

2014 Project Abstract

For the Period Ending June 30, 2017

PROJECT TITLE: Minnesota Breeding Bird Atlas – Final Phase
PROJECT MANAGER: Lee Pfanmuller
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FUNDING SOURCE: Environment and Natural Resources Trust Fund
LEGAL CITATION: M.L. 2014, Chp. 226, Sec. 2, Subd. 05f

APPROPRIATION AMOUNT: \$300,000
AMOUNT SPENT: \$300,000
AMOUNT REMAINING: \$0

Overall Project Outcome and Results

The Final Phase of the Minnesota Breeding Bird Atlas (MNBBA) analyzed field data collected during the five year atlas project and developed a website presenting the results. The MNBBA was a comprehensive, statewide survey on the breeding distribution for all bird species in Minnesota. Initiated in July 2008, it was a collaborative effort among Audubon Minnesota, the Minnesota Department of Natural Resources, the U.S. Fish and Wildlife Service, the Minnesota Ornithologists' Union, and the University of Minnesota's Natural Resources and Research Institute. The atlas encompassed 5 field seasons (2009-2013), involved nearly 700 volunteers and survey staff in data collection, and cataloged the distribution and relative abundance of 249 breeding species statewide down to the 1/4 township level. Similar initiatives have been conducted by states and provinces throughout North America.

Specific project outcomes since July 2014 included: 1) a technical review of the 380,707 records collected during the atlas to insure data integrity; 2) development of 160 predictive distribution models that linked the distribution and abundance of breeding species with data on climate, habitat, and landscape context; 3) analysis of habitat associations for 130 of the most common species; 4) preparation of accounts for each of the 249 species that summarized their life history, conservation status, Minnesota distribution since the late nineteenth century, breeding habitat, and population abundance; and 5) development of a website (mnbirdatlas.org) that presents results for each species, including an interactive map that enables users to conduct a variety of geographic and ecological searches of the MNBBA data.

These data will be invaluable to conservation planning efforts by local, state, and federal agencies as well as non-governmental organizations as they plan and implement efforts that affect Minnesota's natural

resources. As a historical record, the MNBBA also provides baseline data to monitor future changes in avian distribution and abundance.

Project Results Use and Dissemination

All project results, analyses, and interpretation will be displayed on the newly developed website no later than October 30, 2017 (mnbirdatlas.org). Audubon Minnesota will publicize the site's launch. In the interim, all data collected during the atlas continue to be displayed on the website that has serviced the project since the beginning, mnbba.org. Data collected by MNBBA volunteers and point count data collected by the Natural Resources Research Institute will also be displayed and housed by the Midwest Avian Data Center (<http://data.pointblue.org/partners/mwadc/>), a regional node of the Avian Knowledge Network (<http://www.avianknowledge.net>). A Data Sharing Agreement between Audubon Minnesota and the Avian Knowledge Network (AKN) outlines procedures for individuals interested in acquiring full or partial downloads of the original data. Users of the mnbirdatlas.org website who wish to acquire data are directed to the AKN website. These same data also will be made available to the University of Minnesota's Minnesota Biodiversity Atlas maintained by the Bell Museum of Natural History.



Environment and Natural Resources Trust Fund (ENRTF) M.L. 2014 Work Plan: Final Report

Date of Status Update Report: August 11, 2017

Final Report

Date of Work Plan Approval: June 4, 2014

Project Completion Date: June 30, 2017

PROJECT TITLE: Minnesota Breeding Bird Atlas – Final Phase

Project Manager: Lee Pfanmuller

Organization: Audubon Minnesota

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Location: Statewide

Total ENRTF Project Budget:

ENRTF Appropriation: \$300,000

Amount Spent: \$300,000

Balance: \$ 0

Legal Citation: M.L. 2014, Chp. 226, Sec. 2, Subd. 05f

Appropriation Language:

\$300,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Audubon Minnesota to complete a statewide survey of Minnesota's breeding bird distributions through final analysis, preparation, and dissemination of information collected on an ongoing basis since 2008 on breeding birds in the state. The completed atlas must be available for download from the Internet free of charge. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

I. PROJECT TITLE: Minnesota Breeding Bird Atlas – Final Phase

II. PROJECT STATEMENT: The Minnesota Breeding Bird Atlas (BBA) is a comprehensive, statewide survey of the breeding distribution of all bird species found in Minnesota. Initiated in July 2008, it has encompassed 5 field seasons and involved over 800 volunteers in data collection and other tasks. This monumental effort has cataloged the distribution and relative abundance of nearly 250 species statewide down to the 1/4 township level in Minnesota. These data will be invaluable to improve our statewide understanding of natural resources, for conservation planning, and will serve as a guide for the growing eco-tourism industry, especially in rural areas of the state. The 175 partners that make up Bird Conservation Minnesota were involved in the planning process, and funding to date has come from the State of Minnesota through the Environment and Natural Resources Trust Fund and the Department of Natural Resources, the U.S. Fish and Wildlife Service, the Minnesota Ornithologists' Union, the University of Minnesota's Bell Museum and Natural Resources and Research Institute, and Audubon Minnesota.

With five years of data collection having been completed in the summer of 2013 we will now do the final analysis and dissemination of our information by: 1) synthesizing and analyzing these data, 2) preparing written analysis, maps and other graphics, and 3) upgrading our website to fully explain and make available, the information collected in the past five years. Presenting the information in electronic platforms ensures widespread access to the information in the years ahead for citizens, resource managers, and decision makers. The BBA will be an essential tool as a statewide guide for habitat protection, restoration, and management. Up to date information on breeding species will help guide efforts by local, state, and federal agencies as well as non-governmental organizations as they plan and implement efforts that affect natural resources. To the 1.8 million Minnesotans having an interest in birds the BBA will be able to provide information to guide the choice of birding destinations and expand citizen appreciation and understanding of the natural history of Minnesota. As a historical record the BBA will serve as baseline data to help monitor future changes in avian distribution due to climate change, habitat changes and other factors. Because the BBA provides information at local, eco-region, and statewide scales it provides opportunities for data analysis not made available by most other sources.

III. PROJECT STATUS UPDATES:

Overall Project Outcomes and Results: Project Revision 5/15/14 – Moved \$9,000 from Text Writer/Editor to Audubon Office Manager to cover direct expenses in budgeting and billing for project. Moved \$4,707 from Text Writer/Editor to Project Coordinator to cover unexpected need for funds to transition from the Data Collection phase of the project to Analysis and Product Development; this expense will occur in first month of the funding cycle.

Project Status as of January 2, 2015: During the first 6 months of the project we contracted with NRRRI at the University of Minnesota – Duluth to do data analysis and production of text and figures. We also contracted with Lee Pfannmuller to do 1) data review, 2) collaborate with NRRRI on data analysis, 3) oversee production of text and figures for the products, 4) assist with development and creation of the website, and 5) assist with project management duties. The contractors have been reviewing and correcting data in the database, compiling the spatial data needed to analyze the data, and working on detectability adjustments for each species. Dr. Gerald Niemi at NRRRI presented a talk titled: "*An Alternative Design to Sample Breeding Birds for a State Atlas*" at a national ornithological conference in September 2014.

Amendment Request (01/02/2015):

- 1) Moved \$3,000 from Website Development to a new contract "Database Management (Cornell)" to cover the expense of extending our Database Management contract for another year (until Feb 2016). This is needed due to an unexpected high number of data corrections discovered during our quality control. The corrections are a result of having a high number of volunteers entering codes in an inconsistent manner. While this is not a major issue it is time consuming and will extend our Quality Control into the 1st quarter of 2015.
- 2) After obtaining approval of Minnesota DNR, and LCCMR Staff Director, Susan Thornton, we did a "no-bid" contract award to Lee Pfannmuller for text writing and editing. This was based on the unique combination of her familiarity with the BBA, her extensive knowledge of MN birds, and her proven track record in writing and editing. We also included other project duties including Quality Control and serving as the interface with NRRI. To fund these additional duties we moved \$30,907 from Personnel (Project Manager) and \$3,000 from Travel to the Text Writer/Editor contract.

Amendment approved by LCCMR: 1/2/2015

Project Status as of June 30, 2015:

During the second reporting period the focus was on conducting a thorough review of the 381,000 records collected during the course of the five year atlas period. Although numerous qualified reviewers and species experts had examined portions of the database at various times, a comprehensive review was essential before beginning the analyses. This effort was conducted by a core team that included contractors Lee Pfannmuller and Gerald Niemi as well as advisor, Jan Green. An important component of this review was an in-depth assessment of all records that would expand our current knowledge of a species distribution in Minnesota to insure they were valid records.

Once the review was completed a total of 752 records had been invalidated in the official MNBBA database maintained by the Cornell Lab of Ornithology. In addition, breeding evidence codes for 5,297 observations will be changed to more accurately reflect the information depicted by the observation, and breeding evidence codes for 13,066 records that earlier reviewers had flagged to be changed were reviewed and will be kept intact. Because evidence codes cannot be changed in the Cornell database (records can only be invalidated), the Cornell data were downloaded to our contractors in Minnesota on June 12 and these final changes will be made during the last week of June. Once these changes are made the analytical work will begin in earnest. In the interim, staff explored a range of software packages for conducting the analyses with a particular focus on a well-known modelling tool, MaxEnt.

Amendment Request (06/30/2015):

1. As of June 5, 2015, former project manager, Mark Martell, accepted a new job and is no longer working at Audubon Minnesota. In lieu of his departure, we are requesting that Matthew Anderson, Executive Director of Audubon Minnesota, be assigned as the Project Manager.
2. Matthew Anderson, As Interim Project Manager, will not charge time to the project since the executive director's salaries are an ineligible expense.

Amendment approved by LCCMR: 9-25-2015

Project Status as of January 2, 2016:

Work focused on finalizing corrections to the MNBBA data, preparing for the comprehensive analysis of MNBBA data, and developing materials for the new MNBBA website. First, all evidence code corrections and record invalidations identified during the second reporting period were transcribed to a downloaded copy of the

uncorrected MNBBA data file maintained by the Cornell Lab of Ornithology. Although some unanticipated challenges were encountered, a corrected file was completed and ready for analysis by mid-August. In the interim, NRRRI staff prepared to link the MNBBA data with habitat, landscape and climate data by: 1) meeting with a statistician skilled in wildlife survey data to insure that all statistical options for analyzing and modeling the data are explored; 2) examining the possibility of incorporating land cover data that delineates different agricultural crops because birds make such distinctions in selecting suitable habitat; 3) testing predictive models using a subset of non-bba data; and 4) continuing an analysis of bird detectability using the MNBBA point count data. Many factors influence a bird's detectability and there remains some controversy about the importance of accounting for detectability in modeling exercises. MNBBA's point count data provide the opportunity to examine models that use both raw data as well as detectability adjustments, allowing a comparison of the robustness of the resulting models. Finally, preliminary work on the new website's content began. Outlines of the overall content were prepared in addition to a detailed outline for each of the 260+ species accounts that will be included. Drafts of 31 species accounts were prepared.

Amendment Request (01/02/16)

1. Request that the date of the January report be moved to January 30th to align with a six month reporting cycle, allow Audubon adequate time to process financials, and review work completed by independent contractors.

Amendment approved by LCCMR: 2-19-2016

Amendment Request (05/20/2016):

2. Audubon Minnesota has not adequately replaced staff capacity since Mark Martell's departure in June of 2015 and therefore has not had a staff level project manager working on this grant on a daily basis. Lee Pfannmuller, Project Text Writer/Editor, has been performing many of the project management responsibilities since June of 2015. Following LCCMR's recommendation we have appointed Lee Pfannmuller as Project Manager. Kristin Hall, Minnesota Audubon, will serve as Ms. Pfannmuller's liaison with the Audubon Minnesota Office. We have also removed what remains of the project manager budget line item (\$8,368.00) in the Personnel Line and moved it to Activity 3 in the Professional/ Technical/ Services Contracts section of budget to cover Ms. Pfannmuller's contract costs for these additional responsibilities.

Amendment approved by LCCMR: 5-26-2016

Project Status as of June 30, 2016:

During the fourth reporting period work focused on three major outcomes. First, considerable effort was directed at developing models that utilized data collected by the MNBBA point counts and volunteers to predict and map the statewide distribution for 165 of the 249 species reported during the atlas. Different models were employed depending on the number of data points available for each species. Models will not be developed for species with a relatively small number of sampling points or for species that are not suitable for modeling (e.g. colonial nesting species). Staff is in the process of scrutinizing the statistics for all of the maps produced and exploring other options for analyses. Before any of the maps are released, they will be peer-reviewed. The MNBBA data also were used to project statewide population estimates for many of the species and to develop graphs depicting their relative abundance across major habitat cover types. The second major focus was the preparation of drafts for 89 additional species accounts, bringing the total drafted to date to 120. Finally, the third major outcome was the selection of the Natural Resources Research Institute as the entity responsible for developing the new MNBBA website. The contract was awarded in June and work will begin in earnest during the next reporting period.

Project Status as of January 2, 2017:

During the past six months, work has focused on four major tasks. First, all the maps and graphs generated using data collected from the 2,339 point counts have been carefully reviewed. Most of the probability maps and the habitat frequency diagrams for species that are relatively common and have a statewide distribution are quite good. For species with more restricted distributions, however, some of the probability maps have not been satisfactory. We are identifying those maps that would benefit from new modeling that would re-calculate probability predictions over a smaller, more restricted region of Minnesota. Second, statewide population estimates have been generated for 75 of the most common breeding species. These estimates are among the first in North America that use a new analytical technique that accounts for detectability in a sophisticated way. Third, the first drafts of 225 of the 249 species accounts have been completed. Revisions of the accounts, many prepared nearly one year ago, are now underway, as are efforts to finalize the compilation of photographs, graphs, and figures that will accompany each account. Finally, work on the construction of a new website has begun. Using the Wordpress content management system, homepage layout designs have been created with the goals of quickly educating visitors about the breeding bird atlas, generating interest with graphics and text, and allowing users to easily navigate to the information they are looking for. A prototype interactive mapping tool that allows the distribution of each of 249 bird species to be displayed also has been developed.

