

# Application of Remote Sensing and GIS for Mapping Suitable Oil palm Area in Thailand: Case study in Surat Thani Province, Southern Thailand

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**Abstract:** Oil palm is an important economic crop in South-east Asia region, it is used to produce biodiesel, an oil replacement which quantity is insufficient for consumption and the price tend to be more expensive in the near future. The objective of this study is to apply the Remote Sensing technology and GIS to map planted and suitable area for oil palm under the proper environment to produce high yield, high quality in the southern part of Thailand. By using LANDSAT-TM data, the area of oil palm plantation in Surat Thani province was found out to be 831.47 sq.km. or 6.56 % of total province area, with additional data, for example soil suitability map, water resource, climatic data, topographic map and oil palm variety have been used to produce the model. The result of the study indicated that the suitable area for oil palm plantation is 8517 sq.km. or 67.18 % of total province area. Further study in the eastern part of Thailand also get the same result. Finally it is confirmed that Remote Sensing and GIS is useful for mapping of suitable oil palm area plantation.

**Key Words:** Remote Sensing, GIS, Oil palm

## Objective

- To apply Remote Sensing Technology and GIS for oil palm mapping.
- Using GIS to analyze suitable oil palm area under the proper environment to produce high yield, high quality in Surat Thani province

## Study area

Surat Thani is a province in southern part of Thailand which occupied great oil palm planted areas. It is situated between latitude 9°57'75" - 10°77'990" N and longitude 102°07'92" and 102°52'124" E, total area without island approximately 12,677 sq.km. Tropical monsoon climate with average annual rainfall of 1,600-2,400 mm. which wet period 8 months and dry period 4 months per year. Average temperature is 25-28 °C. Relative Humidity is 80-82 %. On highland area, the amount of rainfall are much more than on the lowland and coastal area.

## Methodology

1. Collecting physical data from related organizations: plant variety, average annual rainfall, average temperature, relative humidity, dry periods, slope, soil suitability for oil palm, stream network and reservoir, factory site, administrative boundaries and total yield generated by soil series.
2. Interpretation of LANDSAT 7-TM imagery (26 March 2004) by visual and field check for oil palm plantation.
3. Analyzing data for suitable oil palm area by weighing technique, The formula is as follows and identify parameters by table 1

$$Mt = M_1W_1 + M_2W_2 + M_3W_3 + M_4W_4 + M_5W_5 \quad (1)$$

Where **Mt:** total weighing score

**M<sub>1</sub>- M<sub>n</sub>:** score of parameter 1,2,3,4,5,...n

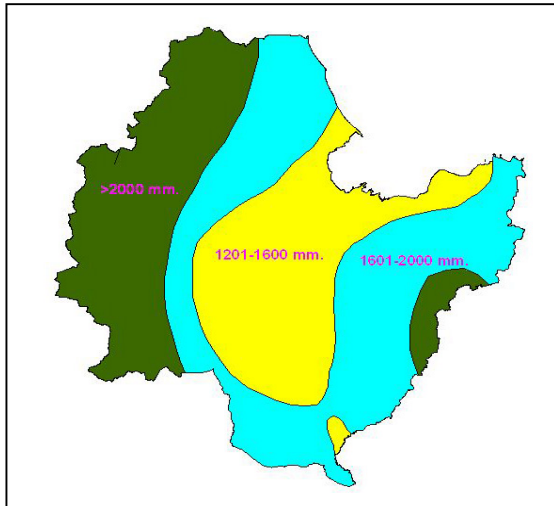
**W<sub>1</sub>- W<sub>n</sub>:** weighing value of parameter 1,2,3,4,5,...n

