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Normalized Difference Vegetation Index (NDVI) In The Integration Conservation Education Forest At Wan Abdul Rachman Using Modis Data

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ABSTRACT

Forest plays an important role to support a global environment. Currently, forest degradation occurs in developing countries. Therefore, the excellent strategies to against the forest degradation must be found. One of the best solutions is understanding the information of vegetation condition. Here, the objective of this paper was to apply a method as the assessment of vegetation monitoring using satellite data in the integration of conservation education forest at great forest Wan Abdul Rachman in Lampung Province, Indonesia. In this study, normalized difference vegetation index (NDVI) was used, completed with satellite data (namely MODIS). This technique helps in monitoring vegetation status. Data NDVI from MODIS satellite data showed that forest area decrease very small from 2000-2017. The data was obtained for June, July, and the end of September.

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1. INTRODUCTION

Forest ecosystems are an essential in economic and environmental point of view, which is widely spread in most regions of the world. Unfortunately, both in developed and developing countries, many forests are presently threatened by the expansion of agricultural, urban, and industrial land or by degradation phenomena caused indirectly by human activities (Waring & Running, 1998). Forest and trees have a function as a carbon sequestration. Tree or plants absorb more CO2 than they release, and the trapped CO2 is stored as a carbon in the biomass (e.g. foliage, branches, trunks, and roots) and soils (Prasetyo, 2016; Permatasari *et al.,* 2016). The carbon storage in the forest is about 50%

of its biomass (Tuly *et al.,* 2005; Chang, 2013, Rahmat and Mutolib, 2016).

Forest monitoring is crucial to support forestry management, but the limitation on funding and technology makes high frequency in monitoring. Indeed, this increases the difficulties. normalized difference vegetation index (NDVI; as an indicator of vegetation growth and coverage) has been widely employed to describe the spatio-temporal characteristics of land use and land cover, including percent vegetation coverage (Kaufmann *et al.,* 2003) Vegetation indices are mainly derived from reflectance data from discrete red (R) and near-infrared (NIR) bands. They are operated by contrasting intense chlorophyll pigment absorption in the red against the high reflectance of leaf mesophyll in the near infrared. This case is well-known as normalized difference vegetation index NDVI=[NIR_R]/[NIR + R] (Bannari *et al.,* 1995) and is the most widely used index, especially when analyzing data taken from satellite platforms. In practice, NDVI is and indicator for plant photosynthetic activity and has been found to be highly related to the green leaf area index (LAI) and the fraction of photosynthetically active radiation absorbed by vegetation (FAPAR) (Bannari *et al.,* 1995; Baret & Guyot, 1991; Veroustraete, Sabbe, & Eerens, 2002; Nandiyanto *et al.,* 2016).

There are various methodologies for studying seasonal changes in vegetation through satellite images, one method of which is to apply vegetation indices relating to the quantity of greenness (Chuvieco, 1998). One of them is NDVI from MODIS setelite data. This paper was to get and use NDVI data from MODIS satelite. The paper also applied NDVI in the assessment of vegetation monitoring using MODIS satellite data in the integration conservation education forest at great forest Wan Abdul Rachman, Lampung Province.

2. METHODS

The study was conducted in IFCE WAR Great Forest Park, which is about 1.143 ha. It is located in Bandar Lampung, Indonesia (between 105°09'22.17"- 105°11'39.13" E and 5°24' 09.78"-5°26'11.41" S) (Unit Pelaksana Teknis Daerah Taman Hutan Raya Wan Abdul Rachman 2009). The study used MODIS data MOD13Q1 product with large area 6.25 x 6.25 km and interval of day is 16 days. The product can provide NDVI. Observation period was from 18 February 2000 to 06 March 2017 (see **Figure 1**).

3. RESULTS AND DISCUSSION

The NDVI is a measurement of the balance between energy received and energy emitted by objects on Earth. When applied NDVI to plant communities, this index establishes a value for how green the area. In short, that showed the quantity of vegetation present in a given area and its state of health or vigour of growth. The NDVI is a dimensionless index, so its values is a dimensionless index and values range from –1 to +1. In a practical sense, the values that are below 0.1 correspond to bodies of water and bare ground, while higher values are indicators of high photosynthetic activity linked to scrub land, temperate forest, rain forest and agricultural activity (Meneses-tavor, 2011)

The results shows, NDVI in the integration conservation education forest at great forest Wan Abdul Rachman decrease very small after 16 years with R2 only 0.0205 (**Figure 2**). Figure 3 shows annual NDVI from 2000 to 2016 (around 0.8 each year). The maximum NDVI every year was around 0.90, but the minimum of is fluctuative. **Figure 4** shows the highest NDVI in 257 DOY. This NDVI is stable in 161 until 209 DOY.