Amendment Request (01/02/2017)

Due to awarding a contract for developing the atlas's new website to the Natural Resources Research Institute (NRRI) for a cost (\$23,841) less than was originally projected (\$47,000), we are proposing to reallocate some of the savings to other work tasks:

1. Allocate \$10,000 to a contract for copyediting the 249 species accounts which average 2,000 to 2,500 words each (budget change made to Activity 2: Task #1);
2. Allocate \$2,500 for the technical review of approximately 40 species accounts by recognized species experts; the cost per account will range from \$50 to \$75 (budget change made to Activity 2: Task #1);
3. Increase the dollars available for purchasing copyrighted photographs of birds from \$2,000 to \$5,000 (budget change made to Activity 2: Task #2); and
4. Increase the dollars available to NRRI to prepare and upload materials to the website by \$5,200. This will include preparation of a live literature cited link in each species account to a compiled literature cited section as well as assistance in organizing and loading graphics and text to the newly designed website (budget change made to Activity 3: Task #2).

Amendment Approved by LCCMR 1/05/2017

Amendment Request (04/28/2017)

This request reflects no change to the work being done or to the overall amount of the project but requests the reallocation of funds in order to facilitate the completion of specific tasks. The budgetary changes are as follows:

1. Reduce the Personnel (Wages and Benefits) total by \$1,500
 - a. Omit \$500 from Activity 2
 - b. Omit \$1000 from Activity 3
2. Remove \$2,500 recently allocated for technical review from Activity 2 (line item 24).
3. **Activity 3 Development and Creation of the Website:** Increase the dollars available to contract to prepare and upload materials to the website by \$3,000 (budget line item 19). This will focus primarily on populating the website and working to establish effective methods for transferring figures and tables to the site.
4. **Activity 3 Development and Creation of the Website:** Increase the dollars available to contract for website development by \$1,000 (budget line item 22). This will cover revisions to the site that arise from internal and external reviews.

Amendment Approved: [05/08/2017]

Amendment Request (06/07/2017)

This request reflects no change to the work being done or to the overall amount of the project but requests the reallocation of funds in order to facilitate the completion of the time and labor intensive task of copy editing. The Breeding Bird Atlas is a content rich project and the copy editing is such a critical piece of the process to ensure continuity and accuracy in the final product.

The budgetary changes requested are as follows:

1. Reduce Website Development- line 22 in Activity 2 by \$2,460.
2. Reduce Other: Purchase of copyright photos- line 26 in Activity 2 by \$1000
3. Reallocate \$3,460 of funds from the above listed reductions to Copy Editing- line 23, Activity 3.

Amendment Approved by LCCMR 6/12/2017

Project Status as of June 30, 2017:

The Final Phase of the Minnesota Breeding Bird Atlas (MNBBA) analyzed field data collected during the five year atlas project and developed a website presenting the results. The MNBBA was a comprehensive, statewide survey on the breeding distribution for all bird species in Minnesota. Initiated in July 2008, it was a collaborative effort among Audubon Minnesota, the Minnesota Department of Natural Resources, the U.S. Fish and Wildlife Service, the Minnesota Ornithologists' Union, and the University of Minnesota's Natural Resources and Research Institute. The atlas encompassed 5 field seasons (2009-2013), involved nearly 700 volunteers and survey staff in data collection, and cataloged the distribution and relative abundance of 249 breeding species statewide down to the 1/4 township level.* Similar initiatives have been conducted by states and provinces throughout North America. Specific project outcomes since July 2014 included: 1) a technical review of the 380,707 records collected during the atlas to insure data integrity; 2) development of 160 predictive distribution models that linked the distribution and abundance of breeding species with data on climate, habitat, and landscape context; 3) analysis of habitat associations for 130 of the most common species; 4) preparation of accounts for each of the 249 species that summarized their life history, conservation status, Minnesota distribution since the late nineteenth century, breeding habitat, and population abundance; and 5) development of a website (mnbirdatlas.org) that presents results for each species, including an interactive map that enables users to conduct a variety of geographic and ecological searches of the MNBBA data. These data will be invaluable to conservation planning efforts by local, state, and federal agencies as well as non-governmental organizations as they plan and implement efforts that affect Minnesota's natural resources. As a historical record, the MNBBA also provides baseline data to monitor future changes in avian distribution and abundance.

*Note: Early project statements repeatedly referred to the fact that MNBBA enlisted the support of 800 volunteers. This number was based on the total number of individuals who registered on the official Cornell website for MNBBA data entry. When that datafile was downloaded and examined carefully two problems became clear: first, some individuals who registered as participants never provided data; and second, many individuals who provided data were registered multiple times under slightly different names. Once those problems were addressed the total number of volunteers, plus paid survey staff, approximates 700. Early statements also mentioned that 250 species were reported during the atlas; the correct number is 249.

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Analysis

Description: Over 350,000 bird observations on 250 species have been entered in the BBA database. These data will undergo quality control and corrections will be made as needed. The corrected data will be analyzed on a species specific basis by geographic region. Data analysis will include linking habitat, landscape, and climate data with the distribution and abundance for each species, estimation of Minnesota breeding population with appropriate confidence intervals, summarizing available population trend information, and summarization of habitat use and landscape associations (e.g., ecological subsections). The level of analyses will vary depending

on the number of observations for each species. We will have the most up to date distribution and range analysis, habitat use, and population density information available.

Summary Budget Information for Activity 1:

ENRTF Budget: \$ 92,848
Amount Spent: \$ 92,848
Balance: \$ 0

Activity Completion Date: June 30, 2015

Outcome	Completion Date	Budget
1. Data quality control and correction	March 31, 2015	\$ 5,637
2. Analysis of species range	December 30, 2014	\$15,000
3. Linkage of habitat, landscape and climate data with species distribution and abundance	June 30, 2015	\$30,000
4. Analysis of habitat use and landscape associations	June 30, 2015	\$42,211

Activity Status as of January 2, 2015: During our initial analysis we discovered that breeding codes were entered in an inconsistent manner by volunteers, which is not surprising given the high number of participants the project attracted (over 800). Although we had been reviewing data throughout the project we ran into unexpected problems. We are currently correcting these codes but it has delayed some of the analysis of the data.

During the past two months, we have primarily focused on three activities.

1. Compiling the necessary spatial data to analyze the distribution and abundance of breeding birds in the state. These data include the National Land Cover Data that was recently completed in 2011 and correspond well to the 2009-2014 period when these bird data were gathered from 2009-2014.
2. A second data base also has been completed recently. It documents how land cover and land use have recently changed due to disturbances such as logging, wind throws, and forest fire that has occurred throughout the state (Hansen et al. 2013, Science 342:85-853). Both of these data bases will provide the necessary base layers for analysis along with data available on climate (PRISM), roads (TIGER), and landscape metrics (FRAGSTATS).
3. Detectability adjustments for species detected on the point counts will also be critical for predictions of species population levels for the state. We have been working cooperatively with Dr. Peter Solymos at the University of Alberta (no expense to this project) who has developed algorithms for adjusting detections on the basis of such factors as observers, weather conditions, and habitat. The Minnesota Breeding Bird Atlas data base of point counts is unique because of the way these data were gathered. Factors of importance included random sampling and systematic sampling across the state, but also data were recorded at minute intervals and distances of detection to an individual bird were estimated within those intervals.

Activity Status as of June 30, 2015:

1. Data quality control and correction
 - The past six months has focused largely on conducting a thorough review of the nearly 381,000 records collected during the course of the five year atlas period. Numerous qualified reviewers and species experts examined portions of the database at various times from 2009-2013. Their comments and suggestions were invaluable. At this point it was important to examine the entire database to insure that the guidelines for coding observations were interpreted and applied consistently across all taxonomic

groups. If and when exceptions to these guidelines were made, they needed to be biologically justified and documented. This effort was conducted by a core team that included our consultant contractor Lee Pfannmuller, our ornithological advisor Jan Green, and our lead NRRRI consultant and ornithologist, Dr. Gerald Niemi and his staff. This critical review included discussions with many of the original observers to insure their confidence in specific observations (e.g., sight or sound) and to insure consistency in their interpretation and documentation of breeding codes (e.g., observed, observed in suitable habitat, probable, and confirmed breeding).

- In addition to insuring the guidelines for assigning breeding codes to individual observations were correctly interpreted by atlas volunteers and paid surveyors, the team addressed some challenging bird identification issues embedded in the observations. A few examples of the challenges confronted because some species are very similar in appearance, and/or their songs are difficult to distinguish from one another, included:
 - ✓ Sharp-shinned Hawks and Cooper's Hawks which are nearly identical in appearance;
 - ✓ Alder Flycatchers and Willow Flycatchers which are also essentially identical in appearance and whose songs are distinct but can sound similar;
 - ✓ Hermit Thrushes and Wood Thrushes whose songs, from a distance, can sound very similar; and
 - ✓ Chestnut-sided Warblers and Yellow Warblers that are very different in appearance but who both have quite variable songs that can sound very similar.
- Once this comprehensive review was completed, a total of 752 records were invalidated in the official MNBBA database maintained by the Cornell Lab of Ornithology. In addition, breeding evidence codes for 5,297 observations were changed to more accurately reflect the information depicted by the observation, and breeding evidence codes for 13,066 records that earlier reviewers had flagged to be changed, were reviewed and kept intact. Because evidence codes cannot be changed in the Cornell database (records can only be invalidated), the Cornell data will be downloaded to our contractors in Minnesota who will make the final changes in these files prior to conducting further analyses.
- Preparations for downloading the data from Cornell were discussed with IT staff at Cornell. Then, on June 12, all the files were downloaded and made available to MNBBA contractors. Changes to the evidence codes will be made in late June.

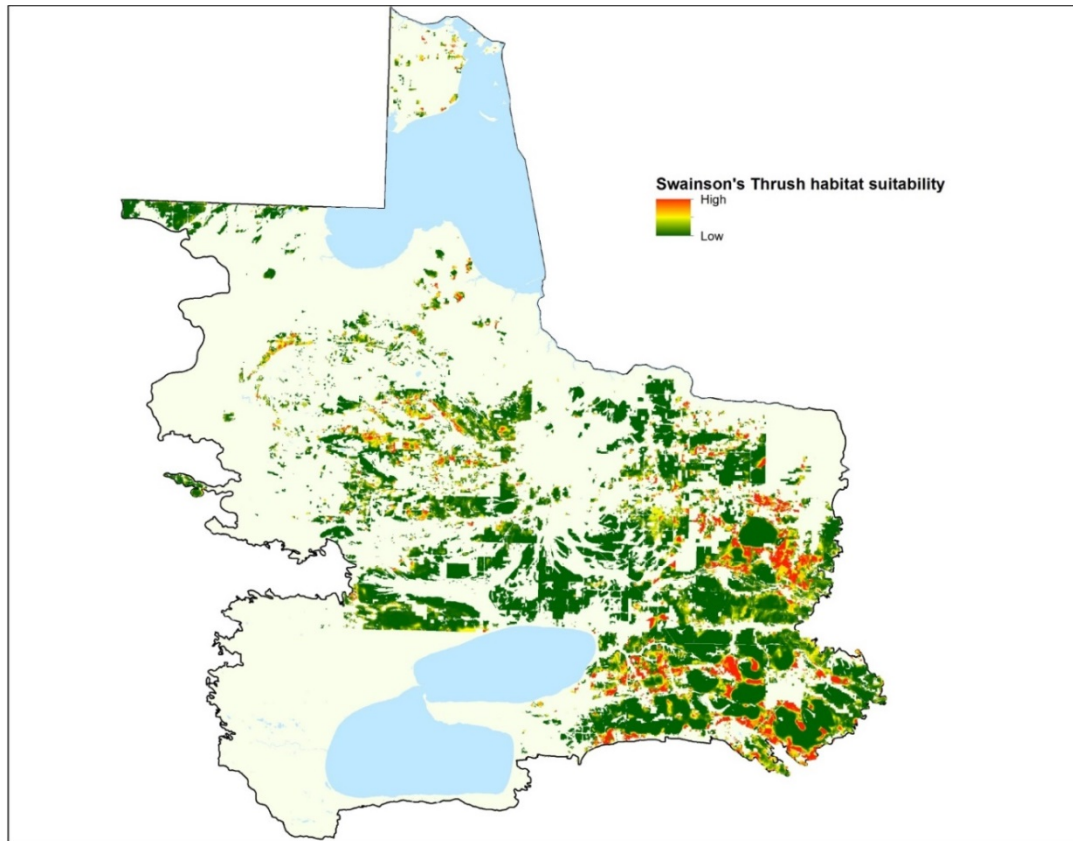
2. Analysis of Species Range

- During this review process, particular attention was focused on records that expanded our knowledge of the distribution of a given species beyond what was previously known. During a two day meeting in March, the distribution maps for each of the 250 breeding species documented during the atlas were carefully reviewed by the core team. Each record that extended beyond the core of the species known breeding distribution was examined closely to insure accurate identification and documentation of each record. Outcomes from this meeting included the invalidation of numerous records and/or delineation of further questions that needed to be addressed before making a final determination.

3. Linkage of habitat, landscape and climate data with species distribution and abundance

- Project staff explored several potential modeling approaches for the ultimate analysis of the breeding bird data across the state of Minnesota. Examples included the popular software package, MaxEnt, which pairs locational data for a species with a set of environmental variables, such as land cover, climate, etc. Several linear models were also examined. These analyses are being tested with data collected in association with on-going bird studies in the Chippewa National Forest and in Minnesota's Agassiz Lowland Ecological Subsection.

- An example of an analysis using the machine-learning program MaxEnt, which has gained considerable popularity in the scientific literature, is shown below for the Swainson's Thrush. This is a habitat suitability map for state-owned forest land in the Agassiz Lowland Ecological Subsection and is an example of the type of map we plan to produce across the entire state for many species based on the breeding bird atlas data. The analyses for the BBA project will include all land ownerships.



