

IT'S BACK!

THE NONGAME WILDLIFE PROGRAM RETOOLS, REBOOTS STATEWIDE FROG AND TOAD CALLING SURVEY

Work begins at sunset, if the conditions are right. Snow, fog or a light drizzle are fine, full-on rain is not. Ideally, the air is calm, but a breeze of up to 12 mph—enough to gently stir the leaves on trees—is also acceptable. If your route is located in western Minnesota's Great Plains region, winds could be a bit higher, since wind moving through grasses is relatively quiet. If conditions aren't right, just wait for another night.

Every year from 1994 to 2017, volunteers serving as community scientists for the Minnesota Frog and Toad Calling Survey documented species heard along their assigned road routes across the state. As per the protocol, each route was run three times annually (early spring, late spring, and summer) to cover the progression of calling periods associated with different species throughout their breeding seasons. Identification was by sound alone. People who devoted their time to the survey—some for decades—attuned their own lives to this ancient natural calendar.

*Trembling shallows music,
the green frog sings
explosions
plucked in ragged rhythm
on deadened banjo strings*

L. Allmann



Green frog



Maggie (left) and Beth (right)

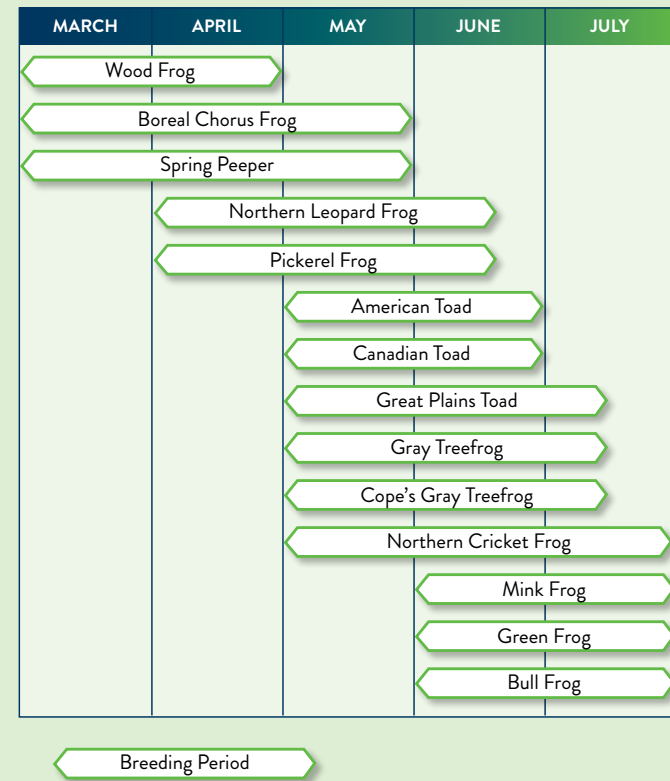
“My two oldest daughters, Maggie and Beth, would go with me,” says Kathy Fillmore, whose route was in a rural area of northwest Minnesota’s Marshall County. “They were three and five years old when we started. They loved it. I’d grab a snack for them, some blankets and pillows. As it got dark, we’d get in the van and head out of town. At each of the ten stops on our route, we’d listen. I’d ask, ‘Okay, what species do we hear? Is it a few or many?’ They weren’t just along for the ride. They got very good at it. We did it all through their high school years, so they basically grew up with it.”

In another corner of the state, Connie and Greg Olson’s route was near Hoyt Lakes in St. Louis County, where they have a little lake place. “We’d schedule our time up there to correspond with the three windows of the count,” says Greg, “then watch the weather channel once we got there, to pick the night we’d go out. The first one in spring came shortly after the water was open, basically just warm enough for the frogs to thaw out. The last one, in summer, we would have a long wait for dusk. It seemed to take forever for the sun to go down.”

As many as 170 survey volunteers were doing the same: waiting for dusk, often solo or in pairs. A route might take two hours to complete. Each time, the steps were the same. Driving along rural roads to reach your starting point. Stopping. Shutting off the engine. Listening for the requisite five minutes. Progressing to the next stop, and the next, until all ten are complete. Documenting species heard on a standardized datasheet, with codes for estimates of abundance. Afterwards, submitting the data to the MN DNR Nongame Wildlife Program.

