

SHORT COMMUNICATION

CLASSIFICATION OF LAND MAPPING UNITS BASED ON SOILS AND HYDROLOGICAL CHARACTERISTICS OF CO DO DISTRICT, CAN THO CITY.

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ABSTRACT

In the Mekong Delta, soil and hydrology condition play very important parts for agricultural cultivation; therefore, the characterization-delineation of physical conditions based on soil and hydrological characteristics is the first step for land evaluation use planning. A case study of Co Do district, Can Tho city has been selected for ground truth survey, characterization and land use planning in this study. Proposed suitable land use types (LUT) (LUT1: Winter-Spring rice – Fresh water Shrimp, LUT2: Winter-Spring rice – Spring- Summer rice + Fish, LUT3: Winter-Spring rice-Spring -Summer Upland crops-Summer-Autumn rice, LUT4: Winter-Summer rice – Spring-Summer rice – Summer-Autumn rice, LUT5: Intensive Fish) have been proposed. The result of physical land evaluation through the merging of GIS and socioeconomic were run and shown that five promising land use types were selected for suitability classification and 4 land suitability zones were identified.

INTRODUCTION

Now, the information concerning the classification of agricultural resources has been limited to rather rough criteria based agro-ecological, *i.e.* irrigated, rainfed lowland, upland, and deep water for paddy field (Herdt and Riely 1987). Land evaluation is the assessment of land performance when used for specified purposes. As such it provide a rational basis for talking land use decision based on analysis of relations between land use and land, giving estimates of required inputs and projected outputs (FAO 1986). A study on the method that will be developed for evaluation of the degree of suitability for physical evaluation based on potential capability of producing rice crop and economic social data in the Co Do district was done by using GIS technique in this paper.

RESEARCH LOCATION DESCRIPTION

1 Location and physical condition

Co Do district located in the Can Tho city, in the East is Phong Dien district, in the Western-South is Kien Giang province, in the Western-North is Vinh Thanh district, in the South is Hau Giang province, in the North is Thot Not district. Total area is 40,256.41 ha including 12 villages and 02

towns. Population total is 174,752 people.

The climatic conditions are similar with two distinct seasons, dry and rainy ones. The dry season starts from January to May, while the rainy one starts from May to December. Total rainfall of the region about 1,700-2,000 mm/year, however, most of 90% rainfall concentrated in the rainy season, while there is no rain in February and March. Rainy season begins from May to December, and dry season begins from December to May. In the rainy season, there is drought spell occurrence, which harmful for cropping season. However, the hydrology conditions of the district are quite suitable for agricultural even though drought spells occurred. Temperature of the district is nearly stabilized in the year, average temperature is about 27.3⁰C, highest temperature drops in May (29.6⁰C), and lowest is in December (25.3⁰C). The district exhibits high air humidity, especially in the rainy season, the highest is in September (91%), and the lowest is in the dry season (79 – 82%). Generally, the climatic conditions of Co Do district are similar to other districts or cities; it is belong to the climatic regime of the region, which suitable for the agricultural development. The inundation depth will effect to the type of crops, cropping system,

and the development of fishery. The inundation of Co Do district is affected by the tidal regime. It receives water from Can Tho river. Since maximum depth of inundation is high, ranging from 30 cm to 150 cm depth.

There are three major soil types in Co Do district, and the largest area belongs to alluvial soil P(f)g, with 27,744.39 ha. Second is acid sulfate soil (SJ) in which pyritic layer depth often occurred at more than 80 cm from soil surface. These soil types presently not harmful for crops, but if it exposed to the surface such as for raised bed, pond making, etc. it will be oxidized and released a lot of toxicity as Al^{3+} , Fe^{2+} , total acid, and low pH. Final major soil type is land tenure consisting of home and fruit garden.

METHODOLOGY

Various types of originally collected and derived data were used in the study. The basic data sources were (a) Occurrence the sulfidic horizon map, (b) Inundation map, (c) Time of inundation maps, (d) Socio-economic data gathered through field survey, and (e) other published and unpublished information, such as agricultural statistics, and soil reports.

