

Roadmap for Recovering
Grassland Species of
Greatest Conservation Need
in the Mississippi Flyway



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*The findings and conclusions in this article are those of the author(s) and do not necessarily represent the views of the U.S. Fish and Wildlife Service. The roadmap isn't intended to replace other efforts targeted to the conservation of grassland Species of Greatest Conservation Need (SGCN), but rather to provide an overview of conservation needs across broad taxa and spatial scales. This document also is not linked to the work of the administrative Mississippi Flyway, one of four established in North America to facilitate management of migratory birds and their habitat.

Note: the videos referenced in the text can be viewed here: www.youtube.com/channel/UCWaTBwV9Rjgx0KEVD63EKew/



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Executive Summary

This document is based upon a series of presentations, recorded as videos and available to the public, by subject-matter experts in fields associated with the goal of developing a Mississippi Flyway-scale action plan to better tailor grassland initiatives to the specific conservation strategies, policies, and resources needed to recover an array of grassland taxa of conservation concern. The project was funded through a multi-state grant from the Association of Fish and Wildlife Agencies to American Bird Conservancy. Representatives from a variety of agencies and organizations helped guide the process of drafting the action plan, deemed a roadmap. The draft document and its recommended actions were then discussed at a virtual summit by members of the conservation community in January 2021 and their feedback incorporated into this, the final version.

Some themes that emerged from the virtual summit, addressed further in the roadmap, are as follows:

The species at risk are many, and their declines can be attributed to two primary factors: the conversion of native prairie grasslands to other land uses, and the suppression of fire. Remaining native prairie remnants should be protected to preserve biodiversity and provide propagules for prairie recreations.

We are challenged to restore and manage the composition and structure of grassland habitats in a way that make them biologically functional for SGCN, and provide adequate amounts of habitat in patch sizes and configurations that allow species with relatively large area requirements and/or poor dispersal abilities to endure. Implementation efforts must be tailored to the needs of SGCN at species-appropriate scales.

To foster communication among planners and practitioners across the range of SGCN, grassland species, as designated in conservation plans of states, provinces, species initiatives, regional partnerships, etc. should be clearly delineated from other habitat categories.

Understanding species' spatial and temporal distributions, life history strategies, and population structures is essential information needed for designing successful conservation strategies. Research and monitoring are needed to determine if applied conservation actions are having their intended effects on the populations in question.

More research is needed on social and economic drivers affecting our ability to protect and restore grasslands that can support SGCN. There also is a need to augment partnerships among science and management, for both biological and social research.

Climate change in the Mississippi Flyway has markedly occurred over the last century, and will have untold impacts on grassland species. It is imperative that we develop and implement appropriate and effective climate-change mitigation and adaptation strategies.

Partnerships bring greater efficiency to the conservation endeavor. There are, however, a lot of partnerships related to grassland conservation in the flyway, focused at varying spatial scales; ideally, plans at smaller scales should not contradict those at more regional scales.

Organizations should be encouraged to form partnerships outside of those that have traditionally centered on the wildlife and conservation communities. It was recognized that relationship-building takes time, but can be key to achieving broader and more direct conservation outcomes. Where coordination is needed, it should be recognized that dedicated staff and funding is needed for success.

Several improvements in existing natural resources policy need to be made to successfully create and maintain sufficient grassland habitat to benefit SGCN at biologically meaningful scales; wildlife conservation organizations should lobby to remove programs that disincentivize the conservation of native grasslands.

Because native grasslands are among the most endangered ecosystems in North America, we need an international grassland conservation initiative to address this conservation crisis. In addition, because the vast majority of grasslands in the Mississippi Flyway are on private lands, a native vegetation standard would help ensure that publicly-funded U.S.D.A. conservation practices on private lands fully promote the use of native vegetation to the benefit SGCN. We also must work together to pass the Recovering America's Wildlife Act (RAWA) to provide \$1.4 billion in dedicated annual funding to state and tribal wildlife agencies for the conservation and management of SGCN.

There is a big need to increase the public's awareness of the importance of grassland systems to biodiversity, ecosystem services, etc. as has been done for wetlands and forests. Public Service Announcements, planning prairie gardens in cities and roadsides, etc. can be useful tools. We also should note the need to embrace diversity and inclusion in both outreach and practice.

Finally, the participants in the virtual summit recommend that entities engaged in revising State Wildlife Action Plan standards for the U.S. consider the priority actions in the roadmap in those revisions, especially as they relate to coordination and collaboration across state lines.

A Roadmap for Recovering Grassland Species of Greatest Conservation Need in the Mississippi Flyway

Goal: To develop a Mississippi Flyway-scale action plan (aka conservation “roadmap”) to better tailor grassland initiatives to the specific conservation strategies, policies, and resources needed to recover an array of grassland taxa of conservation concern.



Preface

In 2019, the Bird Conservation Committee of the Association of Fish and Wildlife Agencies put forth a National Conservation Need entitled “Grassland Conservation and Awareness: Enhance, Conserve, and Restore a Diminishing Ecosystem,” allowing the Multistate Conservation Grant Program to accept proposals related to that need. On behalf the AFWA Grassland subcommittee working under the Bird Conservation Committee, American Bird Conservancy, with several other partners, submitted a successful proposal that, in part, aimed to help to organize grassland conservation workshops in the Mississippi and Central flyways in Summer/Fall 2019. These workshops were intended to bring together thought leaders from federal, state, and nongovernmental organizations, and others, to identify strategies and actions that will contribute to a unified framework for grassland conservation in the two flyways, resulting in a document to be called a “roadmap.”

The Mississippi Flyway summit initially was scheduled for 1 -3 September 2020, in St. Louis, MO, with the

stated goal of “Working toward the development of a Mississippi Flyway-scale action plan to better tailor grassland initiatives to the specific conservation strategies, policies and resources needed to recover an array of grassland taxa of conservation concern.” The in-person meeting was cancelled in April 2020 due to the pandemic outbreak of COVID-19.

The speakers that agreed to speak at the in-person meeting were instead recorded on Zoom, and largely based on those presentations, the roadmap drafted by a team comprised of people from a mix of federal, state, and non-governmental organizations (see below). A second draft was offered to an additional set of reviewers with grassland wildlife diversity, private lands, and policy experience. Their comments were incorporated into a third draft of the document. A “virtual” summit to discuss the roadmap’s third draft, its basic premises, and priority actions, was held the afternoons of January 16, 27, and 28th, 2021.

