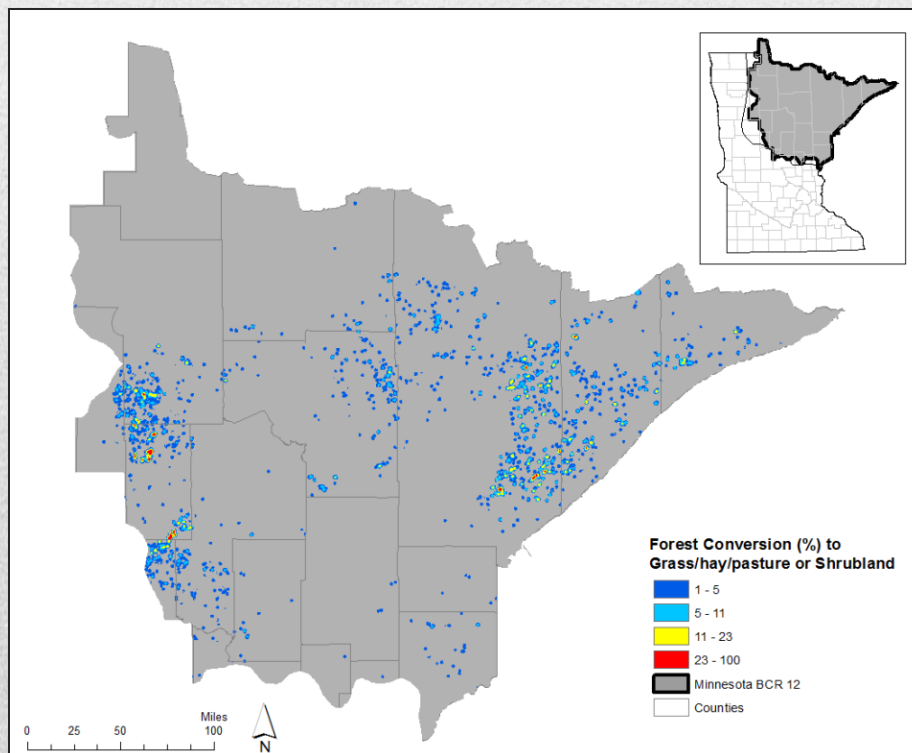




Minnesota BCR 12 – Assessment Summary

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 Minnesota BCR 12 (MN-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 MN-12 assessment for more details.**



Primary cover-types

MN-12 consists of primarily upland forest (38%), forested wetland (31%), open water (10%), emergent marsh (8%), and grassland/hay/pasture (5%) with cover types well interspersed. Gains in emergent wetland (+46,000 ac), grassland/hay/pasture (+31,700 ac), and shrubland (+11,000 ac) between 2001 and 2006 resulted largely from upland forest conversion (-95,300 ac) 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 Minnesota 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	11,609	4,774,746	-0.9
Evergreen forest	880,555	1,425,606	-1.8
Shrubland	1,768,520	832,016	1.3
Other forest	919,087	1,471,426	-1.6
Grassland	286,520	192,678	19.5
Savanna	197,600	n/a	n/a
Marsh, mudflat, and open water			
Emergent wetland	339,472 ^a	911,237 ^b	2.8
Woody wetland	53,902 ^c	6,158,558	-0.1
Dry mudflat	3,952	304,599 ^d	1.3
Open water	40,065	2,013,286	-0.3

^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 Based on NWI spatial data, and substantially less than estimate from NLCD.

^c Includes habitats for multiple focal species combined: marsh with associated shrub/forest and forested wetlands.

^d Based on NWI spatial data, and substantially less than estimate from NLCD.

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.
- 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 expanded from 2001 to 2006 based on NLCD spatial data but remains below JV objective levels 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 shrub and forest, addressing shrubland bird objectives and allowing managers to focus grassland conservation more effectively.

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 plant species may be necessary, preferably 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.



