U.S. Fish and Wildlife Service

Selecting Surrogate Species for Strategic Habitat Conservation in the Upper Midwest Great Lakes Geography

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Executive Summary

The Technical Team developed a list of 36 surrogate species across seven broad habitat types within the Upper Midwest and Great Lakes (UMGL) geography using an eight step selection process grounded in the elements of Strategic Habitat Conservation. Engaging U.S. Fish and Wildlife Service staff, along with state and tribal partners at key decision points throughout the process, the final list of 36 surrogate species emerged from an initial comprehensive list of 3,256 species identified as management priority within the UMGL geography. The initial list was first reduced to 500 potential surrogate species by focusing on those identified as Federal trust. The list was further refined to approximately 100 species based on their occurrence within the UMGL geography during at least a portion of their life history, sensitivity to management and conservation actions, ability to be accurately and precisely measured, and the existence of sufficient information to spatially plan and design conservation. The seven broad habitat systems, including Forest, Shrubland, Grassland, Beach and Open Coast, Riverine and Riparian, Lacustrine, and Palustrine were chosen to represent the major fish and wildlife habitats occurring in the UMGL geography. For each habitat system, the factors that potentially limit species populations on the landscape were assessed and prioritized for each species. Using a management umbrella/management indicator surrogate species approach, the 100 species were evaluated and ranked within each habitat system. Ultimately a suite of species for each habitat system was selected to represent the sub-habitats within each system, as well as other species or natural communities with similar threats and limiting factors in the UMGL geography.

Table 1. Surrogate species for the Upper Midwest Great Lakes geography

Broad Habitat System	Common Name	Scientific Name
Forest	Canada Warbler	*Cardellina canadensis*
	Pine Warbler	*Dendroica pinus*
	Wood Thrush	*Hylocichla mustelina*
Shrubland	American Woodcock	*Scolopax minor*
	Brown Thrasher	*Toxostoma rufum*
	Golden-winged Warbler	*Vermivora chrysoptera*
Grassland	Bobolink	*Dolichonyx orizivorus*
	Eastern Meadowlark	*Sturnella magna*
	Eastern Prairie Fringed Orchid	*Platanthera leucophaea*
	Henslow's Sparrow	*Ammodramus henslowii*
	Karner Blue Butterfly	*Lycaeides melissa samuelis*
	Northern Flicker	*Colaptes auratus*
	Upland Sandpiper	*Bartramia longicauda*
	Monarch Butterfly*	*Danaus plexippus*
Beach and Open Coast	Houghton's Goldenrod	*Solidago houghtonii*
	Piping Plover	*Charadrius melodus*
Riverine & Riparian	Brook Trout	*Salvelinus fontinalis*
	Higgin's Eye Pearlymussel	*Lampsilis higginsi*
	Lake Sturgeon	*Acipenser fulvescens*
	Paddlefish	*Polyodon spathula*
	Red-shouldered Hawk	*Buteo lineatus*
	River Redhorse	*Moxostoma carinatum*
	Smallmouth Bass	*Micropterus dolomieu*
	Snuffbox	*Epioblasma triquetra*
	Walleye	*Sander vitreus*
	Wood Duck	*Aix sponsa*
Lacustrine	Common Loon	*Gavia immer*
	Common Tern	*Sterna hirundo*
	Lesser Scaup	*Aythya affinis*
	Bloater	*Coregonus hoyi*
	Cisco	*Coregonus artedi*
	Lake Trout	*Salvelinus namaycush*
Palustrine	Black Tern	*Chlidonias niger*
	Blue-winged Teal	*Anas discors*
	Mallard	*Anas platyrhynchos*
	Le Conte's Sparrow	*Ammodramus leconteii*

*Monarch butterfly is a national priority species and was included as a flagship surrogate species. A systematic process to represent the habitat needs of multiple pollinator species and species with similar limiting factors was not conducted during this surrogate species selection process.

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Background

The overarching goal for establishing surrogate species as part of Strategic Habitat Conservation (SHC) is to improve efficacy of habitat conservation actions that include protection, restoration, and management with a landscape focus. However, most conservation is site specific and local actions that target surrogate and non-surrogate species remain key to achieving broad conservation outcomes. Site-based conservation efforts are cumulative, potentially contributing to population goals at the landscape scale, while also meeting the needs of more localized priorities. Monitoring a representative group of surrogate species can provide a measure of conservation progress at both local and landscape scales.

In June of 2014, the Midwest Regional Director of the U.S. Fish and Wildlife Service (FWS) identified the Technical Team leads and established a deadline of early October for selecting surrogate species for the geographic region encompassed by the Upper Midwest and Great Lakes (UMGL) Landscape Conservation Cooperative (LCC) (***Figure 1***).

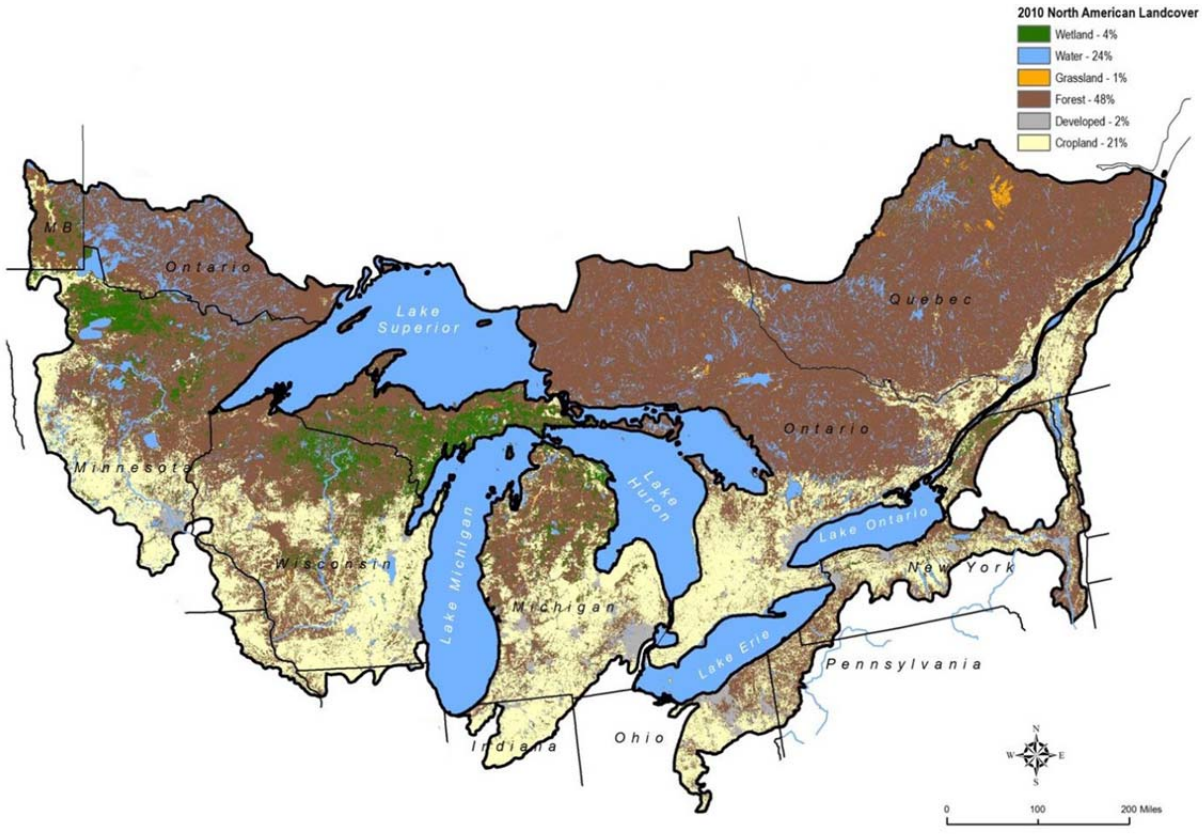

Figure 1. The Upper Midwest and Great Lakes Landscape Conservation Cooperative geography.

