

CHAPTER 4

RESULTS

4.1 Result on the effect when change the classification range

This section scopes on effects of variation in physical environment classification criteria.

4.1.1 Ordinary Classification Range

i. Criteria 1 (Crisp Set, All classification range are Ordinary)

These criteria used the classification ranges, which were given in literature for finding the suitable areas. It combined physical criteria with flood risk map to generate the pairwise comparison matrix in MCE method for finding the suitable areas which less environmental impact under the developing of accommodate area in Sukhothai province.

Figure 4-1 shows the result of the operation when apply crisp set in the given classification range. It is founded that the most suitable area for tourist accommodation development located in amphoe Sri Sat Cha Na Lai, amphoe Ban Dan Lan Hoi, amphoe Thung Sa Liam. The High potential area for tourist accommodation development founded in many part of study area e.g. the center of amphoe Muang Sukhothai and amphoe Khiri Mas.

Figure 4-1 shows physical environment suitability map for accommodation development in Sukhothai province


	Suitability Level	Area (sq. km)	Percent Coverage
	■ Most Suitable	1,889.13	29.50
	■ Moderately Suitable	3,875.41	60.52
	■ Least suitable	638.65	9.97
	Total	641,600.00	100.00

Figure 4-1 Suitability map from crisp set manipulation over the ordinary classification ranges.

ii. Criteria 2 (Fuzzy Set, All classification range are Ordinary)

These criteria used same classification range as in criteria 1 but applied fuzzy membership function, instead of crisp set, to classified the five physical environments. Classified data of the potential area for each physical factor development were, then combined with flood risk map to generate the pairwise comparison matrix to use in MCE method; as have been done in criteria 1.

Figure 4-2 shows the result of the operation. It is founded that the most suitable area for tourist accommodation development located in amphoe Sri Sat Cha Na Lai, amphoe Ban Dan Lan Hoi, amphoe Thung Sa Liam. The High potential area for tourist accommodation development founded in many part of study area e.g. the center of amphoe Muang Sukhothai and amphoe Khiri Mas. Applying Fuzzy membership function has very different results from crisp set. For instance, the areas, which were classified into low suitable area under crisp set condition, were changed

into moderate suitable criteria. The other suitability areas, however, were located in the same trends as found in the crisp classification.


	Suitability Level	Area (sq. km)	Percent Coverage
	■ Most Suitable	1,865.25	29.13
	■ Moderately Suitable	4,532.84	70.79
	■ Least Suitable	5.07	0.08
Total		6,403.19	100.00

Figure 4-2 Suitability map from crisp set manipulation over the ordinary classification ranges.

4.1.2 Variation of erosion classification ranges

This sub-section shows results of the experiments on variations of the soil erosion classification ranges from nominal criteria.

i. Criteria 3 (Crisp Set, increase 5 % of soil erosion classification range)

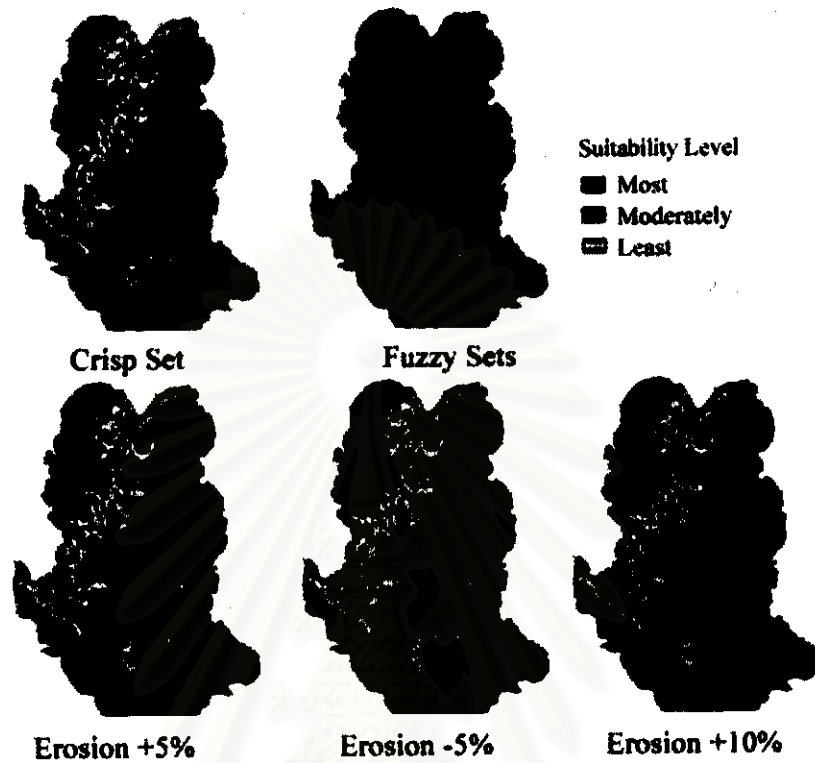
Classification in this variation is similar to criteria 1 except that the ranges of soil erosion classification were varied by increased 5 percents respectively. Figure 4-3 shows suitability levels of the physical environmental factors according to the assign conditions.

