A new multi-species method to correct for sampling bias in presence only niche models, and its application to Pl@ntNet citizen science data in France

Christophe Botella, Alexis Joly, Pierre Bonnet, François Munoz, Pascal Monestiez

4: A new multi-species method to correct for sampling bias in presence only niche models, and its application to Pl@ntNet citizen science data in France

Wednesday, August 14, 2019
02:30 PM - 02:50 PM
Kentucky International Convention Center - L013

Background/Question/Methods

Naturalist mobile applications have been deployed worldwide in the last years and enabled access to a considerable amount of geolocated species presences records. This novel type of data represents a crucial step forward to address ecological and conservation questions through the use of species distribution models (SDMs). However, in the absence of a sampling protocol, the sampling effort often concentrates on specific locations (cities, riverside walks, etc.) located in specific environments, resulting in estimation biases in SDMs. We are introducing a new method to estimate unbiased parameters of ecological niche. It is based on a Poisson process that jointly models niche-based species intensity and sampling effort. The latter is modelled with a spatial step function defined over a regular mesh. We analytically define the design of the spatio-environmental domain allowing separation of species intensity from sampling effort. We simulated virtual species observations in simplistic scenarios to characterize the joint effects of the sampling effort and species niche models on estimation performance. We applied the approach to Pl@ntNet's citizen science data, integrating several hundred plant species and hundreds of thousands of observations. We evaluated the species intensity predictions of our method on complementary presence-absence data and compared them to the MaxEnt predictions and MaxEnt with Target-Group background approach.

Results/Conclusions

Regarding analytical and simulation results, we show that our method requires the real sampling effort to be approximately constant over spatial regions where the environmental variables vary significantly. Efficient bias correction can theoretically be achieved even with one species only. However, it requires many observations to reach a satisfying precision, and it is thus appropriate for data-intensive citizen science programs. Furthermore, we show how integrating multiple species, especially some highly observed ones with broader ecological niche, substantially imroves the precision of each species niche parameter. When applying the method to the Pl@ntNet data, we show that our method significantly improves niche estimation of species with soft environmental preferences compared to the reference methods. Thus, it should be a useful tool, when used in synergy with broad coverage and broadband citizen-science data, to monitor the evolution of invasive or weed species, which are often under-reported in expert datasets.

Authors

Christophe Botella
INRA
INRIA
Université de Montpellier

Alexis Joly
INRIA Sophia-Antipolis

Pierre Bonnet
Cirad

François Munoz
Université de Grenobles Alpes

Pascal Monestiez
INRA

Find Similar

View Related Events

Day: Wednesday, August 14, 2019