Feedback from participants in the virtual meeting was incorporated into this, the final report, and some themes are summarized in Appendix A. The document for down-

load, and links to videos of the speakers' presentations, are available here: www.msflywaygrasslandssummit.com/

The roadmap isn't intended to replace other efforts targeted to the conservation of grassland Species of Greatest Conservation Need, but rather to provide an overview of conservation needs across broad taxa and spatial scales. We acknowledge the work of regional partnerships such as the MLI, SECAS, and JVs, and recognize that some of our recommendations already are being implemented by such partnerships in portions of the flyway. This document also is not linked to the work of the administrative Mississippi Flyway, one of four established in North America to facilitate management of migratory birds and their habitat.

Introduction

This document, or roadmap, establishes actions that are needed within the next five years to significantly advance the ability to recover species of greatest conservation need (SGCN) within the Mississippi Flyway at landscape to regional scales. The species that are at risk are many, but the root causes of their declines can be attributed to two primary factors: the conversion of millions of acres of native prairie grasslands to other land uses, primarily agricultural, and the suppression of fire, beginning with widespread influence by European immigrants in the 19th century. Some accounts follow:

In Illinois: "...the true prairies were converted to agricultural uses soon after European settlement. At the time of the General Land Office surveys in Illinois, around 1820, about two-thirds of the state was covered by tallgrass prairie with the rest in forest, although several hundred thousand acres of prairie would probably be considered wetland or marsh today. Little land was in cultivation or permanent settlements. But soon after the invention in 1837 of the John Deere self-scouring steel plow, there was wholesale conversion to cropland. Wetter areas were quickly drained and tilled when clay tiles came into widespread use by the 1850s." (Walk et al. 2010.)

In Missouri: "Although there are records of plowing in Saline County, Missouri, from 1819 (McKinley 1960), most prairie was not plowed there until after the civil war. Fire suppression in Missouri seems to first have started around the prairies near St. Louis, and as early as the late 1700s. In 1837, Alphonso Wetmore reported that what used to be prairie in the uplands of St. Louis County was 'covered with a young growth of fine thrifty timber... This important change is happily going forward in Missouri wherever the fires are kept out of the prairies.'" (Schroeder 1982.)

In Alabama: "Shortly after 1819, most of the savannas or prairies of Alabama were transformed into farms and were lost before they could be painted, photographed,

illustrated or described by some of the early naturalists that came into Alabama. Most don't even realize they existed. What remains today are small remnants, a few dozen acres of grasslands and prairie here and there. Just scraps. 'In the case of the prairies in the Tennessee Valley of North Alabama, almost nothing remains. They likely were gone by 1850 because they were so easily converted to cotton fields.'" <https://bhamnow.com/2019/08/22/what-did-alabamas-landscapes-look-like-in-1819-hint-think-kansas-with-prairies-and-bamboo/>

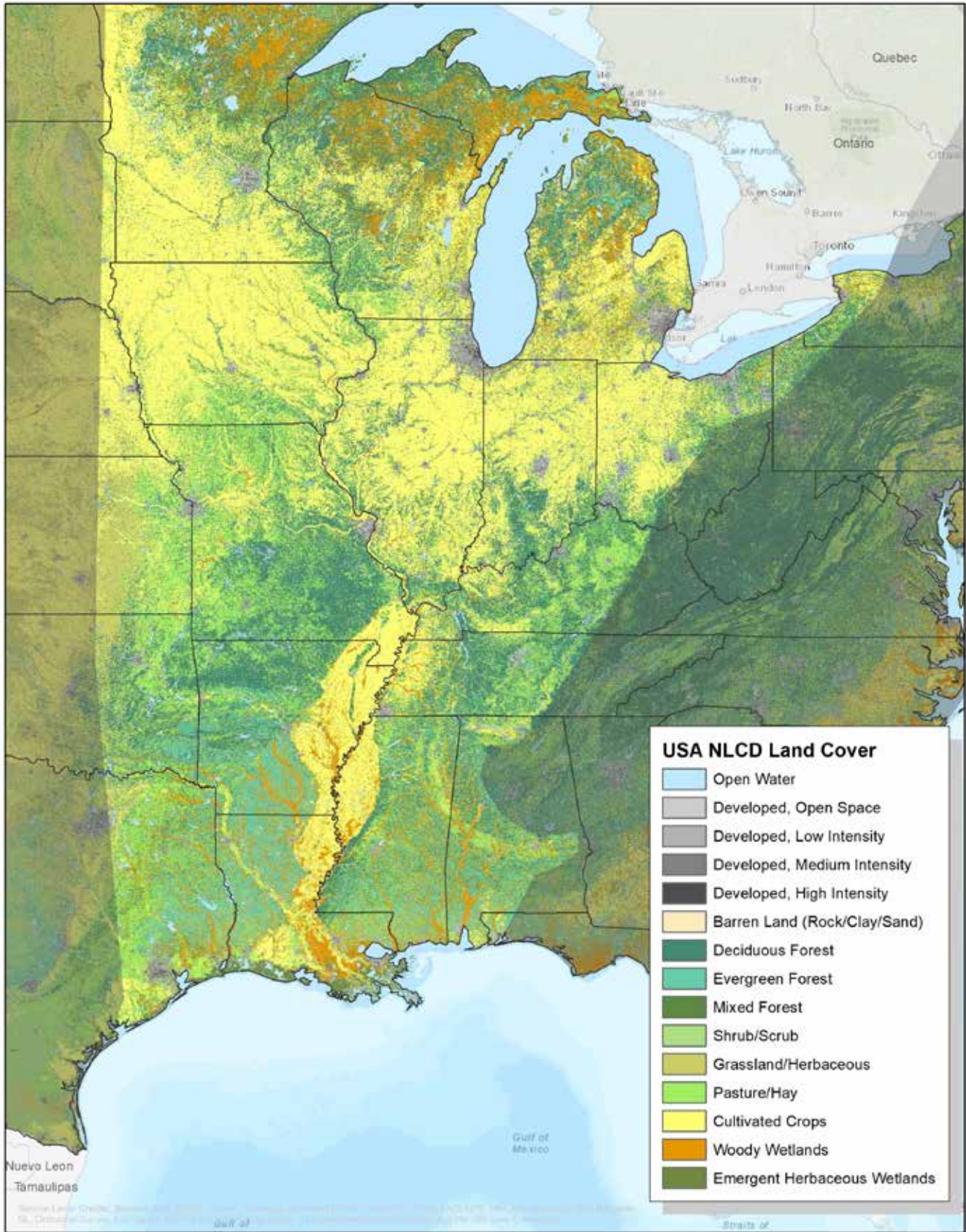
A more recent analysis by the Upper Mississippi River/ Great Lakes Joint Venture found the greatest degree of landscape change in the JV region occurred between pre-European immigration and 1938. For example, the area classified as grassland/herbaceous (native prairie during pre-immigration) was only 3.1 million hectares (12 percent of JV region) by the 1930s, compared with an estimated 26 million hectares before the region was converted by Europeans.

