THE ROAD TO RECOVERY

IDENTIFYING CAUSES OF BIRD DECLINES, PART 2
Linked Populations: Migratory Connectivity & Demographics

ACKNOWLEDGEMENT

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EXECUTIVE SUMMARY

JUSTIFICATION

The recent publication in Science documented the loss of nearly 3 billion birds from the North American avifauna. Although general threats to birds are well known, we still cannot point to the specific causes of declines for most bird species. We must take a species-specific approach to understand species- and population-specific limiting factors across the full annual cycle, including knowledge of migratory connectivity and demographically distinct populations. This will allow us to efficiently target limited conservation resources to the highest-priority landscapes.

THE ROAD TO RECOVERY

The purpose of the second virtual workshop in the Road to Recovery sequence was to build a vision for new science on priority species that focuses on identifying linked populations, understanding limiting factors, and pinpointing specific causes of decline. The workshop convened over 300 virtual attendees to hear from experts on tools and analyses for determining migratory connectivity, measuring population demographics and vital rates, and putting it all together to identify specific causes of decline for linked populations.

The December workshop re-emphasized the need to focus the science on individual declining species, and even on discrete linked populations within species. Many case studies described substantial variation in population trend, limiting demographic factors, and causes of decline across species ranges and among distinct linked breeding and non-breeding populations. If certain populations are declining while others are stable or increasing, and if declines are being driven by different environmental factors in different parts of a species' range, then recovering populations may require distinct, locally-relevant management prescriptions.

MOVING BEYOND THE SCIENCE

After two workshops focused on scientific knowledge gaps around bird declines and on identifying the most effective, efficient strategies for targeting new research to understand specific causes of decline, this workshop series will transition toward how to implement the science and partner with managers, policy-makers, funders, and the public to act on existing science and translate new targeted research into change on the ground.

Both conducting and implementing the science will require expanding the Road to Recovery leadership team to bring in a greater variety and diversity of perspectives, as well as focusing on building international partnerships across the Americas to study and bring back our shared birds.


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THE DECLINE OF NORTH AMERICAN BIRDS

Problem Statement: The recent publication in Science documented the loss of nearly 3 billion birds from the North American avifauna; loss of abundance is pervasive across biomes, taxonomic groups, and among common and familiar species. Although general threats to birds are well known (e.g., habitat loss, anthropogenic causes of mortality), we still cannot point to the specific causes of declines for most bird species. These need to be assessed on a species-by-species basis, even if solutions to reverse declines are implemented more broadly across habitats, geographies, or suites of species. Understanding species- and population-specific limiting factors (the "smoking guns") across the full annual cycle, including knowledge of migratory connectivity and demographically distinct populations, will allow us to efficiently target limited conservation resources to the highest-priority landscapes.

Workshop Purpose: The purpose of the second virtual workshop in the Road to Recovery sequence will be to build a vision for new, targeted science that focuses on identifying linked populations and understanding limiting factors and specific causes of decline for priority species.

Who will attend: Individuals and groups with expertise on (1) determining migratory connectivity, (2) measuring population demographics and vital rates, and (3) putting it all together to identify specific causes of decline for linked populations. Individuals with expertise in incorporating new science into management, policy, and public communication campaigns will also participate. Their insights on the final day of this workshop will set the stage for subsequent workshops on implementing the science to bring back 3 billion birds. This workshop is grounded in conversations that emerged from the work of the Partners in Flight Science Committee and the American Ornithological Society Conservation Committee.
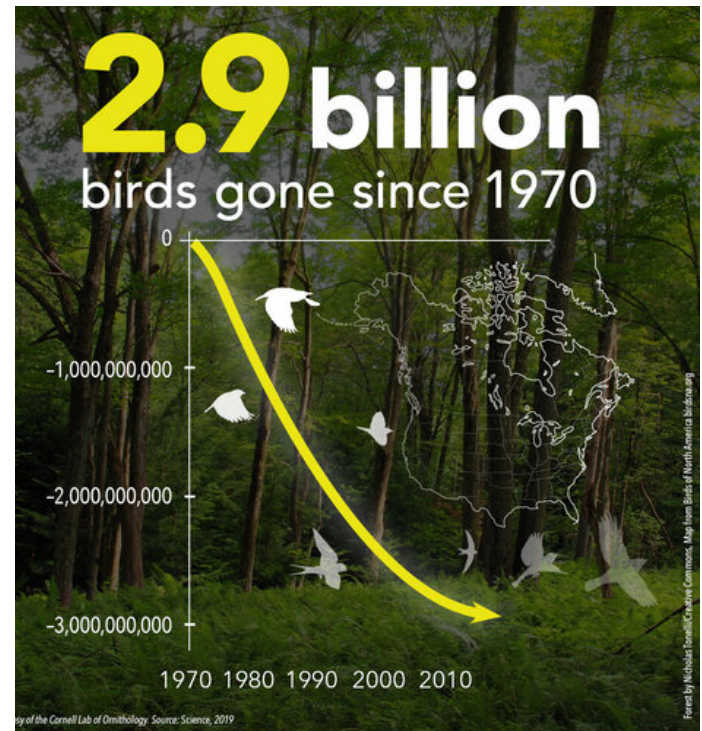
Desired Outcomes for the December Workshop

- A full picture of the steps necessary for identifying specific causes of decline for linked populations, and the tools, analyses, and existing data available for each step
- An understanding of the scale(s) at which targeted new science on declining species can be most effective
- A synthesis of participant input on important considerations and next steps in the Road to Recovery

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AGENDA

TUESDAY 1 DECEMBER

MORNING SESSION 11:00AM - 1:00PM EDT

11:00   Welcome and logistics (Tom Will)

11:05   The Road to Recovery: All hands on deck to Bring Back 3 Billion Birds (Drs. Pete Marra & Ken Rosenberg)

11:15   Why knowledge of migratory connectivity is critical to recovery planning for migratory birds (Dr. Autumn-Lynn Harrison)

