TRACKING PRAIRIE VITALS

VALUABLE DATA FOR THE PRESENT AND FUTURE

"The data sets are outstanding; it's really a great pool of data," says Rhett Johnson, MN DNR Scientific and Natural Areas ecologist.

Back in 2008, that pool of data was still just an idea. Here was the basic concept:

Create a small working group that includes partners from the U.S. Fish and Wildlife Service, the Minnesota Department of Natural Resources and The Nature Conservancy—three entities that own or manage land harboring the majority of the state's protected native prairie, nearly 120,000 acres. Set up a system for long-term monitoring of these prairies, defining one or more permanent transects (study areas) per site. Develop standardized monitoring protocols that will make it possible to assess change over time at any given site and also make "apples to apples" comparisons between sites. Agree on a set of criteria that can be tracked as indicators of ecological health, such as the percent of native prairie vegetation relative to non-native/invasive species and various measures of biodiversity. Send out trained field ecologists to monitor vegetation along the transects at regular intervals.

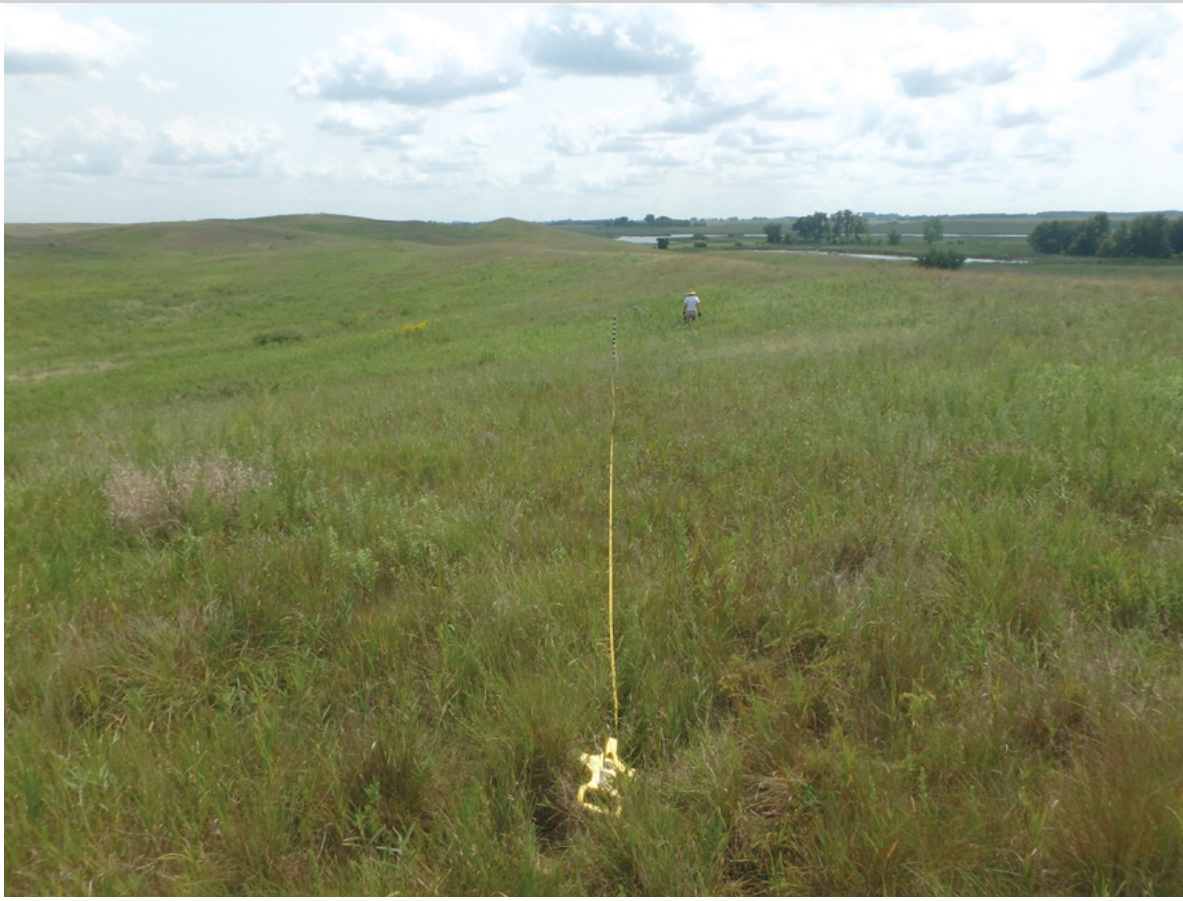
July prairie colors at Glacier Lake State Park
Photo by Richard Hamilton Smith