Breeding Timeline

Calls from multiple species are often layered over each other. Some calls are unmistakable (a chorus frog’s ascending ripple, like a fingernail run across the teeth of a comb) while others are notoriously hard to distinguish unless heard side by side (an eastern gray treefrog from a Cope’s gray treefrog).



Modified from Hine, R. 1982. *Creatures of the Night*. Wisconsin Readers Rev. 29(1): 21 – 2.



Chorus frog, an early spring caller
Photo by Carol Hall, MN DNR

For this to work, participants had to become familiar with a new language—actually, a dozen languages. Each volunteer was given a CD with recordings of the vocalizations of Minnesota’s 14 species of frogs and toads, to learn the calls and to refresh their memories in subsequent years. An online quiz affirmed each volunteer’s ability to accurately identify calls by species. Compared to learning the songs of the more than 300 bird species in the state, it might be considered a relative cakewalk. But there are notable challenges, not the least of which is that calls from multiple species are often layered over each other, sometimes at decibels loud enough to make your ears ring. Some calls are unmistakable (a chorus frog’s ascending ripple, like a fingernail run across the teeth of a comb) while others are notoriously hard to distinguish unless heard side by side (an eastern gray treefrog from a Cope’s gray treefrog).

Most species don’t range statewide, so the actual number of species a volunteer might expect to hear on a given outing was more limited—which is not to say that they wouldn’t encounter the unexpected. It was a volunteer from the Frog and Toad Calling Survey who, in 2004, reported hearing cricket frogs along a route in Winona County. It was the first record of the species in the county and, at the time, was one of only three verified records statewide since 1980 for the cricket frog, a state listed endangered species in Minnesota.

FROG and TOAD SURVEY

When you talk to these volunteer community scientists, they'll tell you that doing the survey was something they looked forward to and enjoyed. They will also tell you that their motivation was rooted in the importance of the task at hand. They knew they were part of something bigger, something with the potential to help perpetuate those voices in the night and to alert us all to issues affecting human communities as well.

Earl Woolsey felt guilty about buying a newer truck back in 2004. "I don't know, it seemed kind of expensive. I thought, I'm going to make sure I get some use out of this truck to volunteer, to do some good with it." He lived just across the Red River in Grand Forks, North Dakota, and signed up for the

Minnesota Frog and Toad Calling Survey after finding the project on the MN DNR website. Thirteen years after he began, Earl and the truck were both still running, completing his survey routes across Douglas and Norman counties and sending in the data. As time passed, he grew increasingly curious about the degree to which climate change would shift the borderlines of the state's biomes—in his region, where prairie meets forest—and with them, the habitats and distribution of species like the treefrogs and American toads he had been documenting. "Different biomes favor different species," he says, "so you have to wonder what will happen as those borders move."



Earl Woolsey, survey volunteer

*"When I first started, finding these sounds in nature was really delightful. It was a surprise to realize that they'd always been there, but I'd just never really separated them from the background noise. Then, after learning their calls, I couldn't **not** hear them. I'd be watching TV and identifying the frog species calling on the X-Files!"*

EARL WOOLSEY, Survey Volunteer



Connie and Greg Olson, survey volunteers

Says Connie Olson, “Greg and I grew up in the time of Rachel Carson. We’re aware that frogs and toads are a way to measure all kinds of changes in the environment, be they for the better or, mostly, for the worse. So, when we read about the survey in the paper, it sounded interesting. We liked the idea that we could provide the researchers with data they’d be able to work with, data that they didn’t need to collect themselves, that they could put together with submissions from all the other volunteers to analyze.”

Exactly so.

The Nongame Wildlife Program initiated the calling survey in 1994, spurred by reports of precipitous declines in frog and toad populations around the world—but also in the general interest of good stewardship of the state’s biodiversity. From 2003–2015, Minnesota’s effort operated as part of the North American Amphibian Monitoring Program (NAAMP), managed by the U.S. Geological Survey.