Physical land evaluation used the limiting factor method for assigning the suitability classes, in which the lowest suitability class will limit for the rest of factor, and the overall suitability class will be the lowest suitability class. This methodology applied for evaluation the physical suitability of the study area as the same method suggested by FAO (1986)

Promising land use types (LUTs) in the study area

In order to select relevant land use types in a specific area, the following criteria were established:

- 1 Objectives of government's development policies: (i) increasing the efficient of land use and management in order to improve a living standard of farmers in the district; (ii) developing new models, this may increase farm income and protect environment

- 2 Development targets which can be reflected in the present land use systems: (i) increasing crop production per ha; (ii) increasing income of farmers; (iii) increasing areas of intercropping with upland crop and aquaculture; and (iv) trials of land use system model.

Based on those reasons and objectives, five promising land use types (LUTs) were selected for study on land suitability classification in Co Do district, that is:

LUT1: WS rice – SA-AW Fresh water Shrimp

LUT2: WS rice – SS rice + Fish

LUT3: WS rice – SS Upland crops- SA rice

LUT4: WS rice – SS rice – AW rice

LUT5: Intensive Fish

(WS: Winter-Spring; SS: Spring-Summer; SA: Summer-Autumn; AW: Autumn-Winter)

Physical land suitability classification method

Land mapping unit of the study area has been created based on the physical conditions of the study area. Various types of originally collected and derived data were used in the study. All maps at the scale of 1/50.000. The basic data sources were

- 2 Depth of pyritic layer map
- 3 Administrative boundary maps
- 4 Depth of inundation map
- 5 Time of inundation map

The diagnostic factor and factor rating for different land use types is showed in Table 1.

Matching for suitability classification

Comparing characteristics and qualities is to determine the suitability of a particular LMU for a specific land use type. The final reclassified map is the suitability map of selected land use type. In order to classify for the suitability classes, the GIS reclassification method will be applied, which:

S1: Highly suitable

S3: Marginally suitable

S2: Moderately suitable

N: Unsuitable

Table 1: Diagnostic factors and factor rating of physical conditions for different land use types in the Co Do district.

Factor rating	Suitability Classes			
	S1	S2	S3	N
LUT 1: WS rice – SA-AW Fresh water Shrimp				
Depth of pyritic layer (cm)	Non-pyrite, 80-120	50-80	<50	-
Time of inundation (month)	< 3	4	-	> 5
LUT2: WS rice – SS rice + Fish				
Depth of pyritic layer (cm)	Non-pyrite, 80-120	50-80	<50	-
Time of inundation (month)	< 3	4	-	> 5
LUT3: WS rice – SS Upland crops- SA rice				
Depth of pyritic layer (cm)	Non-pyrite	80-120	50-80	<50
Time of inundation (month)	< 2	3	4	> 4
LUT4: WS rice – SS rice – SA rice				
Depth of pyritic layer (cm)	Non-pyrite, 80-120	50-80	<50	-
Time of inundation (month)	< 2	3	4	> 4
LUT5: Intensive Fish				
Depth of pyritic layer (cm)	Non-pyrite, 80-120	50-80	<50	-
Depth inundation (cm)	<60	60-100	>100	-

RESULTS AND DISCUSSION

The evaluation is physical land evaluation and social data evaluation, which can be combined if it necessary for land use planner, the physical land evaluation mainly based on the physical conditions in which soil, hydrological conditions are the main factors for developing the criteria, but the socio-economic only considered in the part of description of land use types. The result of land evaluation can be used for planning based on physical condition.

Land mapping units of the study area

Land mapping units are adopted as a basis for land evaluation in this study. These units are based

on combinations of inundation depth, inundation time, and sulfidic layer depth occurrence. There are 20 land map units, which is identified in Co Do district. The description and extent of land mapping units are shown in Table 2 and Figure 1.

Physical suitability classification

Land suitability classification involves the comparison of the land qualities of a land mapping unit (LMU) or the values of the diagnostic factors for a LMU with the requirements of a LUT (expressed in terms of factor ratings). This comparison is part of matching process. These partial suitability for separate land qualities must be combined to come the overall suitability of the LMU for the LUTs. The land suitability classification is following the general methodology for land evaluation. The result is based on the comparison of the land qualities of each of the land mapping units with the requirements of each LUT which are expressed in terms of factor ratings. In assessing suitability for crop combinations, the first step is to obtain suitability assessments for each the crops concerned. In general, the suitability for a cropping system based on two or more crops will not be higher than the lowest of the crop assessments. The results of the land suitability classification were shown in Table 3.

