DUCKS UNLIMITED

SCIENCE SPOTLIGHT 2021

What Science Means to DU

Since its founding, Ducks Unlimited has embraced a scientific approach to conserving wetlands and associated uplands that support North America's waterfowl populations. More recently, DU's application of science has expanded to increase understanding of how habitat conservation affects ecosystem services (e.g., water quality, flood mitigation) that directly improve human health and livelihoods. This approach ensures DU's conservation actions continue to sustain waterfowl populations while increasing their relevance and benefits to broader segments of society.

DU's Science Vision Statement

To strengthen Ducks Unlimited's vital science foundation through a robust internal science team and innovative partnerships that integrate data-based decision making to effectively and efficiently advance the conservation of waterfowl and their habitats in North America, as well as to recruit, retain, and engage a dedicated and diverse group of conservation professionals and conservation supporters.

DU's Science Priorities and Approach

Ducks Unlimited has a choice of where we invest our science resources and capacity. Activities that address our greatest uncertainties, in our most important geographies, and provide the greatest opportunities to advance our conservation mission invariably receive highest priority. Across our 3 organizations, DU's science activities can be classified into 6 thematic areas: 1) conservation program planning, delivery and adaptation, 2) ecosystem services and human dimensions, 3) sustainable agriculture, 4) implications of climate change for conservation, 5) species of concern, and 6) development and refinement of the International Conservation Plan.

Developed to complement our International Science Report, this Science Spotlight details a subset of the more than 100 projects in which DU Inc., DU Canada, and DU de Mexico were collectively engaged or supported during FY2021. Also highlighted in this report are some of the students and researchers leading these projects, a list of the DU Fellowship recipients in 2021, and other science insights from across our organizations. Ducks Unlimited is proud to collaborate with these outstanding students, researchers, and conservation partners, and we look forward to their continued and future leadership for science in support of waterfowl and wetlands conservation.

PROJECTS NEAR COMPLETION

*RESPONSE OF WILD BEE DIVERSITY TO MANAGEMENT OF RESTORED WETLANDS IN AN AGRICULTURAL LANDSCAPE

Molly Jacobson (MS student) & Dr. Mike Schummer, State Univ. of New York – ESF

Across North America, millions of acres of degraded and converted wetlands have been restored to provide critical habitat for a wide variety of wildlife species and ecosystem services like water filtration, carbon sequestration, and biomass production. Notably, hundreds of species of migratory birds use wetlands at some point during the annual cycle. Restored wetlands are often managed with habitat and population goals for target bird species in mind, particularly waterfowl. Management techniques include the use of water control structures that allow land managers to seasonally flood or draw down water levels of wetlands. Manual dewatering mimics historic cycles that may have been previously disrupted and promotes plant communities desirable as waterbird habitat. However, we often lack information about how these management actions affect other types of wildlife, such as invertebrates, which have a tremendous impact on plant and animal communities.

North America is home to over 3,500 species of native bees, from gigantic carpenter bees to tiny fairy bees, as well as thousands of species of other wild pollinators such as flower flies, wasps, and even some beetles. These insects contribute substantially to pollination of wild and crop plants, and many are in decline due to habitat loss and other factors. Habitat creation for pollinators has mostly targeted agricultural fields, prairies, and residential areas, leaving cover types such as wetlands severely understudied for their potential to provide resources for wild bees and other pollinators.

We conducted surveys for wild bees and flower flies at over three dozen wetlands in the Montezuma Wetlands Complex and Seneca Meadows Wetlands Preserve in central New York in 2019 and 2020. Our objectives were to characterize the pollinator assemblages in restored wetlands, describe floral resources available to them through concurrent plant surveys, and determine if water level management affected the diversity and types of pollinators using the habitats. One of three drawdown types were applied to each site annually: full drawdown (all water removed over the course of the growing season), partial drawdown (20–50% dewatered), or passively managed (no active drawdown).

Over 80 species of bees, and nearly 40 species of flower flies, were documented in the restored wetlands, including several rare species known to occur only in wetlands. Few differences were found in the diversity or composition of pollinator assemblages among management treatments, indicating that most of the bees and flies using wetlands are generalist foragers that will visit many wetland flowers, in habitats ranging from moist-soil units to deep-water marshes. Bees likely move from the surrounding landscape to heavily used wetlands when flowers are at their peak in late summer and early autumn, a time when resources in uplands can be scarce. However, we found that increased amounts of open water and invasive plants like common reed and narrow-leaved cattail resulted in decreased bee and flowering plant diversity.

New information from this research should aid conservation efforts for pollinators by showing that restored wetlands provide important habitat to support wild bees and flower flies. Our findings suggest current management techniques offer a variety of floral resources by creating unique habitats through different drawdowns. Maintaining habitat diversity at the landscape scale can simultaneously support generalist and specialist pollinators, and controlling invasive species can make room for more plants that are attractive to pollinators.

STUDENT SPOTLIGHT

Molly Jacobson

Molly Jacobson graduated in May 2021 with her MS degree in Conservation Biology from the State University of New York College of Environmental Science and Forestry, studying the effects of wetland management regimes on wild pollinators. Originally from Merrimack, New Hampshire, Molly received her BS degree in Wildlife and Conservation Biology from the University of New Hampshire in 2017 and published her honors research on bumble bee declines in the northeastern US. While she has been passionate about entomology from a young age, an ornithology course during undergrad sparked a love of birds as well. Molly is an avid birdwatcher and has worked with birds for the US Fish & Wildlife Service and New Jersey Audubon. She enjoys photography, native gardening, and teaching others about the critical connections between plants, insects, and birds that sustain ecosystems, in the hopes of encouraging more people to manage their land in a wildlife-friendly way.

*BEHAVIORAL RESPONSES OF BREEDING DUCKS TO UNMANNED AERIAL VEHICLES

Mason Ryckman (MS student), Dr. Susan Ellis-Felege, Dr. Brian Darby, & Dr. Gregory Vandeberg, Univ. of North Dakota; Kaylan Kemink, DU-GPR

Waterfowl biologists rely on breeding bird surveys to inform harvest regulations and understand annual variability in productivity. Unmanned aerial vehicles (UAV) are becoming a popular tool for conducting waterfowl surveys. Purported benefits of UAVs over standard surveys include easier access to rugged terrain, reduced observer fatigue, improved count accuracy, and reduced disturbance to wildlife. Most evidence of lower disturbance, however, is based on anecdotal observations and studies lacking true controlled designs. Adverse behavioral responses by breeding ducks to the presence of UAVs could reduce time devoted to survival and reproductive activities and may affect the accuracy of counts if birds flush during the survey. We conducted comparative surveys in the Missouri Coteau of North Dakota to evaluate how breeding dabbling ducks respond to UAV surveys. Specifically, this project evaluated behavioral responses of dabbling ducks in two reproductive stages: 1) as pairs on wetlands (April–May) and 2) as nesting females (May–July).

