Spectral Colour Characteristic’s (Red, Green, Blue) of Sick Acacia Mangium Stand

D Abdalla1*, H Ramdan1, R Dungani1

1Forestry Engineering Major, School of Life Science and Technology, Bandung Institute of Technology

*Corresponding author: rio.abdalla@gmail.com

Abstract. Forest protection management are important activities and integrated from the forest resource management system. One of the activities in forest protection is evaluating stand health in a particular forest region. These activities are important because it helps decision making to perform sustainable forest management. Evaluating stand health on a bigger scale needs more cost, time, and manpower. To overcome this obstacle, there is a need for supporting technology. The technology also needs to suffice within the development of remote sensing. Flying drones is a suitable technology that could evaluate stand health. This research has the goal to determine the spectral characteristics of A. mangium leaf in order to identify the area and position of sick trees. This research is executed in A. mangium stand at KPH Bogor. The method that is being used is hyperspectral imaging analysis to determine the characteristic of RGB (Red, Green, Blue). Spectral analysis is sampled from 85 trees on 7 plot at site 23B RPH Maribaya BKPH Parung Panjang KPH Bogor using simple random sampling. The result of this research shows that trees in healthy condition, sick condition, and the dead condition has different spectral RGB value. RGB value for healthy trees is 121-149(B1), 167-189(B2), 120-142(B3). For sick trees the RGB value is 151-165(B1), 183-205(B2), 145-165(B3). For dead trees the RGB values are 192-202(B1), 202-212(B2), 167-199(B3). As trees condition worsen, the RGB value increases. The pattern of RGB band composition is similar but has different values. This indicates the changing process of leaf color from healthy to sick. On the other hand the interval of RGB band is small enough to notice there is a difference in the color of the tree’s status. This research shows that spectral analysis from drone image could be used to analyze forest’s stand health.

1. Introduction
Forest management needed a plan in making decisions. The plan is expected to strengthen decision making that will affect the management of the forest area, so that decision making has a strong enough basis the plan itself requires to be accounted for so that no unnecessary trials are made. Forestry science, in particular, has a trial effort that requires a high cost. This is because the trial requires a lot of time and energy. While resources cannot meet the time and energy needed.

The management itself takes many forms. The most common is the management of forest protection. Forest protection management is one of the important activities and integrated into the management of forest resources. This protection is very important for forest operations managers. This
is because the management of forest resources must protect the production assets of the forest in question. The protection of the forest guaranteed the value of productivity and assets will not reduce. Long-term plans for the forest concerned to be sustainable over time. When viewed from the output it is expected that productivity can meet the planning target.

Protection activities include the stand health assessment. The stand health assessment contains the determination of the health status of each tree. Over time it is hoped that the evaluation of the health assessment can be used in decision making. Often the stand health assessment has limitations. These limitations are usually in the form of implementation resources. Limited resources result in an evaluation that is not optimal and takes a long time.

Stemming from the limited resources, the main problem arises, namely the energy and time that are very relevant in planning and require certainty although small. The solution to this problem is modeling. Modeling can be predicted what results are expected by the treatment of the area, so it can be eliminated the need for time and energy in making decisions. The time and energy can be focused on the needs that can support the making of models such as sample collection in order to make models. The form of making the model is making a map of the area using GIS and this can be applied to the Maribaya RPH Forest Area, BKPH Parung Panjang, KPH Bogor.

2. Methodology
2.1 Time and Area of Research
The research area is located in Parung Panjang sub-district, Bogor district, West Java Province. The implementation area is in Plot 23B Maribaya RPH, BKPH Parung Panjang, KPH Bogor. The geodetic location is -06 ° 25'01.1136 "and 106 ° 28'57.9000". Maribaya RPH is an industrial forest estate owned by Perhutani Corporation which focuses on forest trees. For the Maribaya RPH 23B plot, the focus is on the Acacia mangium plant. This research was conducted from January to June 2019. With details, there are several stages, namely preparation, field data collection, field data processing, and data analysis stages. The preparations are included in the site survey and literature study. It will take place from January to February. While the image taking of the location of the study using a drone was carried out in February on the year 11 2019. Taking the image of the drone only takes one day and in the afternoon. While data processing is carried out from March to April. The processing includes determining the RGB of the sample tree. After that, an analysis is carried out for discussion. The research location can be seen in Figure 1.

![Figure 1 Research Area](Sumber: Personal Documentation)
2.2 Tools and Material
The tools used in this study were Drone Dji Phantom 4 Pro, Erdas Imagine Hexagon Geospatial and Esri ArcGIS ArcMap. As for the materials needed, the Maribaya RPH image map plot 23b 28 hectares 1: 1600.

2.3 Data Collection
Data collection in this study used the Simple Random Sampling method with 1% Sampling Intensity. The data are used for determining the tree to detect the RGB value. To make it easier when processing the data, each tree has its GPS coordinates determined. The final step is to fly the drone and take the plot image of 23B.