ii. Criteria 4 (Crisp Set, decrease 5 % of soil erosion classification range)

Classification in this variation is similar to criteria 1 except that the ranges of soil erosion classification were varied by decreased 5 percents respectively. Figure 4-3 shows suitability levels of the physical environmental factors according to the assign conditions.

iii. Criteria 5 (Crisp Set, increase 10 % of soil erosion classification range)

Classification in this variation is similar to criteria 1 except that the ranges of soil erosion classification were varied by increased 10 percents respectively. Figure 4-3 shows suitability levels of the physical environmental factors according to the assign conditions.



Suitability Level	% Coverage				
	Crisp	Fuzzy	Erosion +5%	Erosion-5%	Erosion+10 %
■ Most Suitable	29.50	29.13	29.50	28.89	29.50
■ Moderately Suitable	60.52	70.79	60.62	61.08	60.64
■ Least Suitable	9.97	0.08	9.87	10.03	9.86
Total	100.00	100.00	100.00	100.00	100.00

Figure 4-3 Result from Physical Constraint Analysis of Sukhothai province calculated by applied crisp set, fuzzy sets and varied by increased 5, decreased 5 and increased 10 percent of ordinary soil erosion classification range.

4.1.3 Variation of runoff classification ranges

This sub-section shows results of the experiments on variations of the runoff classification ranges from nominal criteria.

i. Criteria 6 (Crisp Set, increase 5 % of runoff classification range)

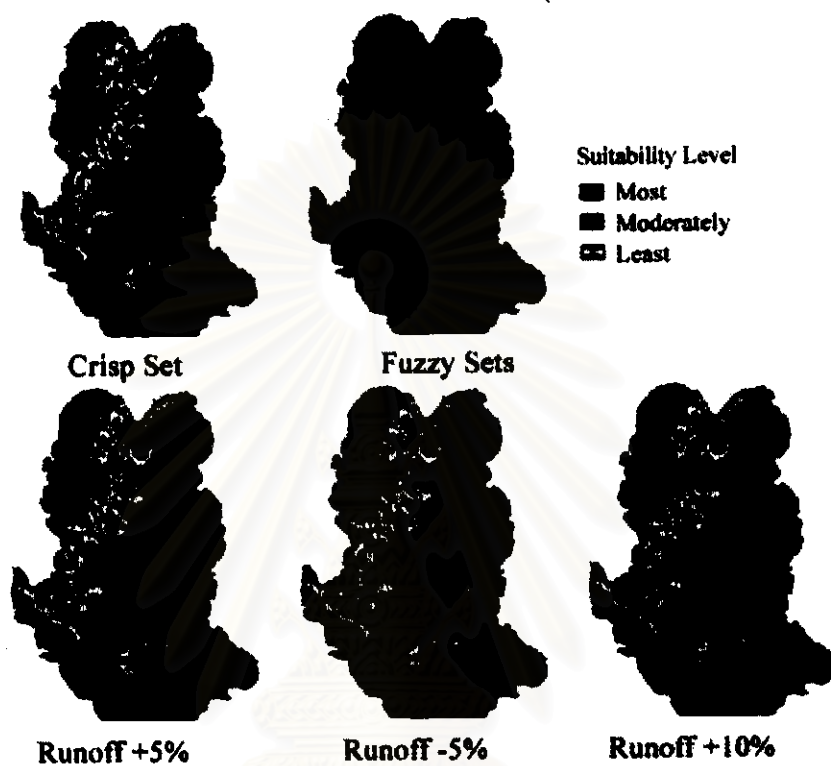
Classification in this variation is similar to criteria 1 except that the ranges of runoff classification were varied by increased 5 percents respectively. Figure 4-4 shows suitability levels of the physical environmental factors according to the assign conditions.

ii. Criteria 7 (Crisp Set, decrease 5 % of runoff classification range)

Classification in this variation is similar to criteria 1 except that the ranges of runoff classification were varied by decreased 5 percents respectively. Figure 4-4 shows suitability levels of the physical environmental factors according to the assign conditions.

iii. Criteria 8 (Crisp Set, increase 10 % of runoff classification range)

Classification in this variation is similar to criteria 1 except that the ranges of runoff classification were varied by increased 10 percents respectively. Figure 4-4 shows suitability levels of the physical environmental factors according to the assign conditions.



