooded openland) could not be determined with NLCD spatial data.
- Future grassland abundance will be largely driven by private land management (e.g., conservation easement and bird-friendly farming practices); however high commodity prices may result in conversion of grassland to row crops in the near term.
- Given the dominance of cropland and forest in MN-23, current JV habitat objectives for grassland and savanna birds are probably beyond achievement. Moreover, habitat objectives for savanna species will likely be reduced in future JV planning given new information.

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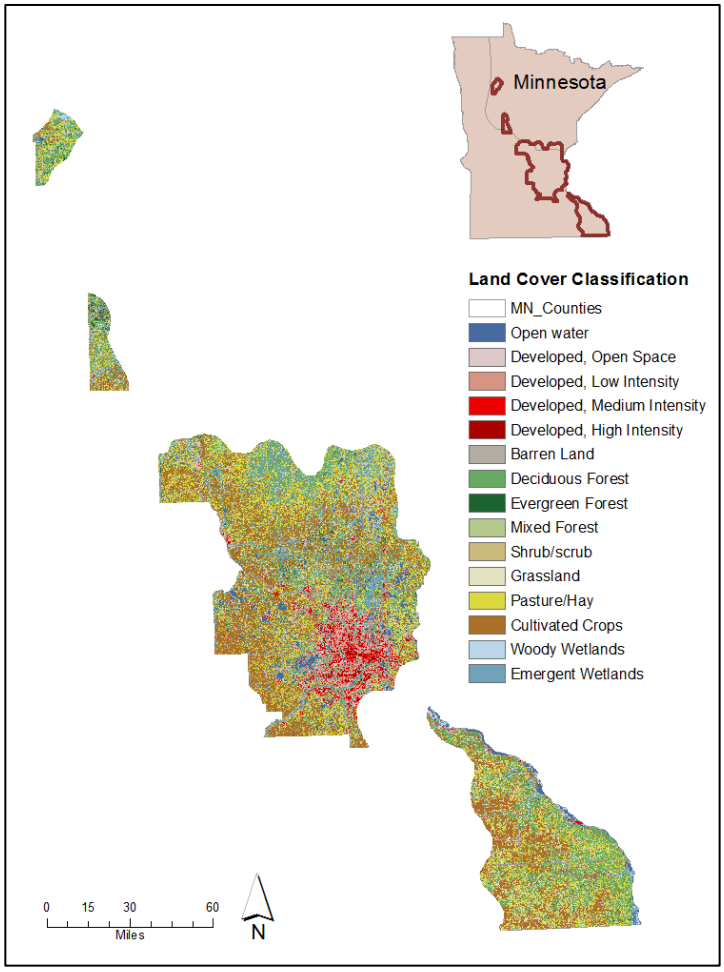
State by BCR Assessment

Minnesota 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 Minnesota BCR 23, the Prairie Hardwood Transition portion of Minnesota. 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 MN-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 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 under protection, primary modes of recent cover type conversion, and general management implications for MN-23 bird conservation partners.

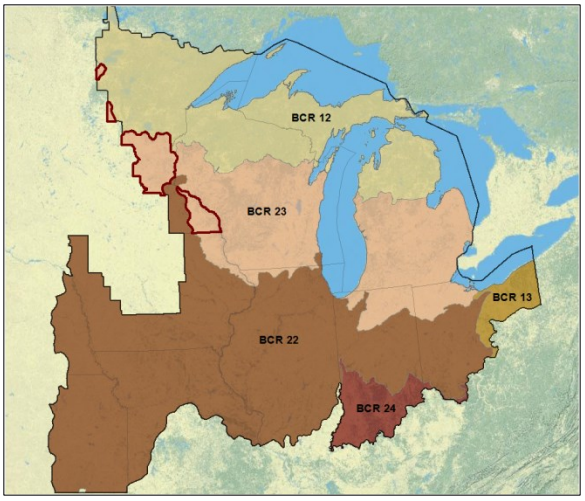


Note: Portions of MN-23 located outside the UMRGL JV region (and within the Prairie Pothole region) are not included in this Assessment.

