

Species distribution models as a useful tool in conservation programs: the case of the Northern Bald Ibis

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The Northern Bald Ibis (*Geronticus eremita*) is one of the most endangered species on the planet. Its original distribution covered from Syria and Turkey (with migrant populations) to Morocco (where the species was sedentary). Over the last century, the species had suffered an extreme decline in its population size, and is now considered to be critically endangered. Nowadays, the original distribution range of the species is restricted to the Agadir region in Morocco. In Europe the Northern Bald Ibis was extinct 400 years ago, and the species is only present in Spain and Austria, and this is due to two different conservation projects, i.e.e. the Eremita project and a LIFE+ project, respectively, with introduced animals born and raised in captivity. The aim of this project is to characterize those past and present areas used by the Northern Bald Ibis in their natural distribution in Morocco, identifying the most favorable areas for the assessment of the species in Morocco and also for making it possible to reintroduce this species to Europe. We used species distribution models with a presence/absence database obtained from bibliography and a set of environmental variables. Spatial variables were combined obtaining a trend surface variable, which is a purely spatial descriptor of the cohesion trend in the distribution of the species regarding its history and population dynamics. Another model was built using only environmental variables to identify those areas which are favorable for the species in relation to the environment, without the effects of the population's cohesion trend. Environmental obtained models were extrapolated to Andalusia, Spain, where the Eremita Project aims to introduce individuals, breaking the historic natural cohesion of the populations. Obtained models classified the areas into 'favorable', 'unfavorable' or 'uncertain'. Using these models we built maps which show that the most favorable regions are in the north of Morocco (environmental model), the middle Atlas (spatial model) and the oriental and occidental coast (both models). Models obtained in the European regions show that the areas where the species is being introduced are not the most favorable for the species, and in the case of Andalusia, introduced individuals have moved to favorable places in the North of Morocco, where the species was not present in the past. Moreover, for the first time there have been new records of this species on the occidental coast of Morocco, where the models also predict a maximum in the favorability. All of the assessments in the obtained models demonstrate the importance of this methodology in the design of conservation programs for the Northern Bald Ibis, which allows us to identify those areas where the species is likely to survive, and allow us to focus our conservation efforts and introduction programs on those areas. This methodology could be used to detect the best places to introduce new individuals or to create protected areas.