
Regional approach of the agricultural dynamics in amphoe Bang Len: regional factors of rice intensification and diversification and interest for the monitoring of changes with a G.I.S.

Eric Mollard¹, Supan Karnchanasutham², Yupa Limsawad

Abstract: *The objective of the study is to map the dynamics of diversification and rice intensification in Amphoe Banglen , Nakornpatom Province , Thailand using Remote Sensing and Geographic Information System (GIS). The main changes in Amphoe Banglen showed by mapping the land use in 1988 and 1995 using Satellite imagery TM of different years and seasons with highlighting the regional determinants (ecological, social ,other dynamics). In the future, the monitoring of change in rice cultivation might be improved by designing adequate tools mixing and leād to be instrumental in upgrading a GIS in charge of agriculture by monitoring the changes and by including social characteristics of the farms response to aiding farmers diversification government policies.*

1 Introduction

The Chao Phraya Delta constitutes a core area of the Thai economy , agriculture and history. Although most of the Delta was reclaimed only quite recently, it has undergone deep transformations over the last 150 years. Just as past changes often started in the Chao Phraya Delta then spread to other regions of Thailand.

Major trends in the agriculture of the Chao Phraya Delta are intensification, diversification and mechanization. Rice has been the most important economic crop in terms of both domestic consumption and export. Thailand is ranking first among the world rice exporters with the income of hundreds million baht.

Now a day, it is rapidly change in agricultural dynamics especially in the Chao Praya Delta not only on the areas but also in socio-economic and ecological characteristics. Geographic Information System (GIS) ,the integration between spatial and attribute data, is therefore necessary for the change monitoring of rice intensification and diversification which will eventually lead to aiding farmers diversification policies decision making.

¹ IRD, Agroeconomist

² Office of Agricultural Economics - Remote Sensing and GIS

2 Objectives

- 1). Mapping of the dynamics of diversification and rice intensification in Amphoe Banglen.
- 2). Highlighting the regional determinants (ecological, social, other dynamics).
- 3). Upgrading of a GIS by monitoring the change and including layers of social features.

3 Materials and Equipment

Several dates LANDSAT TM images acquired between early January and early July 1988 with early March 1994 and lately December 1995 were used. The band combination was always TM band 2 as blue, TM band 3 as green and TM band 4 as red.

The format and the support of the satellite images were chosen to optimize the cost / benefit of the data.

In areas of very intense rice cultivation, we used quarter scene images on positive transparency and the Procom enlarger. For less intense areas we used full screen transparencies. The transparency provides finer details than the print.

TABLE 1 : LIST OF LANDSAT TM IMAGES USED

Path – Row	Date
129-50	1988-01-10
	1988-02-27
	1988-03-14
	1988-03-30
	1988-08-05
	1995-12-31
130-50	1989-02-20
	1992-12-13
	1993-01-30
	1993-03-19
	1994-03-06

Some ancillary data were also used.

1. Topographic maps at a scale of 1:50,000
2. Irrigation maps and irrigation plans of 1988
3. List of rice growing villages and crop calendars
4. Procom 2 projector compositor system

4 Methodology

4.1 Ground data collection

The purpose of the ground data collection was to define the satellite image interpretation keys. These keys vary from one area to the other. This activity was also carried out to estimate the yields of the rice crop. The field work was based on the information from the rice calendar. The number of sample sites per area varied between 10 and 40 depending on the surface, the distribution and the homogeneity of the crop.

4.2 Visual interpretation approach

The interpretation was performed using the color positive transparencies at the original scale of 1:1,000,000

The interpretation of the transparencies was done using an optical – mechanical projector called 'PROCOM'. Because of its zooming and roaming capabilities, the PROCOM allows the superposition of the satellite image onto the map and working directly at the map scale without the use of looking through viewers. Using this equipment, the images were optically enlarged to match with the base maps at the scale of 1:50,000

The interpretation was based on the spectral properties of the crop as well as other characteristics such as tone, shape, size, pattern and temporal changes. The color of the crop rice and upland crop appear in various tones related to the stages of growth.

The blue represents flooded area before the rice is planted. A dark blue color is related to the depth and cleanliness of the water.

The reddish blue represents the area of rice cultivation when the crop is at an early stage. The canopy does not cover the ground completely. Therefore, the color on the image is a combination of the soil (or water) and the rice.

The bright red means that the rice is very healthy and covers the ground completely.

Pale yellow – white represents the areas where the second crop rice has been recently harvested. The sensor records the rice stubble reflectance.