JV

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 MN-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	Killdeer	Yellow Rail
Red-headed Woodpecker	Upland Sandpiper	King Rail
Olive-sided Flycatcher	Sanderling	Black Tern
Willow Flycatcher	Dunlin	
Veery	Short-billed Dowitcher	**Waterfowl**
Wood Thrush	Wilson's Snipe	Tundra Swan
Blue-winged Warbler	American Woodcock	Wood Duck
Golden-winged Warbler	Wilson's Phalarope	American Black Duck
Cape May Warbler		Mallard
Black-throated Blue Warbler		Blue-winged Teal
Cerulean Warbler		Canvasback
Canada Warbler		Lesser Scaup
Henslow's Sparrow		
Eastern Meadowlark		



Bird Conservation Regions in the Upper Mississippi River and Great Lakes JV region.

Introduction

A primary goal of bird conservation 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., MN-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 goal populations 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 MN-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 JV 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 MN-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 Minnesota 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			
Cover Type	2001	2006	% change	Acres gained/lost
Open Water	251,632	255,450	1.5	3,818
Urban	786,593	827,999	5.3	41,405
Barren	3,519	3,814	8.4	294
Upland Forest	1,400,625	1,391,167	-0.7	-9,458
Shrub/Scrub	68,617	69,120	0.7	503
Grassland/Hay/Pasture	1,667,497	1,649,812	-1.1	-17,684
Grassland	317,718	313,970	-1.2	-3,748
Row Crops	1,740,884	1,720,154	-1.2	-20,730
Wetlands	537,976	539,829	0.3	1,853
Emergent Wetlands	401,123	400,939	0.0	-184
Woody Wetlands	136,853	138,889	1.5	2,036
Total	6,457,344	6,457,344		

MN-23 has a nearly equal mixture of row crops, grassland/hay/pasture, and upland forest (Table 1).[1] Row crop cover declined slightly between 2001 and 2006, accounting for a 20,700 acre loss. Likewise, grassland/hay/pasture (-17,700 acres) and upland forest (-9,500 acres) both declined during this period. Conversely, urban cover increased by 41,400 acres, roughly the combined footprint of cities St Cloud, St Augusta, and Sauk Rapids. Gains in urban cover came primarily from land previously in agricultural production and forest (Figure 1, Table 2) and represents permanent habitat loss for some JV focal species. Most conversion to urban cover occurred adjacent to metropolitan areas, but some locations had been identified as priority mudflat and shallow-water areas for migrating wetland birds (Figure 2). Land cover types that were largely stable in area between 2001 and 2006 were open water, shrub/scrub, and emergent and forested wetland.

