Journal of Environment and Earth Science
ISSN 2224-3216 (Paper) ISSN 2225-0948 (Online)
Vol.7, No.10, 2017
www.iiste.org

Investigation Character of Natural Forest Ecosystem, Use High Resolution and LiDAR Data

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Abstract
Ecosystem character the subject very important to investigate, the product of characterizing ecology is map of ecology area, type, vegetation structure. Where vegetation zone it will influence the habitat of biota. To extract the information have used multi data of multi sensor to rising up quality and information. The method used in this research is imagery transformation, OBIA classification, compilation data. The imagery classification to detecting ecology is OBIA technic have used to mapping land cover type, LIDAR analyst and. Compilation data have rising up the quality information of ecology zone. In the research we have find the ecology zone have many difference character, the character it has showing by the vegetation high, fraction vegetation. All of the point has showing the habitat, and the possible to measure the home base to migration and area to protecting the biota. The compilation data include geo- physic data has support the quality and result. In the end the geo- physic data divide the forest ecosystem zone to more detail and set vegetation in class and sub class such as natural forest ecosystem zone.

Keywords: Ecology, Habitat, Remote Sensing.

1. Introduction

Earth-observing remote sensing technologies are becoming widely adopted within the resource management, ecosystem sciences, and sustainable development communities. Satellite data offer unprecedented capabilities to capture the spatial and temporal detail of ecosystem properties at regional to global scales, and remote sensing tools are now employed in characterizing ecosystem structure and biologic properties and in monitoring ecosystem health, seasonal dynamics, and functional processes (Qhao, 2011).

Forest ecosystem, it has many character and biodeversity in tropical zone, include tropical forest ecosystem, mangrove, etc all. To mapping mangroves, Sensitivity band blue, near infrared and red waves used in multi-image transformation for mangrove mapping showed the difference of algorithm specification. On transformation NDVI vegetation in proportion, whole to the transformation of EVI object mangrove preferably in the form of vegetation zones rather dark in the image of gray scale that is on the shore line, the transformation of SAVI is similar to the result of the transformation of EVI, the difference in the vegetation not mangroves, vegetation Mangroves this transformation is quite a good response to the grouping of vegetation that is quite clear with discrimination (Hanif M, Adam T, 2016).

The case to investigate ecology character it's not same to mapping mangroves and character of forest ecosystem. Earth's terrestrial surface is covered by vegetation canopies consisting of diverse structural and functional land-cover types and ecosystems. The relationship between the solar energy incident at the surface and the spectral composition of the reflected energy provides a wealth of information about the biogeochemical nature (pigments, leaf chemistry, soil mineralogy), moisture status, and physical and structural characteristics of the surface (canopy height, leaf area, vegetation physiognomy, soil roughness). Remotely sensed data in the spectral, spatial, and temporal domains further reveal information about surface processes, including photosynthesis, evapotranspiration, land surface functioning, and ecosystem disturbance (Running 2006).

we have highlighted some important advancements in the assessments and studies of ecosystem structure and functioning from space. Remotely sensed measures of green foliage density and vegetation dynamics are powerful tools for assessing the physiological status of vegetation and for monitoring ecosystem processes related to light absorption, in particular canopy photosynthesis, primary production, phonological greening and browning, and plant transpiration. However, there exist important trade-offs and compromises in characterizing ecosystems from space related to the spatial, spectral, and temporal capabilities of the imaging sensors. Multiple sensor systems with appropriate combinations of spectral, spatial, and temporal resolutions are needed to improve the remote characterization of ecosystem structure and function (Qhao, 2011).

