CHAPTER 5
DISSCUSSION

Potential area according to many environmental factors can be obtained by GIS techniques. In this study, potential area for tourism facilities and their impacts to the environment were identified according to the type of tourism facilities development and the condition of Sukhothai province. Five environmental impacts suggested as key indicators, i.e., potential area for soil erosion, surface water runoff, groundwater contamination, slope, and flood risk were incorporated in the analysis.

The mapping of land suitability for tourist accommodation development in this study comprises two experiments after the GIS have been established. Firstly, the effects of varying the classification range of each physical environmental classification factor. This experiment also investigated the effect of changing the classification range between crisp set and fuzzy set in physical environment criteria (soil erosion, runoff, slope, groundwater, and groundwater). This classification range varied by different location of study area and varied by important of result that created.

The second experiment investigated the subjective decision that can vary according to the level of importance defined by experts or according to the judgment of the decision-maker or investment planner. This study has assumed that selections of areas for tourist accommodation development are depended on physical environment condition, transportation accessibility, river scenic distance and water supply facility.

In the changing classification range section, from 17 condition which apply different type of classification range for each physical environment criteria which describe above and show the result in table 4-40. This study founded the very high and high suitable located in different part of study area depended on the factor, which to verified. However, it is located in the same direction and same trends, located in the central of study area, amphoe Muang Sukhothai, amphoe Sawan Kha

Loke and amphoe Sri Nakorn. The very high potential area for tourist accommodation development varied from 23.47 – 37.98 percent of study area depended on different categories. The highest criteria which given the first rank of suitable area is increased 10 percent of groundwater depth classification range, the condition which given lowest rank of suitable area is decreased 5 percent of groundwater depth.

5.1 Effect of changing the classification range

5.1.1 Variation of soil erosion classification ranges

Table 5-1 shows the results when apply fuzzy membership and apply various criteria to the ordinary erosion classification range. The result depended on the range of criteria. When apply fuzzy membership function and crisp set that vary classification range to the ordinary soil erosion classification range. The suitability located in the same trends. Result area when apply crisp set compared with fuzzy set into ordinary classification range is quite different. When look at the raw data that are the output from USLE model and compared with classification range which show in Figure 5-1.

When compared the different between effects of result that create by apply ordinary classification, vary range of ordinary classification range, and apply ordinary classification with fuzzy membership. The classification range to classified data in this class is below 5 ton/hectare/year are very low erosion, 5-15 ton/hectare/year are moderate erosion, 15-25 ton/hectare/year are high erosion, and over 25 ton/hectare/year are very high erosion rate.

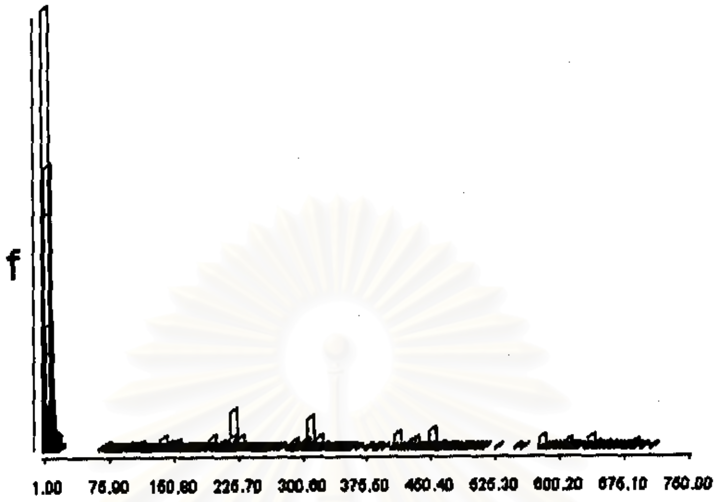

Figure 5-1 Histogram of Soil Erosion data

Reason for such outcome was founded where considering distribution of the soil erosion data (Figure 5-1). Since the data are not continuous, the given classifying criteria fall into either peaks or trough of the histogram. As a consequence, varying the classification ranges will not affect the classification results.

