Identification of suitable areas for cultivation of short rotation coppices of poplar and eucalypt for bio-energy

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Introduction

Short-rotation coppices (SRC) are intensive cultivation systems aiming for biomass production for energy. About 32% of Portugal area (Figure 1) corresponds to uncultivated lands (shrublands and pastures) where these cultivations could be installed. We estimated the available area in eight counties from the Centre and South of the country (Chamusca, Alpiarça, Almeirim, Cartaxo, Grândola, Ferreira do Alentejo, Beja and Aljustrel). These counties total area ranges between 9400 ha and 113000 ha. In Mediterranean countries breeding programs for improving the quality of biomass as fuel were applied to obtain clones of poplar and eucalyptus, considered the most appropriated forest species for this type of cultivation. Variables such as biomass yield, heating power, resistance to biotic agents or plasticity to environment were considered in these programs. In this study a GIS approach was carried out based on environmental and productive variables specific ally graded for both species . The counties were selected, considering climate and soil variables reflecting a medium level site index matching adequately the SRC requirements. A future assessment of the potential biomass production through SRC could be thereby performed.

Materials and methods

► Eleven land use classes from level 5 of CLC 2007, including forest invasive species, shrubs, sclerophitic vegetation, cutted or burned areas, were chosen to implement SRC;

► The variables considered to obtain biomass productive areas of poplar and eucalyptus SRC are average annual air temperature (2 classes), annual rainfall (5 classes), annual days frost (6 classes), soil type (19 classes), soil pH (6 classes) and slope (2 classes);

► It was assumed that eucalyptus clone withered the more severe conditions of rainfall (400-600 mm) vs. poplar (700-1000 mm). Rainfall class for both species was 600-700 mm. Concerning air temperature the classes (16-17,5°C) and (15-16°C) were attributed to eucalyptus and poplar, respectively. It was assumed that neither species in the first year withered more than 30 frost days per year and poplar and eucalypt could grow under 5 to 10 days and 10 to 30 days respectively. Both species were assumed to grow with 0 or 1 frost day per year.

►It was assumed that poplar and eucalyptus grew under all pH classes (six classes between 4,6 and 8,5). About the 19 classes of soil type, it was assumed that the eucalyptus clone grew on 8 soil classes with a coarser texture and lower fertility grade.

►As expected the slope was lower than 20%, in almost study area, excepting in 806.5 ha (Tab 1 and 2)

►Edafoclimatic variables were attributed and weighted for both species, overlayed (Package ArcGIS 10, ESRI) and the final grade allowed for the allocation of potential areas for each SRC species in the eight counties;

► Vector layers were rasterized in 25 m x 25 m pixels.