11:30   ICARUS - a satellite-based IoT tracking system for wildlife (Dr. Martin Wikelski)

11:45   The Bird Genoscape Project: Mapping migratory bird populations using genomics (Dr. Kristen Ruegg)

12:00 Mobilizing Motus: Maximizing efficacy for conservation science (Dr. Stuart McKenzie)

12:15 - 1:00 Panel Discussion (moderated by Tom Will, Anna Lello-Smith, Amy Scarpignato)

AFTERNOON SESSION 2:00 - 4:00PM EDT

2:00   Welcome back (Tom Will)

2:05   Continuous estimation of migratory connectivity across the annual cycle: A range-wide Common Nighthawk case study (Elly Knight)

2:20   Building a connectivity map for Wood Thrush using archival devices (Dr. Calandra Stanley)

2:35   Migratory connectivity of Lesser Yellowlegs revealed through the application of a modern tracking technology (Laura McDuffie)

2:50   Using spatially-explicit network analysis to identify priority habitat and define population units for migratory sea ducks (Dr. Juliet Lamb)

3:05 Panel Discussion (moderated by Tom Will, Anna Lello-Smith, Amy Scarpignato)

AGENDA

WEDNESDAY 2 DECEMBER

MORNING SESSION 11:00AM - 1:00PM EDT

11:00   Welcome back (Tom Will)

11:05   The unique contribution of the MAPS and MoSI Program for understanding causes of declines in North American birds (Dr. Jim Saracco, Steve Albert & Dr. Viviana Ruiz-Gutierrez)

11:15   Using Motus to estimate vital rates – overwinter and beyond (Dr. Camila Gomez & Dr. Ana Gonzalez)

11:30   Wingbees: What can you tell from a wing? (Dr. Tom Cooper)

11:45   Standardizing Migration Monitoring to Inform Life Cycle Models and Local Research (Mark Shieldcastle)

12:00   Panel Discussion (moderated by Tom Will, Anna Lello-Smith, Amy Scarpignato)

AFTERNOON SESSION 2:00 - 4:00PM EDT

2:00   Welcome back (Tom Will)

2:05   Seasonal survival and reversible state effects in a long-distance migratory shorebird (Dr. Rose Swift)

2:20   Developing an Integrated Population Model for the Baird's Sparrow (Dr. Mo Correll & Adam Green)

2:35   What do we know about the declines of Wood Thrush? A look at the evidence so far (Dr. Clark Rushing)

2:50   In search of a modeling approach that explains Golden-winged Warbler population change (Dr. Amber Roth & Dr. Ruth Bennett)

3:05   Integrating tracking technology with remote sensing across the annual cycle to identify causes of population declines (Dr. Mike Hallworth)

3:20   Panel Discussion (moderated by Tom Will, Anna Lello-Smith, Amy Scarpignato)

AGENDA

THURSDAY 3 DECEMBER

MORNING SESSION 11:00AM - 1:00PM EDT

11:00   Welcome back (Tom Will)

11:05   Developing macro-demographic metrics from radar and eBird to understand population changes of migratory birds (Dr. Adriaan Dokter)

11:15   Network analysis for migratory connectivity: identifying priority places and pathways (Dr. Wayne Thogmartin)

11:30   Prioritizing conservation investments based on joint use of movement and behavior data from migratory birds (Dr. Mitch Weegman)

11:45   A strategy for integrating observational monitoring data and predictive modeling of population change (Dr. Adam Smith & Brandon Edwards)

12:00   Panel Discussion (moderated by Tom Will, Anna Lello-Smith, Amy Scarpignato)

AFTERNOON SESSION 2:00 - 4:00PM EDT

2:00   Welcome back (Tom Will)

2:10   What we've learned over the past 2.5 days (Anna Lello-Smith)

2:20 - 3:20   Lightning talks and panel discussion (moderated by Sarah Kendrick)

   Todd Fearer - North American Bird Conservation Initiative and Migratory Bird Joint Ventures

   Noah Matson - USFWS Division of Migratory Birds – R2R Response

   Tammy VerCauteren - Bird Conservancy of the Rockies – Linking R2R with the Central Grasslands Roadmap Summit

   Miyoko Chu - Senior Director of Communications at Cornell Lab of Ornithology and coordinator for the "3BB" outreach coalition

2:20   Moving forward with R2R (Dr. Peter Marra)

3:30   Q&A with audience and panelists (moderated by Tom Will, Anna Lello-Smith, Amy Scarpignato)

4:00   ADJOURN

SUMMARY OF TALKS: TUESDAY 1 DECEMBER 2020

IDENTIFYING LINKED POPULATIONS

Critical for modeling species populations to unravel the causes of decline, this session focused on methodological approaches for linking distinct populations across the annual cycle. Experts explained the fundamental principles and the pros and cons of the diverse tools that can be employed for tracking individuals in order to identify linked populations (e.g., isotopes, geolocators, automated radio telemetry, satellite tracking, genetic analysis, and eBird).

Morning Session: Novel and expanding technologies

Dr. Autumn-Lynn Harrison – Why knowledge of migratory connectivity is critical to recovery planning for migratory birds

A case study of the Swainson's Hawk links foundational migratory connectivity science—migratory connectivity and demographic trends—through to the discovery of the causes of decline, and then onward to recovering the species through outreach, policy, and management. The recovery of the Swainson's Hawk would not have been possible without the ingenuity of technology companies that first enabled satellite tracking of birds in the 1990s. To place this invention in context, presenter Autumn-Lynn Harrison will describe the major methodological, technological and conceptual milestones in the development of the study of migratory connectivity. She will present key terminology and examples of migratory connectivity to provide a foundation for subsequent talks. Finally, she will pose critical conservation questions that knowledge of migratory connectivity helps answer.