4. Analysis of habitat use and landscape associations

- This work, as well as further work to link environmental data with species distribution and abundance, has been delayed by the need to do a more thorough quality control of the individual species records. These analyses will now begin in earnest.

Activity Status as of January 2, 2016:

1. Data Quality Control and Correction

- For a subset of species (largely raptors, herons, egrets, cormorants and pelicans) we discovered that birds reported as 'flyovers' on the nearly 7,000 point counts were not always coded the same as flyovers reported by volunteer observers. Lee Pfanmuller worked with NRRI staff to make corrections where needed.
- BBA data from all 7,000 point counts were maintained in two separate files: one within the Cornell MNBBA database and one at NRRI. Once all the final corrections were made to the data maintained by the Cornell database, Lee Pfanmuller worked with NRRI staff to insure that when data from the point counts were corrected that those changes were also made to the point count database maintained by NRRI.

- The nearly 6,000 evidence code corrections and invalidations that were finalized from January 2015 to June 2015 were done in separate files maintained by the Minnesota Breeding Bird Atlas. During this reporting period all these changes were transcribed to the downloaded Evidence Code File maintained by the Cornell Lab of Ornithology (CLO). This process took many weeks and uncovered several additional issues that needed to be addressed including:
 - ✓ When the MNBBA contractors asked the CLO IT staff to make nearly 2,100 universal code changes in the Cornell data files, we assumed that records changed from probable and possible codes to observed codes would be automatically invalidated if they were outside of the accepted safe dates for each species. Unfortunately when we received the downloaded files from Cornell we discovered that the changes over-rode the accepted safe dates. As a result, all 2,100 records had to be re-examined and, if they were outside the safe dates, invalidated. These invalidations had to be made in the original Cornell database as well as in the final downloaded file from Cornell.
 - ✓ Several smaller inconsistencies also were uncovered during the transcription process including: a) recognition that Sharp-tailed Grouse dancing grounds were coded inconsistently; b) coding issues associated with invalidated records; and c) recognition that M and S Probable codes for all swallow species were not addressed consistently.
 - Once all coding issues were addressed, a copy of the final, corrected Evidence Code File, along with five other downloaded files from the Cornell MNBBA database, was provided to NRRI staff on August 11 for further analyses.
2. Analysis of Species Range
- This work is largely done. One final review of each species map that includes all the coding corrections that have been made in the past year will be done during the next reporting period.
3. Linkage of habitat, landscape and climate data with species distribution and abundance
- As mentioned in the previous progress report, NRRI has been testing and applying models that link breeding bird point count data with 1) habitat data gathered at the point of sample, 2) landscape data at various radii (100m, 200m, 500m, and 1000m) surrounding the point, and 3) contemporary climate data for spring and summer periods. These data have been successfully applied in the Chippewa National Forest and in Minnesota's Agassiz Lowland Ecological Subsection of northwestern MN. In the Chippewa National Forest NRRI used a general linear mixed model approach, while in the Agassiz region they used MaxEnt. These analyses have not used monies from this project, but were funded by other sources for those specific areas. NRRI staff focused on these other analyses largely because of the delay in reviewing the MNBBA data and to make more efficient use of personnel time once all of the bird data have been scrutinized.
 - The modeling procedures are critical to determine what methods work best with different data sets, geographic areas, and especially with different sample sizes. For instance, the MNBBA point count data for individual species varies from 16,554 observations for the Red-winged Blackbird to 10 observations for the Virginia Rail or 1 observation for the White-eyed Vireo. Obviously, 1 or 10 observations will be an inadequate sample size to model the probability distribution for species using any technique. NRRI will apply different modeling approaches to different species data sets, especially depending on sample size. MaxEnt is applicable to species with relatively small sample sizes where absence is unknown, while a general linear modeling approach will be best for species with large sample sizes.
 - The covariate data sets for habitat, landscape, and climate have been compiled. However, in western Minnesota NRRI would like to incorporate an additional data layer that identifies the different crops planted each year. For example, bird species respond differently to corn, soybeans, sunflower, alfalfa, and other common agricultural crops. Incorporating these different crop layers in the geographic information system by year is important for understanding both the immediate habitat where the point count was sampled, but also the landscape context. NRRI staff has completed a preliminary examination of the possibility of incorporating these layers, but a final base layer has not been completed.

4. Analysis of habitat use and landscape associations

- NRRI has completed a preliminary analysis on detectability for the MNBBA point count data set. Adjusting the point counts by species based on their different detectability is an active area of ornithological research. Recently, a software program has been made available called 'QPAD' which uses removal and distance sampling methods to make adjustments in the estimation of detection probability (Sólymos, P., Moreno, M., Lele, S.R., 2013. Detect: analyzing wildlife data with detection error. R package Version 0.3-1).
- There are still controversies on whether detectability of a species needs to be included in modeling efforts, but NRRI plans to use both the raw bird observation data and detectability adjustments in its modeling efforts in linking the bird data with habitat and landscape use. Dr. Niemi recently worked with a group on the publication of a paper that incorporated the QPAD method in an analysis of point count data (Ralston et al. 2015. Combining local-scale survey data to estimate trends in abundance at multiple spatial scales for a threatened community of birds. *Biological Conservation* 187:270-278).
- Now that the data have been scrutinized, NRRI recently hired Nicholas Walton to work with Ed Zlonis in the modeling efforts for the habitat and landscape associations. Walton completed his MS thesis at the University of Wisconsin, Green Bay on precisely this type modeling effort. He modeled approximately 100 breeding bird species using point count data gathered from northern Michigan, northern Wisconsin, and northern Minnesota for his MS degree; some of the data he used were from the MNBBA point counts.
- NRRI recently completed a half-day review of its modeling efforts with Dr. Douglas Johnson on 9 December 2015. Dr. Johnson is a nationally-known, professional statistician who has specialized in wildlife statistical issues. They received an excellent review from Dr. Johnson on their data and the approaches they will be pursuing in future modeling of these data. This meeting was a follow-up to a full-day peer-review meeting held with four professional statisticians (Ph.D. level degrees in statistics) in July 2014. NRRI wanted to insure that they explored all options for data analysis and modeling with both the MNBBA point count and volunteer data.
- Because of delays in NRRI obtaining its original contract in fall of 2014, the necessity of conducting a thorough quality examination of all the MNBBA observation records (the contract for which was also delayed by six months), the need to complete detectability analyses not originally intended, and the importance of reviewing modeling approaches, we anticipate a six month delay in producing 'at minimum' drafts of the probability maps.

Activity Status as of June 30, 2016:

The analyses of the breeding bird atlas data have proceeded in earnest during the past six months. Staff has produced probability distribution maps using both the systematic point count data and the volunteer data; the latter were especially valuable when there was confirmed breeding data for a species. The analyses of the breeding activity have been divided into various categories depending on the availability of these data, primarily the sample sizes for the respective species. These categories are as follows: 1) breeding bird species (n=76) with large sample sizes and adequate data to include detectability adjustments have been analyzed with general linear models (e.g., among the most well-developed and sophisticated models); 2) breeding bird species (n=31) with relatively large sample sizes, but without adequate data for detectability adjustments have also been analyzed with general linear models; 3) breeding bird species (n=21) that are not well-surveyed with point counts or have large numbers of volunteer records, have been analyzed using exploratory analyses with and without detectability adjustments with general linear models; and 4) breeding bird species (n=37) with relatively small samples and geo-referenced volunteer data have been modeled using MaxEnt, a machine-learning program that is briefly discussed on page 8. Hence, a total of 165 of the 249 (66%) breeding bird species that the atlas project identified as nesting in the state of Minnesota will be analyzed in detail as to their potential distribution and abundance. Models will not be developed for species with a relatively small number of sampling points or for species that are not suitable for modeling (e.g. colonial nesting species). An example of

the analyses for species in category 1 above is shown for the Black-capped Chickadee (Figure A) and for category 4 (Figure B) for the American Kestrel.

We are in the process of scrutinizing the statistics for all of the maps produced and exploring other options for analyses. Before public release for any of these maps, they will be peer-reviewed by experts on these species. The use of simulations to determine the statistical robustness of these models are the strongest criteria on how well they reflect the reality of each species distribution and abundance in the state. However, empirical examination and the use of common sense also are important.

Figure A. Preliminary distribution and abundance map for Black-Capped Chickadee using all original variables and a general linear model. The figure also includes 1) estimates of breeding pairs with detectability adjustments, 2) estimates for Minnesota from the Partner's in Flight (PIF) international program, and 3) an analysis of the breeding frequency distribution of the species by habitat cover type for 200 m and 500 m resolution surrounding the observations of the species. Figure A is on following page.

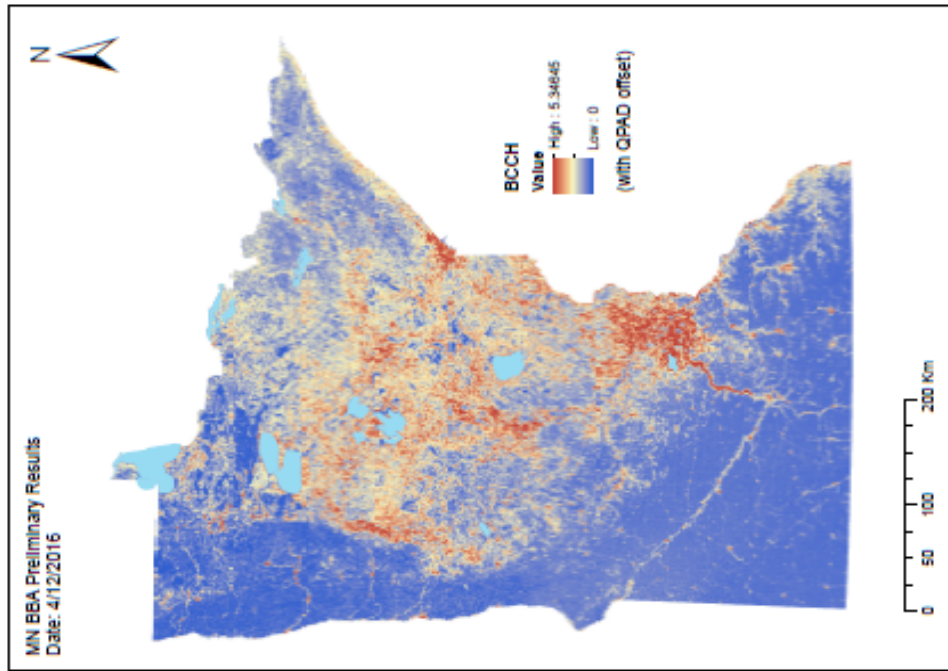


Figure 189. Black-capped Chickadee (*Parus atricapillus*) species distribution model with original variables. Population estimate based on this model is 1,178,350. PIF estimate is 1,100,000.

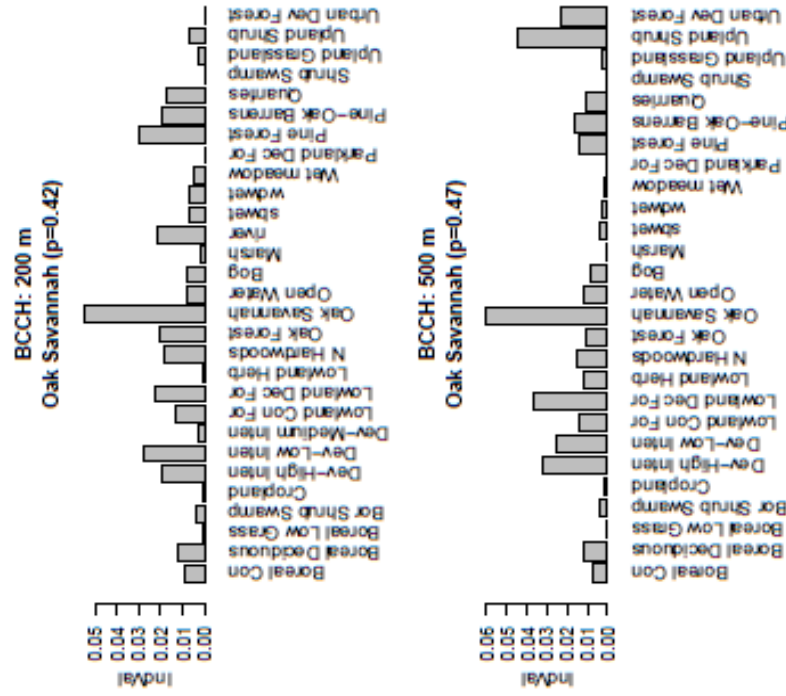
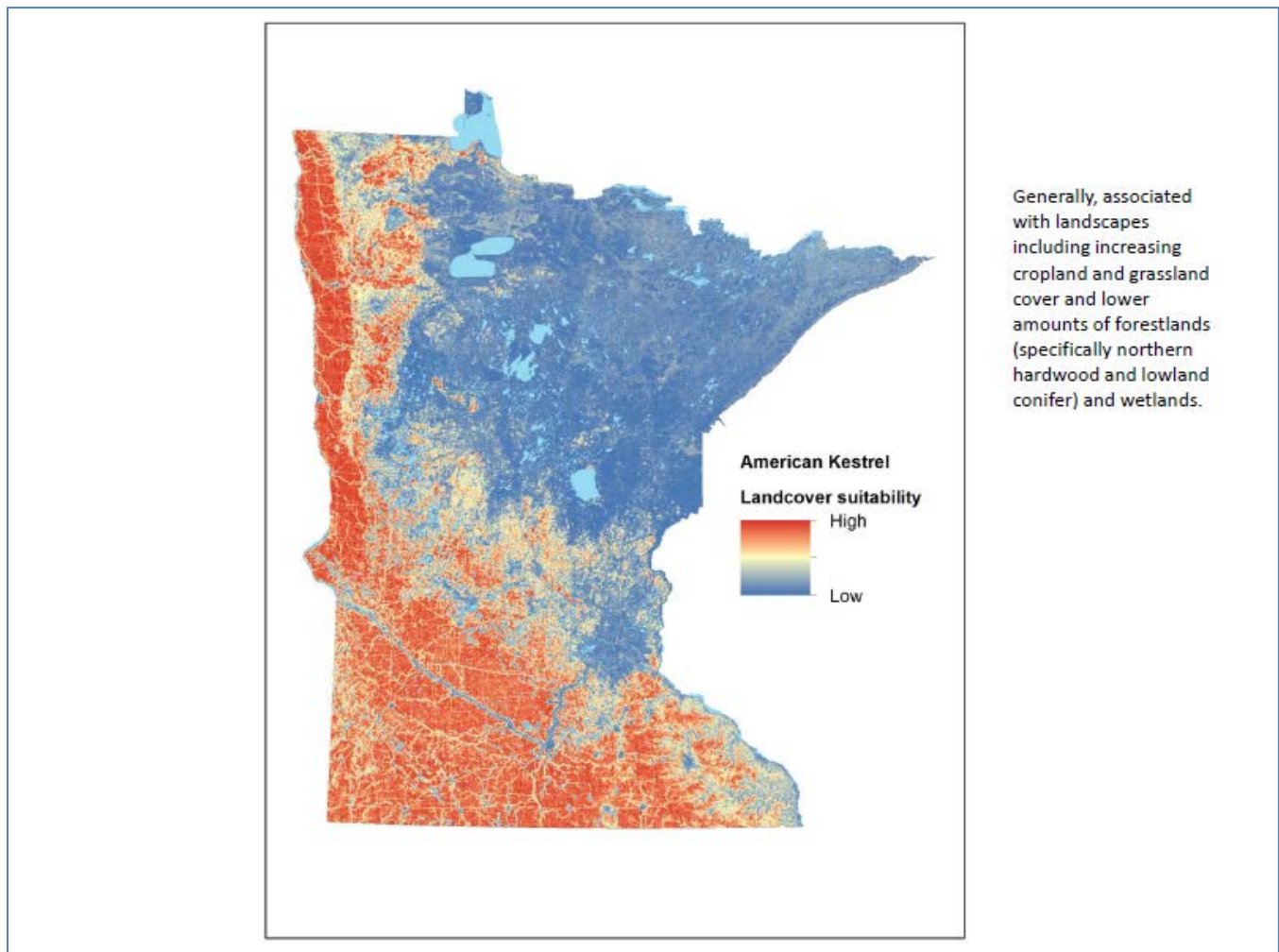


