

DUCKS UNLIMITED INTERNATIONAL SCIENCE REPORT 2 0 2 4

Highlights of Ducks Unlimited
Science in FY2024



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. 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 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 supporters.

DU'S SCIENCE PRIORITIES AND APPROACH

Ducks Unlimited has a choice of where we invest our science capacity. Activities that address our greatest uncertainties, in our most important geographies, and provide the greatest opportunities to achieve our conservation mission 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.

This annual International Science Report highlights the involvement and partnership of DU Inc., DU Canada, and DU de México in scientific efforts during FY2024, reflecting a combination of university-led research, projects conducted internally by DU staff, and other activities in which DU staff are otherwise involved. Just as conservation delivery relies on diverse partnerships and cross-border collaboration for maximum efficiency, so too do our scientific efforts. Paramount among our list of science partners are numerous federal and state agencies, university researchers, non-governmental organizations, foundations, NAWMP Joint Ventures, corporations, private landowners, and our volunteers and donors. The results of DU's science investments will strengthen our continental conservation efforts while contributing to the education and development of our next generation of scientists and conservationists.



DU – INTERNATIONAL

***COMPARING SPRING MIGRATION STRATEGIES OF NORTHERN PINTAILS FROM WINTERING AREAS ACROSS NORTH AMERICA**

Georgina Eccles (PhD student) & Dr. Bart Ballard, Texas A&M Univ.–Kingsville

Understanding factors that influence pintail populations is critical for delivering effective conservation and management. Poor body condition in the Gulf Coast, poor reproductive success in the Prairies, and linkage through “cross-seasonal” mechanisms may be contributing factors to their population dynamics. Employing GPS telemetry on 576 female pintails over 3 years, this study will yield information on differences in individual behavior, habitat use, migration strategy, and their relationship to annual survival and productivity. Support for this study provided by DU-SRO and DUC.

WATER QUALITY IMPROVEMENT CO-BENEFITS OF PRIORITY MALLARD HABITAT RESTORATION

Dr. Pascal Badiou & Dr. Lauren Bortolotti, DUC-IWWR; Dr. Nandita Basu & Dr. Emily Uri (Post-doctoral researcher), Univ. of Waterloo; Cathleen Sampselle & Dr. Ellen Herbert, DU-NHQ; Ed Verhamme & Doug Bradley, Limnotech

Harmful algal blooms fueled by phosphorus in Lake Erie have threatened wildlife habitat, economic livelihoods, and jeopardized clean and reliable drinking water supplies for communities. This study will collect data on the local and landscape factors influencing wetland phosphorus retention efficiency and parameterize a model of phosphorus retention and restoration cost across the U.S. and Canadian Great Lakes region. An ultimate goal is to generate a spatial model of potentially restorable wetlands and associated return on investment for the dual objectives of improving water quality and enhancing mallard habitat.



DU INC. – NATIONAL

IDENTIFYING EFFECTS OF WEATHER AND LAND USE ON AUTUMN AND WINTER WATERFOWL DISTRIBUTION DYNAMICS IN THE 21ST CENTURY

Dr. Bram Verheijen (Post-doctoral researcher) & Dr. Lisa Webb, Univ. of Missouri; Dr. Heath Hagy, USFWS; Mike Mitchell & Dr. Dale James, DU-SR; Dr. Mike Brasher, DU-NHQ

Migration and winter distribution of waterfowl have implications for harvest opportunities, conservation planning, and stakeholder support for wetland and waterfowl conservation. Some evidence suggests the timing of migration and terminal distribution of several common waterfowl species may have shifted. This research will use band recovery, harvest, and aerial surveys to investigate whether waterfowl

distribution during fall and winter in the Mississippi and Central flyways has changed over the past 40 years. This work will also examine how shifts may be influenced by weather (temperature, snow cover, precipitation), land use, or landscape changes throughout the flyways.

***ASSESSING THE CLIMATE CHANGE MITIGATION POTENTIAL OF WETLAND RESTORATION IN THE CONSERVATION RESERVE PROGRAM: MEASUREMENTS, MODELING, AND SCALING CHANGES IN SOIL CARBON AND GREENHOUSE GAS FLUXES**

Dr. Sheel Bansal, U.S. Geological Survey; Dr. Shannon Osborne, USDA Agricultural Research Service; Dr. Chenhui Li, Univ. of Missouri; Dr. Jessica O'Connell & Megan Podolinsky (Ph.D. Student), Univ. of Texas Marine Science Institute; Dr. Siobhan Fennessy, Kenyon College; Dr. Thomas O'Halloran, Clemson Univ.; Dr. Kimberly Van Meter, Pennsylvania State Univ.; Dr. Emily Biggane, United Tribes Technical College; Dr. Ellen Herbert, Cathleen Sampselle, DU-NHQ; Kaylan Kemink & Kyle Kuechle, DU-GPRO
This project will explore how wetland restoration through the Conservation Reserve Program (CRP) in the Agricultural Midwest and Great Plains (~81% of wetland CRP) contributes to climate mitigation by measuring and modeling soil and vegetation carbon stocks and greenhouse gas fluxes in restored wetlands. This study will explore how climate, surrounding land-use, soils, and hydrology impact wetland carbon cycling. Additionally, the team will model other ecosystem functions of restored wetlands including surface water storage, nutrient retention, and waterfowl habitat value.

APPLICATION OF EBIRD DATA TO ENHANCE INTERREGIONAL PLANNING FOR MIGRATORY WATERFOWL DURING THE NONBREEDING PERIOD

Dr. Orin Robinson, Cornell Lab of Ornithology; Dr. Kevin Ringelman, Louisiana State Univ.; Dr. Auriel Fournier & Aaron Yetter, Illinois Natural History Survey; Dr. Mike Brasher, DU-NHQ

Mobile technology and citizen participation in scientific data collection are revolutionizing the type and quantity of information available for natural resource conservation and management. One such data collection and analytical platform relevant to waterfowl conservation is eBird, yet its utility for waterfowl conservation planning remains uncertain. This project will compare eBird data metrics to those obtained from independently collected waterfowl surveys to help identify under what circumstances eBird data are useful in waterfowl conservation and management.

NATURAL INFRASTRUCTURE RESEARCH AND TRAINING

Dr. Brian Bledsoe, Univ. of Georgia; Dr. Ellen Herbert, DU-NHQ; Sara Burns, Jim Feaga, Tamara Jameson, Kali Rush, Mike Sertle, & Tom Pluemer, DU-GLAR; Will Cenac, Cassidy Lejeune, Dr. Aaron Pierce, & Dr. Todd Merendino, DU-SR; Thomas Parker DU-GPR

Natural infrastructure uses, restores, or emulates natural ecological processes to achieve engineering objectives and provide multiple conservation benefits. The UGA–DU partnership will educate a graduate workforce through practical research experience aimed at evaluating existing and planned conservation projects. The partnership will co-develop a research agenda that focuses on (1) enumerating the role wetland loss and conservation have played in regulating past floods and droughts and (2) exploring the biophysical and economic outcomes of future wetland conservation. DU and UGA will also co-develop a curriculum and internship program to further develop the engineering workforce.

TRANSMITTER EFFECTS ON SPRING MIGRATORY STEP-LENGTHS AND LATITUDINAL POSITIONING OF WINTER-MARKED FEMALE MALLARDS

Dr. Doug Osborne, Univ. of Arkansas-Monticello; Dr. Ryan Askren, Five Oaks Ag Research & Education Center; Bret Leach & Luke Naylor, Arkansas Game & Fish Comm.; Dr. Andy Raedeke, Missouri Dept. of Cons.; Dr. Mike Brasher, DU-NHQ

Advances in transmitter technology have made fine-scale movement data much more accessible, but the potential effects of transmitters on movement and behaviour remain uncertain. This study will compare step length and migration latitude of female mallards across 3 different transmitter types to inform the utility of standardizing methodologies to understand avian movements. Comparisons will be made among dorsal backpack units attached with single-loop harnesses, double-loop harnesses, and implantable transmitters.

SURVEILLANCE FOR AVIAN INFLUENZA ANTIBODIES IN HUNTING DOGS IN WASHINGTON STATE

Dr. Justin Brown, Penn St. Univ.; Dr. Adam Black, Adam Black Veterinary Services; Dr. Katherine Haman, Washington Dept. of Fish and Wildlife; Dr. David Stallknecht, Southeastern Coop. Wildlife Disease Study; Dr. Diego Diel, Cornell Univ.

Wild waterfowl are considered important reservoirs for H5N1 Highly Pathogenic Avian Influenza (HPAI) in the current North American outbreak. As such, dogs used in waterfowl hunting may be directly exposed to infected birds or indirectly to virus in the environment. It is unknown how often dogs are infected, remain asymptomatic, or exhibit clinical signs. The goal of this research is to provide preliminary data on potential risks for H5N1 HPAI exposure and test for evidence of prior infection through the detection of antibodies to H5N1 in hunting dogs from Washington State.

duckDNA: ENGAGING WATERFOWL HUNTERS IN THE SCIENCE OF CONSERVATION GENETICS

Dr. Mike Brasher, Rae Moore, Ashley Tunstall, Katie Tucker, & Kai Victor, DU-NHQ; Dr. Philip Lavretsky & Vergie Musni, Univ. of Texas at El Paso

Genetic research is a critical component of wildlife management, providing researchers with information on a wide variety of behavioral, physiological, and ecological variables. This project, termed duckDNA, is engaging waterfowl hunters in providing tissue samples from harvested ducks across the U.S. to enable expanded studies of genetic processes in waterfowl and their implications for population management.

DU INC. – SOUTHERN REGION

***THE EFFICACY OF MARSH TERRACES FOR RESTORING AND ENHANCING GULF COASTAL WETLANDS**

Madelyn McFarland (MSc student), Joseph French (MSc student), Raul Osario (PhD student), Dr. Brian Davis, Dr. Adam Skarke, & Dr. Ana Linhoss, Mississippi St. Univ.; Larry Reynolds, Louisiana Dept. of Wildlife & Fisheries; Dr. Mike Brasher, DU-NHQ

Marsh terracing is a common restoration technique employed by DU along the Gulf Coast. This interdisciplinary study uses diverse data collection techniques to measure the benefits of marsh terracing, including emergent marsh expansion, shoreline erosion reduction, wave energy attenuation, submerged aquatic vegetation growth, and habitat quality for waterfowl and marsh birds. These data will inform future terrace designs to maximize gains for avian habitat and coastal sustainability.

MISSISSIPPI ALLUVIAL VALLEY WINTER MALLARD BANDING PROGRAM-ARKANSAS

Dr. Doug Osborne, Univ. of Arkansas-Monticello

DU is supporting this winter banding project to help understand harvest distribution patterns, winter homing rates, and enable estimation of seasonal survival rates of mallards in the Mississippi Alluvial Valley. This work also provides outreach and education opportunities by involving local students and volunteers in banding efforts.

***ECOSYSTEM SERVICES ANALYSIS IN EDISTO BASIN, SOUTH CAROLINA**

Lucas Clay (PhD Student), Dr. Tomas O'Halloran, & Dr. Marzieh Motallebi, Clemson Univ; Dr. Dale James, DU-SR; Dr. Ellen Herbert, DU-NHQ

DU is supporting a detailed assessment of the ecosystem services provided by land conservation in the Edisto Basin of South Carolina. The goal of this research is to quantify the contribution of protected lands to sequestering carbon and influencing water quality and water supply in the Edisto Basin. This work will also develop future scenarios of habitat loss to quantify the role of targeted land protection in mitigating these losses.

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

Alexandre Dopkin (MSc Student) & Dr. Kevin Ringelman, Louisiana State Univ.; Dr. Aaron Pierce, DU-SR
Mottled duck nest success averaged only 21% during a recent 2018–2020 study in southwestern Louisiana, largely due to nest predation. Researchers at Louisiana State University are using trail cameras and artificial nests across a diversity of habitats to identify the primary nest predators of mottled duck nests and provide information on nest predation risk as it varies by habitat type (e.g., pasture, cordgrass meadow, fallow rice, overwater marsh, marsh terrace, etc.). This study will provide a more holistic understanding of how predators are affecting mottled duck nest success in southwestern Louisiana.

***EVALUATING UNCREWED AERIAL VEHICLES TO MONITOR WATERFOWL RESPONSE TO WETLAND RESTORATION IN THE MISSISSIPPI ALLUVIAL VALLEY**

Zack Loken (MSc student) & Dr. Kevin Ringelman, Louisiana State Univ.; Dr. Aaron Pierce, DU-SR; Dr. Anne Mini, Lower Mississippi Valley Joint Venture

This project will explore novel methods of monitoring duck use within forested and shallow water habitats on Wetland Reserve Easement sites in the Mississippi Alluvial Valley. Uncrewed aerial vehicles were deployed in 2021 and 2022 to investigate their utility to monitor site use by waterfowl. Image analysis and machine learning were used to establish protocols for estimating duck abundance and behavior at a project level scale. The final model achieved a total mean average precision and recall of 99.1% and 82.9%, respectively, after 45 training epochs.