Table 5-1 Comparison between fuzzy set and crisp set when apply various classification range into soil erosion data to find suitable area for tourist development (percent of study area)

Category	Classification Range				
	Ordinary Fuzzy	Ordinary Crisp	+5% of Range	-5% of Range	+10 % of Range
High	29.13	29.50	29.50	28.89	29.50
Moderate	70.79	60.52	60.62	61.08	60.65
Low	0.08	9.98	9.88	10.03	9.85

5.1.2 Variation of runoff classification ranges

Table 5-2 shows the result when apply fuzzy membership and apply various criteria to the ordinary runoff classification range. The suitable area from both maps was established in the same manner. When look at the raw data from TR-55 model and compared with classification range, which show in Figure 5-2.

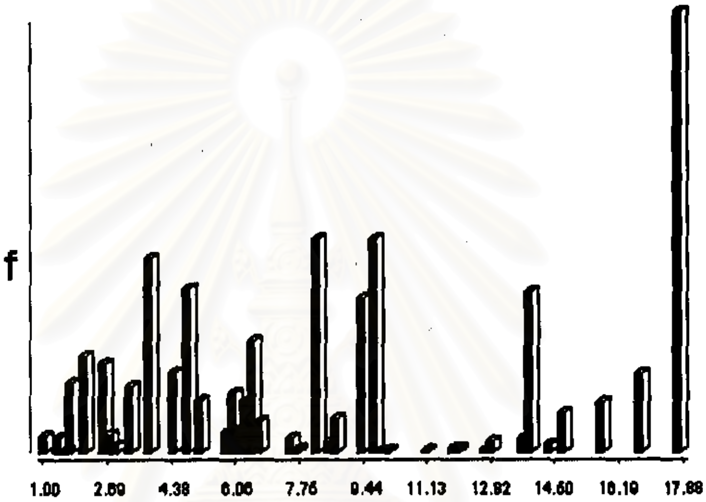

Figure 5-2 Histogram of Runoff data

Reason for such outcome was founded where considering distribution of the runoff data (Figure 5-2). Since the data are not continuous, the given classifying criteria fall into either peaks or trough of the histogram. As a consequence, varying the classification ranges will not affect the classification results.

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Table 5-2 Comparison between fuzzy set and crisp set when apply various classification range into runoff data to find suitable area for tourist development (percent of study area).

Category	Classification Range				
	Ordinary Fuzzy	Ordinary Crisp	+5% of Range	-5% of Range	+10 % of Range
High	29.13	29.50	29.63	29.50	29.63
Moderate	70.79	60.52	60.52	60.53	60.40
Low	0.08	9.98	9.85	9.97	9.97

5.1.3 Variation of groundwater depth classification ranges

Table 5-3 shows the result when apply fuzzy membership and apply various criteria to the ordinary groundwater depth classification range. The Suitable areas from both maps were distributed in the same manner that shows in Figure 5-3.

