

RINGKASAN

NUR ANISA MALISNA. Pola Sebaran Spasial Cadangan Karbon mangrove di Perairan sagulung, Kota Batam Menggunakan Sistem Informasi Geografis. Dibimbing oleh FEBRIANTI LESTARI dan ANDI ZULFIKAR.

Ekosistem mangrove memiliki peran penting dalam mitigasi perubahan iklim karena kemampuannya menyerap dan menyimpan karbon dalam jumlah besar. Kawasan mangrove di Perairan Sagulung, Kota Batam, menghadapi tekanan akibat aktivitas pembangunan pesisir, industri, dan permukiman yang berpotensi memengaruhi kondisi vegetasi serta cadangan karbon yang tersimpan. Penelitian ini bertujuan untuk mendeskripsikan sebaran mangrove, menentukan klasifikasi tutupan lahan mangrove, serta menganalisis pola sebaran spasial cadangan karbon mangrove di Perairan Sagulung, Kota Batam. Penelitian dilaksanakan pada bulan Juli 2025 hingga Januari 2026 di Perairan Sagulung, Kota Batam. Alat yang digunakan meliputi perangkat lunak QGIS, Microsoft Excel, dan laptop. Bahan penelitian berupa citra satelit Sentinel-2A, data cadangan karbon penelitian terdahulu, serta shapefile batas administrasi Kota Batam. Metode penelitian menggunakan pendekatan kuantitatif berbasis Sistem Informasi Geografis (SIG) dengan pengolahan citra Sentinel-2A melalui perhitungan *Normalized Difference Vegetation Index* (NDVI). Analisis data dilakukan menggunakan analisis korelasi, regresi linear, dan *Root Mean Square Error* (RMSE). Hasil penelitian menunjukkan bahwa luas mangrove di kawasan penelitian mencapai 679,64 ha dengan nilai NDVI berkisar antara 0,21–0,42. Klasifikasi kerapatan mangrove terdiri atas mangrove jarang seluas 143,70 ha (21,14%), mangrove sedang seluas 241,96 ha (35,60%), dan mangrove padat seluas 293,59 ha (43,26%). Hasil klasifikasi tutupan lahan menunjukkan adanya kelas lahan terbuka, vegetasi jarang, vegetasi sedang, vegetasi rapat, dan perairan. Pola sebaran spasial cadangan karbon menunjukkan bahwa area dengan vegetasi mangrove yang lebih rapat memiliki cadangan karbon lebih tinggi dibandingkan area dengan vegetasi yang lebih jarang. Analisis hubungan NDVI dengan cadangan karbon menghasilkan korelasi lemah ($r = 0,273$) dan nilai koefisien determinasi yang sangat rendah ($R^2 = 0,00202$), sedangkan nilai RMSE sebesar 24,3 menunjukkan tingkat akurasi model yang masih rendah. Dengan demikian, NDVI belum mampu menjadi prediktor yang baik dalam mengestimasi cadangan karbon mangrove pada kawasan penelitian.

Kata kunci: Cadangan Karbon, Mangrove, NDVI, Perairan Sagulung, Sistem Informasi Geografis.

SUMMARY

NUR ANISA MALISNA. Spatial Distribution Pattern of Mangrove Carbon Stock in Sagulung Waters, Batam City, Using Geographic Information Systems. Supervised by FEBRIANTI LESTARI and ANDI ZULFIKAR.

Mangrove ecosystems play an important role in climate change mitigation due to their ability to absorb and store large amounts of carbon. Mangrove areas in Sagulung Waters, Batam City, are facing increasing pressure from coastal development, industrial activities, and settlements, which may affect vegetation conditions and carbon storage capacity. This study aimed to describe the distribution of mangroves, determine mangrove land cover classification, and analyze the spatial distribution pattern of mangrove carbon stock in Sagulung Waters, Batam City. This research was conducted from July 2025 to January 2026 in Sagulung Waters, Batam City. The tools used included QGIS software, Microsoft Excel, and a laptop. The materials consisted of Sentinel-2A satellite imagery, carbon stock data from previous studies, and the administrative boundary shapefile of Batam City. The study employed a quantitative approach based on Geographic Information Systems (GIS) through Sentinel-2A image processing using the Normalized Difference Vegetation Index (NDVI). Data analysis was carried out using correlation analysis, linear regression analysis, and Root Mean Square Error (RMSE). The results showed that the total mangrove area in the study site was 679.64 ha, with NDVI values ranging from 0.21 to 0.42. Mangrove density classification consisted of sparse mangroves covering 143.70 ha (21.14%), moderate mangroves covering 241.96 ha (35.60%), and dense mangroves covering 293.59 ha (43.26%). Land cover classification revealed several major classes, including open land, sparse vegetation, moderate vegetation, dense vegetation, and water bodies. The spatial distribution pattern of carbon stock indicated that areas with denser mangrove vegetation contained higher carbon stocks than areas with lower vegetation density. The analysis of the relationship between NDVI and carbon stock produced a weak correlation ($r = 0.273$) and a very low coefficient of determination ($R^2 = 0.00202$), while the RMSE value of 24.3 indicated low model accuracy. Therefore, NDVI alone was not a reliable predictor for estimating mangrove carbon stock in the study area.

Keywords: Carbon Stock, Geographic Information System, Mangrove, NDVI, Sagulung Waters.