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The Use of UAV Derived Data for Tree Height Estimation

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Abstract

Kenya, facing a forest cover of only 7% compared to the recommended 10% for sustainable development, contends with severe deforestation attributed to forest fires, unsustainable human activities, and settlement expansion. Afforestation and reforestation initiatives have been implemented by organizations and government agencies to combat deforestation, enhance soil health, and sequester carbon. Kieni forest encapsulates this crisis, exemplifying rampant deforestation's adverse impact on ecosystems and local well-being. The ensuing extended droughts and unpredicted rainfall patterns have led to depleted water sources, affecting agriculture and daily sustenance. Notably, the decline in the African elephant population underscores the loss of biodiversity. This research focuses on the utilization of a novel methodology that leverages remote sensing data from Unmanned Aerial Vehicles (UAVs), in combination with ground-based measurements. The primary objectives of this study include estimating tree height using UAVderived Digital Terrain Model and Digital Surface Model data, as well as tree species identification from UAV-derived images. The methodology entails the derivation of Digital Terrain Model and Digital Surface Model from aerial images. The estimation of tree height was done by the creation of a Canopy Height Model (CHM) through the subtraction of DTM from DSM. To ensure the precision of the CHM model, it was subjected to validation by comparing it against the field measurements obtained during data collection. The accuracy of the estimated tree heights was 0.9979 for R^2 and RMSE at 0.9748. This study underscores the effectiveness of UAV-derived data in accurately estimating tree height. The results demonstrate the potential of UAV technology to revolutionize forest monitoring and management, offering a cost-effective and efficient solution for tree height estimation. The findings presented in this abstract contribute to the growing body of knowledge supporting the integration of UAVs in forestry and environmental research, paving the way for improved resource management and ecological studies.