

ABSTRACT

Rizko Defri Arifaldi. 24020121130070. Estimation of Carbon Stock in Lerep Village, West Ungaran Subdistrict, Semarang Regency Using Remote Sensing. Supervised by Karyadi Baskoro and Jumari.

Lerep Village, located on the slopes of Mount Ungaran in Semarang Regency, is dominated by agroforestry systems and diverse vegetation cover. However, land-use conversion poses a threat to ecosystem balance, particularly in the role of vegetation as a carbon sink. Carbon stock estimation is essential to assess ecosystem potential in climate change mitigation, yet integrated studies combining field data and remote sensing in this area remain limited. This study aims to analyze land cover changes, and estimate and predict carbon stock in Lerep Village. The methods used include: (1) land cover change analysis from 2000 to 2024 using Landsat satellite imagery and machine learning classification in Google Earth Engine; (2) field-based carbon stock estimation through tree biomass measurements from five observation stations, and remote sensing estimation using regression models with NDVI, elevation, and slope as predictors; and (3) 100-year carbon stock prediction using regression modeling. The results show that vegetation cover decreased by 129,41 ha, while open land and settlements increased by 82,90 ha and 46,52 ha, respectively. The average carbon stock based on field measurements was 104,36 tons/ha, remote sensing estimation was 100,76 tons/ha, and regression model estimation was 92,36 tons/ha. Remote sensing proved to be relevant due to its close alignment with field data, whereas the regression model requires improvement due to a relatively high Root Mean Square Error (34,53 tons/ha). The 100-year carbon stock prediction shows a fluctuating pattern (ranging from 77,75 to 143,40 tons/ha) influenced by agroforestry activities such as pruning, replanting, and vegetation restoration. Therefore, planned and sustainable vegetation management is needed to ensure carbon stock stability in the long term.

Keywords: Carbon stock, Google Earth Engine, Remote Sensing, Lerep Village, Land Cover Change