学 位 論 文 の 要 約

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学位論文の題名

Damage assessment and recovery monitoring of coastal vegetation after the 2004 Indian Ocean tsunami

(2004年スマトラ沖地震による津波の沿岸植生への影響と回復の観測)

学位論文の要約

In order to assess and monitor recovery process of coastal vegetation after the 2004 Indian Ocean tsunami, the following three analyses were conducted. The results of this study will have considerable impact on recovery management after devastated disaster.

A Brief Description of Recovery Process of Coastal Vegetation after Tsunami: A Google Earth time series remote sensing data: The recovery of land cover/use after the disaster is sometimes disorderly, especially in developing countries. It is necessary to continuously monitor the progress of land cover/use recovery after disaster in order to sustain vegetation around estuarine and coastal areas. The purpose of this study was to assess the recovery progress of vegetation around estuarine and coastal areas after the Indian Ocean tsunami using a simplified method which consisting Google Earth and visual photo interpretation. Vegetation areas were able to be detected with high accuracy (80% - 100%) using simplified method which consisting Google Earth and visual photo interpretation. We were able to show that all most of area including mangrove forests recovered relatively smoothly. However, the area which has a large vegetation areas have not enough recovered, which reached to half or less than half compare with before tsunami. This may be significant in affecting the role of the coastal ecosystem and bioshield. A large number of small mangrove patches (less than 0.1 ha) were able to found around ponds, a number that rapidly increased after the tsunami. Some site in 2013 was double than in 2004. Fish farmers might have planted them for supplying nutrients to ponds and maintain the water quality. Dozen years has passed after the 2004 tsunami, and it might be time to more focus on the recovery of large vegetation area.

Detection of tree areas using Google Earth images in Banda Aceh, Indonesia - Comparison between the pixel based and the object based image analysis -: In order to monitor changes of tree areas after the 2004 tsunami, the aptitude of the pixel based and the object based image analysis for Google Earth images were compared. Satellite images, which taken in 2004, 2009 and 2013, were downloaded from Google Earth Pro as maximum resolution. They were georeferenced based on a topographic map. The land cover/use was classified to 9 classes by the pixel based and the object based image analysis with supervised learning. The overall accuracy by the pixel based image analysis was 0.65-0.71. By the object based image analysis, it was 0.65-0.71. Although tree areas were misclassified to paddy field, ponds and grassland by methods, user's and producer's accuracy by the object based image analysis were higher accuracy than the pixel based.

Influence of the 2004 Indian Ocean Tsunami Recovery Process on Land Use and Land Cover in Banda Aceh, Indonesia: Unchecked development and land occupation tend to occur during disaster recovery efforts, leading to land degradation. To investigate the influence of the 2004 Indian Ocean tsunami recovery process on land use and land cover (LULC) in Banda Aceh, Indonesia, a time-series of LULC changes was analyzed using Google Earth images from 2004 to 2013. During the first post-disaster recovery period (2004–2009), inland bare land and green spaces changed to built-up land because temporary shelters had been built in safer areas farther from the coast. Conversely, in coastal areas, the

change from bare land to built-up land was greater during the second period (2009–2013) than the first period, possibly because evacuees had returned and rebuilt their houses. The increase in patch density in 2009 might have resulted from the evacuation and construction of temporary shelters in the inland area, forming an urban sprawl-like pattern. The Shannon Diversity Index of the inland area was smaller than that of the coastal area in all monitored years, although it decreased over time in both areas; this indicated that the coastal area was more homogeneous than the inland area, but the homogeneity increased over time in both areas. We observed LULC changes not only in the area affected directly by the tsunami, but also in the evacuation area. Although recovery efforts typically focus on LULC changes in areas directly affected by disasters, they should also consider evacuation areas.