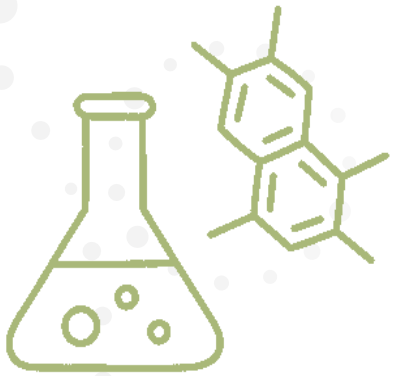
DUCKS UNLIMITED

2023

INTERNATIONAL SCIENCE REPORT

HIGHLIGHTS OF DUCKS UNLIMITED SCIENCE IN FY2023



WHAT SCIENCE MEANS TO DU

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

DU'S SCIENCE VISION STATEMENT

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

DU'S SCIENCE PRIORITIES AND APPROACH

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

This annual International Science Report highlights the involvement and partnership of DU Inc., DU Canada, and DU de México in scientific efforts during FY2023, 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. 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.; 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.

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), Drs. Brian Davis, Adam Skarke, & Ana Linhoss, Mississippi St. Univ.; Larry Reynolds, Louisiana Department 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 will be deployed to investigate their utility to monitor site use by waterfowl. Image analysis and machine learning will be used to establish protocols for estimating duck abundance and behavior at a project level scale.

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.

*SPATIOTEMPORAL PATTERNS OF SANCTUARY USE BY MALLARDS IN THE LMAV: WHITE RIVER NWR

Ethan Dittmer (MSc student), Dr. Doug Osborne, Univ. of Arkansas at Monticello; Dr. Aaron Pierce, DU-SR

Public waterfowl management areas often include sanctuaries closed to hunting and public access to provide waterfowl refugia and areas to obtain and conserve energetic resources. Relatively little research has investigated mallard use patterns of sanctuary in relation to public and private lands. Using satellite transmitters, this project aims to provide fine-scale information on movements and winter habitat selection of mallards associated with White River NWR and their spatiotemporal patterns of use of sanctuary, public hunting areas, and private lands. These data will provide valuable information for policy makers, conservation planners, and managers to make evidence-based decisions when designing wetland complexes with sanctuary.

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, Univ. of Texas Marine Science Institute; 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 Department 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.

*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.

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.

DU INC. – GREAT LAKES & ATLANTIC REGION

*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 will deploy 475+ 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/GSM 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 the Chesapeake Bay. This study will provide information to help identify conservation efforts to benefit wintering populations of scaup.

**LONG-TERM GENETIC EFFECTS OF GAME-FARM MALLARD RELEASES ON WILD MALLARDS IN NORTH AMERICA

Joshua Brown (PhD student) & Dr. Phil Lavretsky, Univ. of Texas El Paso

Current research indicates that ≥15% of eastern mallards have originated from released game-farm birds. To help understand factors contributing to the decline of eastern mallards, this study will assess the contribution of game-farm mallards to the genetic composition of mallards across North America and investigate the extent to which it may be causing maladaptation and decreased fitness in wild mallards.

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

Mike Mitchell & Dr. Dale James, DU-SR; Jess 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 TECHNIQUES FOR AUTOMATED NATIONAL WETLANDS INVENTORY MAPPING IN THE GREAT LAKES REGION: A DATA FUSION APPROACH

Alek Kreiger, Mat Halliday, Rob Paige, & Robb Macleod, DU-GLAR; Jarlath O'Neil-Dunne & Sean MacFadden, Univ. of Vermont

Wetlands are the most difficult land cover type to map due to the temporal changes and diversity of type (open water to forested). Yet, they are one of the most important cover types for waterfowl, fish, and other wildlife. Wetland updates using manual methods are extremely expensive for large areas and not likely to happen on a regular basis. This study is investigating the development of an automated method to efficiently map wetlands and identify temporal changes in a consistent and repeatable manner.

* DENOTES A STUDENT-LED PROJECT

** DENOTES A DU FELLOWSHIP STUDENT-LED PROJECT

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 GEESE

Dr. Mitch Weegman, 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 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 Department 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.

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

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, 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 exhibit at Zoo Montana, Billings, influences the adoption of everyday behaviors to benefit the environment.