In addition to rote loss of the millions of acres of native grasslands that the SGCN evolved with, the patchy and fragmented nature of remaining native grassland remnants often are insufficient in size for some species with large area requirements, and too far apart to maintain populations of others that have poor dispersal capabilities. Not all species, however, require native grasses and forbs to persist, but often in those landscapes that are dominated by non-native grasses, such as pastures and hayfields, the lack of grass and forb diversity, frequent cutting, and over-grazing can render the composition and structure of those surrogate grasslands unsuitable for grassland wildlife.

Thus, our challenge is at least two-fold: restore and manage the composition and structure of grassland habitats in a way that make them biologically functional for SGCN, and provide adequate amount of habitat in patch sizes and configurations that allow species with relatively large area requirements and/or poor dispersal capabilities to endure. Given that much of the upper portion of the flyway has been converted to cropland, and that pastures and hayfields in the lower portion of the flyway are predominantly non-native and of poor quality for wildlife, conservation strategies and solutions will differ by nature of those land use patterns (fig. 1.). For bird species that migrate to the Neotropics during the non-breeding season, reversing declines could also require addressing limiting factors beyond the flyway's geographic limits.

This document is arranged by six themes: Species of Greatest Conservation Need; Research and Evaluation; Conservation Delivery; Partnerships; Challenges and Opportunities; and Policy and Funding Needs. A brief narrative provides background on each and serves as an introduction to a set of priority actions associated with

Fig. 1: Land use patterns, Mississippi Flyway



each, although there often is overlap among actions and themes. A set of videos by subject experts associated with each topic is available on YouTube, and some key pieces of published literature are cited as well.

Species of Greatest Conservation Need

Grassland species are high priority for multi-regional conservation efforts in the Mississippi Flyway. According to the states' Wildlife Action Plans, these species make up 16% of SGCN in nine states that break out species by habitat type (Video 1). And, according to the Southeastern Grasslands Initiative, nearly one-third of all rare southeastern land vertebrates, two-thirds of all rare plants, and 60 percent of the nearly 6,000 native plant species of the Southeast require or prefer grasslands. Plus, more than 600 of the 1,213 rare habitats of the Southeast are rare grassland types. The dramatic decline of grassland birds in the U.S. also has been well documented. Recent publications including the 2019 State of the Birds report (<https://www.stateofthebirds.org/2019>) and Rosenberg et al. 2019 indicate a greater than 50-percent loss of abundance in grassland birds since 1970, the largest among all taxonomic groups and biomes in the report. The State of Canada's Birds reported a 57-percent loss of grassland birds as well (<http://nabci.net/resources/state-of-canadas-birds-2019>).

For more information about U.S. State Wildlife Action plans, and associated species lists, see: <https://www.fishwildlife.org/afwa-informs/state-wildlife-action-plans>. For the Ontario, Canada, species at risk, see: Species at risk in Ontario | Ontario.ca, and for Manitoba, see:

https://www.mhmc.mb.ca/wp-content/uploads/2019/04/SAR_Booklet_LandownersGuide.pdf. For species at risk across Canada as a whole, see: Species search - Species at risk registry (canada.ca)

Grassland birds within this flyway have varying needs due to their diverse life history strategies. Some of these declining bird species are migrants, presumably able to find and colonize grassland patches within a given landscape. Others, like the Greater Prairie-Chicken and the Northern Bobwhite, are non-migratory and need a sufficient amount of suitable habitat within a certain area to complete their full annual cycle (Video 2). Other bird species are more likely to colonize patches of grassland that are relatively large, or are embedded in a landscape with a high percentage of grassland (Video 3). Some bird species will use grazed or hayed non-native grasslands, so long as they offer the levels of vegetation height-density, litter depth, and shrub cover that the species requires (Jacobs et al. 2012). Although the habitat associations and preferences of many grassland birds are better known than those of many other taxa, little is known about how vital rates vary with patch size and landscape context, and which portions of their annual cycle are limiting, warranting new research approaches at unprecedented scales (Video 4).

Grassland insects also are understudied, with little even known about their exact distributions. The Rattlesnake Master Borer Moth, for example, was thought to persist at only a few sites in five states, prompting concern that the species might warrant protection under the U.S. Endangered Species Act. More recent surveys found them to be much more abundant and widespread, with 17 populations considered highly resilient.



LEFT: Northern Bobwhite by Dennis W Donohue, Shutterstock
ABOVE: Dickcissel by Dan Behm

Other SGCN, such as Blanding's Turtle, have declined due to a lack of connectivity between wetlands and wet prairies, where they spend part of their annual cycle, and drier prairie uplands, where they can find refugia from flooding. Some fish species in need of conservation, such as the Topeka Shiner, have declined as once-clean gravel and sand beds associated with cool prairie headwater streams became unsuitable for them due to channelization, siltation, pollution, damming, and diversions.

Priority actions related to SGCN:

Have all U.S. states and Canadian provinces in the flyway separate their open grassland SGCN from other habitat categories, and separate open grasslands/prairie from savanna, woodland, and other grassland-transitional communities in their state and provincial wildlife action plans. Note, if known, which species are tolerant of non-native grass plantings compared with those dependent upon native grass or prairie remnants. Also, note which species are area-sensitive and which can use smaller patches with poor connectivity if possible.

Modify existing and developing regional SGCN lists to include primary habitat associations. (Note that grassland birds in need of conservation attention have been prioritized for Bird Conservation Regions in the flyway by Partners in Flight using an assessment process vetted over more than two decades. See: <https://partnersinflight.org/resources/the-plan/>)

Promote and fund inventory work to determine status of poorly studied SGCN that are regional priorities, and work to fill natural history knowledge gaps needed for conservation planning. Develop species distribution models to guide the aforementioned inventory work if needed.

