Developing a Management Model of the Effects of Future Climate Change on Species: A Tool for the Landscape Conservation Cooperatives

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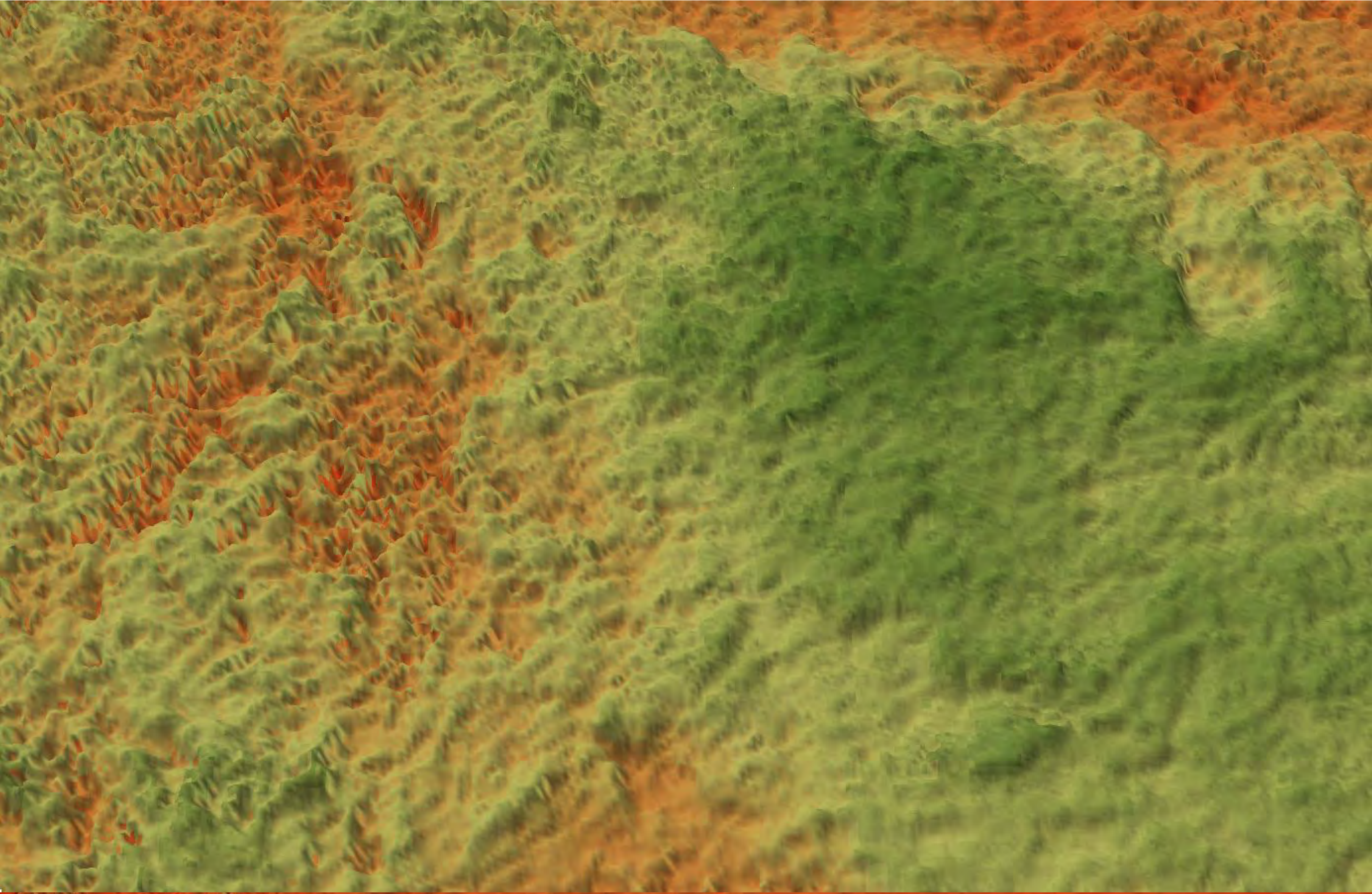

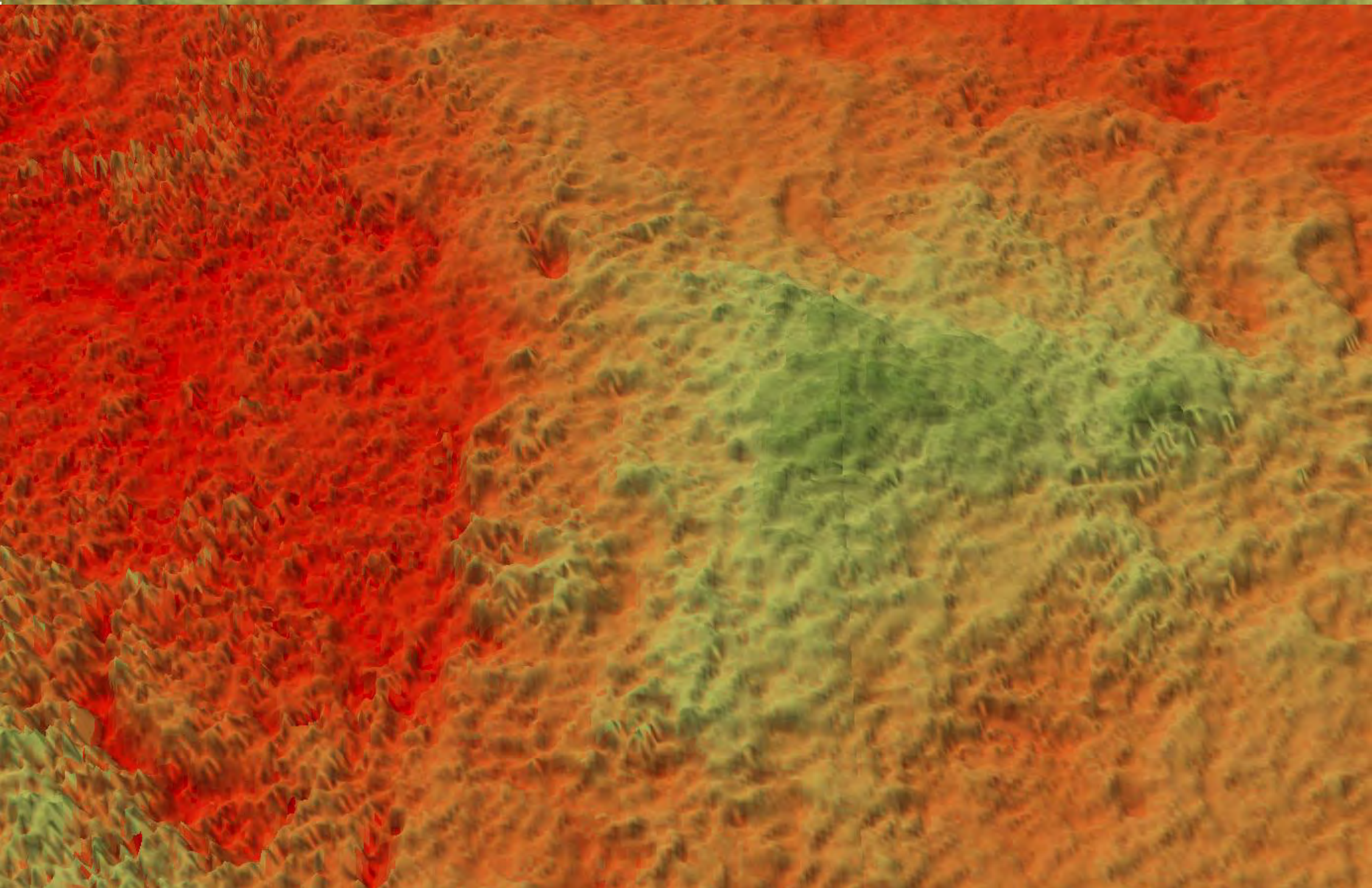

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Executive Summary

Human-induced climate change is increasingly recognized as a fundamental driver of biological processes and patterns, and a threat to the persistence of many species. Recent climate change has already caused shifts in the geographic ranges of myriad species and future climate change is expected to result in even greater redistributions of taxa. As a result, predicting the impact of climate change on future patterns of biodiversity has become a fundamental aspect of conservation planning. Here we use Audubon Christmas Bird Count and North American Breeding Bird Survey data in combination with detailed climate data and projections to estimate the current and future ranges of birds throughout the United States and Canada. Our results address three topics of general interest for broad-scale bird conservation: (1) the impact of climate change on bird diversity in the United States and Canada, (2) identification of areas that are expected to remain important to birds; namely "refugia" that are forecasted to remain climatically suitable from 2000–2080 for individual species and communities, and (3) in-depth analyses of potential climate change impacts on priority species.

Before generating predicted responses of birds to future climate change, we assessed the predictive performance of three modeling algorithms (i.e., Maxent, Generalized Additive Models, and Boosted Regression Trees) when confronted with independent observations of birds made in historical time periods and climate spaces. Boosted regression trees performed as well as, or better than, the other algorithms for 512 of 543 species (94%). We then used our Boosted Regression Tree models to forecast species distributions to future time periods based on climate estimates described by the Intergovernmental Panel on Climate Change (IPCC).When assuming that species can—and will—track their climatic niches perfectly through time and across geographic space, we show that winter species richness is expected to increase over much of the continent using each of two distinct modeling approaches. In the summer, richness is expected to decline over much of the conterminous United States and increase in more northern latitudes though the predictive power of summer species distribution models was lower than for winter models.

To bracket our optimistic assumptions that birds can—and will—track their climatic niches through space and time we also develop a complementary approach in which we identify *in situ* refugia. Refugia are areas that we expect to remain climatically suitable for species and communities into the future. When areas also remain suitable across emissions scenarios, they can be considered "no regrets" areas that are likely to remain suitable regardless of the climate conditions that come to pass. We show that the highest numbers of overlapping refugia persist in areas of high current species richness during both winter and summer seasons. When examining how the integrity of existing communities may erode, however, we detected marked variation in community erosion across space, and especially, time. Going forward in time, bird communities in the western United States and southern Canada are much less certain to remain intact than communities in the Midwest and parts of the Great Plains, particularly during the summer. Relatively little of the variation in our refugia predictions could be attributed to emissions scenarios, though the potential benefits of mitigation become clear by 2080 with the low (B2) emissions scenario fostering the persistence of approximately 13.0-13.9% more species than the high (A2) emissions scenario.

The present document, *Developing a Management Model of the Effects of Future Climate Change on Species: A Tool for the Landscape Conservation Cooperatives*, serves as a general technical report describing our mapping methodology and basic summary results. It accompanies Version 1.0 of our Geographic

Information Systems (GIS) library containing over 100,000 spatially explicit predictions of the past, present, and future distributions of North America's birds. We anticipate further expanding our efforts to address several challenges, including focused approaches to characterizing the relative influence of climate and land cover on species distributions, broadening the study area to incorporate species in Central and South America, and more detailed analyses of the spatial and temporal scales at which climate influences species distributions.

Acknowledgments

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1. Modeling Species Distributions in the Face of Climate Change

Aims and Purpose

The National Audubon Society has completed a continental analysis of how North America's birds may respond to future climate change. Using extensive citizen science data and detailed climate layers, we developed models that characterize the relationship between the distribution of each species and climate. Then, we used our models to forecast species distributions to future time periods based on climate estimates described by the Intergovernmental Panel on Climate Change (IPCC). This core set of analyses will serve as the backbone for informing bird conservation in North America through planning tools for land managers, reports focused on species of conservation concern, and peer-reviewed publications addressing the impacts of climate change on birds. In this report we address three topics of general interest for broad-scale bird conservation: (1) the impact of climate change on bird diversity in the United States and Canada, (2) identification of areas that are expected to remain important to birds; namely "refugia" that are forecasted to remain climatically suitable from 2000–2080 for individual species and communities, and (3) in-depth analyses of potential climate change impacts on priority species.

The Importance of Scale

It is widely recognized that species distributions are influenced by a variety of biotic and abiotic factors, including habitat availability, resource availability, species interactions, and physiology (Brown et al., 1996). However, the respective influences of these factors are highly dependent on the spatial and temporal scales of analysis (Wiens, 1989). One of the major challenges for understanding the effects of climate change on species distributions lies in identifying the appropriate spatio-temporal scales at which species distributions can and cannot be reliably predicted from a mechanistic knowledge of climate dependence (Guisan & Thuiller, 2005). As a first approximation, species distributions considered at small scales tend to be mostly influenced by biotic interactions (Nicholson & Bailey, 1935), mid scales by habitat and resource availability (Orians & Wittenberger, 1991), and large scales by climate, putatively through interactions with the physiological limits of the organism (Andrewartha & Birch, 1954; Whittaker, 1975; Woodward & Williams, 1987; Gaston, 2003).

Here, we use correlative models to predict the geographic responses of the North American avifauna to changes in climate. We intentionally focus on a large geographic extent to approximate the spatial scale at which many bird distributions are proximately shaped by climate (Gaston, 2003; Jiménez-Valverde, 2011; Thomas, 2010), and a 10 x 10 km resolution to approximate the resolution of our survey data. However, non-modeled factors such as habitat dependencies, biotic interactions, and dispersal limitations may in some cases prove highly important even at this coarse scale. Because it is impossible to incorporate all of these "non-climatic" variables into an analysis, the correlative distribution models presented here are best described as capturing the bioclimatic envelope of each species.

Use of bioclimatic envelope models to forecast future distributions has been criticized for making overly simplified assumptions about dispersal and biotic interactions (Dormann, 2007). However, these issues become more of a concern if we are intending to predict actual species distributions, rather than the distribution potential of species (Araújo et al*.,* 2012). In this sense, these climate models should be seen as delineating areas where a species could occur in the future if other variables necessary for the survival of the species such as suitable habitats and biotic interactions are present, and dispersal is non-limiting. Recent studies testing the performance of mechanistic models (MM) that explicitly incorporate hypothetical biological processes against correlative bioclimatic envelope models (BEM), conclude that BEMs performed as well as MMs for estimating current distributions, but showed varying results when predicted to future climate spaces (Hijmans & Graham, 2006; Morin & Thuiller, 2009; Buckley et al., 2010; Kearney et al., 2010).

Given the challenges of collecting the species-specific physiological data necessary for mechanistic niche modeling, it is not primarily intended for use in forecasting, but rather provides a framework for understanding how species respond to particular climatic gradients (Monahan, 2009; Buckley et al., 2010). BEMs remain the most widely used method to project impacts of climate change on species distributions (Huntley et al., 2008; Barbet-Massin et al., 2009; Lawler et al., 2009; Stralberg et al., 2009); and when applied at the macro scale, are suitable for making broad predictions to inform conservation planning (Hannah et al., 2002; Pearson & Dawson, 2003; Holt, 2009; Wiens et al., 2009; Araújo & Petersen, 2012). Hence, the models in this study are not intended to provide a passive answer to the question of how bird species will respond to future climate change. They are instead meant to identify conservation opportunities that can only be realized if we proactively plan for changes in climate and biological responses.

Climate Change Models and Uncertainty

Predictions about the future require the development of models, and all models entail uncertainty. In the case of climate change, our best hope for making sound conservation decisions is to account for uncertainty to the degree possible. There are three major sources of uncertainty to consider when forecasting species responses to climate change: modeling uncertainty, biological uncertainty, and future climate uncertainty. In this analysis, we have gone to great lengths to understand all three sources of uncertainty. We base our methods on recent work showing that with a thorough treatment of algorithmic uncertainties and ensemble forecasting, correlative distribution modeling is a valuable tool for forecasting continental scale impacts of climate change for a large number of species (Araújo et al*.,* 2005; Araújo & New, 2007; Marmion et al., 2009).

Modeling uncertainty stems from the quality of the data used to develop the model, as well as the limits of the modeling technique. Data quality is tied to both the validity and spatial scale of the geographic coordinate data used to formulate the model. Ideally, models constructed from the relationship between current climate and species occurrence should be validated using independent data from other time periods to assess their predictive ability (Araújo et al., 2005). Such validation provides users with a sense of how well the models can correctly predict known presences within different times and climate spaces. Previous studies that have tested for past changes in species distributions using bioclimatic envelope models provide a valuable validation of their use in studies of the potential impacts of future climatic changes (Hill et al., 1999; Green et al., 2008; Tingley et al., 2009; Dobrowski et al. 2011). Modeling uncertainty is further propagated by the fact that different modeling techniques often yield different predictions. To deal with this, we used three different modeling methods that fit complex non-linear relationships between species occurrence data and environmental data. .We then validated each of the models with independent data from historical time periods, compared their predictive ability, and chose the one that performed the best overall.

Biological uncertainty means that we are not sure if a species can persist, or colonize newly suitable areas, under future climate change. Much of the last 100 years of ecology has dealt with understanding how populations and species persist: birth rates, death rates, immigration, emigration, competition, foraging, lifespan, *et cetera*. These key biological factors are challenging to measure and each estimate has sources of uncertainty, too. Our models do not incorporate any of these measures directly, but we can still consider them *post hoc* when issuing conservation recommendations. Here, biological uncertainty is minimized in areas we term 'refugia' where a species has occurred historically, still occurs today, and is predicted to occur in the future after accounting for both future climate uncertainty and modeling uncertainty. In addition to reducing biological uncertainty, areas of 'refugia' that encompass the low-latitude margins of species ranges may be disproportionately important for the long-term conservation of genetic diversity and evolutionary potential (Hampe & Petit, 2005).

Future climate uncertainty is obvious: we don't yet know how much climate will change in the future, and at what rate, because human behaviors that influence emissions are difficult to anticipate, as are the influence of emissions on climate. To deal with this uncertainty, we base our analyses on a suite of possible emissions scenarios and General Circulation Models (GCMs) for which we had reasonable access to climate data layers for North America (Table 1.1). We ensemble predictions using consensus forecasting to explore how biological outcomes might be affected by human action to reduce climate change impacts through reduced emissions. Consensus forecasting is one form of ensemble modeling that uses the central tendency (e.g. mean or median value) from a set of possible models (Araújo et al., 2005). The rationale behind consensus forecasting is that the 'signal' one is interested in emerges from the 'noise' associated with individual model errors and uncertainties (Araújo et al., 2005; Araújo & New, 2007). Some conservation leaders will be uncomfortable making decisions based on models. It is worth noting, however, that assuming species will not shift their distributions in response to climate change is also a model of the future. This *status quo* model has all the same uncertainties associated with change models, except that there is no formal attempt to bracket or measure the uncertainty. A *status quo* model may, in fact, be the riskiest approach of all.

Landscape Conservation Cooperatives

Landscape Conservation Cooperatives (LCCs) are a natural structure through which to implement climate change conservation strategies. LCCs are a network of public-private, applied conservation science partnerships established to ensure the sustainability of United States land, water, wildlife, and cultural resources. LCCs function within the U.S. Fish and Wildlife Service (USFWS) to deal with landscape-scale issues and provide a forum for a diverse group of stakeholders to work

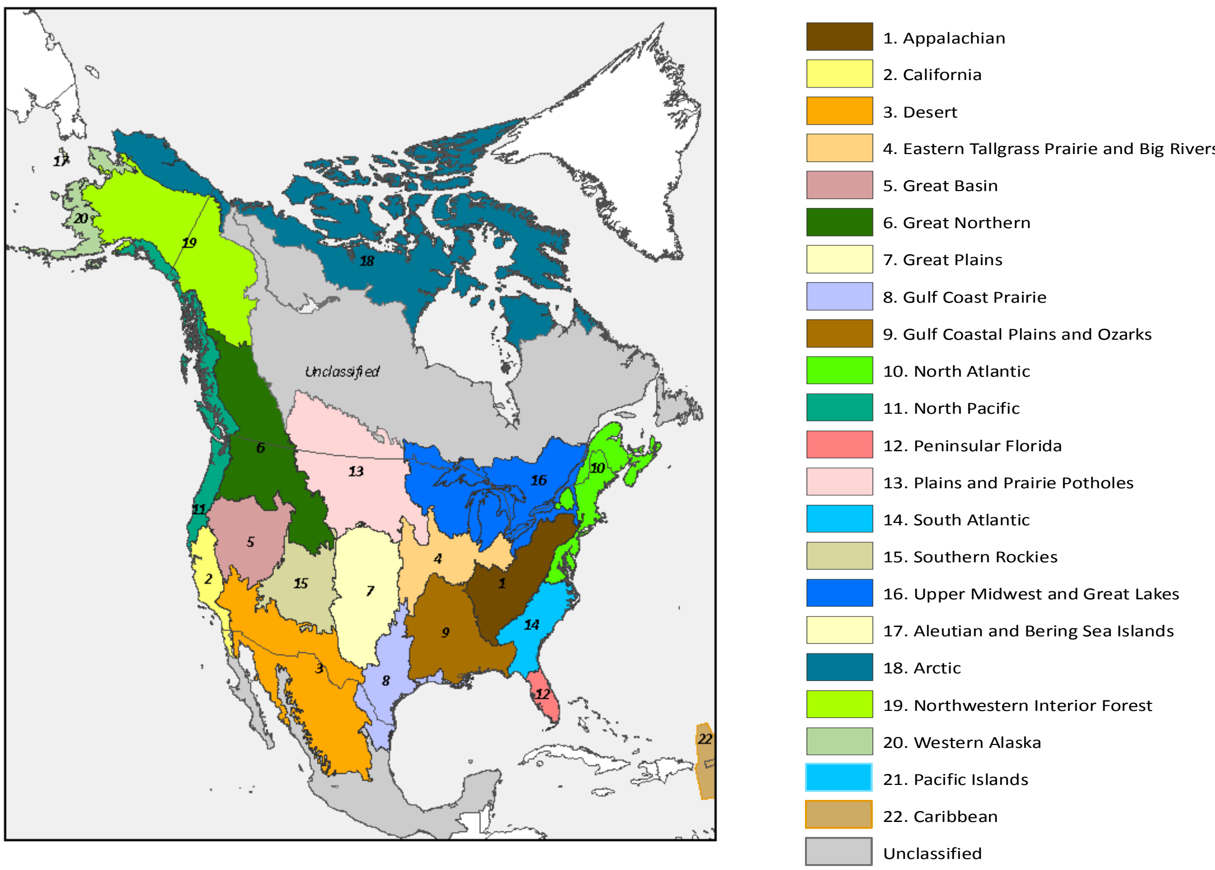


Figure 1.1. Landscape Conservation Cooperatives.

together to affect conservation in the United States. There are 22 individual LCCs (Figure 1.1) that serve two main functions. The first is to provide science and technical expertise for conservation planning at landscape scales. The second function of LCCs is to promote collaboration among their members to achieve shared conservation goals (USFWS, 2012).

Material and Methods

Bird data

Bird distribution data were obtained from two sources: the Audubon Christmas Bird Count (CBC) and the North American Breeding Bird Survey (BBS).

Audubon Christmas Bird Counts began in 1900 as an alternative to the Christmas "side hunt" and have been used to document early winter bird assemblages across North America, and beyond (National Audubon Society, 2012). CBC surveys are conducted by citizen scientists within 24.1-km-diameter circles for one 24 h period during a two-week interval centered on December 25. For this study, all circles that fell within the boundaries of Canada and the United States were included in the analyses (Figure 1.2). We elected not to include data from other areas due to relatively incomplete geographic sampling and poor spatio-temporal resolution of climate data. For every circle and count year, we distilled raw count data into presence/absence information for each species to reflect whether or not it was detected.

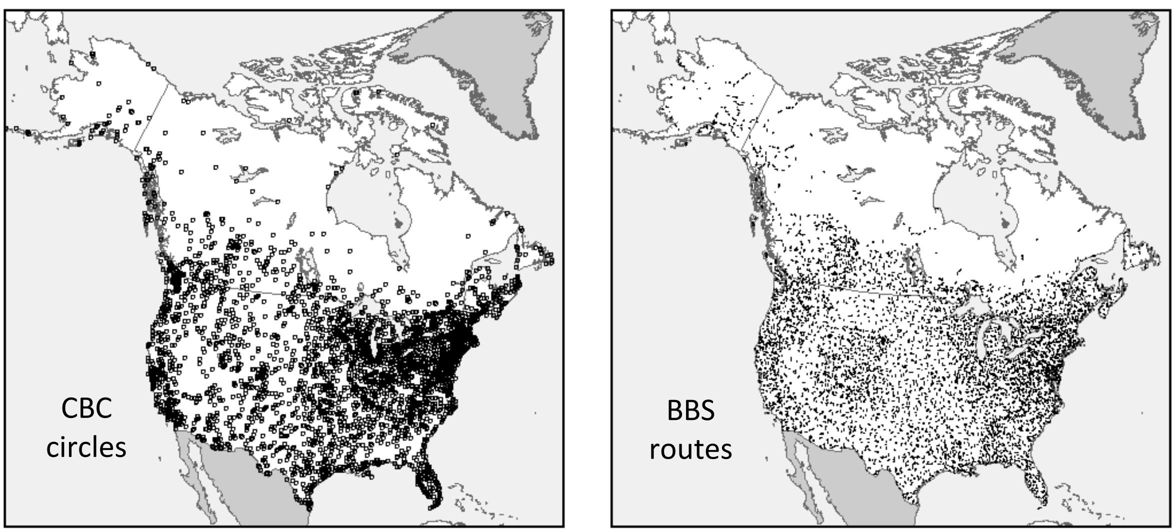


Figure 1.2. Distribution of Audubon Christmas Bird Count circles and North American Breeding Bird Survey routes (2000–2009).

The Breeding Bird Survey was initiated in 1966 for the purpose of monitoring bird populations in the summer months (USGS Patuxent Wildlife Research Center https://www.pwrc.usgs.gov/bbs/about/). Most BBS routes in the United States and Canada are surveyed in June but some are run as early as May and others extend as late as mid-July. Survey routes are 24.5 miles long with stops at 0.5-mile intervals. At each stop, participants conduct a 3-minute point count and record birds seen or heard (Sauer et al., 2011). We used data for the first 30 stops (~24 km) for our analyses in an effort to balance the geographic scales at which CBC and BBS sample the landscape and maintain a reasonable match to the resolution of our climate data (10 x 10 km). Again, we only used data for the United States and Canada and, for every route and year; we distilled raw count data into presence/absence information for each species to reflect whether or not it was detected.

Climate data

We obtained contemporary climate data from the Canadian Forest Service (CFS) (McKenney et al., 2011) and extracted climate data to the mid-point of each CBC circle and to the start-point of each BBS route using the CFS website (https://glfc.cfsnet.nfis.org/mapserver/cl_p/climatepoints.php). The Canadian Forest Service has produced a set of high resolution (10 km) yearly contemporary (1950 – 2010) climate datasets for Canada and the United States based on thin plate smoothing algorithms (McKenney et al., 2006; McKenney et al., 2011).We matched bird data and climate data on an annual basis (i.e., for CBC count year *x* and BBS survey year *x*, we used climate data from year *x*-1), assuming that climate variables from the year leading up to each survey would best inform our understanding of occurrence data. For instance, climate data for the year *prior* to a CBC survey event would actually include monthly climate data from that winter's survey because each CBC survey date is considered as of the 1st of January following the December counts (i.e. survey data from 2000 spans December 1999–January 2000). This is important since our climate parameters include indices of minimum and maximum monthly temperatures and precipitation (Table 1.2), as well as mean variables. Similarly, climate data from the prior year matched to BBS survey events would encompass the winter climate preceding the summer (breeding) season.

To characterize future climates and establish a spatial context for predictions, we added future climate anomaly grids to baseline climate data obtained from CFS that cover the United States and Canada. Generating future climate anomaly grids required several processing steps. First, we obtained spatially downscaled (5-min resolution) WorldClim climate grids for the periods 2010-2039, 2040-2069, and 2070-2099 available from the International Center for Tropical Agriculture (CIAT) (http://www.ccafs-climate.org/statistical_downscaling_delta/) for 13 combinations of emissions scenarios and General Circulation Models (GCMs). (CIAT had produced the grids by adding statistically downscaled IPCC Fourth Assessment future climate grids to contemporary Worldclim climate data [Ramirez-Villegas & Jarvis, 2010]). We then subtracted contemporary Worlclim grids for monthly minimum temperature, maximum temperature, and precipitation from the CIAT future grids to isolate predicted changes in climate from WorldClim baseline values. Finally, we added these monthly anomaly grids to CFS mean climate grids for the base period (1971–2000) (Figure 1.3, Table 1.1). This ensured that we matched our contemporary climate grids with IPCC 4 anomaly grids to produce high-resolution future climate grids for our study region.

Emissions scenarios are described in the IPCC Special Report on Emissions Scenarios (Nakicenovic et al., 2000) and are grouped into families (e.g., A1, A2, B1 and B2) that explore alternative development pathways, covering a wide range of demographic, economic and technological driving forces on greenhouse gas emissions (Figure 1.3). As described by the IPCC (2007), the B2 scenario is a relatively "low" emissions trajectory that emphasizes clean and sustainable technology. In contrast, the A1B scenario is a relatively "middle-of-the-road" emissions scenario where technological change is balanced across fossil and non-fossil energy sources. Finally, the A2 scenario represents a relatively "high" emissions pathway characterized by fragmented technological and economic growth. General Circulation Models (GCMs) are numerical models that represent physical processes in the atmosphere, ocean, cryosphere and land surface used to simulate the response of the global climate system to increasing greenhouse gas concentrations. Future climate predictions can be derived by combining emissions scenarios and GCMs (Figure 1.4).

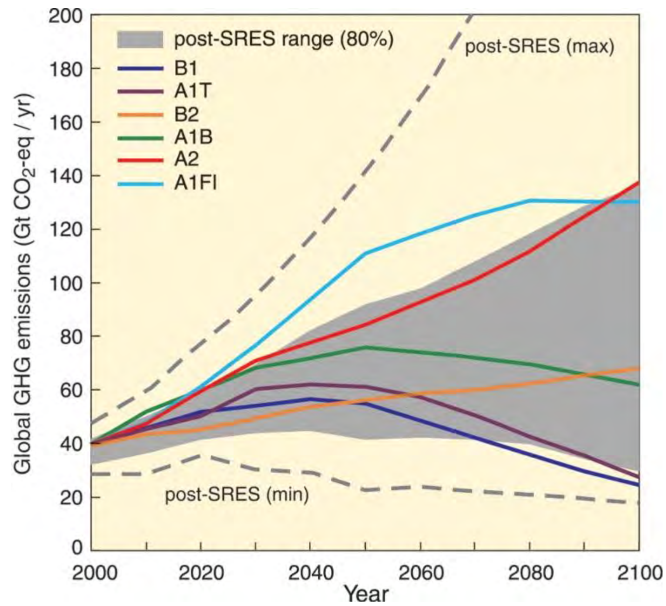


Figure 1.3. Global emissions scenarios for the 21st Century. The present study considers three scenarios: B2, A1B, and A2 (IPCC, 2007).

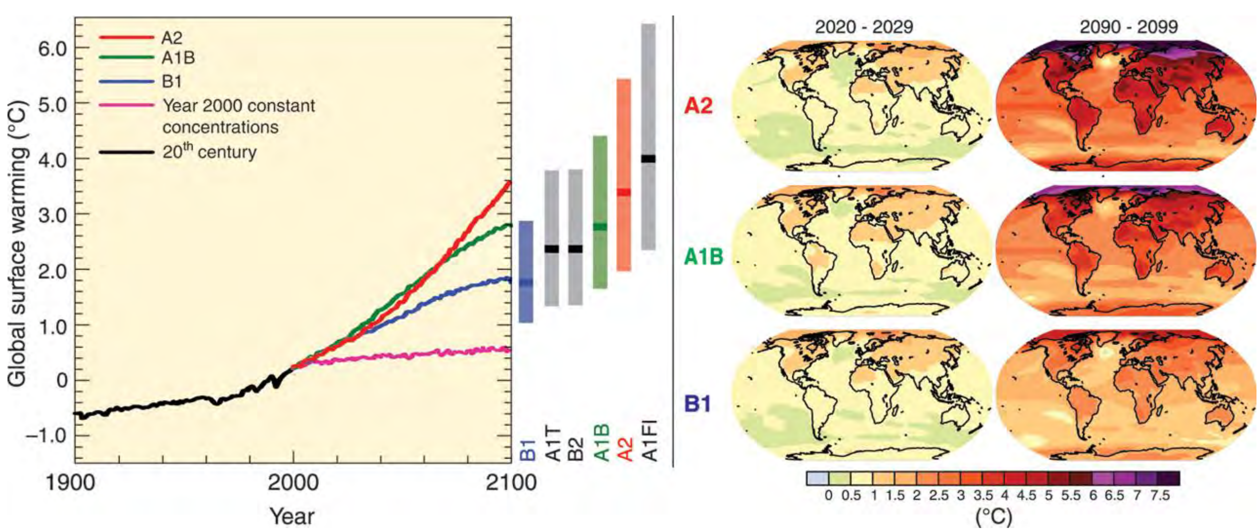


Figure 1.4. Predicted global surface warming by year and emissions scenario (IPCC, 2007).

Table 1.1. Sources of future climate data.

Climate Center	GCM	B2 scenario	A1B scenario	A2 scenario
Canadian Center for Climate Modeling and Analysis	CCCMA-CGCM3.1		x	
Canadian Center for Climate Modeling and Analysis	CCCMA-CGCM3.0			x
Commonwealth Scientific and Industrial Research Organisation	CSIRO-Mk3.0		x	x
Institut Pierre-Simon Laplace	IPSL-CM4		x	
Max Planck Institute for Meteorology	MPI-ECHAM5		x	
National Center for Atmospheric Research	NCAR-CCSM3.0		x	
Hadley Center for Climate Prediction and Research	HCCPR-HADCM3	x	x	x
Hadley Center for Climate Prediction and Research	HCCPR-HADGEM1		x	
National Institute for Environmental Studies	NIES	x		x

Table 1.2. Bioclimatic variables used to model bird distributions. These 17 variables represent more biologically meaningful versions of the original monthly climate variables obtained from CFS and CIAT.

Bioclimatic Variables
Annual Mean Temperature (^{o}C)
Mean Diurnal Range (Mean of monthly [maximum temperature - minimum temperature]) (^{o}C)
Isothermality (Mean Diurnal Temperature Range/Temperature Annual Range)
Maximum Temperature of Warmest Month (^{o}C)
Minimum Temperature of Coldest Month (^{o}C)
Temperature Annual Range (^{o}C)
Mean Temperature of Wettest Quarter (^{o}C)
Mean Temperature of Driest Quarter (^{o}C)
Mean Temperature of Warmest Quarter (^{o}C)
Mean Temperature of Coldest Quarter (^{o}C)
Annual Precipitation (mm)
Precipitation of Wettest Month (mm)
Precipitation of Driest Month (mm)
Precipitation of Wettest Quarter (mm)
Precipitation of Driest Quarter (mm)
Precipitation of Warmest Quarter (mm)
Precipitation of Coldest Quarter (mm)

After creating our future climate grids, we transformed raw temperature and precipitation data into a series of bioclimatic variables (Nix, 1986; Hijmans et al., 2005) using DIVA software (Hijmans et al., 2001) and the 'raster' package (Hijmans & van Etten, 2011) in the statistical software R (R Development Core Team, 2011). Bioclimatic variables are thought to represent more biologically meaningful combinations of the original monthly climate variables because they aggregate climate information in ways known to drive biological processes (Nix 1986; Table 1.2).

Bioclimatic Envelope Models

Species distribution models are formulated by using a modeling algorithm to describe relationships between geographically coincident environmental variables and bird occurrence data (Figure 1.5a). When bioclimatic variables are used as predictor variables, the models are typically referred to as bioclimatic envelope models (BEMs). While the models are simply a mathematical description of climate-bird relationships (Figure 1.5b), they can be projected into spatially organized, gridded climate data. The resulting predictive distribution maps describe geographic areas that are expected to be climatically suitable for a species (Figure 1.5c). Predictive distribution maps can be made for the same time and place from which the data were collected, or, alternatively, they can be projected to different times or places so long as information is available to generate bioclimatic variables used in the model.

We built separate distribution models for winter and summer seasons using CBC and BBS data, respectively. For CBC analyses, we included the number of survey hours invested in each CBC circle as a predictor variable to account for uneven observer effort across circles, in addition to 17 bioclimatic variables. The number of participating individuals and the duration of counts vary among CBC circles and through time, thus the number of party-hours has often been used as a covariate to account for this variation in analyses based on CBC data (Link et al., 2006; Link et al., 2008). We used 19272 records collected at 2278 circles from 2000–2009 to train our models and 30630 records collected from 1980–1999 to assess the predictive ability of our models (Appendix 1). This approach allowed us to take advantage of increased geographic sampling in recent years to build models as well as availability of abundant historical data to assess the predictive ability of our models outside the current time period and climate space. We had sufficient data to construct models for 543 species of wintering birds, representing 90% of the species with at least one count in a CBC circle for the period 1950–2010. In an effort to assess the predictive ability of our models to earlier time periods we also validated models using CBC data from 1956–1965 (Appendix 2).This reduced our sample size from 543 species to 440 species.

Our analysis of BBS data was similar in approach with small adjustments to account for differences in data sets and survey protocols. Instead of survey effort, which varied in the CBC, but was constant in the BBS, we used Julian date to account for variation in timing of surveys across the summer season. We felt this was important because species occurrences and detection probabilities may have been associated with the timing of BBS surveys. For example, surveys that take place later in the summer season may miss bird species that have completed their breeding season and become less conspicuous or departed for their wintering grounds. We used 25081 records collected along 3718 routes from 2000–2009 to train our models and 41959 records collected from 1980–1999 to test the predictive performance of our models. We had sufficient data to construct models for 508 species that occur in the United States and Canada during the summer (Appendix 1) representing 73% of the species identified at any time in a BBS survey since its inception in 1966. Again we assessed the predictive ability of our models using earlier survey time periods (1966–1975; Appendix 2), but this reduced our sample size considerably from 508 species to 403 species.

Results were comparable between the two historical time periods for both the CBC and BBS datasets, so we restrict our presentation of validation results, graphs and figures within the body of this report to those from the 1980-1999 time period. Model performance in earlier time periods for the winter (1956–1965) and summer (1966–1975) seasons are summarized in Appendix 2.

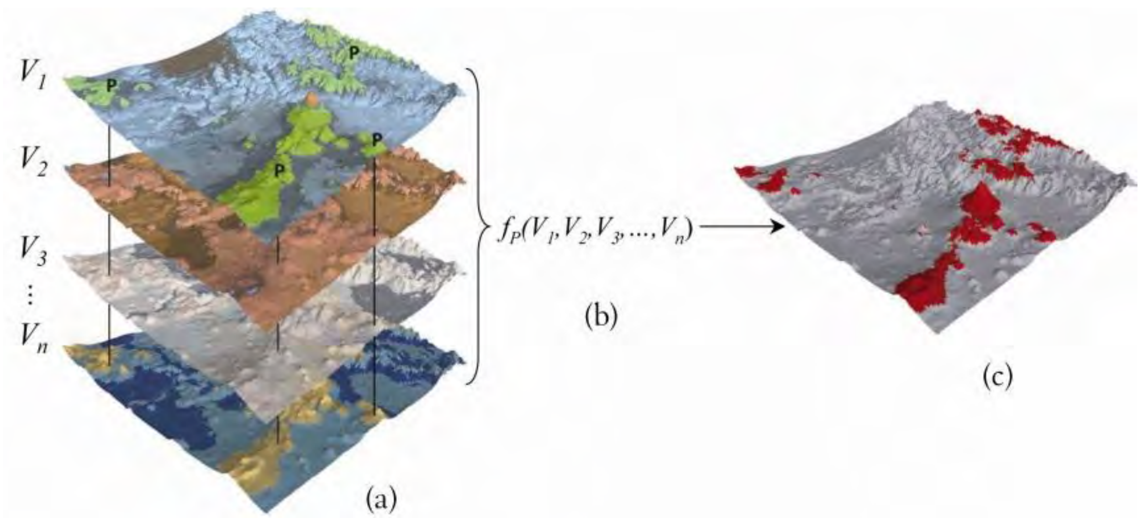


Figure 1.5. Correlative distribution modeling. Models combine species data (P) and bioclimatic variables (V1, V2, V3, …, Vn) (a) to formulate a mathematical model (*f*) (b). The model may then be projected back into geographic space to generate a predictive distribution map (c).

Modeling algorithms

To explicitly address aspects of modeling uncertainty, we used three different modeling algorithms to describe relationships between bioclimatic variables and winter bird occurrence data: boosted regression trees (BRT), maximum entropy (MAX), and generalized additive modeling (GAM). We evaluated the predictive performance of the three algorithms by assessing how well predictions were corroborated by historical observations using Receiver Operating Characteristic (ROC) curves. The metrics of performance, Area Under the Curve (AUC) scores, describe the ability of models to discriminate between presence points and absence points in independent test data (Figure 1.6). High AUC scores indicate that a model very efficiently differentiates true presences from false presences as the discrimination threshold is varied, low AUC scores indicate that the model does a poor job of distinguishing true presences from false presences across a wide range of discrimination thresholds. We then used the 'pROC' package (Robin et al., 2011) in R to compare the predictive performance of all pairwise combinations of models for each species (i.e., BRT-GAM, BRT-MAX, GAM-MAX) to evaluate whether differences between models were statistically significant. The predictive performance of BRT models proved as good as, or better than, GAM or MAX models for 512 of 543 wintering species. GAM or MAX models performed significantly better than BRT models for only 31 species (Figure 1.6). Given these results, we decided to use BRTs alone to model summer distributions.

BRT models combine two modeling algorithms to fit relationships between predictors and a response variable: regression trees and boosting (Elith et al., 2008). Regression trees define relationships between predictors and response through recursive binary splits that act to serially reduce unexplained deviance. Boosting algorithms aim to improve predictive performance of any single model by incorporating information from a multitude of simple models. Resulting models are able to fit complex non-linear relationships in large datasets, are relatively insensitive to outliers, and handle interactions between predictors automatically (Elith et al., 2006, 2008). By partitioning data into subsets, or folds, and training models on those subsets, BRTs are also able to reduce the risks associated with overfitting data.

We built BRT models based on techniques outlined in Elith et al. (2008) using the following parameters: 1) learning rate = 0.01, 2) tree complexity = 5, 3) family = Bernoulli. These settings resulted in models built with an average of 3100 and 2800 trees for winter and summer species, respectively, well beyond the suggested value of 1000 (Elith et al., 2008). All models were constructed using the 'gbm' package (Ridgeway, 2010) in R and cross-validation was performed using 10 folds. Although BRT models are complex, their predictive performance is superior to most traditional modeling methods and their results can be summarized to give valuable ecological insight into the relationships between independent variables and the response (Elith et al., 2008).

Predicting distributions and characterizing ranges

To predict the current distribution of species, we projected species distribution models built with BRTs into a climate surface composed of bioclimatic variables averaged from 1999–2008, the same period used to construct the models. We also projected species distribution models into each of 39 future climate surfaces (i.e., 13 combinations of emissions scenarios and GCMs in each of 3 future time periods) and then averaged across GCMs within each combination of emissions scenario and time period (e.g. consensus forecasting *sensu* Araújo & New, 2007). This process resulted in 9 future prediction grids for each species, one for each emissions scenario (B2, A1B, A2) in each time period (2020, 2050, 2080). All projections were performed using the 'raster' (Hijmans & van Etten, 2011) and 'dismo' packages (Hijmans et al., 2011) in R.

For each species, our prediction grids describe climatic suitability of the United States and Canada on a continuous scale from 0 (unsuitable) *to* 1 (highly suitable). Some of our analyses required that we characterize species ranges using binary grids in order to calculate defined areas of presence or

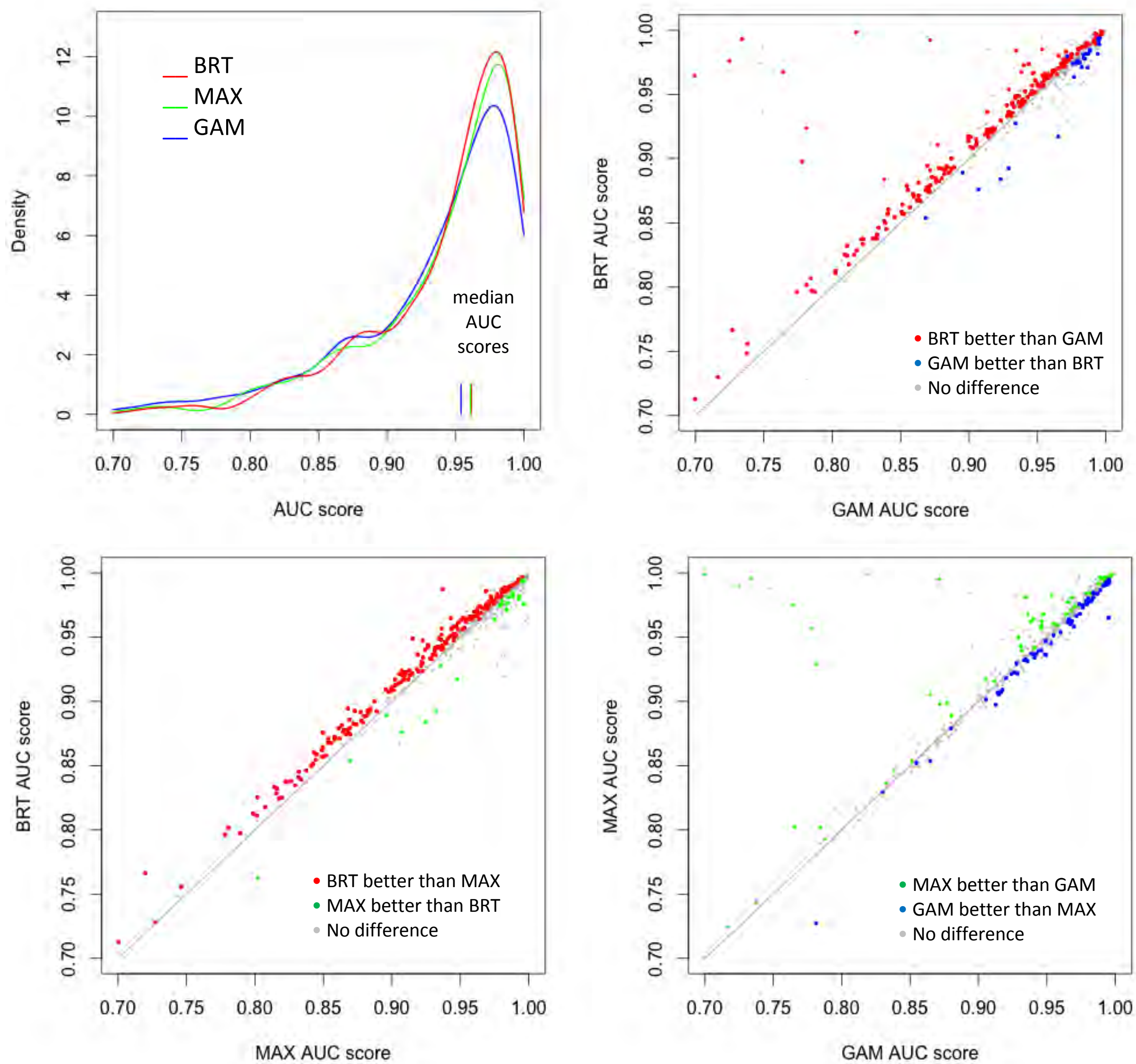


Figure 1.6. Density distribution of AUC scores for three modeling algorithms and pairwise evaluation of performance. Each point represents a species. Red points = BRT performance significantly better than alternative algorithm; blue points = GAM performance significantly better than alternative algorithm; green points = MAX performance significantly better than alternative algorithm; gray points = models do not differ significantly in predictive performance. The solid line has intercept = 0, slope = 1.

absence, as opposed to suitability values between 0-1. We did this by converting our continuous prediction grids to values of 0 (unsuitable) *or* 1 (suitable). To delineate the boundaries of species ranges, we used a threshold value based on themaximum Kappa statistic (Nénzen & Araújo, 2011). The Kappa statistic measures the proportion of correctly predicted sites after the probability of chance agreement has been removed (Moisen & Frescino, 2002). Suitability values below the threshold were considered climatically unsuitable while values above the threshold indicated that an area was suitable. We chose the Kappa statistic because, in most cases, it provided us a conservative estimate of ranges compared to alternative thresholds (Liu et al., 2005). Since many of our analyses required estimates of range size or refugia size, we applied a North American Albers Equal-Area Conic projection to each prediction grid before estimating areas.

2. Anticipating Effects of Climate Change on Avian Biodiversity

Summary

Predicting the impact of climate change on future patterns of biodiversity has become a fundamental aspect of conservation planning. Here we use Audubon Christmas Bird Count and North American Breeding Bird Survey data to estimate current and future species richness of birds in the United States and Canada using two alternative approaches. In the first approach, we model species richness within an area by aggregating distributions derived from species-specific bioclimatic envelope models. In the second, we model species richness directly using the number of co-occurring species as the response variable and bioclimatic variables as predictors. We show that both modeling approaches fit the sample data well, show similar accuracy when validated with historical observations, and result in similar patterns of richness when projected into current and future climate surfaces. So while mechanisms shaping geographic variation in biodiversity remain ambiguous, including the role of species interactions, these limitations do not impede our ability to predict patterns of biodiversity at broad scales. Both modeling approaches suggest marked differences in consequences of climate change for winter and summer bird communities with species richness increasing throughout much of the United States and Canada during the winter and decreasing over significant areas during the summer. Model fit and predictive performance for both approaches were higher for the winter compared to the summer, suggesting that species richness predictions may be more reliable for the winter season. The difference in performance may have arisen because we did not include potentially important predictors of summer distributions in our models. Seasonal differences in responses to climate change will present significant challenges for conservation planning. Adaptation strategies may need to be developed independently for winter and summer communities if areas targeted for conservation do not align across seasons, and may require trade-offs in conservation efforts for winter and summer taxa if conservation resources are limited. In addition to providing complementary perspectives on the past, present, and possible future(s) of birds in the United States and Canada, our results also suggest that reliable estimates of biodiversity can be generated for large geographic areas without modeling individual species distributions. The use of climate-richness models may prove especially valuable for the many geographic areas (and taxa) where comprehensive long-term datasets with large sample sizes for individual species are unavailable. These complementary approaches thus increase the potential to evaluate adaptive management strategies under a variety of constraints.

Introduction

Human-induced climate change is increasingly recognized as a fundamental driver of biological processes and patterns, and a threat to the persistence of many species (Thomas et al., 2004). Recent climate change has already caused shifts in the geographic ranges of myriad species (Root et al., 2002; Parmesan & Yohe, 2003; Parmesan, 2006; Şekercioğlu et al., 2012) and future climate change is expected to result in even greater redistributions of taxa (Hannah et al., 2005; Devictor et al., 2008). While species richness remains a standard index of biodiversity and currency for conservation efforts (Margules & Pressey, 2000; IPCC, 2007; Şekercioğlu et al., 2012), and has long been the focus of ecological research, many climate change mitigation and adaptation strategies rely on modeling responses of individual species to changing conditions rather than richness *per se* (Bellard et al., 2012; Araújo et al., 2011; Lawler et al., 2009; Stralberg et al., 2009).

Typically, researchers build bioclimatic envelope models (BEMs) for individual taxa for current time periods and use relationships between bioclimatic variables and occurrence data to forecast potential range changes based on estimates of future climate (Huntley et al., 2008; Barbet-Massin et al., 2009; Lawler et al., 2009; Stralberg et al., 2009). Ranges for individual species are then combined to estimate the effects of climate change on biodiversity within regions. Bioclimatic envelope modeling is based on the concept of niche conservatism (i.e., the tendency of species to retain ancestral ecological characteristics), and assumes that climate plays an important and consistent role in limiting species distributions (Wiens & Graham, 2005). This approach assumes that species can, and will, shift their geographic ranges to track changing climate rather than adapting in place.

Despite a long history of research, hypotheses proposed to explain geographic variation in species richness are less frequently invoked to frame studies exploring the consequences of future climate change (Currie, 2001; Menéndez et al., 2006). The climate/productivity hypothesis, in particular, (often termed the species-energy, productivity, or water-energy hypothesis) has garnered considerable interest over the past several decades (Wright, 1983; Turner et al., 1988; Currie, 1991; O'Brien, 1998; Francis & Currie, 2003; Hawkins et al., 2003). It suggests that gradients of energy and water availability within an area create and maintain patterns of species richness (Hutchinson, 1959; Pianka, 1966; Brown, 1981; O'Brien, 1993; Rosenzweig, 1995; Currie et al., 2004; Clarke & Gaston, 2006). One version of the hypothesis proposes that energy limits species richness directly through physiological effects such as frost-intolerance in plants (von Humboldt, 1808) or thermoregulatory needs in vertebrates (Currie, 1991). Another version proposes that species richness is determined by the energy flowing through food webs, with higher energy resulting in more productive habitats where species have larger populations less at risk of extinction (Hutchinson, 1959; Connell & Orias, 1964; Wright, 1983; O'Brien, 1998; Currie et al., 2004). In a recent meta-analysis of 393 studies, Field et al. (2009) found that climate/productivity factors explained variation in species richness at extents > 1000 km and at grain sizes > 10 km^2 better than variables describing environmental heterogeneity, area, or biotic interactions.

In this study we use Audubon Christmas Bird Count (CBC) and North American Breeding Bird Survey (BBS) data to describe current patterns of species richness for birds in the United States and Canada using two alternative approaches. In the first, we model species richness by aggregating distributions derived from species-specific BEMs. In the second, we use regression methods to model species richness directly with the number of co-occurring species as the response variable and bioclimatic variables as predictors, consistent with approaches used to evaluate the climate/productivity hypothesis. We refer to this second set of models as climate-richness models (CRMs). We then assess the predictive performance of the two approaches using historical data, make projections into the future (2070-2099), and compare resulting patterns of richness between the two approaches. In doing so, we not only provide predictions of future richness patterns but also estimate the degree to which individual species (and their interactions) influence emergent patterns of biological diversity.

Methods

Bioclimatic Envelope Models

We describe general methods used to generate and project individual BEMs to current and future time periods in Chapter 1. In this analysis, we projected BEMs generated for winter species (N = 543 species) and summer species (N = 508 species) into current climate space (i.e., climate conditions averaged from 1999-2008) (Appendix 1). We also projected BEMs into 13 climate spaces that characterize future climatic conditions (2070-2099), hereafter referred to as the 2080s, reflecting different combinations of possible emissions scenarios and General Circulation Models (GCMs) (B2 low emissions: 2 GCMs; A1B moderate emissions: 7 GCMs; A2 high emissions: 4 GCMs). For each species, our prediction grids describe climatic suitability across the United States and Canada on a continuous scale from 0 (unsuitable) to 1 (highly suitable). To obtain estimated species richness maps for the current winter and summer seasons, we summed single-species BEMs using continuous suitability values for each season. To generate estimated species richness maps for the future winter and summer seasons, we averaged suitability values for each species within each future emissions scenario and season and then summed across all species.

Climate-Richness Models

To estimate species richness using observation records, we added the number of species for each year for the current period (2000-2009) in each CBC circle and along the first 30 stops of each BBS route for the winter and summer seasons, respectively. We then generated our climate-richness models (CRMs) using boosted regression tree (BRT) models in R with species richness as our response variable, and the aforementioned 17 bioclimatic variables as predictors (Table 1.1). We also included predictors for observer effort (CBC) and Julian date (BBS). We matched bird data (2000-2009) with climate data (1999-2008) on a yearly basis to match the methods used for building our bioclimatic envelope models (see Chapter 1). We built BRT models for the winter and summer seasons separately and modeled the response variable using a Poisson distribution.

Model performance

We evaluated the predictive performance of summed single-species BEMs for estimating species richness by projecting our single-species BEMs from the current period into historical climates (i.e., 1979-1998) and summing the resulting predictions. This evaluation provided us historical species richness estimates that we were able to compare against observed richness values during corresponding bird surveys (1980-1999). Similarly, we projected our current CRMs into the same historical climates to estimate species richness, and compared these predictions to historical observations of species richness. In this way we were able to validate our models against actual bird sightings and assess their predictive ability in different climate spaces and time periods.

We also evaluated the predictive performance of summed single-species BEMs for estimating species richness by projecting our current single-species BEMs into 1955-1964 climates (winter models) and 1965-1974 climates (summer models). This allowed us to assess the predictive ability of our models into more distant time periods (~50 years in the past), but reduced our sample size from 543 to 440 species for the winter season and 508 species to 403 species for the summer season. (Many species are poorly represented in earlier surveys). Similarly, we projected our current CRM for winter richness into 1955-1964 climates and our CRM for summer richness into 1965-1974 climates and compared those predictions to actual observations of richness on corresponding historical surveys.

We restrict our presentation of results for this chapter to the 1980-1999 time period because it allowed us to validate the performance of models for markedly more species. In addition, model performance deteriorated only slightly when validated with earlier bird data (Appendix 2).

Predicting distributional responses to future climates

We mapped estimates of current species richness based on predictions derived from summed BEMs and CRMs for both winter and summer bird communities. We also mapped predicted changes in species richness from the current time to the 2080s for each of three emissions scenarios (i.e., B2, A1B, A2) and seasons, to allow readers to visually evaluate predicted patterns of change. We quantified change in species richness for each Landscape Conservation Cooperative (LCC) to help identify potential areas in which conservation efforts could be focused.

Variance components analysis of change in species richness

We used a variance components analysis to characterize how variation in species richness changes between 2000 and 2080 were partitioned among modeling approaches (i.e., BEM, CRM), Landscape Conservation Cooperatives, seasons (i.e.,winter, summer), and scenarios (i.e., B2, A1B, A2). To generate the dataset, we calculated difference grids for each combination of model type, season, and scenario by subtracting current richness values from predicted future richness values. Then we randomly sampled change values from 10,000 grid cells in each grid and assigned them to correspoding Landscape Conservation Cooperatives. We built 15 separate random effects models with all additive combinations of the four random effects (except the null set) and compared models using AICc.

Results

Model performance and important predictors

BEMs effectively predicted distributions of individual taxa when validated with historical observations from 1980-1999 (winter models: median AUC score = 0.957, range = 0.659-0.998; summer models: median AUC score = 0.949, range = 0.494-0.999; Appendix 1). To assess how well those same BEMs were able to estimate species richness, we summed historical predictions across species and compared them to observed species richness data from the same historical period (Figure 2.1). The correlation between predicted and observed richness values was much higher for the winter season (Pearson's r = 92.5) compared to the summer season (Pearson's r = 60.6), suggesting that aggregation of single-species BEMs may be more practical for estimating richness in winter than summer.

We evaluated fit of our CRMs using cross-validation within the current time period (2000-2009) and validated their predictive ability using historical observations (1980-1999). Similar to our results for summed BEMs, the winter season model performed better than the summer season model with the percent deviance explained for the winter model (84.0) over twice that of the summer model (40.8; Table 2.1). Again, these results suggest that species richness predictions may be more reliable during the winter than the summer months.

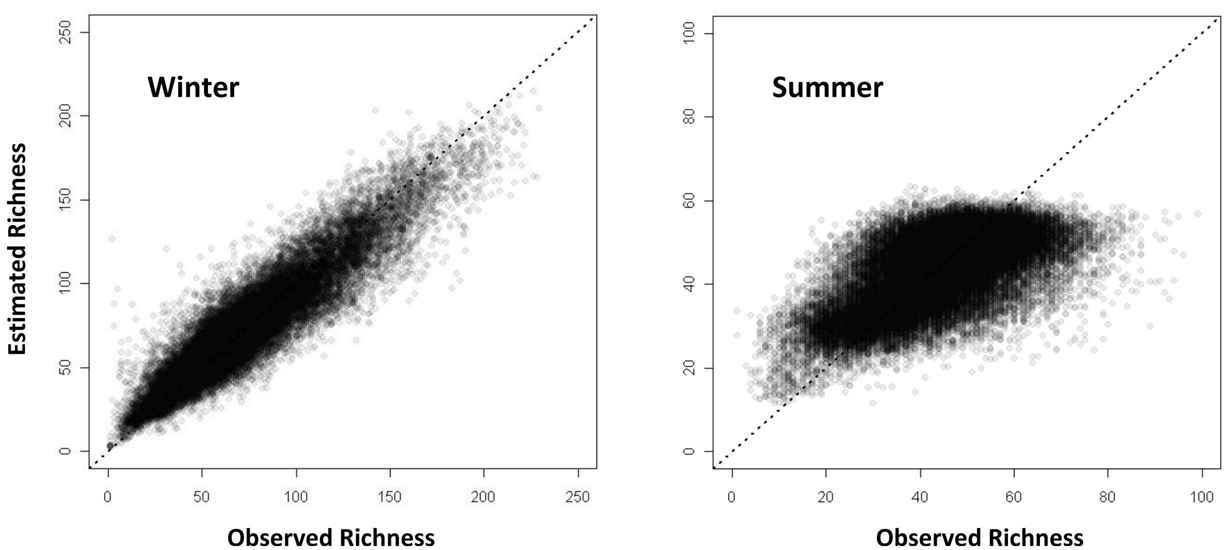


Figure 2.1. Correlations between observed species richness and estimated species richness obtained by summing single-species bioclimatic envelope models for winter and summer seasons. Models were built using bird data for the survey periods 2000–2009, then projected to 1979–1998 climates and tested with observed data from these historical time periods (N=30632 winter; N=41959 summer). Dashed line has intercept=0, slope=1.

Table 2.1. Predictive performance of climate-richness models.

	Winter Models	Summer Models
Number of training records	19259	25081
Number of trees	4700	8400
Number of predictors	18	18
% Deviance explained (Independent)	84.0	40.8
% Deviance explained (CV)	86.8	50.6

Models were built using boosted regression trees and a Poisson distribution with a learning rate = 0.01 and tree complexity = 5. Bird and climate data were used for the survey period 2000–2009, then projected to historical climate surfaces for the period 1979–1998 and tested with observed data (Independent) from this historical time period (N=30632 winter; N=41959 summer). We also cross-validated (CV) the models using ten folds.

When looking across all winter season BEMs, annual mean temperature, mean temperature of the coldest quarter, and precipitation of the warmest quarter were the climate variables that made the greatest relative contributions to model fits. Mean temperature of the coldest quarter, minimum temperature of the coldest month, and annual mean temperature made the greatest relative contribution to the fit of the CRM for the winter season (Table 2.2). Partial dependence plots—which reveal the effect of a variable on the response after accounting for the average effects of all other variables in the model—indicated a positive relationship between temperature and species richness during the winter for the CRM, suggesting that cold temperatures play a dominant role in shaping patterns of species richness during the winter.

During the summer season, annual mean temperature, isothermality, and maximum temperature of the warmest month contributed most to the fit of single-species BEMs. Variables with the highest relative contributions to the summer CRM were annual precipitation, mean temperature of the warmest quarter, and mean diurnal range in temperature (Table 2.2). Partial dependence plots for the summer CRM indicated that species richness increased with precipitation up to 1200 mm and tended to decline in areas with the warmest temperatures and greatest diurnal temperature fluctuations.

Current patterns of species richness

Summed BEMs and CRMs provided similar estimates of current species richness within seasons (Figures 2.2 and 2.3), but patterns of richness varied greatly between seasons. Estimated richness for the winter season was highest in the southern portion of the United States and the Central Valley of California and declined with increasing latitude and altitude (Figure 2.2). In contrast, estimated richness for the summer season was highest in a large swath extending from the northeastern to south-central portion of the United States, with lower richness in the far north and western regions of the study area (Figure 2.3).

Table 2.2. Summary of variable contributions to model fits for bioclimatic envelope models (BEMs) and climate-richness models (CRMs). Contributions for individual bioclimatic envelope models were averaged across all species. The most important variables are in bold.

	Winter Models Variable Contribution (%)		**Summer Models Variable Contribution (%)**	
Predictor	**BEM average**	**CRM**	**BEM average**	**CRM**
Annual mean temperature	**25.0**	**11.7**	**13.0**	**7.0**
Mean diurnal range in temperature	4.5	1.6	6.1	**10.8**
Isothermality (diurnal range/annual range)	5.4	1.1	**10.4**	5.9
Maximum temperature of warmest month	1.7	0.6	**6.7**	5.5
Minimum temperature of coldest month	**7.7**	**17.0**	5.0	2.1
Temperature annual range	6.7	2.4	4.6	4.7
Mean temperature of wettest quarter	1.5	0.5	4.6	2.4
Mean temperature of driest quarter	0.5	1.4	4.5	2.8
Mean temperature of warmest quarter	5.5	1.0	6.2	**11.7**
Mean temperature of coldest quarter	**18.1**	**38.5**	5.5	2.4
Annual precipitation	3	0.7	**6.7**	**26.2**
Precipitation of wettest month	0.3	0.4	3.3	1.7
Precipitation of driest month	0.2	0.2	1.4	0.8
Precipitation of wettest quarter	0.3	0.3	3.5	2.4
Precipitation of driest quarter	2.4	0.2	3.6	3.1
Precipitation of warmest quarter	**11.7**	0.8	5.6	3.1
Precipitation of coldest quarter	1.4	0.4	5.0	4.5
Number of survey hours	4.1	**21.2**	-	-
Julian date	-	-	4.3	2.9

CRMs were built using boosted regression trees based on a Poisson distribution with a learning rate = 0.01 and tree complexity = 5. Models were built using bird data for the survey periods 2000–2009 for winter (N=19259 training records) and summer (N=25081 training records). See Appendix 1 for data used to build individual species BEMs.

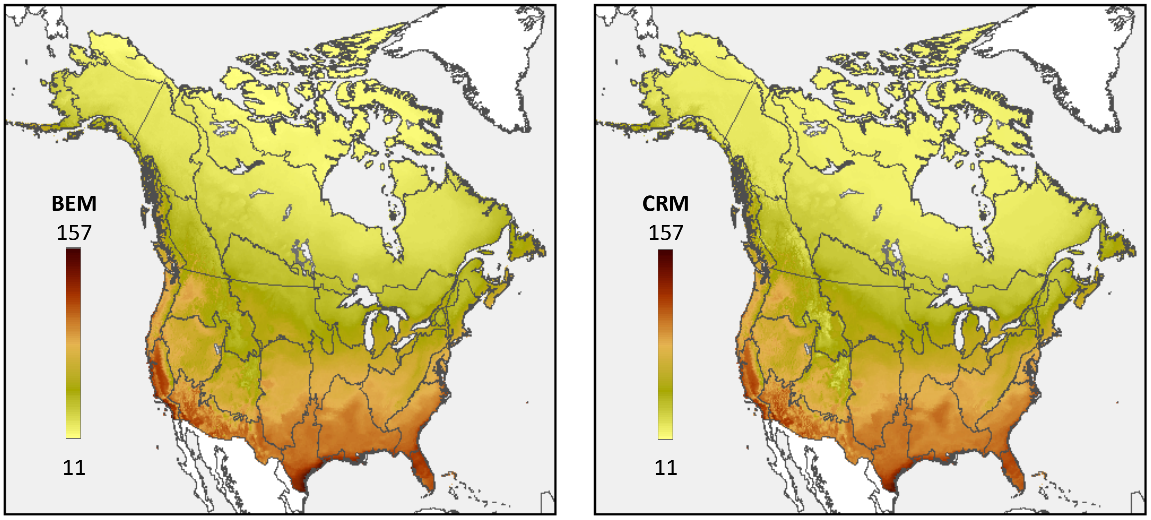


Figure 2.2. Estimated species richness for the winter season in the United States and Canada (2000-2009). Estimates are based on models built using Audubon Christmas Bird Count data using boosted regression trees. Species richness was estimated by summing 543 individual species-specific bioclimatic envelope models (BEM) and directly through a climate-richness model (CRM). Dark grey outlines represent Landscape Conservation Cooperative boundaries.

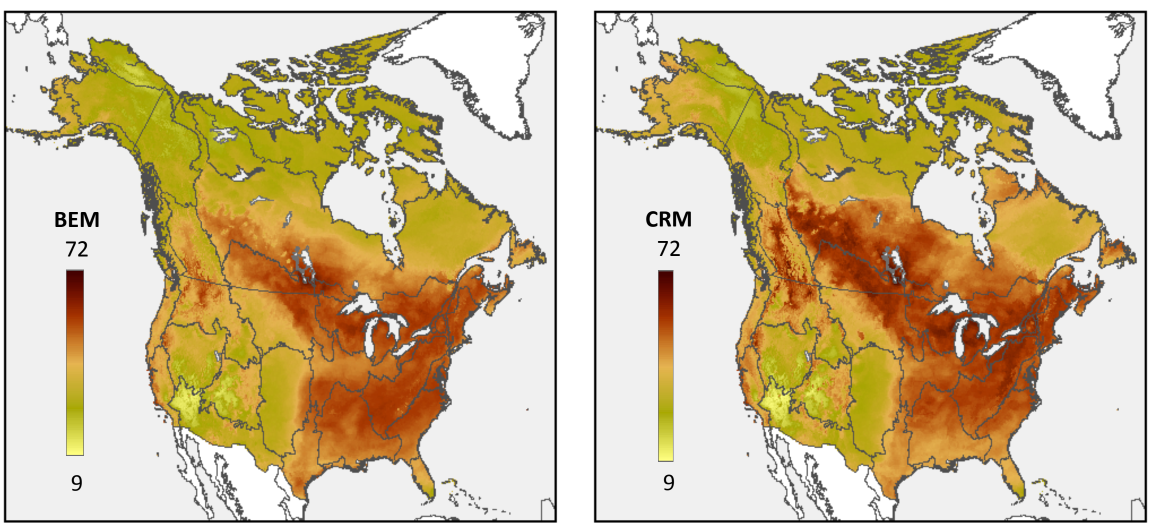


Figure 2.3. Estimated species richness for the summer season in the United States and Canada (2000-2009). Estimates are based on models built using North American Breeding Bird Survey data using boosted regression trees. Species richness was estimated by summing 508 individual species-specific bioclimatic envelope models (BEM) and directly through a climate-richness model (CRM). Dark grey outlines represent Landscape Conservation Cooperative boundaries.

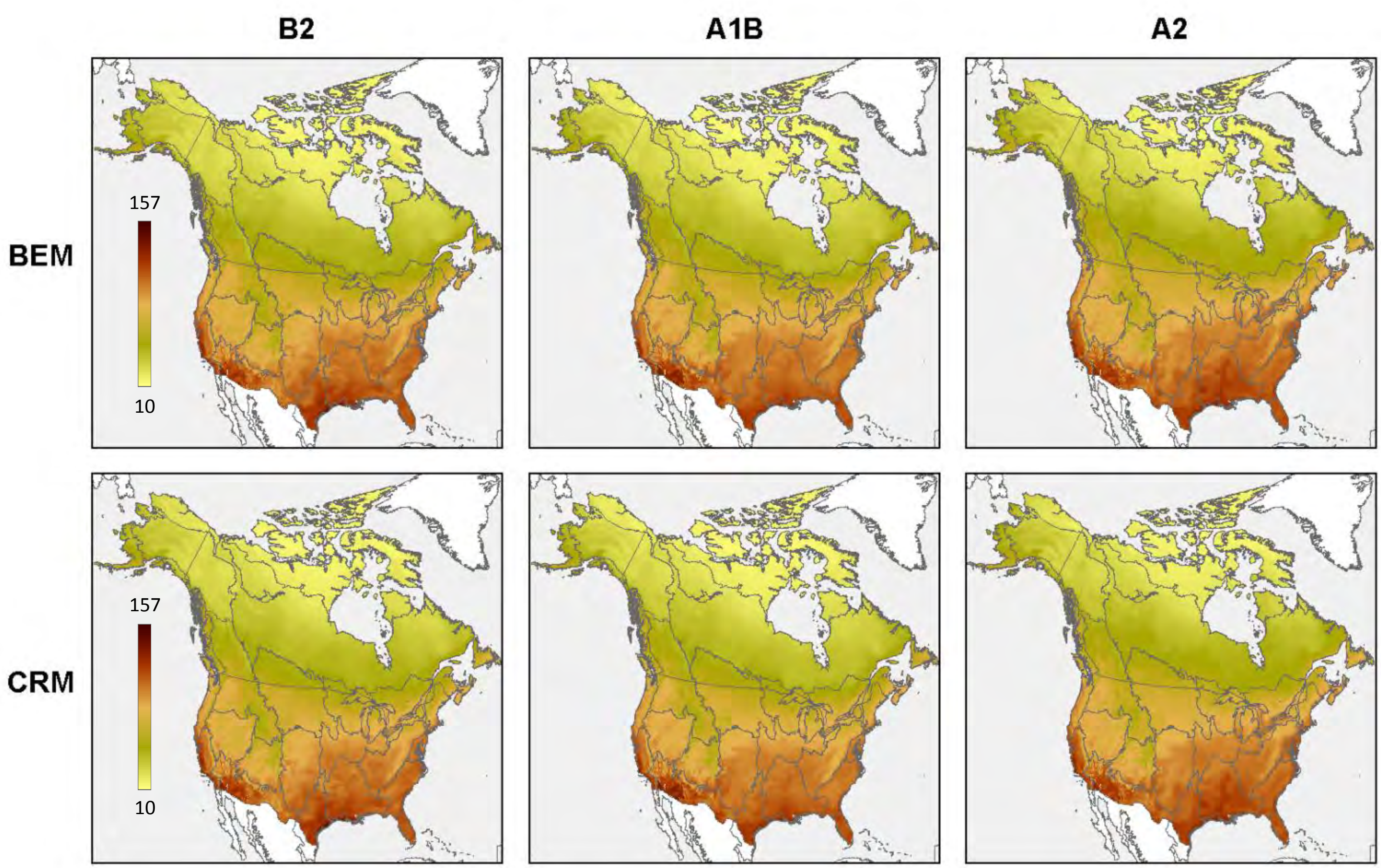


Figure 2.4. Estimated future species richness for the winter season in the United States and Canada (2080). Estimates are based on models built using Audubon Christmas Bird Count data using boosted regression trees. Species richness was estimated by summing 543 individual species-specific bioclimatic envelope models (BEM) and directly through a climate-richness models(CRM). Dark grey outlines represent Landscape Conservation Cooperative boundaries.

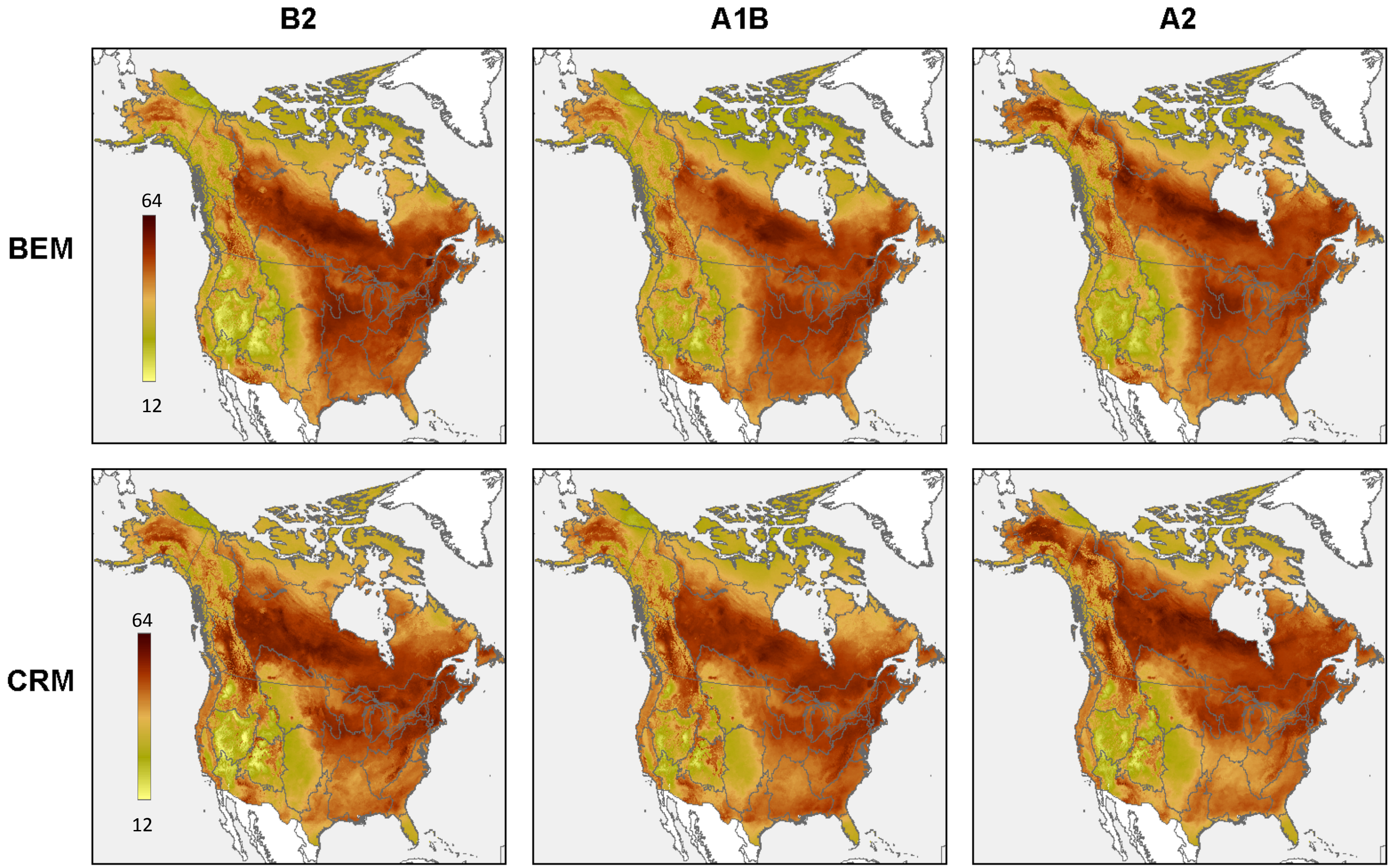


Figure 2.5. Estimated future species richness for the summer season in the United States and Canada (2080). Estimates are based on models built using Breeding Bird Survey data using boosted regression trees. Species richness was estimated by summing 508 individual species-specific bioclimatic envelope models (BEM) and directly through a climate-richness model (CRM). Dark grey outlines represent Landscape Conservation Cooperative boundaries.

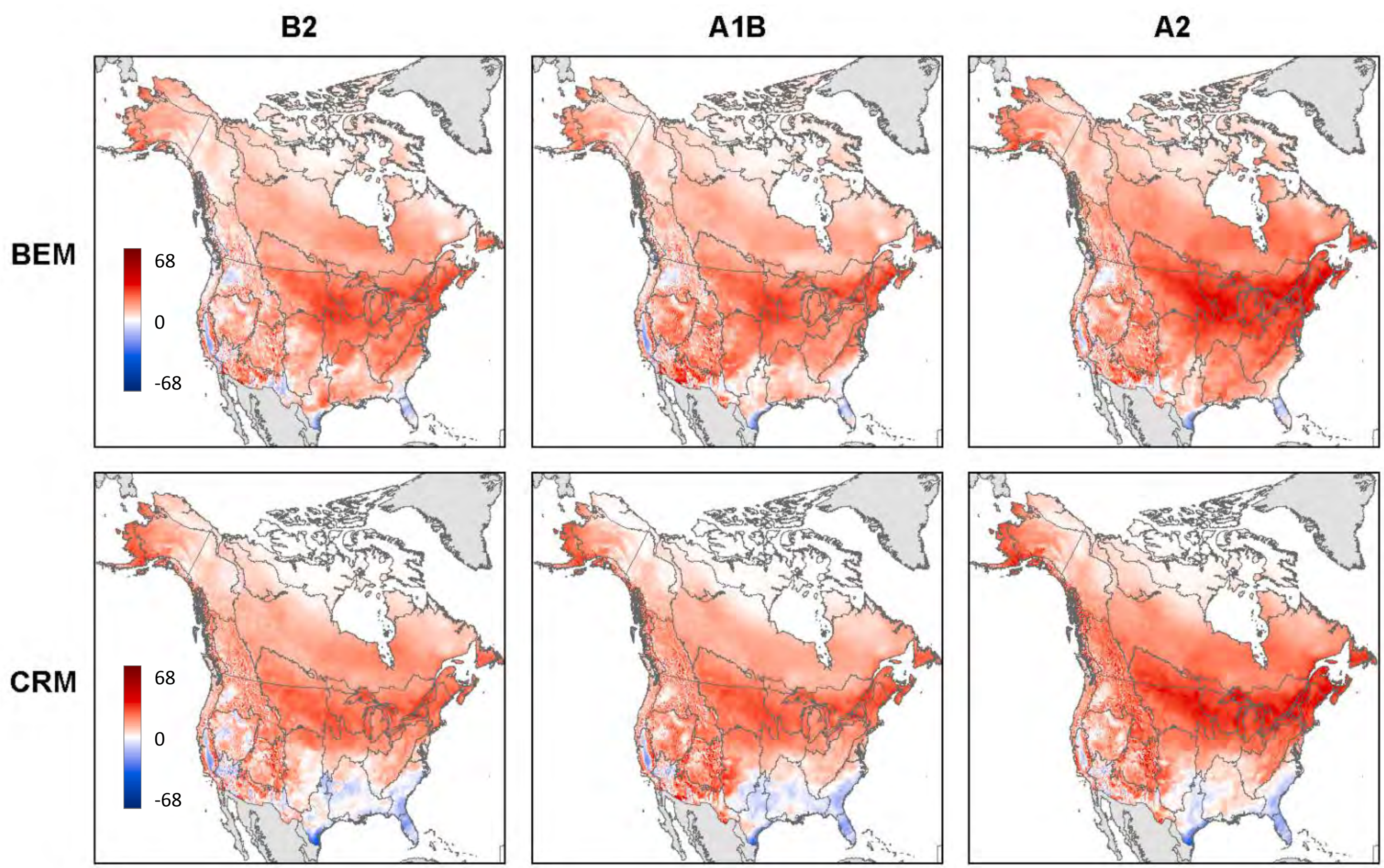


Figure 2.6. Predicted changes in species richness from the current time (2000s) to the future (2080s) for the winter season in the United States and Canada. Estimates are based on models built with Audubon Christmas Bird Count data using boosted regression trees projected to three future emissions scenarios: low emissions (B2), moderate emissions (A1B), and high emissions (A2). Species richness was estimated by summing 543 individual species-specific bioclimatic envelope models (BEM) and directly through a climate-richness model (CRM). Red values show an increase in richness, white values no change, and blue values a decrease in richness. Dark grey outlines represent Landscape Conservation Cooperative boundaries.

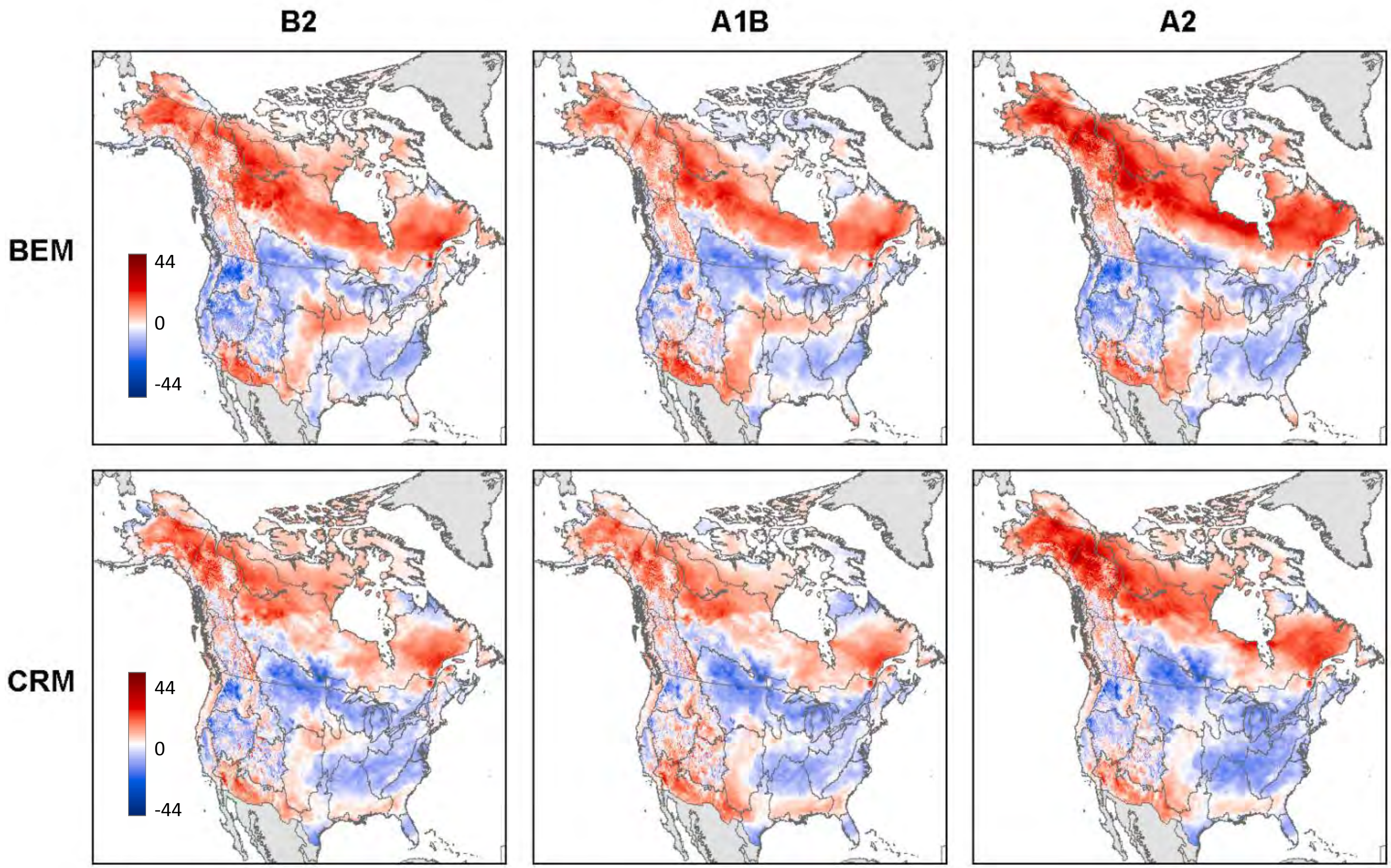


Figure 2.7. Predicted changes in species richness from the current time (2000s) to the future (2080s) for the summer season in the United States and Canada. Estimates are based on models built with North American Breeding Bird Survey data using boosted regression trees projected to three future emissions scenarios: low emissions (B2), moderate emissions (A1B), and high emissions (A2). Species richness was estimated by summing 508 individual species-specific bioclimatic envelope models (BEM) and directly through a climate-richness model (CRM). Red values show an increase in richness, white values no change, and blue values a decrease in richness. Dark grey outlines represent Landscape Conservation Cooperative boundaries

Table 2.3. Model selection table describing relative support for random effects models used to characterize variation in species richness changes between 2000 and 2080.

Variance Components	df	logLik	AICc	ΔAICc	weight
model type, season, LCC, scenario	6	-421694.10	843400.20	0.00	1
season, LCC, scenario	5	-421842.75	843695.51	295.31	0
model type, season, LCC	5	-422735.74	845481.48	2081.28	0
season, LCC	4	-422881.77	845771.55	2371.35	0
model type, season, scenario	5	-431325.94	862661.88	19261.68	0
season, scenario	4	-431467.69	862943.38	19543.18	0
model type, season	4	-432212.21	864432.42	21032.22	0
season	3	-432352.44	864710.87	21310.68	0
model type, LCC, scenario	5	-437952.82	875915.65	32515.45	0
LCC, scenario	4	-438065.67	876139.35	32739.15	0
model type, LCC	4	-438746.94	877501.87	34101.68	0
LCC	3	-438858.23	877722.46	34322.26	0
model type, scenario	4	-445472.02	890952.04	47551.84	0
scenario	3	-445583.27	891172.53	47772.33	0
model type	3	-446170.96	892347.91	48947.71	0

Table 2.4. Variance component estimates of change in species richness between 2000 and 2080. All estimates are derived from the top model in the model selection table (Table 2.3).

Grouping Variable	Variance	SE	Proportion Total Variance
LCC	19.418	4.407	0.178
scenario	1.706	1.306	0.016
season	21.987	4.689	0.201
model type	0.329	0.574	0.003
Residual	65.950	8.121	0.603

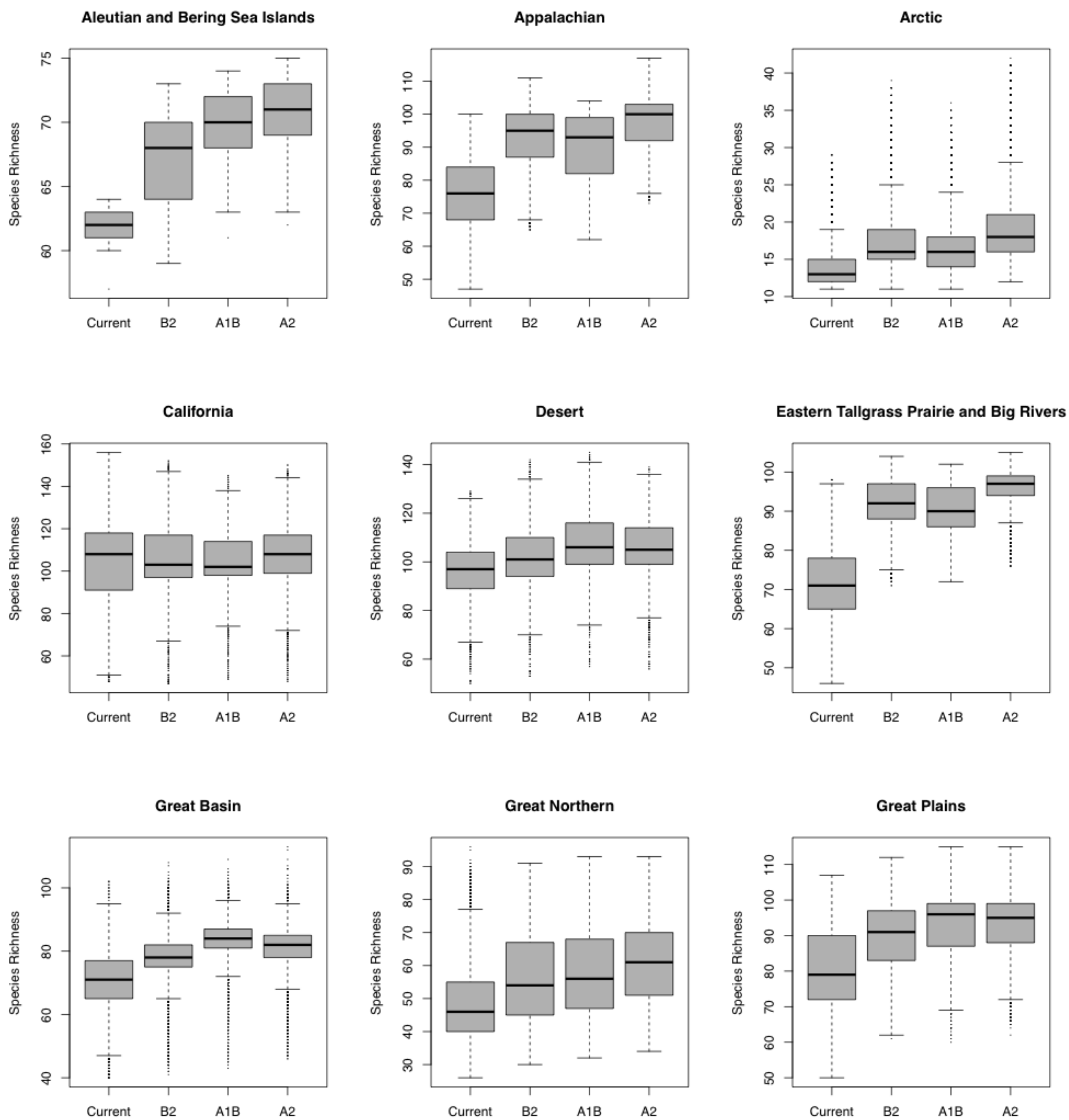
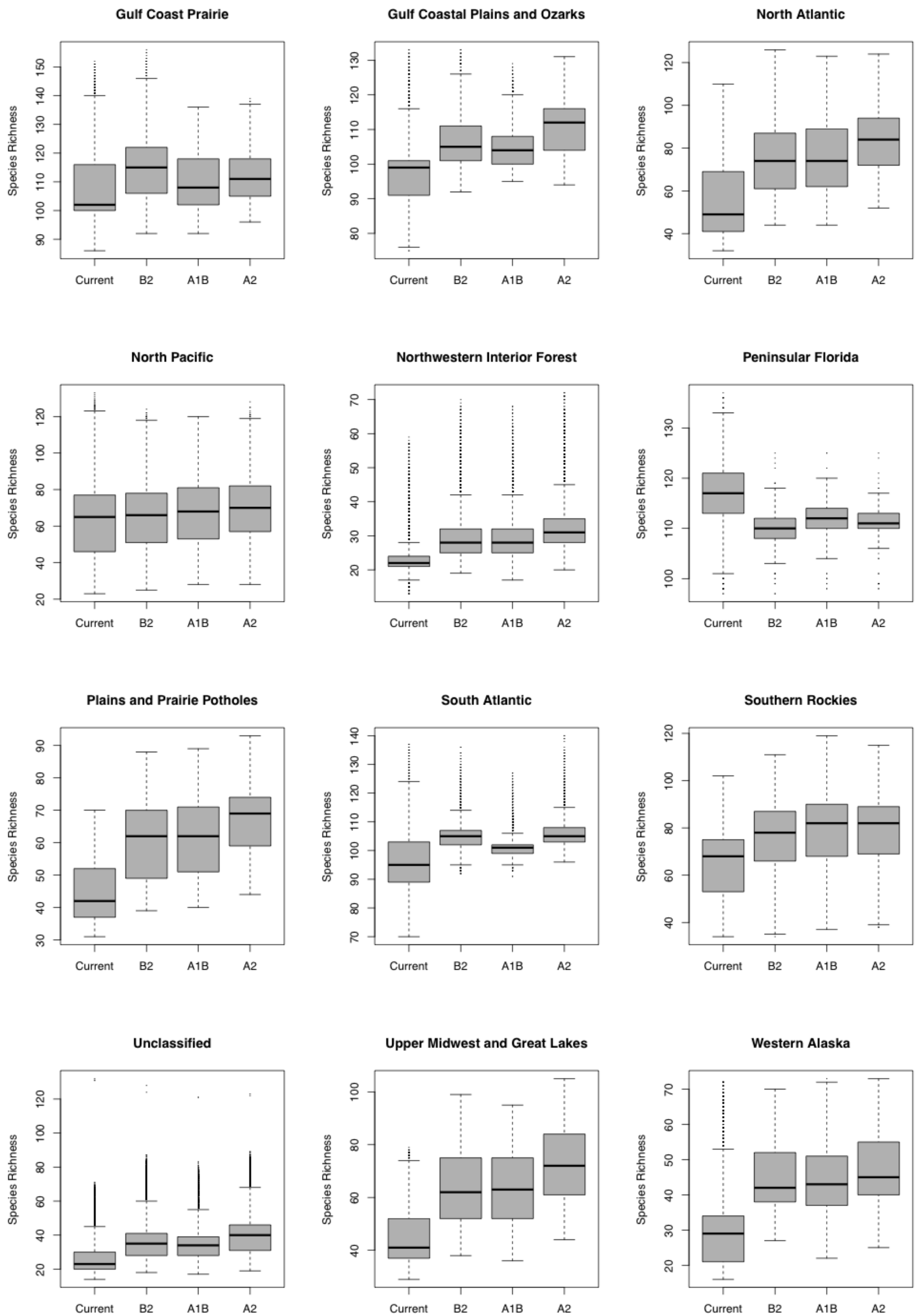


Figure 2.8. Boxplot graphs of predicted changes in species richness within Landscape Conservation Cooperatives from the current time (2000s) to the future (2080s) for the winter season in North America based on models built using Audubon Christmas Bird Count data and boosted regression trees projected to three future emissions scenarios: low (B2), moderate (A1B), and high (A2). Species richness was estimated by summing 543 individual species-specific bioclimatic envelope models. Bands on the boxplots represent the following values for estimated species richness: minimum, lower quartile, median, upper quartile, and maximum

Figure 2.8 (continued)



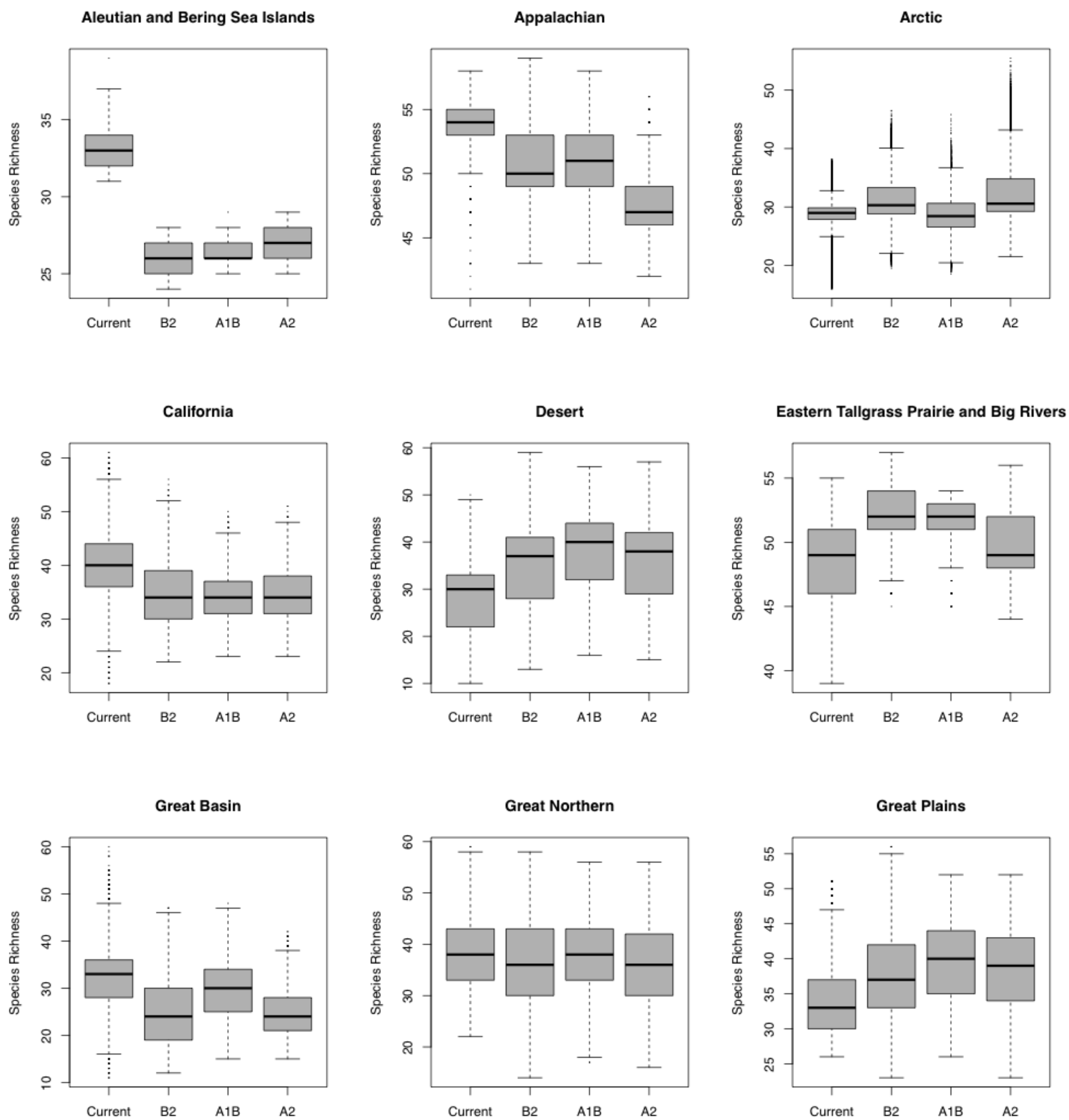
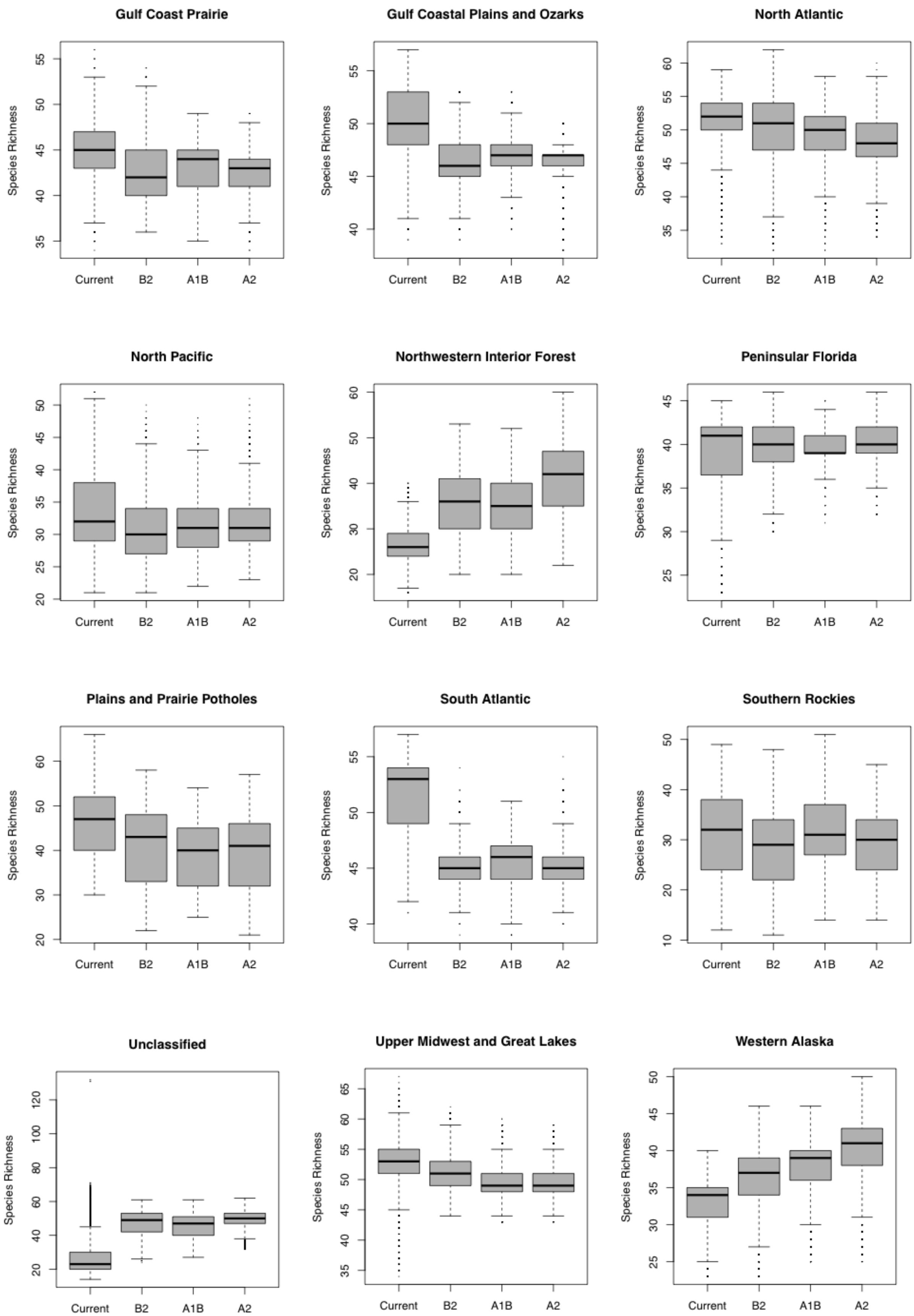


Figure 2.9. Boxplot graphs of predicted changes in species richness within Landscape Conservation Cooperatives from the current time (2000s) to the future (2080s) for the summer season in North America based on models built using North American Breeding Bird Survey data and boosted regression trees projected to three future emissions scenarios: low (B2), moderate (A1B), and high (A2). Species richness was estimated by summing 508 individual species-specific bioclimatic envelope models. Bands on the boxplots represent the following values for estimated species richness: minimum, lower quartile, median, upper quartile, and maximum

Figure 2.9 (continued).



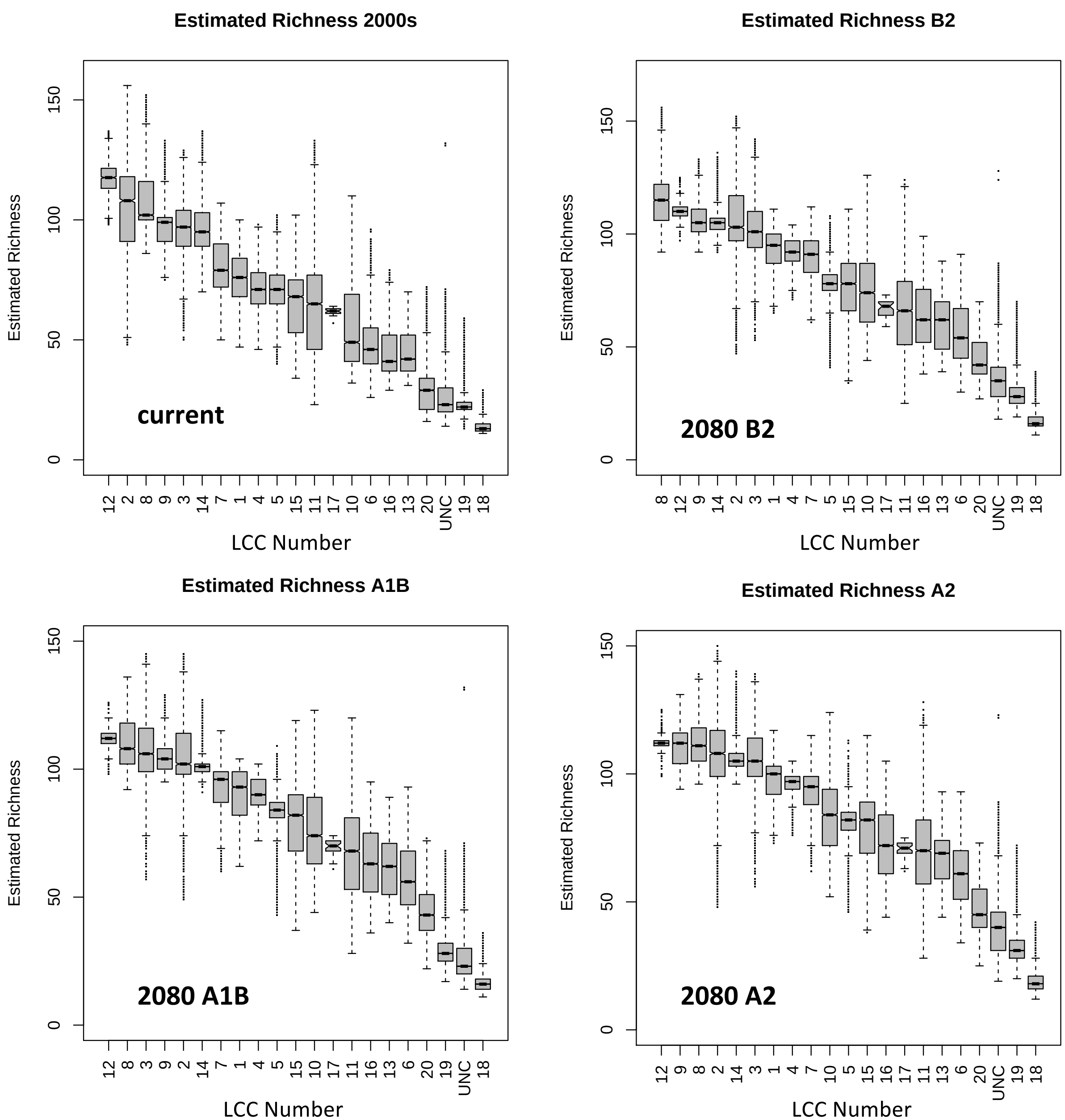


Figure 2.10. Species richness for winter bird communities in current and 2080 time periods by emissions scenario and Landscape Conservation Cooperative. Each point represents the value derived from a 10 x 10 km pixel within each of the Landscape Conservation Cooperatives using summed predictions from single-species bioclimatic envelope models. Notches on the boxplots represent the following values for estimated species richness: minimum, lower quartile, median, upper quartile, and maximum.

