CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The study using remote sensing was undertaken in order to classify age stage of Teak plantation and to quantify the determination of carbon storage. The main data source for the analysis was LANDSAT-5 TM dated may 05, 2010. Pre-processing were geometric correction and radiometric calibration. Image identification of Teak plantation was performed based on visual and computerized technique. And then Age-Class identification, by comparisons between logical operation method and regression model method to identification of Teak age satge. Used band ratio indices of Advanced Vegetation Index (AVI), Bare soil Index (BI) and Water Index (WI) which the study expected a comprehensive physical. And decided to add another index in the case of correlation was low. The values from the indices were used to information data of the classification. The proposed age stages of Teak plantation were classified based on plantation management characteristics of Forest Industry Organization (FIO). They were classified into 2 stages including primary stage (3-7 years old) and rotation stage (25-38 years old). The age stage maps of Teak plantation in Khun Mae Kham Mee Plantation were produced from two methods. Then, error matrix and Kappa Index were used for comparing the result of the classification system by ground truth data.

The result showed the appropriate procedure for Teak plantation area identification in Khun Mae Kham Mee Plantation was an equation;

$$\text{Age} = 7.52 - 207.839SR + 2{,}065.338SR^2 - 6{,}107.702SR^3 \quad R^2 = 0.63$$

By the acquisition of the above equation was derived from 2 classification method which the details as followed: the logical operation used values of AVI, BI and WI for each age stage in the classification and knowledge-based tool. The result found two age stage and unclassified area. Primary stage and rotation stage were

1,407.42 (45.32%) and 914.58 (29.45%) ha respectively. Unclassified area was 783.27 ha (25.22%).

The regression model, starting with correlation analysis found that BI and WI were a few relations. From the result, the researcher chose some indexes related to the vegetation which had been studied in plantation were added in analyze. Then all of vegetation indexes were imported to regression analysis to find the best fit equation. The best fits equation was Age = 7.52 – 207.83SR + 2,065.33SR^2 -6,107.70SR^3 with R^2 = 0.63. The area of primary stage and rotation stage were 848.20 ha (27.27 %) and 2,262.37 ha (72.73%) respectively.

The sample point which distributed to all age-class from ground truth data taken in April 2010 were used to verify classification accuracy. Result was presented that logical operation; the accuracy of primary stage and rotation stage were 50.00% and 84.62% respectively. And total accuracy was 56.67%. By regression model; the accuracy of primary stage and rotation stage were 84.21% and 63.64% respectively. And total accuracy was 73.92%. The highest total accuracy was the classification of regression model then used the result to calculate Teak plantation area and then chose it was the appropriate procedure.

Determination of aboveground biomass and carbon storage was based on ground survey. The collecting sample data were applied the allometric equation. The relationship between biomass and age was in exponential form. The equation was $y = 18.73^{e0.09x}$. Where; y = Biomass of stand and x = Age of Teak. The average biomass of the age stage per tree found that the primary stage and the rotation stage were 26.40 and 244.71 $kg.tree^{-1}$. The biomass content per square meter showed that primary stage and rotation were 1.32 and 7.70 $kg.m^{-2}$. Then, calculate aboveground biomass per age-stage using the area of classification map. The result showed that mature stage was 174,209.49 tons. Followed was young stage (11,196.24 tons). And the total area of Teak plantation stored aboveground carbon at 92,702.865 tons. Divided into the primary stage was 5,598.12 tons and the rotation stage was 87,104.74 tons. The capacity to store carbon of primary stage and rotation stage were 6.60 and 38.50 $ton.ha^{-1}$.

5.2 Recommendations

1) Consideration of the seasonal influences, by compare between wet and dry season satellite imagery.

2) Application of the study process using high resolution imagery integrated with GIS techniques might provide better and detailed result in age class classification.

3) Geographical data such as high elevations, slope, aspect and other are better incorporated with band ratio to classify age class of Teak plantation

4) Use of study process in similar condition areas could provide basis of comparison in terms of accuracy.