# IDENTIFICATION OF VEGETATION SPECIES DISTRIBUTION USING FIELD SPECTROMETER AND WORLDVIEW-2 IMAGERY

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**Abstract**. Wongsorejo Subdistrict in Banyuwangi has a huge variation of vegetation species. In order to manage the forest effectively, it is required to do mapping and inventory of the vegetation species distribution. One of the methods to identify the vegetation species using multispectral imagery integrated with field spectrometry measurement. This paper explain the application of these method in identification of vegetation species distribution located in Wongsorejo Subdistrict. We collects the spectral signature of some distinct unique vegetation species with in situ spectrometry measurement. It used as an input in image classification of Worldview-2 using spectral angle mapper method. The result expected is the spectral library collection of some unique species and its distribution map.

**Keywords:** vegetation species, multispectral, spectrometry, spectral angle mapper

## 1. Introduction

Remote sensing technology is able to obtain information of earth's surface phenomenon without any contact with the object (Lillesand and Kiefer 2004). The vegetation is an object that capable to be analyzed by remote sensing Technology (Jones 2010). In order to identify every vegetation species, remote sensing needs an optimal imagery with spatial and spectral resolutions for analyzed into species level. An imagery with many canals is better for discriminating vegetation species. Hyperspectral's sensor has wavelength 400 to 2500 nm with range 10 to 20 nm (Kamal 2012).

Spectral information of the object can be identify by field spectrometry. This instrument is able to record the reflectance of the object, in this case is species vegetation. Reflectance characteristics of vegetation species has influenced by contain of chlorophyll, water, leaf structure, leaf shape and Sie (Hoffer 1987). Each species has a unique spectral niche defined by its characteristic biochemical and biophysical (Clark 2005).

Worldview-2 imagery is one of nature resources satellite with eight bands that designed with four new bands in the coastal, yellow, red-edge, andnear-infrared 2 spectrum (Digital Globe 2009). Those bands can be used for appearing the difference objects more clearly. Map of distribution vegetation at the species level has important application for ecosystem management and biodiversity assessment (Cho et al. 2007).This study is interesting for tropical area that have variation of vegetation species.

The objective of the study was to assess vegetation species distribution using field spectrometer measurement and combine with Worldview-2 imagery in Bangsring Village. This study will be interesting because output from field spectrometer used for hyperspectral imagery and analyze with Worldview-2 that is multispectral imagery. The result can be observe capability of remote sensing for mapping distribution of vegetation species.

## 2. Material and Method

*2.1 Study area*

The study area is in the east part of Bangsring Village, Wongsorejo Subdistrict, Banyuwangi Regency, East Java Province (figure 1). Bangsring Village is located about 20 km north of Banyuwangi, with 55.26 km$^2$ wide and elevation gradient from sea level is about 37 m. The temperature range from 24 to 26˚C (BPS Banyuwangi 2015).

Field surveys was conducted on 18-23 July 2016. This region has a high diversity of tropical vegetation.This study area is partly forest area that managed by the Perum Perhutani, called the Watudodol forest. The Watudodol forest was dominated by teak stand.

Imagery used for this study is a Worldview-2 (DigitalGlobe, Inc.) that consisting 8 multispectral bands at 2 m spatial resolution and 0.5 m panchromatic band. The image data was acquired on 5 July 2015. The image was corrected for atmospheric effect using ATCOR 2/3 user guide(Richter 2012) and was processed with ENVI.

