

**GIS APPLICATION ON GEOLOGICAL CHARACTERISTICS AS
THE PREDICTINGFOR SOIL EROSION IN KHAEW NOI WATERSHED,
PHITSANULOK PROVINCE**

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“ABSTRACT” In the rainy season, soil erosion is a serious problem in Khaew Noi watershed where located on Phitsanulok province. The effect of soil erosion was a lot of soil sediments eroded into rivers, muddy water and flooding. In this events had derived from deforestation, misuse of agricultural land on sloping land, and lack of the knowledge on soil conservation. Although various strategies of soil conservation have been investigated, most of them emphasize land resources, whereas geological research in rates of soil formation and soil erosion in still rare. The present study applies an integrated scientific knowledge, i.e., the Geographic Information Systems (GIS), to improve the management of geo-spatial data and support the decision-making and planning of land use in watershed. The Objective of this research applied GIS technique to study the effects of geological characteristics on degrees of rock weathering and soil erosion in Khaew Noi watershed. Among 4 from 14 sub-watershed were randomly selected. The 15 geological index were collected in the field, including degree of rock weathering, particle size, degree of rock hardness, number of joint direction, 8 joint spacing in the direction, fault, fold, and slaking index. All data were analyzed, using correlation and stepwise multiple regression to examine effects of the geological characteristics on degree of rock weathering. Soil erosion rate was calculated by using Universal Soil Loss Equation (USLE) and GIS technique. The result revealed that some geological characteristics, such as degree of rock hardness, predict 66.8% of rock weathering. When adding slaking index to the regressing model, these two geological characteristics predict 69.2% of rock weathering. Other geological indices were not significant. The average soil loss, as ranked from slight to severe, was classified at the severely level ($\geq 20 \text{ t ha}^{-1} \text{ yr}^{-1}$) in sub-watershed, which covered 49.34% of total area. Correlation between degree of rock weathering and soil erosion, as presented in overlay of maps, showed that the weathering of rock and soil erosion rate were severe in sub-watershed, Therefore, the intensive soil and water conservation measures should be practiced in these areas in order to decrease soil losses and sediments accumulation in the sub-watershed.

