THE 1988 LANDSLIDE IN SOUTHERN OF THAILAND

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INTRODUCTION

The kingdom of Thailand is situated in the central part of Indochinese Peninsular of southeast Asia. The country looks like an axe with a long panhandle extending southward along the peninsular. The total area of the country is approximately 513,985 sq.km. The estimated total population are 57 millions in 1990. The phisiographic region is divided into 6 regions, they are central plain, southeast coast, northeast plateau, central highland, north and west continental highland and peninsular land.(Fig.1.a) According to Koppen's classification of the world, Thailand falls in two climatic types, they are Tropical rainforest (Af) and Tropical wet and dry climate which are the major part of country. (Fig.1.b)

DISASTER SITUATION

Thailand is a little lucky because we never suffer from such hazardous disaster as volcanic eruption, tsunami, and high intensity earthquake. Anyhow we should have a survillence system for the earthquake which may occur in our neighbor countries such as Indonesia and Phillipine, for we may get some impact from these disasters. The most severe damages of disaster in Thailand are from flood and landslide as detail below.

1. Flooding

Flooding occurred in Thailand through out the country. They can be divided into riverine flood and flash flood. Riverine flood occurred in the low land area along the main river. In the past decade, it occurred in the central plain every 2 or 3 years eg. 1978, 1980, 1983, 1986. Flood damage in these year have been estimated in the order of hundreds of million U.S.dollars. In the southern part of Thailand there are also flood which occurred usually by the heavy rainfall and high discharge from tributary, they caused damages to farmland every years. For flash flood in Thailand, they occurred in the mountainous area due to abnormal meteorological phenomena such as depression, tropical storm or active monsoons. Usually flash flood caused slightly damage but if it is associated with landslide it will cause very severe damages. The memorable example is "The 1988 Flood and Landslide in Southern part of Thailand" which will be shown in detail later.

2. Landslide

Landslide in Thailand usually occurred by the effect of heavy rainfall. The general phenomena occurred in many parts of very high steep mountainous areas which have granite as a base rock. From the geological exploration, they found the granite rock which exposes in many places especially in the Western Range from north to south of Thailand. However no serious damages are recorded in the history, only soil erosion occurred in some steep slope mountain which have no ground cover. And soil erosion is also significant problem in Thailand. But of the biggest land slide occurred in 1988 in southern of Thailand. This landslide

disaster gave us such as expensive lesson, it caused the most severity damages that we never had before.

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The most hazardous disaster of Thailand occurred in November 1988 in the southern part of Thailand.(Fig.2) At that time there were flood disaster combined with landslide disaster. The most effected provinces are Surat Thani and Nakon Si Thammarat which get affected by both the northeast and southwest monsoons receiving annual rainfall up to 2,000 mm. (Fig.3) The worst affected district of Amphoe Ban Nasan, Surat Thani province had its rainguage washed away together with the records. However the rainfall records of the cities of Surat Thani and Nakon Si Thammarat which presented below (Table 1) quite indicative of the extent of rainfall received in the area in such a short duration.

Table 1

Rainfall in millimeter

Nov	19	20	21	22	23	24
Surat Thani	7.4	6.1	164.0	283.3	30.7	1.8
NST	26.4	137.2	447.8	286.5	150.7	2.4

This table presents the daily rainfall received in major centers of Southern during the period. The records indicate that there was no rainfall for three to four days prior to intense rainfall

which started on November 20/21 reaching up to 735 mm. in two days in Na Kon Si Thammarat and 450 mm. in Surat Thani. In all area except the coastal plain flooding due to this heavy rainfall stayed for only one day but causing extensive damage from debris flow, rock slide and landslide. And the coastal plain were still flooded after that three weeks.

Landslide occurred in the mountain of Surat Thani and Nakon Si Thammarat which can be found from sideslope to footslope. They were mainly of two types, debris and sand flow and rock slide. Rock slide mostly occurred on the steepest slope where bedrock was shallow. Sand flow occurred on slopes which were deeply weathered and covered with up to 10 meters of loose sand. The most serious damage occurred on alluvial fans around the base of Khao Luang. The village of Ban Kathun Nua, Ban Kathun Tai, Huai Ko in Nakon Si Thammarat Province were partially buried by sand as they were situated on alluvial fan near the place where streams flowed from Khao Luang. River bank expanded to over 10 kms. After the high water period the velocity of the flood water was reduced and deposition of sediments occurred along with large quantities of wood debris blocking many village roads, and filling agricultural land with sand and silt.