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

Abby Rokosch, Dr. Kaylan Kemink DU-GPR; Dr. Elena Rubino, Univ. of Arkansas

Financial and technical support spread throughout the lifetime 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 expensive legal disagreements. To enhance our understanding of landowner interests and inform future decisions, 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 (e.g., application, stewardship, monitoring, enforcement, easement outcomes).

INTEGRATED DISTRIBUTION MODELS FOR BROOD ABUNDANCE

Catrina Terry, Dr. Kaylan Kemink DU-GPR; Dr. Adam Janke, Iowa State Univ.; Dr. Kevin Ringelman, Louisiana State Univ.

Recent studies suggest that targeting waterfowl conservation programs based solely on pair abundance may overlook some areas important for brood habitat. However, brood surveys are time and labor intensive because of challenges detecting ducklings in heavily vegetated wetlands. This project will use modeling techniques to combine data from road-based and drone-based surveys. Results will inform efforts to expand brood surveys to cover a broader geographic landscape.

*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 wetland 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.

UNDERSTANDING LANDOWNER MOTIVATIONS FOR PARTICIPATION IN CONSERVATION PROGRAMS AND PRACTICES

Dr. Kaylan Kemink, DU-GPR; Dr. Bob Pressey & Dr. Amy Diedrich, James Cook Univ.; Dr. Vanessa Adams, Univ. of Tasmania

Recent research has demonstrated an urgent need to study landowner motivations and values from a multilevel perspective. This project uses a structured equation model that integrates ideas from the value-belief-norm theorem, the theory of cultural cognition, and the theory of planned behavior to examine how individual, group, and cultural values affect landowners' participation in conservation programs and practices in the PPR of North Dakota, South Dakota, and Montana.

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 skill sets of 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 ultimately presenting at scientific conferences. Some returning students have continued their research for several years and now have publications in development describing tests of long-standing nest searching and monitoring protocols and revealing new and innovative 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 practices 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 help develop best practices.

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

Kyle Kuechle, Emily Schwartz, & Tanner Gue, DU-GPR; Greg Sandness, North Dakota Dept. of Environmental Quality

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

VULNERABILITIES OF CANADIAN WETLANDS IN A CHANGING CLIMATE

Dr. Mark Mallory, Acadia Univ.; Dr. John Brazner, Prov. of Nova Scotia; Dr. Cherie Westbrook, Univ. of Saskatchewan; Dr. Paul Keddy (consultant); Dr. Sara Knox, Univ. of British Columbia; Dr. Jan Ciborowski, Univ. of Calgary; Dr. Line Rochefort, Univ. of Laval; Dr. Pascal Badiou, DUC-IWWR; Dr. Maria Strack, Dr. Rebecca Rooney, Dr. Scott Davidson, & Dr. Courtney Robichaud, Univ. of Waterloo

This project is addressing two significant knowledge gaps: 1) what are the vulnerabilities of Canadian wetlands in a changing climate? and 2) how do current Canadian wetland policies address these emerging vulnerabilities (and what improvements could be made)? These questions are of high importance because the expected impacts of climate change on wetlands are varied, but severe, and will have significant implications for the habitats DUC restores, conserves, and manages.

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 vanArdenne, 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, DUC-IWWR/BOR; 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 location and size of beaver dams and inform where BDAs can be built. These efforts will augment DUC conservation planning and project implementation as well as highlight the importance of investing in 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, DUC-IWWR

Pacific Birds Habitat Joint Venture (PBHJV) lacks the ability to inventory and assess waterfowl habitat along the entire 25,000-km BC coastline. 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, Zane Zondervan, Sarah Nathan, & Bruce Harrison, DUC-BC

DUC has constructed hundreds of habitat projects in 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 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) but has lacked 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.

REVISITING A BIOENERGETIC MODEL TO UPDATE WATERFOWL HABITAT OBJECTIVES FOR THE FRASER RIVER DELTA

Kathleen Moore, CWS; Bruce Harrison & Paul Yeung, DUC-BC; Dr. Mark Petrie, DU-WR

The partners conducted a change analysis of agricultural crop composition between 1997–2020 in the Fraser Lowlands to track changes in the availability of wildlife-compatible crops (including vegetables, grasses, and grains) for wintering waterfowl carrying capacity models. Models are used to convert the food energy needs of waterfowl into conservation objectives for agricultural land in this critical Pacific Flyway wintering and staging area.