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

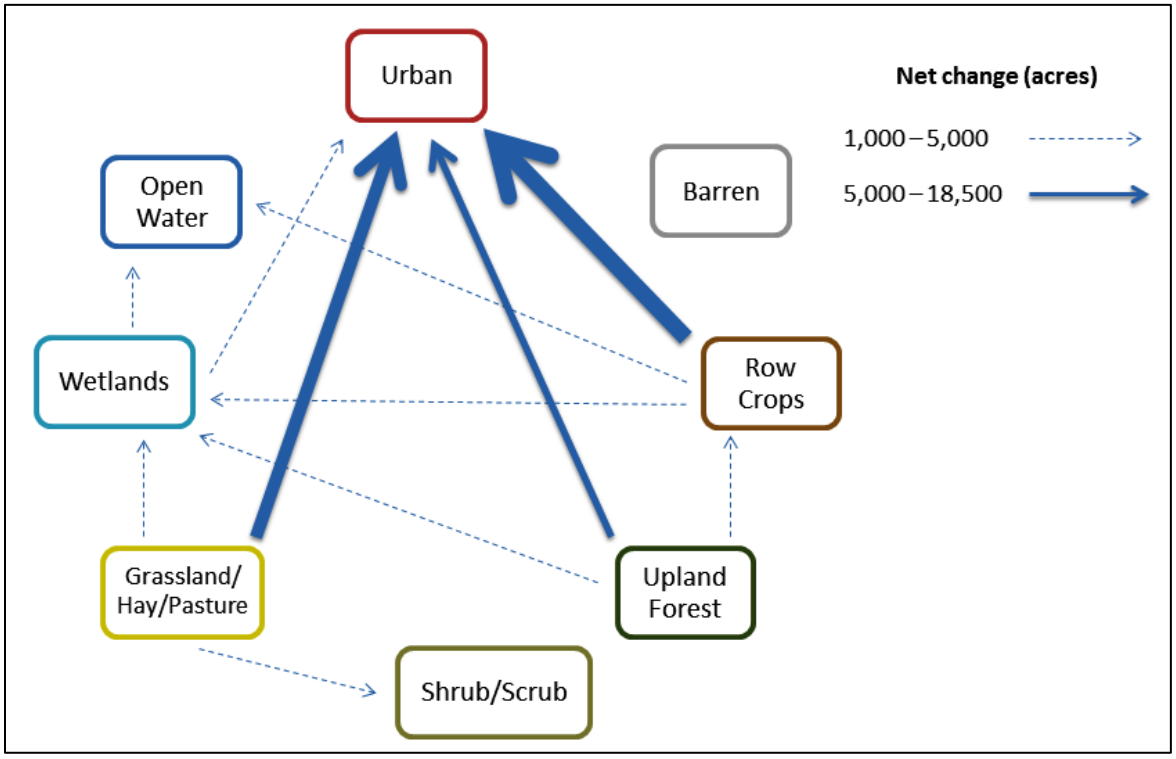


Figure 1. Net change of general land cover types (>1,000 acres converted) in Minnesota BCR 23 between 2001 and 2006 (NLCD). Arrows point in the direction of change between two cover types and line thickness increases in proportion to amount of net change. "Wetlands" include woody and emergent herbaceous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

Table 2. Conversion (acres) of primary land cover types in MinnesotaBCR 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, an estimated 2,336 acres of open water converted to wetland and 3,618 acres of wetland converted to open water, for a net change among these cover types of -1,279 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	247,912	247	86	398	7	75	160	2,336
	Urban	0	785,304	0	2	0	1	0	0
	Barren	110	200	3,081	27	0	44	42	9
	Upland Forest	950	6,695	168	1,384,778	486	1,648	1,325	2,287
	Shrub/Scrub	68	893	59	1,326	65,843	39	73	205
	Grassland/Hay/Pasture	1,026	12,845	154	2,259	1,840	1,644,824	450	1,373
	Row Crops	1,348	18,376	218	95	826	245	1,714,526	2,405
	Wetlands	3,618	2,086	42	8	4	240	766	530,332

