SW001

Assessment of Potential Irrigation Area for Agricultural Planning in Huai Samran basin, Amphoe Khukan, Sisakat Province

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Abstract

Regarding the potential irrigation area assessment, there are many criterias to consider such as water budget, topography, environment and socioeconomic, distance from channel, specific yield of runoff, rainfall, land use, percentage of slope area , and soil series. This study aimed to assess Huai Samran basin area in amphoe Khukan, Sisakat province for agricultural planning. By weighting and scoring of each criterion. Then the levels of suitability area map were constructed by using Geographic Information System (GIS). The results of an analysis showed that, 61.18% of irrigation area was moderately suitable for development. The agricultural area can be divided into 4 zones, there are highly suitable (S1) 58.51%, moderately suitable (S2) 25.17%, marginally suitable (S3) 6.04%, and not suitable (S4) 10.25%, respectively. The results of this study will be used as a guideline for sustainable agricultural planning in Hui Samran basin.

Keywords: potential irrigation area, suitability area, agricultural zoning.

1. Introduction

Thailand is an agricultural country promoting agricultural production. At present, however, however, the country faces a problem in resource exploitation particularly o nwater as a main factor for agriculture as well as industrial factor and consumption. The problem solving in water needs to be dependent on various aspects of concerned data to solve the problem such as agricultural areas, irrigational areas, areas lacking of water, data on land used, rainfall datal, etc. This aims to manage articultural areas to have a highest efficiency in agricultural management. This can be done in the form of geo-informantion system which relies on the object principle on the geo-information system. As a matter of fact, the geo-informantion sysemts is the management of geo-informantion by using computer focusing on the results in the form of a map connecting an area data table and descriptive data to be analyzed together. This is suitbalbe for using it with an analysis which a lot of data are used as well as a big area. Therefore, this study aims to manage irrigational areas in Huay Samran basin. This aims to make a plan on zoining aricultureal lanad use in Huay Samran basin. Data are analyzed in the form of a geographical.

2. Materials and Methods

2.1 Assessment of appropriateness of irrigational areas and level of the agricultural areas based on a score of the total appropriateness of each weighted factor as shown in the equation below:

$$S = \sum_{i=1}^{N} W_i F_i \qquad (1)$$

Where:

S = A weighted total score of appropriateness
Wi = Weight of variables
Fi = A score of appropriate factors
N = A number of factors

2.2 Factors on an appropriateness assessment and irrigational areas.

■ Land use - The project assessment is based on an area size, cultivation area, and cultivation of each kingd of plants. These data are needed for the assessment and need for water of the palnts. This was because the land used pand could help effective existing land use.

■ Slope – Good low and high conditions of the irrigational areas shold be constant slope, not too much planin or slope because it may have a drainage problem. In other words, too much slope may cause a problem in soil erosion while there aer water supplying and rainfall.

This surely makes water supply. That is, appropriate areas for the prjet shold have a slope between 0.1-5.0 percent.

- The ratio of amount of rainfall and reference crops evapotranspiration (ETo) – The amount of rainfall in the cultivation season is not beneficial to all plants. However, the plants can store water in a level that it is not dangerous to the plants. The proportion of rainfall which in beneficial depends on many compronents such as amount of rainfall and evapotranspiration.
- An amount of specific yield – It is the amount of rainfall which has effect on an amount of water directly used in the irrigational project. Therefore, finding a relationship of the amount of water in various time spans must not be less than 5 years. That is many statistical data have an effect on the accuracy. The specific yield value is an average value of the amount of water occurring per time unit per an water catchment area. This value will be variat based on condtions of the water catchment area (iso-yield line).
- A level of salanity of the area – The soil in the areas must have good water lock. However, it is on the basis of good drainage, low level of garouwnd water, not be acidic soil alkali soil, hight soil fertility, and resilstance of sil erosion.
- Distance from a water source – Existing irrigational areas are found not be 6 km. from a stream or river.

2.3 As assessment of appropriateness of the land.

The assessment of appropriateness of the land is making data on various physical factors to consider a level of appropriateness. It is compared with needs of plants. Also, physical factors having effection soil properties which are different are taken into consideration. This is in terms of climate condition, topographic condition, and soil properties. The consideration of soil properties is a regulation on a level of appropriateness of land use. Besides, this can assess kind of plants can be grown in the area and it can be a guideline for appropriate managemtn and improvement.