WETLAND INVENTORY IN PRIORITY WETLAND REGIONS OF THE CIJV AND PBHJV

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

British Columbia does not have a provincial wetland inventory, and 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 our 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, Susan Witherly, & Dr. Matt Dyson, DUC-IWWR; Dr. Vanessa Harriman, DUC-IWWR/BOR

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 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, & Llwellyn Armstrong, DUC-IWWR; Dr. Vanessa Harriman, DUC-IWWR/BOR

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.

*DOES FOREST HARVESTING APPROXIMATE THE EFFECTS OF WILDFIRE FOR BOREAL-NESTING DUCKS?

Mark Bidwell (PhD student) & Dr. Bob Clark, Univ. of Saskatchewan; Dr. Vanessa Harriman, DUC-IWWR/BOR; Dr. Stuart Slattery, DUC-IWWR

Understanding the degree to which industrial disturbance approximates the effects of natural disturbance in the boreal forest is critical for focusing on the most important disturbances there. This study uses aerial surveys to investigate whether forest harvest emulates effects of fire on duck pair settling and productivity, hence whether conservation action is required.

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; Dr. Stuart Slattery, DUC-IWWR; 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 (ABoVE) 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 specific wetland ecosystem services in regions 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, provincial and national governments, and waterfowl modeling experts.

WETLAND MAPPING IN SASKATCHEWAN AND NUNAVUT USING CLOUD-BASED MACHINE LEARNING METHODS

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 (CWI) and Canadian National Wetland Inventory (CNWI) 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.

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

Michael Merchant, Becky Edwards, James Varghese, & Al Richard, DUC-BOR; Lyle Boychuk, DUC-SK

The Alberta Biodiversity Monitoring Institute (ABMI), DUC, and Alberta's Environment and Protected Areas (EPA) are developing a wetland inventory conforming to the Government of Alberta's (GOA) 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 be used to establish a technical workflow for detailed mapping of boreal wetlands cooperatively with project partners. Ultimately, 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.

DENE K'ÉH KUSĀN WETLAND INVENTORY

Becky Edwards, Michael Merchant, & James Varghese, DUC-BOR

Dene K'éh Kusān (DKK) which means, "always will be there" in Kaska, is a proposed Indigenous Protected and Conserved Area (IPCA) in northern British Columbia, which will protect their ancestral territory from biodiversity loss while creating economic opportunity for Kaska Dena and the surrounding communities. DUC, the Dena Keyah Institute and Dane nan yé dāh Kaska Land Guardian Program have partnered to support their IPCA management plan, by providing wetland maps to complement their planning and decision-making processes. The results are a set of reliable and easy-to-read collection of spatial information to support the on-going management of the Kaska region, a region we hope "always will be there."

TŁĮCHǪ WETLAND INVENTORY

James Varghese, Michael Merchant, Becky Edwards, Sonny Lenoir, & Jamie Kenyon, DUC-BOR

In partnership with the Tłı̨chǫ Government (TG), this mapping project identified the spatial extent of wetlands in the Tłı̨chǫ mapping project area and classified them based on the five major classes of the Canadian Wetland Classification System (CWCS; open water, marsh, fen, bog, swamp) using satellite imagery and collected field data. This remote sensing-based wetland classification of the Tłı̨chǫ mapping project area (~39,300 km2), will support identification of important areas for species at risk with resulting land use planning initiatives. Moreover, this inventory is also expected to support new Indigenous Protected and Conservation Areas (IPCA) to protect biodiversity values.

SLAVE/TALTSON DELTA FISH HABITAT WETLAND MAPPING

James Varghese, Michael Merchant, Becky Edwards, & Sonny Lenoir, DUC-BOR

Deninu Kų́ę First Nation, in collaboration with the Fort Resolution Metis Council, DUC, and the Canadian Parks and Wilderness Society developed a fish habitat mapping and monitoring project. This Indigenous Habitat Participation Program project was based in Fort Resolution, NT and guided by a community-led committee. This project involved development and implementation of a field-based sampling program, high resolution satellite-based mapping, and subsequent data analysis.