**Table 1 :** Identify score and weighing value of parameters

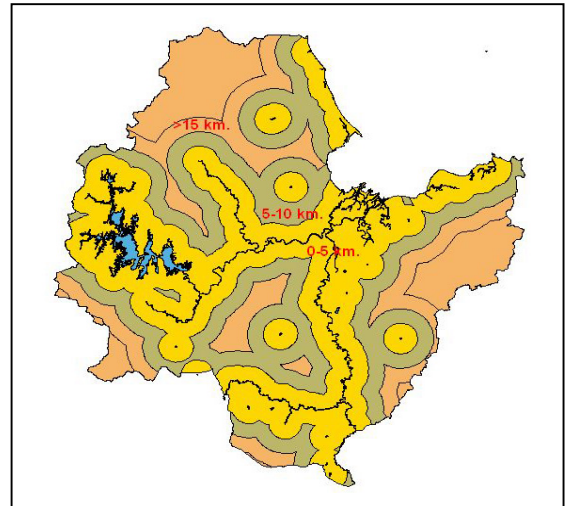
Parameter	Score(M)	Weighing value(W)	Source
1.Average annual rainfall (mm.)		4	[1],[2]
- > 2,000	4		
- 1601 - 2,000	3		
- 1201 - 1,600	2		
- <1200	1		
2. Dry periods (months)		4	[1],[2]
- none	4		
- 1-2	3		
- 3-4	2		
- >4	1		
3.Distance from stream network (km.)		4	[1],[2]
- 0-5	3		
- 5-10	2		
- .>10	1		
4.Soil suitability class		3	[1],[2]
- 1	4		
- 2	3		
- 3	2		
- 4	1		
5.Average annual temperature (°C)		2	[1],[2]
- > 25	4		
- 22-25	3		
- 18-21	2		
- <18	1		
6.Relative humidity (%)		2	[1],[2]
- > 80	3		
- 75-80	2		
- <75	1		
7.Slope (%)		2	[1],[2]
- 0-5	3		
- 5-10	2		
- >10	1		

4.Divide classes of potential area for oil palm plantation into 4 classes

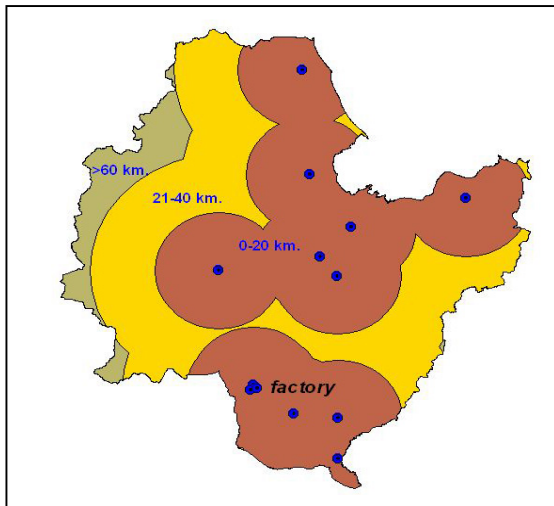
class	scores
- The high potential	1-19
- The moderate potential	19.1-38
- The less potential	38.1-57
- No potential	57.1-76



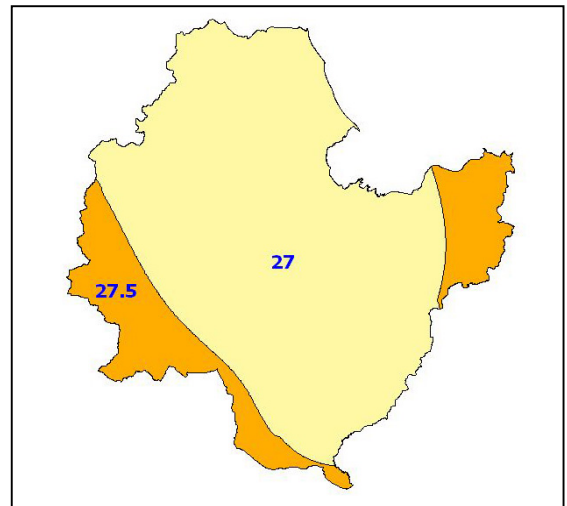
**Figure 1** Average annual rainfall(mm.)