This federal program was created to address urgent needs identified by the Declining Amphibian Populations Task Force, established in December of 1990 by the International Union for Conservation of Nature and

affiliated with the World Congress of Herpetology. An international meeting sponsored by the U.S. National Academy of Sciences earlier that year had affirmed the need for concerted effort to fill gaps in knowledge and produce “scientifically and statistically defensible, long-term distribution and trend data for calling frog and toad populations at both the state and regional level.”

This was not only about the well-being of frogs, toads and their kin, since humans also rely on water. It was in our own best interest to know. If amphibians were indeed disappearing, just how great were these declines, where were they occurring and why? Did this portend a biodiversity crisis at a broader scale?

“Why did I want to participate? I find contributing to scientific knowledge rewarding.”

STEVE WESTON,
Survey Volunteer

“I think the most lasting value is that the NAAMP dataset provides an important historical resource for scientists about frogs and toads. There is no time machine to go collect past information; datasets like NAAMP provide that window into the past.”

LINDA WEIR,
Longtime coordinator of the North American
Amphibian Monitoring Program (NAAMP)
for the U.S. Geological Survey

For the Nongame Wildlife Program and as many as 26 other partner organizations across the central and eastern U.S., NAAMP provided an administrative framework in the form of an interface for uploading and accessing data, managing volunteers, route locations and route assignments, and hosting the online call ID quiz. Data were also made available to the larger scientific community for purposes of research. When NAAMP support ended in 2015, partners retained access to their valuable historical data but were faced with the need to develop their own infrastructure—both a challenge and an opportunity. The Nongame Wildlife Program opted to conduct its survey through the 2017 season, then took a hiatus to retool, with plans to reboot the survey in 2023.



Gray treefrog
Photo by Carol Hall, MN DNR



MN DNR Nongame Wildlife Researcher Krista Larson with a northern leopard frog
Photo by MN DNR

“There’s no question that we needed to continue the Frog and Toad Calling Survey in Minnesota. Amphibians are the most imperiled group of animals in the world. If you’re going to be monitoring anything, it should be amphibians,” says MN DNR’s nongame wildlife researcher Krista Larson. Recent research unfortunately reinforces the ongoing urgency. In a 2020 paper published in the journal *Herpetologica*, investigators Evan H. Campbell Grant and co-authors synthesized field data from more than 100 study sites across North America and Europe, reporting steady rates of decline in the number of sites occupied by amphibians. The authors state: “Expressed at the community level, this is consistent with average species richness of amphibians at any location declining at a rate of 50% every two decades.” Clearly, we still have work to do.

Many benefits have been derived from the earlier data collected by volunteer community scientists in Minnesota. “First, I think it’s so cool that it was a volunteer from the Frog and Toad Calling Survey involved in the rediscovery of cricket frogs in the state, a species that for many years we thought had winked out,” says Larson.

“The data also gave us a way to track potential trends like the expansion of bullfrogs beyond their previous range in the state, and declines of spring peepers in urban areas.”

Calling Survey data sets have been a key resource for planning. They have been used to determine the list of Species in Greatest Conservation Need that sets priorities for action under Minnesota’s Wildlife Action Plan. They have also been used to focus targeted surveys by the MN DNR Minnesota Biological Survey and as a metric (performance measure) for the MN DNR’s Conservation Agenda, a 10-year strategic plan that guides the agency as a whole. Species distribution maps (see figures 1 and 2) will continue to inform the state’s understanding of population trends.

“There’s so much more that can be gained by digging into this data,” says Larson. “While NAAMP offered large-scale regional analyses, the state-level species occupancy trend analysis has been our role all along,” says Larson.