SOUTHEAST WINTERING GROUND CONTRIBUTIONS TO CONTINENTAL WATERFOWL POPULATIONS

Dr. Angela Hsiung (Post-doctoral researcher) & Dr. James Anderson, Clemson Univ.; Dr. Beth Ross & Dr. Heath Hagy, USFWS; Dr. Aaron Pierce, DU-SR

Understanding how non-breeding survival affects waterfowl population growth requires long-term data from multiple sources at a continental scale. This study will use integrated population modeling to test if non-breeding survival contributed to historical population growth rates and provide insights into the role of cross-seasonal effects between non-breeding and breeding season vital rates. This study also aims to describe how winter conditions affect non-breeding survival and population growth rates across a range of habitats, flyways, and species, which will help inform regional conservation priorities.

A REGIONAL ASSESSMENT OF ECOSYSTEM SERVICES PROVISIONING IN RESTORED COASTAL WETLANDS

Dr. Anna R. Armitage, Texas A&M Univ. at Galveston; Dr. Jessica O'Connell, Colorado State Univ.; Dr. Ellen Herbert, DU-NHQ; Dr. Aaron Pierce, DU-SR

Wetland restoration is a critical component of a multi-faceted coastal management strategy to compensate for impacts from disturbance, development, and climate change. An important restoration goal is to support local economies by reestablishing essential ecosystem services such as erosion protection, fishery support, and carbon sequestration. This project will evaluate the provision of ecosystem services in older restoration sites, through a fusion of field and remote sensing assessments. Research will be conducted to understand links between coastal wetland restoration design and the provision of ecosystem services.

***LINKING WETLAND INUNDATION AND HABITAT SELECTION TO BLUE-WINGED TEAL SURVIVAL THROUGHOUT THE FULL ANNUAL CYCLE**

Jeffrey Edwards (MSc student) & Dr. Lisa Webb, Missouri Cooperative Fish and Wildlife Research Unit; Dr. Drew Fowler, Louisiana Cooperative Fish and Wildlife Research Unit; Paul Link, Louisiana Dept. of Wildlife and Fisheries; Chad Courville, Louisiana Waterfowl Working Group; Dr. Aaron Pierce, DU-SR

Wetland habitat conditions at migratory stopover and wintering sites can influence body condition and breeding success of waterfowl. Recognition of this importance has led to increased research on

dabbling duck habitat use during the non-breeding period. Using GPS tracking devices and remotely sensed landcover data, this project will quantify spatial and temporal variation in habitat availability for blue-winged teal during the non-breeding season, assess how inundation and land ownership influence habitat selection, and evaluate relationships between movements and habitat selection on survival. This study will help inform wetland management to improve dabbling duck survival and productivity in support of NAWMP goals.



Photo by J. Hoffman



***UNDERSTANDING HOW WATERFOWL REST AREAS AFFECT WINTERING WATERFOWL DISTRIBUTIONS, LANDSCAPE CONNECTIVITY, AND HUNTER OPPORTUNITY**

Cory Highway (Ph.D. student) & Dr. Bradley Cohen, Tennessee Technological Univ.; Jamie Feddersen, Tennessee Wildlife Resources Agency; Dr. Aaron Pierce, DU-SR

This study attempts to understand how disturbance-free rest areas influence waterfowl behaviors and hunter opportunity across western Tennessee. Previous telemetry work in this region suggests that mallards have high winter site fidelity coupled with limited movements and small home ranges, which may increase survival during the hunting season. This study will examine how rest areas influence mallard movements, habitat selection, survival, and hunter opportunities. Study results will help inform wetland management decisions that account for conservation needs and hunter opportunities.

***DEVELOPMENT OF A DECISION SUPPORT TOOL FOR MANAGING ANTEBELLUM RICE FIELDS**

Akshit Suthar (PhD student), Oluwatobi Olaniyi (PhD student), Dr. James Anderson, Clemson Univ.; Dr. Aaron Pierce, DU-SR; Andy Quattlebaum and Blackwell Family Foundation

South Carolina's Antebellum rice fields provide critical resources for waterfowl and waterbirds. However, sea-level rise and other environmental changes have created challenges for their restoration, maintenance, and management. This project (2024–2029) will use waterfowl abundance and occupancy in Antebellum rice fields combined with relationships between impoundment characteristics and hydrologic conditions to create a comprehensive risk-benefit matrix and decision-support tool for management of coastal rice impoundments.

LEVERAGING RESOURCES: A COLLABORATIVE UNDERGRADUATE WILDLIFE STUDENT INTERNSHIP PROGRAM—BUILDING TOMORROW'S CONSERVATION LEADERS

Welder Wildlife Foundation, Nemours Wildlife Foundation, Texas A&M Univ., Clemson Univ., DU-SR & GLAR DU is partnering with the Welder Wildlife Foundation, Nemours Wildlife Foundation, Texas A&M University and Clemson University to develop and support a student intern exchange program. Participants will have the opportunity to intern at both foundations and assist with research, education, and natural resource management programs. The program will provide experience across multiple landscapes and management regimes while offering diverse learning experiences and skill development. Primary outcomes will be stronger wildlife conservationists and managers, enhanced employment opportunities, and enriched conservation perspectives.

MAPPING OF NON-RICE FIELD COASTAL IMPOUNDMENTS FOR LANDSCAPE HABITAT MANAGEMENT

Nemours Wildlife Foundation, Lowcountry Land Trust, Audubon, Edisto Island Open Land Trust, DU-SR
Since 2017, Nemours Wildlife Foundation and partners have supported GIS interns to map historical rice fields in the Lowcountry of South Carolina. These efforts expanded our understanding of landscape composition, including over 236,000 acres of historical rice fields. In summer 2023, rice field mapping efforts will expand across North Carolina, Georgia, and Florida. DU is partnering on this effort by supporting another GIS intern to map non-rice coastal impoundments in South Carolina. Non-rice impoundments are important for wintering waterfowl and other species of conservation concern, such as black rails. This project will be used to identify additional opportunities for habitat protection and conservation investment.

FIRE EFFECTS IN GULF OF MEXICO MARSHES: HISTORICAL PERSPECTIVES, MANAGEMENT, AND MONITORING OF MOTTLED DUCKS AND BLACK AND YELLOW RAILS

Dr. Auriel Fournier, Univ. of Illinois; Dr. Mark Woodrey & Dr. Kristine Evans, Mississippi State Univ.; Dr. Andy Nyman & Dr. Robert Rohli, Louisiana State Univ.; Dr. Warren Conway Texas Tech Univ.; Dr. Nicholas Enwright, Dr. Michelle Stantial, & Dr. Jim Lyons, USGS; Erik Johnson, Audubon Delta; Jim Cox, Tall Timbers Research Station; Dr. Chris Butler, Univ. of Central Oklahoma; William Vermillion, Gulf Coast JV/USFWS; Dr. Joe Lancaster, Gulf Coast JV/DU-SR; Amy Schwarzer, Florida Fish and Wildlife Cons. Commission; Eric Soehren, Alabama Dept. Cons. and Nat. Res.; Jennifer Wilson & Dr. Jena Moon, USFWS
Prescribed fire is an important tool for managing grasslands but there has been little research into its use in coastal wetlands and bird response in these ecosystems. This project will investigate the value of fire as a management tool of irregularly flooded high marsh wetlands along the U.S. Gulf Coast. Goals of the project are to determine the distribution and abundance of black rails, yellow rails and mottled ducks during selected time periods (e.g., breeding vs. non-breeding). This study will also assess changes in the frequency of frontal passages and their effect on prescribed fire management. Remote sensing and landcover classification will identify high marsh wetlands across the landscape, and collectively this project will help managers evaluate tradeoffs in using prescribed fire to manage habitats for priority bird species.

BARRIERS AND OPPORTUNITIES FOR LANDWARD MIGRATION OF COASTAL WETLANDS ALONG THE TEXAS UPPER AND MIDDLE COAST

Dr. Jena Moon & Colt Sanspree, USFWS; Dr. Nicholas Enwright, Dr. Michael Osland, & Dr. Camille Stagg, USGS; Barry Wilson, Gulf Coast JV/USFWS; Dr. Joe Lancaster, Gulf Coast JV/DU-SR
Coastal wetlands can adapt to changes related to sea level rise by compensating for seaward wetland loss with movement inland where elevation allows. This project will use contemporary elevation data for the middle and upper Texas coast to quantify the spatial probability of wetland hydroperiod (e.g., regularly or irregularly flooded) and make predictions about future conditions using alternative sea level rise scenarios. Additionally, this project will quantify current landcover types and identify areas where wetlands can move upslope. Moreover, on USFWS lands in the region, the project will identify barriers to wetland migration.

DU INC. – GREAT LAKES & ATLANTIC REGION

ECOLOGICAL FUNCTIONS AND SERVICES OF MANAGED WETLANDS

Dr. Rod Lammers, Dr. Amanda Suchy, & Dr. Don Uzarski, Central Michigan Univ.; Sara Burns, DU-GLAR
This project will quantify ecosystem services and disservices under different management strategies at Shiawassee and Pointe Mouillee State Game Areas in Michigan. Data on water quality, greenhouse gas production, soils, plant and waterfowl abundance, and hydrology will be collected to provide a holistic understanding of the nutrient retention capacity, carbon storage, water storage, flood mitigation, and habitat services provided by study wetlands. Results will be used to inform management recommendations while accounting for tradeoffs between ecosystem services and disservices.

***EVALUATING THE IMPACTS OF SUB-LETHAL EXOTIC TREMATODE INFECTIONS ON LESSER SCAUP MIGRATORY AND REPRODUCTIVE EFFORTS**

Scott Herman (PhD student) & Dr. Auriel Fournier, Univ. Illinois; Dr. Jennifer Koop, Northern Illinois Univ.
This study will implant 150 female lesser scaup with GPS accelerometer tracking devices to examine the impacts of sub-lethal trematode infections on migration and reproduction. A subset of hens will be marked in Pools 7 and 8 of the Mississippi River where the trematode is present, while another subset will be marked on staging areas west of Pool 7 and 8 where the trematode is absent. Results will improve our understanding of the potential role that exotic trematodes play in the long-term scaup population decline.

***IDENTIFYING AND ANALYZING BROOD-REARING BEHAVIOR FOR MALLARDS AND AMERICAN BLACK DUCKS WITH GPS-ACCELERATION TRANSMITTERS**

Abbey Butler (MSc student) & Dr. Jake Straub, State Univ. of New York, Brockport; Josh Stiller, New York State Dept. of Environ. Cons.; Dr. John Coluccy, DU-GLAR
This project will leverage two large-scale American black duck and mallard movement ecology studies deploying more than 1,700 GPS accelerometer tracking devices to develop post-hatch behavior classifications. Using location and accelerometer data, we will identify incubating hens, field verify successful hens with broods, use accelerometer data to classify brood-rearing behavior, and use accelerometer signatures to retroactively assign brood-rearing status for all hens in the marked sample. Results will inform analyses evaluating which environmental and landscape variables best explain mallard and black duck reproduction.

***DEVELOPMENT OF BIOCONTROL FOR NON-NATIVE PHRAGMITES**

Dr. Bernd Blossey & Post-doctoral researcher (TBD), Cornell Univ.
This project will assess recent releases of two moth (*Archanara neurica* and *A. geminipuncta*) species introduced in Canada to control non-native Phragmites to ensure host specificity and native Phragmites genotypes are safeguarded. In addition, supporting information will be collected regarding potential non-native Phragmites benefits using a social science questionnaire emailed to wetland managers across North America. This information will assist in securing a USDA/APHIS field release permit in the U.S.

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

Ben Luukkonen (PhD student) & Dr. Scott Winterstein, Michigan State Univ.
This project deployed 592 GPS/GSM transmitters on hen mallards in the Great Lakes states during breeding and post-breeding (August) to document movements and habitat use, estimate philopatry rates to breeding locales, and estimate survival and productivity rates. Results from this study will inform subsequent recommendations for habitat and harvest management for Great Lakes mallards.

***MIGRATION ECOLOGY AND DEMOGRAPHICS OF EASTERN MALLARDS THROUGHOUT THE FULL ANNUAL CYCLE**

Cassidy Waldrep (PhD student) & Dr. Mitch Weegman, Univ. of Saskatchewan; Daria Sparks (MSc student) & Dr. Jacob Straub, State Univ. of New York, Brockport; Josh Stiller, New York State Dept. of Environ. Cons.; Nate Huck, Pennsylvania Game Commission; Dr. John Coluccy, DU-GLAR

This project will deploy 1,200 GPS-acceleration transmitters on hen mallards in the eastern U.S. and Canada to quantify and compare reproductive metrics, estimate seasonal survival rates, quantify and compare movements, habitat use, and selection throughout the annual cycle. This study will fill important gaps in our understanding of eastern mallard population ecology and provide additional insights into potential causes of population declines.



