

Research Paper

Habitat suitability modeling of white-fronted goose (*Anser albifrons* Scopoli 1769) in Iran

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Introduction

Migration is the most dangerous period of a bird's life cycle. Migratory species go through different paths during their migration, so how the habitat is selected and how the species respond to environmental changes, as well as their ability to migrate to succeed in the reproductive process, is important. Geese are constantly on the lookout for feeding sites with the highest quality forage along the migration route. According to studies, the habitats selected by goose are located in open and plain areas and away from forest edges. The white-fronted goose is a migratory waterfowl that travels long distances between mid-latitudes and higher latitudes to reach desirable habitats during migratory seasons. It breeds in tundra regions such as the Kenyan Peninsula to the Kulima River in Russia. Since white-fronted goose is an herbivorous species, and it selects meadows and grasslands of lowlands, grain fields, fallow lands, open grasslands, and large estuaries in saline wetlands as a habitat. Studies show that over the years, the habitat suitability population of white-fronted goose has changed dramatically, and their population is declining. Over the years, many models have been developed to study the habitat suitability of birds and to identify the parameters affecting the

selection of bird habitat habitats. Species distribution modeling links the probability of species presence in habitats with environmental characteristics of the habitat and predicts how species are distributed. To date, no studies have been conducted on the distribution and modeling of white-fronted goose habitat in Iran. Therefore, this study was conducted to model the optimal habitats of the white-fronted white goose in Iran and to identify the effective environmental parameters in the distribution and how to select the habitat of this species using the BIOMOD 2 package available in R (software).

Methods and Materials

Iran covers an area of 164/8 million hectares from latitude 25 degrees to 40 degrees north and longitude 44 degrees to 64 degrees east. Most of Iran is in arid and semi-arid regions, but the existence of several vital international wetlands is very important due to the attraction of migratory birds. In this study, 25 points of presence were used to model the distribution of white-fronted goose species. Environmental variables including topographic, climatic, and land use/land cover variables were used to model. Finally, 23 environmental parameters with a cell size of 1000 m were used by the white-fronted goose to investigate the environmental parameters effective in habitat selection. In this study, Biomod 2 package was used to model the distribution of white-fronted goose species. Thus, 9 models were used in the modeling process. In the modeling process, 70% of the presence points were used to produce models and 30% to evaluate the performance of models. Absence points of the studied species were obtained using Biomod 2 package. Additionally, in this study, 100 replications for the species were considered to increase the modeling accuracy.

Results & Discussion

The results showed that all the models had an acceptable accuracy. The results of this study showed that all the environmental parameters used in the modeling had high importance in the distribution of white-fronted goose. However, parameters such as annual rainfall, distance to dry farming, rainfall of the warmest season, and distance to wetlands have the greatest effect on the habitat. In addition, parameters such as distance to protected areas, distance to streams and distance to roads had relatively less important than other parameters in the modeling. In the modeling process, models with a TSS of less than 0.7 were removed from the modeling process and the rest of the models were combined, which was presented as a habitat suitability map. 7.03% of the total area of Iran is known as suitable habitats, which overlaps with the presence of the species.

Conclusion

This study introduces a new method in behavioral ecology to identify various environmental parameters affecting habitat selection by migratory birds. This is especially important in terms of conservation and economics to reduce potential conflicts between geese and agricultural activities.

Keywords: *Biomod 2 package, Environmental parameters, Habitat suitability, White-fronted goose*

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Declaration of conflict of interest: