

APPLICATIONS OF REMOTE SENSING FOR BECKONING SOCIAL ISSUES

Dewayany Sutrisno¹⁾

¹⁾*Geomatic Research Center – National Coordinating Agency For survey and Mapping
Jln Raya Jakarta Bogor Km 46 Cibinong 1691, Indonesia*

T?F: +62 21 87906041

e-mail: dewayany@gmail.com

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Abstract: Remote sensing technology has great potential for acquisition of detailed and accurate earth systems science. Lots of research and technological development has been done to meet the need. However, social science applications were rarely even considered. Therefore, understanding the underlying social obstacles behind diverse earth phenomena using remote sensing data have to be further assed. As an example, the application of remote sensing for human health has been employed in this study. The water detection and change detection methods have been implemented to see the social hitches of the earth phenomenon. The result underlying the health issues in relation with water detection and changing environment which method can be studied using remote sensing data.

INTRODUCTION:

The major world social issue that should be taken into account is the poverty. This issue has many effects on spatial development aspects such as urbanization, spreading the slump area, healthiness, education, mal nutrition and so does deterioration of the environment. These underlying issues sometimes cannot directly beckoning using remote sensing technology, but can be precisely understood as that knotted problems become disentangled.

Therefore, dealing with the advance of remote sensing technology, the assessment that relate the diverse earth phenomenon that can be noticed by remote sensing technology with the hidden social issues should be employed as the input for policy development.

Using north Jakarta, the capital of Indonesia, as the study area, whereas flooding always become the major issue of environmental degradation, the implementation of remote sensing technology to signal social issue will be examined. Underlying the health issue with the water detection and the changing of the environment will disentangle the relation of physical and social development problem in this area.

METHOD

The method may consist of: (1) Assessing the remote sensing method in determining the water change detection and (2) Assessing the social issue behind the scene of water detection phenomenon.

1. Assessing the remote sensing method in determining the water detection

Remote sensing may become a good tool to indicate the changes of earth features due to its synoptic and multi date coverage system. Indeed, it may give support to indicate the changes of built up area not only by nature phenomenon but also other human catastrophic. Dealing with the flooding and sea related inundation problems, various methods for water detection assessment from optical imagery have been developed. Focusing on the north Jakarta area, the water detection even can be extracted from a single band image, since the reflectance of water is nearly equal to zero in reflective infrared bands. Experience has shown that of the six reflective TM bands, mid infrared band 5 is the best for extracting the land-water interface (Kelley, *et al.*, 1998). Band 5 exhibits a strong contrast between land and water features due to the high degree of absorption of mid-infrared energy by water and strong reflectance of mid-infrared by vegetation and natural features in this range. Of the three TM infrared bands, band 5 consistently comprises the best spectral balance of land to water (Alesheikh *et al.*, 2007).

The dynamic and complex land-water interaction makes the discrimination of land-water features less certain. The mixed pixels and moisture regimes between land and water makes the coastline boundaries remain unclear. Therefore, to find the exact value, ratioing methods for selected bands were selected for this study. Band ratio between band 4 and 2 and also, between band 5 and 2 were being examined. With this method water and land can be separated directly.

The method for water change detection was consisted of employing histogram threshold on one of the infrared band of multi date optical imageries. Follow by ratioing of infrared bands and visible green bands and subtraction of the derived ratioing images to indicate the water change or inundation. Finally, cross-examined the result with other secondary data relating to the inundation of the coastal area was employed.