Dr. Martin Wikelski – ICARUS – a satellite-based IoT tracking system for wildlife

Field ecology does not yet have sufficient governmental support to empower scientists to answer questions about where, when and why migratory animals live and die. Therefore, as a global bottom-up technology project, we developed a novel ground-to-space IoT (Internet-of-Things) communication solution, featuring a low-power receiver on the ISS as an experimental first stage. After 2 decades of preparation, this system is now ready for field tests. First results are encouraging, but many technological aspects still need to be improved.

SUMMARY OF TALKS: TUESDAY 1 DECEMBER 2020

IDENTIFYING LINKED POPULATIONS

Morning Session: Novel and expanding technologies

Dr. Kristen Ruegg – The Bird Genoscape Project: Mapping migratory bird populations using genomics

Kristen Ruegg of the Bird Genoscape at Colorado State University will present on how genomic tools can be applied to connect migratory populations across time and space. Ruegg will also demonstrate that the advantage of a genetic approach to connecting populations is that it provides a strong foundation for understanding the extent to which locally adapted populations track similar or different environmental conditions across the annual cycle. Overall the goal of the Bird Genoscape Project is to help facilitate the development of genomic framework for population monitoring in as many species of concern as possible by working with partners within and outside of academia.

Dr. Stuart McKenzie – Mobilizing Motus: Maximizing efficacy for conservation science

The Motus Wildlife Tracking System (Motus) is an international collaborative research network that uses coordinated automated radio telemetry to facilitate research and education on the ecology and conservation of migratory animals. Motus is a program of Birds Canada in partnership with collaborating researchers and organizations. Motus allows researchers to track the smallest animals possible, with high temporal and geographic precision, over great distances and reveal important aspects of their life movements, connectivity, ecology, and life histories. Motus combines the collective impact of local, regional, and even hemispheric projects into one massive collaborative effort that expands the scale and scope of everyone's work and maximizes the use of scarce resources. It also makes data available and more useful for future projects, collaborative endeavors and large-scale meta analyses. Motus will play a vital role in increasing our understanding of our declining birds, and also help us to meet critical outreach and education objectives.

SUMMARY OF TALKS: TUESDAY 1 DECEMBER 2020

IDENTIFYING LINKED POPULATIONS

Afternoon Session: Putting It Into Practice

Elly Knight – Continuous estimation of migratory connectivity across the annual cycle: A range-wide Common Nighthawk case study

Evaluating migratory connectivity continuously across a species range is important for understanding differential population trends because high migratory connectivity makes individual populations susceptible to local environmental conditions. We developed an approach to estimate spatial and temporal migratory connectivity continuously during migration for a widespread, declining, long-distance migratory bird with variable population trends, the Common Nighthawk (Chordeiles minor). Spatial and temporal connectivity were highest during migration through North America, with a notable peak in connectivity prior to crossing the Gulf of Mexico during spring migration. There was almost no connectivity in Central and South America due to mixing of populations along a common migratory route and similar migration timing across populations. Our study presents a generalizable approach to evaluating migratory connectivity across the full annual cycle that can be used to focus migratory bird conservation towards places and times of the annual cycle where populations are more likely to be limited.

Dr. Calandra Stanley – Building a connectivity map for Wood Thrush using archival devices

Archival tracking devices are the principal tracking devices available for migratory songbirds. This presentation explores how a combination of light-level and archival GPS geolocators were used to develop a range-wide migratory connectivity map for wood thrush (Hylocichla mustelina). The methodological approaches for field work and data analysis are explored as well as the pros and cons associated with both device types.

Laura McDuffie – Migratory connectivity of Lesser Yellowlegs revealed through the application of a modern tracking technology

The Lesser Yellowlegs (Tringa flavipes) has experienced a precipitous population decline since the 1970s. The causes of the decline remain unclear, however, shorebird harvest occurring in the Caribbean and northeastern South America is a clear threat for the species. Using PinPoint GPS Argos satellite transmitters, we tracked the autumn migratory movements of individuals originating from six breeding and post-breeding locations across Alaska and Canada. Results of this tracking indicated that Lesser Yellowlegs originating in eastern Canada had a higher probability of occurrence within shorebird harvest zones, than all other tracked individuals.

Dr. Juliet Lamb – Using spatially-explicit network analysis to identify priority habitat and define population units for migratory sea ducks

Sea ducks (Tribe: Mergini) undertake unusually complex migrations with extended spring and fall staging periods, making it challenging to use traditional breeding-wintering models of migratory connectivity to understand population distribution and overlap. Based on a large, multi-species telemetry dataset from eastern North American sea ducks, we constructed a network of migratory habitats and movements. We then used standard network analysis metrics to assess the relative importance of different sites to habitat connectivity as well as spatial separation of populations throughout the annual cycle. Our results offer a robust, quantitative approach to assessing migratory connectivity in species with complex annual-cycle movement patterns, as well as a means of using individual movement data to prioritize single- and multi-species habitats for conservation in an annual cycle context.

SUMMARY OF TALKS: WEDNESDAY 2 DECEMBER 2020

LINKING VITAL RATES ACROSS THE FULL ANNUAL CYCLE

Once we have established the migratory connectivity of distinct populations of species of concern, how do we assess the demographic parameters that could potentially reveal when and where in the full annual cycle a species is most limited? In this session, speakers presented on the available and evolving tools useful in inferring vital rates during breeding, migration, and wintering. In discussing vital rates of linked populations, we begin the process of combining connectivity and demographic tools to develop informed hypotheses on limiting factors and causes of decline.
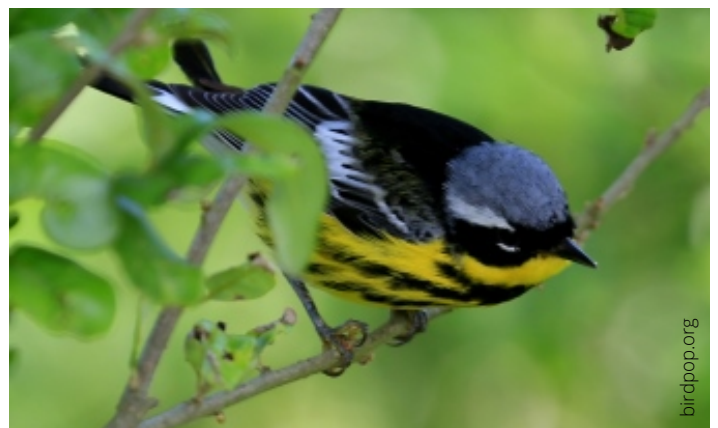
Morning Session: Tools for estimating vital rates

