INTISARI

Pembangunan Bandara Internasional Yogyakarta di kawasan pesisir selatan Pulau Jawa yang berhadapan langsung dengan Australia memicu dinamika perubahan tutupan lahan yang signifikan. Kawasan ini ditetapkan sebagai obyek vital nasional yang memerlukan penataan wilayah pertahanan darat bersifat dinamis untuk mengantisipasi potensi ancaman. Permasalahan penelitian mencakup belum diketahuinya prediksi perubahan tutupan lahan hingga tahun 2030, belum teridentifikasinya zona ruang pertahanan efektif berdasarkan aspek fisik medan, dan belum tersusunnya pola spasial tata wilayah pertahanan darat (mandala) yang mengakomodasi perkembangan kawasan strategis.Penelitian ini bertujuan mengidentifikasi prediksi perubahan tutupan lahan, menganalisis zona ruang pertahanan efektif, dan menerapkan pola spasial tata wilayah pertahanan darat di kawasan sekitar Bandara Internasional Yogyakarta seluas 5.548,62 ha. Metode penelitian menggunakan pendekatan kuantitatif deskriptif. Prediksi perubahan tutupan lahan menggunakan metode *Cellular Automata-Artificial Neural Network* (CA-ANN) dengan data Citra Landsat *multitemporal*, menghasilkan uji akurasi Kappa sebesar 0,81432. Penentuan ruang pertahanan efektif menggunakan metode *Analytical Hierarchy Process* (AHP) berbasis Sistem Informasi Geografi (SIG) dengan 12 parameter aspek fisik medan meliputi kemiringan lereng, kondisi tanah, bentang lahan, akses air, curah hujan, kawasan bangunan, vegetasi, bencana, jaringan sungai-irigasi, jalan-rel kereta api, listrik tegangan tinggi, dan telekomunikasi. Data pembobotan diperoleh melalui wawancara terhadap 10 personel TNI AD berpengalaman. Penentuan ruang pertahanan efisien menggunakan metode *Simple Additive Weighting* (SAW) dengan *Certainty Factor* berdasarkan 5 aspek taktis medan: medan kritis, lindung tinjau-tembak, lapang tinjau-tembak, jalan pendekat, dan rintangan. Hasil penelitian menunjukkan prediksi perubahan tutupan lahan tahun 2030 mengindikasikan pertumbuhan permukiman signifikan dengan konversi lahan pertanian. Analisis aspek fisik medan menghasilkan 69,31% kawasan merupakan ruang pertahanan efektif. Pola spasial mandala tersusun menjadi empat zona operasional: daerah belakang sebagai pangkal perlawanan, daerah komunikasi untuk jalur logistik, daerah bekal untuk persiapan operasi, dan daerah tempur depan sebagai garis pertahanan terdepan. Implikasi penelitian mencakup perlunya sinkronisasi perencanaan tata ruang yang mengakomodasi kepentingan kesejahteraan dan pertahanan-keamanan secara sinergis. Pola spasial tata wilayah pertahanan dinamis ini dapat menjadi masukan bagi pengambil kebijakan dalam Rencana Detail Tata Ruang Kawasan Sekitar Bandara Internasional Yogyakarta.

Kata Kunci : Ruang pertahanan, Sistem Informasi Geografi, Bandara Internasional Yogyakarta, Mandala

ABSTRACT

The construction of Yogyakarta International Airport on the southern coast of Java, directly adjacent to Australia, has triggered significant changes in land cover. This area has been designated a national vital object, requiring dynamic land defense planning to anticipate potential threats. Research challenges include the uncertainty of predicting land cover changes until 2030, the lack of identification of effective defense zones based on the physical aspects of the terrain, and the absence of a spatial pattern for land defense planning (mandala) that accommodates the development of strategic areas. This study aims to identify predicted land cover changes, analyze effective defense zones, and implement a spatial pattern for land defense planning in the 5,548.62 ha area surrounding Yogyakarta International Airport. The research method used a descriptive quantitative approach. Land cover change predictions were performed using the Cellular Automata-Artificial Neural Network (CA-ANN) method with multitemporal Landsat imagery data, resulting in a Kappa accuracy of 0.81432. The determination of effective defense space used the Analytical Hierarchy Process (AHP) method based on a Geographic Information System (GIS) with 12 physical terrain parameters, including slope, soil conditions, landforms, water access, rainfall, built-up areas, vegetation, disasters, river-irrigation networks, roads and railways, high-voltage electricity, and telecommunications. Weighting data was obtained through interviews with 10 experienced Indonesian Army personnel. Efficient defense space was determined using the Simple Additive Weighting (SAW) method with a Certainty Factor based on five tactical terrain aspects: critical terrain, fire-reconnaissance cover, fire-reconnaissance range, approach roads, and obstacles. The results showed that predicted land cover changes in 2030 indicated significant residential growth, accompanied by agricultural land conversion. Analysis of the physical terrain resulted in 69.31% of the area being considered as effective defense space. The spatial pattern of the mandala is structured into four operational zones: the rear area as the base of resistance, the communication area for logistics routes, the supply area for operational preparation, and the forward combat area as the front line of defense. The implications of this research include the need for synchronized spatial planning that synergistically accommodates welfare and defense-security interests. This dynamic spatial pattern of defense planning can provide input for policymakers in the Detailed Spatial Plan for the Area Surrounding Yogyakarta International Airport.

Keywords: Defense Space, Geographic Information System, Yogyakarta International Airport, Mandala