The most recent analysis of state-wide trends (1998-2015) indicated increases in the number of routes where two species were heard: the green frog and Cope’s gray treefrog. Survey results

Figure 1

MINNESOTA ROUTES SURVEYED FOR THE GREAT PLAINS TOAD (ALL YEARS)

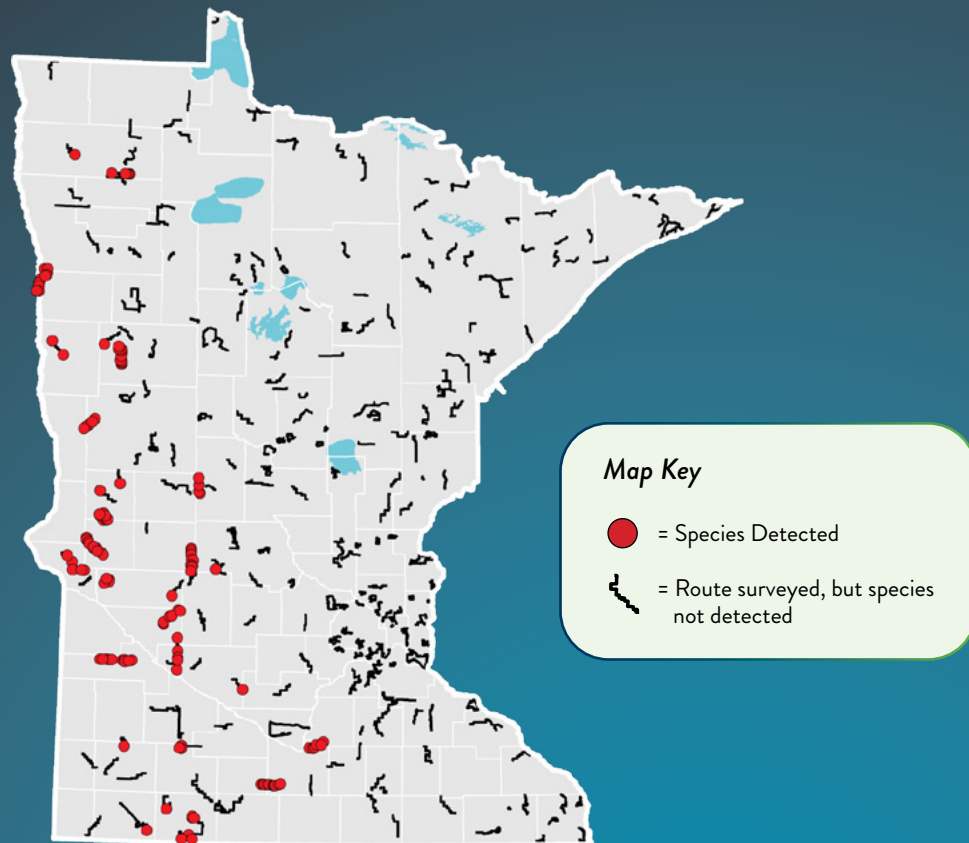
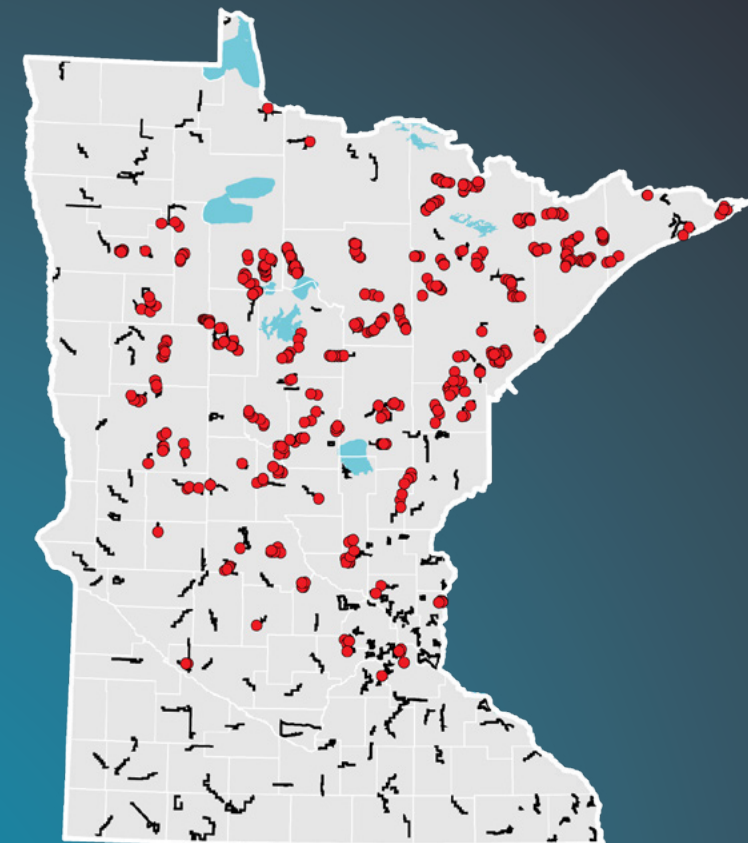


