SUMMARY

ESTRI RAHAJENG. Determination of Swamps Area Suitable for Paddy Field Using Remote Sensing Approach in Banyuasin Regency, South Sumatera Province. Under the Supervision of I WAYAN ASTIKA and HARTANTO SANJAYA.

Swamps area become more and more important for Indonesia and will be the future for agricultural development potential outside of Java. Mainly in Java, there is a continuous loss of agricultural lands for urbanization, industry and roads infrastructure. The spatial and temporal distribution of swamps area is an important parameter to be correctly characterized in order to get the information about the area suitable for agricultural purpose.

South Sumatera government has set Banyuasin Regency as one of the development centre of rice crops. Nearly 80 percent of the Banyuasin Regency is swamps where the areas are marginal lands unsuitable for industrial purposes, but potential for food crops, rice, and coconut, also interesting for the plantation area, such as oil palm. Determination swamps area suitable for agriculture by using terrestrial method needs considerable amount of time, resources and cost. The information obtained from terrestrial method is also limited only at the point observation and certain time period.

The objective of this research is to develop an identification method for determining swamps area suitable for paddy field. The method was then applied in Banyuasin Regency. This research was intended to integrate between Normalized Different Water Index (NDWI) and Land Surface Temperature (LST) analysis as well as land cover analysis by applying supervised classification. The suitability analysis of swamps area for paddy field based on land system data only for the constricted factors data that are peat depth, pH, slope and salinity data.

The method was tested by using Image acquisition on 15 April 2000 with acquisition date on 15 April 2000 and Image acquisition on 16 May 2006 with acquisition date on 16 May 2006. The study area is a subset from full scene image acquisition on 15 April 2000 and acquisition on 16 May 2006. In order to get LST value for 2 sets satellite imagery, the LST processing only used thermal band (Band 61 and Band 62 for Image acquisition on 15 April 2000 and Band 6 for Image acquisition on 16 May 2006). The steps to do LST analysis are converting digital number (DN) to radiance and then converting radiance to brightness temperature. Meanwhile, NDWI analysis use of reflected near-infrared radiation (band 4) and visible green light (band 2) to enhance the presence of such features while eliminating the presence of soil and terrestrial vegetation features. The maximum likelihood method was used for the classification process. This
method is based on the priority of type coverage. Suitability analysis uses peat depth, pH, slope and salinity data by applying overlay processing.

For image acquisition on 15 April 2000 the LST range values are 2°C to 35°C and mean value is 22.8°C. For image acquisition on 16 May 2006 the range values are 3°C to 37°C and mean value is 25.4°C. For NDWI result, image acquisition on 16 May 2006 has the same characteristics with the image acquisition on 15 April 2000, whereas water class having the positive value range and bigger value than others. It indicates that the water presence in the nature such as water body, ocean and inundation area always having positive value. NDWI value indicates high correlation with moisture content of land cover. Bigger NDWI value means bigger the moisture content of land cover than others.

Image acquisition on 15 April 2000 was classified into the 9 classes namely cloud shadow, forest, paddy field, shrub, settlement, bare land, water, inundation area and cloud. Shrub area is the biggest area with the percentage 29.20% and followed by paddy field with percentage 21.00%. Image acquisition on 16 May 2006 was also classified into the 9 classes namely water, mangrove, forest, settlement, paddy field, shrub, bare land, inundation area, and fish pond. Paddy field area is the biggest area with the percentage 23.00% and followed by shrub area with percentage 16.00%. Result of classification is noted that have more classes than those of interest (swamps and not swamps). Next, the pixels of each input image were reclassified to get the swamps and not swamp classes. For image acquisition on 15 April 2000, swamps areas were formed from bare land, inundation area, shrub and paddy field. The others were formed as not swamps areas. Meanwhile for image acquisition on 16 May 2006, swamps areas were formed from bare land, inundation area, shrub, mangrove and paddy field. The others were formed as not swamps areas.

Reclassification process was also done to the LST and NDWI result. In this process, some threshold values was applied to get the good accuracy in reclassifying area become 2 types : swamps and not swamps type. Threshold I was applied LST value 23°C – 33°C and NDWI value -0.43 to 0. Threshold II was applied LST value 23°C – 33°C and NDWI value -0.35 to 0.1. Threshold III was applied LST value 12°C – 20°C and NDWI value -0.4 to 0.2.

The swamps area distribution resulted from reclassification process, image acquisition on 16 May 2006 had smaller area proportion than image acquisition on 15 April 2000. It’s caused by the acquisition date of the image influencing the temperature and water distribution in whole area of interest. It implies to the large area of swamp distribution. Swamps distribution obtained from image acquisition on 15 April 2000 with threshold II analyzing had the area around 6,389 km² and swamps area distribution obtained from image acquisition on 16 May 2006 with threshold I had the area is around 5,493 km².

Overall accuracy of determination swamp area based on the LST, NDWI and supervised classification is still in moderate accuracies. For image acquisition
on 15 April 2000, highest accuracy is 73.5% for the threshold II with LST value range of 23°C - 33°C and NDWI value range of -0.35 – 0.1. Meanwhile for Image acquisition on 16 May 2006, highest accuracy is 63.5% for the threshold I with LST value range of 23°C - 33°C and NDWI value range of -0.43 – 0.

The most problem occurred in the swamps determination is in the image classification processing. In this step, the initial cluster gathering was undertaken using unsupervised classification. The resulting clusters were later edited, assigned names and used in final supervised classification of the image as a base reference for each spectral. Training area was formed by using visual interpretation of the image referring to the each spectral from unsupervised classification. Some land cover types have the similar spectral, but based on field knowledge and visual interpretation is different land cover types. In image acquisition on 15 April 2000, one constraint in image classification is haze. It caused the spectral value of two different land cover type almost similar for example paddy field and shrub have the similar spectral value therefore in visual interpretation it makes confusion among others. Likewise in image acquisition on 16 May 2006, settlement and bare land have the similar spectral value. For the next processing, the classification results would be reclassified into 2 type of land cover that are the swamps and not swamps area. Misclassification in the image classification process can caused the error in determining the swamps area in whole area of interest.

The percentage of suitability classes for paddy field based on land system for whole area of interest were S1 (highly suitable) around 52.2%, S2 (moderately suitable) around 41.8% and S3 (marginally suitable) around 6.07%. This result was overlaid with the swamps distribution from previous method to get the distribution swamps area suitable for paddy field. Suitability classes for paddy field were S1 (highly suitable) class covered 54% area or 3,426 km², S2 (moderately suitable) class covered 40.2% area or 2,550 km² and for S3 (marginally suitable) class around 5.8% area or 369 km². There is no area that included in N (not suitable) class.

This method can be applied as an alternative method in determining alternative area for wetland to support the agricultural development. Referring to the limitation of the method for improving of the accuracy, it is suggested to use some other thresholds value range more detail in order to get the more variety of result possibility. The accuracy assessment is suggested to do in each step by using more detail of ground truth data.

Keywords : NDWI, LST, analisa kesesuaian, rawa.