We surveyed pairs with a DJI Matrice 200 rotary-wing UAV flown at approximately 150 feet above ground level and recorded their behaviors using GoPro cameras attached to spotting scopes. In addition to behavioral observations of focal pairs, observers conducted scan surveys to assess responses across the entire wetland. During the spring of 2020, we conducted 42 pair surveys and recorded behavioral footage of 151 blue-winged teal and 46 northern shoveler pairs, including control birds that were not surveyed with the UAV. Both species increased overhead vigilance during the survey, tilting their head presumably at the aircraft. Blue-winged teal became less active during the UAV flight while northern shovelers became more active. While flushing was rarely observed on focal pairs, ducks at 38% of wetlands surveyed with the UAV did flush. Distance between UAV launch site and wetland edge was the best predictor of whether ducks swam for cover or moved away from the UAV. Behavioral responses of breeding ducks to UAVs are unlikely to cause major consequences in reproduction and survival, but flushing or moving may lead to double counts or failed detection during the survey.

To assess behavioral responses of nesting females to UAVs, we conducted 39 UAV flights during the 2019 and 2020 field seasons, resulting in behavioral footage from 51 nesting hens. We used a fixed-wing Trimble UX5 and rotary DJI Matrice 200 to elicit behavioral responses, and we collected footage of behavioral responses from small surveillance cameras deployed adjacent to nests at ground level. The UX5 was flown at 260 feet above ground level due to flight limitations and the Matrice 200 was flown at two altitudes (115 and 260 feet), as previous studies used the lower altitude of 115 feet to identify nests from UAV-mounted thermal sensors. We documented 5 instances where a female flushed from the nest in response to the Matrice 200 flight (1 blue-winged teal and 4 gadwall), but we observed no hens flushing in response to the fixed-wing UX5 flights. Blue-winged teal and gadwall increased their time spent on alert behavior during the flight period, extending their neck away from the body to scan their surroundings.

Results from this study suggest that rotary wing UAV may incite flushing behaviors that could alter bird detections or nest counts. Nevertheless, UAVs likely have less impact on duck behaviors than current methods of nest searching that detect birds only when they flush. As technology advances and higher quality sensors become available, researchers may be able to fly UAV surveys from higher altitudes with fixed-wing drones to effectively count ducks and detect nesting hens with less disturbance.

STUDENT SPOTLIGHT

Mason Ryckman

Mason Ryckman, a North Dakota native, received his BS degree in Wildlife Management from Valley City State University. Throughout his time at Valley City, he volunteered for the local DU chapter. After obtaining work experience with waterfowl and wildlife management for a couple years, he began his pursuit of a MS degree in the Biology Department at the University of North Dakota. Mason's research focused on the behavioral responses of breeding ducks to Unmanned Aerial Vehicles (UAV) during aerial waterfowl surveys. Mason is an avid sportsman and enjoys hunting, fishing, trapping, and bird watching. He currently works as the waterfowl management technician for the North Dakota Game and Fish Department.

*MALLARD BODY MASS VARIATION WITHIN AND AMONG WINTERS IN THE LOWER MISSISSIPPI ALLUVIAL VALLEY OF ARKANSAS AND MISSISSIPPI

John Veon (MS student), Dr. Brett DeGregorio, & Dr. David Krementz, Univ. of Arkansas-Fayetteville and USGS Arkansas Coop. Fish and Wildlife Research Unit; Luke Naylor, Arkansas Game and Fish Commission

The Lower Mississippi Alluvial Valley (LMAV) is one of the largest wintering areas for waterfowl in the United States. Some ducks fly 1,500 miles or more during fall migration to reach these wintering grounds, endure the challenges of hunting season and harsh winter conditions, then repeat this grueling journey as they migrate back to breeding grounds in the spring. For this reason, wintering waterfowl face the daunting task of needing to increase or maintain energy reserves by alteration of body mass during an environmentally challenging period.

Because body condition and survival of waterfowl during winter is thought to be primarily driven by food availability, state and federal wildlife agencies and non-profit organizations expend considerable resources to conserve and manage foraging habitats for overwintering waterfowl. Despite these efforts, temporal trends in winter waterfowl body condition (i.e., body mass) and factors influencing it in the LMAV are uncertain. Some researchers suggest that body mass has increased over long periods of time in response to habitat management and changing weather patterns, while others argue that increases are due to a shift in wintering destinations, which has reduced migration distance, conserved energy, and enabled gains in body mass. We designed this study to examine long-term changes in waterfowl body mass in the LMAV and investigate relationships between body mass, weather, and land management strategies.

We measured body mass of harvested mallards from cooperating hunters at duck hunting clubs, public wildlife management areas, and at duck processing businesses at multiple locations throughout the LMAV of Mississippi and Arkansas. The objectives of the study were to 1) document trends in body mass of harvested mallards in the LMAV since 1979; 2) explore the intrinsic (age, sex) and extrinsic (weather, river gage height, etc.) factors that most affect body mass of mallards; and 3) explore correlations between mallard body mass and waterfowl habitat management performed in the vicinity of their harvest site to investigate the potential influence of land management.

* DENOTES A STUDENT-LED PROJECT

Our preliminary results suggest that body mass of harvested mallards within the LMAV increased from 1979 to 2021. On average, body mass of harvested mallards increased by >50 g during this time period. Preliminary results also reveal declines in mallard body mass over the course of duck hunting season, likely due to the combination of mallards attempting to attain optimal weight for spring departure and decreases in food resources during winter. Additionally, we found evidence of greater body mass of mallards following rainfall events and rises in river gage height. Body mass appeared most likely to be greater with rising water levels, potentially because mallards are afforded increased access to food resources in newly flooded farmland and timber. Interestingly, we found no relationship between body mass of harvested mallards and severe cold or snowy weather, most likely due to adaptation to extreme cold over time by increasing energy stores preceding harsh winter-weather conditions. Future analyses will use Geographic Information Systems to disentangle the relationship between body mass and food availability at private lands and habitats managed by state and federal wildlife agencies. Results from this study will help inform waterfowl conservation strategies and implementation.

STUDENT SPOTLIGHT

John Veon

John Veon is a native of Texarkana, Arkansas, where he attended Arkansas High School and was a DU volunteer in the Texarkana Chapter since the age of 11. In 2012, he attended the DU Greenwing Camp (i.e., Arkansas Varsity Conservation Camp) and was awarded "Camper of the Year", which sparked his interest in studying waterfowl. After high school, John attended Hendrix College in Conway, Arkansas, where he received his BA in Biology. While at Hendrix College, John conducted undergraduate research on the relationship between noise and waterfowl behavior under the guidance of his advisor, Dr. Maureen McClung. Thereafter, John enrolled at the University of Arkansas to pursue a MS in Biology, where he is co-advised by Drs. Brett DeGregorio and David Krementz. In addition to his MS research, John is also studying temperate-breeding Canada goose populations in Arkansas in collaboration with Arkansas Game and Fish Commission. John is an avid waterfowl hunter, fly fisher, and conservationist. After earning his master's degree, John intends to pursue a PhD in waterfowl ecology.

