# Mangrove Ecosystems Change Mapping and Their Implication to Environmental Change Using Remote Sensing Technique in Segara Anakan, Central Java

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**Abstract:**

Mangroves are unique tropical coastal wetland ecosystems that have important roles to climate change adaptation and mitigation. They provide not only numerous ecosystem services to local communities e.g. fisheries resources,  ecotourism, timber value, protecting coastal area from sea level rise and storm, but also store more soil carbons compared to terrestrial forests because of their high net primary production. Recent studies showed that mangroves have been severely threatened by deforestation, land use change, aquaculture and other human activities. This study investigates spatial extent and above ground biomass dynamics in order to observe the importance of mangrove ecosystem in responding to climate and other environmental aspects changes.

This study focuses on mangrove ecosystem in Segara Anakan, southern coast of Central Java Province. This area is lagoon-mangrove complex ecosystem with fisheries and aquaculture activity as major threatened. We distinguish mangrove types into fringe and inland mangroves, since both mangroves have different vegetation species and characteristics with respect to the distance from coastal lines and associated carbon stocks. Remote sensing technique is employed combining multispectral bands of Landsat Enhanced Thematic Mapper (ETM+) / Thematic Mapper (TM) images, different band ratios (i.e. ratios of bands 4/2, 5/7 and 7/4) and vegetation indices (i.e. NDVI, MSAVI and EVI) to classify spatial extent of these mangrove ecosystems. Spectral responses of multispectral bands, band ratios and vegetation indices were plotted against the field observation data to analyze the sensitivity for characterizing fringe and inland mangroves. We apply transformed divergence algorithm to assess the separability of training data, which are used for image classification. The classification is conducted using different combinations of input, namely reflectance values, vegetation indices and combined inputs. Descriptive statistic analysis shows that these RS data are not normally distributed. Therefore, we explore the potential of non-parametric classification approaches based on Support Vector Machine (SVM) and Artificial Neural Network (ANN) algorithm and compared the results with those of conventional statistical Maximum Likelihood Classification (MLC). The classification results are assessed using error matrices, and *z*-test is used to evaluate the significance of accuracy difference of each classification algorithm pair.

The RS based vegetation indices are correlated with field measurement data to spatially extrapolate in-situ aboveground biomass (AGB) over large areas of mangrove forests. Our observation shows that spatial extent of fringe mangrove is lower than inland mangrove forest ecotypes, because geographically they were located in the estuary lagoon. We found there are loss of carbon above the ground over between 2000 and 2010, mainly due to urban development, fisheries uses, and tourism expansions. It is critical for the government to initiate relevant policies and better management practice to protect mangroves from and to avoid of this particular ecosystem.

Keywords: mangroves, climate change, remote sensing, aboveground biomass, Landsat images