Dr. Jim Saracco, Steve Albert & Dr. Viviana Ruiz-Gutierrez – The unique contribution of the MAPS and MoSI Program for understanding causes of declines in North American birds

The Monitoring Avian Productivity and Survivorship (MAPS) program, established in 1989, consists of a network of constant-effort mist-netting stations operated during the breeding season across North America to provide indices or estimates of vital rates of > 150 landbird species. MAPS data have been used to identify spatial and temporal patterns in demographic rates and population dynamics, to provide links between demography and environmental drivers, and to inform integrated population models. The Monitoreo de Sobrevivencia Invernal (MoSI) program was established in 2002 to complement MAPS by providing demographic data on migratory landbird species on their wintering grounds. MoSI data have been used to estimate site persistence and dynamics of birds during the non-breeding season. Both the MAPS and MoSI programs have been key data sources for identifying migratory connectivity and population structure based on intrinsic and extrinsic markers. These programs can play a unique role in informing broad-scale full annual cycle population models to identify causes of avian population declines and to inform conservation and management to reverse declines.

Dr. Camila Gomez & Dr. Ana Gonzalez – Using Motus to estimate vital rates – overwinter and beyond

Motus is a collaborative network of automated receiving stations that detect flying birds with coded VHF tags that emit at a single frequency. The increasing availability of stations throughout North, Central and South America and the increased effort to tag large numbers of individuals of migratory birds, make Motus a very useful tool to estimate vital rates and understand its drivers throughout the annual cycle. We present how to use Motus to estimate annual and over-winter survival of migrants and show an example of how Motus data can be combined with other research techniques (such as capture and recapture and manual telemetry) to understand potential ecological drivers of vital rates like resource limitation during stopover. We illustrate this through real examples of work carried out by SELVA researchers in Colombia between 2015 and 2018.

SUMMARY OF TALKS: WEDNESDAY 2 DECEMBER 2020

LINKING VITAL RATES ACROSS THE FULL ANNUAL CYCLE

Morning Session: Tools for estimating vital rates

Afternoon Session: Putting it into practice

Dr. Tom Cooper – Wingbees: What can you tell from a wing?

Each year, the U.S. Fish and Wildlife Service coordinates the Parts Collection Survey (PCS) for several species of migratory game birds. Hunters participating in the survey submit one wing from each bird they harvest via a pre-paid envelope on which they record the date and location the bird was harvested. Biologists then go through the wings to determine the species (for waterfowl), age, and sex of the birds submitted based on feather characteristics. The gathering of biologists is known as a "wingbee". Age data from the PCS provide an index to productivity from the previous breeding season and can be useful for informing integrated population models and harvest management.

Mark Shieldcastle – Standardizing Migration Monitoring to Inform Life Cycle Models and Local Research

This presentation introduces a method to provide information to inform the life cycle models through a standardized migration banding operation. Migration provides the template to access the entire population of multiple landbird species similar to the time frame utilized in the waterfowl models in gathering important data points such as age ratios, productivity, and survival. Standardization allows for site to site comparison and the statistical needs for landscape questions. In conjunction with breeding season programs (MAPS) and wintering programs (MoSI) the entire life cycle can be monitored and important demographic information gained for future management of the avian resource.

Dr. Rose Swift – Seasonal survival and reversible state effects in a long-distance migratory shorebird

We use observations from linked populations of two different species, Hudsonian Godwits (Limosa haemastica) and Piping Plovers (Charadrius melodus), to show examples on how to incorporate seasonal vital rates with information from throughout the annual cycle to explore population limiting factors. Using two separate marked populations of Alaskan-breeding Hudsonian Godwits, godwit survival rates were high throughout the annual cycle, but lowest during the breeding season, only slightly higher during southbound migration and highest during the stationary nonbreeding season. Our results indicate that overwintering godwits foraging in high-quality habitats had comparably better nutritional status and pre-migratory body condition, which in turn improved their return rates and the likelihood that their nests and chicks survived during the subsequent breeding season. In contrast, seasonal survival of piping plovers was higher during the breeding season than the rest of the year and harmful algal blooms negatively affected survival both during the nonbreeding season and the subsequent breeding period. Both examples highlight the wealth of information available for linked populations at both the individual- and population-level and show that the nonbreeding season can have long-lasting impacts on individuals throughout the year.

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SUMMARY OF TALKS: WEDNESDAY 2 DECEMBER 2020

LINKING VITAL RATES ACROSS THE FULL ANNUAL CYCLE

Afternoon Session: Putting it into practice

Dr. Mo Correll & Adam Green– Developing an Integrated Population Model for the Baird's Sparrow

Grassland birds are in precipitous decline in North America, including the Baird's sparrow. We collected data on vital rates and population density for this species across its full annual cycle to inform an integrated population model to understand which seasonal factors are limiting this grassland specialist. We found that immigration rates were most influential on the Baird's sparrow population from year to year, followed by winter survival. Winter precipitation as well as the amount of lands enrolled in the Conservation Reserve Program (CRP) on the breeding grounds were positively related to population growth over time. Our preliminary findings highlight the importance of the wintering season in population trajectories for grassland birds, and also identify a potential mechanism for driving positive population change through management (CRP).