LANDSCAPE COMPOSITION, CLIMATE VARIABILITY, AND THEIR INTERACTIONS DRIVE DUCK NEST SURVIVAL IN THE CANADIAN PRAIRIES

Dr. Dave Howerter, DUC-HO; Bob Emery, Llwellyn Armstrong, & Dr. Lauren Bortolotti, DUC-IWWR; other DUC staff

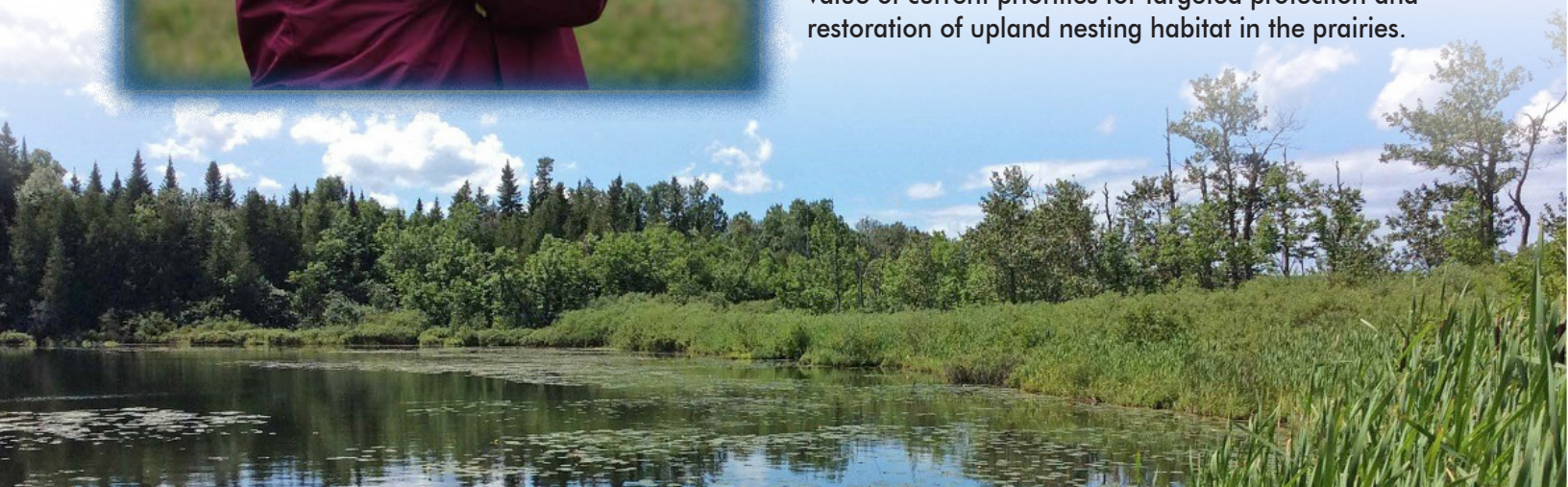
The Prairie Pothole Region is home to many upland-nesting ducks in a vast mosaic of grasslands and wetlands. This landscape has been heavily fragmented due to agricultural expansion and it experiences strong natural climate variability. The highest densities of breeding waterfowl in North America occur here, and the region also supports over 50% of breeding ducks in North America. Yet nesting ducks in this landscape face many challenges to successfully hatching a nest.

Decisions that ducks make on where to nest affects their likely success and overall productivity. Conservation efforts for breeding ducks across prairie Canada have primarily emphasized the protection and restoration of wetlands and associated uplands, including planted cover and perennial grasses that provide attractive nesting habitat and improve the likelihood of duck nest survival by altering predation risks. However, the relative influence of varying climatic conditions on nest survival is poorly studied. Understanding how landscape composition and climate interact to affect duck nest survival will enable better alignment and adaptation of conservation actions to more effectively sustain waterfowl populations.

To understand how duck nest survival varies across space and time with climatic fluctuations, we located and monitored more than 5,500 duck nests over a 10-year period across Alberta, Saskatchewan, and Manitoba. Primary species included blue-winged teal, gadwall, northern shoveler, mallard, and pintail. We monitored each nest to document whether it hatched and collected extensive data on landscape composition across multiple scales.

This study revealed that duck nest survival varied greatly across landscapes and years. Variation across years but within the same study sites suggested that climate-related environmental factors play a role in determining duck nest survival. However, the effect of climatic factors on nest survival depended on landscape composition, providing some evidence that more intact landscapes (i.e., those with more perennial grass) may moderate negative effects of climatic variation.

Analysis and interpretation of the extensive data collected during this study is ongoing, but preliminary implications for DU's conservation efforts are emerging. Across all study sites examined, only 31% had nest survival that is believed high enough to sustain duck populations, revealing the need for continued strategic planning and conservation as outlined by the Prairie Habitat Joint Venture. These findings also confirm the value of current priorities for targeted protection and restoration of upland nesting habitat in the prairies.



RESEARCHER SPOTLIGHT

The "SPaTS" Team

Dr. Dave Howerter

Bob Emery

Llwellyn Armstrong

Dr. Lauren Bortolotti

During his time as Research Scientist and National Manager of the Institute of Wetland and Waterfowl Research, Dr. Dave Howerter was the lead investigator of the project commonly known as SpATS (Spatial and Temporal Survival of duck nests). Dave has been with DUC since 1991 and was responsible for leading the design of the project. He drew on his experience in the Prairie Habitat Joint Venture Assessment study to identify further knowledge gaps for conservation delivery. Numerous individuals including Mike Anderson, Todd Arnold, Jim Devries, Pat Kehoe, Jim Ringelman, and Scott Stephens provided valuable input during project planning. Bob Emery has recently retired from DUC, but during his over 30-year career with the organization he was responsible for managing the implementation of this ambitious project. Spanning 10 years of data collection at 120 sites, this project relied on over 140 technicians. Bob has remained involved with the project, curating the impressive dataset and now working on its publication. Llwellyn Armstrong has been guiding research design and analysis as a statistician with IWWR for 23 years. Her expertise has shaped many facets of this study, including analysis of this large and complex dataset. Dr. Lauren Bortolotti recently joined the project team, taking a lead role in guiding data synthesis and writing manuscripts for peer-reviewed publication.

THE PINTAIL PROBLEM: WHAT WE CAN LEARN FROM INTEGRATED POPULATION MODELS

Dr. Qing Zhao & Dr. Mitch Weegman, Univ. of Missouri; Dr. Jim Devries, DUC-IWWR; Dr. Dave Howerter, DUC-HO; Dr. Todd Arnold, Univ. of Minnesota; Dr. Bob Clark, Environment and Climate Change Canada, retired

At one time, northern pintail numbers rivaled mallards as the most abundant species in the Prairie Pothole Region (PPR). Like most ducks, their numbers dropped dramatically during the drought of the 1960s but rebounded during improved conditions of the 1970s. Pintail populations slumped again during the drought of the 1980s, but their numbers failed to increase with better wetland conditions that began in 1990s and persisted over the last several decades. This failure to rebound contrasts starkly with other prairie nesting dabbling ducks, some of which have recently achieved record levels. Something had changed for pintails.