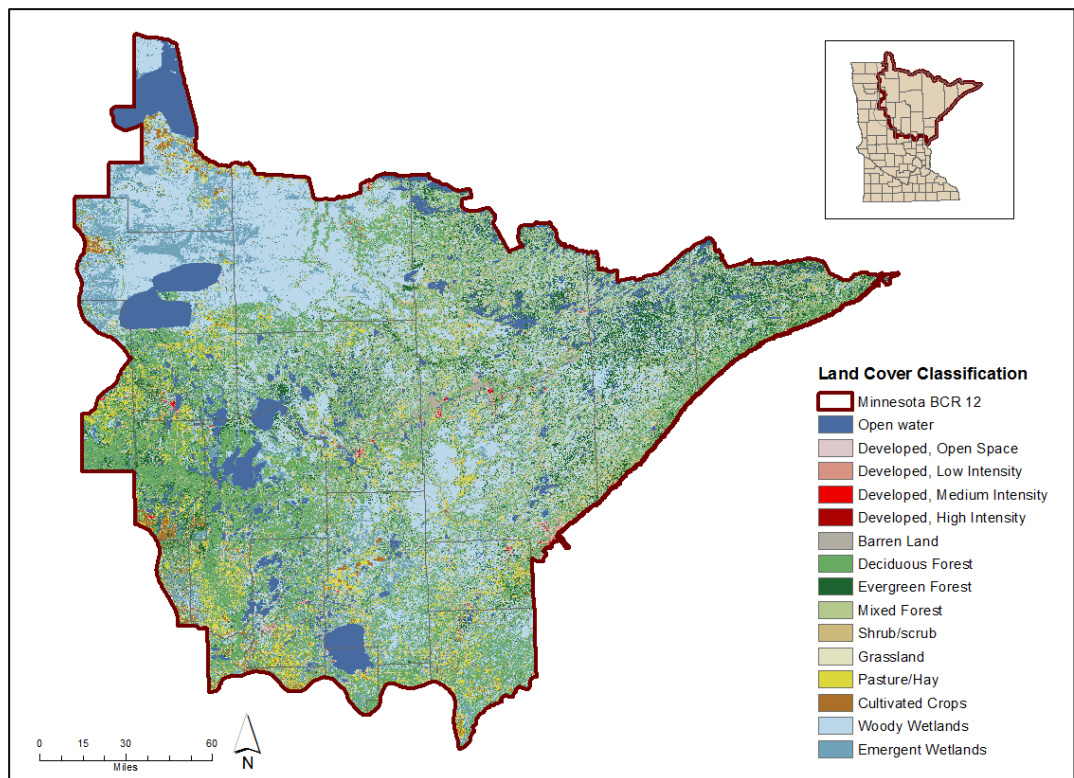
State by BCR Assessment

Minnesota 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 Minnesota BCR 23, the Boreal 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-12. Bird habitat (cover type) objectives are presented for maintenance/protection and restoration/enhancement based on the 2007 JV Plan.

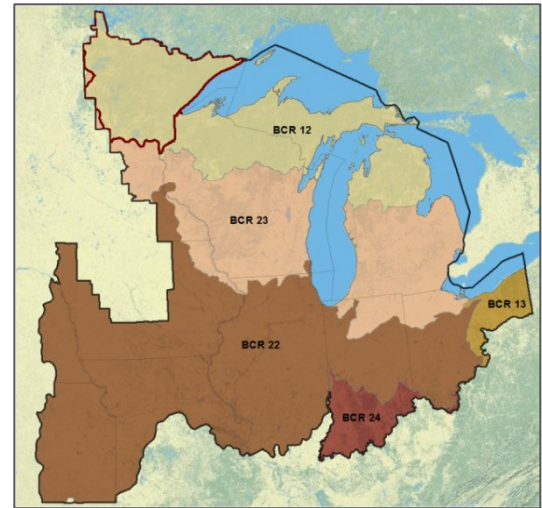
Spatial data were not available to assess each bird habitat type identified in the JV Plan, but recent trends in broad land cover categories believed to be important to JV focal species are provided. Land cover trend analyses are based on quantities (acres) calculated from the 2001 and 2006 [National 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 MN-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 MN-12 (species within guild may be more common than focal species, see 2007 JV Plan).