Develop the capacity to bring information on the distribution, natural history, and other ancillary data needed to improve multi-jurisdictional spatial planning for SGCN into a shareable GIS platform. Work with NatureServe & Cornell/AKN to consolidate and standardize information on the distribution, natural history, and conservation status of SGCN.

Research and Evaluation

Understanding spatial and temporal distribution of species is essential to implementing successful conservation strategies, and the use of space varies for grassland species depending upon species' natural history strategies. (Video 3 provides an overview of these concepts, as well as examples of how conservation of key species benefited from their application.) The spatial heterogeneity of grasslands in the flyway today is a product of how humans have altered the landscape since European settlement. Therefore, the current distribution and abundance of grassland-affiliated species throughout the flyway reflects these anthropogenic habitat changes.

Some populations are structured as metapopulations, where the species is distributed among a network of relatively small patches of useable habitat embedded in a larger landscape dominated by unsuitable habitat. Each patch can support a local population, but the population in any given patch can go extinct but perhaps later be recolonized. The species persists if colonization among patches is greater than extirpation within patches, with smaller patches having a greater probability of extirpation, and colonization of scattered patches depends upon the dispersal ability of the species in question.



ABOVE: Henslow's Sparrow by Frode Jacobsen, Shutterstock



RIGHT: Greater Prairie-chickens by Rob Palmer Photography, Shutterstock



LEFT: Blanding's Turtle by Paul Reeves Photography, Shutterstock
ABOVE: Rattlesnake master borer-moth by Allison Fowler

A “real-life” example of how dispersal ability can affect the recovery of SGCN comes from Missouri Department of Conservation-funded research to determine how long it would take for the biodiversity of native grasshopper and bee species on restored prairies to become similar to nearby prairie remnants within fragmented landscapes. The project showed that the community composition of reconstructed prairies remained distinct from that on remnants for at least 15 years. While some habitat differences are probably partly responsible, species’ dispersal ability also plays a role. The researchers concluded that assisted dispersal could result in more biodiverse and ecologically functional grassland reconstructions (LaRose et al. 2019).

Populations of other taxa, especially some birds, have been shown to exhibit “source-sink” dynamics, where the “source” is a high-quality habitat where more offspring are produced than needed to maintain the population of the site, and the excess individuals are available to colonize other patches. If the other patches are of lower quality, meaning the reproductive success is inadequate to maintain the local population, they are deemed “sinks.” Thus, the source-sink model implies that some habitat patches may be more important to the long-term survival of a population than others, and being able to identify which are “sources” and which are “sinks” is important for the conservation and long-term survival of the species. Organisms are generally assumed to be able to distinguish between high- and low-quality habitat, and to prefer high quality habitat. However, ecological trap theory describes the reasons why organisms may actually prefer sink patches over source patches. Secondary grasslands, for example, can become ecological traps due to human agricultural practices (e.g., harvesting of non-native hayfields during critical times of the SGCN annual cycle).

In order to understand factors affecting population persistence, it’s critical to determine the number of individuals at a site and quantify vital rates such as reproductive success and survival during non-

breeding season (e.g. post-fledging, migration, and over winter). If, over time, more individuals are lost to the population than are born, population declines will follow. Thus, conservation efforts will be most effective if conservationists can identify portions of the annual cycle that are most limiting to population growth, and work to mitigate factors negatively affecting vital rates during those periods. Four migratory bird Joint Ventures, regional partnerships for bird conservation spanning the southern half of the flyway, have designed a research project to determine where in the annual cycle three species of grassland birds are limited. They have identified 13 potential study sites across nine states, and are in the process of building local partnerships and seeking the needed funding (Video 4).

Once conservation actions are taken on behalf of a particular SGCN, it’s important to demonstrate cost effectiveness by implementing research and monitoring on a subset of areas to determine if the actions are having their predicted effect. Only a targeted species’ population response can tell us if we’re getting conservation right. Video 3 gives examples of how continued monitoring and evaluation was key to refining the knowledge needed to help species continue to recover, as some of the target populations responded to conservation efforts in novel and surprising ways.

Priority actions related to research and evaluation:

Develop standardized range-wide conservation plans for SGCN that illuminate life history strategies, population structure and dispersal capacity, current distribution and status, key status drivers (e.g. land conversion), and prioritized information needs.

Promote research and evaluation at range-wide scales for SGCN to identify and address key uncertainties in support of conservation plans.

Work to improve partnerships among science and management for both biological and social research.

Foster more research on social and economic drivers affecting our ability to protect and restore grasslands that can support SGCN.

Initiate coordinated “full annual cycle” research to determine where in the annual cycle species’ populations are limited, which habitat factors contribute to the population limitation, and which factors can be effectively addressed through mitigation or habitat management.

Conservation Delivery

Protecting as many remaining native prairie remnants as possible is important for preserving the biodiversity of those tracts, as well as for providing propagules for prairie recreations elsewhere. Some examples of organizations leading those kinds of efforts are the Missouri Prairie Foundation (<https://moprairie.org/>) and the Southeastern Grassland Initiative (<https://www.segrasslands.org>). However, the relatively few remnants still in existence won’t provide the habitat base needed to support viable populations of all SGCN over time, and high-plant-diversity prairie reconstructions are unlikely to significantly increase that habitat base in the near term, due both to the expense and difficulty in many places of attaining diverse and locally adapted seed sources. Fortunately, some species, especially some bird species, don’t appear to prefer high-diversity, nor even native-grass sites, so long as the structure of the grassland suits their needs (Jacobs et al. 2012).

All implementation efforts, therefore, ideally will be tailored to the needs of SGCN at species-appropriate scales, and take into account knowledge of the distribution, abundance, habitat requirements, and life history and population structures of SGCN to most effectively and efficiently recover their populations. The Minnesota Department of Natural Resources’ Prairie Conservation Plan (<https://www.dnr.state.mn.us/prairieplan/index.html>) incorporates targets for protection, restoration, and enhancement, with core and corridor areas to help enhance grassland quality, patch numbers and size, and connectivity. Efforts like these, that lay out spatially explicit conservation designs, could be very useful in delivering habitat for species that require native prairie vegetation and are more dispersal-challenged than, for example, some bird species that range more widely during their annual cycle.