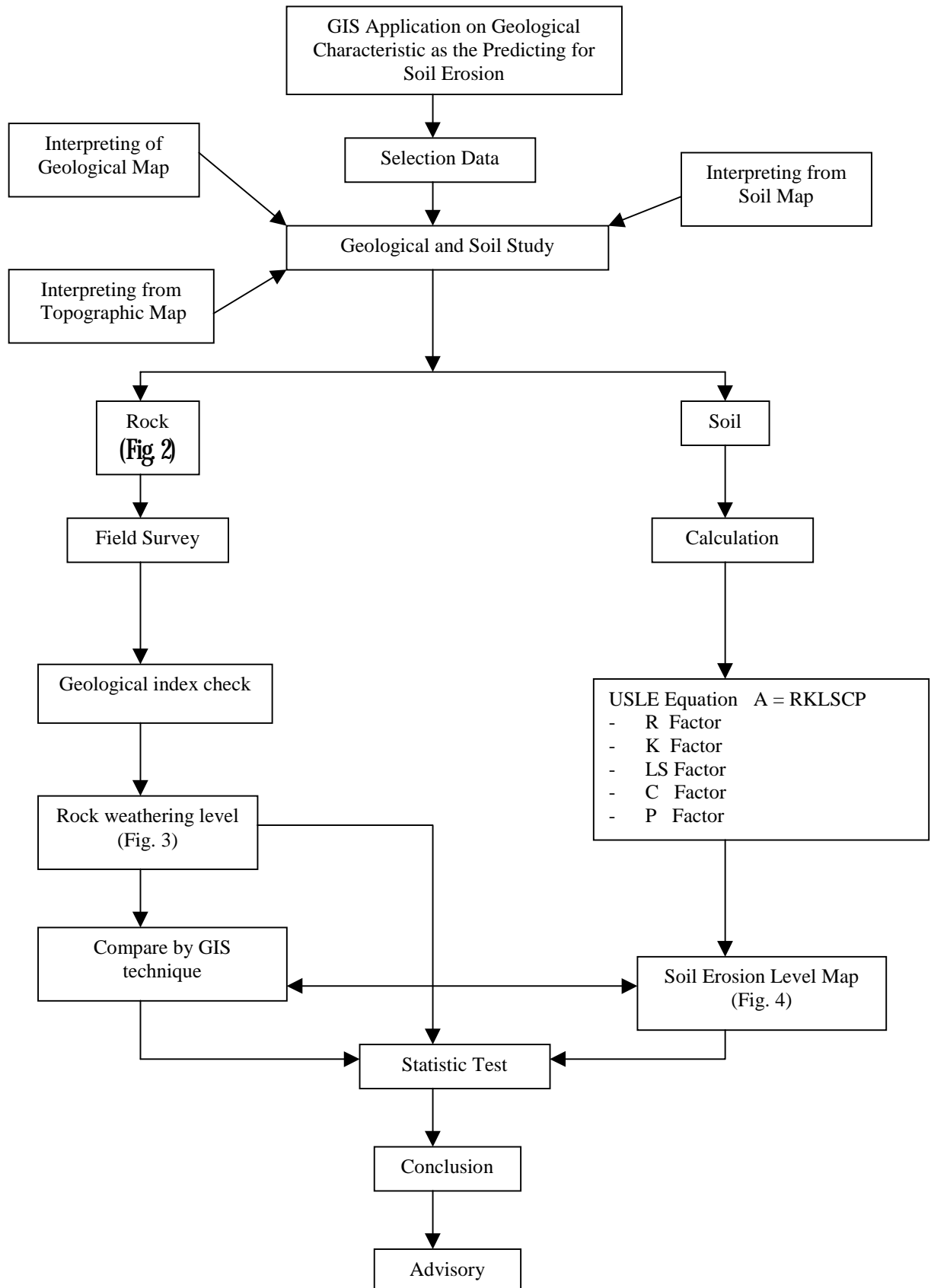
OBJECTIVES

- 1.To study the effects of geological characteristics on degrees of rocks weathering in Khaew Noi Watershed, Phitsanulok province
2. To study Soil erosion by GIS technique
3. To study the correlation between rock weathering with soil erosion

METHODOLOGY

The 15 geological index were collected from the field, including the degree of rock weathering, particles sizes, the degree of rock hardness, the number of joint direction, 8 joint spacing in the direction, fault, fold and slaking index . All data were sampled of 4 from 14 sub-watershed, and analyze by multiple correlation and stepwise multiple regression method. Universal Soil Loss Equation (USLE) and GIS technique were selected to study soil erosion . All data had been overlaid for studying the correlation and critical area for soil and water conservation. The working strategy showed as the following diagram.

DIAGRAM OF RESEARCH METHODOLOGY FOR PREDICTING SOIL EROSION



RESULTS

The 6 rock units were founded in this area including Undifferentiated formation, Khok Kroat formation, Phuphan formation, Saokao formation, Phrawihan formation and Phukraduang formation. The high weathered to strongly weathered were founded in Undifferentiated formation, Khok kroat formation, Phuphan formation. The fairly fresh were found in Saokao formation, Phrawihan formation and Phukraduang formation. The medium particles size to fine grains are always found in the rock ($2 - <1/256$ mm.). The degree of rock hardness in easy to brittle to soft were found in Undifferediated formation, Khok Kroat formation, Phuphan formation, Saokao formation and in the level hard to brittle found in Phawihan and Phukraduang formation. Two joint are direction normally in area with the NW – SE and NE – SW direction. Fault were detected in Undifferediated formation, Phuphan formation, Saokao formation, Phrawihan formation and Phukraduang formation, Fold were detected in Saokao formation, Phrawihan and Phukraduang formation. Siltstone and Claystone from Undifferentiated formation have slake index in level to change into fine particle. The result from statistic revealed that degree of rock hardness, predict 66.8% of rock weathering at .01 significance and adding with slaking index can predict 69.2% of rock weathering at .05 significance (Fig. 5).

The result of soil erosion analyze rank from slight (0 - 2 ton/ ha/yr²) to severe (>20 ton/ha/yr) and average soil loss cover 49.34% of total area were severely level (Table 1). After overlay map of both index showed that the weathering of rock and soil erosion rate were severe in subwatershed that need to have soil and water conservation to decrease soil losses and sediments accumulation in Kharw Noi watershed.

Table 1 The average of soil erosion level in sub-watershed on Khaew Noi watershed

Sub-watershed	Average of Soil Erosion Level					Area	
	1 Very Slight	2 Slight	3 Moderate	4 Severe	5 Very Severe	(Rai)*	(%)
	(0-2)	(2-5)	(5-15)	(15-20)	(>20)		
1 . Khaew Noi 2	-	2.66	-	-	-	6,223.89	0.188
2. Nam Kan	-	-	8.63	-	-	285,983.18	8.634
3. Nam Klung	-	-	9.73	-	-	201,214.36	6.075
4. Khaew Noi 1	-	-	11.22	-	-	758,597.03	22.901
5. Lam Ta Nom	-	-	13.74	-	-	155,230.74	4.686
6. Klong Chaliang	-	-	-	15.23	-	52,574.11	1.587
7. Oomsing	-	-	-	15.40	-	109,636.35	3.310
8. Phaidak	-	-	-	17.95	-	93,404.00	2.820
9. Nam Pan	-	-	-	-	20.59	90,210.36	2.723
10. Khaew Noi 3	-	-	-	-	44.52	498,262.10	15.042
11. Kam Mun	-	-	-	-	50.71	100,292.09	3.028
12. Nam Phua	-	-	-	-	77.86	217,533.34	6.567
13. Prik Kling	-	-	-	-	122.74	160,429.81	4.843
14. Nam Phak	-	-	-	-	131.50	582,849.84	17.596
						1,649,577.54	49.343