Landbird	Shorebird	Waterbird
Greater Prairie-Chicken	American Golden-Plover	Black-crowned Night-Heron
Whip-poor-will	Piping Plover	Yellow Rail
Chimney Swift	Killdeer	King Rail
Red-headed Woodpecker	Upland Sandpiper	Black Tern
Olive-sided Flycatcher	Sanderling	Common Tern
Willow Flycatcher	Dunlin	
Veery	Short-billed Dowitcher	
Wood Thrush	Wilson's Snipe	
Golden-winged Warbler	American Woodcock	
Cape May Warbler	Wilson's Phalarope	
Black-throated Blue Warbler		
Connecticut Warbler		
Canada Warbler		
Eastern Meadowlark		



Bird Conservation Regions (BCR's) 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-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 goal populations 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 MN-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 MN-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 Minnesota 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	Acres gained/lost
	2001	2006		
Open Water	2,120,948	2,114,584	-0.3	-6,364
Urban	475,450	479,403	0.8	3,952
Barren	45,747	55,464	21.2	9,716
Upland Forest	7,769,082	7,673,760	-1.2	-95,322
Shrub/Scrub	821,068	832,016	1.3	10,948
Grassland/Hay/Pasture	1,009,784	1,041,436	3.1	31,652
Grassland	161,190	192,678	19.5	31,488
Row Crops	300,640	304,598	1.3	3,959
Wetlands	7,911,107	7,952,565	0.5	41,459
Emergent Wetlands	1,667,727	1,713,721	2.8	45,994
Woody Wetlands	6,243,380	6,238,844	-0.1	-4,535
Total	20,453,825	20,453,825		

MN-12 is a diverse landscape with highly interspersed cover types, similar amounts of upland and wetland forests, plus large areas of open water and emergent marsh wetlands (Table 1).¹ Upland forest was the only dominant cover type having substantial loss between 2001 and 2006, with apparent conversion of 95,300 acres to other cover types. Loss of forest came largely from conversion to emergent wetland, shrub/scrub, and grassland (Figure 1, Table 2). The large degree of conversion from upland forest to emergent wetland seemed unrealistic, but may be explained by the extraordinary level of interspersed between these cover types. Environmental conditions, such as gap creation via logging and wind storms (and loss of forest transpiration), increased beaver activity, and high precipitation leading up to the collection of 2006 NLCD spatial data may all have contributed to marsh expansion in this mixed landscape. Mapped grassland and shrubland gains occurred across the region (Figure 2); forest conversion to these cover types may have resulted from activities such as logging (and forest regeneration) and expanded agriculture (i.e., misclassified wheat or hay/pasture as grassland). Forest loss is concerning for some bird species, but increases in marsh, shrub, and grassland represent habitat gains for others. Land cover types stable in area were urban and row crop.

