

Ecological climate and population comparison of *Cyanocitta cristata* and *Cardinalis cardinalis*

Christina Fragoso, Katie Shupe, and Lisette Rojero-S — Department of Biology, Abilene Christian University, Abilene, Texas 79699

Introduction

This study aims to discuss two bird species: the Blue Jay, *Cyanocitta cristata*, and Red Cardinals, *Cardinalis cardinalis*. Both species tend to inhabit the same land of eastern and central United States (American Expedition, 2015). This study will explore the species' population distribution by utilizing the internet database GBIF and the Maxent software. It will compare the population distribution to the location's climate, mean average temperature, gathered from the DIVA-GIS software. From these pieces of data, a discussion about present and future trends can be conducted. This is especially important when considering how future climate changes might affect the environments these species currently inhabit and will be capable of inhabiting.

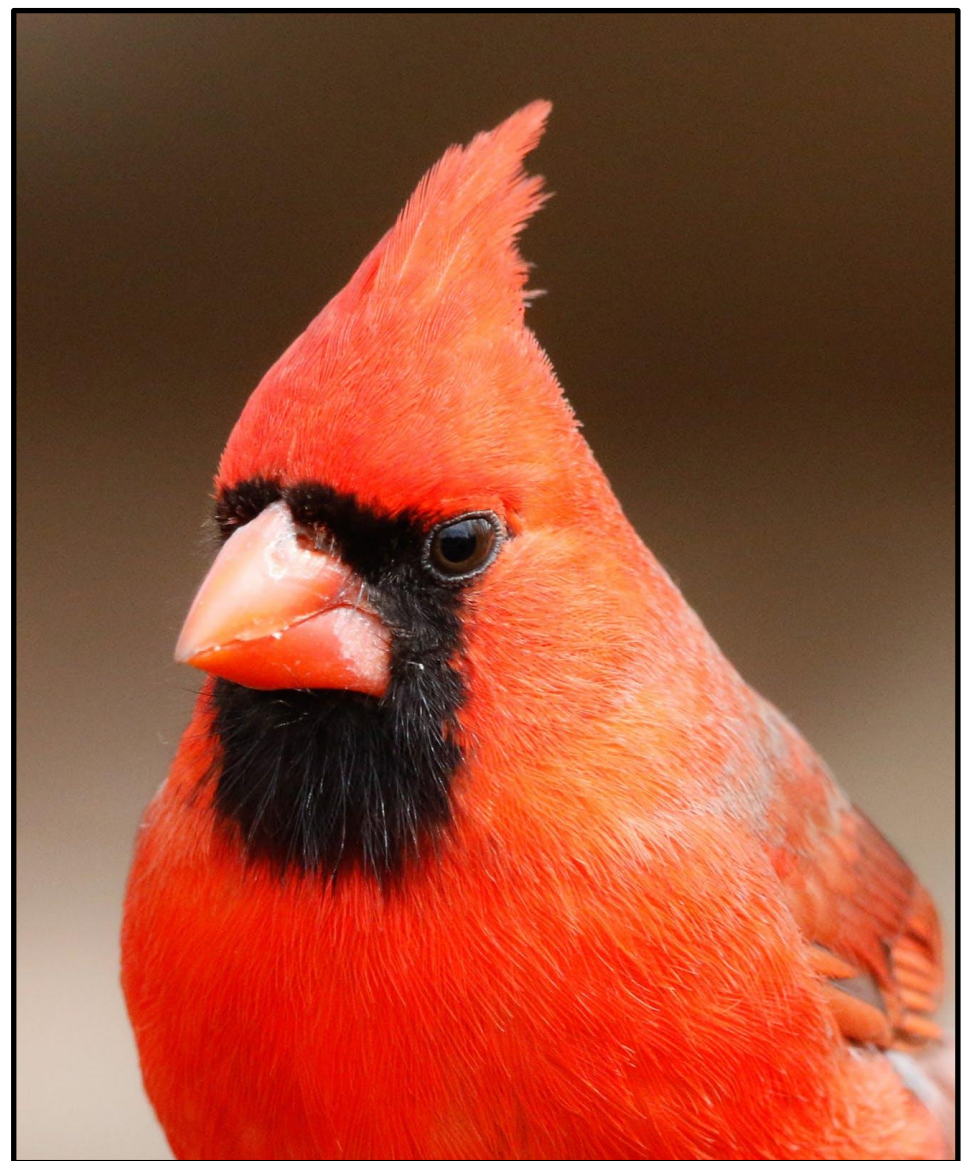


Fig 1 *C. cardinalis* (startribune.com)