* 1 Hectare = 6.25 Rai

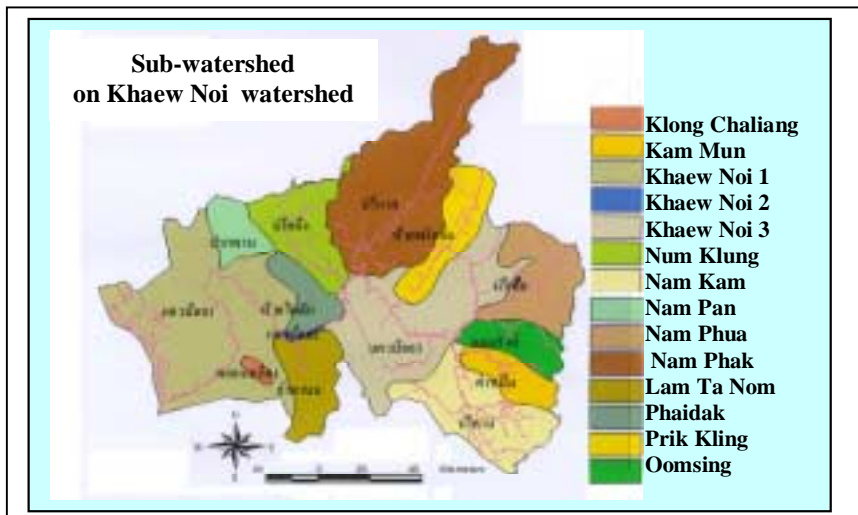


Fig. 1 Sub watershed of Khaew Noi study area , Phitsanulok province

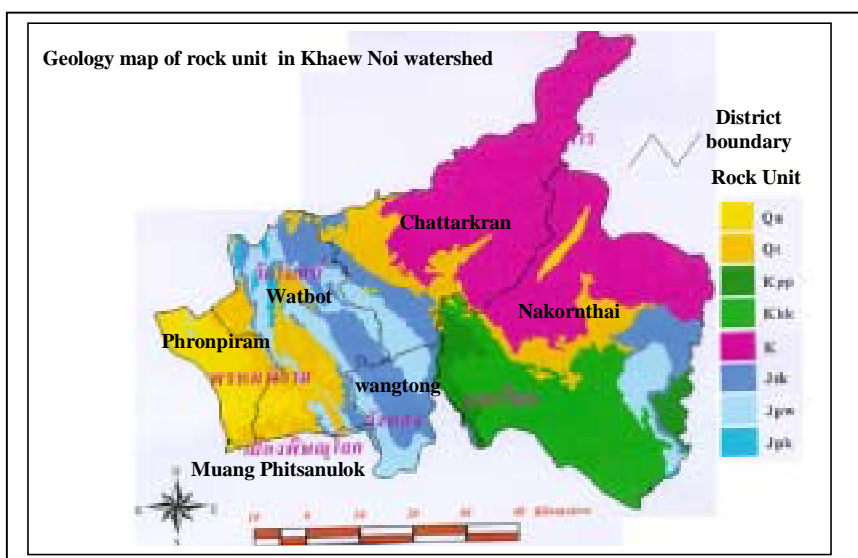


Fig. 2 Geology map of rock unit in Khaew Noi watershed

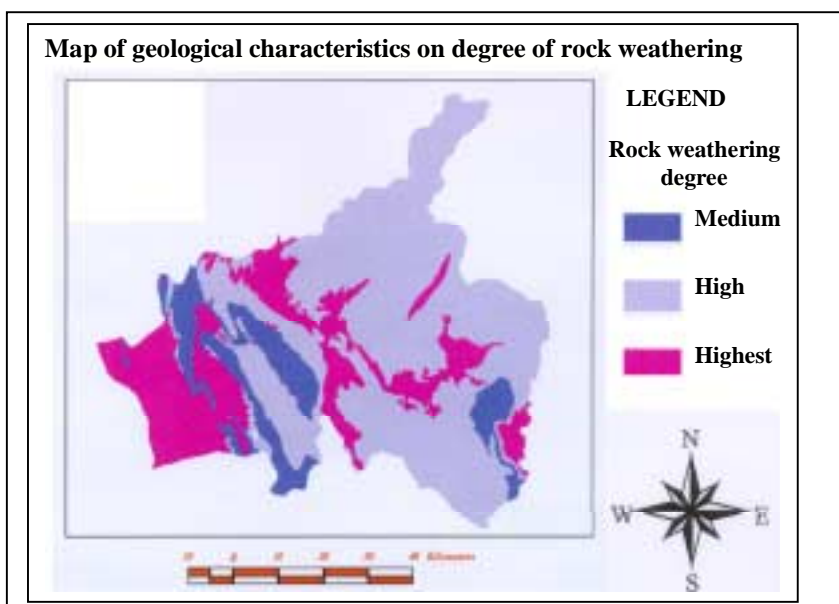


Fig. 3 Map of geological characteristic on degree of rock weathering in Khaew Noi watershed

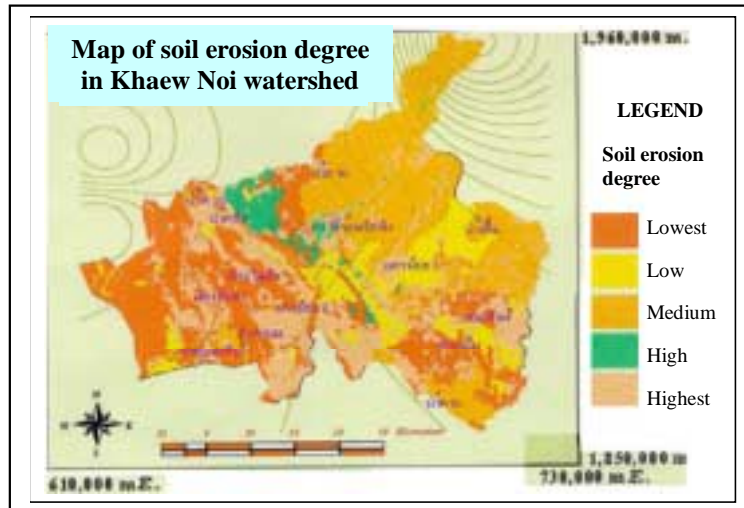


Fig. 4 Map of soil erosion degree in Khaew Noi watershed

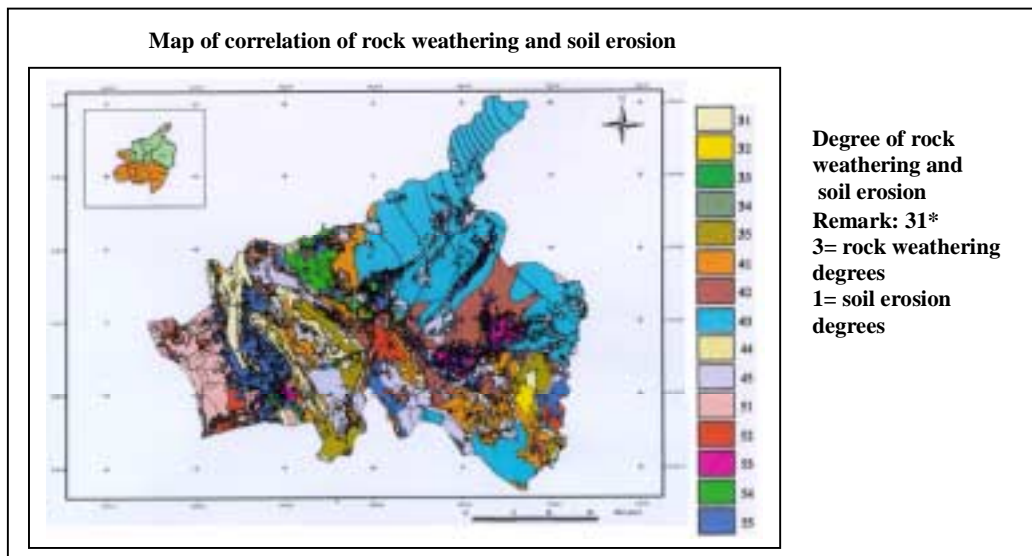


Fig. 5 Map of correlation of rock weathering and soil erosion

CONCLUSIONS

This research could be conclude that

1. The degree of rock hardness in the most influence for rock weathering and can predict 66.8% and make equation to predict the relationship for the same geological characteristic.
2. The soil erosion could rank from slight to severe.
3. The average soil loss in severely level were found in 49.34% of total area such as in Pakpan, Khaew Noi 3, Kammuen, Phuea, Prikklung and Phak subwatershed.
4. The degree of rock weathering has positive relationship with the soil erosion with .01 significance.
5. The geological characteristic have relationship with soil erosion in the lower level because of the weathering of rock is the initial stage not the main of erosion processes.

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