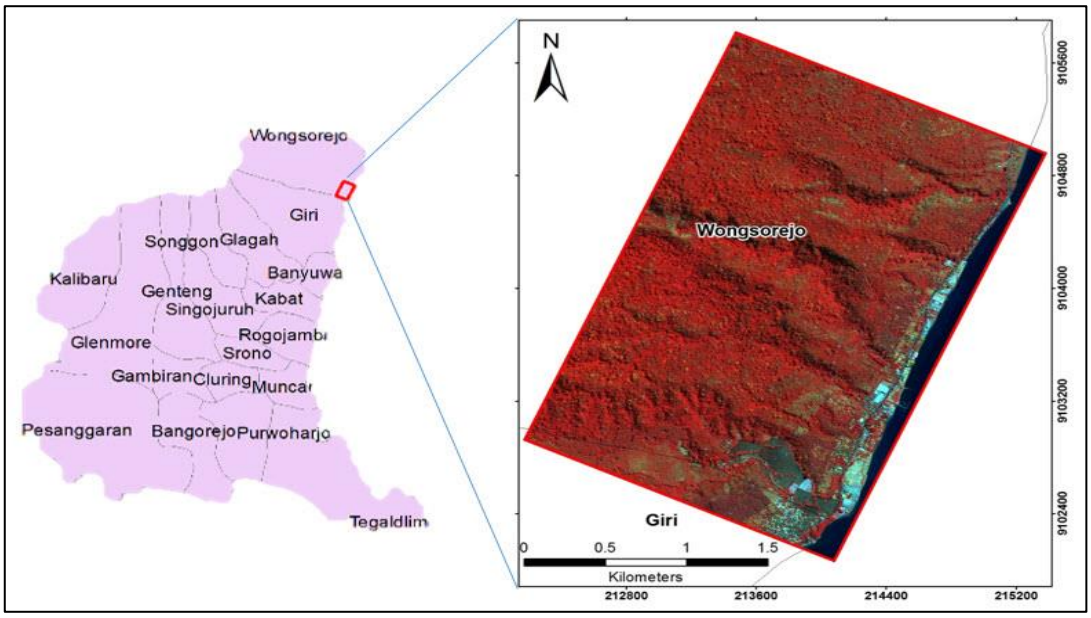



**Figure 1.** Worldview-2 imagery standard false color composite showing location of the Bangsring Village, Wongsorejo Subdistrict, Banyuwangi Regency, East Java Province.

*2.2 Field spectrometer measurement*

Spectral data were collected with Jaz EL-350 VIS-NIR portable spectrometer (figure 2). The spectrometer was acquired white and dark reference for reflectance calibration before have recorded spectral data object. All collected spectral data object was processed with SpetraSuite (Kamal 2012). This output data as spectral library to next processes.