Fig 2. *C. cristata* (Audubon.org)

Methods

This research was conducted with data collected from the geographic information system (<https://www.gbif.org/>), and with Microsoft Excel software (2019) to get coordinates of latitude and longitude of the two specimen. Approximately 98,700 original specimens of *Cyanocitta cristata* and *Cardinalis cardinalis* were collected from GBIF. A map occurrence was performed to determine climate variables in the United States using DIVA-GIS (<https://www.diva-gis.org>) which calculated the average mean temperature. Niche models were performed on the software known as Maxent by using the collected longitude and latitude coordinates from GBIF. The niche model predicted and produced an image of the expected current environmental niches. Finally, the GBIF was used to review and compare past environmental niches of *Cyanocitta cristata* and *Cardinalis cardinalis* with the data that was collected from Maxent to further evaluate current, and future estimates of environmental coordinates.

Results

The results of the Discriminant Analysis revealed that there was a lack of fairly distinct difference between the two species of birds' climate with the areas that they live overlapping nearly entirely. The Picture below is that of the present climate map of the globe as of 2020 (Figure 3), mostly representing temperature differences. The graphs seem to indicate the species are not really distinguishable by temperature over all. Thus, *Cardinalis cardinalis* likely prefers approximately the same climate as *Cyanocitta cristata*. The expected niche models seem to support this observation (Fig. 4).

