MODELLING ABOVEGROUND NPP OF PORTUGUESE FOREST, AT REGIONAL SCALE, USING FIELD INVENTORY DATA AND NDVI FROM LANDSAT 5 TM, MODIS AND SPOT VEGETATION IMAGERY

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ABSTRACT

Estimates of aboveground net primary production (ANPP) have been used to address a broad range of questions, from forage availability for livestock to estimates of the global carbon balance. Considering the importance of ANPP as an ecological variable and additionally the complexity of its measurement, the objective of this paper was to develop and test a procedure of simple implementation, in order to estimate the ANPP, at regional scale. The ANPP was estimated as a function of some stand structural variables and by integrating the normalized difference vegetation index (NDVI) derived from Landsat TM (30m), MODIS (250m) and SPOT vegetation imagery (1Km). A total of 150 plots were sampled, using the destructive method, within *Pinus pinaster* (maritime pine) and *Eucalyptus globulus* (eucalyptus) stands. Within all plots, all trees were measured (e.g. diameter at breast height, total height, dominant height, canopy height, canopy horizontal projection area, age) in order to calculate stands characteristics (e.g. basal area per hectare, number of trees per hectare). Within some plots, the average representing tree was cut and logged in order to weight coppice, branches and log and determine the total weight per hectare. The understory vegetation was measured (shrubs density, height and estimated age), using the line intersection method, and the weight per hectare was achieved. The total biomass was subsequently converted in ANPP ($g.m^{-2}.year^{-1}$). After processing satellite imagery data, the NDVI values were derived, for each sampling plot. The NDVI values and the measured vegetation variables were used for adjustment of regression models, having ANPP as dependent variable. The results obtained were satisfactory, and demonstrate the utility of using the spectral response patterns of vegetation to estimate the ANPP. The best ANPP estimates were achieved for *Pinus pinaster* stands with shrubs in underwood, using the NDVI as independent variable, individually or combined with the vegetation variables, derived from Landsat 5 TM imagery ($R^2aj = 0.52$; RMSE = 23%), MODIS imagery ($R^2aj = 0.60$; RMSE = 21%) and SPOT Vegetation VGT imagery ($R^2aj = 0.54$; RMSE = 23%).

Keywords: Aboveground Net Primary Production, Forest inventory, Landsat 5 TM, MODIS, SPOT Vegetation, NDVI, Eucalyptus, Pinus.