Pemanfaatan Google Earth Engine untuk Analisis Spasial – Temporal Perubahan Tutupan Lahan Pasca Tsunami Aceh Menggunakan Algoritma *Random Forest* (Studi Kasus: Kota Banda Aceh, 2004 – 2024)

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INTISARI

Peristiwa tsunami pada 26 Desember 2004 tidak hanya merubah struktur tutupan lahan, namun juga memengaruhi pola pemanfaatan ruang di Kota Banda Aceh, terutama di kawasan pesisir. Penelitian ini bertujuan untuk menganalisis perubahan tutupan lahan periode 2004 – 2024 guna memahami pola kerusakan dan proses pemulihan pasca-bencana.

Analisis ini memanfaatkan citra satelit Landsat 5, Landsat 8, dan Landsat 9 yang diolah melalui platform Google Earth Engine. Proses klasifikasi tutupan lahan dilakukan dengan algoritma *Random Forest* berbasis indeks spektral, meliputi NDVI, NDWI, dan NDBI, sehingga dapat membedakan enam kelas tutupan lahan di area studi. Uji akurasi hasil klasifikasi dievaluasi melalui *confusion matrix.*

Hasil penelitian menunjukkan penurunan signifikan lahan terbangun pada tahun 2005 akibat tsunami, lalu meningkat secara bertahap hingga 2024 sebagai tanda pemulihan. Perubahan juga terjadi pada tutupan vegetasi, lahan terbuka, badan air, tambak, dan mangrove, akibat faktor rehabilitasi lingkungan dan tekanan pembangunan. Uji akurasi menggunakan *confusion matrix* menghasilkan *overall accuracy* berkisar 87,25% - 93,92% dengan nilai Kappa antara 0,83 – 0,89. Sebagian perubahan sesuai dengan RTRW Kota Banda Aceh 2009 – 2029, namun terdapat pula alih fungsi kawasan lindung dan lahan produktif menjadi area terbangun yang tidak sesuai.

Kata Kunci: Tutupan Lahan, Tsunami, Landsat, Google Earth Engine, *Random Forest*, RTRW

Utilizing Google Earth Engine for Spatial-Temporal Analysis of Land Cover Changes Post-Tsunami in Aceh Using the Random Forest Algorithm (Case Study: Banda Aceh City, 2004–2024)

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ABSTRACT

The tsunami of December 26, 2004, not only altered land cover structures but also affected spatial use patterns in Banda Aceh City, particularly in coastal areas. This study aims to analyze land cover changes from 2004 to 2024 to understand damage patterns and post-disaster recovery processes.

This analysis utilizes Landsat 5, Landsat 8, and Landsat 9 satellite imagery processed using the Google Earth Engine platform. The land cover classification process was performed using a Random Forest algorithm based on spectral indices, including NDVI, NDWI, and NDBI, enabling the distinction of six land cover classes in the study area. The accuracy of the classification results was evaluated using a confusion matrix.

The results of the study showed a significant decrease in built-up land in 2005 due to the tsunami, then increased gradually until 2024 as a sign of recovery. Changes also occurred in vegetation cover, open land, water bodies, ponds, and mangroves, due to environmental rehabilitation factors and development pressures. Accuracy tests using a confusion matrix produced an overall accuracy ranging from 87.25% - 93.92% with a Kappa value between 0.83 - 0.89. Some changes are in accordance with the Banda Aceh City Spatial Plan 2009 - 2029, but there are also changes in the function of protected areas and productive land into unsuitable built-up areas.

Keywords: *Land Cover, Tsunami, Landsat, Google Earth Engine, Random Forest, Spatial Planning*.