

ABSTRACT

*Coastal ecosystems such as mangroves and seagrass have an important role in providing benefits and services that play a role in reducing and adapting to the impacts of climate change. Mangroves are one of the vegetation capable of absorbing carbon which has an important role in controlling CO₂ levels in the atmosphere. This study aims to measure the carbon stock content on the mangrove surface in the field, analyze the relationship between field carbon stock data and multi-resolution spatial imagery, and analyze the comparison of the ability of multiresolution spatial imagery to estimate the carbon stock above the mangrove surface. A semi-empirical approach was undertaken to estimate and map the value of mangrove carbon stocks above the surface. Field carbon calculations were carried out using allometric methods based on mangrove species. The calculation results are then linked through regression analysis with the results of the vegetation index, Difference Vegetation Index (DVI), Enhanced Vegetation Index (EVI), and Normalized Difference Vegetation Index (NDVI). Research conducted in the Bedul Mangrove Forest Area, Alas Purwo National Park, Banyuwangi Regency found 14 mangrove species around the Segara Anak River with the highest carbon value at the sample point with the dominant species *Rhizophora Mucronata* at 114.09 tons/ha and the lowest carbon value at the sample point with the dominant species *Ceriops Tagal* of 12.86 tons/ha. Based on the results of statistical analysis, all data were normally distributed. Besides, the input value that can cross the limit of significance is that all inputs from the vegetation index and the highest R² value of all images are obtained from the DVI index, so that the DVI index is used as input for estimating modeling of carbon stock on the mangrove surface. The amount of total carbon obtained from the PlanetScope image is 535.27 tons, the Sentinel 2A image is 549.23 tons, and the Landsat 8 OLI image is 533.57 tons. Among the three images used, Sentinel 2A reflects the possibility of overfitting with the highest R² value in the calculation. Besides, Sentinel 2A also has the lowest SE value of 3.18 tons/ha compared to PlanetScope and Landsat 8 OLI. Besides, the results of the accuracy-test using a 1: 1 goodness of fit plot from each image, the distribution pattern of the estimated mangrove carbon stock shows that the overall model in mangrove carbon stock mapping is over-estimated.*

Keywords: Carbon stock, spatial multi-resolution imagery, PCA, vegetation index

INTISARI

Ekosistem pesisir seperti mangrove dan lamun memiliki peranan penting dalam menyediakan manfaat dan jasa yang berperan untuk mengurangi dan menyesuaikan dampak perubahan iklim. Mangrove sebagai salah satu vegetasi yang mampu menyerap karbon yang memiliki peranan penting dalam mengendalikan kadar CO₂ di atmosfer. Penelitian ini, bertujuan untuk melakukan pengukuran kandungan stok karbon di atas permukaan mangrove di lapangan, menganalisis hubungan data stok karbon lapangan dengan citra multiresolusi spasial, dan menganalisis perbandingan kemampuan citra multiresolusi spasial untuk estimasi stok karbon di atas permukaan mangrove. Pendekatan semi-empiris dilakukan untuk mengestimasi dan memetakan nilai stok karbon mangrove di atas permukaan. Perhitungan karbon lapangan dilakukan dengan menggunakan metode allometri berdasarkan spesies mangrove. Hasil perhitungan kemudian dihubungkan melalui analisis regresi dengan hasil indeks vegetasi *Difference Vegetation Index* (DVI), *Enhanced Vegetation Index* (EVI), dan *Normalized Difference Vegetation Index* (NDVI). Penelitian yang dilakukan di Kawasan Hutan Mangrove Bedul, Taman Nasional Alas Purwo, Kabupaten Banyuwangi ditemukan 14 spesies mangrove di sekitar Sungai Segara Anak dengan nilai karbon paling tinggi di titik sampel dengan spesies dominan *Rhizophora Mucronata* sebesar 114.09 ton/ha dan nilai karbon paling rendah di titik sampel dengan spesies dominan *Ceriops Tagal* sebesar 12.86 ton/ha. Berdasarkan hasil analisis statistik, semua data berdistribusi normal. Selain itu, nilai input yang mampu melewati batas signifikansi adalah semua input dari indeks vegetasi dan nilai R^2 paling tinggi dari semua citra diperoleh dari indeks DVI, sehingga indeks DVI dijadikan sebagai input untuk pemodelan estimasi stok karbon di atas permukaan mangrove. Besarnya karbon total yang didapat dari citra PlanetScope sebesar 535.27 ton, citra Sentinel 2A sebesar 549.23 ton, dan citra Landsat 8 OLI sebesar 533.57 ton. Di antara tiga citra yang digunakan, Sentinel 2A yang mencerminkan kemungkinan overfitting dengan nilai R^2 paling tinggi dalam perhitungan. Selain itu, Sentinel 2A juga memiliki nilai SE paling rendah sebesar 3.18 ton/ha dibanding dengan PlanetScope dan Landsat 8 OLI. Selain itu, hasil uji akurasi menggunakan *plot goodness of fit* 1:1 dari setiap citra, pola distribusi estimasi stok karbon mangrove menunjukkan bahwa keseluruhan model dalam pemetaan stok karbon mangrove bersifat *over-estimated*.

Kata kunci: Stok karbon, citra multiresolusi spasial, PCA, indeks vegetasi