

Early-nesting ducks at increased risk due to changes in climate, land use

April 25 2023, by Jeff Mulhollem



The researchers focused on nine duck species that have traditionally used the Prairie Pothole Region as their breeding grounds: American wigeon, blue-winged teal (shown here), canvasback, gadwall, mallard, northern pintail, northern shoveler, redhead and ruddy duck. Credit: Delta Waterfowl

Each year approximately 10 million waterfowl fly north to their breeding grounds in the Prairie Pothole Region of North America, but the landscape that greets them has changed. Weather patterns and agricultural practices have significantly transformed the pothole-dotted native grasslands that waterfowl have used for thousands of years.

These changes have resulted in some waterfowl proliferating while others decline. According to a new study by a Penn State-led research team, nesting date is an important factor in determining winners and losers in the Prairie Pothole Region.

Waterfowl nest in a variety of habitats in the region, including idle grassland, cropland and over water, according to team leader Frances Buderman, assistant professor of quantitative wildlife ecology.

"But when early nesting ducks arrive in the Prairie Pothole Region, many fields are covered in debris left from the previous fall's harvest, mainly stubble from cereal grains," she said. "Although this habitat looks inviting, the eventual replanting of these fields, as opposed to leaving them fallow, makes the ducks more vulnerable to predators and often results in their nests being destroyed by [agricultural activities](#) such as tilling and planting."

The U.S. Fish and Wildlife Service and the Canadian Wildlife Service have monitored spring population abundances for North American waterfowl using the Waterfowl Breeding Population and Habitat Survey since 1955—producing one of the largest datasets on vertebrate populations in the world.

These ducks are adapted to nest in mixed-grass prairie, and as that wild habitat has largely been replaced by agriculture in the Prairie Pothole Region, the birds are confused, Buderman explained.

"Last year's stubble looks good to them from the air, but in reality, it does not offer the same advantages and protections that the grass does," she said. "Over time, on a large scale, this association with cropland can lead to lower reproductive success and declining [population numbers](#) for early-nesting ducks that breed in the region."

In earlier research, Buderman's research group in the College of Agricultural Sciences focused on northern pintail ducks, a species that has been in decline since the 1980s. They identified the proclivity of northern pintails to nest in agricultural fields as an "ecological trap" because the number of pintail the following year—a product of demographic processes, such as reproduction and survival—declined with increasing use of cropland.



The Prairie Pothole Region, which spans the northern Great Plains of the United States and Canada, is the most important breeding area for many duck species on the continent. Credit: Penn State. [Creative Commons](#)

However, the researchers were left wondering if the response of northern pintail was unique, possibly providing an explanation for the diverging trends in abundance among waterfowl in the region.

In findings published on April 24 in the *Journal of Animal Ecology*, Buderman and colleagues report that the timing of nesting is a key factor in determining the effect of nesting in cropland on demographic processes. Early nesting ducks had the strongest negative demographic responses to agricultural fields.

"This isn't to say that all early nesting waterfowl are going to struggle," Buderman said. "Early-nesting ducks that don't nest in cropland, and diving ducks such as canvasbacks, nest over water and are not likely to be impacted by this trap. Climate change, which may allow farmers to till and plant earlier in the spring, could make matters worse. An earlier spring warm-up could also lead to a mismatch between nesting activities and food availability."

To reach their conclusions, the researchers analyzed data from the Waterfowl Breeding Population and Habitat Survey from 1958 to 2011 and focused on nine [duck](#) species that have traditionally used the Prairie Pothole Region as their [breeding grounds](#): American wigeon, blue-winged teal, canvasback, gadwall, mallard, northern pintail, northern shoveler, redhead and ruddy duck.

The researchers estimated species-specific responses to climate and land-use variables in the region, which has changed from mixed-grass prairie to fields of cereal grain, oil crops, corn, wheat, sunflower and soybean.

They first estimated the effects of changes in climate and land-use variables on habitat-selection and [population dynamics](#) for the nine species, evaluating species-specific responses to environmental change. This allowed the researchers to see patterns in species-level responses and identify where species selected for variables that were detrimental to their population dynamics (such as northern pintail and cropland).

They found that northern pintail, American wigeon and blue-winged teal often had extreme responses to changes in habitat, although not always in the same way, Buderman pointed out.

"Each of the species we studied reacted a bit differently to changes in climate and land-use," she said. "We observed species-level differences in the demographic and habitat-selection responses to climate and land-use change, which would complicate community-level habitat management. Our work highlights the importance of multi-species monitoring and community-level analysis, even among closely related species."

More information: Frances E. Buderman et al, A life-history spectrum of population responses to simultaneous change in climate and land use, *Journal of Animal Ecology* (2023). [DOI: 10.1111/1365-2656.13919](#)

Provided by Pennsylvania State University

Citation: Early-nesting ducks at increased risk due to changes in climate, land use (2023, April

25) retrieved 27 April 2024 from <https://phys.org/news/2023-04-early-nesting-ducks-due-climate.html>

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