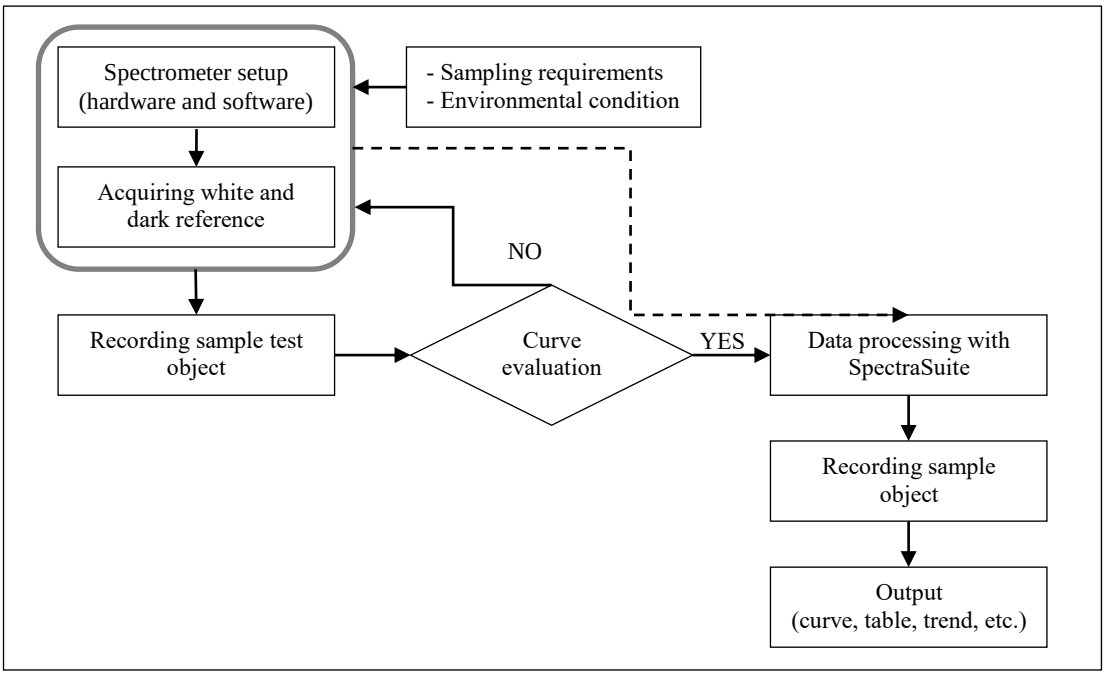



**Figure 2.** Scheme of acquiring data with spectrometer p. 25 (Kamal 2012)

*2.3 Species classification with the spectral angle mapper (SAM)*

Only dominant vegetation species in this study area were collected with spectrometer, namely *Tectona grandis* and *Lantana camara*. Those species were considered for classification. Spectral library were collected from spectrometer then processed for spectral resample. Spectral resample was needed in order to integrate wavelength of spectrometer data and Worldview-2 imagery(Borengasser 2008).

Output of spectral resample data were classified with spectral angel mapper (SAM) algorithm.The spectral angle mapper (SAM) is one of classification methods that can evaluates the influence of the shading to accentuate the target reflectancecharacteristics (Kruse et al. 1993).

*2.4 Data validation*

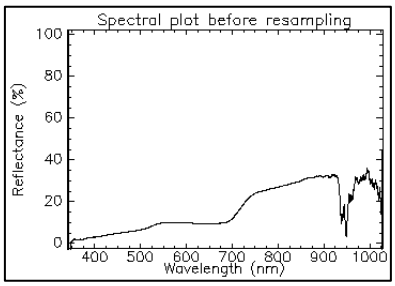
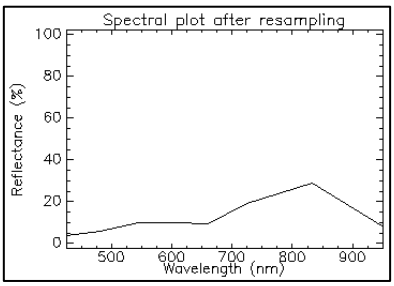
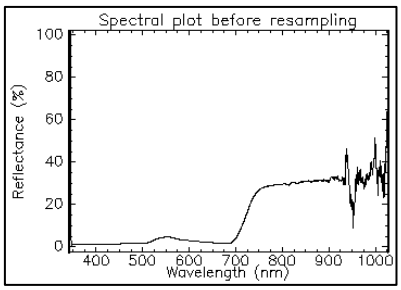
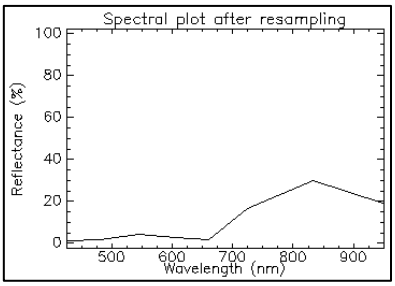
Vegetation species that classified with spectral angle mapper (SAM) was needed to compare with field check to get accuracy data. Within put random point samples, the matrix was built to get percent of each species accuracydata.

**3. Result and Discussion**

Every plant species has specific spectral characteristic. In this study, spectral characteristic of *Tectona grandi*s and *Lantana camara* described with spectral curve. On the red spectrum, *Tectona grandis* was higher curve than *Lantana camara*. It because *Tectona grandis* has space on cover density, so the ground object could be recorded by spectrometer.