Suitability Level	% Coverage				
	Crisp	Fuzzy	Erosion +5%	Erosion-5%	Erosion+10 %
■ Most Suitable	29.50	29.13	29.63	29.50	29.63
■ Moderately Suitable	60.52	70.79	60.40	60.52	60.40
■ Least Suitable	9.97	0.08	9.97	9.97	9.97
Total	100.00	100.00	100.00	100.00	100.00

Figure 4-4 Result from Physical Constraint Analysis of Sukhothai province calculated by applied crisp set, fuzzy sets and varied by increased 5, decreased 5 and increased 10 percent of ordinary runoff classification range.



4.1.4 Vary Range of Groundwater Classification Range

This sub-section shows results of the experiments on variations of the groundwater classification ranges from nominal criteria.

i. Criteria 9 (Crisp Set, increase 5 % of Groundwater Depth classification range)

Classification in this variation is similar to criteria 1 except that the ranges of groundwater depth classification were varied by increased 5 percents respectively. Figure 4-5 shows suitability levels of the physical environmental factors according to the assign conditions.

ii. Criteria 10 (Crisp Set, decrease 5 % of Groundwater Depth classification range)

Classification in this variation is similar to criteria 1 except that the ranges of groundwater depth classification were varied by decreased 5 percents respectively. Figure 4-5 shows suitability levels of the physical environmental factors according to the assign conditions.

iii. Criteria 11 (Crisp Set, increase 10 % of Groundwater Depth classification range)

Classification in this variation is similar to criteria 1 except that the ranges of groundwater depth classification were varied by increased 10 percents respectively. Figure 4-5 shows suitability levels of the physical environmental factors according to the assign conditions.

iv. Criteria 12 (Crisp Set, increase 5 % of Groundwater Volume classification range)

Classification in this variation is similar to criteria 1 except that the ranges of groundwater volume classification were varied by increased 5 percents respectively. Figure 4-6 shows suitability levels of the physical environmental factors according to the assign conditions.

v. Criteria 13 (Crisp Set, decrease 5 % of Groundwater Volume classification range)

Classification in this variation is similar to criteria 1 except that the ranges of groundwater depth classification were varied by decreased 5 percents respectively. Figure 4-6 shows suitability levels of the physical environmental factors according to the assign 7 conditions.

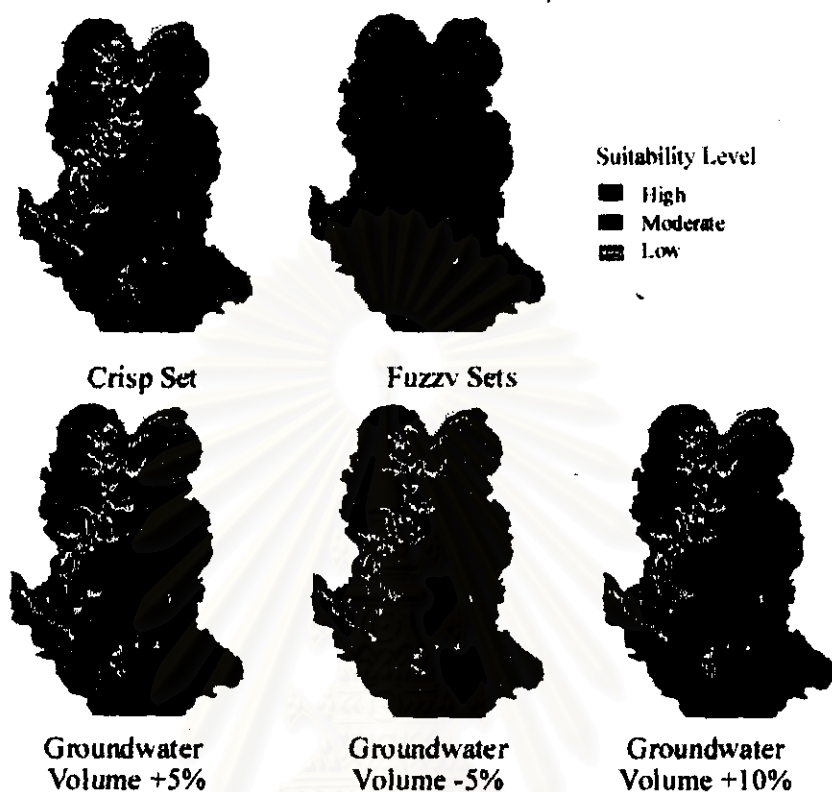
vi. Criteria 14 (Crisp Set, increase 10 % of Groundwater Volume classification range)