Dr. Clark Rushing – What do we know about the declines of Wood Thrush? A look at the evidence so far

The Wood Thrush (WOTH) is a poster child for declining migratory species that breed in eastern deciduous forests. WOTH have declined by 60% across their range since 1970, but this range-wide decline masks substantial spatial variation in the magnitude and even the direction of population change. Here I summarize historical and recent research on which demographic and habitat factors limit WOTH populations at both local and range-wide scales. Studies of patch-level breeding population dynamics have shown that in high-quality patches, population growth is primarily driven by recruitment, whereas in low-quality patches, population growth is driven by emigration. At larger spatial scales, we can combine long-term BBS data on population change with new data that link breeding and wintering populations, as well as high-resolution remote sensing data that can be used to quantify habitat change over time. Using Integrated Population Models and migratory network models, we can identify at which point(s) in the annual cycle linked populations are limited. Research suggests that core breeding populations may be limited by winter habitat loss, whereas the breeding populations in steepest decline may be limited by breeding habitat loss. However, there is much unexplained variation in population trend across the WOTH range, and information is lacking about demographic drivers of population change at range-wide scales.

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SUMMARY OF TALKS: WEDNESDAY 2 DECEMBER 2020

LINKING VITAL RATES ACROSS THE FULL ANNUAL CYCLE

Afternoon Session: Putting it into practice

Dr. Amber Roth & Dr. Ruth Bennett – In search of a modeling approach that explains Golden-winged Warbler population change

Golden-winged Warbler (Vermivora chyrsoptera) is a Neotropical migrant experiencing long-term population decline, a criterion that identifies it as a 3X species in the R2R framework. This species is dependent upon disturbance in broadleaf-dominated forests throughout its range. New research indicates strong migratory connectivity for the two breeding subregional populations and segregation of habitat on the wintering grounds resulting in most females using lower quality habitat than most males. The species is under review for Endangered Species Act protection in the US, a process that has launched a new research effort led by the University of Maine to understand future population viability and spatial distribution for this species. This modeling effort will utilize the substantial information available with the scientific community but key areas of information remain lacking related to adult and juvenile dispersal, within-season and annual survival, and carryover effects among periods of the full annual cycle.

Dr. Mike Hallworth – Integrating tracking technology with remote sensing across the annual cycle to identify causes of population declines

Many migratory species are declining, and for most, the proximate causes of their decline remain unknown. We integrated data collected from tracking technology, community science, and remote sensing data to quantify migratory connectivity, population trends, and habitat loss to determine where populations are limited. We quantified the correlation between forest change throughout the annual cycle and population declines of a long-distance migratory songbird, the Connecticut Warbler (Oporornis agilis, observed decline: -8.99% yr-1). Different Connecticut warbler populations tended to have population-specific fall migration routes but overlapped almost completely within the northern Gran Chaco ecoregion in South America. Cumulative forest loss within 50km of breeding locations and the resulting decline in the largest forested patch index was correlated more strongly with population declines than forest loss on migratory stopover regions or wintering locations in South America, suggesting that habitat loss during the breeding season is the primary driver of observed population declines for the Connecticut Warbler.

SUMMARY OF TALKS: THURSDAY 3 DECEMBER 2020

DIVERSE APPROACHES FOR INTEGRATING DATA TO UNDERSTAND POPULATION LIMITATION

In the absence of perfect information, how do we pinpoint where and when in the annual cycle species are most limited? This final morning session explored a diverse array of approaches for integrating information on migratory connectivity and vital rates to understand the geographies and potential drivers of decline. From Integrated Population Modeling to network analysis and radar demography, speakers discussed how we can move forward in pinpointing precisely where and why species are declining.
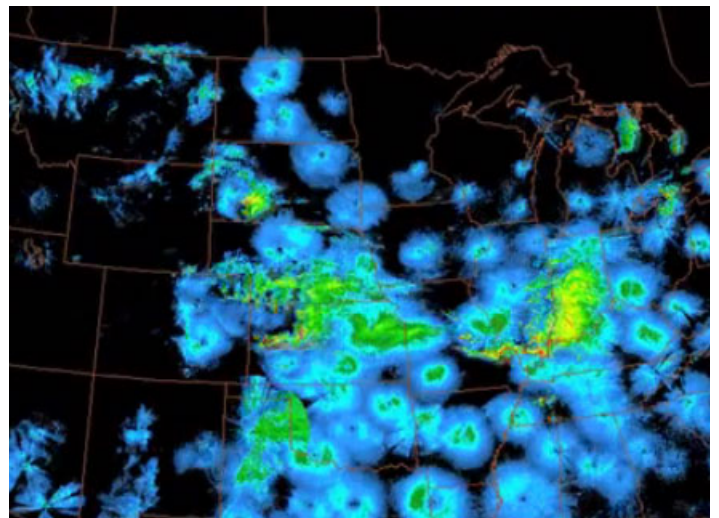
Morning Session

Dr. Adriaan Dokter – Developing macro-demographic metrics from radar and eBird to understand population changes of migratory birds

To understand current bird declines, researchers require accurate estimates of the birth and death rates of birds across the vast geographic areas they visit. However, such information is currently only available for a few select locations during short periods of the year. We will address these challenges by developing novel tools to measure the birth and death rates of birds across an entire continent and throughout the whole year. The insights generated by these efforts will help us to understand which factors, e.g. extreme climatic events, have been causing population declines. To create these new analyses, we will rely on three novel 'big data' resources: First, the US weather radar network (NEXRAD) will be used to study the flow of migrants into and out of North America during fall and spring migration. Comparing these numbers between adjacent seasons will enable us to estimate the birth and death rates of all migratory birds combined. Second, observations from hundreds of thousands of volunteer citizen scientists (eBird data) and dynamic species distribution models will be used to track seasonal variation in the numbers of birds recorded. Third, remote sensing data and the National Ecological Observatory Network (NEON) will be used to understand temperature and phenological extremes, which will be explored as a mechanism driving population changes. Overall, this research aims to develop the tools to understand current population declines and point towards a roadmap for the recovery and conservation of the mass migration of birds.