Figure 2

MINNESOTA ROUTES SURVEYED FOR THE MINK FROG (ALL YEARS)





Mink frog
Photo by Kristi Coughlon, MN DNR

did not point to statistically significant changes in abundance of species statewide over this period, which is not to say that there weren't changes in populations in parts of the state.

There are nuances in the interpretation of the data, says Larson. "You can't presume a species to be stable just because statistically significant changes haven't shown up in analyses. Sometimes a trend is evident but just shy of the standard for statistical significance. In other cases, you have to consider the limitations of the survey itself. It's a bit of a leap to say that pickerel frog populations are stable, for example, because they only breed in backwaters of rivers and streams in southeast Minnesota, where we haven't had enough survey routes to show a change one way or the other. Then there's the Great Plains toad, a little more widely distributed, found in the western prairie part of the state. They breed in a super short window, calling explosively after torrential rains, then shut down again, and don't necessarily breed every year, which makes them very hard to detect. So, these are two species that are going to require a different approach, an expansion of routes or a more targeted survey to really understand what's happening. There are also some routes that have historically gone unfilled, that need volunteers to take them on. People tend to gravitate toward routes with the greatest number of species and volume of calls, but negative data is super important for the science. If you're finding a site that used to have species and now it doesn't, that's exactly the kind of thing we need to know."

“I had one site that was really kind of my favorite site because I could hear several different species of frogs throughout the three calling periods each year. And there were a couple types of toads there, American toad and also Great Plains toad. The site had been pasture land for many, many years, probably 30 to 40 years; there was a wetland area and at least one pond out there. Then, the site ended up getting converted to annually cropped lands.

The dugout pond had been filled in and it was cropped from fencerow to fencerow. It had been about an 80-acre pasture. And all I could pick up and hear after that was a wood frog.

And all I could think is, oh my gosh, what a change that is. I’m sure it was related to less water, less habitat, probably fertilizer and chemical application. It was kind of sad, it really bothered me because every year after that it was the same thing; it just didn’t have the variety of species and the quantity of species that had been there previous to that. It was really an eye-opener for me and for my kids to hear the difference. You get used to these places, and know what you’re going to hear, and all of a sudden it’s not there.”

KATHY FILLMORE, Survey Volunteer



Nongame Wildlife Program
Biometrician Chris Jennelle
Photo by MN DNR

New with Minnesota’s reboot of the Frog and Toad Calling Survey is Biometrician Chris Jennelle, who recently joined the Nongame Wildlife Program team. The field of biometry, he explains, applies statistics to biological systems. “You might say I’m a kind of statistical architect,” Jennelle says. It’s a necessary skill set in researching wildlife populations and their environment, which are complex, dynamic and ever changing. “When we make observations in nature, we can never know the full truth. Biologists spend large parts of their careers counting stuff and then working to make sense of the counts they make

in space and time. With surveys like this, we’re basically getting snapshots—a sampling—of what populations are doing. To make sense of that, we have to use statistics and theoretically-grounded methodology to build models with variables we think are influencing the patterns we observe in nature, with protocols for how data is collected that are rigorous enough so that these models are defensible. It allows us to have confidence in the inferences we make about the results; in this case, the conclusions we draw about frog and toad populations in Minnesota.” Inputs into models include the data provided by survey volunteers but also a host of co-variables: that is, other factors that might influence observations, such as weather conditions, time of year, duration of listening periods and landscape characteristics.