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

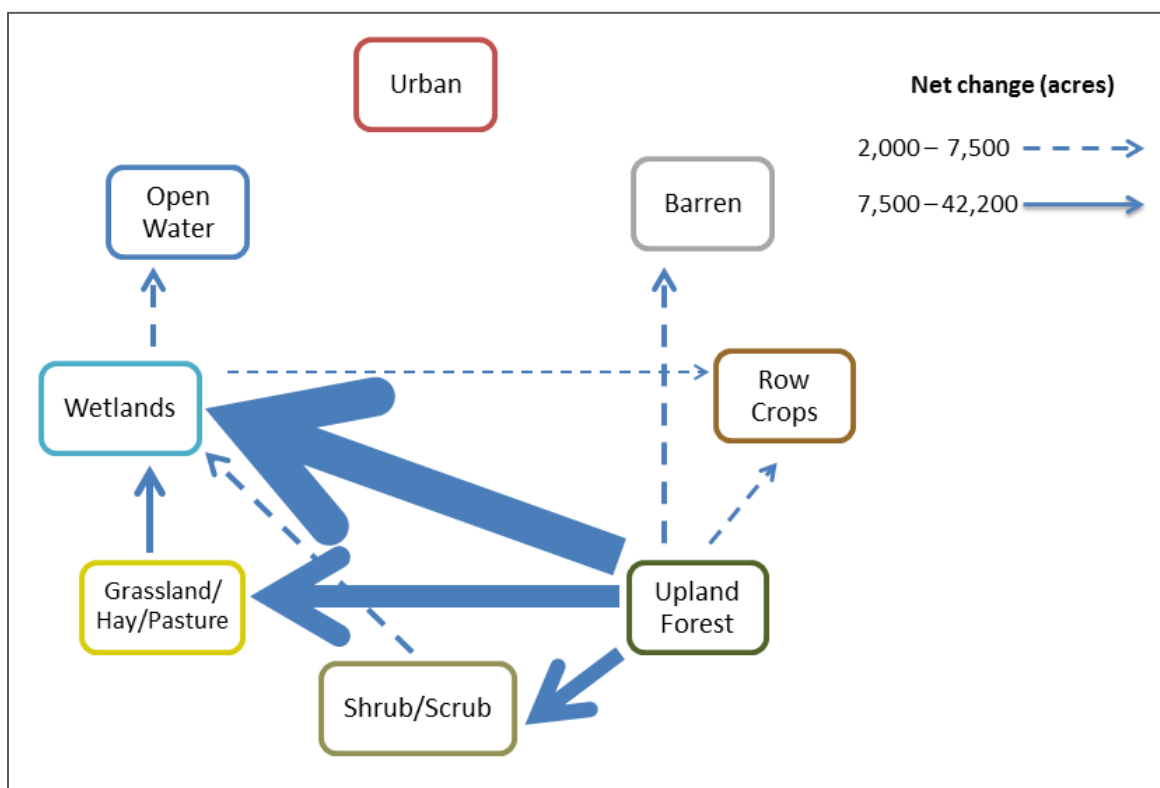


Figure 1. Net change of general land cover types (>2,000 acres converted) in Minnesota BCR 12 between 2001 and 2006 (NLCD). Arrows point in the direction of change between two cover types and line thickness increases in proportion to amount of net change. “Wetlands” include woody and herbaceous wetland, whereas “upland forest” represents upland (non-wetland) forest cover. Inordinate conversion from upland forest to wetland is likely a result of high interspersed between these cover types coupled with a period of high precipitation.

Table 2. Conversion (acres) of primary land cover types in Minnesota 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, an estimated 10,579 acres of open water converted to wetland and 5,134 acres of wetland converted to open water, for a net change among these two cover types of +5,445 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	2,105,400	6	2,765	1,025	207	702	265	10,579
	Urban	0	475,446	0	0	1	3	0	0
	Barren	1,031	71	42,629	130	109	566	2	1,209
	Upland Forest	2,189	1,656	5,551	7,660,641	27,864	25,996	2,949	42,235
	Shrub/Scrub	324	355	1,701	10,679	798,893	2,255	818	6,044
	Grassland/Hay/Pasture	300	698	556	1,163	2,128	1,003,033	654	1,251
	Row Crops	206	207	199	13	2,672	94	295,322	1,926
	Wetlands	5,134	964	2,063	108	142	8,787	4,589	7,889,320