Dr. Wayne Thogmartin – Network analysis for migratory connectivity: identifying priority places and pathways

Migratory networks are comprised of pathways (edges) connecting habitats (nodes), through which organisms move over the annual cycle. The per capita contribution of these habitats and pathways to annual population dynamics can be calculated by season- and location-specific discrete-time matrix population models. Model-based perturbations to habitats and pathways can identify those seasonal locations most sensitive to positive (conservation action) or negative (habitat degradation or loss) consequences, consequences which are not necessarily intuitive or linear in their effect. With these and other similar tools in hand, the timing and magnitude of conservation can be tuned to the need of species.

SUMMARY OF TALKS: THURSDAY 3 DECEMBER 2020

DIVERSE APPROACHES FOR INTEGRATING DATA TO UNDERSTAND POPULATION LIMITATION

Morning Session

Dr. Mitch Weegman – Prioritizing conservation investments based on joint use of movement and behavior data from migratory birds

Prioritizing conservation investments will be a critical task for practitioners given unprecedented climate and land use change globally. Working alongside a team of researchers, we used Global Positioning System-acceleration (behavioral) tracking devices fitted to greater white-fronted geese in Europe and North America to study the consequences of behavior and movement throughout spring migration on reproductive attempt. We found the importance of proportion of time feeding and energy expenditure toward reproductive attempts was relatively consistent throughout spring migration. We also found large individual and between-continent variation in the influence of precipitation rate and temperature on goose behavior and movements. Lastly, we found that habitats selected by birds influenced their behaviors (e.g., how long they feed, or how frequently they sleep or fly). These results improve our understanding of the annual cycle for greater white-fronted geese. More broadly, these results highlight the potential for practitioners to use recent technological and statistical advancements to improve conservation planning for a variety of bird populations.

Dr. Adam Smith & Brandon Edwards – A strategy for integrating observational monitoring data and predictive modeling of population change

Monitoring North American bird populations is at a watershed moment. We have the data and computational tools necessary to evolve the agency-based reporting of status and trends in bird populations into a predictive framework that integrates multiple sources of information to understand the causes of past population change and to predict future changes. We describe our overall vision and focus on one of the major steps, which will allow us to integrate bird counts across any point count-style observation: NA-POPS (Point-count Offsets for Population Size of North American landbirds, www.NA-POPS.org). NA-POPS offsets will convert counts into estimates of density by accounting for variations in sampling protocol and many of the common observation processes and conditions that vary over time, space, and among programs. These density estimates will increase the spatial and temporal grain and extent of suitable bird monitoring data, and improve our estimates of population sizes and trends. Additionally, these density estimates will allow us to better model the relationships between bird density and temporal/spatial factors that influence birds such as land-use, weather, climate, and human activity, all of which are key factors to consider for predicting future changes of bird population sizes.

SUMMARY OF TALKS: THURSDAY 3 DECEMBER 2020

DIVERSE APPROACHES FOR INTEGRATING DATA TO UNDERSTAND POPULATION LIMITATION

Afternoon Panel Discussion: Implementing the Science

Todd Fearer – North American Bird Conservation Initiative and Migratory Bird Joint Ventures

The Migratory Bird Joint Ventures (JVs) played a key role in the success of waterfowl conservation, and we will continue to adapt to a more complex landscape, both geographic and social, to achieve the same success with all birds. The strength of the JVs lies in our partnerships and the ability to empower partners to work across organization and geographic boundaries. Moving forward, we will find ways to make bird conservation relevant to a broader constituency, such as better connecting it to clean water and other ecological services, develop novel partnerships that work at the scales necessary to have a population impact, such as the JV8 effort in the Central Grasslands, and better address full annual cycle issues with priority species, including greater work in the wintering grounds.

Noah Matson – USFWS Division of Migratory Birds – R2R Response

The documented loss of almost 3 billion breeding birds in North America, builds off of years of reports including State of the Birds reports, and put a spotlight on the stunning decline of biodiversity. In response, the U.S. Fish and Wildlife Service initiated a "phase 1" strategy with the following goals: 1) enhance internal coordination across FWS programs to more aggressively address the conservation needs of grassland birds, forest birds, shorebirds, seabirds, and aerial insectivores and reduce the impacts of bird collisions; 2) take advantage of recent policy opportunities, in particular the Great America Outdoors Act (potential funding to reduce bird collisions at existing agency buildings via retrofitting and other strategies) and the permanent authorization of the Land and Water Conservation Fund (potential for dramatic increased habitat protection funding); 3) reinvigorate Federal coordination for the conservation of migratory birds through the Council for the Conservation of Migratory Birds (E.O. 13186); 4) continue to work with partners to Think Big for birds.

Tammy VerCauteren – Bird Conservancy of the Rockies – Linking R2R with the Central Grasslands Roadmap Summit

Business as usual and disparate efforts are not going to make the conservation movement needed to change the plight of our birds. No one entity can address dynamic challenges and needs. We need a unified vision and collaborative approach to change the trends from land health and resiliency to bird declines. To get to sustainable landscapes and bird populations, we need to work outside the normal paradigm of bird conservation partners and build trust and relationships. Our solutions need to address economics of people and communities living on the land, balancing habitat, healthy communities and economic realities and incorporating local knowledge and culture. We need to clearly define the outcomes we are striving for and they need to include diverse values from land resilience to economics to human and wildlife communities.

Dr. Miyoko Chu – Senior Director of Communications at Cornell Lab of Ornithology and coordinator for the "3BB" outreach coalition

The group of communicators and scientists that led publicity for the Science paper on the loss of 3 billion birds is continuing to collaborate on unified messaging for bird conservation. Their work focuses on three areas: science, policy, and lifestyle. Policy efforts will be focused on a legislative agenda for the new Congress, a package of 15 bedrock bird protection policy priorities identified by partners. Lifestyle efforts will build on collaborations with the Bird Friendly Coalition to inspire behavioral changes that help birds, people, and the environment. Science communication efforts will focus on helping to elevate Road to Recovery efforts in collaboration with scientists.