Enter information into a common database that will be available to all. Design models for data analysis that will enable you to ask good questions and get good answers. And here's the kicker: you accept that doing it right will take a while.

At the close of 2021, roughly 13 years later, that digital archive held accumulated data on 2,344 transects within 298 management units defined on 100 unique native prairie sites. That included 263 transects (roughly 11% of the total) located on protected prairies in the eastern Dakotas. In total, over 27,000 acres of native prairie have been monitored. By now, these numbers have likely increased.

The monitoring is exacting, labor-intensive work. Trained field staff visit sites, using GPS coordinates to confirm locations of transects. Completing the basic protocol can take 45 minutes per transect, while an optional—more sophisticated—protocol can take three to four hours per transect.

Surveyors assess diversity in the structure (e.g. height, density) and type of vegetation (e.g. percent grasses versus forbs, degree of encroachment by woody plants). They also document the presence of selected "Tier 1" native species that indicate a quality prairie, such as pasque flower and purple prairie clover.



Data collection underway across a transect in Glacial Lakes State Park
Photo by MN DNR

Standardized monitoring protocols make it possible to assess change over time at any given site and also make "apples to apples" comparisons between sites.

Purple prairie clover indicates quality prairie, which helps support some of Minnesota's more that 500 bee species, such as this *Eucera* long-horned bee.
Photo by Jessica Petersen, MN DNR

Pasque flowers
Photo by ColdSnap

It's work that Johnson, who has personally monitored more than 30 sites, many repeatedly, enjoys. "I like the quiet," he says. Moving slowly along a transect focused on his task, he's often had wildlife come close—a sedge wren singing from its perch, a mink that "came right up and looked me in the eye." Multiply his work by that of dozens of others monitoring sites over the years, then add the data management and coordinating tasks shared by partner organizations, and you begin to get an idea of the scope of the effort.

Such a tremendous investment of time, energy, expertise and resources naturally begs the question: to what end?

SPICE: Sustaining Prairies in a Changing Environment

"The beauty of this data is that it can serve different objectives for each user, now and in the future," says Daren Carlson, research scientist with the MN DNR's Nongame Wildlife Program. "At the start, we were very intentional about developing research with both short- and long-term benefits in mind." Carlson was in on the ground floor of the monitoring initiative's inception and leads a related MN DNR project dubbed SPICE, for Sustaining Prairies in a Changing Environment. SPICE investigates long-term trends in data from a subset of 40 of the monitored sites, aiming to tease out any changes in high-quality prairies due to habitat fragmentation and climate change. By design, some of the 40 sites are large and embedded in a landscape of grasslands, while others are small and isolated. Sites are scattered geographically (see figure 1) to capture potential differences in climate change effects due to latitude.

The SPICE initiative includes a special focus on grassland birds, with annual point-count surveys from established locations within the prairies. To enhance our understanding of these complex systems, plans are underway to add surveys of pollinators which serve critical ecological roles yet may respond differently to habitat management than birds. This kind of "status and trend" research is by its very nature a long game. Thus far, investigators have not observed major trends in vegetation attributable to climate change or habitat fragmentation. "That's not surprising," says Carlson, "since 13 years is a short time frame for the prairie ecosystem." But one facet of SPICE—the monitoring of grassland birds—has recently produced some striking results.