The remote sensing data that were used for this study assessment Landsat MSS data of Jakarta Bay (1976), Landsat TM data of Jakarta Bay (2002), ETM⁺ of Jakarta Bay (2006) dan ETM⁺ of Jakarta Bay (2011). The process of remote sensing data for determining the water change detection can be described as follow;

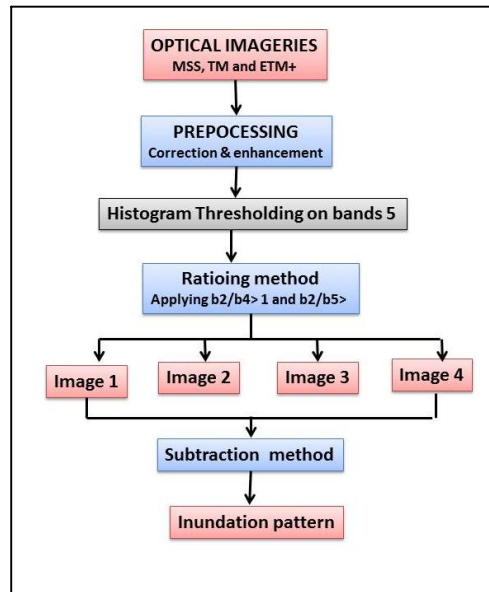


Figure 1. Flowchart of extracting water detection from images

2. Assessing the social issues behind the scene of water detection phenomenon

Social security problems always emerge whereas the inundation or flooding occurred. Therefore, using the feature of inundation of the earth surface, the hitch of social issues will be recognized. The study of the social issue may consist of (a) assessing the direct impact of inundation problems to the healthiness and sanitation problems and (b) assessing the issue behind the inundation upheaval. Comparing the social level, the flow chart of the study was be described as follow:

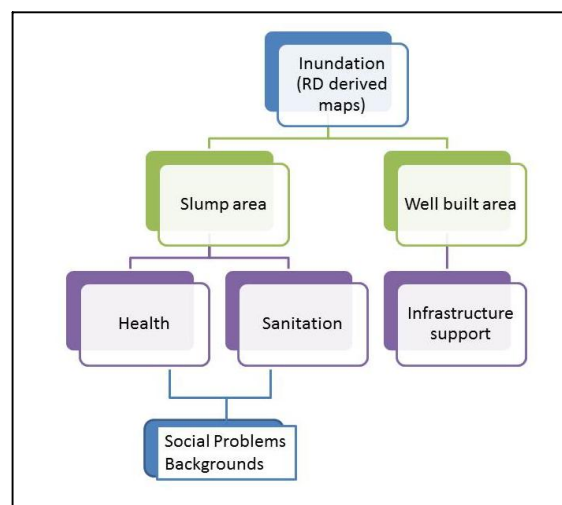


Figure 2. Flowchart of Social assessment

The inundation features, derived from remote sensing data were concerned as the risk area related to the social welfare standard, there is healthiness. The condition of the healthiness among two social level represent by the dwelling environment were employed. Any derived social issue, then were being disentangled based on this physical change.

RESULT AND DISCUSSION

1. Water Change detection aspect

Despite of the rapid urban development, Jakarta look out several environmental problems including sea level rise, land subsidence and salt water intrusion. It means, the inundation on the north Jakarta area is not a simply single factor, such as flooding from river basin but the combination of those plus seasonal aspect. Therefore, the phenomenon of inundation in Jakarta bay was a constituted as the combination of relative and *eustatic* sea level rise, seasonal flooding that will be rise due to the land subsidence, and advance of residential and any industrial and business development.

The water change detection model using multi date Landsat data of Jakarta bay may indicate the problems of those. The threshold values have been chosen such that all water pixels are classified as water, and most of land pixels have been classified as land. In this case, water pixels are then assigned to one and land pixels to zero. Using the band ratio between band 4 and 2 for MSS, and also, between band 5 and 2 for TM and ETM can result in water-land discrimination. Figure 3 illustrates the result of land-water developed technique.