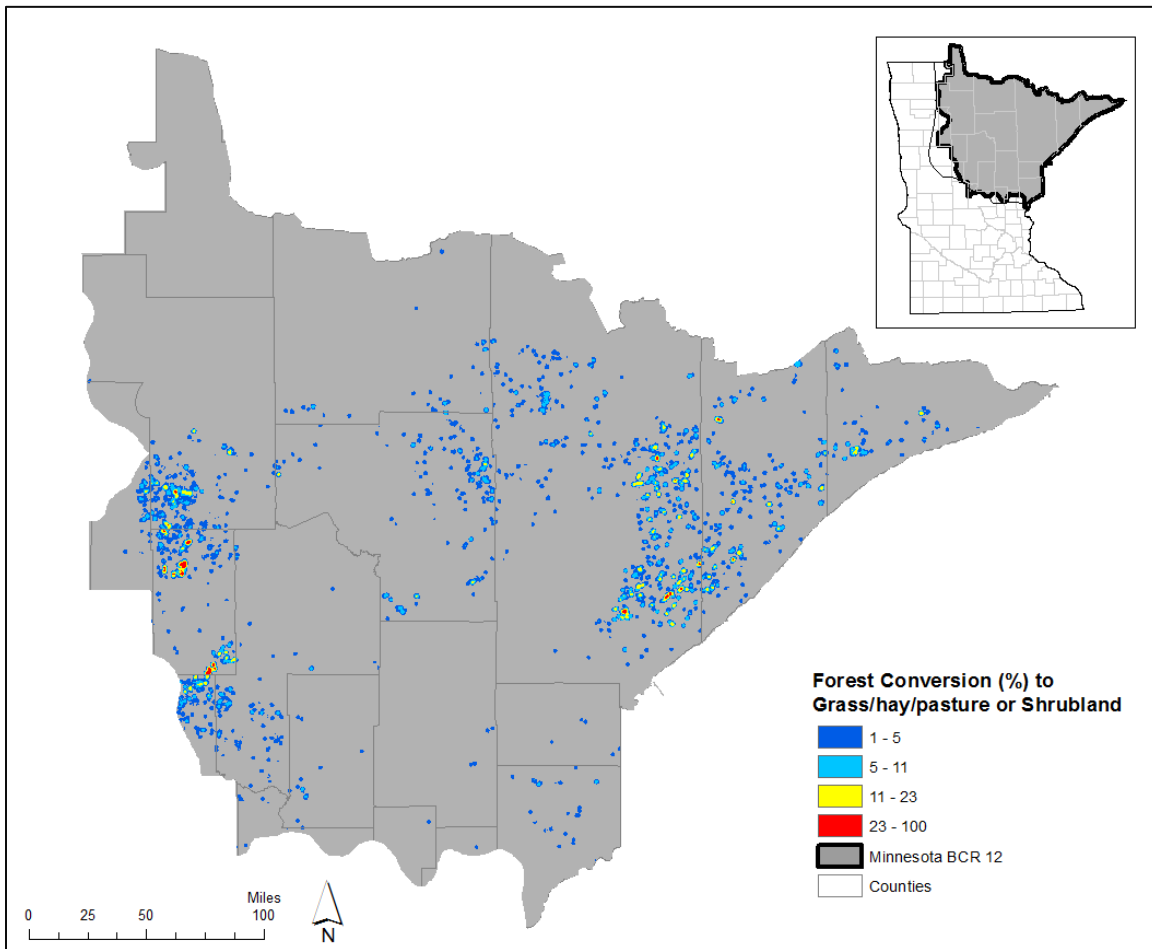


Figure 2. Conversion (percent total area converted within 1 km circular radius) from upland forest to grassland/hay/pasture or shrubland cover in Minnesota BCR 12, 2001 to 2006 (NLCD).

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 area 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 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-12 protected land configuration and ownership composition (Figure 3). In [December 2013](#), 1,310,000 acres

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-12 portion of the state or assess the land cover composition of CRP lands due to privacy protections in the U.S. Farm Bill.