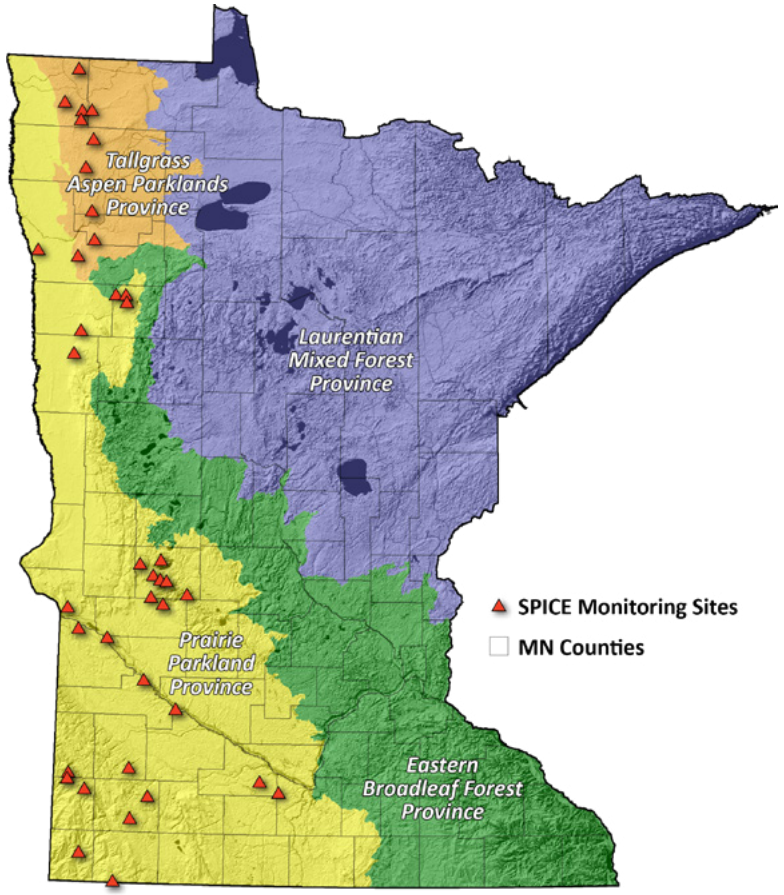


Figure 1. Distribution of monitoring sites

"Status and trend information is akin to personal vital signs—a barometer of the state of our natural world," says Nongame Wildlife Program Research Scientist Daren Carlson. Carlson has played a key role in both SPICE and the Grassland Monitoring Team.
Photo by MN DNR

List of grassland bird species tracked at the 40 SPICE sites. Species not observed are Sprague's pipit, Baird's sparrow, and longspur.

Eastern meadowlark
Western meadowlark
Gray partridge
Ring-necked pheasant
Sharp-tailed grouse
Greater prairie chicken
Northern harrier
Swainson's hawk
Killdeer
Sprague's pipit
Upland sandpiper
Marbled godwit
Wilson's phalarope
Short-eared owl
Horned lark
Sedge wren
Clay-colored sparrow
Vesper sparrow
Lark sparrow
Savannah sparrow
Grasshopper sparrow
Baird's sparrow
Henslow's sparrow
Le Conte's sparrow
Chestnut-collared Longspur
Dickcissel
Bobolink

It's an aspect of the project that Nongame Wildlife Program biologist Mike Worland knows well. Worland has been conducting surveys for grassland birds at the SPICE prairies since the 2016 field season. Four of the 40 sites are surveyed annually, while the remaining are monitored at six-year intervals. Since the project's inception in 2008, every site has been surveyed at least twice. For Worland and his predecessors, it's been work that requires a particular skill set. Most birds are identified by their songs and calls rather than by sight, and surveyors must learn to distinguish individual birds based on location, distance and subtleties in their vocalizations to avoid double-counting.

