Climate change and mountain birds: how exposed is the Northern Wheatear to local extinctions?

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Abstract

Mountain areas host unique biodiversity, and mountain species show specific ecological adaptations enabling survival in extreme climatic conditions. Under the current context of climate change, mountain bird populations tend to shift their ranges to higher elevations, tracking their climatic optima. Nevertheless, space limitations at high altitudes constrain the possibilities of mountain species to cope with climatic changes and make them particularly vulnerable. In an extreme case, the climatic niche of some of these species can move beyond the mountain tops, driving such species ultimately to extinction. We are studying the case of the Northern Wheatear (*Oenanthe oenanthe*) in Spain, and we have compared the breeding distribution of this alpine bird between 2003 and 2022. Spain is in the southernmost distribution limit of the species in Europe, where Wheatears mostly occupy mountainous areas. To determine the factors conditioning the occurrence of the species we have built environmental favourability models using the information from the last two Spanish bird atlases and a set of environmental variables, belonging to the following factors: topography, climate, human activity, and lithology. The influence of climate compared to all other factors was obtained using variation partitioning analysis. The species has suffered a strong reduction (67 %) in occupied areas, as well as in favourability throughout mainland Spain, especially in the southern half, where climate change may have far-reaching consequences, including local extinctions. Climate explained more than 90 % of the variation in the model obtained for 2022. Interestingly, the occupied areas are in 2022, in average, 100 m higher in altitude than in 2003. If the effects of climate change continue, the species is doomed to disappear at its southernmost distribution limit, being the population of Parque Nacional Sierra de las Nieves the most vulnerable at the continental scale.

Keywords: climate change, elevation, favourability, mainland Spain, *Oenanthe oenanthe*, species distribution models

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