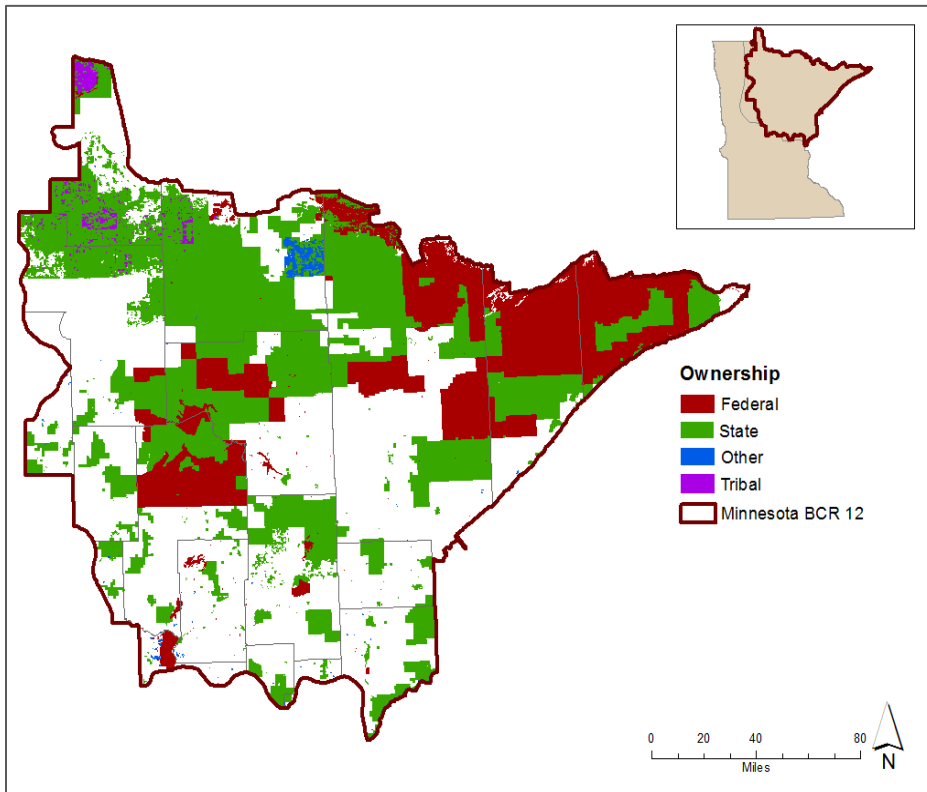


Figure 3. Location of federal, state, or other conservation lands in Minnesota Bird Conservation Region 12. “Other” ownership category includes private land with temporary and permanent easements, conservancy land, and county, township, and city owned land. Conservation lands spatial data suggest total area conserved is about 10,776,200 acres (excluding CRP), including about 7,389,000 acres of woodland and openland plus 2,736,000 acres of marsh wetland, row crops, and open water. However, these estimates include large amounts of private land within mapped state and federal administrative boundaries.

Woodland and Openland

The estimated area of high quality bird habitat needed in woodland and openland to maintain current landbird populations is 3.0 million acres (Table 3). This area, plus an additional 1.0 million acres of restored high quality habitat is predicted to achieve a landscape design adequate to meet JV population goals for breeding woodland and openland birds in MN-12. This total 4.0 million-acre upland bird habitat objective represents 20% of the total area of MN-12. Based on the 2007 JV Plan, 44% of the habitat area needed to meet landbird objectives in MN-12 is shrubland.

Landbird cover types and focal species	
Deciduous forest	Whip-poor-will, Wood Thrush, Black-throated Blue Warbler
Evergreen forest	Olive-sided Flycatcher, Cape May Warbler, Connecticut Warbler
Forest generalist	Chimney Swift, Veery, Canada Warbler
Shrubland	American Woodcock, Willow Flycatcher, Golden-winged Warbler
Grassland	Upland Sandpiper, Greater Prairie-Chicken, Eastern Meadowlark
Savanna	Red-headed Woodpecker

Woodland.—Objectives developed for deciduous and evergreen forest, shrubland, and other mixed forest were all driven by the needs of breeding landbirds. MN-12 encompasses about 12.3 million woodland acres, of which 7.2 million acres were mapped as protected or within a protected land boundary (Table 3). MN-12 forest cover is above goal levels based on the habitat needs of focal species used in the 2007 JV Plan. Although abundant, fragmentation of some forests is a concern because it can limit habitat quality for edge-sensitive forest birds.