Classification in this variation is similar to criteria 1 except that the ranges of groundwater volume classification were varied by increased 10 percents respectively. Figure 4-6 shows suitability levels of the physical environmental factors according to the assign conditions.



Suitability Level	% Coverage				
	Crisp	Fuzzy	Erosion +5%	Erosion-5%	Erosion+10 %
■ Most Suitable	29.50	29.13	34.86	62.75	37.98
■ Moderately Suitable	60.52	70.79	55.50	36.10	52.59
■ Least Suitable	9.97	0.08	9.63	1.15	9.43
Total	100.00	100.00	100.00	100.00	100.00

Figure 4-5 Result from Physical Constraint Analysis of Sukhothai province calculated by applied crisp set, fuzzy sets and varied +5, -5 and +10 percent of ordinary Groundwater Depth classification range.



Suitability Level	% Coverage				
	Crisp	Fuzzy	Erosion +5%	Erosion-5%	Erosion+10%
■ Most Suitable	29.50	29.13	34.86	62.75	37.98
■ Moderately Suitable	60.52	70.79	55.50	36.10	52.59
■ Least Suitable	9.97	0.08	9.63	1.15	9.43
Total	100.00	100.00	100.00	100.00	100.00

Figure 4-6 Result from Physical Constraint Analysis of Sukhothai province calculated by applied crisp set, fuzzy sets and varied +5, -5 and +10 percent of ordinary Groundwater Volume classification range.

4.1.5 Vary Range of Slope Classification Range

This sub-section shows results of the experiments on variations of the slope classification ranges from nominal criteria.

i. Criteria 15 (Crisp Set, increase 5 % of Slope classification range)

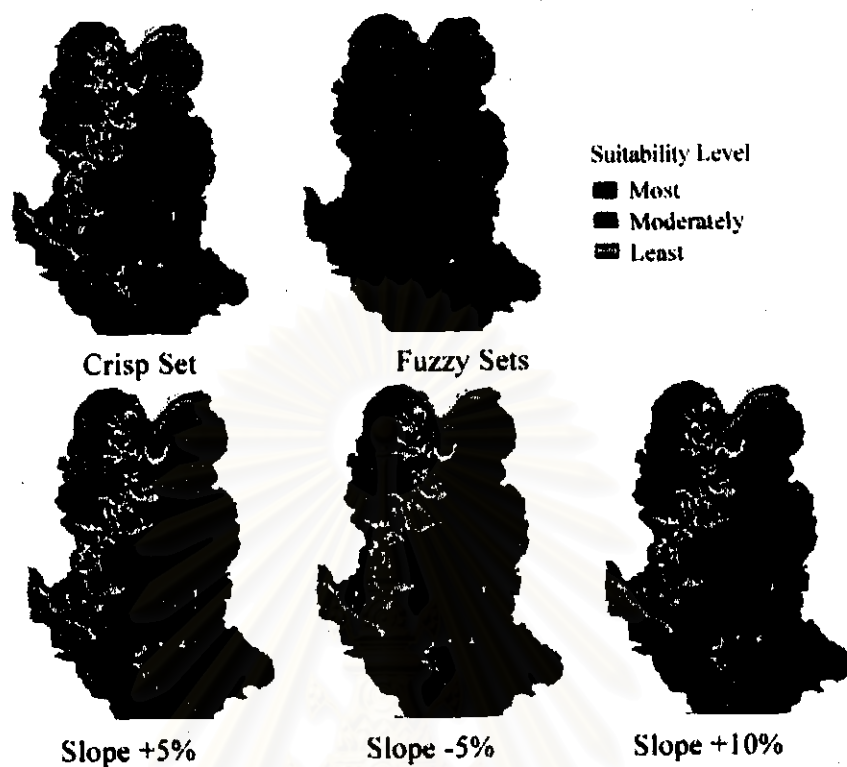
Classification in this variation is similar to criteria 1 except that the ranges of slope classification were varied by increased 5 percents respectively. Figure 4-7 shows suitability levels of the physical environmental factors according to the assign conditions.