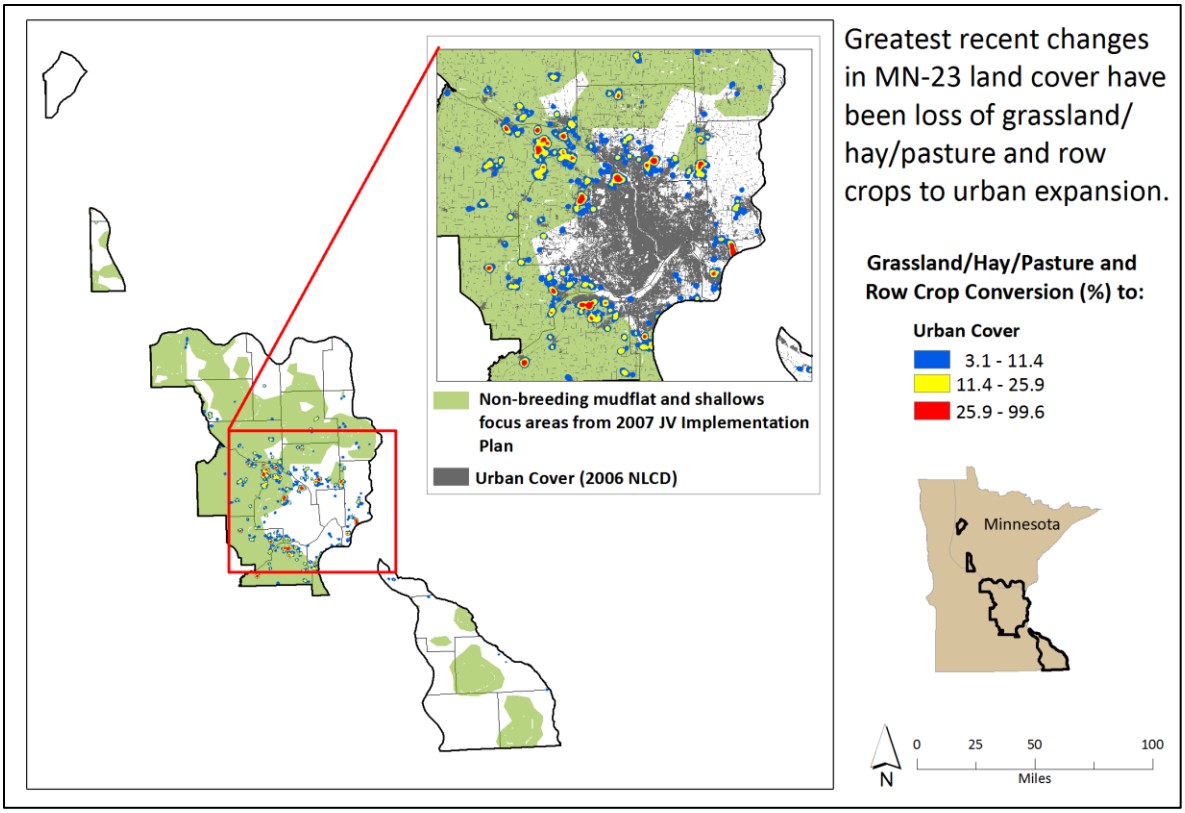


Figure 2. Conversion (percent total area converted within 1 km circular radius) from grassland/hay/pasture and row crops to urban cover in Minnesota BCR 23, 2001 to 2006 (NLCD). Green areas reflect greater habitat conservation emphasis for birds dependent on mudflat and shallows during migration periods (Figure 9a, 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 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 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 MN-23 protected land configuration and ownership composition (Figure 3).[2] In December 2013, 1,310,000 acres

[2] Estimated area of state land is inflated as spatial data included all lands within large acquisition boundaries in southeast MN-23.

were enrolled in the Conservation Reserve Program (CRP) in Minnesota with roughly 498,000 scheduled to expire by 2018. We were unable to partition total Minnesota CRP acreage to the MN-23 portion of the state or asses the land cover composition of CRP lands due to privacy protections in the U.S. Farm Bill.

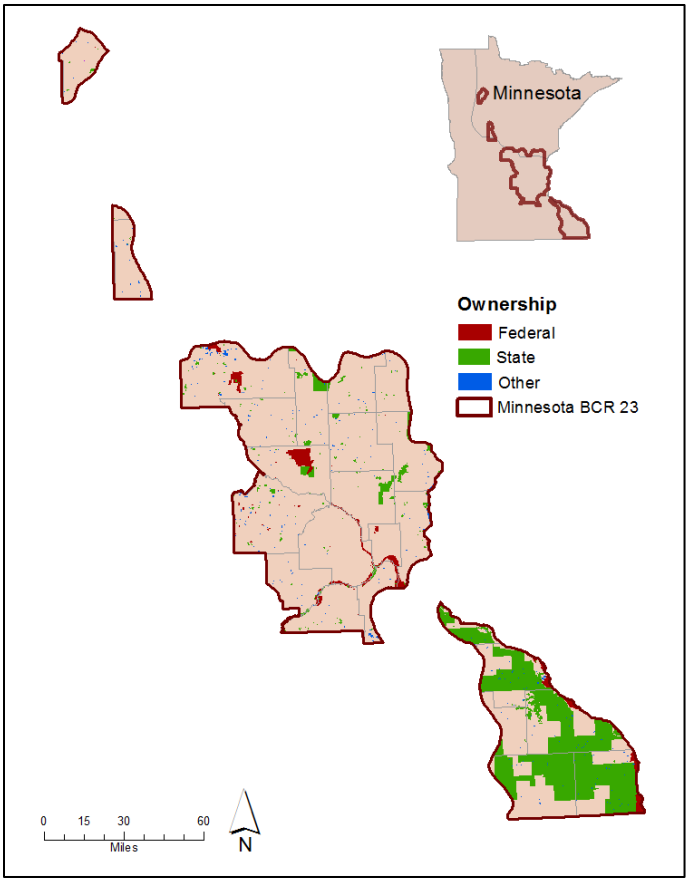


Figure 3. Location of federal, state, or other conservation lands in Minnesota Bird Conservation Region 23. "Other" ownership category includes private land with temporary and permanent easements, conservancy land, and county, township, and city owned land. Conservation lands spatial data suggest 1,216,000 acres are conserved (excluding CRP), with about 363,900 acres of marsh wetland, open water, and row crop, plus 802,100 acres of woodland and grassland. However, these estimates include large amounts of private land within mapped state administrative boundaries in southeast MN-23.

