An Agro-ecological Land Suitability Analysis Using GIS For Oil Palm Plantation in Southern Thailand

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ABSTRACT: *Due to rapid increase in the demand of Natural Rubber (NR) few years ago, NR price sore very higher. The rubber plantation in Thailand expanded very fast to non traditional areas with the result Thai become the biggest NR exporting country in the world. However, the average yield is still lower compared to experimental yield of RRIT (Rubber Research Institute of Thailand) or just 60 % (RRIT, 1998). This is due to many of new rubber planting areas, which are not suitable. The Thai Ministry of Agriculture and Cooperatives thus has set "The complete cycle development strategies for natural rubber" in the medium-term measures by reducing the rubber planting areas by 300,000 rai (1 rai = 0.16ha) through replanting with oil palm.*

The aim of this study is to find out land having lowest potential for rubber production (R3) but highest for oil palm production (P1). Find areas which are unsuitable for rubber and can be replaced by oil palm in order to get a better agricultural production.

The study was applied upon Krabi province, Thailand. Crops requirement, degree of limitation to crops growth, climatic data, crops yield, soil map, topographic map etc., were used to evaluate land potential for both rubber and oil palm production according to FAO framework (Sys, 1992). An Agro-ecological suitability map for rubber and oil palm were produced. This was done by mean of GIS. The database was generated and guide map for the decision makers in view of suitable crop substitution was prepared.

Keywords: Land Evaluation, Crop Requirement, Land-Climatic Characteristics, Limitation to crop growth, Rubber, Oil Palm, GIS

1. Introduction

Due to rapid increase in demand of natural rubber few years ago. The rubber plantation, therefore, has expanded very fast. Due to the increase in the global production the natural rubber prices went down. The over supply resulted in lower rubber prices. To avoid this problem, the ANRPC (Association of Natural Rubber Producing Countries) meeting in 1998 suggested, "All member countries should reduce their planting area". In Thailand the rubber plantations also increased very fast to non traditional areas, Thailand then became the biggest NR exporting country in the world with production capacity of 2 million tons per year or 31 % (1/3) of the world product. However, the average yield is still lower compares to experimental yield of RRIT (Rubber Research Institute of Thailand) or just 60 %. This is due to many of new rubber planting areas are not suitable, which produce lower yield. The Thai Ministry of Agriculture and Cooperatives thus has set "The complete cycle development strategies for natural rubber" in the medium-term measures by reducing the rubber planting areas by 300,000 rai (1rai = 0.16ha) through replanting with oil palm.

The target of this study is to evaluate a land potential for rubber and oil palm production, based on data available in the regional land resources inventory and the crop requirements for rubber and oil palm, which will allow the prediction of yields and crop substitution between rubber and oil palm, based on climatic and physical-chemical soil properties.

To replaced non-suitable crop by the other suitable crop between rubber and oil palm in order to get a better agricultural profit. The basic concepts in land evaluation for both rubber and oil palm must be analyzed.

2. Study Area and Data Used

In order to study the relation between climatic-land characteristics and yield. The 28 study sites (land units) of rubber and 36 study sites (land units) of oil palm have been selected as reference area. They are widely distributed over 4 rainfall zones and different soil units that cover good, moderate, and poor soil, cover all southern part of Thailand Soil sampling of those rubber 28 and oil palm 36 study site respectively have also been taken for physical soil analysis, chemical soil analysis and described soil

profile according to USDA etc. To avoid error due to the variety of rubber clones, only one clone of RRIM600 was selected. Daily yield of around 300 rubber plantations surrounding 28 study sites and monthly yield of around 90 oil palm big estates surrounding 36 oil palm study sites were recorded through 3 years. Using reference data this study was focused on Krabi province (Figure 1).

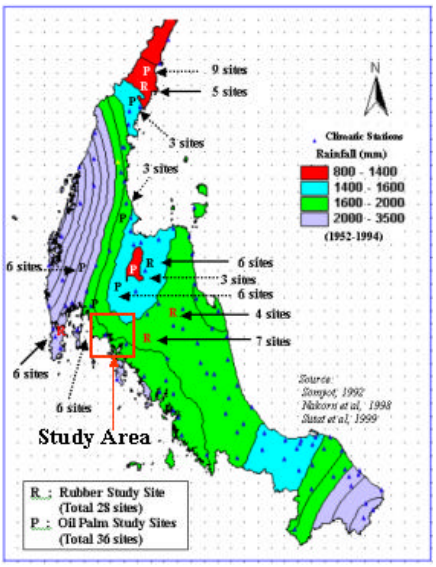

Figure 1 Reference Study Sites of Rubber and Oil Palm Coverall Southern Thailand (*Data source : Somyot 1992, Nakorn et al 1998,and Sutat et al 1999*)

3. Methodology

3.1 Modified FAO framework : Reference data was used and modified FAO framework (Sys et al ,1992) in this study we classified following requirement in to 3 classes, suitable, moderately and not suitable (see Figure 2)

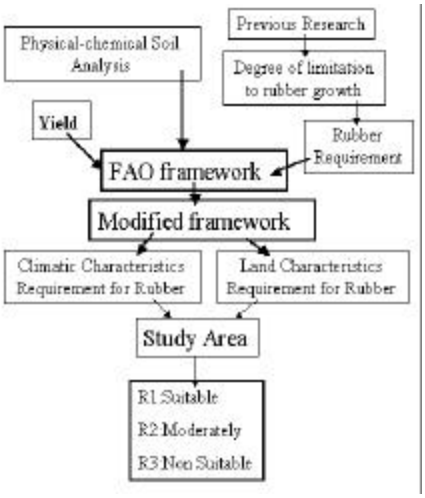

Figure 2 Overall structure of Modified FAO framework

3.1.1 Climatic Requirements for Rubber Production : climatic requirements such as rainfall, growing period, temperature etc. are classified.