ii. Criteria 16 (Crisp Set, decrease 5 % of Slope classification range)

Classification in this variation is similar to criteria 1 except that the ranges of slope classification were varied by decreased 5 percents respectively. Figure 4-7 shows suitability levels of the physical environmental factors according to the assign conditions.

iii. Criteria 17 (Crisp Set, increase 10 % of Slope classification range)

Classification in this variation is similar to criteria 1 except that the ranges of slope classification were varied by increased 10 percents respectively. Figure 4-7 shows suitability levels of the physical environmental factors according to the assign conditions.



Suitability Level	% Coverage				
	Crisp	Fuzzy	Erosion +5%	Erosion-5%	Erosion+10 %
■ Most Suitable	29.50	29.13	29.56	29.29	29.71
■ Moderately Suitable	60.52	70.79	60.47	60.73	60.32
■ Least Suitable	9.97	0.08	9.97	9.99	9.96
Total	100.00	100.00	100.00	100.00	100.00

Figure 4-7 Result from Physical Constraint Analysis of Sukhothai province calculated by applied crisp set, fuzzy sets and varied +5, -5 and +10 percent of ordinary Slope classification range.

4.2 Result on the effect when change the Factor weights

This section shows results where varying weight of considering factors. This section setting up the different weighting to apply to four criteria which this study setting up which are criteria to concern when finding area to development to tourist accommodation development which include physical environmental criteria which study from previous section, distance from road. This factor, represent the accessibility of transport facilities to site which selected. The distance from River was an important factor for natural tourism because of the attractive for tourist. Most of Tourist accommodate suited near the river would be quite advantageous.

There are two major constraint to concern when selected suitable area: forest and historical constrain. Both constrains are area which covered by forest and historical area conservation law. The area that covered by these constraint are prohibit to development if there have very high suitability.

i. Scenario 1 (All criteria have same weight importance, weight =

25%)



Suitability Level	% Coverage	
	Crisp	Fuzzy
☐ Restricted area	45.55	45.55
■ Most Suitable area	10.03	11.19
■ Moderately Suitable area	24.85	24.36
■ Least Suitable area	19.57	18.90
Total	100.00	100.00

Figure 4-8 Comparison of Suitable area when apply fuzzy set and crisp set and use weight in Scenario 1

ii. Condition 2 (most concern about environmental changes)

These condition given the whole weight importance to physical environment factor (weight = 100%). This condition setting represent weighting given from strongly environment expert who which to preserved environmental quality and setting environment are first condition to preserved. These condition will preserve the environmental qualities, if using these condition the environmental qualities will preserve. Then combine this condition with forest and historical constrain to generate the pairwise comparison matrix to use in MCE method to evaluate the suitable area for tourist accommodation development in Sukhothai province.







Suitability Level	% Coverage	
	Crisp	Fuzzy
 Restricted area	45.55	45.55
 Most Suitable area	25.32	25.80
 Moderately Suitable area	26.47	28.60
 Least Suitable area	2.66	0.04
Total	100.00	100.00

Figure 4-9 Comparison of Suitable area when apply fuzzy set and crisp set and use weight in Scenario 2

iii. Condition 3 (Scope on Infrastructure and Accessibility)

This condition highlighted on infrastructure and accessibility to sites by given the high levels of weight important to infrastructure support and facility factor include, transportation accessibility, river scenic distance and water supply (weight = 30%). Then given the less weight important (weight = 10%) to physical environment condition. Then combine with forest and historical constrain to generate the pairwise comparison matrix to use in MCE method to evaluate the suitable area for tourist accommodation development in Sukhothai province.