The bright orange represents the areas where the sugarcane is planted and covers the ground completely.

The dark red represents the areas where the tree is planted.

The reddish orange represents the areas where the orchard is planted.

The white pale represents the areas where is no planted call bare soil.

The dark blue represents the fish pond areas.

The white blue represents the built up area.

4.3 The application of GIS and remote sensing

A geographic information system was used for monitoring the landuse of Amphoe Banglen, Nakornpatom province. The input for the landuse data of the different years was based on remote sensing.

From the Thematic Mapper satellite data of 1988 and 1995 a visual interpretation classification on landuse was made.

This resulting map as well as the existing landuse maps with scale 1:50,000 , based on visual interpretation from 1988 and 1995, were digitised for input in the GIS.

Other existing maps on administration, transportation, irrigation were also digitised.

Data conversion from the existing map into digital format by compiling such maps from relevant agencies. The converted relevant maps include:

1).Irrigation map obtained from the Royal Irrigation Department (RID) comprises both irrigation and non – irrigation zones.

2).Road network map, at scales of 1:1,000,000 and 1:250,000 obtained from the Department of Highway and the Royal Thai Survey Department, includes:

2.1) Road comprises:

- Highway with number
- Provincial road with number
- Road under the office of Accelerated Rural Development
- Dirt road and etc

2.2) Railway

2.3)Road along irrigation canal

3).Administrative boundary map, at a scale 1:50,000 obtained from the National Statistical office, includes: Province boundary, District boundary , Sub – district boundary, Locations of province , district and sub – district offices

4). Land use map, at a scale 1:50,000 obtained from 1988 and 1995

Satellite image interpretation by OAE, includes the following categories:

Landuse type	Code
Paddy field	
Rice 0 (4-7/ 9-12) , (growing / harvesting)	Ri 0
Rice 1 (11-2 / 4-7) , (growing /harvesting)	Ri 1
Rice 1,3 (12-3 / 5-8) , (growing /harvesting)	Ri 1,3
Rice 3 (2-5 / 6-9) , (growing /harvesting)	Ri 3
Field crops	
Sugarcane	Su
Horticultural crops	
Orchard , Mixed orchard	Or
Tree crops (Standing trees)	
Trees along the road or riverene trees	Tr
Standing trees in the village	Tr
City , Village	Ur
Fish pond	Fi
Bare soil	Ba
Other	Ot

Data analysis was carried out by using Intergraph GIS and Oracle softwares under Window NT operating system the steps are follows:

1. Project construction and database establishment to integrate spatial information, obtained from digital map, and attribute information so called topology.
2. Data analysis was undertaken by overlaying of multi-layer spatial information.
3. Calculate the land use area in each year and classes.

5 Results

The results comprise 2 types of information: landuse map of 1988 and 1995 in Amphoe Banglen and classification areas which was ranged into 10 classes. They are:

4. RICE0 (4-7/9-12) refers to rice planted from April to July and harvested from September to December.
5. RICE1(11-2/4-7) refers to rice planted from November to February and harvested from April to July.
6. RICE1,3 (12-3/5-8) refers to rice planted from December to March and harvested from May to August.
7. RICE3 (2-5/6-9) refers to rice planted from February to May and harvested from June to September.
8. Sugarcane
9. Tree
10. Orchard
11. Bare soil
12. Fish pond
13. Other

