ABSTRACT

Rapid land use and land cover (LULC) change in Klungkung Regency, Bali-marked by vegetation decline and built-up area expansion-is a major challenge for sustainable regional management. This research adopts a Knowledge Discovery in Databases (KDD) framework consisting of data selection, preprocessing, transformation, mining, and interpretation stages to analyze multi-temporal Sentinel-2 satellite images of 2019, 2021, and 2023. Analysis was conducted on 1,000 spatial sample points spread across the study area. Six key spatial features were extracted and standardized, namely vegetation indices (NDVI, EVI, FVC), NDBI, elevation and population density. The entire data collection and preprocessing process was conducted using the Google Earth Engine (GEE) platform, which enables efficient management of large-scale geospatial data. The clustering process was performed unsupervised with the K-Means algorithm, using an optimal configuration of k = 2 validated by consistent Silhouette Score values above 0.76 in each year of observation. The analysis results show a clear temporal shift from the dominance of built-up areas (Cluster 1) towards vegetative areas (Cluster 0), where the proportion of Cluster 0 increases from 41% in 2019 to 61% in 2023. This pattern is thought to be influenced by a combination of revegetation efforts, land use policies, or a slowdown in post-pandemic urban expansion. This study shows that the integration of KDD, GEE, and unsupervised clustering frameworks is effective in detecting subtle spatial changes, which can serve as a basis for data-driven policy making, long-term environmental monitoring, and adaptive spatial planning at the regional level.

Keywords: Clustering, Google Earth Engine, Klungkung, K-Means, LULC, Sentinel-2.