***IMPACTS OF PREY RESOURCES, WEATHER AND TIME OF DAY ON HABITAT USE FOR WINTERING LESSER SCAUP IN THE CHESAPEAKE BAY**

Hannah Schley (MSc student) & Dr. Chris Williams, Univ. of Delaware

This study will use state-of-the-art GPS/GSM transmitters implanted in female and male lesser scaup to evaluate wintering habitat use in relation to weather, time of day, and prey abundance and distribution in the Chesapeake Bay. In addition, the study will examine resource selection of lesser scaup to determine characteristics of preferred habitats that can be used to predict probability of use across Chesapeake Bay. This study will provide information to help identify conservation efforts to benefit wintering populations of scaup.

EXPANSION OF AMERICAN BLACK DUCK DECISION SUPPORT TOOL AND SOUTH ATLANTIC BIOENERGETICS MODELING

Mike Mitchell & Dr. Dale James, DU-SR; Jes Skillman & Dr. John Coluccy, DU-GLAR

DU scientists will collaborate with partners from the Black Duck and Atlantic Coast Joint Ventures to expand the scope of the American Black Duck Decision Support Tool to portions of the midwestern U.S., south Atlantic, and eastern Canada. Once completed, the tool will help prioritize watersheds for habitat restoration and protection across most of the black duck's nonbreeding range.

REFINING WETLAND HABITAT CLASSIFICATION FOR WETLANDS WITHIN THE NON-BREEDING RANGE OF AMERICAN BLACK DUCKS WITHIN THE EASTERN HABITAT JOINT VENTURE

Jes Skillman, Evelyn Magner, Alek Kreiger, & Dr. John Coluccy, DU-GLAR; Sylvie Picard & Jacob Demers, DUC

DU and DUC scientists will collaborate to refine wetland data for the Canadian Wetland Inventory in southeastern Canada and create a crosswalk to more closely align with the US National Wetlands Inventory. These refinements will improve the energetics model and output of the American Black Duck Decision Support Tool.

REFINING TECHNIQUES FOR SEMI-AUTOMATED NATIONAL WETLANDS INVENTORY MAPPING IN PENNSYLVANIA, WASHINGTON, TAMPA BAY, AND TEXAS

Alek Kreiger, Evelyn Magner, Heidi Marshall, Maddie Holm and Jes Skillman, DU GLAR; Megan Lang, FWS; Nate Herold, NOAA; Katie Walker, Chesapeake Conservancy

DU is collaborating with partners to improve wetland mapping efficiency for the National Wetland Inventory. Wetlands are the most difficult biome to map due to the temporal changes and diversity of conditions. Despite repeated attempts to automate wetland mapping, updates are still performed via heads-up manual digitization. This study will assess effort required to convert C-CAP wetlands data from NOAA, 3D Hydrography Program riverine and waterbodies data from USGS, and automated wetland mapping data from the Chesapeake Conservancy into NWI standard compliant wetlands.

MICHIGAN'S DOMESTIC ACTION PLAN—LAKE ERIE WATER QUALITY, WILDLIFE HABITAT AND PUBLIC RECREATION IMPROVEMENT PILOT PROJECT

Jason Hill, Rob Paige, Cathleen Sampselle, & Sara Burns, DU-GLAR; Michigan DNR, Michigan EGLE; Dr. Ellen Herbert, DU-NHQ; Ed Verhamme, Limnotech

Wetlands in the western basin of Lake Erie have the potential to contribute significantly to the reduction of nitrogen and phosphorus runoff into Lake Erie. DU is developing a site prioritization tool in Arc GIS to select optimal sites to restore drained agricultural lands to wetlands that intercept agricultural drainage. In collaboration with Limnotech this study will monitor water quality of wetland inflows and outflows both before and after the restoration project.

DU INC. – WESTERN REGION

UPDATING THE WESTERN REGION STRATEGIC PLAN

Dr. Mark Petrie, DU-WR

The Western Region of Ducks Unlimited Inc. is divided into seven conservation areas. In 2022, it was decided to update the strategic plans for each of these areas. The purpose of these plans is to 1) establish duck population objectives for each conservation areas that are directly tied to the North American Waterfowl Management Plan (NAWMP), 2) determine the habitat conditions needed to support these population objectives, 3) identify and leverage the Ecosystem Services that can help DU create these habitat conditions, 4) and identify policy and science priorities. These seven plans are being “rolled-up” into a Western Region wide plan to inform future conservation investments.

MOVEMENT ECOLOGY, HABITAT NEEDS, AND BASIC LIFE-HISTORY MATRICES OF MEXICAN DUCKS IN THE SOUTHERN UNITED STATES

Dr. Philip Lavretsky, Univ. of Texas at El Paso

The Mexican duck (*Anas diazi*) is one of the most least understood waterfowl species in North America, and there is a general lack of knowledge regarding Mexican duck population sizes, movement patterns, and overall habitat needs. The project will use band-recovery and GPS telemetry data to understand movement patterns, habitat use, and basic biology throughout the annual cycle.

POPULATION ECOLOGY OF WRANGEL ISLAND AND WESTERN ARCTIC LESSER SNOW GESE

Dr. Mitch Weegman & Dr. Antti Piironen (Post-doctoral Fellow), Univ. of Saskatchewan

Growing populations of white geese in the Pacific flyway continue to be a conservation concern, especially as it relates to competition for food with dabbling ducks. Key objectives for this study include the development of a population model for Wrangel Island and Western Arctic lesser snow geese that includes banding, productivity, and population survey information for all colonies, 1970–present, and a better understanding of the influence of hunting and other environmental factors on population growth.

THE ROLE OF PUBLICLY MANAGED HABITATS IN SUPPORTING WATERFOWL POPULATIONS IN WASHINGTON'S NORTH PUGET SOUND

Dr. Mark Petrie, DU-WR; Kyle Spragens, Washington Dept. of Fish & Wildlife

North Puget Sound supports the highest density of wintering waterfowl on the U.S. Pacific Coast, but birds are overwhelmingly dependent on agricultural foods in this region, even while the agricultural landscape is rapidly changing. This study is assessing the effects of these changes on landscape carrying capacity and the future role of public lands in offsetting effects on waterfowl.

EVALUATING THE POTENTIAL IMPACTS OF FLOODPLAIN REACTIVATION ON WATERFOWL AND WATERFOWL HUNTING OPPORTUNITIES IN THE SACRAMENTO VALLEY

Dr. Dan Smith, Dr. Mark Petrie, & Virginia Getz, DU-WR

The lack of floodplain habitat for salmon and other anadromous fish in the Sacramento Valley in California has undoubtedly contributed to their decline. As a result, there are proposals to manage floodplain habitats more actively on behalf of fish. This study will determine the effects of "floodplain reactivation" for fish on waterfowl and waterfowl hunting opportunities in the Sacramento Valley.

CONSERVATION PLANNING FOR WATERFOWL AND PEOPLE IN THE CENTRAL VALLEY OF CALIFORNIA

Dr. Mark Petrie, DU-WR; Luke Matthews, California Dept. of Fish & Game

Waterfowl hunters and rice farmers are critical supporters of waterfowl conservation in the Central Valley of California. This study examines how we can integrate objectives for both waterfowl populations and conservation supporters by identifying actions that can simultaneously meet the needs of waterfowl, waterfowl hunters, and rice producers in the Central Valley.

PACIFIC FLYWAY WATER ANALYSIS

Dr. Mark Petrie, DU-WR; Greg Yarris, Central Valley JV; Dave Smith, Intermountain West JV

The California Central Valley, Great Salt Lake, and Southern Oregon/Northeastern California (SONEC) collectively support 70% of all ducks in the Pacific Flyway. Each of these areas is facing long-term water shortages, and because they share birds throughout autumn–winter, the effects on waterfowl habitats and populations may be compounded. This study will examine the potential consequences of regional water shortages for Pacific Flyway waterfowl and identify conservation strategies to mitigate them.





GREENHOUSE GAS FLUX RESPONSE TO TIDAL REINTRODUCTION AT HILL SLOUGH

Dr. Dennis Baldocchi, UC Berkeley; Aaron Will, DU-WR
The Hill Slough Restoration Project will restore 603 acres of managed seasonal wetlands and 46 acres of upland habitat to tidal wetland by improving existing public infrastructure, breaching interior levees, and lowering and breaching exterior levees. DU is partnering with researchers at UC Berkeley to measure pre- and post-construction greenhouse gas emissions using an eddy-flux covariance tower. Data collected at the site will be used to verify calculated quantification of emissions. The project provides a unique opportunity to investigate carbon dynamics in a restored brackish wetland.

CALIFORNIA BREEDING MALLARDS

Mike Casazza, USGS Dixon Field Station, CA; Dr. Mark Petrie DU-WR

This study will capture hen mallards in northeastern California and the Sacramento and San Joaquin Valleys and fit them with transmitters during 2023

and 2024. These marked birds will be used to better understand nest locations, nest fate, and nesting efforts, as well as post-breeding movements and distribution throughout the Central Valley.

EFFECTS OF THE CALIFORNIA DROUGHT ON WATERFOWL DISTRIBUTION AND HABITAT USE

Mike Casazza, USGS Dixon Field Station, CA; Dr. Mark Petrie DU-WR

During fall of 2022, waterfowl in the Central Valley of California experienced record drought. This study marked four species of waterfowl (mallards, pintails, white-fronted geese and snow geese) with satellite transmitters to determine the effects of drought on habitat use, movements, and distribution compared to normal water years.

CANADA GOOSE BOOK

Dr. Mark Petrie DU-WR

This book tells the story of all the Canada goose and cackling goose populations now recognized in North America, including their basic biology, population status, and management challenges they pose.

DU INC. – GREAT PLAINS REGION

UNIVERSITY DUCK HUNT AND PROFESSIONAL DEVELOPMENT FOR NATURAL RESOURCE STUDENTS

Catrina Terry, Katherine Graham, Dr. Kaylan Kemink DU-GPR; Dr. Sarah Cavanah, Univ. of Kansas

The number of waterfowl hunters in the United States has been declining for over 50 years. Mentored hunt programs and educational workshops are some of the tactics being used to help recruit new hunters. This project will examine how participation in an annual hunting and professional development workshop affects students' perceptions of hunting and their perceived likelihood of persisting as a hunter.

MAKE A DUCK DEAL: ASSESSING EFFICACY OF ZOO SIGNAGE

Abby Rokosch, Katherine Graham, Dr. Kaylan Kemink DU-GPR; Dr. Elena Rubino, Univ. of Arkansas; Jeff Ewalt & Pete Bolenbaugh, Zoo Montana

Few studies have been conducted to assess long-term changes in environmentally responsible behaviors after visits to wildlife tourism settings. This project will examine how signage at a wetland and waterfowl exhibits at Zoo Montana, Billings, influences the adoption of everyday behaviors to benefit the environment.

EXAMINING THE EFFICACY OF SOCIAL MEDIA COMMUNICATION IN CONSERVATION NON-PROFIT ORGANIZATIONS

Dr. Kaylan Kemink DU-GPR; Dr. Sarah Cavanah, Univ. of Kansas

Conservation organizations must be successful in social media usage to achieve their mission and goals. While engagement is a key concept in measuring social media success, definitions are scattered and poorly constructed from a conservation perspective. This study will summarize metrics for social media engagement and identify concepts excluded by current definitions. We will also suggest how organizational goals could be accomplished through social media engagement and outline a framework for more meaningful measurement for conservation goals.

INVESTIGATING MOTIVES FOR PARTICIPATION IN AND SATISFACTION WITH FARM BILL WETLAND EASEMENT PROGRAMS

Abby Rokosch, Katherine Graham, Dr. Kaylan Kemink DU-GPR; Dr. Elena Rubino, Univ. of Arkansas, Natural Resources Conservation Service (NRCS)

Financial and technical support throughout the life of a Wetland Reserve Easement might increase landowner satisfaction. This is of particular concern for perpetual easements, as landowner satisfaction decreases with successor landowners, often leading to legal disagreements. This study will survey three groups of landowners to 1) assess whether non-financial motives influence participation in conservation programs and 2) determine relative satisfaction of each landowner group with the easement process.

***EXTENDING BROOD SURVEYS TO THE ENTIRE PRAIRIE POTHOLE REGION: METHODS FOR DEVELOPING ANNUAL PRODUCTIVITY INDICES**

Catrina Terry, Dr. Kaylan Kemink DU- GPR; Dr. Adam Janke, Dr. Anna Tucker, & PhD Student (TBD), Iowa State Univ.; Prairie Pothole Joint Venture
Recent research suggests conservation targeting in the Prairie Pothole Region would benefit from data on brood distribution in addition to breeding pair distribution. This project will provide the framework from which state agencies can acquire these data. We will develop a scalable brood survey methodology using both roadside and drone surveys.



***EXPLORING THE NEXUS BETWEEN WATER-QUALITY AND WATERBIRD HABITAT CONSERVATION IN THE IOWA PRAIRIE POTHOLE REGION**

Evangeline Von Boeckman (MSc student), Dr. Adam Janke, & Dr. William Crumpton, Iowa State Univ.; Dr. Kaylan Kemink, DU-GPR; Dr. Ellen Herbert, DU-NHQ; Dr. John Coluccy, DU-GLAR

Wetlands in the Iowa Prairie Pothole Region provide significant potential to reduce nitrate loads associated with agricultural drainage, and wetlands designed to improve water quality may also provide significant wildlife benefits. This project will assess the bird habitat values of wetlands created or restored to receive drain tile water. Results will help establish restoration guidelines and build synergies between wetland restoration programs for wildlife and water quality.