2.4 Classificaiton of a level of appropriateness of the soil for cultivation.

The classification of the level of appropriateness of the soil for cultivation employs the criteria of the FAO. This relies on the principle of the mose appropriate land for cultivation of a specific kind of palnts. This classification is on the basis of the following : highl suitable: S1, moderately suitable: S2, and marginally suitable: S3. The soil properties which are limitations for land use include temperature, and amount of rainfall, area slope, soil depth, water drainage of the soil, and soil fertility control (FAO, 1983). An assessment of soil potential which FAO (1998) had conducted a study in terms of its utilization in various forms employed 2 factors: physical environment and land use. However, land evaluation for a specific kind of plant growing needs to assess quality of the area regaridn gcompetency of the area for a highest benefit.

3. Methodology

This study was the planning on the mangemnt of Huay Samran bsisn area snd the allocation of areas for land use for sustainable agriculture.

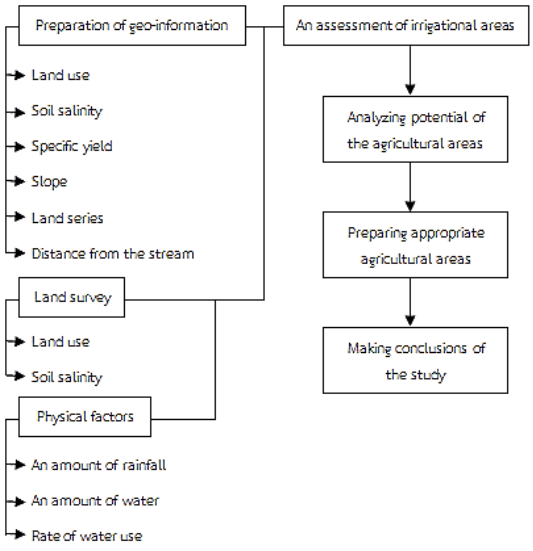


Figure 1 Flow Chat of Methodology.

4. Results and Discussions

Based on enginerring, agriucltureal, and environmental aspects of the study area, the following were found:.

4.1 An analysis of appropriatenss of the irrigational area.

This was based on the determination of weighting and score (Table 1).

Table 1 Weighting the score of appropriateness of the irrigational area in accordance with importance of the variables.

Item	Variable	Variable weight	Fixed criteria	Sequencing of appropriateness	Total score
1	Land use	10	Rice field	S1	0.40
			Cassava	S2	0.30
			Para rubber	S3	0.20
			Forest area and other	N	0.10
		Total			1.00
2	An amount of rainfall / ETo (mm.)	10	4.7-5.2	S1	0.40
			4.2-4.7	S2	0.30
			3.7-4.2	S3	0.20
			3.2-3.7	N	0.10
		Total			1.00
3	Specific Yield (Litres/second/Km^2)	20	More than 30	S1	0.80
			20-30	S2	0.60
			10-20	S3	0.40
			Less than 10	N	0.20
		Total			2.00
4	Slope percentage (%)	20	0-5	S1	0.80
			5-10	S2	0.60
			10-15	S3	0.40
			15-30	N	0.20
		Total			2.00
5	Physical appearance of the soil (%)	20	Sandy loam	S1	0.80
			Loamy sand	S2	0.60
			Clay loam	S3	0.40
			Sandy soil or clay	N	0.20
		Total			2.00
6	Soil salanity (%)	10	Less than 0.2	S1	0.40
			0.2-0.5	S2	0.30
			0.5-10	S3	0.20
			More than 10	N	0.10
		Total			1.00
7	Distance from the stream (Km^2)	10	0-3	S1	0.40
			3-6	S2	0.30
			6-9	S3	0.20
			More than 9	N	0.10
		Total			1.00

4.1.1 Score level of land use.

According to the study, it was found that most of the areas (73%) in this study wer used for agriculture, followed by forest (17%) and residential area/other activities (10%). Huay Samran bsisn had land used for agriculture most (495,675 rai) and it was mostly rice field. Thus, this study

area was very appropriate and the map proparation for land used was shown in Figure 2.

4.1.2 Score level of an amount of rainflall and evapotranspiration of reference crops (ETo) ratio.

It was found that a highest average amount of rainfall was in Huay Samran basin (102.09 mm). ETo was obtained by the computation using Penman-Monteith equation. ETo in Huay Samran basin was equivalent to 4.05 mm. Hence, the appropriateness was a moderate level.

4.1.3 Score level of an amount of specific yield of runoff.

Regarding an amount of specifific yield of basin water, it was found that Hay Samran basisn had an ananual amount of water for 1,168.71 cubic metres. The specific yield value of basin water was 18.87 litres/second/km^2 so the appropriateness was low. The map preparation of an amount of specific yield was shown in Figure 2.

