

MODEL DISTRIBUSI SPASIAL HUTAN RAKYAT KABUPATEN BANGKALAN

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INTISARI

Kabupaten Bangkalan memiliki potensi besar hutan rakyat sebagai sumber bahan baku kayu serta peningkatan kesejahteraan masyarakat. Namun, keterbatasan data spasial persebarannya menyebabkan perencanaan pengelolaan hutan rakyat di kabupaten ini belum optimal. Penelitian ini bertujuan memetakan distribusi spasial hutan rakyat dan kerapatannya, serta merumuskan strategi pengelolaan dan pengembangannya berbasis penginderaan jauh dan Sistem Informasi Geografis.

Analisis dilakukan menggunakan citra multisensor yaitu kombinasi Sentinel-2A dan Sentinel-1 dengan memanfaatkan saluran spektral, indeks spektral, dan tekstur. Data tersebut diklasifikasikan dengan algoritma *Random Forest* pada *Google Earth Engine*. Hutan rakyat diidentifikasi melalui pemotongan tutupan hutan terhadap batas kawasan hutan, sempadan sungai, dan mangrove dengan luas minimal 0,25 ha, sedangkan lahan potensial dihitung dari pengurangan lahan terbuka dan pertanian terhadap lahan sawah dilindungi. Dataset disusun dengan metode *random sampling* (70% *training*, 30% *testing*), divalidasi menggunakan *OOB error* dan *confusion matrix*. Uji akurasi pemetaan dengan dilakukan dengan membandingkan data lapangan yang dikumpulkan dengan *stratified random sampling* berdasarkan proporsi luasan kelas tutupan lahan dan kerapatan hutan. Analisis SIG kemudian mengintegrasikan parameter kerapatan, kelerengan, dan ketersediaan lahan dengan bobot numerik, yang digabungkan untuk menghasilkan peta kesesuaian spasial dan zonasi tingkat desa melalui klasifikasi *Jenks Natural Breaks*.

Hasil penelitian menunjukkan klasifikasi dengan *Random forest* menghasilkan akurasi yang baik (94%) dan dapat mengidentifikasi hutan rakyat di Kabupaten Bangkalan seluas 25.913,32 ha. Kerapatan hutan rakyat didominasi kerapatan rendah, diikuti tinggi dan sedang secara berturut-turut 41,55%, 34,06%, dan 24,40%. Lahan potensial yang teridentifikasi untuk pengembangan seluas 19.115,44 ha. Arahan pengelolaan meliputi intensifikasi pada desa dengan kerapatan hutan rakyat rendah-tinggi, ekstensifikasi pada ketersediaan lahan potensial, serta pendekatan gabungan. Pada zona curam, pola wana/alas lebih sesuai untuk konservasi, sedangkan pada zona datar-landai pola *agroforestry* direkomendasikan untuk integrasi kehutanan dan pertanian. Peta zonasi yang dihasilkan menjadi dasar penentuan prioritas intervensi, penyuluhan, dan strategi pemberdayaan guna menjaga keberlanjutan hutan rakyat

Kata Kunci: Distribusi Spasial, *Random Forest*, Indeks Vegetasi, Kabupaten Bangkalan, Hutan Rakyat

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SPATIAL DISTRIBUTION MODEL OF PRIVATE FORESTS IN BANGKALAN REGENCY

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ABSTRACT

Bangkalan Regency has great potential in private forests as a source of timber and for improving community welfare. However, limited spatial data on their distribution has resulted in suboptimal planning for its management. This study aims to map the spatial distribution and density of private forests and to formulate management and development strategies based on remote sensing and data geospatial models.

The analysis was conducted using multisensor imagery, combination of Sentinel 2A and Sentinel 1, utilizing spectral channels, spectral indices, and texture. The data was classified using the Random Forest algorithm on Google Earth Engine. Community forests were identified by cutting forest cover against state forest, river, and mangroves with a minimum area of 0.25 hectares, potential land was calculated by subtracting open land and agriculture from protected rice fields. The dataset was compiled using the random sampling method and divided into (70% training, 30% testing) and validated using OOB error and confusion matrix. Mapping accuracy using reference data that was collected using stratified random sampling based on the proportion of land cover class area and forest density. Analysis based on scoring then integrated the parameters of density, slope, and land availability with numerical weights, which were combined to produce a spatial suitability map and village-level zoning through Jenks Natural Breaks classification.

The results of the study show that classification using Random Forest produces good accuracy (94%) and can identify community forests in Bangkalan Regency covering an area of 25,913.32 ha. The density of community forests is dominated by low density, followed by high and medium density, respectively 41.55%, 34.06%, and 24.40%. The identified potential land for development covers an area of 19,115.44 ha. Management directives include intensification in villages with low to high community forest density, extensification on potential land availability, and a combined approach. In steep zones, the forest/forest floor pattern is more suitable for conservation, while in flat-sloping zones, the agroforestry pattern is recommended for the integration of forestry and agriculture. The resulting zoning map forms the basis for determining intervention priorities, extension, and empowerment strategies to maintain the sustainability of community forests.

Keywords: Spatial Distribution, Random Forest, Vegetation Index, Bangkalan District, Community Forests

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