The Technical Team met during the week of June 23, 2014 in Traverse City, Michigan to identify a process and timeline that would result in a surrogate species list to meet FWS needs. The team reviewed and modified the selection process previously used to select surrogate species for the Eastern Tallgrass Prairie and Big River LCC geography (Blomquist et al. 2013). Major changes included: 1) placing more emphasis on SHC elements early in the selection process and 2) obtaining early and regular feedback from the FWS programs, state, and tribal representatives at important milestones throughout the process (***Figure 2***).

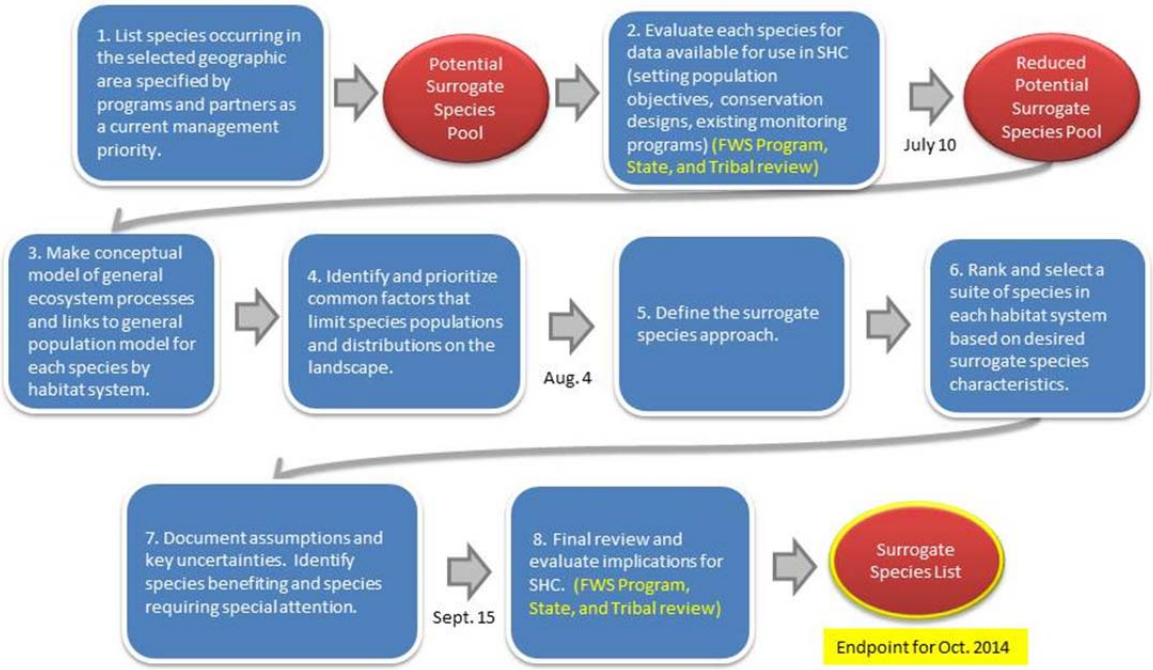

Figure 2. Process diagram depicting steps used to select surrogate species for the Upper Midwest and Great Lakes geography.

Surrogate Species Selection

Step 1: List species occurring in the selected geographic area specified by programs and partners as a current management priority.

The Technical Team assembled an extensive list of 3,256 priority species potentially occurring in the UMGL geography during at least a portion of their annual life cycle. This list was derived from a variety of sources that identified species as a management priority by FWS programs, as well as state and tribal partners. The Technical Team then identified a subset of this priority species pool comprised of FWS programmatic priority trust resources within the United States portion of the UMGL geography (Step 1 in ***Figure 2***). Descriptions of sources used to identify program priorities are described below. This initial attempt resulted in approximately 500 potential surrogate species, referred to as the Potential Surrogate Species Pool in ***Figure 2***.

Migratory Birds

For migratory birds, the primary sources of information included the FWS Migratory Bird Strategic Plan; bird species designated as a surrogate species for the Eastern Tallgrass Prairie and Big Rivers geography (Blomquist et al. 2013); bird species listed as proposed, candidate, threatened or endangered under the Endangered Species Act; FWS Focal Bird Species FY 2012-2016; Midwest Region Birds of Conservation Concern (2012); Birds of Conservation Concern Regional Lists (2008); and Midwest Regional Conservation Priority List (2002).

Fisheries

For fishes, the primary sources of information included the Midwest Regional Conservation Priority List (2002); Mississippi Interstate Cooperative Resource Association Interjurisdictional fishes of the Mississippi River Basin (2009); Great Lakes Fishery Commission lake-specific Fish Community Objectives and species-specific rehabilitation plans; fish species listed as proposed, candidate, threatened or endangered under the Endangered Species Act; and designated surrogate fish species for the Eastern Tallgrass Prairie Big Rivers geography.

Threatened and Endangered Species

For threatened and endangered species, the technical team included species listed as candidate, proposed, threatened, or endangered under the Endangered Species Act. Recovery objective, habitat, and threats for species were derived from relevant recovery plans (see http://ecos.fws.gov/ecos/indexPublic).

National Wildlife Refuge System

For Refuges, the primary sources of information were existing Comprehensive Conservation Plans (CCPs) and Habitat Management Plans (HMPs), which are a step-down plan from the CCP (see http://www.fws.gov/midwest/Planning/). In addition the Technical Team compiled Priority Resources of Concern (PROC) for stations that had a complete HMP or that had a draft list of PROCs. The number of stations designating a species as a PROC was used as a way to rank the importance of species for the National Wildlife Refuge System.

Step 2: Evaluate species data available for use in Strategic Habitat Conservation

To facilitate a review by staff from FWS programs, states, and tribes, the Technical Team developed eight broad questions (Yes/No), grounded in the elements of SHC, including Biological Planning, Conservation Design, Conservation Delivery, and Assessment and Monitoring, to help identify a suite of species that would serve as our starting pool. For each of the approximately 500 species, Technical Team members and targeted staff members from FWS programs, states, and tribes were asked the following questions:

- Is the species a current program priority?
- Can species needs be accurately and precisely estimated/measured?
- Is the species sensitive to management actions?
- Is there sufficient information for the species to conduct spatial planning and design?
- Is the species currently monitored?
    - If not, are protocols in place and is monitoring feasible?
- Are population objectives available?
    - If not, is setting objectives feasible based on available information?

During the review, staff members were also asked to ensure the species occurred within the UMGL geography for an essential component of its life history and attribute the species to one or more of seven broad habitat systems:

- Riverine and Riparian Systems
- Lacustrine Systems
- Palustrine Systems
- Grassland Systems
- Beach and Open Coast Systems
- Shrubland Systems
- Forest Systems

These broad habitat systems were chosen because they contain the major fish and wildlife habitats in the UMGL geography and methods already exist to integrate these systems with existing land cover data (e.g., National Land Cover Data, Jin et al. 2013) typically used for regional conservation planning and design.

The Technical Team concluded that approximately 350 of the 500 species occurred in the UMGL geography during an essential component of their annual cycle and recommended that approximately 100 species continue to be evaluated for their potential as surrogate species, referred to as the Reduced Potential Species Pool in ***Figure 2***. This list of approximately 100 species was then distributed for broad review by FWS programs, states, and tribes. The reviewers were asked to replace, delete, or add species as appropriate and justify their suggestions based on the eight broad-based questions. Approximately 10 species were deleted and 15 species added during the final review of the Reduced Potential Species Pool.

Step 3: Make conceptual diagram of general ecosystem processes and threats affecting each species by habitat system.