Among the study sites, Worland especially appreciates Santee Prairie Scientific and Natural Area, a large prairie where he has heard a greater prairie chicken, and Glacial Lake State Park where, he says, "you can stand in the middle of the park and see nothing but prairie from horizon to horizon." Like many of us, he's aware of the concerning declines in populations of North American birds in recent decades, which have been widely reported in peer-reviewed publications like Science magazine as well as in the popular press. As a group, bird species that breed in grasslands have been hit especially hard, experiencing population declines of an estimated 53% since 1970.

Since the subset of prairies monitored by the SPICE project include many of the highest quality tallgrass prairie remnants in Minnesota, it stands to reason that grassland birds are faring better at these sites than in statewide breeding bird surveys that include more marginal sites.

Except for the fact that, as it turns out, they're not.

Glacial Lakes State Park in June
Photo by Mike Worland, MN DNR

Nongame Wildlife Program Biologist Mike Worland, holding a longhorned beetle
Photo by MN DNR

Declines of about 3% per year have been observed in Western meadowlarks, with greater declines on smaller, isolated sites than on larger sites.
Photo by Bob Dunlap, MN DNR

A recent review of the past 13 years of SPICE bird data found serious declines in many grassland bird species. The western meadowlark, an iconic species that, according to Worland, is known to "perch on top of structures like fence posts and sing its loud, clear, beautiful song," is still relatively common. "But we've observed a decline of about 3% per year for western meadowlarks and savannah sparrows in our project—greater on smaller, isolated sites than on larger sites." Other species have experienced even steeper declines on the SPICE sites. Grasshopper sparrows and upland sandpipers are declining 7% per year. "That might not sound like much, but you need to realize that, at that rate, half of that population is gone in 10 years. It tells us that it's not enough to build refuges within the state to protect these birds," says Worland. "Clearly, we need to think at much larger scales."

Worland hopes that awareness of the findings fuels action. He recalls the recovery of the Kirtland's warbler, a species he studied earlier in his career. When it was learned that the Kirtland's warbler would successfully breed in pine plantations, this federally listed endangered species—which was down to some 200 breeding pairs—began to recover. In 2019 the Kirtland's warbler was removed from the federal

list of threatened and endangered species. "We all need a livelihood," he notes, "and we all need to eat. It may be that part of the solution for grassland birds lies in grass-based agriculture—perennial crops that extend the habitat value of these refuges and also have benefits for people, like a source of income, better water quality and water storage. That could be their path to recovery."

In a 2017 paper published in BioScience (see Selected Resources), Brent Hughes and fellow investigators assert that studies of long duration "are essential to characterizing how and why nature is changing." When compared to studies of shorter duration, they are disproportionately cited in scientific journals, suggesting that they are foundational to the creation of new knowledge and more likely to inform societal and political decision-making. They "allow us to better understand the inherent variability of natural systems, to discern trends and shifting baselines and to witness rare events and unanticipated ecological surprises." The authors note key attributes of well-designed long-term studies, including consistent protocols, rigorous documentation, and having both basic and applied purposes: that is, obtaining knowledge as well as putting that knowledge to work.

Grasshopper sparrows are declining 7% per year.
Photo by Mike Worland, MN DNR

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MIKE WORLAND,
Nongame Wildlife Program Biologist

Informing management: The Grassland Monitoring Team

The Grassland Monitoring Team is another project that relies on this growing archive of data on Minnesota's prairies, making a big contribution on the applied side of things. Core members include Sara Vacek of the U.S. Fish and Wildlife Service and Marissa Ahlering of The Nature Conservancy (TNC), along with Daren Carlson of the Nongame Wildlife Program. While the Grassland Monitoring Team and SPICE share larger goals of prairie conservation as well as some personnel, the Grassland Monitoring Team takes a distinctly different approach.

The Grassland Monitoring Team supports the efforts of site managers with real-time information when it counts. Partners analyze monitoring data, track management practices undertaken and—through computer modeling designed for this purpose—generate management recommendations tailored to individual sites, projected out three years. Should you burn a particular native prairie next year? Should you graze it? Should you let it rest for a few years without any disturbance? Or would a combination of these increase the likelihood of the desired outcomes for ecosystem health?