Marsh, Mudflat, and Open Water

The estimated area of high quality bird habitat needed in marsh wetland, mudflat, and open water to maintain current bird populations is about 529,000 acres (Table 3)[3]. This area, plus an additional 101,000 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 MN-23. JV wetland bird habitat objectives represent about 10% of the total area in MN-23.

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 of 744,400 acres of available marsh and marsh/shrub wetlands, of which 11% are protected (Table 3); however, this estimate includes large amounts of private land within state acquisition boundaries in southeast MN-23. Conservation objectives for marsh cover types

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	Sanderling

[3] 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 MN-23 to maintain current populations of birds dependent on dry mudflat is 7,415 acres, as the breeding objective (7,415 ac) is greater than the non-breeding objective (161 ac) (See Table 3).

were driven largely by the needs of breeding waterfowl and waterbirds. Habitat objectives for the non-breeding period include shallow semi-permanent marsh, deep-water marsh, and open water (Table 3). These values were generated based on the needs of migrating and wintering waterfowl.

Shallow emergent marsh communities are relatively abundant in MN-23 based on NWI (Table 3), however we were unable to determine the quality of these areas for waterfowl and other marsh birds based on these spatial data. The JV Plan calls for high quality wetland-bird habitat totaling 542,800 acres of shallow marsh (includes 343,700 acres for wet meadow with open water) and 43,300 acres of marsh with associated shrub/forest (Table 3) to meet breeding population goals. Objectives for deep-water marsh were higher during the non-breeding period and totaled 5,400 acres. Overall, the amount of marsh wetland available is close to JV targets but the quality of mapped marshes can be low in some areas due to invasive plants (e.g., Phragmites, hybrid cattail), water quality, or proximity to developed lands and human activity.

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 Minnesota 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 periods (N). Cover types were measured using primarily 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 Dabase, 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[a]	Other	Total
Marsh									
Deep-water marsh	2,097	5,436	1,050	0	423	40	101	0	141
Shallow semi-permanent marsh[b]	464,473	33,963	78,376	756	565,712[c]	22,706	39,873	10	62,589
Marsh with shrub/ forest	36,082	0	7,217	0	178,247	6,276	11,488	0	17,764
Mudflat and shallows									
Wet mudflat/shallows[d]	0	2,525	0	812	na[e]	na	na	na	na
Dry mudflat[f]	7,415	161	10,661	94	1,717,340	13,134	211,131	9,852	234,117
Open water and beach									
Extensive open water	0	12,940	0	2,766	256,003[g]	34,422	13,640	0	48,062
Beach	0	25	0	69	3,808[g]	917	297	0	1,214
Total	510,067	55,050	97,304	4,497	2,721,533	77,495	276,530	9,862	363,887

[a]Estimated area of state land is inflated, especially for "dry mudflat" (row crop) as spatial data included all lands within large acquisition boundaries in southeast MN-23.

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

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

[d]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.

[e]na indicates cover type area could not be estimated due to resolution limitations of spatial data.

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

[g]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).

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 3,300 acres of wet mudflat and shallows (Table 3) providing high quality foraging habitat for shorebirds. However, assessments of these cover types are difficult using remotely sensed data and are not adequately identified by NWI. Moreover, mudflat and shallows are dynamic, and 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 (i.e., "row crop" in spatial data) identified as protected totals 234,100 acres; however much of the 211,000 acres of indicated state-land in row crop cover is private land.

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 15,700 acres of quality foraging and resting habitat. The region has abundant open water area (Table 3). Although well above goal, low forage density and human disturbance may negatively influence areas of some open-water. Some species of shorebirds and terns depend on beach. Beach objectives total about 100 acres. The current amount of available beach is also above the estimate needed to achieve JV goals for this bird group.

Woodland and Openland

The amount of woodland and openland/grassland needed in a high quality habitat condition to maintain current landbird populations is about 1.3 million acres (Table 4). An estimated 989,000 additional habitat acres is required to meet goal populations. Conservation lands spatial data suggest 802,000 acres are currently under federal, state or other protection (Table 4); however, this estimate includes large amounts of private land inside state acquisition boundaries in southeast MN-23. A majority of upland-bird habitat needed to maintain and increase landbird populations is shrubland and savanna (mixed wooded openland).