1. Appalachia
2. California
3. Desert
4. Eastern Tallgrass Prairie and Big Rivers
5. Great Basin
6. Great Northern
7. Great Plains
8. Gulf Coast Prairie
9. Gulf Coast Plains and Ozarks
10. North Atlantic
11. North Pacific
12. Peninsular Florida
13. Plains and Prairie Potholes
14. South Atlantic
15. Southern Rockies
16. Upper Midwest and Great Lakes
17. Aleutian and Bering Sea Islands
18. Arctic
19. Northwestern Interior Forest
20. Western Alaska

UNC-Unclassified

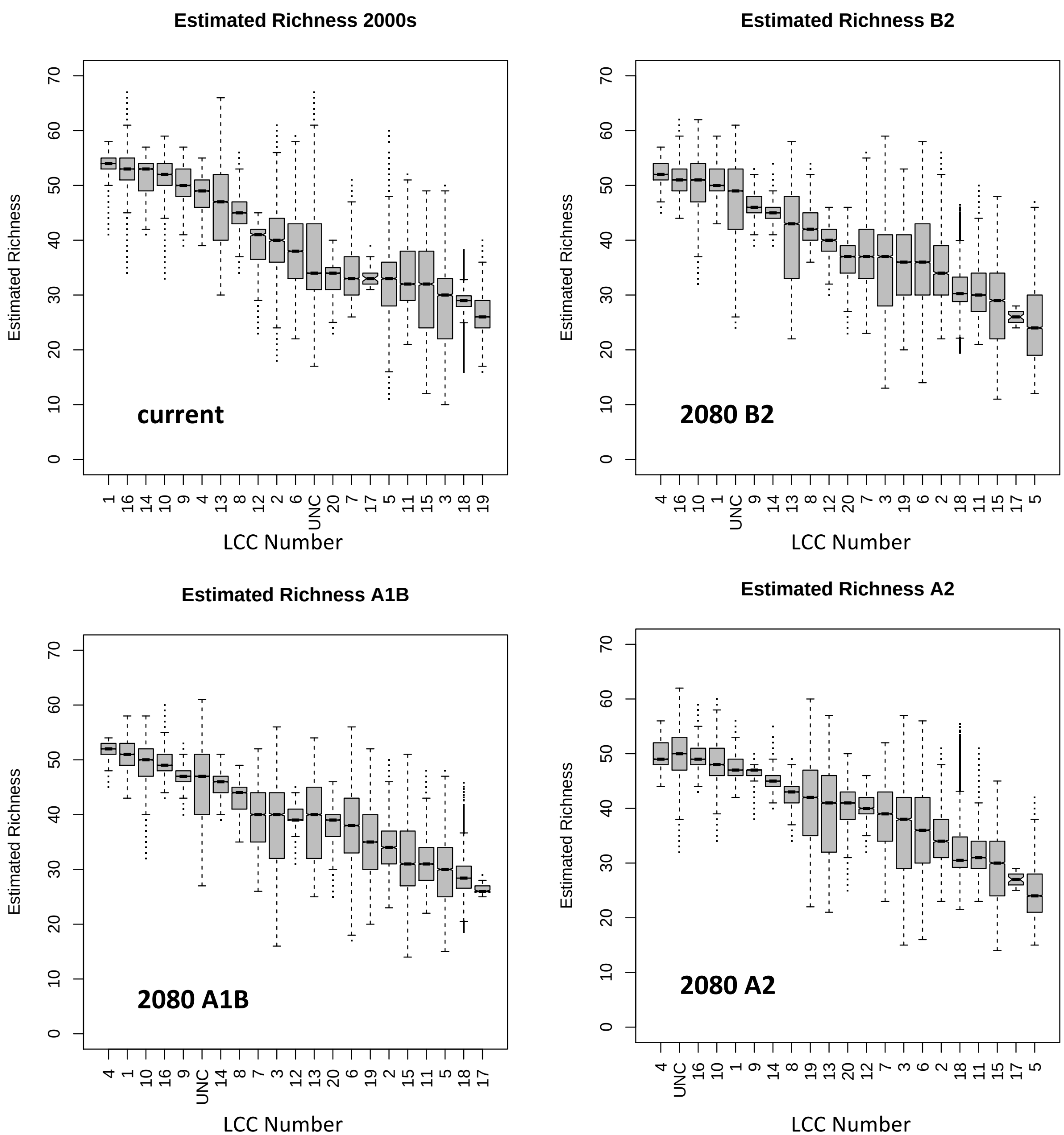


Figure 2.11. Species richness for summer bird communities in current and 2080 time periods by emissions scenario and Landscape Conservation Cooperative. Each point represents the value derived from a 10 x 10 km pixel within each of the Landscape Conservation Cooperatives using summed predictions from single-species bioclimatic envelope models. Notches on the boxplots represent the following values for estimated species richness: minimum, lower quartile, median, upper quartile, and maximum.

1. Appalachia
2. California
3. Desert
4. Eastern Tallgrass Prairie and Big Rivers
5. Great Basin
6. Great Northern
7. Great Plains
8. Gulf Coast Prairie
9. Gulf Coast Plains and Ozarks
10. North Atlantic
11. North Pacific
12. Peninsular Florida
13. Plains and Prairie Potholes
14. South Atlantic
15. Southern Rockies
16. Upper Midwest and Great Lakes
17. Aleutian and Bering Sea Islands
18. Arctic
19. Northwestern Interior Forest
20. Western Alaska

UNC-Unclassified

Future patterns of species richness

The model containing random effects for geography (i.e., LCC), season, scenario, and model type outperformed all others with respect to explaining variation in species richness changes between 2000 and 2080 (Table 2.3). Variance in change values could be attributed to differences between seasons and across LCCs, 20.1% and 17.8% of the total variance, respectively (Table 2.4). Relatively little of the total variance in change values could be attributed to differences among emissions scenarios (1.6%), and essentially none of it could be attributed to differences in the two modeling approaches (0.3%) suggesting that they produce nearly equivalent richness predictions. Approximately 60.3% of the variance could not be attributed to LCCs, seasons, scenarios, or models.

Visual inspection of maps provided complementary information about patterns of change in species richness. Predictions for winter bird communities suggest increasing richness with increasing latitude and altitude throughout most of the central and northern portions of the conterminous United States, western Alaska, and the lower Canadian provinces (Figure 2.6). In contrast, for the summer season, changes in richness were more patchily distributed and decreases in richness were predicted for much of the United States where species richness is currently estimated to be highest (Figure 2.7). Summer species richness is expected to increase in the Canadian provinces, central Alaska, and along a belt in the southwestern United States that includes southeastern California, Arizona, New Mexico, and western Texas. Predicted changes in richness differed markedly between seasons, as suggested in Table 2.4, with three noteworthy exceptions; richness is predicted to decrease in central Florida, southeastern Texas, and California's Central Valley, regardless of season, future emissions scenario, or modeling method employed (Figures 2.6 & 2.7).

We summarized predicted species richness for the current time period and three future emissions scenarios (i.e., B2, A1B, A2) for each Landscape Conservation Cooperative (LCC), for both seasons, using boxplot graphs (Figures 2.8 and 2.9), in an effort to illustrate the potential benefits of mitigation within LCCs and to inform conservation planning at the regional scale.

Discussion

Our results suggest that, in the winter season, bird species richness will increase from 2000 to 2080 with increasing latitude and altitude across much of the United States and Canada. This pattern is consistent with documented responses to recent climate change (Parmesan, 2006; Hitch & Leberg, 2007), but contrasts starkly with predicted changes in richness for the summer season. We anticipate that species richness will decrease over much of the United States and Canada during the summer, indicating climate-induced restriction in the distributions of many breeding birds in the future. These general patterns for winter and summer bird communities were supported, with minor exceptions, across emissions scenarios (i.e., B2, A1B, A2) and modeling approaches (i.e., summed BEMs and CRMs).

We have greater confidence in predictions about the future of winter richness versus summer richness based on predictive performance of individual BEMs and validation of richness estimates with historical data. When we compared species richness predictions from our models with historical records, correlations for the winter season (BEMs: Pearson's r =92.5; CRM: percent deviance explained = 84.0) were higher than those for the summer season (BEMs: Pearson's r = 60.7; CRM: percent deviance explained = 40.8). The difference in predictive power of winter and summer models may reflect methodological differences in how data were collected for the CBC and BBS, with the CBC survey design better revealing relationships between bird occurrence data and climate variables. It is also possible that more direct measures of energy and productivity (e.g., normalized difference vegetation index [NDVI] or potential evapotranspiration) or land cover would significantly improve characterization of species distributions. Alternatively, the difference between seasons may reflect real differences in the degree to which birds are able to track climate change in winter and summer seasons.

At present, other studies do not help us to distinguish the possibilities. Using a standardized survey data set and similar spatial resolution, Evans et al. (2006) found species richness was correlated with climate (temperature) and productivity variables (NDVI) for both winter and summer seasons and that the relationship was stronger for the winter season, a result that mirrors our own. In contrast, Hulbert and Haskell (2003) used CBC and BBS data similar to ours, except that they included only one year of data, and found the relationship between richness and available energy (NDVI) in United States and Canada was similar across seasons despite enormous changes in the geographic pattern of productivity. Thus the nature of the climate-richness relationship between seasons may depend on which mechanisms are most important in limiting the distribution of species within a season (e.g., cold tolerance vs. resource availability). Our results, and those of previous studies, highlight the importance of including seasonality in any predictions of climate change impacts on birds, especially in temperate regions.

An exploration of variable contributions to winter and summer models suggests why there may be very different responses of bird communities to climate change across seasons. For the winter models, minimum temperature variables played a prominent role in explaining bird occurrences. For the summer models, the most important predictor variables were related to warmer temperatures and precipitation. Both of these results are consistent with predictions from the climate/productivity hypothesis, which suggests energy—often measured through temperature or productivity variables—places constraints on richness in areas with cold winter temperatures, or during periods of low plant productivity, whereas water availability becomes more important in areas with warm temperatures and concomitant increased plant productivity (Currie, 1991; O'Brien, 1993; Hawkins et al., 2003; Jetz & Rahbek, 2002).

Changes in patterns of species richness that we expect to occur have important implications for systematic conservation planning. Biodiversity—as measured by species richness—has been, and will be, an important currency with which to establish conservation goals and assess the success or failure of conservation efforts, even while individual species may provide a focal point for management. In the past, conservation planning was often done without regard to potential changes in biodiversity resulting from climate change. Including climate change effects has become an imperative for planning efforts, given the rate at which climate is changing and the rate at which methods are being developed to model potential future distributions (Kujala et al., 2013; Heller & Zavaleta, 2009). The scale and resolution of this study provides information at the landscape level (i.e., LCCs) for assessing which areas are at risk for losing biodiversity, even when we assume that taxa are able to track their climatic niches and are capable of successfully dispersing and colonizing newly suitable areas.

Our results suggest that during the winter season mean species richness will increase in all LCCs except Peninsular Florida (Figure 2.8). Florida may be an exception simply because we did not include birds from the Caribbean, Mexico, and Central America in our analyses, some of which may colonize the southern United States as winter temperatures moderate. For the summer season, four LCCs stand out for their future potential loss in species richness: Appalachian, California, the South Atlantic, and Plains and Prairie Potholes (Figure 2.9). Determining how to prioritize and manage specific areas will inevitably involve the assessment of information that complements our estimates of species richness, including persistence of particular communities, persistence of priority species, potential land use changes, and costs of mitigation or adaptation. We address the persistence of communities and priority taxa in the remaining chapters of this report, and recommend that future work explicitly address the influence of land cover in modeling species distributions and costs of mitigation or adaptation.

Forecasting the effects of climate change on biodiversity within an integrated framework of species distribution modeling and macroecological modeling could greatly improve our estimates of biodiversity for the future (Botkin et al., 2007; Guisan & Rahbek, 2011). It is worth reinforcing that the two modeling approaches we adopted (i.e., summed BEMs and CRMs) provided remarkably similar estimates of future species richness despite being built very differently. The congruence of the resulting predictions suggests species-specific niche processes may not be necessary to model patterns of avian richness for the United States and Canada. Even though the causes of climate-richness relationships for individual taxa may be poorly understood, this lack of understanding may not impede our ability to predict broad scale patterns of diversity for purposes of conservation planning across large landscapes. The use of CRMs may be especially valuable for the many geographic areas (and taxa) where comprehensive long-term datasets with large sample sizes for individual species are unavailable or taxonomies have not been fully characterized.

Conclusion

Previous studies examining the impacts of climate change on bird distributions in the United States and Canada have tended to focus on a single season and have either used a subset of available species (Peterson, 2003; Hitch & Leberg, 2007; Matthews et al., 2011; Stralberg et al., 2009) or coarse occurrence data based on range maps (Jetz et al., 2007; Lawler et al., 2009; Şekercioğlu et al., 2012). This is the first study to simultaneously predict the potential impacts of climate change on avian species in the United States and Canada across seasons, at a relatively fine spatial scale, for nearly all species for which standardized survey data are available. We show that two different modeling approaches and conceptualizations of community assembly yield very similar estimates of species richness in past, present, and future climates. Based on our models, species richness is expected to increase over much of the United States and Canada during the winter season, but not during the summer, and these patterns are largely congruent across future emissions scenarios. One caveat to this conclusion is that range shifts for species that occur south of the United States were not modeled in this study. The predicted decline in species richness in the southern portion of the United States could be misleading if species currently occurring in the Carribean, Mexico, Central America, and South America shift their distributions northward. Future studies on climate change predictions for the United States and Canada would benefit greatly from including additional survey data that cover these geographic regions. Efforts to mitigate consequences of climate change by reducing greenhouse gas emissions are likely to benefit birds throughout most of North America's Landscape Conservation Cooperatives, however, most of the variation in 2080 species richness could be attributed to seasonal and geographic differences rather than differences among emissions scenarios. These results have broad implications for conservation in the United States and Canada and suggest that adaptation strategies are sorely needed that account for seasonal and geographic differences in responses of birds to climate change.

Chapter 3: Identifying Climate Refugia for Bird Communities in the United States and Canada

Summary

In Chapter 2, we characterized changes in species richness between 2000 and 2080 using two methods and conceptualizations of community assembly. In both cases, we made the optimistic assumption that all taxa could—and would—colonize geographic areas that become climatically suitable in the future. We ignored potential complications associated with colonization of areas outside of current ranges and disruption of biotic interactions that shape current distributions. To bracket our optimistic assumptions from Chapter 2 with more conservative assumptions, here we develop a complementary approach in which we identify *in situ* refugia for winter and summer communities of birds in the United States and Canada. Our analysis allows for characterization of locations throughout the continent that we expect to remain climatically suitable across time and emissions scenarios for species and communities. We show that the highest numbers of overlapping refugia persist in areas of high current species richness during both winter and summer seasons. When we accounted for variation in current richness—to examine how the integrity of existing communities may erode over time—we detected marked variation in community erosion across space, and especially, time. In both winter and summer, bird communities in the western United States and southern Canada are much less certain to remain intact than communities in the Midwest and parts of the Great Plains. The similarity in spatial distribution of community refugia across seasons pales in comparison to the overall difference in community integrity between seasons and across time periods. Over most of the continent, winter communities are much more likely to remain intact across time periods and emissions scenarios than summer communities and both show marked erosion by 2080. Relatively little of the variation in our community refugia predictions could be attributed to emissions scenarios, though the benefits of mitigation become clear by 2080 with the low (B2) emissions scenario fostering the persistence of approximately 13.0-13.9% more species than the high (A2) emissions scenario. Accommodating seasonal differences and change through time will require flexible approaches to conservation planning and will potentially involve trading off prioritization of wintering and breeding species.

Introduction

There is a large, and growing, body of evidence to show that species and communities across the planet have responded to historical climate change (Walther et al., 2002; Root et al., 2002; Parmesan & Yohe, 2003; Parmesan, 2006). As the pace of climate change accelerates (Loarie et al., 2009), it is increasingly important that we develop methods for predicting species responses to climate change and implement conservation strategies that balance anticipated risks and opportunities. Bioclimatic envelope models are commonly used to characterize relationships between bioclimatic variables and species occurrence data, and to project those relationships into geographic space. When predicting how species will respond to future climate change, researchers typically rely on several assumptions: 1) bioclimatic niches are important determinants of geographic distributions, 2) niches are conservative and do not change, and 3) species are capable of tracking their niche through space and time (Lavergne et al., 2010; Wiens et al., 2010). Other factors may severely limit the degree to which a species tracks its bioclimatic niche, however, including dispersal constraints (Midgley et al., 2006; Polechova et al., 2009) and interactions with other species (Araújo and Luoto, 2007, Tylianakis et al., 2008).

Dispersal into newly suitable areas may be constrained by a species' ability to survey a climatic landscape that is shifting over potentially large geographic areas (Schloss et al., 2012). While birds are among the most vagile organisms on Earth, and are known for feats of movement and migration (Berthold et al., 2003), there may be constraints on their ability to find and colonize climatically suitable areas outside of their current range. Many species show strong site fidelity (Hoover, 2003), follow ancestral migration routes (Ruegg and Smith, 2002), and possess a variety of mechanisms that predispose them to remaining in areas they have previously occupied (Cochran et al., 2004). In fact, in a recent study, long-distance migrants appeared less likely to track geographic shifts in climate than short-distance migrants or resident species (Tingley et al., 2012), counter to *a priori* expectation.

Biotic interactions are also thought to play an important role in shaping the distributions of some species, but are rarely captured explicitly within bioclimatic models (but see Stralberg et al., 2009; Matthews et al., 2011). This may pose serious problems for species distributions models that are generated from climate information alone, especially if characterisitcs of species interactions shift in response to climate change (Van der Putten et al., 2010; Berg et al., 2010; Yang and Rudolph, 2010). For example, novel assemblages of predators and competitors may directly or indirectly influence the suitability of a species range (Tylianakis et al., 2008). In additon, mutualistic interactions may be compromised as one or more of the species in a mutualism goes extinct, shifts its range in space or time, or changes its relationship with other species in the mutualism (Kiers et al., 2010).

To avoid overestimating responsiveness of birds to future climate shifts, we search across time and space for *in situ* climate refugia (Ashcroft, 2010), areas that are predicted to remain stable and climatically suitable for a species across time. Because these refugia are nested within the current ranges of species, we assume that dispersal will not limit their future use. We also assume that biotic interactions on which species depend are more likely to be maintained inside refugia than outside.

Together, these assumptions help us to generate a conservative picture of future species assemblages, one that complements our previous modeling efforts in which we allowed perfect tracking of bioclimatic niches through space and time. Here, we use models describing the ranges of 543 winter species and 508 summer species to characterize the geographic distributions of species refugia throughout the United States and Canada. We also use them to characterize community refugia for existing species assemblages after accounting for geographic variation in species richness.

Methods

Models

We describe in detail the methods used to generate and project individual bioclimatic envelope models (BEMs) to current and future time periods in Chapter 1. We generated BEMs for all species for which we had adequate data using boosted regression trees. We used bird observations for 2000-2009 from the Audubon Christmas Bird Count (CBC) and North American Breeding Bird Survey (BBS) data to characterize relationships between bioclimatic variables and occurrence data. To illustrate relationships in a geographic context, we made predictions into a current climate space (2000-2009) that covered the whole of the conterminous United States, Canada, and Alaska. Descriptions of future distributions were generated by projecting BEMs into future climate spaces that reflected 13 different combinations of emissions scenarios and Global Circulation Models (GCMs) (low emissions [B2]: 2 GCMs; moderate emissions [A1B]: 7 GCMs; high emissions [A2]: 4 GCMs). We made predictions for all 13 combinations into each of three future time periods (2020, 2050, 2080). We used consensus forecasting to average our predictions across GCMs within each combination of time interval and emissions scenario and then applied a maximum Kappa threshold to partition distributions into suitable and unsuitable ranges (values of 1 and 0, respectively). As described in Chapter 1, we assessed the predictive ability of models by making projections into historical climates (1979-1999) and comparing those predictions with historical observations. We used the 'pROC' packages in R to generate AUC scores for each species (Appendix 1). Details of our methods, including explanations of thresholding, consensus forecasting, AUC scores, and results of model validation, can be found in Chapter 1 and Appendices 1 and 2.

Identifying refugia for individual species

Refugia are areas that remain consistently suitable for species through time. We identified climate refugia for individual species in winter and summer by aggregating thresholded prediction grids (i.e., grids that describe areas as suitable or unsuitable) for each species and looking for areas that are predicted to remain suitable across time. We estimated refugia across three time periods (2000-2020, 2000-2050, 2000-2080) for each of three emissions scenarios (B2: low emissions, A1B: moderate emissions, A2: high emissions). We assumed, rather conservatively, that these areas can—and will—remain suitable for species within each scenario because they fall within existing species ranges and, thus, do not require successful dispersal and colonization. In addition, they are more likely to preserve complex biotic interactions on which each species relies than areas outside the current range.

We also identified “no regrets” refugia that were predicted to remain suitable regardless of emissions scenario. These “no regrets” sites may be ideal targets for conservation prioritization because they also account for uncertainty in future climates and are likely to remain suitable for individual species under a wide range of possible future scenarios. The Intergovermental Panel on Climate Change has not assigned likelihoods to any of the SRES scenarios (IPCC, 2007). Recent studies have attempted to address the likelihoods of one scenario over another (i.e. Ward et al., 2012), however most studies modeling the effects of climate change on species distributions continue to provide a range of outcomes. The “no regrets” approach we describe, mirrors efforts by Kuala et al. (2013) to identify areas for conservation priority based on each SRES scenario individually, and then compare areas of overlap to best inform management decisions.

Stacked refugia

After identifying refugia for individual taxa, we stacked them on top of each other to generate spatially explicit estimates of biodiversity analogous to species richness maps (i.e., stacked refugia indicate the number of species whose refugia overlap). The number of overlapping refugia can serve as a metric for conservation prioritization at very broad scales if conservation practitioners are interested primarily in conserving existing species rich communities.

Community refugia

Because species richness varies considerably across the United States and Canada during both summer and winter, however, and it was difficult to assess changes in community integrity by visual inspection alone, we also generated maps showing proportional loss of species compared to a 2000-2009 baseline. This was achieved by summing stacked refugia and dividing that sum by current species richness. Resulting values of 1 indicated areas in which all species that currently inhabit an area are expected to persist. Resulting values of 0 indicated areas in which no species are certain to persist because the area is expected to become unsuitable for every species in at least one of the time periods or emissions scenarios being considered. Maps showing proportional “erosion” of communities allow for prioritization of conservation efforts at finer scales by allowing comparisons of anticipated loss while controlling for current species richness. They emphasize community integrity as a metric of prioritization rather than richness.

Note: We also characterized refugia using 1970s species ranges as a baseline but decided against presenting those results because we only had data to build robust models for a subset of taxa.

Variance components analysis of community refugia

We used a variance components analysis to characterize how variation in our community refugia predictions was partitioned among Landscape Conservation Cooperatives, seasons (i.e.,winter, summer), time periods (i.e., 2020, 2050, 2080), and scenarios (i.e., B2, A1B, A2). To generate the dataset, we randomly sampled community refugia values from 10,000 grid cells for each combination of season, time period, and scenario and assigned them to correspoding Landscape Conservation Cooperatives. We did not include predictions from the current time period because they were non-informative (i.e., all communities are "whole" in the current time period and community refugia values are all 1). We did not include "no regrets" criteria in the analysis because those data are confounded across the B2, A1B, and A2 scenarios. We built 15 separate random effects models with all additive combinations of the four random effects (except the null set) and compared models using AICc.

Results

We generated models to describe the winter ranges of 543 species and the summer ranges of 508 species (Appendix 1). We described climate refugia within each species' range that are likely to remain consistently suitable from 2000 through 2020, 2050, and 2080 within scenarios. We also looked for "no regrets" refugia that were expected to remain suitable across all scenarios.

The sizes of "no regrets" refugia relative to current range sizes varied from 0 (i.e., none of the current range is certain to remain climatically suitable) to 1 (i.e., all of the current range is likely to remain climatically suitable) and decreased in size as we made projections further into the future . For winter birds, the median size of "no regrets" refugia is expected to decline from 0.68 in 2020 to 0.59 in 2050 to 0.50 in 2080 suggesting that, over the next 80 years, only half of wintering species will be likely to retain 50% or more of their current ranges (Figure 3.1). The current ranges of summer birds are even less likely to remain climatically suitable in the future. In the summer, the median size of "no regrets" refugia is expected to decline from 0.63 in 2020 to 0.44 in 2050 to 0.26 in 2080 suggesting that, over the next 80 years, only half of summering species will be likely to retain 26% or more of their current ranges (Figure 3.1).

Stacked refugia

We stacked refugia of individual species on top of each other to identify areas where large numbers of taxa are expected to persist within their current ranges. In winter, the pattern mirrored that of current species richness described in Chapter 2, with higher numbers of overlapping refugia occurring at lower latitudes and elevations (Figure 3.2). The Gulf Coast of Texas and Louisiana, the desert Southwest, and the Central Valley of California harbored the largest number of overlapping species refugia whether we looked for safe areas within each scenario or across all scenarios using "no regrets" criteria. As expected, the number of overlapping refugia declined moving forward in time as climate change eroded areas that are currently safe for individual species of wintering birds.

In summer, the pattern of overlapping refugia also approximated the geographic distribution of species richness described in Chapter 2, with refugia accumulating in a broad band across the eastern half of the United States and in south-central Canada (Figure 3.3). Moving forward in time, the highest numbers of overlapping refugia became concentrated in the middle of the United States in eastern Kansas, Missouri, southern Illinois and Indiana, and Kentucky. Again, the geographic distribution of refugia was largely consistent across scenarios. Interestingly, in 2020 and 2050, climate change under the A1B and A2 scenarios preserved summer refugia in most of the continent at levels similar to, or higher than, the B2 scenario. By 2080, however, refugia numbers declined markedly under the A1B and A2 scenarios, especially in the western United States and across much of Canada.

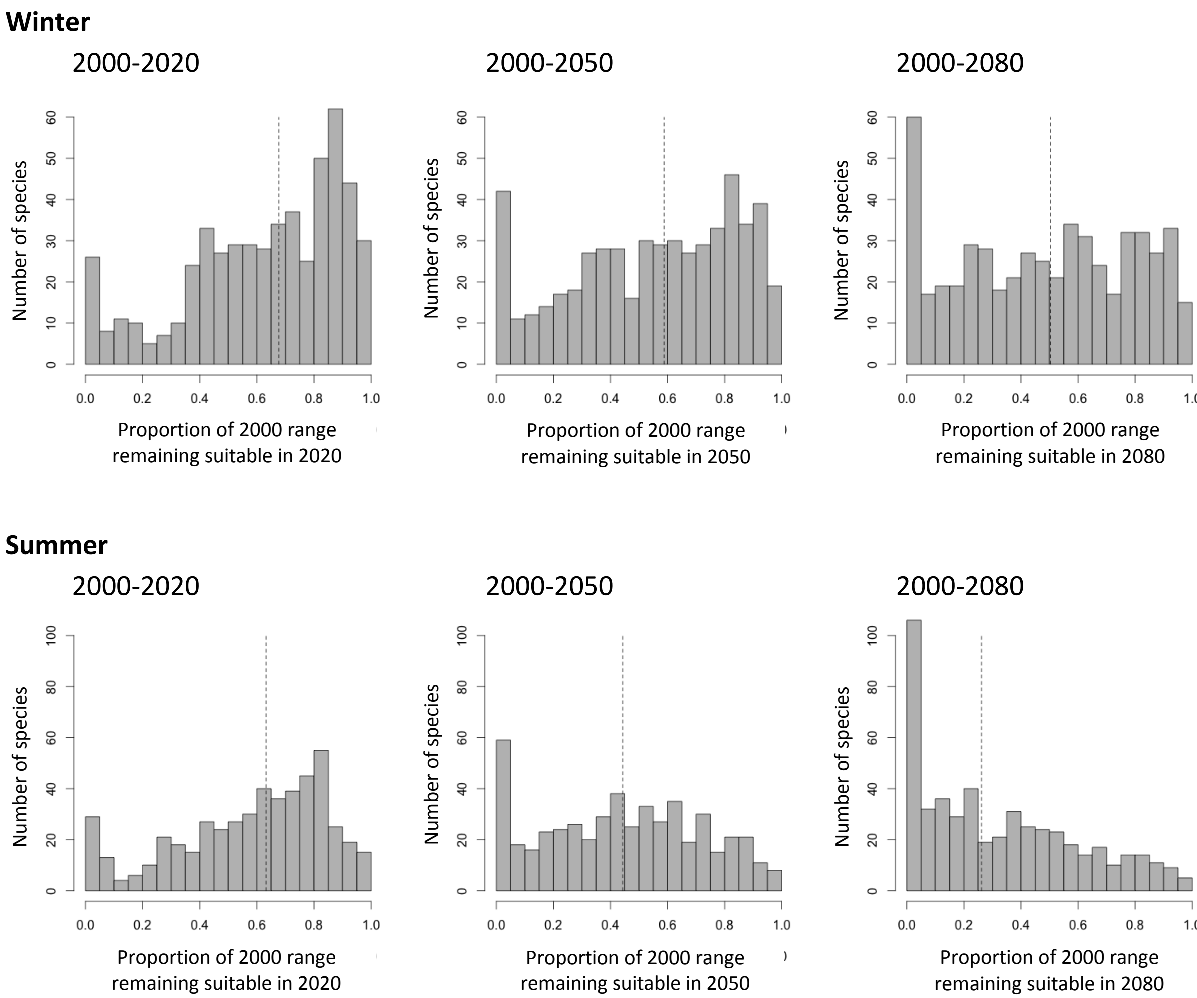


Figure 3.1. Sizes of “no regrets” refugia relative to current range size. Bars show the number of species that share similar refugia sizes. Dashed lines indicate the median size.

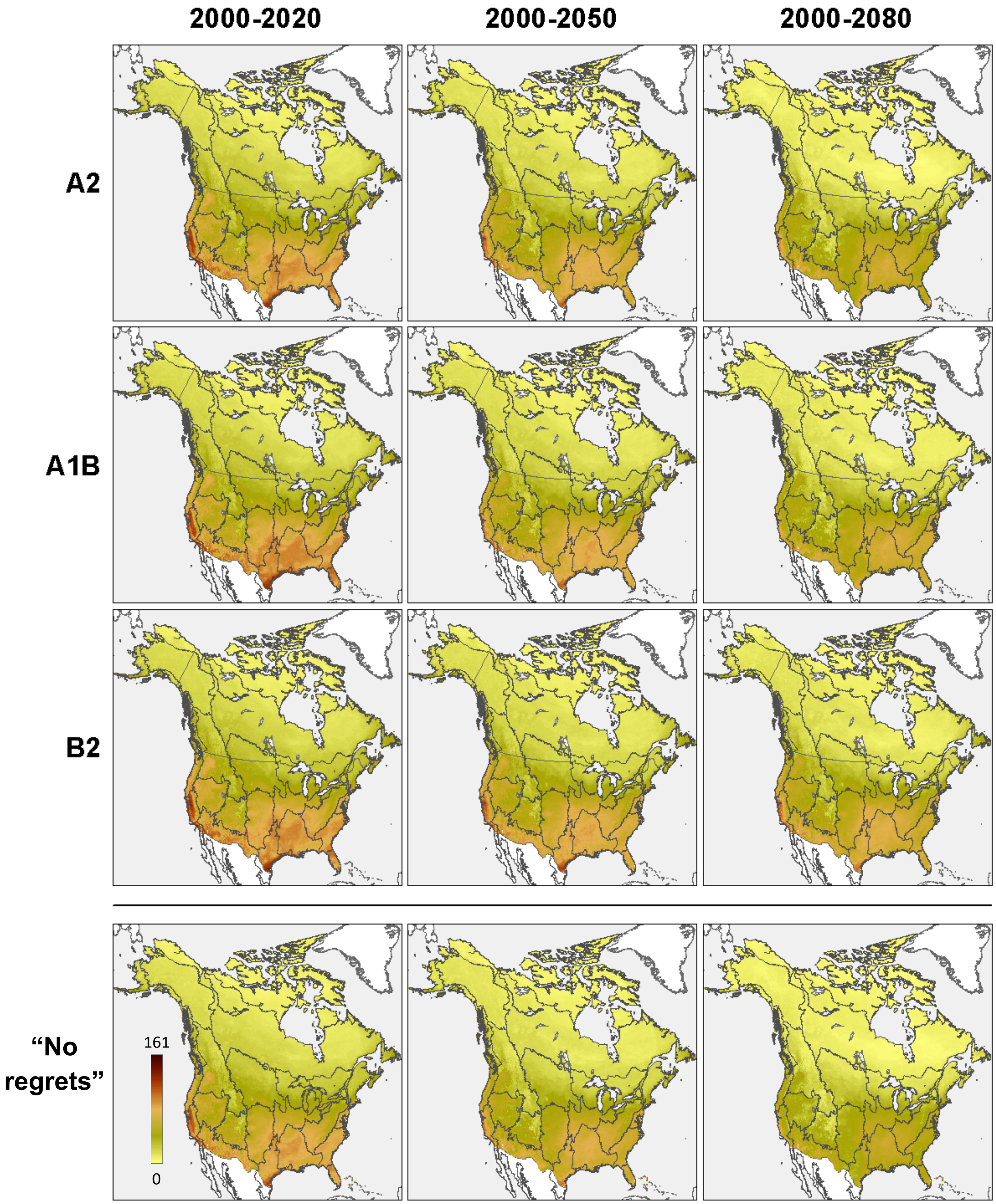


Figure 3.2. Stacked refugia for winter bird species across years and emissions scenarios. The scale indicates the number of species whose refugia overlap.

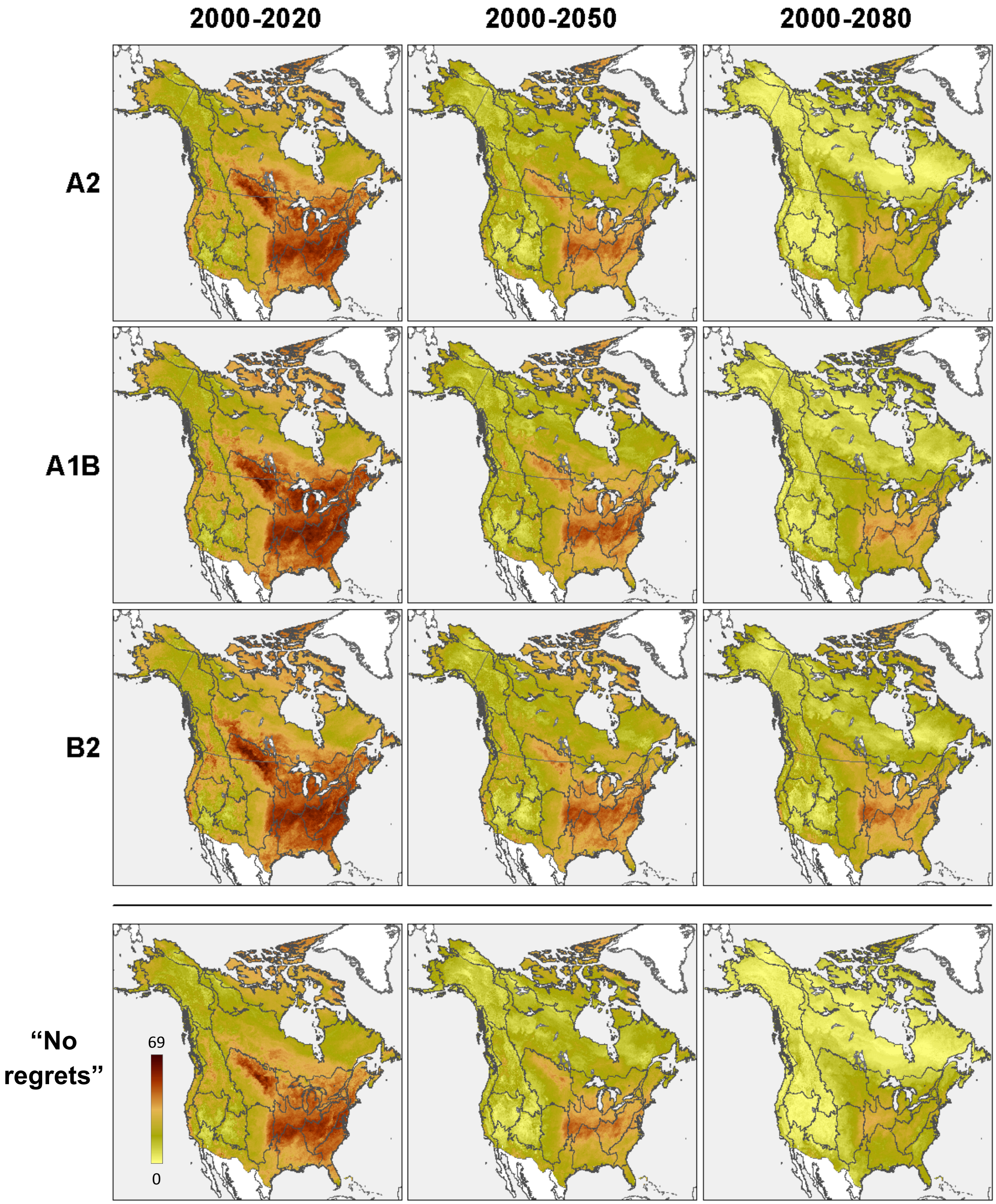


Figure 3.3. Stacked refugia for summer bird species across years and emissions scenarios. The scale indicates the number of species whose refugia overlap.

Community refugia

To identify community refugia, or the degree to which existing communities of birds are likely to remain intact going forward in time, we divided our estimates of stacked refugia by current species richness. By 2020, winter communities are expected to show rather uniform erosion in each of the B2, A1B, and A2 scenarios and across geographic space (Figure 3.4). Moving forward to 2050, existing communities are expected to erode at a greater pace under the A1B and A2 scenarios compared to the B2 scenario, though pockets of relatively high community integrity persist in the south-central United States across all three scenarios. By 2080, distinct changes are expected to appear with increasing erosion of communities occurring from B2 to A1B to A2 scenarios. Bird communities around Hudson Bay, southern Canada, and central Alaska are much less certain to persist intact under the A2 scenario while those along the Pacific Coast of Canada and Alaska seem particularly sensitive under the A1B scenario. Looking across all scenarios at "no regrets" community refugia allows identification of communities that are expected to remain relatively intact regardless of scenario. In winter, "no regrets" areas are located primarily in the northern two-thirds of the eastern United States.

In the summer, we may expect relatively rapid erosion of existing communities across all three scenarios, particularly in the Great Basin and throughout Canada (Figure 3.5). By 2080, the differences among scenarios become more clear. Under the A2 scenario, we have very little confidence that current communities will persist in any way close to their current form, except for in a few areas toward the center of the United States and in the desert southwest of Arizona. Erosion of existing communities is less severe under the A1B and B2 scenarios, particularly in the Great Basin, Alaska, and areas surrounding Hudson Bay. "No regrets" strongholds for existing communities are expected to persist relatively intact in the central United States, including southern Illinois, Iowa, Missouri, Nebraska, and Kansas.

Community refugia in relation to Landscape Conservation Cooperatives

We provide two sets of boxplot summaries of community refugia by Landscape Conservation Cooperative to facilitate development of regional analysis and conservation strategy. The first set of plots shows the proportion of current communities expected to remain intact until 2080 across B2, A1B, and A2 scenarios for each individual Landscape Conservation Cooperative (Figures 3.6 and 3.7). We also show predictions using "no regrets" criteria that emphasize areas likely to remain consistently suitable for communities through time and across scenarios. The second set of plots shows the proportion of current communities expected to remain intact until 2080 across Landscape Conservation Cooperatives for each of the B2, A1B, and A2 scenarios (Figures 3.8 and 3.9). And again, we show "no regrets" predictions for comparison.

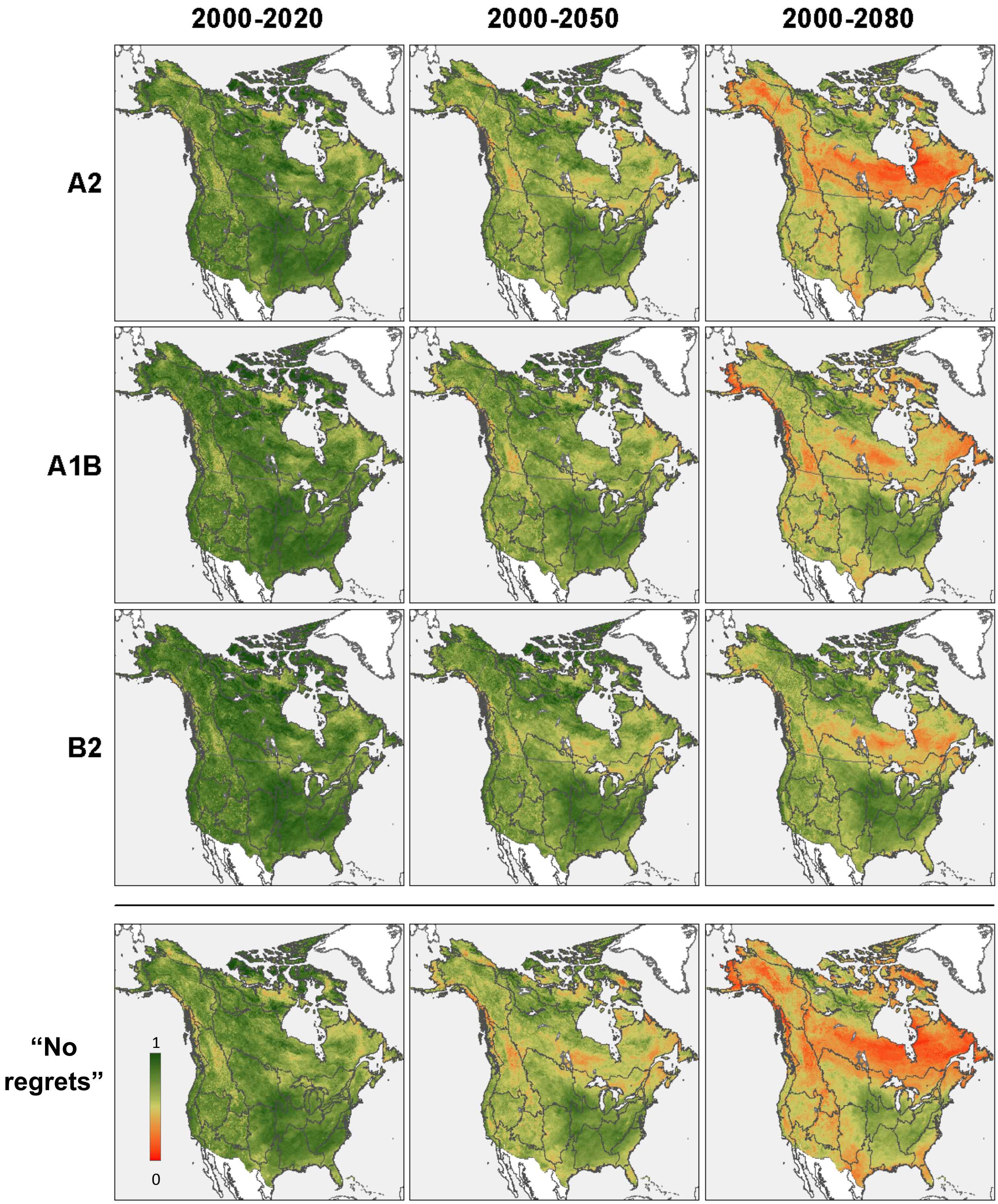


Figure 3.4. Community refugia for winter bird communities across years and emissions scenarios. Values of 1 indicate areas where currently existing communities remain intact over the period of interest. Values of 0 indicate areas where none of the species within currently existing communities are certain to persist over the period of interest.

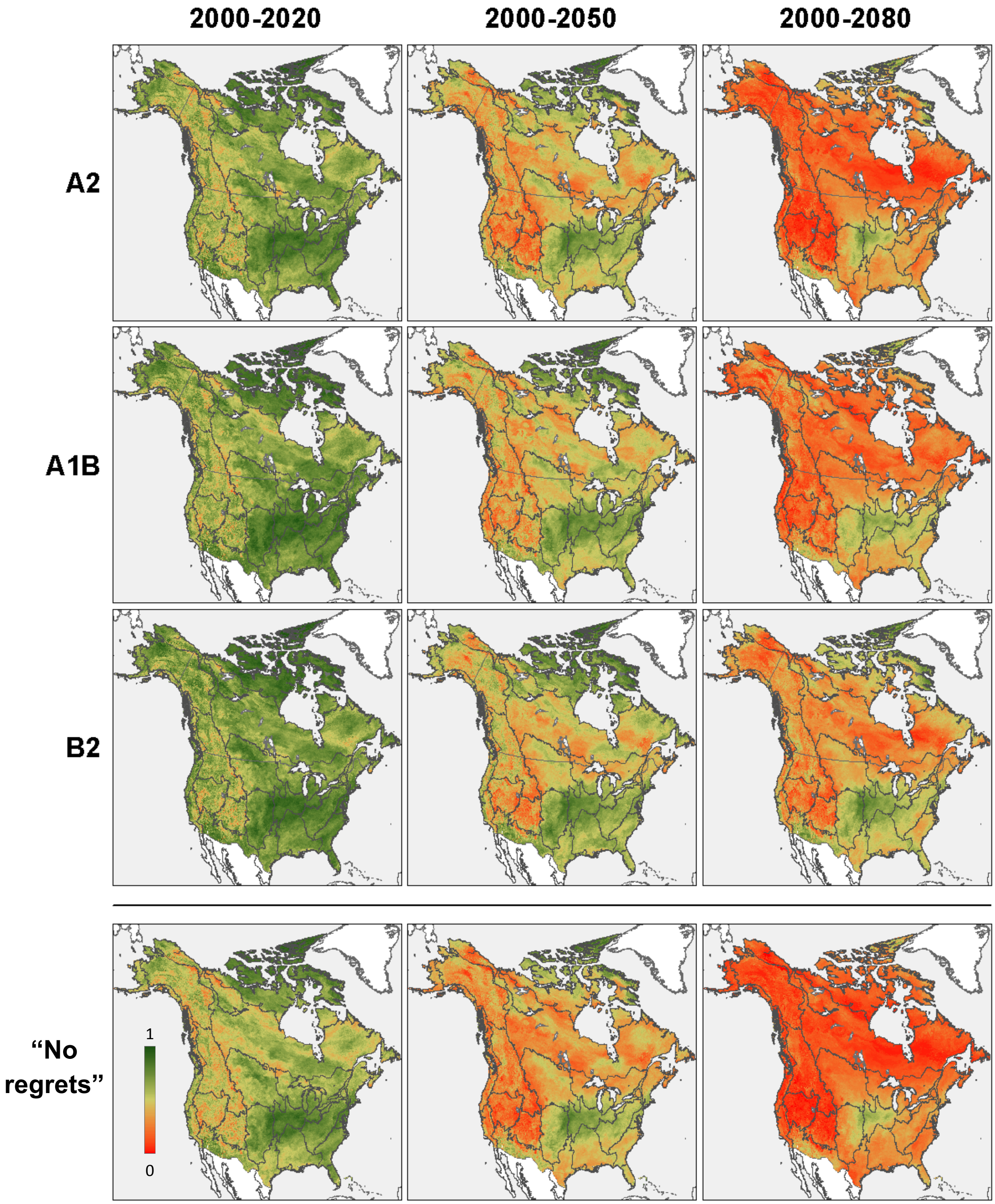


Figure 3.5. Community refugia for summer bird communities across years and emissions scenarios. Values of 1 indicate areas where currently existing communities remain intact over the period of interest. Values of 0 indicate areas where none of the species within currently existing communities are certain to persist over the period of interest.

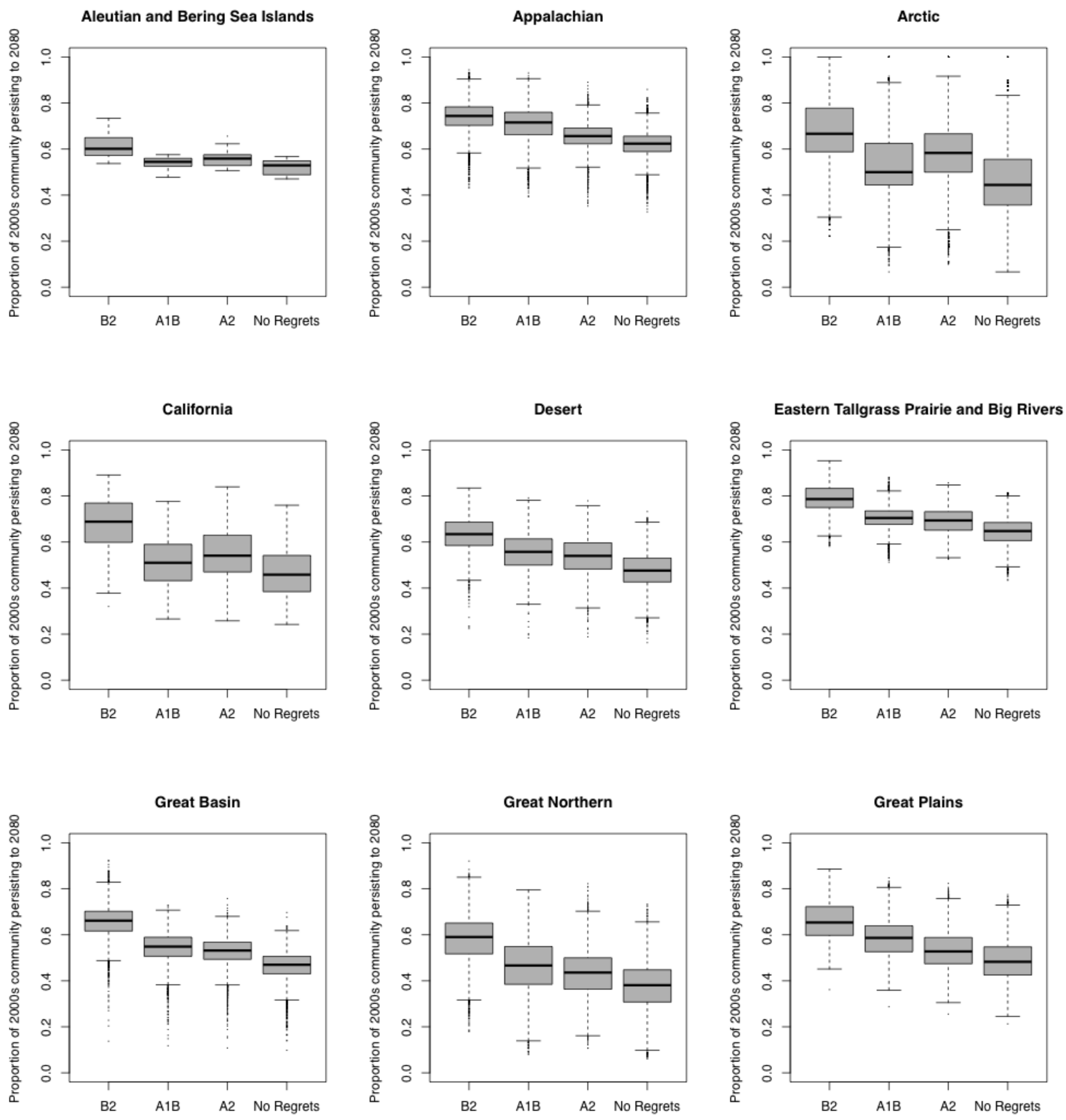
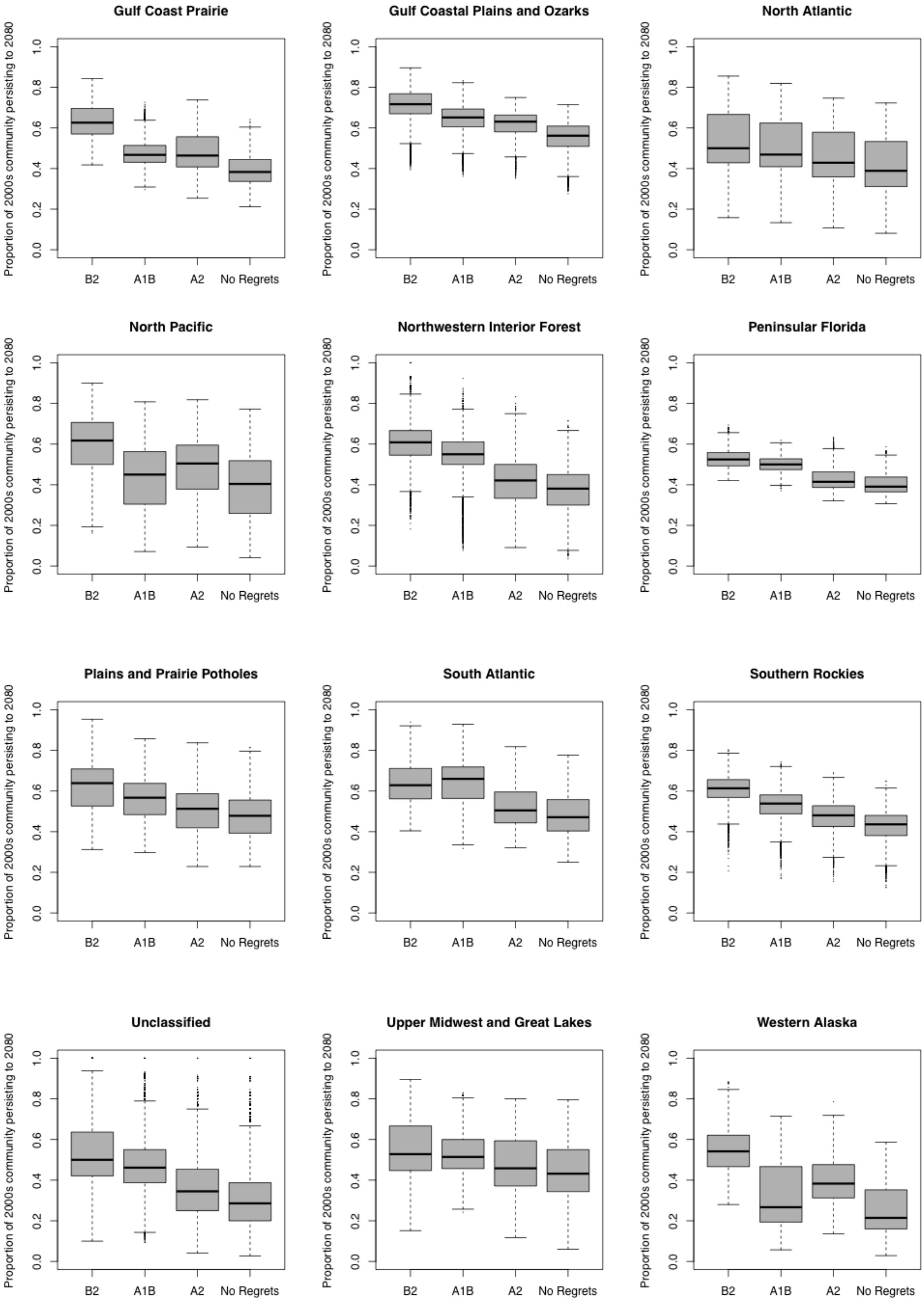


Figure 3.6. Community refugia for winter bird communities from 2000-2080 by emissions scenario. Values of 1 indicate areas where currently existing communities remain intact over the period of interest. Values of 0 indicate areas where none of the species within currently existing communities are certain to persist over the period of interest. Each point represents the value derived from a 10 x 10 km pixel within each of the Landscape Conservation Cooperatives. Bands on the boxplots represent the following values for estimated species richness: minimum, lower quartile, median, upper quartile, and maximum.

Figure 3.6, continued.



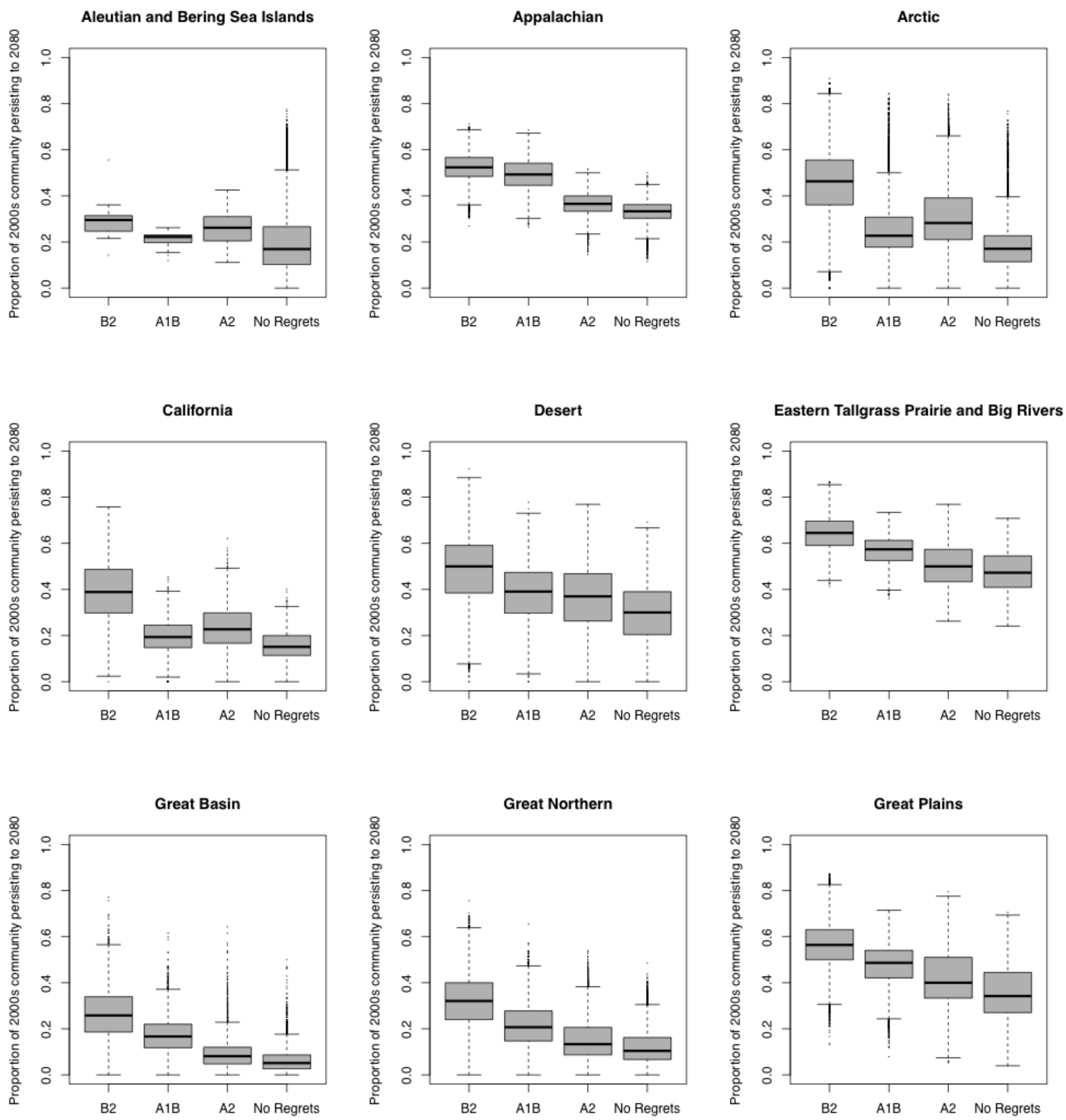
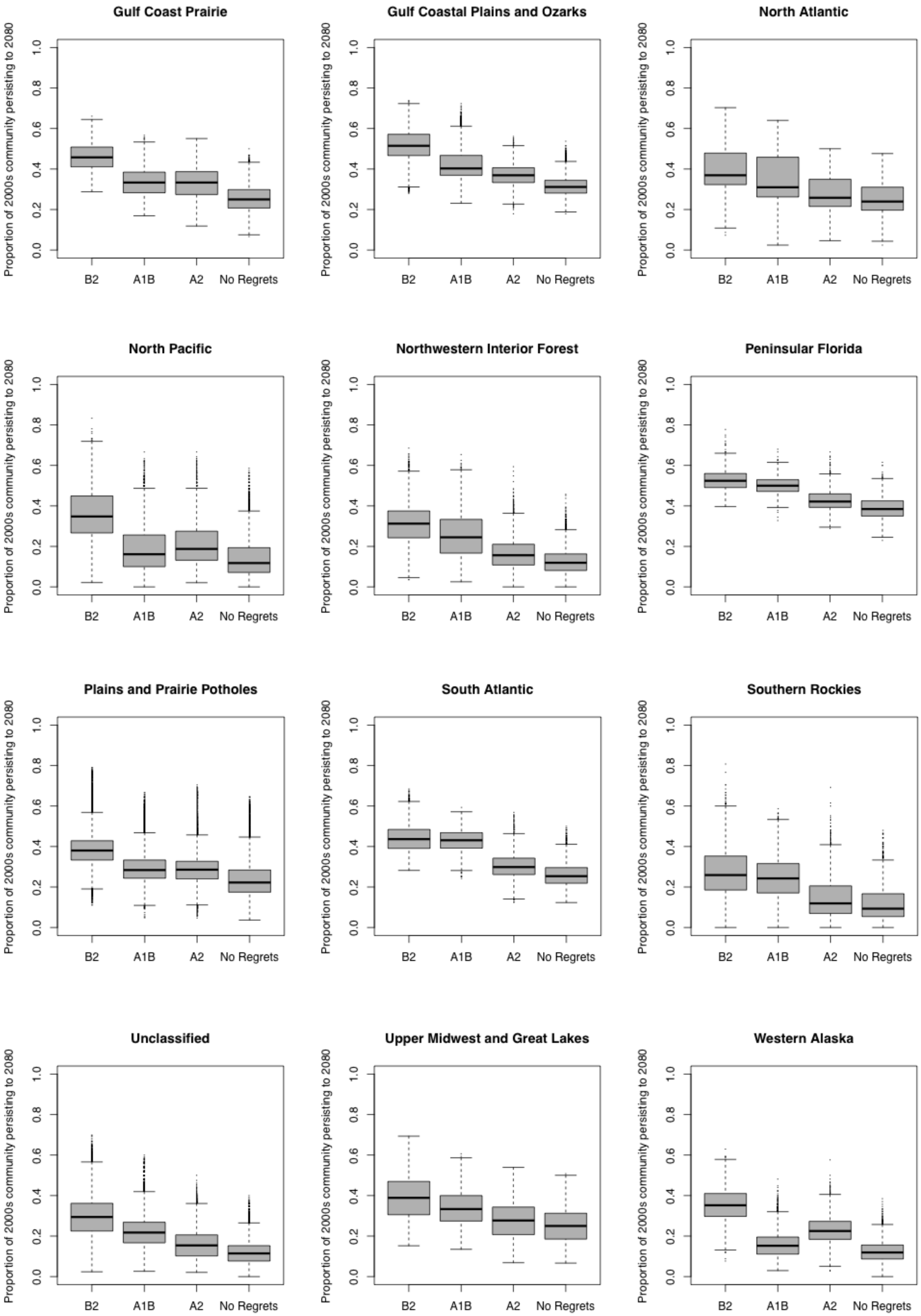


Figure 3.7. Community refugia for summer bird communities from 2000-2080 by emissions scenario. Values of 1 indicate areas where currently existing communities remain intact over the period of interest. Values of 0 indicate areas where none of the species within currently existing communities are certain to persist over the period of interest. Each point represents the value derived from a 10 x 10 km pixel within each of the Landscape Conservation Cooperatives. Bands on the boxplots represent the following values for estimated species richness: minimum, lower quartile, median, upper quartile, and maximum.

Figure 3.7, continued.



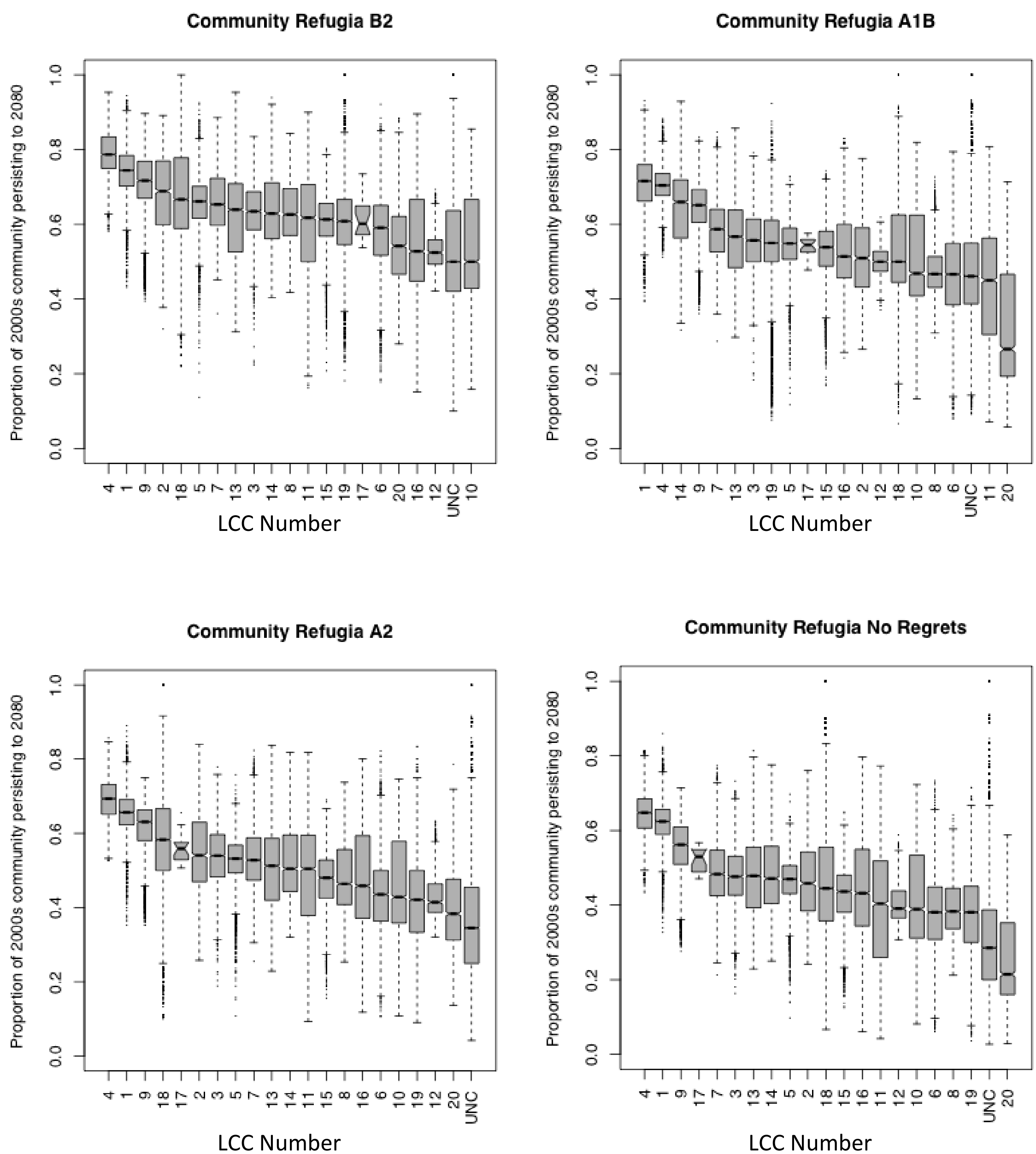


Figure 3.8. Community refugia for winter bird communities from 2000-2080 by Landscape Conservation Cooperative. Values of 1 indicate areas where currently existing communities remain intact over the period of interest. Values of 0 indicate areas where none of the species within currently existing communities are certain to persist over the period of interest. Each point represents the value derived from a 10 x 10 km pixel within each of the Landscape Conservation Cooperatives. Bands on the boxplots represent the following values for estimated species richness: minimum, lower quartile, median (notched area), upper quartile, and maximum.

1. Appalachia
2. California
3. Desert
4. Eastern Tallgrass Prairie and Big Rivers
5. Great Basin
6. Great Northern
7. Great Plains
8. Gulf Coast Prairie
9. Gulf Coast Plains and Ozarks
10. North Atlantic
11. North Pacific
12. Peninsular Florida
13. Plains and Prairie Potholes
14. South Atlantic
15. Southern Rockies
16. Upper Midwest and Great Lakes
17. Aleutian and Bering Sea Islands
18. Arctic
19. Northwestern Interior Forest
20. Western Alaska

UNC-Unclassified

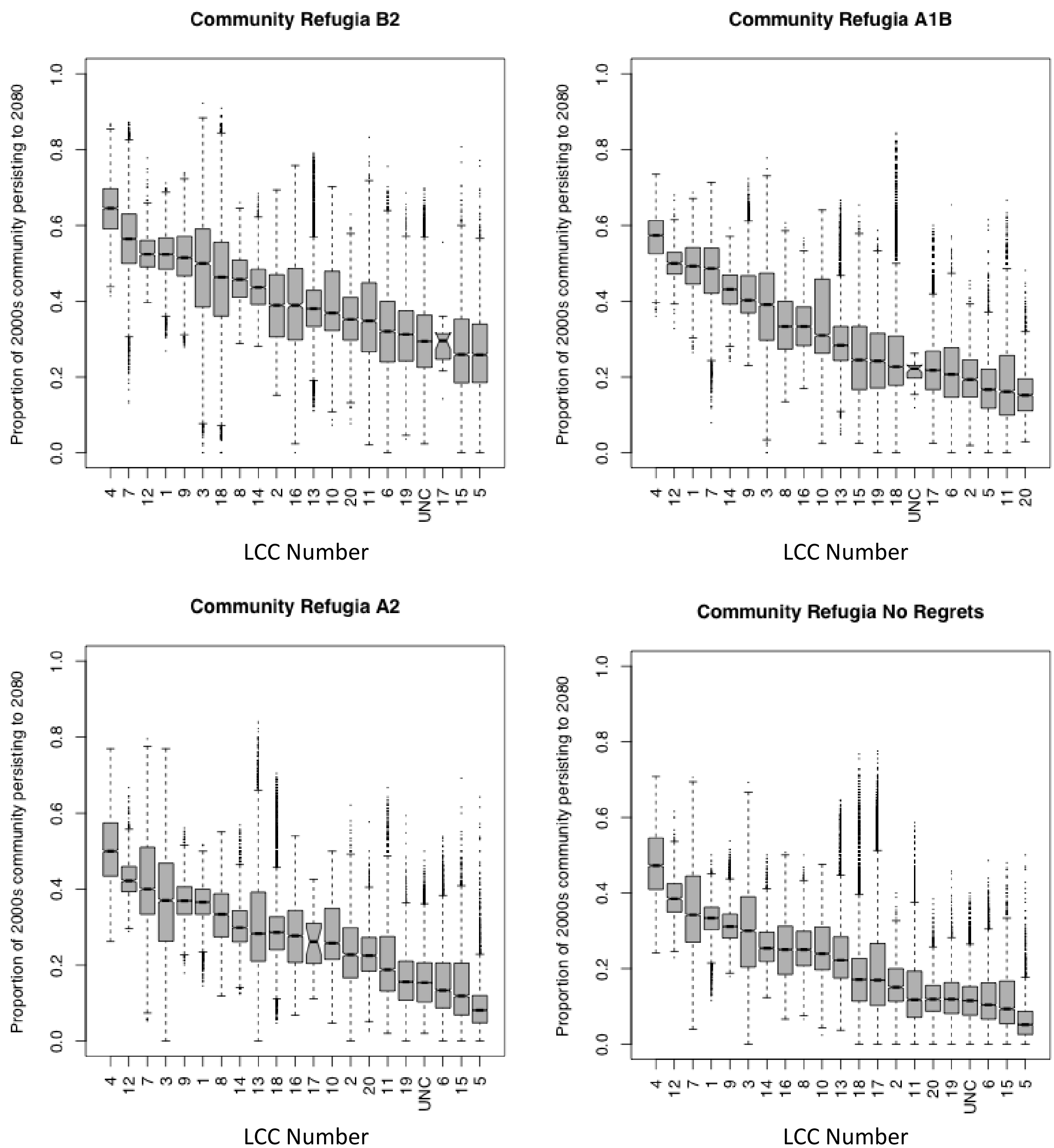


Figure 3.9. Community refugia for summer bird communities from 2000-2080 by Landscape Conservation Cooperative. Values of 1 indicate areas where currently existing communities remain intact over the period of interest. Values of 0 indicate areas where none of the species within currently existing communities are certain to persist over the period of interest. Each point represents the value derived from a 10 x 10 km pixel within each of the Landscape Conservation Cooperatives. Bands on the boxplots represent the following values for estimated species richness: minimum, lower quartile, median (notched area), upper quartile, and maximum.

1. Appalachia
2. California
3. Desert
4. Eastern Tallgrass Prairie and Big Rivers
5. Great Basin
6. Great Northern
7. Great Plains
8. Gulf Coast Prairie
9. Gulf Coast Plains and Ozarks
10. North Atlantic
11. North Pacific
12. Peninsular Florida
13. Plains and Prairie Potholes
14. South Atlantic
15. Southern Rockies
16. Upper Midwest and Great Lakes
17. Aleutian and Bering Sea Islands
18. Arctic
19. Northwestern Interior Forest
20. Western Alaska

UNC-Unclassified

Variance components analysis of community refugia

The most complex model we built, with random effects for Landscape Conservation Cooperative, season, time period, and scenario, accounted for variation in community refugia predictions better than simpler models (Table 3.1). Time period effects accounted for 37.2% of the variance, season effects accounted for 21.5%, Landscape Conservation Cooperatives acounted for 8.5%, while emissions scenarios accounted for only 3.1% of the variance in the data (Table 3.2). Approximately 29.6% of the variance remained unexplained by the random effects we included in the model.

Even though scenarios accounted for relatively little of the variance in community refugia values, the differences among them provide perspective on the potential benefits of mitigation efforts. By the 2080 time period, on average, communities are expected to retain 13.0% more of their winter species under the B2 (low emissions) scenario than under the A2 (high emissions) scenario. In the summer, on average, communities are expected to retain 13.9% more of their species under the B2 scenario than under the A2 scenario.

Table 3.1. Model selection table describing relative support for random effects models used to characterize variation in community refugia values.

Variance Components	df	logLik	AICc	ΔAICc	weight
LCC, time period, scenario, season	6	125288.01	-250564.02	0.00	1
LCC, time period, season	5	119059.14	-238108.28	12455.75	0
time period, scenario, season	5	105272.38	-210534.77	40029.25	0
time period, season	4	100257.03	-200506.06	50057.96	0
LCC, time period, scenario	5	87451.62	-174893.23	75670.79	0
LCC, time period	4	83315.71	-166623.42	83940.61	0
time period, scenario	4	73872.52	-147737.03	102826.99	0
time period	3	70308.06	-140610.12	109953.90	0
LCC, scenario, season	5	60754.44	-121498.87	129065.15	0
LCC, season	4	57664.50	-115321.00	135243.03	0
scenario, season	4	50459.45	-100910.89	149653.13	0
season	3	47701.24	-95396.48	155167.54	0
LCC, scenario	4	40310.74	-80613.47	169950.55	0
LCC	3	37842.52	-75679.04	174884.98	0
scenario	3	32048.73	-64091.46	186472.56	0

Table 3.2. Variance component estimates of community refugia. All estimates are derived from the top model in the model selection table (Table 3.1).

Grouping Variable	Variance	SE	Proportion Total Variance
time period	0.0183	0.135	0.085
season	0.0105	0.103	0.031
LCC	0.0042	0.065	0.372
scenario	0.0015	0.039	0.215
Residual	0.0145	0.121	0.296

Discussion

The refugia concept has provided an important perspective on shifting patterns of biodiversity through Quaternary glaciation events (Bennett & Provan, 2008) and is increasingly being adopted by biologists as they prepare for the consequences of future climate change (Barnosky, 2008; Williams et al., 2008; Rull, 2010). Refugia emphasize the role of historical contingency in limiting the scope of possible outcomes for species subject to the effects of changing climate. Evidence from a number of studies justify the approach. Angert et al. (2011) found that life-history traits expected to influence colonization of expanding range edges had very little explanatory power when incorporated into models. In addition, Hampe & Petit (2005) argue that the rear edges of shifting species ranges may be disproportionately important for survival and evolution because they tend to harbor greater genetic diversity, which may be essential for ongoing adaptation and speciation.

Our results provide a comprehensive picture of climate refugia for birds in the United States and Canada during the winter and summer seasons under each of three emissions scenarios. We also identify areas that we expect to serve as refugia regardless of the emissions scenario that actually comes to pass. These “no regrets” areas provide the closest thing to sure bet conservation investments for species and/or communities because they are nested within currently suitable areas and are expected to remain suitable through time and across scenarios. Risks associated with colonization of new areas are eliminated and the biotic interactions on which species depend are much more likely to remain intact. Several distinct patterns emerged from our analysis that may influence conservation strategy at regional and continental levels.

Numbers of overlapping refugia for winter and summer species generally follow patterns of current species richness. If conservation prioritization at a broad scale is focused on preserving overall richness then California, the Desert Southwest, Gulf Prairie, and Gulf Coastal Plains and Ozarks Landscape Conservation Cooperatives will be of paramount importance for wintering birds. During the summer, the Eastern Tallgrass Prairies and Big Rivers, Gulf Coastal Plains and Ozarks, Appalachia, and sections of the Great Plains are Landscape Conservation Cooperatives where relatively high numbers of existing species are likely to persist.

If conservation efforts are focused on maintaining the integrity of existing communities, regardless of their size, then community refugia provide a valuable perspective. We expect winter communities in Eastern Tallgrass Prairies and Big Rivers, Appalachia, and Gulf Coast Plains and Ozarks Landscape Conservation Cooperatives to remain relatively intact. Summer communities will remain relatively intact across the Eastern Tallgrass Prairies and Big Rivers, Great Plains, and Peninsular Florida Landscape Conservation Cooperatives. We also expect small pockets of community refugia to persist in the Desert Southwest during summer months.

Despite regional differences in the likely persistence of communities, most of the variance in our predictions was accounted for by differences across time, rather than space. Variation across time periods (i.e., 2020, 2050, 2080) and seasons (i.e., winter, summer) together accounted for more than half (58.7%) of the variance in community refugia predictions. Landscape Conservation Cooperatives accounted for relatively little of the variance (8.5%) and differences among emissions scenarios accounted for even less (3.1%). Even so, the difference in impacts between low (B2) and high (A2) emissions scenarios is notable. If the B2 scenario comes to pass, then winter communities are likely to hold onto 13.0% more of their species than under the A2 scenario and summer communities are likely to hold onto 13.9% more of their species.

These results suggest very strongly that while mitigation efforts may provide some stability for bird communities in the United States and Canada—and are essential for preserving the value of existing reserve networks elsewhere in the world (Coetzee et al., 2009; Hannah et al. 2007)—effective conservation in the United States and Canada will depend heavily on development of flexible adaptation strategies across conservation networks through time. Advances in prioritization methods (Carroll et al., 2010) offer promise for development of resilient reserve networks, but conservation solutions may be more difficult to find as landscapes become increasingly fragmented (Krosby et al., 2010).

There are several areas in which our models could, and should, be expanded in the future. Analysis of land use change in combination with climate change is likely to provide important perspective on future distributions of bird species and communities. In a recent study, Jongsomjit et al. (2013) found that development alone accounted for 32% of the overall projected species distribution reductions in 64 species in California. In addition, we hope to more fully explore the spatial and temporal scales at which distributions are shaped by climate and land use. For example, climate and habitat change on the wintering grounds of migrant species may affect their summer distributions (Inouye et al., 2000; Crick, 2004). To account for such dependencies, occurrence data—ideally collected on systematic surveys—and climate data would both be required across the full geographic extents and annual cycles of Neotropical migrants. As of now, neither of those data sets exist at the spatial or temporal resolution we present here.

Conclusion

Refugia have long been invoked to understand patterns of change in species distributions through Quaternary glaciation events (Bennet & Provan, 2008). It seems appropriate that they should also be invoked as we consider how species will respond to accelerating climate change. Here, we use the refugia concept to provide a relatively conservative picture of possible futures for birds in the United States and Canada. Individual species refugia, stacked refugia, and community refugia that we identify here may all be used to guide regional or continental conservation strategy. It is essential that land managers, agencies, policy-makers, and the general public define conservation objectives at their scale of interest and influence, however, before prioritizing areas for conservation action (Vos et al., 2008). They must also be willing to adopt a variety of strategies, and to adjust them, in order to ameliorate climate change effects (Mawdsley et al., 2009). This is particularly important given that the majority of impacts on communities are likely to be seen over time, rather than space, so revisiting and updating strategies will be essential. As methods for predicting species distributions improve and explicitly allow for characterizations of dispersal capacity and biotic interactions across a large number of taxa, we expect that more and more "pictures" of the future will become available. We believe it is important to maintain a conservative perspective, represented here by "no regrets" refugia, as a benchmark for comparison.

4. Anticipating Responses of Avian Species to Changing Climates

Overview

We investigated the influence of current range size, scenario, and year on the sizes of future ranges and refugia across all species. Assuming no constraints on dispersal or dependence on local biotic interactions, the relative size of future winter ranges increased through time but was negatively associated with current range size. The negative relationship may have emerged because species with large ranges have limited potential for increasing their ranges throughout the continent while species with smaller distributions may be able to multiply their current ranges considerably. Winter ranges were also influenced to a small degree by emissions scenarios, with higher emissions resulting in larger ranges of wintering birds. During the summer, the general pattern was similar except that the highest (A2) and lowest (B2) emissions scenarios produced relatively smaller ranges than the moderate (A1B) scenario. When we examined the size of refugia in relation to current range size, scenarios, and year, results differed considerably. During both winter and summer, the relative sizes of refugia decreased through time but were positively associated with current range size suggesting that species with larger ranges may be more resistant to climate change than species with small ranges. We also identified 34 priority species of conservation concern to National Audubon for which to provide in-depth analysis of the estimated climate change impacts. Here, we show our results through maps and graphs depicting current ranges and predicted changes in range size for each species for a combination of three future time periods (2020, 2050, 2080) and three emissions scenarios (B2, A1B, A2). Consensus maps reveal the degree to which predictions agree across time periods and scenarios. Analyses across large numbers of taxa suggest very general relationships between current range size and risks from climate change but focused mapping of individual species will be needed for species-specific conservation plans.

Analyses Across Species

Modeled current range and future ranges

Current summer and winter ranges were modeled using North American Breeding Bird and Audubon Christmas Bird Count data, respectively, for the time period 2000–2009 (2000s). We detail methods for generating and validating bioclimatic envelope models (BEMs) in Chapter 1. We projected BEMs generated for priority species (winter only: N =4 species; summer only: N =12 species; both seasons: N = 18 species) into a mean climate space for the current time period (1999-2008). We also projected species distribution models into each of 39 future climate surfaces (i.e., 13 combinations of emissions scenarios and GCMs in each of 3 future time periods) and then averaged across GCMs within each combination of emissions scenario and time period. This process resulted in 9 future prediction grids for each species, one for each emissions scenario (B2, A1B, A2) in each time period (2020, 2050, 2080).

Modeled ranges and predicted range and refugia sizes by year and emissions scenario

To delineate the boundaries of species ranges in current and future time periods we used a threshold value based on the maximum Kappa statistic and assigned suitability values below the threshold a value of 0 (unsuitable) and those above the threshold a value of 1 (suitable). We then applied a North American Albers Equal-Area Conic projection to each prediction grid and calculated range size based on suitable area. Refugia sizes were calculated by identifying the areas that remained consistently suitable from the current time period (2000s) to three future time periods under the three emissions scenarios.

Relationships between current range size and future range and refugia sizes

We built four model sets to characterize the factors that shape predicted range and refugia sizes during summer and winter seasons. Each model set contained all combinations of three predictors: current range size, emissions scenario (i.e., B2, A1B, A2) and year (i.e., 2020, 2050, 2080). We included species as a random effect in all models to account for repeated measures of range or refugia sizes from the same species. Estimates of current range sizes were generated from maps describing core ranges delimited using a maximum kappa threshold (see Chapter 3). We scaled predictions of future range and refugia size relative to the current range so all metrics of future range and refugia size could be interpreted as a proportion of the current range size. This made comparisons across species much easier to interpret.

Results from these analyses align with results from previous chapters in suggesting that ranges and refugia will be reshaped considerably as we move forward in time. Year effects appeared in all of the models that received support, for all four sets of models (Tables 4.1-4.4). Current range size was negatively associated with future range size, when we assume perfect climate tracking, potentially because species with large ranges can expand only so far into previously unoccupied areas. Species with small ranges, on the other hand, have the potential to inhabit areas many times the size of their current ranges. Future refugia sizes were also influenced by year and the size of current ranges. In the case of refugia, however, current range sizes were positively associated with the relative sizes of future refugia. This suggests that species with large ranges may be buffered from effects of climate change more readily than those with small ranges. Several issues make interpretation of results difficult, however. The data do not meet the assumptions of parametric tests and, without a spatial context, it is difficult to conceptualize how geography constrains the range of potential responses to climate change.

Table 4.1. Model selection table and model averaged parameter estimates for models describing effects of current range size, scenario, and year on future range sizes for the summer season.

Model selection table

	df	logLik	AICc	delta	weight
current range + year	5	-15302.91	30615.83	0.00	0.86
scenario + current range + year	7	-15302.75	30619.53	3.70	0.13
year	4	-15308.82	30625.64	9.81	0.01
scenario + year	6	-15308.66	30629.34	13.52	0.00
current range	4	-15320.50	30649.00	33.17	0.00
scenario + current range	6	-15320.34	30652.70	36.88	0.00
-	3	-15326.40	30658.81	42.99	0.00
scenario	5	-15326.25	30662.52	46.69	0.00

Parameter estimates

Intercept	current range	year	Emissions (A2)	Emissions (B2)
-43.091900	-0.000057	0.022829	-0.124765	-0.086733

Table 4.2. Model selection table and model averaged parameter estimates for models describing effects of current range size, scenario, and year on future range sizes for the winter season.

Model selection table

	df	logLik	AICc	delta	weight
current range + year	5	-20988.45	41986.92	0.00	0.56
scenario + current range + year	7	-20987.31	41988.64	1.71	0.24
year	4	-20990.85	41989.71	2.79	0.14
scenario + year	6	-20989.70	41991.42	4.50	0.06
current range	4	-21020.47	42048.94	62.02	0.00
scenario + current range	6	-21019.33	42050.69	63.77	0.00
-	3	-21022.86	42051.73	64.81	0.00
scenario	5	-21021.73	42053.48	66.55	0.00

Parameter estimates

Intercept	current range	year	Emissions (A2)	Emissions (B2)
-158.666200	-0.000089	0.080463	0.320299	-0.578229

Table 4.3. Model selection table and model averaged parameter estimates for models describing effects of current range size, scenario, and year on future refugia sizes for the summer season.

Model selection table

	df	logLik	AICc	delta	weight
scenario + current range + year	7	3384.78	-6755.54	0.00	1.00
current range + year	5	3373.06	-6736.10	19.44	0.00
scenario + year	6	3340.89	-6669.76	85.78	0.00
year	4	3329.16	-6650.31	105.23	0.00
scenario + current range	6	1692.39	-3372.75	3382.79	0.00
current range	4	1687.36	-3366.72	3388.82	0.00
scenario	5	1648.49	-3286.97	3468.57	0.00
-	3	1643.47	-3280.93	3474.61	0.00

Parameter estimates

Intercept	current range	year	Emissions (A2)	Emissions (B2)
8.735738	0.000004	-0.004039	-0.012775	-0.014865

Table 4.4. Model selection table and model averaged parameter estimates for models describing effects of current range size, scenario, and year on future refugia sizes for the winter season.

Model selection table

	df	logLik	AICc	delta	weight
scenario + current range + year	7	4408.10	-8802.17	0.00	1.00
current range + year	5	4391.07	-8772.13	30.04	0.00
scenario + year	6	4362.74	-8713.47	88.70	0.00
year	4	4345.72	-8683.43	118.74	0.00
scenario + current range	6	3427.37	-6842.73	1959.44	0.00
current range	4	3416.66	-6825.30	1976.87	0.00
scenario	5	3382.02	-6754.03	2048.14	0.00
-	3	3371.30	-6736.60	2065.56	0.00

Parameter estimates

Intercept	current range	year	Emissions (A2)	Emissions (B2)
5.065578	0.000004	-0.002198	-0.015254	-0.009674

Priority Species Models and Maps

For a subset of priority taxa (Table 4.5), we also show predicted current and future ranges for each season. These maps allow readers to interpret the quantitative changes in range sizes, as well as visually inspect the geographic distribution of these predicted future changes. We show current ranges, predicted future ranges, and a consensus map showing the degree to which predictions across times and emissions scenarios coincide. Areas of complete overlap for all years and emissions scenarios are 'no regrets' refugia that are currently suitable and are predicted to remain suitable into the future irrespective of the uncertainties of climate change forecasts.

Table 4.5. Conservation status for 34 priority species.

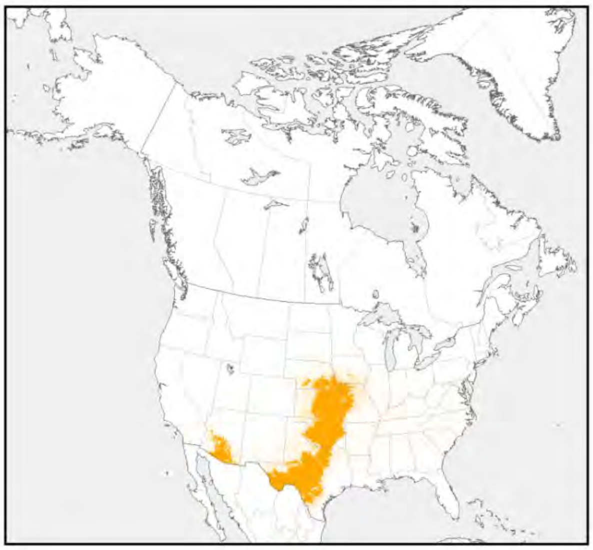
Common Name	Scientific name	Birds of Conservation Concern (2008)	Audubon WatchList (2007)	IUCN (2010)	Federally Listed
Baltimore Oriole	*Icterus galbula*			LC	
Bell's Vireo	*Vireo bellii*	x	Red	NT	(e)
Bobolink	*Dolichonyx oryzivorus*	x		LC	
Brewer's Sparrow	*Spizella breweri*	x	Yellow-D	LC	
Brown-headed Nuthatch	*Sitta pusilla*	x		LC	
Burrowing Owl	*Athene cunicularia*	x		LC	
Canada Warbler	*Wilsonia canadensis*	x	Yellow-D	LC	
Cerulean Warbler	*Dendroica cerulea*	x	Yellow-D	VU	
Chestnut-collared Longspur	*Calcarius ornatus*	x	Yellow-D	NT	
Eastern Kingbird	*Tyrannus tyrannus*			LC	
Eastern Meadowlark	*Sturnella magna*			LC	
Evening Grosbeak	*Coccothraustes vespertinus*			LC	
Field Sparrow	*Spizella pusilla*	x		LC	
Gilded Flicker	*Colaptes chrysoides*	x	Red	LC	
Golden Eagle	*Aquila chrysaetos*	x		LC	
Golden-winged Warbler	*Vermivora chrysoptera*	x	Red	NT	
Grasshopper Sparrow	*Ammodramus savannarum*	x		LC	(e)
Greater Prairie-Chicken	*Tympanuchus cupido*		Red	VU	(e)
Greater Sage-Grouse	*Centrocercus urophasianus*	x	Yellow-D	NT	
Le Conte's Thrasher	*Toxostoma lecontei*	x	Yellow-R	LC	
Lewis's Woodpecker	*Melanerpes lewis*	x	Red	LC	
Loggerhead Shrike	*Lanius ludovicianus*	x		LC	(e)
Long-billed Curlew	*Numenius americanus*	x	Yellow-D	LC	
Mountain Plover	*Charadrius montanus*	x	Red	NT	
Olive-sided Flycatcher	*Contopus cooperi*		Yellow-D	NT	
Prairie Falcon	*Falco mexicanus*	x		LC	
Prothonotary Warbler	*Protonotaria citrea*	x	Yellow-D	LC	
Rose-breasted Grosbeak	*Pheucticus ludovicianus*			LC	
Sprague's Pipit	*Anthus spragueii*	x	Yellow-D	VU	
Swainson's Hawk	*Buteo swainsoni*	x	Yellow-R	LC	
Western Sandpiper	*Calidris mauri*		Yellow-R	LC	
Wood Thrush	*Hylocichla mustelina*	x	Yellow-D	LC	
Yellow Warbler	*Dendroica petechia*	x		LC	
Yellow-billed Magpie	*Pica nuttalli*	x	Yellow-R	LC	

Species on the list of Birds of Conservation Concern (2008) are designated with an “x”. Audubon Watchlist (2007) species are designated with the following codes: Red = species in this category are declining rapidly and/or have very small populations or limited ranges, and face major conservation threats (these typically are species of global conservation concern), Yellow = this category includes species that are either declining or rare (these typically are species of national conservation concern). IUCN categories are as follows: NT = Not Threatened, LC = Least Concern, VU = Vulnerable. Federally Listed subspecies under the Endangered Species Act indicated by an (e).

Bell's Vireo (*Vireo bellii*)

Modeled Current Range (2000-2009)

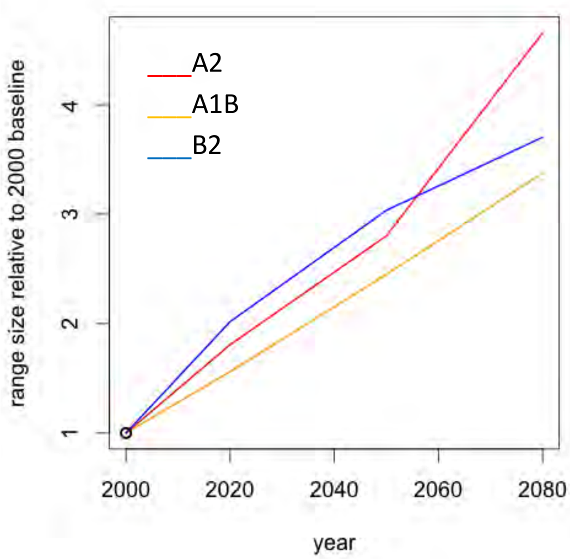
Summer



Current summer range was modeled for Bell's Vireo (*Vireo bellii*) using data from 2000-2009. Solid orange areas show core range estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

Predicted Range Size by Year and Emissions Scenario for Bell's Vireo (*Vireo bellii*)

Summer



Baltimore Oriole (*Icterus galbula*)

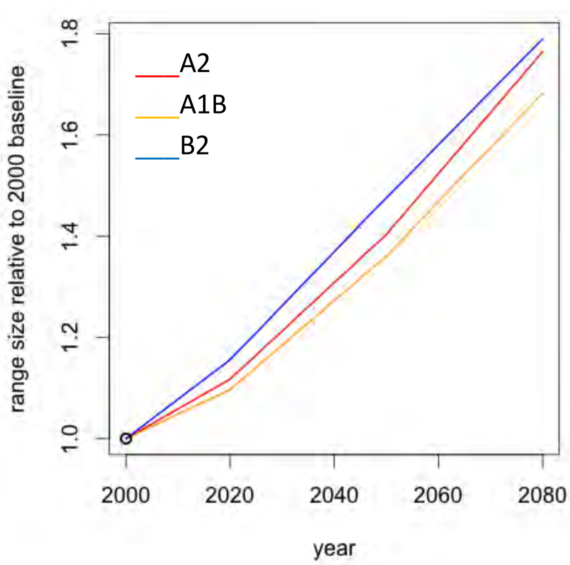
Modeled Current Range (2000-2009)

Summer

Current summer range for Baltimore Oriole (*Icterus galbula*) was modeled using data from 2000-2009. Solid orange areas show core range estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

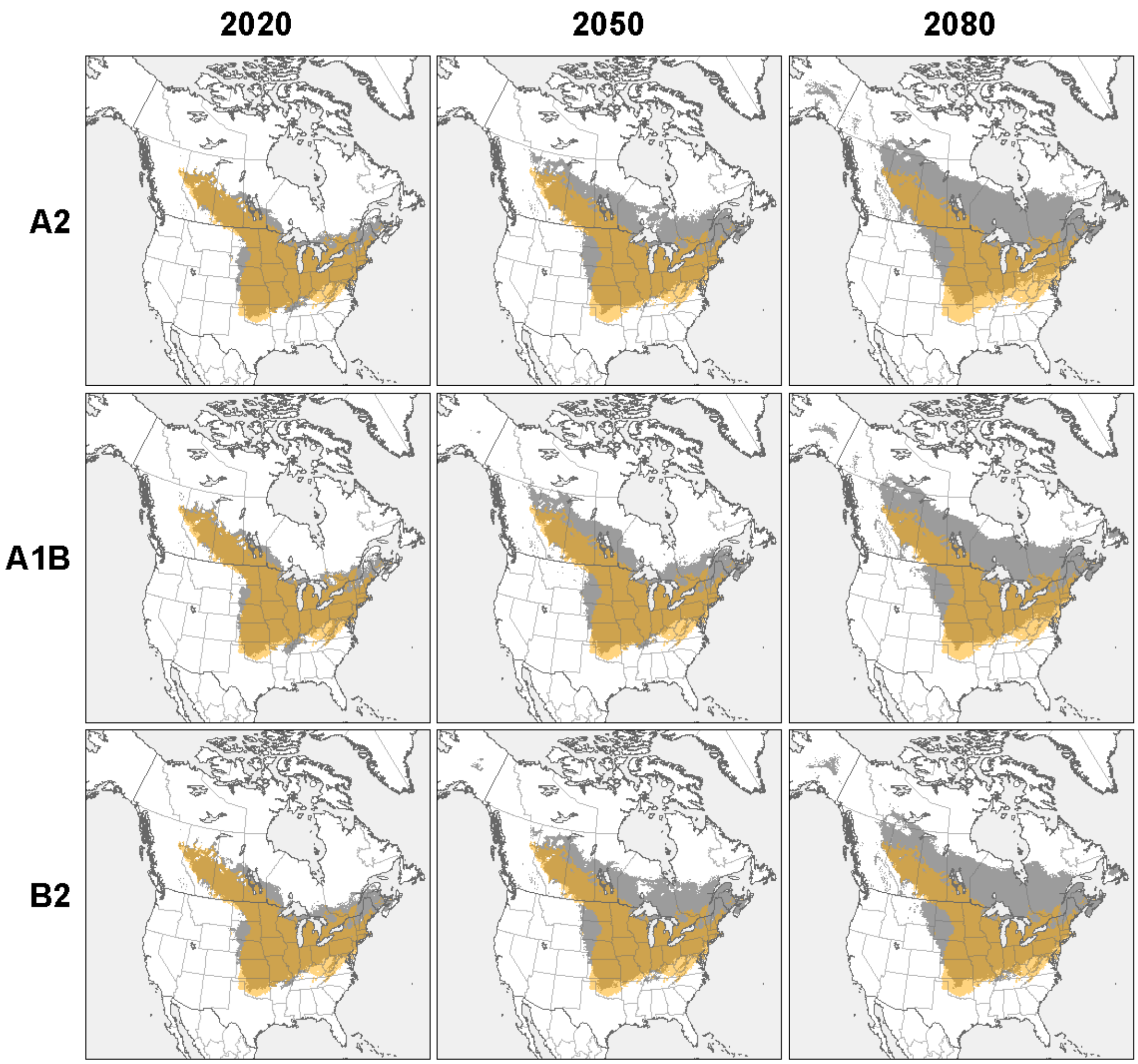
Predicted Range Size by Year and Emissions Scenario for Baltimore Oriole (*Icterus galbula*)

Summer



Baltimore Oriole (*Icterus galbula*)

Modeled Future Summer Range by Year and Emissions Scenario

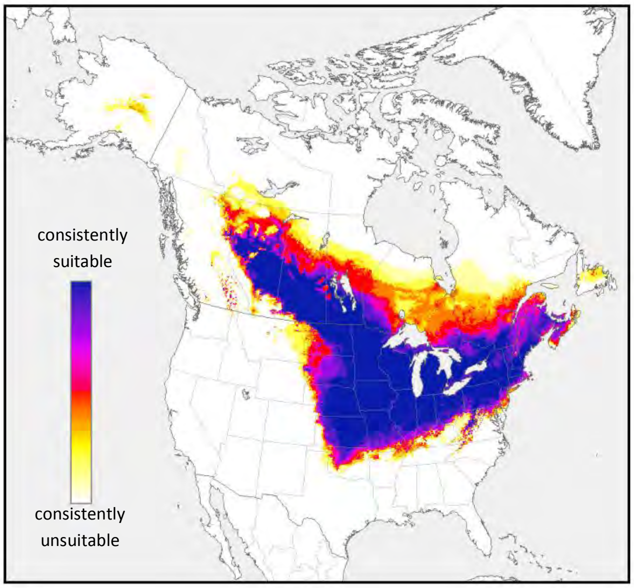


Orange areas indicate the modeled current range (2000-2009) for Baltimore Oriole (*Icterus galbula*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Baltimore Oriole (*Icterus galbula*)

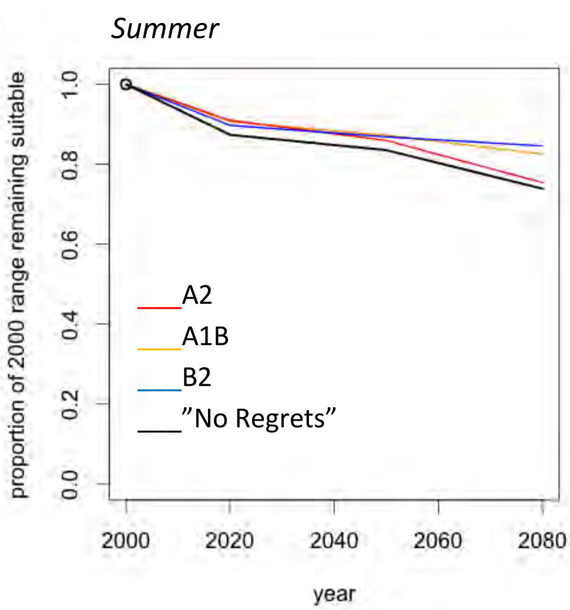
Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

Summer



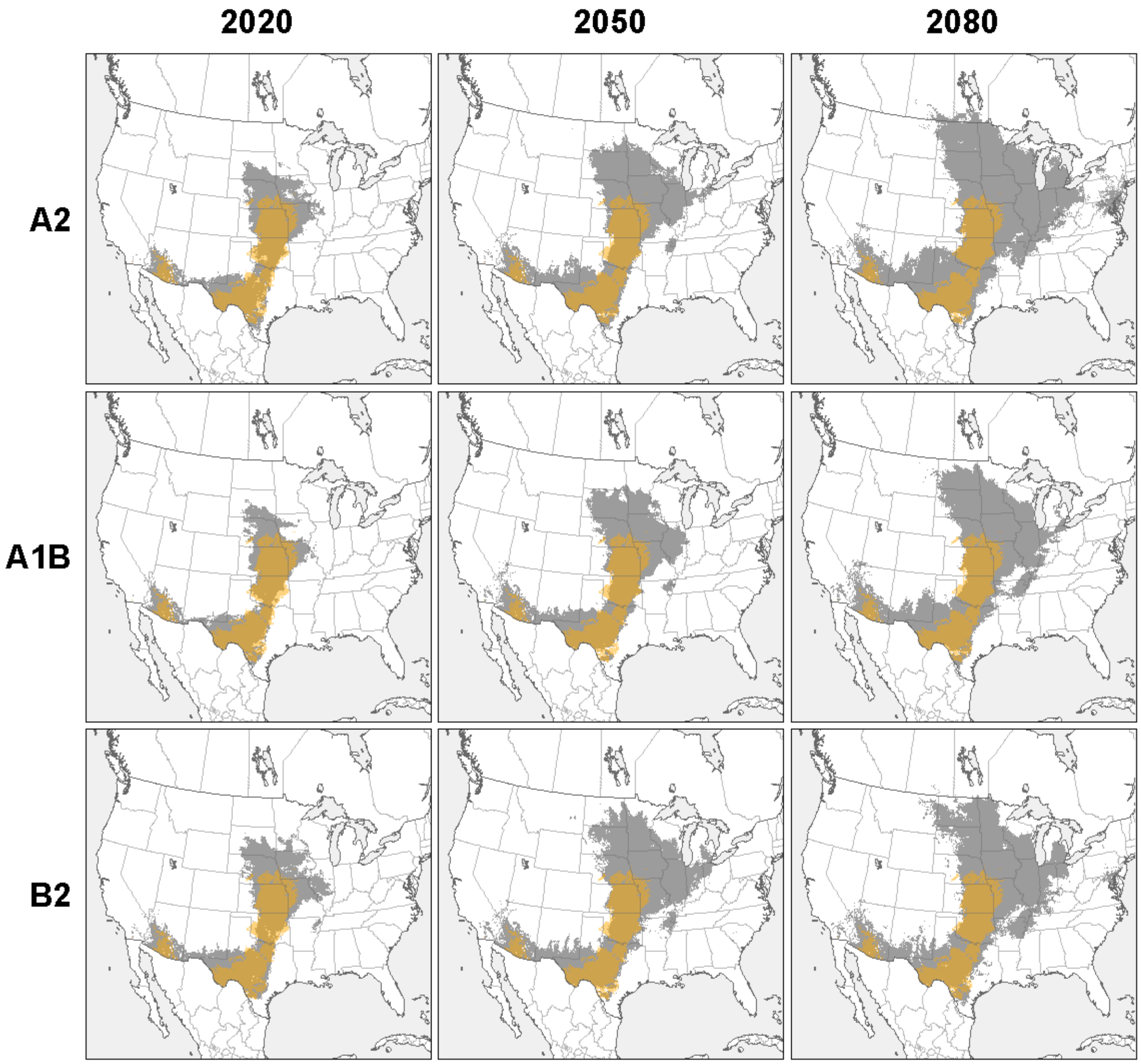
Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Baltimore Oriole (*Icterus galbula*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Baltimore Oriole (*Icterus galbula*)



Bell’s Vireo (*Vireo bellii*)

Modeled Future Summer Range by Year and Emissions Scenario

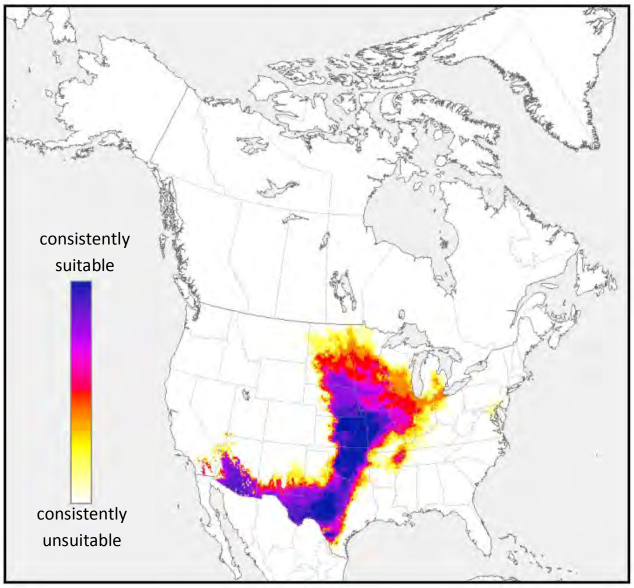


Orange areas indicate the modeled current range (2000-2009) for Bell’s Vireo (*Vireo bellii*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Bell’s Vireo (*Vireo bellii*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

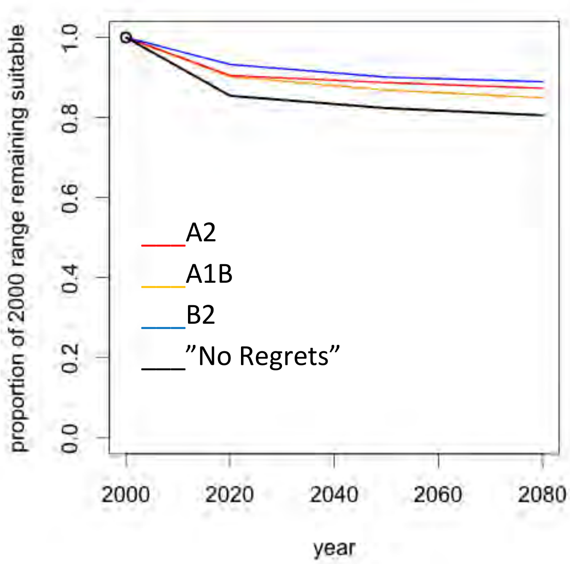
Summer



Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Bell’s Vireo (*Vireo bellii*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Bell’s Vireo (*Vireo bellii*)

Summer



Bobolink (*Dolichonyx oryzivorus*)

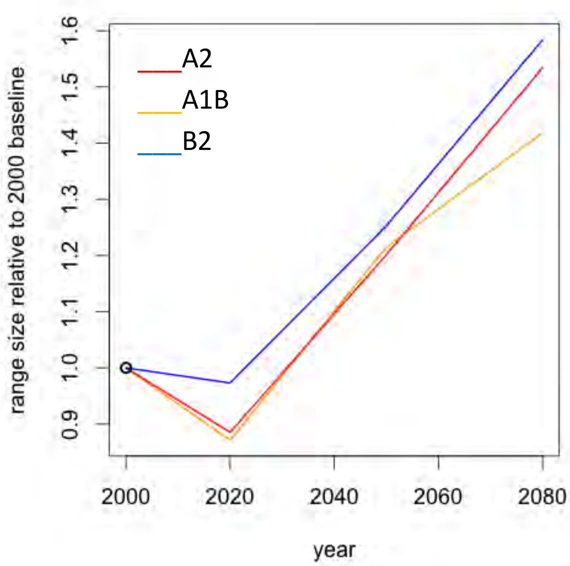
Modeled Current Range (2000-2009)

Summer

Current summer range was modeled for Bobolink (*Dolichonyx oryzivorus*) using data from 2000-2009. Solid orange areas show core range estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