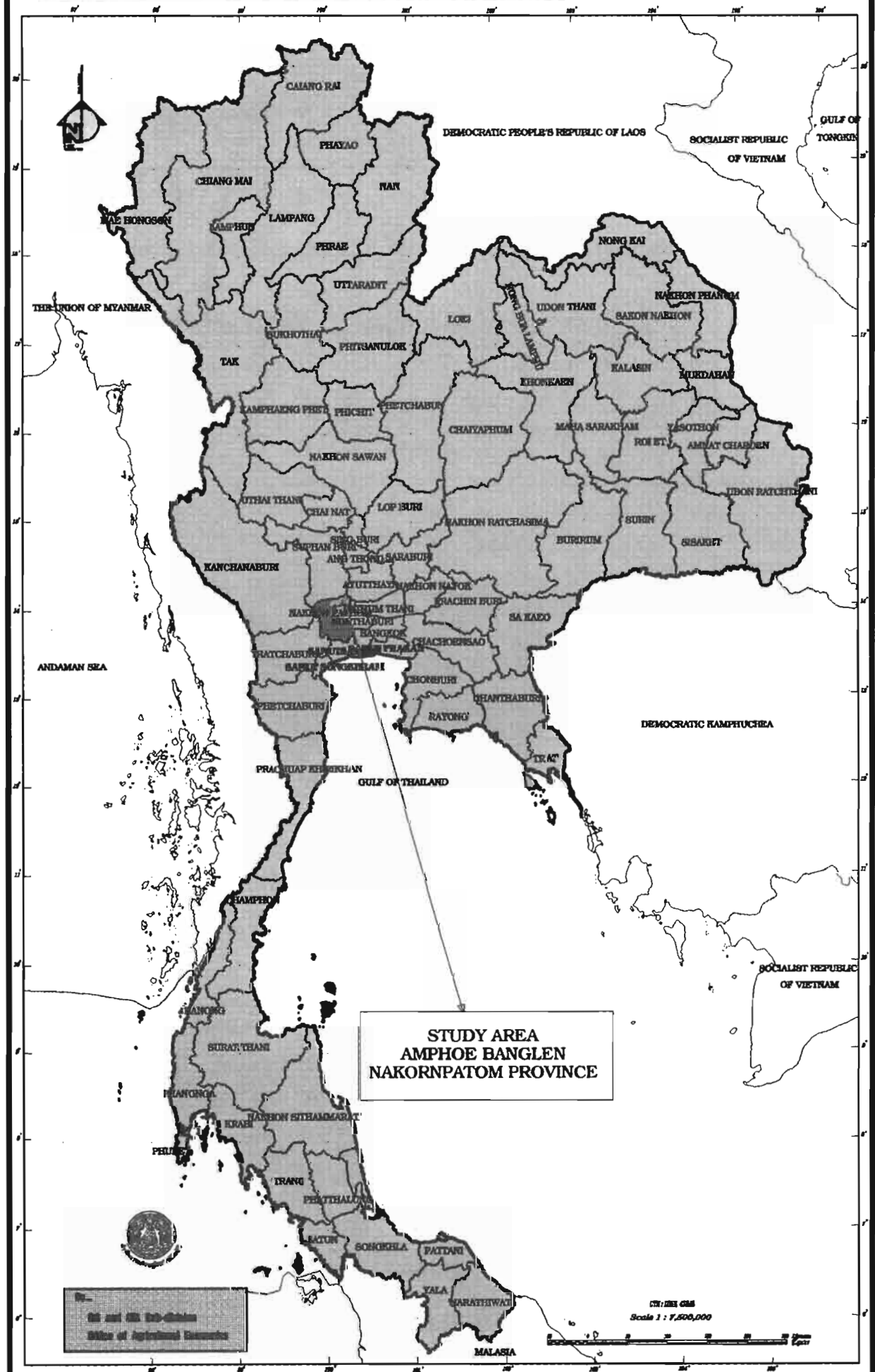
6 Discussion and conclusion

Satellite imagery TM of different years and seasons have been used to map the land use in 1988 and 1995, as well as the main changes in Amphoe Banglen. A questionnaire to farmers in 40 villages in 15 tambons (simple random sampling) will make possible to thoroughly define the changes and to try of explain the particular locations of the change by mapping regional factors such as risk, historical patterns, risk attitude, tenure (given by the Doras-NRC2D Database developed in the phase I) and proximity of rice mills. An historical approach will allow us to understand the personal incentives and the family strategies that are important to promote the change.

Ground information and supplementary data are very important inputs in photointerpretative methodologies. Complete supplementary data and the familiarity of the interpreter with the target area as well as the availability of multirate imagery help to increase the accuracy of the interpretation.