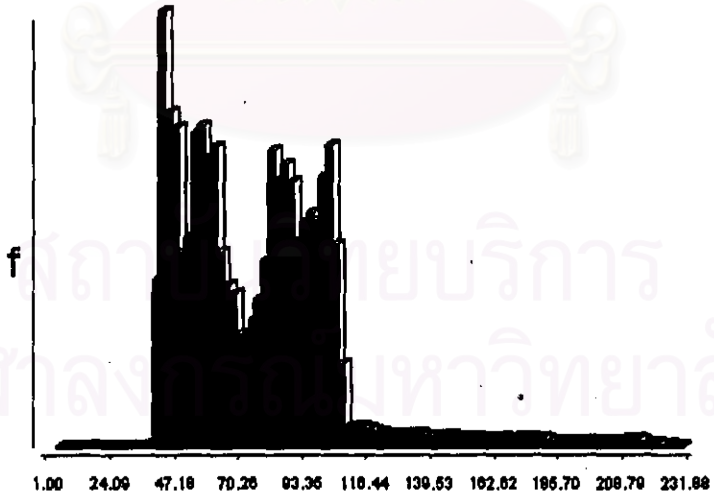

Figure 5-3 Histogram of Groundwater depth data

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From groundwater depth histogram, the data are continuous and when apply ordinary groundwater depth classification range to this datasets, some of classification range which selected in this study are suitable with this output data because of this data preparation by interpolate the groundwater depth data by SURFER program using kriging interpolation procedure. The value use to classified raw data into new class is located in suitable area. For example, to classified the groundwater depth. The classification range to classified data in this class is below 75.5 meter are shallow groundwater, 70-110 meters are moderate deep, and over 110 meter are very deep.

When adjust the classification range from ordinary classification in new range (increased 5 %, decreased 5% and increased 10% of ordinary classification range) effect the large number of data, this is the reason when adjust many range into groundwater depth data given large amount of classification classes.

Table 5-3 Comparison between fuzzy set and crisp set when apply various classification range into groundwater depth data to find suitable area for tourist development (percent of study area).

Category	Classification Range				
	Ordinary Fuzzy	Ordinary Crisp	+5% of Range	-5% of Range	+10 % of Range
High Moderate Low	29.13 70.79 0.08	29.50 60.52 9.98	34.86 55.50 9.63	33.54 60.08 6.38	37.98 52.59 9.43

5.1.4 Variation of groundwater volume classification ranges

Table 5-4 shows the result when apply fuzzy membership and apply various criteria to the ordinary groundwater volume classification range. The suitable areas from both maps were distributed in the same manner. When look at the raw data that are the output from interpolate from groundwater volume data and compared with classification range which show in Figure 5-4.

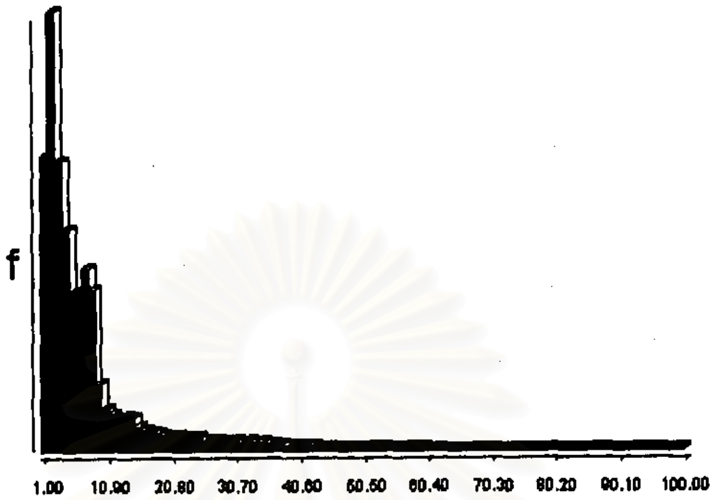

Figure 5-4 Histogram of Groundwater Volume data

From groundwater volume histogram, the data are continuous and when apply ordinary groundwater volume classification range to this datasets, some of classification range which selected in this study are suitable with this output data because of this data preparation by interpolate the groundwater volume data. The given classifying criteria must fall into area, which have data located. When classified this raw data into new class affect the classification results.

Table 5-4 Comparison between fuzzy set and crisp set when apply various classification range into groundwater volume data to find suitable area for tourist development (percent of study area).