Q&A SUMMARY: A SYNTHESIS OF AUDIENCE QUESTIONS AND COMMENTS

The science around identifying limiting factors, while the focus of this workshop, is only one component of what must be a multifaceted approach to Bringing Back 3 Billion Birds. The next workshops in this R2R series will focus on implementing the science (through working with managers, developing policy mechanisms, leveraging funding, etc.) and engaging with partners across Latin America. Below are some of the main sentiments, popular questions, and themes from the December workshop Q&A. These statements are distilled, summarized, or direct quotes from participants.

RESEARCH IDEAS

- Studies must be long-term enough to capture annual variation in survival, habitat use, and habitat quality. This is important for, e.g., identifying critical stopover areas which may change in importance between dry versus wet years. Studies of short duration (i.e. 2 or 3 years) will likely miss this variation and may not identify some key areas for conservation.

- Network approaches to bird conservation: to what extent should we focus on developing networks of protected habitats and sites (e.g. like the Western Hemisphere Shorebird Reserve Network, or Natura 2000 in Europe)?

- Motus data should be made freely available, like BBS data, to facilitate research on migratory connectivity.

- We should expand MoSI monitoring to the temperate zone to get a better handle on short-distance migrant and winter resident vital rates, in particular the role of overwinter survival. This seems especially important for Common Birds in Steep Decline.

MAKING THE SCIENCE MATTER

- Communication with policy-makers should happen at early stages of research development to ensure that research is policy-relevant and meets immediate needs.

- A key part of communicating with stakeholders (like state agencies) is understanding what message will resonate best (e.g. ecological urgency, socio-political urgency, feasibility/likelihood of making a difference, the stakeholder's relative responsibility for protecting a target species). A loss of 3 billion birds is overwhelming, but focused communication about which birds we have a substantial responsibility for, and can feasibly do something about, is most likely to effect change.

- Researchers should become more involved with Joint Ventures Science Committees and Flyway Council Technical Sections to better bridge the research-management gap. Research on identifying limiting factors can help shape priorities for these partnerships that are poised to implement conservation actions.

- Success story of applying science for conservation: Highlighting the importance of Chiloé Island to Hudsonian Godwits led to substantial, long-term regional investments by the Packard Foundation and Audubon. This has supported development of a regional conservation plan, direct conservation of critical roost sites, purchase of aquaculture leases, local training, and more.

IS THERE A SCALE MISMATCH BETWEEN SCIENCE & MANAGEMENT?

What are the most effective scales for science and management to be done? Is there a mismatch in the spatial scales at which science and management are (or should be) done, and if so is this an impediment to successfully implementing the science around causes of decline?

- The emerging science makes clear that the specific causes of decline and even population trends vary substantially within species. Thus the science on identifying causes of decline needs to happen at the level of linked populations, but management solutions are easier to implement across guilds or habitats than species-by-species. To get from science to implementation we need to scale up from sub-species to multi-species.

- However, managers are also asking for science that is done at broad spatial scales to be stepped down to units that are relevant to management (e.g. the state or county level). Science needs to happen across species ranges, at continental or hemispheric scales, but management tends to occur at much smaller scales. Does this mean that research results need to be stepped down to smaller scales at which management is currently being done? Or that the spatial scale of management needs to be stepped up beyond the state, regional, or even national level?
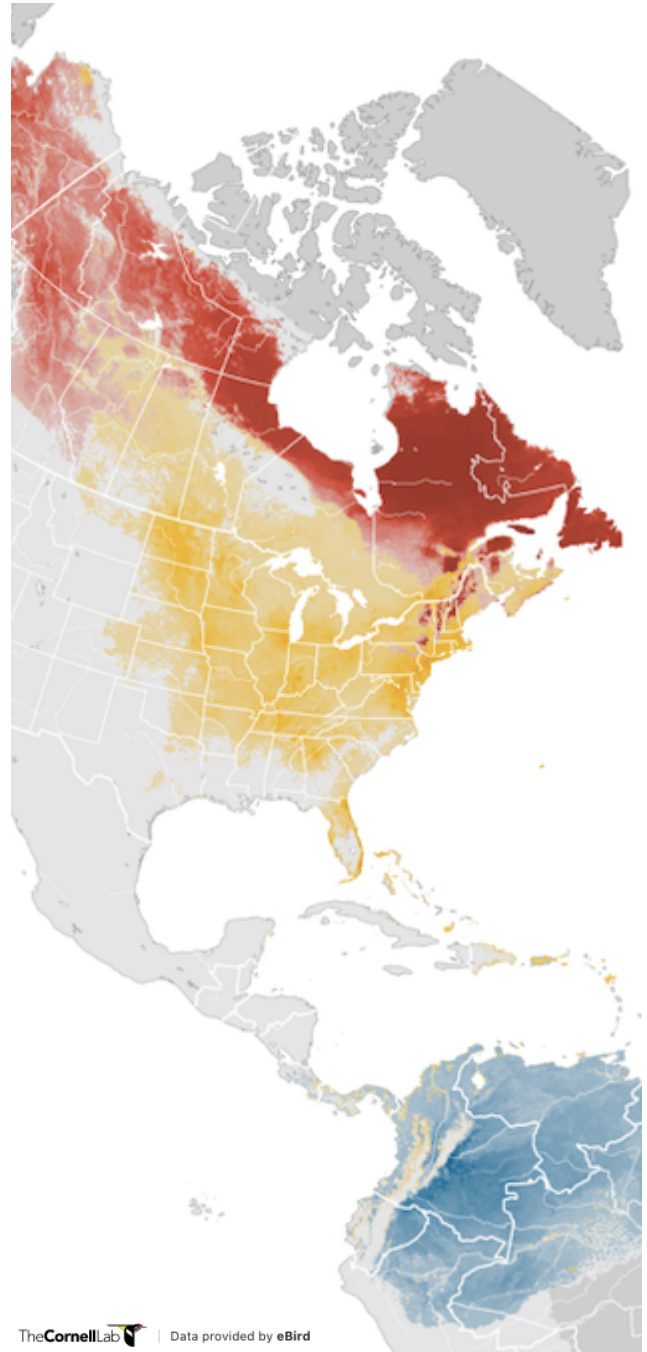
BUILDING FUNDING SOURCES

Bringing Back 3 Billion Birds will require leveraging funding on a much larger scale.