Landbird cover types and focal species	
Deciduous forest	Whip-poor-will, Wood Thrush, Black-throated Blue Warbler, Cerulean Warbler
Evergreen forest	Olive-sided Flycatcher, Cape May 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. MN-23 encompasses about 1,603,400 of woodland and 474,400 acres are protected (Table 4). In general, MN-23 has abundant forest cover, but forest fragmentation is a concern because it can limit habitat quality for breeding forest birds. For example, large forest tracts (>5,000 contiguous acres) are prescribed for some JV focal species, and MN-23 may not include forest areas large enough for species sensitive to fragmentation.

Objectives for shrub/scrub (634,800 acres) and other mixed forest (110,400 acres) are substantially higher than the estimated area of these forest types in the region (Table 4). 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.—Grassland community types are poorly mapped by NLCD, making assessment difficult. The grassland-bird guild used for planning requires an estimated 154,600 acres of high quality habitat, and the region contains an estimated 314,000 acres of grassland plus 1.3 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 (1,317,000 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 the landscape's capacity to support goal populations of savanna birds could not be assessed. In addition, the savanna area objective will likely be reduced substantially in future JV planning based on new information.

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 Minnesota BCR 23. 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. 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				
			Cover type area on landscape	Conservation status (protected)			
	Maintenance	Restoration		Federal	State[b]	Other	Total
Woodland							
Deciduous forest	1,976	1,976	1,313,741	22,912	386,865	8,762	418,539
Evergreen forest	37,050	1,729	71,327	880	9,684	724	11,288
Forested wetland	0	0	145,486	16,880	22,524	0	39,404
Shrub/scrub	494,000	140,790	69,007	1,796	2,315	541	4,652
Other forest	62,985	47,424	3,825	47	437	25	509
Openland							
Grassland	77,311	77,311	313,970	4,732	98,375	2,743	105,850
Pasture/Hay[c]	--	--	1,335,842	7,465	208,181	6,232	221,878
Savanna	658,749	658,749	na[d]	na	na	na	na
Total	1,332,071	927,979	3,253,198	54,712	728,381	19,027	802,120

[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]Estimated area of state land is inflated as spatial data included all lands within large acquisition boundaries in southeast MN-23.

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

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

Management Implications

MN-23 is an extremely diverse bird conservation region, both ecologically and socially. Within the JV region, this landscape is unique for its high value to breeding marsh birds, migrating shorebirds, and migrating waterfowl. The region is also 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 areas of MN-23 open water, marsh, and dry mudflat cover types appear adequate to meet habitat objectives for JV focal species. However, the area of wet mudflat and shallows could not be determined using existing spatial data. Therefore, where capacity exists, management may be necessary to assure wet mudflat is available during shorebird migration periods. Spatial data were also inadequate to assess specific 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). MN-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*, an increasingly problematic invasive wetland plant in MN-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 area is adequate to meet JV objectives for foraging waterfowl, but some locations may have limited value due to human disturbance.

Breeding and migrating woodland birds dependent on mature forests currently have a substantial habitat base in MN-23 despite modest declines in forest cover in recent years. Conversely, those species dependent on shrub and young-growth forest have been in long-term population declines across BCR 23. 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, at least temporarily. However, managers should carefully consider cutting locations, as large un-fragmented forest tracts are critical to viable populations of some MN-23 breeding songbirds. Likewise, maintaining quality forest bird migration habitat, especially along major river corridors, should be considered in management planning.

Although available area of grassland appears greater than JV focal species habitat objectives, existing grassland and hay/pasture is of unknown quality for breeding birds plus this cover type declined between 2001 and 2006. Future abundance of grassland cover in MN-23 will be largely related to private-land management activities (e.g., bird-friendly pasture/hay management, Conservation Reserve Program). There are opportunities to promote grasslands in a working landscape through methods other than taking land out of 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 may result in conversion of grassland, forest, and shrub to agriculture.

Because a significant area of state and federally owned lands are mapped as row crop, managers should seek opportunity to convert areas back to native cover, particularly grassland and emergent wetland. Openlands require periodic management to maintain characteristics required of grassland and savanna birds. Expanding "permanent" openings associated with highway/utility right-of-ways and extensive wet meadow can result in greater management efficiency by providing larger openland areas/unit cost. However, current JV population and habitat objectives for openland species, those dependent on grassland and savanna, may be beyond the capacity of MN-23's agricultural, forested, and increasingly urban-dominated landscape.

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This assessment document and JV Implementation Plan available at: www.UpperMissGreatLakesJV.org (*Last revised 23 July 2014).*