Figure 190. IndVal analysis for Black-capped Chickadee (*Parus atricapillus*).

Figure B. Preliminary habitat suitability map for the American Kestrel using MaxEnt. Results of the analyses are broadly expressed on the right of the map figure.



In summary, we have solid preliminary results on our ability to: 1) make predictions on the distribution and abundance for a large number of breeding bird species in Minnesota; 2) identify important habitat cover types where these species are found breeding in Minnesota; and 3) estimate the statewide breeding populations for many Minnesota species.

Activity Status as of January 2, 2017:

As we have focused on writing the text for each species account in Activity 2, we have been scrutinizing: 1) the Minnesota breeding bird atlas maps; 2) the frequency diagrams for confirmed, probable, possible, and observed categories of breeding birds; 3) the breeding probability maps; and 4) the habitat profiles generated from the point count data. In almost all cases, we are satisfied with the quality and interpretation of the first 2 items (breeding bird atlas maps and frequency diagrams for breeding categories). This is primarily because we have spent considerable time checking these records with original observers and insuring their quality. In contrast, items 3 and 4 (probability maps and habitat profiles) are variable in acceptability. In some cases they may be a more accurate depiction of a species distribution in the state based on our assessment of potentially suitable habitat. The habitat profiles, because they are generated from remote sensing imagery, often include habitat classes that are too broad to reflect specific habitats actually used by a species. All of these data are being evaluated by comparisons with the peer-reviewed published literature, published non-peer reviewed literature,

technical reports, and our knowledge of the species. In some cases, the data we are reviewing are not from Minnesota because of the lack of any published data for some species in the state.

It is important to note that the probability maps, used in conjunction with the atlas field results, are a significant assessment tool. The atlas observational data represent true identifications of a bird species in the field and in specific locations, but they are biased by where individual observers decided to search for birds. That is they are not randomly distributed which is a fundamental assumption of any survey to be valid. This bias is easily observed in many of the breeding bird atlas maps because many observers were located in the Twin Cities, Brainerd, and Duluth where false concentrations are portrayed on these maps. This is commonly known by anyone who has observed birds or who has tried to analyze atlas data. This not an intractable problem and was planned during the atlas project development when randomly distributed point counts were established in each of the 2,339 priority blocks that are evenly distributed across the state. The probability maps are constructed from the field data collected from these point counts and satellite imagery and hence may be more representative of the true distribution and abundance of a bird species in Minnesota. Unfortunately, they can only be verified over time as observers begin to search for a species in predicted locations.

Thus far, we have been quite satisfied with most of the probability maps and the habitat frequency diagrams when a species has a statewide distribution and is common enough to produce a high quality map. For species with a restricted distribution, such as in the prairie region of the state or in the heavily forested region of northeastern Minnesota, we often have been unsatisfied with the probability map. We are in the process of identifying each species probability map that needs to be re-calculated over a smaller, more restricted distribution according to its range in Minnesota.

We also have produced breeding population estimates for 75 breeding bird species in the state. These estimates are among the first in North America, besides the province of Alberta, using a new analytical technique that accounts for detectability in a sophisticated way. For instance, we have estimated that there are approximately 9.7 million adult Song Sparrows, 8.4 million adult Red-winged Blackbirds, 3.6 million adult American Robins, 5.4 million adult Ovenbirds, 5.2 million adult House Wrens, 2.3 million adult Black-capped Chickadees, 914,000 adult Northern Cardinals, 620,000 adult Eastern Bluebirds, and 528,000 adult Scarlet Tanagers during the start of the breeding season in Minnesota. We plan to have the final product also include appropriate confidence intervals for these population estimates.

Final Report Summary: June 30, 2017

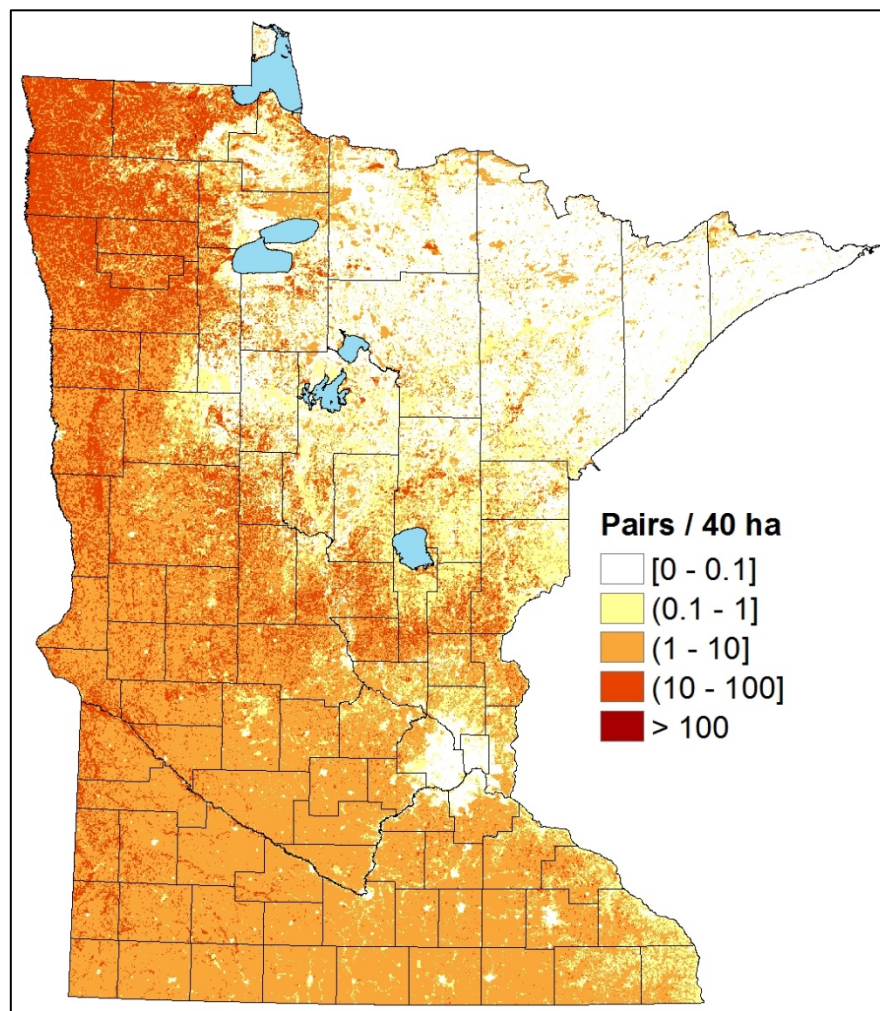
Predictive Distribution Maps

During the final months of the project staff continued to refine and improve the predictive distribution maps for Minnesota's breeding species. In the end, three modeling strategies were employed to maximize the number of species for which we could develop useful predictive distribution maps. In total, we produced predictive models for 160 species.

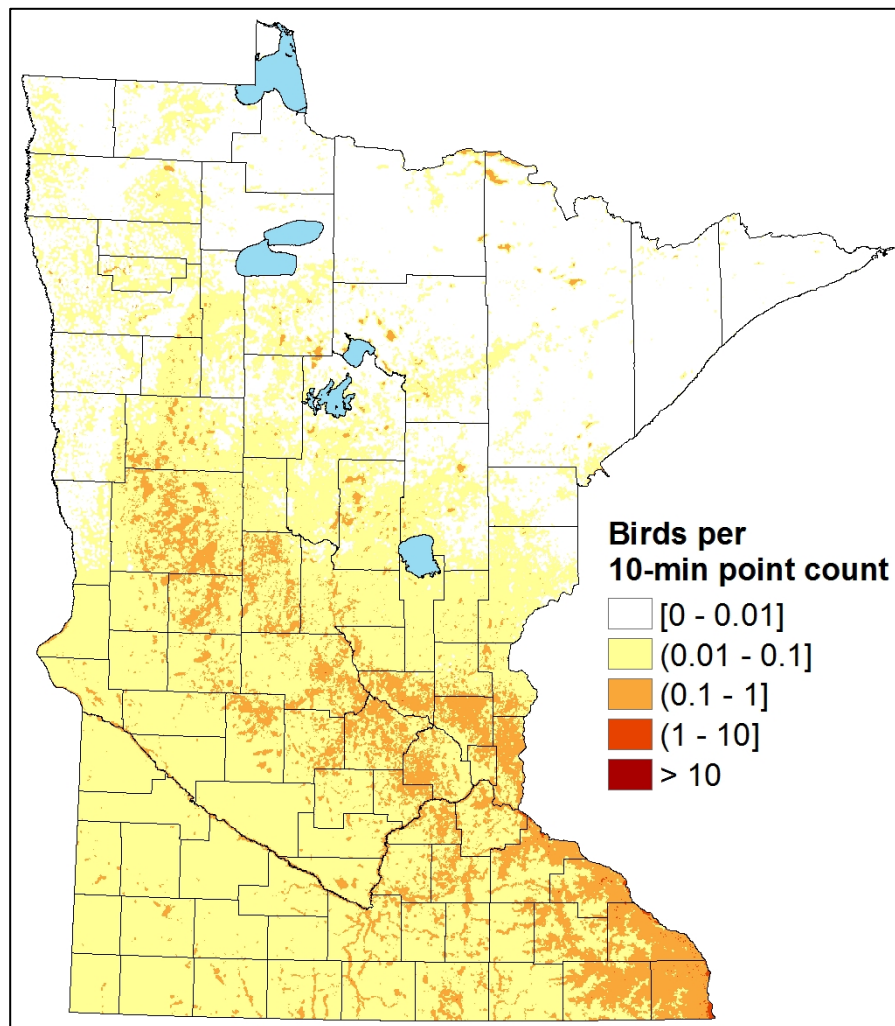
- 1) For bird species with a minimum of 75 detection records (aural or visual observations), with a minimum of 50% being aural records which indicate territorial behavior, we used General Linear Models (GLMs). The GLM models used a bootstrapping technique to identify the sensitivity of the model and a branching forward selection of the variables included in the model. To estimate breeding bird density, we used an approach called QPAD developed by Sólymos et al. (2013). This technique basically converts the number of individuals of a species detected in our sampling unit, a point count, to a density estimate for a specified area. The key factor used in these estimates is to identify the effective sampling distance for each species from the point using its detection profile. More specifically, bootstrap aggregation is an ensemble modeling

method where b number of models are constructed from random samples of the original data. In our case, we used $b = 240$ models. Forward selection iterates over all candidate covariates, and adds the variable that most improves the model; this is repeated until no additional variables improve the model. Branching forward selection is similar, but covariates are grouped for consideration instead of all covariates being considered on each iteration.