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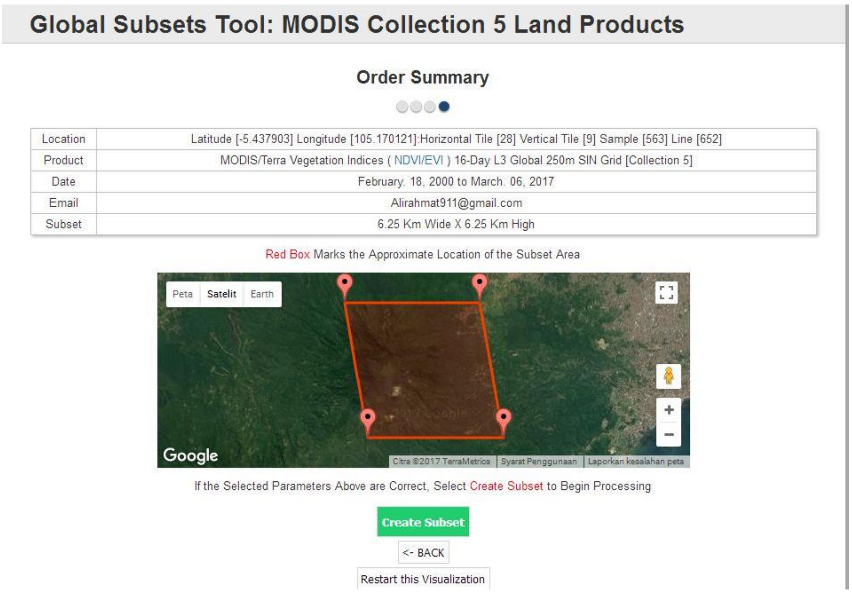

Figure 1. Observation area

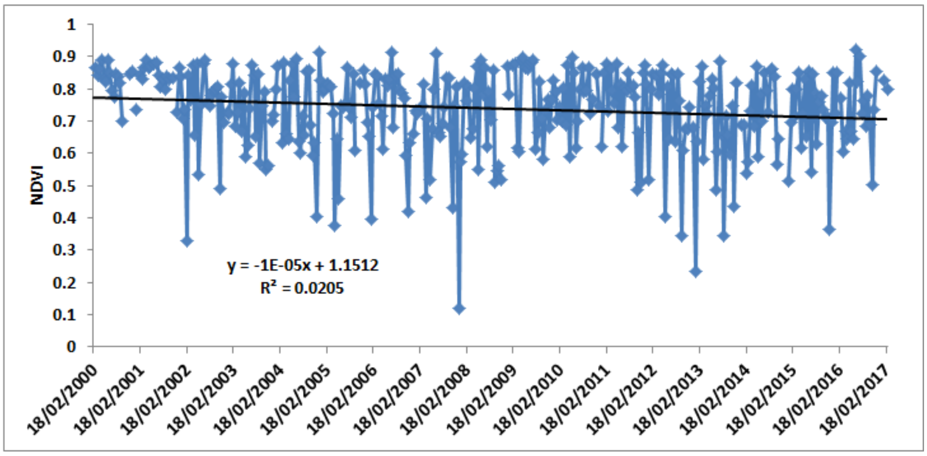

Figure 2. NDVI data from 2000-20017 in Forest Wan Abdul Rachman based on MODIS data

Based on data NDVI from MODIS satelite data, vegetation condition in the integration of conservation education forest at great forest Wan Abdul Rachman is quite good with the NDVI value (around 0.80). The measurement site is far from home residents and inside of forest. This condition also explains no land cover or vegetation change in this site. With growing population pressures, some problems are found, such as in Dhamasraya forest in West Sumatra. Many forest were grabed by community who living sorrounding the forest (Mutolib, *et al.,* 2017). NDVI is influenced by the change of season. The season gives great impact on phenology of the tree. Highest NDVI found in 257 DOY is around the end of september. This correlates with rainfall condition just after dry season. Also, good NDVI in 161 and 209 DOY was found although this time is lack of rainfall. However, this is because enough water for the tree and make tree green (water trapped inside the soil). Bad NDVI was found around in January, October, and November. Although lot of rainfall occurs, clouds disturb sensor of MODIS to have inappropriate condition to take good data from surface.

