Combining interactive GIS tools and expert knowledge in validation of tree species models

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As a basis for current and future threats assessment and evaluation of the *in situ* conservation status of 100 economically and ecologically important tree species in Latin America, Bioversity International has prepared detailed maps of the natural distribution of those species. These species were identified based on priorization exercises by FAO and by the Latin American Forest Genetic Resources Network (LAFORGEN).

Niche modeling was applied to predict the natural distributions of the target species. An advantage of this method is that it can be applied systematically for large number of species, as is the case in our study. A significant challenge in niche modeling is to estimate how representative the predicted areas are for the real distribution ranges. In order to define those models that best represent the distribution for the species in our study, 9 alternative niche models for 6 tree species were evaluated and validated by experts. The selected species are covering different ecological niches in Latin America and are: *Annona cherimola* Mill., *Bactris gasipaes* Kunth, *Bertholletia excelsa* Bonpl., *Caesalpinia spinosa* (Molina) Kuntze, *Cedrela odorata* L.and *Nothofagus nervosa* (Phil.) Krasser.

Materials

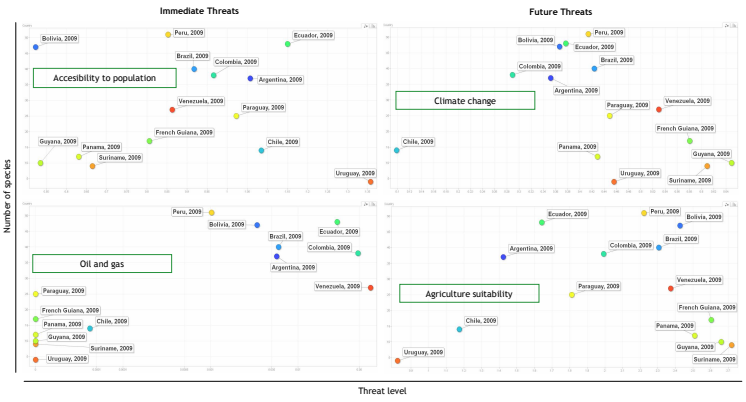
Natural species distributions were predicted in Maxent (Philips et al., 2006) using passport data obtained from GBIF, scientific literature and Laforgen members. Alternative niche models were made with grids for 19 climatic variables which were extracted from WorldClim (Hijmans et al., 2005), a soil map based on the SOTERLAC database (ISRIC World Soil Information, 2009), and a map of ecological zones (FAO, 2001). MODIS processed image was used as a correction of areas with no vegetation. All grids had a 5km spatial resolution.

ArcGIS 9.2® was used as the geographical information system (GIS) software, and all final layers were converted into kml format in order to be read by the Google Earth® API implemented in the survey interface.

Results

Model 8 was selected after receiving feedback from 40 experts. This model received better scores than the other models and it was considered to give a fair representation of the natural distributions and above. This niche model was used to predict the distribution of all 119 species, and therefore to assess their immediate and future threats and to evaluate *in situ* conservation status, as shown in Figure 2 and 3.

Figure 2. Threat levels by country and number of species



Methodology

An online survey for each species was designed and shared with the experts via a website (see Figure 1), where Google Earth® was used as the platform to show the different niche models and to make comparison between them.

Table 1. Variables used to create each niche model

	Variables			
	Climatic		Ecological	Soils
	4 variables	19 variables		
Model 1		x		
Model 2	x			
Model 3		x	x	
Model 4		x		x
Model 5			x	x
Model 6	x		x	
Model 7	x			x
Model 8		x	x	x
Model 9	x		x	x

After receiving all experts survey answers, the model with the highest score among experts, was chosen as the one that better reflects the effective distribution of the species.

Figure 1. Survey interface

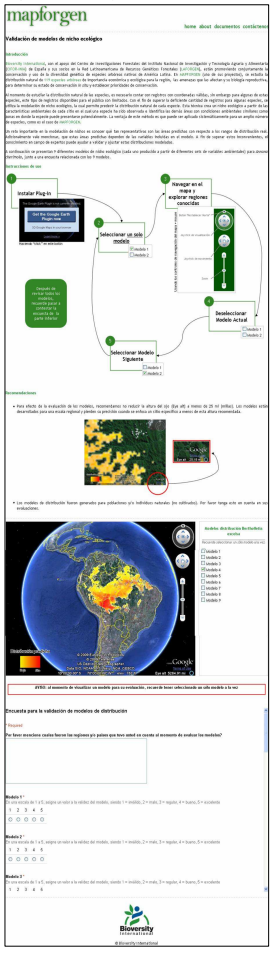
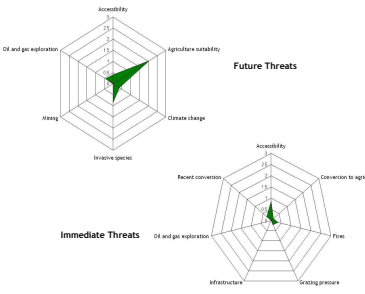


Figure 3. Threat levels for tree species analyzed in the region



Conclusions

The right selection of variables, based in species expertise, can improve the accuracy of niche modeling, leading to a better prediction of natural distributions of species, and a better associated analysis of existing threat and conservation status. Models can further be improved with additional presence data of the prioritized tree species.

References

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