For TNC Land Steward Eric Hoff, who is one of those managers, this is welcome insight. "I can tell you this: when I can get a management recommendation for a particular site from the Grassland Monitoring Team, I use it." Hoff is charged with the responsibility of making management decisions related to 25,000 acres of protected prairie in the Agassiz Beach Ridges landscape of northwestern Minnesota, along with a few sites across the border in North Dakota. These lands hold some of the best prairie in the state and offer important habitat for grassland birds and other wildlife. Native prairies have persisted here in part because the sandy beach ridges left behind by ancient Lake Agassiz made for poor cropland.

"Winter is planning time," says Hoff. The prairies are dormant, migratory songbirds have departed and the waterfowl—ducks, geese, swans—have moved through for the season. "I'll be out fixing fence, or meeting with tenants to hash out a grazing plan, and will visit different areas to make some chicken-scratch notes on site conditions, evaluating whether we've met our objectives, especially in terms of controlling invasive species.

"Plans for the upcoming season are generally ironed out by March, but we're also looking ahead to the following year. Budget and staffing are big considerations in what we're able to accomplish." The smallest units that Hoff oversees are 40 acres in size, the largest are 6,000. "The Grassland Monitoring Team management recommendations are helpful because they're specific: 'pasture x is due for x.'

> *"The Grassland Monitoring Team management recommendations are helpful because they're specific: 'pasture x is due for x.' Sometimes, the recommendation is to leave it alone, let it rest for a few years."*
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> **ERIC HOFF, Land Steward, The Nature Conservancy**

"Sometimes, the recommendation is to leave it alone, let it rest for a few years," he notes. The Team's analysis of long-term monitoring data has indicated that some of the highest-quality prairies benefit from less intensive management.

The Grassland Monitoring Team runs the model and publishes summaries of the data annually that are of broad interest to many managers, but site-level recommendations are issued only for prairies where ongoing monitoring of transects and reporting on management practices is done. As designed, it's power in numbers, a way to learn more and learn it faster than any single person could do on their own.

Eric Hoff (top left), The Nature Conservancy
Photo by The Nature Conservancy

Melissa Ahlering (top right), The Nature Conservancy
Photo by The Nature Conservancy

Sara Vacek (bottom), U.S. Fish and Wildlife Service
Photo by Fred Harris, MN DNR

Spring prairie at Glacier Lake State Park
Photo by Richard Hamilton Smith

The Grassland Monitoring Team's methodology puts it squarely in the realm of adaptive management. At its most basic, adaptive management is sometimes portrayed as doing what every farmer does: take note of what worked and what didn't work, then apply that knowledge to what you do next. But in the science of natural resource management, it means something else. "This is not trial and error," says Sara Vacek. "The model integrates variables that allow us to make a prediction about the condition of a given prairie, about what practices are most likely to bring it from one defined state to another. It's also different from a controlled study, in that we're learning from what managers *choose* to do (burning, grazing, etc.) without *requiring* them to do it. We learn whether they follow the Grassland Monitoring Team's recommendations or not, as long as the monitoring protocols are in place." The Nature Conservancy's Marissa Ahlering adds, "It doesn't replace a manager's own assessment based on their intimate knowledge of a site but, added to the mix, it reduces the uncertainty about what actions will bring about the desired result, which is a healthier prairie."

Both SPICE and the Grassland Monitoring Team offer broader insights into the northern tallgrass prairie ecosystem. They contribute to the scientific literature informing international efforts to preserve grasslands, complementing other long-term research in the state coming out of places like the Cedar Creek Ecosystem Science Reserve. "Grasslands are among the most imperiled ecosystems in the world," says Daren Carlson, "and there are things we can learn about them collectively through long-term monitoring that we can't learn any other way."

Meanwhile, the data keeps rolling in and the model is getting an update with the help of modeling, structured decision-making and adaptive management specialists. The door is always open to more collaborators. Like native prairies, many of the projects' complexities exist out of sight, but the benefits accrue to all, their value just increasing over time.

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