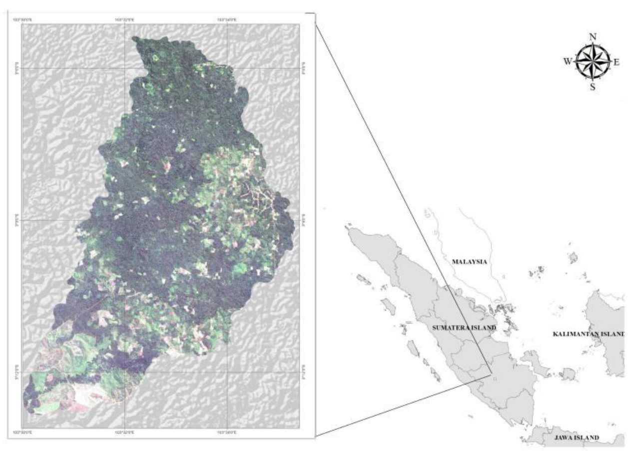
Recent studies, such as the ones conducted by Clawges et al. (2008) or Vierling et al. (2008), show the potential of using airborne lidar in studying animal–habitat relationships and in quantifying the vegetation structural attributes important for wildlife species. Clawges et al. used lidar to assess avian species diversity, density, and occurrence in a pine aspen forest in South Dakota. They concluded that lidar data can provide an alternative to field surveys for some vegetation structure indices, such as total vegetation volume, shrub density index, and foliage height diversity. They calculated different foliage height diversity indices using various foliage height categories and found that habitat assessment may be enhanced by using lidar data in combination with spectral data (Qhao, 2011).

As image spatial resolution continues to improve (e.g., IRS-1D with 5.8 m panchromatic, IKONOS-2 with 1 m panchromatic and 4 m multispectral data) and photo-quality imagery becomes more common from satellite altitudes and improved airborne systems, a resurgence in manual image interpretation can be expected using the principles of the photomorphic approach. On-screen digitizing of forest roads using SPOT 10 m panchromatic imagery, for example, has been used in areas where a high contrast between roads and surrounding features can be expected (Jazouli et al., 1994). Improved results in the classification and mapping of forest and other vegetation types from remote sensing data using topography have been reported in many areas of the world using the more recent Landsat TM and SPOT image data (Franklin, 1992, 1994; Pickup and Chewings, 1996). Generally, the DEM can provide anywhere from 10 to 30% increase in mapping accuracy. LiDAR remote sensing has the ability to provide information about the vertical distribution of quite sparse targets, making LiDAR an innovative technique for studying vegetation. The best strategy for extracting information about vegetation from LiDAR data is to perform a spatial analysis of the point cloud Antonarakis et al.

The Focus of Reviewed Papers and Study Area

The research focus is to estimate characteristic of ecology area use high resolution and radar data, the basic to identification ecology area is (vegetation fraction, high of vegetation). The tools use in the research is ArcGIS.10.3 and ENVI 5.1.

The study area we have delineation is focus area of interest, we decided the area as the location to implementation the methodology and theory in image analyst use remote sensing model.



Capture 1: Study area, the location it's sub Musi River, in Semangus Vilage (Banyuasin Regency, Indonesia)

Data Usage and Methodology

Data

In this research have use multi data to extract information type of vegetation and ecological character, the data has been took from difference sources, some of that from Indonesia government and other sources.

Table 1: Data usage

Dataset	Spatial Resolution	Use in Analyst	Suitable Scale	Sources
RADAR	5 m	Height of vegetation,	1: 5.000	Inter-map Technologies data from BAPPEDA,
SPOT 7	1.5	Land cover type	1: 5.000	LAPPAN
Topography	-	Base geometric correction	1: 50.000	BIG Geo-portal http://tanahair.indonesia.go.id
Land System	-	Eco bass	1 : 50.000	Minister of Agricultural

2. Research Method

The methodology of the research used the technic images transformation, base object classification, radar analysis, and compilation data. **Pre Processing,** as the first step in the research must to do such, geometry correction for Imagery data. Topography map as base reference to geometric correction.