CONSERVATION AREAS NETWORK ANALYSIS PROJECT

Lindsay McBlane, Mark Kornder, & Alain Richard, 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, & Al Richard, 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 km^2 (5,290 mi^2) 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; Kevin Smith & 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 Université de Montréal; Dr. Mary Kang, McGill Univ. The Can-Peat network includes many other collaborators with DUC represented by Kevin Smith, Kristyn Mayner, DUC-BOR and 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, Kristyn Mayner, DUC-BOR; Dr. David Andison, fRI; Courtney Miller-West, Alberta-Pacific Forest Industries Inc.; Paul LeBlanc, Louisiana-Pacific Canada Ltd.; Chris Watson, Parks Canada and supported by 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, DUC-IWWR/BOR; Dr. Lauren Bortolotti, Catherine Brown, DUC-IWWR; Kristyn Mayner, Chelsea Martin, & Leanne Mingo, DUC-BOR; Dr. Yanping Li, Univ. of Saskatchewan; 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.

DU CANADA – PRAIRIES

CLASSIFYING PRAIRIE WETLAND PERMANENCE USING REMOTE SENSING

Dr. James Paterson, Dr. Lauren Bortolotti, & Llwellyn Armstrong, DUC-IWWR; Lyle Boychuk, DUC-SK

Prairie wetlands range from being inundated with water for only a few days a year to being permanently flooded, with this permanence affecting wetland suitability as duck habitat and vulnerability to drainage. This project will use remotely sensed data to develop a classification model that predicts wetland permanence based on wetland size, terrain metrics, and vegetation community composition. Predictions will be incorporated into a tool to identify temporary and ephemeral wetlands that would be candidates for enrollment in conservation programs.

RELATIONSHIP BETWEEN LIFE HISTORY TRAITS, HABITAT SELECTION, AND DEMOGRAPHY IN A DYNAMIC WATERFOWL COMMUNITY

Dr. Frances Buderman, Pennsylvania St. Univ.; Dr. David Koons, Colorado St. Univ.; Dr. James Devries, DUC-IWWR

The study uses data from the annual breeding waterfowl survey, at the survey segment and strata level, in conjunction with spatially and temporally varying climate and land use datasets to explore patterns in habitat selection and demographic response for nine species of prairie breeding ducks. This study identifies species-specific habitat selection and demographic relationships with landcover and climate variables that will be useful in anticipating the future response of species to land use and climate change.

PRAIRIE CONSERVATION PLANNING "COST TOOL" DEVELOPMENT

Dr. James Devries, Llwellyn Armstrong, & Susan Witherly, DUC-IWWR; Dr. David Howerter (retired), DUC-HO; Paul Thoroughgood, DUC-SK; Cynthia Edwards, DUC; 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 & Dr. Matt Dyson, DUC-IWWR; Dr. Dave Howerter (retired), DUC-HO; Dr. Bob Clark, ECCC

This project uses 55 years of breeding waterfowl survey data in the PPR (1961–2016) to develop Bayesian hierarchical models of land use and climate change effects on productivity (i.e., age ratios at banding) for seven common dabbling duck species. These models will be used to predict responses of the dabbling duck community to future 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 PREDATOR COMMUNITY COMPOSITION IN PRAIRIE POTHOLE LANDSCAPES

Dr. Paul Galpern, Univ. of Calgary; Dr. James Devries & 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.

QUANTIFYING TERRESTRIAL ARTHROPOD BIODIVERSITY ALONG A CHRONOSEQUENCE OF WETLAND RESTORATION

Dr. Paul Galpern, Univ. of Calgary; Dr. James Devries, Dr. James Paterson, DUC-IWWR

While prairie wetlands are known as biodiversity hotspots for birds, amphibians, and mammals, less is known about the arthropod diversity these habitats support, especially for restored wetlands. In this study, researchers are sampling the community composition of bees, beetles, flies, spiders and harvestmen under wetland retention and restoration scenarios. Information gathered on arthropod biodiversity will be used in DUC communication and policy efforts aimed at protecting and retaining wetlands in prairie agroecosystems.

*DIVERSITY AND ABUNDANCE OF BEES IN CANADIAN PRAIRIE AGROECOSYSTEMS: UNDERSTANDING THE ROLE OF REMNANT AND RESTORED HABITAT IN SUPPORTING NATIVE BEE POPULATIONS

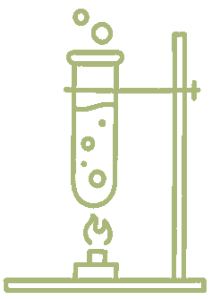
Samantha Morrice (MSc student), Univ. of Saskatchewan; Dr. James Devries, DUC-IWWR; Dr. Sean Prager, Univ. of Saskatchewan

This project is examining the diversity and abundance of native bees associated with wetlands and field edges in croplands and grasslands in the parkland agroecosystem of central Saskatchewan. Quantifying the abundance and diversity of these species provides valuable information on the potential of remnant semi-natural habitats to provide pollination services in prairie agroecosystems. Quantifying ecosystem services provided by wetlands and other habitats supports DUC communication and policy efforts to conserve these important habitats.

