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ORIGINAL PAPER

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Site quality evaluation by classification tree: an application to cork quality in Sardinia

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Abstract Cork harvesting and stopper production represent a major forest industry in Sardinia (Italy). The target of the present investigation was to evaluate the "classification tree" as a tool to discover possible relationships between microsite characteristics and cork quality. Seven main cork oak (*Quercus suber*) producing areas have been identified in Sardinia, for a total of more than 122,000 ha. Sixty-three sample trees, distributed among different geographical locations and microsite conditions, were selected. A soil profile near each sample tree was described, soil samples were collected and analysed. After debarking, cork quality of each sample tree was graded by an independent panel of experts. Microsites where trees had more than 50% of the extracted cork graded in the best quality class, according to the official quality standard in Italy, were labelled as prime microsites, the others as nonprime microsites. Relationships between a binary dummy variable (0 for nonprime microsites, 1 for prime microsites) and site factors were investigated using classification tree analysis to select the relevant variables and to define the classification scheme. Prime quality microsites for cork production proved to be characterised by elevation, soil phosphorus content and sandiness. Results have been compared with those of the more conventional parametric approach by logistic regression. The work demonstrates the advantages of the classification tree method. The model may be appropriate for classifications at landscape and stand mapping levels, where it is possible to sample a number of microsites and to evaluate distributional characteristics of model output, while its precision is only indicative when estimating the prime quality of single microsites.

Keywords *Quercus suber* · Cork quality · Site classification and evaluation · Classification tree · Logistic regression

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Introduction

The production of cork stoppers, the most remunerative industrial product from cork oak (*Quercus suber* L.) stands, requires raw material with high elasticity to assure good bottle closure and with limited porosity (Pereira et al. 1996; Vieira Neto 1996), especially if lenticels have a diameter greater than 2 mm (Ferreira et al. 2000).

The quality of raw cork is determined by the interaction of genetic and environmental factors (Natividade 1934). Frequent allogamy in this species leads to the occurrence of very diversified pheno-genotypes: its total genetic diversity is among the highest recorded in oak species (Toumi and Lumaret 1998). Thus, it is possible to discriminate populations using morphological (Garcia-Valdecantos and Catalan 1993; Schirone and Bellarosa 1996), biochemical (Toumi and Lumaret 1998, 2001) and molecular (Bellarosa 2003) descriptors. However, so far the few studies conducted have not been able to quantify a precise correlation between genotype and cork quality (Nóbrega 1997a, b).

On the other hand, empirical experience has shown that cork oak trees that produce good quality cork tend to maintain this standard through successive strippings