Together, the sampling design, data collection and underlying model structure can provide a useful representation of what is happening to a species across its range. It’s not a complete picture, but it can be meaningful. “It serves as a signal detector, a kind of trip wire to detect trends,” says Jennelle. “If we analyze the data in the context of the model

and note an apparent drop in a species' relative abundance, especially if it continued over a period of years, we'd know that we have to pay more attention. The wire has been tripped. That's the first pass. The power of the science that we do is that we can follow up on that result with more focused study design that might be at a finer scale, that could help affirm the decline and ideally detect the processes that are driving those declines—whether it's predation, contaminants, disease, habitat degradation, a combination of these or something else. That can guide our recommendations for conservation management.

“If we just surveyed opportunistically, where convenient, or without such a systematic, statistical approach,” says Jennelle, “we might never know that a species is getting hammered or might not realize it with enough time to act on the knowledge. We'd be basically blind to the biological loss of the species.”

In addition to advising on the study's foundational issues, as a self-described “keyboard jockey,” Jennelle will code the statistical models and algorithms, pull in raw survey data from the database, analyze it statistically, and—together with Nongame Wildlife Program biologists—write up the results in the context of the survey's objectives. He doesn't lose sight of the fact that the quality of any inferences to be made is rooted in the quality of the data collected, which is owed to the diligence of people in the field conducting the surveys. “Part of my role is making sure that the efforts they're going through are worth it in the end,” Jennelle says.

Transitioning from the earlier calling survey to the new, rebooted survey presents logistical issues for the entire team operating the program. Jennelle likens the process to extending an old railroad track with new track, making sure they align and the train that started rolling back in 1994 will be able to run smoothly the whole length of the track.



American toad
Photo by MN DNR

“I am more than happy to volunteer my time to help the MN DNR discover trends in the state's frog and toad populations, so intervention can be made before an irreversible population decline occurs.”

FRAN HOWARD, Survey Volunteer

For Nongame Wildlife Program biologist Mags Edwards, the process has meant taking on the painstaking work of ground-truthing locations of the stops on prior routes to be sure that narrative descriptions of the routes and GPS coordinates are all current, accurate and in agreement. Many routes were originally established from starting and ending locations provided by the USGS, from which volunteers had to figure out a route and 10 stops (listening points). “This was pre-GIS, so people were using the odometers on their cars and their personal wherewithal to describe these things,” Edwards says. Descriptions like, “west of road by the

little white shed” or “field approach on south side of 45, aspen clump to the east” may have worked fine as reference points for someone already familiar with an area, but not for a person new to the route, especially in the dark. Even features that were once prominent in a landscape may no longer exist. Going forward, many volunteers will be able to use their smart phones for navigation, but not everyone has one, and not every location has cell service. Maps and physical descriptions still have an important place in the calling survey.

Edwards is also heading up the effort to get

more people involved as community scientists in the other projects of the Nongame Wildlife Program. “I think that anyone in Minnesota who wants to participate in something like this should be able to, and I’m really committed to its being inclusive in terms of diversity, that everyone feels welcome.” Like any aspect of the Nongame Wildlife Program’s work, to be successful, it will require adequate staffing and resource levels dedicated to the purpose: a worthwhile investment that can help the program accomplish its aims while also raising public awareness of challenges facing wildlife in our state.



“The original NAAMP survey set the stage and established the baseline long-term monitoring dataset, and we now have an opportunity to build on what we’ve learned and add nuance to the survey to better suit our frog and toad conservation goals for Minnesota. As a team, we’re actively looking at the existing data, reevaluating our research questions, looking into how other states have also moved forward in more focused ways, and making a concerted effort to ensure that the survey design and protocols are giving us the information we need. It’s exciting!”

MAGS EDWARDS, Nongame Wildlife Program, Community Science Coordinator

Photo by MN DNR



Where's the frog? Blanchard's cricket frog with its trademark blaze
Photo by Krista Larson, MN DNR


Even when up and running with a full complement of community scientists, Minnesota's Frog and Toad Calling Survey is just part of the Nongame Wildlife Program's vision for conserving healthy populations of the state's fourteen frog and toad species. It is uniquely valuable for its systematic design, with protocols and constraints that generate consistent long-term data for scientific analysis of both species distribution and abundance. But it is one of many initiatives in the hopper, so to speak. Among these, the Nongame Wildlife Program is pleased to have struck a working partnership with HerpMapper, a community science project with a free, publicly accessible mobile app designed and led by a group of midwestern herpetologists. The app allows anyone to upload photos and recordings of reptiles or amphibians from any location. Under the agreement, the MN DNR will be able to download cricket frog data from the site and also offer guidance on where people might consider listening or looking for these rare frogs.