Shrubland appears to be expanding in MN-12, but objectives for shrubland (1,768,500 acres) are substantially higher than the estimated area of shrub/scrub available (Table 3). 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 JV planning requires an estimated 286,500 acres of high quality habitat, and the region contains an estimated 192,700 acres of grassland plus 848,700 acres of pasture/hay (Table 3). Grassland area has expanded recently and the quantity of grassland is nearly adequate to meet JV objectives. Much of the grassland mapped as protected using available spatial data (Table 3) is more likely privately-owned land within state and federal administrative boundaries. Savanna objectives (197,600 acres; Table 3) are based on the breeding habitat requirements of birds occupying these mixed wooded openlands (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 Minnesota 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. 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) ^b			
				Federal	State	Other	Total
Woodland							
Deciduous forest	11,609	0	4,774,746	708,564	1,389,630	35,746	2,133,940
Evergreen forest	741,000	139,555	1,425,606	548,091	481,716	4,562	1,034,369
Forested wetland	0	0	3,862,654	471,916	1,995,032	99,242	2,566,190
Shrub/scrub	1,561,040	207,480	832,016	162,145	251,654	4,164	417,963
Other forest	465,842	453,245	1,471,426	558,900	520,470	8,916	1,088,286
Openland							
Grassland	143,260	143,260	192,678	16,082	49,873	2,646	68,601
Pasture/Hay ^c	--	--	848,741	21,320	56,706	1,737	79,763
Savanna	98,800	98,800	na ^d	na	na	na	na
Total	3,021,551	1,042,340	13,407,867	2,487,018	4,745,081	157,013	7,389,112

^aUpland 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).

^bEstimated area of protected land is inflated as spatial data included all lands within state and federal administrative boundaries.

^cBird habitat objectives were not established for this primary NLCD cover type providing openland value.

^dna indicates bird habitat objectives were developed 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 350,600 acres (Table 4)². This area, plus an additional 87,100 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-12. This total 437,700-acre wetland-bird habitat objective represents only 2% of the total area in MN-12, a region with extensive marsh and shrub wetland cover and open water (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, Dunlin
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, Yellow Rail, 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 3.2 million acres of available marsh and marsh/shrub wetlands in MN-12, of which 58% were mapped within a protected area boundary (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, deep-water marsh, and open water. These values were generated based on the needs of migrating and wintering waterfowl.

Marsh communities are abundant in MN-12, with area far surpassing JV habitat objectives (Table 4). However, we were unable to determine the quality of these areas for breeding waterfowl and other marsh species based on spatial data. The JV plan calls for high quality wetland-bird habitat totaling 322,700 acres of shallow marsh (includes 123,400 acres for wet meadow with open water) and 53,900 acres of marsh with associated shrub/forest to meet breeding population goals (Table 4). Objectives for deep water marsh (11,500 acres) were higher during the non-breeding period and much greater than the estimated amount of deep marsh available. 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 “wild rice lakes” and active beaver pond wetlands are relatively productive, most bogs and other oligotrophic wetlands typically have limited value to breeding and migrating waterfowl. Large wet meadows, especially those connected to Lake Superior, are unique communities, often with high plant and bird diversity.

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 5,300 acres of wet mudflat and shallow-water (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. These cover types are also dynamic, and conditions can change weekly 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 crops in NLCD (i.e., agricultural fields in spring provide value to some shorebirds), is greater than the objective in the JV Plan. Available spatial data suggest protected area of dry

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 MN-12 to maintain current populations of birds dependent on dry mudflat is 1,620 acres, as the breeding objective (1,620 ac) is greater than the non-breeding objective (390 ac) (See Table 4).

mudflat totals 32,400 acres, but these areas are largely privately-owned agricultural lands located within state and federal administrative boundaries.

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 40,000 acres of high quality foraging and resting habitat. Whereas the region has abundant open water locations (Table 3), low forage availability and human disturbance can negatively influence use of lakes by diving ducks. Some species of shorebirds and terns depend on beach, and objectives for this cover type total 280 acres. Beach is abundant in MN-12 and well above the estimate needed to accommodate JV focal species dependent on this cover type.