ASSESSING AND MAPPING THE BIODIVERSITY POTENTIAL OF PRAIRIE LANDSCAPES

Dr. James Devries, Dr. James Paterson, Dr. Lauren Bortolotti, & Paige Kowal, DUC-IWWR

This project is using prairie-wide observations for mammals, birds, amphibians, 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 use and habitat characteristics at fine spatial scales. This effort will enhance DUC conservation planning by highlighting areas of potential high biodiversity and allowing prediction of the benefits of conservation actions (e.g., restoration), land use, and habitat change (e.g., wetland and grassland loss) on biodiversity potential.



* DENOTES A STUDENT-LED PROJECT

QUANTIFYING PRAIRIE WETLAND ECOSYSTEM SERVICES—THE WETLAND DECISION SUPPORT SYSTEM

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

Wetlands provide many valuable ecosystem services, and quantification and communication of these values can garner support for DU's mission. 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 DSS, will have numerous applications, including communicating wetland values to the public and improving our understanding of how to maximize ecosystem services from waterfowl conservation delivery.

DELTA MARSH, RESTORING THE TRADITION—WATERFOWL RESPONSE

Dr. Lauren Bortolotti, Dr. Dale Wrubleski (retired), Bob Emery (retired), Paige Kowal, Llwellyn Armstrong, & Howie Singer, DUC-IWWR; Dr. Vanessa Harriman, DUC-IWWR/BOR; Dr. Michael Anteau, USGS; Frank Baldwin, ECCC; Cameron Meuckon, Government of Manitoba

This study uses a multi-pronged approach to assess the response of waterfowl to the restoration of Delta Marsh. It leverages historical waterfowl and submersed aquatic vegetation surveys and new data on waterfowl abundance, vegetation response, waterfowl distribution within the marsh, and nutrient acquisition by diving ducks to provide a holistic evaluation of the success of the restoration and value of the marsh as habitat for migratory waterfowl.

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. 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.

APPLYING A GENE-SUITE APPROACH TO EXAMINE THE PHYSIOLOGICAL STATUS OF WILD-CAUGHT WALLEYE

Dr. Jennifer Jeffrey (Post-doctoral researcher), Hunter Carlson, Jason Treberg, & Dr. Ken Jeffries, Univ. of Manitoba; Dr. Eva Enders, DFO; Dr. Dale Wrubleski (retired), DUC-IWWR

A non-lethal technique was used to determine the physiological condition of large walleye held in Delta Marsh during the summer months by the common carp exclusion screens developed by DUC and partners to restore duck habitat. Gill tissue samples were analyzed for the expression of genes linked to heat stress and anaerobic metabolism. The longer fish were held in the marsh, the more apparent was the expression of these genes. Based on this information, the temporary exclusion screens are being lifted earlier in the summer to reduce stress to fish held in the marsh

ESTIMATING THE IMPACT OF CONSERVATION AND LANDSCAPE CHANGE ON WATERFOWL PRODUCTIVITY—THE WATERFOWL PRODUCTIVITY MODEL

Dr. James Devries, Llwellyn Armstrong, & Bob Emery (retired), DUC-IWWR; Dr. David Howerter (retired), DUC-HO; various other DUC staff

This effort combines information from three long-term nesting studies in a predictive model—the Waterfowl Productivity Model—to estimate waterfowl productivity at landscape scales given population density, habitat availability, nest habitat selection, and nest survival. The model is derived from data on over 23,000 duck nests found on 188 study sites across prairie Canada during 1993–2011. This model allows prediction of how conservation actions and background landscape change will impact the number of hatched nests.

*IMPACTS OF CLIMATE CHANGE IN PRAIRIE CANADA—WATERFOWL PRODUCTIVITY

Dr. Lauren Bortolotti, Dr. James Devries, & Llwellyn Armstrong, DUC-IWWR; Zhe Zhang (PhD student) & Dr. Yanping Li, Univ. of Saskatchewan; 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, 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, & 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 & 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.