The heavy rain in this period not only hit Surat Thani and Nakon Si Thammarat but it is also affected 14 provinces in southern part of Thailand. Looses were estimated at a staggering US$ 193,130,000, 358 people were killed, 1,921 people were wounded and 55,049 houses were destroyed. Roads, bridges, schools and government buildings were ruin. Agricultural land was damaged.

Cause of Landslide

The cause of this disaster is the combination of three activities.

1. Meteorological Condition

The depression arriving from the gulf of Thailand causes usually heavy rainfall in mountainous area, intense rainfall continued for several days. Average rainfall is more than 300 mm. per day.

2. Geological and Topographical Conditions

The steep mountain slopes which more than 50% are common and covered by thin layer weather granite, joint planes in rock are parallel to the slope surface. Soil profile consisting of thin layer of top soil followed by layer of coarse sand which contains embedded pebbles and boulders at greatly depth. The rock slide occurred because the joints in the rock slope were completely saturated.

3. Change of Land Use Pattern

In the past two decades Thailand has the rapid decreasing of forest resource. Based on the remote sensing data, the area of forest covered in Thailand has declined from approximately 198,000 km^2 to less than 150,000 km^2 in 1976 to 1985. In the southern part of Thailand in 1961 almost 42% of land area was covered by forest and 1988 only 22% remained. (Table 2).

Table2

(Unit %)

	1961	1973	1976	1978	1982	1985
Whole Thailand	53.33	43.21	38.67	34.15	30.52	29.05
South	41.89	26.07	28.48	24.89	23.25	21.90
Surat Thani	63.56	48.11	39.47	33.71	32.10	29.38
N. S. T.	33.87	18.00	17.55	17.25	16.22	15.08

Under the pressure of commercial logging and shifting cultivation, the land use pattern were changed continuously. Traditionally, rice was cultivated in the low land, fruit trees in the foothill and coconut trees near the coast. Plantation crops such as rubber were cultivated in the better drained lowland and gentle slope in the foothill where there was insufficient water for irrigation of fruit orchards. The high slope on the hills and the mountain were covered with natural or secondary forest. The coastline was covered with mangrove forest. (Fig.4) The most land use change took place in the last 3 to 5 years before this disaster. The forest cover on the top hill was replaced by the rubber trees and the secondary forest. And in the steep slope and gentle slope the land use was changed to rubber plantation where the trees are shallow rooted and practices such as fertilization and cutting of the tap root reduce the depth of plant rooting.

Conclusion

The rainfall records of Surat thani and Nakon Si Thammarat as presented below indicate that similar amounts of rainfall have been experienced in the past, however no appreciable damages were reported in either provinces.(Table 3)

Table 3

	Rainfall in millimeters			
Surat Thani	1 day	2 days	3 days	4 days
1958	192.5	315.5	332.1	447.4
1964	457.1	647.3	660.2	686.5
1975	274.4	301.1	315.6	337.4
1988	283.3	447.3	478.0	484.1
Nakkon Si Thammarat				
1975	433.3	686.7	775.9	
1976	414.0	461.9	491.4	
1988	447.8	734.7	885.4	

Therefore, it becomes obvious that in addition to heavy rainfall some other factors have played significant roles in the severity of floods and resulting damage. the negative change in the vegetative cover over the area, in particular over the steep hill slopes, can be considered as a main factor in the severity of the situation need to be improve, particularly considering that a very significant number of landslides which has already occurred

makes the hill slope more vulnerable to further slides even under lesser amount of rainfall.