ASSESSING LANDOWNER SATISFACTION WITH ENVIRONMENTAL QUALITIES INCENTIVE PROGRAM

Katherine Graham, DU-GPR; Catherine Wightman & Krista Erdman, Northern Great Plains Joint Venture. This pilot study will interview producers in Western South Dakota to learn about outcomes associated with participation in climate-smart EQIP practices and their relationship to producer satisfaction and resilience. The objectives of this work are to 1) describe producer perceptions of the ecological, social, cognitive, and economic outcomes of participating in climate-smart EQIP practices, 2) investigate the role of perceived outcomes in driving producer satisfaction with EQIP participation, and 3) explore the role of perceived outcomes in landowner resilience to a range of stressors. These results will inform recommendations for enhancing program outcomes, marketing, and new practices.

UNDERGRADUATE INTERNSHIP

Univ. of North Dakota; United Tribes Technical College; Univ. of Nebraska-Kearney; The Nature Conservancy; USGS Northern Prairie Wildlife Research Center; Catrina Terry, DU-GPR.

DU and partners collaborate each summer to develop research skills in undergraduate students. Participants develop their own projects and are assisted with identifying appropriate research protocols. Students receive academic credit and present their findings to peers at summer's end, with most presenting at scientific conferences. Some returning students have continued their research and now have publications that describe tests of long-standing nest searching and monitoring protocols while also revealing new behavioral data.

***PRODUCING BEEF AND BIRDS: IMPACTS OF HIGH INTENSITY SHORT DURATION GRAZING ON GRASSLAND SONGBIRDS**

Taylor Linder (PhD student) & Dr. Susan Ellis-Felege, Univ. of North Dakota; Dr. Marissa Ahlering, The Nature Conservancy; Dr. Kaylan Kemink, DU-GPR

Cattle ranchers have alternatives in the grazing systems they employ on their land, which often vary in intensity (i.e., stocking rate) and duration of grazing bouts. This project will evaluate the impacts of high intensity short duration (HISD) grazing on the productivity of grassland nesting birds (songbirds, shorebirds, waterfowl and grouse) and investigate motives and attitudes of ranchers towards grassland birds and on-farm conservation actions to inform best practices.

EFFECTIVENESS OF THE COVER CROP AND LIVESTOCK INTEGRATION PROGRAM FOR IMPROVING WETLAND WATER QUALITY

Kyle Kuechle, Catrina Terry, Emily Schwartz, & Tanner Gue, DU-GPR; Greg Sandness, North Dakota Dept. of Environmental Quality; Dr. Mark Kaemingk & Page Arsenault, Univ. of North Dakota DU and conservation partners developed the Cover Crop and Livestock Integration Program (CCLIP) to help producers adopt sustainable agricultural practices that integrate seasonal cover crops and cattle ranching with traditional grain production to improve soil health and generate broader environmental benefits. This study will ascertain benefits of CCLIP to water quality by monitoring wetland nutrient concentrations and hydrology in seasonal and temporary wetlands embedded in CCLIP fields, conventional agriculture, and pastureland.

EFFECTIVENESS OF THE COVER CROP AND LIVESTOCK INTEGRATION PROGRAM FOR IMPROVING SOIL HEALTH AND SOIL CARBON ACCUMULATION

Kyle Kuechle, Emily Schwartz, Bruce Toay, Brian Chatham, & Tanner Gue, DU-GPR; Dr. Ellen Herbert, DU-NHQ Regenerative agricultural practices such as grazing management, no-till, cover cropping, and livestock integration can build soil health and sequester carbon. DU's science and agronomy teams are partnering with the Soil Health Institute to develop monitoring protocols to measure the accumulation of soil carbon and track other indicators of improved soil health such as water infiltration and microbial activity.



DU CANADA – NATIONAL

WETLANDS AS NATURE-BASED CLIMATE CHANGE SOLUTIONS: QUANTIFYING CARBON-CAPTURE POTENTIAL WHILE BUILDING A STRONGER GREEN ECONOMY

Dr. Irena Creed & Dr. George Arhonditsis, Univ. of Toronto, Scarborough Campus; Dr. Pascal Badiou, Dr. Lauren Bortolotti, Paige Kowal, Bryan Page, & Lee van Ardenne, DUC-IWWR; Dr. Matt Bogard & Dr. Larry Flanagan, Univ. of Lethbridge; Dr. Gail Chmura, Dr. Sara Knox, & Dr. Christian von Sperber, McGill Univ.; Dr. David Lobb, Univ. of Manitoba; Dr. Ali Ameli, Univ. of British Columbia

Freshwater mineral wetlands are integral features of Canada's agricultural landscapes and have the potential to become a key component of Canada's nature-based climate solution (NbS) strategy while supporting a thriving agricultural sector. A barrier to accurately assessing their contribution to climate goals stems from a lack of coverage, carbon stock and greenhouse gas data from these specific types of wetlands. This project will advance science and inform policy by measuring the potential of these wetlands to store carbon in agricultural landscapes. Results will be used to support DUC and decision-makers with the data, tools, and models to incentivize the use of wetlands as NbS.



RESNET: PROMOTING SUSTAINABLE AND RESILIENT ECOSYSTEMS THROUGHOUT CANADA

Dr. Elena Bennett, McGill Univ.; Adam Campbell, DUC-ATL; Dr. Vanessa Harriman & Dr. Lauren Bortolotti, DUC-IWWR; numerous academic, government, non-profit, and industry partners

ResNet is a national research network to improve Canada's capacity to monitor, model, and manage working landscapes and the benefits they provide. DUC is involved in multiple sub-projects that combine scientific quantifications of these benefits with human dimensions of management issues. In Atlantic Canada, this project will improve our understanding of the trade-offs between the reinforcement of dykelands and restoration of tidal

marshes in the Bay of Fundy. In the Prairies, this project will help us understand how to reduce conflict around wetland management through collaborative decision making.

DU CANADA – BRITISH COLUMBIA

GIS MODELLING FOR BEAVER (CASTOR CANADENSIS) RESTORATION POTENTIAL ASSESSMENT IN BRITISH COLUMBIA

Aleksandra (Ola) Kepczynska, Fiona Tse, & Matt Christensen, DUC-BC

Beaver Dam Analogues (BDAs) are designed to mimic wetland natural ecological processes and are a low-cost approach to wetland restoration and fish habitat enhancement. This study uses spatial models to predict a riverscape's capacity in supporting dam-building activity by beavers in British Columbia. The goal is to predict the location and size of beaver dams and inform where BDAs can be built. These efforts will augment DUC conservation planning and project implementation while highlighting the importance of nature-based climate solutions.

PREDICTING HABITAT DISTRIBUTION FOR SEA DUCKS IN BRITISH COLUMBIA

Bruce Harrison, Kyla Bas, & Paul Yeung, DUC-BC; Danielle Morrison, Nature Trust BC; Kathleen Moore, CWS; Llwellyn Armstrong & Dr. James Devries (retired), DUC-IWWR

The coastal waters of British Columbia (BC) support significant populations of sea ducks, though habitat requirements of these species are poorly understood. The Pacific Birds Habitat Joint Venture (PBHJV) lacks the ability to inventory and assess waterfowl habitat along much of the entire 25,000 km BC coastline making it difficult to prioritize conservation actions for these species. This project is developing predictive models to identify key nearshore marine areas for important sea ducks. This product will aid in the assessment and targeting of conservation activity along the BC coast by PBHJV partners.

EVALUATING PERFORMANCE OF HABITAT PROJECTS IN BRITISH COLUMBIA

Kyla Bas, Jayden Andrada, Sarah Nathan, & Bruce Harrison, DUC-BC

DUC has constructed hundreds of habitat projects in British Columbia (BC) since the late 1960s but had not conducted a comprehensive biological performance review since the 1990s. Since 2019 we have been evaluating project performance in terms of bird use and habitat structure across BC projects. Coastal projects include evaluation of the effects of new floodplain restoration techniques.

JOINT VENTURE RESTORATION, MANAGEMENT AND STEWARDSHIP (RMS) DATABASE

Andrew Huang, Kathleen Moore, & Lili Simon, CWS; Bruce Harrison, Paul Yeung, & Alexandra (Ola) Kepczynska, DUC-BC; Danielle Morrison & Leanna Warman, NTBC; Trevor Reid & Cindy McCallum, NCC The Pacific Birds Habitat Joint Venture and Canadian Intermountain Joint Venture Technical Team has used its ENGO Conservation Areas Database for over a decade to track long- and medium-term securement activities among the partners in both Joint Ventures (JV). Though instrumental in measuring JV accomplishments, it lacks the ability to spatially track outcomes from other habitat initiatives across habitat types and ENGO partners. The JV team began developing this new database in FY23 to enable partners including DUC to better assess, evaluate and track their RMS activities within priority habitat types.

WETLAND INVENTORY IN PRIORITY WETLAND REGIONS OF THE CIJV AND PBHJV

Erin Roberts, CWS; Kyla Bas, Bruce Harrison, & Paul Yeung, DUC-BC

British Columbia (BC) does not have a provincial wetland inventory. DUC is collaborating with Environment and Climate Change Canada (and other ENGOs) to locate, categorize, and map wetlands in priority wetland areas of the Canadian Intermountain Joint Venture and the Pacific Birds Habitat Joint Venture with the goal of creating an enhanced wetland mapping product and wetland classification resources for BC. These tools will support a number of joint venture science needs in BC including wetland trend monitoring and waterfowl habitat use models.

FACTORS INFLUENCING THE PERSISTENCE OF CREATED TIDAL MARSHES IN THE FRASER RIVER ESTUARY

Daniel Stewart, Asarum Ecological Consulting; Daniel Hennigar, Robyn Inham, & Eric Balke, DUC-BC; Dr. James Paterson, DUC-IWWR

More than 100 tidal marshes have been constructed in the Fraser River Estuary over the last 40 years, but the factors behind project success have not been investigated. The site is an important waterfowl overwintering area, as well as a stopover site for millions of shorebirds. This project analyzed vegetation survey data from 78 marsh creation sites and 16 reference marshes to determine what factors influence (1) the persistence of created tidal marshes and (2) the resilience of created marsh plant communities. This project provides the most comprehensive analysis of tidal marsh creation efforts in the Fraser River Estuary to date and will support improved outcomes with future tidal marsh creation and restoration efforts.



DU CANADA – BOREAL

EFFECTS OF NATURAL AND ANTHROPOGENIC LINEAR FEATURES ON SETTLING AND PRODUCTIVITY OF DUCKS IN THE WESTERN BOREAL FOREST

Dr. Stuart Slattery, Howie Singer, Llwellyn Armstrong, Dr. Matt Dyson, & Dr. Vanessa Harriman, DUC-IWWR

The Western Boreal Forest is changing rapidly due to industrial development. Implications of these changes for waterfowl nesting guilds (e.g., ground, overwater, cavity) are unknown. This study is assessing the potential effects of roads, pipelines, and seismic lines on waterfowl settling and productivity at the guild level in the Boreal Plains using aerial surveys. This information will be used to guide and refine DUC conservation in the boreal forest.

SPECIES-HABITAT RELATIONSHIPS OF DUCKS IN THE WESTERN BOREAL FOREST

Dr. Matt Dyson, Dr. Stuart Slattery, Howie Singer, Dr. Vanessa Harriman, & Llwellyn Armstrong, DUC-IWWR

Knowledge of species-specific responses to land use and landcover change informs our ability to deliver conservation programs and anticipate conservation needs. The Western Boreal Forest has rapidly changed in recent decades due to industrial development, and there remains uncertainty about the varying effects of these changes among different species of ducks. This study is assessing effects of roads, pipelines, and seismic lines on settling and productivity for American wigeon, blue-winged teal, green-winged teal, lesser scaup, mallard, northern shoveler, ring-necked duck, bufflehead, and common goldeneye across the Boreal Plains.

SPECIES ABUNDANCE MODELLING OF ARCTIC-BOREAL ZONE DUCKS INFORMED BY SATELLITE REMOTE SENSING

Michael Merchant & Kevin Smith, DUC-BOR; Howie Singer, Llwellyn Armstrong, Dr. Vanessa Harriman, & Dr. Stuart Slattery, DUC-IWWR; Michael Battaglia & Dr. Nancy French, Michigan Tech Research Institute

This collaboration is a Phase II project under the auspices of NASA's Arctic Boreal Vulnerability Experiment. The Arctic-Boreal zone (ABZ) is home to numerous duck species, but understanding the spatiotemporal distribution of their populations across this vast landscape is challenging. This project is developing species abundance models using high-resolution, time-varying wetland inundation data from remote sensing methods. This project demonstrated improved estimation of duck abundance and distribution at high latitudes and that innovative datasets are an asset to spatial targeting of biodiversity conservation efforts under rapidly changing climatic conditions.