MAINTAINING WETLAND RESILIENCE IN THE CONTEXT OF AGROECOSYSTEMS AND CLIMATE CHANGE: USING ENVIRONMENTAL GENOMICS TO INFORM BEST MANAGEMENT PRACTICES

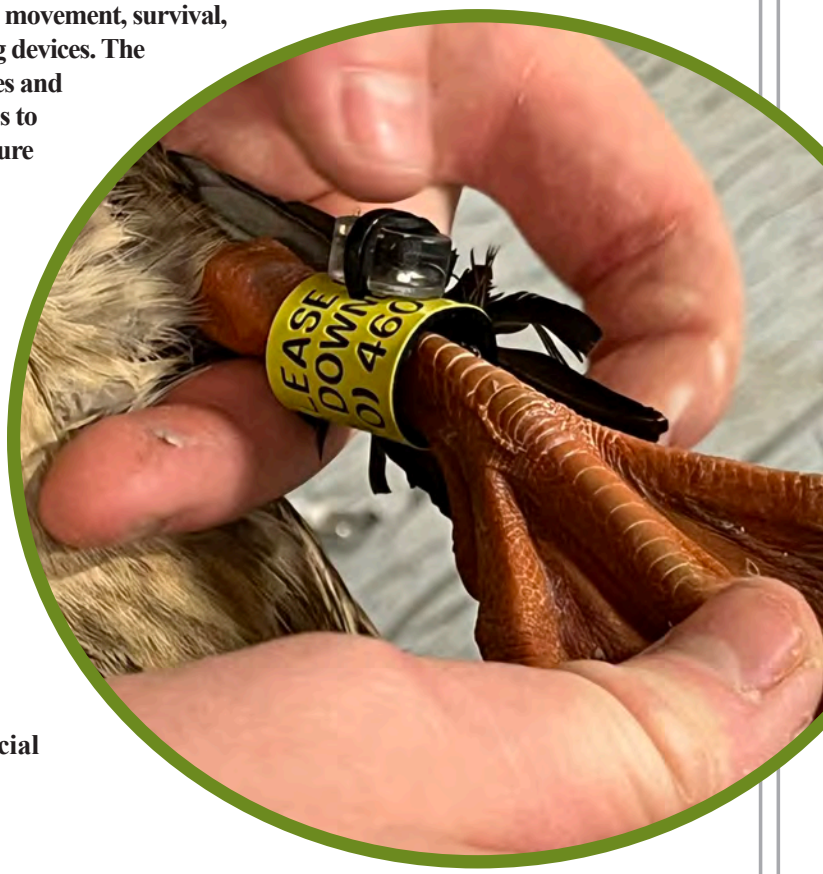
Dr. Matt Dyson, Dr. James Devries, & Andrew Collard, DUC-IWWR; Dr. Tyler Cobb, Dr. Rob Hinchcliffe, & Dr. Jenet Dooley (Alberta Biodiversity Monitoring Institute); Dr. Brian Eaton, Dr. Jim Davies, Dr. Sue Koziel, & Dr. Emily Herdman (Innotech Alberta); Dr. Christy Morrissey, Dr. Kirsty Gurney, & Dr. 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 Department of Wildlife and Fisheries; Dr. James Devries & 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 2024. 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 & Dr. Matt Dyson, DUC-IWWR

This project will test hypotheses about environmental drivers of pintail population dynamics 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.

ASSESSING LAND USE AND CLIMATE CHANGE ON DABBLING DUCK POPULATION DYNAMICS

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

This research will expand recently completed work that tested environmental drivers of dabbling duck productivity across the Prairie Pothole Region. Specifically, this work will develop an integrated population model that estimates productivity and survival using grand means with species-specific deviation, as well as relationships with environmental drivers. Results will inform multi-species conservation planning.

DU CANADA – CENTRAL CANADA

QUANTIFYING THE VALUE AND RISK OF RESTORING WETLAND HABITATS IN AGRICULTURAL LANDSCAPES

Dr. Sarah French (Post-doctoral researcher) & Dr. Rebecca Rooney, Univ. of Waterloo; Dr. Dale Wrubleski (retired) & Dr. James Devries, DUC-IWWR; David McLachlin, DUC-ON

This project is assessing how invertebrates, wildlife, and water quality of restored wetlands are influenced by surrounding land use and cover. Special attention is focused on land use effects on pesticide loading. This information will help DUC understand effects of land use adjacent to restoration projects, especially those receiving surface water runoff from agricultural lands.