In our development of the predictive models, we used a suite of 44 covariates divided into 5 groups (land use/land cover, disturbance, habitat type and structure, patch structure, and climate). We first ran forward selection on the land use/land cover group of variables. We used Bayesian Information Criteria (BIC) to decide if a variable improved the model or not. After completing this selection step, any variables from land use/land cover that improved the model were kept and forward selection was run on the disturbance variables. This was continued until all five covariate groups were considered. This process was repeated 240 times for each species based on different random selections of the data. These models were used to generate 240 population estimates and distribution maps; this distribution of population estimates allowed us to estimate the variability in the predictions. We applied this technique to 77 species that had a suitable sample size of detections during the MNBBA point counts. An example of a predicted distribution and relative abundance (pairs/40 ha) map using the GLM-QPAD modelling approach for the Bobolink follows:

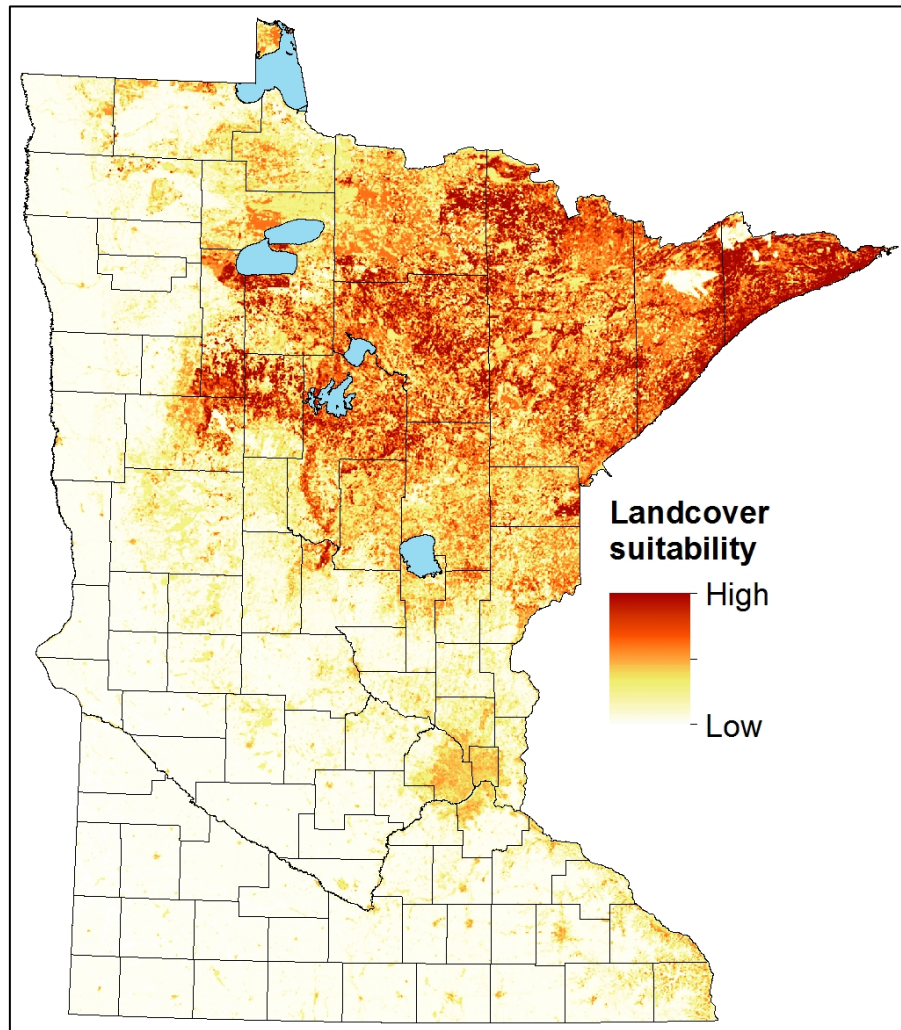


- 2) We used a similar process for bird species with inadequate singing records (i.e., less than 75 singing records or less than 50% records from territorial males) that were still well sampled with point counts (at least 75 point count records). However, we did not use the QPAD offset in this case. This results in predictions of the expected number of individuals detected on a point count but is not amenable to population estimates. The resulting predicted distribution maps project an index of abundance across the state of Minnesota. We applied this method to 27 bird species. An example of a predicted distribution and relative abundance (individuals/10 min point count) map using the GLM modelling approach for the Red-bellied Woodpecker follows:



- 3) We used the Maxent modeling (Phillips et al. 2006) approach for species that did not fit the previous methods, but had at minimum of 20 solid georeferenced records. Maxent is a relatively new modeling technique that compares where a bird species was found to randomly-selected areas within the sampling area. These comparisons are simulated multiple times to identify what was unique about where the species was found relative to the background environment. Many of these species are uncommon or rare species that are often difficult to find in Minnesota, but the predicted distribution maps show where they are most

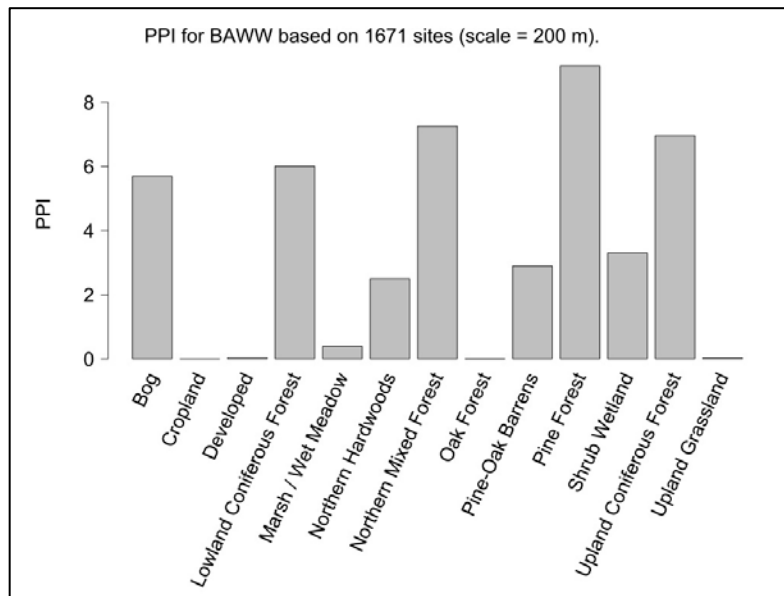
likely to be found. This method was applied to 56 species. An example of the resulting Landcover suitability map using the Maxent modelling approach for the Broad-winged Hawk is shown below:



Habitat Association Graphs

We used Percent Perfect Indicator (PPI; Dufrêne and Legendre, 1997) to quantify habitat associations for all bird species detected during 10 or more point counts. The PPI value for a given species in a particular habitat is the relative abundance of the species in that habitat multiplied by the frequency the species was detected in that habitat. We generated bar plots of the PPI values to help visualize species habitat associations. Because these analysis can produce spurious results for habitats that are poorly represented in the data, we aggregated habitats types to 13 general habitat types (Bog, Cropland, Developed, Lowland Coniferous Forest, Marsh / Wet Meadow, Northern Hardwoods, Northern Mixed Forest, Oak Forest, Pine-Oak Barrens, Pine Forest, Shrub Wetland, Upland Coniferous Forest, and Upland Grassland). While this aggregation is essential for the analysis, it does obscure differences between species at times. For example, Marsh and Sedge Wrens appear to share a strong preference for the Marsh / Wet Meadow habitat type, but we know from experience that Marsh Wrens are in the marsh portion of this habitat and Sedge Wrens are more likely in the wet meadow portion. Habitat types were derived from LANDFIRE (<https://www.landfire.gov/>) existing vegetation types and National Wetlands

Inventory (<https://www.fws.gov/wetlands/>) cover types. An example for the Black-and-White Warbler, a species that utilizes a wide range of different habitats, follows:



Citations:

Dufrêne, M., and P. Legendre. 1997. Species assemblages and indicator species: The need for a flexible asymmetrical approach. *Ecological Monographs* 67:345–366.

Sólymos, P., S. M. Matsuoka, E. M. Bayne, S. R. Lele, P. Fontaine, S. G. Cumming, D. Stralberg, F. K. A. Schmiegelow, and S. J. Song. 2013. Calibrating indices of avian density from non-standardized survey data: Making the most of a messy situation. *Methods in Ecology and Evolution* 4:1047–1058.

Phillips, S. J., R. P. Anderson, and R. E. Schapire. 2006. Maximum entropy modeling of species geographic distributions. *Ecological Modelling* 190:231–259.

ACTIVITY 2: Production of text and figures

Description: For the website we will produce a combination of text, photos, maps, and figures to convey the analysis and information from the Breeding Bird Atlas to professionals and the general public. To do this we will bring together individuals with knowledge and expertise in data analysis, graphic display methods and other skills as necessary.

1. Text – Textual components will include an introduction, acknowledgements, methods, and summary and analysis of atlas results. We will also include an acknowledgement of volunteers and funders. For each species we will include an individual species account summarizing the information from the BBA, including such things as habitat, landscape and population data.
2. Photos –A minimum of one photo will be included for each species. More may be used depending on space and availability. We anticipate getting most photos free of charge from the archives of Audubon Minnesota, the Minnesota Ornithologist’s Union and local photographers. However pictures of some rare or hard to photograph species may require purchase. All photos will have to be reviewed, cataloged, and permission for their use obtained requiring some staff time and effort.

3. Maps – A distribution map for each species with symbols for highest evidence code likely shown at the township level and another showing relative abundance as a density probability. Other maps may be produced depending on what analysis can be done with the data.

4. Figures – Additional tables and graphs with data which may be included are: statistics for evidence codes by number of blocks, population trend from Breeding Bird Survey or other relevant trends and breeding season phenology.

Summary Budget Information for Activity 2:

ENRTF Budget: \$133,278
Amount Spent: \$133,278
Balance: \$ 0

Activity Completion Date: June 30, 2016

Outcome	Completion Date	Budget
1. Writing and editing of text.	June 2016	\$ 94,038*
2. Acquisition of photographs	June 30, 2015	\$ 12,922*
3. Production of maps and figures	January 2, 2016	\$ 26,318

*In our previous status report these numbers were, respectively, \$93,460 and \$13,500; on July 10, 2017, LCCMR staff approved a minor budget adjustment moving \$578 from the purchase of photos to professional contracts for completing the copy editing work on the species accounts. This is also reflected in the budget attachment.

Activity Status as of January 2, 2015: Contracts were finalized between Audubon and NRRI and Audubon and Lee Pfannmuller to accomplish the work needed.

Activity Status as of June 30, 2015:

1. Writing and Editing of Text
 - Background materials that will assist with the preparation of the individual species accounts have begun to be compiled. Particular focus has been on comprehensively documenting the records collected for each species, how the breeding evidence codes were applied to each species, and how unusual records were addressed.
2. Acquisition of Photographs
 - This work will be delayed until work on the individual species accounts begins in the next reporting period.

Activity Status as of January 2, 2016:

1. Writing and Editing of Text
 - A comprehensive outline of all elements that need to be written for the new MNBBA website was prepared, along with a detailed schedule and writing assignments. Two members of the core team, volunteer Jan Green and NRRI’s Dr. Gerald Niemi, have volunteered to write selected species accounts to assist MNBBA contractor, Lee Pfannmuller.
 - An outline was prepared for the nearly 230 comprehensive species accounts that will be written.
 - With assistance from Jan Green, an additional 38 species have been identified that we will prepare abbreviated accounts for. The list includes 14 species that were observed during the atlas but are considered vagrants or visitants to Minnesota and that are not regular breeding species (e.g. Snowy Egret, Little Blue Heron, White-eyed Vireo and Kentucky Warbler); the remaining species have been reported breeding in the state in the past but were not observed during the atlas.
 - Drafts of 31 species accounts have been written and are listed in the following table.

Blue-winged Teal	Red-necked Grebe	Marbled Godwit	Pileated Woodpecker	Golden-winged Warbler
Northern Shoveler	Eared Grebe	Wilson's Phalarope	Olive-sided Flycatcher	Connecticut Warbler
Northern Pintail	Western Grebe	Franklin's Gull	Western Kingbird	Cerulean Warbler
Canvasback	Sora	Black Tern	Black-billed Magpie	
Hooded Merganser	Common Gallinule	Belted Kingfisher	Brown Creeper	
Pied-billed Grebe	Solitary Sandpiper	Red-headed Woodpecker	Blue-gray Gnatcatcher	
Horned Grebe	Upland Sandpiper	Red-bellied Woodpecker	Ovenbird	

2. Acquisition of Photographs

- Work has begun to identify potential photographers who specialize in Minnesota birds; discussions have been initiated with one photographer of northern Minnesota birds.

3. Production of Maps and Figures

- The maps for each species await one last review; figures await more detailed analysis that will occur in the coming year.

Activity Status as of June 30, 2016:

1. Writing and Editing of Text

- Nearly all the effort during the past six months has focused on preparing drafts of additional species accounts. A total of 89 new accounts (in red) were prepared for a combined total of 120 accounts completed to date; work on the accounts for the remaining 129 species reported during the atlas will continue to be the focus of work during the next reporting period.

Canada Goose	Pied-billed Grebe	Spotted Sandpiper	American Three-toed Woodpecker	Brown Creeper
Trumpeter Swan	Horned Grebe	Solitary Sandpiper	Black-backed Woodpecker	Blue-gray Gnatcatcher
Wood Duck	Red-necked Grebe	Upland Sandpiper	Northern Flicker	European Starling
Gadwall	Eared Grebe	Marbled Godwit	Pileated Woodpecker	Ovenbird
American Wigeon	Western Grebe	Wilson's Snipe	American Kestrel	Golden-winged Warbler
American Black Duck	American Bittern	American Woodcock	Merlin	Prothonotary Warbler
Mallard	Least Bittern	Wilson's Phalarope	Peregrine Falcon	Tennessee Warbler
Blue-winged Teal	Green Heron	Franklin's Gull	Olive-sided Flycatcher	Connecticut Warbler
Northern Shoveler	Black-crowned Night-Heron	Black Tern	Eastern Wood-Pewee	Common Yellowthroat
Northern Pintail	Turkey Vulture	Eurasian Collared-Dove	Yellow-bellied Flycatcher	American Redstart
Green-winged Teal	Osprey	Eastern Screech Owl	Least Flycatcher	Cape May Warbler
Canvasback	Bald Eagle	Northern Hawk Owl	Great Crested Flycatcher	Cerulean Warbler
Redhead	Sharp-shinned Hawk	Great Gray Owl	Western Kingbird	Bay-breasted Warbler
Ring-necked Duck	Cooper's Hawk	Boreal Owl	Eastern Kingbird	Eastern Towhee
Lesser Scaup	Red-shouldered Hawk	Northern Saw-whet Owl	Bell's Vireo	Chipping Sparrow
Bufflehead	Broad-winged Hawk	Common Nighthawk	Yellow-throated Vireo	Clay-colored Sparrow
Common Goldeneye	Swainson's Hawk	Eastern Whip-poor-will	Warbling Vireo	Field Sparrow
Hooded Merganser	Red-tailed Hawk	Chimney Swift	Black-billed Magpie	Vesper Sparrow
Common Merganser	Yellow Rail	Ruby-throated Hummingbird	Horned Lark	Lark Sparrow
Red-breasted Merganser	Virginia Rail	Belted Kingfisher	Cliff Swallow	Scarlet Tanager
Ruddy Duck	Sora	Red-headed Woodpecker	Barn Swallow	Bobolink
Ring-necked Pheasant	Common Gallinule	Red-bellied Woodpecker	Boreal Chickadee	Red-winged Blackbird
Spruce Grouse	American Coot	Yellow-bellied Sapsucker	Tufted Titmouse	Orchard Oriole
Sharp-tailed Grouse	Killdeer	Downy Woodpecker	White-breasted Nuthatch	House Sparrow

2. Acquisition of Photographs

- In addition to identifying potential contributors, staff are actively searching public websites where images are available free of charge as well as spending time taking their own photographs that can be used on the new website.

