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Method for evaluation of coarse cork oak root system by means of digital imaging

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Abstract Digital imaging is becoming a powerful tool for data storage and information retrieval. Image comparison and similarity evaluation has become part of the information market and it is today a common part of, for example, web search engines. The cork oak tree (*Quercus suber* L.), the dominant species of the 'montado' woodland system is, due to its cultural and socio-economic value, protected by law that prevents extensive destructive studies on an essential part of the tree—the root. Especially in the Mediterranean zone, where the water is the limiting growth factor, the root development studies are of significant interest. In this work we present a method of using digital images for cork oak coarse root systems-evaluation by means of digital imaging. Acquired images of structural roots are processed automatically to prevent subjective decisions by the human observer. The performance of the method, its potential for semantic retrieval and similarity assessment is demonstrated, having as example eight young cork oak root systems, and critical issues for evaluation and conclusion-making, are discussed.

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Introduction

Cork oak (*Quercus suber* L.) is an important species in the agro-silvo-pastoral systems of southern Portugal, and its product, cork, represents significant income for the farmers. In the Mediterranean ecosystem where there is sometimes no precipitation for 6 months, the water is the limiting growth factor and roots represent the most important organ for its acquisition. Apart from this function, roots are vitally important for nutrient acquisition and tree stability, and they play an important role in sink and storage functions, and deposition and excretion of biochemical compounds (Pagès, 2002 in Danjon and Reubens 2008).

The root systems of cork oak are, however, rarely studied. This is mostly due to the fact that the cork oak is protected by law and only in occasional situations can it be felled and its root system excavated. It is nearly impossible that sufficiently large statistical samples would be excavated in diverse site conditions. On the other hand, construction works, (road cuts, road construction, accidental landslides, etc.) can represent unique opportunities for assessment of root profiles (as demonstrated in Moreno et al. 2005 or Nadezhdina et al. 2008), which can later represent excellent opportunities for similarity studies, if