The 100 species in the Reduced Potential Species Pool were divided into seven habitat categories or systems according to habitat association. For each habitat system, the factors potentially limiting species populations were assessed using a conceptual model, such as the one presented in ***Figure 3***. Each conceptual diagram linked landscape drivers, such as threats and stressors, to landscape metrics, such as amount of habitat. The conceptual diagrams also accounted for the species whose populations were believed to be limited by those metrics. For consistency with other planning efforts, the limiting factors were assessed according to the International Union for Conservation of Nature's (IUCN) threats and stressors taxonomy (Salafsky et al. 2008). The assessment focused on habitat and habitat management actions, and included metrics used to measure change in amount, connectivity and condition of habitat on the landscape. The conceptual diagrams provided a graphical depiction of the total number of species, the number of species affected by each threat and the number of species that responded to each potential landscape metric for each habitat system.

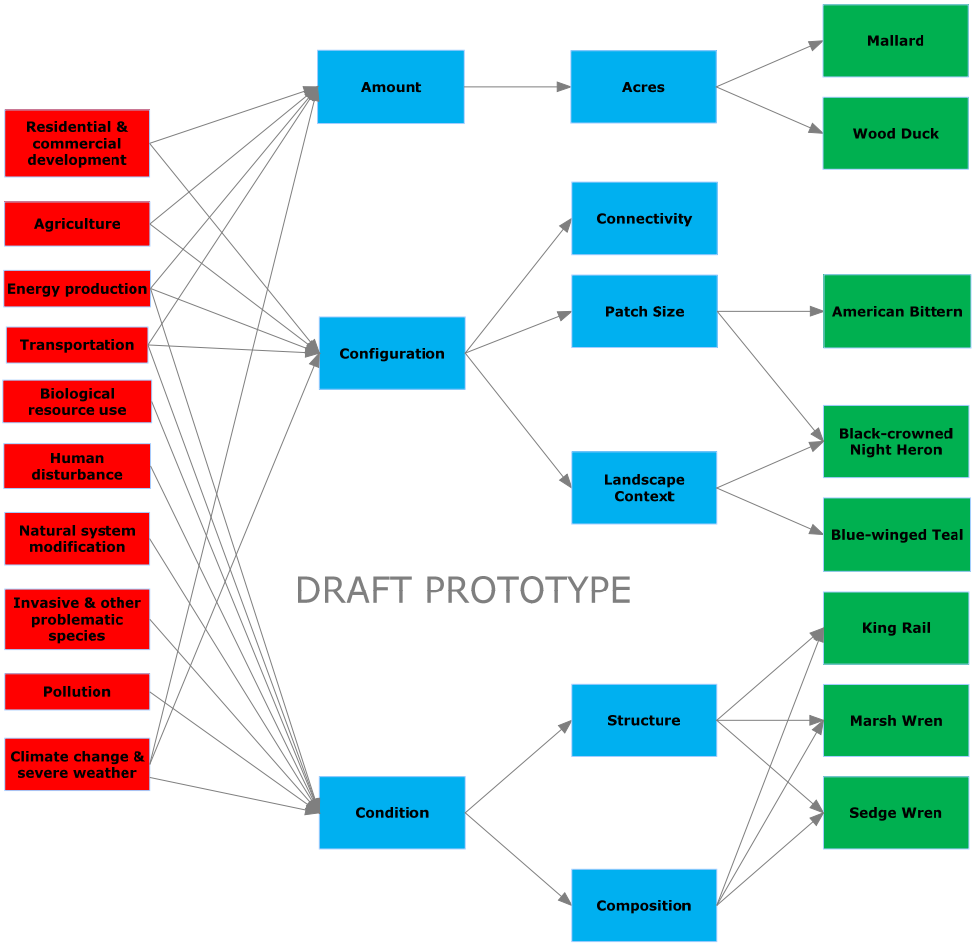

Figure 3. Conceptual diagram for the palustrine habitat system depicting linkages among the IUCN threats (red), landscape metrics (blue), and potential surrogate species (green) in that habitat system.

Step 4: Identify and prioritize common factors that limit species populations and distributions on the landscape.

The conceptual diagrams were converted to tabular form in order to illustrate relationships between potential surrogate species and key landscape metrics for each system (***Table 2***). These tables were used to determine the number of species that responded to each potential landscape metric, prioritize landscape metrics and guide additional information gathering to determine the species most sensitive to each metric.

Table 2. Example for the palustrine system depicting potential surrogate species and their sensitivity to multiple landscape metrics.

		Configuration			Condition		
Species	Amount	Connectivity	Patch Size	Landscape Context	Structure	Composition	Other factors
Blue-winged Teal				x			
Green-winged Teal							
King Rail	x				x	x	
Mallard	x						
Marsh Wren	x				x	x	
Northern Pintail							
Pectoral Sandpiper							
Sedge Wren	x				x	x	
American Bittern	x		x				
Black-crowned Night Heron	x		x	x			
Whooping Crane							
Wood Duck	x						

Step 5: Define the surrogate approach.

Based on the types of landscape metrics limiting the populations of potential surrogate species, the Technical Team decided "management umbrella" and "management indicator" surrogate species approaches were the most appropriate. These two surrogate species concepts focus on habitat management and are well defined for use within the SHC context.

"The umbrella species concept hinges on the assumption that the presence of a certain species in a geographic area indicates that other species will also be present. … Conservation of an umbrella species is believed to protect other species, even if relationships between the umbrella and the community type are poorly established." (Zacharias & Roff 2001, p 69, as cited in Caro 2010, p. 100). More specifically, a management umbrella species is a "convenient shortcut for managing a reserve or ecosystem such that if the population of one species can be kept viable through safeguards and judicious interventions, then it is hoped that populations of many sympatric species will maintain positive growth rates" (Caro 2010,

p. 100). Umbrella species, in general, are useful for planning efforts such as biological planning and conservation design in SHC.

A management indicator species is "any species, group of species, or species habitat elements selected to focus management attention for the purpose of resource production, population recovery, maintenance of population viability, or ecosystem diversity"(USFS 1984 as cited in Caro 2010, p. 231). Changes in populations of management indicator species are believed to indicate the effects of management activities on other species and have a long history of use in federal agencies including FWS. Management indicator species can be thought of as a subset of management umbrella species, and these species are useful for planning efforts as well as directing monitoring activities.

Step 6: Rank and select a suite of species in each habitat system based on desired surrogate species characteristics.

As with all umbrella species concepts, a management umbrella species should have well-known biology, stable enough populations for long-term persistence, be easily monitored, co-occur with species of conservation interest and be sensitive to disturbance (Caro 2010, p. 116). Some authors have also suggested that management umbrella species should also be keystone species, which have a disproportionate effect on the community, have long generation times and are long-lived species. The Technical Team discussed these characteristics and focused on the better established characteristics of umbrella species. Many of these characteristics were previously considered during the SHC review in Step 2. To rank and select a suite of species for each habitat system, the Technical Team considered the following species characteristics:

- Within this broad habitat, is the species wide ranging (i.e., greater than 60 percent of the geography)?
- Can management actions of the FWS affect status of this species on the landscape?
- Will management actions taken by the FWS for this species positively affect other priority species?
- Which species is most sensitive to patch size?
- Which species is most sensitive to connectivity?

Several additional characteristics were considered but lead to increasingly complicated assessment, counter to the intent of the surrogate approach. In general, the Technical Team attempted to select for each habitat system a suite of species reflecting distinct yet widespread cover types within that system. Selection included species considered full-time residents, as well as those occurring in the UMGL geography only during breeding or migration/wintering periods. For details on species selection considerations, see the **Surrogate Species/Habitat System Assessment** accounts below.

Step 7: Document assumptions and key uncertainties. Identify species benefiting and species requiring special attention.

A full review of the approximately 350 priority trust species in the UMGL geography is ongoing. A table of sample species likely to benefit from the conservation actions directed at the surrogate species is included in each habitat system account. Expanding beyond these initial "short lists" of species suites

will require additional consideration. Similarly, some species occurring in specific habitat systems will require special attention due to unique requirements or threats within that system.