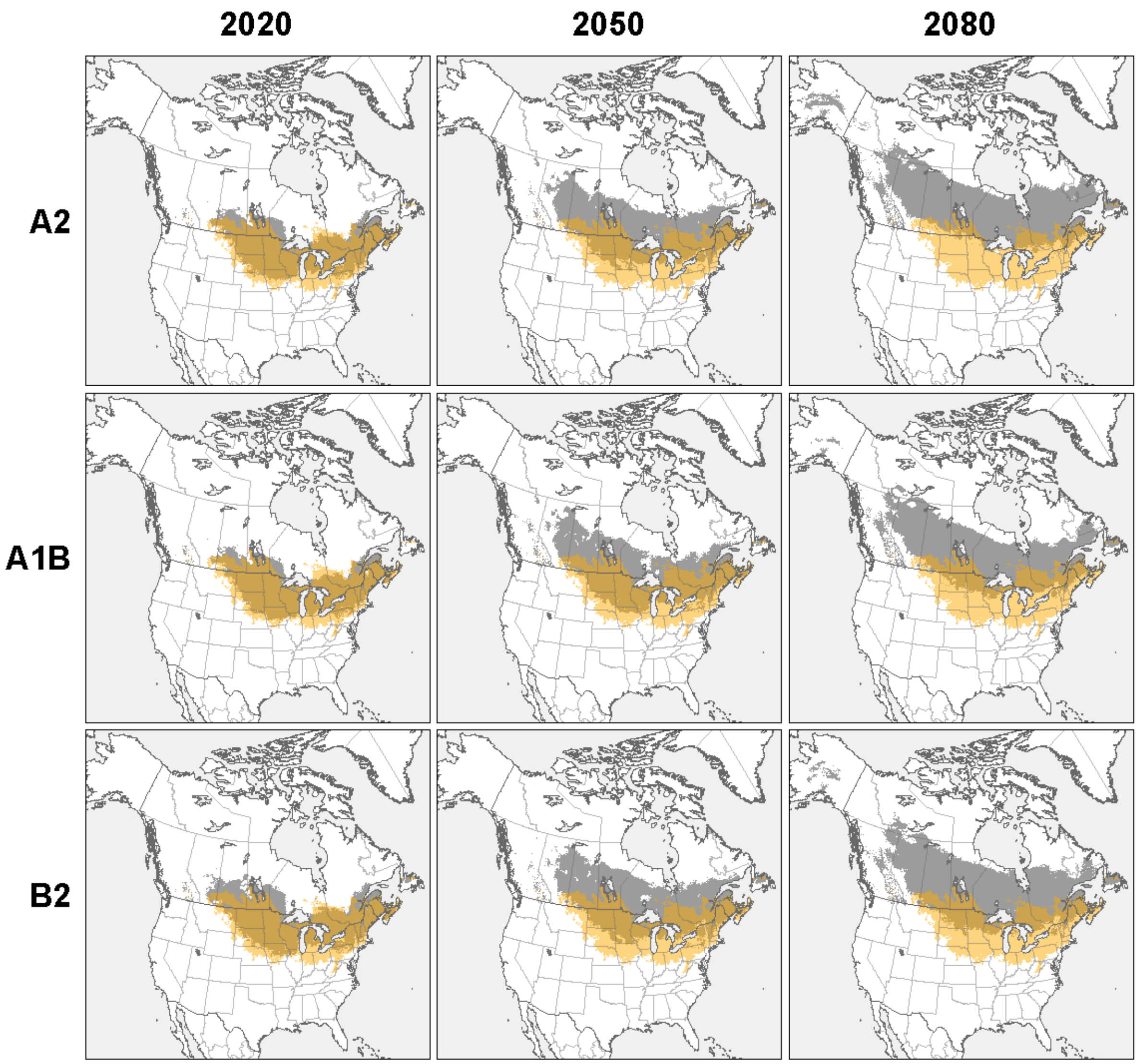
Predicted Range Size by Year and Emissions Scenario for Bobolink (*Dolichonyx oryzivorus*)

Summer



Bobolink (*Dolichonyx oryzivorus*)

Modeled Future Summer Range by Year and Emissions Scenario

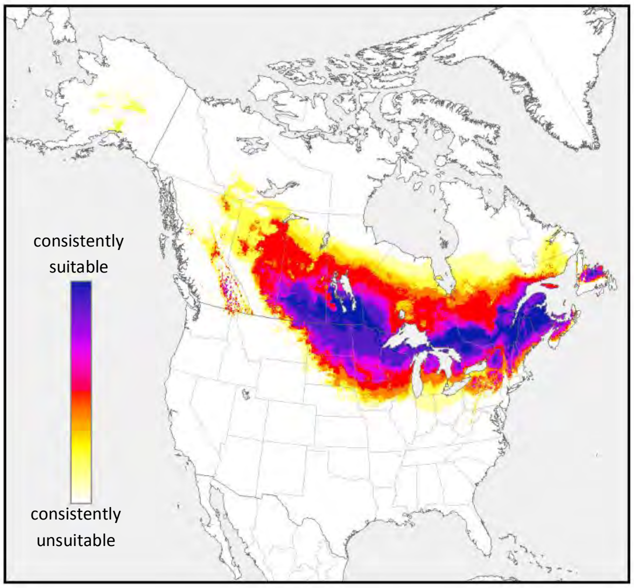


Orange areas indicate the modeled current range (2000-2009) for Bobolink (*Dolichonyx oryzivorus*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Bobolink (*Dolichonyx oryzivorus*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

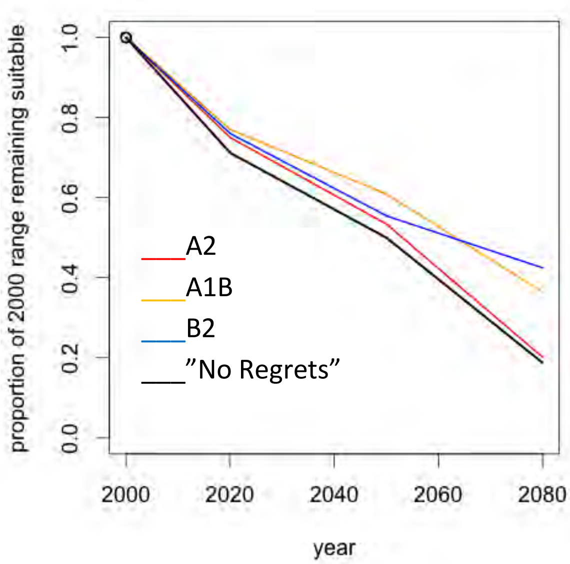
Summer



Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Bobolink (*Dolichonyx oryzivorus*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Bobolink (*Dolichonyx oryzivorus*)

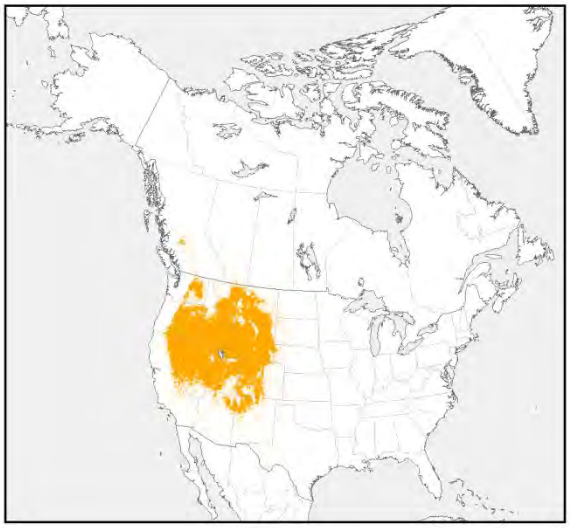
Summer



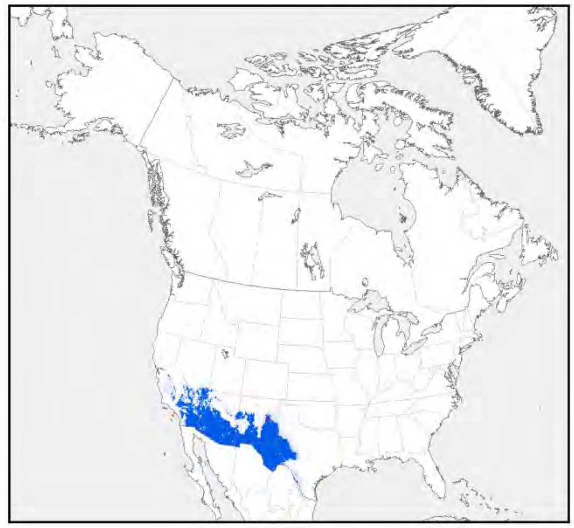
Brewer’s Sparrow (*Spizella breweri*)

Modeled Current Range (2000-2009)

Summer



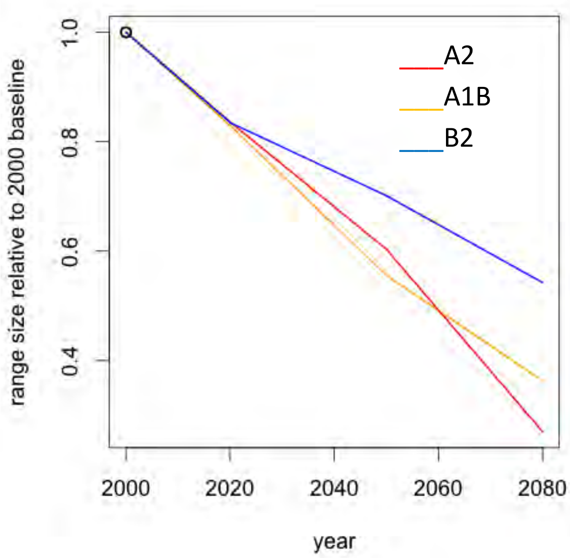
Winter



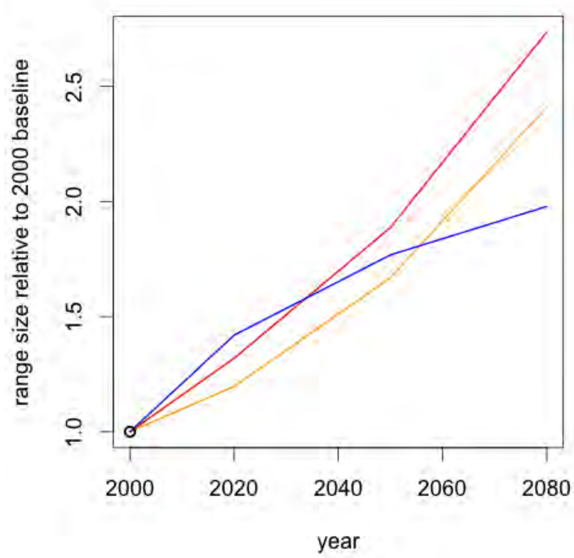
Current summer and winter ranges were modeled for Brewer’s Sparrow (*Spizella breweri*) using data from 2000-2009. Solid orange and blue areas show core ranges estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

Predicted Range Size by Year and Emissions Scenario for Brewer’s Sparrow (*Spizella breweri*)

Summer

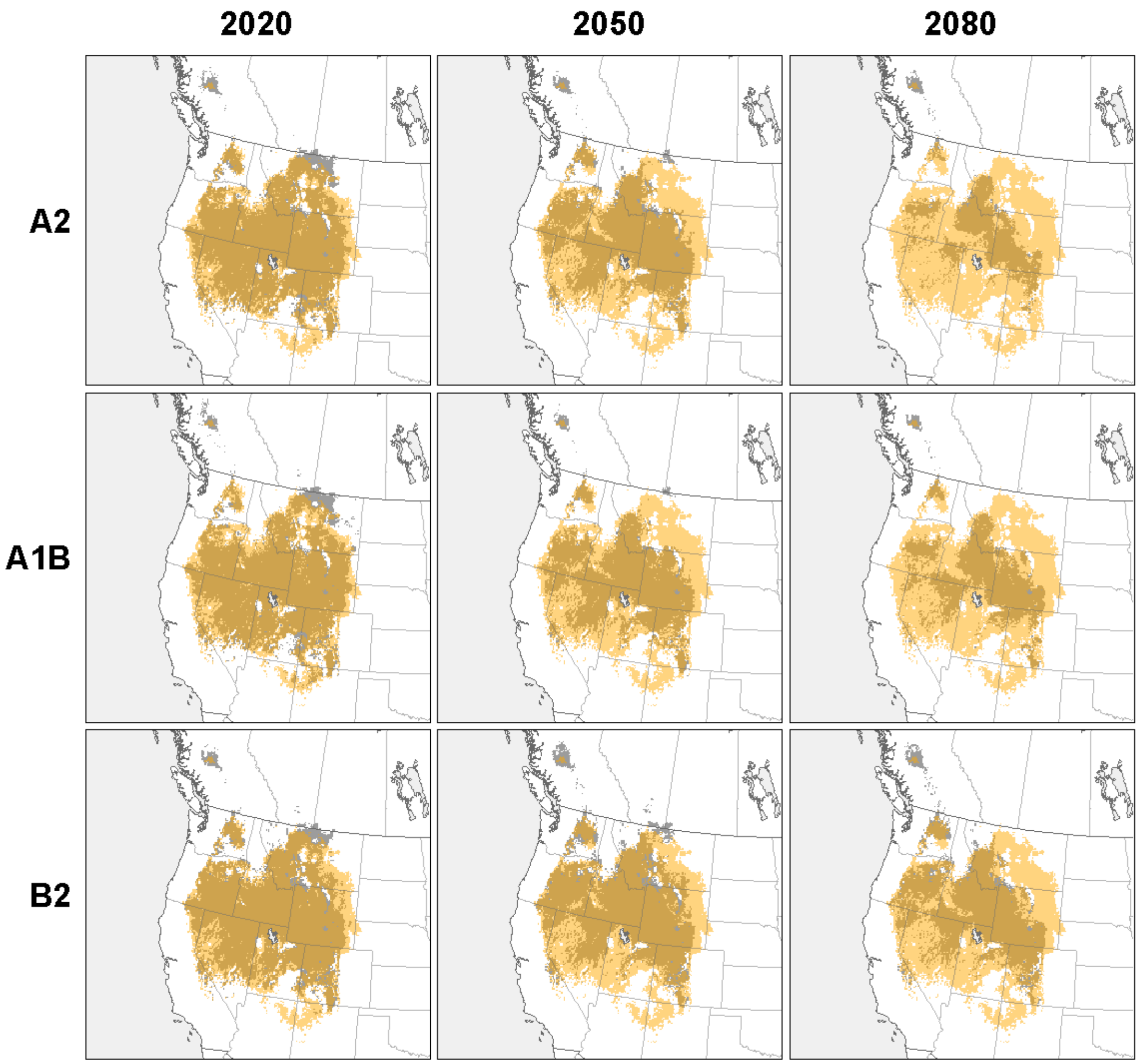


Winter



Brewer's Sparrow (*Spizella breweri*)

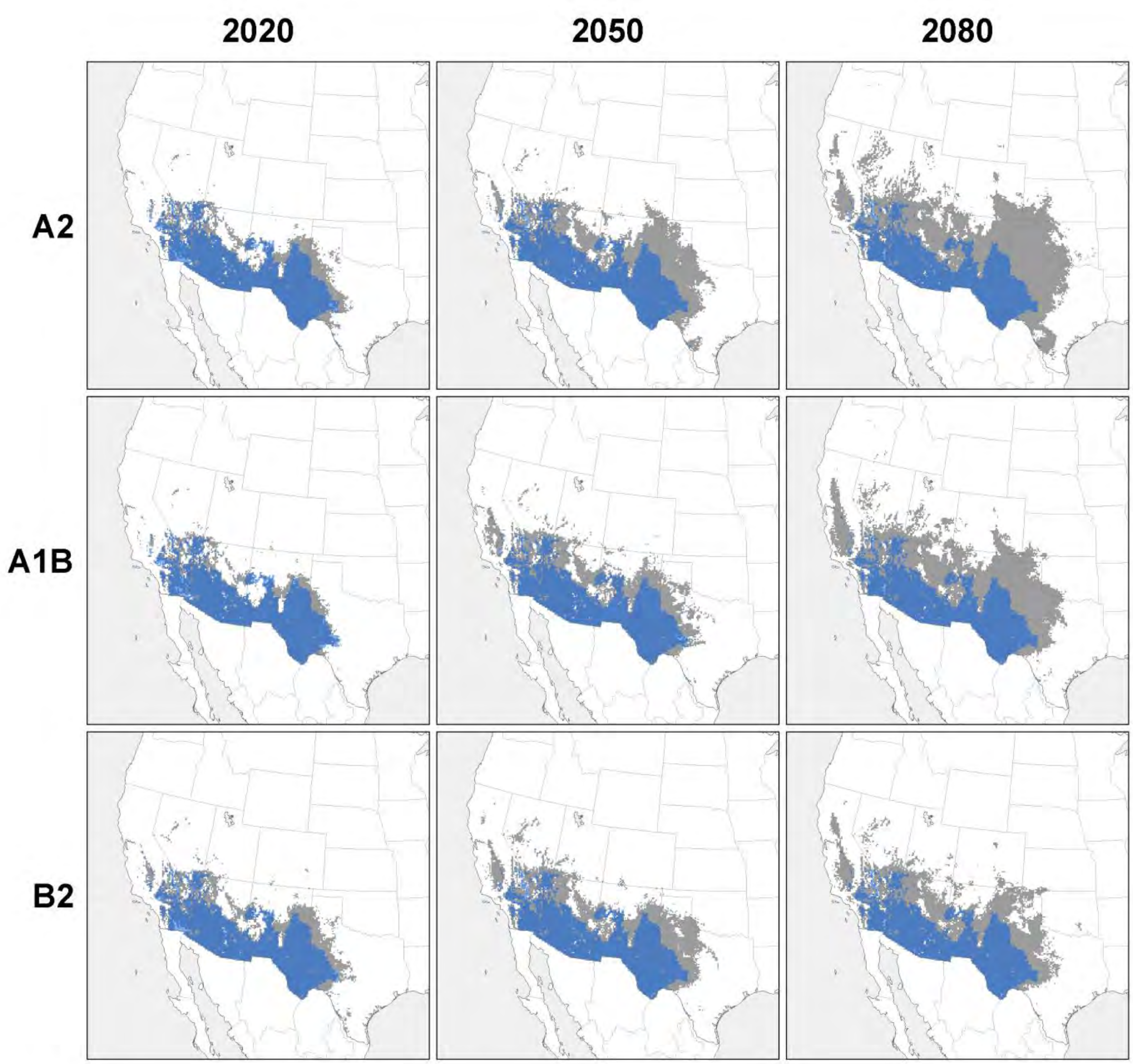
Modeled Future Summer Range by Year and Emissions Scenario



Orange areas indicate the modeled current range (2000-2009) for Brewer's Sparrow (*Spizella breweri*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Brewer's Sparrow (*Spizella breweri*)

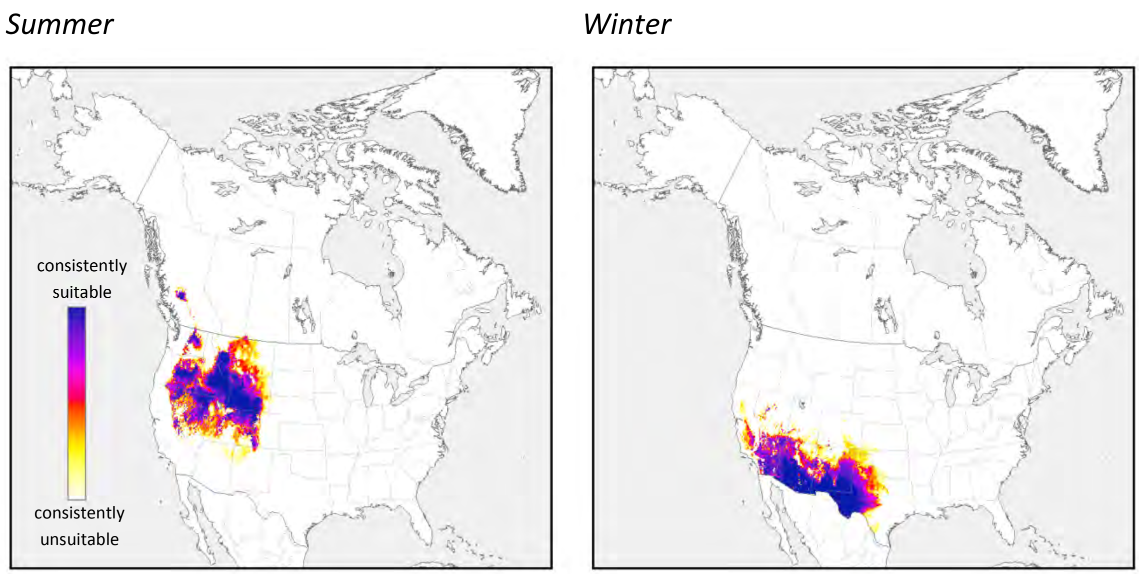
Predicted Future Winter Range by Year and Emissions Scenario



Blue areas indicate the modeled current range (2000-2009) for Brewer's Sparrow (*Spizella breweri*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

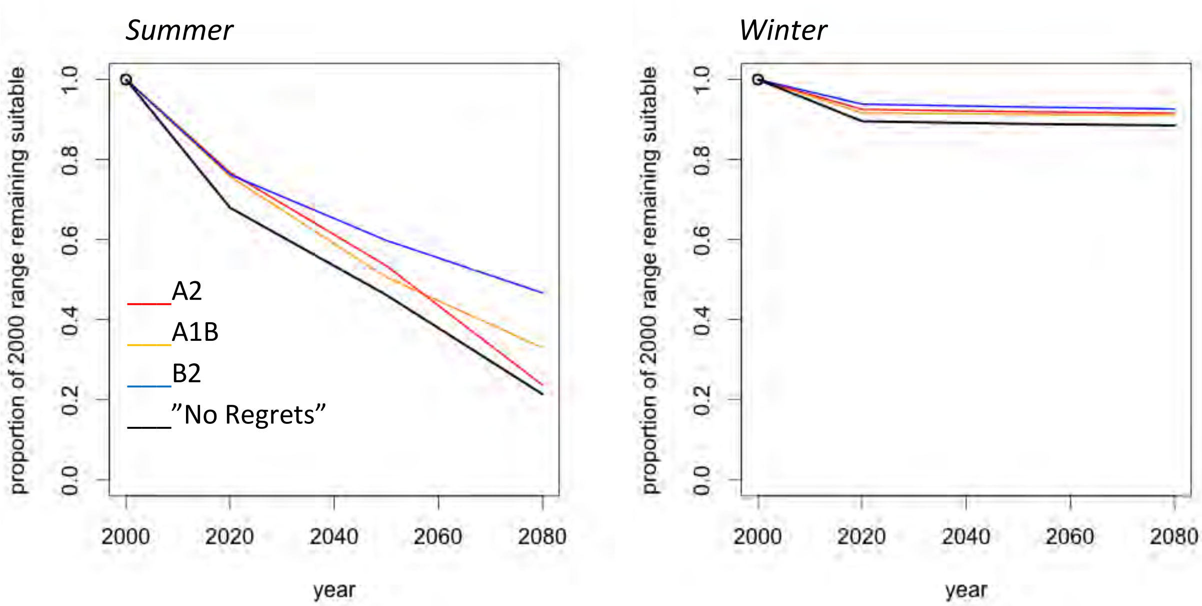
Brewer's Sparrow (*Spizella breweri*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios



Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Brewer's Sparrow (*Spizella breweri*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Brewer's Sparrow (*Spizella breweri*)



Brown-headed Nuthatch (*Sitta pusilla*)

Modeled Current Range (2000-2009)

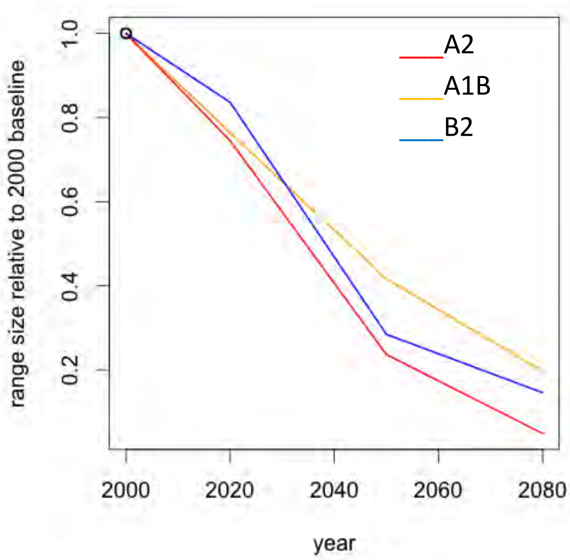
Summer

Winter

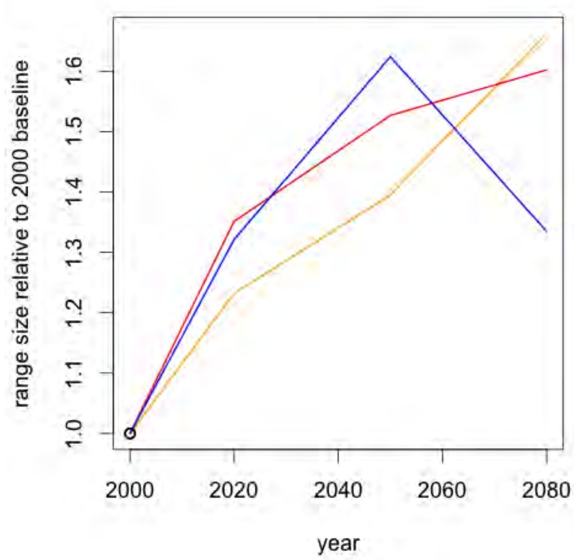
Current summer and winter ranges were modeled for Brown-headed Nuthatch (*Sitta pusilla*) using data from 2000-2009.Solid orange and blue areas show core ranges estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

Predicted Range Size by Year and Emissions Scenario for Brown-headed Nuthatch (*Sitta pusilla*)

Summer

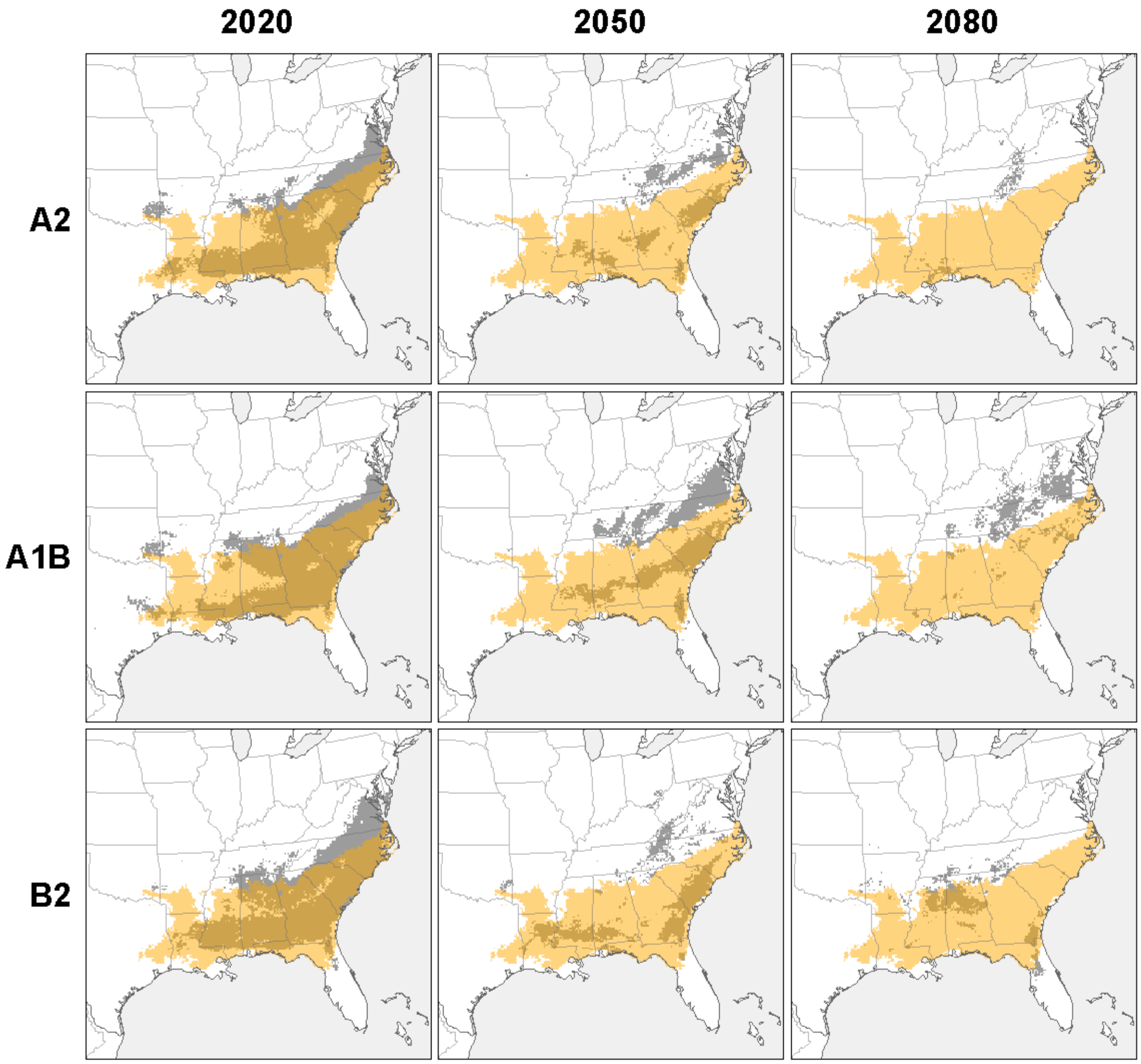


Winter



Brown-headed Nuthatch (*Sitta pusilla*)

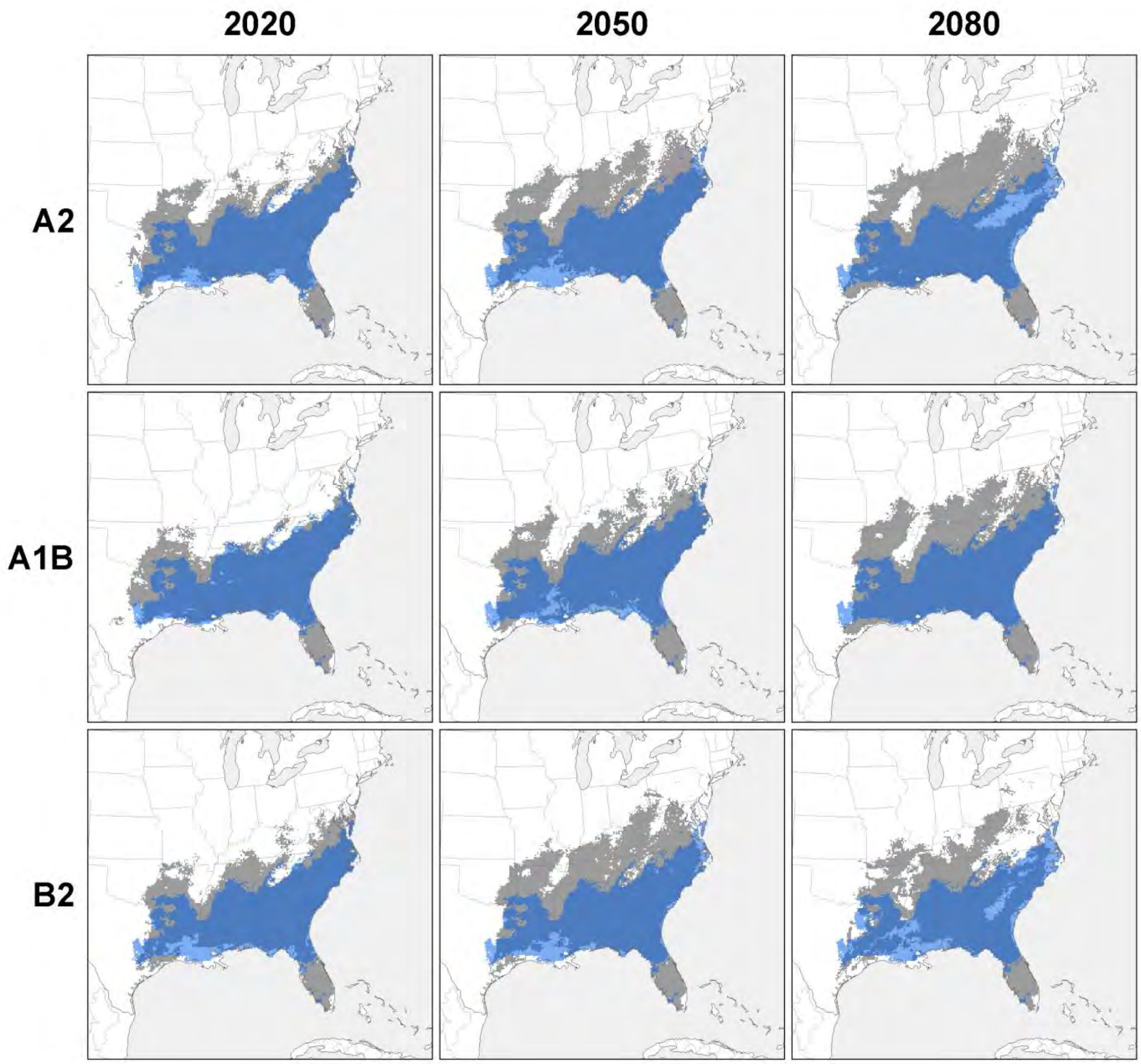
Modeled Future Summer Range by Year and Emissions Scenario



Orange areas indicate the modeled current range (2000-2009) for Brown-headed Nuthatch (*Sitta pusilla*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Brown-headed Nuthatch (*Sitta pusilla*)

Predicted Future Winter Range by Year and Emissions Scenario

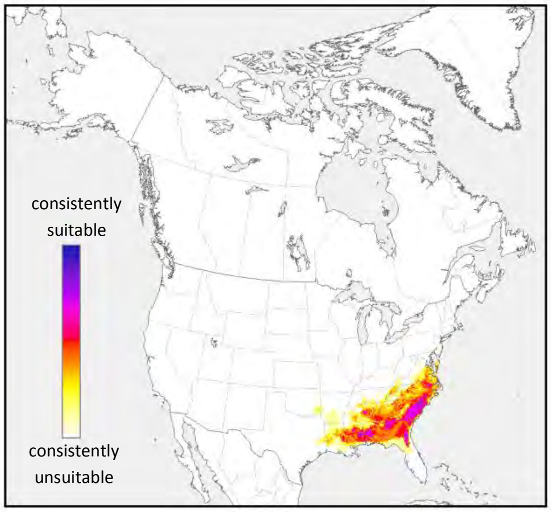


Blue areas indicate the modeled current range (2000-2009) for Brown-headed Nuthatch (*Sitta pusilla*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

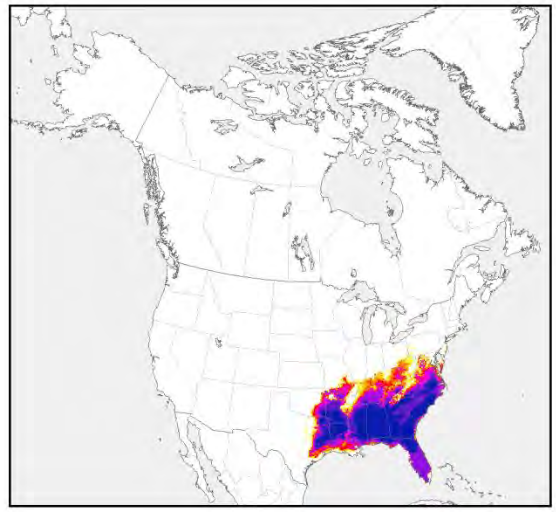
Brown-headed Nuthatch (*Sitta pusilla*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

Summer



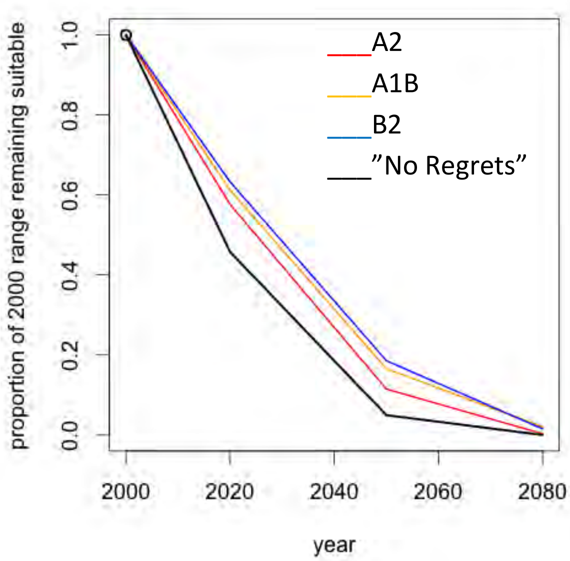
Winter



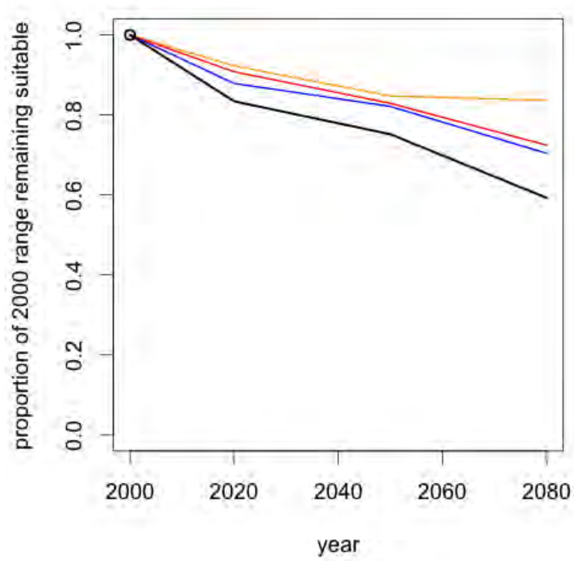
Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Brown-headed Nuthatch (*Sitta pusilla*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Brown-headed Nuthatch (*Sitta pusilla*)

Summer



Winter

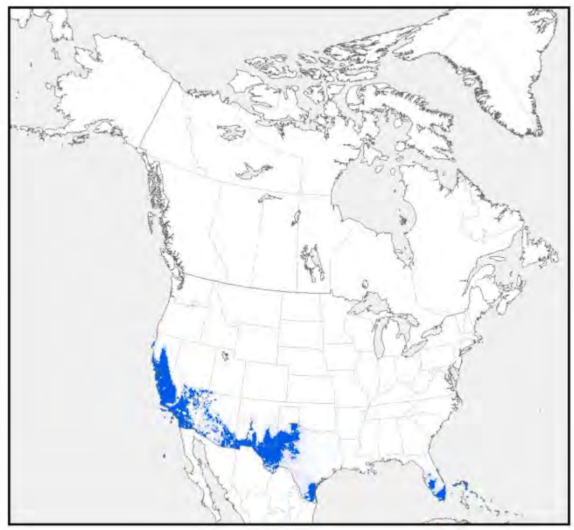


Burrowing Owl (*Athene cunicularia*)

Modeled Current Range (2000-2009)

Summer

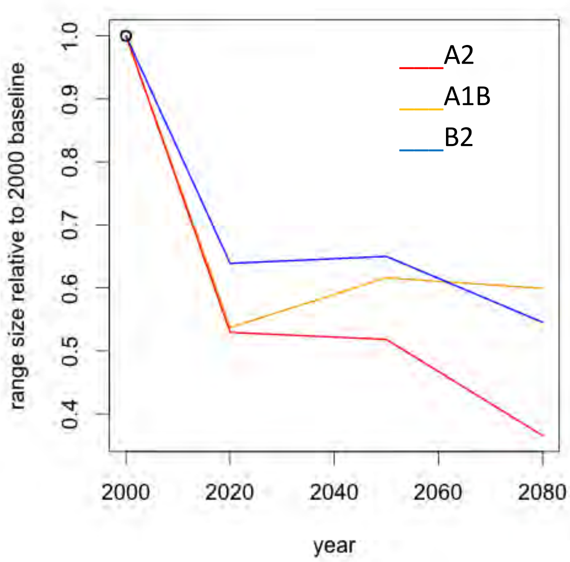
Winter



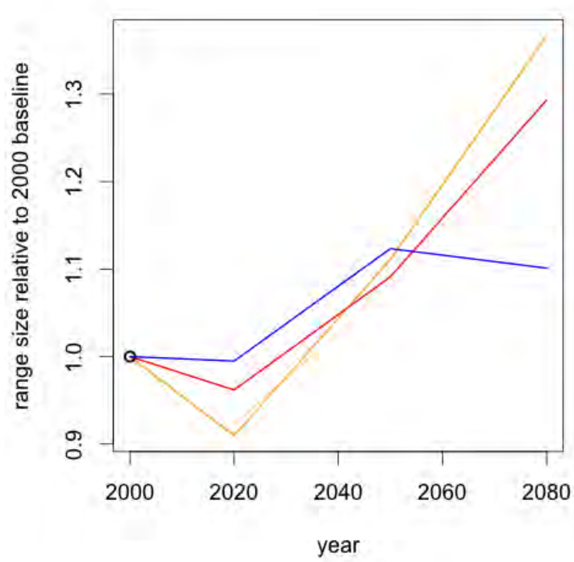
Current summer and winter ranges were modeled for Burrowing Owl (*Athene cunicularia*) using data from 2000-2009. Solid orange and blue areas show core ranges estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

Predicted Range Size by Year and Emissions Scenario for Burrowing Owl (*Athene cunicularia*)

Summer

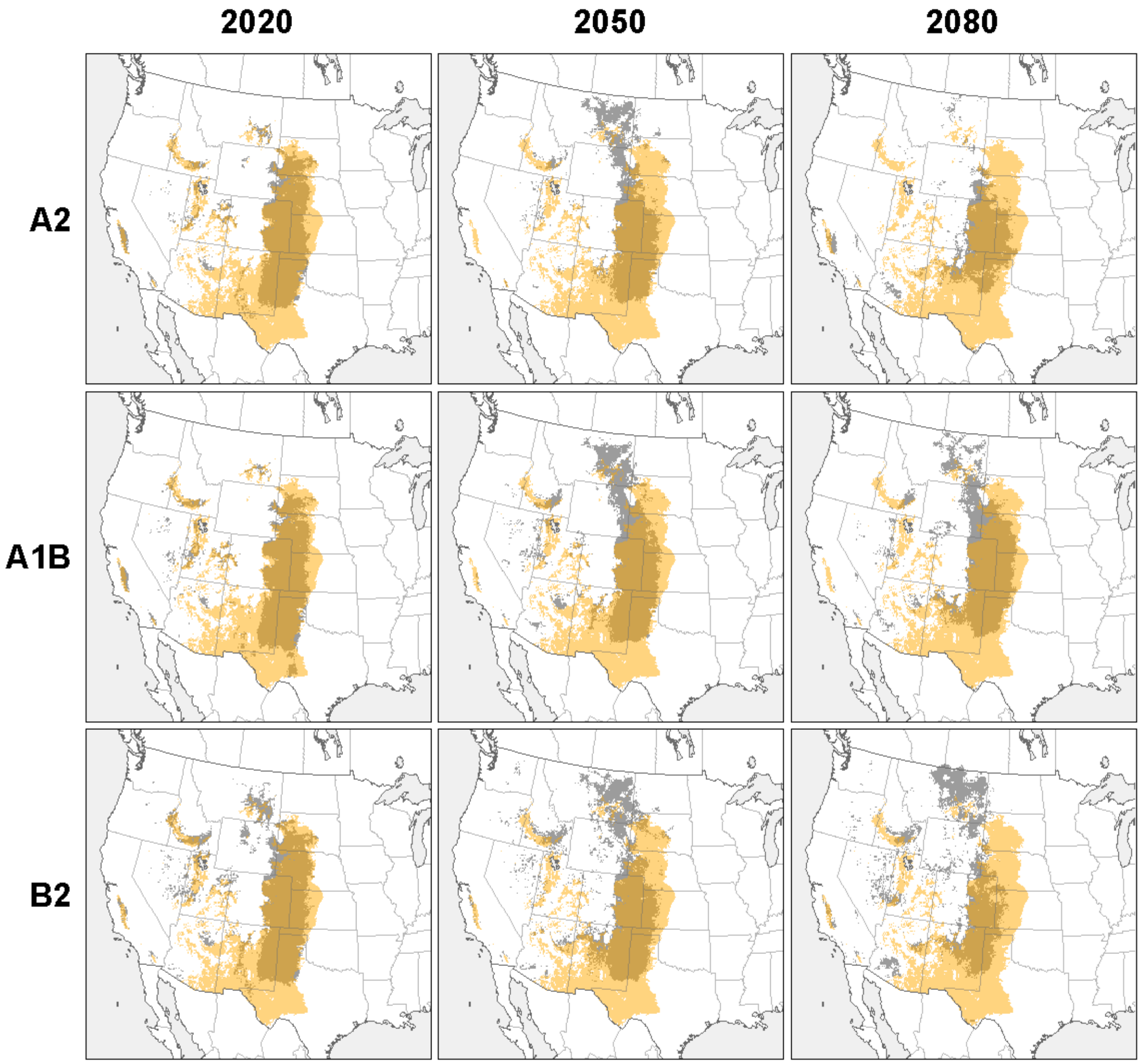


Winter



Burrowing Owl (*Athene cunicularia*)

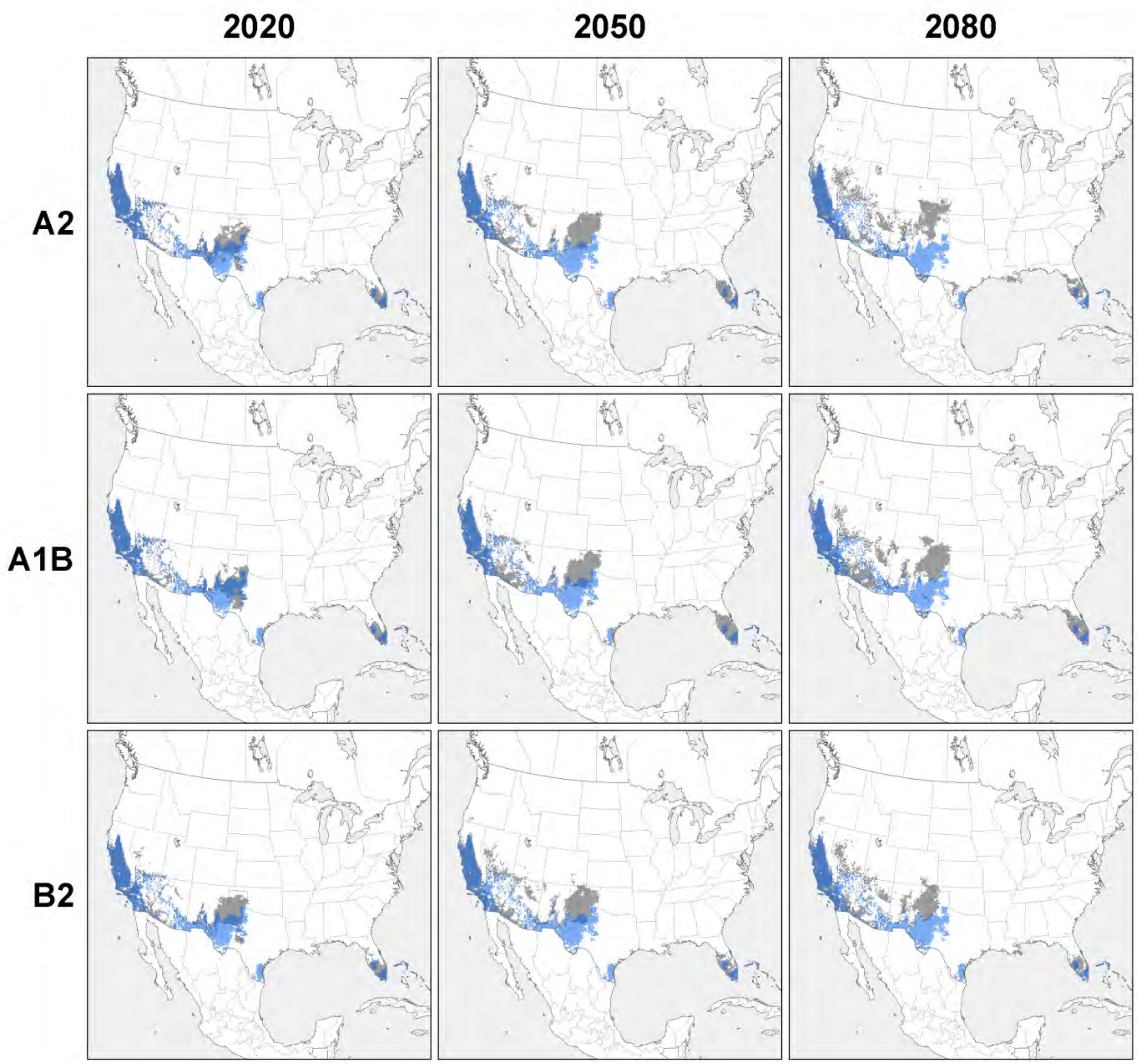
Modeled Future Summer Range by Year and Emissions Scenario



Orange areas indicate the modeled current range (2000-2009) for Burrowing Owl (*Athene cunicularia*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Burrowing Owl (*Athene cunicularia*)

Predicted Future Winter Range by Year and Emissions Scenario

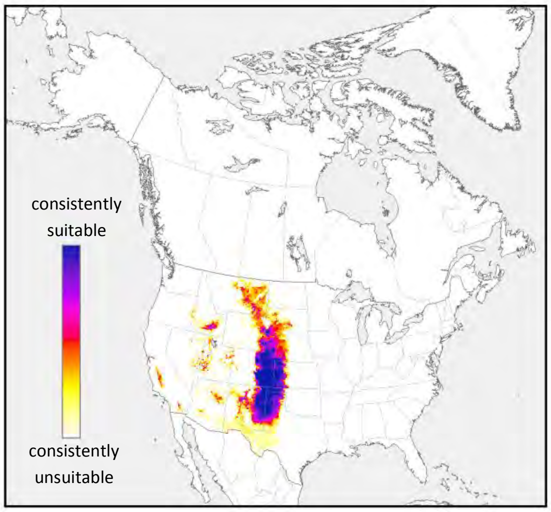


Blue areas indicate the modeled current range (2000-2009) for Burrowing Owl (*Athene cunicularia*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

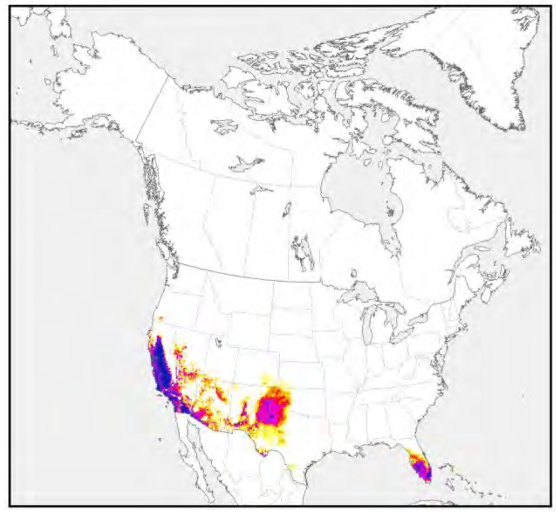
Burrowing Owl (*Athene cunicularia*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

Summer



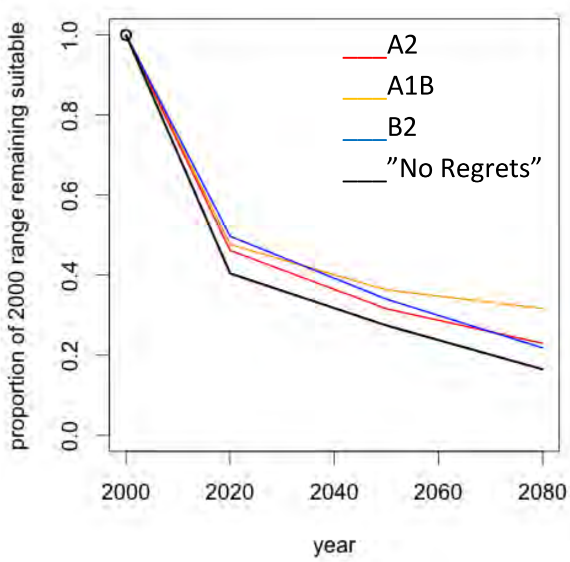
Winter



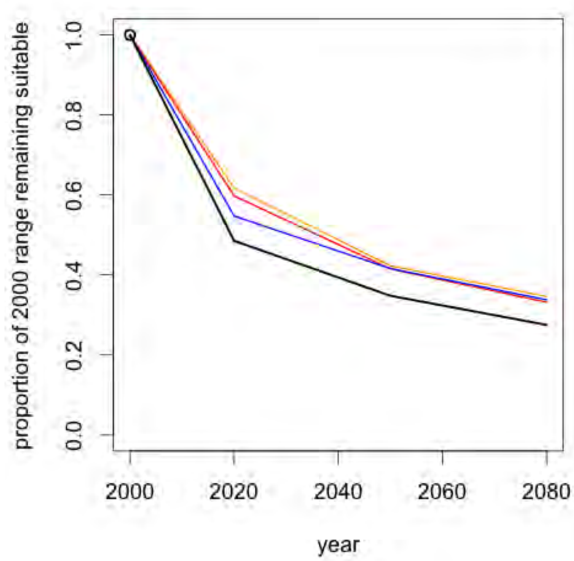
Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Burrowing Owl (*Athene cunicularia*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Burrowing Owl (*Athene cunicularia*)

Summer



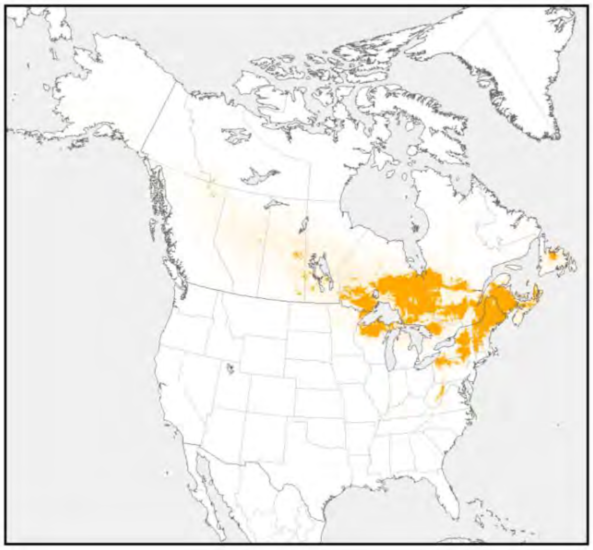
Winter



Canada Warbler (*Cardellina canadensis*)

Modeled Current Range (2000-2009)

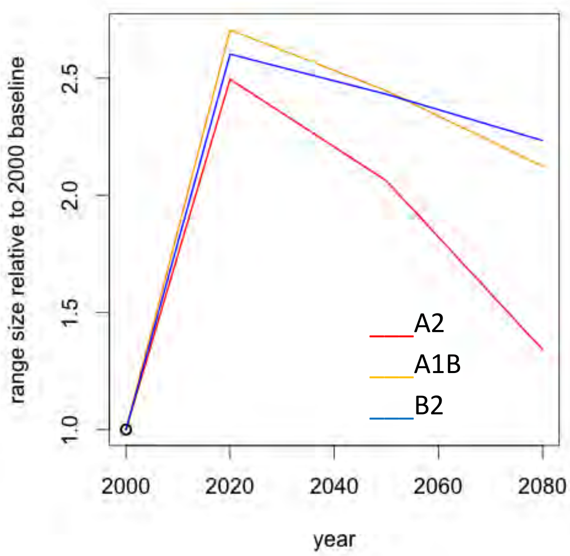
Summer



Current summer range was modeled for Canada Warbler (*Cardellina canadensis*) using data from 2000-2009. Solid orange areas show core range estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

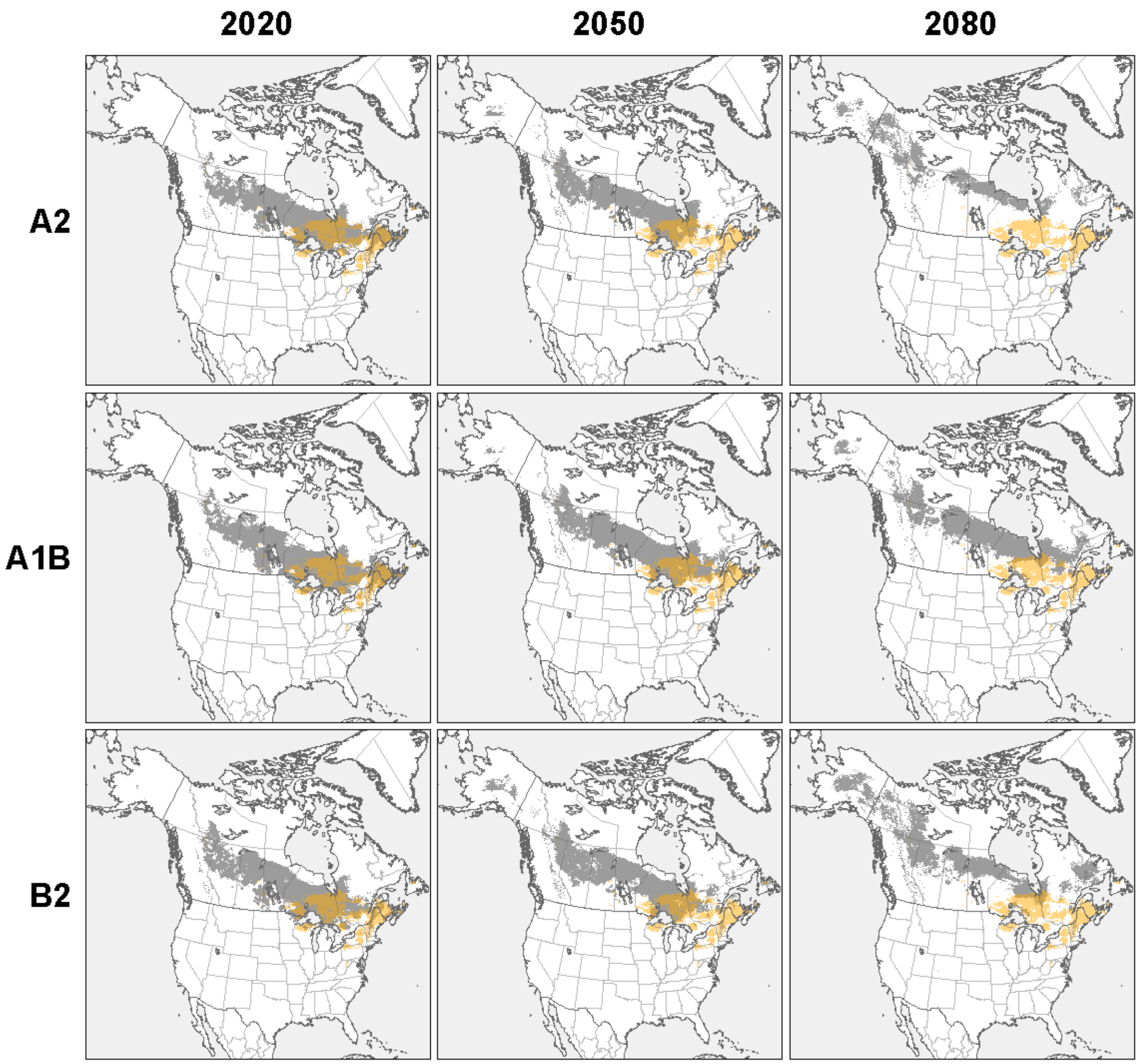
Predicted Range Size by Year and Emissions Scenario for Canada Warbler (*Cardellina canadensis*)

Summer



Canada Warbler (*Cardellina canadensis*)

Modeled Future Summer Range by Year and Emissions Scenario

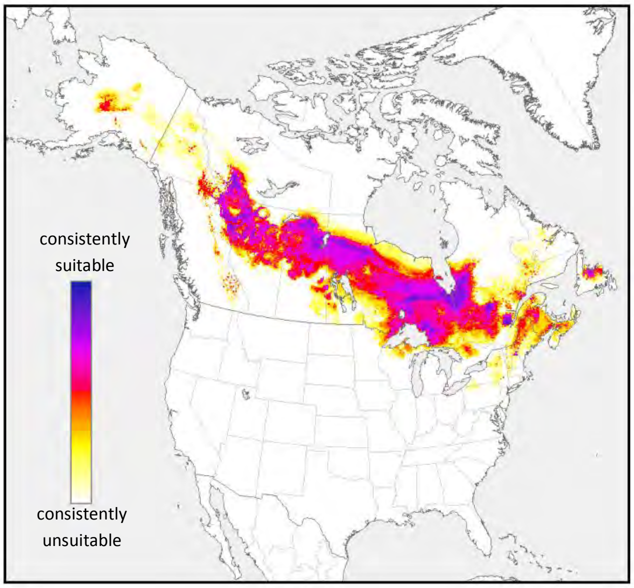


Orange areas indicate the modeled current range (2000-2009) for Canada Warbler (*Cardellina canadensis*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Canada Warbler (*Cardellina canadensis*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

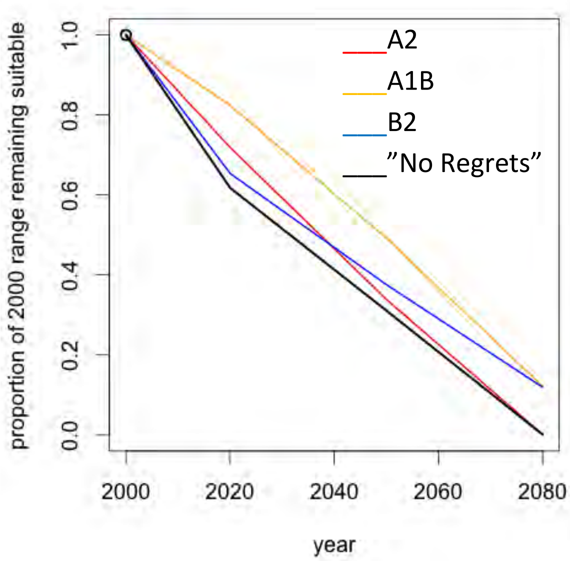
Summer



Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Canada Warbler (*Cardellina canadensis*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Canada Warbler (*Cardellina canadensis*)

Summer



Cerulean Warbler (*Setophaga cerulea*)

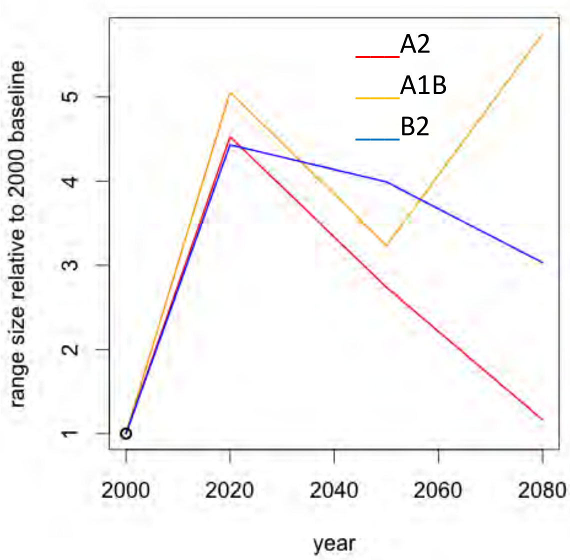
Modeled Current Range (2000-2009)

Summer

Current summer range was modeled for Cerulean Warbler (*Setophaga cerulea*) using data from 2000-2009. Solid orange areas show core range estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

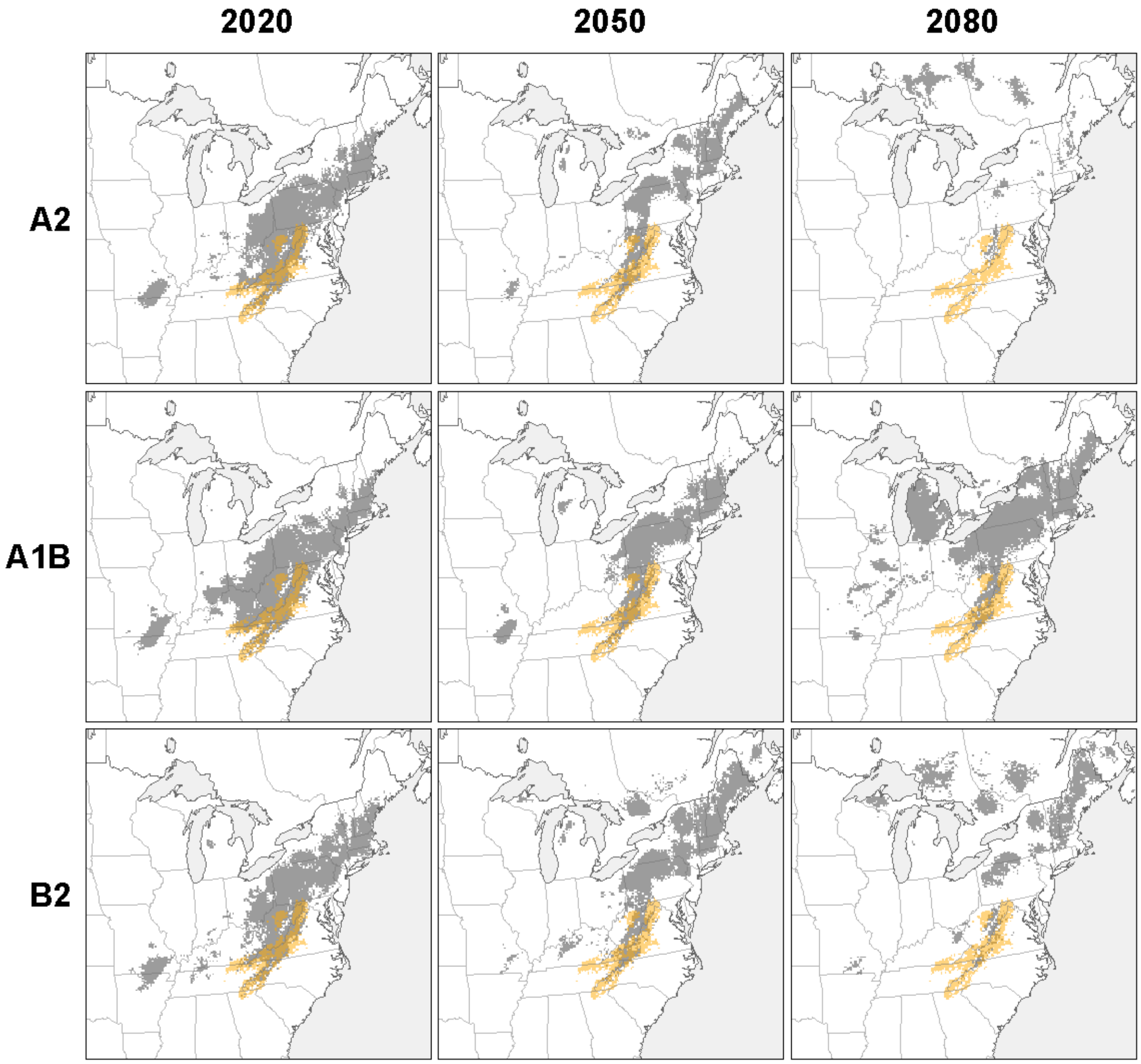
Predicted Range Size by Year and Emissions Scenario for Cerulean Warbler (*Setophaga cerulea*)

Summer



Cerulean Warbler (*Setophaga cerulea*)

Modeled Future Summer Range by Year and Emissions Scenario

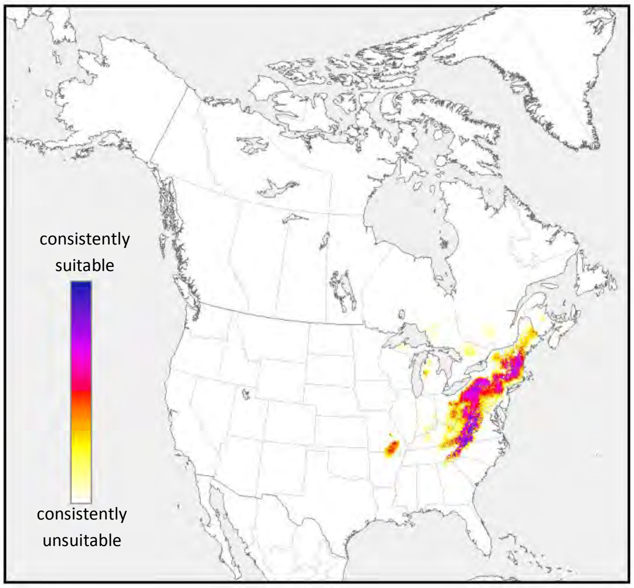


Orange areas indicate the modeled current range (2000-2009) for Cerulean Warbler (*Setophaga cerulea*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Cerulean Warbler (*Setophaga cerulea*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

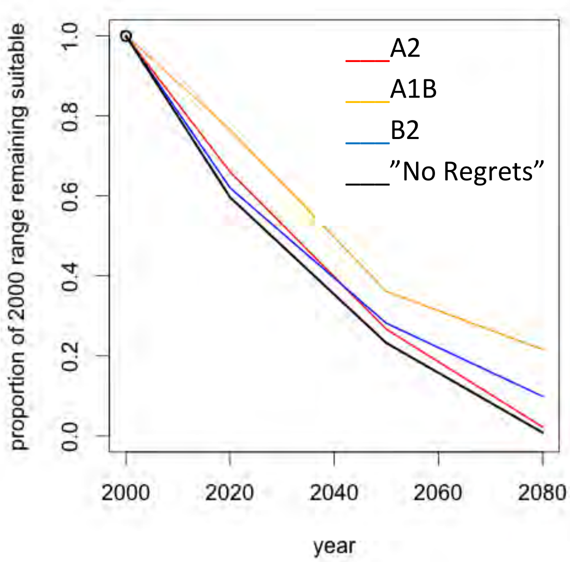
Summer



Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Cerulean Warbler (*Setophaga cerulea*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Cerulean Warbler (*Setophaga cerulea*)

Summer

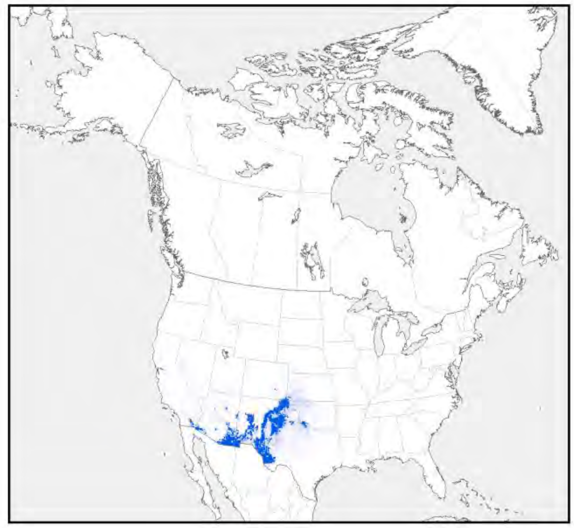


Chestnut-collared Longspur (*Calcarius ornatus*)

Modeled Current Range (2000-2009)

Summer

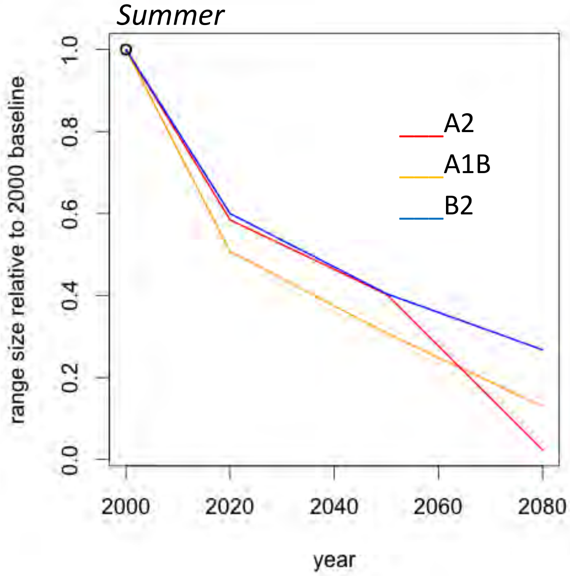
Winter



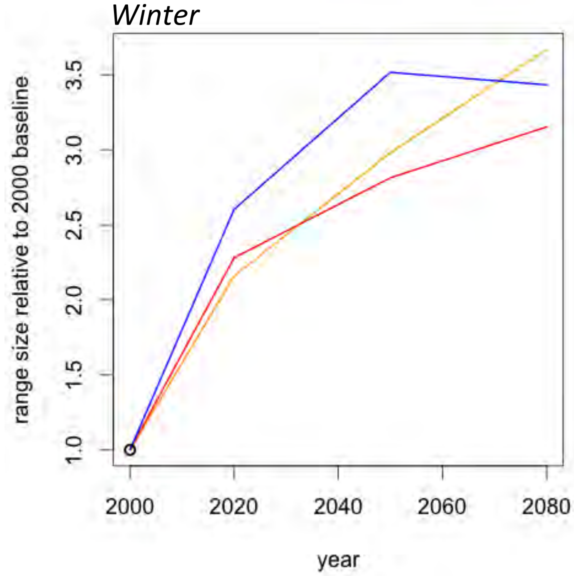
Current summer and winter ranges were modeled for Chestnut-collared Longspur (*Calcarius ornatus*) using data from 2000-2009. Solid orange and blue areas show core ranges estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

Predicted Range Size by Year and Emissions Scenario for Chestnut-collared Longspur (*Calcarius ornatus*)

Summer

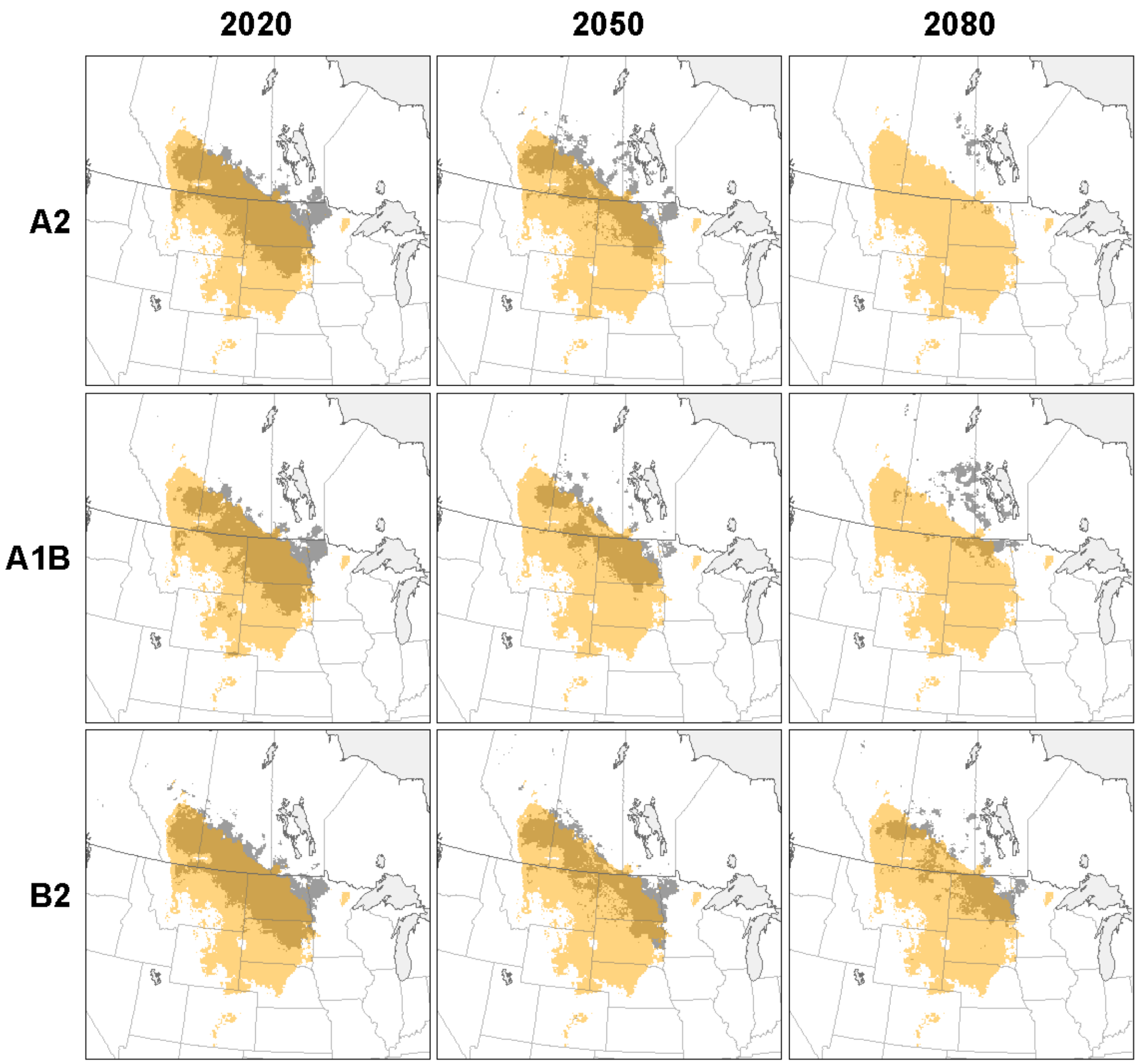


Winter



Chestnut-collared Longspur (*Calcarius ornatus*)

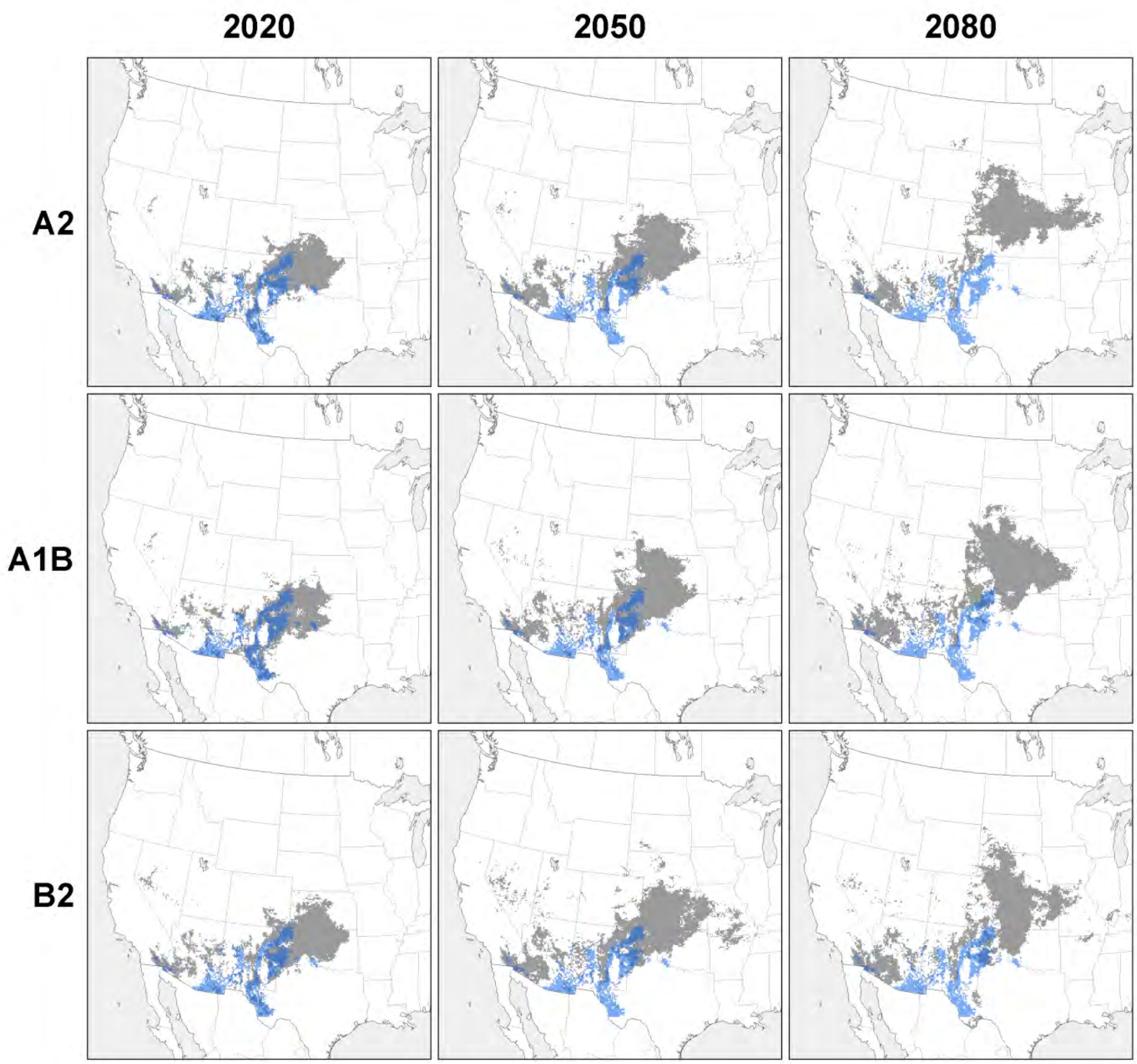
Modeled Future Summer Range by Year and Emissions Scenario



Orange areas indicate the modeled current range (2000-2009) for Chestnut-collared Longspur (*Calcarius ornatus*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Chestnut-collared Longspur (*Calcarius ornatus*)

Predicted Future Winter Range by Year and Emissions Scenario

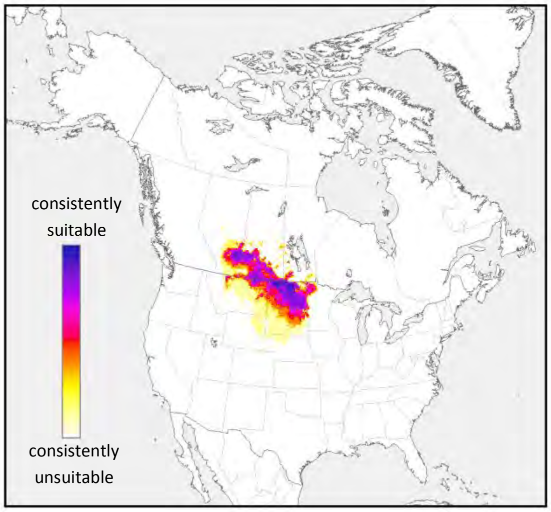


Blue areas indicate the modeled current range (2000-2009) for Chestnut-collared Longspur (*Calcarius ornatus*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

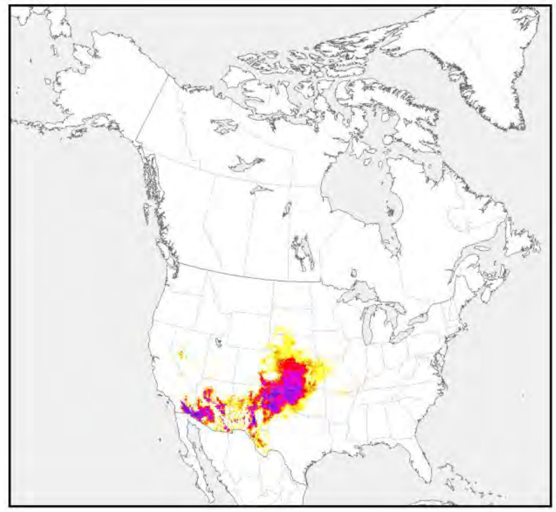
Chestnut-collared Longspur (*Calcarius ornatus*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

Summer



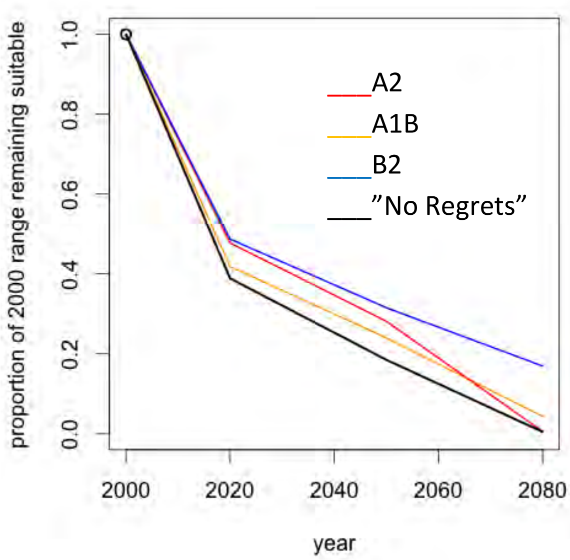
Winter



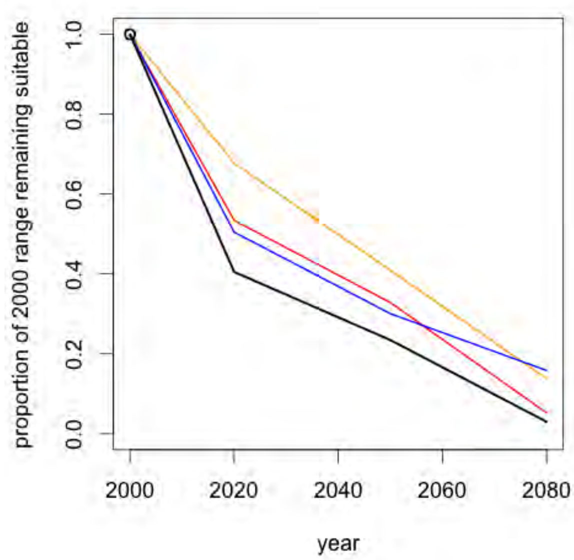
Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Chestnut-collared Longspur (*Calcarius ornatus*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Chestnut-collared Longspur (*Calcarius ornatus*)

Summer



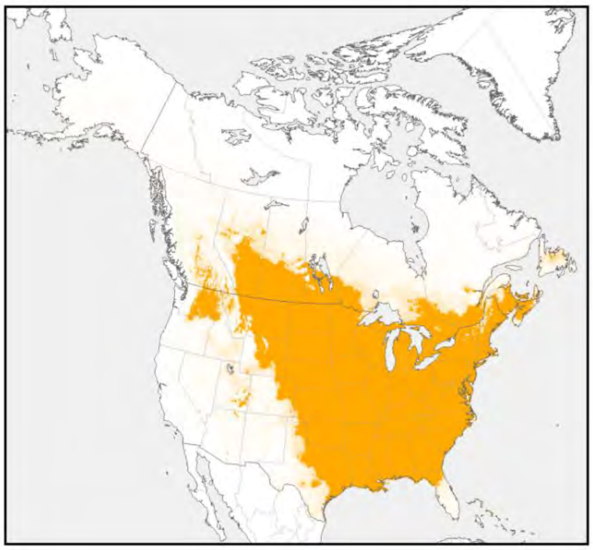
Winter



Eastern Kingbird (*Tyrannus tyrannus*)

Modeled Current Range (2000-2009)

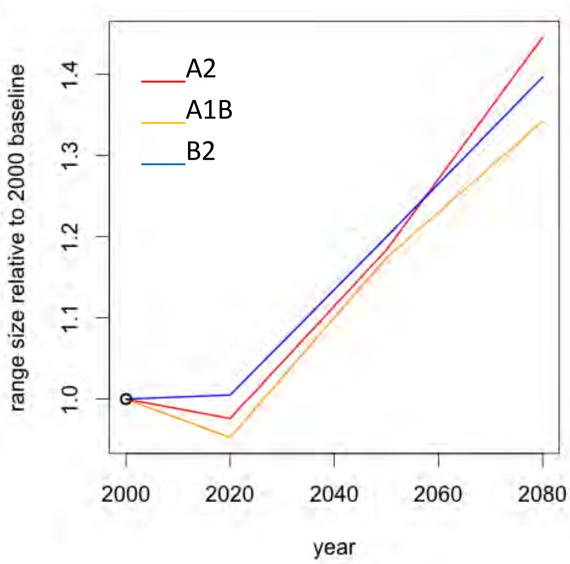
Summer



Current summer range was modeled for Eastern Kingbird (*Tyrannus tyrannus*) using data from 2000-2009. Solid orange areas show core range estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

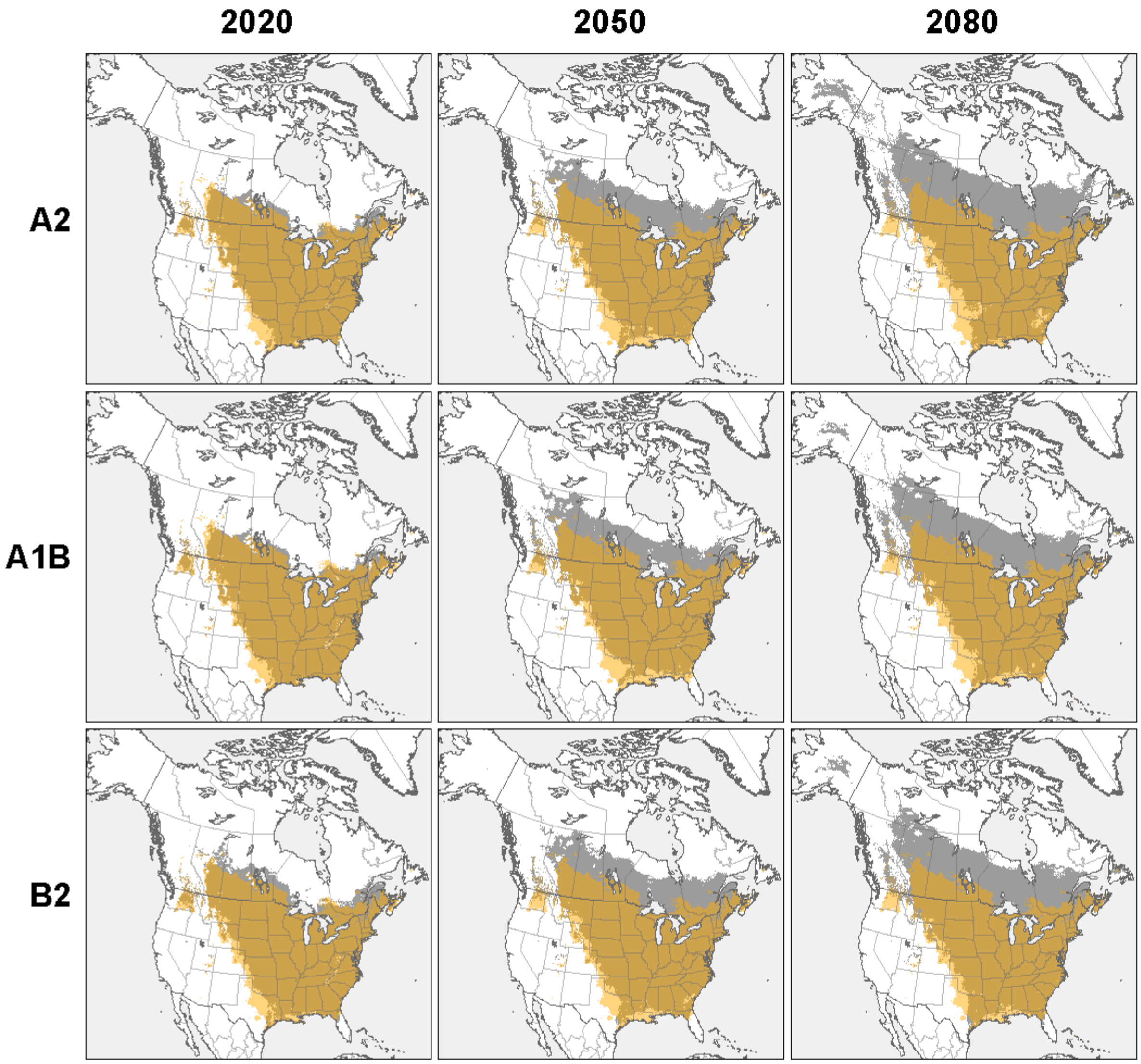
Predicted Range Size by Year and Emissions Scenario for Eastern Kingbird (*Tyrannus tyrannus*)

Summer



Eastern Kingbird (*Tyrannus tyrannus*)

Modeled Future Summer Range by Year and Emissions Scenario

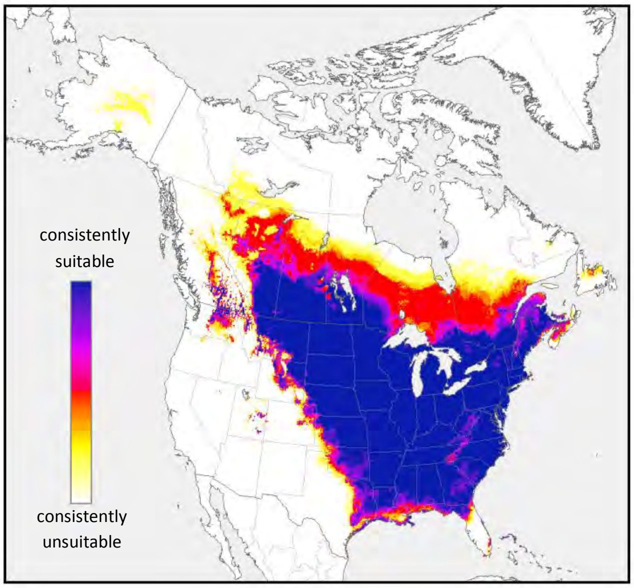


Orange areas indicate the modeled current range (2000-2009) for Eastern Kingbird (*Tyrannus tyrannus*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Eastern Kingbird (*Tyrannus tyrannus*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

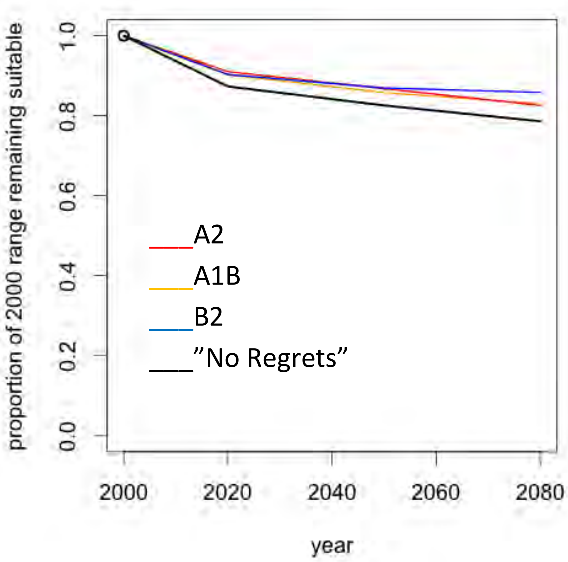
Summer



Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Eastern Kingbird (*Tyrannus tyrannus*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Eastern Kingbird (*Tyrannus tyrannus*)

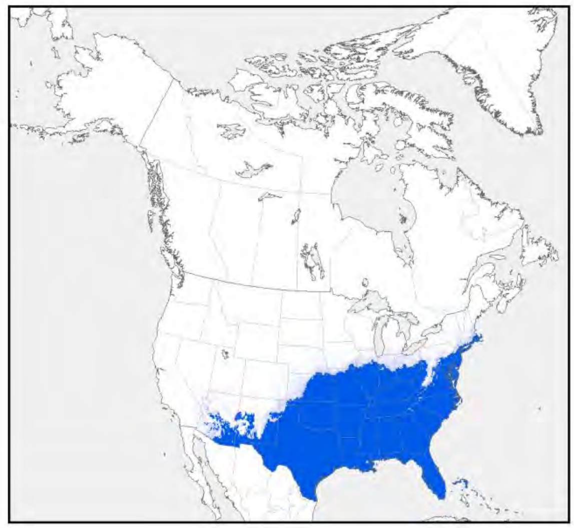
Summer



Eastern Meadowlark (*Sturnella magna*)

Modeled Current Range (2000-2009)

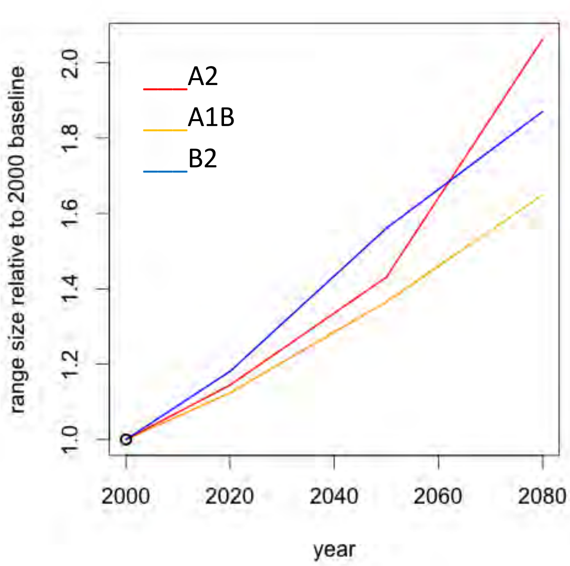
Summer *Winter*

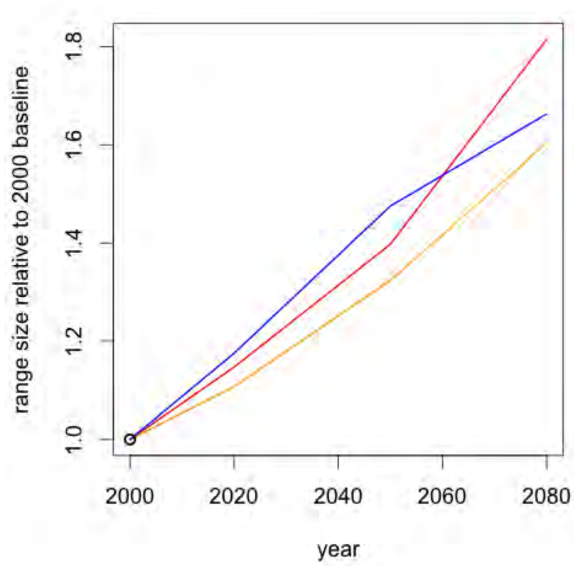


Current summer and winter ranges were modeled for Eastern Meadowlark (*Sturnella magna*) using data from 2000-2009. Solid orange and blue areas show core ranges estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

Predicted Range Size by Year and Emissions Scenario for Eastern Meadowlark (*Sturnella magna*)

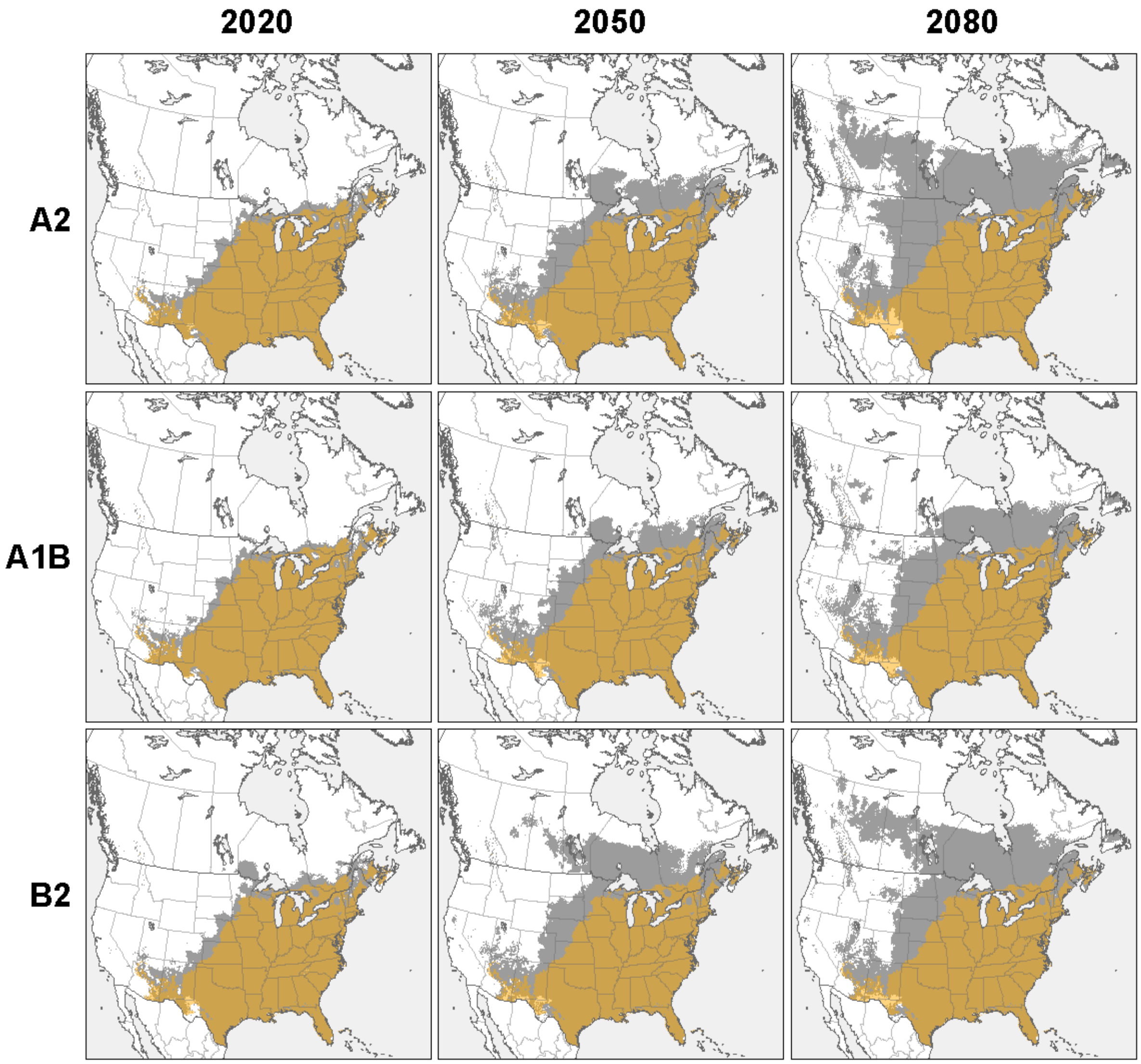
Summer *Winter*





Eastern Meadowlark (*Sturnella magna*)

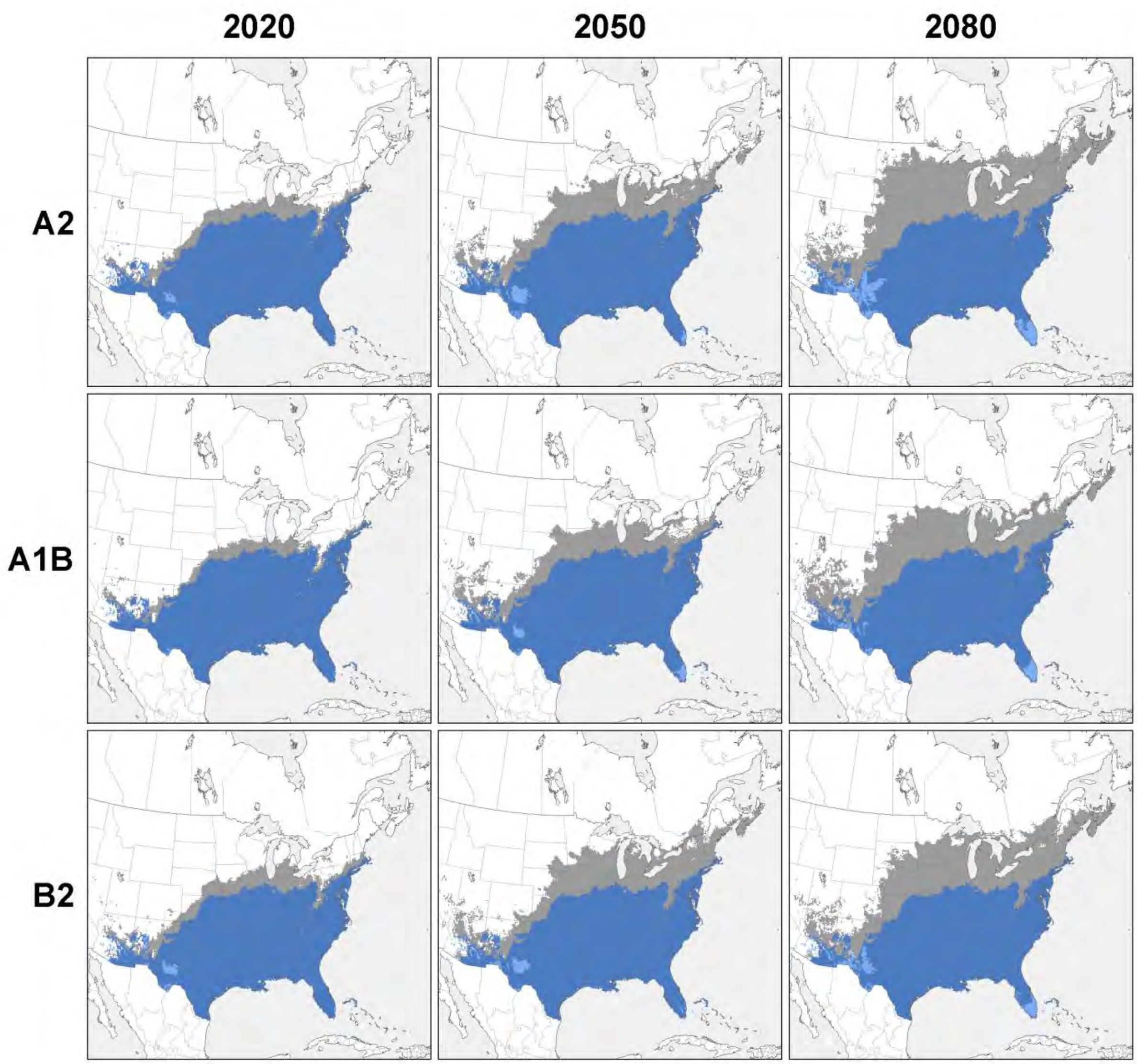
Modeled Future Summer Range by Year and Emissions Scenario



Orange areas indicate the modeled current range (2000-2009) for Eastern Meadowlark (*Sturnella magna*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Eastern Meadowlark (*Sturnella magna*)

Predicted Future Winter Range by Year and Emissions Scenario

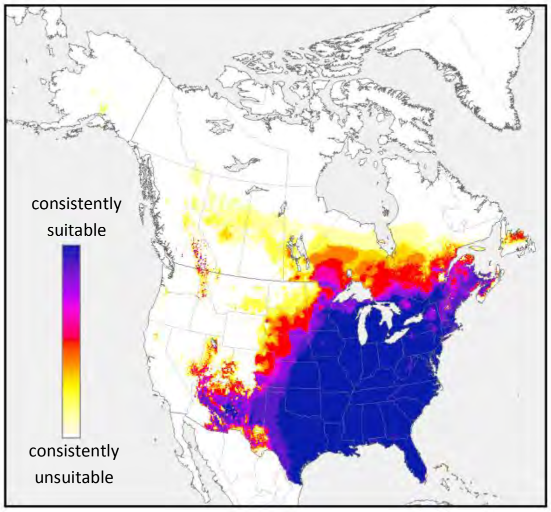


Blue areas indicate the modeled current range (2000-2009) for Eastern Meadowlark (*Sturnella magna*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

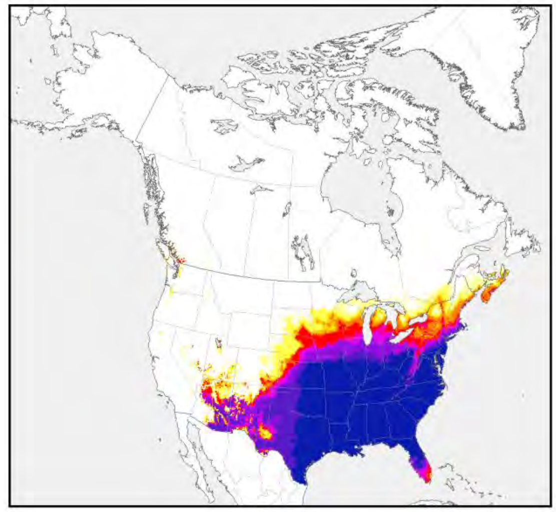
Eastern Meadowlark (*Sturnella magna*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

Summer



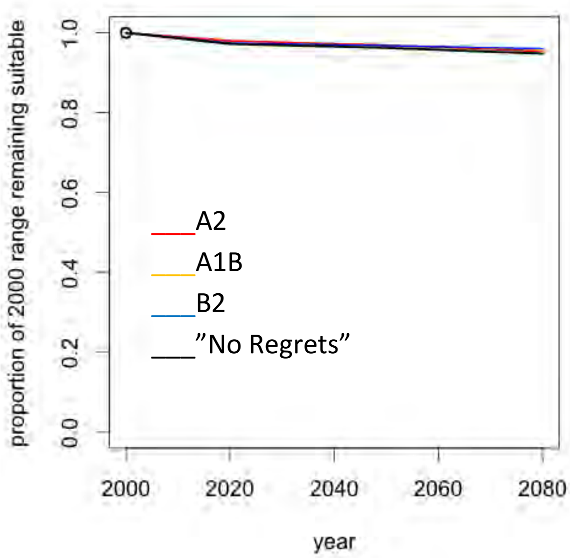
Winter



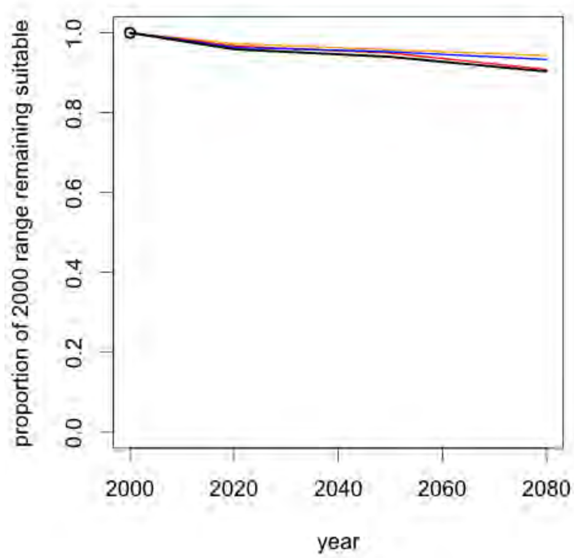
Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Eastern Meadowlark (*Sturnella magna*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Eastern Meadowlark (*Sturnella magna*)

Summer



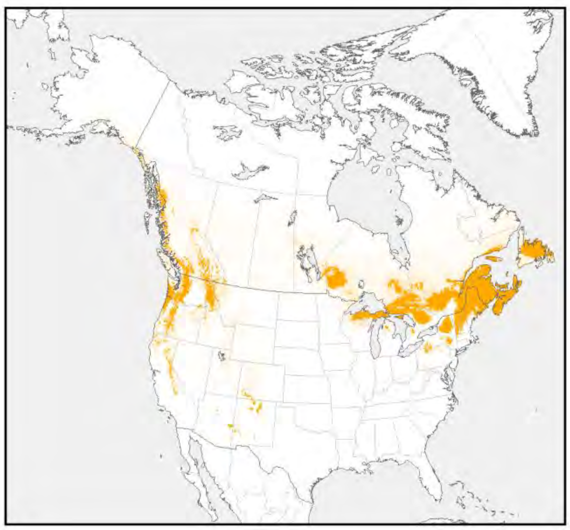
Winter



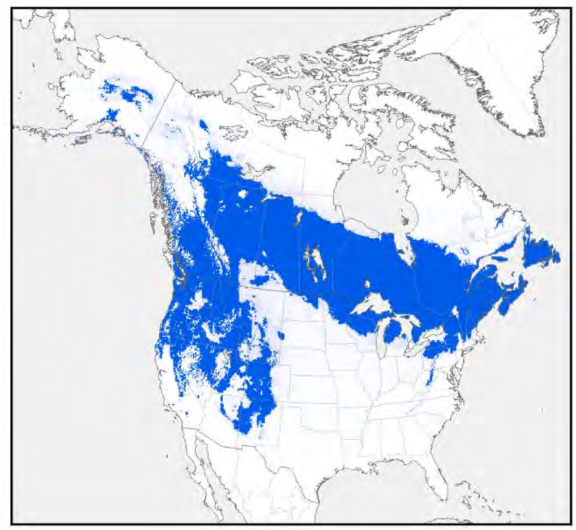
Evening Grosbeak (*Coccothraustes vespertinus*)