INFORMING WETLAND POLICY AND MANAGEMENT FOR WATERFOWL HABITAT AND OTHER ECOSYSTEM SERVICES USING MULTI-FREQUENCY SYNTHETIC APERTURE RADAR

Michael Merchant, Becky Edwards, Kevin Smith, & Sonny Lenoir, DUC-BOR; Michael Battaglia, Dr. Laura Bourgeau-Chavez, & Dr. Nancy French, Michigan Tech Research Institute; Dr. Jennifer Baltzer, Wilfrid Laurier Univ.; Dr. Bruce Chapman, NASA; Dr. Chris Spence, ECCC

This collaboration is a Phase III project under the auspices of NASA's Arctic Boreal Vulnerability Experiment. In Phase II we focused on improving methods to map wetland status, dynamics, and change for waterfowl habitat assessment. In the next phase, we are focusing on using these methods to assess wetland ecosystem services where land stewardship activities lack sufficient information for informed management. This project will identify key species, areas of concern, and ecosystem services vital to stakeholder needs by initiating discussions with regional Indigenous communities and provincial and national governments.

BOREAL BIOME WETLAND CLASSIFICATION USING MULTI-SEASONAL EARTH OBSERVATION DATA ON GOOGLE EARTH ENGINE AND MACHINE LEARNING OPTIMIZATION MODELLING

Michael Merchant & Becky Edwards, DUC-BOR

The primary focus of this project was to develop a wetland inventory for high-priority sites in Canada's Western Boreal Forest, specifically in Saskatchewan's boreal shield and Nunavut's taiga shield ecozone. Sites were 60-by-60 km (360,000 hectares) in size, and similar to the surrounding areas, lack Canadian Wetland Inventory and Canadian National Wetland Inventory compliant data. The results of this pilot project demonstrate the potential of DUC's multi-source and multi-seasonal classification approach for wetland mapping in the taiga and boreal shield ecozones and that cloud-based and machine learning methodology can achieve high classification accuracies in what are notoriously difficult landscapes to map. This information was presented and published at M2GARSS.

THE NEXT GENERATION OF ALBERTA'S WETLAND INVENTORIES (PILOT AREAS)

Michael Merchant, Becky Edwards, James Varghese, Lindsay McBlane, & Al Richard (retired), DUC-BOR; Lyle Boychuk & Josh Evans DUC-SK; Adam Spitzig, DUC-INC

The Alberta Biodiversity Monitoring Institute, DUC, and Alberta's Environment and Protected Areas are developing a wetland inventory conforming to the Government of Alberta's mapping standards in four pilot areas across Alberta (two in the boreal forest and two in the prairies). With methods rooted in artificial intelligence and cloud computing, this project will establish a workflow for mapping



of boreal wetlands with project partners. Our goal is to scale these state-of-the-art methods, create a province-wide, comprehensive wetland inventory for Alberta, support various goals and objectives of the Alberta Wetland Policy, and provide information to support other government led planning information needs.

MACHINE LEARNING-BASED ACTIVE LAYER THICKNESS ESTIMATION OVER PERMAFROST LANDSCAPES BY UPSCALING AIRBORNE REMOTE SENSING MEASUREMENTS WITH CLOUD-COMPUTER GEOTECHNOLOGIES

Michael Merchant & Lindsay McBlane, DUC-BOR

Earth Observation data plays a pivotal role in understanding our planet's rapidly changing environment. Geospatial technologies have made remarkable progress, particularly from innovations in Artificial Intelligence and scalable cloud-computing resources. The project goal is to upscale airborne active layer thickness measurements to satellite observation with machine learning. These methods could also be used in estimating peat depths across northern wetlands. This information was published in IntechOpen and M2GARSS.

MODELLING INLAND ARCTIC BATHYMETRY FROM SPACE USING CLOUD-BASED MACHINE LEARNING AND SENTINEL-2

Michael Merchant & Lindsay McBlane, DUC-BOR

Lakes and ponds are extensive features throughout the circumpolar region, spanning a range of environmental conditions that control their hydro-ecological processes and spatiotemporal distribution. In this study, satellite derived bathymetry methods were implemented to model regional inland Arctic water depths within the open-source and cloud-based Google Earth engine platform. This research will improve mapping of shallow open waters of boreal ecosystems.



AUTONOMOUS RECORDING UNITS DEPLOYMENT FOR AVIAN ACOUSTIC INVENTORY

Becky Edwards, DUC-BOR;

Howie Singer, DUC-IWWR

Dene K'éh Kusān (DKK), which means "the peoples way we follow" in Kaska, is a proposed Indigenous Protected and Conserved Area (IPCA) in northern British Columbia. DUC, the Dene Keyah Institute, and Dane nan yé dāh Kaska Land Guardian Program have partnered to support their IPCA management plan, using the wetland inventory created by DUC in 2023 to select suitable wetland sites for ARU deployment across the territory. The goal is to build a baseline avian acoustic inventory across DKK.

WETLANDS AND WATERFOWL IN DENE K'ÉH KUSĀN STORYMAP

Becky Edwards, Darrell Kovacz, & Raina Mithrush, DUC-BOR; Howie Singer, DUC-IWWR

Dene K'éh Kusān is a proposed Indigenous Protected and Conserved Area (IPCA) in northern British Columbia and provides important nesting habitat for migratory birds and waterfowl. DUC has partnered with Dene Keyah Institute and Dane nan yé dāh Kaska Land Guardian Program to create a storymap amplifying Indigenous stories, knowledge, and science regarding wetland and waterfowl in the region.



INTERLAKE WETLAND INVENTORY

Becky Edwards & Aaron Sneep, DUC-BOR

The Interlake region in Manitoba's Boreal Plains ecozone has been identified as a high-priority wetland and waterfowl conservation region in Canada's Western Boreal Forest. This area lacks Canadian National Wetland Inventory (CNWI) compliant data for baseline analysis and conservation initiatives. DUC will produce a wetland inventory that meets CNWI standards, by mapping five CNWI classes and further differentiating into DUC's Enhanced Wetland Classification system. Wetland location, extent, and distribution will be determined using satellite-collected data sets via cloud-based software and predictive machine learning methods.

CONSERVATION AREAS NETWORK ANALYSIS PROJECT

Lindsay McBlane, Darrell Kovacz, Mark Kornder, & Alain Richard (retired), DUC-BOR; Elston Dzus, Tom Habib, Kiera Steward-Shepherd, & Sandra Cardinal, Alberta-Pacific Forest Industries Inc.; Kevin Gillis, Mistik Management Ltd.; Kecia Kerr, Ryan Cheng, & Gord Vaadeland, CPWS

This project uses GIS modeling (Marxan) to assess how well current protected areas network in northeast Alberta and northwest Saskatchewan represent features of conservation interest, including waterfowl abundance. The goal is to recommend an expanded, representative network of conservation areas throughout the region, meet forestry certification goals, and contribute towards the Canadian Federal Government's protected areas goals. DUC is leading the technical portion of this multi-stakeholder project to leverage waterfowl and wetlands conservation, engage with Indigenous communities, and build opportunities for conservation through various mechanisms (e.g., OECMs, IPCAs, Protected Areas, Special Management Areas, etc.).

IMPROVING WATERFOWL HABITAT CONSERVATION IN A MANAGED FOREST. A CASE STUDY ON THE BLACK SPRUCE FOREST MANAGEMENT AREA

Michael Merchant, Darrell Kovacz, Dr. Marcel Darveau (retired), & Al Richard (retired), DUC-BOR; Dave Thomson, Thomson Environmental; Al Harris, Northern Bioscience; Keith Hautala, Confederation College; Dr. Ashley Thomson, Lakehead Univ.

This collaborative project will improve tools used by forest managers by converting standard forestry maps to DUC's Enhanced Wetland Classification System, and then identifying key waterfowl habitats. The result will be more accurate inclusion of waterfowl needs in ongoing planning and operational decisions on a 13,700 km² (5,290 mi²) forest management area.

QUANTIFYING THE EFFECT OF IN SITU OIL SANDS DEVELOPMENT ON WETLAND FUNCTION: MANAGING TO MITIGATE IMPACT AND OPTIMIZE RECLAMATION OUTCOMES

Dr. Scott Ketcheson, Athabasca Univ.; Dr. Maria Strack, Univ. of Waterloo; Dr. Greg McDermid, Univ. of Calgary; Dr. Bin Xu, NAIT Centre for Boreal Research; Lindsay McBlane & Kylie McLeod, DUC-BOR

This project is examining the effect of resource-access roads and well pads on the surrounding hydrological processes and subsequent impacts to wetlands. Changes in water movement can impact the type and amount of vegetation growth and the research team will check to see if these changes are occurring, how long it takes them to occur and understand what they mean for ecological suitability for habitat, including boreal waterfowl. The research team has partnered with Imperial Oil Ltd. so that the research outcomes can be directly applied in their operations and with DUC to extend the reach and application of the findings.

CAN-PEAT: CANADA'S PEATLANDS AS NATURE-BASED CLIMATE SOLUTIONS

Dr. Maria Strack, Univ. of Waterloo; Dr. Elyn Humphreys, Carleton Univ.; Dr. Jianghua Wu, Memorial Univ.; Dr. David Olefeldt, Univ. of Alberta; Dr. Oliver Sonnentag & Dr. Michelle Garneau, Univ. de Montréal; Dr. Mary Kang, McGill Univ. The Can-Peat network includes many other collaborators with DUC represented by Lindsay McBlane & Kylie McLeod, DUC-BOR; Dr. Pascal Badiou, DUC-IWWR Peatlands are the world's largest terrestrial organic carbon (C) stock, with Canada home to the largest portion of global peat C stores. The Can-Peat project brings together a diverse team of researchers and partners to quantify the potential of peatland management to reduce Canada's greenhouse-gas emissions and mobilize this information to support peatland research, management, and policy. Can-Peat's focus is to create an open access database of peatland distribution, condition and vulnerability, innovative modelling of peatland response to disturbance, and developing decision-support tools for peatland management. This research will benefit conservation, as preserving C-rich peat soils is a key nature-based climate solution.

fRI RESEARCH HEALTHY LANDSCAPES PROGRAM: A WHOLE LANDSCAPE APPROACH TO ECOSYSTEM BASED MANAGEMENT

Kylie McLeod & Marissa Green, DUC-BOR; Dr. David Andison, fRI; Courtney Miller, Alberta-Pacific Forest Industries Inc.; Paul LeBlanc, Louisiana-Pacific Canada Ltd.; Chris Watson, Parks Canada; others from the HLP Activity Team (consisting primarily of forest industry and provincial government)



fRI Research's Healthy Landscapes Program (HLP) is a forest management research partnership among industry, government, academia, and others. DUC is leading this project, which was driven by the growing understanding of the role of wetlands, and particularly peatlands, on the landscape (e.g., drying peatlands contributing to catastrophic wildfire). The purpose of this project is to (1) define the "whole landscape" for the HLP bringing together forest and wetland classifications and (2) assess HLP's current gaps in wetland knowledge, identify past and current research, and create a road map for future research.



IMPACTS OF CLIMATE CHANGE ON BOREAL WETLANDS

Dr. Vanessa Harriman, Dr. Lauren Bortolotti, & Catherine Brown, DUC-IWWR; Chelsea Martin, Leanne Mingo, & Kylie McLeod, DUC-BOR; Dr. Yanping Li & Dr. Danqiong Dai, Western Univ.; Dr. Zhe Zhang, National Center for Atmospheric Research; Dr. Scott Ketcheson, Athabasca Univ.

Boreal wetlands are expected to be sensitive to climate change with consequences for the communities, industries, forests, and wildlife that depend on them. This study will produce predictions of future wetland abundance and distribution in the Western Boreal Forest (WBF) and will respectfully engage and learn from communities that may be affected by wetland change. Results from this study will support not only DUC's planning efforts but also conservation planning for other migratory birds and conservation efforts in the WBF.

SPATIAL ESTIMATES OF WETLAND SOIL ORGANIC CARBON IN THE BOREAL PLAINS ECOZONE, CANADA

Heather Peacock, Darrell Kovacz, & Lindsay McBlane, DUC-BOR; Dr. Vanessa Harriman, Dr. Pascal Badiou, & Llwellyn Armstrong, DUC-IWWR; James Guindon, Govt AB.

Carbon accounting is increasingly important in land management and the forestry sector, particularly in the context of Canada's carbon-rich ecosystems. Current spatial mapping products at the national scale do not allow for accurate estimates of carbon stocks at local scales. This project is estimating wetland soil organic carbon across the Boreal Plains ecozone for various wetland classes determined using DUC's Enhanced Wetland Classification. Understanding the quantity and distribution of soil organic carbon holds pivotal significance for climate change mitigation. This fine-grained map product can assist carbon accounting and conservation by highlighting where and which wetland classes store large amounts of carbon.

DU CANADA – PRAIRIES

ASPECTS OF BUFFLEHEAD BREEDING BIOLOGY IN SOUTHWESTERN MANITOBA: AN AREA OF RECENT POPULATION GROWTH

Gord Hammel, Erickson-MB; Howie Singer & Llwellyn Armstrong, DUC-IWWR

Understanding species-specific breeding information is important for conservation and harvest management decisions. This project collected data on a relatively understudied duck species, Bufflehead, in southwestern Manitoba from 2008–2018. Data were collected on population size, duckling age and size, hatch date, and productivity to investigate the potential range expansion and population growth of this species. This information will inform future conservation plans.