Step 8: Final review and evaluate implications for Strategic Habitat Conservation

A final review by FWS programs and partners was used to obtain feedback from the conservation community on the draft list of surrogate species. FWS staff and partners were asked for two pieces of feedback:

1. Is the suite of surrogate species identified for each habitat system complimentary with regard to the selection descriptions?
    a. For example, do the four species in the forest system represent different types of forest, different sensitivity to forest structure and composition, or different portions of the UMGL geography?
2. Have the key considerations for each habitat system been evaluated? If not, which species would you add and why?
    a. For example, do the four species in the forest system represent the different major types of forest in the UMGL geography?

If FWS staff and partners suggested an additional management umbrella or management indicator species, they were asked to limit their suggestions to those on the list of 100 trust species occurring in the UMGL geography with adequate information to proceed through the SHC cycle.

Surrogate Species/Habitat System Assessments

Forest

System description and attributes

Forests are dominated by woody vegetation greater than 20 feet tall in both wetland (saturated soils) and upland sites. Forests in the UMGL geography transition from a landscape blanketed by dense boreal and mixed hardwood forest in the north to patchier forest stands composed of primarily deciduous tree species and remnants of oak savanna woodlands in the south. Whereas northern forests of the geography include extensive and relatively intact forested wetlands and uplands, much of the historical forests in the southern portion of the geography were cleared and replaced with farms, cities and suburbs. A diverse suite of wildlife species depend on the forests of this region for all or portions of their life history.

Following a period when nearly all forest land in the region was cleared, forests and forest-wildlife populations rebounded remarkably during the past 100 years. The amount of habitat in this geography for forest wildlife species today is impressive, yet concerns and conservation opportunities remain. For example, fragmentation of many forest areas has decreased patch size and connectivity, reducing the habitat quality required by interior forest species. Likewise, structure and juxtaposition of woodlands are important during migration for birds in migration corridors along the Great Lakes, and for daily,

seasonal, and dispersal movements for other priority species. Additional concerns include the effects of fire suppression, herbivory, lack of management, and invasive species (e.g., buckthorn, emerald ash borer beetle) on forest composition and structure (e.g., more even-age stands with fewer tree species).

The loss, degradation and fragmentation of forests can limit populations of many priority species and these factors were therefore the focus of surrogate species selection (***Table F1***). Specifically, surrogate species were selected to represent the numerous priority species that are sensitive to the amount of mature conifer, mixed, and deciduous forest (young-forest dependent species are considered in the shrubland system), large forest patches and the degree of fragmentation of the landscape. Collectively, these attributes should reflect both habitat quantity and quality, including high species recruitment and survival.

Table F2 provides a list of other forest species likely to receive significant benefits from widespread conservation actions directed at the suite of surrogate species. It is not comprehensive, but provides examples of species the FWS has an adequate biological understanding of its life history to infer similar limiting factors with surrogate species. ***Table F2*** also includes examples of forest species in need of special attention because of unique habitat requirements, narrow geographic distribution, threats other than habitat loss and degradation, or other considerations that were not accounted for by the suite of surrogate species.

Table F1. Surrogate species for the forest system and brief reasoning for selection.

Surrogate species	Selection description	Selection consideration
Canada Warbler	Inhabits coniferous and mixed northern deciduous forests with well-developed understory	Represents species that use mixed deciduous and conifer, semi-mature forests
Pine Warbler	A conifer specialist that inhabits and breeds in conifer forests with sparse understory in the northern portion of the geography	Represents species that require northern conifer forest
Wood Thrush	Breeds in mature deciduous and mixed forests with a well-developed understory	Represents species that require large blocks of mature deciduous forest

Table F2. Forest species likely to receive significant benefits from actions directed at the surrogate species and those species likely to need special attention.

Species benefiting		Species requiring special attention	
Common name	**Scientific name**	**Common name**	**Scientific name**
Black-and-white Warbler	*Mniotilta varia*	Dwarf Lake Iris	*Iris lacustris*
Black-throated Blue Warbler	*Setophaga caerulescens*	Indiana Bat	*Myotis sodalis*
Black-throated Green Warbler	*Setophaga virens*		
Cape May Warbler	*Setophaga tigrina*		
Cerulean Warbler	*Setophaga cerulea*		
Great-crested Flycatcher	*Myiarchus crinitus*		

Louisiana Waterthrush	*Parkesia motacilla*
Olive-sided Flycatcher	*Contopus cooperi*
Ruby-crowned Kinglet	*Regulus calendula*
Scarlet Tanager	*Piranga olivacea*
Spruce Grouse	*Falcipennis canadensis*
Veery	*Catharus fuscescens*
Worm-eating Warbler	*Helmitheros vermivorum*
Yellow-rumped Warbler	*Dendroica coronata*

Shrubland

System description and attributes

Shrubland is a dynamic cover type typically dominated by areas of dense deciduous or mixed deciduous-conifer woody cover less than 20 feet tall. It is composed of shrub-vegetation species or tree species in a young-growth forest condition and providing shrub-like characteristics at least temporary (i.e., before maturing to pole-sized trees). In the UMGL geography, shrubland was far more abundant during the mid- and late-1900s, following extensive clear-cutting of virgin forest and subsequent forest regeneration across the region. Extensive clear-cutting is relatively less common today and the natural actions important to maintaining large areas of shrub, such as wildfire and thriving beaver populations, are not supported by society and are regularly suppressed by management agencies. Populations of shrubland wildlife species have declined in recent decades, reflecting this proportionate decline of shrub and young-growth forest cover.

Greatest habitat quality for breeding shrub-wildlife species often occurs within landscape mosaics, where patches of shrub are intermixed with grassland and forest. Juxtaposition of shrubland can be important for species that migrate, especially as a provision of north-south corridors in upland and riparian systems.

Loss of shrubland and the transitional shrubland zone between forest and open landscapes has influenced populations of priority shrubland species. Surrogate species were selected to represent the attributes most limiting populations (***Table S1***). Specifically, surrogate species were selected to represent the amount of deciduous and mixed shrub and young-forest cover, and the juxtaposition of this cover type on the landscape. Collectively, these attributes should reflect both habitat quantity and quality that impact high species recruitment and survival.

Table S2 provides a list of other shrubland species likely to receive significant benefits from widespread conservation actions directed at the suite of surrogate species. It is not comprehensive, but provides examples of species that FWS has an adequate biological understanding of their life history to infer strong habitat-relationships with surrogate species. ***Table S2*** also includes examples of shrubland species in need of special attention because of unique habitat requirements, narrow geographic distribution, threats other than habitat loss and degradation, or other considerations that were not accounted for by the suite of surrogate species.

Table S1. Surrogate species for the shrubland system and brief reasoning for selection.

Surrogate species	Selection description	Selection consideration
American Woodcock	Requires a mosaic of deciduous shrub/young forest with openings during breeding and deciduous shrub and mixed young forest during non-breeding	Represents species that require shrub in a transitional landscape, including a lowland (wet soil) component
Brown Thrasher	Uses both shrub and regenerating forest during breeding; more dependent on shrub species than other selected surrogates	Represents species that use shrub and mature shrubland
Golden-winged Warbler	Requires shrub or early succession deciduous forest, especially aspen, for reproduction	Represents species that require shrub and young-forest in an early succession landscape

Table S2. Shrubland species likely to receive significant benefits from actions directed at the surrogate species and those species likely to need special attention.

Species benefiting		Species requiring special attention	
Common name	**Scientific name**	**Common name**	**Scientific name**
Blue-winged Warbler	*Vermivora cyanoptera*	Kirtland's Warbler	*Setophaga kirtlandii*

Grassland

System description and attributes

The grassland system in the UMGL geography ranges from native prairie and oak savanna to working grasslands that include agricultural uses such as hayfields, small grains, old fields, pastures and set-aside fields. A great diversity of species use habitats within the grassland system for all or portions of their life history. Native grassland systems were broken and planted to a wide variety of agricultural crops dominated by corn, soybeans and alfalfa. Grassland systems were also compromised through loss of natural processes such as wildfire and other disturbance that prevented succession to forest. The value of many existing grasslands is also reduced by the presence of fence rows dominated by trees and invasive species, as well as the fragmented distribution of grass on the landscape. The loss and degradation of grasslands limit abundance for many priority species. Surrogate species were selected to represent the attributes that most limit populations (***Table G1***). Specifically, surrogate species were selected to represent the amount and distribution of quality grassland across the landscape, the size of grassland blocks, the habitat characteristics (short grass, tall grass, savanna, high quality remnants, etc.) and the context of the surrounding landscape. Collectively, these attributes should reflect both habitat quantity and quality that impact high species recruitment and survival.

