OC 3.4 How will climate change impact maritime pine forest distribution and productivity in Portugal?

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Portuguese maritime pine forests are severely affected by forest fires. The study aimed at modelling: (1) species' current distribution and productivity; and (2) species' distribution for projected future climate change scenarios. The land cover, national forest inventory, and environmental data were used. A Bayesian Machine Learning (ML) analysis allowed exploring the most influential environmental variables. Species' spatial productivity was modelled by stochastic Sequential Gaussian Simulation.

Species' potential distribution modelling was performed using two methodological approaches: (1) ML algorithms (Random Forest and Maximum Entropy); and (2) GIS map algebra (ecological envelopes) maps regarding a set of environmental variables and previously known thresholds. Results showed that species distribution was mainly determined by precipitation-related variables, but elevation and temperature-related variables were important to differentiate species productivity. Species' distribution for the present using ML modelling provided fitting efficiencies around 70% and matched well the species' current distribution. The species ecological envelope map for the present was closer to the species' empiric potential distribution. Climate change impacts on species' future distributions by the ML approach were moderate with areas being relocated (47.3% regular-medium-high suitability area to 48.7%–48.3% in the future). The impacts in species' ecological envelopes maps were higher and with greater future losses than the latter (76.5% regular-favourable-optimum suitability area to 58.2%–51.6% in the future). The two approaches showed a 44% concordance in the present, decreasing to 30%–35% in the future. These maps are key to support recommendations to set species' best suitability areas in planning future afforestation to attain fire-resilient landscapes, enhanced forest ecosystems biodiversity, functionality, and productivity under climate change scenarios.