PRAIRIE CONSERVATION PLANNING “COST TOOL” DEVELOPMENT

Dr. Vanessa Harriman, Dr. James Devries (retired), & Llwellyn Armstrong, DUC-IWWR; Dr. David Howerter (retired) & Paul Thoroughgood, DUC-HO; Cynthia Edwards, DU-NHQ; other DUC staff

Developed from years of field research, the “Cost Tool” incorporates data on waterfowl nest habitat selection and success with costs of habitat conservation to provide a decision support tool predicting return on investment (cost per hatched nest) across prairie Canada. This planning product provides a powerful tool for mapping the relative value of conservation actions across prairie Canada and is being used by DUC to guide conservation decisions.

QUANTIFYING THE DEMOGRAPHY OF NORTH AMERICAN DABBLING DUCKS USING INTEGRATED ANALYSES AND SCENARIO-PLAYING TO GUIDE CONSERVATION PLANNING

Dr. Dan Gibson (Post-doctoral researcher) & Dr. Todd Arnold, Univ. of Minnesota; Dr. Mitch Weegman, Univ. of Saskatchewan; Dr. James Devries (retired) & Dr. Matt Dyson, DUC-IWWR; Dr. David Howerter (retired), DUC-HO; Dr. Bob Clark (retired), ECCC

This project uses 55 years of breeding survey data in the Prairie Pothole Region (1961–2022) to develop Bayesian hierarchical models of land use and climate change effects on productivity (i.e., age ratios at banding) for seven dabbling duck species. These models will be used to predict responses of the dabbling duck community to climate and land use change scenarios, thereby providing a more holistic view of conservation measures that differentially or uniformly benefit waterfowl.

UNDERSTANDING WETLAND CARBON, NITROGEN, AND PHOSPHORUS SEQUESTRATION POTENTIAL IN AGRICULTURAL LANDSCAPES

Dr. Irena Creed, Univ. of Saskatchewan; Dr. Tim Moore & Dr. Christian von Sperber, McGill Univ.; Dr. Pascal Badiou, DUC-IWWR; Dr. David Lobb, Univ. of Manitoba

Understanding the benefits of waterfowl habitat to society is important for expanding support for conservation. This project focused on how wetlands in agricultural landscapes capture carbon, nitrogen, and phosphorus and improve quality of downstream waters. Monitoring and research efforts focus on vulnerable agricultural landscapes in Alberta, Manitoba, and Ontario.

PRAIRIE ECOSYSTEM SERVICES PROJECT: QUANTIFYING THE CONTRIBUTION OF WETLANDS IN LIVESTOCK PRODUCTION LANDSCAPES TO CLIMATE CHANGE MITIGATION

Dr. Pascal Badiou & Dr. Lauren Bortolotti, DUC-IWWR; Dr. Sara Knox, Univ. of British Columbia; Dr. Aaron Glenn, AAFC; Dr. Kim Ominski, Univ. of Manitoba; Dr. Matt Bogard & Dr. Laura Logozzo, Univ. of Lethbridge; and others from AAFC and Univ. of Manitoba

This project will focus on wetlands embedded in grazing lands and cropped fields to understand how land use affects wetland greenhouse gas emissions and carbon sequestration. Information from this project will determine the degree to which wetlands in agricultural landscapes contribute to natural climate solutions and how to manage these systems to maximize benefits.

SEMI-NATURAL LANDSCAPE FEATURES AS BENEFICIAL INSECT RESERVOIRS: ARTHROPOD COMMUNITY COMPOSITION IN PRAIRIE POTHOLE LANDSCAPES

Dr. Paul Galpern, Univ. of Calgary; Dr. James Devries (retired) & Dr. James Paterson, DUC-IWWR

This project is quantifying the value of wetlands in croplands to pollinating and beneficial insects that may provide value to farmers through improved crop pollination and pest control. Researchers are measuring the abundance and diversity of insects at varying distances from the wetland into the adjacent cropland in prairie agroecosystems of southern Alberta. Understanding the value of wetlands in providing these important ecosystem services to producers provides valuable information supporting the retention of wetland habitat in prairie agroecosystems.



***DIVERSITY AND ABUNDANCE OF GROUND-DWELLING ARTHROPODS IN CANADIAN PRAIRIE AGROECOSYSTEMS: UNDERSTANDING THE ROLE OF REMNANT AND RESTORED HABITATS**

Georgiana Antochi-Crihan (MSc student) & Dr. Sean Prager, Univ. of Saskatchewan; Dr. James Devries (retired) & Dr. James Paterson, DUC-IWWR

This project is examining the diversity and abundance of ground-dwelling arthropods associated with wetlands and field edges in croplands and grasslands of central Saskatchewan. Quantifying the abundance and diversity of these species provides valuable information on the potential of remnant semi-natural habitats to provide pest control services in prairie agroecosystems. Quantifying ecosystem services provided by wetlands and other habitats supports DUC communication and policy efforts to promote conservation.

PRAIRIE BIODIVERSITY MAPPING AND ASSESSMENT TOOL

Dr. James Paterson, Dr. Lauren Bortolotti, Ashley Pidwerbesky, Paige Kowal, & Dr. James Devries (retired), DUC-IWWR

This project is using prairie-wide observations for amphibians, birds, mammals, and reptiles to develop probability of occurrence layers for each species as a function of habitat and climate variables at multiple scales. These layers will be used to map biodiversity potential across prairie Canada as a function of land cover at fine spatial scales. This effort will enhance DUC conservation planning by highlighting areas of potential high biodiversity and allowing prediction of the effects of conservation actions (e.g., restoration) and land cover change (e.g., wetland and grassland loss) on biodiversity potential.

QUANTIFYING PRAIRIE WETLAND ECOSYSTEM SERVICES—THE WETLAND ECOSYSTEM SERVICES TOOL

Dr. Lauren Bortolotti, Llwellyn Armstrong, Paige Kowal, Lee van Ardenne, Dr. Pascal Badiou, Bryan Page, Dr. James Paterson, & Dr. James Devries (retired), DUC-IWWR; Dr. Henry Wilson, AAFC

Wetlands provide many ecosystem services, and quantification and communication of these values can garner support for DU's continental conservation objectives. This study is developing spatially explicit models of prairie wetland ecosystem services including water storage, nutrient retention, carbon storage, and biodiversity. The resulting product, the Wetland Ecosystem Services Tool, will have numerous applications, including communicating wetland values to the public and informing efforts to maximize ecosystem services from waterfowl conservation delivery.

DELTA MARSH, RESTORING THE TRADITION—FISHERIES RESPONSE

Dr. Dale Wrubleski (retired), Bob Emery (retired), Paige Kowal, & Llwellyn Armstrong, DUC-IWWR; Doug Watkinson & Dr. Amanda Caskenette, DFO

A ten-year research and monitoring program was undertaken to determine how temporary exclusion screens could be used to exclude invasive common carp while minimizing impacts to the native fish assemblage at Delta Marsh, Manitoba. A combination of sampling methods was used to study changes in the fish assemblage pre- and post-exclusion, and inside and outside the carp exclusion zone in the marsh. This information is essential for assessing how the exclusion of carp to restore Delta Marsh is affecting other fish species.

DELTA MARSH, RESTORING THE TRADITION—FISHERIES METHODS

Dr. Amanda Caskenette, Dr. Eva Enders, Ricky Di Rocco, & Doug Watkinson, DFO; Dr. Dale Wrubleski (retired), Bob Emery (retired), & Paige Kowal, DUC-IWWR

Fisheries monitoring for the Delta Marsh restoration project provided an opportunity to work with Canadian federal government staff to develop or improve fish sampling methods for large wetlands. This project is the first to develop fish length-width relationships that will be useful for selecting screen size for fish passage or exclusion projects where only length data is available. This study also determined methods for correcting gillnet selectivity bias in a habitat in which gillnets are not commonly used. This project is also likely the first to use trail cameras to monitor fish movement under different environmental conditions at common carp exclusion structures.

IMPACTS OF CLIMATE CHANGE IN PRAIRIE CANADA—WATERFOWL PRODUCTIVITY

Dr. Lauren Bortolotti, Dr. James Devries (retired), & Llwellyn Armstrong, DUC-IWWR; Dr. Zhe Zhang, National Center for Atmospheric Research; Dr. Yanping Li, Western Univ.; Dr. Benjamin Rashford, Univ. of Wyoming

Future improvements in conservation planning for waterfowl will require enhanced understanding of the effects of climate change on prairie wetlands, agricultural land use, and population demographics. In the second part of a multi-stage project, this study is incorporating direct impacts of climate change on wetlands and indirect (economically driven) effects on land use into models of prairie waterfowl productivity.

***INFLUENCE OF WETLAND PESTICIDE POLLUTION ON WATERFOWL DISTRIBUTION, ABUNDANCE AND PRODUCTIVITY IN THE PRAIRIE POTHOLE REGION**

Tyler Bryan (MSc student) & Dr. Christy Morrissey, Univ. of Saskatchewan; Dr. James Devries (retired), DUC-IWWR

This project examines the hypothesis that waterfowl presence, abundance, and composition will decrease in relation to increasing rate of pesticide pollution because of impacts on aquatic invertebrate communities. Understanding the relationship between incidence of pesticide pollution and changes in the waterfowl community using prairie potholes will help DUC engage the agricultural industry and landowners in adopting environmentally sustainable agricultural practices.

EVALUATING DITCH PLUG WETLAND RESTORATIONS IN THE PRAIRIE POTHOLE REGION

Dr. James Paterson, Dr. Matt Dyson, Howie Singer, Ashley Pidwerbesky, & Dr. Stuart Slattery, DUC-IWWR

This study is evaluating the success of ditch plug wetland restorations in supporting ducks and other wildlife by sampling restored wetlands of various ages and comparing waterfowl and other biodiversity to undrained wetlands in similar landscapes. Results from this study will improve wetland restoration decisions (e.g., value of restoring wetlands in different landscapes) and build support for the value of restored wetlands supporting ducks and other biodiversity.

LINKAGES BETWEEN BIODIVERSITY AND GREENHOUSE GAS FLUXES IN PRAIRIE WETLANDS

Dr. Sam Woodman & Dr. Matt Bogard, Univ. of Lethbridge; Dr. Lauren Bortolotti, Dr. James Paterson, & Dr. Pascal Badiou, DUC-IWWR

Wetlands provide numerous benefits including storing carbon and supporting biodiversity, but there may be trade-offs between the provisioning of different services. This study will analyse greenhouse gas flux and bird and amphibian biodiversity data collected from wetlands across the prairie provinces. These data will be used to evaluate hypotheses about linkages between carbon and biodiversity functions and inform the management of wetlands systems to provide multiple benefits in both grazing lands and annual crops.

WETLANDS IN WORKING LANDSCAPES: MAINTAINING WETLAND RESILIENCE IN THE CONTEXT OF AGROECOSYSTEMS AND CLIMATE CHANGE

Dr. Matt Dyson, Dr. James Devries (retired), Andrew Collard, Ashley Pidwerbesky, & Dr. James Paterson, DUC-IWWR; Dr. Tyler Cobb & Dr. Rob Hinchcliffe, Alberta Biodiversity Monitoring Institute- Univ. of Alberta; Dr. Brian Eaton, Dr. Jim Davies, Dr. Sue Koziel, & Dr. Emily Herdman, Innotech Alberta; Dr. Mitch Weegman, Univ. of Saskatchewan

The Prairie Pothole Region (PPR) is the most productive waterfowl breeding habitat on the continent, but over the past century wetlands have been extensively drained and converted for agricultural production. This study is evaluating PPR wetlands across an agricultural gradient to understand how agricultural land use affects wetland water quality, invertebrate communities, abundance, and their ability to support waterfowl pairs and broods. Results will clarify the influence of agricultural land use and water quality on wetlands and their ability to support sustainable populations of waterfowl and other wetland dependent species in the PPR.





***COMPARING MOVEMENTS, BEHAVIOUR, SURVIVAL AND REPRODUCTIVE SUCCESS IN DABBLING DUCKS FITTED WITH TRACKING DEVICES USING DIFFERENT ATTACHMENT TECHNIQUES**

Kelsie Huss (MSc Student), Dr. Mitch Weegman, & Dr. Karen Machin, Univ. of Saskatchewan; Dr. Frank Rohwer & Dr. Chris Nicolai, Delta Waterfowl Foundation; Paul Link, Louisiana Dept. of Wildlife and Fisheries; Dr. James Devries (retired) & Dr. Matt Dyson, DUC-IWWR

This project is deploying state-of-the-art GPS-acceleration tracking devices on midcontinent mallards using four attachment techniques to compare movements, behaviour, survival, and reproductive success throughout the full annual cycle. Geolocators also are being deployed to collect movement, survival, and reproductive data as a control for comparison to GPS tracking devices. The project anticipates deploying 300 GPS-acceleration tracking devices and 300 geolocators from 2022 to 2025. We also will develop simulations to understand optimal sample sizes of tracking devices to support future research on movement ecology.