Modeled Current Range (2000-2009)

Summer



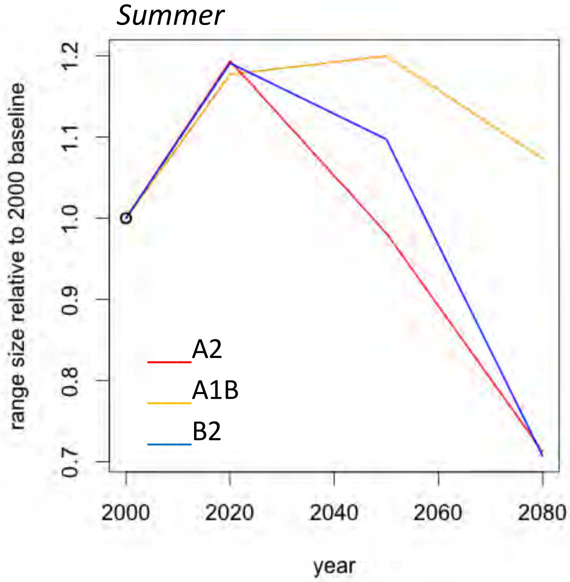
Winter



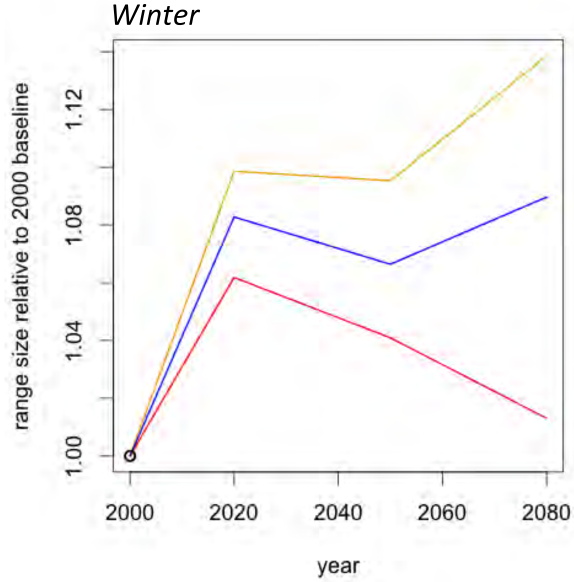
Current summer and winter ranges were modeled for Evening Grosbeak (*Coccothraustes vespertinus*) using data from 2000-2009. Solid orange and blue areas show core ranges estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

Predicted Range Size by Year and Emissions Scenario for Evening Grosbeak (*Coccothraustes vespertinus*)

Summer

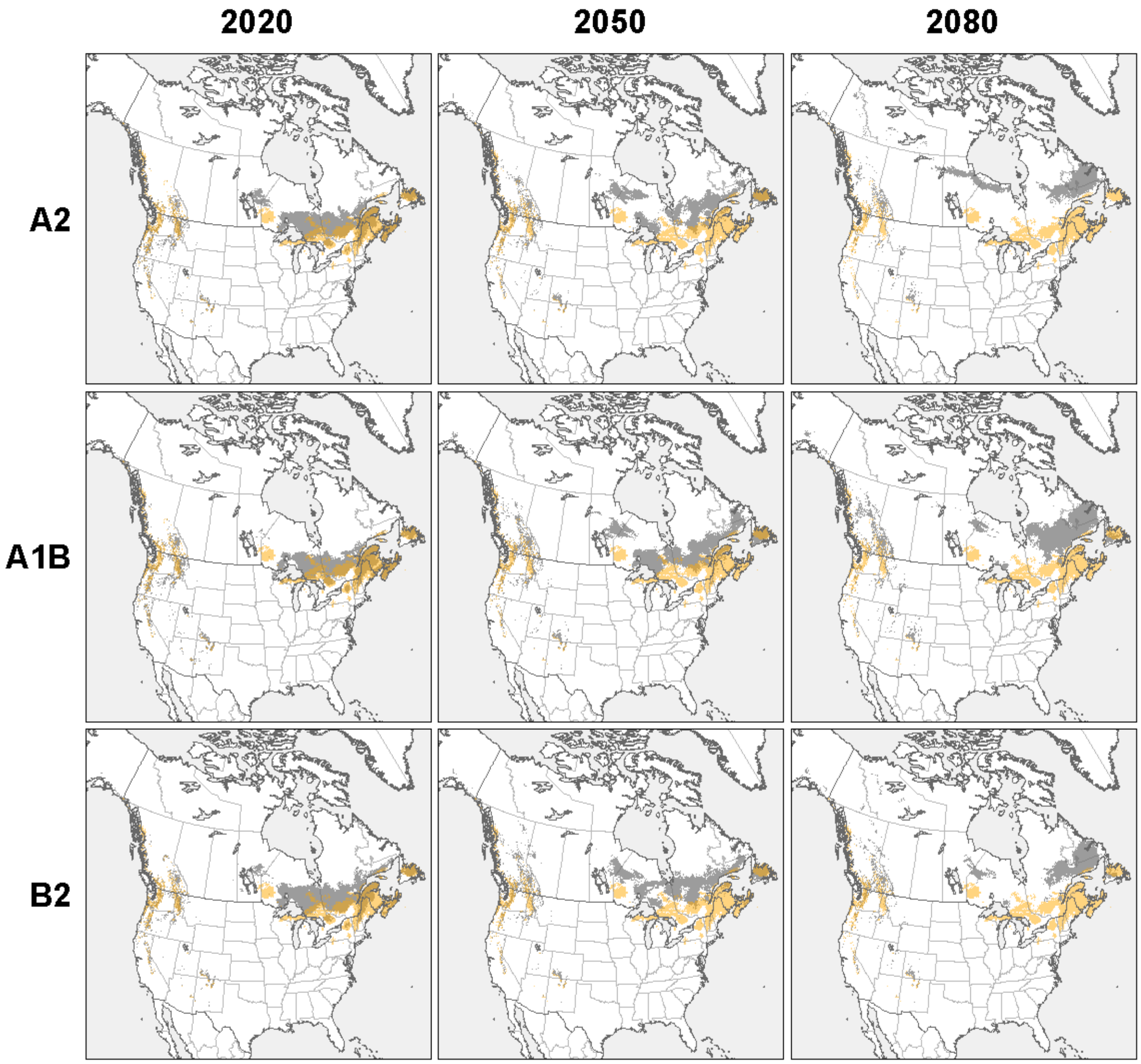


Winter



Evening Grosbeak (*Coccothraustes vespertinus*)

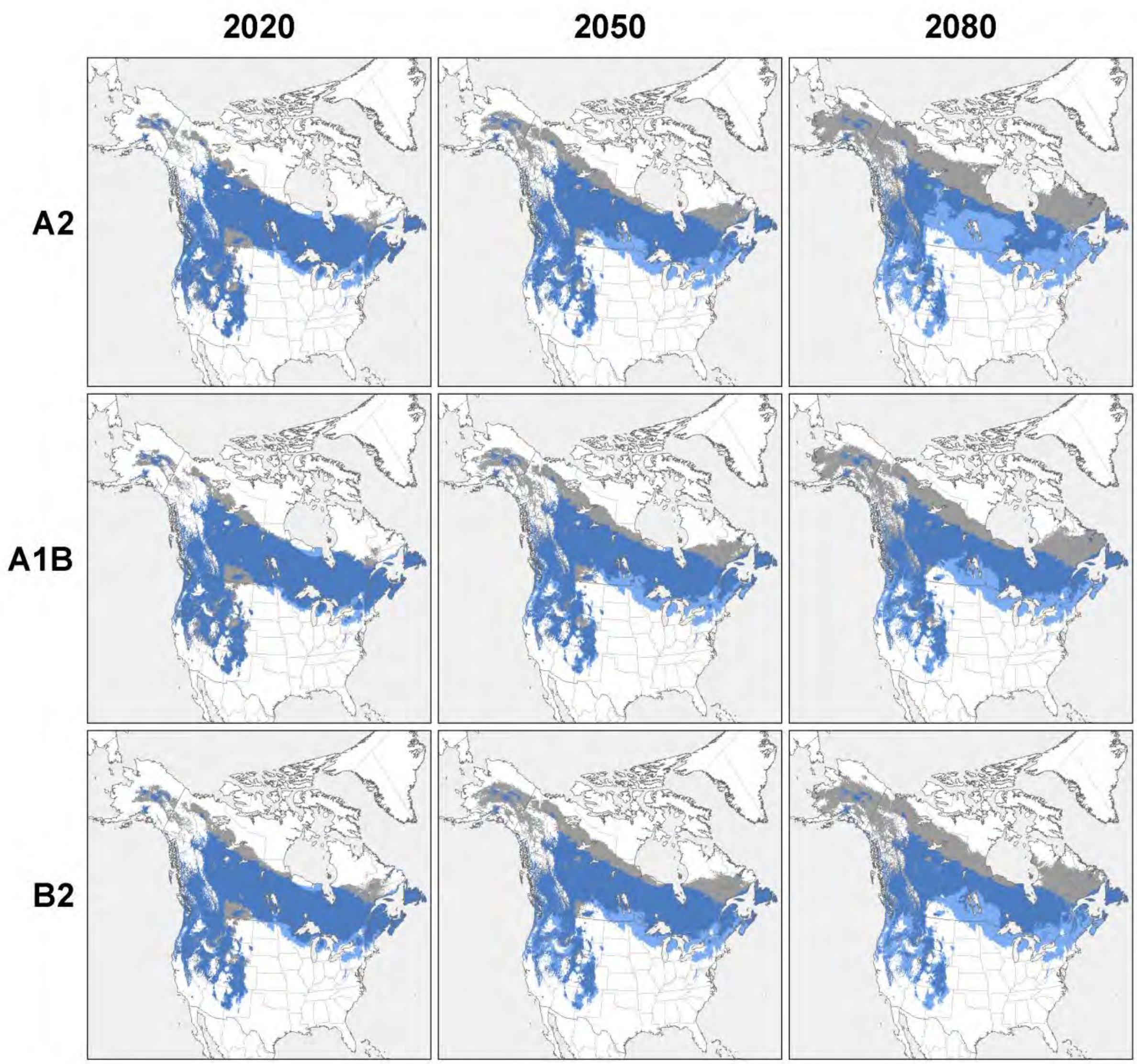
Modeled Future Summer Range by Year and Emissions Scenario



Orange areas indicate the modeled current range (2000-2009) for Evening Grosbeak (*Coccothraustes vespertinus*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Evening Grosbeak (*Coccothraustes vespertinus*)

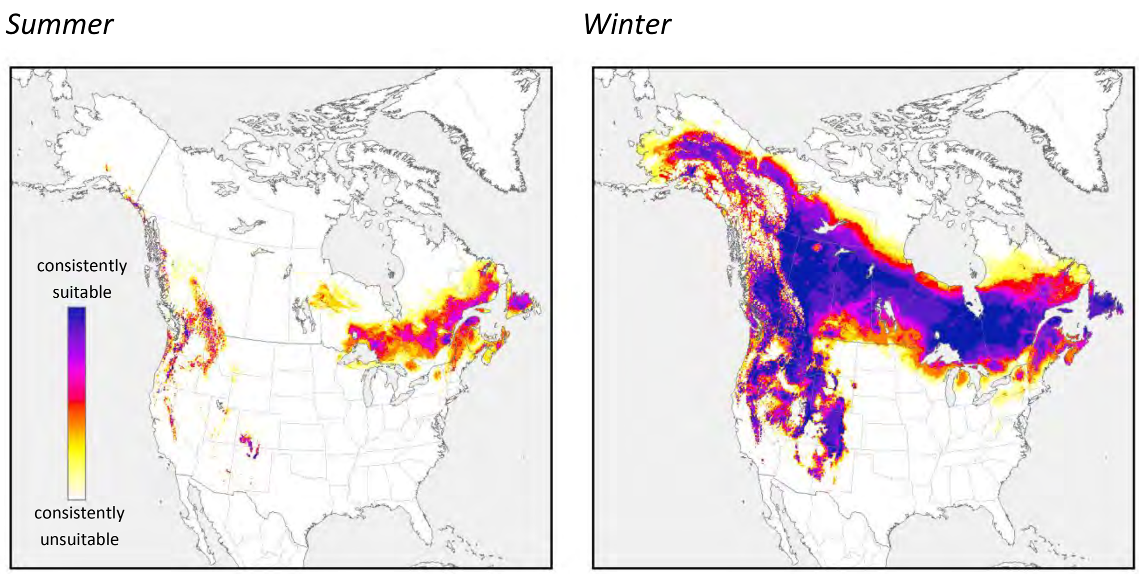
Predicted Future Winter Range by Year and Emissions Scenario



Blue areas indicate the modeled current range (2000-2009) for Evening Grosbeak (*Coccothraustes vespertinus*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

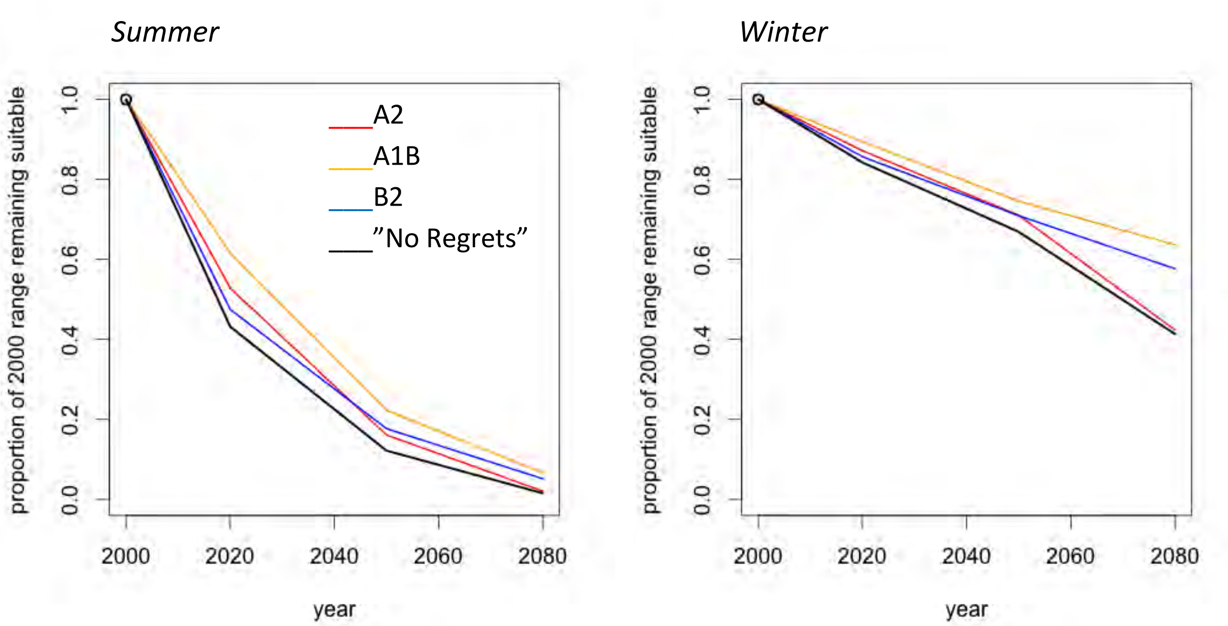
Evening Grosbeak (*Coccothraustes vespertinus*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios



Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Evening Grosbeak (*Coccothraustes vespertinus*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

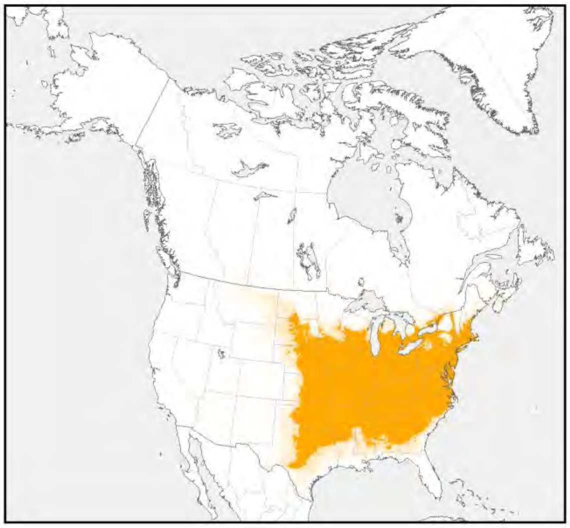
Predicted Refugia Size by Year and Emissions Scenario for Evening Grosbeak (*Coccothraustes vespertinus*)



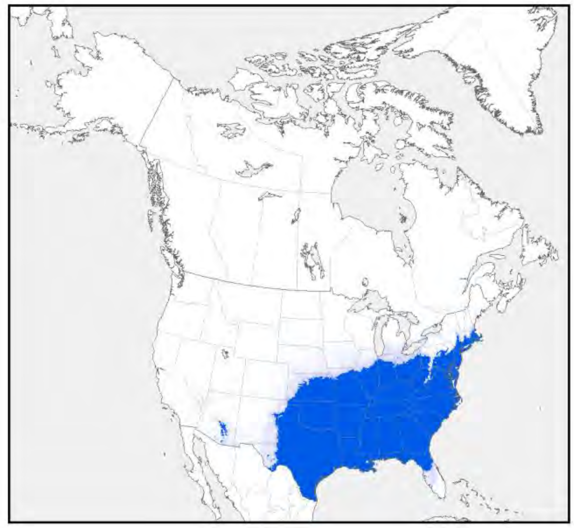
Field Sparrow (*Spizella pusilla*)

Modeled Current Range (2000-2009)

Summer



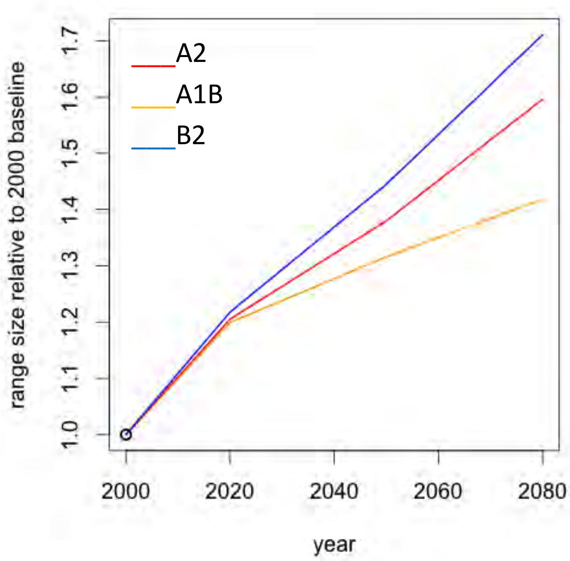
Winter



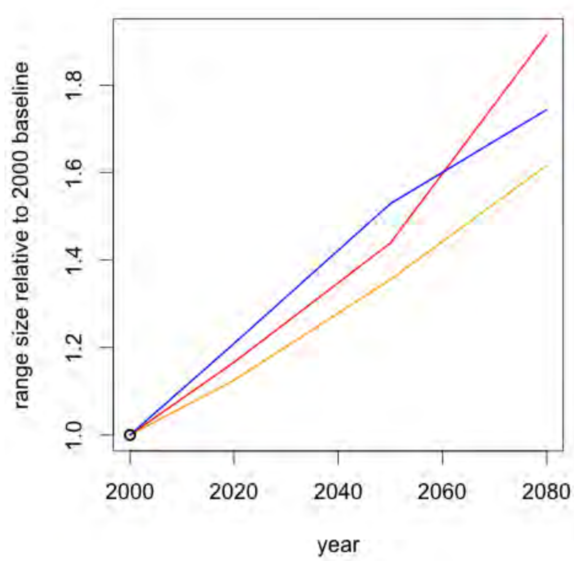
Current summer and winter ranges were modeled for Field Sparrow (*Spizella pusilla*) using data from 2000-2009. Solid orange and blue areas show core ranges estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

Predicted Range Size by Year and Emissions Scenario for Field Sparrow (*Spizella pusilla*)

Summer

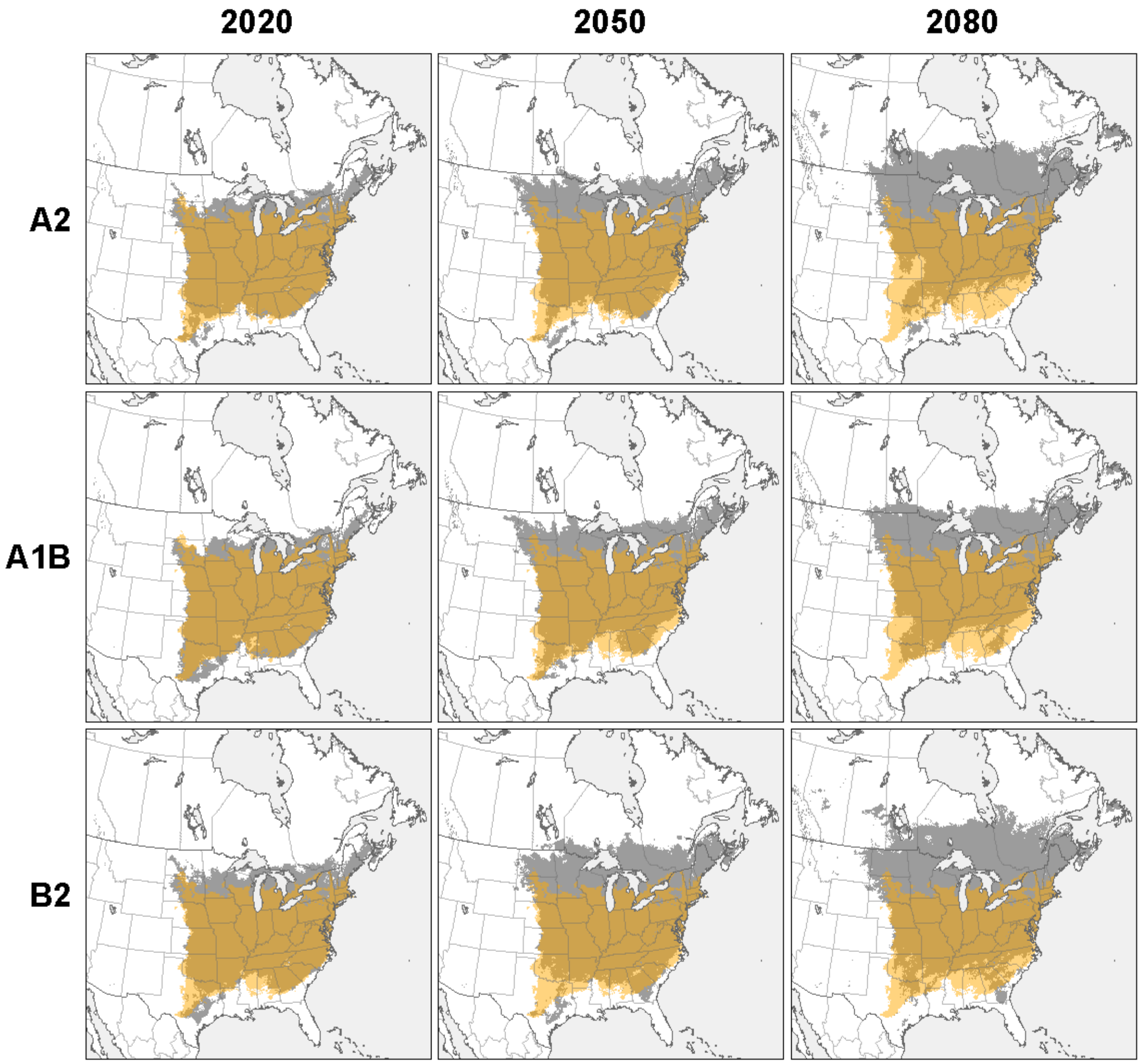


Winter



Field Sparrow (*Spizella pusilla*)

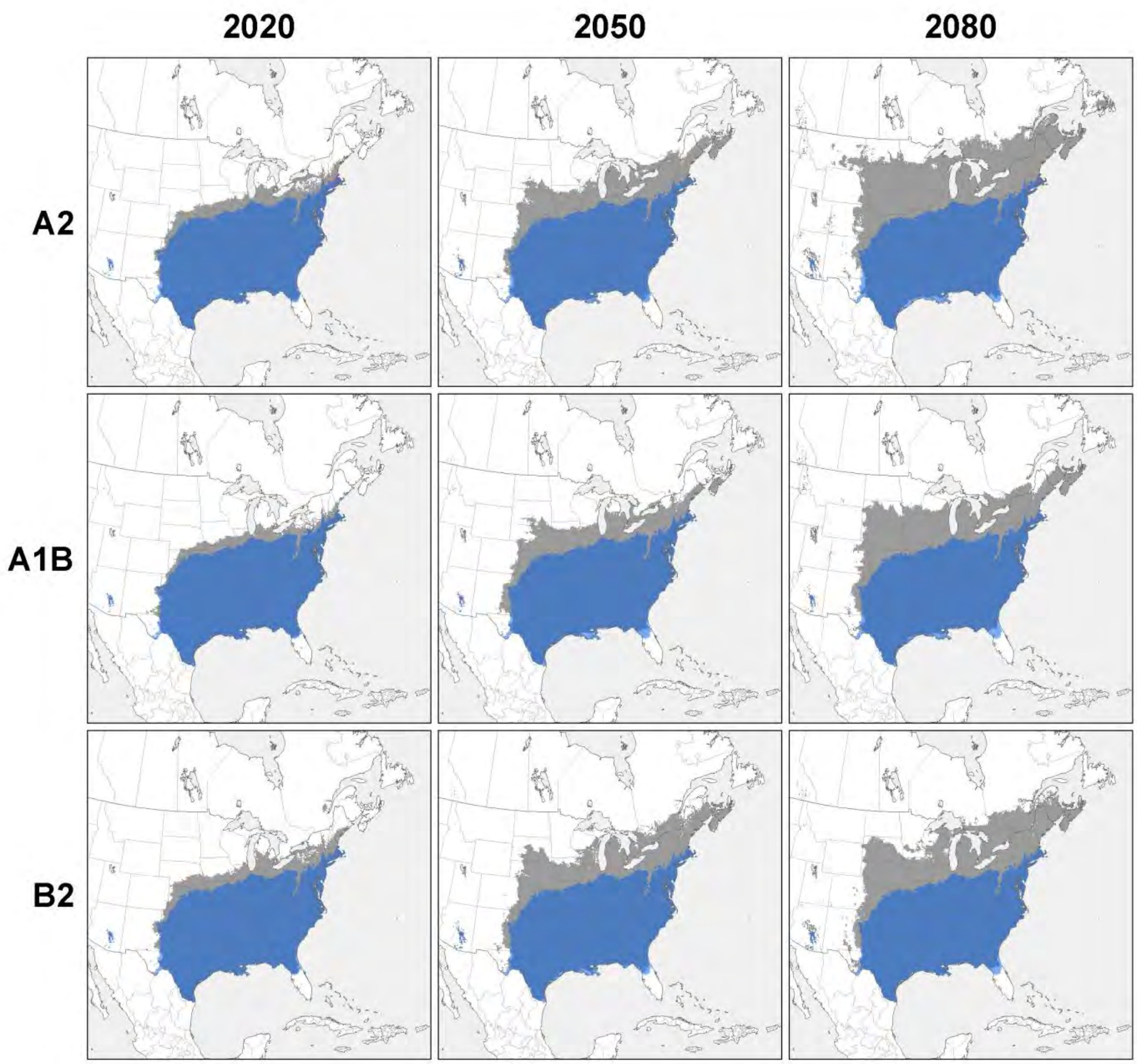
Modeled Future Summer Range by Year and Emissions Scenario



Orange areas indicate the modeled current range (2000-2009) for Field Sparrow (*Spizella pusilla*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Field Sparrow (*Spizella pusilla*)

Predicted Future Winter Range by Year and Emissions Scenario

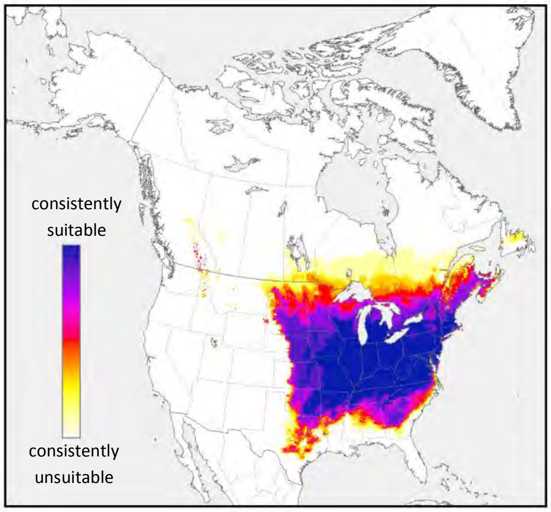


Blue areas indicate the modeled current range (2000-2009) for Field Sparrow (*Spizella pusilla*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

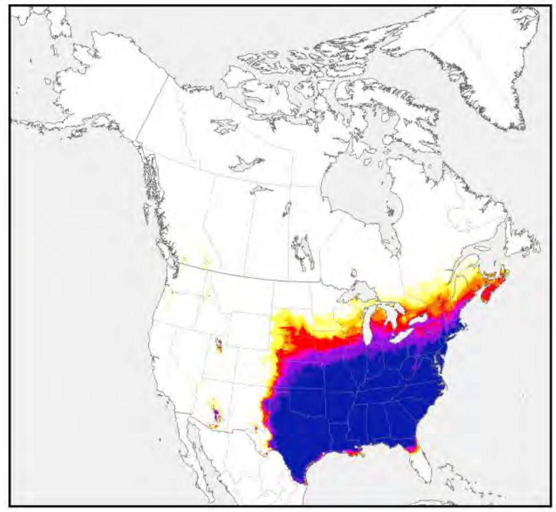
Field Sparrow (*Spizella pusilla*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

Summer



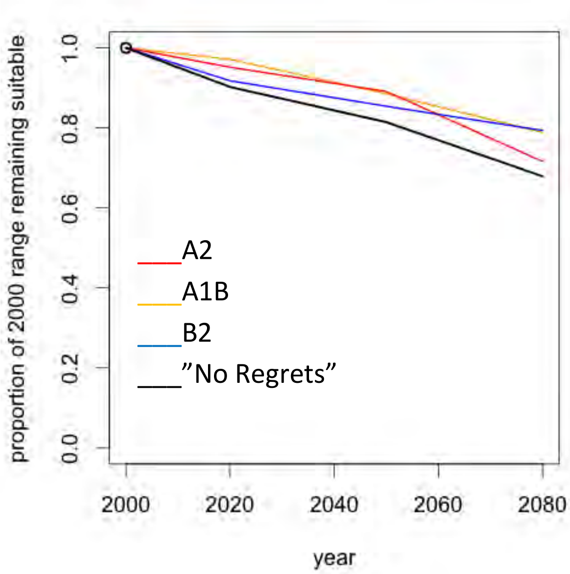
Winter



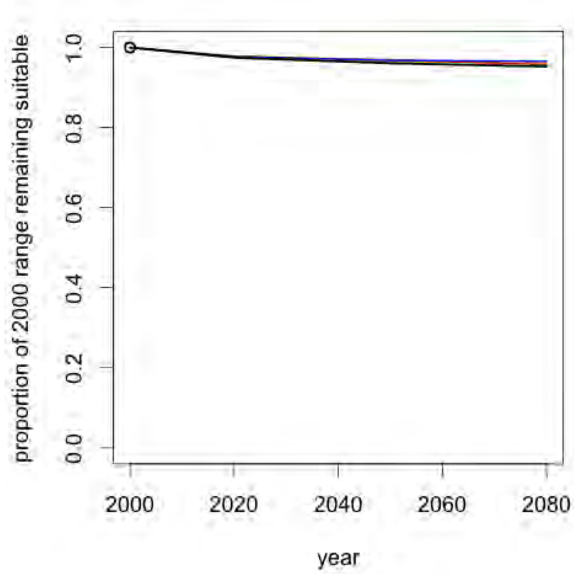
Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Field Sparrow (*Spizella pusilla*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Field Sparrow (*Spizella pusilla*)

Summer



Winter

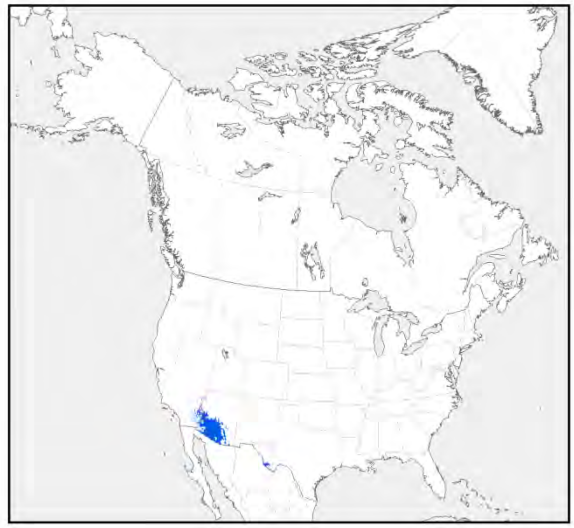


Gilded Flicker (*Colaptes chrysoides*)

Modeled Current Range (2000-2009)

Summer

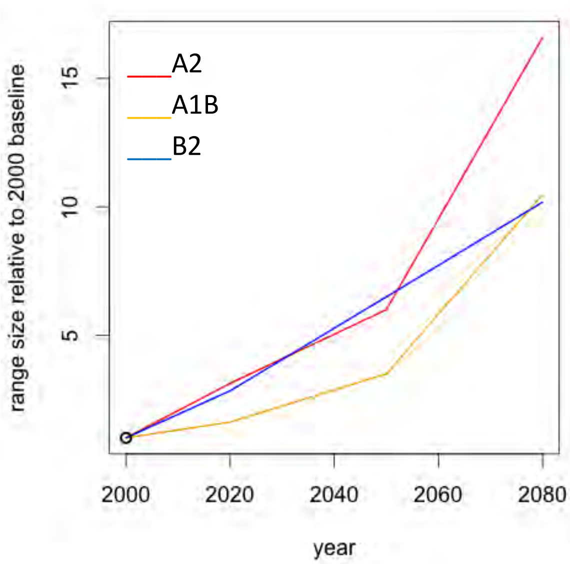
Winter



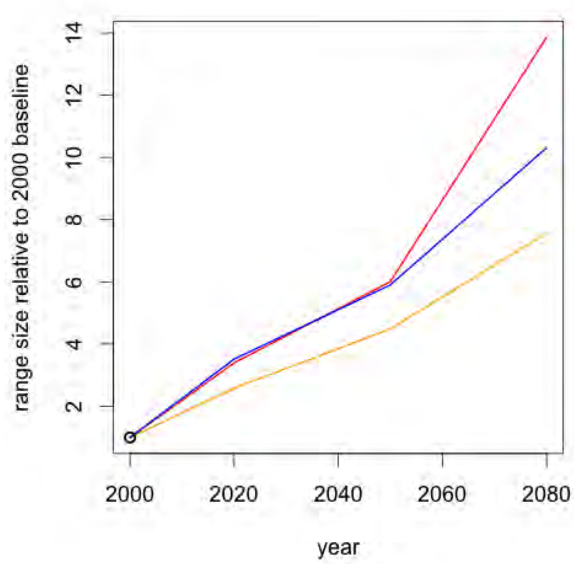
Current summer and winter ranges were modeled for Gilded Flicker (*Colaptes chrysoides*) using data from 2000-2009. Solid orange and blue areas show core ranges estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

Predicted Range Size by Year and Emissions Scenario for Gilded Flicker (*Colaptes chrysoides*)

Summer

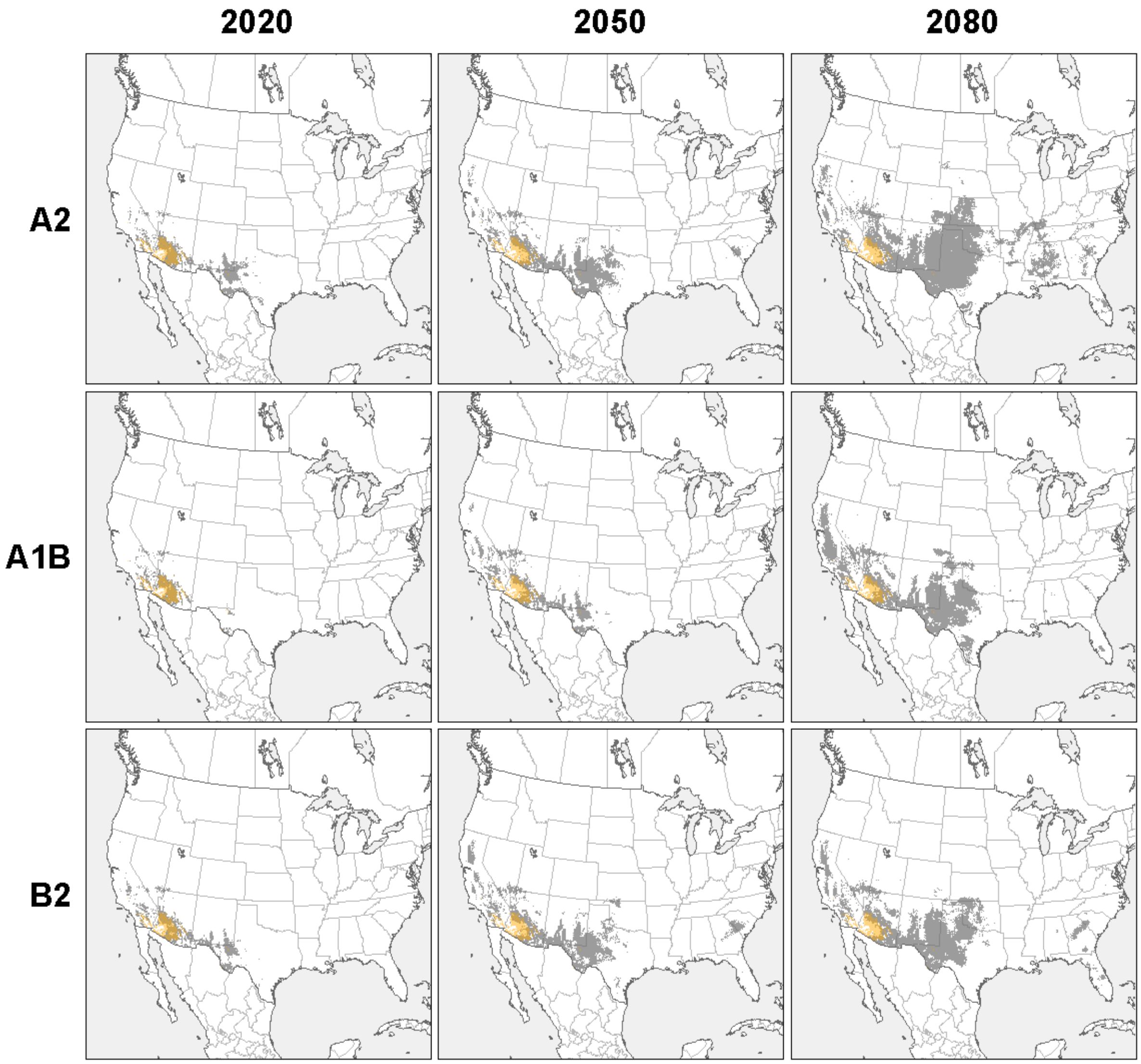


Winter



Gilded Flicker (*Colaptes chrysoides*)

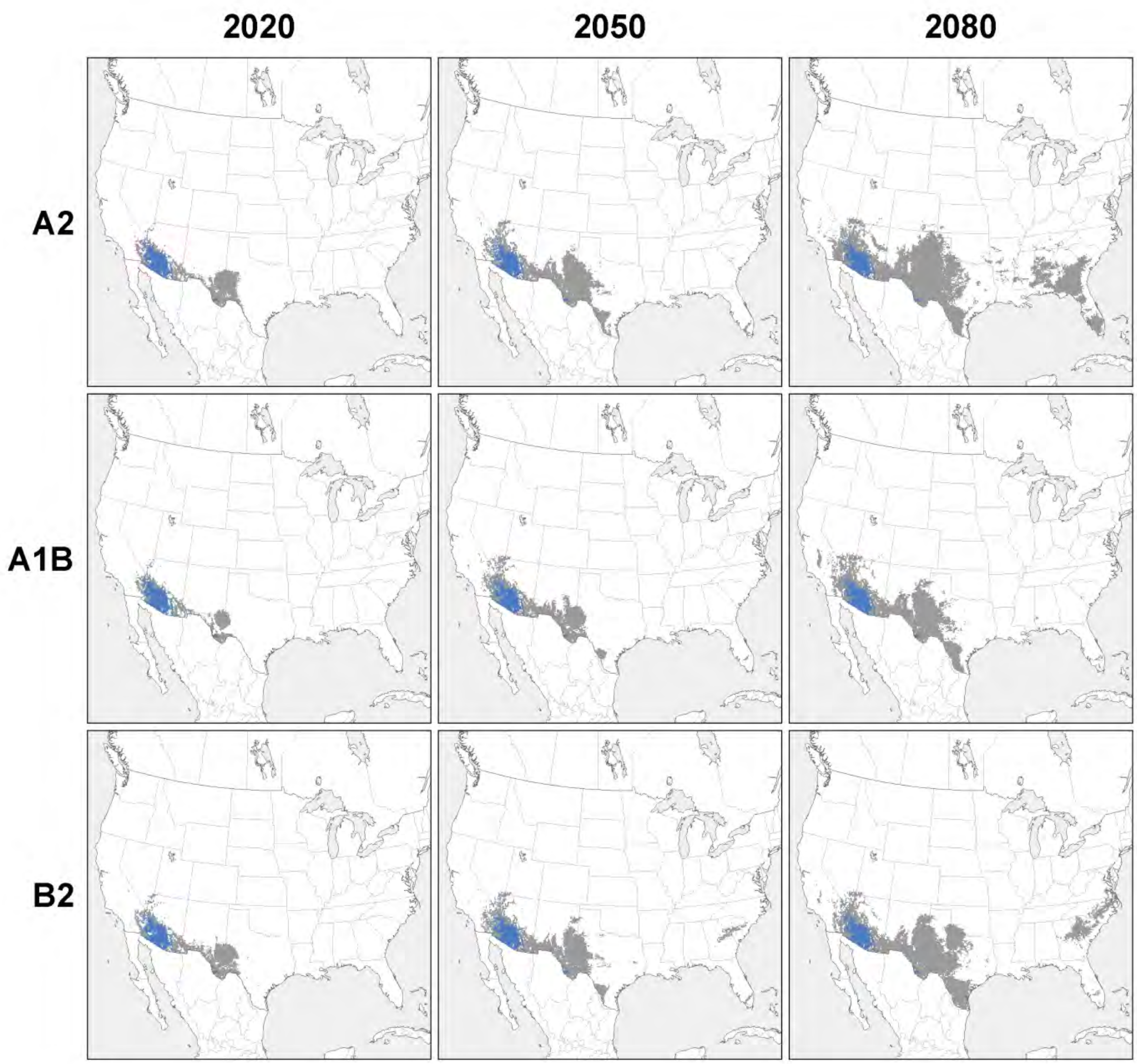
Modeled Future Summer Range by Year and Emissions Scenario



Orange areas indicate the modeled current range (2000-2009) for Gilded Flicker (*Colaptes chrysoides*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Gilded Flicker (*Colaptes chrysoides*)

Predicted Future Winter Range by Year and Emissions Scenario

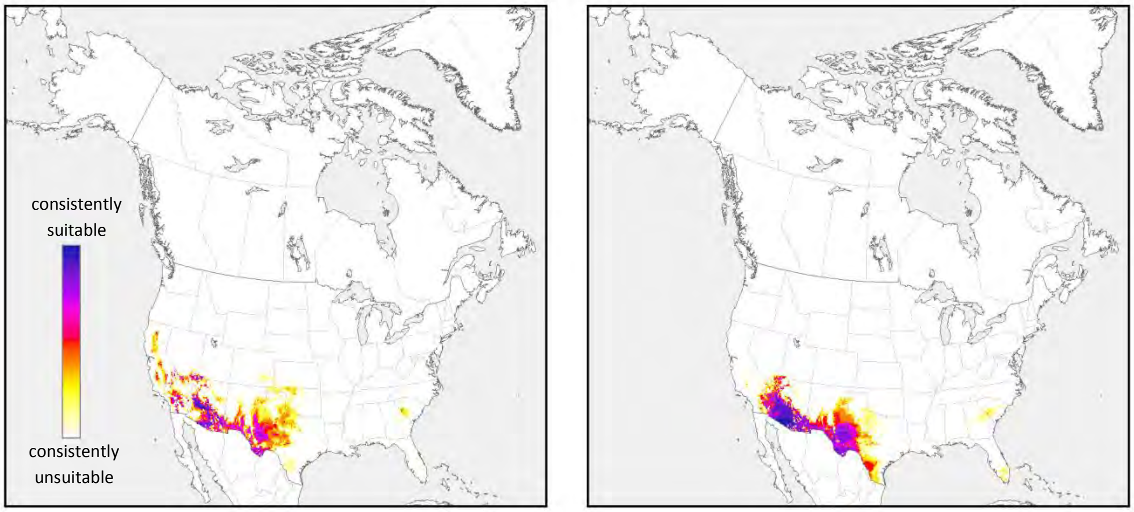


Blue areas indicate the modeled current range (2000-2009) for Gilded Flicker (*Colaptes chrysoides*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Gilded Flicker (*Colaptes chrysoides*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

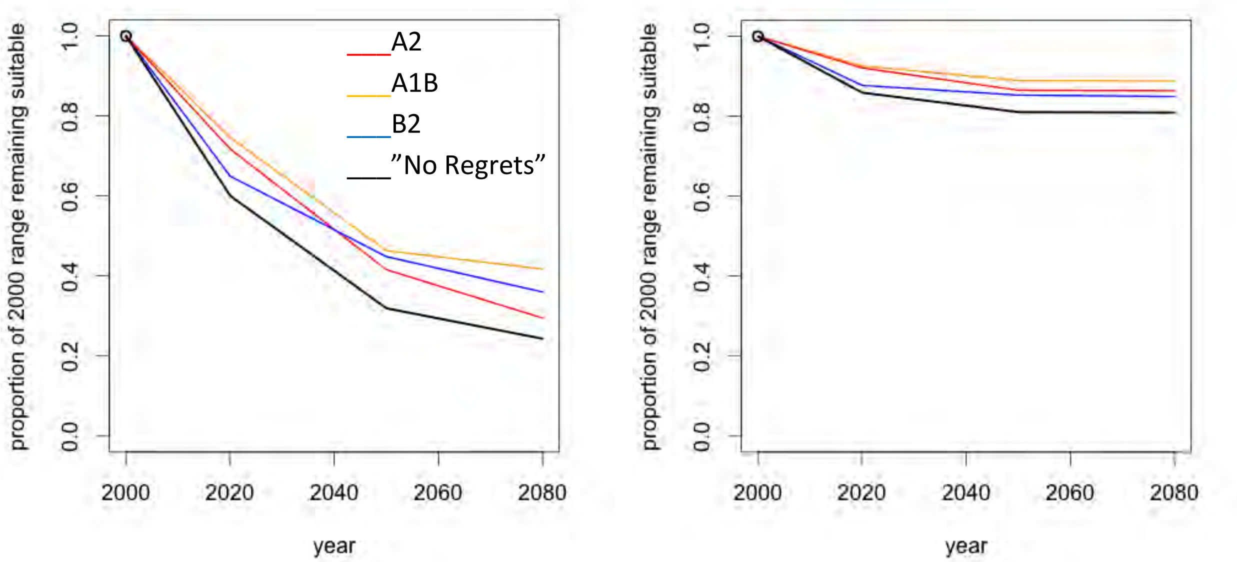
Summer *Winter*



Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Gilded Flicker (*Colaptes chrysoides*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Gilded Flicker (*Colaptes chrysoides*)

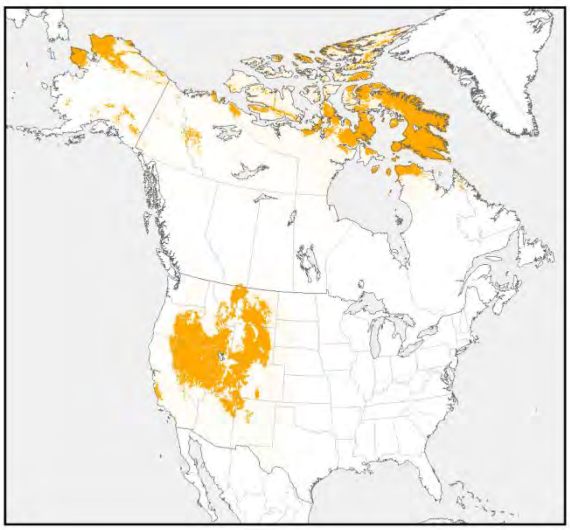
Summer *Winter*



Golden Eagle (*Aquila chrysaetosi*)

Modeled Current Range (2000-2009)

Summer

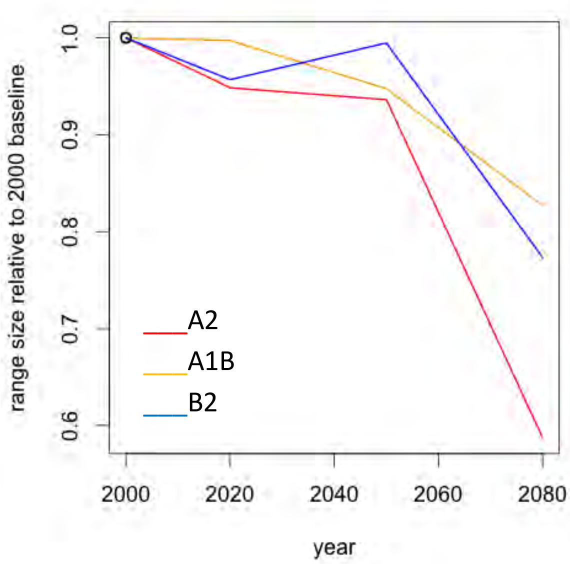


Winter

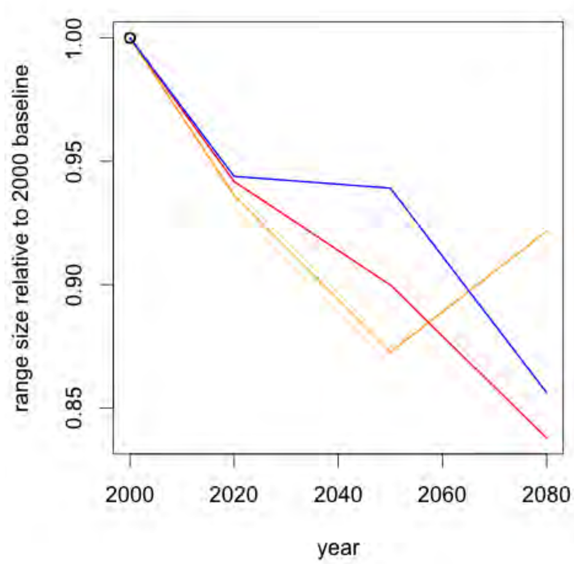
Current summer and winter ranges were modeled for Golden Eagle (*Aquila chrysaetosi*) using data from 2000-2009. Solid orange and blue areas show core ranges estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

Predicted Range Size by Year and Emissions Scenario for Golden Eagle (*Aquila chrysaetosi*)

Summer

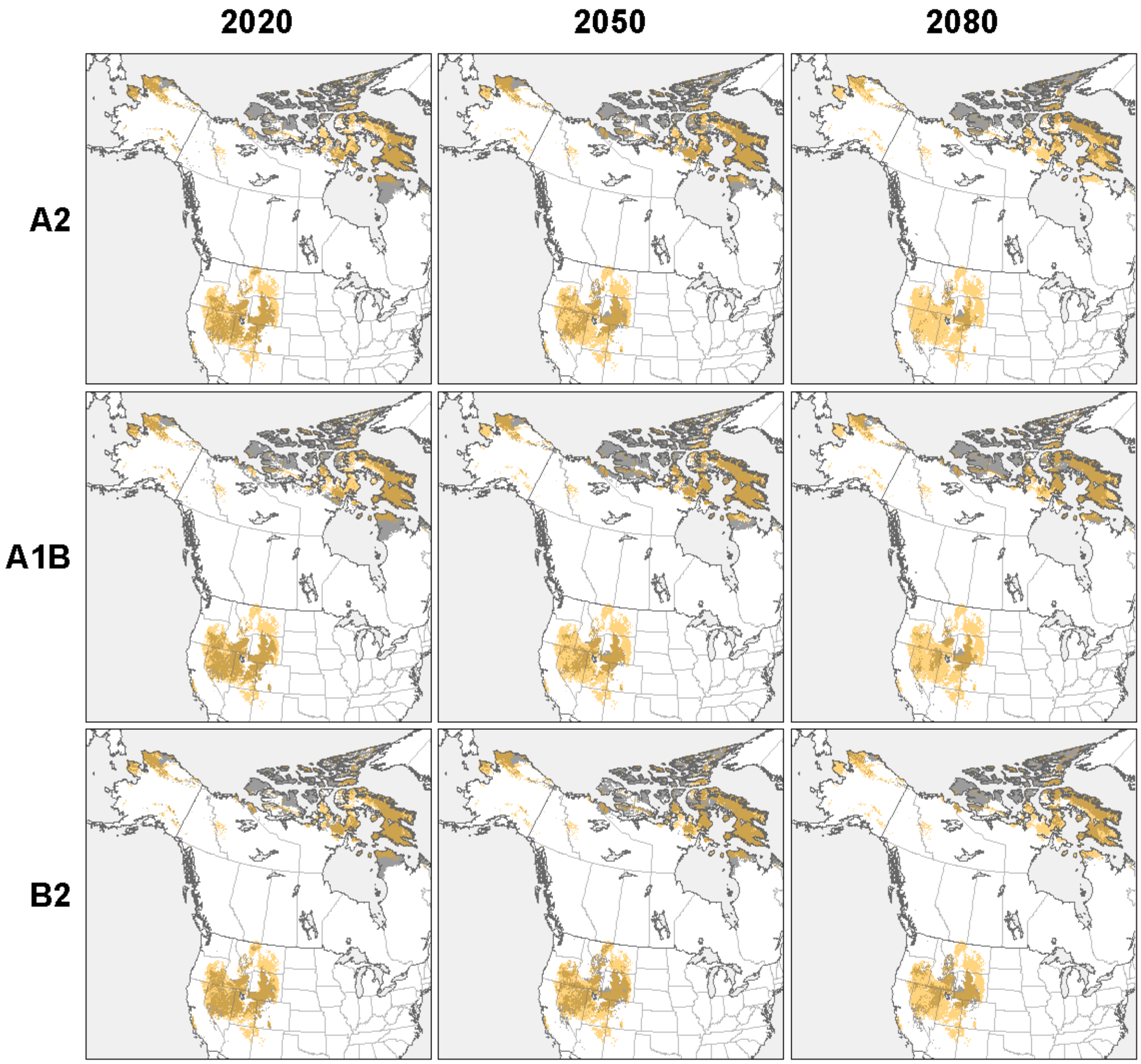


Winter



Golden Eagle (*Aquila chrysaetosi*)

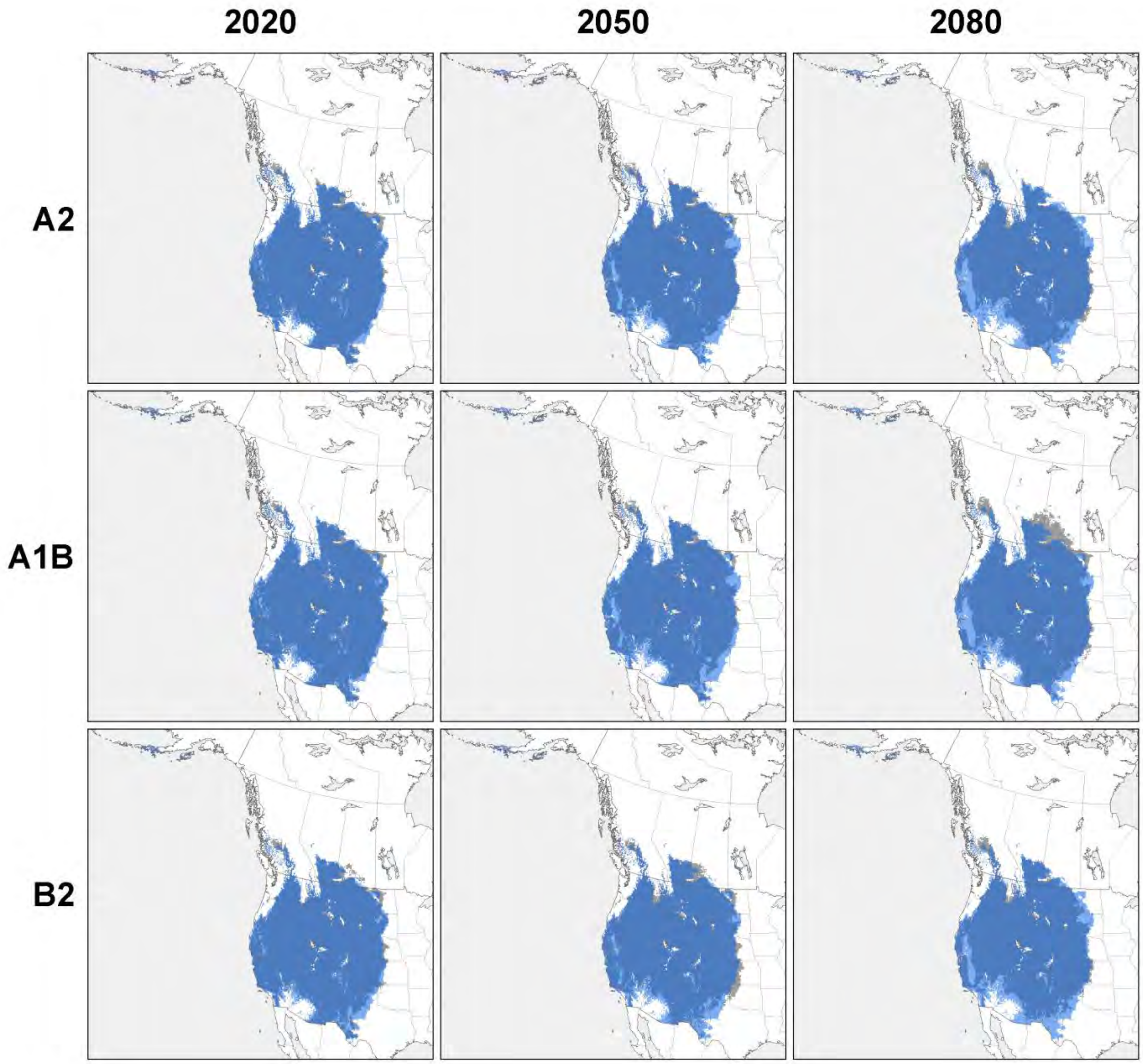
Modeled Future Summer Range by Year and Emissions Scenario



Orange areas indicate the modeled current range (2000-2009) for Golden Eagle (*Aquila chrysaetosi*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Golden Eagle (*Aquila chrysaetosi*)

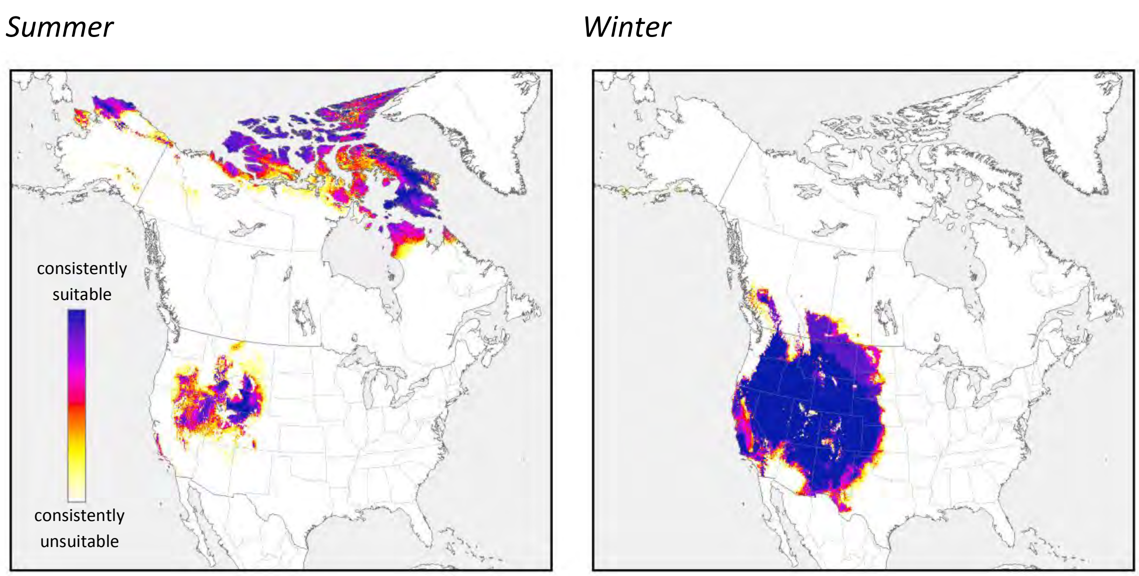
Predicted Future Winter Range by Year and Emissions Scenario



Blue areas indicate the modeled current range (2000-2009) for Golden Eagle (*Aquila chrysaetosi*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

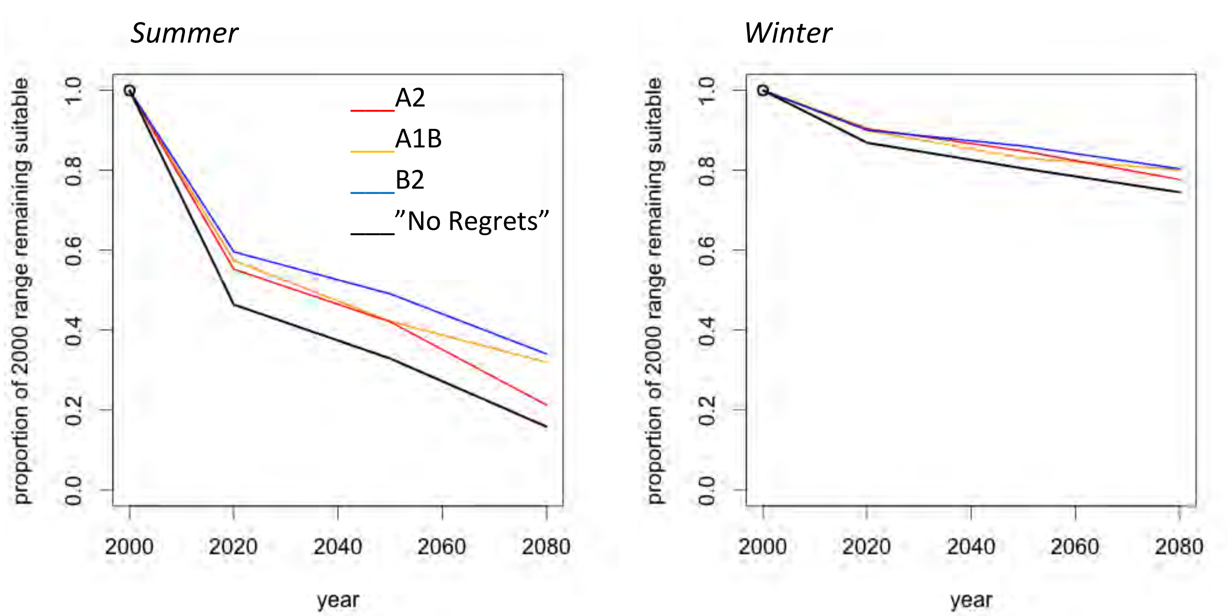
Golden Eagle (*Aquila chrysaetosi*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios



Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Golden Eagle (*Aquila chrysaetosi*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Golden Eagle (*Aquila chrysaetosi*)



Golden-winged Warbler (*Vermivora chrysoptera*)

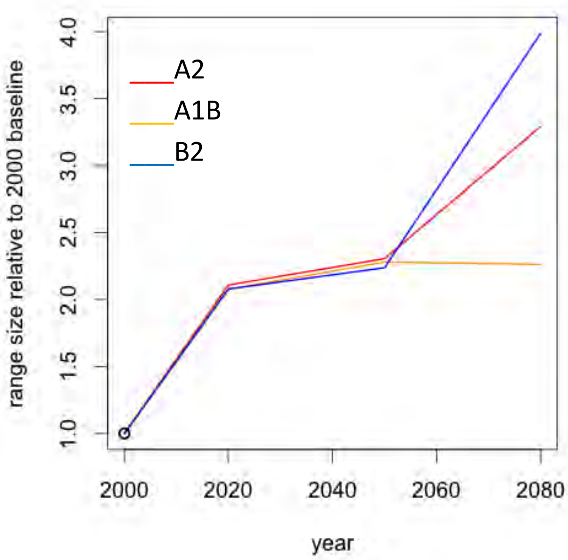
Modeled Current Range (2000-2009)

Summer

Current summer range was modeled for Golden-winged Warbler (*Vermivora chrysoptera*) using data from 2000-2009. Solid orange areas show core range estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

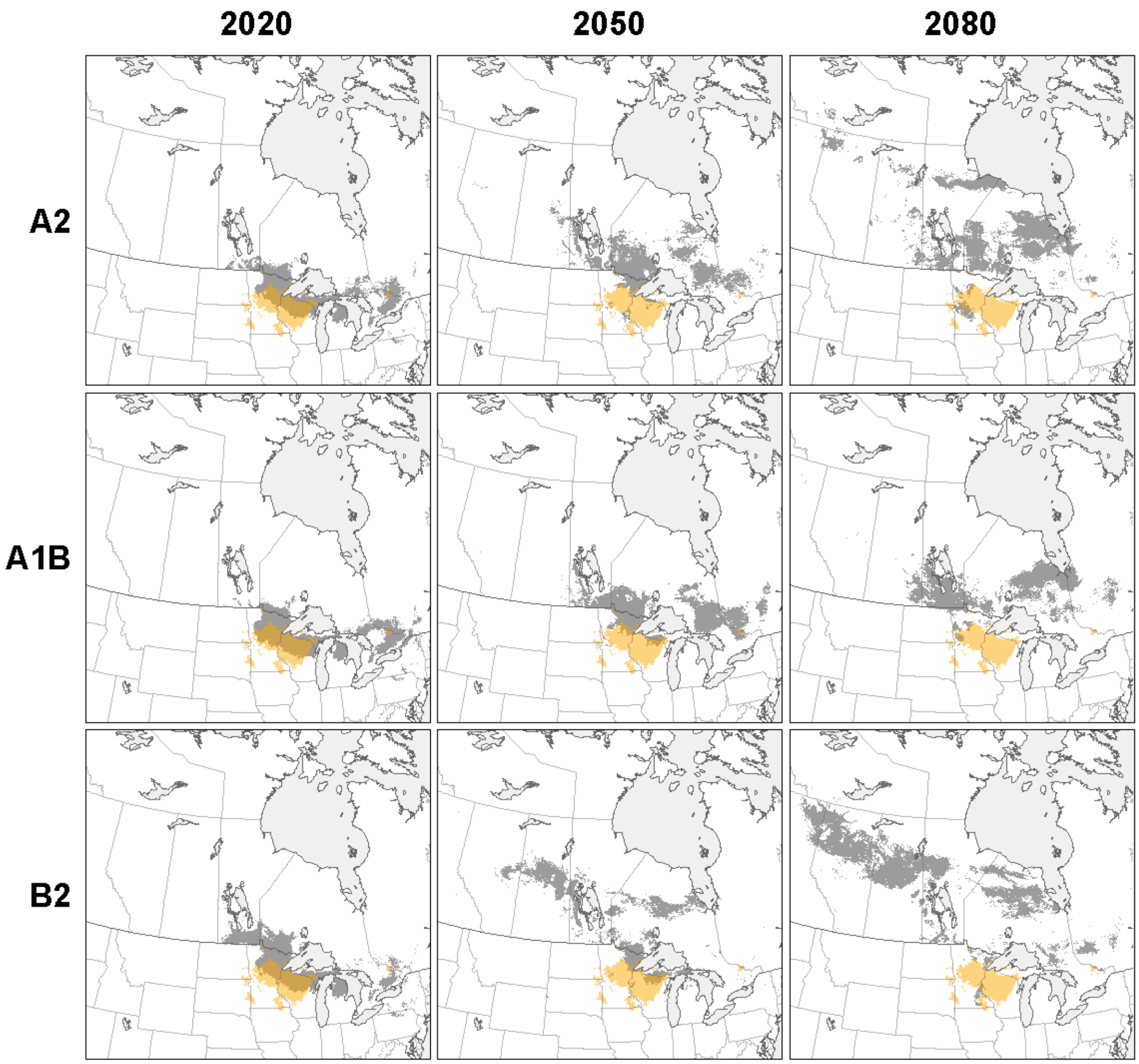
Predicted Range Size by Year and Emissions Scenario for Golden-winged Warbler (*Vermivora chrysoptera*)

Summer



Golden-winged Warbler (*Vermivora chrysoptera*)

Modeled Future Summer Range by Year and Emissions Scenario

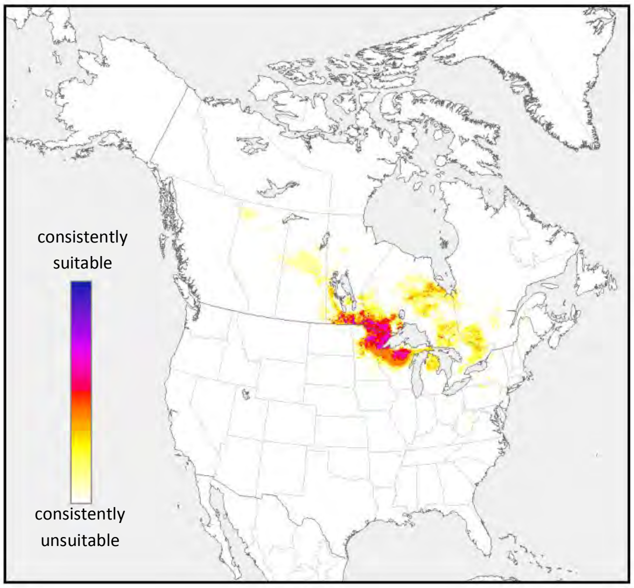


Orange areas indicate the modeled current range (2000-2009) for Golden-winged Warbler (*Vermivora chrysoptera*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Golden-winged Warbler (*Vermivora chrysoptera*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

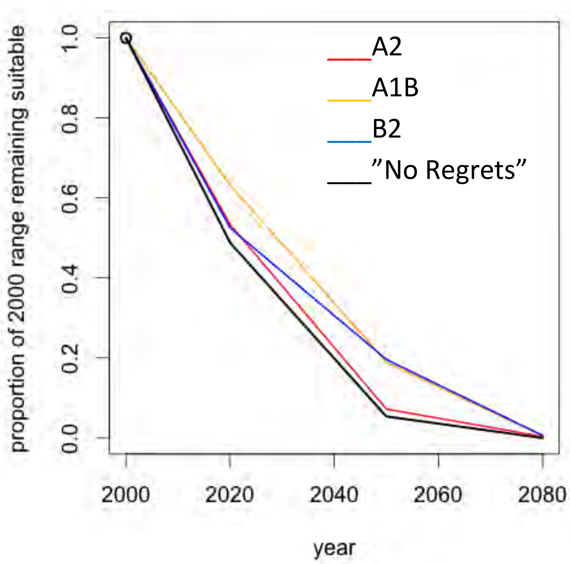
Summer



Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Golden-winged Warbler (*Vermivora chrysoptera*).Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario Scenario for Golden-winged Warbler (*Vermivora chrysoptera*)

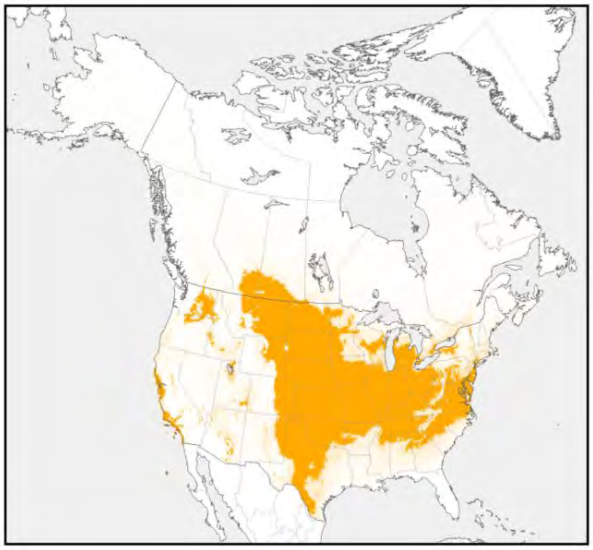
Summer



Grasshopper Sparrow (*Ammodramus savannarum*)

Modeled Current Range (2000-2009)

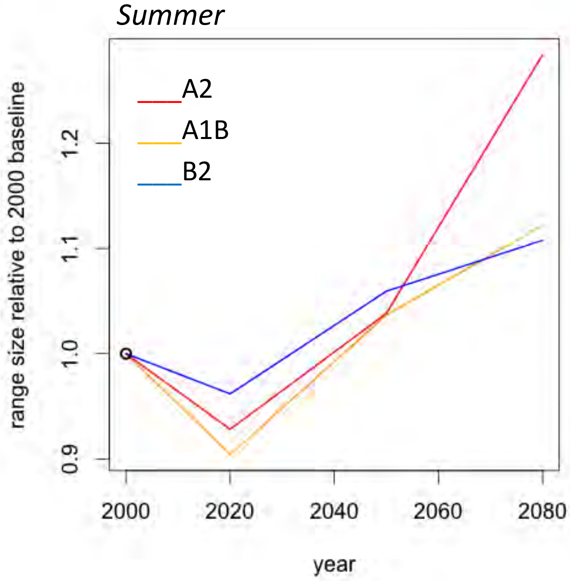
Summer



Current summer range was modeled for Grasshopper Sparrow (*Ammodramus savannarum*) using data from 2000-2009. Solid orange areas show core range estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

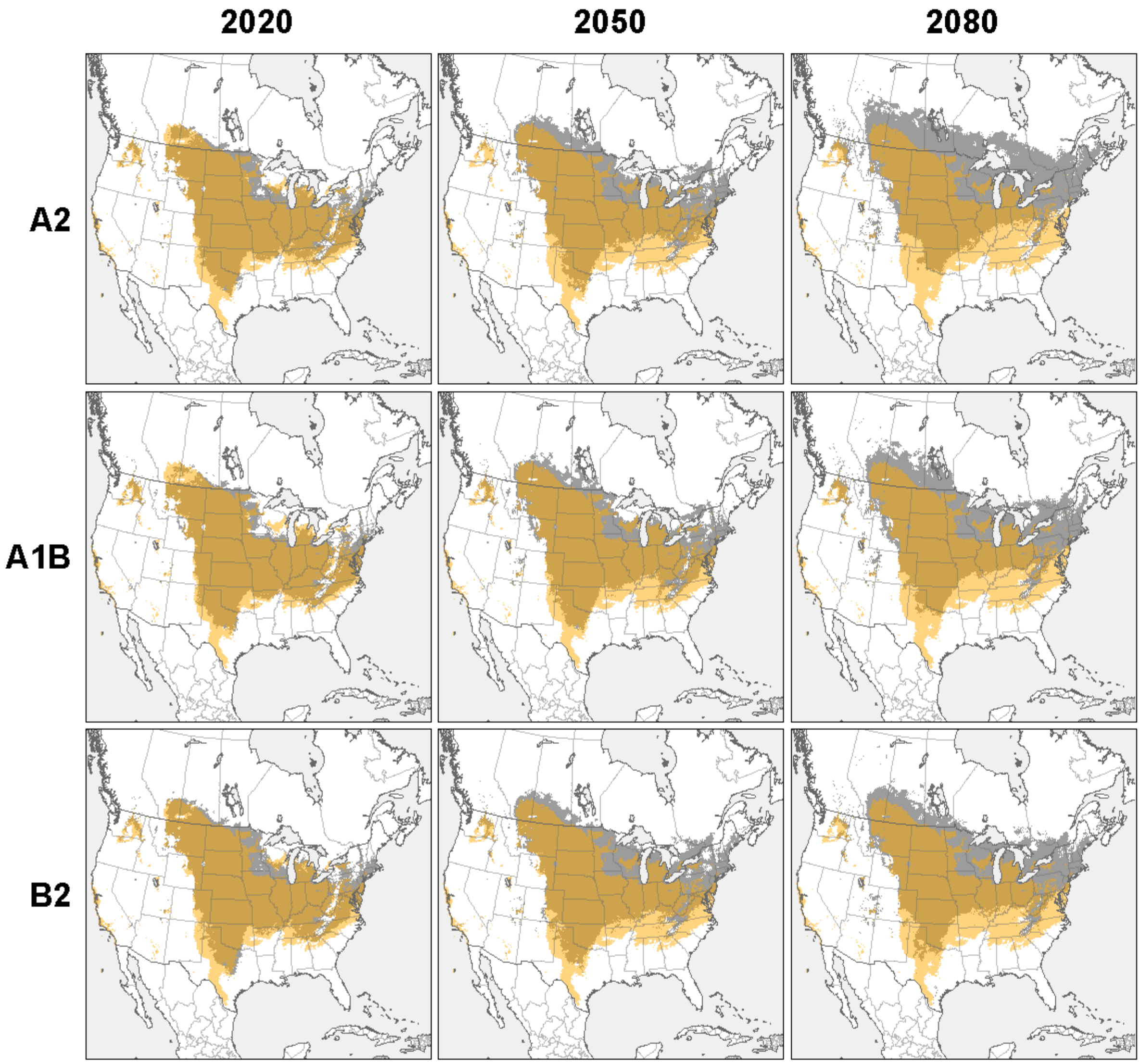
Predicted Range Size by Year and Emissions Scenario for Grasshopper Sparrow (*Ammodramus savannarum*)

Summer



Grasshopper Sparrow (*Ammodramus savannarum*)

Modeled Future Summer Range by Year and Emissions Scenario

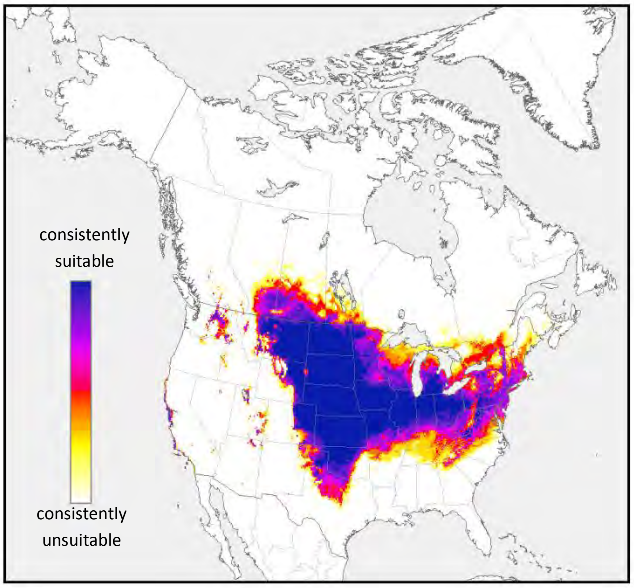


Orange areas indicate the modeled current range (2000-2009) for Grasshopper Sparrow (*Ammodramus savannarum*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Grasshopper Sparrow (*Ammodramus savannarum*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

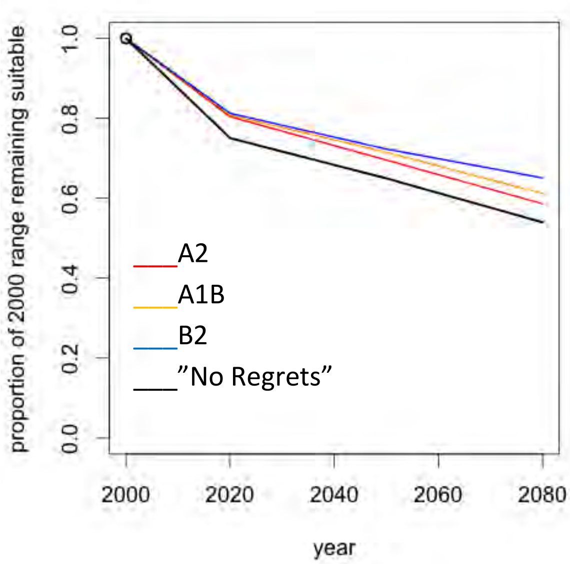
Summer



Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Grasshopper Sparrow (*Ammodramus savannarum*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Grasshopper Sparrow (*Ammodramus savannarum*)

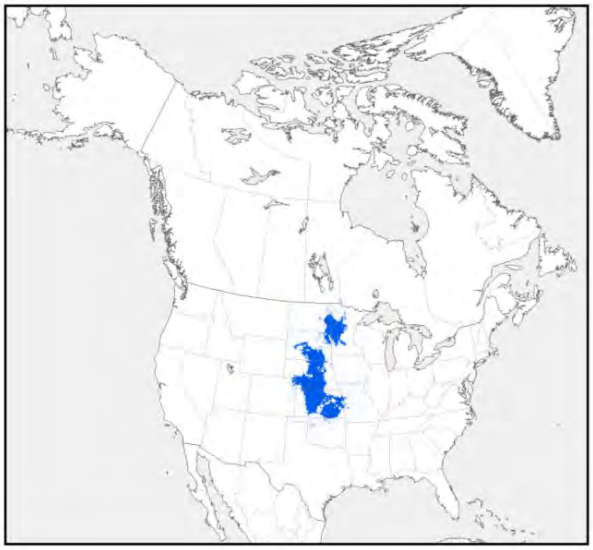
Summer



Greater Prairie-Chicken (*Tympanuchus cupido*)

Modeled Current Range (2000-2009)

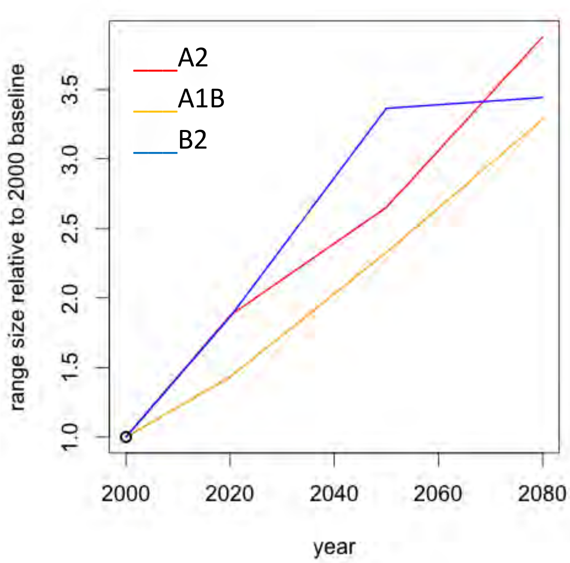
Winter



Current winter range was modeled for Greater Prairie-Chicken (*Tympanuchus cupido*) using data from 2000-2009. Solid blue areas show core range estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

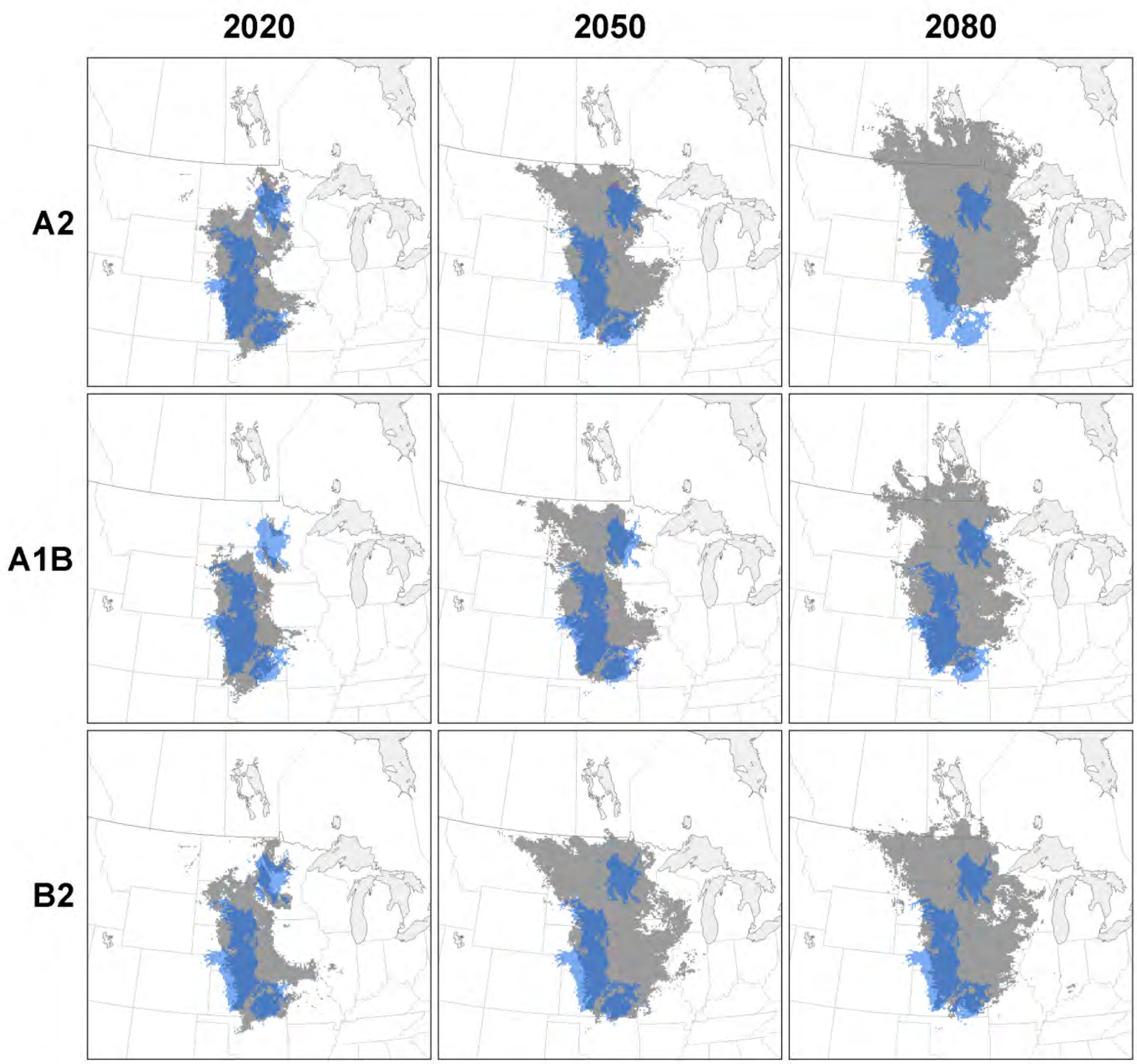
Predicted Range Size by Year and Emissions Scenario for Greater Prairie-Chicken (*Tympanuchus cupido*)

Winter



Greater Prairie-Chicken (*Tympanuchus cupido*)

Predicted Future Winter Range by Year and Emissions Scenario

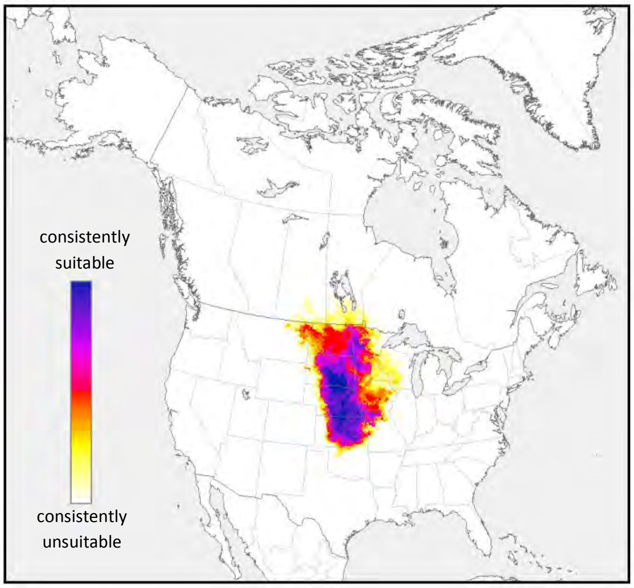


Blue areas indicate the modeled current range (2000-2009) for Greater Prairie-Chicken (*Tympanuchus cupido*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Greater Prairie-Chicken (*Tympanuchus cupido*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

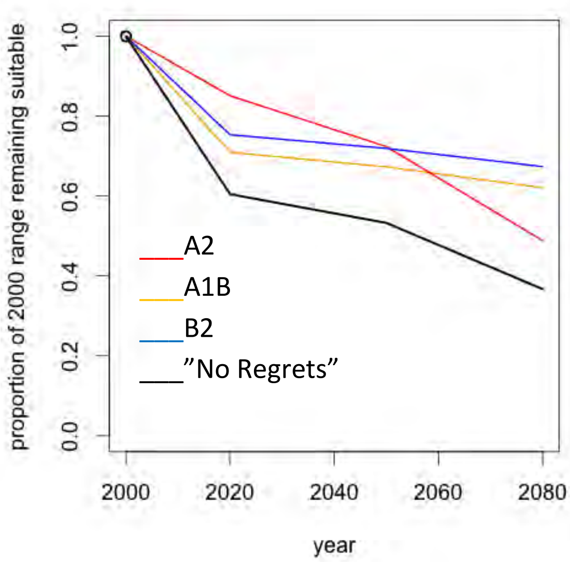
Winter



Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Greater Prairie-Chicken (*Tympanuchus cupido*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Greater Prairie-Chicken (*Tympanuchus cupido*)

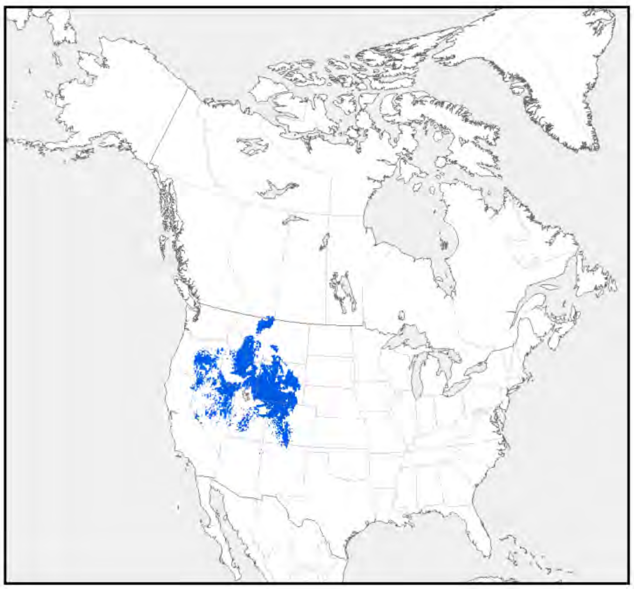
Winter



Greater Sage-Grouse (*Centrocercus urophasianus*)

Modeled Current Range (2000-2009)

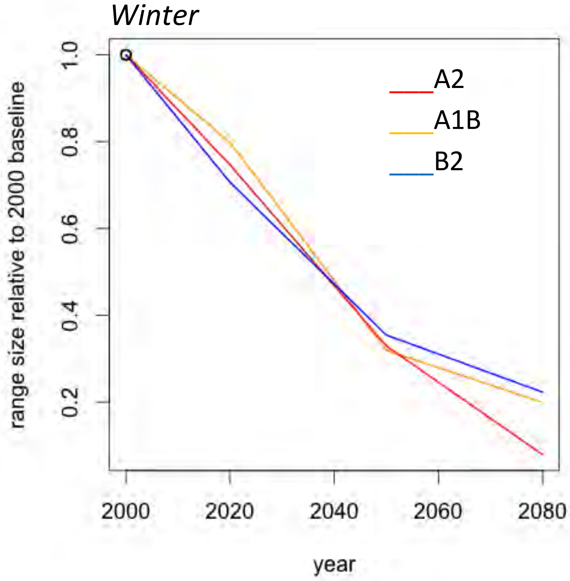
Winter



Current winter range was modeled for Greater Sage-Grouse (*Centrocercus urophasianus*) using data from 2000-2009. Solid blue areas show core range estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

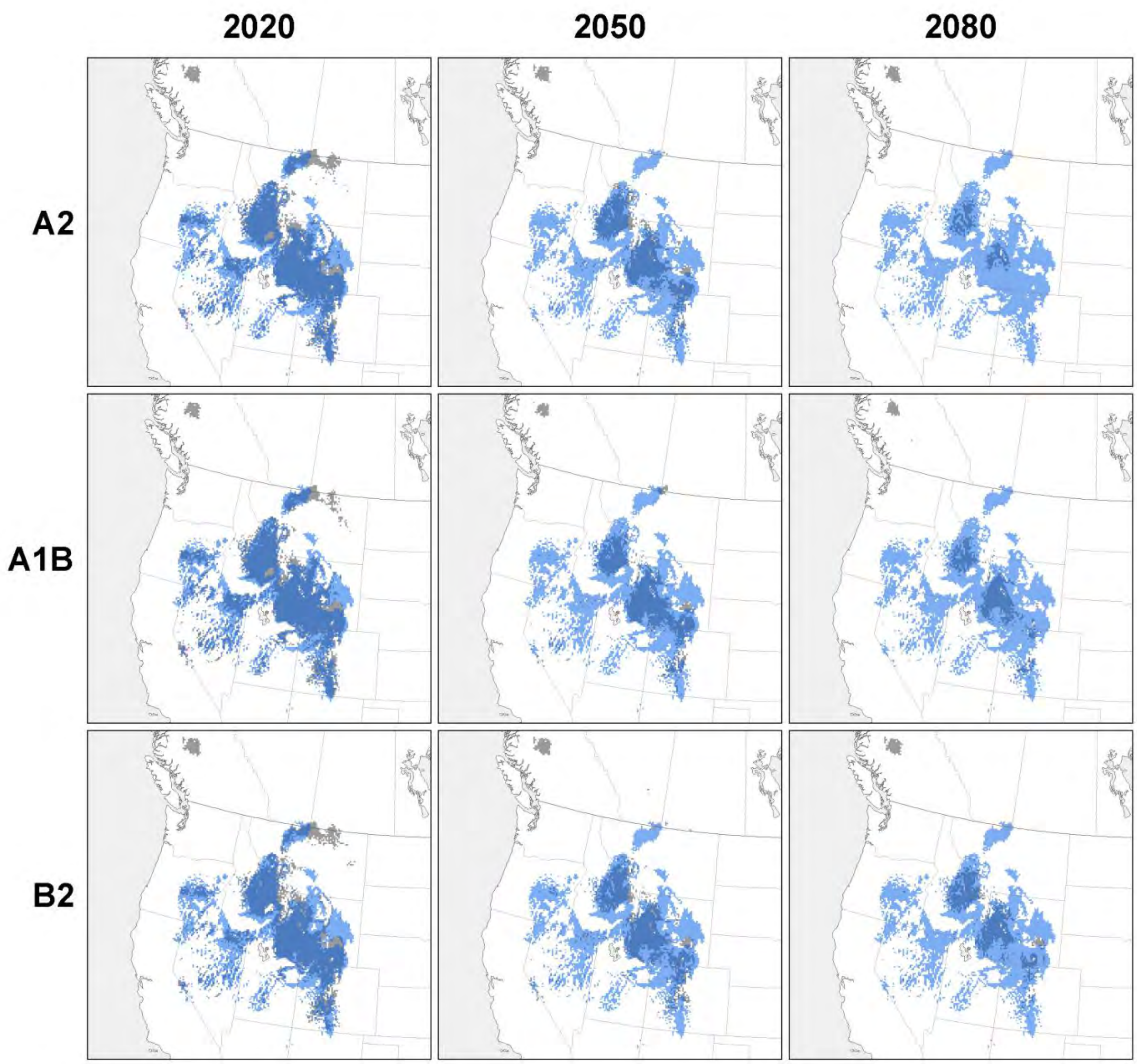
Predicted Range Size by Year and Emissions Scenario for Greater Sage-Grouse (*Centrocercus urophasianus*)

Winter



Greater Sage-Grouse (*Centrocercus urophasianus*)

Predicted Future Winter Range by Year and Emissions Scenario

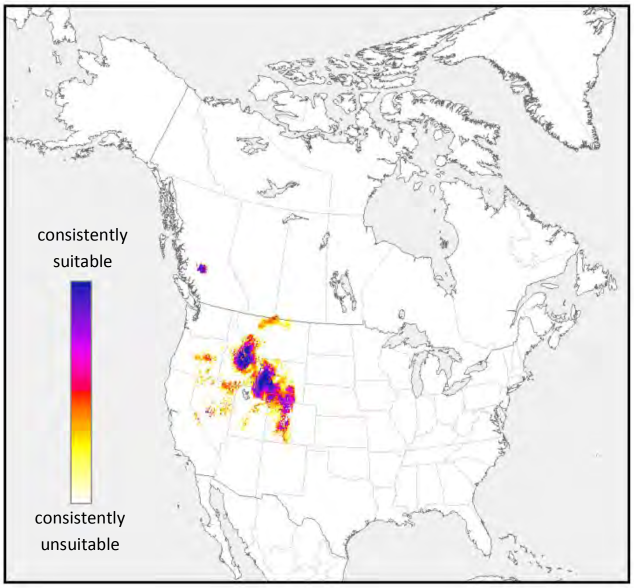


Blue areas indicate the modeled current range (2000-2009) for Greater Sage-Grouse (*Centrocercus urophasianus*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Greater Sage-Grouse (*Centrocercus urophasianus*)

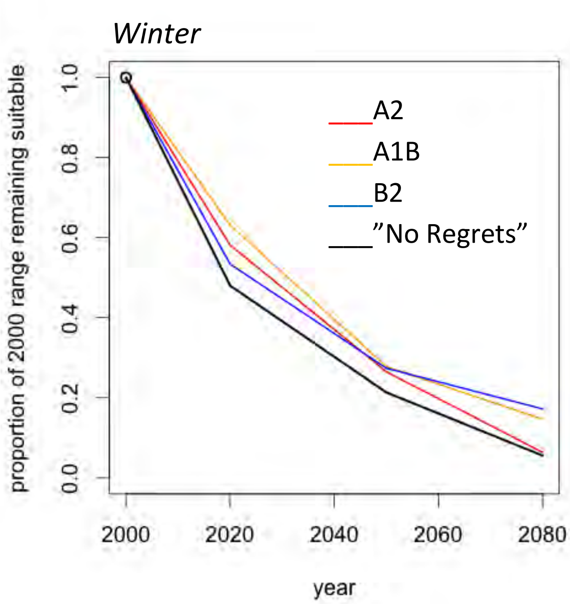
Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

Winter



Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Greater Sage-Grouse (*Centrocercus urophasianus*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

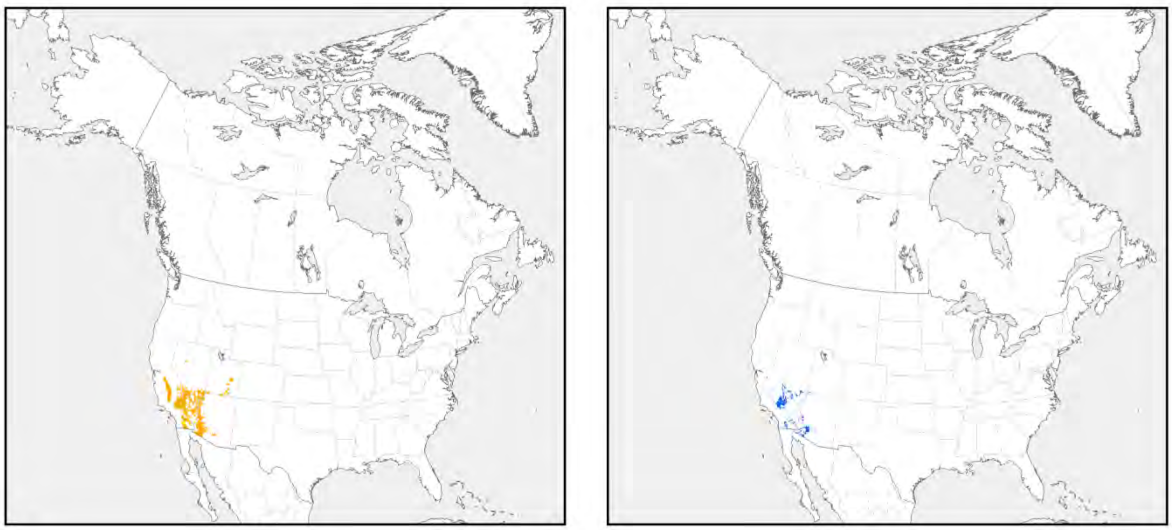
Predicted Refugia Size by Year and Emissions Scenario for Greater Sage-Grouse (*Centrocercus urophasianus*)



Le Conte’s Thrasher (*Toxostoma lecontei*)

Modeled Current Range (2000-2009)

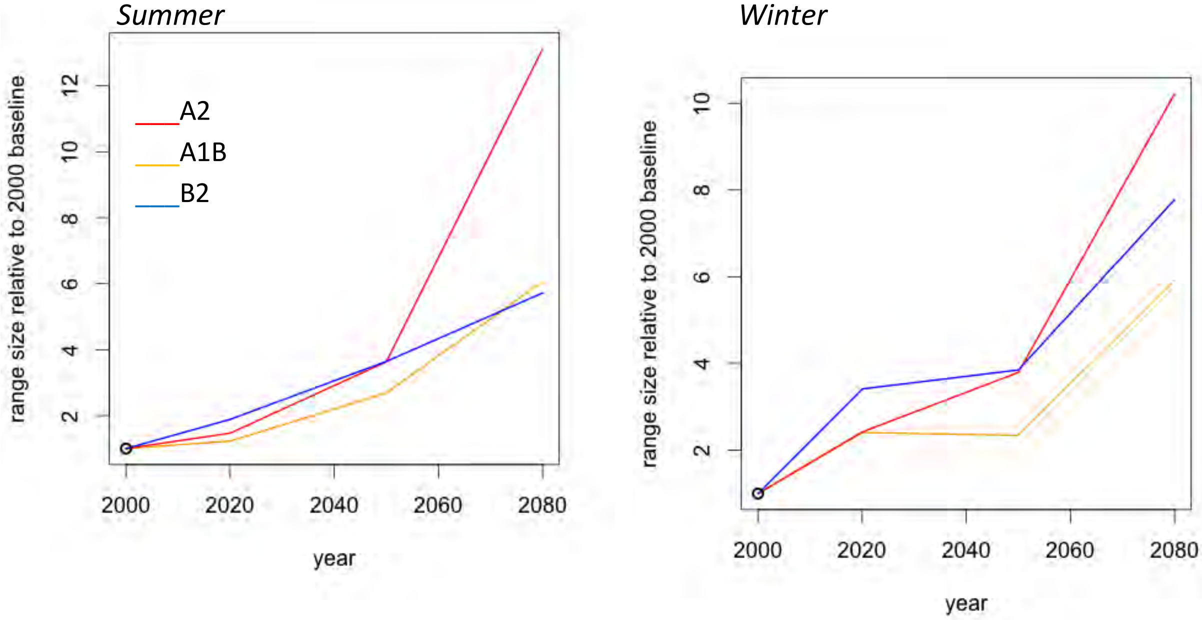
Summer *Winter*



Current summer and winter ranges were modeled for Le Conte’s Thrasher (*Toxostoma lecontei*) using data from 2000-2009. Solid orange and blue areas show core ranges estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

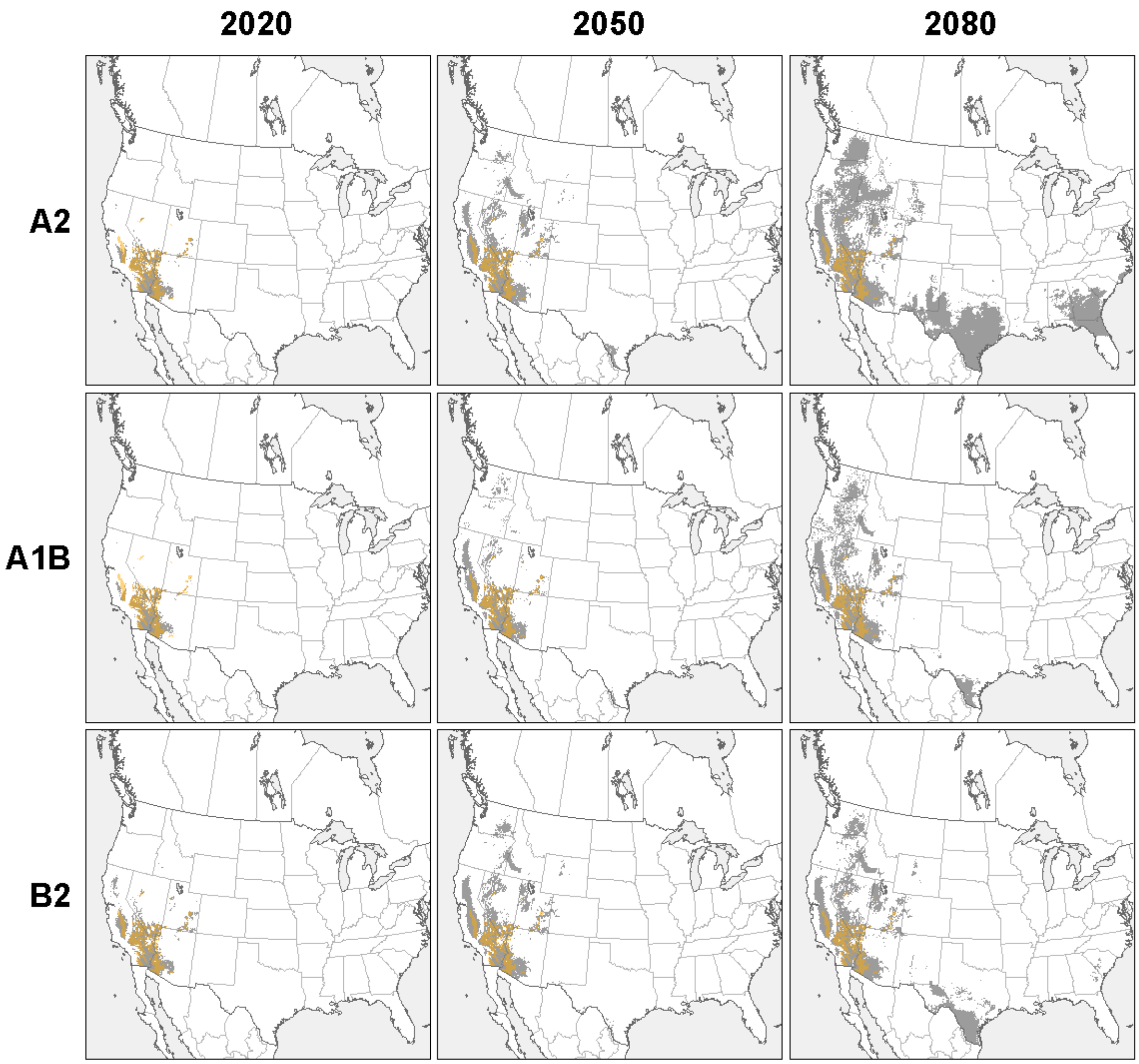
Predicted Range Size by Year and Emissions Scenario modeled for Le Conte’s Thrasher (*Toxostoma lecontei*)

Summer *Winter*



Le Conte's Thrasher (*Toxostoma lecontei*)

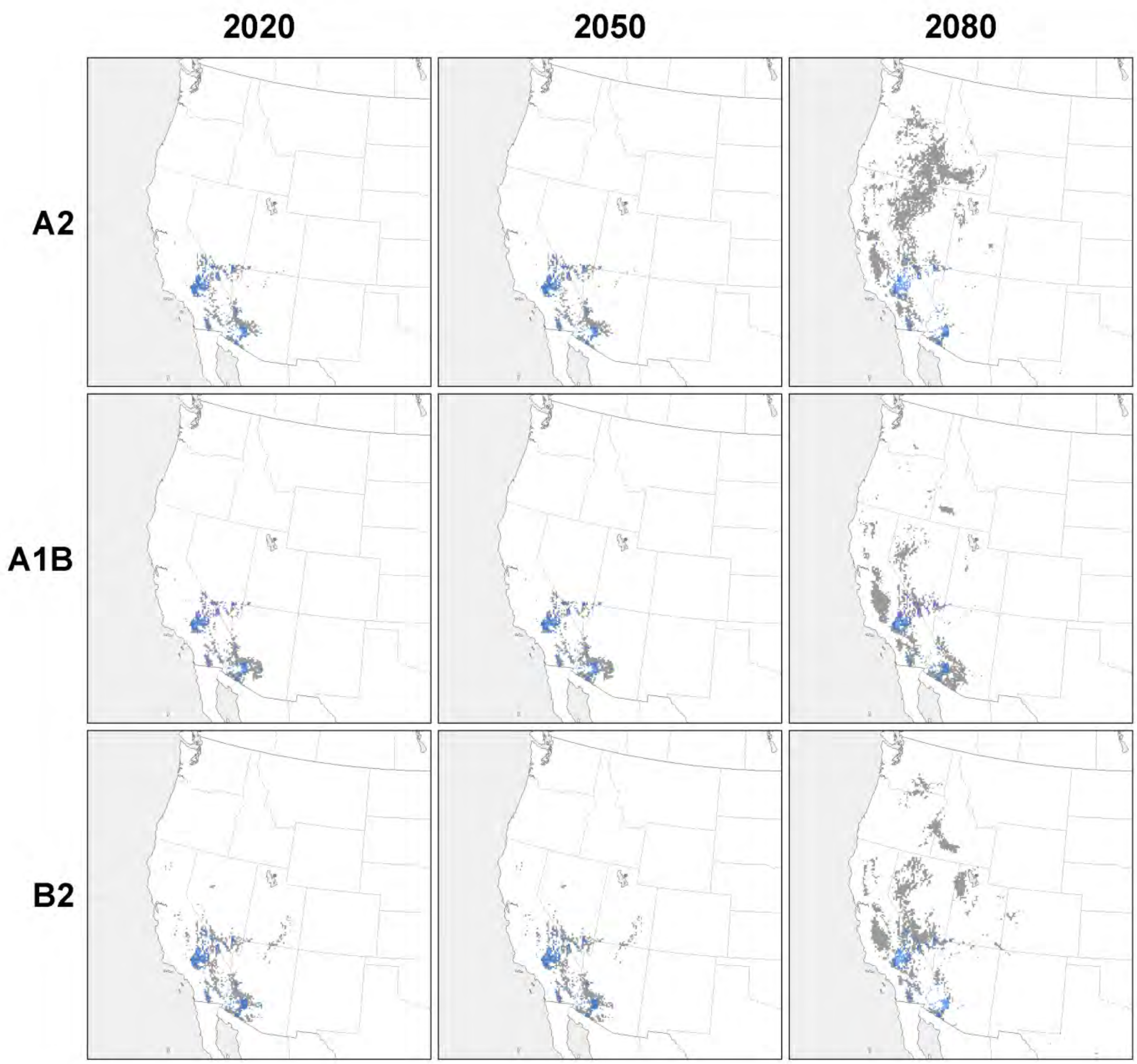
Modeled Future Summer Range by Year and Emissions Scenario