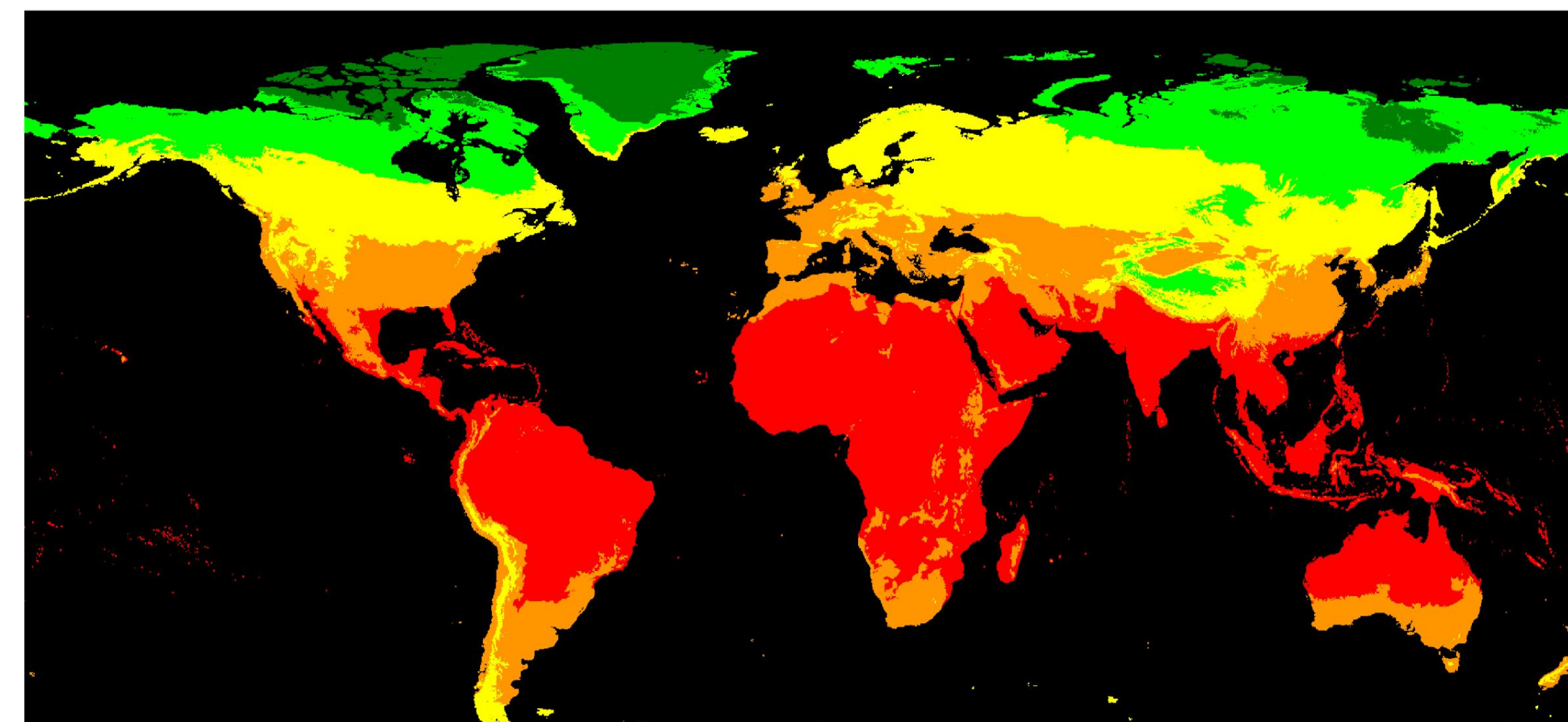


Fig. 3. Mean average temperature climate map (DIVA -GIS software)

Key: Dark green: -27--15, Lime green: -15--4, Yellow:-4-8, Orange:8-20, Red:20-32, Black: No data

The niche models for each of these species indicate potential ranges for the present (in blue and green) that are very similar to what has actually been documented by other sources (Fig. 4.) However, be warned, the range has the potential to be much larger than what has been observed to be true. The interesting thing about these models is that they can be used to a reasonable degree to infer about future niches and past ones for each species based on predicted climate changes. Because our future map ended up looking just like the present one, only one is included (Fig. 4.) The species appear to prefer the eastern half of the United States predominantly and seem to prefer milder, by comparison, climates. Our past niches indicate a move from west to east .

