PREDICTING THE DISTRIBUTION OF BLACK-THROATED BLUE WARBLER (*Dendroica caerulescens*) UNDER CLIMATE CHANGE ACCOUNTING DISPERSAL CAPACITY.

Tamara C. F. Souza – Universidade Federal de Goiás, Instituto de Ciências Biológicas 1, Goiânia, GO. tamaracristinabio@gmail.com Thiago F. L. V. B. Rangel – Universidade Federal de Goiás, Instituto de Ciências Biológicas 1, Goiânia, GO.

INTRODUÇÃO

Many studies reveal that, under increasing global temperature, complex interactions between life history, disturbance regime and distribution pattern, the species will be more exposed to increased extinction risks (Keith *et al*. 2008). Species responses to climate change may be influenced by changes in available habitat, as well as species interactions (Araújo & Luoto 2007) and interactions between demographic and landscape dynamics (Wintle *et al*. 2005). Potential distribution's models are important tools to determine the distribution of species, simultaneously allowing the study of biogeographical processes underlying drivers of species' ranges and better conservation planning. These models are based on statistical functions that define species' niche based on species occurrence points in the ecological niche space. These functions can be later used to project the species distribution in the geographic space given the environmental conditions of each locality (De Marco e Siqueira, 2009). Currently, ecologists and biogeographers employ many statistical methods to predict the species geographic distribution based on interpolated climatic surfaces. Thus, if it is acceptable to generalize the relation among occurrence of specie and climatic factors, such as temperature and precipitation, it is therefore possible to infer (interpolate) the species geographic distribution without the need of an exhaustive sample of biogeographic domain. Although species distribution models are widely used, these models lack an explicit incorporation of the geographical space (Ashcroft *et al*. 2012). Geographical space is admittedly one of the most important factors on species distribution (Ashcroft *et al*. 2012), as the distribution is always restricted by species dispersion capacity (Elith and Leathwick, 2009). Interest in dispersal capacity has been increasing (Paradis *et al*. 2002). There are at least four reasons to justify this attention: the development of spatially population models which integrate the structure of the landscape and population dynamics (Conroy *et al*.,1995); the frequency of dispersal distribution distances (DDD), that affect invasion patterns (Clark, 1998); dispersal as a vector for gene flow ((Mayr, 1963); and the study of dispersal as the way we estimate fitness in local populations (Lambrechts *et al*., 1999). In this study we employ MigClim, a new method to predict species distribution while incorporating species' dispersal capacity. We used as a model organism the Black Thoated Blue Warbler, Dendroica caerulescens which is a well studied passerine species distributed from Central America, Caribbean islands to northeasten North America.

OBJETIVOS

Predict the consequences of global climate change over the distribution of *D. caerulescens*, while accounting for the dispersal capacity of the species under three scenarios: "no dispersal", "unlimited dispersal" and "realistic dispersal".

MATERIAL E MÉTODOS

Dendroica caerulescens (Aves: Passeriformes: Parulidae) it's a migratory passerine, found along eastern North America, reproduces on northeast E.U.A. and winter in the Caribbean basin (Graves, 1997). In this study we used MaxEnt (Philip *et al*. 2004) To generate map of climatic suitability for *D. caerulescens*. The climatic data was downloaded from www.worldclim.org (Minimum and maximum temperature, and precipitation). The occurrence data was compiled from the Smithsonian Institution collection, spanning 594 different sampling sites across the breeding range. Commission errors in the suitability map were corrected by applying a mask to remove sites where the species is knowingly absent from. MigClim R package was used for an analysis of species range under future climate change scenarios. The MigClim R package is a function library for the open source R software. It enables the implementation of species-specific dispersal constraints into projections of species distribution models under environmental change and/or landscape fragmentation scenarios. The model is based on a cellular automaton and the basic modeling unit is a cell that is inhabited or not (Engler *et al*. 2012). To use the MigClim function, the user gives an initial species distribution and one or more habitat suitability maps. Using this data and the information about the dispersal ability of the species, MigClim simulates the dispersal of the species and produce a potential distribution map that accounts for dispersal limitation. The program was run under three temporal projections: 2020, 2050 and 2080.

RESULTADOS

The species has, initially, 14,663 occupied and 518,734 unoccupied cells (155 meters each cell). Under "unlimited dispersal" scenario, the first environmental change step (2020 - 2050) causes an average increase in range size of 7,190 cells, whereas the "no dispersal" scenario cause an increase of 986. If a more realistic dispersal capacity implementation is implemented 3402 cells are colonized and 13,377 decolonized, totaling an average of 4,388 occupied and 529,009 unoccupied cells. In the second environmental change step (2050 - 2080), the number of cells colonized was 7,173, while 973 under the "unlimited dispersal" and "no dispersal" scenarios respectively. For a realistic scenario, 1,665 cells were colonized and 1823 decolonized, in total of 4,234 occupied and 529,163 unoccupied cells. In the third environmental change step (2080 - further), the results were 9,475 and 835 to "unlimited dispersal" and "no dispersal" respectively. For the scenario with dispersion capacity included, 3,062 cells were colonized and 948 were decolonized. At the end of the simulation, the number of occupied cells was 6,330 and 527,067 unoccupied cells.

DISCUSSÃO

Recent studies show that global warming is affecting species distribution through habitat loss (Araújo *et al*. 2001). Much of the suitable distribution area of *D. caerulescens* probably is going to turn as unsuitable areas. Actually, the species will lose approximately 43% of its territory in the next 67 years.

CONCLUSÃO

This research showed that the dispersal capacity it's a fundamental parameter when model species geographic distribution, especially studying these distributions under future climate and environmental change scenarios.

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