Orange areas indicate the modeled current range (2000-2009) for Le Conte's Thrasher (*Toxostoma lecontei*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Le Conte's Thrasher (*Toxostoma lecontei*)

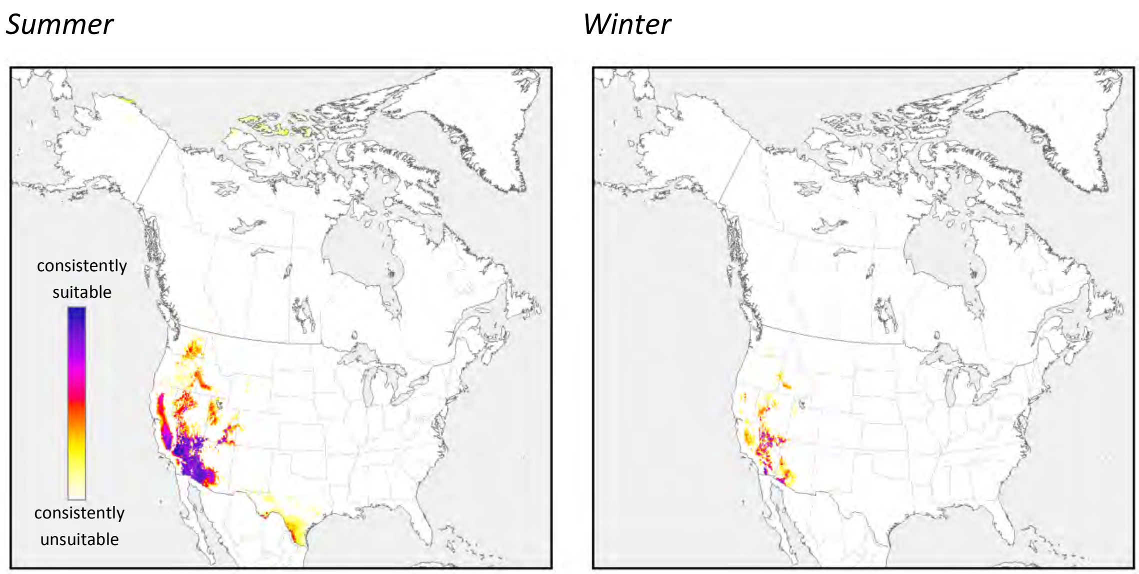
Predicted Future Winter Range by Year and Emissions Scenario



Blue areas indicate the modeled current range (2000-2009) for Le Conte's Thrasher (*Toxostoma lecontei*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

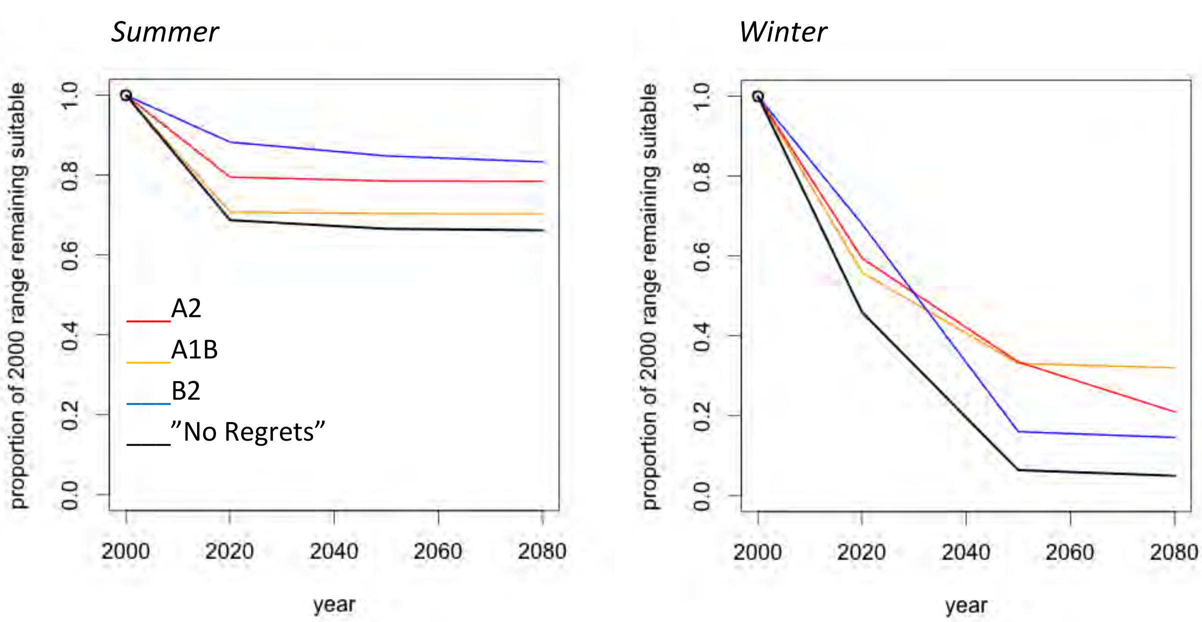
Le Conte's Thrasher (*Toxostoma lecontei*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios



Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Le Conte's Thrasher (*Toxostoma lecontei*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

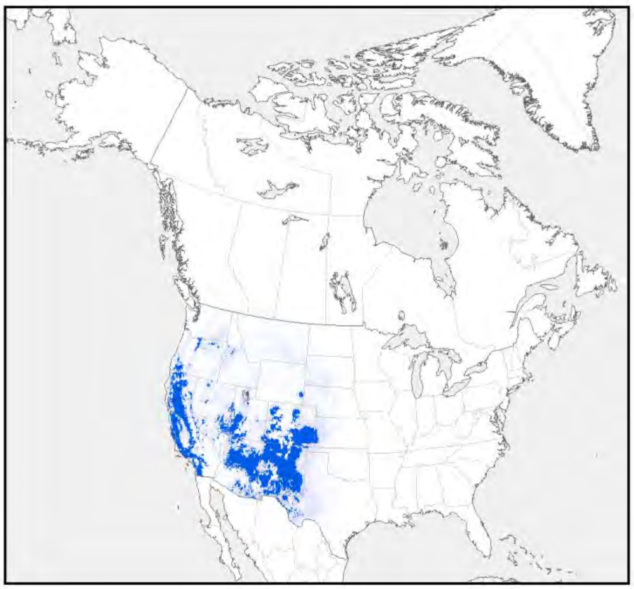
Predicted Refugia Size by Year and Emissions Scenario modeled for Le Conte's Thrasher (*Toxostoma lecontei*)



Lewis's Woodpecker (*Melanerpes lewis*)

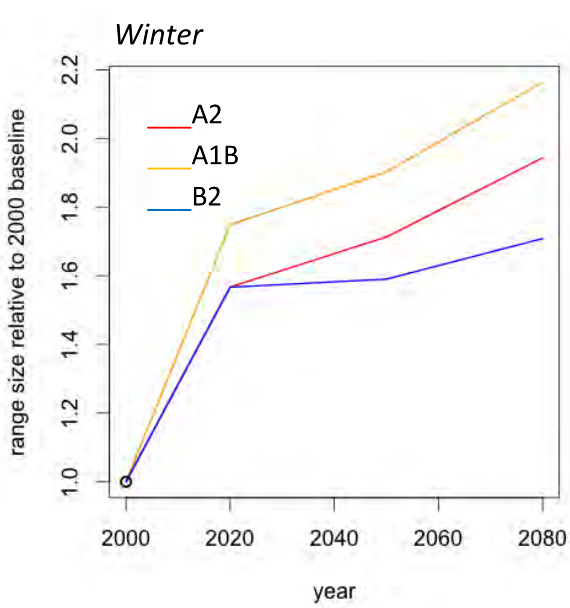
Modeled Current Range (2000-2009)

Winter



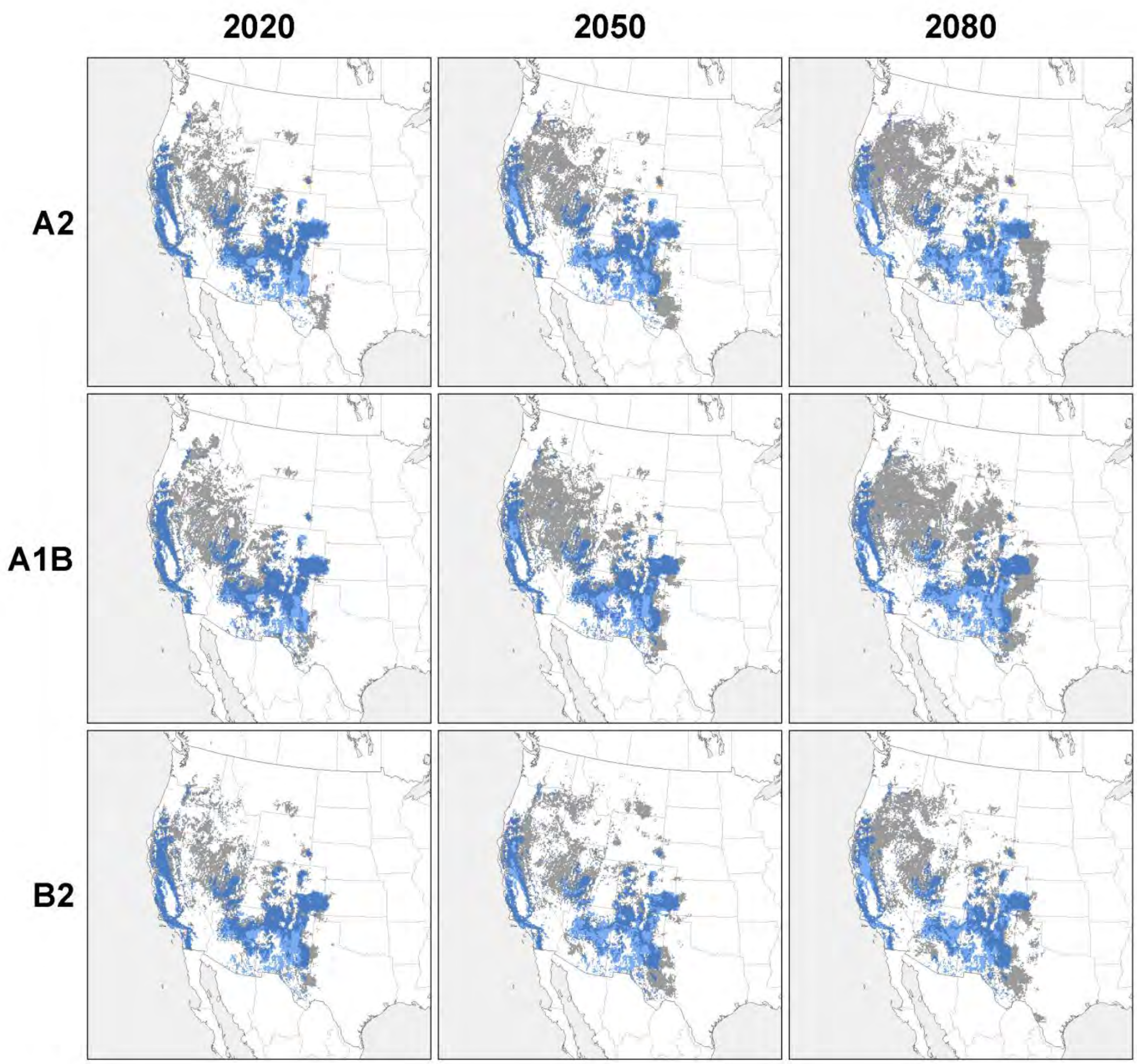
Current winter range was modeled for Lewis's Woodpecker (*Melanerpes lewis*) using data from 2000-2009. Solid blue areas show core range estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

Predicted Range Size by Year and Emissions Scenario for Lewis's Woodpecker (*Melanerpes lewis*)



Lewis's Woodpecker (Melanerpes lewis)

Predicted Future Winter Range by Year and Emissions Scenario

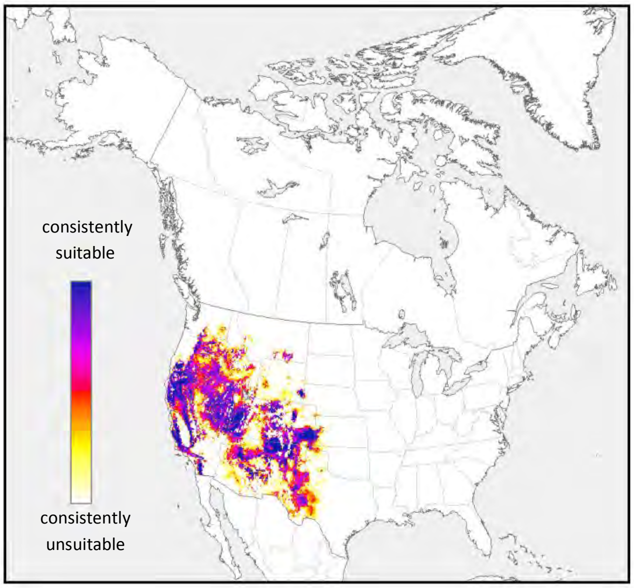


Blue areas indicate the modeled current range (2000-2009) for Lewis's Woodpecker (*Melanerpes lewis*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Lewis's Woodpecker (*Melanerpes lewis*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

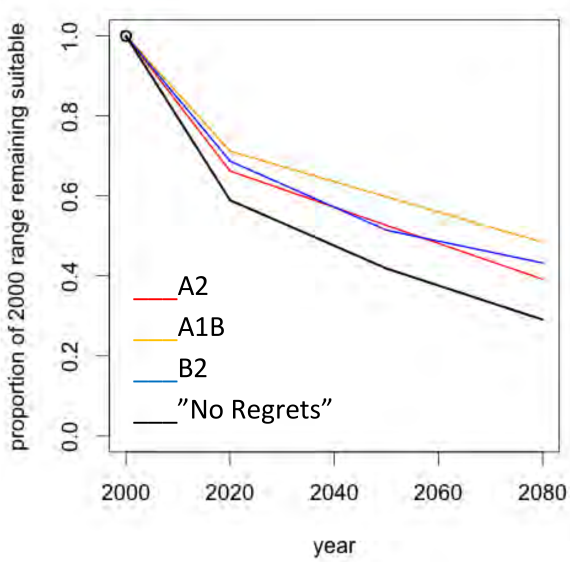
Winter



Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Lewis's Woodpecker (*Melanerpes lewis*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Lewis's Woodpecker (*Melanerpes lewis*)

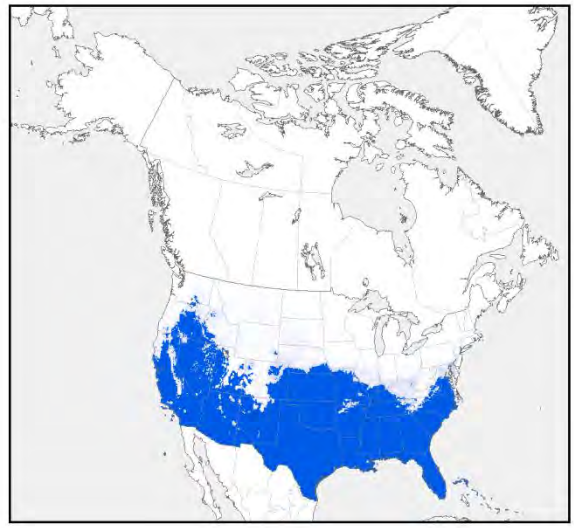
Winter



Loggerhead Shrike (*Lanius ludovicianus*)

Modeled Current Range (2000-2009)

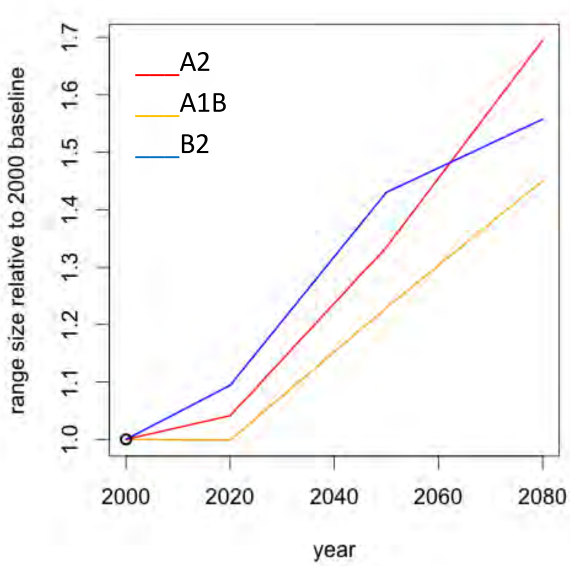
Summer *Winter*



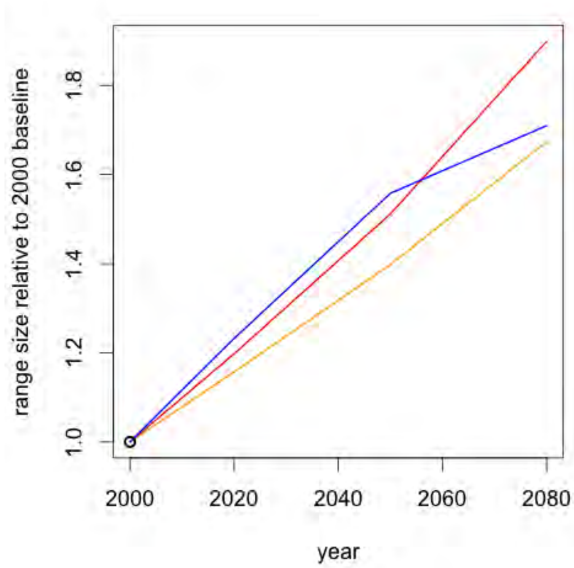
Current summer and winter ranges were modeled for Loggerhead Shrike (*Lanius ludovicianus*) using data from 2000-2009. Solid orange and blue areas show core ranges estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

Predicted Range Size by Year and Emissions Scenario for Loggerhead Shrike (*Lanius ludovicianus*)

Summer

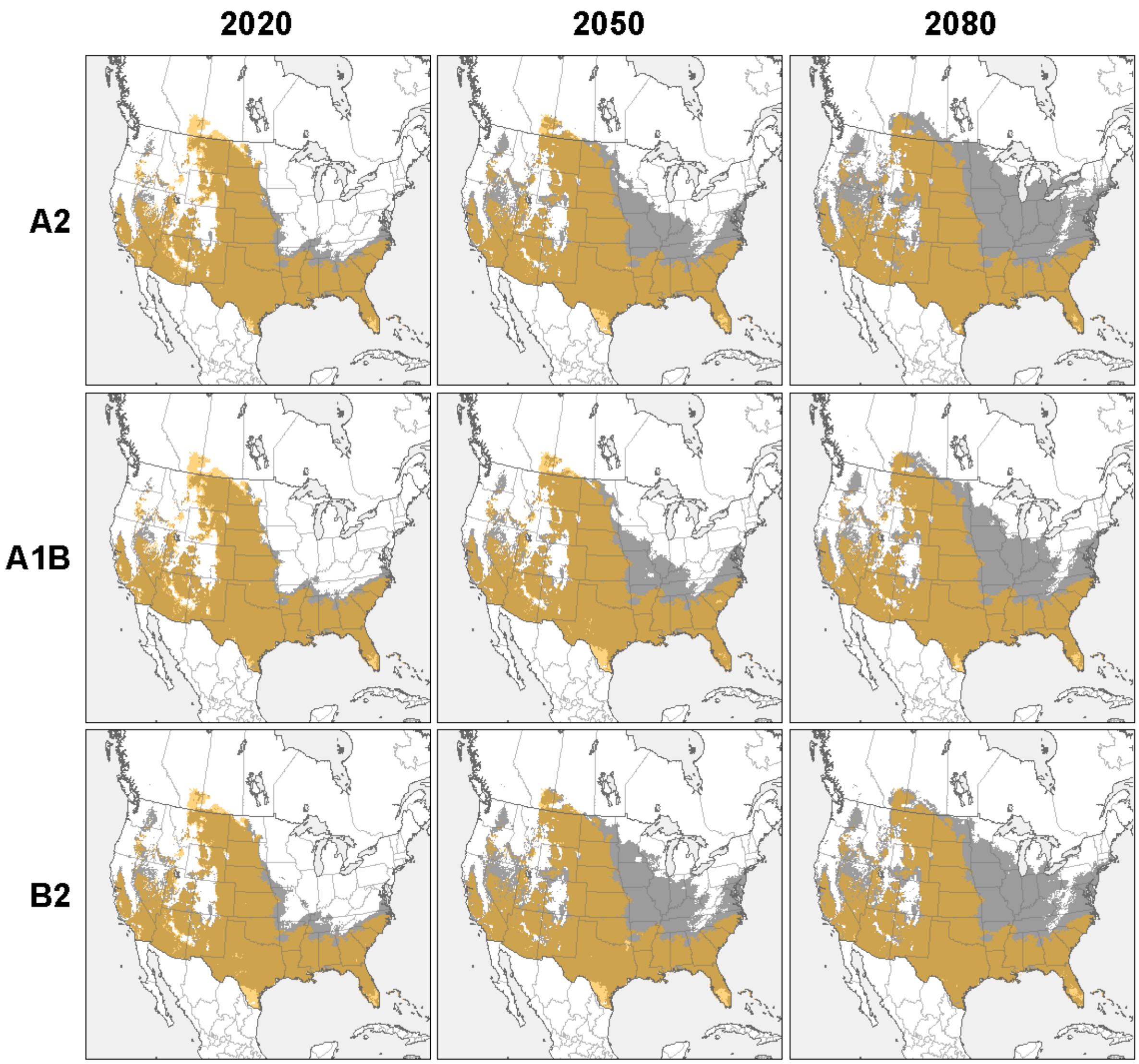


Winter



Loggerhead Shrike (*Lanius ludovicianus*)

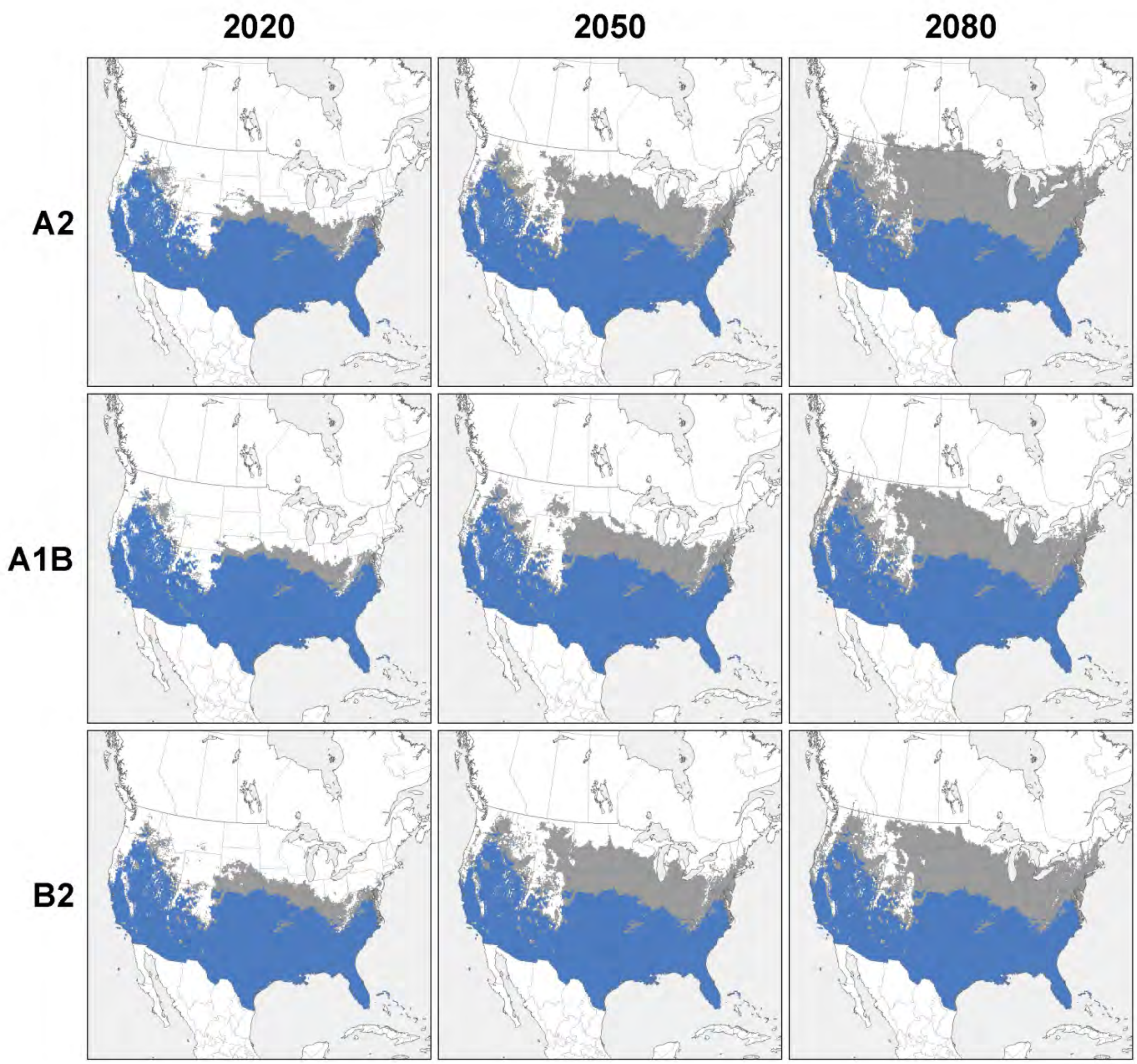
Modeled Future Summer Range by Year and Emissions Scenario



Orange areas indicate the modeled current range (2000-2009) for Loggerhead Shrike (*Lanius ludovicianus*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Loggerhead Shrike (*Lanius ludovicianus*)

Predicted Future Winter Range by Year and Emissions Scenario

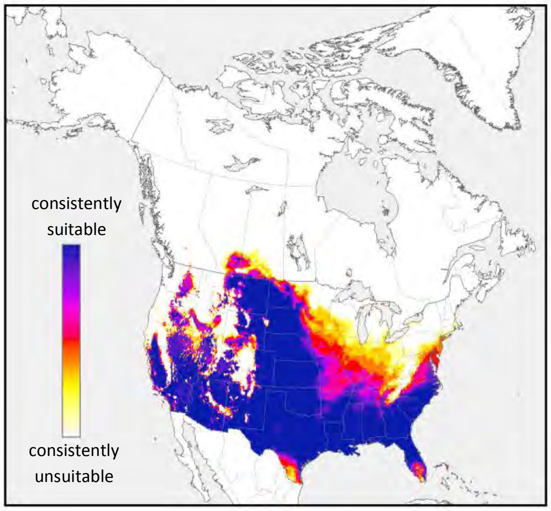


Blue areas indicate the modeled current range (2000-2009) for Loggerhead Shrike (*Lanius ludovicianus*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

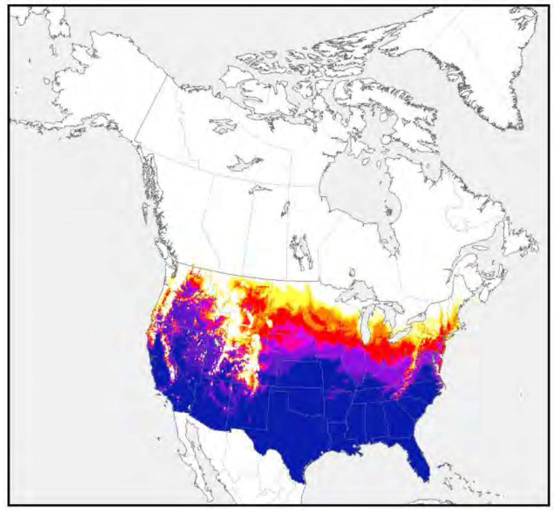
Loggerhead Shrike (*Lanius ludovicianus*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

Summer



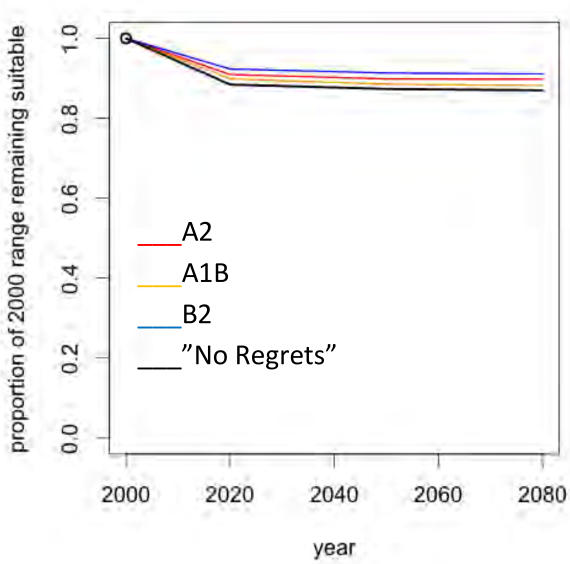
Winter



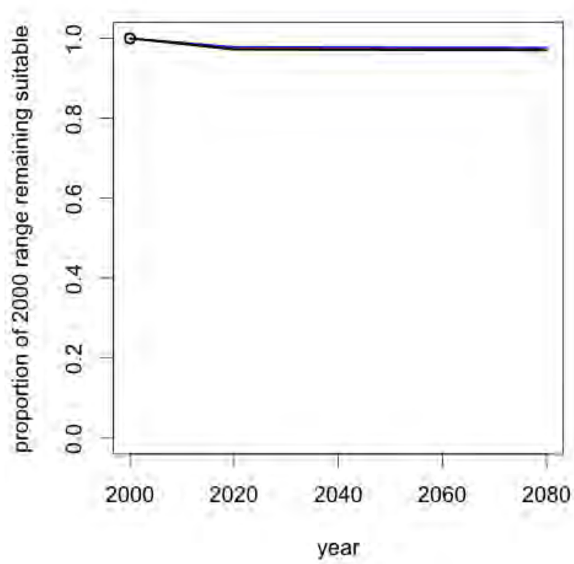
Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Loggerhead Shrike (*Lanius ludovicianus*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Loggerhead Shrike (*Lanius ludovicianus*)

Summer

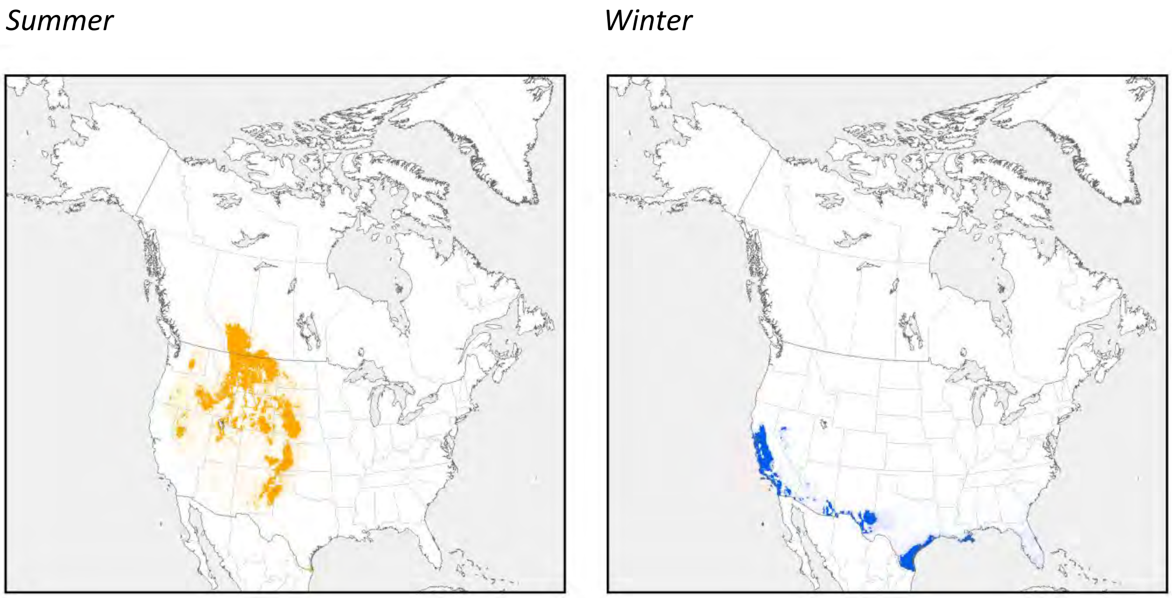


Winter



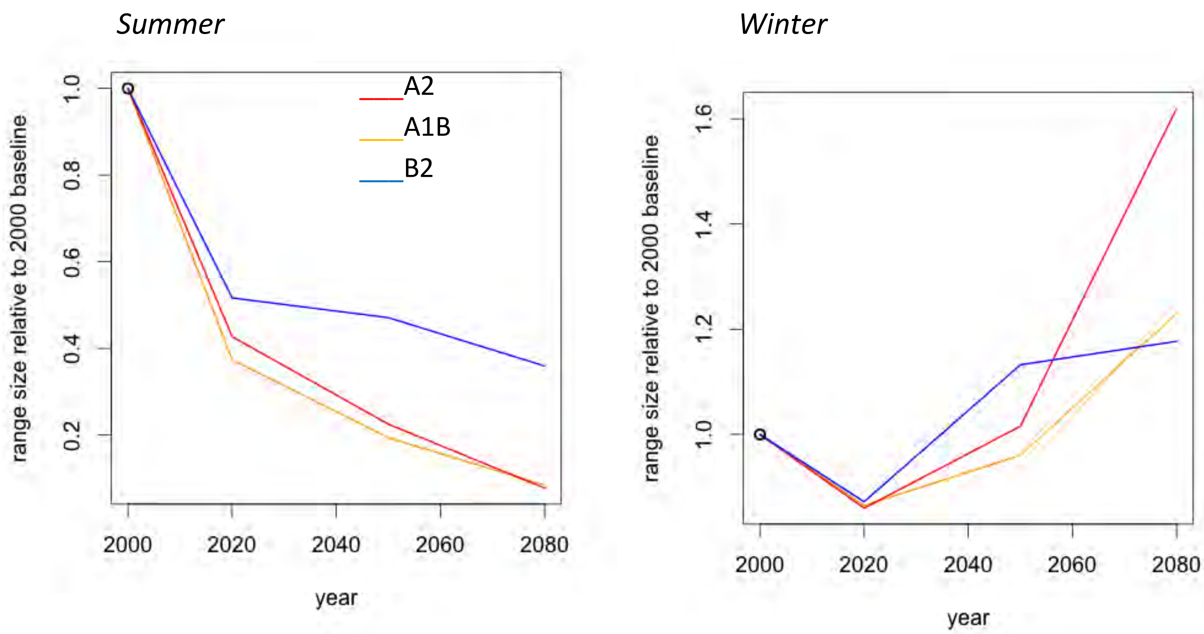
Long-billed Curlew (*Numenius americanus*)

Modeled Current Range (2000-2009)



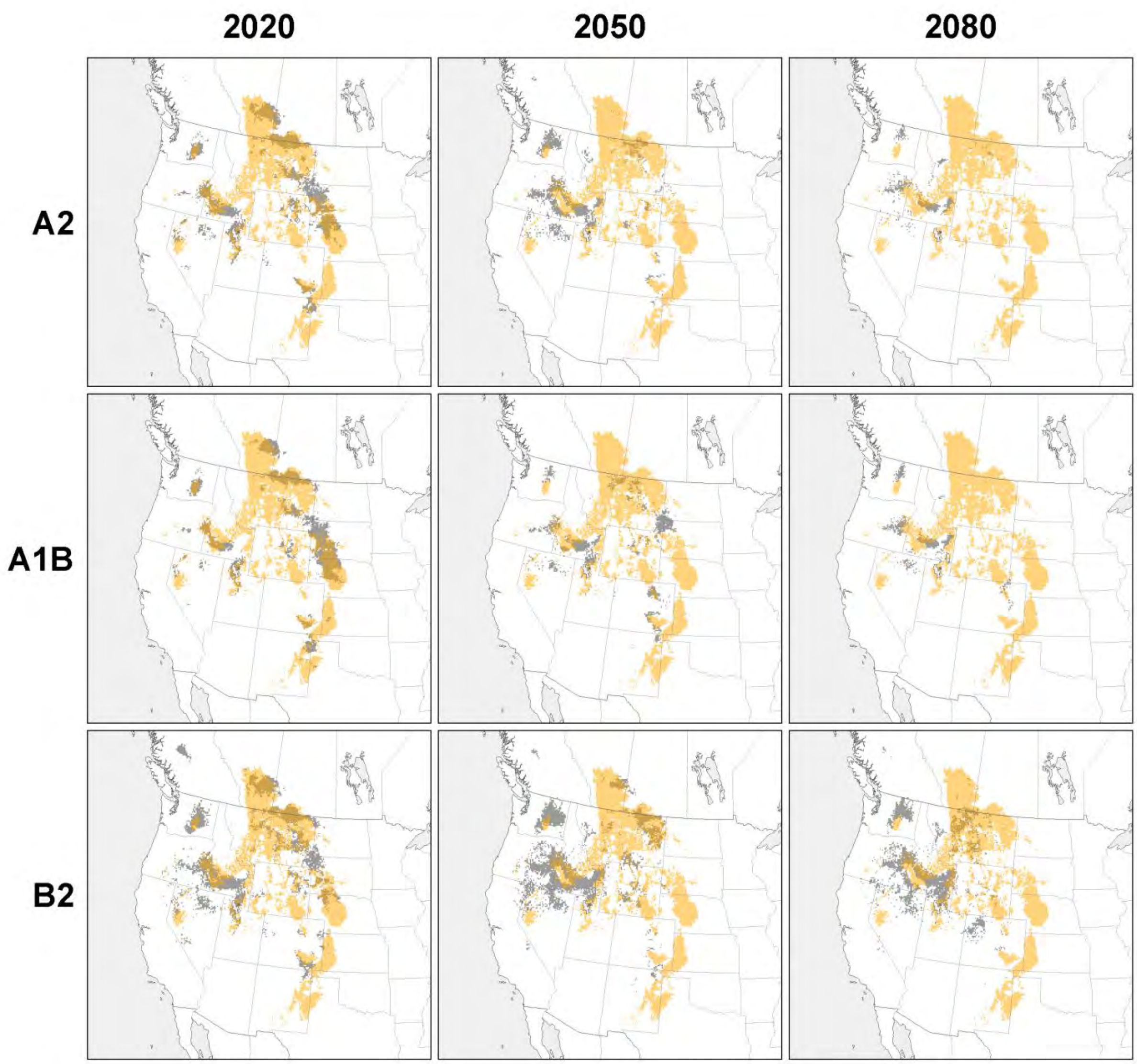
Current summer and winter ranges were modeled for Long-billed Curlew (*Numenius americanus*) using data from 2000-2009. Solid orange and blue areas show core ranges estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

Predicted Range Size by Year and Emissions Scenario for Long-billed Curlew (*Numenius americanus*)



Long-billed Curlew (*Numenius americanus*)

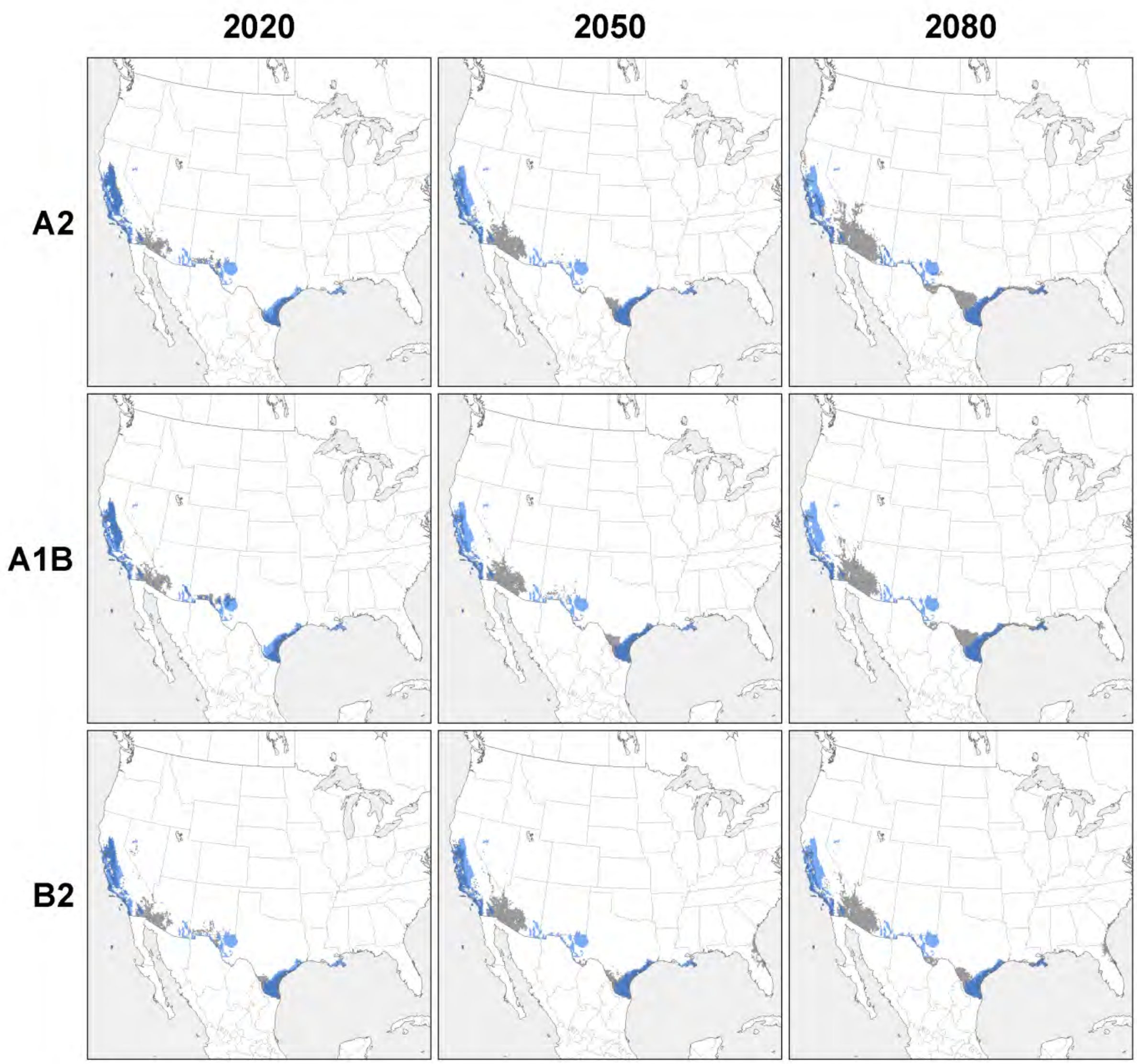
Modeled Future Summer Range by Year and Emissions Scenario



Orange areas indicate the modeled current range (2000-2009) for Long-billed Curlew (*Numenius americanus*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Long-billed Curlew (*Numenius americanus*)

Predicted Future Winter Range by Year and Emissions Scenario

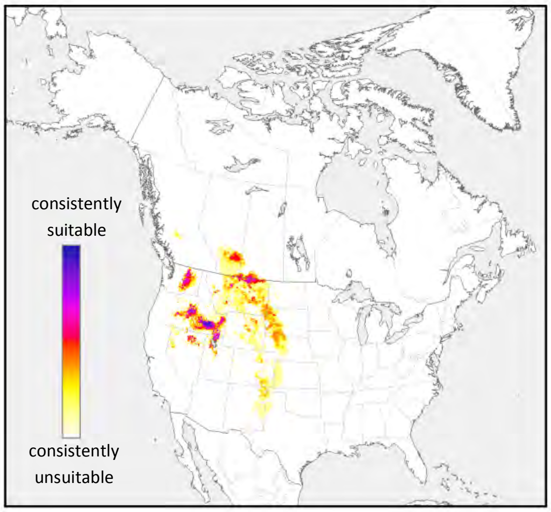


Blue areas indicate the modeled current range (2000-2009) for Long-billed Curlew (*Numenius americanus*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

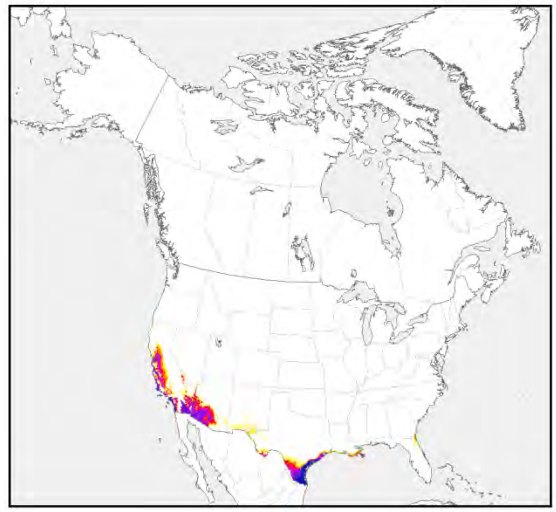
Long-billed Curlew (*Numenius americanus*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

Summer



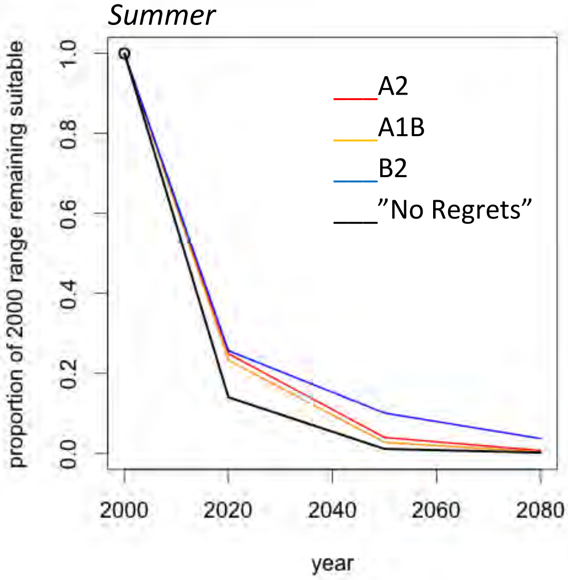
Winter



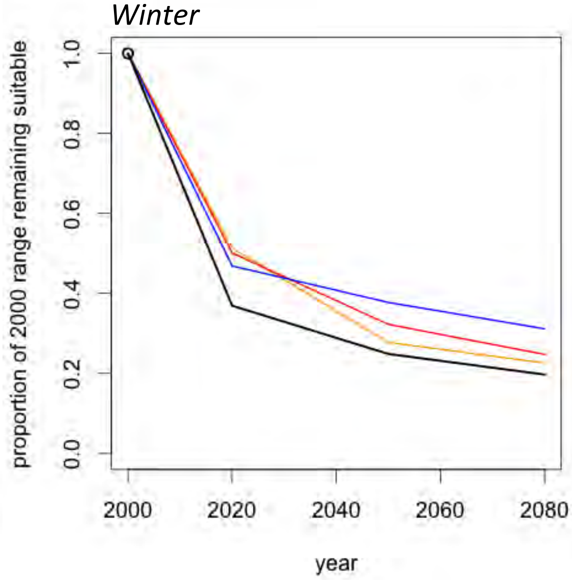
Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Long-billed Curlew (*Numenius americanus*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Long-billed Curlew (*Numenius americanus*)

Summer



Winter



Mountain Plover (*Charadrius montanus*)

Modeled Current Range (2000-2009)

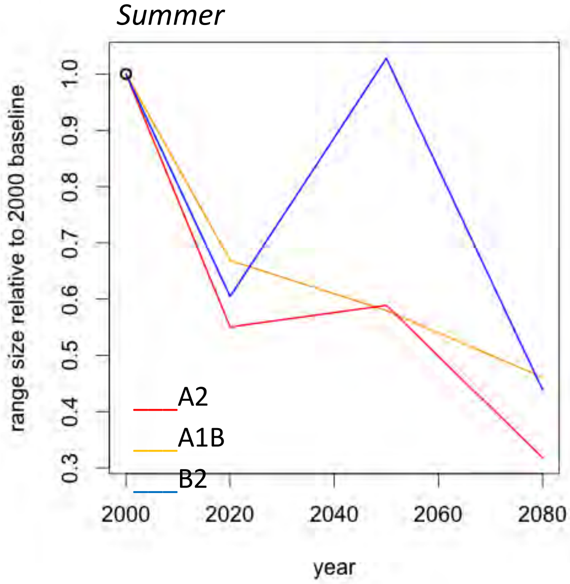
Summer

Winter

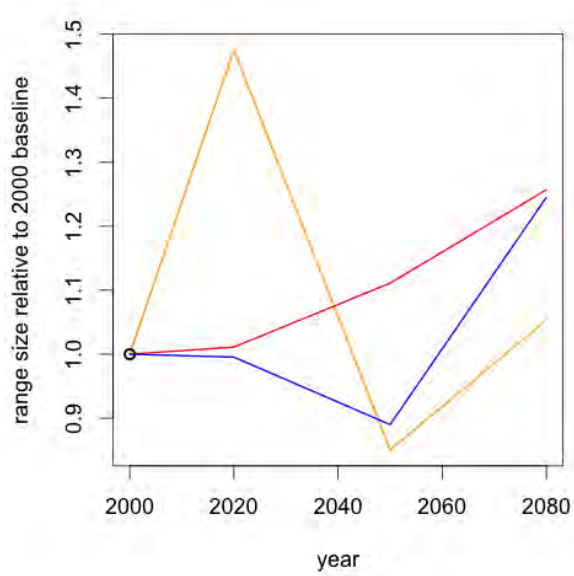
Current summer and winter ranges were modeled for Mountain Plover (*Charadrius montanus*) using data from 2000-2009. Solid orange and blue areas show core ranges estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

Predicted Range Size by Year and Emissions Scenario for Mountain Plover (*Charadrius montanus*)

Summer

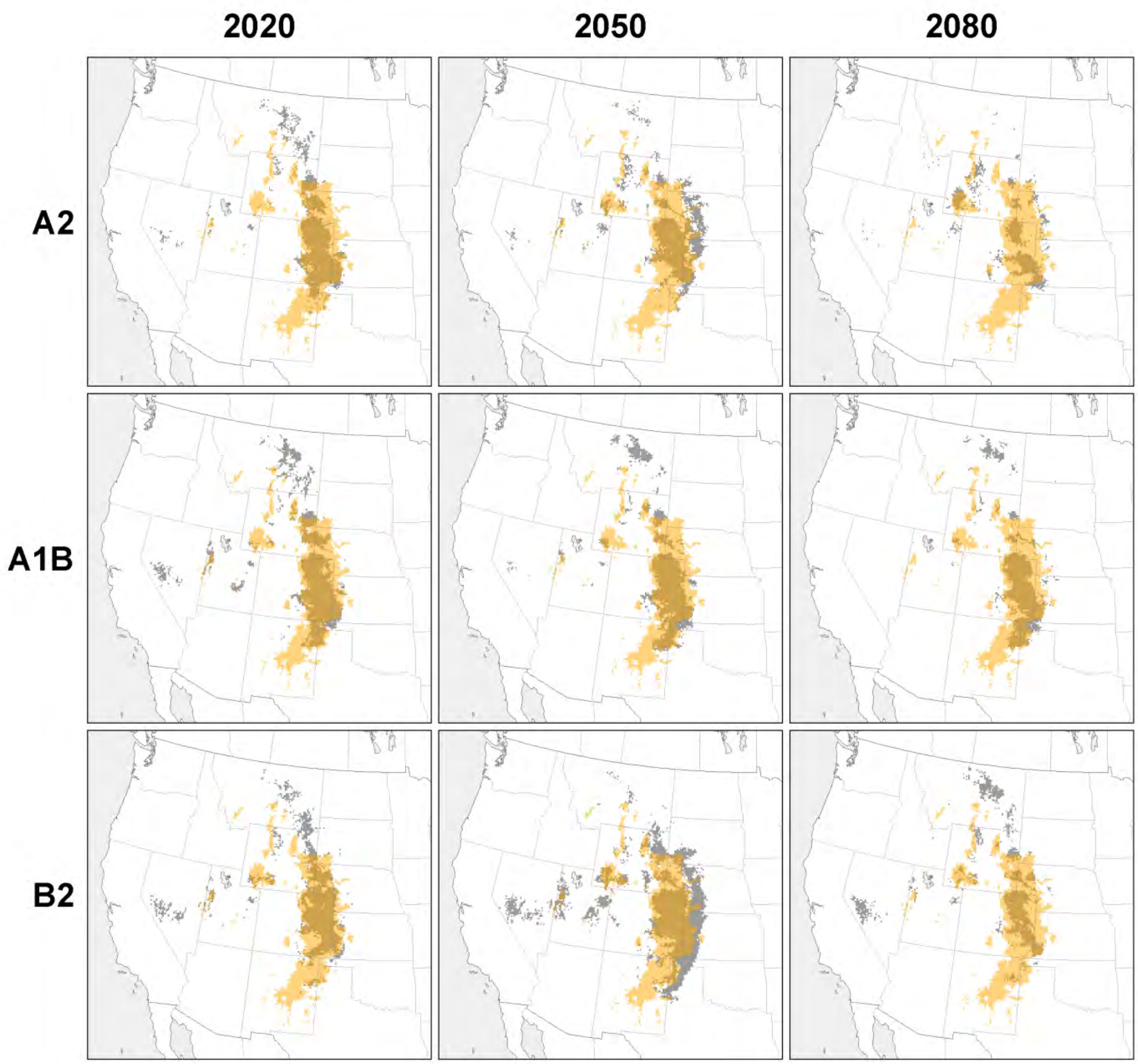


Winter



Mountain Plover (*Charadrius montanus*)

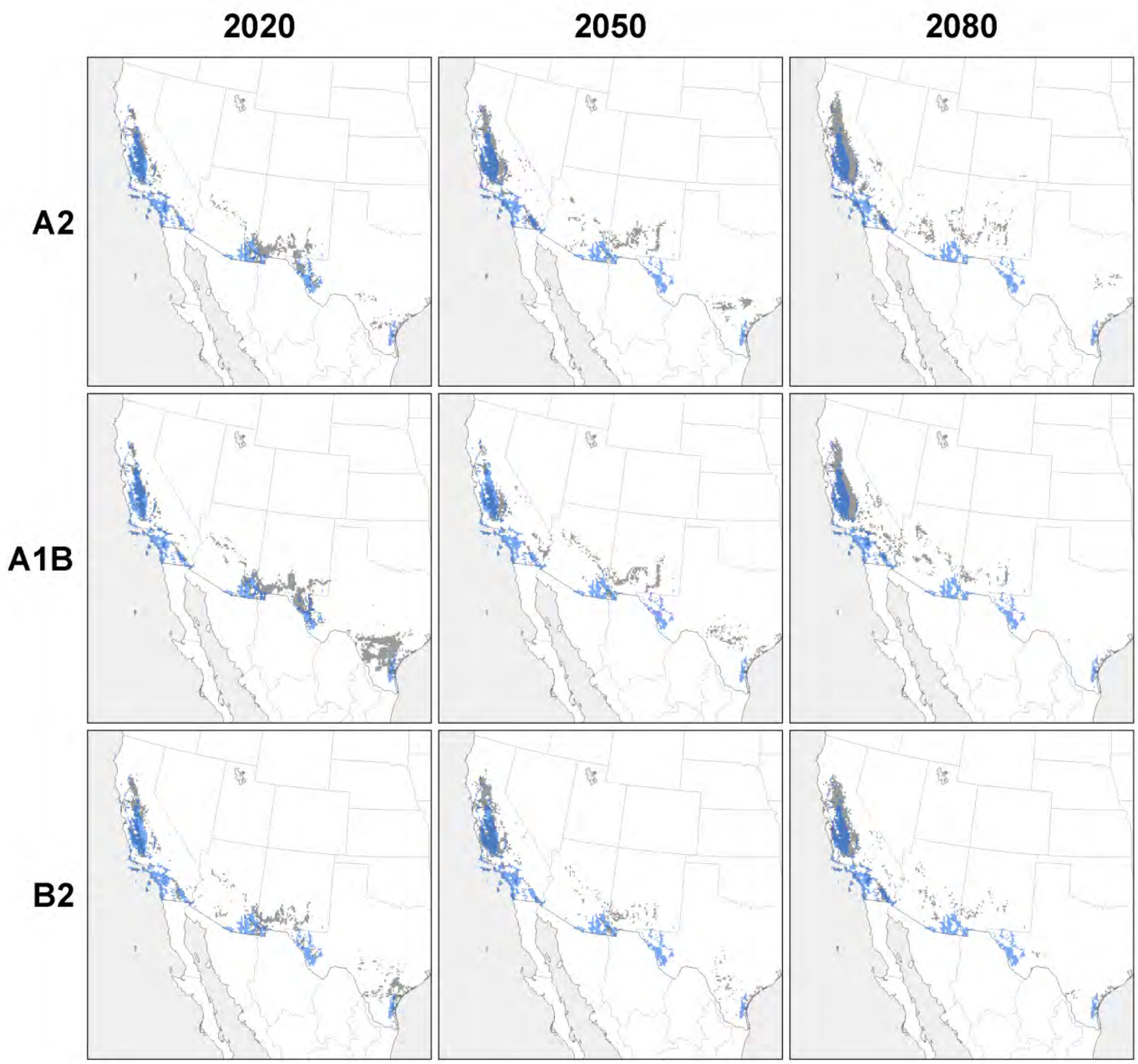
Modeled Future Summer Range by Year and Emissions Scenario



Orange areas indicate the modeled current range (2000-2009) for Mountain Plover (*Charadrius montanus*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Mountain Plover (*Charadrius montanus*)

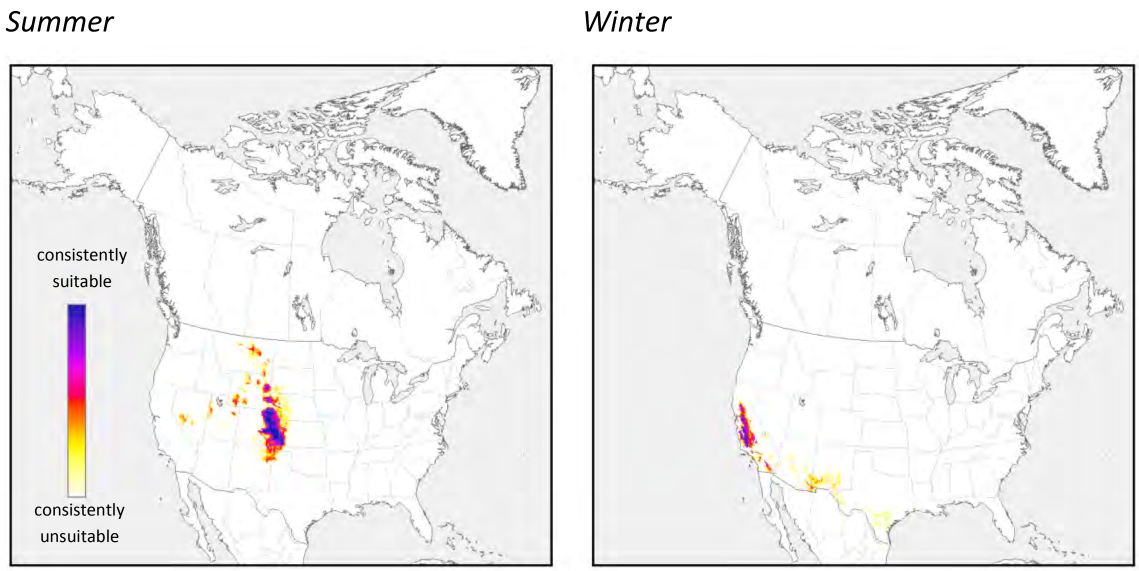
Predicted Future Winter Range by Year and Emissions Scenario



Blue areas indicate the modeled current range (2000-2009) for Mountain Plover (*Charadrius montanus*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

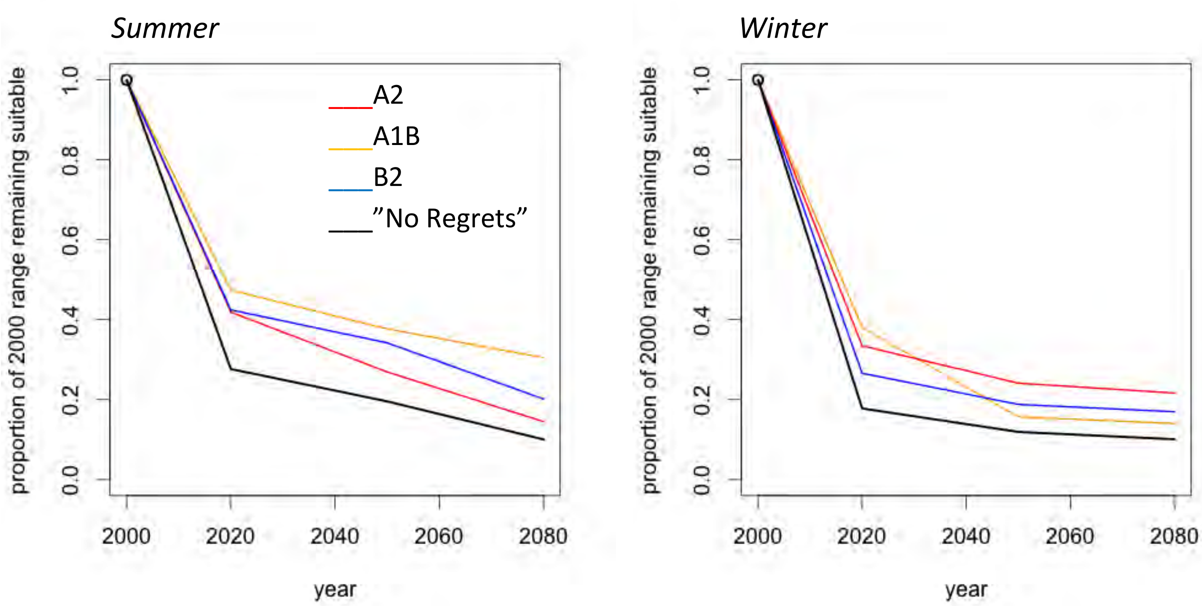
Mountain Plover (*Charadrius montanus*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios



Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Mountain Plover (*Charadrius montanus*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Mountain Plover (*Charadrius montanus*)



Olive-sided Flycatcher (*Contopus cooperi*)

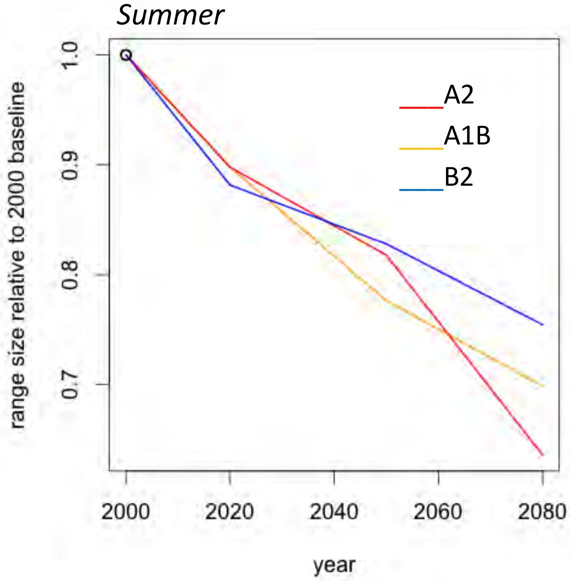
Modeled Current Range (2000-2009)

Summer

Current summer range was modeled for Olive-sided Flycatcher (*Contopus cooperi*) using data from 2000-2009. Solid orange areas show core range estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

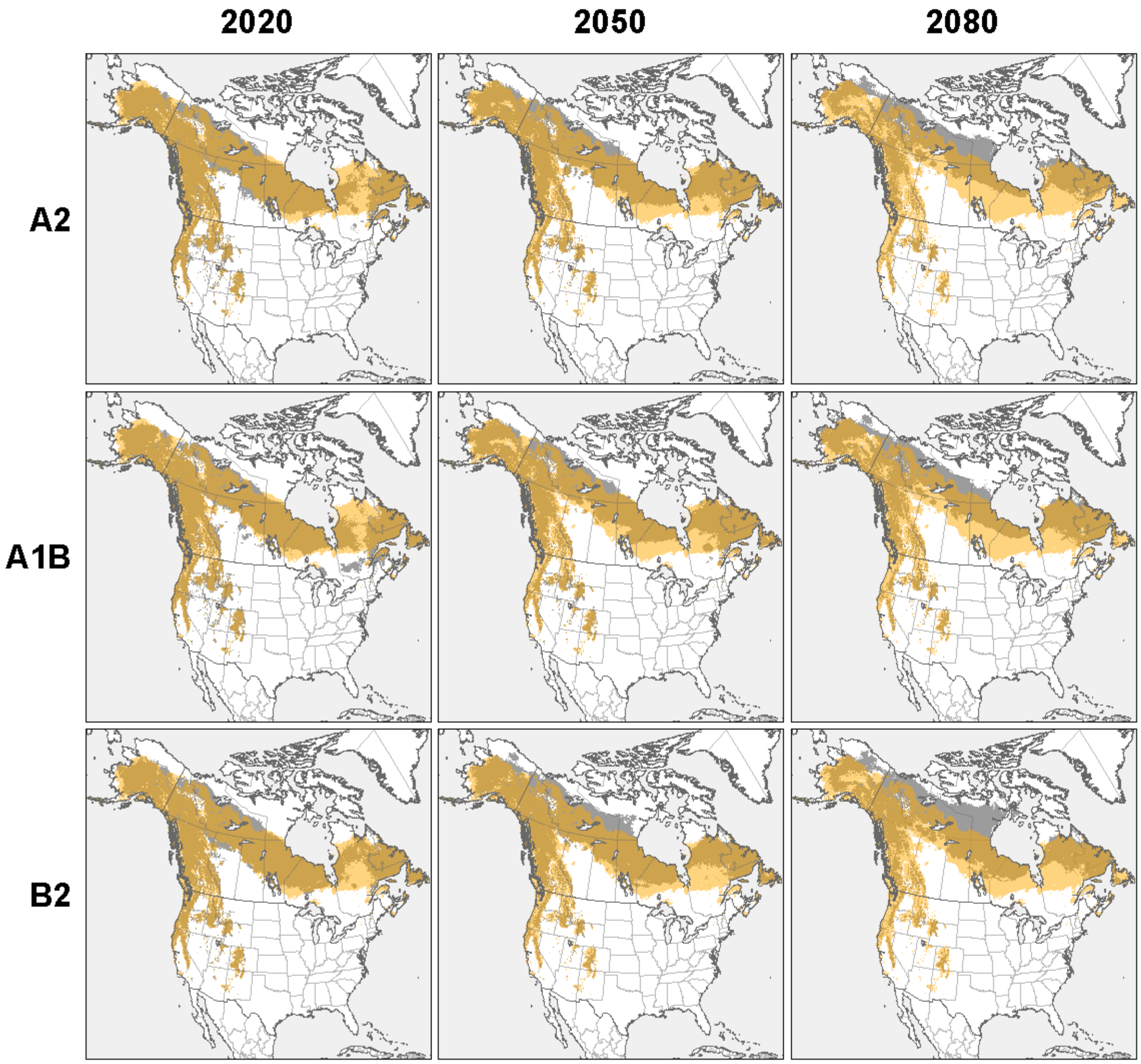
Predicted Range Size by Year and Emissions Scenario for Olive-sided Flycatcher (*Contopus cooperi*)

Summer



Olive-sided Flycatcher (*Contopus cooperi*)

Modeled Future Summer Range by Year and Emissions Scenario

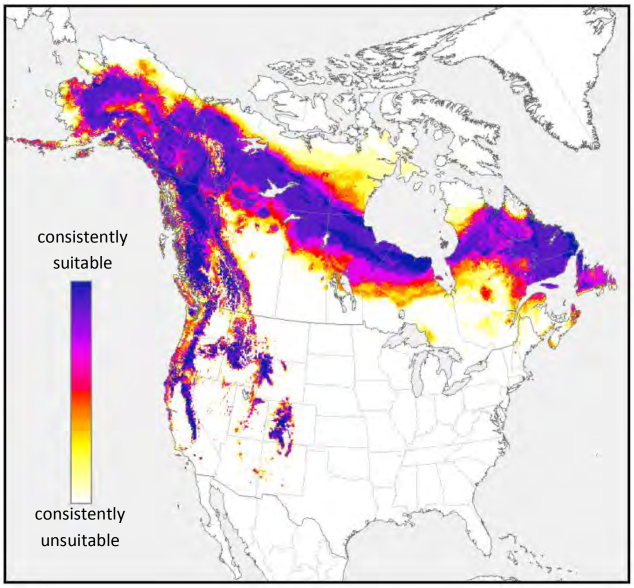


Orange areas indicate the modeled current range (2000-2009) for Olive-sided Flycatcher (*Contopus cooperi*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Olive-sided Flycatcher (*Contopus cooperi*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

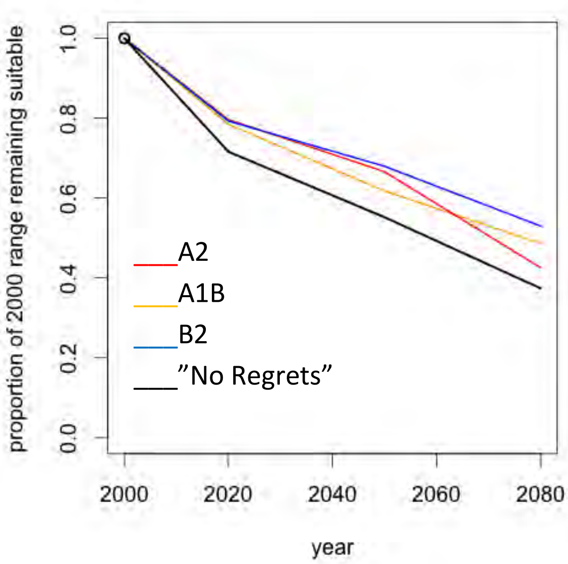
Summer



Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Olive-sided Flycatcher (*Contopus cooperi*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Olive-sided Flycatcher (*Contopus cooperi*)

Summer

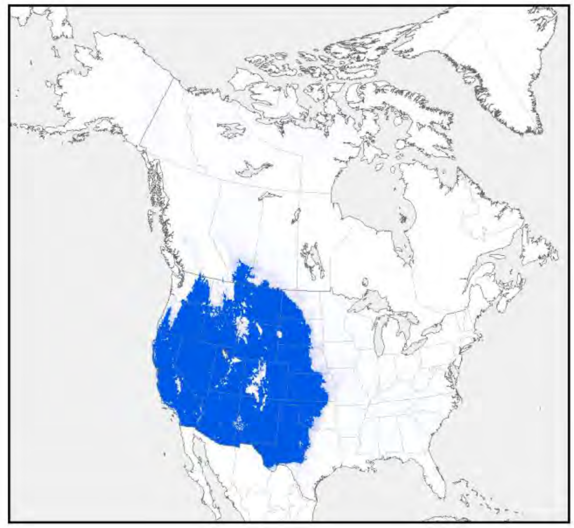


Prairie Falcon (*Falco mexicanus*)

Modeled Current Range (2000-2009)

Summer

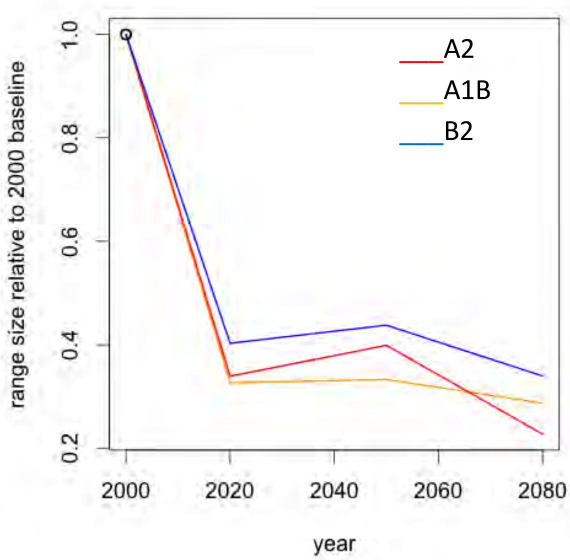
Winter



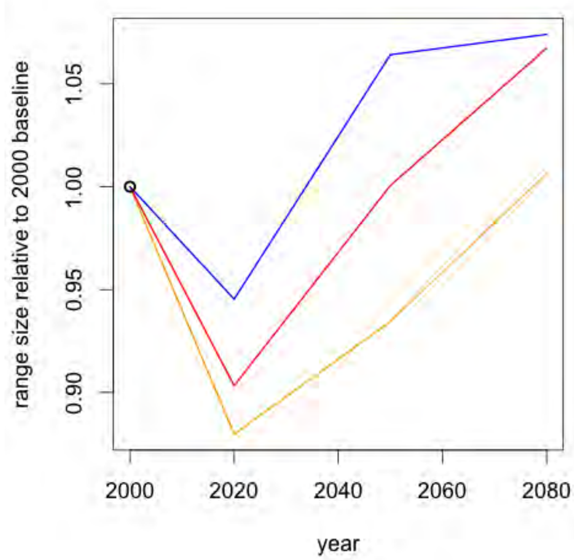
Current summer and winter ranges were modeled for Prairie Falcon (*Falco mexicanus*) using data from 2000-2009. Solid orange and blue areas show core ranges estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

Predicted Range Size by Year and Emissions Scenario for Prairie Falcon (*Falco mexicanus*)

Summer

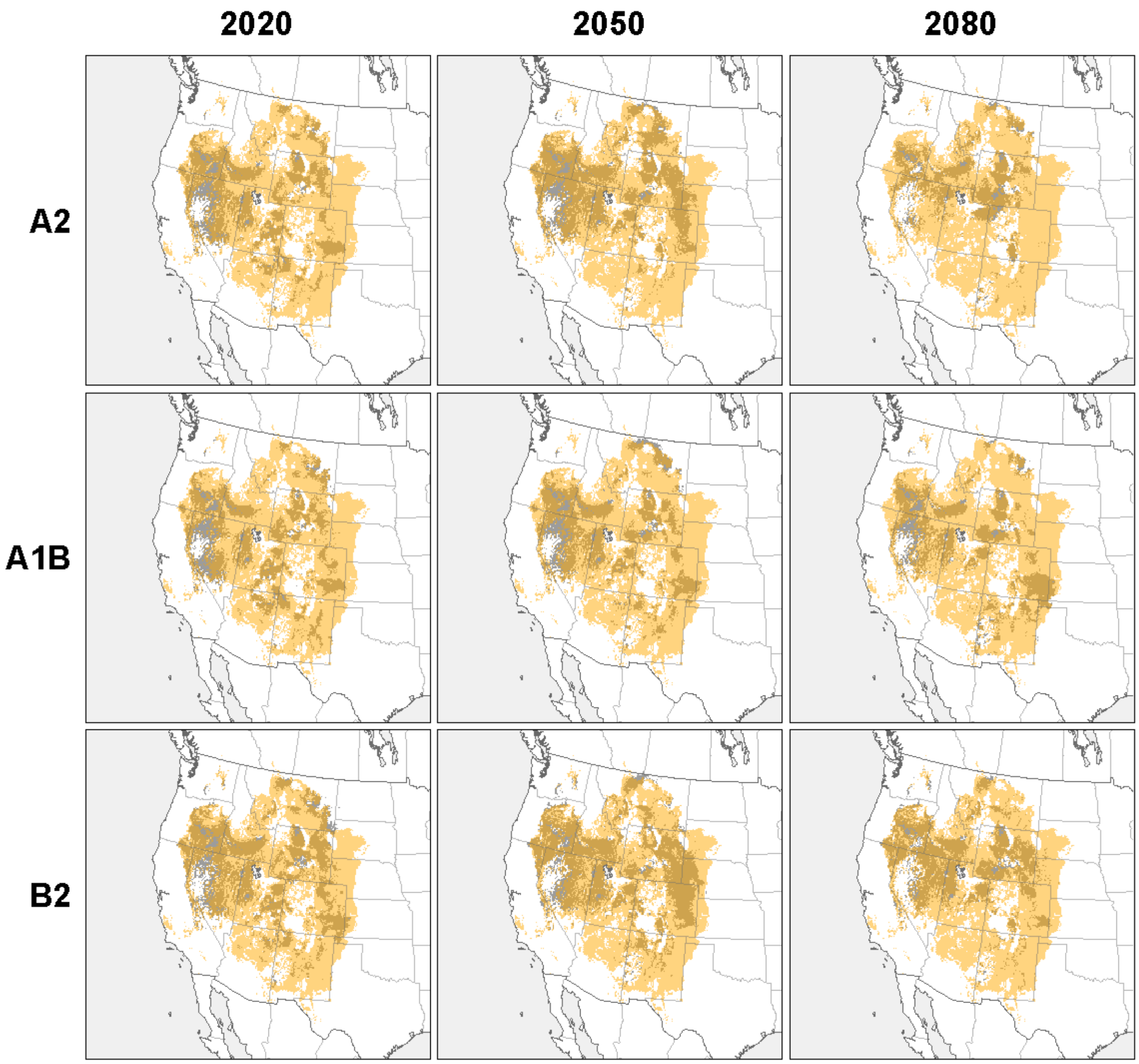


Winter



Prairie Falcon (*Falco mexicanus*)

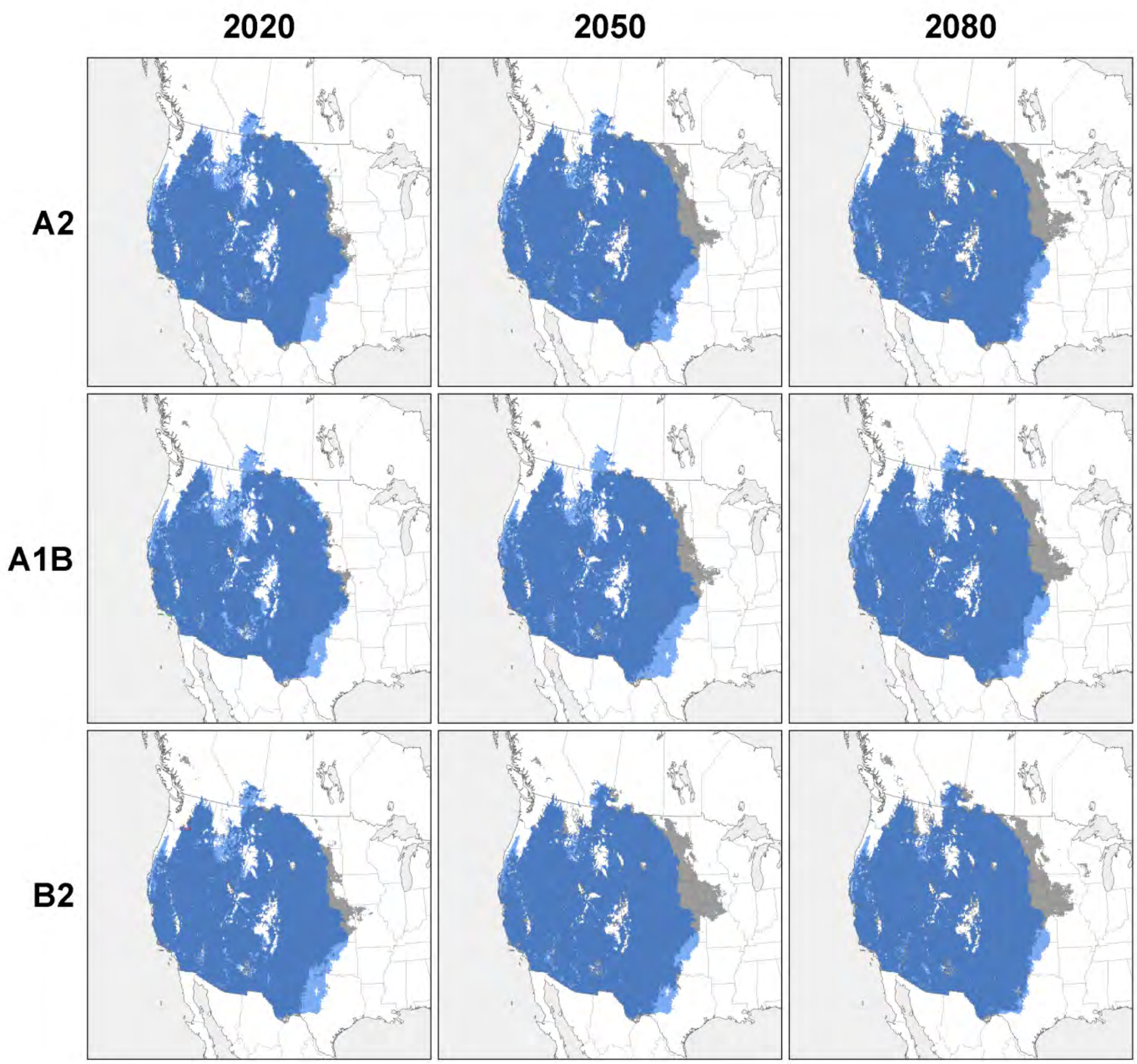
Modeled Future Summer Range by Year and Emissions Scenario



Orange areas indicate the modeled current range (2000-2009) for Prairie Falcon (*Falco mexicanus*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Prairie Falcon (*Falco mexicanus*)

Predicted Future Winter Range by Year and Emissions Scenario

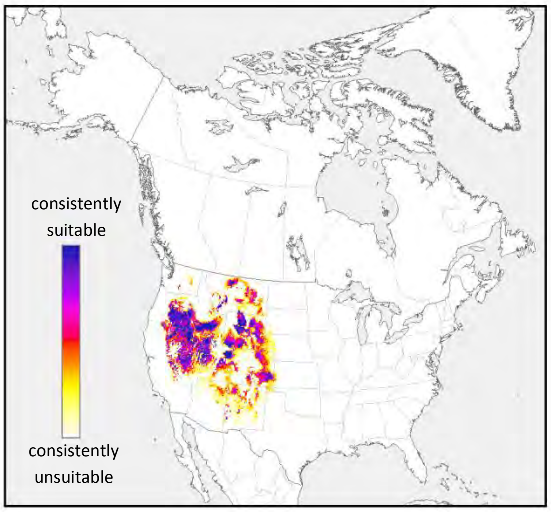


Blue areas indicate the modeled current range (2000-2009) for Prairie Falcon (*Falco mexicanus*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

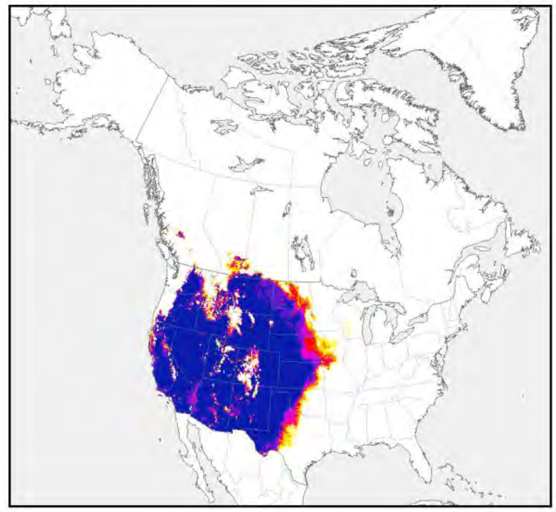
Prairie Falcon (*Falco mexicanus*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

Summer



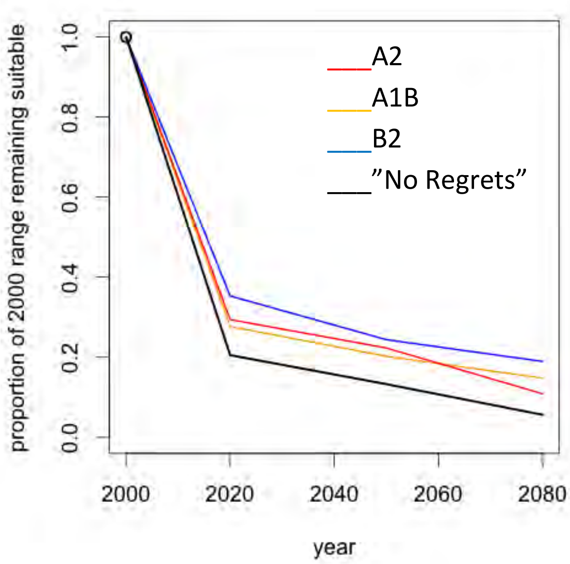
Winter



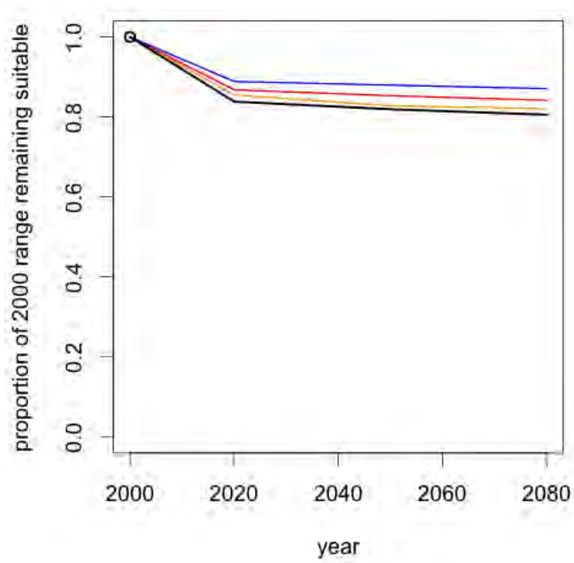
Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Prairie Falcon (*Falco mexicanus*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Prairie Falcon (*Falco mexicanus*)

Summer



Winter



Prothonotary Warbler (*Protonotaria citrea*)

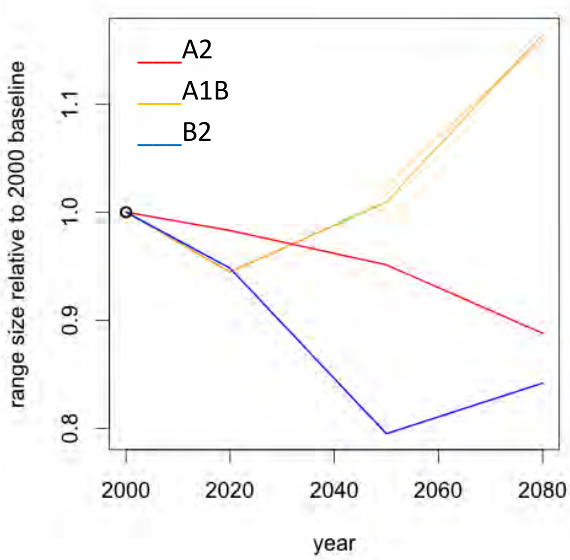
Modeled Current Range (2000-2009)

Summer

Current summer range was modeled for Prothonotary Warbler (*Protonotaria citrea*) using data from 2000-2009. Solid orange areas show core range estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

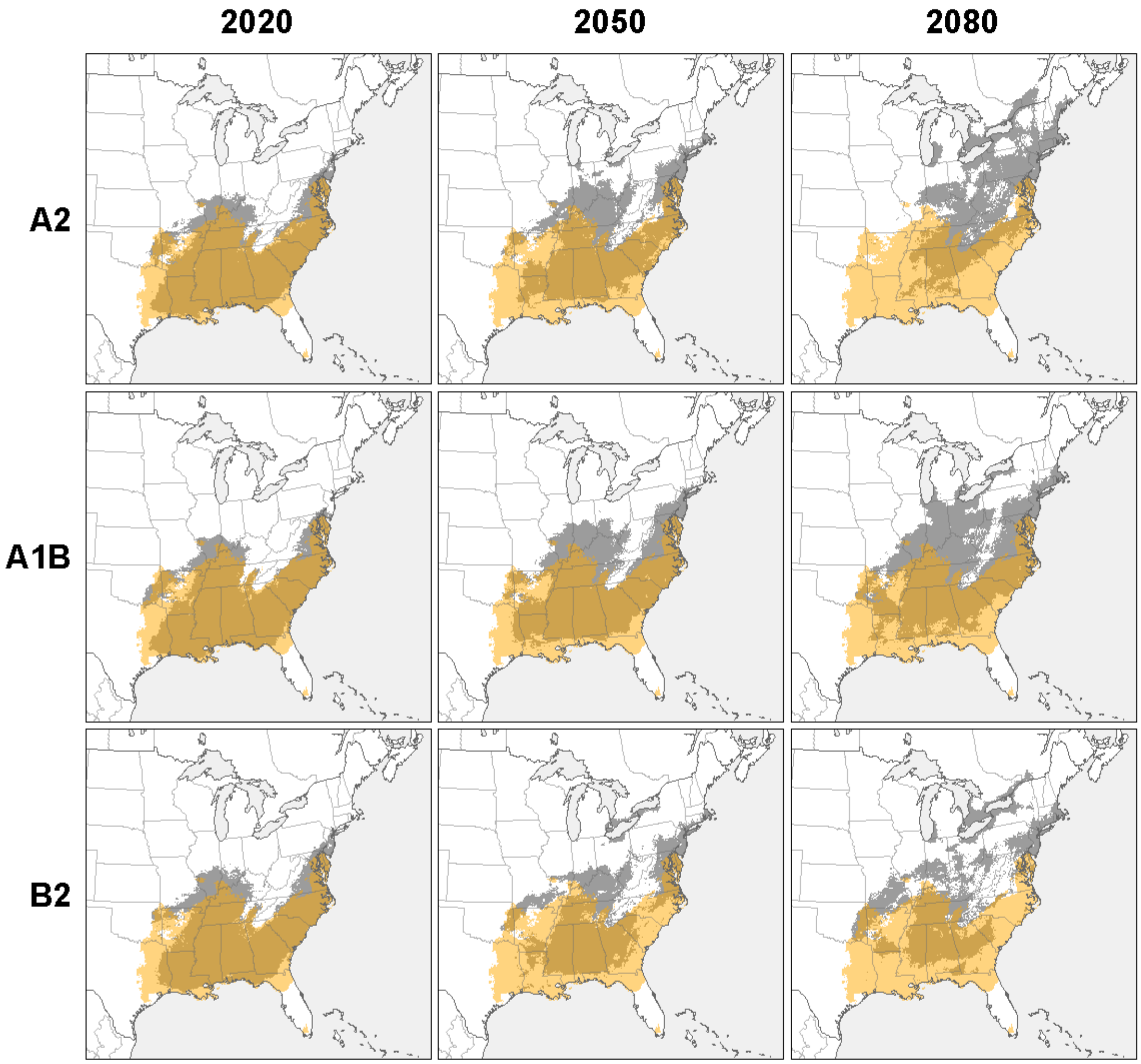
Predicted Range Size by Year and Emissions Scenario for Prothonotary Warbler (*Protonotaria citrea*)

Summer



Prothonotary Warbler (*Protonotaria citrea*)

Modeled Future Summer Range by Year and Emissions Scenario

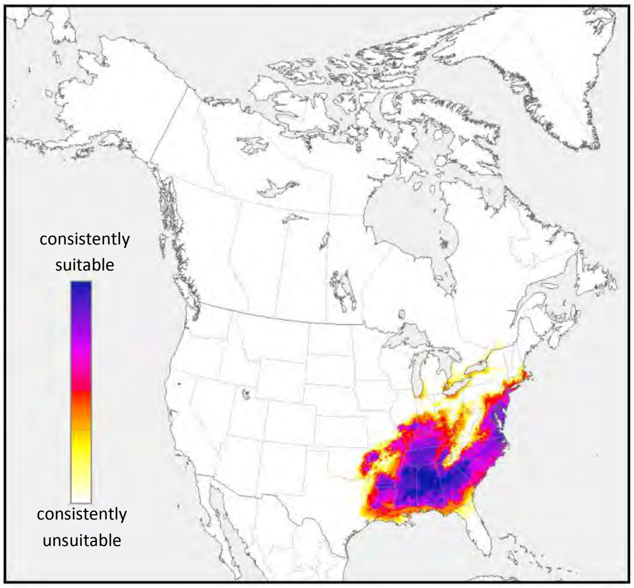


Orange areas indicate the modeled current range (2000-2009) for Prothonotary Warbler (*Protonotaria citrea*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Prothonotary Warbler (*Protonotaria citrea*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

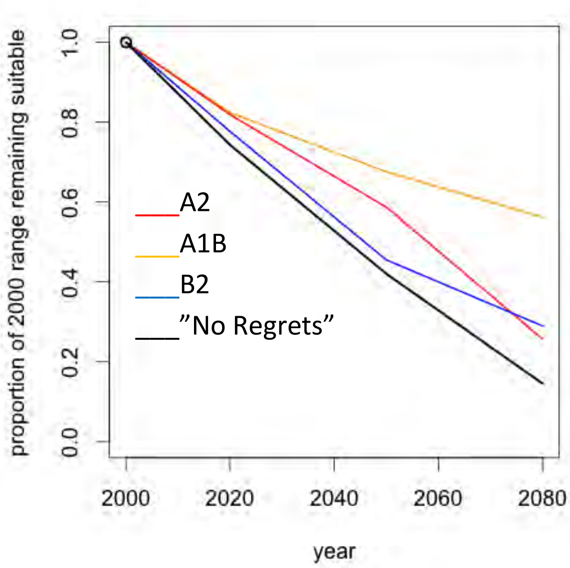
Summer



Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Prothonotary Warbler (*Protonotaria citrea*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Prothonotary Warbler (*Protonotaria citrea*)

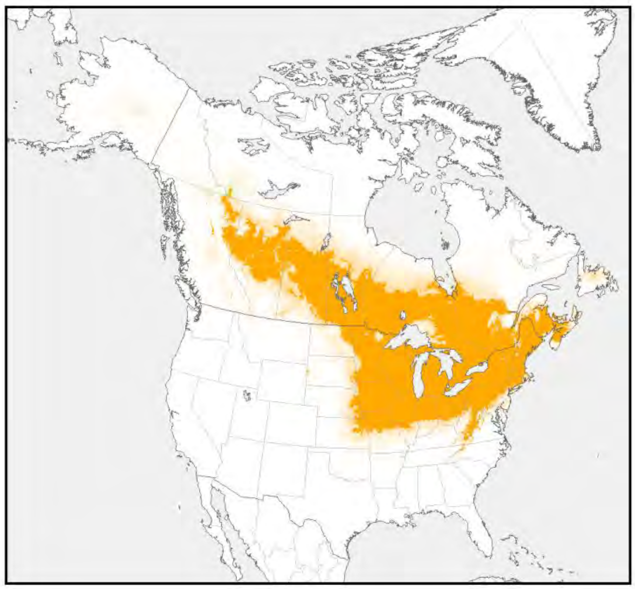
Summer



Rose-breasted Grosbeak (*Pheucticus ludovicianus*)

Modeled Current Range (2000-2009)

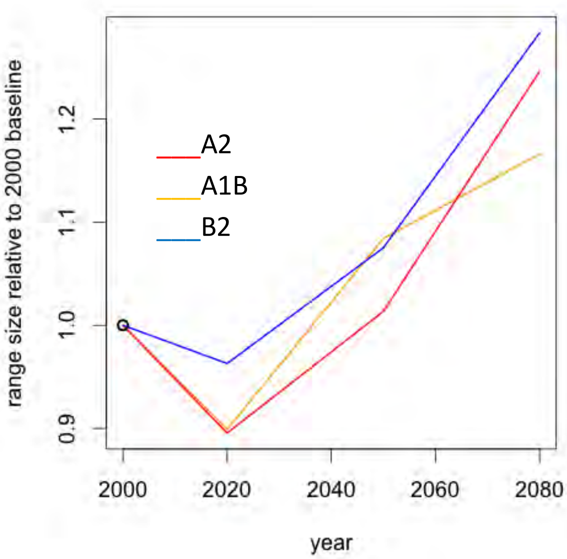
Summer



Current summer range was modeled for Rose-breasted Grosbeak (*Pheucticus ludovicianus*) using data from 2000-2009. Solid orange areas show core range estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

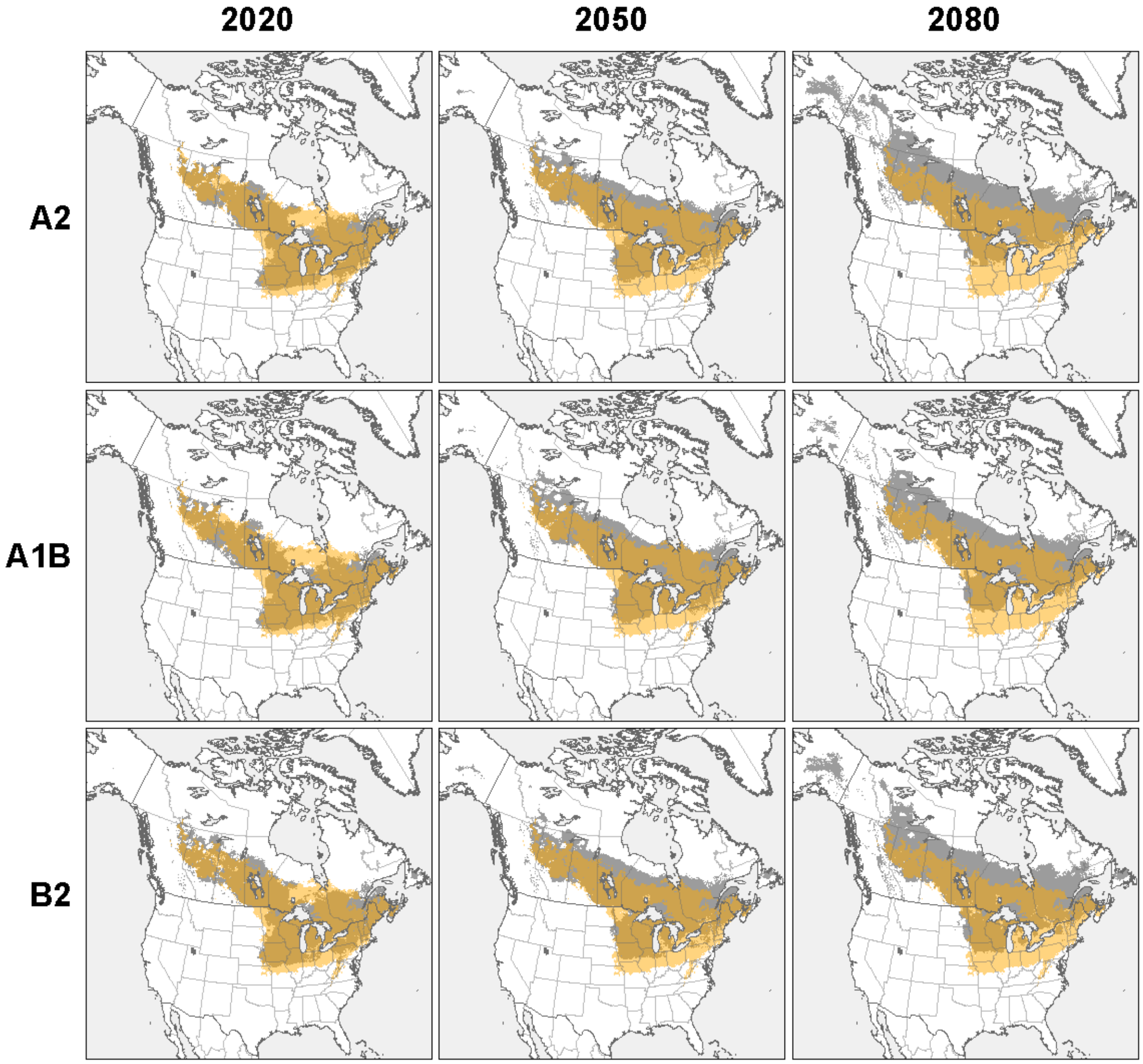
Predicted Range Size by Year and Emissions Scenario for Rose-breasted Grosbeak (*Pheucticus ludovicianus*)

Summer



Rose-breasted Grosbeak (*Pheucticus ludovicianus*)

Modeled Future Summer Range by Year and Emissions Scenario

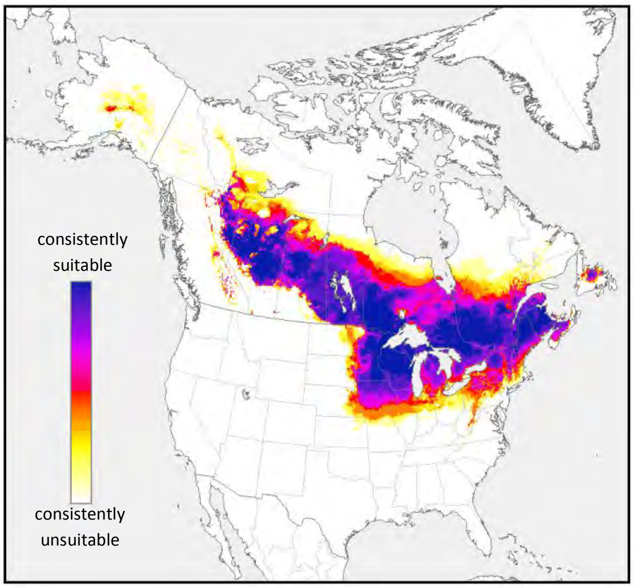


Orange areas indicate the modeled current range (2000-2009) for Rose-breasted Grosbeak (*Pheucticus ludovicianus*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Rose-breasted Grosbeak (*Pheucticus ludovicianus*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

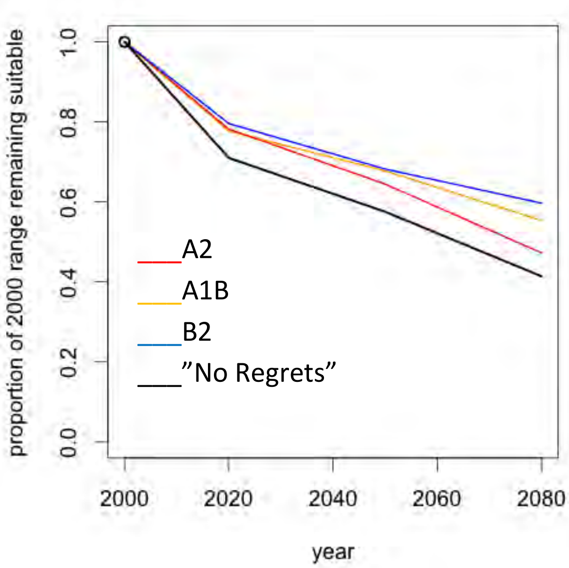
Summer



Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Rose-breasted Grosbeak (*Pheucticus ludovicianus*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Rose-breasted Grosbeak (*Pheucticus ludovicianus*)

Summer

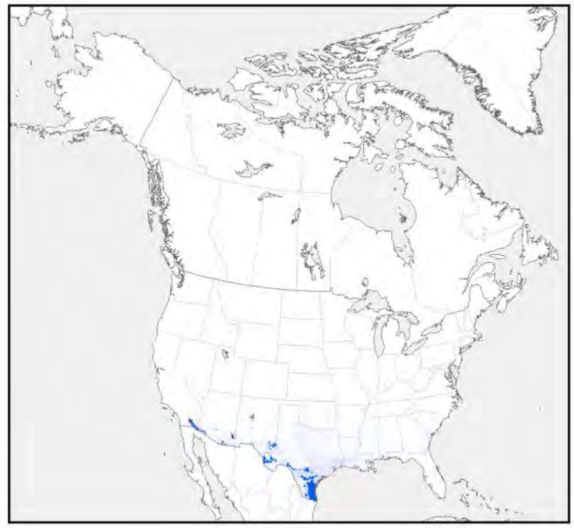


Sprague’s Pipit (*Anthus spragueii*)

Modeled Current Range (2000-2009)

Summer

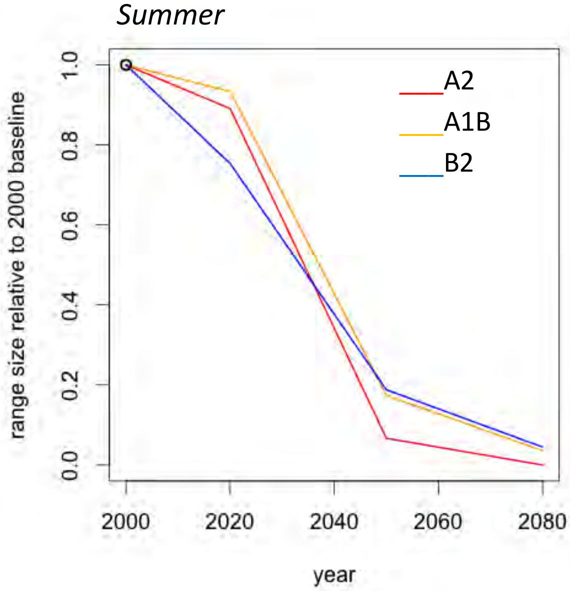
Winter



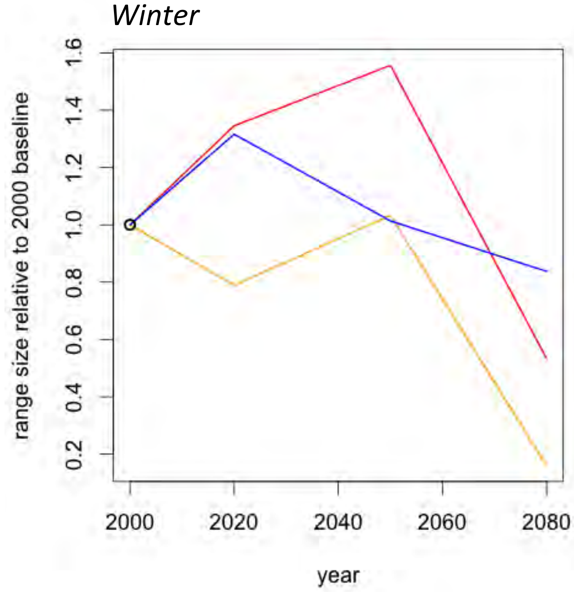
Current summer and winter ranges were modeled for Sprague’s Pipit (*Anthus spragueii*) using data from 2000-2009. Solid orange and blue areas show core ranges estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

Predicted Range Size by Year and Emissions Scenario for Sprague’s Pipit (*Anthus spragueii*)

Summer

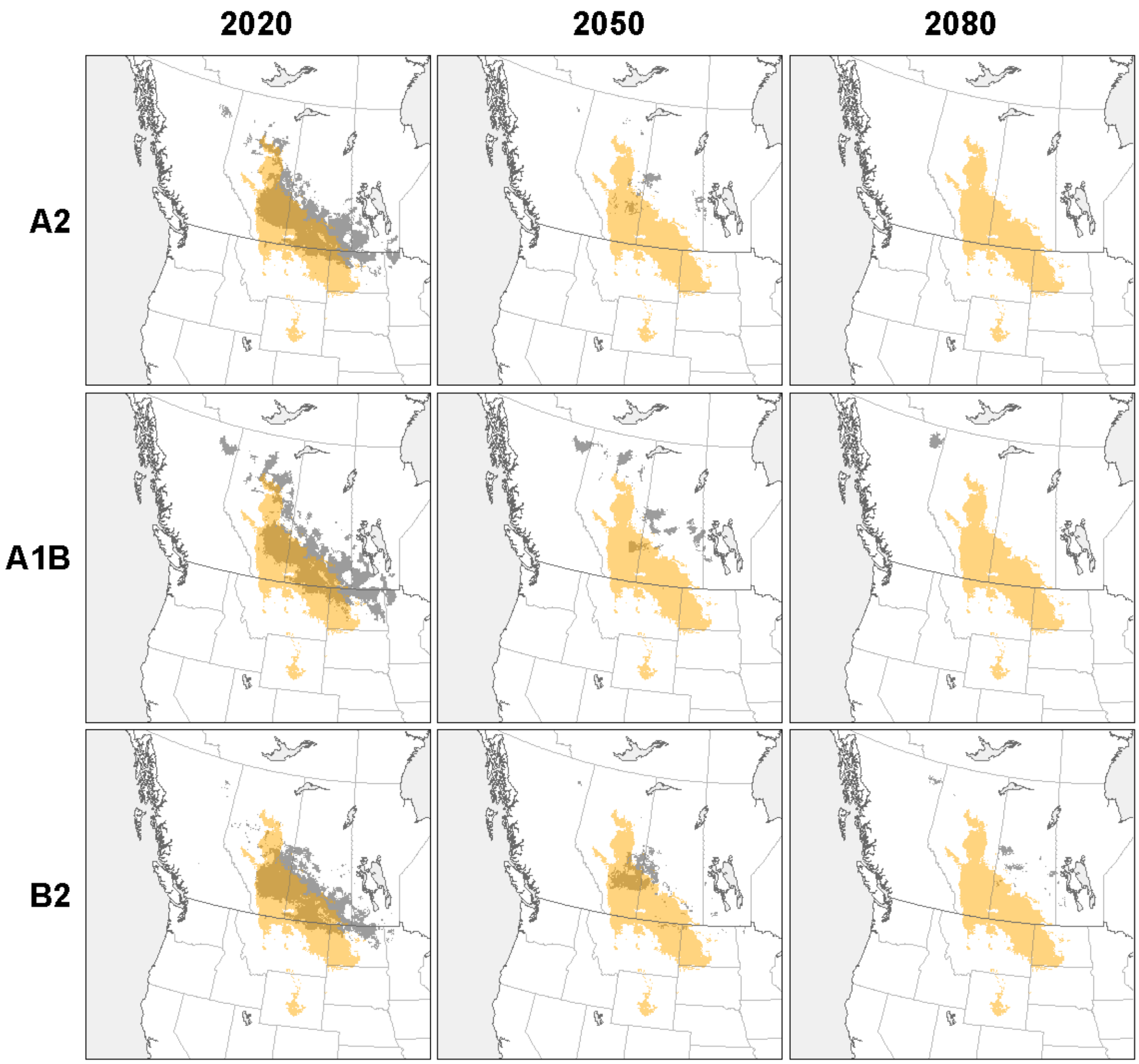


Winter



Sprague's Pipit (*Anthus spragueii*)

