

ABSTRAK

INTEGRASI PENGINDERAAN JAUH DAN CELLULAR AUTOMATA UNTUK PREDIKSI PERUBAHAN TUTUPAN LAHAN DAN STOK KARBON DI KABUPATEN LAMPUNG TENGAH

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Perubahan tutupan lahan memengaruhi dinamika stok karbon terestrial dan berimplikasi pada mitigasi iklim. Kabupaten Lampung Tengah menghadapi tekanan pembangunan tinggi yang mendorong alih fungsi lahan. Penelitian ini bertujuan menganalisis perubahan tutupan lahan 2013–2023, memprediksi kondisi 2043 dengan model Cellular Automata–Logistic Regression (CA-LR), mengestimasi perubahan stok karbon, serta merumuskan strategi pengendalian berbasis mitigasi karbon. Metode menggunakan penginderaan jauh dan SIG dengan citra satelit multiwaktu (2013, 2018, 2023). Estimasi stok karbon mengacu pada pedoman IPCC dan literatur terkait.

Hasil menunjukkan penurunan pertanian lahan kering dan lahan kosong, sementara pertanian lahan basah, hutan, dan lahan terbangun meningkat. Proyeksi 2043 memperlihatkan lahan terbangun dominan (naik 29,06%), sedangkan hutan hanya bertambah 1,34%. Stok karbon naik dari 52,07 juta ton C (2013) menjadi 54,62 juta ton C (2023), namun diperkirakan turun menjadi 52,98 juta ton C pada 2043 akibat ekspansi lahan terbangun dan berkurangnya lahan pertanian. Penelitian menyimpulkan perlunya pengendalian lahan terbangun, perlindungan hutan, dan integrasi stok karbon dalam perencanaan tata ruang wilayah. Temuan ini menegaskan pentingnya kebijakan tata ruang yang berorientasi pada keberlanjutan dan mitigasi perubahan iklim, sekaligus memberikan dasar ilmiah bagi perumusan strategi pembangunan daerah yang lebih adaptif dan berwawasan lingkungan.

Kata Kunci: perubahan tutupan lahan, stok karbon, Cellular Automata, penginderaan jauh, Kabupaten Lampung Tengah

ABSTRACT

INTEGRATING REMOTE SENSING AND CELLULAR AUTOMATA TO PREDICT LAND COVER CHANGE AND CARBON STOCK IN CENTRAL LAMPUNG REGENCY

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Land use change significantly affects terrestrial carbon stock dynamics and has major implications for climate change mitigation. Central Lampung Regency faces increasing development pressure, leading to substantial land conversion. This study aims to analyze land use changes during 2013–2023, predict land use in 2043 using the Cellular Automata–Logistic Regression (CA-LR) model, estimate carbon stock changes, and propose land use control strategies based on carbon mitigation. Remote sensing and Geographic Information System (GIS) approaches were applied using multi-temporal satellite imagery (2013, 2018, 2023). Carbon stock estimation was calculated based on land use area and carbon stock factors derived from IPCC guidelines and relevant literature.

Results show that dryland agriculture and vacant land decreased, while wetland agriculture, forest, and built-up areas increased. The 2043 projection indicates built-up land will dominate (up 29.06%), while forest area rises only 1.34%. Carbon stock increased from 52.07 million tons C in 2013 to 54.62 million tons C in 2023, but is expected to decline to 52.98 million tons C by 2043 due to built-up expansion and reduced agricultural land. The study concludes that effective land use control, forest protection, and integration of carbon considerations into spatial planning are essential. These findings highlight the urgency of sustainable spatial policies and provide a scientific basis for regional development strategies that are adaptive and environmentally sound.

Keywords: land use change, carbon stock, Cellular Automata, remote sensing, Central Lampung Regency