Fortunately, we can gain insights from long-term data on pintail populations from extensive annual breeding ground surveys and banding efforts dating back to the 1950s and 60s. These data are well-suited for use in integrated population models (IPMs) that enable multiple data sets to be combined into a unified analysis. These models allow improved estimation of population size, trajectory, and vital rates (survival and reproduction), as well as the ability to examine how ecological processes, like land use and climate change, may drive patterns in population metrics. This project has brought the power of IPMs to examine pintail population change and factors that likely have contributed to their observed decline.

Given that the population decline has been most prevalent in the prairies, our initial objective was to explore the influence of land use change and climate on productivity and survival within six subregions of the PPR—Alberta prairies and parklands, Saskatchewan prairies and parklands, Manitoba parklands, and U.S. prairies. While breeding pintails are like other ducks in their dependence on wetlands, their extensive use of croplands for nesting makes them particularly vulnerable to changes in agricultural land use on prairie breeding grounds. Thus, we analyzed over five decades (1961–2014) of band recovery, breeding population survey, and agricultural land use data from the Canadian and U.S. PPR.

RESEARCHER SPOTLIGHT

Dr. Qing Zhao

Qing is a quantitative ecologist with strong interests in modeling wildlife populations and communities under global change to inform conservation decision making. Qing received a BS in Ecology and Environmental Biology and a Ph.D. in Zoology from Peking University in 2000 and 2009, respectively. He received a MS in Statistics from the University of Toledo in 2010. Qing's current work focuses on developing integrated population models to understand the effects of agricultural land use, climate, and harvest on northern pintail demography and population dynamics, and uses the modeling results to inform the most efficient habitat conservation strategy and harvest regulation under climate change. Qing has also worked on mallards, snowy plovers, barn swallows, boreal birds, as well as wild monkeys. Qing is also a birder and always has great enthusiasm for nature.

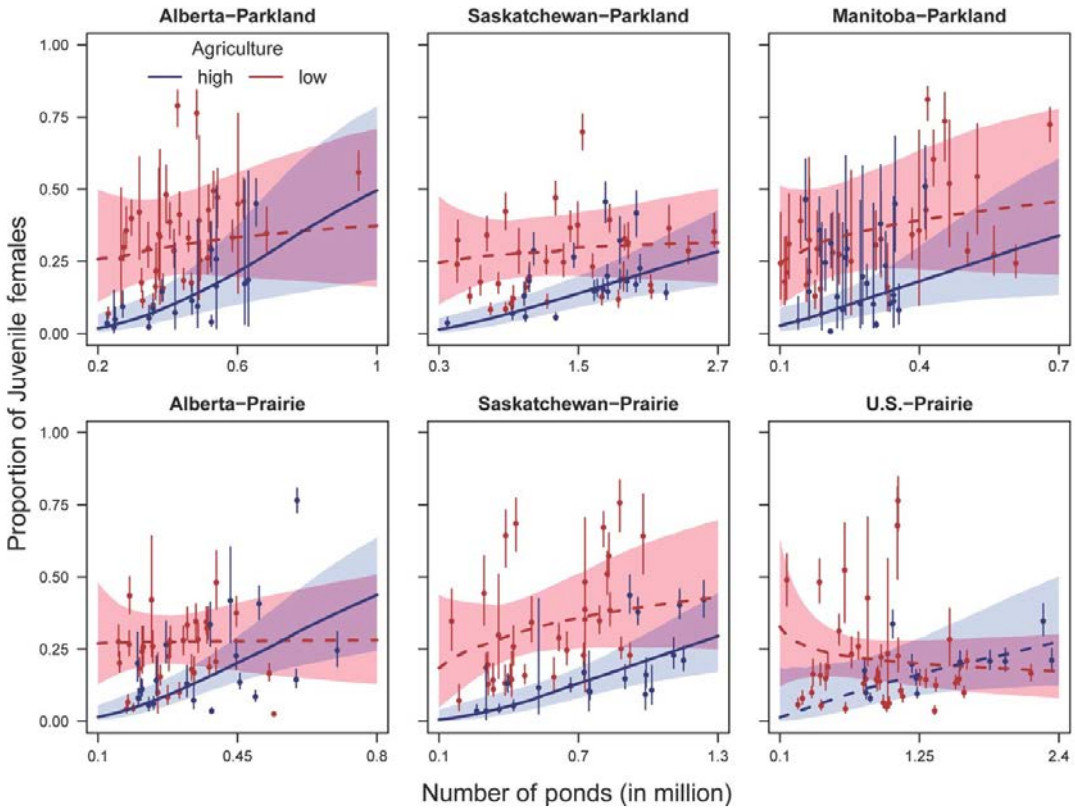


FIGURE 1. Pintail productivity, measured as proportion of juvenile females in fall population, increased with increasing number of May ponds, but the strength of this relationship varied among regions and was weaker in areas of high agricultural intensification (Zhao et al. 2021).

Our IPM clearly indicated pintail population trajectory was driven primarily by annual variation in productivity rather than survival. Productivity in all regions was positively correlated with wetter years and negatively correlated with agricultural intensification as indexed by declines in idle cropland (summerfallow) and adoption of minimum tillage practices (i.e., increased spring seeding into standing stubble) (Figure 1). The negative effect of agricultural intensification was most apparent in prairie Canada, especially in subregions with the greatest intensification. Further, a positive interaction between pond count and agricultural intensification indicated that pintail populations were more negatively impacted by decreases in ponds under higher agricultural intensification.

We have since extended this IPM to the continental scale, which will generate estimates of pintail population size, productivity, and survival for three breeding regions (PPR, Alaska, and northern unsurveyed regions). This model will account for pintail movements among breeding regions and include influences of prairie agricultural intensification and climate, wintering ground rice acreage and climate, and harvest. We will use this model to test hypotheses about drivers of population change at the continent-scale. We anticipate that the predictive power and statistical flexibility of this model will help habitat and harvest management practitioners consider practical alternatives to maximize the use of financial resources based on forecasted impacts of future climate and land-use change.

NEW PROJECTS in FY21

*FROM HYPOXIA TO HABITAT: SHIFTING GULF OF MEXICO EXPORTS FROM NITRATES TO MIGRATORY BIRDS WITH STRATEGIC WETLAND CONSERVATION

Dr. Adam Janke & Dr. William Crumpton, Iowa State Univ.; Kaylan Kemink, DU-GPR; Dr. Ellen Herbert, DU-NHQ; Dr. John Coluccy, DU-GLAR; Graduate student (1) TBD

The southern and eastern portions of the U.S. Prairie Pothole Region are among the mostly highly hydrologically modified landscapes in the world. The fundamental challenge facing bird conservation in these landscapes is how to compel conservation action on this mostly privately owned, highly agriculturally productive, and highly modified landscape. Coupling bird conservation with another critical natural resource challenge created by drainage—water quality impairments through nutrient enrichment—may offer renewed hope for synergistic gains in each. Intensively farmed landscapes in the upper Mississippi River Basin are a substantial source of nutrient loads to the Gulf of Mexico, creating challenges for farmers and communities burdened with the impacts of eutrophication. Wetlands can be particularly effective at reducing nitrate loads associated with agricultural drainage. Understanding how wetlands restored for water-quality improvement can contribute to wildlife habitat in comparison to those focused on wildlife benefits may enable specialized targeting to maximize the collective value of all wetlands restored in working landscapes. This research will evaluate a range of conditions in water-quality wetlands and compare them to conditions in comparable wetlands restored for wildlife habitat. Findings from this work will help integrate water quality and wildlife conservation in working landscapes, ultimately improving conditions for wildlife, water quality, and other societal benefits.