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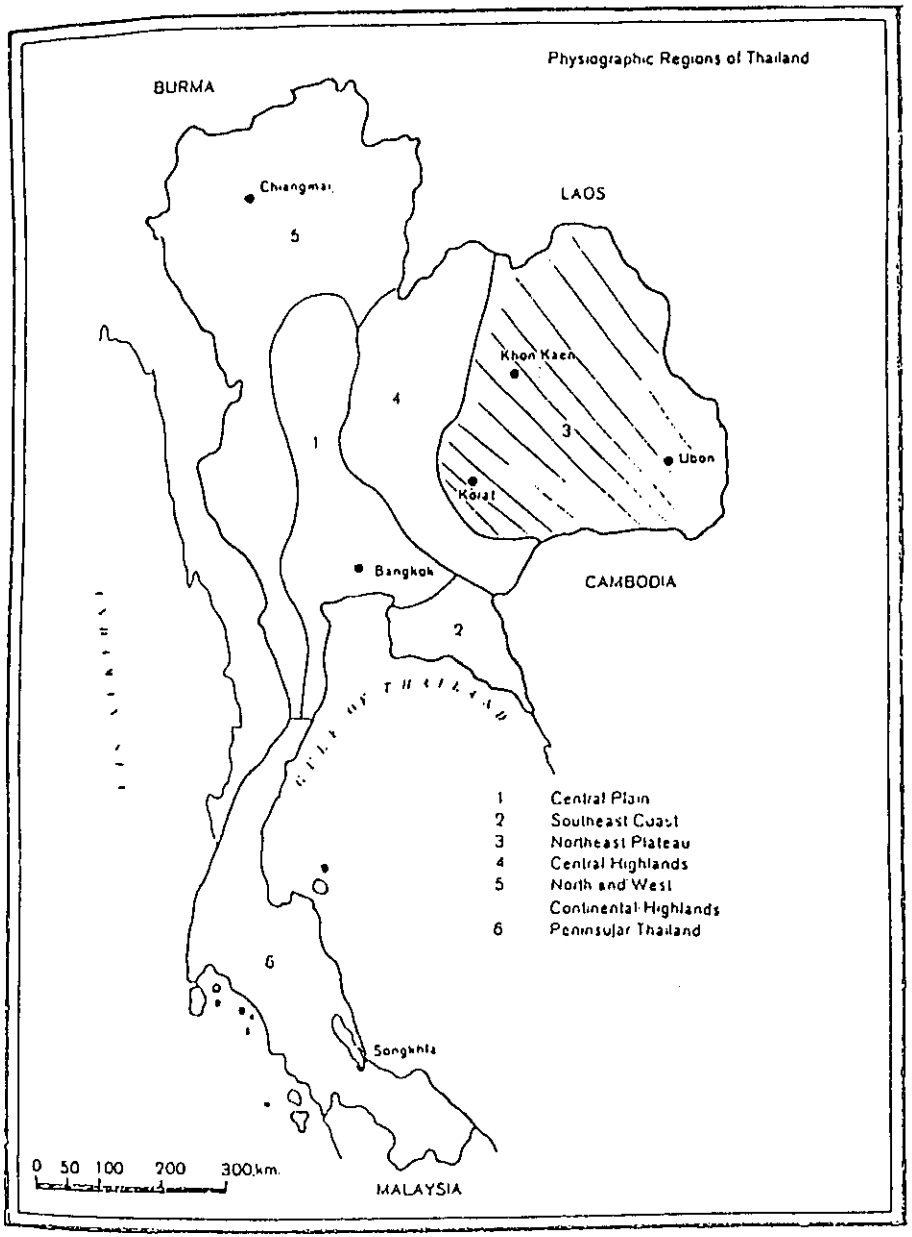


FIG.1.a Physiographic Regions of Thailand

(After Moormann and Rojanasoonthon, 1972)