3. Production of Maps and Figures

- The BBA distribution maps underwent their final review in mid-January. Only a few additional corrections were needed. All the data are now in the hands of the web designers at NRRI who will produce the final maps for display.
- The figures are being produced using outcomes from the work conducted under Activity #1 and include both the probability maps as well as the species' relative abundance in different cover types. As noted earlier, significant progress has been made on 165 of the most common species.

Activity Status as of January 2, 2017:

1. Writing and Editing of Text

- During the past six months drafts of an additional 105 species have been prepared for a total, to date, of 225 accounts. Only 24 remain to be drafted. In addition, work has already begun to revise and edit a total of 32 accounts that were initially drafted nearly one year ago.

2. Acquisition of Photographs

- A list of potential contributors has been prepared and staff has been assigned to contact each individual beginning in January to assess the availability of photos for specific species and as well as conditions for release and use on the web. Species have been ranked based on the potential difficulty of finding suitable photographs.

3. Production of Maps and Figures

- As noted under Activity #1, work continues to assess the adequacy of probability maps and habitat graphs for each species. When feasible, a small subset of probability maps will be re-calculated with stricter assumptions regarding the species overall distribution.

Final Report Summary: June 30, 2017

1. Writing and Editing of Text

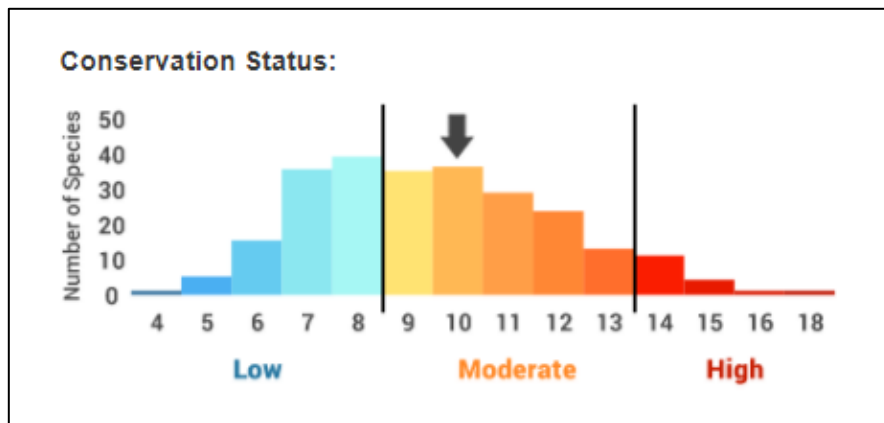
- Draft accounts were completed for all 249 birds observed during the atlas. Accounts averaged 2,000 words in length, ranging from approximately 1,100 words for a very common species, the Rock Dove, to nearly 4,200 words for the very uncommon and state-listed Common Tern. We reported earlier (January 2016) that we would prepare abbreviated accounts for 24 species that formerly bred in the state but were not observed during the atlas. In the interest of saving time, project staff decided, however, to limit the accounts to those species that were observed during the atlas. Once drafts of the 249 species accounts were completed, staff conducted an initial review and edit of each account. Two copy editors, hired under contract with Audubon Minnesota, then collaborated to develop a style guideline for the accounts and proceeded to provide final edits to each account. All the edits were then reviewed by Lee Pfannmuller and Dr. Gerald Niemi and the accounts were loaded onto the website where they have undergone a final review.

2. Acquisition of Photographs

- Photographs were acquired for all 249 species. Some were generously donated while a small fee was paid for many others.

3. Production of Maps and Figures

- As noted under Activity #1, work continued to assess the adequacy of probability maps and habitat graphs for each species. Final probability maps were generated for 160 species and habitat association graphs for 130 species.
- Staff also developed a graphic for each species that summarized its Continental Conservation Status as recently assessed by Partners in Flight (2017; *Avian Conservation Assessment Database* [Online]. Version 2017. <http://pif.birdconservancy.org/ACAD>). PIF assigned each species a score of 4 (low concern) to 20 (highest concern) based on information about its population size, population trend, threats to its breeding habitat, threats to its wintering habitat, the size of its breeding distribution, and the size of its wintering distribution. The Continental Concern Score is presented within a histogram that illustrates how many Minnesota species have been assigned each score. The scores for Minnesota species ranged from a low of 4 (Great-tailed Grackle) to a high of 18 (Piping Plover). The delineation of “Low”, “Moderate”, and “High” scores is taken from the Partners in Flight 2016 Landbird Conservation Plan (<https://www.partnersinflight.org/wp-content/uploads/2016/07/pif-continental-plan-final-spread-7-27-16.pdf>). An example of the graphic for the Bufflehead, which has a Continental Concern Score of 10, follows:



ACTIVITY 3: Development and creation of website

Description: Results from the MNBBA have been updated daily since early in the project and are already available on our website (mnbba.org). We will update this website to include species narratives, online maps, photos, and other graphic information. Website design will make results easily accessible to maximize the effective use of observational information as well as our analysis and summaries.

Summary Budget Information for Activity 3:

ENRTF Budget: \$ 73,874
Amount Spent: \$ 73,874
Balance: \$ 0

Activity Completion Date: June 30, 2017

Outcome	Completion Date	Budget
1. Website design and construction	June 30, 2017	\$24,840
2. Preparation of data and materials for website	January 2, 2017	\$49,034

Activity Status as of January 2, 2015: Our current website (mnbba.org) is still active and providing information to the public.

Activity Status as of June 30, 2015:

1. Website design and construction
 - All websites for U.S. and Canadian Breeding Bird Atlases that have been completed and are currently operational, were reviewed in detail. Based on that review an initial outline of the specific components that we wish to include in Minnesota's BBA website have been identified. This will be used as the basis for discussion with potential users at a future date.

Activity Status as of January 2, 2016:

1. Website design and construction
 - As noted earlier, a schedule and writing assignments for preparing each element of the website has been completed.
 - An initial draft of the specific qualifications required for a potential website designer has been prepared. Audubon will solicit bids to construct the website during the next reporting period.
2. Preparation of data and materials for the website.
 - Most of the focus during this reporting period was noted earlier and is on the initial development of the species accounts.
 - In addition, it became apparent during this reporting period that the current mnbbba.org website needs to be moved from the Minnesota Ornithologists' Union server. Unauthorized changes were being made to the website that compromised the data review process until they were discovered and addressed. Considerable time focused on addressing this issue during this reporting period.

Activity Status as of June 30, 2016:

1. Website design and construction
 - Audubon received four bids from organizations interested in developing the new MNBBA website. The contract was awarded to the University's Natural Resources Research Institute in Duluth. Monies for the website development were just approved by MN Audubon and an appropriate budget number was received by NRRI from the University in June 2016. Work to develop this new interactive site will begin in earnest during the next reporting period.
2. Preparation of data and materials for the website.
 - NRRI will begin to incorporate results of the analyses conducted under Activity #1 into the new website for the MN breeding bird atlas during the next reporting period.

Activity Status as of January 2, 2017:

1. Website design and construction
 - A draft website has been constructed using the Wordpress content management system. This system contains custom data forms for uploading Species Accounts, with separate sections for Conservation Status, Breeding Status, Migration and other life history attributes, along with photographs, figures and literature citations. Initial homepage layout designs have been created, with the goals of quickly educating visitors about what the breeding bird atlas is, generating interest with graphics and text, and allowing users to easily navigate to the information they are looking for. In addition, we have developed a prototype interactive mapping tool that allows the distribution of each of 249 bird species to be displayed, along with information on the confidence of the observation. The map utility will also generate figures summarizing the confidence data (% observations confirmed, probable, possible, etc). Users can select among a variety of base maps, such as roads, aerial photography, or county boundaries. Clicking on a block brings up a table listing all species found in that block along with their confidence levels. Future work will allow birds to be summarized by county, ecoregion or other boundaries.

- In the interim, the Minnesota Breeding Bird Atlas website maintained by the Cornell Lab of Ornithology for data entry has been officially closed down. After considerable discussion staff decided to keep the second website (mnbbba.org) up and available while our new website is under development.
2. Preparation of data and materials for the website
- Focus has continued on drafting species accounts and finalizing graphics. A small subset of draft accounts, along with accompanying graphics, were uploaded onto the new website to assess potential challenges and to further inform the design of individual pages.

Final Report Summary: June 30, 2017

The newly established MNBBA website (mnbirdatlas.com) will go “live” no later than October 30, 2017. As of August 11, 2017, all the primary design elements have been completed and written and graphic materials have been loaded. The only items still waiting for upload are pictures of the breeding habitat for approximately 220 of the 249 breeding species. In the coming weeks, the content of each page will be reviewed one last time by Lee Pfannmuller and Dr. Gerald Niemi and the site’s overall functionality will be assessed and minor corrections implemented as necessary. A small number of resource professionals then will be asked to “test” the site for a couple of weeks; identified problems will be assessed and addressed before the site is finally launched in October. Until the new website is launched the data continue to be accessible at mnbbba.org.

The new website’s overall organization is as follows:

1. Home Page
This page allows users to immediately access individual species accounts or the interactive map that displays each species distribution using different geographical layers (Attachment #1).
2. Using the Atlas
This tab enables the user to access information on: a) Reading Species Accounts; 2) Using the Interactive Map; and 3) Citing the Website.
3. Explore the Atlas
This tab enables the user to access:
 - Species Accounts (Attachment #2 illustrates the first of six pages available for each species: Overview; Minnesota Breeding Distribution; Breeding Habitat; Population Abundance; Conservation; and Literature Cited).
 - Interactive Map (allows the user to display the results for each species in a variety of formats and to select any point within the state and identify which birds were documented within a radius of 2 to 100 miles from the point; Attachment #3 illustrates just 2 of the many display options available to the user).
 - Data Summaries (includes a tabular display of the number of records by breeding evidence code for all 249 species).
 - Literature Cited (in addition to providing the complete reference for all literature cited in each species account, a complete list of all literature cited on the website is included).
4. Data and Methods
 - Data Collection (describes how the MNBBA data were collected).
 - Methods of Analysis (describes the analyses that were conducted).
 - Access Raw Data (describes how the raw data collected by the volunteers and the point counts can be accessed through the Avian Knowledge Network).

5. About the Atlas

- History and Purpose (background on the history of atlas projects in general and Minnesota's atlas specifically)
- Project Partners (acknowledges all the organizations who contributed to the success of the atlas).
- Project Personnel (acknowledges the contributions of all atlas committee members and project staff).
- Volunteers (acknowledges the contributions of all atlas volunteers).
- Data Contributions (acknowledges those organizations and agencies who contributed data to the atlas in addition to that contributed by volunteers and paid surveyors).

V. DISSEMINATION:

Description: Breeding Bird Atlas data will be of interest to many people both in and outside of Minnesota. Because these individuals will vary from professional ornithologists and natural resource managers to government officials and staff, birders and other outdoor enthusiasts, and just curious citizens, we will disseminate our analysis and BBA data through a variety of mediums. Our most focused effort will be to make our information, analysis, and products available through our website (likely to be mnbbba.org) which will contain a combination of text, photos, maps, and figures to convey the analysis and information from the Breeding Bird Atlas. We will also be working through the USFWS to put raw data on the Avian Knowledge Network (AKN). The AKN is intended to draw bird survey data from around the country together in one place allowing access and use by researchers and others. The BBA is also in discussions with the University of Minnesota Press about publishing a book. We have an outline of an agreement with them and are seeking funds to publish a book.

Activity Status as of January 2, 2015:

The abstract below was presented at a national ornithological meeting in September 2014 and will also be presented at a Minnesota Chapter of The Wildlife Society meeting in February 2015. The abstract describes how the data on breeding birds in the state were gathered. We are currently working on a peer-reviewed publication that describes this method because it will likely prove useful for future breeding bird atlases in other states or provinces.

An Alternative Design to Sample Breeding Birds for a State Atlas

Gerald J. Niemi,, Anna Peterson, Josh Bednar, Terry Brown, and Edmund Zlonis. Natural Resources Research Institute, U of Minnesota, 5013 Miller Trunk Highway, Duluth, MN 55811.

For Minnesota's first state atlas, we designed a means to systematically sample all of the 2,353 townships (9.65 x 9.65 km) with at least 50% land throughout the state. Within each township, the northeast quadrant (typically 4.83 x 4.83 km) was randomly selected as the priority block for detection of breeding bird activity. Within each priority block, we compiled data layers for roads from the 2008 Minnesota DOT data base and land cover types from the 2001 National Land Cover Data. Non-major roads (e.g., no Interstate or State Highways) were buffered within 45 m and these buffers searched by an automated GIS procedure for appropriate land cover types. Each priority block was sampled with three 10-minute, unlimited-distance point counts; generally sampled between 0500 and 1000 and within the safe nesting dates for breeding bird species in Minnesota. The first point was a randomly-selected point, the second in the predominant land cover type, and the third point in the second most common land cover type of the township. From 2009 to 2013 we successfully sampled 6,993 points in all but 5 of the 2,353 townships in Minnesota. We observed a total of 219 species and 195,475 individual birds over the five-year period. These data will allow a systematic, re-sampling of the Minnesota breeding bird atlas in future years with standard effort and an equal distribution across the state. These data allow for estimates of population size, habitat distribution, and the development of probability distribution maps for species breeding in the state.