QUANTIFYING ENVIRONMENTAL DRIVERS OF CONTINENTAL-SCALE PINTAIL POPULATION DYNAMICS

Dr. Dan Gibson (Post-doctoral fellow) & Dr. Mitch Weegman, Univ. of Saskatchewan; Dr. Todd Arnold, Univ. of Minnesota; Dr. James Devries (retired) & Dr. Matt Dyson, DUC-IWWR

This project will test hypotheses about environmental drivers of pintail populations across North America by linking three breeding regions and two wintering regions, via movement and seasonal survival estimates, calculated in one integrated population model. This unique approach will allow simultaneous assessment of mechanisms of population change and consider the full annual cycle to guide conservation planning in space and time. Results will also enable scenario-playing to guide financial investments given anticipated land use and climate change.

TEMPORAL VARIATION IN PRAIRIE WATERFOWL PRODUCTIVITY: LINKING LOCAL NESTING DATA TO POPULATION SURVEYS AND BANDING DATA TO INFORM CONSERVATION DELIVERY

Dr. Matt Dyson & Dr. James Devries (retired), DUC-IWWR; Dr. Mitch Weegman, Univ. of Saskatchewan
Nest success contributes strongly to explaining variation in waterfowl population change, and this information has influenced conservation programs at a continental scale. However, there have been few studies linking local nest success to measures of productivity at larger scales (e.g., banding age ratios or hunter-submitted wings). This study will compare measures of waterfowl productivity at local and population scales to assess their representativeness relative to other commonly estimated parameters. These comparisons will enhance our understanding of the effectiveness of habitat conservation programs to benefit waterfowl.

MAPPING RISK OF GRASSLANDS CONVERSION ACROSS THE CANADIAN PRAIRIES

Dr. Samuel Robinson, Dr. James Devries (retired), & Llwellyn Armstrong, DUC-IWWR

Grasslands provide crucial habitat to a variety of songbirds and waterfowl, and are one of the most at-risk ecosystems worldwide. This risk is especially high in the Prairie Pothole Region of Canada, where roughly 75% of grasslands have been converted to annual crops. Using machine-learning techniques and remotely sensed imagery, this project aims to a) identify where grassland loss is occurring most quickly, and b) determine landscape-level predictors of grassland loss. This project will identify high-risk areas for conservation, support policy to reduce grassland loss, and ultimately help preserve the habitat and ecosystem services provided by grasslands.

DU CANADA – CENTRAL CANADA

DEVELOPING SPECIES-HABITAT CONSERVATION MODELS FOR PRIORITY WATERFOWL IN EASTERN CANADA

Dr. Mark Mallory, Acadia Univ.; Dr. Mark Gloutney, DUC-HO; Dr. Matt Dyson, DUC-IWWR

Conservation planning under NAWMP is increasingly driven by biological planning models that connect duck demography or abundance to habitat conditions. This project will use data collected over 5 decades in eastern Canada to link breeding waterfowl abundance to a suite of habitat characteristics and develop regional, species-habitat models to predict distribution of priority waterfowl. These models will be used to advance spatial targeting of conservation delivery in the Eastern Habitat Joint Venture.

IMPLEMENTING BIOLOGICAL CONTROL OF INTRODUCED

***Phragmites australis* IN ONTARIO**

Dr. Michael McTavish (Post-doctoral researcher) & Dr. Ian Jones (Post-doctoral researcher), Smith Forest Health Lab and AAFC; Dr. Rob Bouchier, AAFC; Dr. Sandy Smith, Univ. of Toronto; Matt Bolding, DUC-ON

Introduced common reed (*Phragmites australis*) is one of the most invasive plants in North America, displacing native species and threatening wetland biodiversity. Mechanical and chemical management have proved costly and ineffective for larger populations. As an alternative, nearly 20 years of research has identified the stem-boring noctuid moths as suitable biocontrol agents, and a petition for their release in Canada has recently been approved. This project is part of a larger initiative that will determine the impact of the stem-boring noctuid moths on introduced and native *Phragmites* and survival of the moths at all life stages.



ADVANCING DETECTION AND SURVEILLANCE OF EUROPEAN WATER CHESTNUT

Dr. Peyman Saidi & Dr. Medhi Sanjari, saiwa inc; Kyle Borrowman, Matt Bolding & Mallory Carpenter, DUC-ON saiwa inc. and DUC are integrating image processing and artificial intelligence techniques for invasive species surveillance. The main objective is to automate the detection of European water chestnut (EWC) in RGB and IR images collected by drone. Windows-based software has been developed to detect EWC in aggregation of RGB images making use of the SegDecNet model, which was trained on nearly 1,400 images collected in the Wolfe Island and Welland River areas in July 2022. The ultimate goal is to develop a hands-off, rapid method by which to detect EWC for early detection and control.

WATERFOWL SURVEY DESIGN AND SPECIES-HABITAT RELATIONSHIPS IN THE RING OF FIRE REGION OF ONTARIO

Dr. Matt Dyson, DUC-IWWR; Dr. Shannon Badzinski, Shawn Meyer, Chris Sharpe, Ross Wood, & Brigitte Colins, CWS-ON Region

CWS-ON is undertaking surveys of migratory birds, with a focus on waterfowl within the remote regions of northern Ontario to obtain baseline information on abundance, distribution and habitat associations. Data from these surveys will inform a Regional Impact Assessment within the Ring of Fire mine claims area and the Ontario Breeding Bird Atlas. To align with current surveys, CWS-ON desires to develop a new helicopter waterfowl survey within this region that will account for relevant habitat and logistical considerations while maximizing cost efficiencies. Results of this work will improve our understanding of waterfowl distributions and species-habitat relationships in remote parts of Canada.

ADVANCING CONSERVATION DECISION SUPPORT TOOLS FOR THE EASTERN HABITAT JOINT VENTURE

Dr. Matt Dyson & Dr. James Paterson, DUC-IWWR; Nic McLellan, DUC-ATL/IWWR, Dr. Richard Schuster & Marc Edwards, NCC; Dr. Kristin Bianchini, CWS/ECCC; Dr. Joseph Bennett, Carleton Univ.

The Eastern Habitat Joint Venture (EHJV) requires an improved decision support tool to guide strategic habitat conservation. This information will guide regional conservation to support waterfowl and social values while remaining consistent with other bird conservation goals. This project will advance the EHJV decision support tools to provide a common standard among partners and improve allocation of resources to maximize the return on investment for habitat conservation that benefits waterfowl, society, biodiversity, and other ecosystem services.

EASTERN CANADA BIODIVERSITY MAPPING AND ASSESSMENT TOOL

Dr. James Paterson, Dr. Lauren Bortolotti, Ashley Pidwerbesky, & Paige Kowal, DUC-IWWR; Dr. Julie Lee-Yaw, Univ. of Ottawa

This project will construct species distribution models for all amphibians, birds, mammals and reptiles in the Mixedwood Plains and Atlantic Maritime ecozones. The stacked model predictions will map biodiversity potential across eastern Canada as a function of land cover and climate variables. This effort will enhance DUC conservation planning by highlighting areas of potential high biodiversity and examine spatial variation in the benefits of conservation programs (e.g., restoration) to biodiversity.

DU CANADA – ATLANTIC

IDENTIFYING DEMOGRAPHIC BOTTLENECKS AND HABITAT USE TO SUPPORT THE RECOVERY AND MANAGEMENT OF AMERICAN COMMON EIDER

Scott Gilliland (retired), Dr. Greg Robertson, Dr. Al Hanson, Dr. Sarah Gutowsky, & Christine LePage, CWS/ECCC; Nic McLellan, DUC-ATL/IWWR; Kelsey Sullivan, State of Maine; Lucas Savoy, Biological Resource Institute; Dr. Jean-François

Giroux, Univ. du Québec à Montréal; Dr. Oliver Love, Univ. of Windsor; Dr. Mark Mallory, Acadia Univ. This multi-year project will deploy satellite tracking devices on hen American common eiders across their breeding range. The project aims to develop a methodology to assess breeding status, assess breeding propensity, and identify periods in the annual cycle when female mortality occurs. It will also provide information on movement and habitat use at various spatial scales, identify linkages between breeding and wintering areas, and help identify conservation opportunities for this sub-species.



*ESTIMATING NESTING STATUS OF PTT-EQUIPPED AMERICAN COMMON EIDER (*Somateria mollissima dresseri*) HENS TO DETERMINE BREEDING PROPENSITY

Asha Grewal (MSc student) & Dr. Mark Mallory, Acadia Univ.; Dr. Greg Robertson, Scott Gilliland (retired), & Dr. Sarah Gutowsky, ECCC; Dr. Frances Buderman, Pennsylvania State Univ.; Nic McLellan, DUC-ATL/IWWR

This project uses telemetry data from American common eider hens across their breeding range to estimate breeding state based on movement patterns. This will be used to determine breeding propensity, an important vital rate for this sub-species that has been declining in the southern portion of its breeding range.

REDISTRIBUTION OF WINTERING AMERICAN COMMON EIDERS (*Somateria mollissima dresseri*)

Dr. Sarah Gutowsky (Post-doctoral researcher) & Dr. Mark Mallory, Acadia Univ.; Dr. Greg Robertson & Scott Gilliland, ECCC; Nic McLellan, DUC-ATL/IWWR

This study assessed changes in wintering common eiders along the eastern coasts of the northern U.S. and southern Canada using aerial survey and Christmas Bird Count data. Widespread declines were observed in areas of the southern part of the wintering range (Nova Scotia to Massachusetts), while in the northern part, stable or increasing trends were observed (southeast Newfoundland and the Gulf of St. Lawrence). This suggests large scale redistributions in the wintering range which is important information for habitat conservation as well as harvest management of the species.

ASSESSING AND IMPROVING ALEWIFE FISH PASSAGE AT DUC FISHWAYS IN ATLANTIC CANADA

Dr. Aaron Spares & Nic McLellan, DUC-ATL/IWWR; Dr. Mike Stokesbury, Acadia Univ.; Dr. Royce Steeves, DFO Science; Jonathan Platts, DUC-ATL

This long-term project uses PIT tagging technology and other proxies, including eDNA, to assess and improve passage efficiency of migratory fish species, including alewife and American eel at DUC wetlands with fishways in coastal Atlantic Canada. This assessment has broadened to include other anthropogenic obstructions, including tide gates and culverts. Improved connectivity should increase the health and productivity of both freshwater and marine environments.



RIVER- AND SEX-SPECIFIC ANNUAL SURVIVAL RATES OF MATURE ANADROMOUS ALEWIFE (*Alosa pseudoharengus*)

Dr. Aaron Spares & Nic McLellan, DUC-ATL/IWWR; Dr. Greg Robertson, Dr. Anna Calvert, & David Fifield, ECCC; Dr. Sarah Gutowsky, Dr. Mike Dadswell (retired), & Dr. Mike Stokesbury, Acadia Univ.; Rachele Vincent (past summer student), DUC-ATL

Alewife is an important anadromous fish species in many Atlantic coastal watersheds. This research used mark recapture data to assess annual survival rates of alewife. This is vital information for fisheries managers and organizations like DU, as it demonstrates the importance of watershed connectivity, including fish passage management, to the conservation of fish populations.

UNDERSTANDING AND MEASURING BLUE CARBON STORAGE IN SALT MARSHES OF THE MARITIME PROVINCES

Dr. Jeff Ollerhead, Mount Allison Univ.; Dr. Holly Abbandonato & Nic McLellan, DUC-ATL/IWWR; Dr. Amanda Loder, ECCC

This project aims to better understand how to measure and quantify carbon storage in natural and restored salt marshes. In addition, it will identify knowledge gaps for the region to address and facilitate the verification of carbon storage for offsetting. This project will improve our knowledge of this important function of salt marshes.

***CARBON STORAGE AND GAS FLUX IN DUC MANAGED FRESHWATER WETLANDS ON DYKELANDS IN THE MARITIME PROVINCES**

Wendy Ampuero Reyes (PhD student) & Dr. Gail Chmura, McGill Univ.; Dr. Pascal Badiou, DUC-IWWR; Nic McLellan, DUC-ATL/IWWR

In Atlantic Canada, DUC continues to restore and manage large freshwater wetlands on dykelands (lands that were formerly saltmarsh) as priority waterfowl and wildlife habitat. This project will help DUC better understand the role and value of these wetlands for carbon storage while informing future projects.

***NESTING HABITAT USE AND AVAILABILITY FOR CAVITY-NESTING DUCKS IN THE LOWER SAINT JOHN RIVER FLOODPLAIN, NEW BRUNSWICK**

Jared Sonnleitner (MSc student) & Dr. Joe Nocera, Univ. of New Brunswick; Nic McLellan, DUC-ATL/IWWR
Evidence suggests that common goldeneye have experienced regional population declines in New Brunswick, possibly related to a decline in natural cavity availability. This project investigates whether natural cavity availability has changed over time along the lower St. John River, the regional effect of a long-term nest box program, reproductive parameters for cavity nesters, and whether site characteristics can inform cavity or nest box usage. This information will inform nest box programs and conservation for cavity nesting waterfowl.