Table G2 provides a list of other grassland species likely to receive significant benefits from widespread conservation actions directed at the suite of surrogate species. It is not comprehensive but provides examples of species that the FWS has an adequate biological understanding of life history to infer strong habitat-relationships with surrogate species. *Table G2* also includes examples of grassland species in need of special attention because of unique habitat requirements, narrow geographic distribution, threats other than habitat loss and degradation, or other considerations that were not accounted for by the suite of surrogate species.

Table G1. Surrogate species for the grassland system and brief reasoning for selection.

Surrogate Species	Selection description	Selection consideration
Bobolink	Mid-height grass species using grasslands with medium litter layer, standing residual vegetation and some bare ground	Representative of species that use native prairie grasslands, uncut pastures and overgrown fields and meadows, wide distribution across LCC and often found in working agricultural landscapes
Eastern Meadowlark	Species uses grasslands with high litter layer, medium grass to forb ratio and tolerant of up to 30 percent shrubs	Representative of species found in grassland systems later in succession as well as smaller block sizes than other species
Eastern Prairie Fringed Orchid	Relies on mesic prairie habitats and also found in wet meadows and sedge meadows and wetland edges, threatened by conversion of habitats to cropland, and pasture as well as succession to woody vegetation and competition from non-native species , sensitive to distribution of hawkmoths for pollination	Representative of species that are found in high quality fully functioning remnant native prairie often associated with wetlands
Henslow's Sparrow	Requires tall grass with a deep litter layer as well as a high grass to forb ratio, low amounts of woody vegetation and minimum area of 25250 acres	Representative of species using denser, later successional grassland cover with medium to high grassland distribution on the landscape
Karner Blue Butterfly	Requires lupine for reproduction, often associated with quality oak savanna habitats with a full complement of forb species, limited population distribution in high quality habitats	Representative of species found in oak savanna and oak barrens habitat, representative of species that are sensitive to connectivity of quality grassland and oak savannas on the landscape
Monarch Butterfly	For use as a flagship species	A flagship for pollinator conservation and grassland conservation
Northern Flicker	Associated with scattered trees and	Wide geographic range,

	open grasslands, adapted to a wide range of open grassland, forest edge habitats	migratory woodpecker, habitat can accommodate species that tolerate or require scattered trees in a grassland system
Upland Sandpiper	Requires short grass with limited litter layer and some bare ground, requires larger percentage of grass on the landscape	Representative of species sensitive to percentage grassland on the landscape and species found in open short grass systems including short grass prairie, pasture, and oak barrens

Table G2. Grassland species likely to receive significant benefits from actions directed at the surrogate species and those species likely to need special attention.

Species benefiting		Species requiring special attention	
Common name	**Scientific name**	**Common name**	**Scientific name**
Barn Owl	*Tyto alba*	Mitchell's satyr butterfly	*Neonympha mitchellii mitchellii*
Barn Swallow	*Hirundo rustica*		
Dickcissel	*Spiza americana*		
Grashopper Sparrow	*Ammodramus savannarum*		
Hine's Emerald Dragonfly	*Somatochlora hineana*		
Red-headed Woodpecker	*Melanerpes erythrocephalus*		

Beach and Open Coast

System description and attributes

In the UMGL geography beach and open coast habitat includes relatively non-vegetated shorelines on the Great Lakes and some interior lakes and large rivers. Although patchy in many areas, beach and open coast can be extensive along the shoreline of all five Great Lakes. The location and size of this habitat system is directly dependent on changing Great Lakes water levels. The habitat consists of primarily open, sand and cobble beaches with vegetation cover less than 40 percent, often backed by sand dunes. Due to their aesthetics and accessibility, beach and open coast systems are favored locations for human recreation and home development. Human use has resulted in direct loss and degradation of this system. Surrogate species were selected to represent those attributes that most limit populations (***Table B1***), specifically the amount and distribution of beach and open coast habitat across the Great Lakes, the length of beach and open coast shoreline patches, and the context of the surrounding landscape. Collectively, these attributes reflect both habitat quantity and quality that impact high species recruitment and survival.

Table B2 shows beach and open coast species likely to receive significant benefits from widespread conservation actions directed at the surrogate species. This list is not comprehensive and only includes

species that have information to proceed with implementation of SHC and are hypothesized to be represented by the suite of surrogate species for the shoreline and open beach system.

Table B1. Surrogate species for the beach and open coast system and brief reasoning for selection.

Surrogate species	Selection description	Selection consideration
Houghton's Goldenrod	Grows in relatively undisturbed, moist, open beach habitat	Other species utilize wet beach habitat; shorebirds utilize barren shoreline along the Great Lakes for foraging during spring and fall migration
Piping Plover (Great Lakes pop.)	Requires wide expanses of relatively undisturbed open beach habitat backed by dunes for nesting, feeding and brood rearing	Other species require open beach and dune habitat or occur along forested edges; barren shoreline along the Great Lakes used by multiple shorebirds during spring and fall migration

Table B2. Beach and open coast system species likely to receive significant benefits from actions directed at the surrogate species and those species likely to need special attention.

Species benefiting		Species requiring special attention	
Common name	**Scientific name**	**Common name**	**Scientific name**
Caspian Tern	*Sterna caspia*	None identified	
Dwarf Lake Iris	*Iris lacustris*		
Pitcher's Thistle	*Cirsium pitcheri*		

Riverine and Riparian

System description and attributes

Riverine systems throughout the UMGL geography range from small, cold headwater streams to large, warm rivers like the upper Mississippi. The riparian systems throughout the UMGL geography supply food, cover and water to a great diversity of aquatic and terrestrial species, plus serve as migration corridors and stopping points for species moving between habitats.

Riverine and riparian systems were significantly altered due to hydrologic modifications such as dams, diversions, groundwater withdrawals, channelization and levee construction. These modifications indirectly impact riparian communities through changes in stream morphology and hydrologic processes. Habitat alterations that result in direct modification of riparian communities through land clearing include agriculture, timber harvest, commercial/residential development, or disturbance, such as sand/gravel mining and invasive species.

The loss and degradation of riverine and riparian systems limit abundance for many priority species, and surrogate species were selected to represent those attributes that most limit populations (***Table R1***).

Specifically, surrogate species were selected to represent the amount, distribution, and connectedness of quality riverine and riparian habitat across the landscape. Collectively, these attributes should reflect both habitat quantity and quality that impact high species recruitment and survival. Other habitat quality metrics (e.g., water quality) impacting the selected species are noted in the selection consideration for informational purposes. These secondary metrics were not the main focus of selection because surrogate species approaches for environmental indicators were not considered.

Table R2 provides a list of other riverine and riparian species likely to receive significant benefits from widespread conservation actions directed at the suite of surrogate species. It is not comprehensive, but provides examples of species that the FWS has an adequate biological understanding of life history to infer strong habitat-relationships with surrogate species. ***Table R2*** also includes examples of riverine and riparian species in need of special attention because of unique habitat requirements, narrow geographic distribution, threats other than habitat loss and degradation, or other considerations that were not accounted for by the suite of surrogate species.

Table R1. Surrogate species for the riverine and riparian system and brief reasoning for selection.

