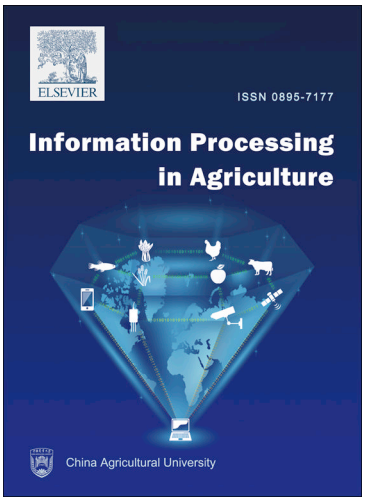

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Exploring Changes of Land Use and Mangrove Distribution in the Economic Area of Sidoarjo District, East Java using Multi-temporal Landsat Images

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ABSTRACT

Remotely sensed data are capable of providing spatial and temporal information on land use land cover (LULC) over a large extent of land. The Sidoarjo District in East Java Province has recently been extensively explored for economic development opportunities. This paper examines the use of multi-temporal Landsat images in deriving information for LULC maps, changes of land development and natural ecosystems such as mangrove forest within particular economic reform areas. Results suggest a minimum accuracy (baseline) for LULC mapping using Landsat multispectral reflectance data of 74% for the overall accuracy (OA) and 0.70 for the kappa coefficient of agreement (kappa). On average an acceptable accuracy (OA=88% and kappa=0.86) can be achieved by integrating multispectral reflectance and green normalized difference vegetation index (GNDVI) to support vector machine classification. The economic reform in the Sidoarjo District made a significant change to LULC and mangrove distribution. From 1995 to 2015, 25% of crop land and 15% of bare land changed to become built-up areas, and 8% of wetland and 22% of mangroves changed to crop land. A remarkable decrease of mangrove forest occurred in the interior land along the river systems over the whole district. Fortunately, the coastal mangroves areas saw a significant increase due to the Lumpur Sidoarjo (LUSI)-caused mud flow sediments near the estuary of the river. The impact of extensive economic activities and development on the natural mangrove forests was partially compensated for by the LUSI events and also newly developed local community oriented conservative management.

Keywords: Mangroves; Land use land cover changes; Support vector machine (SVM); Vegetation index; Lumpur Sidoarjo (LUSI)

1. Introduction

Mangrove ecosystems can be found in sub-tropical and tropical areas of the world. They are found growing along coastlines at sites such as river estuaries, tidal marshes, or around ponds [1]. Mangrove forests are important coastal ecosystems because they provide unique resources to meet the needs of human societies and wildlife [2] and also reduce emission of carbon dioxide. Forests offer a nursery ground for various aquatic species, help to maintain coastal communities from natural disasters, provide sediment stabilization of sea-land interactions and adsorption of pollutants [3]. They also provide food, medicine, fuels and building materials as well as increasing biodiversity values for local communities [4, 5]. Yet, Mangrove forests have been threatened globally by deforestation due to human activities, especially industry, residency, and aquaculture activities [6]. The rapid disappearance and