Table 2: Extent of soil units in Co Do district

Id-LMU	Symbol	Depth of pyritic layer (cm)	Depth of inundation (cm)	Time of inundation (month)	Area (ha)	(%)
1	P(f)g	Non pyrite	30-60	2	3304.68	8.21
2	P(f)g	Non-pyrite	30-60	3	2626.46	6.52
3	P(f)g	Non-pyrite	60-100	2	2048.47	5.09
4	P(f)g	Non-pyrite	60-100	3	14666.74	36.43
5	P(f)g	Non-pyrite	60-100	4	1918.90	4.77
6	P(f)g	Non-pyrite	100-150	3	3179.14	7.90
7	SJ1	0-50	30-60	2	17.46	0.04
8	SJ1	0-50	60-100	3	532.05	1.32
9	SJ1	0-50	60-100	4	345.14	0.86
10	SJ1	0-50	100-150	3	502.34	1.25
11	SJ2	50-80	30-60	2	71.65	0.18
12	SJ2	50-80	60-100	2	33.80	0.08
13	SJ2	50-80	60-100	3	873.62	2.17
14	SJ2	50-80	60-100	4	394.16	0.98
15	SJ2	50-80	100-150	3	74.14	0.18
16	SJ3	> 80	60-100	2	78.97	0.20
17	SJ3	> 80	60-100	3	3505.17	8.71
18	SJ3	> 80	60-100	4	1104.01	2.74
19	SJ3	> 80	100-150	3	1107.34	2.75
20	Home-Fruit gaden				3871.67	9.62
	Total				40,256.41	100

Table 3: Present land suitability classification and area of LUTs in Co DO district.

Code	Classification		LUT1	LUT2	LUT3	LUT4	LUT5
1	S1	(ha)	5931.14	5931.14	5353.15	5432.12	5931.14
		(%)	14.7	14.7	13.3	13.5	14.7
2	S2	(ha)	24695.5	24695.5	25163.82	26138.06	24695.5
		(%)	61.4	61.4	62.5	64.9	61.4
3	S3	(ha)	894.65	894.65	4470.29	4814.56	5758.11
		(%)	2.2	2.2	11.1	12	14.3
4	N	(ha)	4863.45	4863.45	1397.49	-	-
		(%)	12.1	12.1	3.5	-	-
5	Home-Fruit garden	(ha)	3871.67	3871.67	3871.67	3871.67	3871.67
		(%)	9.6	9.6	9.6	9.6	9.6
Total			40256.41	40256.41	40256.42	40256.41	40256.42

*LUT1: WS rice – SA-AW Fresh water Shrimp; LUT2: WS rice – SS rice + Fish;
LUT3: WS rice – SS Upland crops- SA rice; LUT4: WS rice – SS rice – SA rice; LUT5: Intensive Fish*

From the results shown in Table 3, the zoning of land suitability classification were established. The land suitability classification zones are as basis for land use planning in term of physical conditions.

The district area was zoned to fourth types. The details of land suitability zones were shown in Table 4 and Figure 2.

Table 4: Zoning land suitability classification of land use types in the Co Do district.

Zone	LMUs	Suitable classes Propose land use types	Area	
			(ha)	(%)
I	1,2,3,4,5,11,12,13,14,16,17,18	Highly suitable LUT 1,2,3,4,5	30626.63	76.1
II	7,8,9	Medium suitable LUT 1,2,4,5	894.65	2.2
III	6,15,19	Medium suitable LUT 3,4,5	4360.62	10.8
IV	10	Highly suitable LUT 4,5	502.84	1.3
	Home-Fruit garden		3871.67	9.6
	Total		40256.41	100.0

*LUT1: WS rice – SA-AW Fresh water Shrimp; LUT2: WS rice – SS rice + Fish;
LUT3: WS rice – SS Upland crops- SA rice; LUT4: WS rice – SS rice – SA rice; LUT5: Intensive Fish*

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

- 6 The results of land evaluation showed that five promising land use types were classified for suitability of 20 land mapping units in the Co Do district, in that four zones for suitable classification of land use types were identified.
- 7 LUT4 and LUT5 have the largest area that gives high suitability of land under those conditions.