- The Neotropical Migratory Bird Conservation Act (NMBCA) is an important funding source, but the current 3:1 match requirement is limiting, especially for researchers and NGOs in Latin America. Ideas for and examples of leveraging match funds include:
  - Bird Conservation Investment Strategies: internationally co-created strategies for bird conservation that emphasize leveraging resources effectively
  - Pennsylvania Game Commission funding was used as match for an NMBCA grant project in Costa Rica
  - Motus funds for the Northeast Motus Collaboration were used as match for an NMBCA grant proposal from Birds Caribbean
  - Efforts are underway to reduce the 3:1 match requirement for NMBCA grants
- In addition to conservation funding from agencies or private foundations, conservation financing (using financial instruments such as green bonds) could be an important tool for increasing funding.
- A tax on birding gear (e.g. binoculars, feeders) could leverage the community of people that appreciate birds at any level for conservation funding.

HEMISPHERE-WIDE COORDINATION

Given how many priority species spend the majority of the year in Latin America, it is critical to focus on coordinating efforts across the hemisphere on research, management, policy, and communication. Some ideas put forth about how to foster international partnership and collaboration across the Americas include:

- Extend the Joint Venture model south of the U.S. border. This model engages various stakeholders as equal partners and seeks to understand needs in particular regions

- Capitalize on existing conservation alliances in Latin America (e.g. the Southern Cone Grasslands Alliance, MesoAmerican Pine-Oak Forest Alliance, Birds Caribbean)

- Collaborate better with in-country NGOs and governments to tap international lenders (World Bank, Inter-American Development Bank) for research and conservation funding

- Use the Americas Flyways Framework as a model for conserving birds across borders. Many participants agree that the Americas Flyways Framework is an 'oven-ready' mechanism to engage with Latin America on flyway conservation.
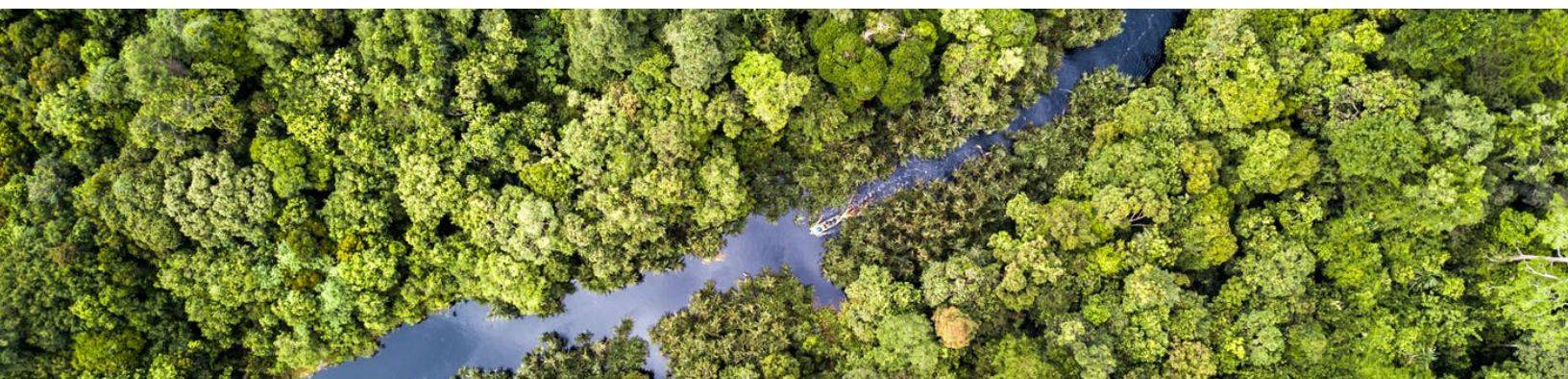
INCLUSIVITY IN R2R

Critical to successful implementation of R2R science is ensuring that we are more deliberately inclusive of historically underrepresented groups at all stages and levels of the R2R effort. This includes prioritizing inclusivity (beyond gender) in planning for future workshops, e.g. in terms of identifying presenters and panelists.

Participant Comment: "Making the bird conservation and wider environmental movements intersectional is the only way to future success. Thank you for acknowledging efforts toward wider inclusion within the ornithological community. We've done good work, but do have a lot of necessary work to do. I want to extend a thank you to all panelists who included their pronouns in their name. These small steps are how we actually make change in our community and make space for inclusion."

(c) Noppadol Paothong

(c) Dominic Sherony

NEXT STEPS

UPCOMING WORKSHOPS

The next workshops in this continued R2R series will transition from a focus on how to most effectively target new science on bird declines toward how to implement the science, through partnerships with managers, policy-makers, funders, social scientists and communications experts. Based on widespread interest from participants during this workshop, the next workshops will also center building and expanding international partnerships across the hemisphere. More intentional collaboration between North America and Latin American and the Caribbean is critical for both studying and conserving birds across the full annual cycle.

EXPANDING THE R2R LEADERSHIP TEAM

The immediate focus of the Road to Recovery effort following this workshop is to expand the R2R leadership team to make it more inclusive and to bring in a diversity of organizations and perspectives. To this end, an expanded steering committee has been identified and will begin meeting in late January 2021. The R2R steering committee is also working to develop a fund to support new, targeted research on priority species as well as a more cohesive strategy for moving forward with the R2R effort.

Link to December Workshop Recordings