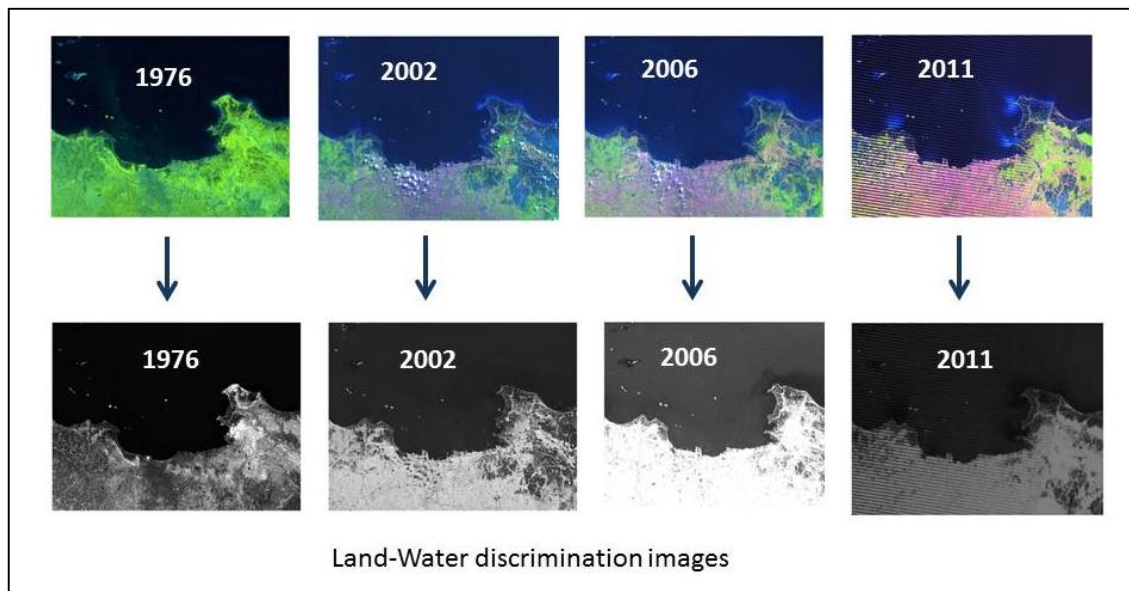


Figure 3. Land-water discrimination results (black = water, grey to white = soil with degradation of water content) (Sutrisno, 2011)

Those land-water discrimination images then were being composited for inundation assessment. Differences method was applied for this purpose. Figure 4 illustrates the inundation pattern between the years of data acquired, 1976 – 2011. The dark area (black) indicates the changes of inundation pattern while the grey area indicates the unchangeable earth surface coverage.

The above assessment indicates that north Jakarta area is facing the high risk of flooding and inundation from both the sea and the upland area. Indeed, the climate change is given rise to the coastal inundation pattern whereas high tide flooding is daily occurred in some area, especially within the area that facing the risk of land subsidence and sea level rise phenomenon



Figure 4. Illustration of inundation trend (1976 – 2011) initiated by inundation pattern (*black*)

The study of land subsidence in northern part of Jakarta was detected by InSAR over the period of June 2006 to February 2007 (Abidin *et al.*, 2009). Figure 5 shows that subsidence along the coastal zone of Jakarta are varied, with subsidence rates can reach about 12 cm/year whereas. The deepest subsidence is located in Pantai Mutiara housing complex, which is actually a land reclamation area (Abidin *et al.*, 2009). The result justifies that the coastline of Jakarta is slowly sunk.

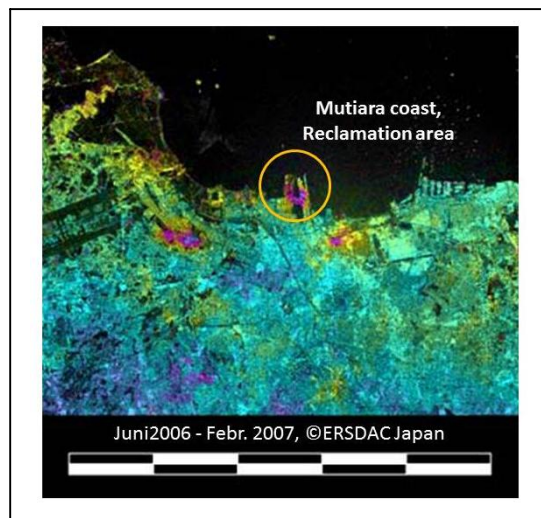


Figure 5. Subsidence in Reclamation area (Abidin *et al.*, 2009).