2.4 Environment Condition while Drone Imagery Acquisition
In Collecting satellite imagery, the environment has a color that will be the determining factor. The color itself can be detected by Drones. The result is that the color of an image can change due to the environment. Plot 23B daily Maribaya RPH has a relative temperature of 33 degrees Celsius when it is hottest and 23 degrees Celsius when it is coldest. But when shooting Maribaya RPH has a temperature of 30 degrees Celsius. With a light intensity of 1000 lux so the light is stable makes the color interpretation unchanged. The lack of clouds also helps light to be more stable.

2.5 Determine Spectral Characteristic Spectrum of Healthy, Sick, and Dead Trees
The results of the image taken with the drone must first be integrated and adjusted for the projection. This is done so that the image of the drone does not have an error in the scale. Before starting the classification should be done on screen digitation (OSD). The results of the OSD will be used as an initial reference in the classification of hyperspectral imaging. The accuracy of the hyperspectral imaging method can be compared. The next step is the results of the drone image will be extracted ASCII data or pixel data using the ERDAS software. Keep in mind that only the tree sample per tree status is extracted. The number of tree samples must be sufficiently representative. The ASCII data will contain coordinates and RGB. RGB of the diseased stand is determined. These data will be used as a reference to determine the RGB range per tree health status. The accuracy and range of RGB are calculated using statistical methods.

2.6 Determine the Area of Healthy, Sick, and Dead Trees (Hyperspectral Imaging)
After determining the RGB range, you can look for a 23B plot area. Determine area by counting the number of pixels that have spectral RGB characteristics that correspond to each tree's health status. ASCII data and pixels from all fields must be extracted. The extract results are then sorted by RGB. The sort can be calculated by the number of pixels that matches the spectral characteristics of the health RGB status. In determining the tree canopy area per status using SPSS software. This is because the ASCII or pixel data used will be very much.

2.7 Data Analysis
2.7.1 Determine Mean and Standard Deviation
Determine to mean has a purpose to know the median of RGB spectrum. After determining the mean value, the next step is to determine the standard deviation. Standard deviation is used to determine the normal distribution of the data and how wide the RGB spectrum from the mean. Resulting in determine the spectrum of the RGB value

\[ s = \sqrt{\frac{\sum_{i=1}^{N} (x_i - \bar{x})^2}{N - 1}} \]

\[ S \quad : \quad \text{Standard Deviation} \]
\[ x_i \quad : \quad \text{RGB value} \]
\[ N \quad : \quad \text{Sample size} \]
\[ \bar{x} \quad : \quad \text{Sample mean} \]
The standard deviation equation that will be used, are used to determine the range of value. The expected result from the standard deviation is the data changes and variation. The smaller the range is, the better and more accurate the RGB value will be:

\[ \bar{X} = \frac{\sum_{i=1}^{N} x_i}{N} \]

N : Sample size
Xi : RGB value
\( \bar{X} \) : Sample mean

The mean value sample is used to determine the value of RGB in a tree wellness status. With more sample being used, the better data will be shown

\[ RGB \text{ Range } = \bar{x} \pm S \]

S : Standard Deviation
\( \bar{X} \) : Mean sample

The result from mean RGB value will show the range of the tree wellness status. Determine the RGB spectrum will be very useful due to its use. In the future, the data can be used for predicting the area of the infected trees base of the range or the RGB value.

2.7.2 Determine the Sick A. mangium area
The area of the sick acacia trees can be calculated from the size of the pixel times the amount of sick trees pixel. The sick trees pixel-based of matching the RGB range with the research area pixel.

3. Result and Discussion

3.1 Land cover classification
Figure 2 will show the result that land classification has a few types of land covers. The land covers are acacia stand, rice field, open land, bushes, etc. the land covers are based on land that could be identified. From the land classification, it can be determined that the most significant land covers are the acacia stand and rice field.

![Figure 2 Land Classification Map Site 23B RPH Maribaya, Kabupaten Bogor, West Java](image)

The classification result shows that acacia stand has an area of 28.38 hectares from a total of 29.29 hectares. The result of classification is consistent with the ground check that there is a treatment in the form of logging, the treatment is expected to improve the quality of the stand. Resulting in affecting the area of acacia stand. In the end the number of trees cannot be represented by the land covers. This comes from space of each tree that is different due to logging. Rice field is not counted in the area site because they are outside of site 23B.
Figure 3 the Accuracy of Drone Image

For accuracy of the Land Cover using Drones can not use the method of comparison with satellite imagery. This is because drones have a higher resolution compared to satellite imagery. So that the validity of the classification must be carried out to a better quality resolution. One way is by directly observing the area. A direct review is a problem because it requires a high cost and time. While time and cost are problems that should be tried with drones. So far as to find out which classification method is most appropriate for the image of the drone is still being investigated. One of them is using the hyperspectral imaging method from this research itself [1]. The most representative result for the accuracy of the drone image is the software progress report for processing the image of the drone as Draw 3. The report shows reprojection error, pixel size, and Drone camera specifications. Reprojection error itself is a geometric error caused by the distance of the projection point to the object [2]. So the higher the projection error, the more it does not match the real conditions with the image of the Drone. Drone specifications in the report can be used as a comparison for image quality.