Surrogate species	Selection description	Selection consideration
Brook Trout	Prefers, clear, cold, well-oxygenated streams with little to no siltation. Prefers water temperatures less than 20ºC, a meandering stream channel with well-defined pool and riffle habitats with a combination of sand, gravel, and cobble substrates, undercut banks, large woody debris, and an intact riparian corridor.	Representative of resident or migratory (i.e., Great Lakes) trout and salmon requiring that use coldwater streams and rivers for spawning, nursery, and rearing. Species serves as an indicator of overall watershed health.
Higgin's Eye Pearlymussel	Relies on moderate to large, deep, free-flowing rivers with clean water, moderate current, and sand/gravel substrates. Relies on healthy populations of host fish (i.e., walleye, largemouth bass, smallmouth bass, whitebass).	Representative of species in large rivers with moderate current, within the greater Mississippi River Basin. This includes species sensitive to water quality, habitat alteration and the presence of non-native invasive species.
Lake Sturgeon	Relies on medium to large, cool to warmwater rivers with clean, gravel shoals and rapids, and water temperatures of 12 to 17ºC for spawning. Relies on shallow, sandy/gravel substrates, with little to no velocity, and water temperatures of 14 to 17ºC for nursery and rearing of	Representative of cool and warmwater migratory species requiring connectivity to current and/or historic spawning, rearing, and nursery habitats.

	young.	
Paddlefish	Relies on open, free-flowing large rivers, including their associated oxbows and backwaters for feeding. Adults required clean gravel bars for spawning.	Representative of planktivorous, filter-feeding fish species requiring diverse habitat types for feeding and reproduction.
Red-shouldered Hawk	Favors large mature, mixed deciduous-coniferous forest in riparian areas and flooded swamps; tolerates some interspersed development.	Species reliant on mature mixed forested areas near water.
River Redhorse	Prefers moderate to swift currents in large connected rivers systems, including impoundments and pools. Clean gravel substrates are preferred for spawning and foraging.	Representative of species that require connected systems and intolerant to siltation and turbidity.
Smallmouth Bass	Prefers mainly cool or warmwater streams and rivers of moderate to large size with moderate gradients and substantial (>45%) rocky substrate.	Representative of predatory cool to warmwater species intolerant of sedimentation and other organic pollution.
Snuffbox	Relies on small to medium rivers, inhabiting areas with varying velocities of current. Adults burrow deep in sand, gravel, or cobble substrate. Relies on healthy populations of host fish (i.e., log perch).	Representative of species requiring free flowing riverine systems and those sensitive to increased temperature, turbidity, siltation and poor water quality.
Walleye	Relies on medium to large, cool to warmwater rivers with riffles, rapids, and areas of swift current with suitable substrate (e.g., gravel, cobble, mussel beds) for spawning.	Represents healthy, intact riverine habitats, which in turn, serves as an important host fish for several mussel species found in this habitat system.
Wood Duck	Requires shallow palustrine or riverine wetlands (or waterways leading to those wetlands) less than 1 mile from mature deciduous forest during breeding period and shallow wetlands typically associated with forest during non-breeding period	Represents species dependent on old growth forest characteristics, particularly tree cavities and mast production, near river or shallow wetlands

Table R2. Riverine and riparian species likely to receive significant benefits from actions directed at the surrogate species and those species likely to need special attention.

Species benefiting		Species requiring special attention	
Common name	**Scientific name**	**Common name**	**Scientific name**
American Eel	*Anguilla rostrata*	Copperbelly Watersnake	*Nerodia erythrogaster neglecta*
Black Redhorse	*Moxostoma duquesnei*		
Blackside Dace	*Rhinichthys atratulus*		
Greater Redhorse	*Moxostoma valenciennesi*		
Prothonotary Warbler	*Prothonotary citrea*		
Pugnose Minnow	*Opsopoeodus emiliae*		
Shoal Chub	*Macrhybopsis hyostoma*		
Shovelnose Sturgeon	*Scaphirhynchus platorynchus*		
Slimy Sculpin	*Cottus cognatus*		
Weed Shiner	*Notropis texanus*		

Lacustrine

System description and attributes

The lacustrine systems throughout the UMGL geography are quite varied and include ponds, permanently flooded natural lakes and artificially-created reservoirs. Subsystems found within lacustrine habitats include limnetic (deepwater habitats) and littoral (wetlands extending from the shore to maximum extent of non-persistent emergent growth). By definition, lacustrine systems include wetlands and deepwater habitats with all of the following characteristics: 1) situated in a topographic depression or a dammed river channel; 2) lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30 percent areal coverage; and 3) total area exceeds 20 acres. Similar wetland and deepwater habitats totaling less than 20 acres are also included in the lacustrine system if an active wave-formed or bedrock shoreline feature makes up all or part of the boundary, or if the water depth in the deepest part of the basin exceeds 2 meters at low water.

Impacts to lacustrine systems include filling and dredging, sedimentation, degradation of water quality from effluents, hydrologic alteration, shoreline development, overdrafting of groundwater basins and water tables and introduction of exotic species. All of these impacts occurred to varying degrees in natural and artificial lacustrine environments of the UMGL geography. The degradation of lacustrine systems limits abundance of many priority species. Surrogate species were selected to represent those attributes that most limit populations (***Table L1***). Specifically, surrogate species were selected to represent the amount and distribution of quality lacustrine habitat across the landscape. Collectively, these attributes reflect both habitat quantity and quality that impact high species recruitment and survival, and stable food webs. Other habitat quality metrics (e.g., water quality) impacting the selected species are noted in the selection consideration for informational purposes. These secondary metrics

were not the main focus of selection because surrogate species approaches for environmental indicators were not considered.

Table L2 provides a list of other lacustrine species likely to receive significant benefits from widespread conservation actions directed at the suite of surrogate species. It is not comprehensive, but provides examples of species that the FWS has an adequate biological understanding of life history to infer strong habitat-relationships with surrogate species. *Table L2* also includes examples of lacustrine species in need of special attention because of unique habitat requirements, narrow geographic distribution, threats other than habitat loss and degradation, or other considerations that were not accounted for by the suite of surrogate species.

Table L1. Surrogate species for the lacustrine system and brief reasoning for selection.

Surrogate species	Selection description	Selection consideration
Bloater	Relies on open, free-flowing large rivers, including their associated oxbows and backwaters for feeding. Adults required clean gravel bars for spawning.	Representative of planktivorous, filter-feeding fish species requiring diverse habitat types for feeding and reproduction.
Cisco	Relies on medium to large, cool to warmwater rivers with clean, gravel shoals and rapids, and water temperatures of 12 to 17ºC for spawning. Relies on shallow, sandy/gravel substrates, with little to no velocity, and water temperatures of 14 to 17ºC for nursery and rearing of young.	Representative of cool and warmwater migratory species requiring connectivity to current and/or historic spawning/rearing/nursery habitats.
Common Loon	Uses clear-water lakes greater than 60 acres in size with substantial 5 to 30 foot depth zone, often near other large water bodies , and with abundant small fish and undeveloped shoreline.	Represents species occurring in moderate to large, northern lakes with little human disturbance.
Common Tern	Relies on Great Lakes and inland lakes greater than 500 acres with moderate to high water clarity and with a substantial un-vegetated shallow (<3 feet deep) zone where bays and inlets provide small fish; also requires rocky islands, peninsulas, or patches of artificial substrate with low disturbance.	Represents large-lake species requiring abundant shallows and relatively high water quality.
Lake trout	Prefers, clear, cold, well-	Representative of resident or

	oxygenated streams with little to no siltation. Prefers water temperatures less than 20ºC, a meandering stream channel with well-defined pool and riffle habitats with a combination of sand, gravel, and cobble substrates, undercut banks, large woody debris, and an intact riparian corridor.	migratory (i.e., Great Lakes) trout and salmon requiring that use coldwater streams and rivers for spawning, nursery, and rearing. Species serves as an indicator of overall watershed health.
Lesser Scaup	Found in region during non-breeding period only, using extensive open water (>30 acres) lakes and lacustrine river pools with depth 3 to 30 feet.	Represents species using productive (mesotrophic) lake systems typically with unconsolidated substrate.