2. Social issue assessment

Many social issues have been emerging from the problem of inundation. Water related disease such as *dengue*, *diarrhea*, *leptospirosis*, *severe respiratory problem* and any *skin diseases* are the problem that can be emerged from the risky inundation area. It seems people that live in the slump area are more risky in facing the water related diseases than those that lives in adequate residential area, showing by points that many slump areas are located on the risk flooding area (Figure 6). Meanwhile Figure 7 indicates the environmental condition of the slump area in compare with the adequate one. Poor sanitation and lack of access to the adequate health facilities and so does the education and the inadequate income is the factors that increase the risk of the people living within this slump area.

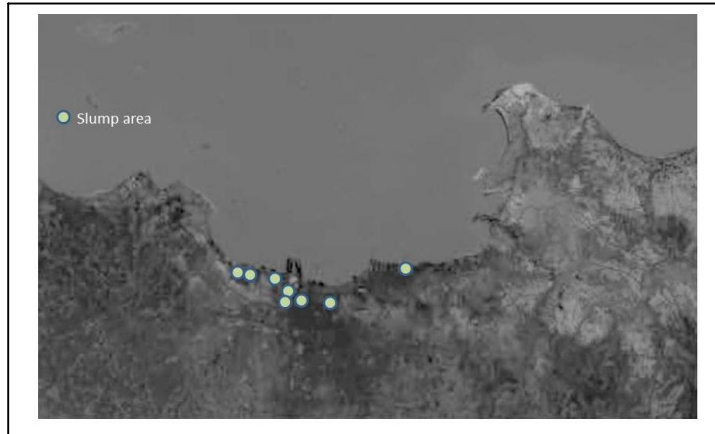


Figure 6. slumps indication within the inundation area



Figure 7. Comparison of inadequate (slump area) and adequate environment

Disentangle the inundation feature derived from remote sensing analysis, the risk of healthiness from the needy are the source of social issue. The risk of healthiness mainly relate to the poverty and inability to access to the well sanitation environment. Furthermore, the poverty is related to the lack of job vacancies in the nearby area or in their home town due to the conversion of agriculture land to the other economic infrastructure, agriculture policy that do not take side the grass root, and other cultural problems. Searching the way of living in the nearby town is the short solution. Jakarta seems provide many opportunities in earning the money for those who are struggling. Therefore, population growth in Jakarta is remained higher. This urbanization is the problems that the government of Jakarta should anticipate every year.

As the consequences of population, the need for housing, business area is increasing. Figure 8 indicate the land cover change of Jakarta, Meanwhile, Figure 9 indicate the housing density in north Jakarta, whereas, the orderly residential indicate the adequate housing environment and the disarranged residential area indicate the poor housing estate or slump area.

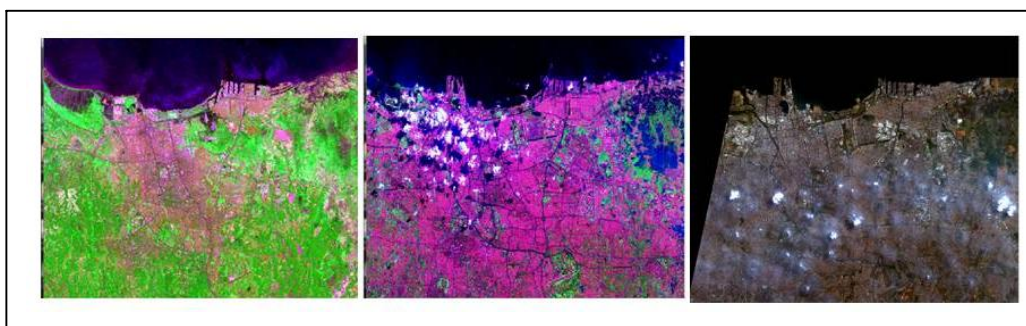


Figure 8. The development of the Jakarta (1976 – 2011)