3.2 RGB Acacia Tree Range

The area of 30.08 hectares of plot 23B has an acreage of 12.63 hectares. Then 86 samples of acacia trees were taken from the 12.63 hectares. 86 samples were taken in 7 plots each of which an area of 0.04 hectares. 7 the plot can be seen in its distribution in Figure 4. The sample results from the total area are 0.28 hectares. Making a plot using simple random sampling. The plot position itself is located along with the 23B plot because forests are homogeneous with acacia composition so that tree position does not affect significant differences between samples. The Acacia tree itself is scattered in areas close to the road. The need to take samples up to the 23B plot area in the east is not required.

Based on the results of the spectrum of analysis of 86 tree samples, it was found that the range of red bands, blue bands, and green bands differed. Range results have a pretty good differentiator so they don't cause bias. Judging from the value of the maximum and minimum tree conditions that
intersect with the average data of other tree conditions. So much data is needed for and more definitive tree identification to avoid this contact.

![Graph 1](image)

**Graph 1** RGB means Composition based on wellness status

References Based on Graph 1 above, it can be seen that healthy trees have a lower RGB band compared to sick and dead ones. But over time, the RGB band changes its range. The condition of the tree also becomes sick and even dies. This is because there is a change in the color of the sick and dead tree. This finding is consistent with the fact that the leaves change color when they are sick and die [3]. When viewed, the graph consistently rises as the condition of the tree becomes sick. This is because the color of the leaves of the tree is getting younger. For colors getting younger, then the RGB band has also increased. When seen, the combination is always the highest band 2 followed by band 1 and the most recent band 3. This indicates the color combination is still the same but has a different feel [4].

| status statistik | B1     | B2     | B3     |
|------------------|--------|--------|--------|
| average          | 135,00 | 178,23 | 131,09 |
| min              | 81,08  | 139,24 | 91,45  |
| sehat max        | 148,92 | 194,97 | 152,32 |
| simpangan baku   | 14,41  | 11,69  | 11,98  |
| average          | 158,60 | 194,73 | 155,01 |
| Min              | 151,80 | 159,32 | 137,86 |
| sakit max        | 176,95 | 212,15 | 177,28 |
| simpangan baku   | 7,12   | 11,79  | 10,38  |
| average          | 197,55 | 207,47 | 183,42 |
| Min              | 192,87 | 197,36 | 166,38 |
| mati max         | 206,26 | 211,44 | 206,16 |
| simpangan baku   | 5,22   | 5,85   | 16,56  |

**Table 1 Mean and Standard Deviation of each Wellness status RGB**

Whereas the range of the RGB band in each condition of the tree has almost no contact at all as seen in Table 1. As an example, in the B1 band, the healthy tree has a range of 121 to 149 while in the sick tree B1 also ranges from 151 to 165. It should be in the process of declining the color of tree leaves the process is gradual [5]. The result between bands has a little contact though. It indicates that the process of changing leaf color becomes sick. The initial assumption was that this was due to a lack of tree samples so that not all tree colors entered the main data. But the range of the RGB band is
fairly small. It can be seen that the differences between tree conditions are very visible. The determination of a healthy or diseased tree has the distinction of being unbiased.

3.3 Area Land Classification Based on RGB Range
From the calculation of the number of pixels in Table 2. The result is the area of diseased acacia trees is 0.41 hectares while the healthy trees are 24.34 hectares. Dead trees have an area of 0.06 hectares. A healthy tree area is just an acacia tree area. While the acacia tree land classification area is 28 hectares based on the digitization of 23B plot maps. So out of the 28 hectares of acacia trees, there are trees that have been cut down so that they are considered to be missing when matched according to RGB. Another possibility could also be due to the similarity of the green color between healthy acacia trees with other vegetation so that when detected in RGB healthy acacia trees, other healthy trees also enter into the detection. The light factor also affects because the amount of light that illuminates the leaves can change the color of the leaves [6]. So the hours of sampling effect because the main light is the sun

| Status | Jumlah pixel | Luas pixel(cm) | Luas lahan(hektar) |
|--------|--------------|----------------|-------------------|
| Sakit  | 4.606.974    | 9              | 0.41              |
| Sehat  | 270.411.999  |                | 24.34             |
| Mati   | 638.698      |                | 0.06              |

Table 2 Each Wellness Status Amount of Pixel and Area of Each Status

3.4 Identifying the Color of RGB
Based on the RGB range obtained, it can be seen the color of the leaves in Acacia. These colors can be identified through the RGB composition. So when you calculate the RGB combination, you will get the specific color of the leaf.

Figure 5 Leaf Color of Each Wellness Status (Healthy, sick, dead)

4. Conclusion
1. The RGB value of Healthy Trees is 121-149(B1), 167-189(B2), 120-142(B3).
2. The RGB value of sick trees is 151-165(B1), 183-205(B2), 145-165(B3).
3. The RGB value of dead trees is 192-202(B1), 202-212(B2), 167-199(B3).
4. The difference in leaf color happened because of degradation of leaf physical condition from well to died. The area of acacia stand is different between on-screen digitizing and RGB range matching. This happened due to many trees had treatment such as logging or rotation

References
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