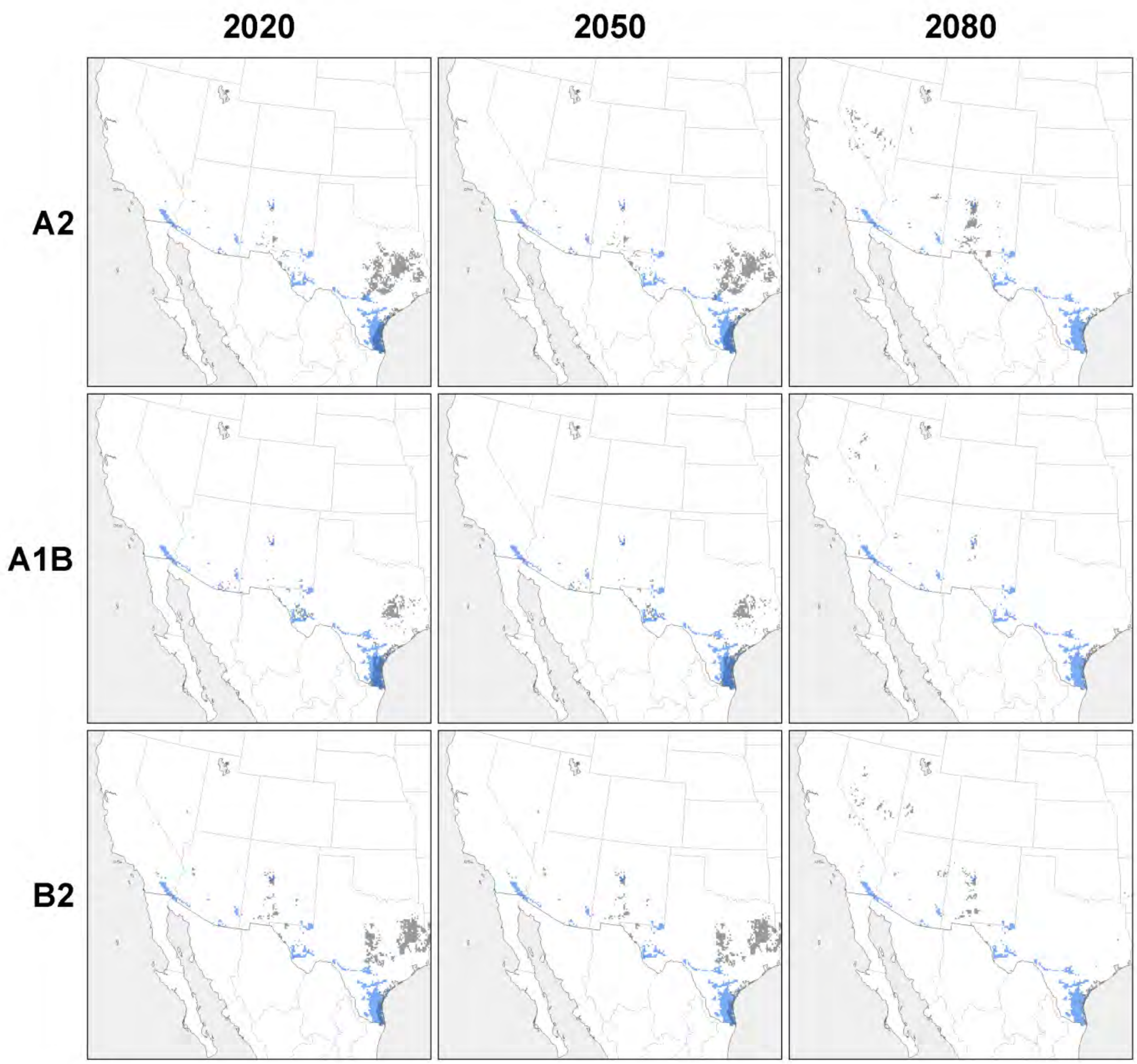
Modeled Future Summer Range by Year and Emissions Scenario



Orange areas indicate the modeled current range (2000-2009) for Sprague's Pipit (*Anthus spragueii*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Sprague's Pipit (*Anthus spragueii*)

Predicted Future Winter Range by Year and Emissions Scenario

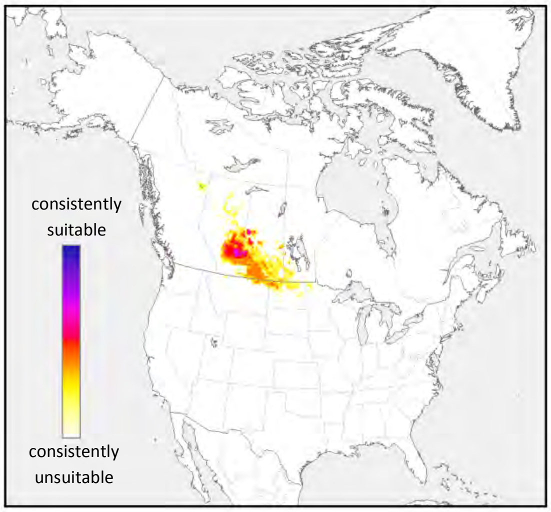


Blue areas indicate the modeled current range (2000-2009) for Sprague's Pipit (*Anthus spragueii*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Sprague’s Pipit (*Anthus spragueii*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

Summer

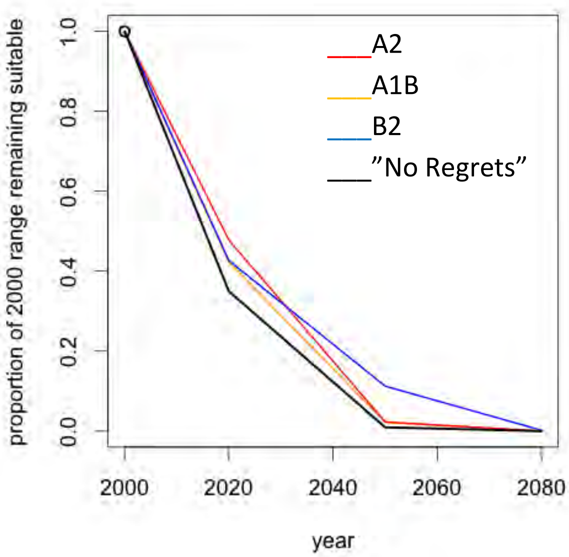


Winter

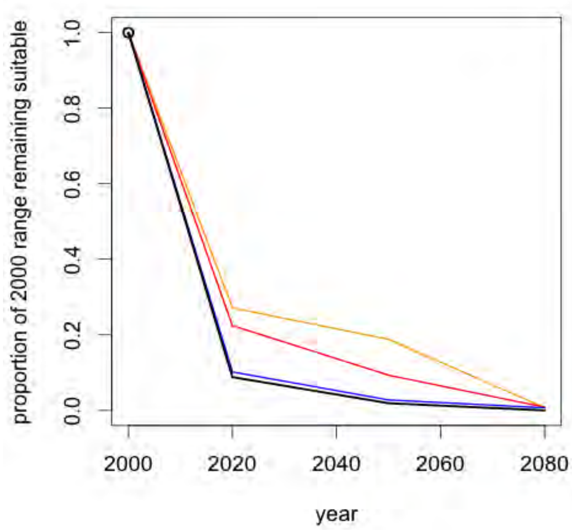
Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Sprague’s Pipit (*Anthus spragueii*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Sprague’s Pipit (*Anthus spragueii*)

Summer



Winter



Swainson's Hawk (*Buteo swainsoni*)

Modeled Current Range (2000-2009)

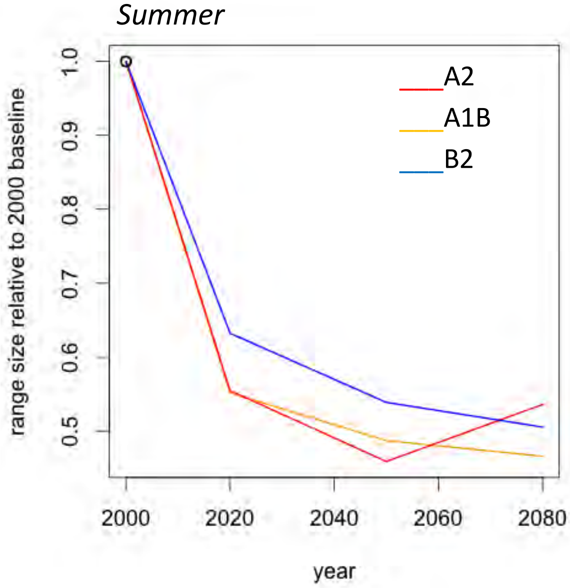
Summer

Winter

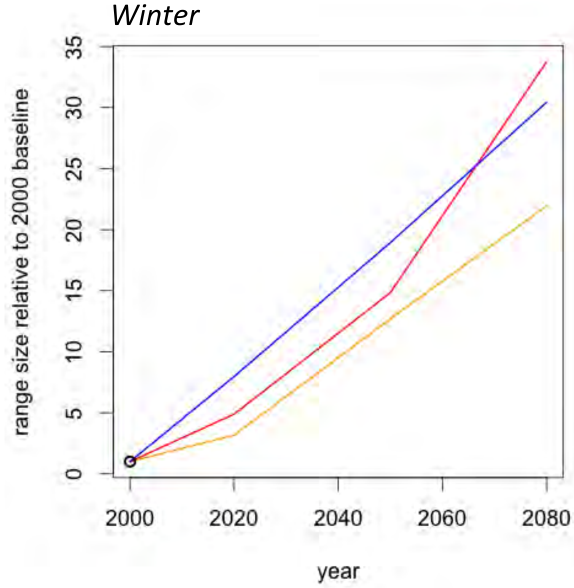
Current summer and winter ranges were modeled for Swainson's Hawk (*Buteo swainsoni*) using data from 2000-2009. Solid orange and blue areas show core ranges estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

Predicted Range Size by Year and Emissions Scenario for Swainson's Hawk (*Buteo swainsoni*)

Summer

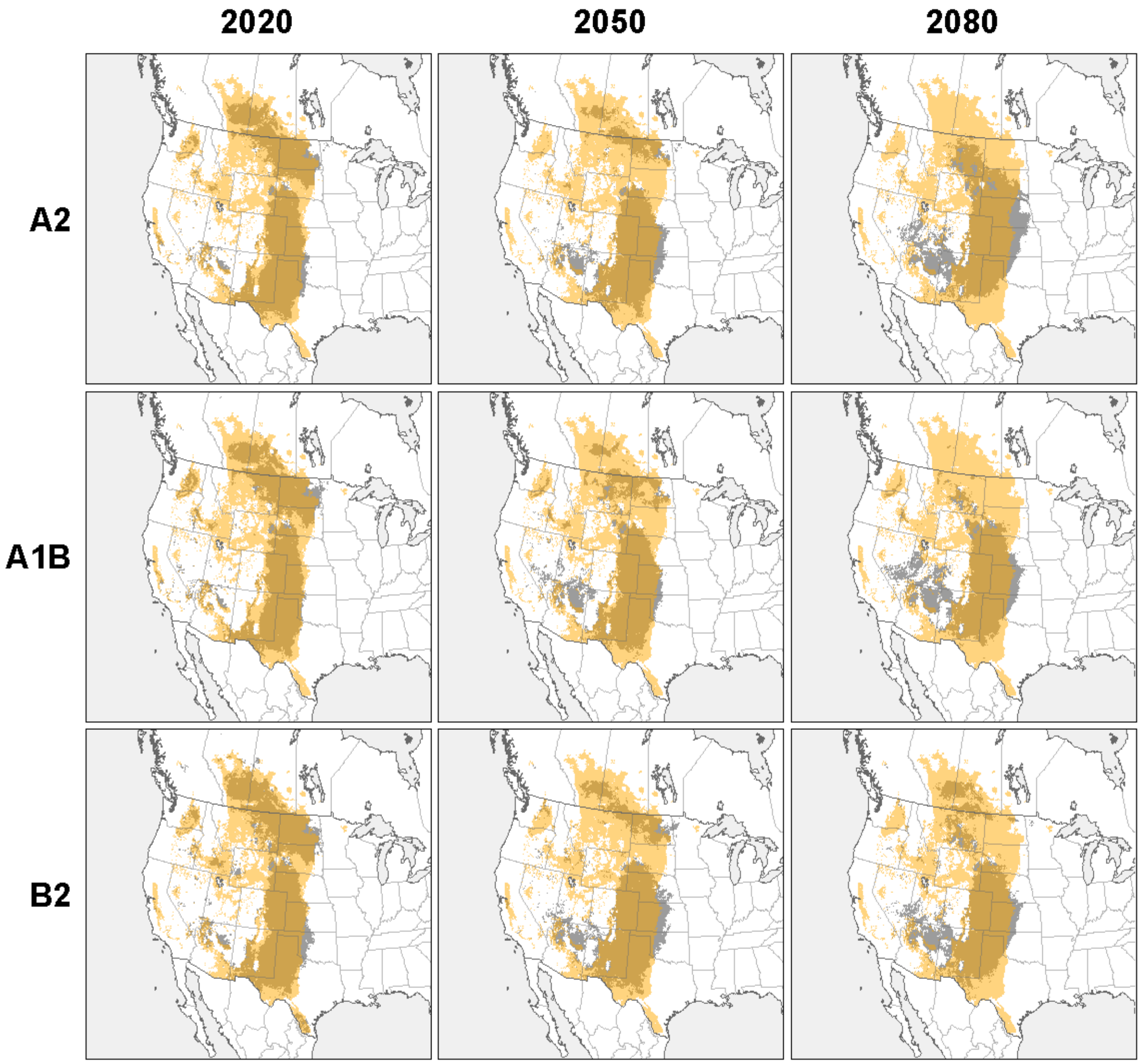


Winter



Swainson's Hawk (*Buteo swainsoni*)

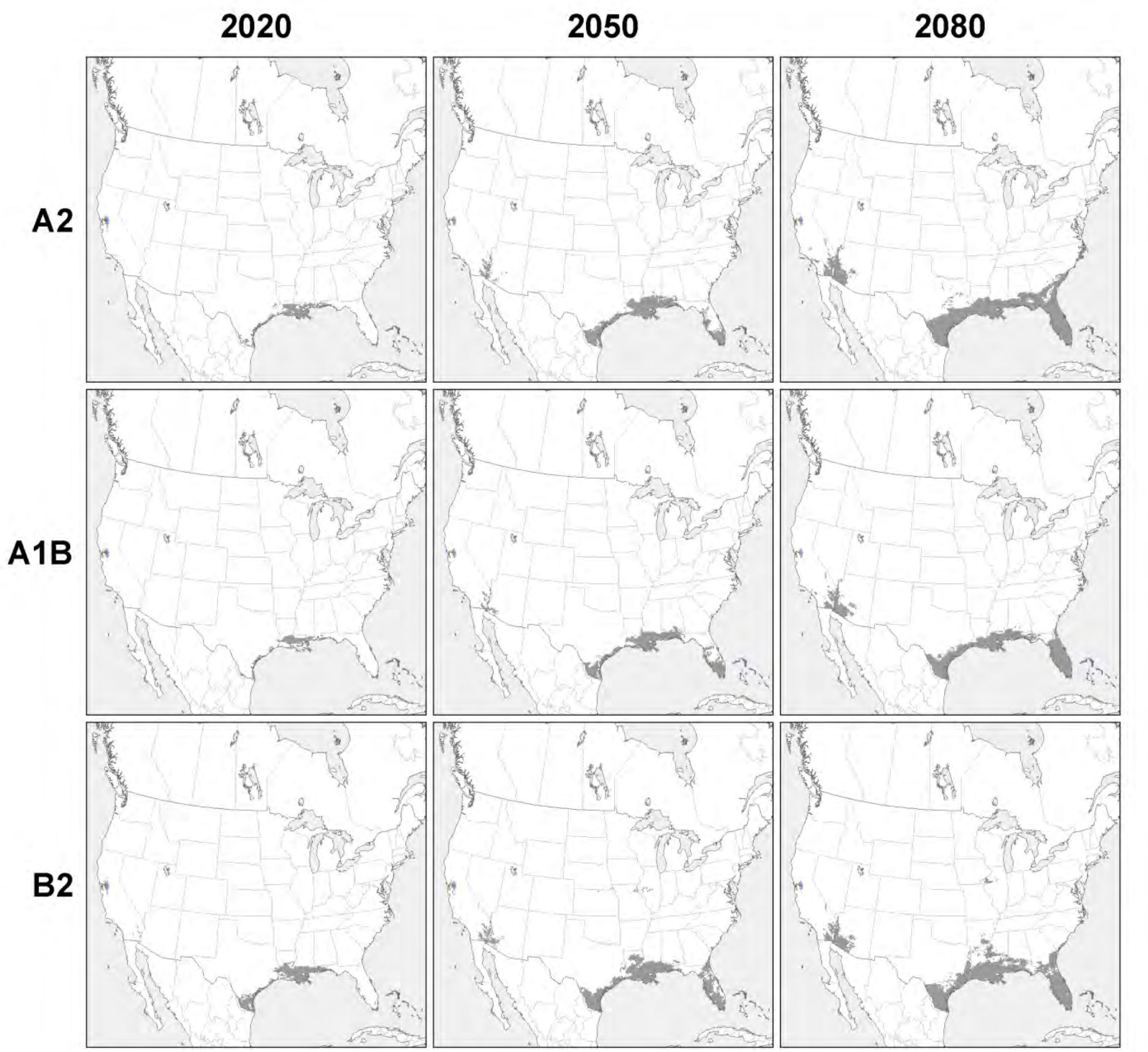
Modeled Future Summer Range by Year and Emissions Scenario



Orange areas indicate the modeled current range (2000-2009) for Swainson's Hawk (*Buteo swainsoni*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Swainson's Hawk (*Buteo swainsoni*)

Predicted Future Winter Range by Year and Emissions Scenario

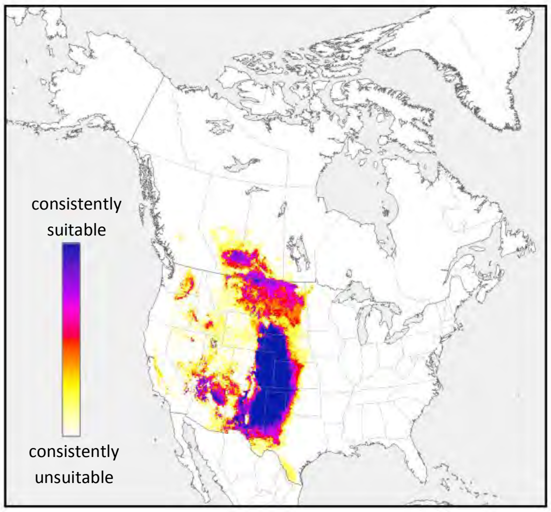


Blue areas indicate the modeled current range (2000-2009) for Swainson's Hawk (*Buteo swainsoni*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

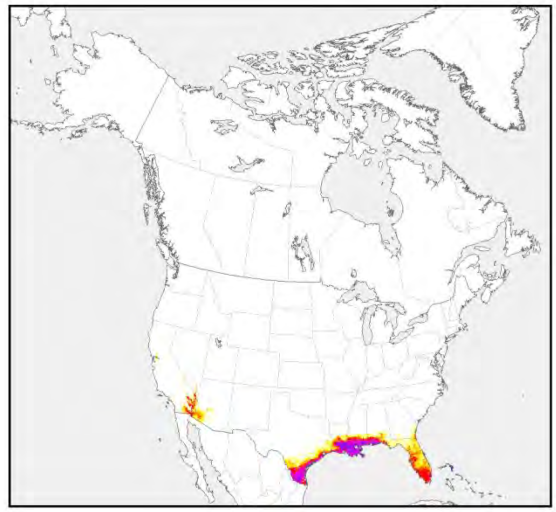
Swainson's Hawk (*Buteo swainsoni*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

Summer



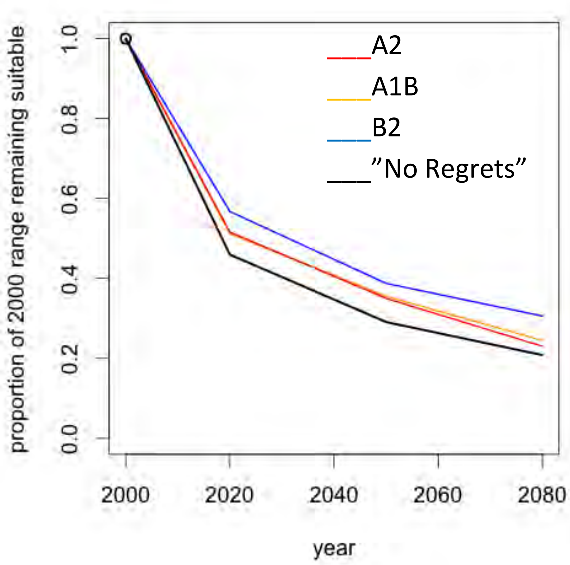
Winter



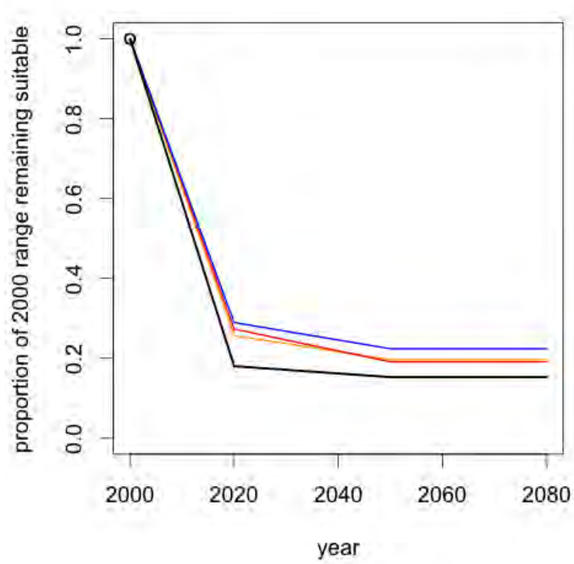
Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Swainson's Hawk (*Buteo swainsoni*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Swainson's Hawk (*Buteo swainsoni*)

Summer



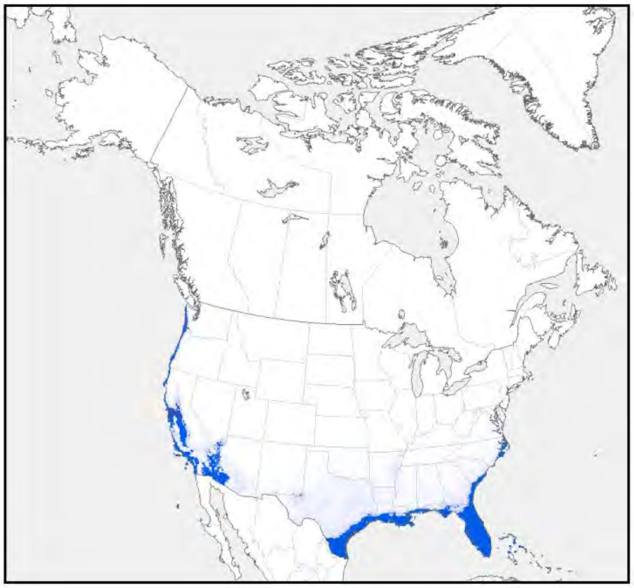
Winter



Western Sandpiper (*Calidris mauri*)

Modeled Current Range (2000-2009)

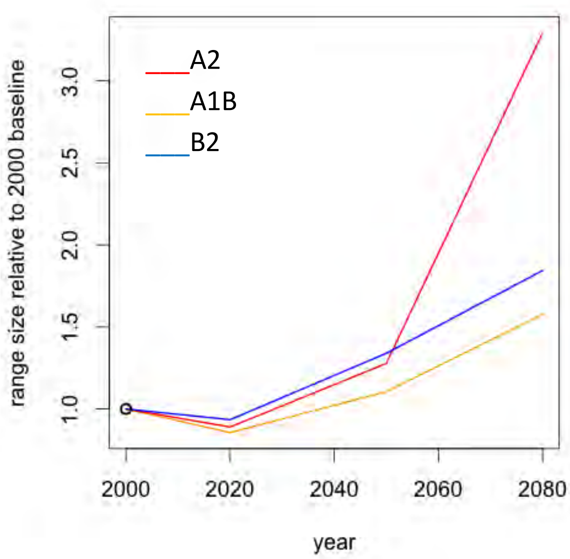
Winter



Current winter range was modeled for Western Sandpiper (*Calidris mauri*) using data from 2000-2009. Solid blue areas show core range estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

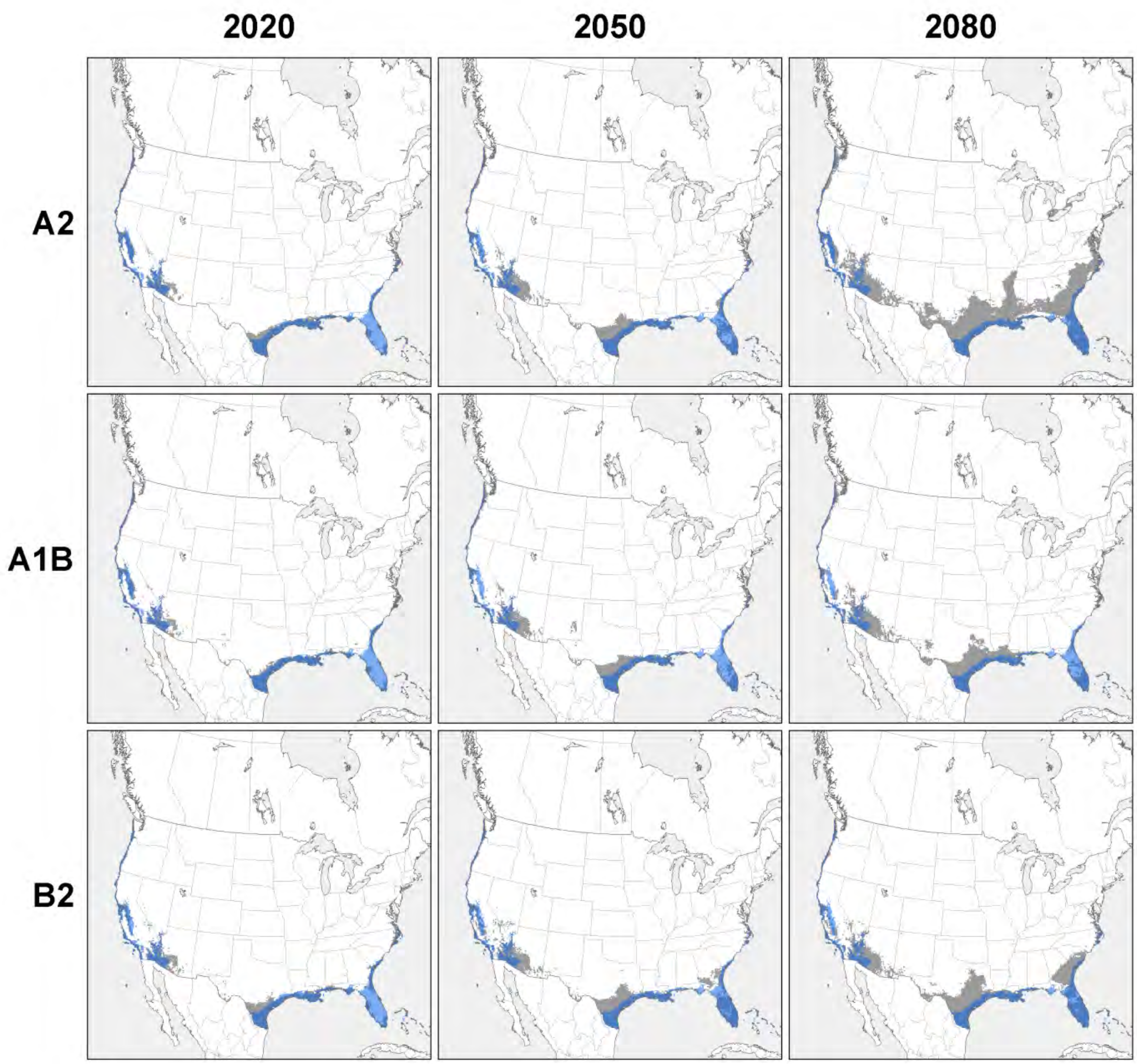
Predicted Range Size by Year and Emissions Scenario for Western Sandpiper (*Calidris mauri*)

Winter



Western Sandpiper (*Calidris mauri*)

Predicted Future Winter Range by Year and Emissions Scenario

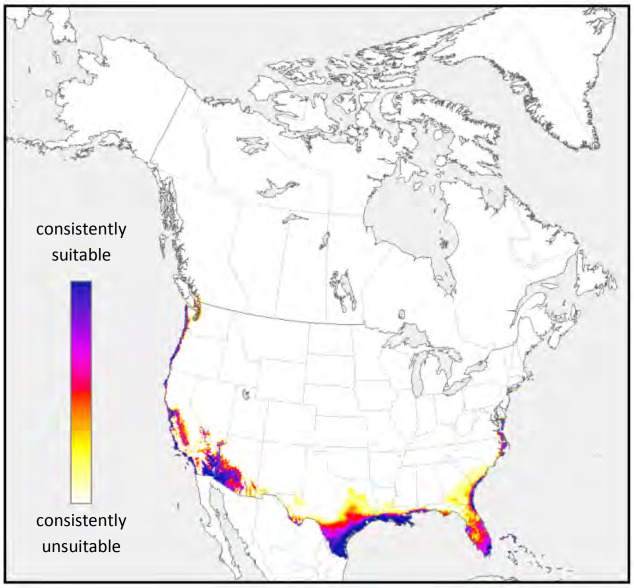


Blue areas indicate the modeled current range (2000-2009) for Western Sandpiper (*Calidris mauri*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Western Sandpiper (*Calidris mauri*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

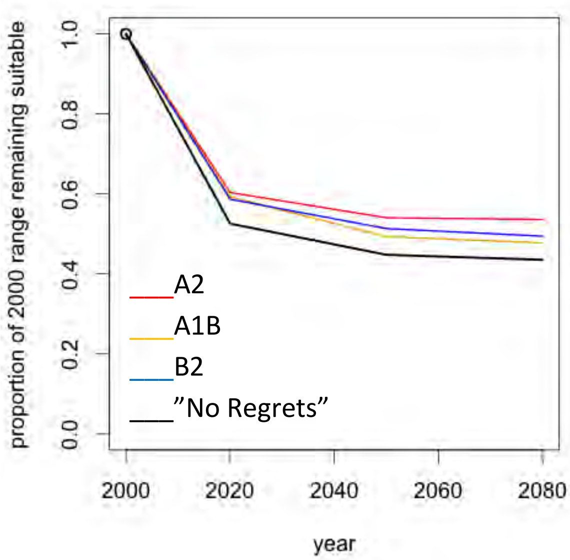
Winter



Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Western Sandpiper (*Calidris mauri*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Western Sandpiper (*Calidris mauri*)

Winter



Wood Thrush (*Hylocichla mustelina*)

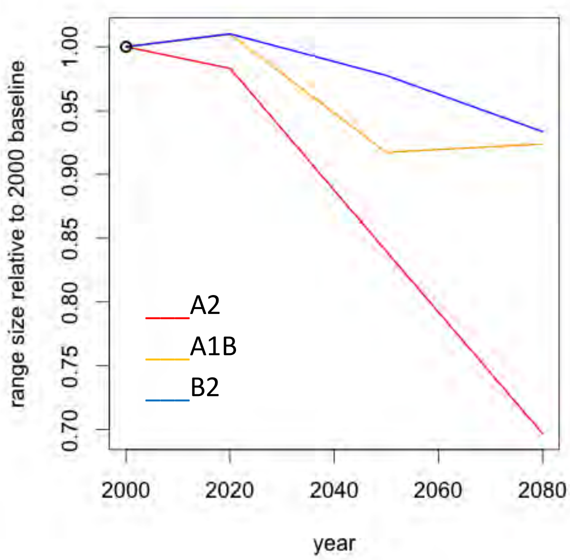
Modeled Current Range (2000-2009)

Summer

Current summer range was modeled for Wood Thrush (*Hylocichla mustelina*) using data from 2000-2009. Solid orange areas show core range estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

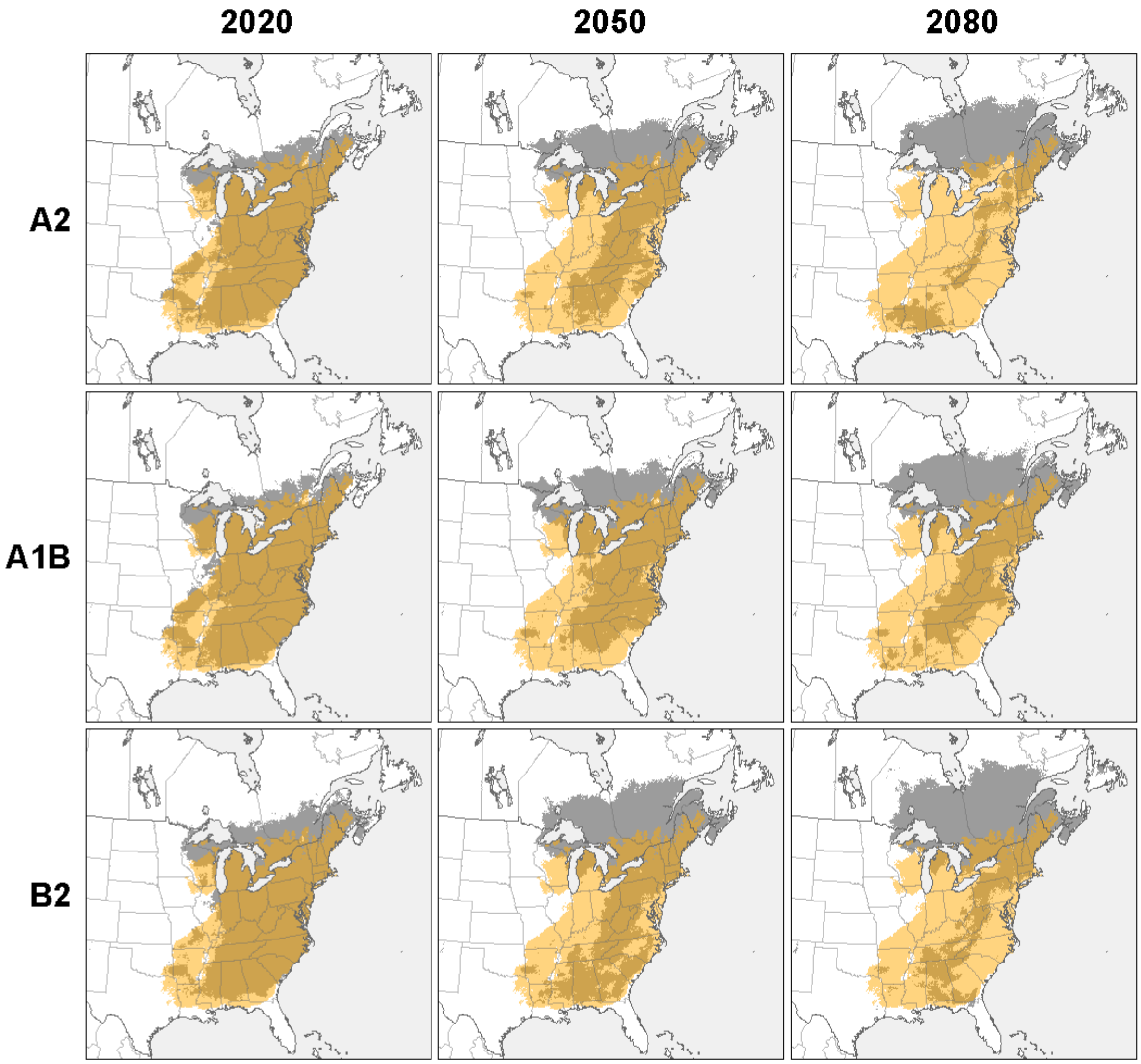
Predicted Range Size by Year and Emissions Scenario for Wood Thrush (*Hylocichla mustelina*)

Summer



Wood Thrush (*Hylocichla mustelina*)

Modeled Future Summer Range by Year and Emissions Scenario

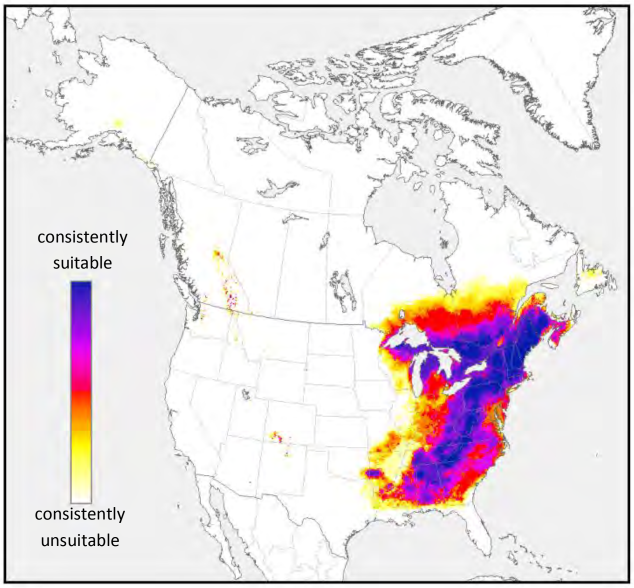


Orange areas indicate the modeled current range (2000-2009) for Wood Thrush (*Hylocichla mustelina*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Wood Thrush (*Hylocichla mustelina*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

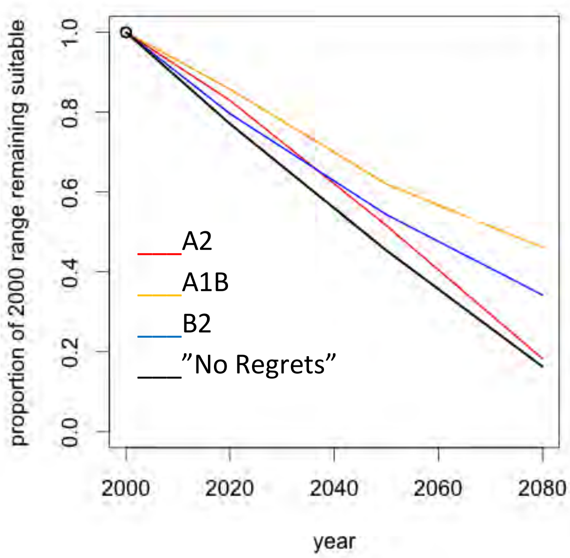
Summer



Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Wood Thrush (*Hylocichla mustelina*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Wood Thrush (*Hylocichla mustelina*)

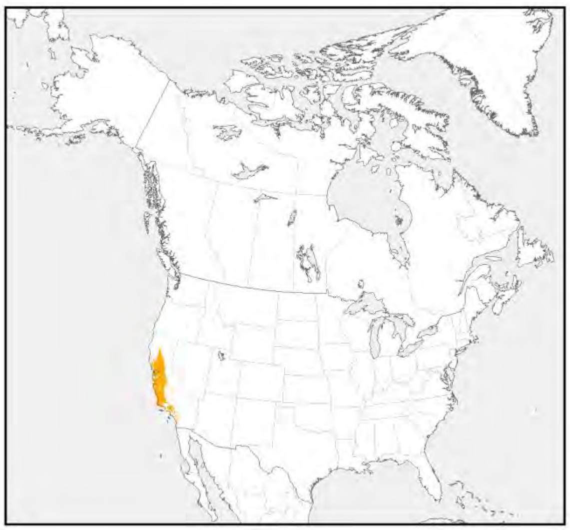
Summer



Yellow-billed Magpie (*Pica nuttalli*)

Modeled Current Range (2000-2009)

Summer

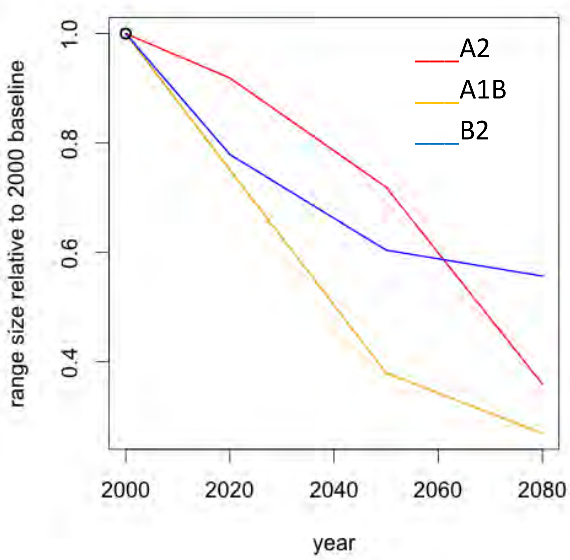


Winter

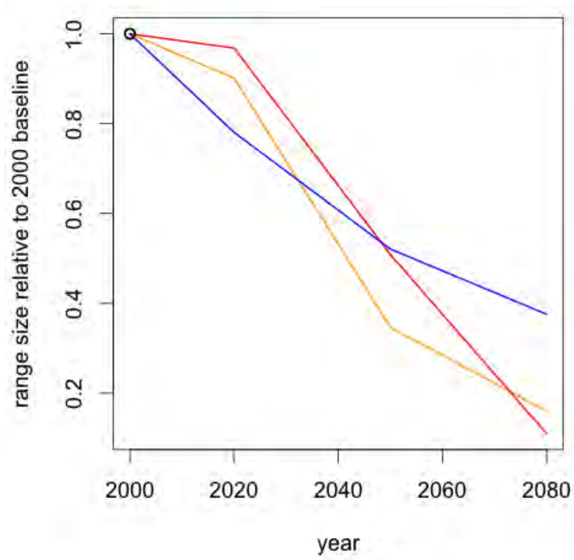
Current summer and winter ranges were modeled for Yellow-billed Magpie (*Pica nuttalli*) using data from 2000-2009. Solid orange and blue areas show core ranges estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

Predicted Range Size by Year and Emissions Scenario for Yellow-billed Magpie (*Pica nuttalli*)

Summer

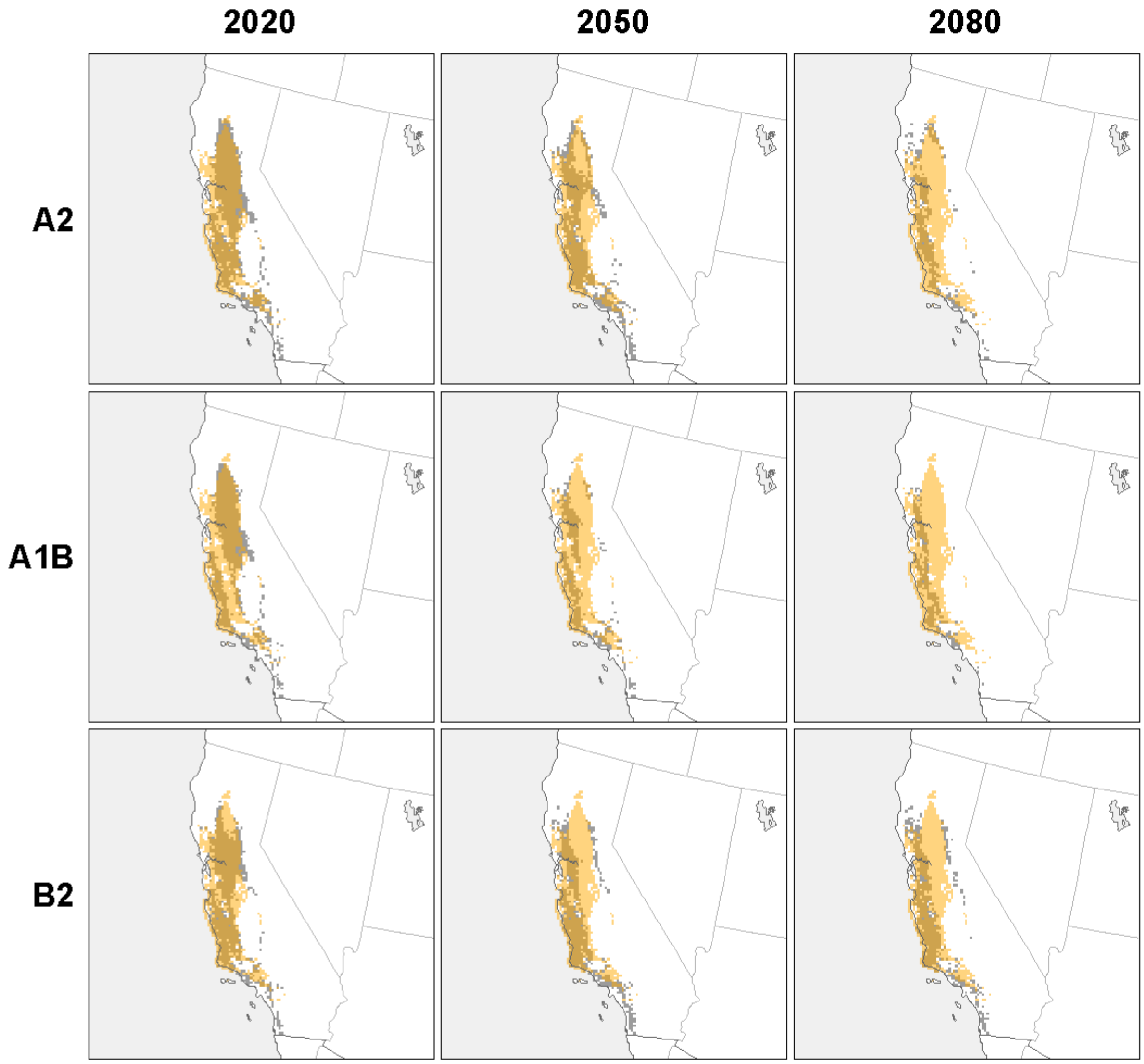


Winter



Yellow-billed Magpie (*Pica nuttalli*)

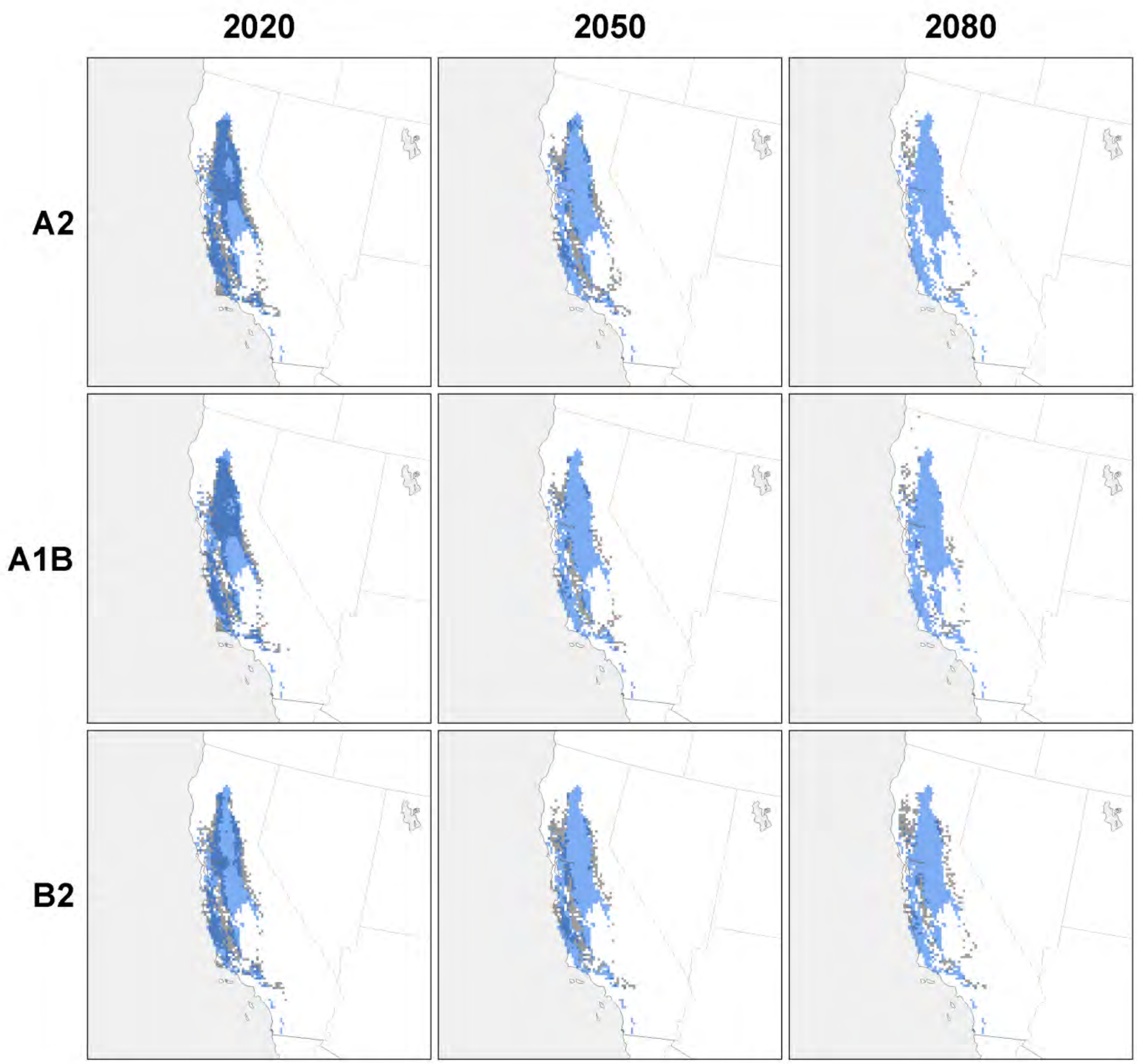
Modeled Future Summer Range by Year and Emissions Scenario



Orange areas indicate the modeled current range (2000-2009) for Yellow-billed Magpie (*Pica nuttalli*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Yellow-billed Magpie (*Pica nuttalli*)

Predicted Future Winter Range by Year and Emissions Scenario

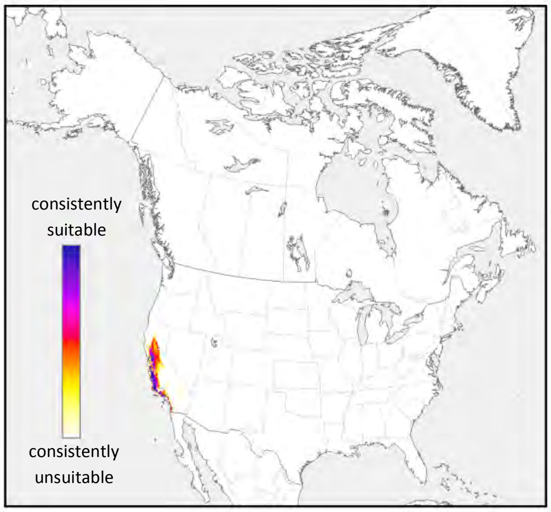


Blue areas indicate the modeled current range (2000-2009) for Yellow-billed Magpie (*Pica nuttalli*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Yellow-billed Magpie (*Pica nuttalli*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

Summer

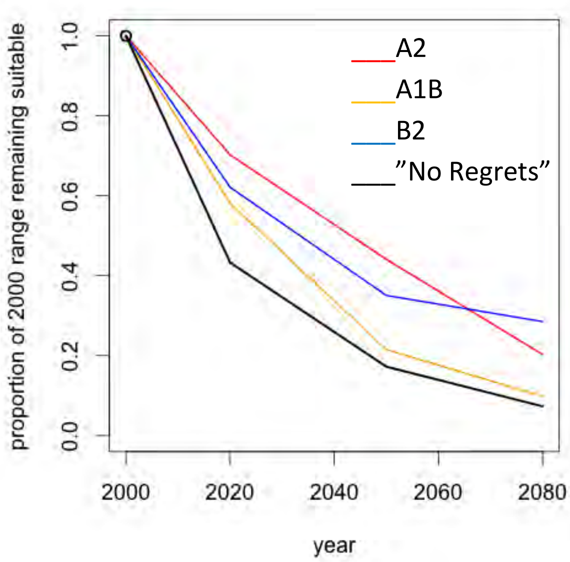


Winter

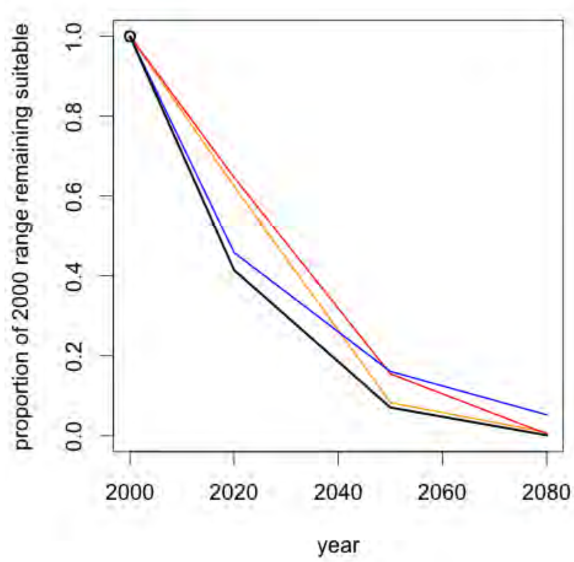
Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Yellow-billed Magpie (*Pica nuttalli*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Yellow-billed Magpie (*Pica nuttalli*)

Summer



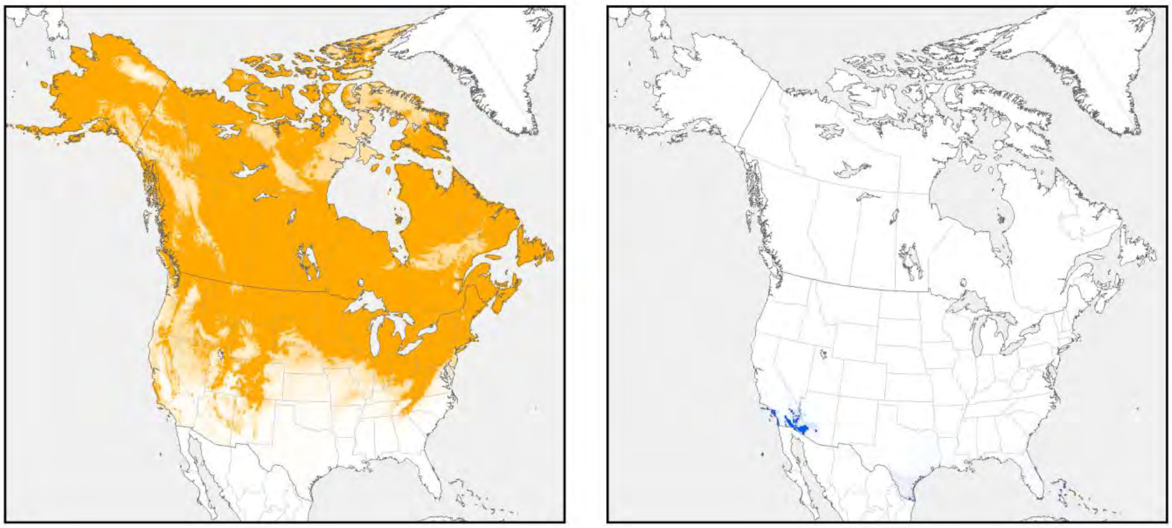
Winter



Yellow Warbler (*Dendroica petechia*)

Modeled Current Range (2000-2009)

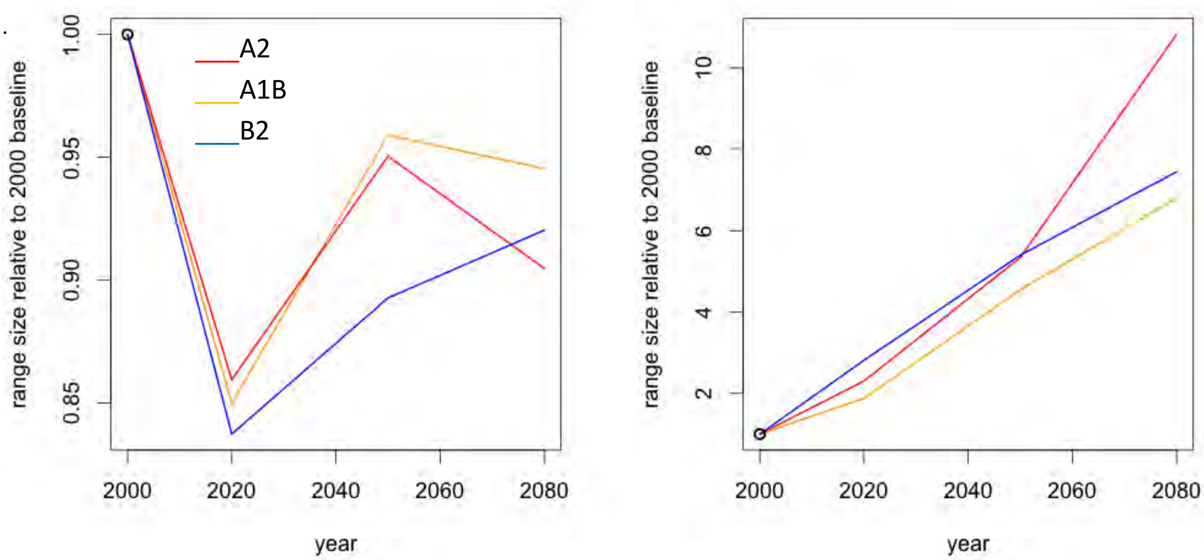
Summer *Winter*



Current summer and winter ranges were modeled for Yellow Warbler (*Dendroica petechia*) using data from 2000-2009. Solid orange and blue areas show core ranges estimated by using a maximum kappa threshold. Graded tones indicate areas that are marginally climatically suitable.

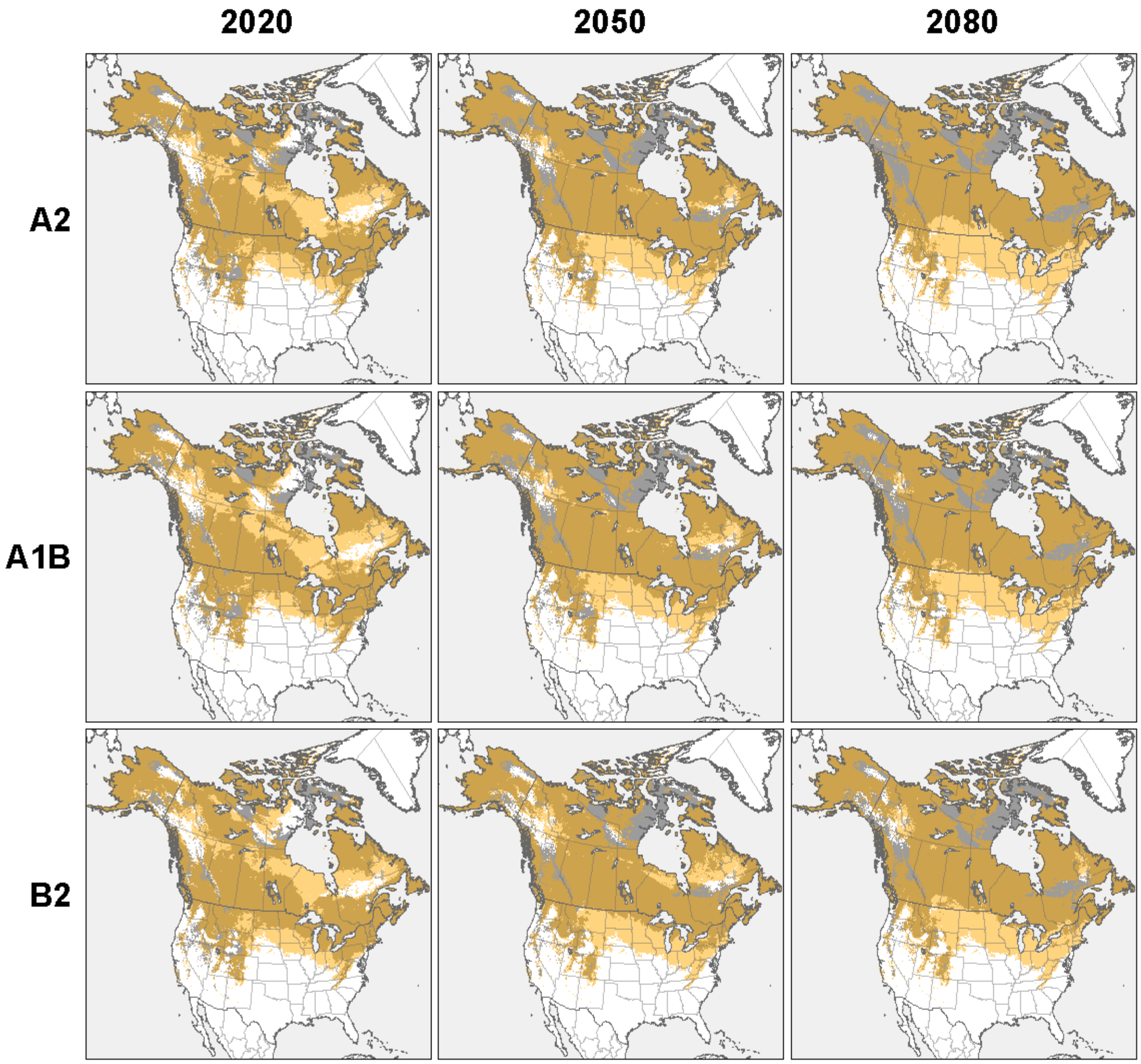
Predicted Range Size by Year and Emissions Scenario for Yellow Warbler (*Dendroica petechia*)

Summer *Winter*



Yellow Warbler (*Dendroica petechia*)

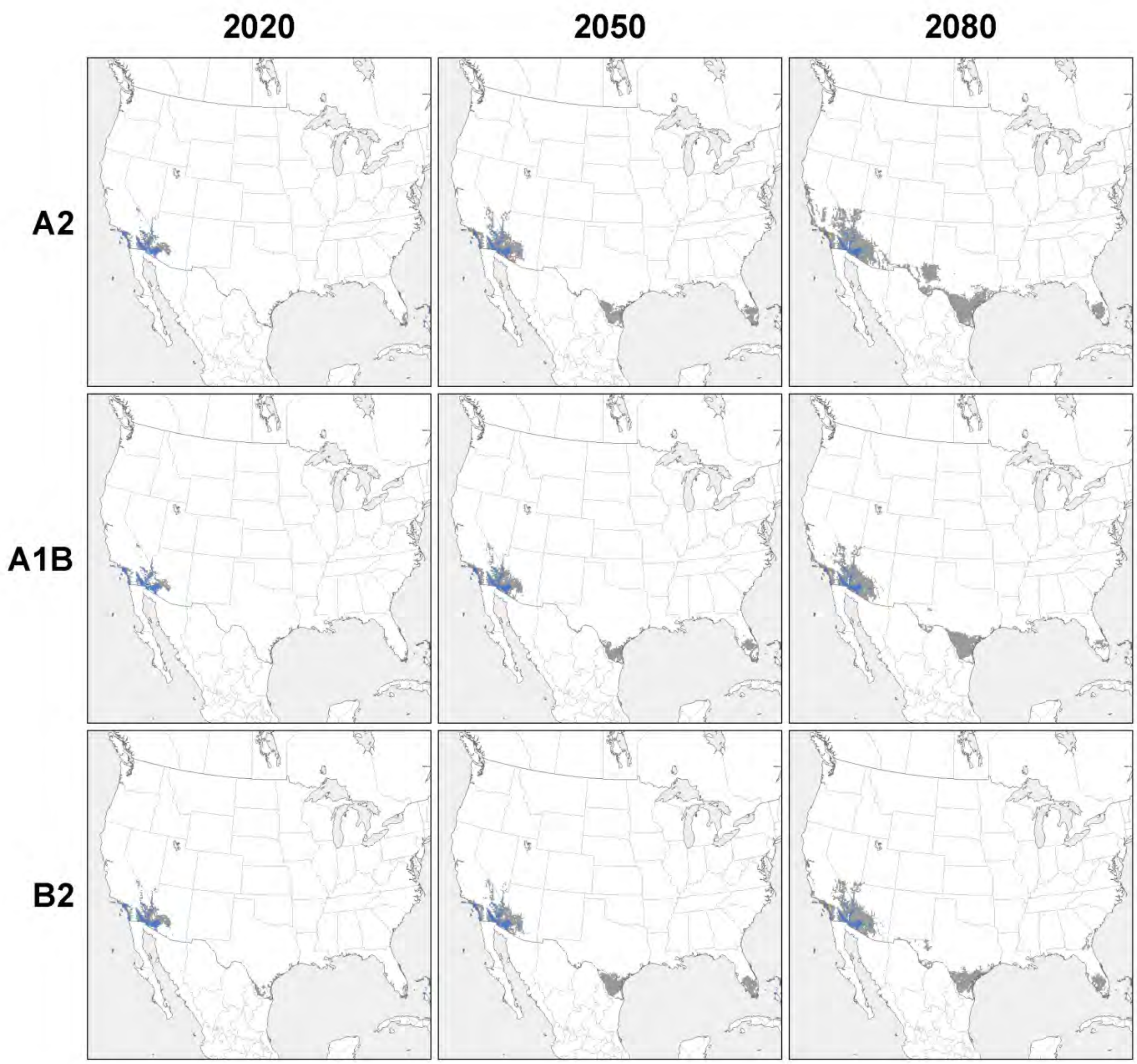
Modeled Future Summer Range by Year and Emissions Scenario



Orange areas indicate the modeled current range (2000-2009) for Yellow Warbler (*Dendroica petechia*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

Yellow Warbler (*Dendroica petechia*)

Modeled Future Summer Range by Year and Emissions Scenario

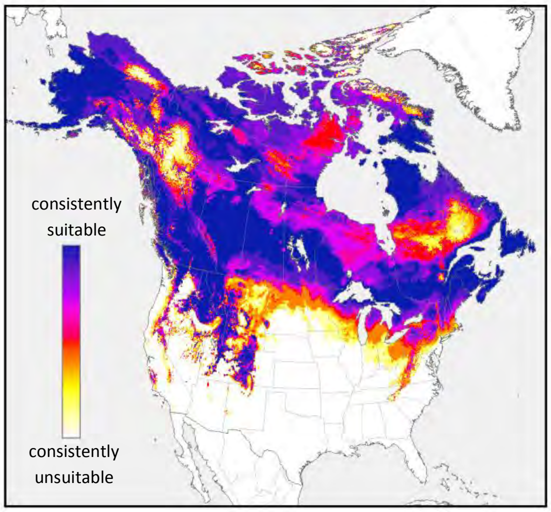


Blue areas indicate the modeled current range (2000-2009) for Yellow Warbler (*Dendroica petechia*). Overlying gray areas indicate predicted future ranges for each combination of year and emissions scenario (B2=low emissions; A1B=moderate emissions; A2=high emissions).

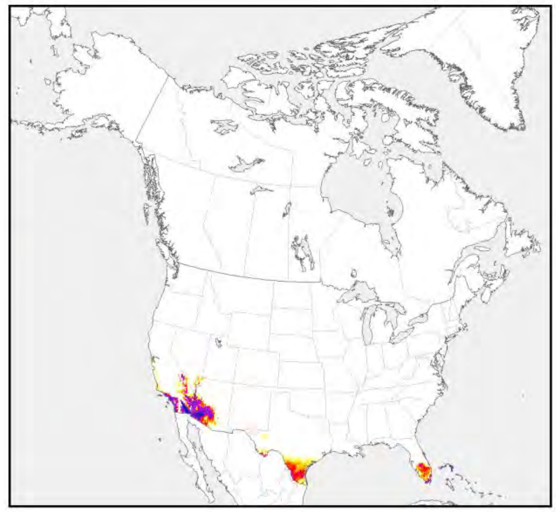
Yellow Warbler (*Dendroica petechia*)

Consensus of Predictions across Years (2000-2080) and Emissions Scenarios

Summer



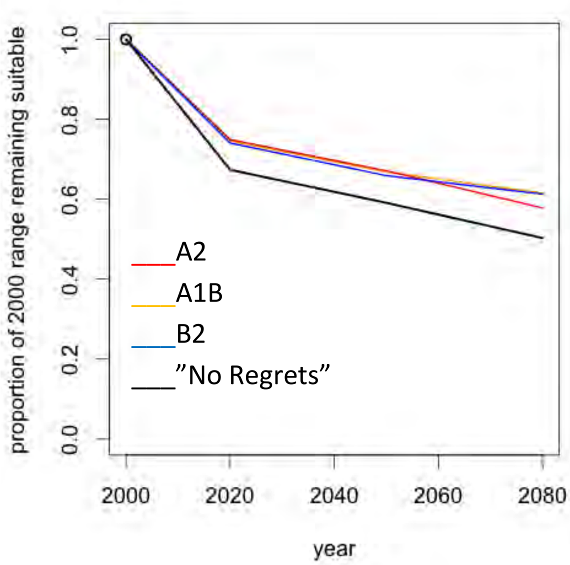
Winter



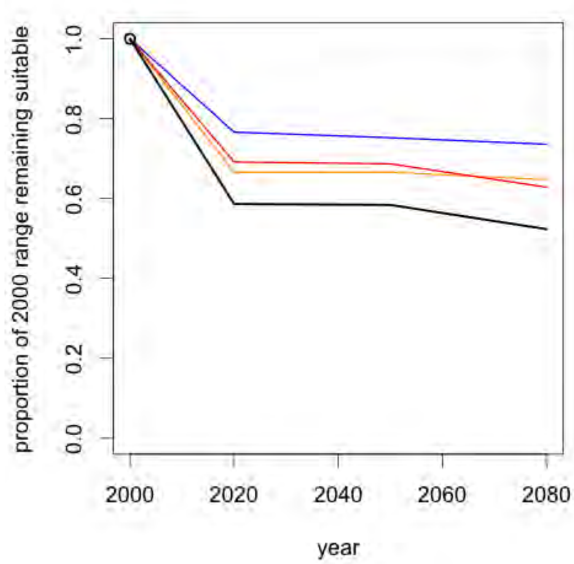
Colors indicate the degree to which models agree on the climatic suitability of areas across years and emissions scenarios for Yellow Warbler (*Dendroica petechia*). Dark purple areas indicate strong consensus that an area is suitable. White areas indicate strong consensus that an area is unsuitable. Red areas indicate relative lack of consensus across times or emissions scenarios.

Predicted Refugia Size by Year and Emissions Scenario for Yellow Warbler (*Dendroica petechia*)

Summer



Winter



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Appendix 1: Species Data and Model Performance

Table A.1. Summary of raw species data and model performance for winter and summer distribution models. Species are listed alphabetically.

		Winter Distribution Models				Summer Distribution Models			
		1970-1979		2000-2009		1970-1979		2000-2009	
Common Name	**Scientific Name**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**
Abert's Towhee	*Melozone aberti*	1.05	0.991	1.50	0.997	0.16	0.954	0.36	0.995
Acadian Flycatcher	*Empidonax virescens*	-	-	-	-	13.13	0.904	13.81	0.909
Acorn Woodpecker	*Melanerpes formicivorus*	6.17	0.991	6.40	0.991	3.32	0.988	2.17	0.988
Alder Flycatcher	*Empidonax alnorum*	-	-	-	-	11.30	0.945	18.00	0.949
Aleutian Tern	*Onychoprion aleuticus*	-	-	-	-	-	-	-	-
Allen's Hummingbird	*Selasphorus sasin*	0.34	0.955	1.06	0.982	0.57	0.993	0.32	0.971
Altamira Oriole	*Icterus gularis*	0.54	0.998	0.54	0.991	-	-	-	-
American Avocet	*Recurvirostra americana*	4.29	0.967	4.53	0.969	1.34	0.888	1.67	0.898
American Bittern	*Botaurus lentiginosus*	11.35	0.915	6.58	0.905	7.20	0.867	5.67	0.868
American Black Duck	*Anas rubripes*	43.79	0.920	37.04	0.925	2.57	0.895	1.10	0.900
American Coot	*Fulica americana*	50.72	0.873	49.99	0.877	-	-	-	-
American Crow	*Corvus brachyrhynchos*	82.07	0.944	81.92	0.944	81.55	0.918	73.77	0.929
American Dipper	*Cinclus mexicanus*	7.97	0.952	11.88	0.959	0.40	0.922	0.70	0.934
American Golden-Plover	*Pluvialis dominica*	-	-	-	-	-	-	0.17	0.987
American Goldfinch	*Spinus tristis*	82.85	0.932	83.48	0.940	52.14	0.882	51.19	0.886
American Kestrel	*Falco sparverius*	80.56	0.941	71.96	0.944	22.81	0.704	19.81	0.710
American Oystercatcher	*Haematopus palliatus*	2.54	0.940	3.67	0.970	-	-	0.12	0.826
American Pipit	*Anthus rubescens*	24.43	0.918	28.95	0.917	-	-	0.18	0.976
American Redstart	*Setophaga ruticilla*	1.45	0.953	1.73	0.957	21.87	0.904	21.20	0.909
American Robin	*Turdus migratorius*	80.16	0.882	81.31	0.888	80.69	0.950	80.65	0.958
American Three-toed Woodpecker	*Picoides dorsalis*	1.87	0.944	1.17	0.931	-	-	0.67	0.952
American Tree Sparrow	*Spizella arborea*	59.97	0.952	50.51	0.950	0.06	0.982	0.93	0.998
American White Pelican	*Pelecanus erythrorhynchos*	5.05	0.915	13.14	0.925	0.50	0.863	2.19	0.893
American Wigeon	*Anas americana*	40.42	0.859	42.02	0.862	2.34	0.919	3.11	0.923
American Woodcock	*Scolopax minor*	13.25	0.927	10.45	0.922	1.75	0.785	0.81	0.792
Ancient Murrelet	*Synthliboramphus antiquus*	0.80	0.977	1.36	0.983	-	-	-	-
Anhinga	*Anhinga anhinga*	5.17	0.989	7.09	0.990	0.42	0.968	0.74	0.970

Table A.1. continued.

		Winter Distribution Models				Summer Distribution Models			
		1970-1979		2000-2009		1970-1979		2000-2009	
Common Name	**Scientific Name**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**
Anna's Hummingbird	*Calypte anna*	6.76	0.985	9.61	0.987	1.83	0.982	1.61	0.983
Aplomado Falcon	*Falco femoralis*	0.06	-	0.25	0.979	-	-	-	-
Arctic Loon	*Gavia arctica*	-	-	-	-	-	-	-	-
Arctic Tern	*Sterna paradisaea*	-	-	-	-	-	-	0.56	0.990
Arctic Warbler	*Phylloscopus borealis*	-	-	-	-	-	-	0.40	0.998
Arizona/Strickland's Woodpecker	*Picoides arizonae/stricklandi*	0.46	0.992	0.36	0.990	-	-	0.03	0.960
Ash-throated Flycatcher	*Myiarchus cinerascens*	0.89	0.932	2.13	0.954	6.69	0.971	9.05	0.975
Ashy Storm-Petrel	*Oceanodroma homochroa*	-	-	-	-	-	-	-	-
Atlantic Puffin	*Fratercula arctica*	0.21	0.945	0.28	0.955	-	-	-	-
Audubon's Oriole	*Icterus graduacauda*	0.43	0.982	0.42	0.974	-	-	0.11	0.997
Audubon's Shearwater	*Puffinus lherminieri*	-	-	-	-	-	-	-	-
Bachman's Sparrow	*Peucaea aestivalis*	1.22	0.954	0.65	0.962	1.77	0.957	1.03	0.966
Baird's Sandpiper	*Calidris bairdii*	-	-	-	-	-	-	-	-
Baird's Sparrow	*Ammodramus bairdii*	0.28	0.971	0.20	0.945	1.28	0.962	1.21	0.964
Bald Eagle	*Haliaeetus leucocephalus*	27.63	0.744	67.76	0.740	0.43	0.819	3.59	0.873
Baltimore Oriole	*Icterus galbula*	7.12	0.859	4.51	0.865	39.04	0.896	28.57	0.892
Band-tailed Pigeon	*Patagioenas fasciata*	4.54	0.978	4.55	0.977	2.68	0.979	2.51	0.977
Bank Swallow	*Riparia riparia*	-	-	-	-	10.94	0.779	6.46	0.764
Barn Owl	*Tyto alba*	15.73	0.887	14.85	0.890	-	-	0.25	0.865
Barn Swallow	*Hirundo rustica*	0.89	0.893	2.92	0.895	76.07	0.802	65.48	0.810
Barred Owl	*Strix varia*	27.93	0.843	35.98	0.845	4.92	0.801	6.17	0.809
Barrow's Goldeneye	*Bucephala islandica*	5.63	0.901	11.25	0.916	-	-	0.49	0.965
Bar-tailed Godwit	*Limosa lapponica*	-	-	-	-	-	-	-	-
Bay-breasted Warbler	*Setophaga castanea*	-	-	-	-	1.85	0.958	1.50	0.956
Bell's Vireo	*Vireo bellii*	-	-	0.29	0.967	3.42	0.903	3.52	0.926
Belted Kingfisher	*Megaceryle alcyon*	73.60	0.908	71.78	0.910	17.37	0.668	11.64	0.678
Bendire's Thrasher	*Toxostoma bendirei*	0.44	0.986	0.46	0.988	0.33	0.969	0.25	0.943
Bewick's Wren	*Thryomanes bewickii*	19.01	0.971	18.57	0.974	8.97	0.919	8.02	0.930
Bicknell's Thrush	*Catharus bicknelli*	-	-	-	-	-	-	0.02	0.849
Black Guillemot	*Cepphus grylle*	1.94	0.943	2.36	0.954	-	-	0.06	0.991
Black Oystercatcher	*Haematopus bachmani*	1.57	0.989	2.92	0.993	0.09	0.970	0.09	0.971
Black Phoebe	*Sayornis nigricans*	7.43	0.994	10.04	0.995	1.83	0.982	2.04	0.983
Black Rail	*Laterallus jamaicensis*	0.64	0.960	0.70	0.942	-	-	-	-

Table A.1. continued.

		Winter Distribution Models				Summer Distribution Models			
		1970-1979		2000-2009		1970-1979		2000-2009	
Common Name	**Scientific Name**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**
Black Rosy-Finch	*Leucosticte atrata*	0.94	0.975	0.68	0.936	-	-	-	-
Black Scoter	*Melanitta americana*	10.51	0.925	9.87	0.919	-	-	0.05	0.993
Black Skimmer	*Rynchops niger*	4.49	0.981	3.92	0.979	0.32	0.919	0.23	0.913
Black Swift	*Cypseloides niger*	-	-	-	-	0.27	0.927	0.11	0.953
Black Tern	*Chlidonias niger*	-	-	-	-	3.70	0.909	2.72	0.920
Black Turnstone	*Arenaria melanocephala*	3.31	0.993	4.06	0.992	-	-	-	-
Black Vulture	*Coragyps atratus*	15.95	0.956	23.87	0.958	1.83	0.910	5.08	0.920
Black-and-white Warbler	*Mniotilta varia*	6.09	0.963	6.94	0.963	17.51	0.883	17.25	0.885
Black-backed Woodpecker	*Picoides arcticus*	2.04	0.921	3.07	0.917	0.29	0.900	0.55	0.931
Black-bellied Plover	*Pluvialis squatarola*	12.79	0.969	11.49	0.965	-	-	-	-
Black-bellied Whistling-Duck	*Dendrocygna autumnalis*	0.49	0.957	2.60	0.976	0.37	0.983	1.15	0.992
Black-billed Cuckoo	*Coccyzus erythropthalmus*	-	-	-	-	15.20	0.836	7.22	0.838
Black-billed Magpie	*Pica hudsonia*	11.83	0.985	18.69	0.987	8.73	0.943	14.18	0.948
Black-billed Magpie	*Pica hudsonia*	11.83	0.985	18.69	0.987	8.73	0.943	14.18	0.948
Blackburnian Warbler	*Setophaga fusca*	-	-	-	-	5.61	0.935	7.08	0.940
Black-capped Chickadee	*Poecile atricapillus*	59.12	0.965	58.11	0.970	29.33	0.901	33.65	0.915
Black-capped Vireo	*Vireo atricapilla*	-	-	-	-	-	-	0.13	0.954
Black-chinned Hummingbird	*Archilochus alexandri*	0.51	0.926	1.30	0.947	1.10	0.929	1.95	0.926
Black-chinned Sparrow	*Spizella atrogularis*	0.96	0.984	1.14	0.988	0.86	0.971	0.52	0.967
Black-crested Titmouse	*Baeolophus atricristatus*	-	-	-	-	1.19	0.985	1.13	0.983
Black-crowned Night-Heron	*Nycticorax nycticorax*	15.41	0.923	17.44	0.932	2.44	0.734	2.30	0.745
Black-headed Grosbeak	*Pheucticus melanocephalus*	0.90	0.874	0.74	0.873	7.44	0.950	11.22	0.957
Black-headed Gull	*Chroicocephalus ridibundus*	1.73	0.903	1.41	0.908	-	-	-	-
Black-legged Kittiwake	*Rissa tridactyla*	4.39	0.887	3.09	0.890	-	-	0.10	0.984
Black-necked Stilt	*Himantopus mexicanus*	2.97	0.977	5.63	0.977	0.83	0.935	1.20	0.947
Blackpoll Warbler	*Setophaga striata*	-	-	-	-	1.09	0.970	1.84	0.977
Black-tailed Gnatcatcher	*Polioptila melanura*	1.67	0.983	2.20	0.990	0.43	0.984	1.10	0.993
Black-throated Blue Warbler	*Setophaga caerulescens*	0.68	0.913	0.57	0.925	3.83	0.938	5.73	0.951
Black-throated Gray Warbler	*Setophaga nigrescens*	1.45	0.966	2.15	0.973	2.04	0.957	3.50	0.969
Black-throated Green Warbler	*Setophaga virens*	0.99	0.956	1.66	0.958	8.47	0.926	11.46	0.935
Black-throated Sparrow	*Amphispiza bilineata*	3.10	0.986	3.60	0.986	3.53	0.977	5.14	0.980
Black-vented Shearwater	*Puffinus opisthomelas*	0.00	-	0.75	0.990	-	-	-	-
Black-whiskered Vireo	*Vireo altiloquus*	-	-	-	-	0.06	0.998	0.12	0.988

Table A.1. continued.

		Winter Distribution Models				Summer Distribution Models			
		1970-1979		2000-2009		1970-1979		2000-2009	
Common Name	**Scientific Name**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**
Blue Grosbeak	*Passerina caerulea*	-	-	-	-	19.68	0.927	23.23	0.934
Blue Jay	*Cyanocitta cristata*	76.42	0.983	71.66	0.985	64.18	0.948	55.47	0.949
Blue-gray Gnatcatcher	*Polioptila caerulea*	11.80	0.973	14.38	0.974	17.17	0.876	26.64	0.887
Blue-headed Vireo	*Vireo solitarius*	-	-	-	-	-	-	-	-
Bluethroat	*Luscinia svecica*	-	-	-	-	-	-	-	-
Blue-throated Hummingbird	*Lampornis clemenciae*	-	-	0.22	0.952	-	-	-	-
Blue-winged Teal	*Anas discors*	12.06	0.896	12.21	0.900	6.88	0.892	5.82	0.890
Blue-winged Warbler	*Vermivora cyanoptera*	-	-	-	-	5.14	0.892	4.13	0.884
Boat-tailed Grackle	*Quiscalus major*	5.01	0.971	6.46	0.987	1.47	0.987	1.96	0.982
Bobolink	*Dolichonyx oryzivorus*	-	-	-	-	27.51	0.925	18.51	0.917
Bohemian Waxwing	*Bombycilla garrulus*	8.58	0.915	14.96	0.909	-	-	0.38	0.968
Bonaparte's Gull	*Chroicocephalus philadelphia*	19.83	0.870	23.74	0.876	-	-	0.50	0.970
Boreal Chickadee	*Poecile hudsonicus*	7.34	0.962	7.15	0.965	1.49	0.953	2.41	0.958
Boreal Owl	*Aegolius funereus*	0.18	0.853	0.51	0.889	-	-	-	-
Botteri's Sparrow	*Peucaea botterii*	-	-	-	-	-	-	0.08	0.991
Brandt's Cormorant	*Phalacrocorax penicillatus*	2.95	0.995	3.78	0.993	-	-	0.09	0.961
Brant	*Branta bernicla*	5.55	0.937	5.61	0.943	-	-	-	-
Brewer's Blackbird	*Euphagus cyanocephalus*	25.40	0.917	24.16	0.919	18.22	0.947	20.44	0.948
Brewer's Sparrow	*Spizella breweri*	2.27	0.983	2.77	0.985	3.98	0.966	7.82	0.970
Bridled Titmouse	*Baeolophus wollweberi*	1.08	0.986	1.23	0.997	-	-	0.14	0.995
Bristle-thighed Curlew	*Numenius tahitiensis*	-	-	-	-	-	-	-	-
Broad-billed Hummingbird	*Cynanthus latirostris*	0.32	0.937	0.65	0.972	-	-	0.06	0.843
Broad-tailed Hummingbird	*Selasphorus platycercus*	0.10	-	0.58	0.967	0.73	0.931	3.27	0.981
Broad-winged Hawk	*Buteo platypterus*	2.02	0.886	1.17	0.858	2.73	0.771	2.68	0.788
Bronzed Cowbird	*Molothrus aeneus*	1.47	0.981	1.54	0.981	0.67	0.972	0.81	0.985
Brown Booby	*Sula leucogaster*	-	-	-	-	-	-	-	-
Brown Creeper	*Certhia americana*	70.66	0.876	66.44	0.876	3.58	0.871	6.22	0.889
Brown Pelican	*Pelecanus occidentalis*	5.01	0.981	8.39	0.986	0.23	0.956	0.43	0.979
Brown Thrasher	*Toxostoma rufum*	32.98	0.933	23.01	0.937	53.97	0.866	37.71	0.880
Brown-capped Rosy-Finch	*Leucosticte australis*	0.53	0.983	0.37	0.958	-	-	-	-
Brown-crested Flycatcher	*Myiarchus tyrannulus*	-	-	0.40	0.932	0.65	0.979	0.99	0.988
Brown-headed Cowbird	*Molothrus ater*	58.33	0.839	46.65	0.854	77.63	0.731	71.33	0.750
Brown-headed Nuthatch	*Sitta pusilla*	8.02	0.968	8.56	0.972	3.66	0.955	4.33	0.958

Table A.1. continued.

		Winter Distribution Models				Summer Distribution Models			
		1970-1979		2000-2009		1970-1979		2000-2009	
Common Name	**Scientific Name**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**
Buff-bellied Hummingbird	*Amazilia yucatanensis*	0.51	0.955	1.26	0.984	-	-	-	-
Buff-breasted Flycatcher	*Empidonax fulvifrons*	-	-	-	-	-	-	-	-
Buff-breasted Sandpiper	*Tryngites subruficollis*	-	-	-	-	-	-	-	-
Bufflehead	*Bucephala albeola*	41.65	0.816	52.40	0.829	0.29	0.921	1.21	0.952
Buller's Shearwater	*Puffinus bulleri*	-	-	-	-	-	-	-	-
Bullock's Oriole	*Icterus bullockii*	1.29	0.916	1.18	0.920	8.36	0.930	10.13	0.933
Burrowing Owl	*Athene cunicularia*	5.37	0.961	4.68	0.960	2.61	0.929	2.33	0.935
Bushtit	*Psaltriparus minimus*	10.94	0.987	13.34	0.986	3.12	0.963	2.77	0.963
Cactus Wren	*Campylorhynchus brunneicapillus*	4.84	0.988	4.73	0.988	2.90	0.989	3.05	0.991
California Condor	*Gymnogyps californianus*	-	-	-	-	-	-	-	-
California Gnatcatcher	*Polioptila californica*	0.00	-	0.58	0.993	-	-	-	-
California Gull	*Larus californicus*	6.68	0.963	9.96	0.968	1.21	0.900	1.96	0.918
California Quail	*Callipepla californica*	8.62	0.991	10.91	0.993	5.90	0.976	5.32	0.977
California Thrasher	*Toxostoma redivivum*	3.27	0.993	3.47	0.992	1.76	0.988	0.74	0.986
California Towhee	*Melozone crissalis*	0.00	-	5.13	0.985	3.24	0.994	1.89	0.991
Calliope Hummingbird	*Stellula calliope*	0.02	-	0.38	0.949	0.51	0.937	0.94	0.937
Canada Warbler	*Cardellina canadensis*	-	-	-	-	6.39	0.935	3.39	0.929
Canada/Cackling Goose	*Branta canadensis/hutchinsii*	50.19	0.840	74.04	0.842	-	-	-	-
Canvasback	*Aythya valisineria*	34.50	0.823	27.33	0.817	0.95	0.928	1.01	0.941
Canyon Towhee	*Melozone fusca*	-	-	4.04	0.984	1.30	0.972	1.92	0.982
Canyon Wren	*Catherpes mexicanus*	6.26	0.958	7.65	0.962	0.98	0.907	1.51	0.925
Cape May Warbler	*Setophaga tigrina*	0.53	0.813	0.31	0.825	1.37	0.940	1.58	0.944
Carolina Chickadee	*Poecile carolinensis*	28.78	0.970	26.79	0.972	22.14	0.961	23.56	0.962
Carolina Wren	*Thryothorus ludovicianus*	43.31	0.969	46.76	0.971	26.94	0.975	31.27	0.977
Caspian Tern	*Hydroprogne caspia*	5.44	0.984	5.87	0.983	0.47	0.887	0.74	0.873
Cassin's Auklet	*Ptychoramphus aleuticus*	0.57	0.986	0.42	0.986	-	-	-	-
Cassin's Finch	*Carpodacus cassinii*	4.16	0.948	5.60	0.954	1.62	0.960	3.63	0.961
Cassin's Kingbird	*Tyrannus vociferans*	0.78	0.984	1.91	0.990	1.19	0.973	2.52	0.974
Cassin's Sparrow	*Peucaea cassinii*	1.44	0.984	1.04	0.982	3.35	0.982	4.53	0.984
Cassin's Vireo	*Vireo cassinii*	-	-	-	-	-	-	-	-
Cattle Egret	*Bubulcus ibis*	9.12	0.971	8.59	0.970	6.78	0.960	7.66	0.962
Cave Swallow	*Petrochelidon fulva*	0.00	-	1.04	0.986	-	-	0.93	0.992
Cedar Waxwing	*Bombycilla cedrorum*	55.45	0.828	64.47	0.836	21.57	0.870	33.01	0.883

Table A.1. continued.

		Winter Distribution Models				Summer Distribution Models			
		1970-1979		2000-2009		1970-1979		2000-2009	
Common Name	**Scientific Name**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**
Cerulean Warbler	*Setophaga cerulea*	-	-	-	-	2.34	0.892	1.59	0.900
Chestnut-backed Chickadee	*Poecile rufescens*	5.17	0.989	7.98	0.991	2.11	0.979	3.30	0.987
Chestnut-collared Longspur	*Calcarius ornatus*	1.73	0.934	1.11	0.937	2.41	0.967	1.71	0.966
Chestnut-sided Warbler	*Setophaga pensylvanica*	-	-	0.16	0.900	17.50	0.956	15.30	0.958
Chihuahuan Raven	*Corvus cryptoleucus*	1.62	0.981	2.60	0.980	0.94	0.984	1.76	0.985
Chimney Swift	*Chaetura pelagica*	-	-	-	-	46.50	0.902	32.41	0.909
Chipping Sparrow	*Spizella passerina*	23.00	0.901	28.03	0.908	59.36	0.869	63.22	0.891
Chuck-will's-widow	*Caprimulgus carolinensis*	0.93	0.974	0.35	0.972	12.10	0.948	8.29	0.950
Chukar	*Alectoris chukar*	1.42	0.933	1.95	0.939	0.50	0.950	1.02	0.955
Cinnamon Teal	*Anas cyanoptera*	5.26	0.960	5.81	0.957	1.19	0.909	1.58	0.913
Clapper Rail	*Rallus longirostris*	8.06	0.965	5.46	0.962	-	-	-	-
Clark's Grebe	*Aechmophorus clarkii*	0.00	-	4.21	0.977	-	-	0.24	0.940
Clark's Nutcracker	*Nucifraga columbiana*	3.73	0.967	4.74	0.969	0.89	0.937	2.78	0.957
Clay-colored Sparrow	*Spizella pallida*	1.36	0.871	2.09	0.899	7.13	0.966	10.08	0.966
Cliff Swallow	*Petrochelidon pyrrhonota*	-	-	-	-	19.71	0.773	23.53	0.735
Collared Turtle-Dove	*Streptopelia roseogrisea*	0.56	0.801	0.49	0.692	-	-	-	-
Common Black-Hawk	*Buteogallus anthracinus*	-	-	-	-	-	-	-	-
Common Eider	*Somateria mollissima*	4.51	0.930	4.16	0.938	-	-	0.16	0.946
Common Goldeneye	*Bucephala clangula*	53.04	0.781	52.39	0.790	0.50	0.913	1.11	0.929
Common Grackle	*Quiscalus quiscula*	56.84	0.881	41.74	0.888	72.04	0.931	57.89	0.943
Common Ground-Dove	*Columbina passerina*	7.77	0.983	7.21	0.984	3.21	0.980	3.37	0.981
Common Loon	*Gavia immer*	23.50	0.833	28.72	0.834	4.16	0.907	6.85	0.914
Common Merganser	*Mergus merganser*	41.95	0.812	49.18	0.819	1.35	0.828	3.23	0.846
Common Moorhen/Gallinule	*Gallinula chloropus/galeata*	10.90	0.969	11.03	0.969	-	-	-	-
Common Murre	*Uria aalge*	3.47	0.984	4.05	0.984	-	-	-	-
Common Myna	*Acridotheres tristis*	0.40	-	0.67	0.980	-	-	-	-
Common Nighthawk	*Chordeiles minor*	-	-	-	-	20.66	0.834	19.30	0.846
Common Pauraque	*Nyctidromus albicollis*	1.13	0.998	0.74	0.997	0.15	0.997	0.14	0.994
Common Poorwill	*Phalaenoptilus nuttallii*	0.30	0.942	0.26	0.924	1.11	0.916	1.29	0.918
Common Raven	*Corvus corax*	25.55	0.941	50.67	0.937	14.42	0.896	33.81	0.894
Common Redpoll	*Acanthis flammea*	23.70	0.886	26.13	0.874	0.11	0.984	1.63	0.995
Common Ringed Plover	*Charadrius hiaticula*	-	-	-	-	-	-	-	-
Common Tern	*Sterna hirundo*	3.52	0.959	0.71	0.937	1.26	0.849	0.68	0.855

Table A.1. continued.

		Winter Distribution Models				Summer Distribution Models			
		1970-1979		2000-2009		1970-1979		2000-2009	
Common Name	**Scientific Name**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**
Common Yellowthroat	*Geothlypis trichas*	18.33	0.939	18.80	0.938	68.54	0.896	60.54	0.910
Connecticut Warbler	*Oporornis agilis*	-	-	-	-	0.82	0.940	1.13	0.959
Cooper's Hawk	*Accipiter cooperii*	42.07	0.825	68.60	0.832	1.41	0.544	4.13	0.627
Cordilleran Flycatcher	*Empidonax occidentalis*	-	-	-	-	0.63	0.921	2.35	0.946
Costa's Hummingbird	*Calypte costae*	1.33	0.984	2.17	0.991	0.44	0.968	0.26	0.974
Couch's Kingbird	*Tyrannus couchii*	0.00	-	1.30	0.994	0.05	0.995	0.43	0.998
Craveri's Murrelet	*Synthliboramphus craveri*	-	-	-	-	-	-	-	-
Crested Auklet	*Aethia cristatella*	-	-	-	-	-	-	-	-
Crested Caracara	*Caracara cheriway*	1.13	0.978	1.40	0.980	0.30	0.987	1.08	0.993
Crissal Thrasher	*Toxostoma crissale*	1.82	0.991	2.50	0.994	0.21	0.970	0.47	0.986
Curve-billed Thrasher	*Toxostoma curvirostre*	4.46	0.990	4.51	0.986	1.63	0.984	2.12	0.983
Dark-eyed Junco	*Junco hyemalis*	88.27	0.943	86.38	0.944	8.36	0.940	10.11	0.951
Dickcissel	*Spiza americana*	2.34	0.815	0.81	0.815	19.36	0.919	16.42	0.935
Double-crested Cormorant	*Phalacrocorax auritus*	17.38	0.908	38.13	0.917	1.75	0.721	4.76	0.757
Dovekie	*Alle alle*	1.84	0.956	1.23	0.963	-	-	-	-
Downy Woodpecker	*Picoides pubescens*	87.24	0.954	88.63	0.959	38.78	0.803	40.18	0.814
Dunlin	*Calidris alpina*	15.98	0.937	15.02	0.938	-	-	0.05	0.998
Dusky Flycatcher	*Empidonax oberholseri*	-	-	0.66	0.973	2.06	0.946	6.97	0.957
Dusky Grouse	*Dendragapus obscurus*	0.92	0.935	0.54	0.921	-	-	0.25	0.939
Dusky-capped Flycatcher	*Myiarchus tuberculifer*	-	-	0.46	0.956	0.03	0.829	0.07	0.991
Eared Grebe	*Podiceps nigricollis*	11.22	0.939	11.47	0.941	0.68	0.886	0.88	0.908
Eastern Bluebird	*Sialia sialis*	35.48	0.945	47.71	0.949	24.60	0.877	36.88	0.884
Eastern Kingbird	*Tyrannus tyrannus*	-	-	-	-	57.22	0.832	44.78	0.827
Eastern Meadowlark	*Sturnella magna*	45.01	0.941	29.65	0.953	56.87	0.907	38.04	0.918
Eastern Phoebe	*Sayornis phoebe*	20.06	0.958	25.85	0.963	36.10	0.881	39.32	0.881
Eastern Screech-Owl	*Megascops asio*	0.02	-	38.48	0.871	1.46	0.763	0.84	0.777
Eastern Towhee	*Pipilo erythrophthalmus*	-	-	-	-	41.99	0.918	30.74	0.932
Eastern Whip-poor-will	*Caprimulgus vociferus*	1.13	0.975	0.86	0.971	8.65	0.822	3.47	0.844
Eastern Whip-poor-will 2	-	1.13	0.975	0.86	0.975	-	-	-	-
Eastern Wood-Pewee	*Contopus virens*	-	-	0.13	0.806	44.91	0.892	36.84	0.895
Eastern Yellow Wagtail	*Motacilla tschutschensis*	-	-	-	-	-	-	0.18	1.000
Elegant Tern	*Thalasseus elegans*	-	-	-	-	-	-	-	-
Elegant Trogon	*Trogon elegans*	-	-	0.31	0.995	-	-	-	-

Table A.1. continued.

		Winter Distribution Models				Summer Distribution Models			
		1970-1979		2000-2009		1970-1979		2000-2009	
Common Name	**Scientific Name**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**
Elf Owl	*Micrathene whitneyi*	-	-	-	-	-	-	-	-
Emperor Goose	*Chen canagica*	0.29	0.972	0.30	0.985	-	-	-	-
Eurasian Collared-Dove	*Streptopelia decaocto*	0.00	-	20.23	0.962	-	-	7.75	0.974
Eurasian Tree Sparrow	*Passer montanus*	0.69	0.871	1.08	0.901	0.18	0.930	0.36	0.952
Eurasian Wigeon	*Anas penelope*	2.58	0.916	6.32	0.942	-	-	-	-
European Starling	*Sturnus vulgaris*	94.04	0.915	92.10	0.918	80.29	0.810	66.53	0.827
Evening Grosbeak	*Coccothraustes vespertinus*	50.39	0.793	17.20	0.822	4.86	0.907	4.01	0.903
Ferruginous Hawk	*Buteo regalis*	6.16	0.950	9.20	0.954	0.70	0.908	1.95	0.925
Ferruginous Pygmy-Owl	*Glaucidium brasilianum*	-	-	0.30	0.989	-	-	-	-
Field Sparrow	*Spizella pusilla*	44.61	0.951	32.56	0.950	46.19	0.916	30.47	0.913
Fish Crow	*Corvus ossifragus*	13.33	0.944	14.10	0.947	6.55	0.936	9.49	0.941
Five-striped Sparrow	*Amphispiza quinquestriata*	0.03	-	0.07	0.996	-	-	-	-
Flammulated Owl	*Otus flammeolus*	-	-	-	-	-	-	-	-
Florida Scrub-Jay	*Aphelocoma coerulescens*	0.00	-	1.07	0.988	-	-	0.10	0.985
Forster's Tern	*Sterna forsteri*	9.02	0.978	12.52	0.980	0.62	0.826	1.06	0.834
Fox Sparrow	*Passerella iliaca*	40.99	0.899	38.97	0.903	1.56	0.950	5.49	0.964
Franklin's Gull	*Leucophaeus pipixcan*	0.78	0.840	0.65	0.854	1.64	0.945	1.97	0.945
Fulvous Whistling-Duck	*Dendrocygna bicolor*	0.77	0.964	0.56	0.956	0.23	0.983	0.40	0.980
Gadwall	*Anas strepera*	32.70	0.836	46.80	0.844	2.65	0.912	5.25	0.919
Gambel's Quail	*Callipepla gambelii*	2.75	0.992	3.20	0.994	1.05	0.988	1.90	0.983
Gila Woodpecker	*Melanerpes uropygialis*	1.15	0.993	1.63	0.997	0.18	0.978	0.61	0.997
Gilded Flicker	*Colaptes chrysoides*	0.81	0.996	0.88	0.996	0.12	0.892	0.40	0.978
Glaucous Gull	*Larus hyperboreus*	6.98	0.846	7.79	0.851	-	-	0.18	0.996
Glaucous-winged Gull	*Larus glaucescens*	5.57	0.986	8.30	0.991	0.44	0.990	0.78	0.993
Glossy Ibis	*Plegadis falcinellus*	2.27	0.975	2.94	0.963	0.39	0.923	0.37	0.926
Golden Eagle	*Aquila chrysaetos*	15.19	0.908	18.61	0.906	1.02	0.910	1.74	0.925
Golden-cheeked Warbler	*Setophaga chrysoparia*	-	-	-	-	-	-	0.06	0.943
Golden-crowned Kinglet	*Regulus satrapa*	62.03	0.876	64.57	0.876	4.13	0.927	9.75	0.936
Golden-crowned Sparrow	*Zonotrichia atricapilla*	8.57	0.982	10.61	0.984	-	-	0.52	0.958
Golden-fronted Woodpecker	*Melanerpes aurifrons*	2.67	0.989	2.47	0.985	1.41	0.991	1.41	0.989
Golden-winged Warbler	*Vermivora chrysoptera*	-	-	-	-	3.09	0.876	1.21	0.885
Grace's Warbler	*Setophaga graciae*	-	-	-	-	0.16	0.957	0.76	0.995
Grasshopper Sparrow	*Ammodramus savannarum*	3.96	0.943	4.29	0.939	24.94	0.822	19.31	0.831

Table A.1. continued.

		Winter Distribution Models				Summer Distribution Models			
		1970-1979		2000-2009		1970-1979		2000-2009	
Common Name	**Scientific Name**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**
Gray Catbird	*Dumetella carolinensis*	17.84	0.935	19.48	0.938	52.70	0.893	40.18	0.902
Gray Flycatcher	*Empidonax wrightii*	0.53	0.974	1.42	0.980	0.39	0.928	2.21	0.970
Gray Hawk	*Buteo nitidus*	0.39	-	0.46	0.966	-	-	0.09	0.998
Gray Jay	*Perisoreus canadensis*	7.37	0.946	11.09	0.949	2.14	0.933	5.51	0.941
Gray Kingbird	*Tyrannus dominicensis*	-	-	-	-	0.11	0.910	0.13	0.990
Gray Partridge	*Perdix perdix*	6.22	0.928	5.99	0.931	1.56	0.905	1.61	0.927
Gray Vireo	*Vireo vicinior*	-	-	-	-	-	-	0.65	0.967
Gray-cheeked Thrush	*Catharus minimus*	-	-	-	-	0.09	0.944	1.18	0.991
Gray-crowned Rosy-Finch	*Leucosticte tephrocotis*	2.69	0.964	2.38	0.966	-	-	-	-
Gray-headed Chickadee	*Poecile cinctus*	-	-	-	-	-	-	-	-
Great Black-backed Gull	*Larus marinus*	19.18	0.915	20.96	0.924	1.53	0.946	0.90	0.944
Great Blue Heron	*Ardea herodias*	55.33	0.907	70.84	0.920	18.11	0.645	27.53	0.668
Great Cormorant	*Phalacrocorax carbo*	4.90	0.891	5.54	0.925	-	-	0.01	0.634
Great Crested Flycatcher	*Myiarchus crinitus*	1.36	0.981	1.29	0.980	46.32	0.871	39.51	0.872
Great Egret	*Ardea alba*	14.22	0.964	21.60	0.976	4.01	0.896	8.06	0.908
Great Gray Owl	*Strix nebulosa*	0.35	0.813	1.96	0.906	-	-	-	-
Great Horned Owl	*Bubo virginianus*	62.42	0.805	66.67	0.811	8.71	0.663	9.45	0.689
Great Kiskadee	*Pitangus sulphuratus*	0.94	0.996	1.55	0.997	-	-	0.28	0.978
Great Skua	*Stercorarius skua*	-	-	-	-	-	-	-	-
Great White Heron	*Ardea herodias*	-	-	-	-	0.06	0.896	0.05	0.888
Greater Pewee	*Contopus pertinax*	-	-	0.34	0.982	-	-	-	-
Greater Prairie-Chicken	*Tympanuchus cupido*	0.88	0.902	0.72	0.921	0.30	0.906	0.50	0.920
Greater Roadrunner	*Geococcyx californianus*	8.64	0.972	8.76	0.973	2.37	0.959	3.08	0.959
Greater Sage-Grouse	*Centrocercus urophasianus*	0.48	0.973	0.50	0.966	0.53	0.959	0.47	0.954
Greater Scaup	*Aythya marila*	19.03	0.845	21.84	0.854	-	-	0.36	0.986
Greater White-fronted Goose	*Anser albifrons*	5.35	0.847	13.04	0.859	-	-	0.10	0.998
Greater Yellowlegs	*Tringa melanoleuca*	14.48	0.953	19.87	0.953	0.17	0.911	0.98	0.972
Great-tailed Grackle	*Quiscalus mexicanus*	3.47	0.933	11.26	0.954	2.71	0.939	4.62	0.960
Green Heron	*Butorides virescens*	11.75	0.957	10.98	0.956	21.43	0.813	12.49	0.817
Green Jay	*Cyanocorax yncas*	0.87	0.991	1.07	0.989	0.08	0.996	0.21	0.996
Green Kingfisher	*Chloroceryle americana*	0.72	0.974	1.43	0.984	-	-	-	-
Green Parakeet	*Aratinga holochlora*	0.15	-	0.35	0.967	-	-	-	-
Green-tailed Towhee	*Pipilo chlorurus*	2.81	0.964	2.79	0.964	2.02	0.968	5.17	0.971

Table A.1. continued.

		Winter Distribution Models				Summer Distribution Models			
		1970-1979		2000-2009		1970-1979		2000-2009	
Common Name	**Scientific Name**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**
Green-winged Teal	*Anas crecca*	35.55	0.856	43.95	0.858	1.61	0.897	2.47	0.910
Groove-billed Ani	*Crotophaga sulcirostris*	1.58	0.984	0.85	0.973	-	-	-	-
Gull-billed Tern	*Gelochelidon nilotica*	1.65	0.992	1.09	0.984	-	-	0.19	0.954
Gyrfalcon	*Falco rusticolus*	0.62	0.849	1.66	0.877	-	-	0.03	0.574
Hairy Woodpecker	*Picoides villosus*	81.05	0.916	79.19	0.920	16.87	0.713	21.70	0.725
Hammond's Flycatcher	*Empidonax hammondii*	0.05	-	0.81	0.977	1.97	0.955	6.24	0.966
Harlequin Duck	*Histrionicus histrionicus*	3.61	0.936	5.29	0.942	-	-	0.19	0.937
Harris's Hawk	*Parabuteo unicinctus*	1.69	0.981	2.12	0.984	0.51	0.980	0.41	0.991
Harris's Sparrow	*Zonotrichia querula*	12.33	0.872	9.86	0.879	-	-	-	-
Heermann's Gull	*Larus heermanni*	1.74	0.993	1.79	0.993	-	-	-	-
Henslow's Sparrow	*Ammodramus henslowii*	0.99	0.950	1.18	0.944	1.73	0.766	0.92	0.788
Hepatic Tanager	*Piranga flava*	-	-	0.32	0.960	-	-	0.47	0.987
Hermit Thrush	*Catharus guttatus*	37.77	0.920	45.76	0.922	13.56	0.916	21.81	0.924
Hermit Warbler	*Setophaga occidentalis*	0.59	0.976	0.92	0.975	1.40	0.988	2.21	0.986
Herring Gull	*Larus argentatus*	49.68	0.853	50.13	0.859	5.42	0.901	3.66	0.891
Himalayan Snowcock	*Tetraogallus himalayensis*	-	-	-	-	-	-	-	-
Hoary Redpoll	*Acanthis hornemanni*	1.77	0.927	4.39	0.934	-	-	0.05	0.989
Hooded Merganser	*Lophodytes cucullatus*	31.26	0.801	54.01	0.809	0.25	0.757	0.92	0.808
Hooded Oriole	*Icterus cucullatus*	0.79	0.970	0.74	0.973	0.44	0.962	0.58	0.978
Hooded Warbler	*Setophaga citrina*	-	-	-	-	7.13	0.902	10.52	0.910
Hook-billed Kite	*Chondrohierax uncinatus*	-	-	0.09	0.924	-	-	-	-
Horned Grebe	*Podiceps auritus*	27.75	0.834	24.94	0.845	0.74	0.959	0.52	0.963
Horned Lark	*Eremophila alpestris*	56.30	0.794	46.30	0.790	32.80	0.855	32.02	0.858
Horned Puffin	*Fratercula corniculata*	-	-	-	-	-	-	-	-
House Finch	*Carpodacus mexicanus*	33.14	0.837	78.52	0.842	11.43	0.721	36.46	0.818
House Sparrow	*Passer domesticus*	94.78	0.885	89.01	0.895	77.37	0.826	54.07	0.832
House Wren	*Troglodytes aedon*	18.59	0.947	21.68	0.950	45.03	0.871	42.42	0.875
Hudsonian Godwit	*Limosa haemastica*	-	-	-	-	-	-	0.06	0.996
Hutton's Vireo	*Vireo huttoni*	4.98	0.988	7.06	0.988	1.15	0.979	1.92	0.984
Iceland Gull	*Larus glaucoides*	5.31	0.901	6.34	0.907	-	-	-	-
Inca Dove	*Columbina inca*	3.71	0.980	6.99	0.982	0.75	0.974	1.83	0.980
Indigo Bunting	*Passerina cyanea*	1.93	0.904	2.00	0.940	52.84	0.950	44.95	0.949
Ivory Gull	*Pagophila eburnea*	-	-	-	-	-	-	-	-

Table A.1. continued.