Activity Status as of June 30, 2015:

- Avian Knowledge Network (AKN)
Project staff is collaborating with the Migratory Bird Office of the U.S. Fish and Wildlife Service and Point Blue Conservation Science Center to share Minnesota's BBA data with the Midwest Avian Data Center, a regional node of the Avian Knowledge Network (AKN) hosted by the Midwest Coordinated Bird Monitoring Partnership and Point Blue. The goal is to make the raw BBA data readily accessible to land managers, resource professionals and conservation biologists to enable further integration and analysis with other data sets hosted on the node. Two meetings have been held during this reporting period to review and discuss the content of the data files, the scope of data that will be shared, and the timeline for data transfer, which now has been established as December 20, 2015. The U.S. Fish and Wildlife Service allocated \$4,000 to cover the costs incurred by Point Blue to facilitate this MNBBA data transfer.
- Book Publication
Project staff met with the University of Minnesota Press twice during this reporting period to expand our discussions about publication of a book on Minnesota's Breeding Bird Atlas.

Activity Status as of January 2, 2016:

- Presentations
Project contractors prepared a new Power point presentation on the status of the MNBBA work and data analysis for presentation to the DNR Commissioner's Advisory Committee on Natural Heritage on October 7th.
- Avian Knowledge Network (AKN)
Communication has continued between IT staff at the Point Blue Conservation Science Center in California and staff at the U.S. Fish and Wildlife Service regarding the nature of the data being transferred and meta data regarding each of the data fields. We also are pursuing clarification on access to and use of the data. The final transfer should occur early within the next reporting period.
- Book Publication
Project contractors have continued to meet and communicate with staff at the University of Minnesota Press regarding publication of a book on the Minnesota Breeding Bird Atlas. A detailed book outline and examples of species accounts were presented and discussed in mid-October. The Press is extremely supportive.

Use of MNBBA data in another book being published by the Press has been the subject of many discussions and meetings. MNBBA staff are working to insure that the most recent, corrected version of the data is used and that all contributors to and funders of the MNBBA are properly credited.

Activity Status as of June 30, 2016:

- Avian Knowledge Network (AKN)
In light of several changes in project management, transfer of the BBA data to AKN was temporarily placed on hold as other issues were addressed. This will be a priority in the coming reporting period.
- Dissemination of BBA Data by other venues
Project staff is working closely with two other venues where BBA data have been incorporated and displayed to varying degrees, including a draft manuscript on the status of Minnesota birds by the University of Minnesota Press and a new webpage developed by the Minnesota Ornithologists' Union. In both cases there are some concerns that are being addressed with the relevant parties.

Activity Status as of January 2, 2017:

- Avian Knowledge Network (AKN)
A Data Use Agreement between Audubon Minnesota and the Avian Knowledge Network was prepared and finalized; we now are waiting to hear from AKN on how they wish to have the data transmitted.
- Dissemination of BBA Data by other venues
Considerable time continued to be directed at working with others on how the BBA data is incorporated and displayed, specifically with the author of a draft manuscript that has been submitted to the University of Minnesota Press and with the Minnesota Ornithologists’ Union (MOU). Concerns are now largely addressed with both parties.

Final Report Summary: June 30, 2017

- All volunteer data and point count data have been provided to the Avian Knowledge Network and a link to the site is provided on the new MNBBA website for users who wish to have access to the original raw data.
- Project staff will also make the data available to the University of Minnesota’s Minnesota Biodiversity Atlas that is maintained by the Bell Museum of Natural History.
- Further discussions with the University of Minnesota Press regarding the potential to publish a book have been on hold while project staff devoted their available time to completing development of the new MNBBA website.
- The new MNBBA website (mnbirdatlas.org) will be live no later than October 30, 2017. Until then, the current site (mnbba.org) will remain available to all users.

VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget Overview:

Budget Category	\$Amount	Explanation
Personnel:	\$32,932	1 project manager at 7% FTE for 3 1 years, 1 communications manager at 0.17% FTE for 1 year, 1 Office Manager at 7% FTE for 3 years, 1 Project Coordinator at 9% FTE for 1 year.
Professional/Technical/Service Contracts:	\$263,646*	NRRI for data analysis and graphics production. Text writer/editor, copy editing, graphics coordinator, and website development and project management responsibilities for 2 years.
Other: Purchase of Copyright Photos	\$3,422*	Photos of some rarer or hard to find birds may need to be purchased
TOTAL ENRTF BUDGET:	\$ 300,000	

* In our previous status report these numbers were, respectively, \$263,068 and \$4,000; on July 10, 2017, LCCMR staff approved a minor budget adjustment moving \$578 from the purchase of photos to professional contracts to complete the copy editing work on the species accounts. This is also reflected in the budget attachment.

Explanation of Use of Classified Staff: N/A

Explanation of Capital Expenditures Greater Than \$5,000: N/A

Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: 1.25

Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: 1.5

B. Other Funds:

Source of Funds	\$ Amount Proposed	\$ Amount Spent	Use of Other Funds
Non-state			
Audubon	\$ 50,000	\$ 22,786	In kind providing oversight, administration and overhead to the project.
State			
NRRRI	\$ 35,000	\$ 53,136	In kind to oversee data analysis and produce products.
TOTAL OTHER FUNDS:	\$85,000	\$75,922	

VII. PROJECT STRATEGY:

A. Project Partners: An editorial board of 3 – 5 people will be established to oversee the content of the website, and ensure accuracy, and coordinate content.

Audubon Minnesota - Lee Pfannmuller, Project Manager, oversee project, data synthesis, writing
Natural Resources Research Institute at the Univ. of MN Duluth – Dr. Gerald J. Niemi, Professor, data analysis, synthesis, writing and general contributions

Other primary partners not receiving funds – Minnesota Ornithologists’ Union, U. S. Fish and Wildlife Service, Minnesota Department of Natural Resources.

B. Project Impact and Long-term Strategy: Because data will be available to land and resource managers, the public, and policy makers, through a variety of medium (website, database, book) the BBA will be widely available and accessed. As baseline data for a specific period of time the BBA will prove an invaluable resource as we monitor and respond to events such as global warming in the coming years. BBA data will also prove beneficial to studies on Minnesota birds and natural resources. Birders and others will be able to use BBA data to plan trips and outings to the benefit of local communities and the travel industry. Our long-term strategy includes further data collection utilizing the volunteers we have organized over the past years. We anticipate that information will continue to be collected by partners and others providing a unique and robust view of Minnesota’s birds.

C. Spending History:

Funding Source	M.L. 2008 or FY09	FY10	M.L. 2010 or FY11	M.L. 2011 or FY12-13	FY14
ENTRF	\$ 270,000		\$ 372,000	\$ 250,000	
USFWS	\$ 2,347	\$ 3,007	\$ 7,187	\$ 117,180	\$ 16,151
MN DNR	\$ 10,749	\$ 9,250			
MN Ornithologists’ Union	\$ 10,000	\$ 10,000	\$ 10,000	\$ 20,000	\$ 10,000
Audubon	\$ 11,477	\$ 5,296	\$ 15,840	\$ 46,253	\$ 26,044

VIII. ACQUISITION/RESTORATION LIST: N/A

IX. VISUAL ELEMENT or MAP(S): See attached examples of possible species write-ups and graphics

X. ACQUISITION/RESTORATION REQUIREMENTS WORKSHEET: N/A

XI. RESEARCH ADDENDUM: N/A

XII. REPORTING REQUIREMENTS:

Periodic work plan status update reports will be submitted no later than January 2, 2015, June 30, 2015, January 2, 2016, June 30, 2016, and January 2, 2017. A final report and associated products will be submitted between June 30 and August 15, 2017.

Osprey



Introduction

A fish eating bird, Ospreys are found nesting across North America, Europe, and parts of Asia and Australia on large lakes, rivers, and coasts. In North America, the densest populations occur along the Atlantic and Gulf Coasts through from Maine through Florida and in the Great Lakes region. Wintering populations are found from Florida through the Caribbean and throughout Central and South America. In Minnesota the birds build large nests at the top of both live and dead trees and increasingly use human-made structures particularly power poles, light structures and cellphone towers.

Distribution

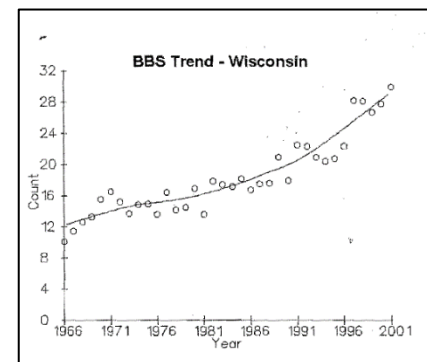
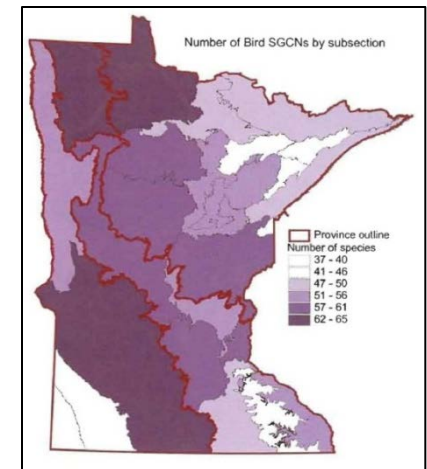
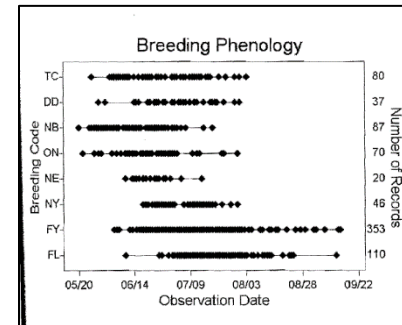
Ospreys have been recorded nesting in the state since the first descriptions of birds were recorded, with T.S. Roberts noting that they occurred on “every sizable lake” as far south as Hennepin County. Cutting of trees, shooting, and pesticides were all factors that reduced their population levels and in the 1980’s they were listed as a Species of Concern by the State of Minnesota. Since that time their population has increased both in number and range. Atlas data shows they are concentrated in the lake regions of the central and northeastern parts of the state and also in the Metro area, this last the result of a reintroduction project conducted in the 1980s and 90s. Atlas results show a slight expansion of the species range since the time of the last statewide survey in 2004.

Breeding Biology

Minnesota Ospreys winter in Central and South America and return to their nesting territories in early April. Fiercely loyal to their territories, individuals will use the same nests for many years resulting in strong pair bonds and a predictability of nest use. Dates of egg laying vary slightly in a given part of the state, often affected by weather and the age and experience of the pair. Typically around two, and rarely up to four chicks will hatch in June. Young fledge from the nest in late July and August. Adults and young migrate separately to their own wintering areas beginning in late August. By the middle of October few Ospreys are left in the state.

Conservation Needs

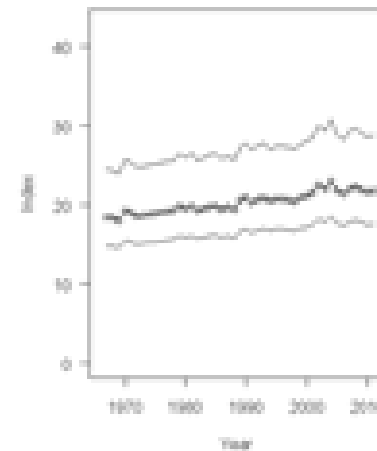
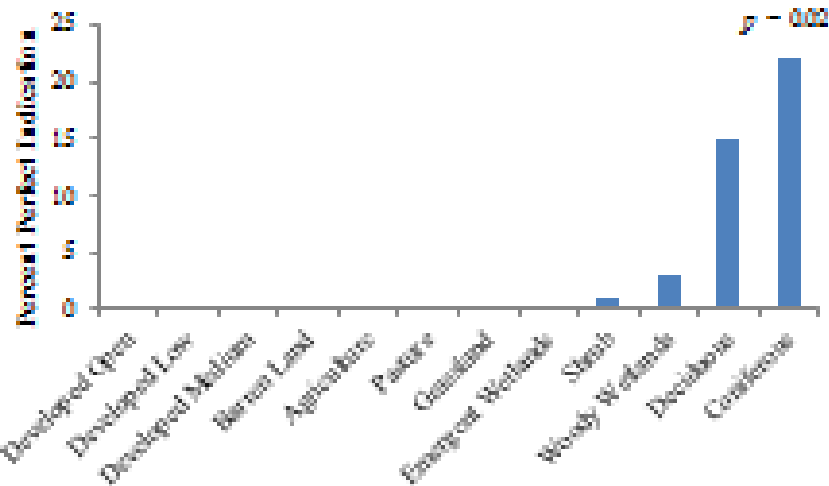
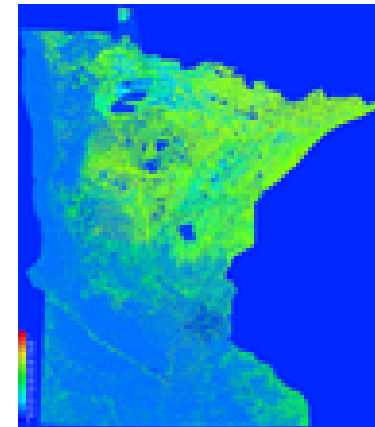
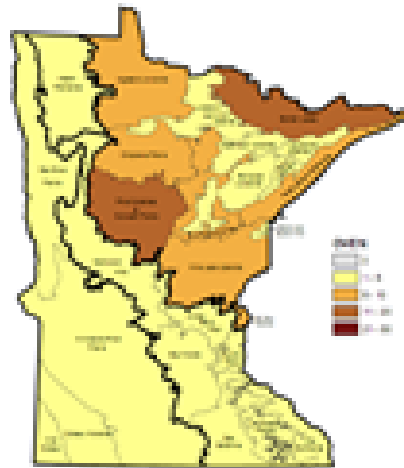
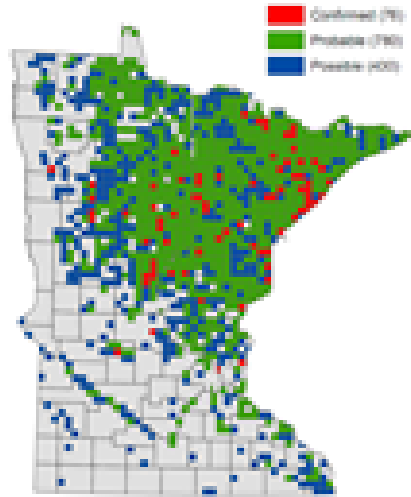
Ospreys are not listed in the State of Minnesota. They depend on suitable water bodies for fishing and large trees or human made structures on which to build their nests. They will build nests on power poles which can pose a threat to both the birds (from electrocution) and the power delivery system (from shorting out wires). Management of these situations includes constructing alternate nest sites and this strategy is expected to be needed into the foreseeable future.