Table 4. Wetland bird habitat maintenance and restoration objectives (acres) for marsh, mudflat, and open water and the estimated amount of each cover type on the landscape in Minnesota 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 and non-breeding periods. Cover types were measured using National 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				Cover type area on landscape	Land cover			
	Maintenance		Restoration			Conservation status (protected) ^a			
	B	N	B	N		Federal	State	Other	Total
Marsh									
Deep-water marsh	1,971	10,520	986	0	334	109	74	10	193
Shallow semi-permanent marsh ^b	257,334	41,703	65,352	1,351	910,903 ^c	101,585	313,972	9,044	424,601
Marsh with shrub/ forest	44,919	0	8,983	0	2,295,904	184,968	1,177,646	58,648	1,421,262
Mudflat and Shallows									
Wet mudflat/ shallows ^d	0	2,944	0	2,336	na ^e	na	na	na	na
Dry mudflat ^f	1,620	390	2,332	227	304,599	6,044	24,834	1,559	32,437
Open Water and beach									
Extensive open water	0	33,142	0	6,923	2,013,286 ^g	466,505	379,487	1,342	847,334
Beach	1	79	0	205	55,460 ^f	7,013	2,666	7	9,686
Total	305,845	88,778	77,653	11,042	5,580,486	766,224	1,898,679	70,610	2,735,513

^aEstimated area of protected land is inflated as spatial data included all lands within state and federal administrative boundaries.

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

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

^dBird 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.

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

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

^gCover 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).

Management Implications

Within the JV region, MN-12 is especially unique for its expansive wetlands, lakes, and vast forests. It provides relatively high value to marsh and open-water wetland birds and forest birds during both breeding and non-breeding periods. Objectives for migrating and wintering forest birds were not developed for the 2007 JV Implementation Plan, but this emphasis will be addressed in future JV landbird planning efforts.

The current areas of MN-12 marsh, mudflat, and open water cover 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. Spatial data were also inadequate to thoroughly assess emergent wetland types (amount of hemi-marsh vs. wet meadow), quality (high vs. low reproduction / survival), and timing of availability (recently wet vs. wet when image was taken). Open water area was also adequate in quantity to meet JV objectives for foraging waterfowl, but some locations may have limited value due human disturbance, especially boating. Even with the tremendous wetland-bird habitat base in MN-12, there may be opportunities to continue expanding protection of key parcels and maintaining the natural processes important to wetland health and productivity. For example, some areas may require implementing effective management of invasive plants such as *Phragmites* and hybrid cattail. *Phragmites australis*, an invasive problem primarily around the southern Great Lakes region is gradually moving north. This plant 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.

Breeding and migrating woodland birds dependent on mature forests currently have a substantial habitat base in MN-12. Although this cover type experienced the greatest decline in area between 2001 and 2006, it remains above JV goals for forest birds. Conversely, shrub and young-growth forest is far below goal and species dependent on this habitat type have been in long-term population decline across much of the JV region. 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 forest fragmentation trends and patch size as they evaluate cutting locations because large un-fragmented forest tracts are critical to viable populations of some breeding songbirds. Managing utility corridors for shrubland and grasses and establishing young forest and shrub cover in irregular patterns, rather than hard edges, can reduce the effects of fragmentation while simultaneously working toward meeting shrub habitat goals. Additional concerns in wooded cover types 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 future management scenarios.

The estimated area of grassland increased substantially between 2001 and 2006 in MN-12 due primarily to conversion from forest cover. Although available area of grassland appears to be adequate to support JV focal species, existing grassland and hay/pasture is of unknown quality for breeding birds. Justification for grassland bird management in MN-12 is greatest in the southwestern portion of the region, where prairie is a more common and natural component of the landscape. Where grassland maintenance is most challenging (e.g., northeast MN-12) managers should consider allowing reversion to native covers, especially shrubland and young forest. Moreover, managers may find efficiencies working with private land owners to improve pasture and hay practices for grassland birds (e.g., adjusting timing and or intensity of grazing/mowing).

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