		Winter Distribution Models				Summer Distribution Models			
		1970-1979		2000-2009		1970-1979		2000-2009	
Common Name	**Scientific Name**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**
Juniper Titmouse	*Baeolophus ridgwayi*	-	-	-	-	0.34	0.926	1.29	0.968
Kentucky Warbler	*Geothlypis formosa*	-	-	-	-	9.78	0.908	8.46	0.904
Killdeer	*Charadrius vociferus*	57.04	0.928	47.74	0.931	64.79	0.733	55.41	0.760
King Eider	*Somateria spectabilis*	1.68	0.898	0.91	0.899	-	-	-	-
King Rail	*Rallus elegans*	4.50	0.963	3.34	0.957	-	-	-	-
Kirtland's Warbler	*Setophaga kirtlandii*	-	-	-	-	-	-	-	-
Kittlitz's Murrelet	*Brachyramphus brevirostris*	-	-	0.04	0.947	-	-	-	-
Ladder-backed Woodpecker	*Picoides scalaris*	7.19	0.987	7.16	0.986	2.66	0.979	3.06	0.976
Lapland Longspur	*Calcarius lapponicus*	13.19	0.745	13.68	0.752	-	-	0.28	0.991
Lark Bunting	*Calamospiza melanocorys*	2.53	0.977	1.92	0.971	4.88	0.974	4.48	0.974
Lark Sparrow	*Chondestes grammacus*	9.27	0.960	8.30	0.960	13.49	0.903	15.88	0.911
Laughing Gull	*Leucophaeus atricilla*	7.94	0.978	8.00	0.969	1.18	0.969	1.80	0.962
Lawrence's Goldfinch	*Spinus lawrencei*	1.39	0.970	0.97	0.971	0.77	0.984	0.36	0.978
Lazuli Bunting	*Passerina amoena*	-	-	-	-	4.03	0.922	6.35	0.929
Le Conte's Sparrow	*Ammodramus leconteii*	4.06	0.944	5.08	0.952	1.25	0.954	3.10	0.971
Le Conte's Thrasher	*Toxostoma lecontei*	0.37	0.965	0.40	0.972	0.41	0.988	0.18	0.982
Leach's Storm-Petrel	*Oceanodroma leucorhoa*	-	-	-	-	-	-	-	-
Least Auklet	*Aethia pusilla*	-	-	-	-	-	-	-	-
Least Bittern	*Ixobrychus exilis*	1.77	0.962	1.29	0.964	0.35	0.830	0.39	0.865
Least Flycatcher	*Empidonax minimus*	0.30	-	0.95	0.946	23.08	0.945	19.82	0.946
Least Grebe	*Tachybaptus dominicus*	1.12	0.981	1.44	0.988	-	-	-	-
Least Sandpiper	*Calidris minutilla*	15.09	0.958	16.37	0.960	-	-	0.16	0.993
Least Tern	*Sternula antillarum*	-	-	-	-	0.55	0.921	0.47	0.904
Lesser Black-backed Gull	*Larus fuscus*	0.44	0.828	7.11	0.879	-	-	-	-
Lesser Goldfinch	*Spinus psaltria*	9.23	0.986	11.77	0.985	4.29	0.964	4.25	0.969
Lesser Nighthawk	*Chordeiles acutipennis*	-	-	0.36	0.961	1.37	0.983	1.83	0.986
Lesser Prairie-Chicken	*Tympanuchus pallidicinctus*	0.16	0.956	0.09	0.957	-	-	0.10	0.891
Lesser Scaup	*Aythya affinis*	41.38	0.832	44.30	0.840	1.92	0.937	2.52	0.940
Lesser Yellowlegs	*Tringa flavipes*	8.37	0.954	9.57	0.953	0.36	0.981	1.24	0.987
Lewis's Woodpecker	*Melanerpes lewis*	3.94	0.942	3.49	0.945	0.48	0.885	0.49	0.927
Limpkin	*Aramus guarauna*	1.13	0.990	1.59	0.989	-	-	-	-
Lincoln's Sparrow	*Melospiza lincolnii*	16.24	0.923	20.32	0.935	3.28	0.934	9.46	0.944
Little Blue Heron	*Egretta caerulea*	7.71	0.989	7.48	0.989	4.88	0.952	3.97	0.954

Table A.1. continued.

		Winter Distribution Models				Summer Distribution Models			
		1970-1979		2000-2009		1970-1979		2000-2009	
Common Name	**Scientific Name**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**
Little Gull	*Hydrocoloeus minutus*	0.90	0.875	0.67	0.878	-	-	-	-
Loggerhead Shrike	*Lanius ludovicianus*	39.34	0.955	27.40	0.961	22.76	0.843	12.88	0.860
Long-billed Curlew	*Numenius americanus*	4.68	0.973	4.51	0.974	2.00	0.923	3.61	0.939
Long-billed Dowitcher	*Limnodromus scolopaceus*	6.42	0.954	8.75	0.953	-	-	-	-
Long-billed Thrasher	*Toxostoma longirostre*	1.23	0.996	1.26	0.995	0.13	0.957	0.38	0.971
Long-eared Owl	*Asio otus*	10.72	0.796	8.37	0.790	-	-	-	-
Long-tailed Duck	*Clangula hyemalis*	16.67	0.875	13.75	0.880	-	-	0.15	0.981
Long-tailed Jaeger	*Stercorarius longicaudus*	-	-	-	-	-	-	0.20	0.998
Louisiana Waterthrush	*Parkesia motacilla*	-	-	0.35	0.896	4.45	0.857	4.99	0.863
Lucifer Hummingbird	*Calothorax lucifer*	-	-	-	-	-	-	-	-
Lucy's Warbler	*Oreothlypis luciae*	-	-	-	-	0.20	0.963	0.59	0.993
MacGillivray's Warbler	*Geothlypis tolmiei*	-	-	0.45	0.940	3.62	0.957	8.06	0.966
Magnificent Frigatebird	*Fregata magnificens*	1.53	0.991	1.20	0.992	0.06	0.902	0.05	0.922
Magnificent Hummingbird	*Eugenes fulgens*	-	-	0.32	0.990	-	-	-	-
Magnolia Warbler	*Setophaga magnolia*	0.63	0.957	0.55	0.949	7.17	0.953	9.86	0.960
Mallard	*Anas platyrhynchos*	79.38	0.869	85.79	0.872	20.65	0.788	30.31	0.796
Mangrove Cuckoo	*Coccyzus minor*	-	-	-	-	-	-	0.05	0.936
Manx Shearwater	*Puffinus puffinus*	-	-	-	-	-	-	-	-
Marbled Godwit	*Limosa fedoa*	4.61	0.975	4.30	0.975	2.13	0.967	3.12	0.965
Marbled Murrelet	*Brachyramphus marmoratus*	2.14	0.990	2.96	0.987	-	-	0.39	0.995
Marsh Wren	*Cistothorus palustris*	19.74	0.919	26.14	0.921	2.88	0.779	4.54	0.827
Masked Duck	*Nomonyx dominicus*	-	-	-	-	-	-	-	-
McCown's Longspur	*Rhynchophanes mccownii*	0.68	0.934	0.56	0.945	0.51	0.950	0.55	0.951
McKay's Bunting	*Plectrophenax hyperboreus*	-	-	0.06	0.993	-	-	-	-
Merlin	*Falco columbarius*	16.04	0.813	36.56	0.826	-	-	1.39	0.904
Mew Gull	*Larus canus*	5.21	0.982	7.46	0.985	-	-	1.14	0.992
Mexican Chickadee	*Poecile sclateri*	0.13	0.971	0.19	0.926	-	-	-	-
Mexican Duck	*Anas platyrhynchos diazi*	-	-	-	-	-	-	0.12	0.976
Mexican Jay	*Aphelocoma wollweberi*	1.09	0.993	0.86	0.992	0.06	0.990	0.12	0.996
Mississippi Kite	*Ictinia mississippiensis*	-	-	-	-	0.86	0.941	1.60	0.934
Monk Parakeet	*Myiopsitta monachus*	0.76	0.846	2.21	0.924	-	-	0.07	0.949
Montezuma Quail	*Cyrtonyx montezumae*	0.50	0.995	0.45	0.992	-	-	0.09	0.958
Mottled Duck	*Anas fulvigula*	3.79	0.989	4.71	0.991	0.86	0.991	0.84	0.983

Table A.1. continued.

		Winter Distribution Models				Summer Distribution Models			
		1970-1979		2000-2009		1970-1979		2000-2009	
Common Name	**Scientific Name**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**
Mountain Bluebird	*Sialia currucoides*	4.98	0.940	6.41	0.948	3.49	0.938	7.83	0.946
Mountain Chickadee	*Poecile gambeli*	8.99	0.972	13.09	0.975	3.69	0.969	7.65	0.969
Mountain Plover	*Charadrius montanus*	0.71	0.960	0.50	0.958	0.36	0.951	0.34	0.964
Mountain Quail	*Oreortyx pictus*	1.67	0.976	1.58	0.974	2.23	0.982	1.92	0.983
Mourning Dove	*Zenaida macroura*	79.72	0.947	81.42	0.953	85.24	0.910	84.49	0.924
Mourning Warbler	*Geothlypis philadelphia*	-	-	-	-	7.28	0.945	8.10	0.940
Muscovy Duck	*Cairina moschata*	0.13	-	1.91	0.913	-	-	-	-
Mute Swan	*Cygnus olor*	6.80	0.863	15.40	0.887	0.10	0.755	0.41	0.883
Nashville Warbler	*Oreothlypis ruficapilla*	1.69	0.926	2.40	0.924	10.69	0.938	12.08	0.940
Nelson's/Saltmarsh Sparrow	*Ammodramus nelsoni/caudacutus*	5.37	0.955	3.56	0.942	-	-	-	-
Neotropic Cormorant	*Phalacrocorax brasilianus*	1.32	0.981	3.07	0.986	-	-	0.27	0.982
Northern Beardless-Tyrannulet	*Camptostoma imberbe*	0.34	0.986	0.44	0.979	-	-	0.09	0.995
Northern Bobwhite	*Colinus virginianus*	40.04	0.912	14.69	0.920	43.65	0.964	27.43	0.967
Northern Cardinal	*Cardinalis cardinalis*	70.23	0.987	63.97	0.987	55.52	0.985	49.68	0.986
Northern Flicker	*Colaptes auratus*	78.34	0.951	79.63	0.946	10.43	0.952	14.78	0.956
Northern Fulmar	*Fulmarus glacialis*	1.01	0.976	0.92	0.971	-	-	-	-
Northern Gannet	*Morus bassanus*	3.56	0.945	6.27	0.950	-	-	0.12	0.995
Northern Goshawk	*Accipiter gentilis*	14.83	0.794	14.76	0.801	-	-	0.43	0.809
Northern Harrier	*Circus cyaneus*	57.08	0.859	62.50	0.868	6.41	0.835	7.58	0.841
Northern Hawk Owl	*Surnia ulula*	0.61	0.887	1.65	0.917	-	-	0.12	0.942
Northern Jacana	*Jacana spinosa*	-	-	-	-	-	-	-	-
Northern Mockingbird	*Mimus polyglottos*	58.96	0.956	52.43	0.959	45.51	0.955	41.56	0.955
Northern Parula	*Setophaga americana*	1.76	0.963	2.05	0.971	11.55	0.858	17.96	0.865
Northern Pintail	*Anas acuta*	37.71	0.813	36.76	0.812	4.11	0.907	3.11	0.905
Northern Pygmy-Owl	*Glaucidium gnoma*	3.92	0.938	6.16	0.950	0.31	0.916	0.47	0.926
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	1.53	0.950	2.35	0.961	17.20	0.655	18.10	0.681
Northern Saw-whet Owl	*Aegolius acadicus*	5.20	0.813	9.59	0.826	-	-	0.13	0.775
Northern Shoveler	*Anas clypeata*	25.34	0.875	35.38	0.873	2.59	0.923	3.72	0.931
Northern Shrike	*Lanius excubitor*	29.43	0.895	33.50	0.877	-	-	-	-
Northern Waterthrush	*Parkesia noveboracensis*	1.61	0.918	1.69	0.926	6.06	0.922	8.54	0.928
Northern Wheatear	*Oenanthe oenanthe*	-	-	-	-	-	-	-	-
Northwestern Crow	*Corvus caurinus*	1.69	0.992	2.66	0.994	0.56	0.995	0.81	0.998
Nuttall's Woodpecker	*Picoides nuttallii*	4.01	0.996	4.66	0.995	1.78	0.991	1.18	0.989

Table A.1. continued.

		Winter Distribution Models				Summer Distribution Models			
		1970-1979		2000-2009		1970-1979		2000-2009	
Common Name	**Scientific Name**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**
Oak Titmouse	*Baeolophus inornatus*	-	-	-	-	2.68	0.992	1.38	0.986
Olive Sparrow	*Arremonops rufivirgatus*	1.01	0.996	1.01	0.997	0.34	0.982	0.60	0.997
Olive Warbler	*Peucedramus taeniatus*	0.33	0.977	0.43	0.986	-	-	0.13	0.993
Olive-sided Flycatcher	*Contopus cooperi*	-	-	-	-	8.20	0.915	8.51	0.925
Orange-crowned Warbler	*Oreothlypis celata*	15.58	0.957	20.93	0.959	4.83	0.955	9.93	0.965
Orchard Oriole	*Icterus spurius*	-	-	0.40	0.877	25.36	0.893	23.52	0.899
Osprey	*Pandion haliaetus*	6.50	0.930	13.84	0.936	1.59	0.792	4.51	0.821
Ovenbird	*Seiurus aurocapilla*	2.50	0.948	2.37	0.957	27.97	0.918	28.35	0.926
Pacific Golden-Plover	*Pluvialis fulva*	0.00	-	0.93	0.980	-	-	0.06	0.949
Pacific Loon	*Gavia pacifica*	3.92	0.963	5.82	0.970	-	-	0.24	0.982
Pacific-slope Flycatcher	*Empidonax difficilis*	0.00	-	0.21	0.890	3.39	0.977	4.10	0.980
Painted Bunting	*Passerina ciris*	2.01	0.949	2.25	0.968	7.26	0.973	6.35	0.976
Painted Redstart	*Myioborus pictus*	0.36	0.945	0.53	0.984	0.03	0.875	0.09	0.985
Palm Warbler	*Setophaga palmarum*	10.65	0.938	12.43	0.942	0.41	0.890	1.09	0.935
Parakeet Auklet	*Aethia psittacula*	-	-	-	-	-	-	-	-
Parasitic Jaeger	*Stercorarius parasiticus*	0.83	0.936	0.72	0.938	-	-	0.06	0.964
Pectoral Sandpiper	*Calidris melanotos*	-	-	-	-	-	-	-	-
Pelagic Cormorant	*Phalacrocorax pelagicus*	3.71	0.995	4.94	0.995	0.15	0.993	0.10	0.938
Peregrine Falcon	*Falco peregrinus*	6.68	0.835	21.51	0.844	-	-	-	-
Phainopepla	*Phainopepla nitens*	3.48	0.987	4.87	0.990	0.93	0.979	1.11	0.982
Philadelphia Vireo	*Vireo philadelphicus*	-	-	-	-	1.03	0.952	2.02	0.957
Pied-billed Grebe	*Podilymbus podiceps*	47.36	0.905	47.25	0.914	3.53	0.804	4.23	0.828
Pigeon Guillemot	*Cepphus columba*	2.10	0.989	2.57	0.989	0.10	0.944	0.13	0.979
Pileated Woodpecker	*Dryocopus pileatus*	44.62	0.873	58.18	0.874	16.44	0.794	26.49	0.802
Pine Grosbeak	*Pinicola enucleator*	16.68	0.923	16.27	0.926	0.46	0.917	1.24	0.953
Pine Siskin	*Spinus pinus*	49.71	0.680	47.56	0.701	6.52	0.919	10.00	0.926
Pine Warbler	*Setophaga pinus*	12.64	0.961	17.93	0.962	11.41	0.906	18.16	0.905
Pinyon Jay	*Gymnorhinus cyanocephalus*	2.80	0.970	3.05	0.965	1.14	0.955	2.37	0.964
Piping Plover	*Charadrius melodus*	3.13	0.978	2.05	0.973	-	-	-	-
Plain (Oak/Juniper) Titmouse	*Baeolophus inornatus/ridgwayi*	6.40	0.985	7.15	0.986	-	-	-	-
Plain Chachalaca	*Ortalis vetula*	0.72	0.992	0.61	0.974	-	-	0.01	0.494
Plumbeous Vireo	*Vireo plumbeus*	-	-	-	-	-	-	-	-
Pomarine Jaeger	*Stercorarius pomarinus*	0.83	0.930	1.01	0.952	-	-	-	-

Table A.1. continued.

		Winter Distribution Models				Summer Distribution Models			
		1970-1979		2000-2009		1970-1979		2000-2009	
Common Name	**Scientific Name**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**
Prairie Falcon	*Falco mexicanus*	9.49	0.942	14.13	0.948	0.40	0.899	1.05	0.917
Prairie Warbler	*Setophaga discolor*	2.85	0.972	3.24	0.973	12.40	0.899	9.58	0.900
Prothonotary Warbler	*Protonotaria citrea*	-	-	0.11	0.889	5.45	0.928	4.86	0.933
Purple Finch	*Carpodacus purpureus*	58.60	0.821	44.09	0.835	15.32	0.915	11.19	0.914
Purple Gallinule	*Porphyrio martinica*	-	-	-	-	-	-	-	-
Purple Gallinule	*Porphyrio martinica*	-	-	-	-	-	-	-	-
Purple Martin	*Progne subis*	-	-	-	-	29.88	0.867	21.54	0.887
Purple Sandpiper	*Calidris maritima*	5.08	0.918	4.05	0.927	-	-	-	-
Pygmy Nuthatch	*Sitta pygmaea*	4.65	0.965	5.62	0.969	0.90	0.951	1.70	0.956
Pyrrhuloxia	*Cardinalis sinuatus*	4.11	0.991	3.88	0.990	1.49	0.992	1.80	0.992
Razorbill	*Alca torda*	0.83	0.892	2.13	0.958	-	-	-	-
Red Crossbill	*Loxia curvirostra*	14.90	0.760	11.15	0.816	1.78	0.888	4.84	0.923
Red Knot	*Calidris canutus*	4.04	0.955	3.28	0.945	-	-	-	-
Red Phalarope	*Phalaropus fulicarius*	1.02	0.958	0.73	0.954	-	-	-	-
Red-bellied Woodpecker	*Melanerpes carolinus*	51.37	0.972	53.93	0.971	30.54	0.959	37.77	0.960
Red-billed Pigeon	*Patagioenas flavirostris*	-	-	0.18	0.975	-	-	-	-
Red-breasted Merganser	*Mergus serrator*	27.41	0.857	28.85	0.860	-	-	0.44	0.955
Red-breasted Nuthatch	*Sitta canadensis*	58.84	0.814	63.74	0.815	8.78	0.906	17.92	0.915
Red-breasted Sapsucker	*Sphyrapicus ruber*	0.35	0.959	8.31	0.982	1.61	0.962	2.46	0.971
Red-cockaded Woodpecker	*Picoides borealis*	2.22	0.958	1.27	0.955	0.30	0.948	0.14	0.941
Red-crowned Parrot	*Amazona viridigenalis*	0.32	0.961	0.58	0.971	-	-	-	-
Reddish Egret	*Egretta rufescens*	2.25	0.990	2.82	0.989	-	-	0.13	0.984
Red-eyed Vireo	*Vireo olivaceus*	-	-	-	-	52.00	0.898	48.93	0.907
Red-faced Cormorant	*Phalacrocorax urile*	0.13	0.964	0.14	0.980	-	-	-	-
Red-faced Warbler	*Cardellina rubrifrons*	-	-	-	-	-	-	0.15	0.992
Redhead	*Aythya americana*	25.89	0.788	24.19	0.795	1.61	0.900	2.04	0.913
Red-headed Woodpecker	*Melanerpes erythrocephalus*	33.92	0.874	22.57	0.883	21.34	0.863	13.05	0.865
Red-legged Kittiwake	*Rissa brevirostris*	-	-	-	-	-	-	-	-
Red-naped Sapsucker	*Sphyrapicus nuchalis*	-	-	4.56	0.965	1.10	0.946	3.59	0.957
Red-necked Grebe	*Podiceps grisegena*	6.76	0.912	9.64	0.926	0.44	0.927	1.37	0.962
Red-necked Phalarope	*Phalaropus lobatus*	-	-	-	-	0.01	0.847	0.12	0.982
Red-shouldered Hawk	*Buteo lineatus*	32.54	0.918	38.34	0.926	5.35	0.892	11.04	0.899
Red-tailed Hawk	*Buteo jamaicensis*	82.35	0.958	83.52	0.960	17.58	0.677	33.93	0.686

Table A.1. continued.

		Winter Distribution Models				Summer Distribution Models			
		1970-1979		2000-2009		1970-1979		2000-2009	
Common Name	**Scientific Name**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**
Red-throated Loon	*Gavia stellata*	10.22	0.929	10.77	0.936	-	-	0.30	0.994
Red-throated Pipit	*Anthus cervinus*	-	-	-	-	-	-	-	-
Red-winged Blackbird	*Agelaius phoeniceus*	70.41	0.866	63.63	0.872	87.76	0.847	75.47	0.857
Rhinoceros Auklet	*Cerorhinca monocerata*	1.11	0.985	1.78	0.987	-	-	0.03	0.568
Ring-billed Gull	*Larus delawarensis*	48.29	0.866	60.82	0.876	4.27	0.834	7.81	0.850
Ringed Kingfisher	*Megaceryle torquata*	0.48	0.972	0.72	0.986	-	-	-	-
Ring-necked Duck	*Aythya collaris*	34.08	0.858	49.29	0.863	0.50	0.846	1.62	0.890
Ring-necked Pheasant	*Phasianus colchicus*	45.58	0.860	31.49	0.860	26.74	0.867	20.11	0.876
Rock Pigeon	*Columba livia*	50.63	0.705	87.06	0.857	37.92	0.752	31.65	0.762
Rock Ptarmigan	*Lagopus muta*	0.27	0.991	0.22	0.991	-	-	0.05	0.997
Rock Sandpiper	*Calidris ptilocnemis*	1.12	0.987	1.18	0.988	-	-	0.02	1.000
Rock Wren	*Salpinctes obsoletus*	8.19	0.977	9.06	0.981	4.08	0.934	7.44	0.943
Roseate Spoonbill	*Platalea ajaja*	1.58	0.991	3.16	0.989	-	-	0.46	0.967
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	1.25	0.707	0.85	0.729	24.75	0.918	20.54	0.911
Ross's Goose	*Chen rossii*	1.27	0.864	8.55	0.878	-	-	-	-
Ross's Gull	*Rhodostethia rosea*	-	-	-	-	-	-	-	-
Rough-legged Hawk	*Buteo lagopus*	43.80	0.811	37.47	0.821	-	-	0.07	0.839
Royal Tern	*Thalasseus maximus*	5.75	0.988	6.00	0.989	0.32	0.963	0.30	0.959
Ruby-crowned Kinglet	*Regulus calendula*	51.29	0.938	49.12	0.939	7.78	0.939	12.11	0.946
Ruby-throated Hummingbird	*Archilochus colubris*	1.60	0.969	2.54	0.982	9.01	0.785	14.26	0.784
Ruddy Duck	*Oxyura jamaicensis*	31.47	0.873	36.46	0.875	1.63	0.895	2.19	0.902
Ruddy Ground-Dove	*Columbina talpacoti*	0.16	-	0.48	0.963	-	-	-	-
Ruddy Turnstone	*Arenaria interpres*	8.57	0.962	7.87	0.961	-	-	-	-
Ruff	*Philomachus pugnax*	-	-	-	-	-	-	-	-
Ruffed Grouse	*Bonasa umbellus*	30.61	0.917	25.72	0.921	3.38	0.858	3.68	0.871
Rufous Hummingbird	*Selasphorus rufus*	0.98	0.914	3.25	0.931	2.24	0.972	2.72	0.970
Rufous-crowned Sparrow	*Aimophila ruficeps*	5.48	0.981	5.81	0.981	1.09	0.964	1.32	0.967
Rufous-winged Sparrow	*Peucaea carpalis*	0.35	0.979	0.43	0.984	-	-	0.05	0.982
Rusty Blackbird	*Euphagus carolinus*	29.04	0.805	19.24	0.805	1.09	0.956	0.56	0.953
Sabine's Gull	*Xema sabini*	-	-	-	-	-	-	-	-
Sage Sparrow	*Amphispiza belli*	2.91	0.973	3.28	0.977	1.94	0.959	2.81	0.963
Sage Thrasher	*Oreoscoptes montanus*	1.78	0.955	1.78	0.952	2.56	0.971	4.62	0.976
Sanderling	*Calidris alba*	12.27	0.960	11.43	0.959	-	-	-	-

Table A.1. continued.

		Winter Distribution Models				Summer Distribution Models			
		1970-1979		2000-2009		1970-1979		2000-2009	
Common Name	**Scientific Name**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**
Sandhill Crane	*Grus canadensis*	5.09	0.874	10.03	0.888	-	-	-	-
Sandwich Tern	*Thalasseus sandvicensis*	2.09	0.988	2.00	0.989	-	-	-	-
Savannah Sparrow	*Passerculus sandwichensis*	35.33	0.941	38.17	0.944	28.64	0.887	30.87	0.887
Say's Phoebe	*Sayornis saya*	8.91	0.987	10.87	0.987	3.74	0.927	8.55	0.936
Scaled Quail	*Callipepla squamata*	3.22	0.989	2.36	0.989	2.35	0.986	2.65	0.981
Scarlet Tanager	*Piranga olivacea*	-	-	-	-	24.32	0.895	20.13	0.902
Scissor-tailed Flycatcher	*Tyrannus forficatus*	0.68	0.960	1.19	0.963	7.81	0.974	6.73	0.972
Scott's Oriole	*Icterus parisorum*	0.37	0.952	0.57	0.966	1.40	0.968	1.97	0.979
Seaside Sparrow	*Ammodramus maritimus*	4.30	0.964	3.07	0.959	0.27	0.939	0.30	0.959
Sedge Wren	*Cistothorus platensis*	6.42	0.968	8.56	0.969	4.15	0.928	5.85	0.940
Semipalmated Plover	*Charadrius semipalmatus*	7.03	0.972	6.05	0.970	-	-	0.24	0.994
Semipalmated Sandpiper	*Calidris pusilla*	3.82	0.918	0.13	0.815	-	-	0.05	0.998
Sharp-shinned Hawk	*Accipiter striatus*	46.33	0.832	71.29	0.850	-	-	1.51	0.657
Sharp-tailed Grouse	*Tympanuchus phasianellus*	2.83	0.965	4.99	0.967	0.89	0.933	1.46	0.945
Shiny Cowbird	*Molothrus bonariensis*	-	-	-	-	-	-	-	-
Short-billed Dowitcher	*Limnodromus griseus*	5.33	0.975	4.64	0.972	-	-	0.08	0.994
Short-eared Owl	*Asio flammeus*	17.96	0.733	13.00	0.717	1.12	0.872	0.97	0.896
Short-tailed Hawk	*Buteo brachyurus*	0.32	0.987	0.75	0.985	-	-	-	-
Sinaloa Wren	*Thryothorus sinaloa*	-	-	-	-	-	-	-	-
Sky Lark	*Alauda arvensis*	-	-	0.22	0.928	-	-	-	-
Slaty-backed Gull	*Larus schistisagus*	-	-	-	-	-	-	-	-
Smith's Longspur	*Calcarius pictus*	0.47	0.923	0.55	0.939	-	-	0.06	1.000
Smooth-billed Ani	*Crotophaga ani*	1.32	0.994	0.07	0.659	-	-	-	-
Snail Kite	*Rostrhamus sociabilis*	0.18	0.975	0.41	0.984	-	-	-	-
Snow Bunting	*Plectrophenax nivalis*	29.22	0.888	26.48	0.878	-	-	-	-
Snow Goose	*Chen caerulescens*	17.78	0.788	26.95	0.790	-	-	-	-
Snowy Egret	*Egretta thula*	10.66	0.982	12.88	0.986	1.56	0.887	2.04	0.888
Snowy Owl	*Bubo scandiacus*	7.71	0.855	5.63	0.860	-	-	-	-
Snowy Plover	*Charadrius nivosus*	3.41	0.979	3.09	0.981	-	-	-	-
Solitary Sandpiper	*Tringa solitaria*	0.97	0.938	1.13	0.949	-	-	0.58	0.976
Solitary Vireo complex	-	9.34	0.971	12.72	0.976	-	-	-	-
Song Sparrow	*Melospiza melodia*	82.03	0.933	77.08	0.939	58.58	0.927	55.90	0.936
Sora	*Porzana carolina*	10.70	0.935	11.03	0.942	-	-	-	-

Table A.1. continued.

		Winter Distribution Models				Summer Distribution Models			
		1970-1979		2000-2009		1970-1979		2000-2009	
Common Name	**Scientific Name**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**
Spectacled Eider	*Somateria fischeri*	-	-	-	-	-	-	-	-
Spot-breasted Oriole	*Icterus pectoralis*	0.33	0.996	0.15	0.939	-	-	-	-
Spotted Dove	*Streptopelia chinensis*	1.81	0.990	0.74	0.962	-	-	-	-
Spotted Owl	*Strix occidentalis*	0.51	0.968	0.69	0.955	-	-	0.04	0.928
Spotted Sandpiper	*Actitis macularius*	13.61	0.967	14.96	0.969	8.10	0.826	7.14	0.830
Spotted Towhee	*Pipilo maculatus*	-	-	-	-	8.11	0.948	12.21	0.956
Sprague's Pipit	*Anthus spragueii*	2.13	0.967	1.70	0.971	1.00	0.954	1.54	0.965
Spruce Grouse	*Falcipennis canadensis*	0.82	0.939	1.93	0.953	-	-	-	-
Steller's Eider	*Polysticta stelleri*	0.24	0.987	0.27	0.988	-	-	-	-
Steller's Jay	*Cyanocitta stelleri*	11.50	0.975	16.43	0.980	5.30	0.976	8.58	0.979
Stilt Sandpiper	*Calidris himantopus*	1.00	0.968	1.36	0.976	-	-	-	-
Sulphur-bellied Flycatcher	*Myiodynastes luteiventris*	-	-	-	-	-	-	0.04	0.932
Summer Tanager	*Piranga rubra*	0.89	0.915	1.78	0.927	16.98	0.951	16.69	0.955
Surf Scoter	*Melanitta perspicillata*	11.27	0.928	12.36	0.935	-	-	-	-
Surfbird	*Aphriza virgata*	2.02	0.989	2.40	0.990	-	-	-	-
Swainson's Hawk	*Buteo swainsoni*	1.62	0.852	0.59	0.852	4.45	0.909	7.57	0.919
Swainson's Thrush	*Catharus ustulatus*	-	-	-	-	11.38	0.956	16.12	0.960
Swainson's Warbler	*Limnothlypis swainsonii*	-	-	-	-	0.51	0.909	1.03	0.924
Swallow-tailed Kite	*Elanoides forficatus*	-	-	-	-	-	-	0.34	0.972
Swamp Sparrow	*Melospiza georgiana*	44.11	0.910	41.98	0.912	10.95	0.894	11.52	0.896
Tennessee Warbler	*Oreothlypis peregrina*	0.59	0.954	0.37	0.951	3.54	0.946	3.46	0.949
Thayer's Gull	*Larus thayeri*	2.57	0.888	7.69	0.924	-	-	-	-
Thick-billed Kingbird	*Tyrannus crassirostris*	0.08	-	0.20	0.981	-	-	0.03	0.912
Thick-billed Murre	*Uria lomvia*	1.21	0.943	0.70	0.948	-	-	-	-
Townsend's Solitaire	*Myadestes townsendi*	10.77	0.953	14.45	0.959	1.28	0.935	4.08	0.946
Townsend's Warbler	*Setophaga townsendi*	3.54	0.982	5.44	0.983	1.08	0.954	3.49	0.977
Tree Swallow	*Tachycineta bicolor*	8.59	0.965	9.80	0.968	28.48	0.867	36.34	0.855
Tricolored Blackbird	*Agelaius tricolor*	2.50	0.989	3.35	0.988	0.61	0.977	0.33	0.972
Tricolored Heron	*Egretta tricolor*	7.34	0.992	7.42	0.989	0.95	0.983	1.03	0.980
Tropical Kingbird	*Tyrannus melancholicus*	0.79	0.946	0.76	0.947	-	-	-	-
Tropical Parula	*Setophaga pitiayumi*	-	-	0.21	0.950	-	-	-	-
Trumpeter Swan	*Cygnus buccinator*	1.17	0.878	7.91	0.903	0.10	0.860	0.38	0.890
Tufted Puffin	*Fratercula cirrhata*	-	-	-	-	-	-	-	-

Table A.1. continued.

		Winter Distribution Models				Summer Distribution Models			
		1970-1979		2000-2009		1970-1979		2000-2009	
Common Name	**Scientific Name**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**
Tufted Titmouse	*Baeolophus bicolor*	-	-	-	-	35.98	0.965	36.43	0.967
Tufted/Black-crested Titmouse	*Baeolophus bicolor/atricristatus*	55.25	0.972	49.73	0.972	-	-	-	-
Tundra Swan	*Cygnus columbianus*	11.47	0.807	13.81	0.814	-	-	0.17	0.975
Turkey Vulture	*Cathartes aura*	26.35	0.943	34.60	0.951	8.22	0.789	15.91	0.797
Upland Sandpiper	*Bartramia longicauda*	-	-	-	-	7.56	0.886	6.97	0.887
Varied Bunting	*Passerina versicolor*	-	-	-	-	-	-	0.12	0.980
Varied Thrush	*Ixoreus naevius*	7.71	0.957	10.42	0.965	1.70	0.971	4.84	0.984
Varied Thrush	*Ixoreus naevius*	7.71	0.957	10.42	0.965	1.70	0.971	4.84	0.984
Vaux's Swift	*Chaetura vauxi*	-	-	0.32	0.971	0.62	0.941	0.77	0.933
Veery	*Catharus fuscescens*	-	-	-	-	22.27	0.931	18.49	0.943
Verdin	*Auriparus flaviceps*	4.07	0.988	4.35	0.989	1.42	0.989	2.05	0.990
Vermilion Flycatcher	*Pyrocephalus rubinus*	3.66	0.972	5.00	0.976	0.50	0.972	0.73	0.981
Vesper Sparrow	*Pooecetes gramineus*	19.07	0.915	12.86	0.922	23.97	0.871	23.73	0.886
Violet-crowned Hummingbird	*Amazilia violiceps*	-	-	0.25	0.995	-	-	-	-
Violet-green Swallow	*Tachycineta thalassina*	1.38	0.975	1.13	0.973	6.27	0.940	9.60	0.947
Virginia Rail	*Rallus limicola*	13.00	0.880	16.21	0.892	-	-	-	-
Virginia's Warbler	*Oreothlypis virginiae*	-	-	-	-	0.26	0.955	1.69	0.983
Wandering Tattler	*Tringa incana*	1.62	0.991	1.13	0.993	-	-	0.06	0.998
Warbling Vireo	*Vireo gilvus*	-	-	-	-	27.81	0.805	35.90	0.804
Western Bluebird	*Sialia mexicana*	8.51	0.983	10.11	0.984	3.11	0.957	3.54	0.964
Western Grebe	*Aechmophorus occidentalis*	6.17	0.949	10.30	0.956	-	-	1.12	0.884
Western Gull	*Larus occidentalis*	3.29	0.991	4.77	0.992	0.30	0.995	0.16	0.980
Western Kingbird	*Tyrannus verticalis*	1.02	0.888	1.49	0.889	15.84	0.931	19.68	0.936
Western Meadowlark	*Sturnella neglecta*	21.82	0.958	20.34	0.960	30.20	0.940	28.64	0.944
Western Sandpiper	*Calidris mauri*	10.45	0.959	8.94	0.959	-	-	0.09	0.943
Western Screech-Owl	*Megascops kennicottii*	0.02	-	6.73	0.960	0.15	0.877	0.13	0.892
Western Scrub-Jay	*Aphelocoma californica*	0.03	-	13.19	0.926	5.63	0.973	5.57	0.980
Western Tanager	*Piranga ludoviciana*	1.05	0.936	1.83	0.939	7.18	0.959	12.75	0.967
Western Wood-Pewee	*Contopus sordidulus*	-	-	-	-	9.11	0.941	14.14	0.946
Whimbrel	*Numenius phaeopus*	3.20	0.973	2.84	0.974	-	-	0.16	0.996
Whiskered Auklet	*Aethia pygmaea*	-	-	-	-	-	-	-	-
Whiskered Screech-Owl	*Megascops trichopsis*	0.12	0.951	0.19	0.990	-	-	-	-
White Ibis	*Eudocimus albus*	5.20	0.991	7.32	0.993	1.30	0.978	2.56	0.982

Table A.1. continued.

		Winter Distribution Models				Summer Distribution Models			
		1970-1979		2000-2009		1970-1979		2000-2009	
Common Name	**Scientific Name**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**
White-breasted Nuthatch	*Sitta carolinensis*	71.48	0.938	71.06	0.943	19.98	0.789	29.11	0.800
White-crowned Pigeon	*Patagioenas leucocephala*	0.33	0.999	0.32	0.958	0.06	0.999	0.09	1.000
White-crowned Sparrow	*Zonotrichia leucophrys*	49.62	0.878	51.04	0.883	3.32	0.974	6.88	0.979
White-eyed Vireo	*Vireo griseus*	6.80	0.981	8.08	0.982	20.22	0.951	20.56	0.950
White-faced Ibis	*Plegadis chihi*	1.55	0.962	3.49	0.969	0.31	0.889	0.95	0.929
White-headed Woodpecker	*Picoides albolarvatus*	1.13	0.974	1.24	0.975	0.77	0.979	0.77	0.976
White-rumped Sandpiper	*Calidris fuscicollis*	-	-	-	-	-	-	-	-
White-tailed Hawk	*Buteo albicaudatus*	0.75	0.990	1.35	0.981	-	-	0.12	0.995
White-tailed Kite	*Elanus leucurus*	4.82	0.982	6.65	0.984	0.78	0.976	0.34	0.967
White-tailed Ptarmigan	*Lagopus leucura*	0.18	0.949	0.15	0.954	-	-	-	-
White-throated Sparrow	*Zonotrichia albicollis*	59.98	0.919	56.97	0.920	15.64	0.975	14.60	0.975
White-throated Swift	*Aeronautes saxatalis*	3.41	0.984	3.65	0.984	0.98	0.897	1.18	0.914
White-tipped Dove	*Leptotila verreauxi*	0.75	0.986	0.92	0.998	-	-	0.13	0.998
White-winged Crossbill	*Loxia leucoptera*	7.93	0.876	9.34	0.884	0.44	0.945	2.09	0.957
White-winged Dove	*Zenaida asiatica*	2.06	0.962	8.44	0.965	0.92	0.982	2.98	0.991
White-winged Scoter	*Melanitta fusca*	13.80	0.913	11.45	0.911	-	-	0.10	0.926
Whooping Crane	*Grus americana*	0.14	0.965	0.30	0.928	-	-	-	-
Wild Turkey	*Meleagris gallopavo*	7.89	0.689	50.06	0.725	1.54	0.683	17.20	0.730
Willet	*Tringa semipalmata*	7.97	0.983	7.17	0.981	3.45	0.901	4.21	0.896
Williamson's Sapsucker	*Sphyrapicus thyroideus*	0.90	0.966	1.11	0.961	0.16	0.940	1.10	0.976
Willow Flycatcher	*Empidonax traillii*	-	-	-	-	12.66	0.847	15.47	0.846
Willow Ptarmigan	*Lagopus lagopus*	0.61	0.977	0.91	0.988	-	-	0.36	0.996
Wilson's Phalarope	*Phalaropus tricolor*	-	-	0.18	0.917	1.83	0.910	2.18	0.917
Wilson's Plover	*Charadrius wilsonia*	1.89	0.982	1.33	0.980	-	-	-	-
Wilson's Snipe	*Gallinago delicata*	48.09	0.856	12.25	0.766	11.91	0.897	17.99	0.898
Wilson's Warbler	*Cardellina pusilla*	2.58	0.940	3.90	0.950	5.27	0.942	7.95	0.949
Winter Wren	*Troglodytes hiemalis*	39.60	0.874	41.59	0.878	9.37	0.946	13.70	0.953
Wood Duck	*Aix sponsa*	28.82	0.836	37.22	0.841	6.46	0.716	9.44	0.735
Wood Stork	*Mycteria americana*	2.48	0.991	3.61	0.992	0.41	0.936	0.58	0.971
Wood Thrush	*Hylocichla mustelina*	0.94	0.862	0.21	0.828	45.00	0.931	32.71	0.932
Worm-eating Warbler	*Helmitheros vermivorum*	-	-	0.16	0.971	2.67	0.876	4.02	0.881
Wrentit	*Chamaea fasciata*	4.37	0.995	4.78	0.994	2.97	0.991	1.98	0.991
Xantu's Murrelet	*Synthliboramphus hypoleucus*	-	-	-	-	-	-	-	-

Table A.1. continued.

		Winter Distribution Models				Summer Distribution Models			
		1970-1979		2000-2009		1970-1979		2000-2009	
Common Name	**Scientific Name**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% CBC Circles)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**	**Presence Data (% BBS Routes)**	**Model Performance (AUC)**
Yellow Rail	*Coturnicops noveboracensis*	0.23	0.961	0.31	0.954	-	-	-	-
Yellow Warbler	*Setophaga petechia*	1.48	0.932	2.23	0.941	43.20	0.850	44.22	0.856
Yellow-bellied Flycatcher	*Empidonax flaviventris*	-	-	-	-	1.87	0.948	2.86	0.951
Yellow-bellied Sapsucker	*Sphyrapicus varius*	45.87	0.886	37.21	0.925	8.24	0.929	12.24	0.932
Yellow-billed Cuckoo	*Coccyzus americanus*	-	-	-	-	38.92	0.935	29.49	0.937
Yellow-billed Loon	*Gavia adamsii*	0.40	0.902	0.78	0.915	-	-	-	-
Yellow-billed Magpie	*Pica nuttalli*	1.46	0.991	1.52	0.981	1.18	0.993	0.65	0.948
Yellow-breasted Chat	*Icteria virens*	2.13	0.908	2.16	0.913	27.05	0.910	23.39	0.912
Yellow-crowned Night-Heron	*Nyctanassa violacea*	4.16	0.982	3.79	0.977	1.29	0.933	0.92	0.933
Yellow-eyed Junco	*Junco phaeonotus*	0.38	0.985	0.37	0.983	-	-	0.03	0.990
Yellow-footed Gull	*Larus livens*	0.00	-	0.19	0.996	-	-	-	-
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	2.87	0.838	3.37	0.846	6.74	0.913	8.19	0.915
Yellow-rumped Warbler	*Setophaga coronata*	49.77	0.930	52.21	0.931	7.92	0.951	13.13	0.959
Yellow-throated Vireo	*Vireo flavifrons*	0.69	0.959	0.46	0.953	13.58	0.816	15.54	0.832
Yellow-throated Warbler	*Setophaga dominica*	4.55	0.976	4.46	0.979	3.98	0.899	5.86	0.901
Zone-tailed Hawk	*Buteo albonotatus*	-	-	0.62	0.976	-	-	-	-

Appendix 2: Model Performance Tested Using Historical Data

Table A.2. Summary of model performance for winter and summer bioclimatic envelope models (BEMs) and climate-richness models (CRMs).

	Winter (CBC) 1956 - 1965	**Summer (BBS) 1966 - 1975**
Bioclimatic Envelope Models		
Number of species	440	403
Median AUC (AUC Range)	0.942 (0.572 – 0.999)	0.942 (0.564 – 0.999)
Summed BEMs		
Pearson's r	89.0	58.5
Climate Richness Models		
Number of test records	6080	2180
% Deviance explained (Independent)	82.6	36.1
% Deviance explained (CV)	84.6	51.1

Bioclimatic envelope models and climate-richness models were built using bird and climate data for the survey period 2000–2009, then projected to historical climate surfaces (1955 – 1964 and 1965 – 1974, for winter and summer seasons, respectively) and tested with observed data from the corresponding historical survey periods (1956 – 1965 and 1966 – 1975, for winter and summer, respectively). Bioclimatic envelope models (BEMs) were built for individual species and Area Under the Receiver Operating Curve (AUC) was calculated for each species. Median AUC scores across all species, for each season, are shown in the table above with the range in AUC values shown in parentheses (). To assess how well those same BEMs were able to estimate species richness, we summed historical predictions from BEMs across species and compared them to observed species richness from the same historical period. Climate-richness models were built using boosted regression trees and a Poisson distribution with a learning rate = 0.01 and tree complexity = 5. See the Methods section in Chapter 1 for modeling details.

Appendix 3: Winter Refugia

Table A.3. Estimates of the size of winter climate refugia relative to current range size for wintering birds. Current range sizes represent core areas within the winter distribution estimated using a maximum Kappa threshold and are reported in units of 100 km^2. Refugia estimates indicate the proportion of the current range that will remain consistently suitable over the period of interest. Measures are provided for each of three future emissions scenarios (i.e., low (B2), moderate (A1B), and high (A2) emissions) as well as a “no regrets” approach which identifies areas that are expected to remain suitable across all scenarios for the period of interest.

			2000-2020				2000-2050				2000-2080			
Common Name	**Scientific Name**	**Current range**	**B2**	**A1B**	**A2**	**No regrets**	**B2**	**A1B**	**A2**	**No regrets**	**B2**	**A1B**	**A2**	**No regrets**
Abert's Towhee	*Melozone aberti*	2310	0.90	0.83	0.87	0.81	0.90	0.82	0.87	0.80	0.89	0.81	0.86	0.79
Acorn Woodpecker	*Melanerpes formicivorus*	3630	0.90	0.92	0.90	0.88	0.82	0.88	0.87	0.80	0.74	0.83	0.74	0.68
Allen's Hummingbird	*Selasphorus sasin*	206	0.24	0.30	0.27	0.19	0.06	0.07	0.09	0.03	0.02	0.00	0.00	0.00
Altamira Oriole	*Icterus gularis*	234	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
American Avocet	*Recurvirostra americana*	1880	0.57	0.54	0.56	0.43	0.38	0.34	0.37	0.32	0.34	0.27	0.30	0.25
American Bittern	*Botaurus lentiginosus*	2796	0.62	0.59	0.62	0.52	0.39	0.32	0.36	0.25	0.29	0.25	0.28	0.20
American Black Duck	*Anas rubripes*	26878	0.75	0.82	0.79	0.71	0.49	0.61	0.52	0.46	0.44	0.44	0.37	0.35
American Coot	*Fulica americana*	52451	0.90	0.89	0.91	0.87	0.89	0.89	0.91	0.85	0.88	0.88	0.89	0.83
American Crow	*Corvus brachyrhynchos*	90889	0.88	0.89	0.87	0.85	0.82	0.84	0.81	0.78	0.75	0.78	0.71	0.67
American Dipper	*Cinclus mexicanus*	72365	0.76	0.80	0.79	0.72	0.64	0.64	0.63	0.56	0.48	0.54	0.42	0.38
American Goldfinch	*Spinus tristis*	77106	0.95	0.95	0.95	0.94	0.92	0.93	0.92	0.91	0.91	0.90	0.86	0.85
American Kestrel	*Falco sparverius*	71497	0.99	0.99	0.98	0.98	0.99	0.98	0.98	0.98	0.98	0.98	0.98	0.98
American Oystercatcher	*Haematopus palliatus*	2070	0.21	0.21	0.14	0.10	0.05	0.08	0.07	0.03	0.03	0.03	0.04	0.02
American Pipit	*Anthus rubescens*	25812	0.92	0.89	0.92	0.88	0.91	0.89	0.91	0.87	0.88	0.87	0.86	0.82
American Redstart	*Setophaga ruticilla*	338	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
American Robin	*Turdus migratorius*	71016	0.93	0.94	0.94	0.92	0.91	0.92	0.92	0.90	0.89	0.89	0.86	0.85
American Three-toed Woodpecker	*Picoides dorsalis*	68821	0.49	0.55	0.52	0.40	0.34	0.35	0.35	0.25	0.22	0.28	0.18	0.12
American Tree Sparrow	*Spizella arborea*	55461	0.83	0.83	0.82	0.79	0.79	0.77	0.75	0.73	0.75	0.69	0.62	0.61
American White Pelican	*Pelecanus erythrorhynchos*	12666	0.69	0.76	0.70	0.63	0.56	0.63	0.59	0.53	0.53	0.53	0.48	0.43
American Wigeon	*Anas americana*	59391	0.85	0.83	0.86	0.80	0.82	0.82	0.85	0.78	0.82	0.79	0.84	0.76

American Woodcock	*Scolopax minor*	12605	0.95	0.93	0.94	0.92	0.94	0.93	0.93	0.91	0.93	0.93	0.92	0.90
Ancient Murrelet	*Synthliboramphus antiquus*	996	0.43	0.48	0.48	0.40	0.39	0.42	0.43	0.34	0.35	0.32	0.33	0.23
Anhinga	*Anhinga anhinga*	5904	0.92	0.91	0.92	0.88	0.86	0.87	0.89	0.81	0.86	0.86	0.89	0.81
Anna's Hummingbird	*Calypte anna*	4589	0.85	0.84	0.85	0.81	0.81	0.81	0.82	0.78	0.79	0.80	0.79	0.76
Aplomado Falcon	*Falco femoralis*	59	0.36	0.36	0.32	0.24	0.27	0.34	0.22	0.15	0.27	0.34	0.22	0.15
Arizona/Strickland's Woodpecker	*Picoides arizonae/stricklandi*	145	0.84	0.91	0.84	0.80	0.74	0.88	0.74	0.68	0.65	0.81	0.48	0.44
Ash-throated Flycatcher	*Myiarchus cinerascens*	722	0.88	0.87	0.87	0.87	0.88	0.87	0.87	0.87	0.88	0.87	0.87	0.86
Atlantic Puffin	*Fratercula arctica*	1620	0.16	0.19	0.23	0.12	0.13	0.16	0.18	0.08	0.06	0.10	0.10	0.02
Audubon's Oriole	*Icterus graduacauda*	479	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Bachman's Sparrow	*Peucaea aestivalis*	1871	0.88	0.87	0.88	0.87	0.83	0.87	0.84	0.80	0.80	0.87	0.78	0.75
Baird's Sparrow	*Ammodramus bairdii*	272	0.19	0.40	0.25	0.19	0.05	0.09	0.03	0.02	0.00	0.01	0.00	0.00
Bald Eagle	*Haliaeetus leucocephalus*	74349	0.75	0.76	0.75	0.68	0.60	0.65	0.62	0.54	0.53	0.53	0.42	0.38
Baltimore Oriole	*Icterus galbula*	2476	0.63	0.55	0.47	0.40	0.49	0.48	0.43	0.34	0.43	0.46	0.32	0.26
Band-tailed Pigeon	*Patagioenas fasciata*	2743	0.61	0.61	0.64	0.54	0.50	0.52	0.55	0.43	0.46	0.46	0.43	0.36
Barn Owl	*Tyto alba*	13067	0.68	0.74	0.71	0.62	0.50	0.60	0.56	0.45	0.40	0.46	0.38	0.32
Barn Swallow	*Hirundo rustica*	2083	0.78	0.77	0.80	0.70	0.74	0.72	0.77	0.66	0.68	0.71	0.74	0.61
Barred Owl	*Strix varia*	36977	0.89	0.90	0.90	0.87	0.88	0.88	0.88	0.85	0.87	0.87	0.85	0.82
Barrow's Goldeneye	*Bucephala islandica*	32361	0.49	0.49	0.52	0.41	0.38	0.36	0.39	0.29	0.29	0.27	0.27	0.20
Bell's Vireo	*Vireo bellii*	185	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Belted Kingfisher	*Megaceryle alcyon*	79872	0.96	0.97	0.97	0.96	0.95	0.97	0.96	0.94	0.94	0.96	0.95	0.92
Bendire's Thrasher	*Toxostoma bendirei*	221	0.86	0.87	0.88	0.84	0.86	0.87	0.86	0.82	0.85	0.87	0.84	0.79
Bewick's Wren	*Thryomanes bewickii*	20835	0.95	0.94	0.94	0.93	0.89	0.92	0.92	0.87	0.86	0.86	0.86	0.81
Black Guillemot	*Cepphus grylle*	9811	0.48	0.48	0.57	0.43	0.44	0.45	0.53	0.39	0.40	0.39	0.47	0.33
Black Oystercatcher	*Haematopus bachmani*	1733	0.44	0.52	0.47	0.40	0.36	0.42	0.39	0.31	0.32	0.33	0.34	0.26
Black Phoebe	*Sayornis nigricans*	8563	0.94	0.90	0.91	0.89	0.93	0.90	0.91	0.89	0.93	0.89	0.90	0.89
Black Rail	*Laterallus jamaicensis*	641	0.69	0.59	0.68	0.56	0.63	0.56	0.61	0.52	0.61	0.54	0.58	0.50
Black Rosy-Finch	*Leucosticte atrata*	910	0.22	0.40	0.31	0.18	0.06	0.11	0.09	0.03	0.00	0.01	0.00	0.00
Black Scoter	*Melanitta americana*	6216	0.66	0.66	0.68	0.62	0.60	0.63	0.66	0.57	0.59	0.60	0.65	0.55
Black Skimmer	*Rynchops niger*	2019	0.37	0.37	0.30	0.23	0.14	0.16	0.16	0.12	0.12	0.12	0.10	0.08
Black Turnstone	*Arenaria melanocephala*	3163	0.69	0.76	0.75	0.68	0.65	0.73	0.73	0.64	0.63	0.67	0.70	0.60
Black Vulture	*Coragyps atratus*	17906	0.97	0.98	0.97	0.96	0.96	0.97	0.96	0.95	0.93	0.97	0.93	0.91
Black-and-white Warbler	*Mniotilta varia*	3588	0.68	0.69	0.59	0.57	0.57	0.63	0.55	0.52	0.55	0.58	0.55	0.50
Black-backed Woodpecker	*Picoides arcticus*	42058	0.68	0.69	0.67	0.59	0.48	0.54	0.51	0.40	0.31	0.34	0.25	0.19
Black-bellied Plover	*Pluvialis squatarola*	3634	0.55	0.58	0.56	0.46	0.42	0.44	0.48	0.35	0.35	0.37	0.45	0.30
Black-bellied Whistling-Duck	*Dendrocygna autumnalis*	755	0.00	0.46	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Black-billed Magpie	*Pica hudsonia*	92305	0.78	0.80	0.81	0.74	0.62	0.70	0.71	0.58	0.47	0.56	0.50	0.39

Black-billed Magpie	*Pica hudsonia*	92305	0.78	0.80	0.81	0.74	0.62	0.70	0.71	0.58	0.47	0.56	0.50	0.39
Black-capped Chickadee	*Poecile atricapillus*	125249	0.91	0.93	0.91	0.89	0.83	0.87	0.85	0.81	0.79	0.80	0.73	0.71
Black-chinned Hummingbird	*Archilochus alexandri*	60	0.07	0.40	0.03	0.02	0.05	0.08	0.00	0.00	0.00	0.08	0.00	0.00
Black-chinned Sparrow	*Spizella atrogularis*	1147	0.83	0.84	0.80	0.77	0.73	0.78	0.76	0.71	0.60	0.72	0.65	0.53
Black-crowned Night-Heron	*Nycticorax nycticorax*	12587	0.68	0.66	0.68	0.59	0.60	0.55	0.61	0.51	0.53	0.50	0.57	0.44
Black-headed Grosbeak	*Pheucticus melanocephalus*	29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Black-headed Gull	*Chroicocephalus ridibundus*	2940	0.46	0.44	0.49	0.40	0.40	0.40	0.46	0.36	0.34	0.33	0.37	0.27
Black-legged Kittiwake	*Rissa tridactyla*	4907	0.59	0.48	0.58	0.45	0.54	0.44	0.55	0.40	0.48	0.42	0.52	0.38
Black-necked Stilt	*Himantopus mexicanus*	1532	0.76	0.74	0.75	0.68	0.60	0.56	0.66	0.48	0.45	0.39	0.52	0.34
Black-tailed Gnatcatcher	*Polioptila melanura*	2374	0.94	0.89	0.92	0.89	0.93	0.89	0.92	0.89	0.93	0.89	0.91	0.88
Black-throated Blue Warbler	*Setophaga caerulescens*	179	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Black-throated Gray Warbler	*Setophaga nigrescens*	171	0.67	0.71	0.70	0.64	0.62	0.67	0.66	0.60	0.61	0.66	0.55	0.50
Black-throated Green Warbler	*Setophaga virens*	268	0.70	0.67	0.70	0.66	0.67	0.67	0.70	0.63	0.66	0.67	0.70	0.62
Black-throated Sparrow	*Amphispiza bilineata*	6667	0.93	0.92	0.94	0.88	0.93	0.91	0.93	0.88	0.92	0.91	0.93	0.87
Black-vented Shearwater	*Puffinus opisthomelas*	260	0.38	0.33	0.38	0.28	0.31	0.22	0.32	0.18	0.27	0.12	0.20	0.07
Blue Jay	*Cyanocitta cristata*	79800	0.96	0.97	0.96	0.95	0.95	0.95	0.95	0.94	0.94	0.94	0.92	0.91
Blue-gray Gnatcatcher	*Polioptila caerulea*	10672	0.88	0.85	0.87	0.83	0.85	0.85	0.87	0.81	0.84	0.84	0.87	0.80
Blue-winged Teal	*Anas discors*	4664	0.82	0.83	0.83	0.79	0.82	0.81	0.82	0.79	0.82	0.81	0.82	0.79
Boat-tailed Grackle	*Quiscalus major*	2830	0.67	0.63	0.58	0.55	0.42	0.44	0.44	0.36	0.31	0.35	0.32	0.27
Bohemian Waxwing	*Bombycilla garrulus*	81537	0.75	0.79	0.77	0.70	0.64	0.68	0.64	0.57	0.53	0.57	0.48	0.43
Bonaparte's Gull	*Chroicocephalus philadelphia*	20049	0.88	0.87	0.83	0.80	0.68	0.76	0.74	0.64	0.65	0.69	0.67	0.57
Boreal Chickadee	*Poecile hudsonicus*	98361	0.87	0.89	0.88	0.85	0.73	0.76	0.74	0.70	0.64	0.65	0.62	0.59
Boreal Owl	*Aegolius funereus*	1024	0.04	0.14	0.14	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Brandt's Cormorant	*Phalacrocorax penicillatus*	1202	0.60	0.66	0.65	0.59	0.56	0.61	0.63	0.54	0.53	0.51	0.61	0.48
Brant	*Branta bernicla*	1299	0.43	0.52	0.51	0.40	0.36	0.47	0.46	0.31	0.30	0.43	0.42	0.27
Brewer's Blackbird	*Euphagus cyanocephalus*	43929	0.82	0.78	0.83	0.75	0.79	0.73	0.79	0.71	0.78	0.71	0.75	0.68
Brewer's Sparrow	*Spizella breweri*	5259	0.94	0.92	0.93	0.90	0.93	0.91	0.92	0.89	0.93	0.91	0.92	0.89
Bridled Titmouse	*Baeolophus wollweberi*	757	0.91	0.92	0.91	0.89	0.86	0.92	0.89	0.83	0.81	0.88	0.81	0.73
Broad-billed Hummingbird	*Cynanthus latirostris*	207	0.74	0.88	0.79	0.71	0.61	0.88	0.77	0.59	0.48	0.86	0.35	0.27
Broad-tailed Hummingbird	*Selasphorus platycercus*	56	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Broad-winged Hawk	*Buteo platypterus*	259	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
Bronzed Cowbird	*Molothrus aeneus*	907	0.58	0.62	0.48	0.45	0.43	0.52	0.43	0.37	0.03	0.46	0.25	0.02
Brown Creeper	*Certhia americana*	65911	0.92	0.96	0.95	0.91	0.87	0.92	0.90	0.85	0.85	0.87	0.80	0.78
Brown Pelican	*Pelecanus occidentalis*	2948	0.41	0.46	0.43	0.36	0.29	0.36	0.37	0.28	0.28	0.29	0.29	0.25
Brown Thrasher	*Toxostoma rufum*	20952	0.97	0.98	0.97	0.97	0.93	0.94	0.93	0.92	0.91	0.91	0.84	0.84
Brown-capped Rosy-Finch	*Leucosticte australis*	657	0.56	0.76	0.64	0.52	0.24	0.52	0.31	0.21	0.10	0.27	0.03	0.03

Brown-crested Flycatcher	*Myiarchus tyrannulus*	329	0.61	0.29	0.29	0.13	0.61	0.26	0.28	0.13	0.61	0.26	0.28	0.13
Brown-headed Cowbird	*Molothrus ater*	46227	0.92	0.90	0.91	0.88	0.90	0.88	0.89	0.86	0.89	0.86	0.87	0.84
Brown-headed Nuthatch	*Sitta pusilla*	8834	0.88	0.92	0.91	0.83	0.82	0.85	0.83	0.75	0.70	0.84	0.72	0.59
Buff-bellied Hummingbird	*Amazilia yucatanensis*	176	0.20	0.01	0.00	0.00	0.13	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Bufflehead	*Bucephala albeola*	46239	0.77	0.75	0.77	0.70	0.63	0.65	0.66	0.55	0.58	0.56	0.58	0.49
Bullock's Oriole	*Icterus bullockii*	175	0.40	0.41	0.43	0.35	0.29	0.31	0.33	0.23	0.15	0.19	0.05	0.03
Burrowing Owl	*Athene cunicularia*	5272	0.55	0.62	0.60	0.49	0.42	0.42	0.42	0.35	0.34	0.35	0.33	0.28
Bushtit	*Psaltriparus minimus*	13995	0.89	0.93	0.92	0.87	0.78	0.85	0.83	0.77	0.71	0.79	0.71	0.68
Cactus Wren	*Campylorhynchus brunneicapillus*	7047	0.91	0.91	0.93	0.87	0.90	0.90	0.92	0.85	0.85	0.89	0.91	0.81
California Gnatcatcher	*Polioptila californica*	113	0.58	0.70	0.69	0.54	0.58	0.66	0.69	0.50	0.58	0.58	0.59	0.44
California Gull	*Larus californicus*	17029	0.45	0.41	0.44	0.34	0.36	0.33	0.36	0.27	0.30	0.29	0.29	0.22
California Quail	*Callipepla californica*	12221	0.88	0.86	0.87	0.83	0.79	0.83	0.85	0.74	0.75	0.77	0.77	0.70
California Thrasher	*Toxostoma redivivum*	1912	0.90	0.88	0.91	0.87	0.87	0.86	0.89	0.83	0.86	0.85	0.86	0.81
California Towhee	*Melozone crissalis*	2086	0.92	0.89	0.91	0.88	0.87	0.88	0.89	0.84	0.86	0.86	0.86	0.82
Canada/Cackling Goose	*Branta canadensis/hutchinsii*	64121	0.88	0.90	0.89	0.86	0.78	0.81	0.79	0.75	0.72	0.73	0.69	0.66
Canvasback	*Aythya valisineria*	42514	0.87	0.80	0.85	0.78	0.87	0.79	0.84	0.77	0.86	0.79	0.84	0.77
Canyon Towhee	*Melozone fusca*	5750	0.87	0.93	0.93	0.84	0.80	0.80	0.89	0.73	0.76	0.73	0.82	0.65
Canyon Wren	*Catherpes mexicanus*	12345	0.82	0.79	0.80	0.74	0.71	0.72	0.75	0.63	0.64	0.65	0.64	0.55
Cape May Warbler	*Setophaga tigrina*	126	0.50	0.48	0.48	0.47	0.36	0.42	0.47	0.34	0.31	0.40	0.42	0.29
Carolina Chickadee	*Poecile carolinensis*	24321	0.96	0.97	0.97	0.96	0.94	0.94	0.94	0.93	0.93	0.93	0.91	0.91
Carolina Wren	*Thryothorus ludovicianus*	29422	0.98	0.98	0.98	0.97	0.97	0.98	0.97	0.96	0.95	0.97	0.93	0.92
Caspian Tern	*Hydroprogne caspia*	2426	0.63	0.65	0.66	0.57	0.59	0.60	0.64	0.52	0.51	0.56	0.59	0.47
Cassin's Auklet	*Ptychoramphus aleuticus*	240	0.14	0.19	0.19	0.12	0.12	0.18	0.18	0.11	0.12	0.18	0.17	0.11
Cassin's Finch	*Carpodacus cassinii*	20487	0.70	0.75	0.73	0.65	0.46	0.59	0.54	0.40	0.38	0.47	0.33	0.27
Cassin's Kingbird	*Tyrannus vociferans*	270	0.77	0.77	0.77	0.76	0.73	0.71	0.71	0.70	0.70	0.66	0.54	0.54
Cassin's Sparrow	*Peucaea cassinii*	3167	0.87	0.92	0.90	0.85	0.81	0.90	0.83	0.78	0.69	0.82	0.64	0.59
Cattle Egret	*Bubulcus ibis*	5104	0.89	0.88	0.89	0.87	0.89	0.88	0.89	0.87	0.88	0.87	0.89	0.86
Cave Swallow	*Petrochelidon fulva*	127	0.59	0.50	0.13	0.06	0.52	0.06	0.06	0.00	0.47	0.06	0.06	0.00
Cedar Waxwing	*Bombycilla cedrorum*	52802	0.92	0.92	0.93	0.89	0.86	0.88	0.88	0.82	0.79	0.81	0.69	0.64
Chestnut-backed Chickadee	*Poecile rufescens*	7475	0.79	0.86	0.83	0.78	0.69	0.77	0.75	0.68	0.62	0.66	0.64	0.59
Chestnut-collared Longspur	*Calcarius ornatus*	1876	0.50	0.68	0.53	0.41	0.30	0.41	0.33	0.23	0.16	0.14	0.05	0.03
Chihuahuan Raven	*Corvus cryptoleucus*	6400	0.87	0.90	0.89	0.83	0.79	0.88	0.85	0.76	0.71	0.87	0.82	0.68
Chipping Sparrow	*Spizella passerina*	21349	0.96	0.97	0.96	0.96	0.95	0.95	0.95	0.94	0.93	0.94	0.92	0.90
Chuck-will's-widow	*Caprimulgus carolinensis*	377	0.70	0.53	0.70	0.53	0.69	0.53	0.69	0.53	0.69	0.53	0.69	0.53
Chukar	*Alectoris chukar*	3126	0.66	0.72	0.68	0.54	0.38	0.54	0.48	0.28	0.30	0.31	0.16	0.09
Cinnamon Teal	*Anas cyanoptera*	4671	0.73	0.70	0.73	0.62	0.66	0.65	0.69	0.57	0.62	0.63	0.67	0.53

Clapper Rail	*Rallus longirostris*	2861	0.46	0.46	0.46	0.41	0.32	0.36	0.39	0.30	0.31	0.32	0.38	0.29
Clark's Grebe	*Aechmophorus clarkii*	2222	0.70	0.70	0.73	0.64	0.55	0.59	0.64	0.49	0.44	0.40	0.49	0.35
Clark's Nutcracker	*Nucifraga columbiana*	19623	0.67	0.79	0.75	0.64	0.44	0.55	0.52	0.41	0.32	0.37	0.25	0.23
Clay-colored Sparrow	*Spizella pallida*	1827	0.83	0.83	0.81	0.71	0.79	0.80	0.77	0.68	0.64	0.77	0.70	0.59
Collared Turtle-Dove	*Streptopelia roseogrisea*	1002	0.46	0.39	0.51	0.34	0.41	0.37	0.41	0.30	0.41	0.37	0.37	0.29
Common Eider	*Somateria mollissima*	35160	0.66	0.66	0.76	0.61	0.60	0.59	0.71	0.54	0.55	0.50	0.66	0.45
Common Goldeneye	*Bucephala clangula*	78107	0.71	0.68	0.71	0.63	0.68	0.64	0.67	0.60	0.66	0.63	0.65	0.57
Common Grackle	*Quiscalus quiscula*	50513	0.90	0.87	0.90	0.87	0.89	0.87	0.89	0.86	0.89	0.86	0.87	0.84
Common Ground-Dove	*Columbina passerina*	5364	0.79	0.85	0.77	0.72	0.68	0.76	0.72	0.63	0.62	0.75	0.67	0.56
Common Loon	*Gavia immer*	25712	0.49	0.53	0.49	0.42	0.33	0.39	0.37	0.29	0.26	0.28	0.25	0.21
Common Merganser	*Mergus merganser*	77765	0.75	0.73	0.75	0.68	0.68	0.66	0.68	0.60	0.62	0.62	0.61	0.52
Common Moorhen/Gallinule	*Gallinula chloropus/galeata*	6950	0.79	0.76	0.77	0.70	0.74	0.67	0.71	0.63	0.71	0.64	0.70	0.60
Common Murre	*Uria aalge*	4839	0.74	0.77	0.78	0.74	0.70	0.74	0.75	0.70	0.67	0.68	0.70	0.65
Common Myna	*Acridotheres tristis*	108	0.46	0.33	0.44	0.33	0.00	0.19	0.06	0.00	0.00	0.00	0.00	0.00
Common Pauraque	*Nyctidromus albicollis*	832	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Common Poorwill	*Phalaenoptilus nuttallii*	697	0.44	0.48	0.46	0.41	0.42	0.46	0.45	0.38	0.41	0.45	0.45	0.37
Common Raven	*Corvus corax*	147969	0.92	0.94	0.92	0.91	0.85	0.87	0.85	0.83	0.75	0.76	0.65	0.64
Common Redpoll	*Acanthis flammea*	108601	0.82	0.81	0.82	0.79	0.76	0.74	0.74	0.72	0.68	0.66	0.62	0.60
Common Tern	*Sterna hirundo*	814	0.59	0.62	0.64	0.55	0.50	0.54	0.58	0.46	0.49	0.52	0.58	0.45
Common Yellowthroat	*Geothlypis trichas*	16371	0.93	0.93	0.94	0.91	0.83	0.92	0.91	0.81	0.78	0.87	0.91	0.75
Cooper's Hawk	*Accipiter cooperii*	55594	0.98	0.97	0.98	0.97	0.98	0.97	0.98	0.97	0.97	0.97	0.98	0.96
Costa's Hummingbird	*Calypte costae*	1672	0.87	0.85	0.86	0.83	0.86	0.84	0.86	0.82	0.85	0.83	0.85	0.81
Couch's Kingbird	*Tyrannus couchii*	429	0.27	0.69	0.21	0.10	0.16	0.04	0.00	0.00	0.04	0.00	0.00	0.00
Crested Caracara	*Caracara cheriway*	1840	0.38	0.05	0.28	0.03	0.25	0.05	0.21	0.03	0.25	0.05	0.20	0.03
Crissal Thrasher	*Toxostoma crissale*	5581	0.93	0.88	0.92	0.87	0.88	0.86	0.89	0.81	0.84	0.84	0.85	0.76
Curve-billed Thrasher	*Toxostoma curvirostre*	8749	0.94	0.93	0.95	0.91	0.93	0.92	0.95	0.90	0.91	0.92	0.95	0.89
Dark-eyed Junco	*Junco hyemalis*	159218	0.85	0.84	0.85	0.79	0.81	0.79	0.80	0.74	0.79	0.77	0.76	0.70
Dickcissel	*Spiza americana*	283	0.26	0.17	0.22	0.15	0.12	0.17	0.17	0.09	0.10	0.16	0.13	0.07
Double-crested Cormorant	*Phalacrocorax auritus*	31530	0.77	0.75	0.77	0.70	0.74	0.72	0.74	0.67	0.73	0.68	0.72	0.64
Dovekie	*Alle alle*	1721	0.58	0.45	0.61	0.42	0.53	0.42	0.55	0.39	0.47	0.34	0.45	0.28
Downy Woodpecker	*Picoides pubescens*	128580	0.93	0.94	0.93	0.91	0.90	0.91	0.89	0.87	0.87	0.87	0.82	0.81
Dunlin	*Calidris alpina*	8794	0.50	0.55	0.52	0.43	0.37	0.40	0.41	0.32	0.32	0.36	0.37	0.28
Dusky Flycatcher	*Empidonax oberholseri*	223	0.70	0.76	0.73	0.66	0.62	0.74	0.70	0.57	0.52	0.74	0.65	0.45
Dusky Grouse	*Dendragapus obscurus*	3877	0.45	0.46	0.53	0.38	0.35	0.36	0.44	0.29	0.30	0.28	0.40	0.23
Dusky-capped Flycatcher	*Myiarchus tuberculifer*	10	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Eared Grebe	*Podiceps nigricollis*	15384	0.84	0.80	0.85	0.76	0.76	0.75	0.81	0.68	0.75	0.72	0.78	0.66

Eastern Bluebird	*Sialia sialis*	34387	0.95	0.96	0.95	0.94	0.91	0.95	0.92	0.90	0.89	0.93	0.86	0.85
Eastern Meadowlark	*Sturnella magna*	31008	0.96	0.97	0.97	0.96	0.95	0.96	0.95	0.94	0.93	0.94	0.91	0.90
Eastern Phoebe	*Sayornis phoebe*	20555	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.95	0.95
Eastern Screech-Owl	*Megascops asio*	38490	0.96	0.98	0.97	0.95	0.94	0.96	0.96	0.93	0.93	0.96	0.95	0.91
Eastern Whip-poor-will	*Caprimulgus vociferus*	1477	0.71	0.72	0.52	0.47	0.09	0.28	0.09	0.03	0.02	0.14	0.01	0.00
Eastern Wood-Pewee	*Contopus virens*	62	0.73	0.74	0.37	0.37	0.31	0.23	0.24	0.19	0.26	0.08	0.08	0.08
Emperor Goose	*Chen canagica*	693	0.54	0.55	0.54	0.53	0.49	0.41	0.43	0.40	0.29	0.08	0.03	0.03
Eurasian Collared-Dove	*Streptopelia decaocto*	4778	0.55	0.61	0.49	0.41	0.42	0.55	0.43	0.32	0.14	0.43	0.19	0.07
Eurasian Tree Sparrow	*Passer montanus*	7525	0.52	0.48	0.45	0.43	0.37	0.35	0.33	0.28	0.22	0.18	0.16	0.11
Eurasian Wigeon	*Anas penelope*	1448	0.52	0.59	0.58	0.47	0.41	0.48	0.49	0.34	0.29	0.30	0.35	0.17
European Starling	*Sturnus vulgaris*	101726	0.98	0.97	0.97	0.97	0.97	0.97	0.97	0.96	0.97	0.97	0.97	0.96
Evening Grosbeak	*Coccothraustes vespertinus*	64374	0.86	0.89	0.87	0.84	0.71	0.75	0.71	0.67	0.58	0.64	0.42	0.41
Ferruginous Hawk	*Buteo regalis*	17957	0.89	0.88	0.89	0.85	0.86	0.82	0.86	0.80	0.84	0.81	0.84	0.78
Ferruginous Pygmy-Owl	*Glaucidium brasilianum*	46	0.61	0.63	0.63	0.35	0.28	0.61	0.54	0.28	0.26	0.59	0.54	0.24
Field Sparrow	*Spizella pusilla*	28480	0.98	0.98	0.98	0.97	0.97	0.97	0.97	0.96	0.97	0.96	0.96	0.95
Fish Crow	*Corvus ossifragus*	9862	0.75	0.82	0.77	0.72	0.52	0.55	0.49	0.39	0.42	0.49	0.23	0.19
Forster's Tern	*Sterna forsteri*	9925	0.88	0.88	0.88	0.82	0.71	0.72	0.79	0.61	0.70	0.65	0.78	0.57
Fox Sparrow	*Passerella iliaca*	28060	0.83	0.90	0.87	0.83	0.73	0.78	0.75	0.72	0.62	0.64	0.48	0.47
Franklin's Gull	*Leucophaeus pipixcan*	420	0.75	0.66	0.70	0.64	0.74	0.66	0.69	0.62	0.73	0.65	0.69	0.62
Gadwall	*Anas strepera*	53732	0.93	0.92	0.94	0.90	0.93	0.91	0.92	0.89	0.92	0.90	0.91	0.88
Gambel's Quail	*Callipepla gambelii*	6260	0.91	0.89	0.91	0.86	0.88	0.87	0.91	0.83	0.87	0.87	0.90	0.83
Gila Woodpecker	*Melanerpes uropygialis*	1899	0.95	0.94	0.94	0.93	0.95	0.94	0.94	0.93	0.94	0.93	0.94	0.93
Gilded Flicker	*Colaptes chrysoides*	823	0.88	0.93	0.92	0.86	0.85	0.89	0.87	0.81	0.85	0.89	0.86	0.81
Glaucous Gull	*Larus hyperboreus*	23580	0.60	0.61	0.63	0.54	0.55	0.57	0.59	0.48	0.51	0.49	0.53	0.44
Glaucous-winged Gull	*Larus glaucescens*	6326	0.74	0.81	0.79	0.73	0.68	0.74	0.73	0.66	0.61	0.63	0.65	0.57
Glossy Ibis	*Plegadis falcinellus*	879	0.91	0.88	0.90	0.87	0.89	0.88	0.90	0.86	0.88	0.87	0.88	0.84
Golden Eagle	*Aquila chrysaetos*	35679	0.90	0.90	0.90	0.87	0.86	0.83	0.85	0.80	0.80	0.80	0.78	0.74
Golden-crowned Kinglet	*Regulus satrapa*	61230	0.89	0.91	0.90	0.87	0.86	0.89	0.88	0.84	0.84	0.86	0.84	0.81
Golden-crowned Sparrow	*Zonotrichia atricapilla*	8040	0.83	0.84	0.85	0.80	0.78	0.80	0.82	0.74	0.73	0.75	0.74	0.67
Golden-fronted Woodpecker	*Melanerpes aurifrons*	3719	0.60	0.72	0.63	0.51	0.42	0.64	0.54	0.36	0.19	0.54	0.38	0.15
Grasshopper Sparrow	*Ammodramus savannarum*	3112	0.88	0.89	0.87	0.84	0.82	0.86	0.85	0.78	0.72	0.86	0.77	0.66
Gray Catbird	*Dumetella carolinensis*	7715	0.94	0.93	0.94	0.93	0.93	0.93	0.94	0.93	0.93	0.93	0.94	0.92
Gray Flycatcher	*Empidonax wrightii*	639	0.60	0.60	0.66	0.51	0.39	0.30	0.46	0.26	0.26	0.21	0.22	0.15
Gray Hawk	*Buteo nitidus*	102	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Gray Jay	*Perisoreus canadensis*	99876	0.86	0.89	0.87	0.84	0.76	0.78	0.75	0.72	0.63	0.65	0.56	0.55
Gray Partridge	*Perdix perdix*	25981	0.60	0.54	0.59	0.49	0.47	0.40	0.42	0.35	0.37	0.27	0.23	0.20

Gray-crowned Rosy-Finch	*Leucosticte tephrocotis*	22453	0.58	0.62	0.60	0.53	0.37	0.37	0.36	0.30	0.24	0.22	0.13	0.12
Great Black-backed Gull	*Larus marinus*	10413	0.72	0.73	0.75	0.70	0.66	0.70	0.72	0.65	0.65	0.69	0.70	0.63
Great Blue Heron	*Ardea herodias*	65104	0.97	0.97	0.97	0.96	0.97	0.96	0.97	0.95	0.96	0.96	0.96	0.95
Great Cormorant	*Phalacrocorax carbo*	5116	0.52	0.46	0.52	0.43	0.49	0.45	0.51	0.41	0.47	0.44	0.50	0.40
Great Crested Flycatcher	*Myiarchus crinitus*	696	0.85	0.84	0.85	0.84	0.85	0.84	0.85	0.84	0.85	0.84	0.85	0.84
Great Egret	*Ardea alba*	14855	0.88	0.89	0.89	0.85	0.84	0.85	0.85	0.82	0.83	0.83	0.83	0.80
Great Gray Owl	*Strix nebulosa*	26677	0.68	0.72	0.64	0.58	0.32	0.37	0.34	0.23	0.15	0.15	0.06	0.05
Great Horned Owl	*Bubo virginianus*	81252	0.88	0.86	0.88	0.84	0.82	0.82	0.84	0.78	0.80	0.79	0.79	0.74
Great Kiskadee	*Pitangus sulphuratus*	703	0.72	0.83	0.66	0.65	0.53	0.74	0.57	0.45	0.16	0.35	0.37	0.12
Great-tailed Grackle	*Quiscalus mexicanus*	11822	0.89	0.83	0.87	0.81	0.87	0.81	0.86	0.79	0.87	0.81	0.85	0.78
Greater Prairie-Chicken	*Tympanuchus cupido*	3157	0.75	0.71	0.85	0.60	0.72	0.67	0.72	0.53	0.67	0.62	0.49	0.37
Greater Roadrunner	*Geococcyx californianus*	13671	0.96	0.93	0.93	0.90	0.95	0.91	0.93	0.90	0.95	0.90	0.93	0.89
Greater Sage-Grouse	*Centrocercus urophasianus*	5775	0.53	0.63	0.58	0.48	0.27	0.28	0.27	0.21	0.17	0.15	0.06	0.06
Greater Scaup	*Aythya marila*	17223	0.48	0.49	0.49	0.44	0.44	0.45	0.46	0.42	0.43	0.44	0.45	0.41
Greater White-fronted Goose	*Anser albifrons*	14439	0.55	0.54	0.54	0.44	0.42	0.42	0.41	0.34	0.39	0.39	0.32	0.27
Greater Yellowlegs	*Tringa melanoleuca*	15396	0.82	0.86	0.85	0.76	0.64	0.71	0.70	0.58	0.60	0.58	0.63	0.49
Green Heron	*Butorides virescens*	4111	0.69	0.75	0.73	0.64	0.58	0.59	0.62	0.52	0.52	0.52	0.58	0.47
Green Jay	*Cyanocorax yncas*	726	0.94	0.88	0.90	0.87	0.85	0.87	0.89	0.83	0.52	0.84	0.63	0.48
Green Kingfisher	*Chloroceryle americana*	1690	0.75	0.67	0.65	0.60	0.60	0.65	0.61	0.54	0.21	0.58	0.30	0.19
Green-tailed Towhee	*Pipilo chlorurus*	4187	0.94	0.90	0.93	0.88	0.92	0.89	0.93	0.86	0.91	0.89	0.93	0.86
Green-winged Teal	*Anas crecca*	55257	0.86	0.87	0.88	0.83	0.83	0.84	0.85	0.80	0.80	0.80	0.83	0.76
Groove-billed Ani	*Crotophaga sulcirostris*	385	0.73	0.78	0.78	0.72	0.61	0.74	0.69	0.61	0.37	0.71	0.54	0.32
Gull-billed Tern	*Gelochelidon nilotica*	255	0.53	0.54	0.52	0.45	0.52	0.52	0.52	0.45	0.52	0.51	0.52	0.44
Gyrfalcon	*Falco rusticolus*	40763	0.53	0.51	0.58	0.48	0.45	0.47	0.53	0.41	0.40	0.45	0.49	0.37
Hairy Woodpecker	*Picoides villosus*	138956	0.92	0.94	0.91	0.89	0.84	0.88	0.83	0.81	0.82	0.84	0.71	0.70
Hammond's Flycatcher	*Empidonax hammondii*	82	0.76	0.72	0.74	0.71	0.62	0.71	0.72	0.60	0.59	0.71	0.71	0.56
Harlequin Duck	*Histrionicus histrionicus*	4421	0.68	0.70	0.70	0.67	0.64	0.68	0.68	0.63	0.60	0.62	0.65	0.56
Harris's Hawk	*Parabuteo unicinctus*	3192	0.94	0.93	0.94	0.93	0.94	0.93	0.94	0.93	0.94	0.93	0.94	0.92
Harris's Sparrow	*Zonotrichia querula*	21130	0.64	0.62	0.62	0.58	0.63	0.59	0.60	0.56	0.63	0.57	0.55	0.52
Heermann's Gull	*Larus heermanni*	383	0.55	0.57	0.57	0.54	0.54	0.50	0.54	0.49	0.52	0.44	0.51	0.44
Henslow's Sparrow	*Ammodramus henslowii*	1201	0.44	0.56	0.48	0.40	0.17	0.31	0.26	0.16	0.04	0.17	0.00	0.00
Hepatic Tanager	*Piranga flava*	2	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00	0.00
Hermit Thrush	*Catharus guttatus*	33952	0.87	0.91	0.89	0.86	0.82	0.87	0.84	0.80	0.75	0.82	0.70	0.67
Hermit Warbler	*Setophaga occidentalis*	78	0.03	0.06	0.04	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Herring Gull	*Larus argentatus*	42237	0.59	0.56	0.53	0.45	0.46	0.44	0.46	0.37	0.43	0.41	0.45	0.35
Hoary Redpoll	*Acanthis hornemanni*	100233	0.87	0.88	0.88	0.85	0.78	0.79	0.80	0.75	0.69	0.69	0.67	0.63

Hooded Merganser	*Lophodytes cucullatus*	37855	0.61	0.60	0.61	0.52	0.42	0.44	0.45	0.35	0.34	0.35	0.35	0.26
Hooded Oriole	*Icterus cucullatus*	134	0.50	0.65	0.63	0.45	0.29	0.34	0.29	0.25	0.29	0.33	0.28	0.25
Hook-billed Kite	*Chondrohierax uncinatus*	58	0.71	0.83	0.83	0.71	0.45	0.55	0.74	0.40	0.45	0.19	0.53	0.19
Horned Grebe	*Podiceps auritus*	30246	0.68	0.67	0.66	0.59	0.57	0.60	0.60	0.50	0.53	0.55	0.54	0.45
Horned Lark	*Eremophila alpestris*	60828	0.87	0.86	0.86	0.81	0.79	0.80	0.80	0.74	0.74	0.71	0.64	0.60
House Finch	*Carpodacus mexicanus*	65206	0.94	0.96	0.95	0.93	0.90	0.90	0.90	0.88	0.84	0.85	0.81	0.80
House Sparrow	*Passer domesticus*	120008	0.95	0.93	0.95	0.93	0.94	0.93	0.94	0.92	0.94	0.93	0.94	0.92
House Wren	*Troglodytes aedon*	17042	0.90	0.94	0.92	0.88	0.82	0.90	0.86	0.80	0.72	0.81	0.63	0.61
Hutton's Vireo	*Vireo huttoni*	2337	0.74	0.79	0.80	0.71	0.62	0.70	0.70	0.60	0.54	0.62	0.60	0.49
Iceland Gull	*Larus glaucoides*	10194	0.61	0.65	0.67	0.58	0.55	0.62	0.63	0.52	0.49	0.56	0.57	0.45
Inca Dove	*Columbina inca*	9503	0.96	0.93	0.96	0.91	0.96	0.92	0.96	0.91	0.96	0.92	0.96	0.91
Indigo Bunting	*Passerina cyanea*	600	0.71	0.71	0.75	0.67	0.61	0.69	0.71	0.58	0.60	0.68	0.71	0.57
Killdeer	*Charadrius vociferus*	47890	0.96	0.97	0.97	0.96	0.95	0.97	0.97	0.95	0.95	0.97	0.97	0.94
King Eider	*Somateria spectabilis*	1161	0.42	0.43	0.46	0.39	0.35	0.31	0.33	0.28	0.20	0.10	0.08	0.06
King Rail	*Rallus elegans*	2604	0.45	0.53	0.47	0.37	0.25	0.33	0.33	0.21	0.17	0.12	0.13	0.04
Kittlitz's Murrelet	*Brachyramphus brevirostris*	346	0.33	0.34	0.38	0.29	0.19	0.16	0.19	0.14	0.07	0.07	0.03	0.03
Ladder-backed Woodpecker	*Picoides scalaris*	10020	0.98	0.96	0.97	0.96	0.96	0.96	0.96	0.94	0.94	0.95	0.95	0.92
Lapland Longspur	*Calcarius lapponicus*	27227	0.77	0.78	0.80	0.72	0.73	0.75	0.75	0.67	0.72	0.72	0.65	0.59
Lark Bunting	*Calamospiza melanocorys*	6499	0.93	0.92	0.93	0.88	0.92	0.91	0.93	0.87	0.90	0.91	0.93	0.86
Lark Sparrow	*Chondestes grammacus*	5912	0.94	0.91	0.94	0.90	0.90	0.90	0.92	0.86	0.83	0.89	0.87	0.80
Laughing Gull	*Leucophaeus atricilla*	3567	0.74	0.73	0.76	0.69	0.64	0.66	0.72	0.58	0.64	0.64	0.72	0.58
Lawrence's Goldfinch	*Spinus lawrencei*	631	0.40	0.38	0.42	0.32	0.32	0.27	0.28	0.20	0.28	0.25	0.18	0.13
Le Conte's Sparrow	*Ammodramus leconteii*	6916	0.91	0.91	0.93	0.86	0.88	0.85	0.90	0.81	0.87	0.82	0.80	0.75
Le Conte's Thrasher	*Toxostoma lecontei*	281	0.68	0.56	0.59	0.46	0.16	0.33	0.33	0.06	0.15	0.32	0.21	0.05
Least Bittern	*Ixobrychus exilis*	770	0.77	0.75	0.79	0.70	0.67	0.71	0.70	0.62	0.61	0.67	0.63	0.55
Least Flycatcher	*Empidonax minimus*	207	0.12	0.41	0.15	0.07	0.07	0.07	0.09	0.06	0.01	0.05	0.07	0.00
Least Grebe	*Tachybaptus dominicus*	986	0.68	0.81	0.61	0.52	0.48	0.59	0.40	0.34	0.23	0.25	0.23	0.08
Least Sandpiper	*Calidris minutilla*	19537	0.93	0.91	0.92	0.87	0.89	0.87	0.92	0.81	0.88	0.87	0.92	0.80
Lesser Black-backed Gull	*Larus fuscus*	450	0.57	0.56	0.58	0.53	0.47	0.51	0.55	0.44	0.44	0.42	0.55	0.41
Lesser Goldfinch	*Spinus psaltria*	9523	0.84	0.82	0.84	0.78	0.77	0.76	0.78	0.71	0.72	0.72	0.70	0.65
Lesser Nighthawk	*Chordeiles acutipennis*	1863	0.87	0.82	0.88	0.81	0.87	0.82	0.88	0.81	0.87	0.81	0.87	0.80
Lesser Prairie-Chicken	*Tympanuchus pallidicinctus*	274	0.07	0.30	0.10	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lesser Scaup	*Aythya affinis*	48351	0.86	0.84	0.86	0.79	0.81	0.81	0.83	0.74	0.79	0.77	0.81	0.70
Lesser Yellowlegs	*Tringa flavipes*	4194	0.88	0.90	0.90	0.86	0.86	0.88	0.87	0.82	0.85	0.87	0.85	0.80
Lewis's Woodpecker	*Melanerpes lewis*	6351	0.69	0.71	0.66	0.59	0.51	0.60	0.53	0.42	0.43	0.48	0.39	0.29
Limpkin	*Aramus guarauna*	844	0.93	0.92	0.93	0.92	0.93	0.92	0.93	0.92	0.93	0.92	0.93	0.92

Lincoln's Sparrow	*Melospiza lincolnii*	17227	0.95	0.94	0.95	0.93	0.86	0.92	0.93	0.85	0.78	0.83	0.74	0.70
Little Blue Heron	*Egretta caerulea*	3101	0.88	0.85	0.84	0.83	0.84	0.81	0.83	0.80	0.83	0.81	0.82	0.79
Little Gull	*Hydrocoloeus minutus*	89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loggerhead Shrike	*Lanius ludovicianus*	40407	0.98	0.97	0.98	0.97	0.98	0.97	0.98	0.97	0.98	0.97	0.97	0.97
Long-billed Curlew	*Numenius americanus*	2423	0.47	0.51	0.50	0.37	0.38	0.28	0.32	0.25	0.31	0.23	0.25	0.20
Long-billed Dowitcher	*Limnodromus scolopaceus*	5333	0.76	0.72	0.76	0.67	0.72	0.69	0.74	0.63	0.68	0.67	0.72	0.60
Long-billed Thrasher	*Toxostoma longirostre*	1024	0.94	0.87	0.93	0.87	0.89	0.87	0.92	0.83	0.74	0.86	0.84	0.67
Long-eared Owl	*Asio otus*	16814	0.49	0.48	0.49	0.43	0.42	0.40	0.41	0.36	0.37	0.36	0.27	0.24
Long-tailed Duck	*Clangula hyemalis*	15487	0.63	0.63	0.67	0.58	0.60	0.61	0.66	0.55	0.58	0.60	0.64	0.53
Louisiana Waterthrush	*Parkesia motacilla*	14	0.21	0.29	0.29	0.21	0.21	0.14	0.29	0.14	0.21	0.14	0.21	0.14
MacGillivray's Warbler	*Geothlypis tolmiei*	10	0.40	0.50	0.50	0.40	0.40	0.50	0.50	0.40	0.40	0.50	0.50	0.40
Magnificent Frigatebird	*Fregata magnificens*	330	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74
Magnolia Warbler	*Setophaga magnolia*	100	0.57	0.54	0.56	0.53	0.55	0.54	0.56	0.52	0.54	0.54	0.56	0.51
Mallard	*Anas platyrhynchos*	98619	0.94	0.93	0.93	0.91	0.93	0.92	0.93	0.90	0.93	0.92	0.92	0.90
Marbled Godwit	*Limosa fedoa*	463	0.48	0.52	0.49	0.45	0.43	0.42	0.46	0.41	0.41	0.31	0.36	0.28
Marbled Murrelet	*Brachyramphus marmoratus*	7225	0.62	0.66	0.68	0.61	0.57	0.63	0.64	0.56	0.51	0.55	0.56	0.49
Marsh Wren	*Cistothorus palustris*	25954	0.91	0.89	0.90	0.87	0.85	0.86	0.87	0.80	0.83	0.80	0.82	0.77
McCown's Longspur	*Rhynchophanes mccownii*	2548	0.69	0.84	0.74	0.66	0.57	0.70	0.59	0.53	0.44	0.60	0.37	0.33
McKay's Bunting	*Plectrophenax hyperboreus*	5838	0.77	0.78	0.89	0.70	0.73	0.74	0.89	0.66	0.67	0.70	0.89	0.60
Merlin	*Falco columbarius*	31402	0.52	0.38	0.47	0.34	0.46	0.34	0.41	0.30	0.41	0.30	0.35	0.24
Mew Gull	*Larus canus*	8220	0.69	0.73	0.74	0.67	0.64	0.68	0.69	0.62	0.59	0.60	0.63	0.55
Mexican Jay	*Aphelocoma wollweberi*	590	0.86	0.90	0.88	0.85	0.83	0.84	0.81	0.78	0.71	0.78	0.68	0.61
Monk Parakeet	*Myiopsitta monachus*	522	0.47	0.45	0.46	0.38	0.22	0.21	0.21	0.16	0.15	0.16	0.17	0.12
Montezuma Quail	*Cyrtonyx montezumae*	213	0.09	0.34	0.25	0.06	0.04	0.06	0.02	0.01	0.01	0.00	0.00	0.00
Mottled Duck	*Anas fulvigula*	2240	0.76	0.76	0.76	0.72	0.70	0.69	0.70	0.67	0.60	0.58	0.58	0.55
Mountain Bluebird	*Sialia currucoides*	19984	0.87	0.86	0.86	0.81	0.84	0.81	0.82	0.77	0.82	0.80	0.78	0.74
Mountain Chickadee	*Poecile gambeli*	43423	0.59	0.64	0.61	0.57	0.49	0.52	0.51	0.46	0.41	0.43	0.34	0.32
Mountain Plover	*Charadrius montanus*	1090	0.27	0.38	0.33	0.18	0.19	0.16	0.24	0.12	0.17	0.14	0.22	0.10
Mountain Quail	*Oreortyx pictus*	2054	0.80	0.73	0.79	0.67	0.64	0.61	0.69	0.53	0.54	0.54	0.56	0.43
Mourning Dove	*Zenaida macroura*	71928	0.97	0.96	0.97	0.96	0.97	0.96	0.97	0.96	0.97	0.96	0.97	0.96
Muscovy Duck	*Cairina moschata*	2030	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Mute Swan	*Cygnus olor*	1691	0.68	0.78	0.79	0.67	0.42	0.65	0.59	0.40	0.17	0.25	0.04	0.03
Nashville Warbler	*Oreothlypis ruficapilla*	375	0.77	0.64	0.66	0.53	0.74	0.64	0.65	0.51	0.72	0.63	0.65	0.50
Nelson's/Saltmarsh Sparrow	*Ammodramus nelsoni/caudacutus*	889	0.53	0.62	0.58	0.49	0.36	0.44	0.47	0.35	0.33	0.30	0.33	0.22
Neotropic Cormorant	*Phalacrocorax brasilianus*	1813	0.56	0.70	0.60	0.51	0.51	0.62	0.55	0.47	0.48	0.59	0.55	0.45
Northern Beardless-Tyrannulet	*Camptostoma imberbe*	147	0.84	0.81	0.85	0.76	0.51	0.63	0.73	0.44	0.50	0.57	0.56	0.33

Northern Bobwhite	*Colinus virginianus*	31046	0.94	0.96	0.95	0.92	0.88	0.91	0.90	0.85	0.87	0.89	0.89	0.83
Northern Cardinal	*Cardinalis cardinalis*	48730	0.98	0.98	0.98	0.97	0.98	0.98	0.98	0.97	0.98	0.97	0.98	0.97
Northern Flicker	*Colaptes auratus*	79331	0.97	0.97	0.97	0.96	0.95	0.95	0.95	0.94	0.94	0.94	0.93	0.92
Northern Fulmar	*Fulmarus glacialis*	248	0.39	0.43	0.42	0.36	0.33	0.38	0.39	0.31	0.31	0.32	0.33	0.24
Northern Gannet	*Morus bassanus*	1742	0.40	0.43	0.42	0.30	0.26	0.32	0.34	0.20	0.22	0.26	0.26	0.16
Northern Goshawk	*Accipiter gentilis*	143552	0.89	0.89	0.89	0.86	0.80	0.80	0.79	0.76	0.70	0.73	0.61	0.61
Northern Harrier	*Circus cyaneus*	66010	0.96	0.94	0.96	0.94	0.96	0.94	0.96	0.94	0.96	0.94	0.95	0.93
Northern Hawk Owl	*Surnia ulula*	39884	0.54	0.59	0.60	0.46	0.38	0.44	0.44	0.29	0.26	0.29	0.23	0.15
Northern Mockingbird	*Mimus polyglottos*	37626	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Northern Parula	*Setophaga americana*	305	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Northern Pintail	*Anas acuta*	45543	0.80	0.75	0.80	0.70	0.75	0.72	0.78	0.64	0.71	0.65	0.76	0.58
Northern Pygmy-Owl	*Glaucidium gnoma*	14380	0.64	0.74	0.70	0.60	0.43	0.56	0.54	0.38	0.30	0.43	0.33	0.23
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	1916	0.88	0.83	0.86	0.81	0.86	0.83	0.86	0.80	0.82	0.81	0.85	0.75
Northern Saw-whet Owl	*Aegolius acadicus*	12235	0.06	0.05	0.04	0.03	0.02	0.02	0.02	0.01	0.02	0.01	0.01	0.00
Northern Shoveler	*Anas clypeata*	41781	0.85	0.81	0.88	0.79	0.83	0.80	0.87	0.77	0.82	0.79	0.86	0.75
Northern Shrike	*Lanius excubitor*	69739	0.77	0.78	0.77	0.73	0.63	0.66	0.65	0.59	0.52	0.51	0.41	0.38
Northern Waterthrush	*Parkesia noveboracensis*	171	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58
Northwestern Crow	*Corvus caurinus*	4531	0.75	0.78	0.78	0.74	0.74	0.76	0.76	0.72	0.71	0.73	0.73	0.69
Nuttall's Woodpecker	*Picoides nuttallii*	2204	0.89	0.87	0.88	0.86	0.86	0.86	0.87	0.83	0.84	0.85	0.84	0.81
Olive Sparrow	*Arremonops rufivirgatus*	857	0.95	0.94	0.95	0.94	0.94	0.94	0.95	0.93	0.87	0.94	0.94	0.87
Olive Warbler	*Peucedramus taeniatus*	6	0.17	0.50	0.33	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Orange-crowned Warbler	*Oreothlypis celata*	19107	0.93	0.92	0.93	0.91	0.93	0.91	0.93	0.90	0.93	0.91	0.93	0.90
Orchard Oriole	*Icterus spurius*	54	0.07	0.09	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Osprey	*Pandion haliaetus*	6059	0.80	0.83	0.76	0.68	0.68	0.68	0.68	0.63	0.68	0.67	0.68	0.63
Ovenbird	*Seiurus aurocapilla*	878	0.47	0.53	0.44	0.39	0.29	0.45	0.31	0.20	0.23	0.40	0.25	0.16
Pacific Golden-Plover	*Pluvialis fulva*	19	0.05	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pacific Loon	*Gavia pacifica*	6089	0.61	0.65	0.65	0.60	0.56	0.62	0.63	0.54	0.52	0.55	0.56	0.47
Pacific-slope Flycatcher	*Empidonax difficilis*	40	0.65	0.65	0.63	0.63	0.55	0.45	0.58	0.40	0.43	0.28	0.25	0.23
Painted Bunting	*Passerina ciris*	487	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.77	0.80	0.80	0.77
Painted Redstart	*Myioborus pictus*	40	0.45	0.55	0.50	0.28	0.28	0.30	0.25	0.10	0.13	0.18	0.10	0.00
Palm Warbler	*Setophaga palmarum*	6397	0.76	0.78	0.66	0.60	0.41	0.42	0.36	0.30	0.37	0.37	0.34	0.29
Parasitic Jaeger	*Stercorarius parasiticus*	174	0.33	0.37	0.34	0.26	0.23	0.28	0.20	0.17	0.13	0.13	0.06	0.04
Pelagic Cormorant	*Phalacrocorax pelagicus*	4567	0.75	0.80	0.81	0.75	0.72	0.78	0.79	0.71	0.69	0.75	0.77	0.67
Peregrine Falcon	*Falco peregrinus*	2951	0.46	0.54	0.50	0.41	0.34	0.35	0.36	0.31	0.26	0.29	0.27	0.22
Phainopepla	*Phainopepla nitens*	5217	0.88	0.86	0.87	0.81	0.86	0.83	0.85	0.78	0.84	0.82	0.83	0.76
Pied-billed Grebe	*Podilymbus podiceps*	46428	0.94	0.92	0.94	0.91	0.93	0.92	0.94	0.90	0.93	0.91	0.94	0.90

Pigeon Guillemot	*Cepphus columba*	2882	0.55	0.60	0.61	0.50	0.44	0.49	0.49	0.39	0.37	0.34	0.34	0.28
Pileated Woodpecker	*Dryocopus pileatus*	59803	0.91	0.92	0.91	0.88	0.86	0.86	0.84	0.81	0.82	0.79	0.68	0.66
Pine Grosbeak	*Pinicola enucleator*	99175	0.87	0.89	0.88	0.86	0.81	0.81	0.79	0.77	0.72	0.72	0.64	0.63
Pine Siskin	*Spinus pinus*	74781	0.88	0.91	0.90	0.86	0.78	0.83	0.81	0.75	0.69	0.75	0.58	0.55
Pine Warbler	*Setophaga pinus*	15007	0.96	0.94	0.96	0.93	0.94	0.93	0.95	0.92	0.92	0.92	0.92	0.89
Pinyon Jay	*Gymnorhinus cyanocephalus*	13401	0.74	0.73	0.74	0.65	0.55	0.56	0.54	0.43	0.45	0.45	0.34	0.27
Piping Plover	*Charadrius melodus*	1116	0.46	0.57	0.52	0.43	0.32	0.42	0.42	0.31	0.32	0.39	0.38	0.29
Plain (Oak/Juniper) Titmouse	*Baeolophus inornatus/ridgwayi*	6814	0.86	0.91	0.90	0.84	0.73	0.80	0.81	0.71	0.67	0.67	0.64	0.58
Plain Chachalaca	*Ortalis vetula*	205	0.86	0.85	0.86	0.85	0.86	0.85	0.86	0.85	0.86	0.85	0.86	0.85
Pomarine Jaeger	*Stercorarius pomarinus*	392	0.14	0.14	0.13	0.08	0.07	0.09	0.10	0.06	0.05	0.04	0.04	0.03
Prairie Falcon	*Falco mexicanus*	36418	0.89	0.85	0.87	0.84	0.88	0.83	0.85	0.82	0.87	0.82	0.84	0.81
Prairie Warbler	*Setophaga discolor*	1136	0.89	0.85	0.88	0.85	0.88	0.85	0.88	0.85	0.88	0.85	0.88	0.85
Prothonotary Warbler	*Protonotaria citrea*	13	0.38	0.38	0.38	0.38	0.38	0.38	0.31	0.31	0.38	0.38	0.31	0.31
Purple Finch	*Carpodacus purpureus*	44354	0.77	0.74	0.73	0.67	0.62	0.61	0.58	0.53	0.55	0.52	0.41	0.38
Purple Sandpiper	*Calidris maritima*	2558	0.51	0.53	0.52	0.47	0.48	0.50	0.50	0.45	0.44	0.47	0.46	0.40
Pygmy Nuthatch	*Sitta pygmaea*	9034	0.48	0.59	0.56	0.43	0.21	0.34	0.31	0.18	0.14	0.17	0.11	0.07
Pyrrhuloxia	*Cardinalis sinuatus*	7731	0.84	0.84	0.83	0.77	0.71	0.79	0.79	0.67	0.60	0.72	0.70	0.57
Razorbill	*Alca torda*	424	0.53	0.49	0.54	0.46	0.43	0.43	0.51	0.33	0.40	0.31	0.45	0.27
Red Crossbill	*Loxia curvirostra*	38967	0.48	0.59	0.53	0.45	0.32	0.40	0.35	0.27	0.21	0.27	0.19	0.16
Red Knot	*Calidris canutus*	1771	0.21	0.24	0.20	0.13	0.17	0.18	0.17	0.10	0.16	0.17	0.17	0.10
Red Phalarope	*Phalaropus fulicarius*	245	0.49	0.48	0.49	0.45	0.47	0.47	0.49	0.43	0.47	0.47	0.49	0.43
Red-bellied Woodpecker	*Melanerpes carolinus*	40441	0.97	0.98	0.98	0.97	0.97	0.97	0.97	0.96	0.97	0.97	0.97	0.96
Red-billed Pigeon	*Patagioenas flavirostris*	43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Red-breasted Merganser	*Mergus serrator*	21523	0.52	0.53	0.53	0.47	0.46	0.48	0.50	0.44	0.45	0.46	0.49	0.43
Red-breasted Nuthatch	*Sitta canadensis*	80627	0.83	0.88	0.85	0.81	0.71	0.76	0.71	0.67	0.64	0.67	0.58	0.56
Red-breasted Sapsucker	*Sphyrapicus ruber*	5883	0.88	0.91	0.90	0.87	0.83	0.89	0.88	0.81	0.79	0.84	0.83	0.76
Red-cockaded Woodpecker	*Picoides borealis*	3061	0.76	0.66	0.63	0.44	0.48	0.46	0.42	0.24	0.39	0.46	0.36	0.21
Red-crowned Parrot	*Amazona viridigenalis*	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Red-faced Cormorant	*Phalacrocorax urile*	1469	0.58	0.61	0.65	0.57	0.57	0.56	0.63	0.54	0.50	0.51	0.53	0.45
Red-headed Woodpecker	*Melanerpes erythrocephalus*	28874	0.95	0.96	0.97	0.93	0.92	0.94	0.93	0.89	0.89	0.93	0.84	0.80
Red-naped Sapsucker	*Sphyrapicus nuchalis*	6269	0.90	0.87	0.90	0.84	0.86	0.85	0.88	0.78	0.82	0.81	0.80	0.70
Red-necked Grebe	*Podiceps grisegena*	11502	0.50	0.51	0.51	0.45	0.45	0.48	0.47	0.41	0.43	0.43	0.43	0.38
Red-shouldered Hawk	*Buteo lineatus*	24880	0.97	0.97	0.97	0.96	0.95	0.96	0.95	0.94	0.94	0.94	0.91	0.91
Red-tailed Hawk	*Buteo jamaicensis*	71321	0.99	0.99	0.99	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Red-throated Loon	*Gavia stellata*	3539	0.66	0.69	0.68	0.64	0.61	0.63	0.64	0.58	0.59	0.57	0.57	0.52
Red-winged Blackbird	*Agelaius phoeniceus*	62759	0.97	0.96	0.96	0.95	0.97	0.96	0.96	0.95	0.97	0.96	0.96	0.95

