Species Distribution Models of Threatened Bats in Global Biodiversity Hotspots

Nicole Roberts
Department of Biology, CSU Dominguez Hills

Introduction

- Bats make up over one-fifth of all mammals on the planet, and it is estimated that over 30% of all bat species are threatened or data deficient.
- Migratory species such as bats remain poorly understood because broad and diverse global habitats.
- Species Distribution Modeling is an effective way to predict species richness based on current and future trends of environmental variables and can help provide guidance for future adaptive management plans.

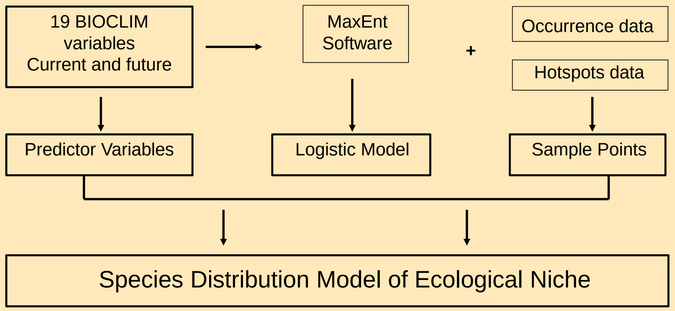
Objective

To generate species distribution models of threatened bats species using various bioclimatic variables in global biodiversity hotspots in order to prioritize areas for conservation.

Research Questions

1. What are significant variables for climate change?
2. What do current species distribution maps for bats in hotspots look like?
3. Which hotspots have a high prioritization for conservation?

Fig. 1 – Concept Map for ecological niche modeling.



Study Area

2 global hotspots of interest:

Mediterranean Basin and Irano-Anatolian Region

Fig 2. – Global Biodiversity Hotspots (Conservation International), 2014

Methods

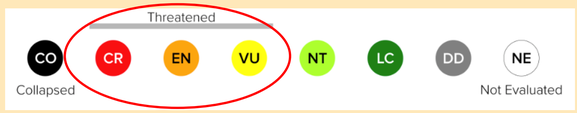


Fig. 3 – Threatened bats of interest (IUCN)

Data Collection

- Occurrence data: A total of 209 bat species were identified as threatened (Fig. 3) by the IUCN Red List. Of these, 128 species had known occurrence records (decimal Latitude and Longitude) and these were converted into point data in ArcMap v. 10.7.1.
- Climate variables: 19 BioClim variables (1960-1990) at 30s (0.5 res) were downloaded from WorldClim v.2 CMIP5 protocol and converted into ascii (.asc) format using the raster, maps and mapdata libraries in R (v. 3.6.1). The Global Climate Model (GCM) used was the Community Climate System Model v.4 (CCSM4-"CC").
- MaxEnt: Models for current bioclim variables were run in MaxEnt v. 3.4.1 with minimum and 10th percentile training presence at 0% and random 30% test omission rate.
- Land Cover data: ArcMap was used to visualize 12 classes of global land cover data (www.earthenv.org) as a shapefile at 0.5s resolution (Table 1).

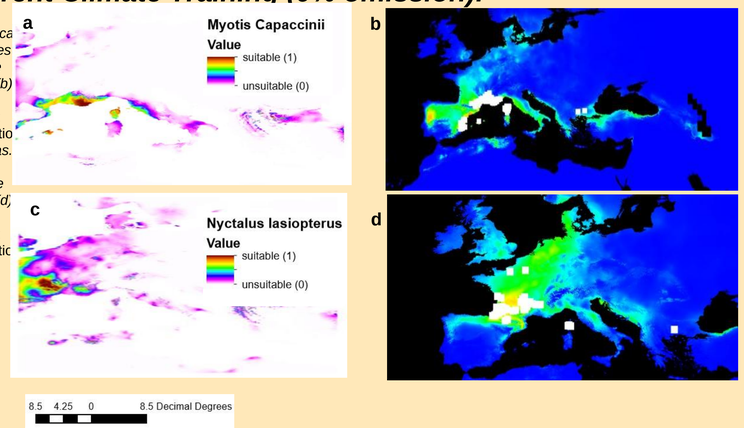
Table 1. 12 classes of global land cover at 1-km.

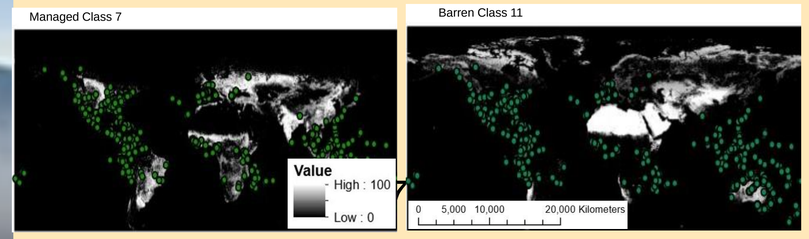
1. Evergreen/Deciduous Needleleaf Trees	7. Cultivated and Managed Vegetation
2. Evergreen Broadleaf Trees	8. Regularly Flooded Vegetation
3. Deciduous Broadleaf Trees	9. Urban/Built-up
4. Mixed/Other Trees	10. Snow/Ice
5. Shrubs	11. Barren
6. Herbaceous Vegetation	12. Open Water

Results

Threatened Bats: *Myotis capaccinii* and *Nyctalus lasiopterus*
Predictive Bioclim variables: 1, 4, 14, 17
Current Climate Training (0% omission):

Fig 4. *(a) M. ca at 0.5 res suitable areas. (b) M. cap.* Maxent distributio *(c) N. las. 0.5 res* Suitable areas. *(d) N. las.* Maxent distributic





Conclusion

- *M. capaccinii* is most sensitive to precipitation while *N. lasiopterus* is most sensitive to annual mean temp. and seasonality. Both are carnivorous and vulnerable.
- Managed vegetation and barren areas have little bat presence data.
- Adaptive management plans need to focus on conservation in the Mediterranean basin and Irano-Anatolian areas.