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Abstract

Characterization of the Canopy in Mediterranean Forest Stands by Terrestrial Laser Scanning †

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The definition of the structural parameters of forest vegetation and trees provides useful information for different environmental applications. A precise description of the forest structure is particularly important for fire hazard mitigation planning because it allows for the correct management and planning of fire prevention measures.

Obtaining detailed information on forest stand and canopy variables requires extensive, difficult, and laborious field campaigns. The use of a terrestrial laser scanner (TLS) can help to overcome the limitations of the conventional ground-based forest inventory techniques, but the accuracy and applicability of TLS techniques for canopy characterization require further investigation.

In this work, we developed and tested an automatic procedure based on point density algorithms to correctly separate the points representing shrubs, woody material, leaves, and small branches. The main aim was to propose a methodology for estimating the forest structure at the plot level in forest stands.

The study was carried out in several areas located in Sardinia, Italy, which are mainly covered by pine forest, mixed forest, and oak forest, with different understory types. Destructive and non-destructive measurements were performed inside circular plots of a 10 m radius. TLS data sets were collected in field by multiple scanning of the plots. The 3D point clouds were processed to isolate the trees, ground, and understory, and subsequently to separate wood from foliage. Cloud points were partitioned in cubic volumes (voxels) that were used as inputs to separate the stand components (by applying principal component analysis) and to generate wood and non-wood clusters (by applying the point density algorithm DBSCAN).

The first results showed that the proposed method allows us to correctly identify foliage, trunks, and main branches, especially when the underlying layer is dominated by low herbaceous vegetation. However, further studies are required to assess the utility of this method when applied in forest stands characterized by high and dense undergrowth and with different species of trees.

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