Category	Classification Range				
	Ordinary Fuzzy	Ordinary Crisp	+5% of Range	-5% of Range	+10 % of Range
High	29.13	29.50	30.61	28.18	31.29
Moderate	70.79	60.52	59.42	61.85	58.74
Low	0.08	9.98	9.97	9.98	9.97

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5.1.5 Variation of slope classification ranges

Table 5-5 shows the result when apply fuzzy membership and apply various criteria to the ordinary slope classification range. The suitable areas from both maps were distributed in the same manner. When look at the raw data that are the output from interpolate from slope data and compared with classification range which show in Figure 5-5.

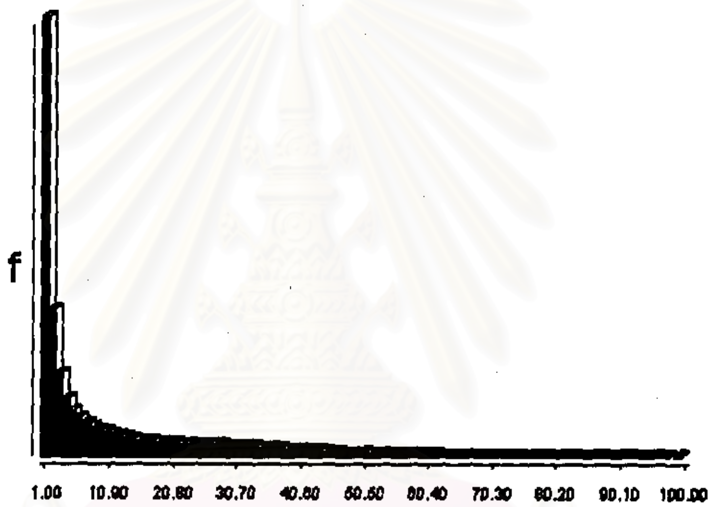

Figure 5-5 Histogram of Slope data

From slope histogram, the data are continuous and when apply ordinary groundwater volume classification range to this datasets, some of classification range which selected in this study are suitable with this output data because of this data preparation by interpolate the elevation data. The given classifying criteria must fall into area, which have data located. When classified this raw data into new class affect the classification results.

Table 5-5 Comparison between fuzzy set and crisp set when apply various classification range into slope data to find suitable area for tourist development (percent of study area).

Category	Classification Range				
	Ordinary Fuzzy	Ordinary Crisp	+5% of Range	-5% of Range	+10 % of Range
High	29.13	29.50	29.56	29.29	29.71
Moderate	70.79	60.52	60.47	60.73	60.32
Low	0.08	9.98	9.97	9.99	9.96

5.2 Effect of the changing weights

Effects of weight linear combination was examined through the weight linear combination procedure performed by Multi Criteria Evaluation module (MCE) in IDRISI with four factors and two constraints. This generated weighting and rating suitability categories into 11 scenarios the results illustrated in Figure 4-8 to 4-18. The results shown as potential map showing three classes: most suitable, moderately suitable and least suitable area for tourist accommodation development. The effect of changing weight importance in many combinations, areas selected for each objective are geographically coherent and meaningful in terms of the criteria specified.

When applied high value of weight into crisp set, the effect of this factor will override others. However, the other factors may be more suitable than the considering factor, which has high weighting value. For example, in scenario 5 and scenario 9, the transportation accessibility are major criteria to concern, but scenario 5 have weighting value higher than scenario 9 (Transportation accessibility in scenario 5 = 70% other factors = 10%, Scenario 9 = 40%, others = 20%). In crisp set, high potential area in transportation accessibility (buffer 100 meters from both sides of roads) received weight = 70% from scenario 5 and area which are beyond the 100 meters buffer have zero weight. Minor weighting levels (weight = 10%) has far less effects in the suitability ranking process. Areas with such condition were grouped into low suitable or moderate suitable area.

When apply the lower value of weight (scenario 9 have decrease the importance of transportation accessibility from 70% to 40% and increased others importance from 10% to 20%) the suitable areas are more diversified (have more variety of class than scenario 5) because of more comparable weight allowed other factors to promote itself when analyze with MCE procedure.