Analysis

Object Base Image Analyst

To mapping functional ecology and land cover type, use the OBIA technic. OBIA approach is tied in with high spatial resolution situations. In an image, such a situation may occur if the pixels are significantly smaller than the objects under consideration (Blaschke 2010; Strahler 1986, Qhao, 2011). Burnett and Blaschke (2003) called these groups “object candidates,” which must be recognized by further processing steps and must be transformed into meaningful objects. It is well known that semantically significant regions are found in an image at different spatial scales of analysis (Hay et al. 2001; Hay et al. 2003, Qhao, 2011).

the selection of object-based classi fi cation is based on the consideration that this method is capable of generating segments and classes in the form of polygons (not generalizable results) that can be edited based on a field check. The object-based classification process includes two steps, namely (a) object-based segmentation, and (b) object-based classification. In the meantime, object-based classification results are further processed through correction of field data to become a properly considered reference map (Danoedoro. 2015).

The Height of Vegetation

The basic measurement made by a lidar sensor is the distance between the sensor and the target surface, determined by the elapsed time between the emission of a laser pulse and the arrival of the reflection of that pulse (Lefsky et al. 2002, Qhao, 2011). For to analyst vertical vegetation, use the LiDAR data. Where the Lidar data have two difference kinds of data is digital terrain mode DTM and digital surface mode DSM, compilation between the difference information of LiDAR data can do extraction to new object information, recognised the land-cover type (planted forest, natural forest, type of soil) of three river meanders based on the spatial distribution and reflectance of the LiDAR returns (Carbonneau E.P, and Piegay Harve, 2012).

Compilation Data

That is technic to interpretation and zoning the forest ecosystem by the internal character of objet. In the technic we had also involving spatial data such as land system. In the end we can take many information of ecosystem so deep including by cover and habitat by the forest ecosystem.

3. Result and Discussion

Land Cover

The land cover map being tested is processed in a standard manner, both in terms of sample selection and execution of its classification. Segment image is then used as the basis for sampling, that is, by considering the segments as the area of interest or region of interest. Each sample labeled class name refers to the classification scheme, and each sample has a certain spectral signature, as well as the pixel value of all falling channels within each segment. Segment-based sampling is then followed by the classification process by pixel (Danoedoro, 2015)

The techniques Interpretation in the object base image analyst (OBIA) model and high image data in land cover mappings, of course, improve the quality of results. By specifying the dominant object that is recognized as the object character representing as the sample. Model is higher for. From the image seating results, it can be described the type of closing cover on the sub sub class that is more dominant with different characteristics in it.

Journal of Environment and Earth Science
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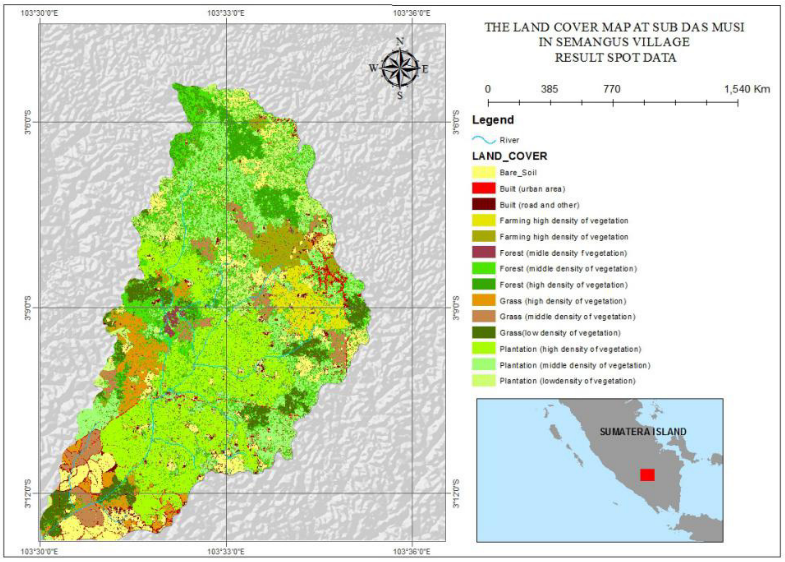
The result of forest land cover mapping in this study is in the early stages divided into sub sub characters of the forest, which is assessed from the texture of forest objects and divided into sub respectively.