4.1.4 Score level of slope percentage of the area.

Slope had an effect on the investmane of water supply system as shown in Figure 2. According to the study area, it could be seen that most of the area had 0-5 percent slope so it was very appropriate.

4.1.5 Score level of physical appearcne of the soil.

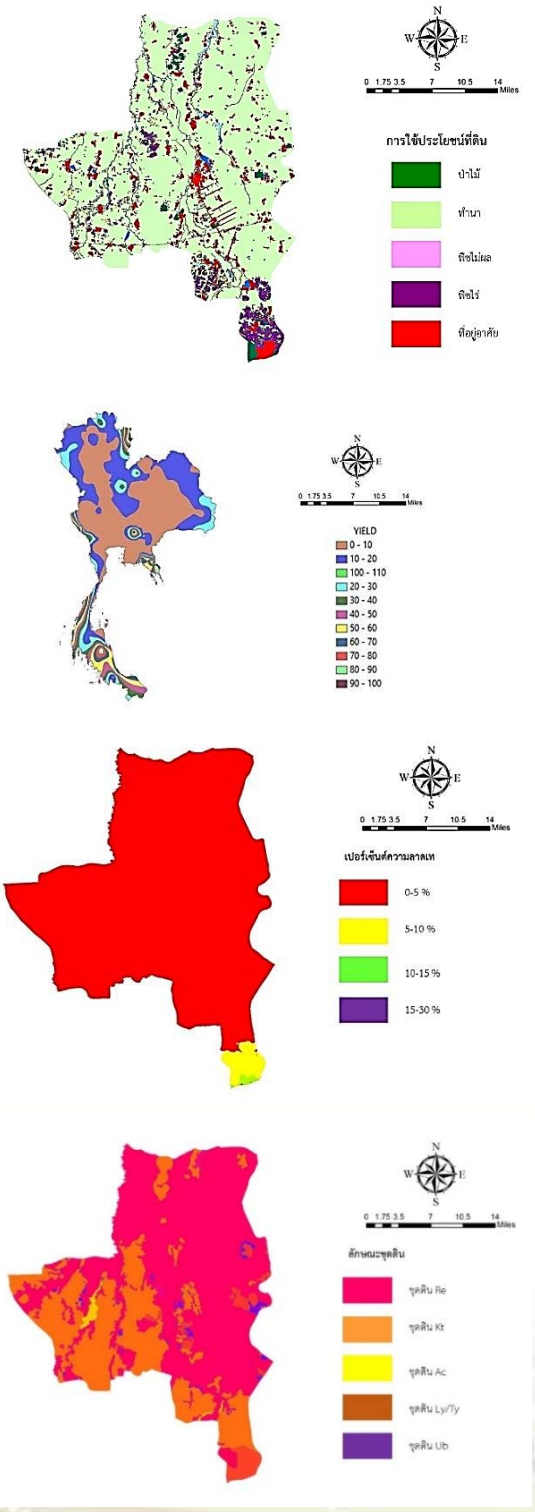
Physical appearance of the soil shown in Figure 2 showed that it was sandy loam. There was Roi-Et sery (Re) and followed by Korat sery (Kt) which was loamy sand. The rest were Ubon sery (Ub), Ly/Ty and Ac so the study area was very appropriate.

4.1.6 Score level of soil salinity.

Soil salinity in the study as shown in Figure 2 was less than 0.2 pecnet and its area was bigger than the area having soil salinity of 0.5-10 but less than the level of soil salinity of 0.2-0.5. Hence, the study area was appropriate at a moderate level.

4.1.7 Score level of distance from the stream.

It was found that most of the study area in Huay Samran basin was far from the irrigational area for not more than 15 km. so a level of appropriateness was low.



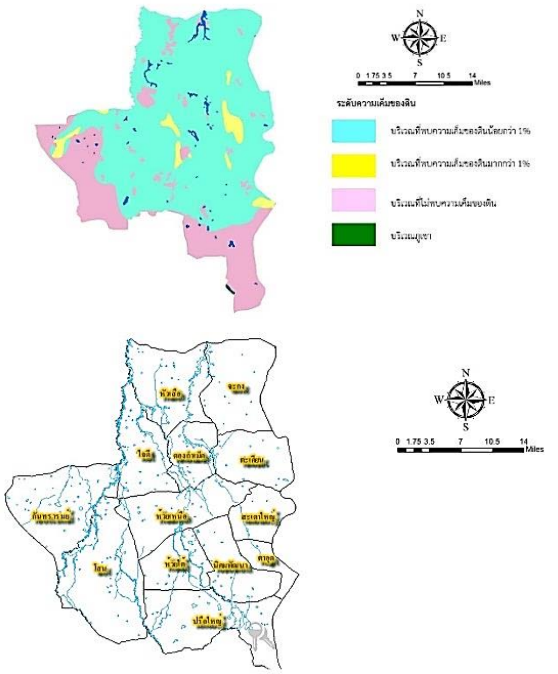


Figure 2. Maps showing levels of appropriateness of the development of irrigational area in Huay Samran basin, Khukhan district, Srisaket province.

