FOREST4EU

ITHub 3 - Sustainable Forest Management and Ecosystem Services

FOREST4EU partner: UNIFI
OG: SURF
OG's country: Italy
Type of Innovation: Technological

Biomass accounting for Sustainable Forest Management Plans using UAV data

Introduction

Forest biomass and carbon play a crucial role in the development of strategies aimed at implementing multi-objective forest management plans. Estimating forest biomass is essential for assessing carbon sequestration and the potential carbon balance of forest ecosystems. Forests, acting as significant carbon sinks, provide a valuable means to reduce atmospheric carbon levels. Accurate estimation of carbon stored in forests is vital to support climate change mitigation efforts and facilitate the transition to a low-carbon economy.

Recent research activities have shown great potential in using 3D data derived from images captured by unmanned aerial vehicles (UAVs) for forest biomass estimation. This approach has proven to reduce costs and improve estimation accuracy. In the context of OG SURF, UAV photogrammetric data was acquired using an RGB camera in five tested areas (Vallombrosa, Monte Morello, Rincine, Grosseto, Maesano, Pizzorne) to serve as a basis for extracting predictors of forest biomass. OG SURF has been working on this, as estimating forest biomass is crucial for quantifying carbon credits and additionality within the voluntary carbon market, which is currently the only available market in Italy. Additionally, establishing standard procedures for estimating business-as-usual carbon stocks is necessary according to many voluntary carbon market standards.

The UAV data provided very high-resolution data with a derived 3D point cloud density of 50 points/m2, allowing for the creation of a Canopy Height Model (CHM) using an available regional LiDAR dataset for normalization. For each of the tested areas, a high-resolution biomass map with a spatial resolution of 23x23 m was derived using a model approach. The map was created by using forest inventory plots as input data, predictors calculated based on the CHM, and high-resolution forest tree species maps. In each tested area different types of spatialization models were tested, including both parametric (linear) and non-parametric models (random forest and k-nn), in order to develop the best model for estimating the biomass.

The generated maps were then validated through ground surveys and implemented into the Decision Support System Platform developed by OG SURF. This resulted in the first high-resolution biomass map for the study area, which can be used in conjunction with additional layers derived in OG SURF for various analyses in order to establish multi-objective forest management plans. The derived high-resolution biomass map is available within the Decision Support System Platform developed in the context of OG SURF.

Lessons learned

UAVs provide reliable predictors of biomass. The test areas exhibit diverse forest types and topography, and the Root Mean Square error obtained through the model approach is consistent across all areas. This indicates that the instrument's applicability can be beneficial in various contexts.

In the tested areas, the biomass map is highly accurate, as it is calibrated to the specific area. The map offers spatial information that cannot be generated using traditional data sources. It enhances the optimization of forest interventions and provides greater precision. Forest managers in the tested areas have emphasized that the biomass map serves as a valuable starting point for considering carbon credits and designing the business-as-usual scenario.

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Further information

https://www.go-surf.it/

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