Output from field spectrometer of *Lantana camara* showed a curve which similar of health vegetation curve (See table 1). Becauseitis grownby grouping and spreading distribution. Sample of the field spectrometer avoid reflectance another object. Ecologically, *Lantana camara* is a major weed in many tropical and subtropical country. *Lantana camara*was an invasive terrestrial weed of tropical and subtropical country, which has caused huge repercussions to the native composition of terrestrial ecosystem (Priyanka et al. 2013).*Tectona grandis* has distribution pattern that tend to be cluster because the species of plantation on a regular space, so that, the pattern of the canopy relatively homogeneous. Classification in some places produced the pixel value in an image that has pattern of spectral reflectance of vegetation belongs to the spectral pattern of leaves *Tectona grandis*. Classification showed the distribution of this species that tend to be in the south side because the region has been used for *Tectona grandis* plantation (See table 1).

**Table 1.** Curve of reflectance field spectrometer and spectral resample of Worldview-2 imagery

| Species | Field spectrometer | Spectral resample of Worldview-2 |
|---|---|---|
| *Tectona grandis* |   |   |
| *Lantana camara* |   |   |

The result showed that the classification accuracy of *Tectona grandis* and *Lantana camara* are very low and too much wrong classification. This is due to field measurements made on the leaves while the reflectance values in one image pixel Worldview-2 imagery is a mixture of various objects reflectance values. The result of classification with spectral angle mapper (SAM) showing on figure 3.

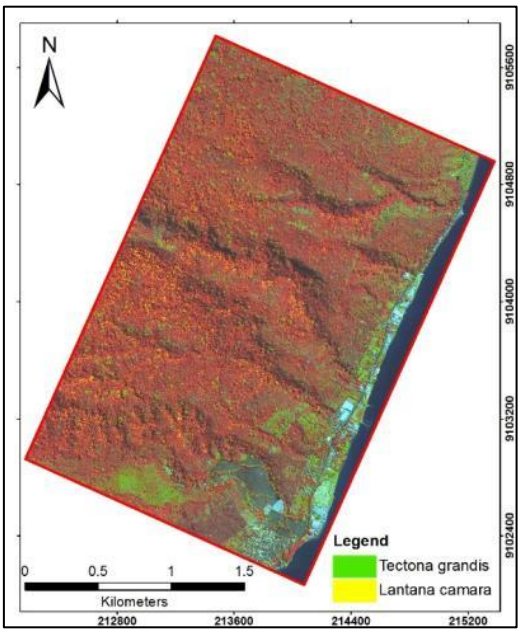



**Figure 3.** Worldview-2 imagery standard false color composite showing spectral resample with the spectral angle mapper (SAM) algorithm.

Reflectance pattern results of field measurements on green vegetation objects is strongly influenced by the activity of photosynthesis in plants. In a lot of reflected green band channel while the blue and red bands occur uptake. The spectral reflection of the sharp rise in the near infrared band. The spectral reflectance patterns resampling results look rough and many omit information that is detailed. Overall, the results of the classification are only using spectral angle mapper (SAM) is not optimal, so this study needs to be improve. From the two types data have different numbers of bands are very different, so the result cannot be maximal. In order to get analysis to species level, need to improve with another parameters data, such as geographic conditions and LIDAR data, as well as other data which if capable of sharpening the information about the species of vegetation.

## 4. Conclusion and Recommendation

Every spectral characters of the object could not at all be better representation to Worldview-2 imagery. Mapping vegetation to species level could not be optimal result. Spectral data only were not adequate todiscriminate vegetation species fromsurround object because influenced by its spectral reflectance. Another approach that integrated with another parameters could improve accuracy of species mapping. In comparing the high spatial resolution with a spectrometer for Identification of species of vegetation. Worldview-2 spatial resolution of 2 m covers most of the surface of the vegetation canopy. Spectrometer samples represent multiple values of pixels in the image worldview 2. Crown width characteristics and diverse vegetation in various types of vegetation should be considered in sample quantities spectrometer each pixel value. Characteristics of heterogeneous and homogeneous vegetation types in certain types have different values, although still in the type of vegetation. Reflectance around samples with different vegetation types have an influence on the value of the spectrometer and the pixel values.

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