Recommendations

- 8 This study is just to evaluate to the suitability classification of land use types based on the highly physical classification of land mapping units. Therefore, it just gives primary results.
- 9 For further study, we propose to select more socio-economic characteristics for land use requirements in combination to the physical characteristics in the same land unit.

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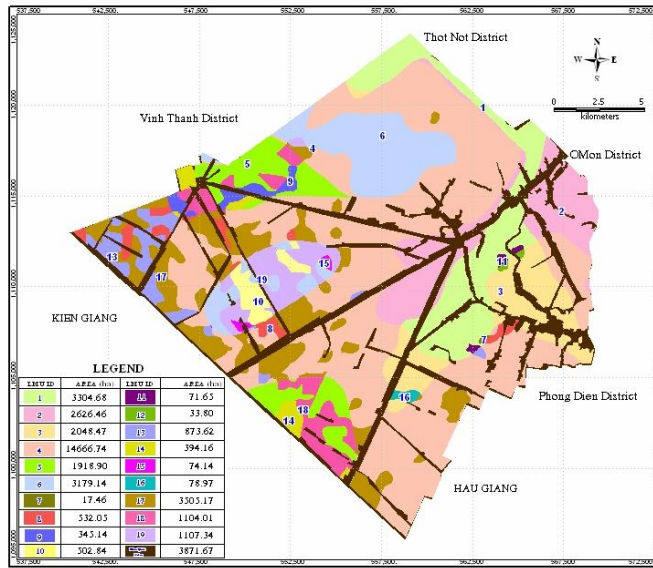


Figure1: Land Mapping Unit of Co Do district

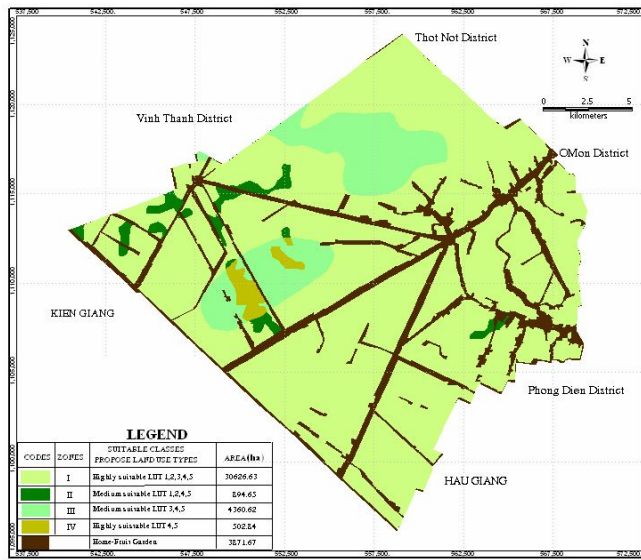


Figure 2: Zoning of land suitability classification of Co Do district

Đất và thủy văn đóng vai trò rất quan trọng trong canh tác nông nghiệp ở Đồng Bằng Sông Cửu Long, do đó mô tả các đặc tính đất đai theo điều kiện tự nhiên dựa trên các đặc tính đất và thủy văn là cơ sở đầu tiên cho đánh giá quy hoạch sử dụng đất. Khảo sát thực địa, mô tả các đặc tính và kế hoạch sử dụng đất đã được thực hiện ở huyện Cờ đô TP Cần Thơ. Với 5 kiểu sử dụng thích nghi được đề nghị với LUT1: Lúa ĐX – Tôm càng xanh (HT-TĐ), LUT2: Lúa ĐX – Lúa XH + Cá, LUT3: Lúa ĐX- Mầu XH- Lúa HT, LUT4: Lúa ĐX – Lúa XH–Lúa HT, LUT5: Chuyên Cá. Kết quả của sự đánh giá đất đai theo đặc tính tự nhiên thông qua sự kết hợp công cụ của GIS và số liệu kinh tế xã hội được thực hiện cho thấy 5 kiểu sử dụng thích nghi có triển vọng đã được đề nghị và 4 vùng thích nghi đã được phân lập.