COASTAL EROSION DYNAMICS IN THE TELCHAC-CELESTUN SHORELINE OF THE YUCATAN: DIAGNOSIS AND POSSIBLE MITIGATION MEASURES

Dr. Paulo Salles de Almeida & Dr. Alec Torres Freyermuth, National Autonomous Univ. of Mexico; Gabriela de la Fuente & Eduardo Carrera, DUMAC

The coastal zone of Mexico's Yucatan peninsula is a highly dynamic ecosystem due to the interaction of atmospheric, oceanic, hydrological, geological, and socioeconomic processes. Changes in the position and integrity of the shoreline on the north coast of the Yucatan peninsula occur as a product of the gradient in sediment transport due to natural and anthropogenic conditions (e.g., variability in the frequency and intensity of storms, coastal infrastructure) as well as the gradual rise in sea level. Barrier islands and beach dune systems offer protection to coastal lagoons and wetlands from the influences of marine waters of the Gulf of Mexico. However, shoreline erosion and changes in the sediment transport processes threaten to breach these protections in some locales. Loss of protection from the erosive forces and elevated salinities of marine waters will degrade the habitat value of coastal lagoons for waterfowl and other wetland birds. This study will quantify the coastal erosion dynamics from the Port of Telchac to the Port of Celestún, evaluate contributing factors to coastal erosion and aggradation, and identify mitigation activities to increase the resilience of this region, thereby preserving its value as an important coastal wintering area for migratory and resident waterfowl species.

*EVALUATING MOTTLED DUCK NEST PREDATOR COMMUNITY IN SOUTHWESTERN LOUISIANA USING CAMERA TRAPS AND ARTIFICIAL NESTS

Alexandre Dopkin (MS student) & Dr. Kevin Ringelman, Louisiana State Univ.

Mottled ducks rely on coastal marsh and nearby uplands to fulfill their needs throughout the annual cycle. In Louisiana, mottled ducks have experienced a threefold decline in breeding population size over the past decade, with the 2018 estimate the lowest ever recorded. Researchers suspect the decline is due to low recruitment rates. Nest survival is the most important factor driving other dabbling duck populations, so understanding mottled duck nest survival rates and factors influencing it is a research priority throughout the region. Recent research in southwestern Louisiana estimated average mottled duck nest survival of 21% from 2018–2020. Primary causes of nest failure for mottled ducks are poorly understood. Thus, researchers at Louisiana State University are using trail cameras and artificial nests across a diversity of habitats to document predators and other causes of nest failures for mottled ducks in Louisiana. Researchers will create artificial nests that closely simulate real nests in habitat characteristics relevant to foraging predators. This study will provide information on nest predation risk across habitat types (e.g., pasture, cordgrass meadow, fallow rice, overwater marsh, marsh terrace, etc.) and a more wholistic understanding of predator communities affecting mottled ducks (e.g., predator density and species).

EVALUATING DITCH PLUG WETLAND RESTORATIONS IN THE PRAIRIE POTHOLE REGION

Dr. James Paterson, Howie Singer, & Dr. Stuart Slattery, DUC-IWWR

Restoring wetlands using ditch plugs is an important component of DU Canada's habitat conservation programs. Understanding how waterfowl and other biodiversity respond to restoration is important for evaluating our success and building support for wetland conservation. This study will evaluate the extent to which wetlands restored using ditch plugs result in ecosystems that support ducks as well as other wetland biodiversity in the Prairie Pothole Region. In 2021, pilot work used autonomous recording units to test how bird and amphibian biodiversity at restored wetlands is affected by landscape features, including wetland basin and road densities. Remote sensing will also be used to monitor changes in vegetation primary productivity post-restoration. Biodiversity will be compared between restored and reference wetlands. Results from this study will estimate biodiversity for amphibians, birds, and other priority taxa at wetland restoration sites, which will enable DU to better communicate the biodiversity benefits of habitat restoration initiatives. These data will also inform modifications to restoration efforts to maximize duck and biodiversity benefits (e.g., targeting landscapes that provide the greatest return on investment).

* DENOTES A STUDENT-LED PROJECT

*GREAT LAKES MALLARD MOVEMENTS, HABITAT SELECTION, SURVIVAL, AND PRODUCTIVITY

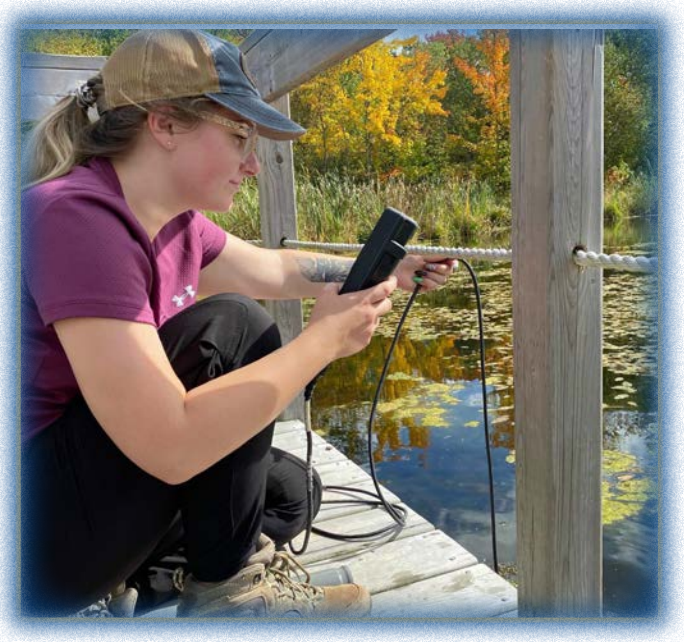
Ben Luukkonen (PhD student), Dr. Scott Winterstein, & Dr. David Luukkonen, Michigan State Univ.