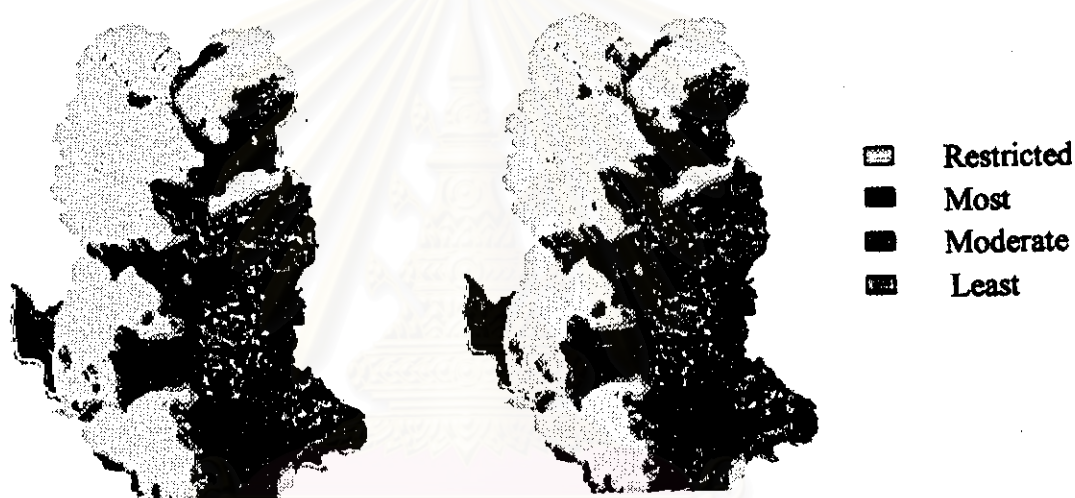


Suitability Level	% Coverage	
	Crisp	Fuzzy
<input type="checkbox"/> Restricted area	45.55	45.55
<input type="checkbox"/> Most Suitable area	5.18	6.26
<input type="checkbox"/> Moderately Suitable area	29.08	25.50
<input type="checkbox"/> Least Suitable area	20.19	22.69
Total	100.00	100.00

Figure 4-10 Comparison of Suitable area when apply fuzzy set and crisp set and use weight in Scenario 3

iv. Condition 4 (Scope mainly on physical environment)

These conditions are highlight on physical environment is the main component to concern when promoting area to tourist accommodation development. These conditions given physical environment factor are mainly condition to concern (weight = 70%) and apply the residual condition with lower weight (weight = 10%). Then combine with forest and historical constrain to generate the pairwise comparison matrix to use in MCE method to evaluate the suitable area for tourist accommodation development in Sukhothai province.

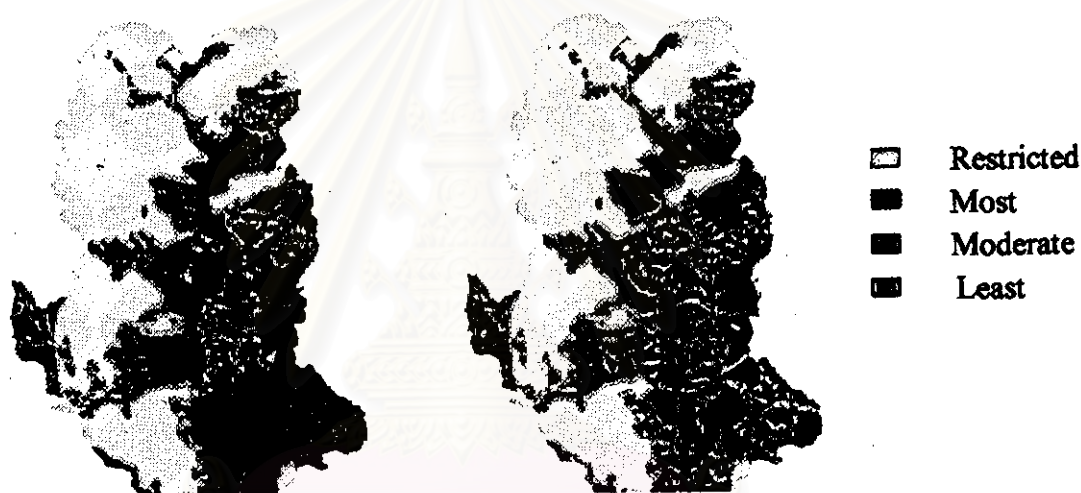


Suitability Level	% Coverage	
	Crisp	Fuzzy
Restricted area	45.55	45.55
Most Suitable area	5.94	6.88
Moderately Suitable area	26.08	25.48
Least Suitable area	22.44	22.09
Total	100.00	100.00

Figure 4-11 Comparison of Suitable area when apply fuzzy set and crisp set and use weight in Scenario 4

v. Condition 5 (Scope mainly on transportation accessibility)

These conditions are highlight on transportation accessibility is the main component to concern when promoting area to tourist accommodation development. These conditions given physical environment factor are mainly condition to concern (weight = 70%) and apply the residual condition with lower weight (weight = 10%). Then combine with forest and historical constrain to generate the pairwise comparison matrix to use in MCE method to evaluate the suitable area for tourist accommodation development in Sukhothai province.