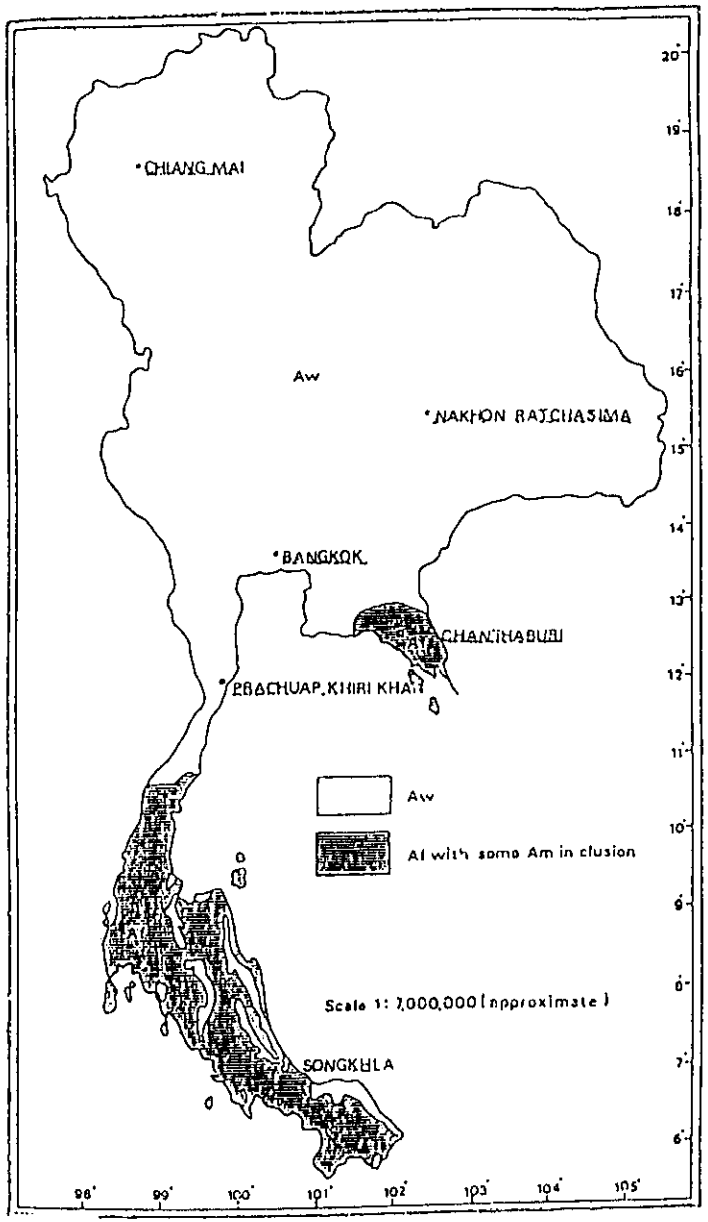


FIG.1.b Types of climate of Thailand after Koppen

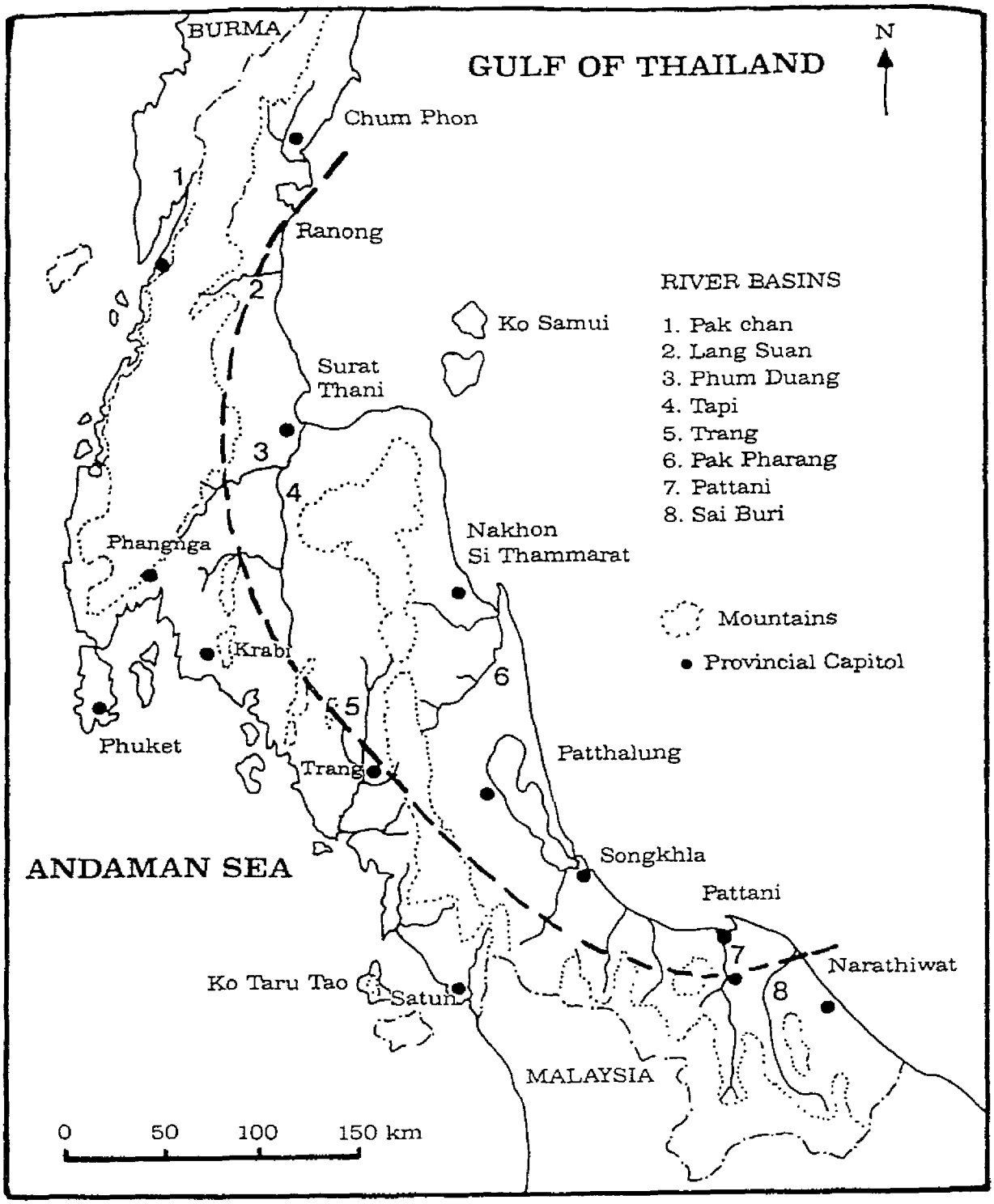