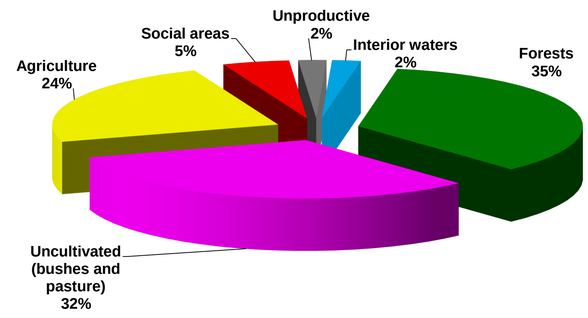

Figure 1 – Portuguese Land Cover

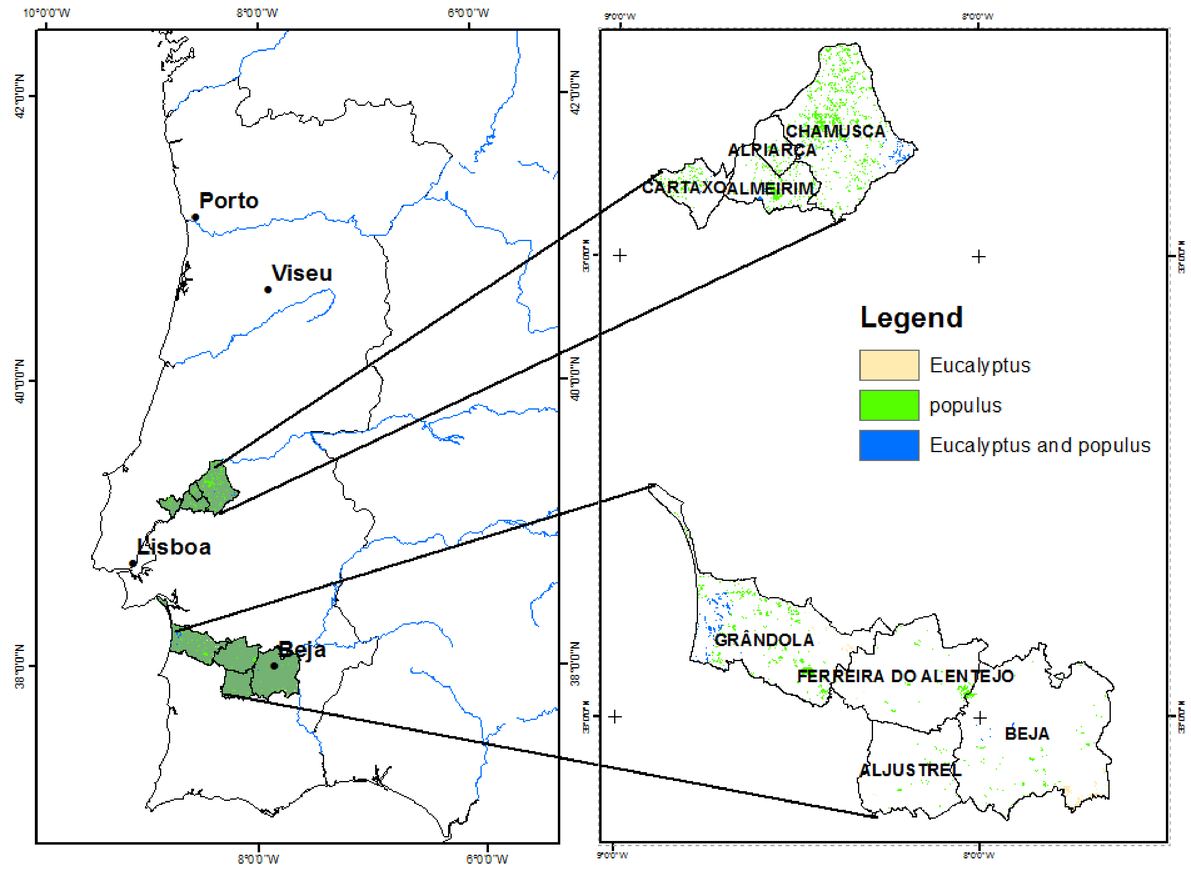

Figure 2 – Potential areas for SRC species in each study county

Results

► The SRC areas allocated to the eleven land use classes from level 5 of CLC 2007, including forest invasive species, shrubs, sclerophitic vegetation, cutted or burned areas are indicated in Table 1, totalizing about 21600 ha. The areas forecasted for both species in the study area totalize about 20800 ha (Table 2).

Table 1 – CLC 2007 Class areas

Level 5 CLC 2007 Classes	Area (ha)
Burned areas	134,2
Cutted areas	6348,9
Invasive species forests	44,4
Invasive species forests mixed with hardwoods	19,0
Dense shrubs	2959,7
Sparse shrubs	2788,2
Other wood forests	319,9
Dense sclerophitic vegetation	903,0
Sparse sclerophitic vegetation	1505,2
Sparce vegetation	868,9
Herbaceous vegetation	5707,6
Total area	21598,9

Table 2 – Potential area for SRC cultivation

Species	Area (ha)
Eucalyptus	1844,9
Poplar	16722,9
Both	2224,6
	20792,4

Conclusion

► The estimated areas for eucalyptus and poplar SRC of about 20000 ha is a credible starting point for planning SRC cultivations in Portugal, given the existent SRC total areas in other Mediterranean countries, which are of the same order of magnitude.

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