Table L2. Lacustrine species likely to receive significant benefits from actions directed at the surrogate species and those species likely to need special attention.

Species benefiting		Species requiring special attention	
Common name	**Scientific name**	**Common name**	**Scientific name**
Deepwater Sculpin	*Myoxocephalus thompsonii*	None identified	
Lake Sturgeon	*Acipenser fulvescens*		
Lake Whitefish	*Coregonus clupeaformis*		
Smallmouth Bass	*Micropterus dolomieu*		
Tundra Swan	*Cygnus columbianus*		
Ring-necked Duck	*Aythya collaris*		
Pied-billed Grebe	*Podilymbus podiceps*		
Greater Scaup	*Aythya marila*		
Horned Grebe	*Podiceps auritus*		
Red-breasted Merganser	*Mergus serrator*		

Palustrine

System description and attributes

The palustrine system in the UMGL geography ranges from wet meadow and emergent marsh to scrub-shrub and forested wetlands (see Cowardin et al. 1992 for complete description). In the most human modified landscapes of the region, shallow wetlands were drained and converted to other land cover types or often had some hydrologic alteration. A great diversity of species use habitats within the palustrine system for all or portions of their life history. The loss and degradation of these wetland types limit abundance of many priority species. Surrogate species were selected to represent those attributes that most limit populations (***Table P1***). Specifically, surrogate species were selected to represent the amount of quality palustrine wetland across the landscape, the size of wetlands or wetland complexes, the context of the surrounding landscape, and unique wetland types that support

priority palustrine species. Collectively, these attributes should reflect both habitat quantity and quality that impact high species recruitment and survival.

Table P2 provides a list of other palustrine species likely to receive significant benefits from widespread conservation actions directed at the suite of surrogate species. It is not comprehensive, but provides examples of species that the FWS has an adequate biological understanding of life history to infer strong habitat-relationships with surrogate species. ***Table P2*** also includes examples of palustrine species in need of special attention because of unique habitat requirements, narrow geographic distribution, threats other than habitat loss and degradation, or other considerations that were not accounted for by the suite of surrogate species.

Table P1. Surrogate species for the palustrine system and brief reasoning for selection.

Surrogate species	Selection description	Selection consideration
Black Tern	Requires large deep (2 to 4 feet) native-plant emergent marsh with adjacent open water for breeding.	Represents species sensitive to wetland (or wetland complex) size and quality (e.g., invasive plants).
Blue-winged Teal	Requires shallow emergent marsh and open-water complex in low-forest settings, preferably surrounded by grasslands, for breeding.	Other species also rely on wetlands in open settings.
Le Conte's Sparrow	Requires open marshy meadows with grasses and sedges for breeding.	Represents a variety of priority species occupying wet meadows.
Mallard	Uses many wetland types for breeding and nonbreeding; maintaining large goal populations requires large amounts of wetland.	Wide geographic range and habitat needs can accommodate other wetland species.

Table P2. Palustrine species likely to receive significant benefits from actions directed at the surrogate species and those species likely to need special attention.

Species benefiting		Species requiring special attention	
Common name	**Scientific name**	**Common name**	**Scientific name**
American Bittern	*Botaurus lentiginosus*	Wild Rice	*Zizania sp*.
Belted Kingfisher	*Megaceryle alcyon*	Common Tern	*Sterna hirundo*
Black-crowned Night Heron	*Nycticorax nycticorax*		
Green-winged Teal	*Anas crecca*		
Marsh Wren	*Cistothorus palustris*		
Northern Pintail	*Anas acuta*		
Pectoral Sandpiper	*Calidris melanotos*		
Sedge Wren	*Cistothorus platensis*		
Wood Duck	*Aix sponsa*		

Future Considerations

On several occasions, the Technical Team used personal expertise coupled with feedback from FWS, state, and tribal partners to discuss and debate the importance of other habitat systems occurring within the UMGL geography, additional federal trust species that could potentially serve as surrogate species, as well as alternative types of surrogate species approaches. The Technical Team recognized the importance and need to consider these aspects of the landscape and alternate approaches, but chose to remain focused on the eight step process developed early on. Within that process the Technical Team decided to focus on selecting species that were "habitat limited" and therefore chose surrogates that were management umbrella/indicator species. Because of this, we were not able to fully incorporate all the input and feedback provided (e.g. species that might serve as environmental indicators). In addition, the surrogate species selection process used focused on species with readily available information to conduct SHC. As such, approximately 250 priority trust species were not further evaluated to serve in the role as a surrogate species due to inadequacy of information or other immediate practical constraints. Assessing this list of approximately 250 additional species for potential candidates as management umbrella/indicators should be considered when developing and prioritizing future research and monitoring efforts.

As FWS begins to implement SHC using the surrogate species of the UMGL geography, the Technical Team recommends further evaluating the following:

Urban/Developed Areas as a Habitat System

Developed landscapes range from low-human density suburbs to highways and industrial parks. These areas occur across the UMGL geography, and this cover type is expanding significantly, especially in southern portions of the region. The metropolitan areas of Minneapolis/St. Paul, Chicago, Cleveland, and Buffalo have an ever increasing footprint as the urban fringe of these and many other cities continues to grow. However, developed areas can contain some or all of the species-habitat components found in more natural areas, and they can play an important role in population persistence for at least some species. An equally important role for conservation actions in developed landscapes may be the opportunity to partner with communities in conservation efforts in their backyards, helping to garner appreciation for conservation both within and outside urban areas (i.e., flagship species). Identification of surrogates for use in urban areas also ties in directly with the FWS Urban Refuge Initiative, Urban Bird Treaty Program, Lights Out Twin Cities, and similar programs. Selection of urban system surrogates could provide a common link for these programs as they are further developed. Moreover, attention to this system can provide outreach to help people connect to the larger landscape and learn about the many conservation challenges related to choices humans make every day.

Ecological umbrella or indicator species in developed habitats could include an insectivorous bird species which relies on a forage base provided by urban microhabitats or on the structural components provided in urban areas. Potential surrogate species include Purple Martin (whose houses once graced most Midwestern cities and towns), Common Nighthawk, or Chimney Swift. Other flagship species, much like the Monarch butterfly, could be used effectively to engage the public in conservation, locally and regionally, as well as provide a metric to assess public involvement in conservation over time.

Environmental Indicators

The current surrogate species selection effort focused on identifying species for Strategic Habitat Conservation and was based on species "habitat" limiting factors. Other factors (e.g., persistent chemicals in the environment) can contribute to depressed populations or be the primary population limiting factor for some priority trust species. Using an environmental indicator surrogate approach would be useful to track the effects of these non-habitat based factors. The criteria and process for selecting environmental indicators would differ from the process the Technical Team used to select management umbrella and indicator species. The Technical Team recognizes the importance of tracking non-habitat based limiting factors and recommends that we consider an additional process to identify species specifically for this purpose. If an environmental indicator approach were pursued, it should begin by reviewing the work of several FWS and state colleagues that supported the inclusion of Bald Eagle as an environmental indicator on early versions of the proposed surrogate species list.

Air-space as a Habitat System

Air-space provides an essential habitat for many priority species and it was not fully considered in this selection process. Aerial-insectivore bird species depend on air-space for food and they could serve multiple surrogate roles, including an indication of the insects and pollinators comprising food webs within the air. Below is an example consideration of a surrogate species (management indicator) that deserves further evaluation.

> *Barn Swallow* - Widespread but declining species such as Barn Swallow need an abundant aerial insect forage base from spring through fall, directly depending on insects supported by roadside, prairie, pasture, and grassland vegetation and forest and savannah habitats. These and other migratory bird species often arrive in the UMGL geography early in the spring (April) and stay until late summer (August to mid-September), as long as flying insects are available. The insects that support their energetic demands depend on a wide variety of host plants, including both cool and warm-season grasses and flowering forbs that bloom throughout this entire period. As such, the success and conservation efforts directed at these species support a diverse group of other species that respond to the ongoing presence of flowering forbs and the resulting insect populations.
>
> Other species that would benefit from an abundant supply of aerial insects include Bank Swallow, Northern Rough-winged Swallow, and Tree Swallow, Eastern Bluebird, Cedar Waxwing, Red-headed Woodpecker, Least Flycatcher, Chimney Swift. Most of these species are obligate aerial insectivores while some like the red-headed woodpecker use aerial insects opportunistically or seasonally. Some bat species may also serve as good surrogate species for habitat quality and insect diversity; monitoring insect populations directly may also be warranted.