For those species that need more complex and species-diverse prairies and prairie reconstructions, management at the site level needs to be carefully planned. Prescribed fire is a very beneficial management technique for setting back succession and regenerating native grassland systems, but some species can be harmed by fire at certain stages within the annual cycle. Some reptiles, such as

Blanding’s Turtle and Massasagua rattlesnakes, are very vulnerable to fire after they emerge in spring, while the Regal Fritillary is sensitive to fire in all stages (Video 1). Leaving unburned refugia by dividing tracts into separate burn units can be hard to manage, but is critical, especially for species restricted to isolated patches. A number of states have developed best practices for use of fire and grazing that also benefit pollinators and other wildlife. Such strategies could serve as models for other efforts.

One approach gaining traction among state wildlife agencies is the designation of landscape-scale “Conservation Opportunity Areas” or “COAs.” COA’s typically encompass both public and private lands, and are based upon parameters such as the presence of target species and natural communities, current condition or restoration potential of the landscape, resource threat, and the level of landowner and partner engagement. For COAs to be effective, it is essential that they be focused on the best opportunities for collaborative conservation under the premise that conservation endeavors will be more successful if focused in a small number of COAs of a manageable size than through smaller investments in more, or larger, COAs. The COAs should have clearly identified species and natural community targets; an explicitly stated desired future condition; and a plan and set of metrics to be used to evaluate the effectiveness of conservation efforts.

Given that the vast majority of land in the Mississippi Flyway is privately owned, conservation efforts must involve collaboration with landowners to implement conservation actions and programs. Motivations for private landowner conservation action are diverse and can be driven by finances, a strong conservation ethic, desire to maintain the quality of a property for future generations, desire to have certain species on the property, and a host of other reasons (Videos 5 and 6). The most successful private lands conservation programs work with a landowner’s pre-existing motivations and encourage long-term management actions, since grasslands need regular disturbance to maintain function.

Incorporating native grasses into cattle grazing systems, especially in the Fescue Belt across the central portion of the flyway (Video 6), could be key to achieving biologically significant acreages of native grass habitat for some bird SGCN while also increasing profit for producers and providing ecosystem services like carbon sequestration and improvements in soil health. As referenced previously, some species of birds will also use species-diverse cool-season pastures provided that the grazing systems used result in the kind of habitat structure they prefer. Market-based incentive programs like Audubon’s Conservation Ranching certification, provide producers with a premium price while assuring consumers that their beef is raised using bird-friendly



grazing practices (see: <https://www.audubon.org/conservation/ranching>).

The use of precision agriculture is increasingly being used to make a variety of agronomic management decisions on farms. Various spatial technologies can be used to create acre-by-acre profitability maps and pinpoint which portions of a field are consistently losing money. These unprofitable areas then can become the target areas for Farm Bill, state, and local conservation programs (Video 7). Both precision agriculture and efforts to motivate livestock producers to implement more bird-friendly grazing practices are promising new approaches. However, precision agriculture approaches may not benefit species that need large patch sizes or some combination of patches within a certain proximity to each other.

Cost share practices, which help to defray the expense of implementing conservation actions on private lands with owners wishing to restore wildlife populations on their properties, have been key to restoring populations of some grassland SGCN, but might not be as effective for others. The Conservation Reserve Program, for example, has been shown to help increase populations of Henslow's Sparrows (Herkert 2007), with a majority of its population both breeding and wintering in the Mississippi Flyway, but appears less useful for resident bird species like Northern Bobwhite, unless sited within close proximity to an existing population (Video 2).

Clockwise from upper left: Eastern Massasauga by Ryan M. Boton, Shutterstock; Topeka Shiner by USFWS; Regal Fritillary by Nancy Bauer, Shutterstock; Slender Glass Lizard by John MacGregor

For those species of SGCN that require or benefit from native grasslands, a voluntary and non-regulatory but incentivized use of native plant species in United State Department of Agriculture (USDA) "Farm Bill" programs could have a huge geographic impact (acres and area) (Video 8). The recently formed Native Grasslands Alliance (Video 9) is working to shape policy, rules, and regulations prioritizing native grassland vegetation and to educate technical advisors and farmers about the advantages of native vegetation, allowing them to make informed decisions. The alliance is encouraging the USDA to recognize the role native grasses play in conservation, take the emphasis off of introduced species in private lands programs, and put all options forward with equal importance.

Again, the use of geographic information systems (GIS) and spatial models are critical tools for planning and implementing conservation actions. Because the resulting maps and other ancillary data can be shared among planners and practitioners, plans at local scales can be more easily coordinated with those at more regional scales for more efficient and effective outcomes.

Priority actions related to conservation delivery:

Integrate social science into conservation program design, delivery, and evaluation. Social scientists can help locate relevant literature or design research to understand landowner motivations and behavioral intentions. This information will help target landowners most likely to adopt and continue conservation actions into the future. The conservation social science expert directory can help conservation professionals locate a social scientist in their area. Further, it is extremely important for conservation organizations to hire conservation delivery professionals with strong social science skills and knowledge. Without landowner conservation action, successful conservation of many SGCN across the Mississippi Flyway is unlikely.

Increase funding to advance spatial modeling of species-habitat relationships and create technology to correctly identify grasslands from remote-sensing, both native and non-native. Both of these needs are essential to target grassland conservation on private lands where actions are most needed and beneficial.

Focus conservation efforts and programs where SGCN still occur or where grassland ecosystems occurred historically. The Grasslands Working Group, a subcommittee of the Association of Fish and Wildlife Agencies' Bird Conservation Committee, requested a "grassland conservation gap analysis" (Video 12) that gives an idea of what currently is being done in terms of grassland conservation in North American private lands programs. Results from the state-by-state survey indicate that some programs are targeted very generally, often across entire states, creating a potential mismatch between the location and scale of existing grassland conservation programs and what is needed to most effectively recover SGCN.

Encourage administrators of rights of ways, public-private corridors, roadsides, etc. at county, state, and federal levels to shift vegetation management practices toward invasive species management and to allow, where possible, native species to flourish. Remnants of native plant communities can be useful for public education as well as providing seeds and propagules for prairie recreations, if done in accordance with applicable laws.

Partnerships

Partnerships are key to conservation because they bring greater efficiency to the conservation endeavor. Resources and information can be pooled; tasks can be assigned to the most suitable partner; and workloads can be shared. Partnerships also make conservation more effective, at a more biologically meaningful scale.