In the other hand, applying high value of weighting importance with fuzzy logic can produce more suitable area when compare with crisp set. From nature of crisp and fuzzy which describe in figure 5-6, crisp have sharp clear to delineate the boundary of itself but fuzzy haven't. Fuzzy sets provide higher value of suitable area because when apply weight importance with fuzzy set (Scenario 5), area which far from 100 meters from both roadsides have its membership different from crisp set. When areas are outside the criteria crisp set gave weight importance = 0 (same as membership function = 0 in fuzzy sets), area which have importance = 0 couldn't promote itself when use MCE procedure. In Fuzzy set the area outside the criteria have its membership function between 1 and 0. The areas have membership function close to 1 means it locates near criteria (when criteria are distance from something e.g. road like criteria 5).

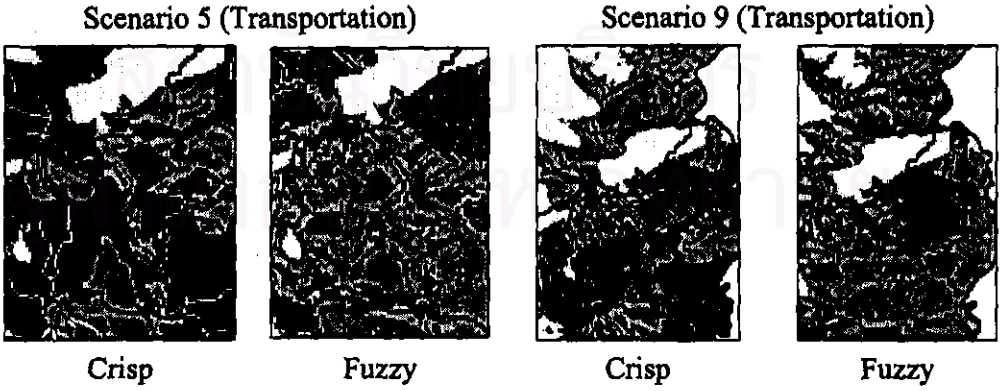

Figure 5-6 Comparison or suitable area between crisp and fuzzy when apply in transportation accessibility

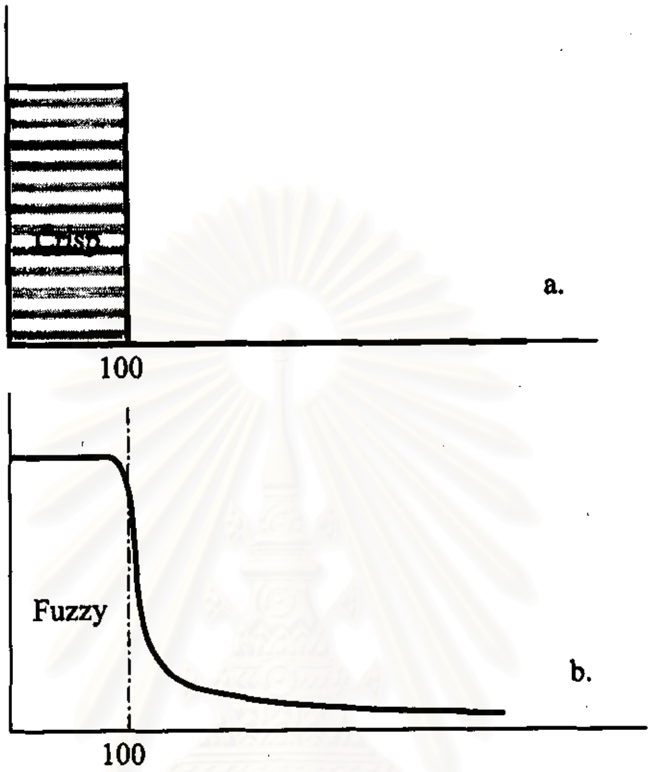

Figure 5-7 Comparison of membership function of transportation accessibility set

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