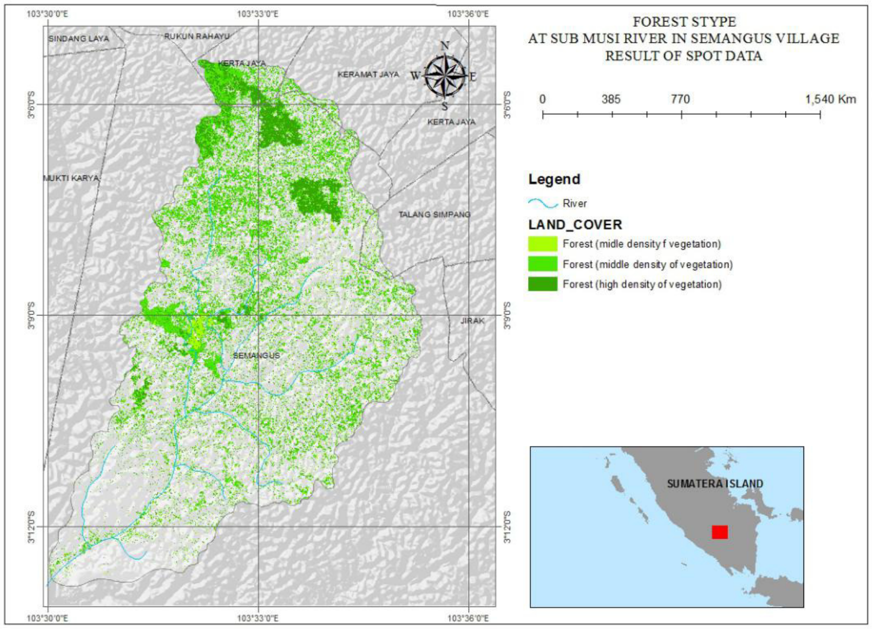


Capture 2. The land cover map result of OBIA Classification Spot Imagery data to forest ecosystem zoning.

Result of the research the land cover data has analyst by the Spot imagery then also eliminate by the natural forest ecosystem. All of the land cover type had did include human activity will eliminate by the natural ecosystem. We found the forest ecosystem in three forest density or fraction, the grade we re-class by the forest character in the first step to interpretation. Iswandi, 2012. The tropical ecosystem has divide in three class, the The tropical down rains forest zone, the place at region by the elevated 0- 1000 m at shore line. The distribution area is Sumatera Island, Kalimatan, Jawa, Nusa Northeast, Irian, Sulawesi, and some of archipelago of Maluku as Tabilu Island, Mangole, Sanan, Obi and Mandioi Island.

As new possibilities for landscape ecological investigation develop of basic spatial information can become a significant barrier to fully implementing concepts. Even in situations in which there is a wealth of spatial data, the capture of sufficiently detailed and accurate landscape information, in a format compatible with the application can be non-trivial (Groom Geof, at all, 2006).

In the case ecology investigation for character of forest ecosystem we found the tree general zone for forest from extraction SPOT data.

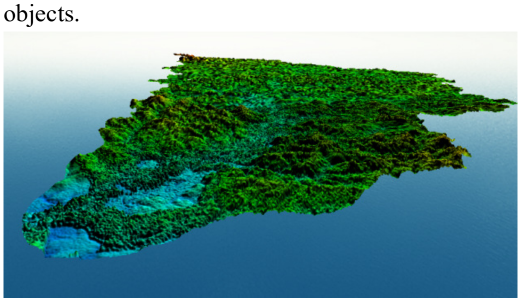


Captur 4. The cllas of forest texture

The forest grade is forest with tree high density, forest with tree middle density and forest with tree low density. The result of calculate geometry to measure of poly-gone area, we have found the forest with tree middle density as the common population in the study area, but the forest with tree high density stand in second grade, because the total area it not to largest.