Surrogate Species and Strategic Habitat Conservation

Interpreting Surrogate Species and Implementation

Strategic conservation of broad suites of plants, fish, and wildlife comprising shared natural communities can be achieved with greater efficacy and more easily communicated when using representatives of those communities. As such, "surrogate species" are a tool to focus and implement Strategic Habitat Conservation (SHC). Through conservation planning, design, and outcome tracking, surrogate species help answer questions regarding "what, where, how, and how much habitat" is needed, plus they provide a metric for measuring collective conservation efforts. The surrogate approach enables concise communication of the desired outcomes for conservation actions in terms of species populations and their associated habitats.

The overarching goal for establishing surrogate species is to improve efficacy of habitat conservation actions, including protection, restoration, and management with a landscape focus. However, most conservation is site specific and local actions that target surrogate and non-surrogate species remain a key to achieving broad conservation outcomes. It is important for site-based conservation efforts to pursue goals that contribute to cumulative effects for populations at the landscape scale, while also meeting the needs of more localized priorities. Measuring conservation progress through monitoring a representative group of surrogate species should also be conducted at both local and landscape scales.

SHC Tools

Greater efficacy of conservation will result from using SHC tools to inform resource allocation. The tools are expressed at multiple spatial scales and for a variety of purposes as described below and as depicted in ***Figure 4***. These SHC tools include:

- **Outcome tracking** – establish population and habitat baselines and trends; monitor and evaluate conservation outcomes in the context of explicit objectives to document success or failures and adapt accordingly; communicate conservation progress to decision makers and stakeholders and potential program supporters; evaluate efficiency in terms of costs and benefits; focus on information required to learn, adapt, and adjust conservation actions.
- **Landscape conservation planning and design** – define objectives, both population and habitat; identify priority locations for surrogates species and other priority species with sufficient information; develop site-based local actions with a broader landscape context.
- **Management practices and strategies** – describe the specific desired landscape conditions to target when implementing local conservation actions; develop best management practices.
- **Research and monitoring** – support science needed to gather knowledge about the species and the systems in which they operate; inform our scientific understanding of cause-effect relationships through monitoring; test planning assumptions and improve understanding of factors limiting populations; reduce uncertainty and increase knowledge to move priority species into and around the SHC framework.

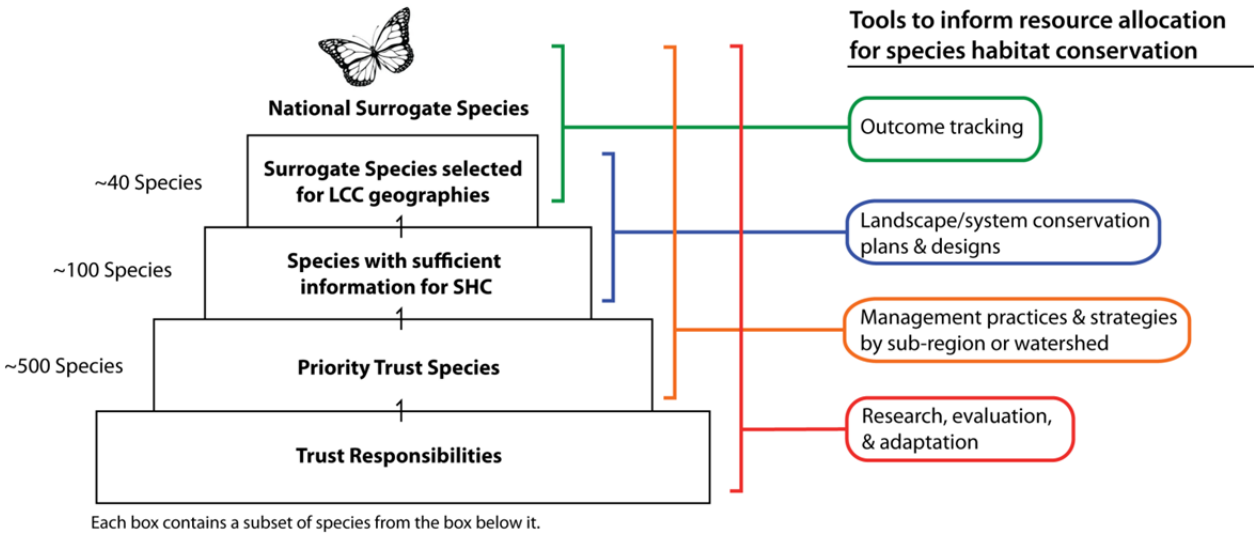

Figure 4. Integration of surrogate species with SHC.

The above graphic depicts how surrogate species and SHC are integrated. At the top are national surrogate species (e.g., Monarch Butterfly). Universally recognized species typically serve a flagship role and as a communication tool reminding society of the relevance of wildlife, wild places, and the environment we depend on for healthy living. It is important to track the status of these species and incorporate their needs into regional landscape planning and conservation practices.

Down one level in the graphic are surrogate species selected for LCC regional geographies. In this case, the species selected to represent suites of species or natural communities with similar threats and limiting factors in the UMGL geography. A detailed filtering process around the following criteria was used to identify these species: 1) occurs in geography in manageable numbers, 2) FWS program priority, 3) responsive to management, 4) is monitored adequately to detect population change (or can be monitored adequately), 5) population objectives exist (or setting objectives is feasible with available information), and 6) is widely distributed with adequate stakeholder recognition across the region. To achieve the most parsimonious list, additional criteria reflecting each species' ability to represent the needs of other species were applied. This list of surrogate species will be a significant focus for FWS conservation planning, implementation, and outcome tracking. Their needs, management strategies, and population status will be communicated widely among the conservation community and shared with the public. Unlike the example monarch butterfly above, these surrogate species are not intended to serve the role as "flagship" species, but rather as a primary metric for regional conservation progress.

Below the surrogates selected by LCC geographies are those species with sufficient information to implement and integrate full-cycle SHC at the landscape-scale (e.g., scale of Bird Conservation Regions). This broader list includes surrogates species plus other species that can be used to better define the questions related to what, where, and how much of a particular conservation action is needed in order to reach a desired population outcome. This group will also be used to form the "suites" represented by surrogates when planning conservation for habitat systems. Using the relatively abundant scientific

knowledge available for this group will result in better representative coverage than only using information available for the surrogate species selected for LCC geographies. Additional advantages include demonstrating cross programmatic and partnership opportunities and testing the assumptions of the surrogate approaches.

The next level down in the graphic is a box representing the approximately 500 Priority Trust Species that individual FWS programs have identified as priorities within the LCC region. These are the migratory, inter-jurisdictional, and threatened and endangered fish, wildlife and plant species whose population status and management were identified as highest priority to the FWS. For many of these species, there are known localized habitat limiting factors, which can and should be included in strategies and management practices for the sub-region or watershed where they occur. These strategies are developed at geographic scales smaller than the landscape planning and design for surrogates, but they should be integrated within these landscape efforts to pursue measurable benefits for both local priority species and the surrogate species.

Finally, the last tier of the graphic encompasses all fish, wildlife, and plant species entrusted to the FWS and potentially influenced by conservation for surrogate species. Over time, all trust species should be prioritized for research and monitoring. In particular, evaluation should address critical assumptions for the surrogate species and those being used for conservation planning and design. Other top priority species will be studied to collect the information necessary for future landscape planning and design and for consideration to future revisions of the surrogate species list.

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