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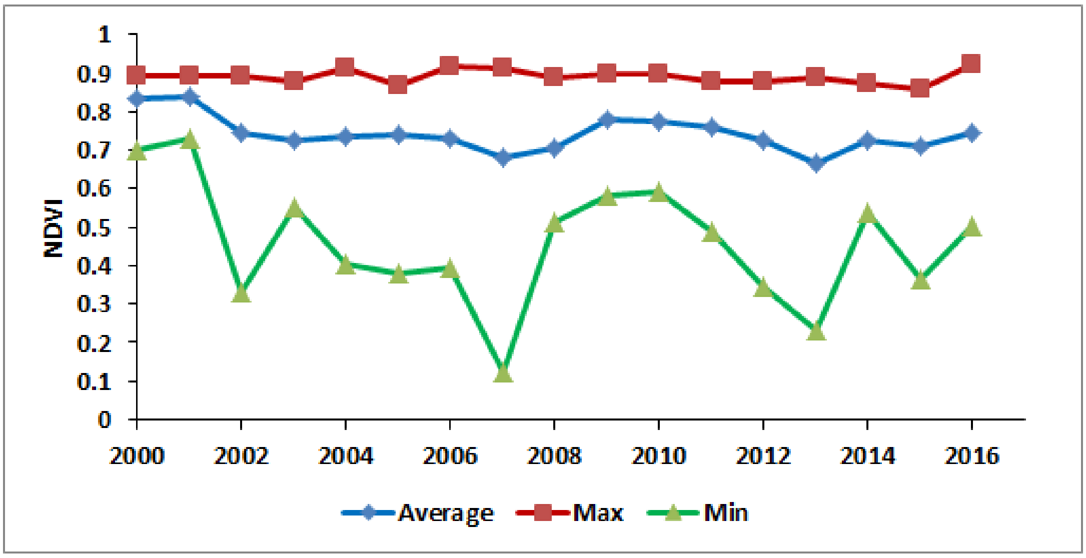

Figure 3. Yearly average, Max, Min of NDVI in Forest Wan Abdul Rachman

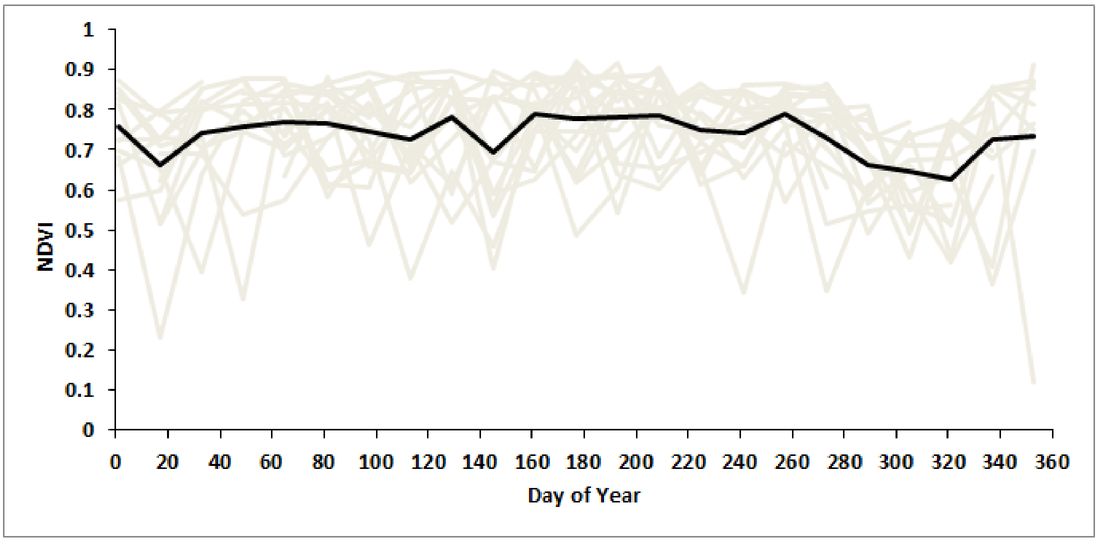

Figure 4. Day of year NDVI data in Forest Wan Abdul Rachman

4. CONCLUSION

Analysis forest has been investigated. Data NDVI from MODIS satellite data can be used to monitoring vegetation condition in the integration of conservation education forest at great forest Wan Abdul Rachman. NDVI in Wan Abdul Rachman forest decreases slightly from 2000 to 2017. NDVI in Abdul Rachman forest is around 0.80 annually. Good NDVI data was found in June, July, and the end of September.

Appendix

How to get MODIS data (following: Rahmat, 2017)

1. Open: https://daac.ornl.gov/MODIS/ by your computer, choose "Create Subset" (see right bottom).
2. Specify the coordinates for the center of area of interest: Insert the coordinate data (longitude and latitude) can use

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direct GPS data or estimating using Google Earth. Click “continue”.

3. Select product and sub size then continue: select MOD13Q1 and replace “3” to “0” (if you want size in the minimum size) in bottom table. Click “continue”.
4. Select date and provide email then place order: select starting date and ending date and fill your email address in bottom. Click “Review order”.
5. Order summary : Click “create subset”
6. After around 1 hour, some information comes to the email.
7. Click on the following URL to obtain your result
8. Data visualization and download: choose “download data”
9. Download data: “statistics_LST_DAY_1km.asc” and “statistics_LST_Night_1km.asc”.
10. Copy and paste to excel or notepad and manually extract.

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6. AUTHORS’ NOTE

The author(s) declare(s) that there is no conflict of interest regarding the publication of this article. Authors confirmed that the data and the paper are free of plagiarism.

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