In the flyway, there are many partnerships related to grassland conservation, some appropriately small scale, like prairie recreations and some at landscape scale, like Conservation Opportunity Areas and the Southwest Wisconsin Grasslands Network. Some are more eco-regional, like the Migratory Bird Joint Ventures in the southern portion of the flyway, and some work across much larger geographies, including the Upper Mississippi Valley Great Lakes Joint Venture (UMRGLJV) and the Eastern Habitat Joint Venture (EHJV) in Canada; the Midwest Landscape Initiative (MLI, Video 10); and the Southeast Conservation Adaptation Strategy (SECAS, Video 11). Some are international, like those focused on the Bobolink and Monarch conservation plans (<https://partnersinflight.org/resources/full-life-cycle-conservation-plan-bobolink/>; https://www.fs.fed.us/wildflowers/pollinators/Monarch_Butterfly/conservation/conservation_plan.shtml.)



Native prairie, Minnesota by MN DNR

Ideally, for more efficient and effective outcomes, plans at smaller scales should at least communicate and not contradict those at more regional scales. With so many planning efforts in existence within the flyway, this is a daunting task. For example, MLI and SECAS could be good candidates for integrating plans for recovering SGCN at regional scales, but some SGCN cross regional boundaries, so those must be accounted for, too. Joint Ventures (JVs) are widely viewed as having extensive experience with bird species planning and conservation delivery efforts, but they could have better inter-JV coordination. For example, four JVs in southern part of the flyway are working on products that will allow better coordination on grassland bird conservation planning, but to date are not linked with grassland bird planning efforts of the UMRGLJV and EHJV.

Priority actions related to partnerships:

Identify and implement mechanisms for better coordination among plans and partnerships at local to regional scales, and among plans and partnerships focused on different taxonomic groups or issues.

Encourage efforts to broaden partnerships beyond those traditionally centered on the wildlife and conservation communities, and recognize that relationship-building is as important to conservation outcomes as is habitat enhancement. Where coordination is needed, realize

that it must have dedicated staff and funding. (For more on forming and maintaining partnerships, see: <https://nabci-us.org/wp-content/uploads/2021/01/Partnerships-NABCI-20210120.pdf>)

Develop knowledge-to-action networks within the grassland conservation community that generate knowledge by synthesizing information from diverse sources, such as ecological and social science, management, indigenous knowledge, etc. That knowledge then informs actions that can then feed back into knowledge creation in an iterative manner (Graham et al. 2006; Kauneckis and Martin 2020) to help predict likely outcomes of conservation actions on SGCN.

Ensure that data and outcomes from monitoring of SGCN and their habitat are disseminated to partners to help adapt future conservation strategies that maximize conservation benefits.

Encourage more states to increase participation in Southern Wings, a partnership of state fish and wildlife agencies created in 2009 by AFWA's Bird Conservation Committee. Southern Wings provides a mechanism for state wildlife agencies to partner on conservation projects for priority Neotropical migrant bird species with partners in Mexico, Central America, South America, and the Caribbean. (<https://www.fishwildlife.org/afwa-inspires/southern-wings>)



Springbrook Prairie Nature Preserve, DuPage County IL. Photo by Mark Baldwin, Shutterstock

Policy and Funding

Native grasslands are the most endangered ecosystems in North America. It is time that an international grassland conservation initiative is created to address this conservation crisis. Such an initiative would increase awareness of the need for grassland conservation among both agency personnel and the general public, and help to build a fully funded international enterprise to provide dedicated, long-term funding for the restoration, conservation, and maintenance of native grassland habitats across the United States. Furthermore, a predictable source of funding would enable conservation partners to draft comprehensive, long-term, spatially explicit plans for the restoration and maintenance of grassland ecosystems. Stable funding sources would provide financial assistance to incentivize necessary grassland management practices, as well as provide resources to hire personnel who could provide wildlife management technical assistance to private landowners.

The vast majority of grasslands in the Mississippi Flyway are on private lands. Farm-Bill-based efforts, such as the NRCS Longleaf Pine Initiative, have set a precedent for such a venture by using existing policy and programs that provide millions of dollars through the Conservation Title of the U.S. Farm Bill. Improvements in existing natural resources policy must be made to successfully create and maintain sufficient grassland habitat to benefit SGCN at meaningful scales. The USDA Farm Bill is the largest source of conservation funding for private lands in the United States. Canadian national policy has also recently included massive investments in conservation programs.

Other USDA farm bill programs, such as the Conservation Reserve Program (CRP) and the Environmental Quality Improvement Program (EQIP), have been used to create millions of acres of grassland habitat of varying quality. These same programs also work counter to grassland

habitat restoration and maintenance goals by subsidizing the planting of introduced, often invasive, plant species. Introduced species such as Bermudagrass and Tall Fescue generally provide little to no habitat value for grassland birds and other wildlife. Establishing a native vegetation standard for Farm Bill programs (Video 8) is one of the most important and impactful policy actions that can be achieved for grassland wildlife. A native vegetation standard would help ensure that publicly funded conservation practices fully promote the use of native vegetation, while still allowing cool-season grass planting that benefit some species of birds, benefiting grassland wildlife and still providing effective conservation solutions on private working lands.

Various practices under NRCS (Natural Resource Conservation Service) programs, such as EQIP, and the FSA (Farm Service Agency), like CRP, can be used to create habitat for SGCN. However, contracts for EQIP and similar programs are short-term (two-10 years). Even CRP contracts are 10 to 15 years with insufficient mid-contract management opportunity to effectively maintain grassland habitat. When contracts expire, there is no guarantee that a landowner will maintain the long-term conservation benefit of the habitat. Policy mechanisms need to be created to provide incentives to landowners to maintain the conservation benefit of CRP, EQIP, and similar programs beyond the lifespan of the initial contract. Incentives could be in the form of rental payments to landowners or financial incentives for maintenance practices, like CSP (Conservation Stewardship Program).

Wildlife conservation organizations should lobby to remove programs that disincentivize the conservation of native grasslands. Programs such as the Renewable Fuel Standard (RFS) increased demand for corn across the Midwest and other row-cropping regions. Subsequently, increased commodity prices incentivized farmers to convert remaining native grasslands and wetland areas to cropland, resulting in a substantial loss of these remaining habitat types. Additionally, with increased crop prices, CRP rental rates were no longer competitive. A substantial amount of highly-erodible, expired CRP fields was returned to crop production, resulting in a loss of tax-payer funded grassland habitat. Furthermore, former CRP lands, as well as newly broken ground, are marginal for crop production. Federally-subsidized crop insurance programs remove much of the risk otherwise associated with farming marginal land, further facilitating the loss of remaining grassland habitats.