***WETLAND BIRD RESPONSE TO HISTORICAL AND CURRENT ANTHROPOGENIC HABITAT DRIVERS AND CONSERVATION IMPLICATIONS IN ATLANTIC CANADA**

Kiirsti Owen (PhD student) & Dr. Joe Nocera, Univ. of New Brunswick; Dr. Mark Mallory, Acadia Univ.; Nic McLellan, DUC-ATL/IWWR

This broad research project will assess waterfowl and wetland bird use of coastal, dykeland habitats along the Bay of Fundy, including DUC wetland projects, throughout the annual cycle. This project will also build on previous wetland senescence research and assess bird use with respect to wetland age, habitat, and management techniques.

***SUB-HABITAT USE BY FISH IN, AND PHYSICAL CHARACTERISTICS OF, RESTORED AND ESTABLISHED SALT MARSHES IN MEGA- AND MICROTIDAL REGIMES**

Kiana Endresz (PhD Student), John Linihan (MSc Student), & Dr. Myriam Barbeau, Univ. Of New Brunswick; Dr. Jeff Ollerhead, Mount Allison Univ.; Nic McLellan, DUC-ATL/IWWR

This project is researching how fish utilize salt marsh habitats in the Maritime Provinces and how this varies depending on location and tidal regime. In addition, it will focus on how the physical characteristics of salt marshes relate to fish usage. This project will improve our understanding of salt marsh values and how we design salt marsh restoration projects in the future to maximize biodiversity outcomes.

***LINKAGES BETWEEN SALT MARSHES AND MUDFLATS IN MEGA-TIDAL AND MICROTIDAL REGIMES IN MARITIME CANADA**

Alexa Stack Mills (PhD Student) & Dr. Myriam Barbeau, Univ. of New Brunswick; Dr. Jeff Ollerhead, Mount Allison Univ.; Dr. Holly Abbandonato & Nic McLellan, DUC-ATL/IWWR

This project will use stable isotope analyses to assess trophic linkages within and between salt marsh and mudflat habitats in different tidal environments. This project will also assess organic carbon sources in restored and established salt marshes, which is an important need for carbon verification protocols. This project will improve DUC's ecological knowledge of coastal habitats and ability to quantify carbon storage.



DU de MÉXICO

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

Dr. Paulo Salles de Almeida & Dr. Alec Torres-Freyermuth, Engineering Institute of the National Univ. of Mexico; Secretary of Sustainable Development of the state of Yucatan; Eduardo Carrera & Gabriela de la Fuente, DUMAC-NHQ

Coastline erosion along Mexico's Yucatan peninsula threatens the ecological integrity of mangrove swamps and other wetlands that provide important habitat for waterfowl wintering in Mexico. This study will estimate coastline erosion and accretion rates from Telchac to Celestun, determine the effect of port infrastructure on sediment transport processes and coastline erosion, and identify possible mitigation activities to increase the resilience of coastal wetlands in this region.



SEAGRASS STUDY IN THE LAGUNA MADRE DE TAMAULIPAS

Dr. Leonardo Arellano & Dr. Arturo Mora, Tamaulipas St. Univ. In 1996, DUMAC and the Tamaulipas State University conducted the first seagrass biomass study at Laguna Madre Tamaulipas. In 2019, the study was replicated to determine contemporary shoalgrass biomass, a critical food resource for redheads, and compare to earlier findings from the 1970s. This information will help determine trends in seagrasses and guide development of policies at state and federal levels to conserve this important habitat for migratory and resident waterfowl species.

WETLANDS INVENTORY AND CLASSIFICATION IN MEXICO

Eduardo Carrera, Gabriela de la Fuente, Norma Rangel, & Diana Sánchez, DUMAC-NHQ

The lack of a wetlands inventory in Mexico and associated data related to wetland characteristics and extent motivated DUMAC to initiate in 1991 the Mexico National Wetlands Inventory and Classification. Since then, DUMAC has been working regionally to complete what represents the first wetlands inventory to include all Nearctic and Neotropical wetland types in Mexico. Completed in 2020, this information will be available through a web-based map server for all institutions and agencies to support their wetlands conservation initiatives in Mexico.

COASTAL DIGITAL CHANGE DETECTION ANALYSIS IN SINALOA AND SONORA

Gabriela de la Fuente, Eduardo Carrera, Carlos Salinas, & Norma Rangel, DUMAC-NHQ

Coastal wetlands along the upper Pacific coast (UPC) of Mexico support 38% of migratory waterfowl wintering in Mexico. Prior to 1987, the most important threats for these coastal wetlands were agricultural expansion and runoff of agrochemicals and fertilizers, causing uncontrolled growth of cattail at important intertidal areas for waterfowl and shorebirds. After 1987, intensive shrimp farming began in Sinaloa and Sonora and became the primary cause of the loss and degradation of mangrove forests in this region. This study, initiated in 2016, measured the amount and distribution of mangrove forest loss due to shrimp farm growth. This information will serve as a visual tool to show local and federal authorities the damages of the shrimp farm industry to mangrove forests within the coastal wetlands ecosystems of the UPC, and will inform public policy to guide the management, restoration, and conservation of these important habitats.

WATERFOWL SURVEYS OF MEXICO: A MULTI-ORGANIZATIONAL COLLABORATION

Metropolitan Univ.; Biopicture A.C.; Birds.mx; National Commission of Natural Protected Areas; Biodiversity Conservation of Central Mexico, A.C.; Municipality of Almoloya de Juarez; Mexico St. Univ.; Chihuahua State Government; Chihuahua Municipality Government; ITZAMNA, A.C.; Aguascalientes Environmental Movement, A.C.; Wildlife Management Unit at Chiconahuapan Lagoon and Los Golodrin, ASOCIES, A.C.; PROFAUNA; Secretary of Urban Development and Environment of Yucatan; Secretary of Environment and Territorial Planning of the State of Guanajuato; Secretary of Environment and Natural Resources of the States of Mexico, Durango and Zacatecas; Black Forest A.C.; Secretary of Environment and Territorial Development of Durango, Society for Research and Use of Wildlife; Forest and Wildlife Services; Morelos St. Univ.; Sinaloa St. Univ.; Zacatecas St. Univ.; Queretaro St. Univ., Michoacán St. Univ.; U.S. Fish and Wildlife Service; and DUMAC.

Effective conservation and management of migratory waterfowl populations requires an understanding of their ecology and distribution throughout the annual range. In recognition of this, the U.S. Fish and Wildlife Service began collaborating with Mexican biologists in 1937 to conduct aerial surveys of the distribution of wintering waterfowl across major wetland complexes in Mexico. Resource constraints and logistical considerations became increasingly challenging in the early 2000s, ultimately leading to discontinuation of the survey after 2006. DUMAC is using a diverse coalition of partners to renew the Mexico mid-winter waterfowl surveys, thus providing a critical data stream for understanding contemporary trends in waterfowl populations and guiding conservation efforts in Mexico. DUMAC has been working with current and retired USFWS biologists for the aerial surveys and train pilots and observers following the protocols used in the original mid-winter waterfowl surveys. The renewed survey was flown annually during January 2018–2020, providing a foundation from which to resume Mexico mid-winter waterfowl surveys.

SHOREBIRD SURVEYS OF MEXICO: A MULTI-ORGANIZATIONAL COLLABORATION

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After the conclusion in 2006 of the National Strategy for the Conservation and Management of Shorebirds, which followed similar documents developed for Canada and the USA, it became clear that limited data on shorebirds in Mexico hindered effective prioritization and conservation of the most important wetlands for this group of birds. In response, DUMAC collaborated with professionals from partner organizations and universities to design and conduct a national shorebird survey for Mexico between 2010 and 2017. The survey was divided into 3 regions: Gulf Coast, Pacific Coast, and Northern and Central Highlands. The data gathered was used to help update the National Strategy and identify the most important areas for shorebirds in Mexico. This information will support management decisions and help focus additional resources and conservation efforts on priority habitats shared with migratory waterfowl.

DU FELLOWSHIP SUPPORT

EDWARD D. AND SALLY M. FUTCH GRADUATE FELLOWSHIP

****DEVELOPMENT OF FULL ANNUAL CYCLE FRAMEWORK USING STATE-OF-THE-ART GPS ACCELERATION TRACKING DEVICES ON WATERFOWL: THE CASE OF THE GREENLAND WHITE-FRONTED GOOSE**

Alec Schindler (PhD student) & Dr. Mitch Weegman, Univ. of Saskatchewan

Activities throughout the annual cycle convey trade-offs in individual fitness and lifetime reproductive success. For example, long-lived species may reduce reproductive effort in some years to increase the potential for future production. This study will use GPS-tracking devices to quantify decision-making of Greenland white-fronted geese and use these data in a full annual cycle model to assess their individual and population level effects on survival, reproduction, and population growth. This research will inform conservation of a declining species and provide a scientific framework applicable to other species.

WATERFOWL RESEARCH FOUNDATION FELLOWSHIP

****RECONSTRUCTING THE GENOMIC HISTORY AND CONSERVATION THREAT FROM A CENTURY OF GAME-FARM MALLARD RELEASES IN NORTH AMERICA**

Lauren McFarland (PhD student) & Dr. Philip Lavretsky, Univ. of Texas El Paso

Recent genetic work has demonstrated that releases of game-farm mallards along the eastern seaboard of North America have resulted in extensive hybridization with North American wild mallards, and it has been hypothesized that hybridization has introduced maladaptive traits that may partially explain declining mallard populations in eastern North America. This study will shed light on the consequences of hybridization, producing information that can guide state and federal agencies in establishing management practices to reverse the impacts of game-farm releases and educate hunters and the general public about the issues of this practice.

BONNYCASTLE FELLOWSHIP FOR WATERFOWL AND WETLAND RESEARCH

****EVALUATING TOXICITY IMPLICATIONS OF WETLAND SEDIMENT INSECTICIDE CONCENTRATIONS ON BENTHIC AQUATIC INSECTS AND TEMPORAL CHANGES IN AQUATIC INVERTEBRATE COMMUNITIES IN MISSOURI WETLAND ECOSYSTEMS**

Corinne Sweeney (PhD student) & Dr. Lisa Webb, Univ. of Missouri

Because of their widespread application and chemical properties, neonicotinoid pesticides may negatively impact non-target species, including aquatic insects that form an important component of wetland food webs. This study will close knowledge gaps around sediments as a pathway of exposure for aquatic insects and improve our understanding of risks to aquatic insects in Missouri wetlands and the organisms, including ducks, that depend on them for food.

MICHAEL F.B. NESBITT FAMILY RESEARCH FELLOWSHIP

****QUANTIFYING THE INFLUENCE OF ENVIRONMENTAL CONDITIONS AND AMERICAN BLACK DUCK BEHAVIOUR AND MOVEMENTS THROUGHOUT THE FULL ANNUAL CYCLE ON SUBSEQUENT PRODUCTIVITY**

Ilsa Griebel (PhD student) & Dr. Mitch Weegman, Univ. of Saskatchewan

American black duck populations decreased between the 1950s and 1980s and have not recovered to historic levels. Financial and logistical challenges of accessing the boreal region, where black ducks breed, has hindered assessment of whether black duck population growth is limited by factors during the breeding season. This study will use GPS-acceleration tracking devices to collect data on black duck movement and behaviour to identify factors which influence their productivity. This project will provide information critical for identifying landscapes most important for the management and conservation of black duck populations.

SPENCER T. AND ANN W. OLIN FOUNDATION WETLANDS AND WATERFOWL RESEARCH FELLOWSHIP

****MALLARD DISTRIBUTIONS, HABITAT SELECTION, AND MOVEMENT BEHAVIOR RELATIVE TO SPATIOTEMPORAL CHANGES IN LANDSCAPE ENERGETICS AND HUNTING PRESSURE**

Nick Masto (PhD student) & Dr. Bradley Cohen, Tennessee Tech Univ.

Food energy, habitat availability, and hunting pressure are thought to drive duck distributions during winter, though datasets have not been available to evaluate this in an integrated framework. This study will use hundreds of GPS-tagged mallards plus frequent estimates of landscape conditions and energetics to evaluate the relative contributions of landscape energetics, hunting pressure, and shifts in wetland availability on wintering waterfowl movements and distributions. This research will help refine regional conservation planning tools and facilitate wetland restoration efforts for habitat features most limiting to waterfowl during the non-breeding period.

DR. BRUCE D.J. BATT FELLOWSHIP IN WATERFOWL CONSERVATION

****QUANTIFYING EFFECTS OF JAMES BAY STAGING AREA HABITAT CONDITIONS ON SUBSEQUENT PRODUCTIVITY OF ATLANTIC BRANT**

Lindsay Carlson (PhD student) & Dr. Mitch Weegman, Univ. of Saskatchewan

Atlantic brant have experienced significant habitat loss on both their wintering (mid-Atlantic coast) and staging grounds (James Bay coast) over the past 100 years and, in recent decades, their population has fluctuated dramatically, likely due to variation in the number of young produced. This study will examine relationships between brant behaviour, habitat use and reproductive success and will work closely with Cree land users in data collection and research development. This work will be useful for developing targeted conservation plans for the James Bay coast.





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