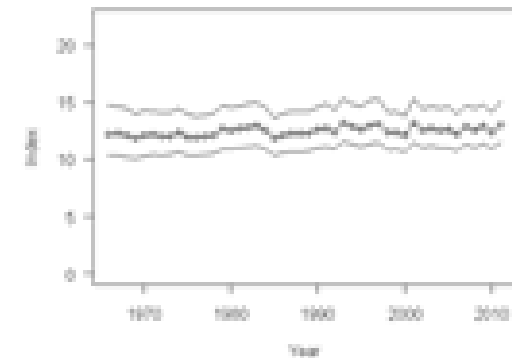
Ovenbird (*Seiurus aurocapilla*)



Evidence	Number	% of all blocks
Observed	4	0.0%
Possible	751	7.7%
Probable	1008	10.3%
Confirmed	80	0.8%
Total	1843	18.9%




Annual trend MN = 0.4%;
95% CI (0.0, 0.7); n = 61



Annual trend NA = 0.1%;
95% CI (-0.2, 0.5); n = 1956

*

Attachment #1: Home page of the new MNBBA website (mnbirdatlas.org).




Minnesota
Breeding Bird Atlas

[Home](#) [Using the Atlas](#) [Explore the Atlas](#) [Data and Methods](#) [About the Atlas](#)

Explore the habits of the breeding birds of Minnesota

The Minnesota Breeding Bird Atlas (MNBBA) is a critical bird conservation project designed to document every species that currently breeds in Minnesota and where in the state each species breeds.

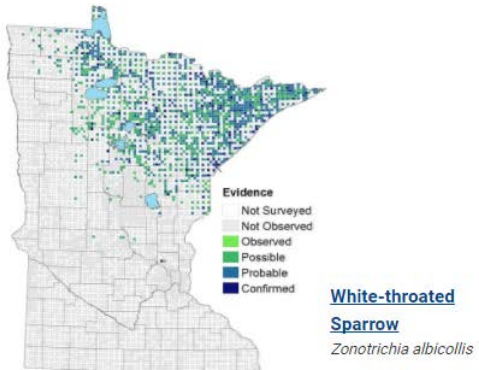
Species Accounts



Species accounts provide analysis of the habits of specific birds. Read about the breeding habits and history of Minnesota birds. Species accounts include maps and graphs depicting surveyed abundance across the state.

[Find a Species Account](#) [Learn about Species Accounts](#)

Interactive Maps



Use our interactive maps to see exactly where the birds of Minnesota have been breeding. Evidence of breeding is scored based on a number of factors. Our interactive map uses these color coded indicators to display likelihood of breeding.


[Use Interactive Map](#) [Map Tutorial](#) [Read about our Methods](#)

Contact Us
info@mnbba.org

The Minnesota Breeding Bird Atlas Website was a collaborative project led by Audubon Minnesota and the University of Minnesota, Natural Resources Research Institute. Major funding was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

© 2017 Copyright Minnesota Breeding Bird Atlas.

Attachment #2: First Page of a Species Account on the MNBBA website (mnbirdatlas.org).



Home Using the Atlas Explore the Atlas Data and Methods About the Atlas

Pileated Woodpecker

Dryocopus pileatus

Minnesota Breeding Bird Atlas > Species Accounts > Pileated Woodpecker

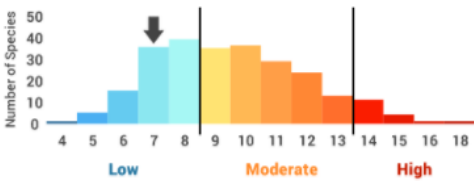
[View Interactive Map](#)

Overview Minnesota Breeding Bird Distribution Breeding Habitat Population Abundance Conservation Literature Cited

Overview

Minnesota Seasonal Status: A permanent breeding resident and common during the Minnesota Breeding Bird Atlas (MNBBA).

Conservation Status:



Conservation Status	Number of Species
4	5
5	10
6	15
7	35
8	40
9	35
10	30
11	25
12	20
13	15
14	10
15	5
16	2
17	1
18	0

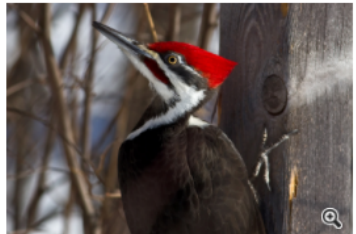
Assigned a Continental Concern Score of 7/20 by the North American Bird Conservation Initiative.

Migration: Permanent resident and not considered migratory. Some have reported southern movements during the fall, but these are believed to represent dispersal of young birds or seasonal movements following the breeding season (Bull and Jackson 2011).

Food: Bark gleaner and excavator that forages primarily on ants and larva of wood-boring beetles. Also consumes nuts and berries.

Nest: Primary cavity excavator.

North American Breeding Distribution and Relative Abundance: Distributed throughout southern Canada, the eastern United States, and portions of several states located in the northern Rockies and Pacific Northwest. Some of the highest breeding densities can be found in the southeastern United States (Figure 1).



Pileated Woodpecker. *Dryocopus pileatus*
© David Brislanec

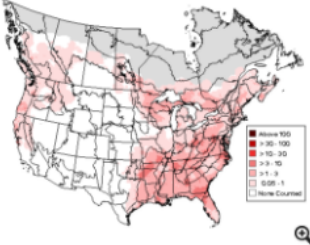


Figure 1. Breeding distribution and relative abundance of the Pileated Woodpecker in North America based on the federal Breeding Bird Survey from 2011 to 2015 (Sauer et al. 2017).

Attachment #3: Examples of Interactive Map Displays on the MNBBA website (mnbirdatlas.org).

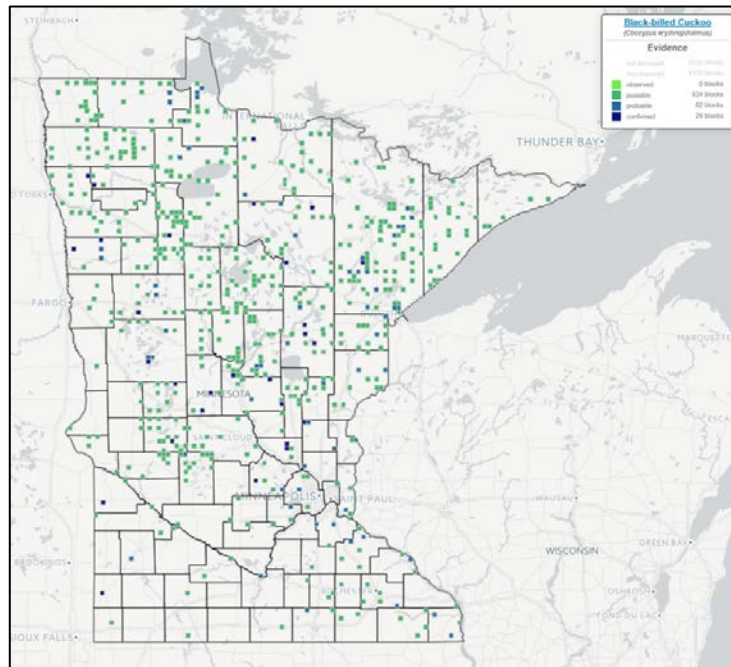


Figure 1. Illustration of all atlas blocks where the Black-billed Cuckoo occurred and the highest level of breeding evidence per block.

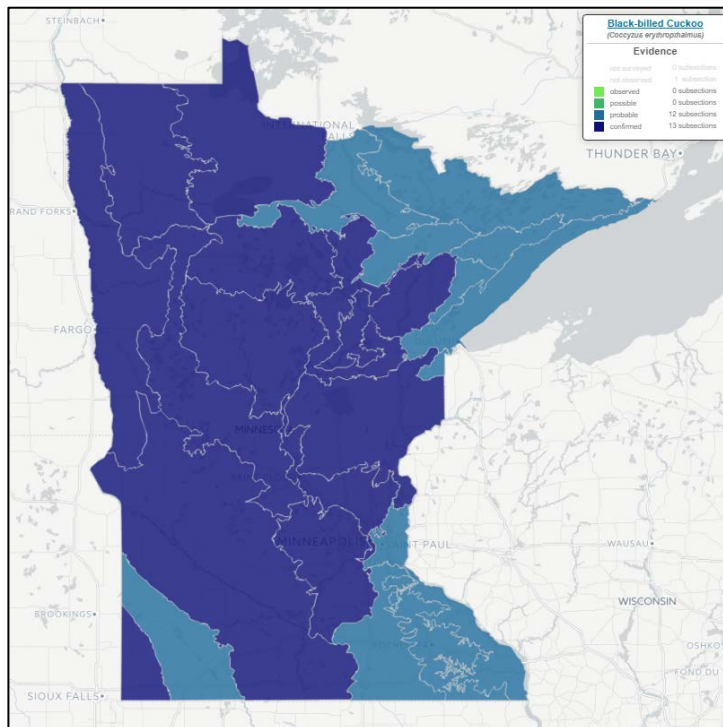


Figure 2. Illustration of ecological subsections where the Black-billed Cuckoo occurred and the highest level of breeding evidence per subsection.

Environment and Natural Resources Trust Fund									
M.L. 2014 Project Budget									
Project Title: Minnesota Breeding Bird Atlas – Final Phase									
Legal Citation: M.L. 2014, Chp. 226, Sec. 2, Subd. 05f									
Project Manager: Lee Pfannmuller									
Organization: Audubon Minnesota									
M.L. 2014 ENRTF Appropriation: \$ 300,000									
Project Length and Completion Date: 3 Years, June 30,									
Date of Report: June, 30, 2017									
ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET									
	Activity 1 Budget	Amount Spent	Activity 1 Balance	Activity 2 Budget 06/07/2017	Amount Spent	Activity 2 Balance	Activity 3 Budget 06/07/2017	Amount Spent	Activity 3 Balance
BUDGET ITEM	Analysis			Production of Text and figures			Development and Creation of Website		
Personnel (Wages and Benefits)	\$11,798.00	\$11,798.00	\$0.00	\$15,818.00	\$15,818.00	\$0.00	\$5,316.00	\$5,316.00	\$0.00
<i>Mark Martell, Project Manager: - \$9,952 - (75% salary, 25% benefits): 7% FTE for- 1 year</i>									
<i>Ashley Peters Communications Manager: \$10,000 (75% salary, 25% benefits): .17 FTE for 1 year.</i>									
<i>Susan Swanson, Office Manager: \$9,000 (75% salary, 25% benefits): 7% FTE for 3 years</i>									
<i>Bonita Sample, Project Coordinator: \$5,480 (75% salary, 25% benefits), 9% FTE for 1 year</i>									
Professional/Technical/Service Contracts									
Natural Resources Research Institute - U of MN - Duluth: Data analysis, assistance with graphics production, integration of graphics with website, and species text write-up.	\$70,000.00	\$70,000.00	\$0.00	\$20,000.00	\$20,000.00	\$0.00	\$18,200.00	\$18,200.00	\$0.00
Lee Pfannmuller Text Writer/Editor: Write sections of website and species accounts and work with other experts to complete species accounts and be responsible for final editing of text and coordination of text and graphics before placement on website. With approval of MNDNR and LCCMR, did a direct hire of Lee Pfannmuller, \$42,080/yr over 2.5 years. Project management responsibilities were added 5-20-16 for an additional \$8,368 that were moved from line 14 under Personnel.	\$8,050.00	\$8,050.00	\$0.00	\$80,000.00	\$80,000.00	\$0.00	\$25,518.00	\$25,518.00	\$0.00
Database Management (Cornell University) \$3000/yr for 1 year.	\$3,000.00	\$3,000.00	\$0.00						
Website Development - NRRRI							\$24,840.00	\$24,840.00	\$0.00
Copy editing of text for 249 species accounts (01/02/2017)				\$14,038.00	\$14,038.00	\$0.00			
Technical review of approximately 40 species accounts by recognized species experts: the cost per account will range from \$50 to \$75 (01/02/2017)				\$0.00		\$0.00			
Travel expenses in Minnesota: staff travel locally and between Duluth and the Twin Cities as meeting and coordination needs demand									
Other: Purchase of copyright photos - will be used only for photos of species that we cannot obtain at no charge, will be obtained through vendors such as VIREO				\$3,422.00	\$3,422.00	\$0.00			
COLUMN TOTAL	\$92,848.00	\$92,848.00	\$0.00	\$133,278.00	\$133,278.00	\$0.00	\$73,874.00	\$73,874.00	\$0.00