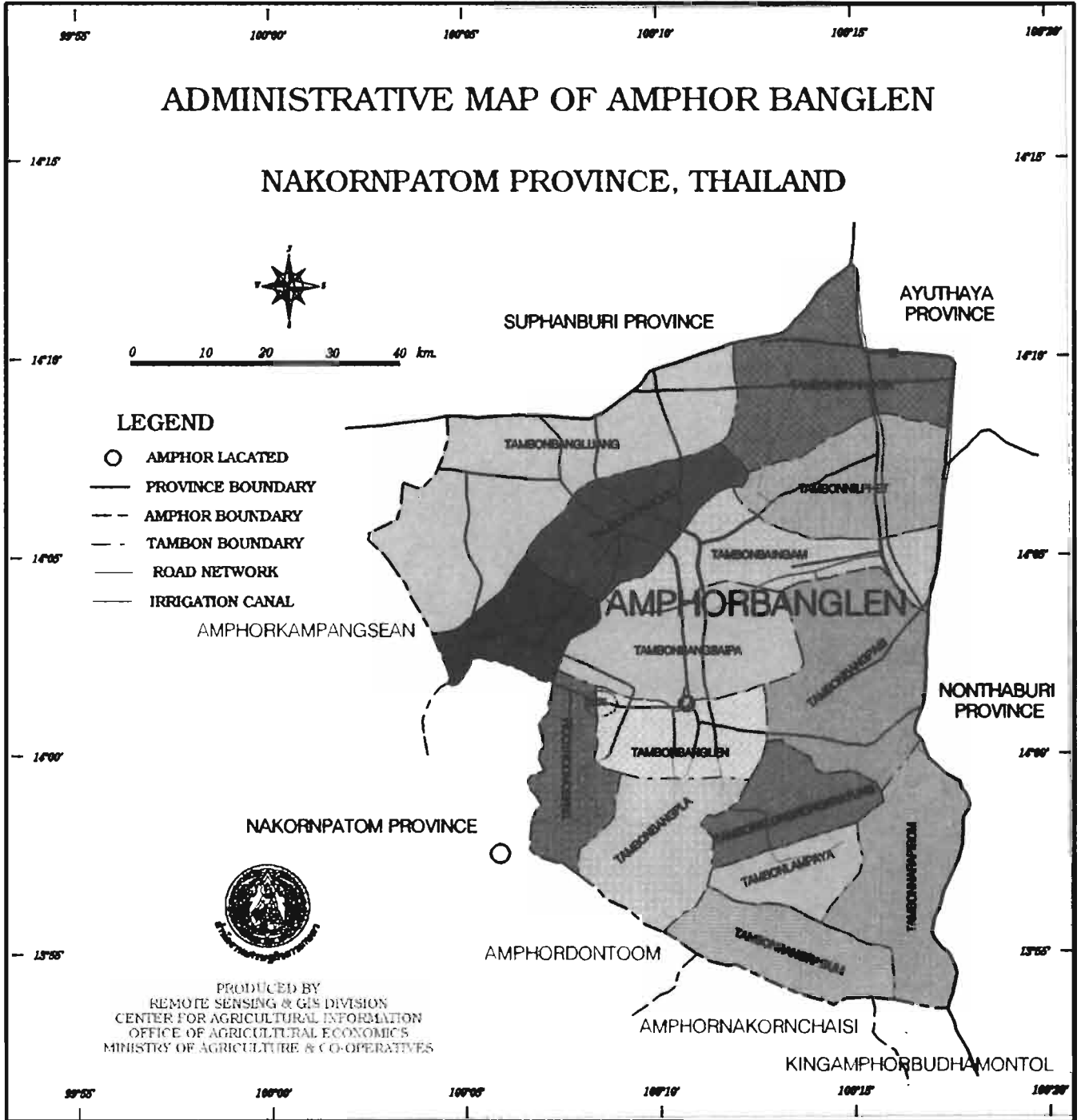
In the future, the monitoring of change in rice cultivation might be improved by designing adequate tools mixing, for example, radar imagery and surveys. Such a research can be instrumental in upgrading a GIS in charge of agriculture by monitoring the changes and by including social characteristics of the farms, in particular from the Doras-NRC2D database. This kind of information would be a useful tool in aiding farmers allowing the necessary help they need (training, credit,.....) to be determined and to swiftly assess the impact of diversification policies.

