Joana A. Paulo (joanaap@isa.ulisboa.pt), João H.N. Palma, Margarida Tomé
Universidade de Lisboa, Instituto Superior de Agronomia,
Centro de Estudos Florestais, Forest Ecosystem Management under Global Change (ForChange)

Objectives

- ➢Explore a methodology that allows the hybridization of the Yield-Safe 'big leaf' process based model (van der Werf 2007) and the empirical individual tree growth model for *Quercus suber* L.: SUBER model (Paulo 2011)
- ➢Simulate stand growth and stand cork production variations under future climate, in new plantations

Materials

Download this poster:

- ➢Yield-Safe model calibrated for cork oak
- ➢SUBER cork production module (Paulo 2010)
- ➢Data from cork oak plantations installed in 1992 and measured in 2007 (15 years old stands):
  - ▪Soil information: texture and soil depth
  - ▪Number of trees per hectare at plantation
  - ▪Forest inventory data collected in 2007: diameter at breast height and total tree height
- ➢IPCC scenario A1B climate daily data from ENSEMBLES EU project retrieved through Clipick (Palma, 2014): total shortwave radiation, precipitation and mean temperature
- ➢Simulated climate data between 1951-2000 was considered for the 'control' simulation, and periods 2001–2050 and 2050–2100 for the 'climate change' simulations.

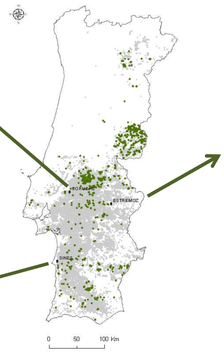
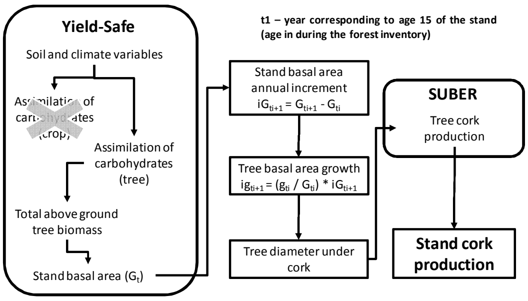
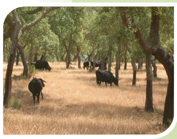


Figure 1. Distribution of pure and mixed adult cork oak stands (grey area) and young cork oak plantations (green). Case studies used in this research are identified by black markers.

Hybridization scheme





Results

- ➢The proposed hybridization methodology was used to simulate cork production response to different climate change scenarios
- ➢Figures 2 and 3 show the values of virgin and mature cork production for the case studies, along the simulation period, and for each of the three climate scenarios considered.
- ➢The effect of climate change in cork production was different for the considered case studies. A clear reduction was observed at the centre and inland case studies, but for the seashore case study the values are similar despite the scenario considered. (Tables 1 and 2 present values for the cork production percentage variation, considering the control scenario as base value).
- ➢The results show that the climate change impacts will be different, depending on site geographical location and soil conditions, evidencing the importance of a careful selection for the location of new plantations.

Table 1. Total virgin cork production values according to climate scenario (kg ha⁻¹)

Case study	Simulation: Control (data 1951-2000)	Climate change (data 2001-2050)	Climate change (data 2051-2100)
Coruche (centre)	1223	1164 (-4.9%)	1086 (-11.2%)
Sines (seashore)	1747	1755 (+0.5%)	1615 (-7.6%)
Estremoz (inland)	1392	1071 (-23.0%)	713 (-48.8%)

Values under brackets are the percentage of cork production variation in relation to the control scenario. The three simulations vary in the climate data used.

Table 2. Total mature cork production values according to climate scenario (kg ha⁻¹)

Case study	Simulation: Control (data 1951-2000)	Climate change (data 2001-2050)	Climate change (data 2051-2100)
Coruche (centre)	7240	6430 (-11.2%)	5921 (-18.2%)
Sines (seashore)	10726	10492 (-2.2%)	10489.5 (-2.2%)
Estremoz (inland)	2370	1662 (30.0%)	871 (63.2%)

Values under brackets are the percentage of cork production variation in relation to the control scenario. The three simulations vary in the climate data used.

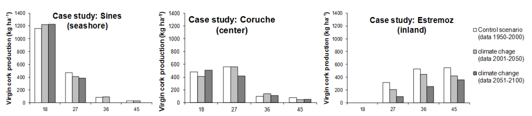


Figure 2. Virgin cork production simulation for the three case studies. The three simulations vary in the climate data used.

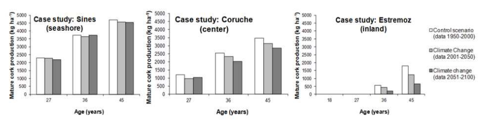


Figure 3. Mature cork production simulation for the three case studies. The three simulations vary in the climate data used.

References:

- ➢Palma, JHN 2014. Clipick : Climate Change Web Picker. Bridging climate and biological modelling scientific communities. Web Tool
- ➢Paulo, J. A. e Tomé, M. 2010. Predicting mature cork biomass with t years of growth from one measurement taken at any other age. Forest Ecology and Management 259: 1993-2005.
- ➢Paulo, J. A. 2011. Development of a growth and yield model for the sustainable management of cork oak stands. Dissertation. Technical University of Lisbon. Instituto Superior de Agronomia. 188 pp.
- ➢van der Werf, V. D., Keesman, K., Burges, P., Graves, A., Pilbeam, D., Incoll L.D., Metselaar, K., Mayus, M., Stappers, R., Keulen, H., Palma, J., Dupraz, C. 2007. Yield-SAFE: A parameter-sparse, process-based dynamic model for predicting resource capture, growth, and production in agroforestry systems. Ecological engineering 29: 419–433.

Acknowledments:

Projects StarTree (Grant Agreement 311919) and AgForward (Grant Agreement 613520), both financed by the European Commission under the Seventh Framework Program for Research and Technological Development. The Portuguese Science Foundation under the project CorkCarbon Footprint (PTDC/AGR-FOR/4360/2012).

ForChange · Instituto Superior de Agronomia, Universidade de Lisboa · FCT Fundação para a Ciência e a Tecnologia, Ministério da Educação e Ciência · World Congress on Agroforestry, Delhi – 2014 · StarTree · Seventh Framework Programme