In the newest version of the U.S. Farm Bill, the Regional Conservation Partnership Program (RCPP) was created as a mechanism to build the kind of public-private partnerships to fully implement a comprehensive strategy that could take advantage of the various USDA-based



Cattle grazing on native grasses by Kyle Brazil

programs (video 13.) RCPPs allow for the creativity and collective reach of state agencies and NGOs that want to work with private landowners to protect, restore, create, and maintain native grassland habitats needed to sustain SGCN, while supporting the activities associated with private working lands, such as crop and livestock production. RCPP opportunities should be expanded as local and regional partnerships coalesce.

Finally, we must work together to pass the Recovering America's Wildlife Act (RAWA). If passed, RAWA would provide \$1.4 billion in dedicated annual funding to state and tribal wildlife agencies for the conservation and management of SGCN. This enormous increase in funding would give state and tribal agencies the resources needed to begin effectively addressing the needs of SGCN as identified in state wildlife action plans by creating scaled-up programs with sufficient private lands staff to provide financial and technical assistance needed to address conservation needs on private lands.

Priority actions related to policy and funding:

United States:

Establish a native vegetation standard for Farm Bill programs to ensure that publicly funded conservation practices fully encourage the use of predominantly native vegetation, benefiting grassland wildlife while still providing effective conservation solutions on private working lands. Meanwhile, work to retain the Natives First managers language in the 2023 Farm Bill.

Support legislation that results in increased resources and acreages eligible to be enrolled in private lands programs that contribute to the habitat needs of grassland SGCN, whether through the Farm Service Agency (FSA) or National Resources Conservation Service (NRCS).

Encourage the development of a standardized method for requesting access to spatial data from FSA and NRCS that planners and researchers can use to better understand which practices and spatial arrangements positively affect grassland SGCN.

Investigate opportunities to encourage and refine mechanisms for CRP grasslands to be managed to provide optimum benefits to grassland birds and associated wildlife.

Create policy mechanisms that provide incentives to landowners to maintain the conservation benefit of Farm Bill programs beyond the lifespan of the initial contract.

Create a fully funded national grassland initiative to increase awareness of the need for grassland conservation among government agencies and the general public. A predictable source of funding would enable conservation partners to draft comprehensive, long-term, spatially explicit plans for the restoration and maintenance of grassland ecosystems and grassland-dependent SGCN.

Work to pass the Recovering America's Wildlife Act (RAWA) to provide \$1.4 billion in dedicated annual funding to state and tribal wildlife agencies for the conservation and management of SGCN.



Bobolink by James W. Thompson, Shutterstock

Work to increase funding for the Neotropical Migratory Bird Conservation Act that provides financial support and fosters international cooperation to recover and sustain healthy bird populations through a federal matching grant program. (<https://www.fws.gov/birds/grants/neotropical-migratory-bird-conservation-act.php>)

Canada:

Implement and fully fund the agriculture priority sector plan currently in development (possibly including a grassland task force).

Address and fix policies that negatively impact biodiversity (including well-intended policies such as “conservation cropping” and organics that can have unintended consequences and exacerbate loss of native grasslands).

Design and implement either a “farm bill” equivalent or an international mechanism permitting focus on preservation and restoration of native grasslands (likely funded through a sustainable agriculture approach or possibly through a nature-based-solutions approach).

Ensure that the “30 by 30” (30 percent protected by 2030) Initiative includes appropriate ecosystem-level representation that protects a sufficient scale of native grasslands to permit ecosystem function (likely through proper establishment of an effective OECM standard).

Ensure a diverse toolkit of conservation funding mechanisms that fill all necessary gaps and allow equal opportunity.

Challenges and Opportunities

Climate Change

The Mississippi Flyway has experienced marked climate change over the last century. Based on data presented in the U.S. 2014 National Climate Assessment (Walsh et al., 2014), temperatures have generally increased in the Midwest (~1.5oC), but changed less in the South, where some areas have experienced mild warming but others have even been cooler. Projections for future temperatures vary depending on models and CO2 emissions, but increases are expected across the entire flyway, with greater increases in more northern latitudes. Total precipitation levels have increased nearly everywhere across the flyway, ranging from -5 to 20 percent change relative to 1900, with greater increases observed in the North. Future precipitation shifts will depend strongly on emissions scenarios and will likely exhibit strong annual and seasonal variation.

These aspects of climate change, in addition to direct effects of CO2 levels on vegetation, have had and will continue to have diverse impacts on grasslands and

grassland-dwelling vertebrates and invertebrates in the Mississippi Flyway. Temperature and precipitation, with concomitant shifts in growing season lengths and soil moisture, determine the suitability of land for growing crops (Lant et al., 2016) — for which the majority of grasslands in the flyway (particularly the Midwest) have already been plowed. It is difficult to predict exactly where agricultural suitability will increase or decrease, for which crops, and the degree to which grasslands may be lost or gained as a result, but these changes will have effects on the quantity and quality of grassland habitats, as well as the potential for grassland restoration in the region.

In addition, grassland-dwelling vertebrates and invertebrates in the region face a myriad of taxon-specific impacts to population viability. A review of these impacts is beyond the scope of this document. Overall, climate change will have varied impacts on grassland vertebrates and invertebrates, posing challenges to conservationists and managers. To address these challenges, it is worthwhile to consider implementing climate-change adaptation strategies. While exploring these is beyond the scope of this document, there are a number of tools being developed that may be helpful as the Roadmap develops (e.g., Climate Adaptation Menu for Grassland Conservation, Zuckerberg et al., 2019; Resilient Sites for Terrestrial Conservation in the Great Lakes and Tallgrass Prairie Region, Anderson et al., 2018). These, and other efforts, could provide tools and tactics for use in grassland conservation in the Mississippi Flyway over the coming years. National Climate Adaptation Centers also can provide more tools to managers as their work continues (<https://www.usgs.gov/ecosystems/climate-adaptation-science-centers>).

Meanwhile, suggestions for how to mitigate climate change in grasslands are as follows:

Incorporate native warm-season grasses into grazing systems to help drought-proof cattle operations.

Consider adjusting native seed mixes for prairie recreations so that species associated with more southerly clines are moved north, as well as the assisted migration of SCGN into areas where climate is predicted to favor them going forward.