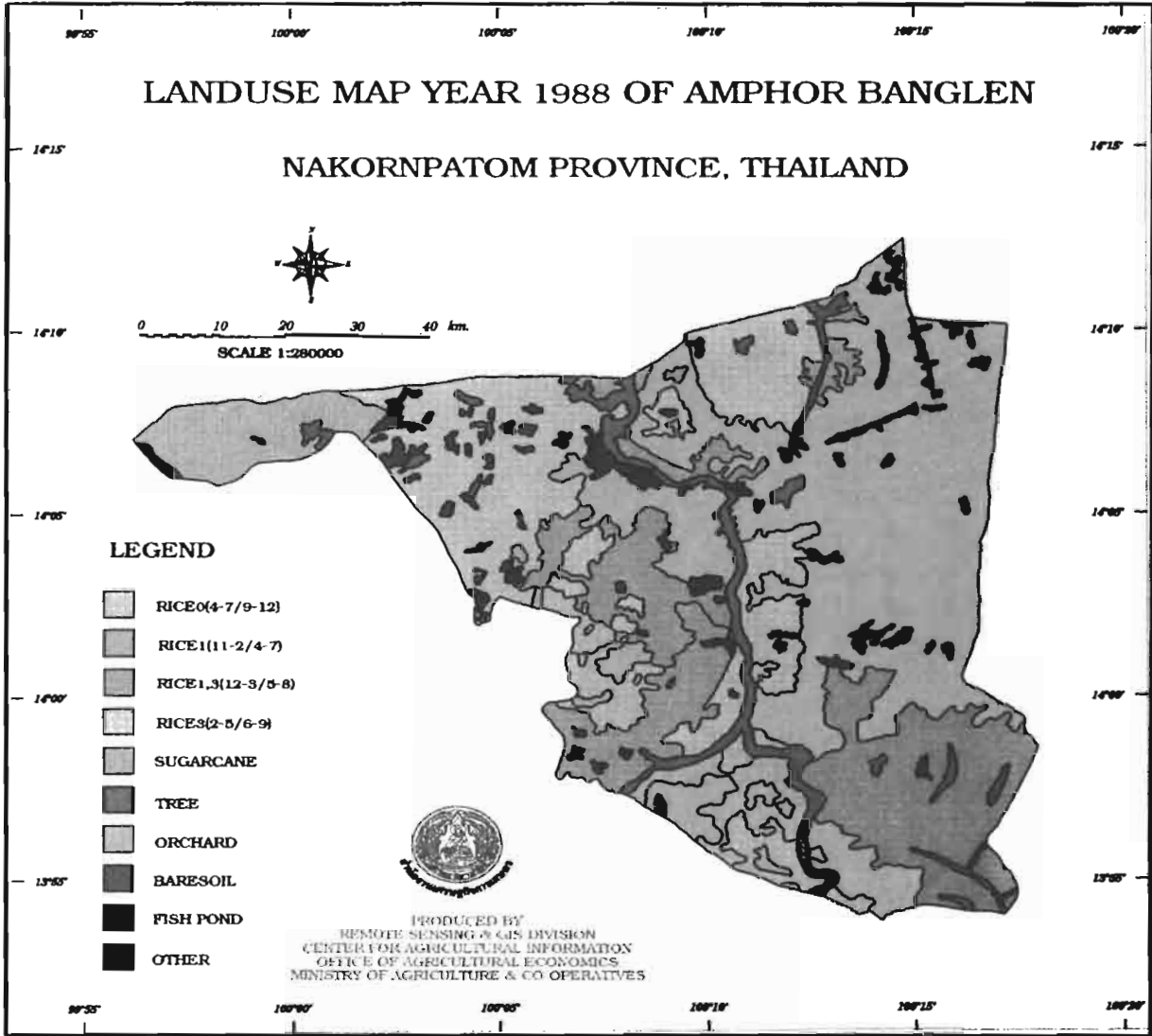
ADMINISTRATIVE MAP OF THAILAND

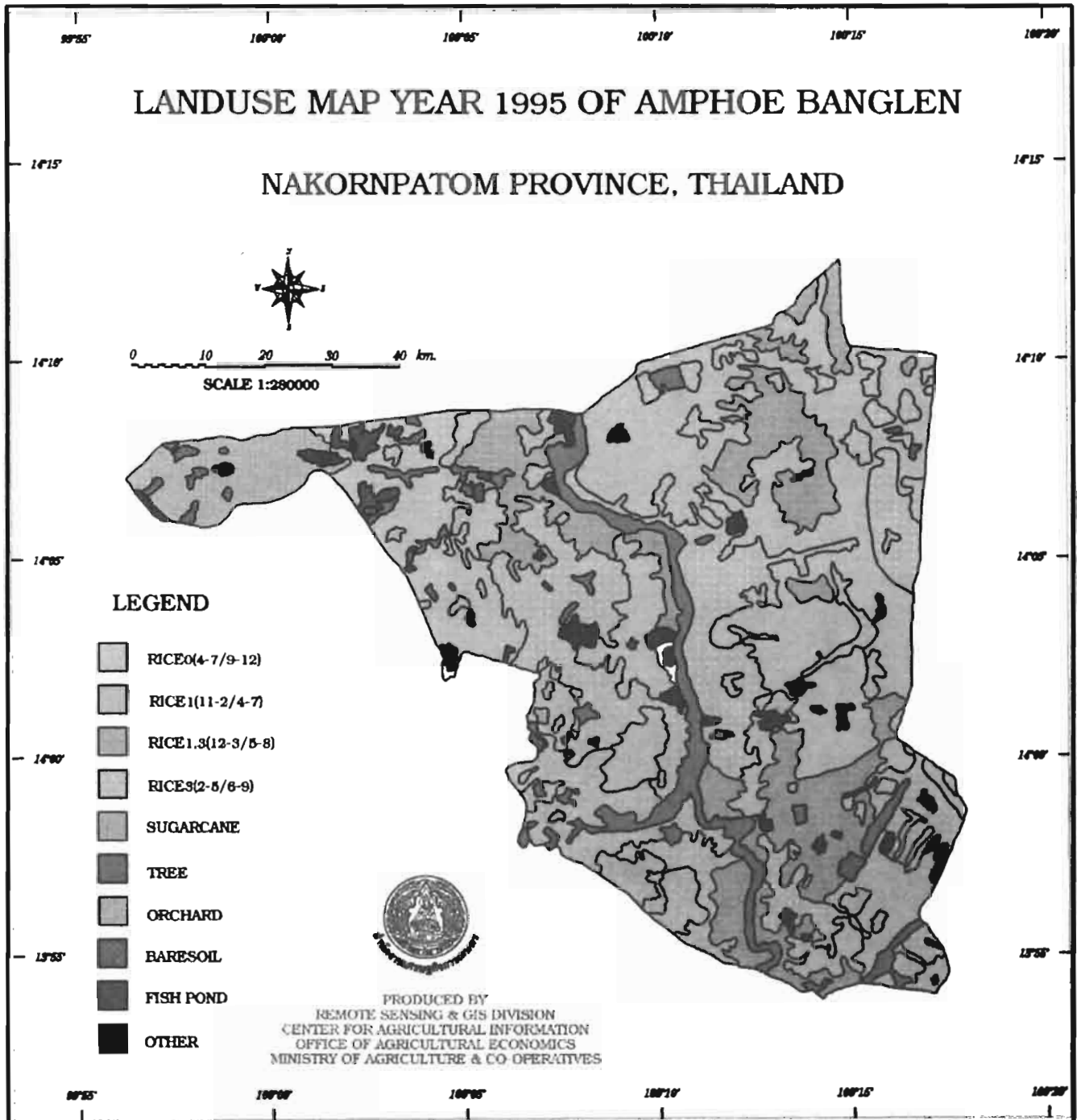


ADMINISTRATIVE MAP OF AMPHOR BANGLEN

NAKORNPATOM PROVINCE, THAILAND







LANDUSE OF AMPHOE BANGLEN, NAKORNPATOM PROVINCE, THAILAND

ITEM	1988	%	1995	%	DIFFERENCE	%
RICE0(4-7/9-12)	57,500	14.89	43,125	11.17	- 14,375	-25.00
RICE1(11-2/4-7)	143,750	37.22	135,625	35.11	- 8,125	-5.65
RICE1,3(12-3/5-8)	83,750	21.68	63,750	16.5	- 20,000	-23.88
RICE3(2-5/6-9)	43,125	11.17	86,250	22.33	43,125	100.00
SUGARCANE	18,125	4.69	15,625	4.05	- 2,500	-13.79
TREE	23,125	5.99	25,625	6.63	2,500	10.81
ORCHARD	1,250	0.32	1,250	0.32	-	0.00
BARE SOIL	1,250	0.32	1,875	0.49	625	50.00
FISH POND	4,375	1.13	3,750	0.97	- 625	-14.29
OTHER	10,000	2.59	10,000	2.59	-	0.00
TOTAL	386,250	100	386,250	100	-	0.00

REMARK: UNIT = RAIS



Kasetsart University
มหาวิทยาลัยเกษตรศาสตร์



Proceedings of the International Conference:

The Chao Phraya Delta : Historical Development, Dynamics and Challenges of Thailand's Rice Bowl

Volume 1



12-13-14-15 December 2000, Kasetsart University, Bangkok

**Kasetsart University
IRD (Institut de Recherche pour le Développement)
Chulalongkorn University, CUSRI
Koto University, CSEAS**

Proceedings of the International Conference:

**The Chao Phraya Delta :
Historical Development, Dynamics and Challenges
of Thailand's Rice Bowl**

Volume 1

Keynote address

P2: Land use: constraints, competition and opportunities

P3: Water resources management and environmental issues

Volume 2

P1: The delta way of life and transformation: tradition and change

P4: The village community: transformations of the farm structure and economy

P5: Rural-urban interactions: the Delta and Bangkok Metropolitan area

P6: The Delta in the National and Regional Context