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; Kyle Borrowman, 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.

DETERMINING THE NUTRIENT RETENTION CAPACITY OF NEWLY RESTORED WETLANDS IN SOUTHWESTERN ONTARIO

Bryan Page, Dr. Pascal Badiou, & Shane Gabor, DUC-IWWR; Owen Steele, DUC-ON

Restored wetlands have been identified as natural infrastructure with the potential to reduce phosphorus loads entering streams and rivers across the working landscape of southwestern Ontario, ultimately reducing phosphorus loading to Lake Erie. This project studied restored edge-of-field wetlands to determine their ability to remove nutrients from agricultural runoff. Results indicate that restored wetlands can effectively reduce nutrients entering Lake Erie. This information will help DUC promote restoration of small wetlands in Ontario.

ADVANCING DETECTION AND SURVEILLANCE OF EUROPEAN WATER CHESTNUT

Dr. Peyman Saidi & Dr. Medhi Sanjari, saiwa inc; Kyle Borrowman & 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.

INDIVIDUAL AND SYNERGISTIC EFFECTS OF WETLAND LOSS AND ROAD DENSITY ON LOCAL EXTINCTION RATES OF AMPHIBIANS

Dr. James Paterson, DUC-IWWR; Tanya Pulfer, Ontario Nature and CWS; Emma Horrigan, Smera Sukumar, & Brittney Vezina, Ontario Nature; Dr. Ryan Zimmerling, CWS; Dr. Christina Davy, Carleton Univ.

This project uses community science data to estimate how wetland loss and road density interact to affect local extinction and colonization rates of amphibians in Ontario. This information will identify which species are most sensitive to habitat change and the locations of populations most at risk of local extinction. This will improve spatial targeting for conserving wetland biodiversity and highlight the importance of waterfowl habitats for other wildlife.

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 (OBBA). 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.

DU CANADA – ATLANTIC

IDENTIFYING DEMOGRAPHIC BOTTLENECKS AND HABITAT USE TO SUPPORT THE RECOVERY AND MANAGEMENT OF AMERICAN COMMON EIDER: A RANGE-WIDE, FULL LIFE-CYCLE TELEMETRY PROJECT

Scott Gilliland, Dr. Greg Robertson, Dr. Al Hanson, & Christine LePage, CWS/ECCC; Nic McLellan, DUC-ATL/IWWR; Dr. Matt Dyson, DUC-IWWR; Kelsey Sullivan, State of Maine; Lucas Savoy, Biol. Res. Inst.; 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 tags 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 and help identify conservation opportunities for this sub-species.

MARINE ECOSYSTEM CHANGES IN ATLANTIC CANADA: DRIVERS OF ALTERED ABUNDANCE AND HABITAT USE BY WATERFOWL AND MARINE BIRDS?

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

This project will model distributions and abundances of American common eiders and other waterfowl species to identify changes and associated drivers through time. This will involve the collection and exploration of waterfowl and environmental data. This work will help identify important areas for waterfowl and predict how they may change through time, providing insights for marine and coastal conservation planning.

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.; Rachelle Vincent (past summer student), DUC-ALT

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 marsh relate to fish usage. This project improves 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 saltmarsh 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.

