

CLIVAR-SPAIN contributions: Influence of climate change in the regions inhabited by the Brown Bear in Spain

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The Brown Bear is, according to the Spanish National Catalogue is one of the 56 endangered species in the Iberian Peninsula,. The need to conserve its habitat is one of the key points for ensuring the survival of this mammal. To date, the working groups assigned for managing and protecting the Brown Bear in Spain have been limited to use climatic and phytoclimatic information based on meteorological observations and chorological references in recent decades, but without considering the possible future climate conditions. The evidence of climate change, which has already begun, and which will affect the future climate conditions in which the Brown Bear has to survive in a changed habitat, highlights the need to know the climatic and phytoclimatic conditions in the future, so it will be possible to design more effective and better adaptations to climate change. With this objective, we have carried out a phytoclimatic study in the future that will determine whether the current Brown Bear habitat will be altered or shifted to other regions where it doesn't live right now. To carry out the phytoclimatic study in the future it is needed to have future climate local scenarios. These scenarios have been produced on a set of stations with observed daily series of temperature and precipitation, located in the areas of interest for the Brown Bear (the Pyrenees and the Cantabrian Mountains). These local scenarios have been produced with a statistical downscaling technique based on an analog method in two steps developed by the Climate Research Foundation (Fundación para la Investigación del Clima, FIC), applied to different General Circulation Models (GCMs - we have used BCM2 and EGMAM models) outputs for different Greenhouse Gases Emission scenarios (we have used different combinations looking for higher, lower, and medium range changes in our area). The downscaled data are "raw" daily precipitation and temperatures series, therefore we had to correct the systematic error (associated to the GCM and/or to the method) on a monthly basis so they can be used in subsequent phytoclimatic studies. Using the corrected scenarios, a full phytoclimatic study on the areas of interest was performed. The used methods are the Sub-types Method (AlluÈ, Andrade) and the Species Method (García-López, AlluÈ) that allows, combining different monthly variables, to analyze the effects of climate on vegetation. Applying these methods to both past observations and future climate local scenarios, future evolution of the forest areas of interest can be assessed. The results for the period 2040/2070 in the bear area of interest expect an increase in the temperatures, both maximum and minimum, ranging from 1.5 to 3 °C, and a decrease in rainfall of up to 11% in summer and autumn. The three chosen scenarios agree to present a future situation in which the forests of the bears' area will face hard changes in the composition and in the competitive relationships between species, some of them leading even to the total incompatibility with the areas in which the bears currently inhabit (ie, the areas of high-mountain vegetation will be reduced, and shifted to higher zones). Nevertheless, many areas have current vegetation under its phytoclimatic potential, so this can be beneficial in a future with changes towards greater temperatures and periods of greater aridity, because those species are already prepared to the future changes. This study was funded by the Spanish Ministry of Environment.