Suitability Level	% Coverage	
	Crisp	Fuzzy
 Restricted area	45.55	45.55
 Most Suitable area	17.85	6.88
 Moderately Suitable area	25.02	25.48
 Least Suitable area	11.57	22.09
Total	100.00	100.00

Figure 4-12 Comparison of Suitable area when apply fuzzy set and crisp set and use weight in Scenario 5

vi. Condition 6 (Scope mainly on river scenic distance)

These conditions are highlight on river scenic distance is the main component to concern when promoting area to tourist accommodation development. These conditions given river scenic distance are mainly condition to concern (weight = 70%) and apply the residual condition with lower weight (weight = 10%). Then combine with forest and historical constrain to generate the pairwise comparison matrix to use in MCE method to evaluate the suitable area for tourist accommodation development in Sukhothai province.



Suitability Level	% Coverage	
	Crisp	Fuzzy
<input type="checkbox"/> Restricted area	45.55	45.55
<input checked="" type="checkbox"/> Most Suitable area	18.81	15.68
<input checked="" type="checkbox"/> Moderately Suitable area	16.16	24.81
<input checked="" type="checkbox"/> Least Suitable area	22.48	13.95
Total	100.00	100.00

Figure 4-13 Comparison of Suitable area when apply fuzzy set and crisp set and use weight in Scenario 6

vii. Condition 7 (Scope mainly on water supply)

These conditions are highlight on water supply is the main component to concern when promoting area to tourist accommodation development. These conditions given water supply are mainly condition to concern (weight = 70%) and apply the residual condition with lower weight (weight = 10%). Then combine with forest and historical constrain to generate the pairwise comparison matrix to use in MCE method to evaluate the suitable area for tourist accommodation development in Sukhothai province.



Suitability Level	% Coverage	
	Crisp	Fuzzy
Restricted area	45.55	45.55
Most Suitable area	5.84	7.11
Moderately Suitable area	17.06	17.15
Least Suitable area	31.56	30.19
Total	100.00	100.00

Figure 4-14 Comparison of Suitable area when apply fuzzy set and crisp set and use weight in Scenario 7

viii. Condition 8 (Scope mainly on physical environment)

These conditions are highlight on physical environment is the main component to concern when promoting area to tourist accommodation development. These conditions given physical environment factor are major condition to concern (weight = 40%) and apply the residual condition with minor weight (weight = 20%). Then combine with forest and historical constrain to generate the pairwise comparison matrix to use in MCE method to evaluate the suitable area for tourist accommodation development in Sukhothai province.



Suitability Level	% Coverage	
	Crisp	Fuzzy
Restricted area	45.55	45.55
Most Suitable area	9.73	9.75
Moderately Suitable area	38.60	35.19
Least Suitable area	6.12	9.51
Total	100.00	100.00

Figure 4-15 Comparison of Suitable area when apply fuzzy set and crisp set and use weight in Scenario 8

ix. Condition 9 (Scope mainly on transportation accessibility)

These conditions are highlight on transportation accessibility is the main component to concern when promoting area to tourist accommodation development. These conditions given physical environment factor are major condition to concern (weight = 40%) and apply the residual condition with minor weight (weight = 20%). Then combine with forest and historical constrain to generate the pairwise comparison matrix to use in MCE method to evaluate the suitable area for tourist accommodation development in Sukhothai province.