The Height of Trees

The analysis technique of measuring the height of vegetation is part of the process of interpretation of radar data, which uses simple principle in radar data processing, that is using algebra technique. Which the basic principle of radar data consists of DSM and DTM, in which DSM data stores surface altitude information, and DTM data stores basic ground level information. Then DSM data is subtracted with DTM data. Obtained object height from vegetation, which then, the entire height of the object in the extract corresponding zonation of forest ecosystem objects.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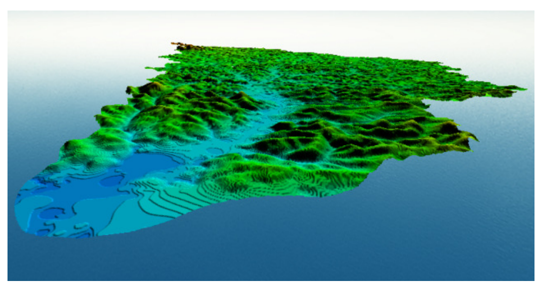
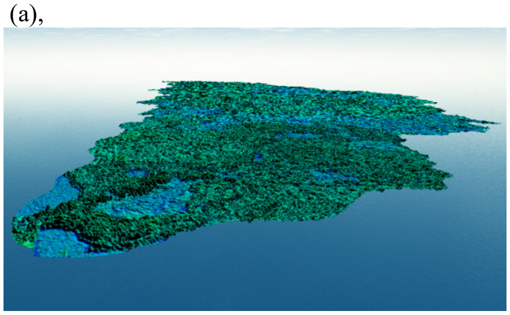


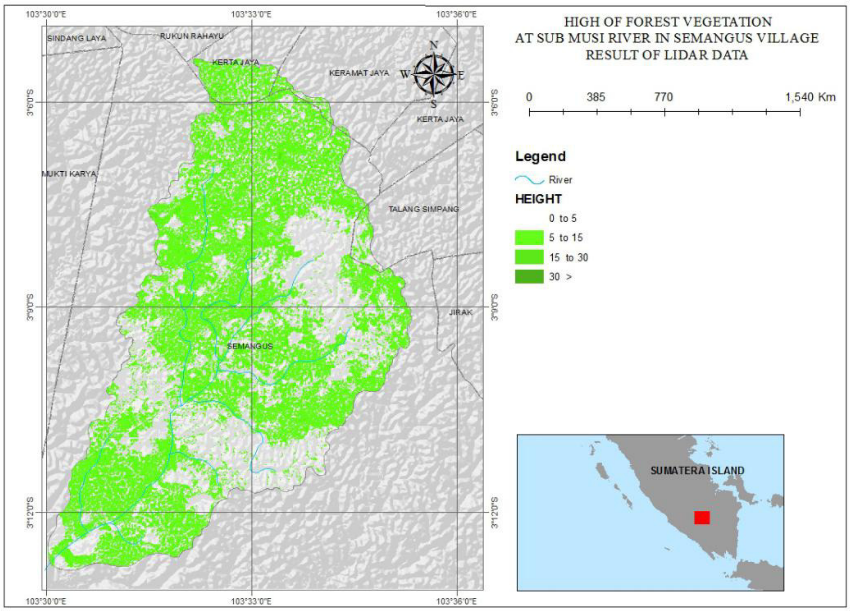
(a), (b)



(c)

Capture 3. The comparison and model interpretation (high vegetation) where (a) DSM digital surface mode, (b) DTM digital terrain mode, (c) high vegetation from estimation

The high of vegetation it reclassify to be 4 class, directly by Iswandi U, 2012, he's told as the tropical forest have character in high vegetation in 3 interval class. The reason why we create 4 class because the imagery recording full area it's not only tropical forest and the reason why we should make 4 class, the interval class from 0 to 5 m it's not forest.