Mallards are a shared migratory resource and the most heavily harvested duck species in the Mississippi Flyway, and most mallards harvested in the Great Lakes region are locally produced. Since the early 2000s, the Great Lakes mallard breeding population has declined from approximately 1.1 million to 600,000. Waterfowl biologists in the Great Lakes states are at a loss to explain the decline, especially when scientists have seen ideal regional breeding habitats go unoccupied. Based on data from band reporting and harvest surveys, both breeding productivity and survival rates appear stable over the period of decline. Various explanations for the decline are being considered, including potential shifts in breeding distributions, increased use of urban environments that aren't covered by population surveys, and emigration to other breeding regions. This multi-year project, led by researchers at Michigan State University in collaboration with numerous partners, will use GPS/GSM, solar-powered transmitters to study year-round movements, habitat use, site fidelity, survival, and reproductive indices of 150 female mallards (annually) from the Great Lakes region. Results will provide unprecedented insights on the ecology of Great Lakes mallards and help diagnose causes for their recent declines.

IDENTIFYING THE WATER QUALITY IMPROVEMENT CO-BENEFITS OF PRIORITY MALLARD HABITAT RESTORATION

Dr. Nandita Basu & Dr. Emily Ury, Univ. of Waterloo; Dr. Ellen Herbert, DU-NHQ; Dr. Pascal Badiou, DUC-IWWR

The Great Lakes region provides important nesting and migratory habitat for mallards, which play a central role both culturally and economically for waterfowlers across the midcontinent. Wetlands also perform other functions on the landscape, such as floodwater retention and water quality improvement. Because they slow the flow of water and harbor uniquely active plant and microbial communities, wetlands are "hot-spots" of nutrient removal on the landscape. However, the adoption of wetland restoration as a tool to mitigate nutrient runoff from urban and agricultural sources is only now becoming mainstream. There is limited scientific information on how restored wetlands should be designed and located on the landscape to maximize water quality benefits. This research, conducted in partnership with Michigan DNR, H2Ohio, DU Canada, and University of Waterloo, will identify local and landscape factors influencing wetland phosphorus retention efficiency. These findings will be used to construct a model of wetland phosphorus retention and restoration costs for the US-Canada Great Lakes region, which will enable spatial mapping of potentially restorable wetlands with the highest return on investment for water quality improvement. These data will be combined with a mallard habitat suitability model to prioritize projects that maximize both water quality and waterfowl habitat benefits. Results will inform policy and communications efforts to accelerate wetland conservation in the Great Lakes region.



* DENOTES A STUDENT-LED PROJECT

2021 DUCKS UNLIMITED *Fellowship Recipients*

Educating the next generation of conservation scientists and managers is critical to the success of DU and waterfowl management across North America. In addition to including graduate students in many staff-led research projects, DU provides dedicated support to graduate students (MS or PhD). This support is provided in the form of annual graduate fellowships designed to help develop young professionals who are dedicated to conservation, while advancing our scientific understanding of waterfowl and wetlands. To date DU has awarded fellowships to over 60 students from 26 universities. In 2021, DU awarded 3 fellowships to new recipients and renewed fellowships for 5 continuing students.

NEW RECIPIENTS IN 2021

EDWARD D. AND SALLY M. FUTCH GRADUATE FELLOWSHIP – Thanks to the generous support of one couple with a special interest in DU's scientific work, this fellowship helps to advance our understanding of waterfowl and wetlands in North America. Alec Schindler was awarded this fellowship in 2021. His PhD project at the University of Missouri looks at trade-offs in reproduction and survival in the Greenland white-fronted goose by developing a sophisticated life-cycle model from tracking and behavior data. Alec's research will inform conservation of this declining species and provide us with a scientific framework applicable to other species and systems.

Alec Schindler

WATERFOWL RESEARCH FOUNDATION FELLOWSHIP – This fellowship is an investment in young waterfowl professionals with three primary objectives: 1) developing critical scientific information that will contribute to the future conservation of waterfowl and wetland resources, 2) contributing to the training of future professionals in the field of waterfowl and wetlands conservation, and 3) honoring the critical role that waterfowlers have played in supporting waterfowl and wetland conservation throughout North America. This fellowship has been award to Rob Blenk, a PhD student at the University of California, Davis for his research on a model of energetics, habitat use, and survival of wintering waterfowl. Rob's research will integrate results from waterfowl foraging behavior experiments into a model that will be applied to California's Suisun Marsh to assess the effect of tidal wetland restoration on the area's ability to sustain target populations of waterfowl.

Rob Blenk

BONNYCASTLE FELLOWSHIP FOR WATERFOWL AND WETLAND RESEARCH – This fellowship supports talented young professionals who are dedicated to furthering conservation in North America and advancing our scientific understanding of wetland and waterfowl biology. We awarded this fellowship to Brett Leach, a MS student at the University of Missouri. Blue-winged teal migration timing and distribution in Central and South America have made it challenging to study this species during non-breeding period using traditional approaches. Brett's research will fill key knowledge gaps about the annual cycle of this species using modern GPS/GSM satellite telemetry methods.

Brett Leach

CONTINUING RECIPIENTS IN 2021

Madeleine Lohman

BONNYCASTLE FELLOWSHIP IN WETLAND AND WATERFOWL BIOLOGY – This fellowship is awarded to graduate students throughout North America for projects focusing on any aspect of wetland or waterfowl ecology that promises to advance conservation. Madeleine Lohman is our recipient of this award. She is completing her PhD at the University of Nevada, Reno, using advanced modelling to understand how climate and land use influence mallard populations in the Prairie Pothole Region.

DUC-MBNA CANADA BANK® CONSERVATION FELLOWSHIP – Sponsored by a long-time partner of DU Canada, this fellowship helps support tomorrow's conservation leaders while providing new information that can be applied today. The DUC-MBNA Canada Bank® Conservation Fellowship is awarded to Moriah Tanguay, a MS student at the University of Saskatchewan for her research on habitat selection by scoters in the Northwest Territories. Moriah will identify wetland and landscape characteristics that predict breeding scoter abundance, improving identification of priority habitat for these ducks.

Moriah Tanguay

Sarah Clements

MICHAEL F.B. NESBITT FAMILY RESEARCH FELLOWSHIP – This fellowship honors the many contributions by members of the Nesbitt family to science and conservation. It was awarded to Sarah Clements for her PhD research at the University of Missouri. Sarah's research seeks to improve our understanding of the fitness consequences of habitat availability and quality for a declining group of birds—migratory shorebirds.

SPENCER T. AND ANN W. OLIN FOUNDATION WETLANDS AND WATERFOWL RESEARCH FELLOWSHIP – This fellowship reflects the long-term commitment made by a family that has been supporting DU since 1941. Emily Tarsa is the most recent winner of this fellowship for her PhD work at Utah State University. Her research is focused on restoring native wetland plant communities after control of invasive Phragmites to improve waterfowl habitat and return critical functions and services, particularly in the wetlands surrounding the Great Salt Lake.

Emily Tarsa

Casey Setash

DR. BRUCE D.J. BATT FELLOWSHIP IN WATERFOWL CONSERVATION – This fellowship was established in recognition of a retired DU Chief Biologist who was particularly passionate about the role of sound science in guiding conservation. This award is currently held by Casey Setash for her work at Colorado State University. Casey's PhD project examines waterfowl productivity in a flood-irrigated system in the North Platte Basin, Colorado. Her work will inform best management practices benefitting both agricultural producers and waterfowl managers.