Identify Conservation Opportunity Areas that cross state boundaries to provide connectivity for wildlife to move as needed.

Promote carbon markets for grasslands; they are as good at sequestering carbon as woody vegetation.

Acknowledge that some aspects of alternative energy sources can be problematic for grassland wildlife, such as risks that species used for biofuels might become invasive, or wind and solar arrays being sited in grasslands,

with potentially negative direct and indirect effects on surrounding wildlife. There's a need to increase public awareness that grasslands are of worth.

Diversity and Inclusion:

The environment shapes and is shaped by culture. Along with great ecological diversity, native grasslands also have supported rich cultural heritages. Both the North American landscape and its human demographics have changed over the last several centuries. Recognizing the connections between a culture and its environment provides an important perspective.

This Conservation Roadmap recognizes that we need to engage more diverse conservation partners so that our conservation approaches are more equitable, inclusive, and representative, both in process and in the ecosystem services these actions ultimately provide. This diversity in turn brings greater knowledge, perspectives, and resources to the table and can stimulate more innovative problem-solving, and creates more successful landscape-level conservation efforts.

We also need to better engage more racially, ethnically, and gender diverse publics. People tend to support only what they care about. The more people learn about and spend time in grasslands, the more they may be likely to directly engage in grassland conservation or lend their support as voters, consumers, decision-makers, funding institutions, recreationists, agricultural producers, and private landowners. Likewise, we in the conservation community can learn by listening to and engaging with Indigenous peoples, as well as other diverse cultures. Together, we build our collective knowledge and resources to support and restore healthy grassland ecosystems and the wildlife that depend on them.

Public awareness:

There is a big need to build the public's awareness of the importance of grassland systems to biodiversity, ecosystem services, etc., as has been done with wetlands and forests. Public service announcements, prairie gardens in cities and along roadsides, etc. can be useful tools to raise public awareness of the subtle beauty of grasslands and the plight of so many interesting species of plants animals associated with them.

Videos

1. Grassland SGCN of the Mississippi Flyway, Kelly Rezac, Missouri Department of Conservation
2. Influence of the Conservation Reserve Program and National-Scale Coordinated Management on Northern Bobwhite. John Yeiser, University of Georgia.
3. Spatial Structure Considerations for Conserving Grassland Species of Conservation Concern. Christine Ribic, U.S. Geological Survey, Wisconsin Cooperative Wildlife Research Unit, University of Wisconsin, Madison.
4. Southern Mississippi Flyway Joint Venture Partnership's Grassland Initiative: A Multi-Joint Venture Effort to Model Full Annual Cycle Population-habitat Relationships of Grassland Birds. Jim Giocomo and Cara Joss, American Bird Conservancy and Thomas Bonnot, University of Missouri, Columbia.
5. Social Science Insights to Improve Grassland Conservation on Private Lands. Ashley Gramza, Arkansas Game and Fish Commission.
6. Producer Adoption of Native Grass Forages: Moving Working Lands Conservation Forward. Patrick Keyser, Center for Native Grasslands Management, University of Tennessee, Knoxville.
7. Current and Future Applications of Precision Agriculture for Conservation Delivery. Mark McConnell, Mississippi State University.
8. Grassland Birds: The Case for a Native Vegetation Standard. Jef Hodges, National Bobwhite Conservation Initiative.
9. The Native Grasslands Alliance
10. The Midwest Landscape Initiative: Strengthening Conservation Collaboration. Kelley Myers, U.S. Fish and Wildlife Service.
11. The Southeastern Conservation Adaptation Strategy. Todd Jones-Farrand, U.S. Fish and Wildlife Service.
12. International Assessment of State-level and Province-level Grassland Conservation Programs. Amanda Haverland, American Bird Conservancy.
13. Learning from and Embracing USDA Farm Bill and Other Large Conservation Programs for Grassland Conservation. Jim Giocomo, American Bird Conservancy.

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Grasshopper Sparrow by C. Hamilton, Shutterstock

Appendix A

Themes from the summit

The roadmap isn't intended to replace other efforts targeted to the conservation of grassland SGCN, but rather to provide an overview of conservation needs across taxa and spatial scales. We acknowledge the work of regional partnerships such as the MLI, SECAS and JVs, and that some of our recommendations already are being implemented by such partnerships in portions of the flyway.

This document also is not linked to the work of the administrative Mississippi Flyway, one of four established in North America to facilitate management of migratory birds and their habitat.

Regional lists have been developed for the southeast, and are being developed for the Upper Midwest, but also need to address those species that occur in both regions for better coordination of conservation efforts. With regards to birds with larger ranges than many SGCN, only some species (e.g. HESP, EAME, FISP) occur throughout the entire geography during their annual cycles, but others inhabit more than one state, region or country so coordination of conservation efforts at species-appropriate scales would be beneficial for them as well.

Species needs vary within the flyway; how management is used to create and manage the appropriate grassland habitat structure for a given species or suite of species must take that variation into account.

There is a need to increase efforts to foster partnerships among science and management, for both biological and social research.

Sharing spatial info and building population- and species-habitat models are very important to understanding where to target conservation efforts, especially across jurisdictions. Focus on areas where efforts can benefit multiple species of SGCN, but watch for species falling through cracks.

There is a great need for landcover data that accurately identifies grasslands, separates native from non-native, and is consistent throughout the flyway and beyond.

There's a great need for more research on social and economic drivers affecting our ability to protect and restore grasslands that can support SGCN.

Efforts to form partnerships outside of those traditionally centered on the wildlife and conservation communities should be encouraged. Recognize that relationship-building is as important as more overt conservation outcome, and note the need to embrace diversity and inclusion in both outreach and practice. (For more on forming and maintaining partnerships, see: <https://nabci-us.org/wp-content/uploads/2021/01/Partnerships-NABCI-20210120.pdf>)

Where coordination is needed, realize that it must have dedicated staff and funding. Develop a "landing page" where the array of grassland conservation plans can be found.

Work to build the public's awareness of the importance of grassland systems to biodiversity, ecological services, etc. as has been done with wetlands and forests. Public service announcements, prairie demonstration gardens in cities and along roadsides, etc. can be useful as outreach and education tools.

Priority actions/recommendations from the Mississippi Flyway and Central Flyway Roadmaps should be integrated where there is a similar purpose or intent.

Recommend that entities engaged in revising SWAP standards consider the priority actions in the roadmap in those revisions, especially as they relate to coordination and collaboration across state lines.

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