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Evaluating the impacts of climate change on Atlas cedar using refined plant traits in a dynamic vegetation model

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It is expected that climate change will strongly alter plant species distributions and ecosystem functions, since the migration speeds of many plant species are presumably too small to follow climate change. Mountain floras of Mediterranean regions are particularly subject to the climatic threat. Indeed, first climate models predict a significant reduction of precipitation in the Mediterranean area, which combined with the increase of evapotranspiration associated to the warming, will result in severe water stress in these ecosystems. Second, these mountain floras contain a large proportion of endemic species, which are limited in their migration potentialities due to the risk of reaching the summit. Third, these environments are often strongly impacted by man and undergo the pressure of animals, such as goats and sheeps, which through grazing limit the regeneration of the plant species.

In this contribution, we use the dynamic vegetation model CARAIB to evaluate the impact of climate change on Atlas cedar (Cedrus atlantica (Endl.) Manetti ex Carrière) in its natural geographical area, the Rif and Middle Atlas mountains in Morocco. This tree species is considered as endangered, according to the IUCN red list. In a series of localities, we determined several traits (specific leaf area, leaf C/N, sapwood C/N, as well as leaf longevity) and we assessed biomass and net primary productivity as validation data, thanks to forest inventories, dendrochronology analyses and allometric equations combined with leaf area index estimations. We used the collected trait data to force the dynamic vegetation model and compared the net primary productivity and biomass simulated at each locality to the field estimates. We then performed high resolution spatial simulations on the Rif and Middle Atlas mountains to assess the potential impacts of climate change on this endangered tree species.