WELCOME TO OUR NEW SCIENTISTS

DR. STEVE ADAIR, CHIEF SCIENTIST, DU INC. - Dr. Steve Adair was recently selected as DU Inc.'s new Chief Scientist, taking the reins following the retirement of Dr. Tom Moorman. Adair will lead DU's waterfowl and habitat science, providing vision and direction for information and planning needs throughout North America and maintaining DU's standing as a scientific authority in wetlands and waterfowl conservation. A long-time DU wetlands biologist, Adair served most recently as National Director of Conservation Strategy. Adair also served as Great Plains Region director of operations in Bismarck, ND for many years, and his contributions to waterfowl biology and conservation planning are well known in the field. Adair received a BS degree in biology from the University of Texas at Austin, an MS degree in wildlife and fisheries sciences from Texas A&M University, and a PhD in wildlife ecology from Utah State University.

DR. JAMES PATERSON, RESEARCH SCIENTIST, DU CANADA-IWWR -
DU Canada welcomes Dr. James Paterson as our new research scientist working on biodiversity and associated ecosystem services. James grew up in southern Ontario catching snakes and frogs in wetlands where he developed a passion for science and conservation. He received a BS in zoology from the University of Guelph, a MS in biology from Laurentian University, and a PhD in biology from the University of Ottawa. His past research examined how habitat loss affects wildlife abundance and distribution and how conservation interventions, such as habitat creation, can benefit wildlife. His current research is examining how biodiversity responds to wetland restoration and how it contributes to ecosystem services in working landscapes.

DR. MATT DYSON, WATERFOWL ECOLOGIST, DU CANADA-IWWR
DU Canada welcomes Dr. Matt Dyson as our newest waterfowl ecologist. Matt grew up in southern Ontario where he developed a love for the outdoors while camping with family, fishing on Lake Huron, and exploring the Bruce Peninsula. His passion for waterfowl and wetlands came from tromping through the marshes of Long Point on Lake Erie. Matt completed his BS with Honors at the University of Northern British Columbia, then received a MS on wood ducks breeding in Ontario from Western University and a PhD on boreal breeding ducks from University of Waterloo. He also held DU's MBNA Fellowship and Echo Award and received support from the Waterfowl Research Foundation during his PhD. Matt's research interests include understanding how human land use influences species interactions and their movement, habitat use, and survival. He looks forward eagerly to working with his new colleagues and partners with DUC to advance waterfowl science and conservation.

CATRINA TERRY, RESEARCH SCIENTIST, DU INC.-GPR - DU Inc. welcomes Catrina Terry as our new research scientist to the Great Plains Region office. Catrina was a MS student at Louisiana State University where she studied duck brood abundance and use of wetlands in crop-dominated landscapes in the Dakotas under the advisement of Dr. Kevin Ringelman. Originally from California, Catrina completed her undergraduate research with Dr. John Eadie at the University of California, Davis, and it was there that Catrina first hunted waterfowl. She has since become an avid hunter. Catrina is excited to start her career with DU in the prairies and expand research opportunities throughout the Great Plains region. When she's not in a wetland you can find her cooking, reading, or training her two bird dogs.

SARA BURNS, WATER PROGRAM SPECIALIST, DU INC.-GLAR - DU Inc. welcomes Sara Burns as our new water program specialist to the Great Lakes/Atlantic Region office. Sara worked most recently as a water resource scientist with the Massachusetts chapter of The Nature Conservancy where she oversaw watershed restoration, dam removal, coastal water quality, and climate resilience projects. Sara received a MS degree from Indiana University studying aquatic ecology and impacts of river restoration on macroinvertebrate communities. Between her undergraduate work at Kenyon College in Ohio and graduate school, she lived in Michigan and started an organic vegetable farm. Sara is thrilled to be joining DU to support wetland restoration programs to meet water quality and flood reduction goals throughout the Great Lakes/Atlantic Region. Sara currently lives in Rhode Island with her husband, one dog, two cats, and 20 tomato plants, and tries to get on the water whenever she can.

CATHLEEN SAMPSELLE, ECOSYSTEM SERVICES RESEARCH SCIENTIST, DU INC.,-NHQ
DU Inc. welcomes Cathleen Sampselle as our new ecosystem service research scientist at National Headquarters. Cathleen holds a BS from the University of Michigan and MS from the University of Idaho. Cathleen served a restoration biologist and GIS analyst for the Nisqually Indian Tribe in Washington state for nearly a decade where she oversaw project planning, grant writing, monitoring, and development of tools to evaluate project outcomes. Cathleen worked most recently as senior analyst with the Office of Economic Development, State of Michigan DOT where she led the development of project plans and tracked their implementation. Cathleen lives in Brighton, MI, and in her free time enjoys hiking, camping, kayaking, botanizing, cooking from scratch and growing vegetables. Cathleen and her husband Dan have a pact to visit all national parks together and are one-third of the way there.

SUNSHINE CHARITABLE FOUNDATION PROVIDES $1 MILLION TO SUPPORT GREAT LAKES WATER QUALITY AND MALLARD RESEARCH

A $2.1 million international study led by Ducks Unlimited and supported by a substantial grant from the Sunshine Charitable Foundation will connect how wetlands in the Great Lakes watersheds can reduce harmful algal blooms while enhancing productivity of regional mallard populations. The large-scale study will guide conservation stakeholders and U.S and Canadian governmental agencies to identify wetland restoration projects to improve water quality for the more than 30 million people who get drinking water from the Great Lakes, as well as the hundreds of species of wildlife that rely on healthy water during their life cycles.

The research, which will blend new technologies and interdisciplinary expertise, is made possible by a $1 million grant from Denise and Dave Bunning through the Chicago-based Sunshine Charitable Foundation. Researchers from DU Inc., DU Canada, and numerous partners will study how wetland restoration reduces agricultural phosphorus runoff fueling the harmful algal blooms that threaten economies, recreation, and safe drinking water in the Great Lakes.

“Our Great Lakes are a national gem, and further understanding how wetlands keep these waters healthy for people and wildlife is a responsibility of which Ducks Unlimited is proud to engage,” said Adam Putnam, Ducks Unlimited chief executive officer. “The Sunshine Charitable Foundation is a champion for wetlands conservation, and we are grateful for Denise and Dave's support.”

The project also provides a great example of the role and application of interdisciplinary science, as it will help waterfowl managers answer questions about recent declines of the Great Lakes mallard population. Waterfowl biologists in the Great Lakes states are at a loss to explain the decline, especially given observations of ideal breeding habitats being unoccupied.

“Hunters who enjoy the outdoors generate an estimated $1.4 billion in revenue for Mississippi Flyway states, and mallards are one of the most popular game birds sought by waterfowlers,” said DU chief conservation officer Dr. Karen Waldrop.

Michigan State University, in partnership with Mississippi Flyway states and non-profit organizations like DU, will use cutting-edge Global Position System (GPS)/Global System for Mobile Communications (GSM) transmitter technology to study the movement, habitat selection and productivity of Great Lakes mallards. Information from the study will inform recommendations about habitat programs and harvest management to assist with mallard population recovery in the Great Lakes region.