4.2 Potential in the development of irrigational area and a guideline for agriculture zoning in the area of Huay Samran basin.

4.2.1 Potentail in irrigational area development.

Factors employed for an assessment of potential of the irrigational area included: 1) land benefit, 2) soil type, 3) soil salinity, 4) slope of the area, 5) distance from the stream, 6) an amount of specific yield and 7) ratio of amount of rainfall and ETo. It was found that the area had potential in irrigational area development at a moderate level. The area most appropriate for the develpemtn (S1) covered 103,382.89 rai or around 18.09 percent whereas S2 was found at a moderate level (346,624.66 rai or 61.8%) and S3 was found at a low level (10,307.90 rai or 1.80%) beside, an inappropriate area covered 108,112.42 rai or 18.91 percent (Table 2).

Table 2 Potentail of the area for irrigational development.

Level of appropriatencess	Area	
	Rai	%
Highly appropriate	103,382.89	18.09
Moderately appropriate	349,624.66	61.18
Lowly appropriate	10,307.90	1.80
Inappropriate (N)	108,111.42	18.91

4.2.2 A guidline for agricultural area zoning in Huay Samran basin.

According to Table 3, it was found that most of the area was suitable for growing rice (334,380.75 rai). This was followed by cassava (143,880.56 rai) and vegetagbles and tocacco (34,562.11 rai), an area covering 58,634.50 rai was not suitable for cultivation was show in figure 3. (58.5, 25.17, 6.04, and 10.25 percent, respectively).

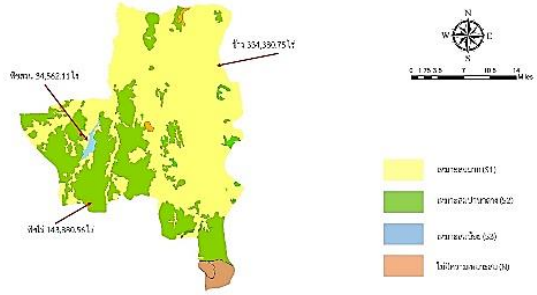


Figure 3 A map showing the arrangment of agriculture in Huay Samran basin

Table 3 An area suitable for agricultural zoning.

Leverl of appropriateness	Existing area	
	Rai	%
Highly appropriate	334,380.75	58.51
Moderately appropriate	143,880.56	25.17
Lowly appropriate	34,562.11	6.04
Inappropriate (N)	58,634.50	10.25

5. Conclusions

To judge the irrigational area, various factors must be taken into counsideration i.e. land use, amount of rainfall and ETo ratio, an amount of specific yield of soil series, level of salinity, distance from the stream, and socio-economic aspect, respectively.

According to the study, it was found that the study area mostly had land use on agriculture (73%) whereas forest area account for 17% and residential area and other activities accournt for 10%. Huay Samran basin had land use for agriculute most (495,675 rai).

Regarding an amount of raninfall and ETo in the study area, it was found that an amount of a highest average rainfall in Huay Samran basin was around 102.09 mm. The evaporation of reference water obtained from the computation of climate data based on the equation of Penman- Monteith. Its amount was found to be at 4.05 mm. for an amount of specific yield of basin water of Huay

Samran basin, it was found to be at 1,168.71 cubic metres per year on average. After, that, finding the specific yield value of basin water found to be at 28.87 litres/second/km^2.

The slope had an effect on the investment of water supply system. It could be seen that the sutyd area mostly ahd a lope level at 0-5 percent. For distance form the stdream, it was that the study area in Huay Samran mostly far from the irrigational area for not more than 15 km.

Regarding results of the study on potential in irrigational area development and a guideline for agricultural area zoning, it was found that the potential area for development had appropriateness at a moderate lovel. The area most appropriate for the development (S1) covered an area for 18.09 percent whereas an area of moderately and lowly appropriate (S2) (S3) covered an area for 61.18 and 1.80 percent respectvely. However, an inappropriate area covered 18.91 percent. Besides, it was found that the study area was mostly suitable for growing rice, followed by field corps such as cassava, vegetables and tocacco, and inappropriate for farming (58.51, 25.17, 6.04, and 10.25%, respectively).

6. Acknowledgement

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