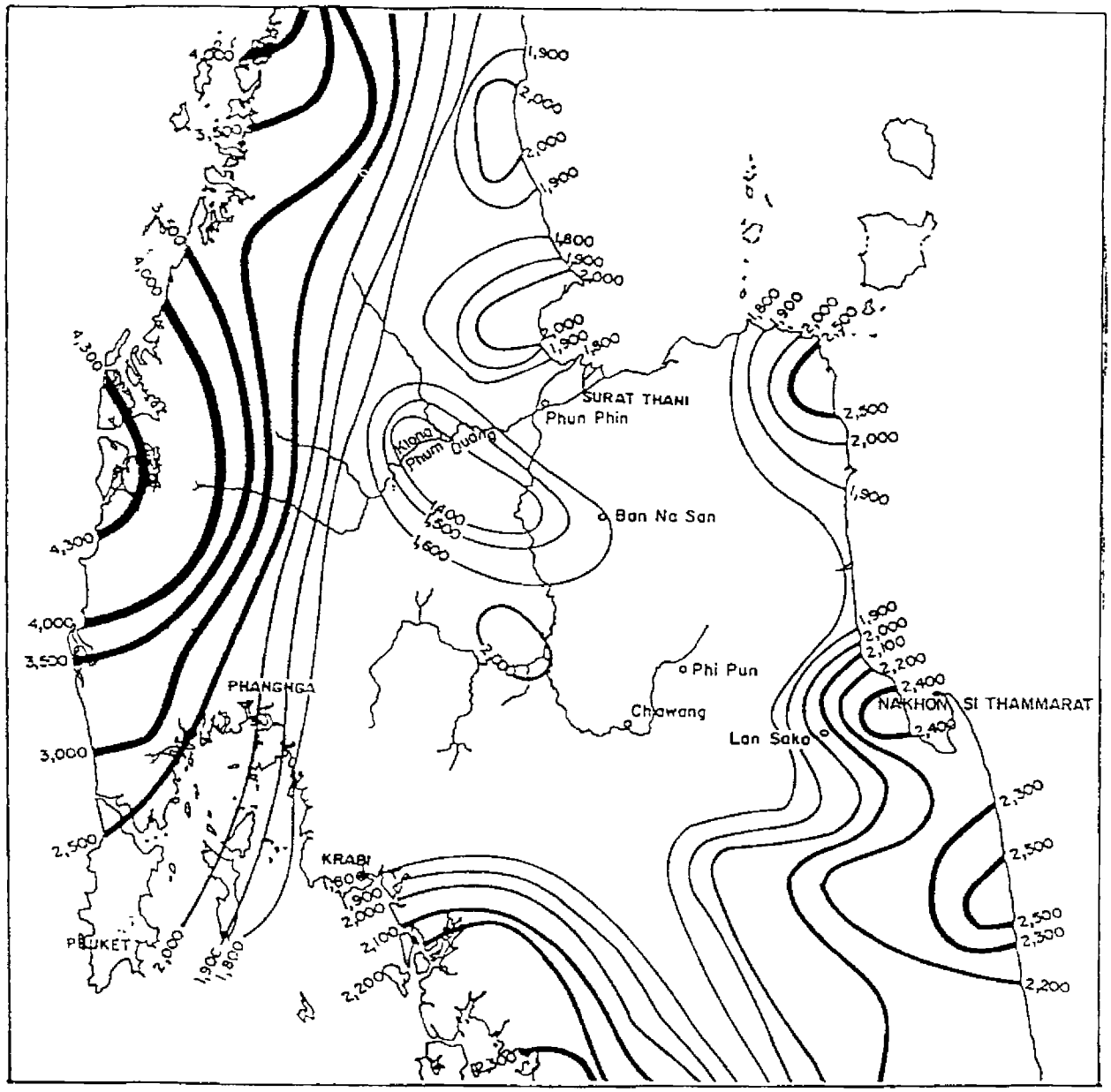


Figure 2. Simplified map of the main storm-affected area in the South.