Reddish Egret	*Egretta rufescens*	1157	0.23	0.25	0.24	0.20	0.20	0.20	0.22	0.17	0.20	0.20	0.22	0.17
Redhead	*Aythya americana*	50643	0.81	0.73	0.79	0.70	0.78	0.72	0.77	0.67	0.78	0.70	0.75	0.65
Rhinoceros Auklet	*Cerorhinca monocerata*	815	0.43	0.55	0.50	0.40	0.35	0.46	0.42	0.31	0.28	0.29	0.33	0.19
Ring-billed Gull	*Larus delawarensis*	49863	0.81	0.80	0.81	0.74	0.73	0.71	0.71	0.64	0.68	0.65	0.68	0.59
Ring-necked Duck	*Aythya collaris*	50945	0.91	0.89	0.91	0.88	0.90	0.88	0.90	0.86	0.88	0.88	0.89	0.84
Ring-necked Pheasant	*Phasianus colchicus*	42424	0.80	0.80	0.79	0.75	0.70	0.69	0.67	0.64	0.63	0.60	0.55	0.52
Ringed Kingfisher	*Megaceryle torquata*	688	0.93	0.89	0.88	0.86	0.92	0.89	0.88	0.86	0.90	0.89	0.87	0.85
Rock Pigeon	*Columba livia*	104246	0.96	0.96	0.96	0.95	0.96	0.95	0.96	0.94	0.95	0.95	0.95	0.93
Rock Ptarmigan	*Lagopus muta*	33296	0.68	0.72	0.74	0.62	0.56	0.59	0.62	0.48	0.44	0.50	0.44	0.35
Rock Sandpiper	*Calidris ptilocnemis*	4531	0.65	0.68	0.69	0.60	0.57	0.58	0.63	0.50	0.46	0.46	0.48	0.36
Rock Wren	*Salpinctes obsoletus*	12104	0.97	0.94	0.96	0.94	0.97	0.94	0.96	0.94	0.96	0.94	0.95	0.93
Roseate Spoonbill	*Platalea ajaja*	1473	0.51	0.56	0.59	0.49	0.42	0.46	0.46	0.42	0.42	0.45	0.46	0.42
Ross's Goose	*Chen rossii*	12394	0.65	0.65	0.68	0.57	0.59	0.54	0.57	0.49	0.54	0.50	0.49	0.42
Rough-legged Hawk	*Buteo lagopus*	56116	0.87	0.87	0.87	0.84	0.81	0.80	0.79	0.76	0.74	0.70	0.64	0.62
Royal Tern	*Thalasseus maximus*	3101	0.47	0.50	0.50	0.39	0.28	0.29	0.33	0.26	0.26	0.28	0.32	0.24
Ruby-crowned Kinglet	*Regulus calendula*	46678	0.97	0.95	0.97	0.95	0.97	0.95	0.97	0.95	0.97	0.95	0.97	0.95
Ruby-throated Hummingbird	*Archilochus colubris*	256	0.70	0.66	0.68	0.66	0.70	0.66	0.68	0.66	0.69	0.66	0.68	0.66
Ruddy Duck	*Oxyura jamaicensis*	26179	0.75	0.77	0.78	0.68	0.60	0.65	0.63	0.52	0.54	0.51	0.50	0.42
Ruddy Ground-Dove	*Columbina talpacoti*	14	0.36	0.43	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
Ruddy Turnstone	*Arenaria interpres*	3096	0.46	0.50	0.44	0.39	0.27	0.32	0.35	0.25	0.26	0.30	0.34	0.24
Ruffed Grouse	*Bonasa umbellus*	80383	0.86	0.87	0.84	0.82	0.77	0.77	0.74	0.71	0.67	0.65	0.54	0.53
Rufous Hummingbird	*Selasphorus rufus*	805	0.11	0.26	0.25	0.04	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
Rufous-crowned Sparrow	*Aimophila ruficeps*	6316	0.62	0.77	0.65	0.57	0.43	0.57	0.50	0.39	0.31	0.39	0.28	0.23
Rufous-winged Sparrow	*Peucaea carpalis*	403	0.85	0.90	0.86	0.83	0.84	0.87	0.85	0.81	0.82	0.86	0.83	0.79
Rusty Blackbird	*Euphagus carolinus*	24721	0.90	0.91	0.91	0.88	0.88	0.87	0.88	0.85	0.86	0.84	0.77	0.74
Sage Sparrow	*Amphispiza belli*	5796	0.86	0.82	0.85	0.79	0.84	0.79	0.82	0.75	0.79	0.79	0.78	0.70
Sage Thrasher	*Oreoscoptes montanus*	5200	0.96	0.95	0.95	0.94	0.95	0.95	0.95	0.93	0.94	0.95	0.95	0.92
Sanderling	*Calidris alba*	4202	0.55	0.60	0.58	0.49	0.44	0.46	0.55	0.36	0.43	0.42	0.53	0.34
Sandhill Crane	*Grus canadensis*	6162	0.61	0.70	0.68	0.56	0.47	0.47	0.53	0.36	0.38	0.40	0.42	0.29
Sandwich Tern	*Thalasseus sandvicensis*	784	0.32	0.24	0.31	0.21	0.17	0.13	0.17	0.12	0.16	0.10	0.13	0.10
Savannah Sparrow	*Passerculus sandwichensis*	32057	0.96	0.95	0.96	0.95	0.96	0.95	0.96	0.94	0.96	0.95	0.95	0.94
Say's Phoebe	*Sayornis saya*	10709	0.92	0.90	0.91	0.89	0.89	0.87	0.90	0.87	0.89	0.87	0.90	0.86
Scaled Quail	*Callipepla squamata*	7375	0.87	0.89	0.87	0.83	0.81	0.80	0.76	0.72	0.68	0.67	0.58	0.52
Scissor-tailed Flycatcher	*Tyrannus forficatus*	632	0.65	0.75	0.73	0.63	0.61	0.73	0.64	0.59	0.61	0.69	0.58	0.56
Scott's Oriole	*Icterus parisorum*	111	0.77	0.71	0.75	0.71	0.77	0.71	0.75	0.71	0.77	0.71	0.75	0.71
Seaside Sparrow	*Ammodramus maritimus*	1432	0.39	0.43	0.40	0.35	0.19	0.28	0.30	0.18	0.17	0.16	0.18	0.10

Sedge Wren	*Cistothorus platensis*	5851	0.83	0.88	0.85	0.82	0.64	0.77	0.76	0.63	0.50	0.57	0.29	0.26
Semipalmated Plover	*Charadrius semipalmatus*	2670	0.35	0.39	0.33	0.27	0.26	0.29	0.27	0.21	0.24	0.28	0.27	0.20
Semipalmated Sandpiper	*Calidris pusilla*	93	0.19	0.19	0.17	0.16	0.16	0.17	0.17	0.16	0.16	0.16	0.17	0.16
Sharp-shinned Hawk	*Accipiter striatus*	65501	0.94	0.95	0.94	0.93	0.92	0.93	0.93	0.90	0.87	0.90	0.92	0.85
Sharp-tailed Grouse	*Tympanuchus phasianellus*	32090	0.73	0.70	0.76	0.64	0.64	0.60	0.66	0.54	0.49	0.47	0.41	0.31
Short-billed Dowitcher	*Limnodromus griseus*	2961	0.17	0.19	0.18	0.14	0.12	0.13	0.15	0.10	0.11	0.12	0.13	0.09
Short-eared Owl	*Asio flammeus*	31565	0.24	0.21	0.23	0.17	0.19	0.18	0.19	0.14	0.18	0.14	0.10	0.07
Short-tailed Hawk	*Buteo brachyurus*	248	0.53	0.34	0.33	0.33	0.29	0.33	0.31	0.28	0.25	0.28	0.27	0.25
Smith's Longspur	*Calcarius pictus*	829	0.58	0.92	0.86	0.58	0.22	0.41	0.17	0.16	0.16	0.20	0.13	0.11
Smooth-billed Ani	*Crotophaga ani*	247	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Snail Kite	*Rostrhamus sociabilis*	24	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
Snow Bunting	*Plectrophenax nivalis*	60065	0.82	0.81	0.82	0.77	0.71	0.71	0.70	0.65	0.63	0.60	0.57	0.53
Snow Goose	*Chen caerulescens*	36193	0.75	0.73	0.79	0.68	0.69	0.67	0.73	0.62	0.67	0.64	0.71	0.60
Snowy Egret	*Egretta thula*	5870	0.83	0.83	0.83	0.81	0.82	0.81	0.82	0.80	0.81	0.80	0.82	0.79
Snowy Owl	*Bubo scandiacus*	36705	0.56	0.53	0.58	0.47	0.45	0.46	0.49	0.38	0.37	0.37	0.39	0.28
Snowy Plover	*Charadrius nivosus*	1117	0.57	0.59	0.57	0.51	0.52	0.50	0.51	0.46	0.48	0.44	0.44	0.38
Solitary Sandpiper	*Tringa solitaria*	1039	0.87	0.85	0.87	0.85	0.87	0.85	0.87	0.85	0.86	0.85	0.87	0.85
Solitary Vireo complex	*Vireo spp.*	9666	0.94	0.95	0.95	0.94	0.92	0.95	0.94	0.92	0.90	0.92	0.89	0.88
Song Sparrow	*Melospiza melodia*	75851	0.95	0.96	0.95	0.94	0.92	0.94	0.93	0.91	0.90	0.91	0.87	0.86
Sora	*Porzana carolina*	8482	0.74	0.80	0.77	0.67	0.61	0.57	0.64	0.48	0.55	0.53	0.58	0.42
Spot-breasted Oriole	*Icterus pectoralis*	73	0.55	0.60	0.60	0.55	0.37	0.60	0.00	0.00	0.00	0.25	0.00	0.00
Spotted Dove	*Streptopelia chinensis*	210	0.50	0.49	0.55	0.43	0.46	0.48	0.53	0.39	0.41	0.48	0.45	0.33
Spotted Owl	*Strix occidentalis*	144	0.35	0.53	0.44	0.33	0.13	0.24	0.25	0.09	0.06	0.07	0.02	0.01
Spotted Sandpiper	*Actitis macularius*	12175	0.81	0.80	0.82	0.76	0.78	0.78	0.80	0.73	0.76	0.75	0.79	0.71
Sprague's Pipit	*Anthus spragueii*	579	0.10	0.27	0.22	0.09	0.03	0.19	0.09	0.02	0.01	0.01	0.01	0.00
Spruce Grouse	*Falcipennis canadensis*	57135	0.84	0.90	0.88	0.81	0.72	0.72	0.72	0.66	0.55	0.55	0.41	0.38
Steller's Eider	*Polysticta stelleri*	1074	0.61	0.65	0.66	0.60	0.56	0.56	0.59	0.54	0.49	0.41	0.35	0.31
Steller's Jay	*Cyanocitta stelleri*	25695	0.82	0.89	0.87	0.81	0.66	0.77	0.76	0.64	0.55	0.64	0.54	0.49
Stilt Sandpiper	*Calidris himantopus*	747	0.52	0.50	0.56	0.45	0.51	0.47	0.54	0.44	0.45	0.42	0.48	0.41
Summer Tanager	*Piranga rubra*	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Surf Scoter	*Melanitta perspicillata*	9791	0.66	0.65	0.71	0.61	0.58	0.63	0.70	0.56	0.56	0.60	0.69	0.52
Surfbird	*Aphriza virgata*	2220	0.37	0.42	0.39	0.30	0.26	0.33	0.30	0.21	0.22	0.24	0.25	0.15
Swainson's Hawk	*Buteo swainsoni*	183	0.29	0.26	0.27	0.18	0.22	0.20	0.19	0.15	0.22	0.20	0.19	0.15
Swamp Sparrow	*Melospiza georgiana*	33628	0.93	0.95	0.94	0.91	0.87	0.92	0.89	0.86	0.85	0.89	0.83	0.82
Tennessee Warbler	*Oreothlypis peregrina*	23	0.09	0.09	0.09	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Thayer's Gull	*Larus thayeri*	6151	0.51	0.56	0.54	0.48	0.45	0.51	0.50	0.43	0.40	0.45	0.45	0.38

Thick-billed Kingbird	*Tyrannus crassirostris*	57	0.23	0.16	0.19	0.14	0.12	0.16	0.16	0.12	0.12	0.14	0.16	0.12
Thick-billed Murre	*Uria lomvia*	303	0.67	0.59	0.65	0.54	0.53	0.51	0.53	0.45	0.45	0.29	0.34	0.21
Townsend's Solitaire	*Myadestes townsendi*	32384	0.91	0.92	0.91	0.89	0.87	0.86	0.86	0.84	0.84	0.81	0.77	0.76
Townsend's Warbler	*Setophaga townsendi*	1318	0.76	0.82	0.82	0.75	0.68	0.77	0.76	0.67	0.61	0.65	0.68	0.56
Tree Swallow	*Tachycineta bicolor*	3646	0.67	0.69	0.59	0.52	0.53	0.42	0.47	0.39	0.49	0.38	0.44	0.35
Tricolored Blackbird	*Agelaius tricolor*	1914	0.81	0.79	0.80	0.75	0.69	0.65	0.74	0.61	0.61	0.55	0.54	0.48
Tricolored Heron	*Egretta tricolor*	3611	0.71	0.67	0.66	0.63	0.62	0.63	0.64	0.59	0.58	0.59	0.63	0.55
Tropical Kingbird	*Tyrannus melancholicus*	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tropical Parula	*Setophaga pitiayumi*	26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trumpeter Swan	*Cygnus buccinator*	3916	0.53	0.56	0.55	0.48	0.43	0.46	0.44	0.38	0.36	0.37	0.33	0.29
Tufted/Black-crested Titmouse	*Baeolophus bicolor/atricristatus*	33892	0.99	0.99	0.99	0.98	0.99	0.99	0.98	0.98	0.99	0.99	0.98	0.98
Tundra Swan	*Cygnus columbianus*	12622	0.56	0.52	0.57	0.45	0.46	0.39	0.47	0.32	0.38	0.33	0.39	0.25
Turkey Vulture	*Cathartes aura*	22770	0.97	0.97	0.97	0.96	0.96	0.97	0.96	0.96	0.96	0.96	0.96	0.95
Varied Thrush	*Ixoreus naevius*	9232	0.75	0.81	0.79	0.73	0.59	0.71	0.67	0.58	0.53	0.58	0.57	0.52
Varied Thrush	*Ixoreus naevius*	9232	0.75	0.81	0.79	0.73	0.59	0.71	0.67	0.58	0.53	0.58	0.57	0.52
Verdin	*Auriparus flaviceps*	7173	0.92	0.89	0.91	0.86	0.91	0.87	0.91	0.86	0.91	0.87	0.91	0.85
Vermilion Flycatcher	*Pyrocephalus rubinus*	3680	0.93	0.92	0.93	0.91	0.90	0.91	0.91	0.88	0.82	0.87	0.86	0.79
Vesper Sparrow	*Pooecetes gramineus*	19702	0.95	0.95	0.95	0.93	0.94	0.94	0.94	0.93	0.93	0.94	0.93	0.91
Violet-crowned Hummingbird	*Amazilia violiceps*	1	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00
Violet-green Swallow	*Tachycineta thalassina*	796	0.64	0.62	0.68	0.59	0.60	0.58	0.63	0.56	0.59	0.58	0.63	0.55
Virginia Rail	*Rallus limicola*	15678	0.67	0.69	0.69	0.58	0.55	0.54	0.52	0.43	0.48	0.50	0.48	0.36
Wandering Tattler	*Tringa incana*	317	0.62	0.61	0.64	0.58	0.59	0.53	0.61	0.52	0.56	0.50	0.59	0.49
Western Bluebird	*Sialia mexicana*	8793	0.86	0.87	0.87	0.81	0.77	0.80	0.81	0.72	0.71	0.78	0.73	0.64
Western Grebe	*Aechmophorus occidentalis*	9645	0.65	0.70	0.68	0.59	0.57	0.60	0.61	0.51	0.53	0.53	0.58	0.44
Western Gull	*Larus occidentalis*	1227	0.43	0.54	0.50	0.38	0.31	0.30	0.33	0.25	0.26	0.22	0.28	0.20
Western Kingbird	*Tyrannus verticalis*	1123	0.71	0.77	0.77	0.69	0.66	0.68	0.65	0.62	0.64	0.67	0.65	0.60
Western Meadowlark	*Sturnella neglecta*	34117	0.88	0.84	0.86	0.80	0.85	0.81	0.83	0.78	0.82	0.79	0.81	0.76
Western Sandpiper	*Calidris mauri*	4472	0.59	0.59	0.60	0.53	0.51	0.49	0.54	0.45	0.49	0.48	0.54	0.44
Western Screech-Owl	*Megascops kennicottii*	12414	0.59	0.63	0.62	0.53	0.42	0.54	0.49	0.35	0.29	0.47	0.31	0.20
Western Scrub-Jay	*Aphelocoma californica*	8387	0.83	0.84	0.83	0.79	0.68	0.75	0.73	0.64	0.60	0.61	0.46	0.42
Western Tanager	*Piranga ludoviciana*	104	0.63	0.63	0.68	0.62	0.63	0.63	0.68	0.62	0.63	0.63	0.63	0.58
Whimbrel	*Numenius phaeopus*	592	0.27	0.25	0.23	0.21	0.26	0.24	0.23	0.21	0.26	0.23	0.22	0.20
Whiskered Screech-Owl	*Megascops trichopsis*	122	0.11	0.18	0.11	0.04	0.09	0.16	0.10	0.04	0.00	0.14	0.08	0.00
White Ibis	*Eudocimus albus*	2977	0.76	0.78	0.79	0.72	0.62	0.72	0.76	0.58	0.57	0.62	0.72	0.49
White-breasted Nuthatch	*Sitta carolinensis*	85103	0.89	0.90	0.89	0.86	0.83	0.84	0.83	0.79	0.77	0.78	0.64	0.62
White-crowned Pigeon	*Patagioenas leucocephala*	240	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72

White-crowned Sparrow	*Zonotrichia leucophrys*	52993	0.95	0.95	0.96	0.94	0.94	0.94	0.95	0.92	0.93	0.92	0.93	0.91
White-eyed Vireo	*Vireo griseus*	6108	0.89	0.90	0.78	0.75	0.88	0.85	0.77	0.70	0.83	0.85	0.71	0.64
White-faced Ibis	*Plegadis chihi*	1730	0.19	0.35	0.33	0.12	0.05	0.12	0.13	0.03	0.02	0.02	0.05	0.00
White-headed Woodpecker	*Picoides albolarvatus*	2903	0.63	0.63	0.68	0.53	0.46	0.50	0.53	0.36	0.37	0.40	0.25	0.19
White-tailed Hawk	*Buteo albicaudatus*	636	0.67	0.69	0.59	0.54	0.64	0.64	0.58	0.51	0.64	0.59	0.56	0.46
White-tailed Kite	*Elanus leucurus*	2324	0.83	0.82	0.84	0.78	0.66	0.66	0.73	0.60	0.57	0.51	0.52	0.48
White-tailed Ptarmigan	*Lagopus leucura*	33756	0.67	0.74	0.72	0.64	0.56	0.61	0.54	0.52	0.43	0.57	0.36	0.35
White-throated Sparrow	*Zonotrichia albicollis*	39335	0.89	0.90	0.89	0.88	0.86	0.88	0.86	0.85	0.85	0.85	0.81	0.81
White-throated Swift	*Aeronautes saxatalis*	4081	0.78	0.69	0.79	0.65	0.75	0.68	0.78	0.63	0.73	0.66	0.76	0.60
White-tipped Dove	*Leptotila verreauxi*	633	0.92	0.70	0.86	0.70	0.91	0.70	0.86	0.69	0.83	0.70	0.85	0.66
White-winged Crossbill	*Loxia leucoptera*	120191	0.89	0.91	0.91	0.87	0.80	0.82	0.82	0.76	0.68	0.71	0.63	0.61
White-winged Dove	*Zenaida asiatica*	6425	0.80	0.87	0.85	0.77	0.67	0.80	0.77	0.63	0.45	0.70	0.55	0.36
White-winged Scoter	*Melanitta fusca*	9967	0.62	0.64	0.66	0.58	0.59	0.62	0.64	0.55	0.56	0.59	0.62	0.52
Whooping Crane	*Grus americana*	201	0.16	0.24	0.15	0.12	0.11	0.18	0.15	0.07	0.11	0.18	0.15	0.07
Wild Turkey	*Meleagris gallopavo*	19646	0.68	0.80	0.70	0.64	0.49	0.57	0.47	0.42	0.38	0.43	0.13	0.13
Willet	*Tringa semipalmata*	2932	0.44	0.48	0.45	0.36	0.26	0.31	0.32	0.25	0.26	0.29	0.30	0.24
Williamson's Sapsucker	*Sphyrapicus thyroideus*	1910	0.51	0.69	0.57	0.45	0.25	0.42	0.34	0.19	0.12	0.21	0.10	0.06
Willow Ptarmigan	*Lagopus lagopus*	81966	0.88	0.89	0.90	0.86	0.82	0.79	0.82	0.77	0.73	0.69	0.68	0.65
Wilson's Phalarope	*Phalaropus tricolor*	4	0.50	1.00	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.50	0.00	0.00
Wilson's Plover	*Charadrius wilsonia*	594	0.24	0.22	0.23	0.14	0.24	0.15	0.23	0.13	0.24	0.15	0.23	0.13
Wilson's Snipe	*Gallinago delicata*	73158	0.79	0.80	0.82	0.73	0.73	0.75	0.76	0.65	0.70	0.74	0.73	0.62
Wilson's Warbler	*Cardellina pusilla*	823	0.38	0.35	0.36	0.27	0.17	0.21	0.17	0.15	0.17	0.20	0.17	0.14
Winter Wren	*Troglodytes hiemalis*	34384	0.88	0.92	0.91	0.87	0.84	0.89	0.87	0.84	0.81	0.86	0.81	0.78
Wood Duck	*Aix sponsa*	33575	0.74	0.75	0.74	0.69	0.69	0.68	0.67	0.64	0.63	0.64	0.61	0.56
Wood Stork	*Mycteria americana*	1409	0.77	0.71	0.71	0.68	0.76	0.68	0.71	0.67	0.76	0.67	0.71	0.67
Wood Thrush	*Hylocichla mustelina*	132	0.52	0.49	0.55	0.47	0.52	0.48	0.55	0.47	0.52	0.48	0.55	0.47
Worm-eating Warbler	*Helmitheros vermivorum*	61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wrentit	*Chamaea fasciata*	2120	0.92	0.93	0.93	0.91	0.88	0.91	0.93	0.88	0.87	0.91	0.92	0.85
Yellow Rail	*Coturnicops noveboracensis*	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yellow Warbler	*Setophaga petechia*	428	0.77	0.67	0.69	0.59	0.75	0.67	0.69	0.58	0.74	0.65	0.63	0.52
Yellow-bellied Sapsucker	*Sphyrapicus varius*	27625	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.97	0.97
Yellow-billed Loon	*Gavia adamsii*	6132	0.43	0.43	0.45	0.41	0.40	0.37	0.42	0.36	0.35	0.24	0.36	0.23
Yellow-billed Magpie	*Pica nuttalli*	820	0.46	0.62	0.65	0.41	0.16	0.08	0.15	0.07	0.05	0.01	0.00	0.00
Yellow-breasted Chat	*Icteria virens*	29	0.03	0.34	0.24	0.03	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00
Yellow-crowned Night-Heron	*Nyctanassa violacea*	1065	0.65	0.62	0.68	0.58	0.58	0.59	0.61	0.51	0.50	0.55	0.59	0.46
Yellow-eyed Junco	*Junco phaeonotus*	126	0.33	0.35	0.43	0.11	0.07	0.03	0.09	0.00	0.00	0.00	0.00	0.00

Yellow-footed Gull	*Larus livens*	26	0.85	0.92	0.81	0.81	0.81	0.88	0.81	0.81	0.81	0.88	0.81	0.81
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	17494	0.56	0.52	0.56	0.44	0.43	0.45	0.48	0.34	0.32	0.40	0.36	0.24
Yellow-rumped Warbler	*Setophaga coronata*	44550	0.98	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.96
Yellow-throated Vireo	*Vireo flavifrons*	107	0.54	0.47	0.49	0.46	0.54	0.45	0.49	0.45	0.54	0.45	0.49	0.45
Yellow-throated Warbler	*Setophaga dominica*	1892	0.88	0.87	0.84	0.84	0.79	0.83	0.80	0.77	0.78	0.83	0.80	0.77
Zone-tailed Hawk	*Buteo albonotatus*	388	0.06	0.62	0.25	0.05	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.00

Appendix 4: Summer Refugia

Table A.4. Estimates of the size of summer climate refugia relative to current range size for summer birds. Current range sizes represent core areas within the summer distribution estimated using a maximum Kappa threshold and are reported in units of 100 km^2. Refugia estimates indicate the proportion of the current range that will remain consistently suitable over the period of interest. Measures are provided for each of three future emissions scenarios (i.e., low (B2), moderate (A1B), and high (A2) emissions) as well as a "no regrets" approach which identifies areas that are expected to remain suitable across all scenarios for the period of interest.

			2000-2020				2000-2050				2000-2080			
Common Name	**Scientific Name**	**Current range**	**B2**	**A1B**	**A2**	**No regrets**	**B2**	**A1B**	**A2**	**No regrets**	**B2**	**A1B**	**A2**	**No regrets**
Abert's Towhee	*Melozone aberti*	372	0.94	0.88	0.91	0.87	0.94	0.88	0.91	0.87	0.92	0.86	0.89	0.86
Acadian Flycatcher	*Empidonax virescens*	18286	0.94	0.94	0.93	0.92	0.90	0.92	0.91	0.88	0.89	0.92	0.84	0.83
Acorn Woodpecker	*Melanerpes formicivorus*	1718	0.75	0.75	0.79	0.69	0.64	0.59	0.69	0.52	0.55	0.49	0.53	0.39
Alder Flycatcher	*Empidonax alnorum*	66348	0.91	0.91	0.90	0.87	0.79	0.80	0.78	0.74	0.67	0.66	0.51	0.49
Allen's Hummingbird	*Selasphorus sasin*	165	0.41	0.41	0.45	0.32	0.25	0.24	0.33	0.15	0.10	0.09	0.07	0.04
American Avocet	*Recurvirostra americana*	4987	0.28	0.30	0.35	0.15	0.03	0.12	0.12	0.01	0.00	0.01	0.00	0.00
American Bittern	*Botaurus lentiginosus*	21002	0.72	0.69	0.71	0.62	0.46	0.52	0.52	0.39	0.22	0.29	0.16	0.08
American Black Duck	*Anas rubripes*	12507	0.45	0.52	0.52	0.38	0.34	0.35	0.41	0.29	0.29	0.29	0.37	0.24
American Crow	*Corvus brachyrhynchos*	69466	0.97	0.97	0.97	0.96	0.94	0.96	0.95	0.93	0.92	0.93	0.91	0.90
American Dipper	*Cinclus mexicanus*	145	0.37	0.47	0.50	0.31	0.23	0.24	0.28	0.16	0.15	0.19	0.12	0.06
American Golden-Plover	*Pluvialis dominica*	29217	0.79	0.85	0.83	0.78	0.57	0.58	0.58	0.54	0.13	0.26	0.25	0.08
American Goldfinch	*Spinus tristis*	49565	0.89	0.91	0.88	0.85	0.74	0.79	0.75	0.70	0.67	0.69	0.57	0.56
American Kestrel	*Falco sparverius*	57937	0.62	0.65	0.65	0.57	0.42	0.53	0.50	0.37	0.33	0.42	0.29	0.23
American Oystercatcher	*Haematopus palliatus*	88	0.15	0.38	0.42	0.15	0.15	0.38	0.40	0.15	0.15	0.38	0.40	0.15
American Pipit	*Anthus rubescens*	7307	0.39	0.38	0.49	0.27	0.22	0.11	0.22	0.05	0.05	0.01	0.07	0.00
American Redstart	*Setophaga ruticilla*	27480	0.86	0.90	0.86	0.82	0.63	0.69	0.60	0.56	0.42	0.34	0.11	0.10
American Robin	*Turdus migratorius*	153099	0.91	0.93	0.92	0.90	0.85	0.88	0.86	0.83	0.82	0.83	0.78	0.77
American Three-toed Woodpecker	*Picoides dorsalis*	3507	0.05	0.09	0.07	0.04	0.02	0.03	0.03	0.02	0.01	0.01	0.01	0.01
American Tree Sparrow	*Spizella arborea*	52059	0.79	0.85	0.83	0.78	0.65	0.70	0.71	0.65	0.48	0.59	0.53	0.46
American White Pelican	*Pelecanus erythrorhynchos*	17609	0.33	0.27	0.33	0.23	0.22	0.17	0.21	0.15	0.16	0.08	0.09	0.05

American Wigeon	*Anas americana*	65034	0.53	0.53	0.61	0.44	0.33	0.35	0.43	0.25	0.26	0.27	0.35	0.19
American Woodcock	*Scolopax minor*	2113	0.37	0.42	0.39	0.28	0.21	0.26	0.18	0.10	0.09	0.01	0.00	0.00
Anhinga	*Anhinga anhinga*	696	0.68	0.75	0.71	0.65	0.17	0.23	0.15	0.13	0.09	0.17	0.05	0.02
Anna's Hummingbird	*Calypte anna*	1377	0.60	0.58	0.65	0.51	0.50	0.49	0.59	0.41	0.43	0.40	0.50	0.31
Arctic Tern	*Sterna paradisaea*	52455	0.81	0.78	0.86	0.76	0.74	0.72	0.83	0.69	0.69	0.69	0.80	0.66
Arctic Warbler	*Phylloscopus borealis*	5419	0.56	0.59	0.61	0.53	0.41	0.46	0.44	0.36	0.25	0.24	0.13	0.10
Arizona/Strickland's Woodpecker	*Picoides arizonae/stricklandi*	15	0.07	0.07	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00
Ash-throated Flycatcher	*Myiarchus cinerascens*	11673	0.90	0.88	0.89	0.85	0.87	0.84	0.87	0.81	0.85	0.84	0.85	0.78
Bachman's Sparrow	*Peucaea aestivalis*	1764	0.95	0.95	0.93	0.92	0.84	0.94	0.87	0.83	0.78	0.94	0.74	0.71
Baird's Sparrow	*Ammodramus bairdii*	6566	0.49	0.45	0.45	0.33	0.16	0.06	0.04	0.03	0.02	0.00	0.00	0.00
Bald Eagle	*Haliaeetus leucocephalus*	13504	0.30	0.33	0.33	0.27	0.26	0.29	0.29	0.23	0.24	0.25	0.26	0.21
Baltimore Oriole	*Icterus galbula*	35404	0.90	0.91	0.91	0.87	0.87	0.87	0.86	0.84	0.85	0.83	0.75	0.74
Band-tailed Pigeon	*Patagioenas fasciata*	1863	0.67	0.72	0.74	0.62	0.47	0.48	0.56	0.37	0.34	0.29	0.25	0.16
Bank Swallow	*Riparia riparia*	47748	0.40	0.38	0.45	0.32	0.28	0.27	0.34	0.22	0.20	0.18	0.22	0.12
Barn Owl	*Tyto alba*	62	0.10	0.16	0.02	0.00	0.02	0.02	0.02	0.00	0.02	0.00	0.02	0.00
Barn Swallow	*Hirundo rustica*	77313	0.87	0.86	0.87	0.83	0.84	0.84	0.84	0.80	0.81	0.80	0.77	0.75
Barred Owl	*Strix varia*	18578	0.93	0.93	0.94	0.90	0.92	0.92	0.93	0.89	0.92	0.92	0.92	0.88
Barrow's Goldeneye	*Bucephala islandica*	14765	0.28	0.35	0.35	0.23	0.14	0.19	0.16	0.09	0.06	0.08	0.03	0.01
Bay-breasted Warbler	*Setophaga castanea*	10319	0.73	0.84	0.78	0.69	0.46	0.38	0.31	0.26	0.20	0.06	0.04	0.03
Bell's Vireo	*Vireo bellii*	6431	0.93	0.90	0.90	0.85	0.90	0.87	0.89	0.82	0.89	0.85	0.87	0.81
Belted Kingfisher	*Megaceryle alcyon*	47080	0.77	0.78	0.79	0.70	0.65	0.69	0.67	0.56	0.56	0.61	0.51	0.43
Bendire's Thrasher	*Toxostoma bendirei*	279	0.51	0.52	0.49	0.33	0.19	0.22	0.33	0.09	0.14	0.20	0.29	0.06
Bewick's Wren	*Thryomanes bewickii*	10367	0.85	0.85	0.85	0.80	0.75	0.80	0.81	0.72	0.68	0.75	0.75	0.64
Black Oystercatcher	*Haematopus bachmani*	6449	0.34	0.42	0.37	0.28	0.16	0.22	0.12	0.08	0.10	0.03	0.03	0.02
Black Phoebe	*Sayornis nigricans*	1993	0.83	0.83	0.84	0.79	0.78	0.81	0.82	0.75	0.77	0.80	0.81	0.74
Black Scoter	*Melanitta americana*	114	0.23	0.23	0.19	0.17	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01
Black Skimmer	*Rynchops niger*	539	0.10	0.06	0.06	0.02	0.04	0.05	0.04	0.01	0.04	0.01	0.00	0.00
Black Swift	*Cypseloides niger*	998	0.03	0.04	0.03	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Black Tern	*Chlidonias niger*	11076	0.72	0.71	0.76	0.62	0.42	0.58	0.60	0.36	0.30	0.34	0.21	0.10
Black Vulture	*Coragyps atratus*	8169	0.59	0.60	0.62	0.50	0.51	0.52	0.55	0.40	0.42	0.44	0.41	0.29
Black-and-white Warbler	*Mniotilta varia*	30408	0.84	0.84	0.83	0.79	0.63	0.63	0.59	0.55	0.47	0.41	0.17	0.15
Black-backed Woodpecker	*Picoides arcticus*	6281	0.78	0.68	0.81	0.65	0.41	0.15	0.19	0.10	0.14	0.02	0.01	0.01
Black-bellied Whistling-Duck	*Dendrocygna autumnalis*	1527	0.91	0.84	0.91	0.83	0.85	0.84	0.89	0.77	0.75	0.81	0.68	0.57
Black-billed Cuckoo	*Coccyzus erythropthalmus*	12892	0.80	0.84	0.80	0.74	0.56	0.56	0.55	0.45	0.37	0.34	0.28	0.17
Black-billed Magpie	*Pica hudsonia*	30258	0.72	0.74	0.74	0.67	0.49	0.46	0.47	0.39	0.25	0.24	0.14	0.13
Black-billed Magpie	*Pica hudsonia*	30258	0.72	0.74	0.74	0.67	0.49	0.46	0.47	0.39	0.25	0.24	0.14	0.13

Black-capped Chickadee	*Poecile atricapillus*	42378	0.73	0.76	0.72	0.67	0.60	0.63	0.59	0.54	0.50	0.52	0.37	0.34
Black-capped Vireo	*Vireo atricapilla*	110	0.35	0.65	0.39	0.33	0.20	0.30	0.20	0.18	0.10	0.15	0.05	0.05
Black-chinned Hummingbird	*Archilochus alexandri*	4898	0.51	0.66	0.60	0.41	0.27	0.41	0.36	0.19	0.22	0.30	0.27	0.15
Black-chinned Sparrow	*Spizella atrogularis*	792	0.25	0.42	0.33	0.23	0.06	0.09	0.09	0.04	0.02	0.01	0.00	0.00
Black-crested Titmouse	*Baeolophus atricristatus*	3251	0.76	0.82	0.80	0.65	0.46	0.60	0.50	0.29	0.19	0.20	0.14	0.07
Black-crowned Night-Heron	*Nycticorax nycticorax*	4079	0.30	0.32	0.38	0.24	0.22	0.18	0.23	0.12	0.19	0.13	0.12	0.08
Black-headed Grosbeak	*Pheucticus melanocephalus*	7609	0.74	0.78	0.76	0.69	0.57	0.67	0.63	0.52	0.47	0.55	0.42	0.39
Black-legged Kittiwake	*Rissa tridactyla*	2326	0.27	0.28	0.34	0.19	0.13	0.13	0.15	0.08	0.06	0.06	0.08	0.03
Black-necked Stilt	*Himantopus mexicanus*	1444	0.62	0.66	0.67	0.57	0.54	0.63	0.64	0.48	0.52	0.60	0.62	0.45
Black-tailed Gnatcatcher	*Polioptila melanura*	1801	0.94	0.91	0.92	0.90	0.94	0.91	0.92	0.90	0.93	0.90	0.92	0.90
Black-throated Blue Warbler	*Setophaga caerulescens*	3631	0.61	0.72	0.61	0.55	0.18	0.22	0.12	0.10	0.02	0.01	0.00	0.00
Black-throated Gray Warbler	*Setophaga nigrescens*	2806	0.70	0.74	0.72	0.67	0.58	0.61	0.60	0.53	0.45	0.48	0.36	0.32
Black-throated Green Warbler	*Setophaga virens*	8298	0.62	0.81	0.63	0.55	0.25	0.41	0.23	0.20	0.11	0.13	0.03	0.03
Black-throated Sparrow	*Amphispiza bilineata*	8245	0.88	0.85	0.86	0.80	0.83	0.76	0.79	0.72	0.79	0.72	0.76	0.67
Black-whiskered Vireo	*Vireo altiloquus*	166	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
Blackburnian Warbler	*Setophaga fusca*	12534	0.64	0.76	0.64	0.57	0.28	0.36	0.21	0.18	0.03	0.03	0.00	0.00
Blackpoll Warbler	*Setophaga striata*	46054	0.77	0.76	0.79	0.72	0.67	0.61	0.67	0.57	0.49	0.46	0.45	0.38
Blue Grosbeak	*Passerina caerulea*	29168	0.94	0.97	0.97	0.93	0.87	0.95	0.92	0.86	0.72	0.88	0.63	0.56
Blue Jay	*Cyanocitta cristata*	53135	0.98	0.97	0.98	0.96	0.97	0.96	0.97	0.95	0.96	0.96	0.95	0.94
Blue-gray Gnatcatcher	*Polioptila caerulea*	21260	0.96	0.98	0.97	0.95	0.94	0.96	0.95	0.92	0.92	0.96	0.94	0.90
Blue-winged Teal	*Anas discors*	21003	0.63	0.61	0.64	0.56	0.43	0.53	0.57	0.38	0.34	0.42	0.39	0.25
Blue-winged Warbler	*Vermivora cyanoptera*	6929	0.60	0.74	0.68	0.55	0.34	0.42	0.24	0.21	0.18	0.36	0.05	0.04
Boat-tailed Grackle	*Quiscalus major*	2303	0.64	0.65	0.63	0.56	0.34	0.45	0.41	0.24	0.12	0.09	0.05	0.02
Bobolink	*Dolichonyx oryzivorus*	28145	0.76	0.77	0.75	0.71	0.55	0.61	0.53	0.50	0.42	0.36	0.20	0.19
Bohemian Waxwing	*Bombycilla garrulus*	12946	0.45	0.48	0.51	0.38	0.24	0.16	0.17	0.12	0.06	0.09	0.01	0.00
Bonaparte's Gull	*Chroicocephalus philadelphia*	34697	0.69	0.68	0.77	0.63	0.63	0.62	0.71	0.57	0.56	0.54	0.61	0.48
Boreal Chickadee	*Poecile hudsonicus*	31537	0.57	0.51	0.54	0.41	0.37	0.32	0.34	0.27	0.23	0.20	0.16	0.12
Botteri's Sparrow	*Peucaea botterii*	57	0.23	0.05	0.14	0.05	0.11	0.05	0.12	0.05	0.11	0.04	0.12	0.04
Brewer's Blackbird	*Euphagus cyanocephalus*	37583	0.71	0.78	0.76	0.68	0.52	0.56	0.56	0.48	0.39	0.41	0.29	0.26
Brewer's Sparrow	*Spizella breweri*	13713	0.76	0.76	0.77	0.68	0.60	0.51	0.53	0.46	0.47	0.33	0.24	0.21
Bridled Titmouse	*Baeolophus wollweberi*	81	0.64	0.72	0.68	0.59	0.62	0.65	0.68	0.56	0.60	0.62	0.60	0.52
Broad-billed Hummingbird	*Cynanthus latirostris*	70	0.09	0.17	0.10	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Broad-tailed Hummingbird	*Selasphorus platycercus*	1746	0.74	0.85	0.79	0.71	0.43	0.68	0.59	0.41	0.29	0.52	0.17	0.14
Broad-winged Hawk	*Buteo platypterus*	20587	0.71	0.67	0.72	0.62	0.59	0.50	0.55	0.44	0.42	0.37	0.27	0.21
Bronzed Cowbird	*Molothrus aeneus*	1335	0.69	0.62	0.68	0.40	0.66	0.55	0.66	0.37	0.64	0.54	0.64	0.37
Brown Creeper	*Certhia americana*	4473	0.59	0.62	0.65	0.51	0.40	0.40	0.44	0.28	0.25	0.26	0.22	0.15

Brown Pelican	*Pelecanus occidentalis*	738	0.41	0.33	0.45	0.28	0.35	0.31	0.42	0.27	0.35	0.30	0.42	0.27
Brown Thrasher	*Toxostoma rufum*	46161	0.94	0.94	0.95	0.91	0.84	0.87	0.86	0.80	0.74	0.77	0.64	0.62
Brown-crested Flycatcher	*Myiarchus tyrannulus*	1660	0.90	0.89	0.90	0.86	0.89	0.88	0.90	0.85	0.82	0.88	0.86	0.78
Brown-headed Cowbird	*Molothrus ater*	81128	0.94	0.94	0.94	0.92	0.90	0.92	0.91	0.87	0.87	0.90	0.85	0.82
Brown-headed Nuthatch	*Sitta pusilla*	6994	0.63	0.61	0.58	0.46	0.19	0.17	0.11	0.05	0.02	0.02	0.00	0.00
Bufflehead	*Bucephala albeola*	31493	0.64	0.53	0.63	0.50	0.35	0.22	0.41	0.15	0.16	0.06	0.21	0.02
Bullock's Oriole	*Icterus bullockii*	25445	0.93	0.90	0.91	0.88	0.88	0.88	0.89	0.84	0.83	0.87	0.86	0.78
Burrowing Owl	*Athene cunicularia*	10957	0.50	0.48	0.46	0.40	0.34	0.36	0.32	0.27	0.22	0.32	0.23	0.17
Bushtit	*Psaltriparus minimus*	1505	0.69	0.68	0.71	0.63	0.56	0.55	0.60	0.49	0.50	0.46	0.48	0.39
Cactus Wren	*Campylorhynchus brunneicapillus*	6250	0.92	0.88	0.91	0.86	0.91	0.87	0.90	0.85	0.90	0.86	0.88	0.83
California Gull	*Larus californicus*	6622	0.19	0.15	0.17	0.10	0.11	0.09	0.08	0.04	0.09	0.05	0.03	0.02
California Quail	*Callipepla californica*	8369	0.85	0.84	0.85	0.79	0.76	0.77	0.80	0.72	0.67	0.71	0.68	0.61
California Thrasher	*Toxostoma redivivum*	827	0.66	0.70	0.73	0.61	0.57	0.60	0.66	0.53	0.55	0.59	0.62	0.49
California Towhee	*Melozone crissalis*	1575	0.78	0.78	0.81	0.71	0.69	0.68	0.74	0.61	0.66	0.63	0.66	0.58
Calliope Hummingbird	*Stellula calliope*	2955	0.51	0.51	0.54	0.41	0.40	0.40	0.41	0.28	0.29	0.25	0.22	0.15
Canada Warbler	*Cardellina canadensis*	9571	0.65	0.82	0.72	0.62	0.38	0.49	0.34	0.31	0.12	0.12	0.00	0.00
Canvasback	*Aythya valisineria*	20753	0.42	0.44	0.40	0.34	0.11	0.11	0.13	0.08	0.01	0.04	0.02	0.01
Canyon Towhee	*Melozone fusca*	4629	0.86	0.89	0.88	0.83	0.84	0.86	0.86	0.80	0.71	0.82	0.77	0.64
Canyon Wren	*Catherpes mexicanus*	1980	0.64	0.65	0.64	0.53	0.52	0.58	0.56	0.41	0.46	0.55	0.51	0.34
Cape May Warbler	*Setophaga tigrina*	34488	0.81	0.80	0.81	0.75	0.64	0.59	0.60	0.53	0.37	0.28	0.20	0.16
Carolina Chickadee	*Poecile carolinensis*	21603	0.96	0.97	0.96	0.95	0.89	0.92	0.90	0.88	0.83	0.88	0.77	0.75
Carolina Wren	*Thryothorus ludovicianus*	23677	0.94	0.97	0.96	0.94	0.90	0.93	0.92	0.89	0.87	0.90	0.81	0.80
Caspian Tern	*Hydroprogne caspia*	1311	0.50	0.45	0.49	0.33	0.25	0.21	0.21	0.13	0.14	0.09	0.06	0.04
Cassin's Finch	*Carpodacus cassinii*	9088	0.70	0.78	0.76	0.67	0.45	0.59	0.54	0.39	0.30	0.35	0.23	0.19
Cassin's Kingbird	*Tyrannus vociferans*	3976	0.85	0.91	0.89	0.81	0.73	0.85	0.84	0.69	0.67	0.81	0.73	0.59
Cassin's Sparrow	*Peucaea cassinii*	11254	0.87	0.87	0.87	0.82	0.82	0.84	0.84	0.78	0.72	0.82	0.76	0.66
Cattle Egret	*Bubulcus ibis*	11408	0.90	0.94	0.93	0.90	0.88	0.90	0.89	0.87	0.87	0.88	0.87	0.86
Cave Swallow	*Petrochelidon fulva*	1286	0.74	0.77	0.68	0.63	0.71	0.69	0.66	0.62	0.65	0.67	0.57	0.53
Cedar Waxwing	*Bombycilla cedrorum*	24923	0.86	0.91	0.88	0.85	0.66	0.75	0.68	0.64	0.55	0.53	0.39	0.38
Cerulean Warbler	*Setophaga cerulea*	929	0.62	0.77	0.66	0.60	0.28	0.36	0.27	0.23	0.10	0.22	0.02	0.01
Chestnut-backed Chickadee	*Poecile rufescens*	5319	0.77	0.82	0.81	0.76	0.68	0.73	0.72	0.65	0.59	0.59	0.56	0.51
Chestnut-collared Longspur	*Calcarius ornatus*	10072	0.49	0.42	0.48	0.39	0.32	0.24	0.28	0.19	0.17	0.04	0.01	0.00
Chestnut-sided Warbler	*Setophaga pensylvanica*	18884	0.84	0.91	0.85	0.82	0.54	0.62	0.51	0.48	0.34	0.34	0.12	0.12
Chihuahuan Raven	*Corvus cryptoleucus*	4038	0.83	0.82	0.85	0.78	0.80	0.76	0.80	0.73	0.75	0.75	0.75	0.66
Chimney Swift	*Chaetura pelagica*	37436	0.97	0.97	0.97	0.96	0.95	0.96	0.95	0.94	0.93	0.95	0.92	0.89

Chipping Sparrow	*Spizella passerina*	77839	0.80	0.80	0.78	0.75	0.68	0.71	0.68	0.63	0.64	0.63	0.56	0.54
Chuck-will's-widow	*Caprimulgus carolinensis*	15144	0.88	0.91	0.92	0.83	0.69	0.75	0.74	0.60	0.52	0.64	0.38	0.32
Chukar	*Alectoris chukar*	5039	0.70	0.59	0.67	0.52	0.55	0.51	0.58	0.41	0.54	0.48	0.52	0.38
Cinnamon Teal	*Anas cyanoptera*	14650	0.51	0.55	0.54	0.42	0.28	0.37	0.37	0.21	0.17	0.24	0.13	0.06
Clark's Grebe	*Aechmophorus clarkii*	1534	0.08	0.05	0.11	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01
Clark's Nutcracker	*Nucifraga columbiana*	3234	0.54	0.67	0.65	0.48	0.25	0.38	0.36	0.21	0.15	0.22	0.16	0.09
Clay-colored Sparrow	*Spizella pallida*	17594	0.71	0.72	0.72	0.65	0.40	0.55	0.51	0.37	0.29	0.35	0.18	0.15
Cliff Swallow	*Petrochelidon pyrrhonota*	58890	0.72	0.69	0.72	0.64	0.66	0.62	0.66	0.56	0.62	0.59	0.61	0.51
Common Eider	*Somateria mollissima*	30372	0.59	0.55	0.68	0.51	0.47	0.44	0.56	0.40	0.36	0.26	0.33	0.18
Common Goldeneye	*Bucephala clangula*	41123	0.82	0.80	0.85	0.75	0.63	0.56	0.62	0.50	0.45	0.37	0.39	0.29
Common Grackle	*Quiscalus quiscula*	68462	0.96	0.96	0.96	0.94	0.93	0.94	0.93	0.90	0.89	0.91	0.89	0.85
Common Ground-Dove	*Columbina passerina*	3800	0.91	0.88	0.86	0.85	0.90	0.88	0.86	0.84	0.86	0.88	0.85	0.80
Common Loon	*Gavia immer*	68839	0.80	0.82	0.81	0.76	0.69	0.70	0.68	0.62	0.52	0.52	0.44	0.38
Common Merganser	*Mergus merganser*	10190	0.57	0.58	0.64	0.49	0.44	0.41	0.45	0.33	0.27	0.25	0.28	0.16
Common Nighthawk	*Chordeiles minor*	41012	0.86	0.87	0.87	0.83	0.80	0.83	0.80	0.76	0.72	0.74	0.66	0.62
Common Pauraque	*Nyctidromus albicollis*	505	0.68	0.75	0.75	0.65	0.42	0.46	0.51	0.38	0.40	0.17	0.12	0.07
Common Poorwill	*Phalaenoptilus nuttallii*	9034	0.43	0.52	0.48	0.34	0.26	0.36	0.31	0.17	0.19	0.29	0.26	0.12
Common Raven	*Corvus corax*	72700	0.80	0.85	0.84	0.77	0.66	0.69	0.68	0.60	0.46	0.47	0.39	0.34
Common Redpoll	*Acanthis flammea*	43592	0.68	0.69	0.76	0.61	0.54	0.50	0.55	0.42	0.32	0.29	0.23	0.17
Common Tern	*Sterna hirundo*	1256	0.42	0.39	0.48	0.34	0.33	0.25	0.34	0.19	0.20	0.14	0.20	0.07
Common Yellowthroat	*Geothlypis trichas*	74960	0.88	0.88	0.87	0.85	0.78	0.80	0.75	0.73	0.72	0.72	0.62	0.61
Connecticut Warbler	*Oporornis agilis*	11055	0.63	0.67	0.64	0.53	0.32	0.13	0.19	0.12	0.14	0.00	0.00	0.00
Cooper's Hawk	*Accipiter cooperii*	8590	0.68	0.74	0.68	0.58	0.49	0.64	0.57	0.40	0.42	0.59	0.44	0.31
Cordilleran Flycatcher	*Empidonax occidentalis*	1760	0.56	0.71	0.63	0.52	0.32	0.52	0.43	0.29	0.20	0.40	0.15	0.12
Costa's Hummingbird	*Calypte costae*	1479	0.67	0.71	0.70	0.57	0.53	0.61	0.59	0.43	0.48	0.60	0.50	0.38
Couch's Kingbird	*Tyrannus couchii*	426	0.67	0.77	0.62	0.52	0.65	0.74	0.61	0.52	0.59	0.58	0.36	0.31
Crested Caracara	*Caracara cheriway*	1260	0.79	0.77	0.77	0.69	0.57	0.67	0.61	0.48	0.29	0.27	0.15	0.06
Crissal Thrasher	*Toxostoma crissale*	930	0.90	0.84	0.90	0.81	0.89	0.83	0.89	0.80	0.88	0.83	0.88	0.78
Curve-billed Thrasher	*Toxostoma curvirostre*	5210	0.86	0.86	0.85	0.79	0.84	0.83	0.84	0.76	0.83	0.81	0.83	0.74
Dark-eyed Junco	*Junco hyemalis*	61075	0.87	0.87	0.87	0.83	0.75	0.73	0.72	0.68	0.63	0.58	0.53	0.50
Dickcissel	*Spiza americana*	22644	0.92	0.92	0.93	0.89	0.91	0.90	0.92	0.87	0.89	0.90	0.86	0.83
Double-crested Cormorant	*Phalacrocorax auritus*	7697	0.44	0.33	0.47	0.29	0.28	0.23	0.36	0.18	0.22	0.19	0.21	0.13
Downy Woodpecker	*Picoides pubescens*	34905	0.93	0.96	0.95	0.93	0.89	0.91	0.90	0.89	0.89	0.88	0.82	0.82
Dunlin	*Calidris alpina*	3751	0.45	0.13	0.17	0.05	0.14	0.02	0.05	0.00	0.01	0.00	0.00	0.00
Dusky Flycatcher	*Empidonax oberholseri*	15070	0.60	0.73	0.69	0.57	0.40	0.53	0.51	0.37	0.30	0.36	0.27	0.22
Dusky Grouse	*Dendragapus obscurus*	125	0.09	0.27	0.12	0.06	0.04	0.19	0.03	0.01	0.02	0.11	0.00	0.00

Dusky-capped Flycatcher	*Myiarchus tuberculifer*	12	0.42	0.58	0.58	0.42	0.42	0.50	0.50	0.33	0.42	0.50	0.33	0.33
Eared Grebe	*Podiceps nigricollis*	6815	0.20	0.19	0.21	0.08	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
Eastern Bluebird	*Sialia sialis*	26955	0.93	0.95	0.93	0.92	0.89	0.89	0.90	0.86	0.81	0.84	0.81	0.76
Eastern Kingbird	*Tyrannus tyrannus*	61970	0.90	0.90	0.91	0.87	0.87	0.86	0.87	0.83	0.86	0.83	0.83	0.79
Eastern Meadowlark	*Sturnella magna*	45290	0.97	0.98	0.98	0.97	0.97	0.97	0.97	0.96	0.96	0.96	0.95	0.95
Eastern Phoebe	*Sayornis phoebe*	34111	0.78	0.78	0.77	0.72	0.72	0.67	0.69	0.62	0.62	0.58	0.50	0.46
Eastern Screech-Owl	*Megascops asio*	3222	0.65	0.52	0.67	0.44	0.64	0.49	0.66	0.43	0.64	0.49	0.66	0.43
Eastern Towhee	*Pipilo erythrophthalmus*	23343	0.85	0.89	0.86	0.83	0.48	0.70	0.51	0.44	0.28	0.52	0.16	0.16
Eastern Whip-poor-will	*Caprimulgus vociferus*	10387	0.53	0.61	0.58	0.46	0.27	0.32	0.27	0.21	0.15	0.20	0.02	0.02
Eastern Wood-Pewee	*Contopus virens*	36956	0.84	0.87	0.84	0.82	0.77	0.80	0.78	0.75	0.75	0.74	0.66	0.64
Eastern Yellow Wagtail	*Motacilla tschutschensis*	14242	0.79	0.83	0.83	0.76	0.71	0.76	0.73	0.68	0.61	0.67	0.54	0.52
Eurasian Collared-Dove	*Streptopelia decaocto*	1614	0.69	0.63	0.71	0.53	0.62	0.62	0.70	0.49	0.56	0.55	0.57	0.37
Eurasian Tree Sparrow	*Passer montanus*	1005	0.09	0.20	0.04	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
European Starling	*Sturnus vulgaris*	63187	0.88	0.91	0.90	0.86	0.79	0.85	0.83	0.77	0.75	0.76	0.72	0.67
Evening Grosbeak	*Coccothraustes vespertinus*	10412	0.48	0.62	0.53	0.43	0.18	0.22	0.16	0.12	0.05	0.07	0.02	0.02
Ferruginous Hawk	*Buteo regalis*	11030	0.56	0.50	0.53	0.40	0.36	0.34	0.31	0.18	0.18	0.14	0.06	0.02
Field Sparrow	*Spizella pusilla*	28484	0.92	0.97	0.95	0.90	0.85	0.89	0.89	0.81	0.79	0.79	0.72	0.68
Fish Crow	*Corvus ossifragus*	11591	0.83	0.74	0.84	0.72	0.75	0.69	0.78	0.61	0.56	0.66	0.52	0.38
Florida Scrub-Jay	*Aphelocoma coerulescens*	87	0.22	0.24	0.07	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Forster's Tern	*Sterna forsteri*	1837	0.34	0.26	0.39	0.24	0.29	0.19	0.30	0.18	0.24	0.15	0.19	0.13
Fox Sparrow	*Passerella iliaca*	72274	0.83	0.82	0.85	0.79	0.72	0.67	0.71	0.65	0.54	0.53	0.47	0.43
Franklin's Gull	*Leucophaeus pipixcan*	6922	0.55	0.52	0.61	0.40	0.10	0.27	0.20	0.02	0.03	0.01	0.01	0.00
Fulvous Whistling-Duck	*Dendrocygna bicolor*	396	0.72	0.67	0.72	0.65	0.72	0.67	0.72	0.65	0.72	0.67	0.71	0.65
Gadwall	*Anas strepera*	21245	0.49	0.45	0.48	0.39	0.27	0.31	0.34	0.22	0.20	0.14	0.09	0.06
Gambel's Quail	*Callipepla gambelii*	3753	0.88	0.87	0.87	0.84	0.87	0.86	0.86	0.83	0.85	0.86	0.86	0.81
Gila Woodpecker	*Melanerpes uropygialis*	697	0.66	0.85	0.80	0.63	0.50	0.55	0.47	0.44	0.34	0.30	0.23	0.22
Gilded Flicker	*Colaptes chrysoides*	736	0.65	0.75	0.72	0.60	0.45	0.46	0.42	0.32	0.36	0.42	0.29	0.24
Glaucous Gull	*Larus hyperboreus*	21712	0.86	0.88	0.80	0.78	0.71	0.77	0.56	0.54	0.37	0.60	0.23	0.21
Glaucous-winged Gull	*Larus glaucescens*	4198	0.65	0.65	0.68	0.60	0.47	0.58	0.59	0.44	0.28	0.36	0.20	0.17
Glossy Ibis	*Plegadis falcinellus*	232	0.51	0.63	0.66	0.44	0.40	0.25	0.42	0.22	0.30	0.25	0.35	0.19
Golden Eagle	*Aquila chrysaetos*	22104	0.60	0.57	0.55	0.46	0.49	0.42	0.42	0.33	0.34	0.32	0.21	0.16
Golden-cheeked Warbler	*Setophaga chrysoparia*	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Golden-crowned Kinglet	*Regulus satrapa*	21483	0.66	0.74	0.72	0.62	0.43	0.48	0.46	0.37	0.33	0.33	0.31	0.25
Golden-crowned Sparrow	*Zonotrichia atricapilla*	23252	0.87	0.86	0.87	0.85	0.82	0.80	0.80	0.76	0.69	0.72	0.60	0.57
Golden-fronted Woodpecker	*Melanerpes aurifrons*	3000	0.49	0.55	0.47	0.37	0.39	0.43	0.40	0.33	0.33	0.42	0.38	0.30
Golden-winged Warbler	*Vermivora chrysoptera*	1895	0.53	0.63	0.53	0.49	0.20	0.19	0.07	0.05	0.01	0.01	0.00	0.00

Grace's Warbler	*Setophaga graciae*	206	0.74	0.85	0.82	0.71	0.56	0.66	0.60	0.50	0.37	0.51	0.30	0.25
Grasshopper Sparrow	*Ammodramus savannarum*	35946	0.81	0.81	0.80	0.75	0.72	0.72	0.70	0.65	0.65	0.61	0.59	0.54
Gray Catbird	*Dumetella carolinensis*	33590	0.81	0.84	0.81	0.77	0.69	0.68	0.66	0.63	0.59	0.55	0.43	0.40
Gray Flycatcher	*Empidonax wrightii*	3487	0.74	0.82	0.80	0.69	0.43	0.63	0.52	0.37	0.25	0.33	0.09	0.05
Gray Hawk	*Buteo nitidus*	58	0.48	0.52	0.52	0.48	0.43	0.43	0.48	0.43	0.43	0.29	0.29	0.21
Gray Jay	*Perisoreus canadensis*	56730	0.83	0.83	0.85	0.80	0.71	0.67	0.68	0.64	0.54	0.50	0.38	0.37
Gray Kingbird	*Tyrannus dominicensis*	147	0.64	0.56	0.68	0.56	0.64	0.56	0.68	0.56	0.64	0.56	0.68	0.56
Gray Partridge	*Perdix perdix*	8522	0.66	0.64	0.67	0.61	0.47	0.43	0.48	0.37	0.30	0.20	0.23	0.16
Gray Vireo	*Vireo vicinior*	69	0.62	0.77	0.68	0.58	0.01	0.33	0.14	0.01	0.01	0.01	0.03	0.00
Gray-cheeked Thrush	*Catharus minimus*	56425	0.73	0.72	0.77	0.65	0.59	0.54	0.60	0.49	0.43	0.37	0.33	0.27
Great Black-backed Gull	*Larus marinus*	3117	0.37	0.40	0.43	0.32	0.31	0.36	0.41	0.27	0.27	0.34	0.40	0.23
Great Blue Heron	*Ardea herodias*	32823	0.91	0.92	0.94	0.90	0.89	0.90	0.92	0.87	0.89	0.89	0.89	0.83
Great Crested Flycatcher	*Myiarchus crinitus*	44367	0.93	0.92	0.93	0.89	0.89	0.89	0.90	0.85	0.83	0.87	0.86	0.77
Great Egret	*Ardea alba*	8626	0.82	0.85	0.85	0.78	0.77	0.77	0.79	0.71	0.76	0.74	0.77	0.69
Great Horned Owl	*Bubo virginianus*	22379	0.59	0.48	0.54	0.45	0.56	0.45	0.51	0.41	0.55	0.44	0.50	0.40
Great Kiskadee	*Pitangus sulphuratus*	345	0.42	0.78	0.61	0.42	0.35	0.39	0.39	0.35	0.34	0.35	0.37	0.34
Great White Heron	*Ardea herodias*	45	0.27	0.27	0.27	0.27	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Great-tailed Grackle	*Quiscalus mexicanus*	6294	0.88	0.86	0.90	0.81	0.82	0.81	0.83	0.74	0.76	0.78	0.80	0.68
Greater Prairie-Chicken	*Tympanuchus cupido*	1316	0.78	0.88	0.83	0.68	0.61	0.76	0.56	0.51	0.47	0.55	0.06	0.05
Greater Roadrunner	*Geococcyx californianus*	7482	0.95	0.93	0.94	0.91	0.91	0.92	0.93	0.89	0.90	0.92	0.93	0.87
Greater Sage-Grouse	*Centrocercus urophasianus*	420	0.39	0.50	0.47	0.29	0.10	0.33	0.21	0.06	0.06	0.09	0.01	0.00
Greater Scaup	*Aythya marila*	47552	0.84	0.84	0.88	0.82	0.77	0.77	0.82	0.73	0.71	0.71	0.68	0.64
Greater White-fronted Goose	*Anser albifrons*	1782	0.01	0.16	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Greater Yellowlegs	*Tringa melanoleuca*	10249	0.58	0.64	0.70	0.49	0.41	0.39	0.48	0.31	0.19	0.20	0.19	0.10
Green Heron	*Butorides virescens*	24535	0.93	0.94	0.95	0.92	0.93	0.93	0.94	0.91	0.93	0.93	0.94	0.91
Green Jay	*Cyanocorax yncas*	363	0.76	0.85	0.88	0.73	0.76	0.78	0.77	0.69	0.71	0.77	0.74	0.66
Green-tailed Towhee	*Pipilo chlorurus*	8391	0.59	0.71	0.64	0.55	0.37	0.47	0.36	0.29	0.24	0.29	0.11	0.09
Green-winged Teal	*Anas crecca*	72594	0.61	0.60	0.66	0.54	0.50	0.52	0.58	0.47	0.48	0.49	0.57	0.45
Gull-billed Tern	*Gelochelidon nilotica*	273	0.45	0.38	0.43	0.34	0.33	0.36	0.42	0.29	0.33	0.34	0.38	0.29
Gyrfalcon	*Falco rusticolus*	16788	0.55	0.64	0.68	0.51	0.34	0.44	0.45	0.26	0.16	0.40	0.21	0.11
Hairy Woodpecker	*Picoides villosus*	44132	0.77	0.81	0.78	0.72	0.60	0.61	0.57	0.52	0.49	0.45	0.22	0.20
Hammond's Flycatcher	*Empidonax hammondii*	16136	0.62	0.67	0.66	0.55	0.44	0.50	0.50	0.39	0.32	0.36	0.33	0.26
Harlequin Duck	*Histrionicus histrionicus*	43498	0.78	0.83	0.84	0.76	0.69	0.73	0.72	0.67	0.59	0.63	0.57	0.54
Harris's Hawk	*Parabuteo unicinctus*	670	0.90	0.86	0.87	0.84	0.89	0.83	0.85	0.81	0.85	0.83	0.85	0.78
Henslow's Sparrow	*Ammodramus henslowii*	1177	0.32	0.24	0.31	0.18	0.15	0.06	0.15	0.02	0.01	0.02	0.01	0.00
Hepatic Tanager	*Piranga flava*	391	0.49	0.68	0.56	0.47	0.28	0.41	0.26	0.18	0.16	0.20	0.10	0.07

Hermit Thrush	*Catharus guttatus*	60726	0.79	0.78	0.78	0.71	0.64	0.60	0.61	0.52	0.44	0.38	0.27	0.22
Hermit Warbler	*Setophaga occidentalis*	2197	0.78	0.69	0.70	0.65	0.57	0.56	0.57	0.48	0.45	0.44	0.40	0.34
Herring Gull	*Larus argentatus*	70395	0.66	0.62	0.72	0.56	0.57	0.53	0.66	0.46	0.50	0.49	0.62	0.40
Hoary Redpoll	*Acanthis hornemanni*	61519	0.76	0.76	0.84	0.71	0.68	0.70	0.81	0.63	0.61	0.68	0.79	0.58
Hooded Merganser	*Lophodytes cucullatus*	2463	0.42	0.40	0.46	0.25	0.13	0.18	0.13	0.07	0.08	0.11	0.09	0.05
Hooded Oriole	*Icterus cucullatus*	461	0.50	0.47	0.45	0.37	0.43	0.35	0.42	0.30	0.38	0.25	0.38	0.21
Hooded Warbler	*Setophaga citrina*	11627	0.67	0.48	0.61	0.42	0.57	0.39	0.52	0.33	0.45	0.36	0.37	0.22
Horned Grebe	*Podiceps auritus*	7195	0.40	0.39	0.46	0.26	0.03	0.05	0.02	0.01	0.00	0.01	0.00	0.00
Horned Lark	*Eremophila alpestris*	67858	0.88	0.88	0.89	0.85	0.78	0.79	0.80	0.73	0.61	0.63	0.53	0.48
House Finch	*Carpodacus mexicanus*	25123	0.58	0.61	0.58	0.55	0.41	0.45	0.42	0.38	0.34	0.34	0.31	0.28
House Sparrow	*Passer domesticus*	57914	0.92	0.92	0.93	0.89	0.90	0.90	0.92	0.87	0.88	0.88	0.87	0.82
House Wren	*Troglodytes aedon*	52610	0.75	0.79	0.77	0.71	0.62	0.66	0.62	0.57	0.55	0.54	0.41	0.38
Hudsonian Godwit	*Limosa haemastica*	892	0.43	0.10	0.34	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hutton's Vireo	*Vireo huttoni*	1592	0.53	0.55	0.56	0.48	0.40	0.38	0.41	0.32	0.32	0.30	0.28	0.24
Inca Dove	*Columbina inca*	2365	0.88	0.90	0.92	0.82	0.67	0.88	0.88	0.61	0.54	0.85	0.81	0.46
Indigo Bunting	*Passerina cyanea*	36023	0.96	0.99	0.97	0.96	0.94	0.95	0.94	0.93	0.93	0.92	0.89	0.89
Juniper Titmouse	*Baeolophus ridgwayi*	1805	0.70	0.85	0.82	0.67	0.29	0.55	0.56	0.27	0.16	0.23	0.16	0.09
Kentucky Warbler	*Geothlypis formosa*	16370	0.98	0.99	0.99	0.98	0.96	0.97	0.97	0.95	0.95	0.96	0.92	0.91
Killdeer	*Charadrius vociferus*	72153	0.86	0.85	0.85	0.81	0.79	0.81	0.79	0.74	0.76	0.75	0.72	0.69
Ladder-backed Woodpecker	*Picoides scalaris*	7691	0.96	0.96	0.96	0.94	0.91	0.95	0.95	0.90	0.85	0.94	0.91	0.82
Lapland Longspur	*Calcarius lapponicus*	38772	0.87	0.90	0.90	0.86	0.78	0.78	0.77	0.75	0.66	0.66	0.55	0.55
Lark Bunting	*Calamospiza melanocorys*	13561	0.71	0.74	0.72	0.64	0.58	0.63	0.57	0.50	0.44	0.52	0.30	0.27
Lark Sparrow	*Chondestes grammacus*	32272	0.84	0.82	0.82	0.77	0.78	0.78	0.78	0.71	0.74	0.73	0.71	0.64
Laughing Gull	*Leucophaeus atricilla*	2243	0.41	0.46	0.45	0.37	0.35	0.44	0.43	0.33	0.34	0.40	0.42	0.32
Lawrence's Goldfinch	*Spinus lawrencei*	971	0.69	0.64	0.74	0.57	0.63	0.60	0.68	0.53	0.62	0.58	0.63	0.52
Lazuli Bunting	*Passerina amoena*	12449	0.75	0.79	0.78	0.70	0.59	0.64	0.64	0.53	0.50	0.51	0.44	0.38
Le Conte's Sparrow	*Ammodramus leconteii*	12778	0.48	0.57	0.54	0.39	0.11	0.28	0.22	0.09	0.09	0.03	0.01	0.00
Le Conte's Thrasher	*Toxostoma lecontei*	1337	0.88	0.71	0.80	0.69	0.85	0.70	0.79	0.67	0.83	0.70	0.78	0.66
Least Bittern	*Ixobrychus exilis*	1045	0.35	0.35	0.40	0.30	0.25	0.30	0.32	0.24	0.25	0.28	0.31	0.23
Least Flycatcher	*Empidonax minimus*	46322	0.86	0.89	0.87	0.84	0.69	0.74	0.70	0.66	0.59	0.55	0.40	0.38
Least Sandpiper	*Calidris minutilla*	41657	0.76	0.82	0.87	0.74	0.68	0.72	0.80	0.66	0.60	0.62	0.71	0.51
Least Tern	*Sternula antillarum*	262	0.34	0.30	0.29	0.26	0.23	0.24	0.23	0.18	0.21	0.14	0.18	0.13
Lesser Goldfinch	*Spinus psaltria*	4292	0.61	0.64	0.61	0.56	0.52	0.57	0.57	0.48	0.50	0.53	0.52	0.46
Lesser Nighthawk	*Chordeiles acutipennis*	3469	0.86	0.84	0.82	0.77	0.82	0.81	0.79	0.73	0.75	0.80	0.79	0.70
Lesser Prairie-Chicken	*Tympanuchus pallidicinctus*	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lesser Scaup	*Aythya affinis*	26080	0.57	0.58	0.67	0.50	0.29	0.39	0.46	0.19	0.17	0.28	0.35	0.11

Lesser Yellowlegs	*Tringa flavipes*	25920	0.52	0.55	0.60	0.46	0.33	0.36	0.39	0.25	0.16	0.23	0.17	0.09
Lewis's Woodpecker	*Melanerpes lewis*	278	0.17	0.20	0.16	0.08	0.00	0.07	0.01	0.00	0.00	0.00	0.00	0.00
Lincoln's Sparrow	*Melospiza lincolnii*	74166	0.85	0.86	0.87	0.81	0.69	0.66	0.67	0.62	0.52	0.52	0.40	0.39
Little Blue Heron	*Egretta caerulea*	8666	0.96	0.96	0.96	0.95	0.96	0.96	0.96	0.95	0.95	0.96	0.95	0.95
Loggerhead Shrike	*Lanius ludovicianus*	40363	0.92	0.90	0.91	0.88	0.91	0.89	0.90	0.87	0.91	0.88	0.90	0.87
Long-billed Curlew	*Numenius americanus*	7263	0.26	0.23	0.25	0.14	0.10	0.03	0.04	0.01	0.04	0.00	0.01	0.00
Long-billed Thrasher	*Toxostoma longirostre*	366	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Long-tailed Duck	*Clangula hyemalis*	38526	0.83	0.83	0.86	0.81	0.73	0.73	0.74	0.68	0.46	0.54	0.41	0.32
Long-tailed Jaeger	*Stercorarius longicaudus*	33883	0.86	0.87	0.88	0.85	0.79	0.81	0.79	0.75	0.65	0.72	0.56	0.53
Louisiana Waterthrush	*Parkesia motacilla*	2131	0.54	0.68	0.68	0.53	0.31	0.39	0.33	0.24	0.14	0.26	0.03	0.03
Lucy's Warbler	*Oreothlypis luciae*	668	0.93	0.90	0.92	0.90	0.93	0.90	0.92	0.90	0.93	0.90	0.92	0.90
MacGillivray's Warbler	*Geothlypis tolmiei*	12036	0.79	0.85	0.84	0.75	0.61	0.69	0.68	0.57	0.47	0.52	0.47	0.39
Magnificent Frigatebird	*Fregata magnificens*	51	0.31	0.25	0.31	0.25	0.31	0.25	0.31	0.25	0.31	0.25	0.31	0.25
Magnolia Warbler	*Setophaga magnolia*	27088	0.81	0.89	0.84	0.78	0.53	0.66	0.58	0.50	0.18	0.27	0.09	0.08
Mallard	*Anas platyrhynchos*	66848	0.52	0.52	0.54	0.46	0.39	0.42	0.41	0.34	0.33	0.31	0.25	0.22
Mangrove Cuckoo	*Coccyzus minor*	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marbled Godwit	*Limosa fedoa*	8077	0.56	0.47	0.58	0.41	0.24	0.09	0.13	0.05	0.12	0.00	0.00	0.00
Marbled Murrelet	*Brachyramphus marmoratus*	2146	0.65	0.67	0.70	0.63	0.64	0.65	0.68	0.61	0.63	0.63	0.66	0.59
Marsh Wren	*Cistothorus palustris*	10913	0.49	0.49	0.54	0.41	0.35	0.39	0.45	0.25	0.25	0.30	0.26	0.12
McCown's Longspur	*Rhynchophanes mccownii*	4259	0.19	0.23	0.21	0.10	0.03	0.05	0.03	0.01	0.01	0.00	0.00	0.00
Merlin	*Falco columbarius*	14840	0.08	0.08	0.09	0.05	0.04	0.04	0.06	0.03	0.02	0.02	0.03	0.01
Mew Gull	*Larus canus*	60089	0.72	0.73	0.81	0.68	0.65	0.65	0.71	0.59	0.56	0.58	0.59	0.52
Mexican Jay	*Aphelocoma wollweberi*	10	0.00	0.30	0.20	0.00	0.00	0.10	0.10	0.00	0.00	0.10	0.10	0.00
Mississippi Kite	*Ictinia mississippiensis*	747	0.68	0.87	0.73	0.66	0.47	0.70	0.40	0.39	0.34	0.30	0.12	0.12
Monk Parakeet	*Myiopsitta monachus*	35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Montezuma Quail	*Cyrtonyx montezumae*	10	0.90	0.90	0.90	0.90	0.90	0.90	0.80	0.80	0.90	0.90	0.70	0.70
Mottled Duck	*Anas fulvigula*	1567	0.67	0.70	0.68	0.63	0.64	0.64	0.64	0.59	0.61	0.56	0.56	0.50
Mountain Bluebird	*Sialia currucoides*	11738	0.72	0.83	0.78	0.69	0.47	0.59	0.55	0.43	0.35	0.39	0.23	0.21
Mountain Chickadee	*Poecile gambeli*	10685	0.71	0.79	0.77	0.68	0.47	0.63	0.61	0.43	0.31	0.45	0.29	0.22
Mountain Plover	*Charadrius montanus*	3531	0.42	0.47	0.42	0.28	0.34	0.38	0.27	0.20	0.20	0.31	0.15	0.10
Mountain Quail	*Oreortyx pictus*	1597	0.61	0.59	0.65	0.54	0.48	0.48	0.55	0.43	0.38	0.42	0.42	0.32
Mourning Dove	*Zenaida macroura*	84614	0.98	0.96	0.97	0.96	0.97	0.96	0.97	0.95	0.97	0.96	0.97	0.95
Mourning Warbler	*Geothlypis philadelphia*	25789	0.81	0.85	0.81	0.77	0.55	0.56	0.51	0.47	0.33	0.27	0.04	0.03
Mute Swan	*Cygnus olor*	2	0.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00
Nashville Warbler	*Oreothlypis ruficapilla*	25643	0.72	0.77	0.74	0.68	0.46	0.51	0.47	0.41	0.26	0.31	0.06	0.05
Neotropic Cormorant	*Phalacrocorax brasilianus*	101	0.32	0.16	0.14	0.03	0.24	0.16	0.14	0.03	0.23	0.14	0.14	0.03

Northern Beardless-Tyrannulet	*Camptostoma imberbe*	117	0.85	0.80	0.85	0.80	0.85	0.80	0.85	0.80	0.82	0.80	0.82	0.77
Northern Bobwhite	*Colinus virginianus*	33422	0.95	0.96	0.97	0.94	0.93	0.94	0.94	0.91	0.92	0.93	0.94	0.90
Northern Cardinal	*Cardinalis cardinalis*	39047	0.99	0.99	0.99	0.99	0.98	0.99	0.98	0.98	0.98	0.98	0.98	0.98
Northern Flicker	*Colaptes auratus*	24478	0.76	0.87	0.84	0.75	0.55	0.69	0.67	0.54	0.45	0.56	0.46	0.41
Northern Gannet	*Morus bassanus*	56	0.09	0.04	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Northern Goshawk	*Accipiter gentilis*	5187	0.07	0.02	0.05	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.01	0.00
Northern Harrier	*Circus cyaneus*	47329	0.42	0.40	0.42	0.33	0.33	0.30	0.32	0.24	0.25	0.20	0.15	0.12
Northern Hawk Owl	*Surnia ulula*	3466	0.14	0.22	0.11	0.06	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Northern Mockingbird	*Mimus polyglottos*	42337	0.97	0.98	0.98	0.97	0.97	0.97	0.97	0.96	0.97	0.97	0.97	0.96
Northern Parula	*Setophaga americana*	24195	0.74	0.78	0.77	0.68	0.60	0.58	0.58	0.48	0.52	0.49	0.45	0.35
Northern Pintail	*Anas acuta*	51038	0.78	0.78	0.83	0.74	0.67	0.70	0.76	0.62	0.60	0.63	0.70	0.52
Northern Pygmy-Owl	*Glaucidium gnoma*	680	0.14	0.15	0.20	0.08	0.05	0.05	0.08	0.03	0.02	0.03	0.03	0.01
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	44859	0.67	0.70	0.72	0.61	0.58	0.62	0.62	0.51	0.51	0.55	0.49	0.42
Northern Shoveler	*Anas clypeata*	42534	0.55	0.56	0.57	0.48	0.36	0.40	0.43	0.29	0.23	0.19	0.25	0.10
Northern Waterthrush	*Parkesia noveboracensis*	92384	0.83	0.85	0.88	0.79	0.77	0.79	0.80	0.71	0.68	0.65	0.63	0.56
Northwestern Crow	*Corvus caurinus*	3307	0.64	0.65	0.66	0.57	0.61	0.64	0.64	0.54	0.59	0.63	0.64	0.53
Nuttall's Woodpecker	*Picoides nuttallii*	1522	0.78	0.82	0.82	0.75	0.58	0.74	0.77	0.55	0.53	0.65	0.70	0.46
Oak Titmouse	*Baeolophus inornatus*	1523	0.77	0.78	0.77	0.72	0.70	0.71	0.74	0.63	0.65	0.66	0.65	0.55
Olive Sparrow	*Arremonops rufivirgatus*	1021	0.92	0.92	0.94	0.90	0.83	0.90	0.84	0.78	0.54	0.76	0.50	0.38
Olive Warbler	*Peucedramus taeniatus*	9	0.22	0.56	0.56	0.11	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00
Olive-sided Flycatcher	*Contopus cooperi*	67625	0.79	0.78	0.80	0.72	0.68	0.62	0.67	0.55	0.53	0.49	0.43	0.37
Orange-crowned Warbler	*Oreothlypis celata*	64651	0.80	0.82	0.82	0.77	0.69	0.71	0.72	0.65	0.58	0.56	0.49	0.46
Orchard Oriole	*Icterus spurius*	30026	0.86	0.93	0.89	0.85	0.76	0.82	0.79	0.74	0.67	0.71	0.54	0.52
Osprey	*Pandion haliaetus*	18740	0.37	0.41	0.42	0.31	0.27	0.29	0.32	0.21	0.18	0.18	0.21	0.11
Ovenbird	*Seiurus aurocapilla*	35825	0.86	0.88	0.85	0.82	0.69	0.69	0.64	0.60	0.56	0.49	0.33	0.31
Pacific Golden-Plover	*Pluvialis fulva*	19256	0.85	0.85	0.87	0.84	0.80	0.84	0.83	0.78	0.68	0.80	0.72	0.62
Pacific Loon	*Gavia pacifica*	43606	0.80	0.78	0.86	0.74	0.72	0.69	0.78	0.61	0.54	0.56	0.60	0.43
Pacific-slope Flycatcher	*Empidonax difficilis*	5777	0.67	0.73	0.72	0.66	0.60	0.66	0.67	0.56	0.52	0.54	0.48	0.40
Painted Bunting	*Passerina ciris*	10579	0.85	0.84	0.85	0.82	0.82	0.83	0.84	0.79	0.81	0.78	0.76	0.71
Painted Redstart	*Myioborus pictus*	24	0.17	0.25	0.25	0.17	0.13	0.04	0.00	0.00	0.04	0.00	0.00	0.00
Palm Warbler	*Setophaga palmarum*	11617	0.83	0.72	0.83	0.70	0.77	0.65	0.75	0.62	0.66	0.38	0.49	0.37
Parasitic Jaeger	*Stercorarius parasiticus*	34542	0.86	0.87	0.88	0.85	0.83	0.82	0.83	0.80	0.74	0.67	0.68	0.60
Phainopepla	*Phainopepla nitens*	1876	0.91	0.86	0.87	0.83	0.89	0.85	0.86	0.81	0.84	0.83	0.81	0.75
Philadelphia Vireo	*Vireo philadelphicus*	5248	0.55	0.67	0.58	0.50	0.30	0.27	0.26	0.21	0.16	0.05	0.06	0.04
Pied-billed Grebe	*Podilymbus podiceps*	21053	0.65	0.61	0.67	0.55	0.57	0.54	0.60	0.48	0.47	0.50	0.52	0.38
Pigeon Guillemot	*Cepphus columba*	19564	0.63	0.72	0.71	0.61	0.56	0.69	0.66	0.54	0.51	0.68	0.64	0.49

Pileated Woodpecker	*Dryocopus pileatus*	26182	0.81	0.76	0.81	0.68	0.68	0.63	0.65	0.51	0.51	0.51	0.38	0.26
Pine Grosbeak	*Pinicola enucleator*	28676	0.52	0.56	0.58	0.45	0.35	0.34	0.39	0.26	0.19	0.22	0.13	0.08
Pine Siskin	*Spinus pinus*	25232	0.71	0.74	0.74	0.68	0.57	0.63	0.62	0.55	0.47	0.49	0.41	0.38
Pine Warbler	*Setophaga pinus*	11458	0.58	0.44	0.53	0.39	0.47	0.24	0.38	0.19	0.35	0.22	0.28	0.11
Pinyon Jay	*Gymnorhinus cyanocephalus*	2726	0.58	0.75	0.67	0.55	0.30	0.49	0.38	0.26	0.17	0.24	0.07	0.05
Plain Chachalaca	*Ortalis vetula*	8	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Prairie Falcon	*Falco mexicanus*	17878	0.35	0.28	0.29	0.21	0.24	0.20	0.22	0.13	0.19	0.15	0.11	0.06
Prairie Warbler	*Setophaga discolor*	10976	0.64	0.62	0.65	0.54	0.55	0.53	0.51	0.41	0.47	0.51	0.33	0.24
Prothonotary Warbler	*Protonotaria citrea*	12529	0.78	0.82	0.82	0.74	0.46	0.68	0.59	0.42	0.29	0.56	0.26	0.15
Purple Finch	*Carpodacus purpureus*	31270	0.68	0.67	0.67	0.59	0.48	0.50	0.47	0.38	0.32	0.23	0.11	0.09
Purple Martin	*Progne subis*	25921	0.93	0.93	0.94	0.93	0.93	0.93	0.94	0.93	0.93	0.93	0.93	0.92
Pygmy Nuthatch	*Sitta pygmaea*	1585	0.43	0.57	0.51	0.39	0.15	0.31	0.26	0.14	0.09	0.18	0.09	0.06
Pyrrhuloxia	*Cardinalis sinuatus*	4274	0.87	0.89	0.86	0.79	0.76	0.85	0.81	0.70	0.61	0.69	0.64	0.53
Red Crossbill	*Loxia curvirostra*	18261	0.55	0.66	0.63	0.52	0.36	0.48	0.47	0.34	0.26	0.34	0.29	0.21
Red-bellied Woodpecker	*Melanerpes carolinus*	29029	0.96	0.97	0.97	0.96	0.95	0.96	0.96	0.94	0.95	0.96	0.96	0.94
Red-breasted Merganser	*Mergus serrator*	10646	0.45	0.42	0.54	0.34	0.32	0.33	0.41	0.23	0.22	0.19	0.19	0.10
Red-breasted Nuthatch	*Sitta canadensis*	32727	0.68	0.75	0.70	0.65	0.49	0.54	0.49	0.44	0.28	0.30	0.19	0.18
Red-breasted Sapsucker	*Sphyrapicus ruber*	5563	0.54	0.57	0.57	0.47	0.40	0.44	0.46	0.34	0.33	0.32	0.31	0.23
Red-eyed Vireo	*Vireo olivaceus*	59667	0.82	0.82	0.80	0.76	0.70	0.67	0.65	0.62	0.60	0.57	0.47	0.45
Red-faced Warbler	*Cardellina rubrifrons*	79	0.49	0.66	0.51	0.47	0.34	0.34	0.32	0.30	0.20	0.28	0.24	0.14
Red-headed Woodpecker	*Melanerpes erythrocephalus*	27932	0.87	0.91	0.89	0.84	0.73	0.83	0.75	0.66	0.66	0.80	0.58	0.53
Red-naped Sapsucker	*Sphyrapicus nuchalis*	5296	0.55	0.70	0.66	0.49	0.31	0.48	0.42	0.27	0.20	0.31	0.18	0.12
Red-necked Grebe	*Podiceps grisegena*	14555	0.30	0.34	0.40	0.23	0.12	0.12	0.17	0.08	0.07	0.05	0.09	0.03
Red-necked Phalarope	*Phalaropus lobatus*	39145	0.78	0.80	0.81	0.75	0.67	0.68	0.67	0.62	0.52	0.60	0.46	0.44
Red-shouldered Hawk	*Buteo lineatus*	12731	0.74	0.68	0.75	0.60	0.68	0.63	0.67	0.54	0.54	0.61	0.60	0.42
Red-tailed Hawk	*Buteo jamaicensis*	72705	0.75	0.73	0.75	0.67	0.63	0.68	0.68	0.57	0.59	0.63	0.60	0.50
Red-throated Loon	*Gavia stellata*	24659	0.64	0.58	0.70	0.53	0.48	0.42	0.57	0.34	0.38	0.33	0.39	0.21
Red-winged Blackbird	*Agelaius phoeniceus*	95978	0.87	0.84	0.85	0.81	0.84	0.82	0.83	0.78	0.81	0.79	0.80	0.74
Reddish Egret	*Egretta rufescens*	225	0.48	0.40	0.54	0.39	0.30	0.34	0.41	0.26	0.26	0.24	0.37	0.21
Redhead	*Aythya americana*	15887	0.50	0.52	0.54	0.45	0.30	0.43	0.47	0.28	0.22	0.27	0.17	0.11
Rhinoceros Auklet	*Cerorhinca monocerata*	363	0.17	0.18	0.23	0.16	0.15	0.18	0.22	0.15	0.15	0.18	0.22	0.15
Ring-billed Gull	*Larus delawarensis*	34533	0.52	0.51	0.57	0.45	0.35	0.39	0.44	0.29	0.24	0.29	0.30	0.18
Ring-necked Duck	*Aythya collaris*	26702	0.31	0.27	0.29	0.18	0.17	0.17	0.17	0.09	0.12	0.09	0.08	0.04
Ring-necked Pheasant	*Phasianus colchicus*	41211	0.71	0.71	0.71	0.66	0.63	0.59	0.58	0.54	0.55	0.51	0.46	0.44
Rock Pigeon	*Columba livia*	41978	0.65	0.67	0.65	0.60	0.52	0.58	0.56	0.47	0.46	0.47	0.42	0.35
Rock Ptarmigan	*Lagopus muta*	18452	0.87	0.88	0.89	0.87	0.84	0.86	0.84	0.81	0.59	0.82	0.53	0.49

Rock Sandpiper	*Calidris ptilocnemis*	3613	0.57	0.73	0.85	0.54	0.51	0.68	0.81	0.46	0.42	0.63	0.74	0.38
Rock Wren	*Salpinctes obsoletus*	13115	0.90	0.89	0.89	0.84	0.84	0.81	0.84	0.75	0.80	0.75	0.76	0.66
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	36761	0.80	0.78	0.78	0.71	0.68	0.68	0.64	0.58	0.60	0.55	0.47	0.41
Roseate Spoonbill	*Platalea ajaja*	508	0.66	0.70	0.69	0.66	0.64	0.66	0.66	0.64	0.63	0.58	0.58	0.53
Rough-legged Hawk	*Buteo lagopus*	28928	0.81	0.84	0.85	0.80	0.75	0.75	0.74	0.71	0.60	0.57	0.43	0.39
Royal Tern	*Thalasseus maximus*	484	0.33	0.30	0.31	0.28	0.27	0.27	0.30	0.25	0.27	0.26	0.30	0.25
Ruby-crowned Kinglet	*Regulus calendula*	68839	0.86	0.86	0.86	0.82	0.69	0.68	0.67	0.63	0.53	0.50	0.38	0.37
Ruby-throated Hummingbird	*Archilochus colubris*	27624	0.81	0.81	0.83	0.73	0.73	0.75	0.75	0.64	0.70	0.70	0.71	0.59
Ruddy Duck	*Oxyura jamaicensis*	11474	0.82	0.82	0.83	0.77	0.65	0.74	0.74	0.60	0.58	0.60	0.57	0.45
Ruffed Grouse	*Bonasa umbellus*	44115	0.58	0.61	0.63	0.50	0.45	0.41	0.44	0.35	0.30	0.28	0.23	0.20
Rufous Hummingbird	*Selasphorus rufus*	6299	0.66	0.71	0.69	0.62	0.53	0.55	0.55	0.47	0.41	0.42	0.41	0.35
Rufous-crowned Sparrow	*Aimophila ruficeps*	1816	0.69	0.77	0.73	0.64	0.59	0.63	0.59	0.51	0.35	0.42	0.25	0.21
Rufous-winged Sparrow	*Peucaea carpalis*	41	0.41	0.49	0.39	0.29	0.15	0.10	0.12	0.05	0.07	0.00	0.00	0.00
Rusty Blackbird	*Euphagus carolinus*	37913	0.79	0.78	0.80	0.72	0.66	0.62	0.64	0.55	0.49	0.49	0.44	0.37
Sage Sparrow	*Amphispiza belli*	8154	0.61	0.57	0.62	0.44	0.40	0.28	0.41	0.19	0.32	0.10	0.12	0.03
Sage Thrasher	*Oreoscoptes montanus*	9299	0.74	0.75	0.75	0.66	0.57	0.45	0.51	0.42	0.42	0.22	0.14	0.12
Savannah Sparrow	*Passerculus sandwichensis*	108863	0.79	0.79	0.79	0.74	0.64	0.64	0.64	0.59	0.54	0.53	0.47	0.44
Say's Phoebe	*Sayornis saya*	21275	0.77	0.73	0.74	0.71	0.70	0.66	0.67	0.61	0.62	0.65	0.62	0.55
Scaled Quail	*Callipepla squamata*	6312	0.87	0.88	0.86	0.84	0.82	0.84	0.83	0.79	0.68	0.75	0.73	0.60
Scarlet Tanager	*Piranga olivacea*	13657	0.67	0.72	0.66	0.63	0.41	0.47	0.37	0.35	0.24	0.32	0.07	0.07
Scissor-tailed Flycatcher	*Tyrannus forficatus*	8649	0.95	0.95	0.94	0.93	0.94	0.93	0.91	0.90	0.94	0.92	0.88	0.87
Scott's Oriole	*Icterus parisorum*	4103	0.79	0.85	0.83	0.74	0.69	0.78	0.77	0.62	0.59	0.70	0.68	0.50
Seaside Sparrow	*Ammodramus maritimus*	778	0.32	0.31	0.43	0.25	0.24	0.30	0.30	0.22	0.20	0.28	0.29	0.19
Sedge Wren	*Cistothorus platensis*	12752	0.79	0.81	0.80	0.75	0.46	0.63	0.60	0.42	0.34	0.45	0.29	0.24
Semipalmated Plover	*Charadrius semipalmatus*	34885	0.86	0.87	0.89	0.85	0.79	0.81	0.84	0.77	0.69	0.75	0.71	0.66
Semipalmated Sandpiper	*Calidris pusilla*	29275	0.86	0.85	0.86	0.81	0.73	0.66	0.66	0.60	0.51	0.49	0.42	0.37
Sharp-shinned Hawk	*Accipiter striatus*	6582	0.15	0.04	0.18	0.03	0.12	0.02	0.16	0.02	0.12	0.02	0.13	0.02
Sharp-tailed Grouse	*Tympanuchus phasianellus*	9039	0.55	0.40	0.51	0.38	0.38	0.25	0.33	0.24	0.31	0.14	0.20	0.12
Short-billed Dowitcher	*Limnodromus griseus*	1431	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Short-eared Owl	*Asio flammeus*	25470	0.36	0.36	0.37	0.27	0.20	0.21	0.19	0.14	0.11	0.13	0.07	0.05
Smith's Longspur	*Calcarius pictus*	1850	0.36	0.41	0.38	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Snowy Egret	*Egretta thula*	2214	0.78	0.77	0.78	0.75	0.73	0.73	0.74	0.71	0.72	0.72	0.72	0.70
Solitary Sandpiper	*Tringa solitaria*	20981	0.79	0.73	0.81	0.68	0.52	0.29	0.42	0.24	0.24	0.07	0.07	0.04
Song Sparrow	*Melospiza melodia*	61174	0.85	0.88	0.86	0.83	0.69	0.78	0.73	0.67	0.63	0.65	0.56	0.54
Spotted Owl	*Strix occidentalis*	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Spotted Sandpiper	*Actitis macularius*	74797	0.62	0.66	0.66	0.57	0.49	0.53	0.52	0.43	0.41	0.43	0.43	0.35

Spotted Towhee	*Pipilo maculatus*	7205	0.72	0.78	0.74	0.67	0.55	0.66	0.61	0.51	0.47	0.52	0.38	0.36
Sprague's Pipit	*Anthus spragueii*	5175	0.43	0.42	0.48	0.35	0.11	0.02	0.02	0.01	0.00	0.00	0.00	0.00
Steller's Jay	*Cyanocitta stelleri*	8425	0.74	0.83	0.80	0.73	0.56	0.67	0.66	0.53	0.44	0.52	0.38	0.33
Sulphur-bellied Flycatcher	*Myiodynastes luteiventris*	17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Summer Tanager	*Piranga rubra*	19420	0.86	0.93	0.89	0.84	0.74	0.82	0.78	0.72	0.68	0.73	0.60	0.57
Swainson's Hawk	*Buteo swainsoni*	24702	0.57	0.51	0.52	0.46	0.39	0.36	0.35	0.29	0.31	0.25	0.23	0.21
Swainson's Thrush	*Catharus ustulatus*	75941	0.82	0.85	0.84	0.79	0.65	0.70	0.67	0.61	0.50	0.53	0.45	0.43
Swainson's Warbler	*Limnothlypis swainsonii*	1181	0.89	0.46	0.91	0.45	0.89	0.45	0.90	0.45	0.89	0.45	0.90	0.45
Swallow-tailed Kite	*Elanoides forficatus*	30	0.57	0.63	0.53	0.30	0.37	0.37	0.30	0.13	0.20	0.27	0.30	0.10
Swamp Sparrow	*Melospiza georgiana*	37056	0.72	0.70	0.70	0.63	0.55	0.50	0.51	0.41	0.40	0.36	0.31	0.26
Tennessee Warbler	*Oreothlypis peregrina*	40657	0.83	0.86	0.85	0.80	0.69	0.63	0.62	0.60	0.55	0.46	0.42	0.41
Thick-billed Kingbird	*Tyrannus crassirostris*	5	0.20	0.20	0.60	0.00	0.20	0.00	0.60	0.00	0.20	0.00	0.60	0.00
Townsend's Solitaire	*Myadestes townsendi*	19671	0.27	0.35	0.32	0.25	0.11	0.21	0.19	0.10	0.07	0.14	0.09	0.05
Townsend's Warbler	*Setophaga townsendi*	12840	0.52	0.61	0.58	0.48	0.43	0.51	0.49	0.39	0.35	0.41	0.37	0.29
Tree Swallow	*Tachycineta bicolor*	59516	0.73	0.72	0.73	0.64	0.58	0.59	0.59	0.50	0.50	0.46	0.39	0.33
Tricolored Blackbird	*Agelaius tricolor*	737	0.52	0.70	0.76	0.48	0.19	0.19	0.36	0.13	0.13	0.05	0.08	0.04
Tricolored Heron	*Egretta tricolor*	1358	0.58	0.63	0.65	0.56	0.45	0.50	0.49	0.43	0.45	0.43	0.46	0.40
Trumpeter Swan	*Cygnus buccinator*	125	0.02	0.04	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tufted Titmouse	*Baeolophus bicolor*	27334	0.92	0.94	0.93	0.90	0.89	0.91	0.90	0.87	0.83	0.89	0.87	0.81
Tundra Swan	*Cygnus columbianus*	27754	0.86	0.87	0.90	0.85	0.80	0.76	0.79	0.75	0.65	0.53	0.56	0.50
Turkey Vulture	*Cathartes aura*	9026	0.83	0.83	0.83	0.81	0.76	0.80	0.80	0.74	0.72	0.79	0.77	0.69
Upland Sandpiper	*Bartramia longicauda*	22317	0.66	0.66	0.68	0.59	0.57	0.58	0.59	0.50	0.55	0.51	0.55	0.47
Varied Bunting	*Passerina versicolor*	243	0.78	0.79	0.76	0.70	0.72	0.75	0.61	0.56	0.66	0.72	0.49	0.42
Varied Thrush	*Ixoreus naevius*	44488	0.58	0.66	0.61	0.53	0.45	0.46	0.45	0.37	0.29	0.25	0.18	0.16
Varied Thrush	*Ixoreus naevius*	44488	0.58	0.66	0.61	0.53	0.45	0.46	0.45	0.37	0.29	0.25	0.18	0.16
Vaux's Swift	*Chaetura vauxi*	1013	0.43	0.45	0.44	0.33	0.16	0.14	0.16	0.07	0.05	0.01	0.01	0.00
Veery	*Catharus fuscescens*	21486	0.73	0.79	0.73	0.70	0.47	0.54	0.45	0.44	0.31	0.30	0.11	0.11
Verdin	*Auriparus flaviceps*	4059	0.95	0.89	0.91	0.87	0.88	0.86	0.90	0.83	0.84	0.85	0.88	0.79
Vermilion Flycatcher	*Pyrocephalus rubinus*	2227	0.58	0.75	0.72	0.41	0.46	0.57	0.63	0.30	0.33	0.52	0.56	0.22
Vesper Sparrow	*Pooecetes gramineus*	29251	0.83	0.88	0.85	0.78	0.52	0.61	0.53	0.47	0.42	0.40	0.27	0.25
Violet-green Swallow	*Tachycineta thalassina*	16139	0.60	0.71	0.66	0.56	0.43	0.58	0.54	0.39	0.33	0.44	0.36	0.27
Virginia's Warbler	*Oreothlypis virginiae*	550	0.46	0.69	0.56	0.44	0.20	0.42	0.33	0.18	0.16	0.32	0.14	0.09
Warbling Vireo	*Vireo gilvus*	49189	0.78	0.81	0.80	0.75	0.69	0.73	0.70	0.64	0.62	0.63	0.50	0.46
Western Bluebird	*Sialia mexicana*	2978	0.71	0.76	0.77	0.67	0.52	0.58	0.63	0.44	0.42	0.46	0.37	0.29
Western Grebe	*Aechmophorus occidentalis*	4237	0.40	0.33	0.39	0.21	0.11	0.14	0.10	0.05	0.08	0.07	0.04	0.02
Western Gull	*Larus occidentalis*	191	0.58	0.60	0.61	0.58	0.53	0.60	0.61	0.53	0.49	0.60	0.61	0.49

Western Kingbird	*Tyrannus verticalis*	41185	0.85	0.78	0.82	0.76	0.82	0.76	0.81	0.73	0.79	0.75	0.80	0.71
Western Meadowlark	*Sturnella neglecta*	45688	0.85	0.83	0.85	0.80	0.80	0.78	0.80	0.75	0.76	0.74	0.73	0.69
Western Sandpiper	*Calidris mauri*	857	0.46	0.58	0.58	0.43	0.36	0.53	0.48	0.34	0.32	0.52	0.46	0.32
Western Screech-Owl	*Megascops kennicottii*	243	0.06	0.07	0.09	0.04	0.01	0.04	0.04	0.00	0.00	0.02	0.01	0.00
Western Scrub-Jay	*Aphelocoma californica*	2389	0.85	0.89	0.88	0.83	0.74	0.76	0.80	0.70	0.70	0.61	0.63	0.56
Western Tanager	*Piranga ludoviciana*	17983	0.67	0.72	0.71	0.62	0.45	0.54	0.52	0.41	0.34	0.41	0.30	0.26
Western Wood-Pewee	*Contopus sordidulus*	28989	0.56	0.70	0.65	0.54	0.38	0.48	0.47	0.35	0.27	0.35	0.26	0.22
Whimbrel	*Numenius phaeopus*	36585	0.84	0.82	0.88	0.81	0.76	0.71	0.75	0.68	0.61	0.54	0.46	0.42
White Ibis	*Eudocimus albus*	2943	0.71	0.68	0.72	0.64	0.69	0.66	0.70	0.63	0.66	0.65	0.69	0.60
White-breasted Nuthatch	*Sitta carolinensis*	25989	0.70	0.74	0.71	0.65	0.47	0.56	0.49	0.40	0.36	0.40	0.22	0.20
White-crowned Pigeon	*Patagioenas leucocephala*	52	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37
White-crowned Sparrow	*Zonotrichia leucophrys*	79232	0.85	0.89	0.88	0.85	0.72	0.71	0.71	0.68	0.56	0.57	0.48	0.48
White-eyed Vireo	*Vireo griseus*	20947	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.97	0.97	0.98	0.98	0.97
White-faced Ibis	*Plegadis chihi*	1642	0.57	0.58	0.63	0.52	0.48	0.48	0.53	0.43	0.46	0.43	0.49	0.41
White-headed Woodpecker	*Picoides albolarvatus*	1057	0.43	0.29	0.43	0.21	0.22	0.08	0.17	0.05	0.08	0.02	0.00	0.00
White-tailed Hawk	*Buteo albicaudatus*	51	0.25	0.51	0.12	0.08	0.02	0.08	0.08	0.00	0.02	0.04	0.08	0.00
White-tailed Kite	*Elanus leucurus*	1186	0.56	0.60	0.68	0.44	0.45	0.32	0.52	0.27	0.42	0.27	0.49	0.24
White-throated Sparrow	*Zonotrichia albicollis*	45015	0.83	0.86	0.85	0.78	0.64	0.70	0.67	0.59	0.42	0.49	0.27	0.23
White-throated Swift	*Aeronautes saxatalis*	1987	0.41	0.34	0.36	0.27	0.31	0.26	0.29	0.19	0.29	0.24	0.27	0.16
White-tipped Dove	*Leptotila verreauxi*	182	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
White-winged Crossbill	*Loxia leucoptera*	17898	0.88	0.89	0.88	0.81	0.62	0.59	0.56	0.41	0.29	0.25	0.15	0.10
White-winged Dove	*Zenaida asiatica*	2307	0.91	0.92	0.93	0.88	0.88	0.91	0.91	0.86	0.87	0.90	0.91	0.85
White-winged Scoter	*Melanitta fusca*	37154	0.79	0.76	0.85	0.74	0.76	0.73	0.80	0.71	0.71	0.68	0.72	0.65
Wild Turkey	*Meleagris gallopavo*	17046	0.76	0.79	0.76	0.68	0.64	0.65	0.60	0.51	0.59	0.59	0.52	0.43
Willet	*Tringa semipalmata*	8899	0.54	0.47	0.55	0.41	0.24	0.16	0.15	0.10	0.13	0.05	0.05	0.04
Williamson's Sapsucker	*Sphyrapicus thyroideus*	492	0.29	0.46	0.41	0.27	0.05	0.13	0.11	0.05	0.02	0.03	0.01	0.01
Willow Flycatcher	*Empidonax traillii*	22113	0.67	0.73	0.71	0.64	0.41	0.50	0.43	0.37	0.25	0.27	0.16	0.13
Willow Ptarmigan	*Lagopus lagopus*	37399	0.79	0.85	0.82	0.78	0.69	0.72	0.70	0.67	0.58	0.60	0.50	0.48
Wilson's Phalarope	*Phalaropus tricolor*	17229	0.52	0.53	0.51	0.45	0.24	0.29	0.26	0.20	0.14	0.06	0.00	0.00
Wilson's Snipe	*Gallinago delicata*	138023	0.82	0.86	0.84	0.80	0.72	0.76	0.75	0.70	0.62	0.66	0.59	0.57
Wilson's Warbler	*Cardellina pusilla*	69921	0.68	0.71	0.69	0.61	0.55	0.55	0.54	0.47	0.39	0.35	0.24	0.22
Winter Wren	*Troglodytes hiemalis*	31440	0.67	0.75	0.71	0.64	0.44	0.54	0.48	0.40	0.20	0.26	0.14	0.12
Wood Duck	*Aix sponsa*	13248	0.63	0.60	0.64	0.54	0.53	0.47	0.54	0.43	0.49	0.34	0.31	0.25
Wood Stork	*Mycteria americana*	840	0.75	0.77	0.80	0.71	0.41	0.29	0.50	0.23	0.06	0.02	0.02	0.00
Wood Thrush	*Hylocichla mustelina*	25953	0.80	0.86	0.83	0.77	0.54	0.62	0.52	0.45	0.34	0.46	0.18	0.16
Worm-eating Warbler	*Helmitheros vermivorum*	3489	0.69	0.70	0.76	0.62	0.42	0.52	0.48	0.31	0.21	0.48	0.11	0.07

Wrentit	*Chamaea fasciata*	1373	0.73	0.76	0.78	0.71	0.62	0.63	0.70	0.59	0.55	0.57	0.63	0.50
Yellow Warbler	*Setophaga petechia*	127877	0.74	0.75	0.75	0.67	0.66	0.67	0.67	0.59	0.61	0.62	0.58	0.50
Yellow-bellied Flycatcher	*Empidonax flaviventris*	14720	0.88	0.89	0.90	0.85	0.75	0.69	0.64	0.59	0.47	0.29	0.17	0.15
Yellow-bellied Sapsucker	*Sphyrapicus varius*	16250	0.78	0.85	0.79	0.74	0.52	0.61	0.51	0.45	0.38	0.38	0.12	0.11
Yellow-billed Cuckoo	*Coccyzus americanus*	26173	0.97	0.96	0.97	0.96	0.97	0.96	0.97	0.96	0.97	0.96	0.96	0.95
Yellow-billed Magpie	*Pica nuttalli*	887	0.62	0.58	0.70	0.43	0.35	0.22	0.44	0.17	0.29	0.10	0.20	0.07
Yellow-breasted Chat	*Icteria virens*	27447	0.75	0.79	0.76	0.73	0.69	0.73	0.70	0.65	0.65	0.68	0.56	0.54
Yellow-crowned Night-Heron	*Nyctanassa violacea*	1509	0.84	0.85	0.88	0.82	0.80	0.83	0.86	0.77	0.79	0.82	0.85	0.76
Yellow-eyed Junco	*Junco phaeonotus*	97	0.13	0.24	0.20	0.09	0.06	0.08	0.08	0.03	0.04	0.05	0.02	0.00
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	24413	0.73	0.68	0.75	0.62	0.57	0.52	0.58	0.45	0.43	0.38	0.32	0.24
Yellow-rumped Warbler	*Setophaga coronata*	66137	0.85	0.85	0.84	0.80	0.73	0.71	0.68	0.64	0.57	0.53	0.44	0.41
Yellow-throated Vireo	*Vireo flavifrons*	16218	0.68	0.67	0.70	0.55	0.54	0.51	0.52	0.36	0.43	0.46	0.27	0.17
Yellow-throated Warbler	*Setophaga dominica*	13862	0.56	0.49	0.54	0.42	0.53	0.42	0.49	0.36	0.47	0.40	0.41	0.28