"We really do need a deeper bench on this," says Lisa Gelvin-Innvaer, Nongame Wildlife Program biologist who lives and works in the southwest region of the state. "There's a fleeting sweet spot for doing these seasonal surveys, and it's good to have more eyes and ears out there." She also points to conservation projects that—while not exclusively targeting frogs and toads—serve to benefit their populations and the ecological community as a whole. "For example, stream restoration projects like the one at Lower Mound Creek in Blue Mound State Park," she says, "where they decided to restore the creek after a

dam blew out from extreme flooding. And efforts to provide better technical guidance during environmental reviews of proposed construction or other developments, having early coordination with a project so that we can avoid unintentional negative impacts. We'd like people to know that these are not isolated efforts. It's an overall integrated approach under the Wildlife Action Plan that benefits people too, whether it's reducing erosion and flooding or protecting water supplies. There is the absolutely necessary science that we do, and then there is that connection you get when you work closely with a species in the environment and you see not only what individual animals and populations face but how they fit into the bigger scheme. We also learn a lot from people who are actually embedded in these landscapes. Local landowners are among our best sources of information and make such an important contribution.”

There is no denying the gravity of the continuing global declines in amphibian populations. If there is a bright spot—or at least, a takeaway to inspire action—in the synthesis of evidence put forth by Grant and colleagues in the recent *Herpetologica* paper, it is that there is a wide degree of variation in these

declines, by species and by region. Further, there is no one-size-fits-all ranking of the threats driving declines, since amphibian species and populations in different places demonstrate differing sensitivity to threats. In other words, Minnesota must define for itself the status of populations here and respond to the unique situations as they are playing out at the local level. The rebooted, redesigned Frog and Toad Calling Survey will put us in a better position to understand what is happening and move the dial in a good direction.

Doing community science in fairly remote places—in this case, listening for frogs and toads after dark—may not be everyone's choice as a volunteer project. But for others, those very qualities have a distinct appeal. “I'll be glad when the calling survey starts up again,” says Nick Krueger, a Montevideo physician who, together with his wife, Donna, surveyed a route near Bunde, Minnesota. “It became part of my identity. We're frog spotters, which is to say, *hearers*,” he laughs. “The frogs and toads add to the diversity of nature here, but they're also part of the beauty for us, the beauty of the soundscape. It's good to take time to be amazed at the world.” 



Nick and Donna Krueger, survey volunteers

“They're indicator species for your water quality. They're food for other critters. Everything matters.”

DONNA KRUEGER, Survey Volunteer

SELECTED RESOURCES

Eastern Ecological Science Center. (2016, December 8).
North American Amphibian Monitoring Program. USGS. Retrieved from
<https://www.usgs.gov/centers/eesc/science/north-american-amphibian-monitoring-program>

Grant, Evan H. Campbell; David A.W. Miller, Erin Muths. (2020, June 23).
A Synthesis of Evidence of Drivers of Amphibian Declines. *Herpetologica*, 76(2), 101-107.

HerpMapper. (n.d.). *Global Herp Atlas*. HerpMapper. Retrieved from
<https://www.herpmapper.org/>

HerpMapper. (n.d.). *Frogs and Toads of Minnesota*. Minnesota Amphibian & Reptile Survey.
Retrieved from https://www.mnherps.com/group/frogs_and_toads

Minnesota Department of Natural Resources. (2022, August 12).
Volunteer with DNR. Minnesota Department of Natural Resources.
Retrieved from <https://www.dnr.state.mn.us/volunteering/index.html>

Minnesota Department of Natural Resources. (2016). *Minnesota's Wildlife Action Plan*.
Retrieved from mndnr.gov/mnwap

Minnesota Department of Natural Resources. (n.d.). *Rare Species Guide*.
Retrieved from mndnr.gov/rsg

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Cope's gray treefrog