Source: Adopted from the report "The Sub-regional Development Study of the Upper-Southern Part of Thailand", Japan International Co-operation Agency, March 1985.

FIG 3 *Mean Annual Rainfalls in the Study Area*

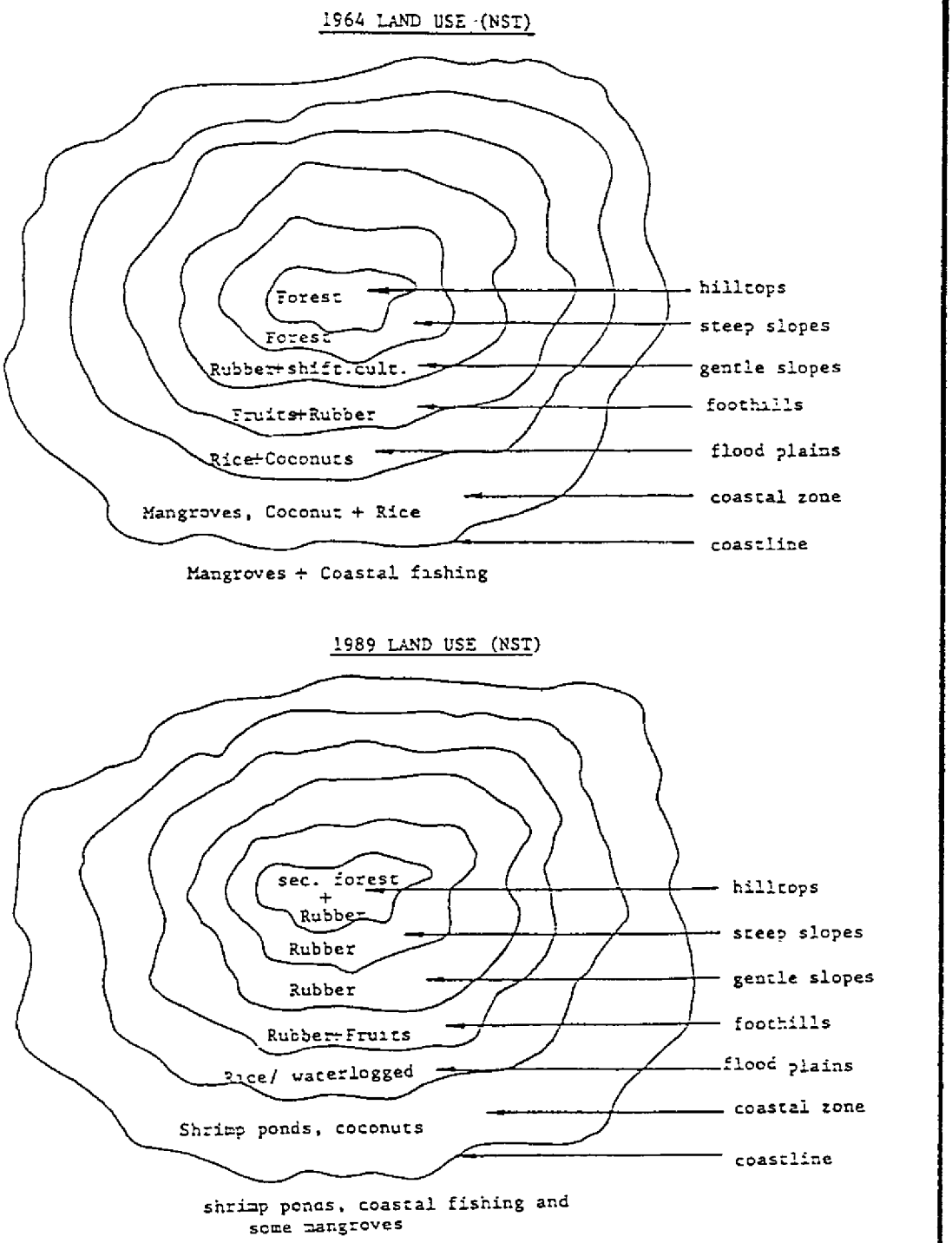


Figure 4. Land use changes in Nakorn Si Thammarat Province between 1964 and 1989.