ABSTRAK

ANALISIS SPASIAL EMISI CO_2 DAN ESTIMASI SERAPAN KARBON PADA KEGIATAN HAULING PERTAMBANGAN EMAS DI KABUPATEN MURUNG RAYA, KALIMANTAN TENGAH

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Aktivitas pertambangan berkontribusi signifikan terhadap emisi Gas Rumah Kaca (GRK), terutama dari konsumsi bahan bakar B35 pada alat operasional Hauling. Namun, analisis neraca karbon yang terintegrasi secara spasial masih terbatas, menghambat perencanaan mitigasi efektif. Penelitian ini bertujuan menginventarisasi emisi CO_2, menganalisis pola dispersi spasial, mengevaluasi metode serapan karbon, serta merumuskan arahan pengelolaan berbasis neraca karbon di Pit Bantian 6-4 PT. Indo Muro Kencana.

Penelitian menggunakan pendekatan kuantitatif dengan inventarisasi emisi mengacu pada IPCC *Tier* 2 untuk akurasi faktor emisi spesifik. Dispersi spasial emisi dimodelkan menggunakan AERMOD dengan input meteorologi dan topografi lokal. Kapasitas serapan karbon dievaluasi melalui perbandingan komparatif antara metode regresi NDVI–AGB yang dikalibrasi lapangan dan pendekatan LULC–InVEST berbasis stok karbon nasional. Integrasi spasial kedua komponen dilakukan melalui *overlay* GIS untuk menentukan zonasi defisit serta ekses karbon yang dihitung secara agregat.

Hasil menunjukkan total emisi CO_2 sebesar 5.558,30 ton/tahun dengan dominasi sumber bergerak. Metode NDVI–AGB terbukti lebih representatif (RMSE 0,06) dibandingkan LULC–InVEST yang cenderung overestimasi. Neraca karbon spasial mengalami defisit signifikan sebesar -4.349,77 ton CO_2/tahun. Strategi mitigasi kombinasi transisi bahan bakar B35, B50, LNG dan reklamasi progresif berbasis spesies lokal diproyeksikan mencapai surplus karbon pada masing-masing BBM di tahun ke-18, ke-33, dan ke-40. Studi ini menyediakan roadmap implementatif menuju operasional pertambangan berketahanan iklim.

Kata kunci: Neraca Karbon Spasial, Emisi CO_2, Pertambangan Emas, Model AERMOD, Serapan Karbon.

ABSTRACT

SPATIAL ANALYSIS OF CO_2 EMISSIONS AND CARBON SEQUESTRATION ESTIMATION IN GOLD MINING HAULING ACTIVITIES IN MURUNG RAYA REGENCY, CENTRAL KALIMANTAN

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Mining activities COntribute significantly to Greenhouse Gas (GHG) emissions, particularly stemming from B35 fuel COnsumption in hauling operations. However, spatially integrated carbon balance analysis remains limited, hindering effective mitigation planning. This study aims to inventory CO_2 emissions, analyze spatial dispersion patterns, evaluate carbon Sequestration methods, and formulate management directives based on carbon balance at Gold Mining, Pit Bantian 6-4, PT. Indo Muro Kencana, Murung Raya Gegency, Central Kalimantan Province.

The research employs a quantitative approach with emission inventory referencing IPCC Tier 2 to ensure accurate specific emission factors. Spatial emission dispersion was modeled using AERMOD, inCOrporating local meteorology and topography inputs. Carbon Sequestration capacity was evaluated through a COmparative analysis between the field-calibrated NDVI–AGB regression method and the LULC–InVEST approach based on national carbon stock. Spatial integration of both COmponents was COnducted via GIS overlay to determine zoning for carbon deficit and excess.

The results show total CO_2 emissions of 5,558.30 tons/year, dominated by mobile sources. The NDVI–AGB method proved to be more representative (RMSE 0.06) compared to LULC–InVEST, which tended to overestimate. The spatial carbon balance experienced a significant deficit of -4,349.77 tons CO_2/year. Mitigation strategies combining fuel transitions (B35, B50, LNG) and progressive reclamation using local species are projected to achieve a carbon surplus for each fuel type by Year 18, 33, and 40, respectively. This study provides an implementable roadmap toward climate-resilient mining operations.

Keywords: Spatial Carbon Balance, CO_2 Emissions, Gold Mining, AERMOD Model, Carbon Sequestration.