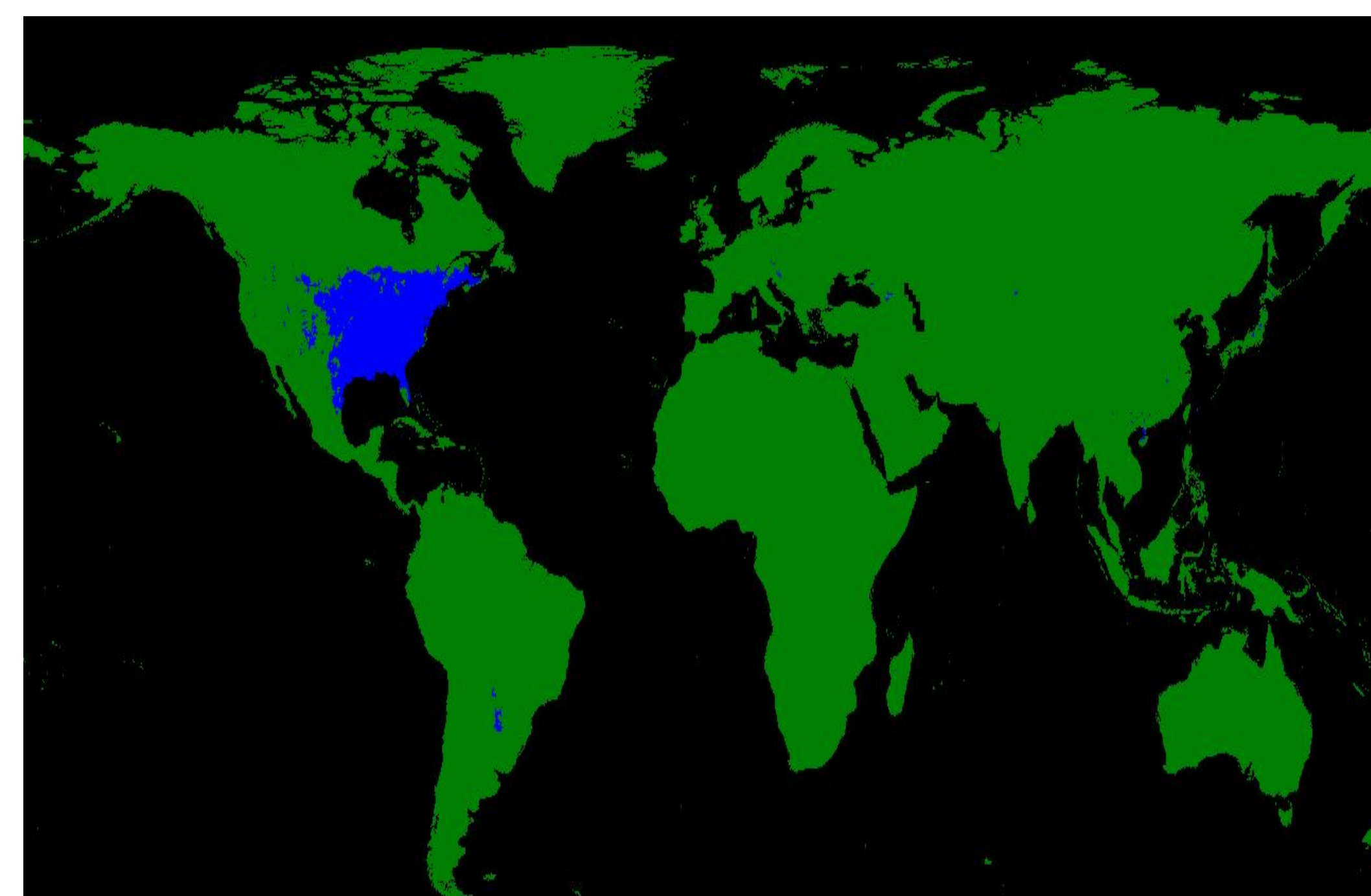


Fig. 4. *Cardinalis cardinalis* & *Cyanocitta cristata* niche distribution (Maxent software)

Discussion

The applications for this kind of research may not be immediately evident, but in a world filled with discussions on climate change, endangered species, human environmental impacts, and conservation on a wide scale, there are all sorts of areas into which niche analysis can provide knowledge for useful insight. For example, we used this to determine that these common birds, both *Cyanocitta cristata* and *Cardinalis cardinalis*, are actually quite hardy and can survive more drastic temperatures in different areas very well. They appear to prefer the eastern half of the United States predominantly we suspect that this may be because of the boundaries created by the Rocky mountains and the desert surrounding them, the gulf of Mexico to the south, and perhaps the cold of further north in Canada. The shift east from west could be a result from the last ice age drying out the arid deserts near the mountains. The lack of both *Cyanocitta cristata* and *Cardinalis cardinalis*, in Europe seems to indicate that these birds are not built for flying distances that large. Particularly the detail that these birds appear to prefer areas with trees overall so we can now infer about their food sources specifically as well. Truly research such as this is simply invaluable to understanding the species of this earth .



Fig. 5. *Cardinalis cardinalis* & *Cyanocitta cristata* (pinterest.com)

Conclusions

- The observed current niches and the past niches overlap, indicating a high chance of accuracy of niche predictions for the future.
- Both *Cyanocitta cristata* and *Cardinalis cardinalis* prefers regions that range from -4.0- 20.0 on the climate map.
- Past niches have indicated a significant shift from the west to the east, which could be a significant factor for future shifts .
- The ranges of both species will likely continue to shift or remain East with climate change.

Works Cited

Hijmans, R.J., S.E. Cameron, J.L. Parra, P.G. Jones and A. Jarvis. 2005. Very high resolution interpolated climate surfaces for global land areas. *International Journal of Climatology* 25: 1965-1978.

Expedition, A. 2015. Northern Cardinal Facts & Information. Expedition, A. 2015. Blue Jay Information, Facts, Pictures and Bird Feeding Tips.

GBIF.org. 2020. GBIF Occurrence Download

<https://doi.org/10.15468/dl.19111>

Facilitating this research is credited to ACU's Ecology Lab BIOL 364.L1 for its access and knowledge of the result gathering programs utilized.