Capture 4. The lheight of vegetation map result Lidar analyst data to forest ecosystem zoning.

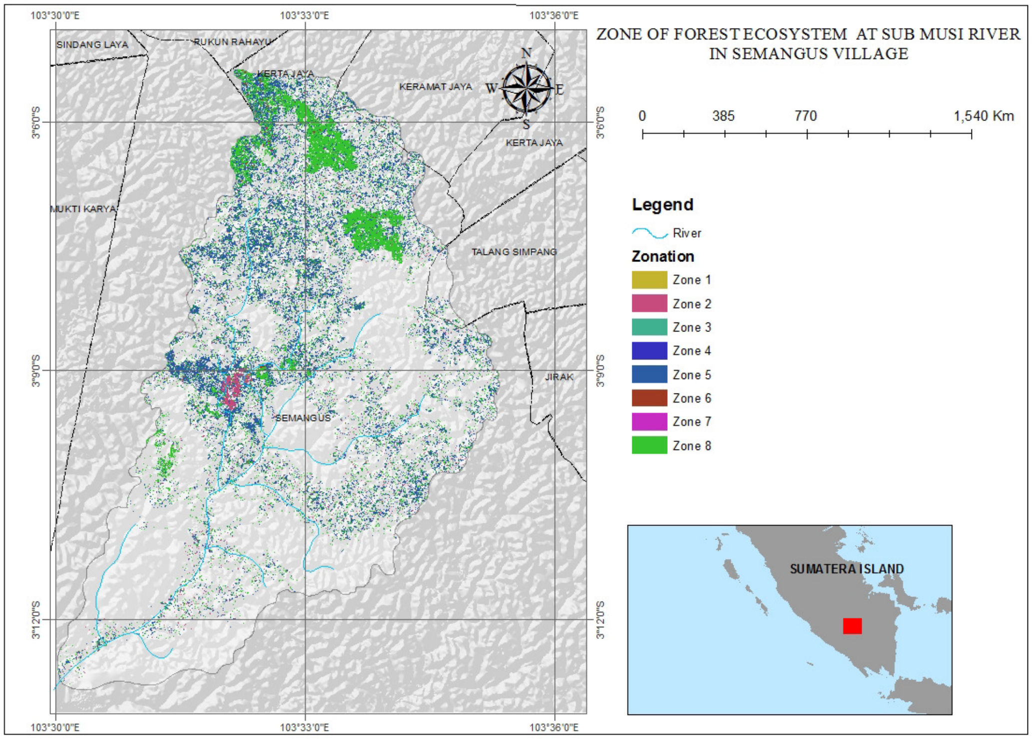
Result of analyst Lidar data, give information the variant height of vegetation in case study area. The location has dominate by the vegetation with the height in 5 to 15 m, and in second grade is 15 to 30 m. and up the 30m. the height of vegetation very use full to zoning forest ecosystem character, the forest ecosystem character can to divide more detail involving height character, Iswandi, 2012, divide the tropical forest interval in tree zone.

Table 2. The level of Tropical Forest Zone.

No	The High of Tropical Forest zone	Range
1	A	>30
2	B	15 to 30
3	C	5 > 15

Sources. Iswandi, U. 2012.

The range of high tropical forest interval have showing the character and structure of the tree in forest ecosystem (tropical forest ecosystem). The dominant character of vegetation like the vegetation density or fraction, high of vegetation, giving the detail information the Forest ecosystem, we can divide one each other by the point have make the class so difference. The geo- physic data has support quality of ecology zone. The inclined the natural forest ecosystem make the cluster in some area, the forest the dominate has high object between 5 to 10 m, that is mean the canopy so high and enough old. The forest zone can do support live area for biodiversity.



Capture 5. The zone of forest ecosystem.