The population growth is the induced factor in the environmental problems. Degradation of green area as the conservation area for water infiltration, increasing of ground water discharge for fresh water and decreasing infrastructure and facilities that not in balance with the population growth. Land subsidence is the impact of ground water discharge that will give rise to the inundation. Flooding is the impact of green area conversion. Indeed, the increasing phenomenon of daily high tide (people called it as rob) due to the decreasing mangrove ecosystem along the coastline, land subsidence and climate change are many factors that related to the growing population.

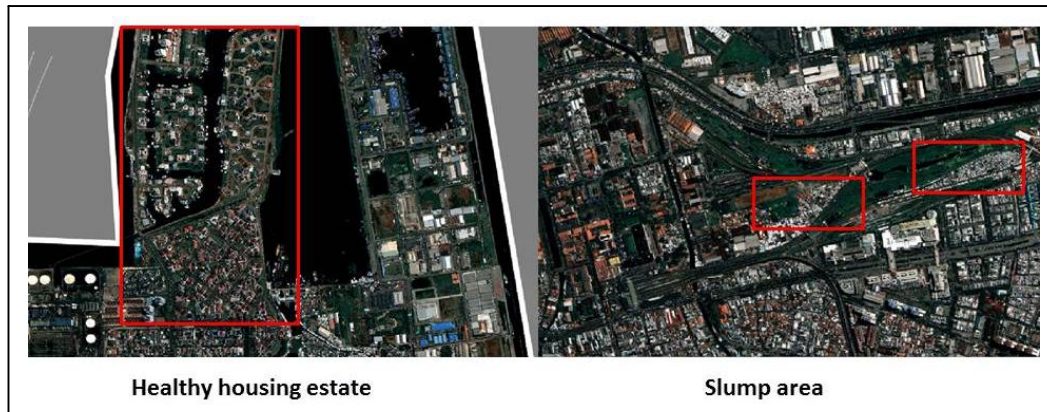


Figure 9. Identification of healthy housing environment using remote sensing data

It seems managing the well spatial planning integrated with the nearby government, increasing the job vacancies in rural area, and the policy in oppressive the urbanization and build the healthy infrastructure are the knotted that should be solve by the Jakarta Government. Jakarta urgent flood mitigation project has been employed to mitigate the inundation problems. Indeed, the development of affordable apartments for the needy has been employed as well. However, the result is still far from the target since the number of urbanization is remained advancing. At last, this effort should be follow by developing the green area for water reservoir, that things that not yet been managed by the local government.

CLOSING REMARKS

The remote sensing derive spatial data is a good source of information in beckoning social issue. The water change detection assessment is the example, whereas many social issues can be disentangled. Healthiness and sanitation dealing with poverty, and so does the urban population growth are the social issues than can be simply recognized from remote sensing data. Therefore, the advance of remote sensing data in beckoning social issue should be further employed.

REFERENCES

- Abidin H.Z., Heri Andreas, Irwan Gumilar, Mohammad Gamal, Yoichi Fukuda and T. Deguchi, 2009. Land Subsidence and Urban Development in Jakarta (Indonesia). Proceeding of 7th FIG Regional Conference, Hanoi Vietnam, pp 1 - 16
- Alesheikh, A.A., Ghorbanali, A., Nouri, N., (2007). Coastline change detection using remote sensing. Int. J. Environ. Sci. Tech., 4 (1), 61-66.
- Kelley, G.W., Hobgood, J.S., Bedford, K.W., Schwab D.J., (1998). Generation of three-dimensional lake model forecasts for Lake Erie, J. Weat. For., 13, 305-315.
- Sutrisno, Dewayany. 2011. Modelling The Projection Of Climate Change Impact On Shoreline Retreat: Remote Sensing Approach. ACRS 2011 Proceedings. Taipeh. 2011.