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Assessing potential changes of chestnut productivity in Europe under future climate conditions

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The European chestnut is cultivated for its nuts and wood. Several studies point to the dependency of chestnut productivity on specific soil and climate characteristics. For instance, this species dislikes chalky and poorly drained soils, appreciates sedimentary, siliceous and acidic to neutral soils. Chestnut trees also seems to appreciate annual mean values of sunlight spanning between 2400 and 2600 h, rainfall ranging between 600 and 1500 mm, mean annual temperature between 9 and 13ºC, 27ºC being the mean of the maximum temperature (Heiniger and Conedera, 1992; Gomes-Laranjo et al.,2008). The amount of heat between May and October must range between 1800ºD and 2400ºD (Dinis et al., 2011) . In Poland, the growing season is defined as the period of time when the mean 24-h temperature is greater than 5ºC (Wilczynski and Podalski, 2007). In Portugal, maximum photosynthetic activity occurs at 24-28ºC for adult trees, but exhibits more than 50% of termoinhibition when the air temperature is above 32ºC, which is frequent during summer (Gomes- Laranjo et al., 2006, 2008). Recently Pereira et al (2011) identified a set of meteorological variables/parameters with high impact on chestnut productivity. The main purpose of this work is to assess the potential impacts of future climate change on chestnut productivity in Portugal as well as on European chestnut orchards. First, observed data from the European Climate assessment (ECA) and simulations with the Regional Circulation Model (RCM) COSMO-CLM for recent climate conditions are used to assess the ability of the RCM to model the actual meteorological conditions. Then, ensemble projections from the ECHAM5/COSMO-CLM model chain for two climate scenarios (A1B and B1) are used to estimate the values of relevant meteorological variables and parameters und future climate conditions. Simulated values are then compared with those obtained for present climate. Results point to changes in the spatial and temporal distribution of meteorological variables and parameters. In particular, more severe conditions during spring and summer are expected, especially in the Mediterranean area, with less precipitation and higher temperatures. All these changes will have impacts on chestnut fruits and wood in Europe.

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