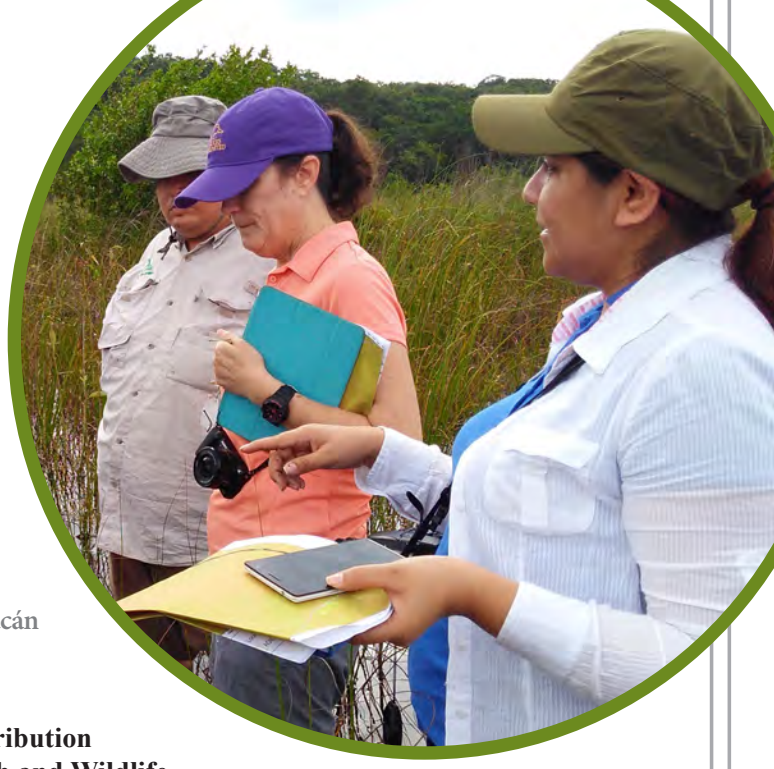
COASTAL DIGITAL CHANGE DETECTION ANALYSIS IN SINALOA AND SONORA

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 Golodrinos, 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

Alberto Lafon, PROFAUNA; José Juan Flores, ASTERESI, AC; Héctor Garza, Tamaulupas St. Univ.; Ignacio González, Alina Olalla & Adrian Varela, Nuevo Leon St. Univ.; Hugo Corzo, Veracruz St. Univ.; Cesar Tejeda, UNICACH; Juan Manuel Koller & Stefan Louis Arriaga, Tabasco St. Univ.; Jorge Correa, ECOSUR; Juan Chablé, Yucatan St. Univ.; Javier Sosa, CEGES; Jesús Vargas, Campeche St. Univ.; Moisés Rosas, José Hernández, Edwin Chay, Rene Kantun, Cristobal Cáceres & César Romero, National Commission of Natural Protected Areas; Alejandro Meléndez, Metropolitan Univ.; Ruben Pineda, Queretaro St. Univ.; Tiberio Monterrubio, Michoacan St. Univ.; Fernando Urbina, Morelos St. Univ.; Lucia B. Ramírez, Chiapas St. Univ.; Miguel Angel Díaz & Manuel Macias, Secretariat of Environment and Natural Resources; Jonathan Hiley, York Univ.; Mario Marín, Erika Maldonado & Antonio Martínez, Sinaloa State Government; Humberto Almanza & Salvador Hernández, Univ. of Guadalajara; Mireya Carrillo & Mateo Ruíz, ECOSUR; Eduardo Carrera, Gabriela de la Fuente, David Colón, DUMAC-NHQ; Jorge Cerón and David Canul, DUMAC-SERO; Aurea Estrada, DUMAC- CRO

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.

DUC-MBNA CANADA BANK® CONSERVATION FELLOWSHIP

**POLYCYCLIC AROMATIC COMPOUND CONTAMINATION AND HEALTH IMPLICATIONS IN COMMON EIDER DUCKS AT A DIESEL SPILL SITE AND A REFERENCE SITE IN NUNATSIAVUT, CANADA

Reyd Smith (PhD student) & Dr. Jennifer Provencher, Carleton Univ.

Small-scale oil spills and chronic leaks can impact wildlife through sub-lethal exposure. For example, oil exposure may alter gene expression, with downstream effects on reproductive success. This study will examine the exposure patterns and toxicogenomic effects of polycyclic aromatic compounds (PACs) on female common eiders and will work with local Inuit knowledge holders to improve understanding of local bird biology through other knowledge systems and achieve shared conservation objectives.

BONNYCASTLE FELLOWSHIP IN WETLAND AND WATERFOWL BIOLOGY

**SPATIOTEMPORAL VARIATION IN MALLARD DEMOGRAPHIC RATES

Madeleine Lohman (PhD student) & Dr. Perry Williams, Univ. of Nevada, Reno

Population dynamics and distributions of waterfowl shift over time and space. Elucidating the mechanisms behind these changes will enable us to better predict the effects of environmental change. This study involves the development and implementation of mathematical models to assess the effects of precipitation and land use on survival, harvest mortality, and fecundity for mallards in the Prairie Pothole Region from 1961–2015. These models will help inform how and where to direct management efforts in light of changing climate and land use.

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