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Determination of Mangrove Change in Matang Mangrove Forest Using Multi Temporal Satellite Imageries

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Abstract. Mangrove protects shorelines from damaging storm and hurricane winds, waves, and floods. Mangroves also help prevent erosion by stabilizing sediments with their tangled root systems. They maintain water quality and clarity, filtering pollutants and trapping sediments originating from land. However, mangrove has been reported to be threatened by land conversion for other activities. In this study, land use and land cover changes in Matang Mangrove Forest during the past 18 years (1993 to 2011) were determined using multi-temporal satellite imageries by Landsat TM and RapidEye. In this study, classification of land use and land cover approach was performed using the maximum likelihood classifier (MCL) method along with vegetation index differencing (NDVI) technique. Data obtained was evaluated through Kappa coefficient calculation for accuracy and results revealed that the classification accuracy was 81.25% with Kappa Statistics of 0.78. The results indicated changes in mangrove forest area to water body with 2,490.6 ha, aquaculture with 890.7 ha, horticulture with 1,646.1 ha, palm oil areas with 1,959.2 ha, dry land forest with 2,906.7 ha and urban settlement area with 224.1 ha. Combinations of these approaches were useful for change detection and for indication of the nature of these changes.

Keywords: Mangrove change; MLC; NDVI; satellite imageries; Matang Mangrove Forest.
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INTRODUCTION

Land use and land cover mapping are essential components where all parameters are integrated as the requirement to drive various developmental indexes for land and water resource. Land use refers to man's activities and the other uses which are carried on land and land cover refers to natural vegetation, water bodies, rock/soil, artificial cover and others [1]. Land cover is defined as the assemblage of biotic and abiotic components on the earth's surface and is one of the most crucial properties of the earth system. Land cover covers the surface of the earth and land use describes how the land cover is modified. Land cover includes water, snow, and others. Land use includes agricultural land, built up land, recreation area, wildlife management area and others [2]. The knowledge of land use and land cover change is very important to understand the natural resources, their utilization, conservation and management [3].

Malaysia is rich with mangrove forests which are scattered at the muddy shorelines, lagoons and along the river and influenced by tidal. Mangrove forests are unique ecosystem generally found along sheltered coasts where they grow abundantly in saline soil and brackish water subject to periodic fresh- and salt-water inundation. Mangrove forest resources, such as timber and fuel wood, nipah (for roof), various species of fish, crabs and shrimp (as food source) as well as medicinal seeds and fruit, have high commercial value. In addition, mangrove forests are also useful for other activities such as agriculture, aquaculture, ports, landfills and construction of fishing jetty [4].

Mangrove forest area is also suitable for secondary production and commercial fishing [5] nursery for many commercial juvenile fish and shrimp species and serves as area of migration, protection [6], and reproduction and life cycle completion for some organisms [7]. However, a 12% decrease in mangrove forest in Malaysia from 505.345 ha in 1980 to 445.802 ha in 1990 was due to the non-agricultural development activities [8]. According to Malaysian Nature Society, only 1.8% of land areas are covered by mangroves now, with over 50% of mangrove forests was lost between years 1950 to 1985. This phenomenon impacted negatively on both humans and environment which causing decline in water quality, reduction in biodiversity of forests and destroying habitats for fish and crustaceans.

The major threat is posed by the conversion of mangrove forests into agricultural land use, shrimp ponds and urban development [9]. Mangroves are threatened by coastal development projects and other forms of exploitation of non-renewable development [10]. Monitoring and evaluation of the structure and dynamics of land cover, and its