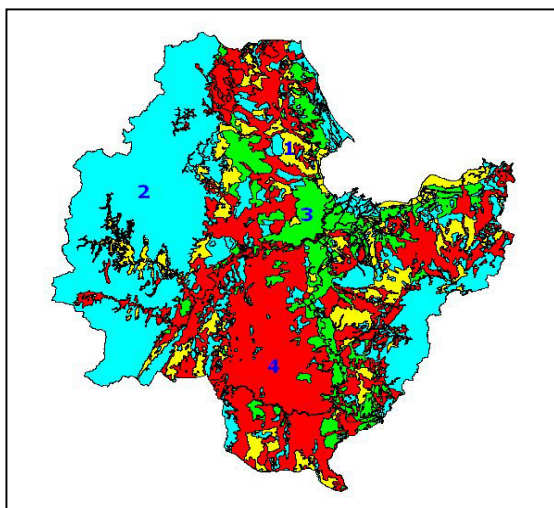
**Figure 2** Stream network buffer 5 km.



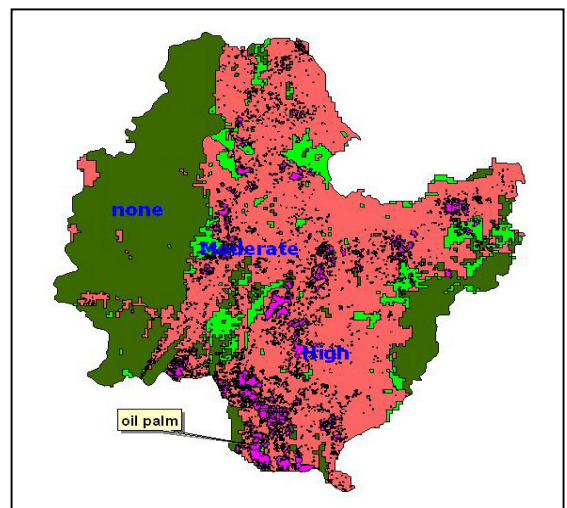
**Figure 3** Factory buffer (km.)



**Figure 4** Average Temperature (°C)



**Figure 5** Soil Suitability of oil palm



**Figure 6** Suitability areas of oil palm

## Results

The area of oil palm plantation in Surat Thani province was found out to be 831.47 sq.km. or 6.56 % of total province area. Base on the overall parameters of suitable area could be classified into several classes. Details of oil palm plantation areas and suitability classes areas were shown in table 2. Further study in Trad province, in the eastern part of Thailand also get the same result and details were shown in table 3. By PLANTGRO model could estimate yield of oil palm for soil series, yield in the high suitability classes 2,691-3,225 kg./rai and in the moderate suitability classes 2,166-2,690 kg./rai.[3]

**Table 2** Oil palm plantation areas and suitability classes areas in Surat Thani province.

Suitability classes	Yield(kg./rai)	Oil palm plantation areas		Suitability areas	
		sq.km.	% of Total area	sq.km.	% of Total area
1	1,095-1,630	-	-	-	-
2	1,631-2,165	-	-	-	-
3	2,166-2,690	68.55	0.54	1,016	8.01
4	2,691-3,225	762.92	6.02	7,501	59.17
<b>Total area</b>		<b>831.47</b>	<b>6.56</b>	<b>8,517</b>	<b>67.18</b>

**Table 3** Oil palm plantation areas and suitability classes areas in Trad province.

Suitability classes	Yield(kg./rai)	Oil palm plantation areas		Suitability areas	
		sq.km.	% of Total area	sq.km.	% of Total area
1	1,095-1,630	-	-	-	-
2	1,631-2,165	-	-	-	-
3	2,166-2,690	15.59	0.62	1,086	43.49
4	2,691-3,225	5.37	0.22	1,047	41.93
<b>Total area</b>		<b>20.96</b>	<b>0.84</b>	<b>2,133</b>	<b>85.42</b>

## Conclusion

The result of the study indicated that the suitable area for oil palm plantation in Surat Thani Province is 8,517 sq.km. or 67.18 % of total province area and in Trad Province, suitable area for oil palm plantation is 2,133 sq.km. or 85.42 % of total province area. Therefore it is indicated that Remote Sensing and GIS is useful for mapping of suitable oil palm area plantation.

## References

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- [3] Kongthon, S. et.al.,2004. Analyze of Limited Factors of Soil Series and Climate in Oil Palm Plantation, Land Development Department, Ministry of Agriculture & Cooperatives, Thailand.