INTISARI

Penelitian ini dilatarbelakangi oleh percepatan perubahan tutupan lahan akibat pertambangan dan urbanisasi di Kabupaten Luwu Timur yang kerap tidak selaras dengan RTRW, sehingga menekan daya dukung lahan dan menyulitkan perencanaan ruang. Permasalahannya, belum tersedia model spasial prediksi tutupan lahan yang dapat menilai kesesuaian ruang serta menghitung kapasitas lahan yang layak permukiman. Tujuannya adalah memetakan perubahan tutupan lahan 2015–2025, memprediksi tutupan lahan hingga 2030, dan mengintegrasikannya ke perhitungan daya dukung lahan permukiman (DDPm) untuk mendukung kebijakan ruang yang adaptif. Pendekatan yang digunakan menggabungkan klasifikasi citra Sentinel-2 berbasis SVM dan model prediksi berbasis CA–ANN pada data multispektral.

Data utama berupa citra Sentinel-2 tahun 2015, 2020, dan 2025. Faktor pendorong perubahan lahan adalah data jarak ke jalan, sungai, dan pusat-pusat pelayanan. Klasifikasi tutupan lahan dilakukan dengan metode *support vector machine* (SVM), kemudian metode prediksi menggunakan *cellular automata – artificial neural network* (CA-ANN). Analisis akurasi menggunakan matriks konfusi dan indeks Kappa, lalu proyeksi penduduk 2025–2030 dihitung secara geometrik, kemudian dihitung luas lahan layak permukiman (LPm) dan daya dukung lahan permukiman (DDPm) pada tingkat kecamatan.

Hasil klasifikasi dan model menunjukkan kinerja tinggi, *overall accuracy* (OA) klasifikasi 98,06% dan model prediksi 97,51% dengan Kappa masing-masing 0,9744 dan 0,9673. Tantangan terbesar ada pada kelas permukiman (PA prediksi 55,64%), sementara kelas lain stabil tinggi. Pada 2030, seluruh kecamatan tetap berada pada kondisi DDPm>1; misalnya Angkona (137,92) dan Mangkutana (117,04), sedangkan sebagian kecamatan lain relatif lebih rendah namun masih mampu menampung penduduk. Secara agregat, DDPm kabupaten adalah 78,07, yang menuntut pengelolaan ruang adaptif dan spesifik wilayah. Kesimpulannya, integrasi SVM–CA-ANN dengan perhitungan DDPm menghasilkan indikator spasial yang andal untuk mendukung penyesuaian RTRW dan perencanaan permukiman berkelanjutan hingga 2030.

Kata kunci : prediksi lahan, *support vector machine*, *cellular automata*, daya dukung permukiman, luwu timur

ABSTRACT

This study was motivated by the accelerated change in land cover due to mining and urbanization in East Luwu Regency, which often conflicts with the Spatial Plan (RTRW), thereby reducing land carrying capacity and complicating spatial planning. The problem is that there is no spatial model for predicting land cover that can assess spatial suitability and calculate the capacity of land suitable for settlement. The objectives are to map land cover changes from 2015 to 2025, predict land cover until 2030, and integrate it into the calculation of residential land carrying capacity (DDPm) to support adaptive spatial policies. The approach used combines SVM-based Sentinel-2 image classification and CA-ANN-based prediction models on multispectral data.

The main data consists of Sentinel-2 images from 2015, 2020, and 2025. The driving factors of land change are data on distance to roads, rivers, and service centers. Land cover classification was performed using the support vector machine (SVM) method, followed by the cellular automata – artificial neural network (CA-ANN) prediction method. Accuracy analysis was performed using a confusion matrix and Kappa index, then the 2025–2030 population projection was calculated geometrically, followed by the calculation of the area of land suitable for settlement (LPm) and the carrying capacity of settlement land (DDPm) at the subdistrict level.

The classification and model results show high performance, with an overall accuracy (OA) of 98.06% for classification and 97.51% for prediction models, with Kappa values of 0.9744 and 0.9673, respectively. The biggest challenge is in the settlement class (PA prediction 55.64%), while other classes are stable and high. In 2030, all subdistricts will remain in a DDPm>1 condition; for example, Angkona (137.92) and Mangkutana (117.04), while some other subdistricts are relatively lower but still able to accommodate residents. Aggregately, the district's DDPm is 78.07, which requires adaptive and region-specific spatial management. In conclusion, the integration of SVM–CA-ANN with DDPm calculations produces reliable spatial indicators to support RTRW adjustments and sustainable settlement planning until 2030.

Keywords : *land prediction, support vector machine, cellular automata, settlement carrying capacity, East Luwu*