Results from these studies, which began in spring 2021, will enable DU and partners to target wetland conservation that simultaneously benefits water quality and duck production. Nearly 2 dozen state, federal, university, and non-profit partners are collaborating on the projects.

DU CANADA ENDOWED CHAIR
in Wetland and Waterfowl Conservation

DR. MITCH WEEGMAN SELECTED AS DU CANADA ENDOWED CHAIR AT THE UNIVERSITY OF SASKATCHEWAN

A rising star in conservation science has been hired as the Ducks Unlimited Canada (DUC) Endowed Chair in Wetland and Waterfowl Conservation at the University of Saskatchewan (USask). Dr. Mitch Weegman, an avian ecologist, will teach and mentor USask students while delivering research that addresses some of the most pressing environmental issues of our time.

Dr. Mitch Weegman

"Saskatchewan, and more broadly the Canadian prairies and parklands, are legendary for wetlands and waterfowl. Even as a kid, I read about and dreamed of visiting these landscapes. Launching the chair is the honour of my lifetime and I'm looking forward to getting started," said Weegman, who began his role in USask's Department of Biology on July 1, 2021.

The first of its kind in Canada, the new endowed chair is the result of a partnership between DUC and USask. Endowed chairs are prestigious faculty positions established in perpetuity, through the support of donors, to focus on targeted areas of research.

"Establishing the endowed chair alongside our longtime partners at USask is one of the most exciting achievements in our organization's 83-year history," said Karla Guyn, chief executive officer for DUC. "We're thrilled to have someone of Mitch's talent leading, challenging and inspiring the next generation of conservation scientists who will help ensure our natural environment is safeguarded now and into the future."

Weegman, who holds a PhD in biological sciences from the University of Exeter, was recruited to USask's College of Arts and Science from the University of Missouri, where he served as assistant professor of avian ecology in the School of Natural Resources. As the DUC Endowed Chair in Wetland and Waterfowl Conservation, Weegman will train future scientists, conservationists and wildlife managers studying at USask. His research will tackle the greatest challenges in wetland and waterfowl conservation and will shape strategies for sustaining the environment in the face of climate and land-use change.

USask was chosen as the site of the chair for several reasons, including its ideal location in the Prairie Pothole Region near the western boreal forest—some of North America's most important landscapes for wetland and waterfowl conservation.

"In the coming years, Mitch and his students will launch new projects and collaborations to build upon USask's already established research excellence," said Peta Bonham-Smith, dean of the College of Arts and Science at USask. "We are proud to partner with Ducks Unlimited Canada on advancing conservation science and creating outstanding new opportunities for our students."

DUC and USask have launched a $5-million fundraising initiative to support the chair's research and create student awards. Donations can be made online at ducks.ca/endowedchair.

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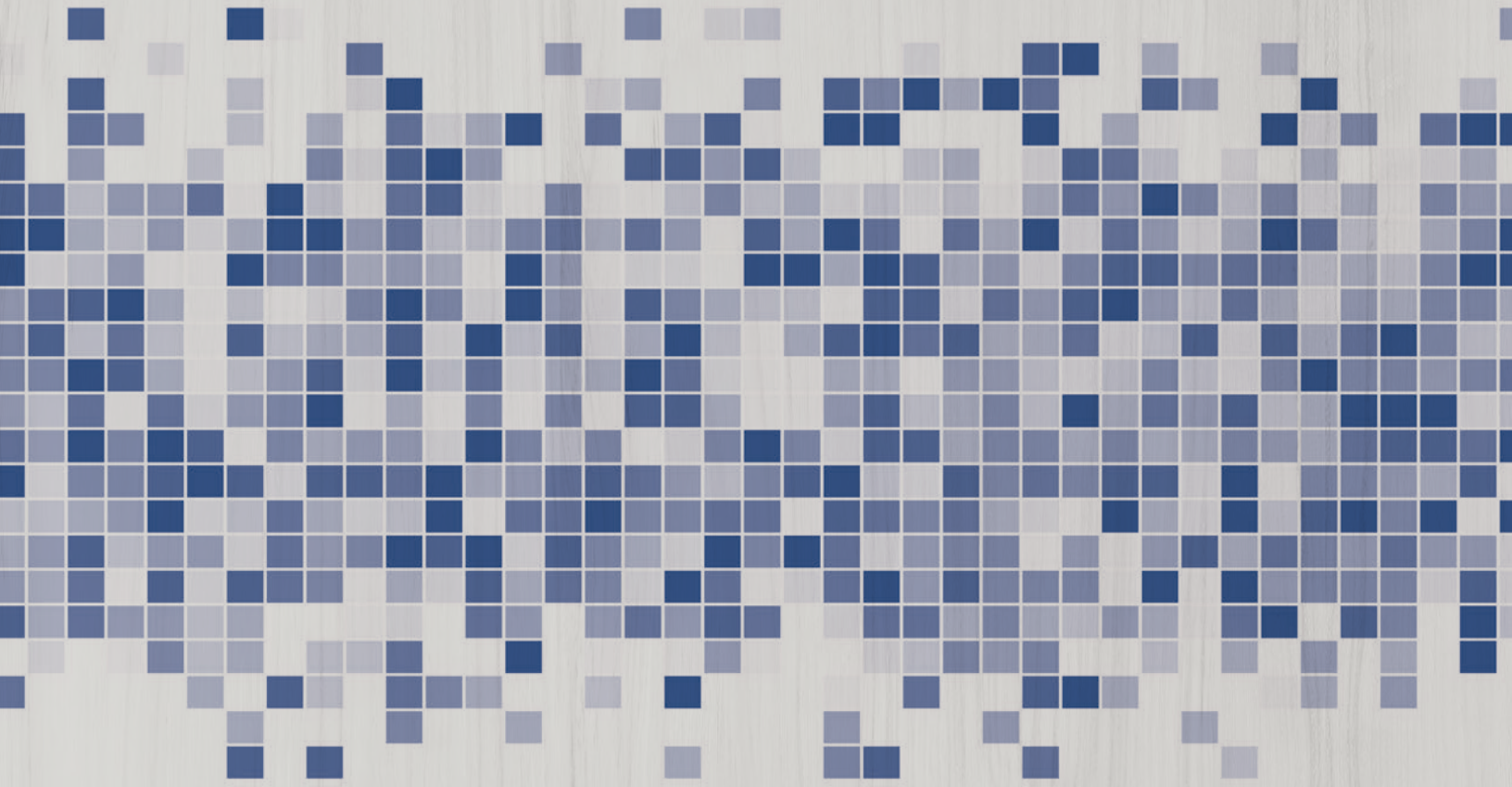

Ducks Unlimited Canada

DUCKS UNLIMITED

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Three companies with a shared Mission:

Ducks Unlimited conserves, restores and manages wetlands and associated habitats for North America's waterfowl. These habitats also benefit other wildlife and people.