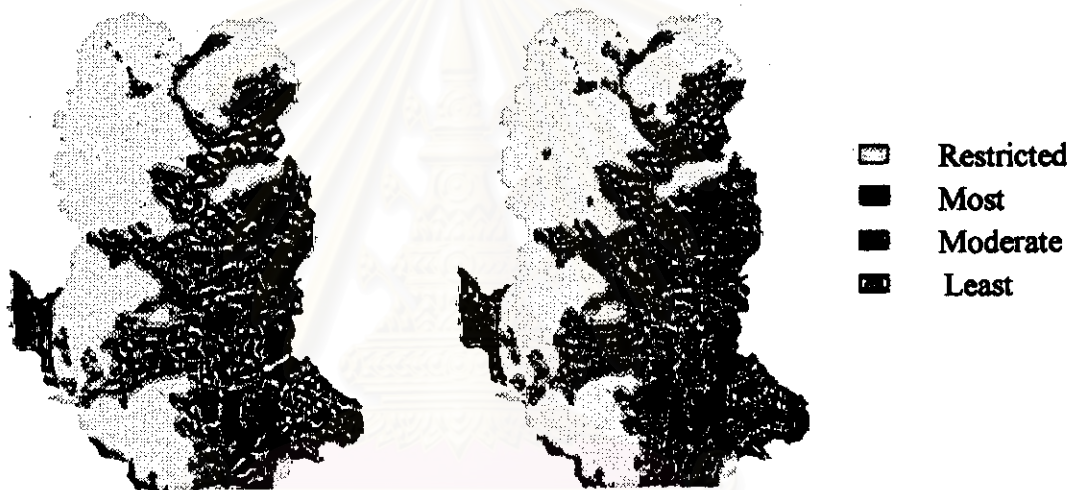


Suitability Level	% Coverage	
	Crisp	Fuzzy
☐ Restricted area	45.55	45.55
■ Most Suitable area	6.10	9.24
■ Moderately Suitable area	27.63	20.83
■ Least Suitable area	20.72	24.38
Total	100.00	100.00

Figure 4-16 Comparison of Suitable area when apply fuzzy set and crisp set and use weight in Scenario 9

x. Condition 10 (Scope mainly on river scenic distance)

These conditions are highlight on river scenic distance is the main component to concern when promoting area to tourist accommodation development. These conditions given river scenic distance are major condition to concern (weight = 70%) and apply the residual condition with minor weight (weight = 10%). Then combine with forest and historical constrain to generate the pairwise comparison matrix to use in MCE method to evaluate the suitable area for tourist accommodation development in Sukhothai province.

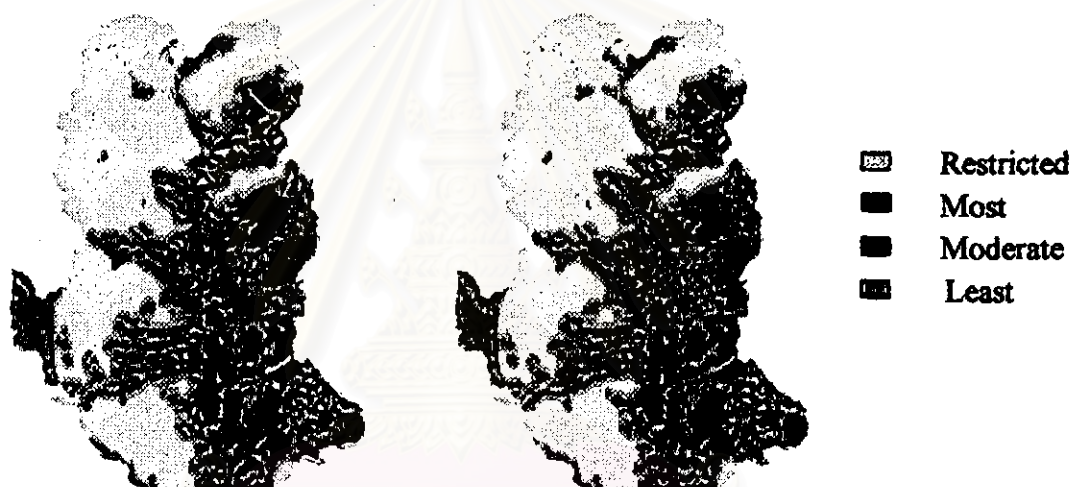


Suitability Level	% Coverage	
	Crisp	Fuzzy
☐ Restricted area	45.55	45.55
■ Most Suitable area	8.88	6.72
■ Moderately Suitable area	21.11	26.53
■ Least Suitable area	24.46	21.20
Total	100.0	100.00

Figure 4-17 Comparison of Suitable area when apply fuzzy set and crisp set and use weight in Scenario 10

xi. Condition 11 (Scope mainly on water supply)

These conditions are highlight on water supply is the main component to concern when promoting area to tourist accommodation development. These conditions given water supply are major condition to concern (weight = 70%) and apply the residual condition with minor weight (weight = 10%). Then combine with forest and historical constrain to generate the pairwise comparison matrix to use in MCE method to evaluate the suitable area for tourist accommodation development in Sukhothai province.



Suitability Level	% Coverage	
	Crisp	Fuzzy
Restricted area	45.55	45.55
Most Suitable area	7.48	8.54
Moderately Suitable area	22.51	21.90
Least Suitable area	24.46	24.01
Total	100.00	100.00

Figure 4-18 Comparison of Suitable area when apply fuzzy set and crisp set and use weight in Scenario 11