3.1.2 Land Characteristics Requirements for Rubber Production : land requirements such as topography, soil physical properties, fertility etc. are classified.

3.1.3 Climatic Requirements for Oil Palm Production : requirements such as rainfall, water deposit, RH etc. are classified.

3.1.4 Land Characteristics Requirements for Oil Palm Production : requirements such as topography, soil physical properties, salinity etc. are classified.

3.2 Application of GIS for Land Evaluation : Due to there are a lot of discussions concerning the choice between land characteristics and land qualities as a basis for land evaluation. From FAO (Sys, 1992) it is possible to use (1) land characteristics or (2) land qualities measured or estimated by mean of land characteristics or (3) a mixture of land qualities and land characteristics. In this study we then used land characteristics requirements and climatic characteristics requirements which were classified above for our final land evaluation and mapping (see Figure 3).

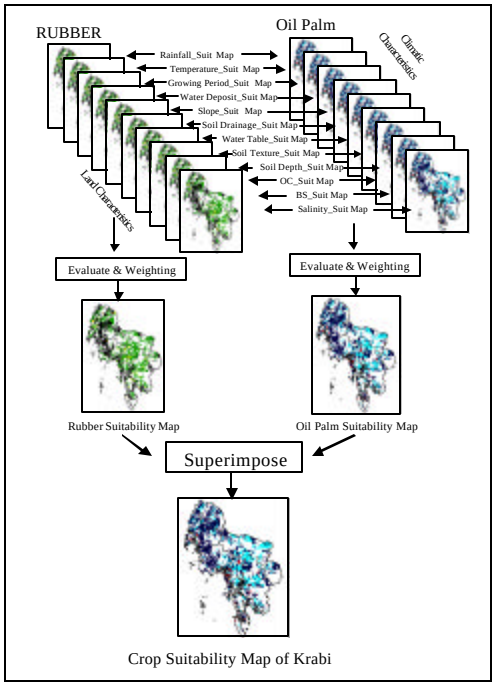

Figure 3 Overall structure of GIS application

4. Results and Discussion

Due to lack of some required data for water deposit and growing period calculation, then these two important factors (2 of 9 factor) are not taken into account for overall land evaluation. We used the modified framework to the study area to classify rubber and oil palm zones into 3 different suitability classes and mapping (see Figure 4 and 5)

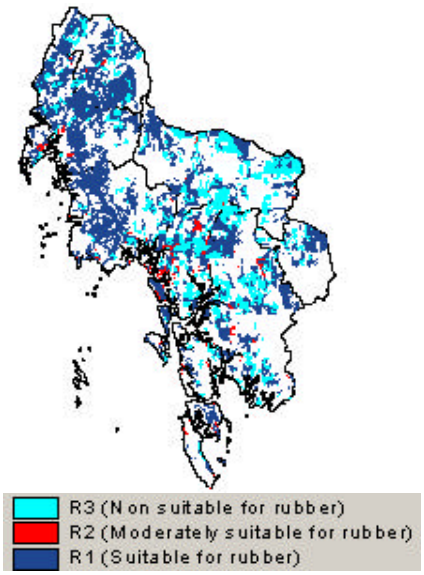

Figure 4 Rubber Suitable Zone Map of Krabi

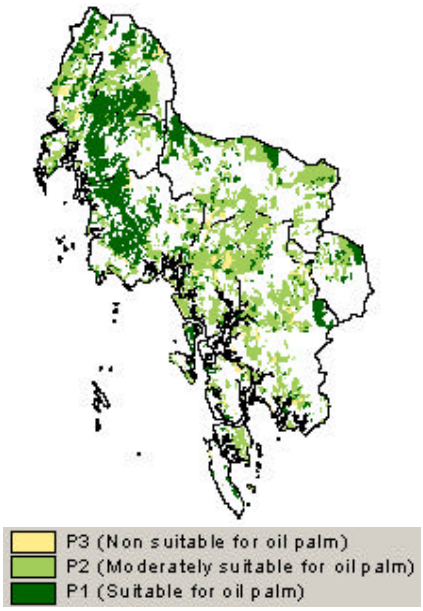

Figure 5 Oil Palm Suitable Zone Map of Krabi

After superimposed Rubber Suitable Zone Map and Oil Palm Suitable Zone Map we found that the areas which are unsuitable for rubber and can be replaced by oil palm (R3P1) is about 13,160 ha. or areas moderately suitable for rubber and can be replaced by oil palm R2P1 is about 6,350 ha. This area has high potential for oil palm production with more than 18.75 ton/ha/year. On this other hand we also found that the areas which are unsuitable for oil palm and can be replaced by Rubber (R1P3) is about 4,330 ha etc. see Table 1

Table 1 Total Area of Rubber and Oil Palm Suitable Zone in Krabi

Zone	Area (ha)		Zone	Area (ha)
R1P1	203,250		R2P3	480
R1P2	87,590		R3P1	13,160
R1P3	4,330		R3P2	54,680
R2P1	6,350		R3P3	81,000
R2P2	20,050			

5. Conclusions

From the results obtained, even lack of some important required data (2 of 9 factor), accuracy of evaluation still need to improve. However, based on the data available, we can conclude that the result of this study could be a database and a guide map for the decision makers in view of suitable crop substitution between rubber and oil palm in order to get a better agricultural production in this study area.

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