The results of this study, found nine types of tropical rain forest ecosystem character down. Which characters are identified based on the texture and height of forest vegetation. The circumstances provide a fairly clear variation. Examples of ecosystem conditions in zone one with coarse vegetation textures and density object. It has variations in object heights of types 5 to 15m, 15 to 30 m and up 30m. These conditions also apply to two ecosystem zone types, also divided into the height variation of objects of types 5 to 15m, 15 to 30 m and up 30m.. Combinations between the results of ecology analysis based on land cover characteristics and in combination with lidar analysis showing the phenotype of sub zone of tropical forest ecosystem.

Table 3. Classification Forest Zone

Zoning	Forest Texture and Density	High of vegetation
Zone 1	Forest High Density	15 to 30
Zone 2	Forest High Density	5 to 15
Zone 3	Forest High Density	30>
Zone 4	Forest Middle Density	30 >
Zone 5	Forest Middle Density	5 to 15
Zone 6	Forest Middle Density	15 to 30
Zone 7	Forest Low Density	15 to 30
Zone 8	Forest Low Density	30 >
Zone 9	Forest Low Density	5 to 15

Sources: Own data

The basic principle have used in the research to zonation forest ecology to more detail, we have use base object classification, to discriminate natural ecosystem and no natural, and then we mixed data use the high of vegetation, to divide forest ecosystem to be sub class. The vegetation high such one key to identification the forest ecosystem.

4. Conclusion

Investigation character forest ecosystem zone, used variant data it have support quality of interpretation to detect character of zone. Because the principle of the imagery high resolution rising up the views of object and the lidar data is help full to identification vertical vegetation. In the end, compilation of remote sensing data from difference sensor can to developing forest ecology type. We can divide the general zone to be sub- class of forest ecosystem zone.

References

Cambell, J. B and Wynee, R. H. 2011. *Introduction to Remote Sensing*, Fifth Edition. New York: Guildford Press. ISBN 978-1-60918-176-5.

Carbonneau E.P, Piegay H.2012. Fluvial Remote Sensing for Science and Management. Wiley Blackwell, UK.

Clawges, R., K. T. Vierling, L. A. Vierling, and E. Rowell. 2008. Use of airborne lidar for assessment of avian habitat and estimation of select vegetation indices in the Black Hills National Forest, South Dakota, USA. *Remote Sens Environ.*

Burnett, C., and T. Blaschke. 2003. A multi-scale segmentation/object relationship modelling methodology for landscape analysis. *Ecol Modell.*

Danoedoro P. 2015. Pengaruh Jumlah dan Metode Pengambilan Titik Sampel Penguji Terhadap Tingkat Akurasi Klasifikasi Citra Digital Penginderaan Jauh. SImposium Sains Information. Journal Prosiding. Faculty of Geography UGM.

Franklin E Steven. 2001. Remote Sensing for Sustainable Forest Management. Lewis Publisher. New York.

Groom Geof at, all. 2006. Remote sensing in landscape ecology: experiences and perspectives in a European context. Journal. Springer.

Hanif M, and Adam T. 2016. Application Multi Vegetation Index to MappingMangroves Distribution Coast Environmental Northeast Province of Aceh. Sumatera Jurnal of Disaster, Geography and Geography Education. Vol 1.

Iswandi U. 2012. Ekologi dan Ilmu Lingkungan. UNP Press.

Jazouli, R., D. L. Verbyla, and D. L. Murphy. 1994. Evaluation of SPOT Panchromatic digital imagery for updating road locations in a harvested forest area. *Photogramm. Eng. Rem. Sensing.*

Lillesand M Thomas and Kiefer W Ralph. 2004. *Remote Sensing and Image Intrepetation*. United States of America.

Running, S. W. 2006. Is global warming causing more, larger wildfires? *Science* 313:927

Qhao Weng. 2011. Advance in Environmental Remote Sensing. CRC Press. New York.