Researchers pore through dusty records, modern databases to identify every creature and plant in Minnesota

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Some of the records are in journals filed away in cabinets of small universities around the state. Some are in the hand-scribbled notes that

priests and nuns used a century ago to teach about Minnesota's plants. Others are in the meticulously kept collections, computers and notebooks of professors, bird watchers and botanists.

Now the goal is to get all known records of every living thing that's been found in Minnesota into a single public online database—the Minnesota Biodiversity Atlas.

"There might be a specimen of a very rare thing in some of these smaller collections," said George Weiblen, the science director of the University of Minnesota's Bell Museum. "That's where we find these little gems. The answers to some of our big questions are potentially sitting in a cabinet somewhere, and now is the time to get them, before we lose a lot of these old notebooks."

Weiblen and other researchers with the Bell Museum are painstakingly expanding the atlas to include the collections and biodiversity records of other colleges, agencies and nonprofit groups across the state. This month they began adding thousands of insect, plant and animal records from Concordia College and Minnesota State University Moorhead.

When it's finished, the atlas will offer the most comprehensive record ever made of living things in the state and offer biologists and wildlife managers a powerful tool to find out where and why species are struggling the most, and where they are thriving.

The work comes as the world faces a mass extinction crisis, as countless species in Minnesota and the Upper Midwest are being lost to habitat destruction, climate change and pesticide use.

The biodiversity atlas doesn't just show what's been lost, but is used to map out how certain species are spreading and predict where plants and animals are going to be in the near future, Weiblen said.

"Our environment is changing faster than ever before in human history," he said. "Change is challenging for all of us. We don't like change. We don't like things we can't control. But those are two of the most fundamental aspects of nature. So we're going to need to adapt."

The online atlas was created in 2016 with the digitization of the Bell Museum's vast records in St. Paul. It's now grown to more than 650,000 records of plants and animals, ranging from beetles and minnows to moose and bear.

It's already helped scientists understand one of the region's more drastic die-offs.

In 2019, researchers at the College of William and Mary in Virginia used the atlas, along with similar databases in Wisconsin and other parts of the Midwest, to find out when the massive decline of monarch butterflies began. The leading theory at the time had been that herbicides used on genetically modified crops over the last few decades killed off the milkweed that monarch caterpillars needed to survive.

But researchers found that Minnesota's milkweed has been steadily disappearing since the 1940s, long before modified crops were widely used. The consolidation of smaller farms and the loss of farmland to development most likely the main factors in the decline of monarchs, the study concluded.

"It's research like that that really helps us decide where we need to focus our efforts here," Weiblen said.

The collections at Concordia College and Minnesota State Moorhead will help fill in a gap in the atlas of western Minnesota species, especially insects.

Concordia has collected more than 4,500 specimens of insects, including tiger beetles, a wide variety of bees and other prairie natives, said Joseph Whittaker, a biologist and professor at Concordia.

"The great thing about this is that it makes these collections and this data really approachable for the public," he said. "It will help scientists who need to find specific specimens to study genetics, and it's going to help third grade teachers and students and just interested people find the spread of rare species, and learn more about what's in their backyard."

While the atlas does show species in decline, it also shows an impressive resilience of wildlife, Weiblen said.

Minnesota's recent history shows how quickly species can bounce back if given the right attention, he said, pointing to the recovery of eagles, wolves and peregrine falcons.

Sometimes the solutions are relatively simple and cheap.

Digging out a series of shallow oxbow ponds a few feet deep and less than 100 yards long seems to have entirely saved one of Minnesota's most endangered fish—the Topeka shiner.

The towering old cottonwood trees that have been dying off in the Mississippi River's floodplains are starting to come back. It just took digging small trenches to provide a fresh layer of silt for seedlings to take root, Weiblen said.

"Sometimes we just have to pay attention, we just have to get out there and look at stuff," he said.

The hope is the atlas will encourage more people to start logging what they see and when, and to keep adding more observations.