

## Chapter 3

### Results

#### 3.1 Land-use data from digital grid

The outcome of the research was a thematic map. It did not only provide sufficient information on the land-use change of Phuket Island from 1967 to 2009 but also provided quantitative information about urban change by simple geographical from freely available software R program. Thematic maps used as results of research were useful to illustrate loss and gain of land, by detect by using the grid-digitized method. The computation of land-use data by from the digital grid was based on the actual number of observations for land-use data. Figure 17 (a-d) shows loss and gain of land on Phuket Island from 1967 to 2009.

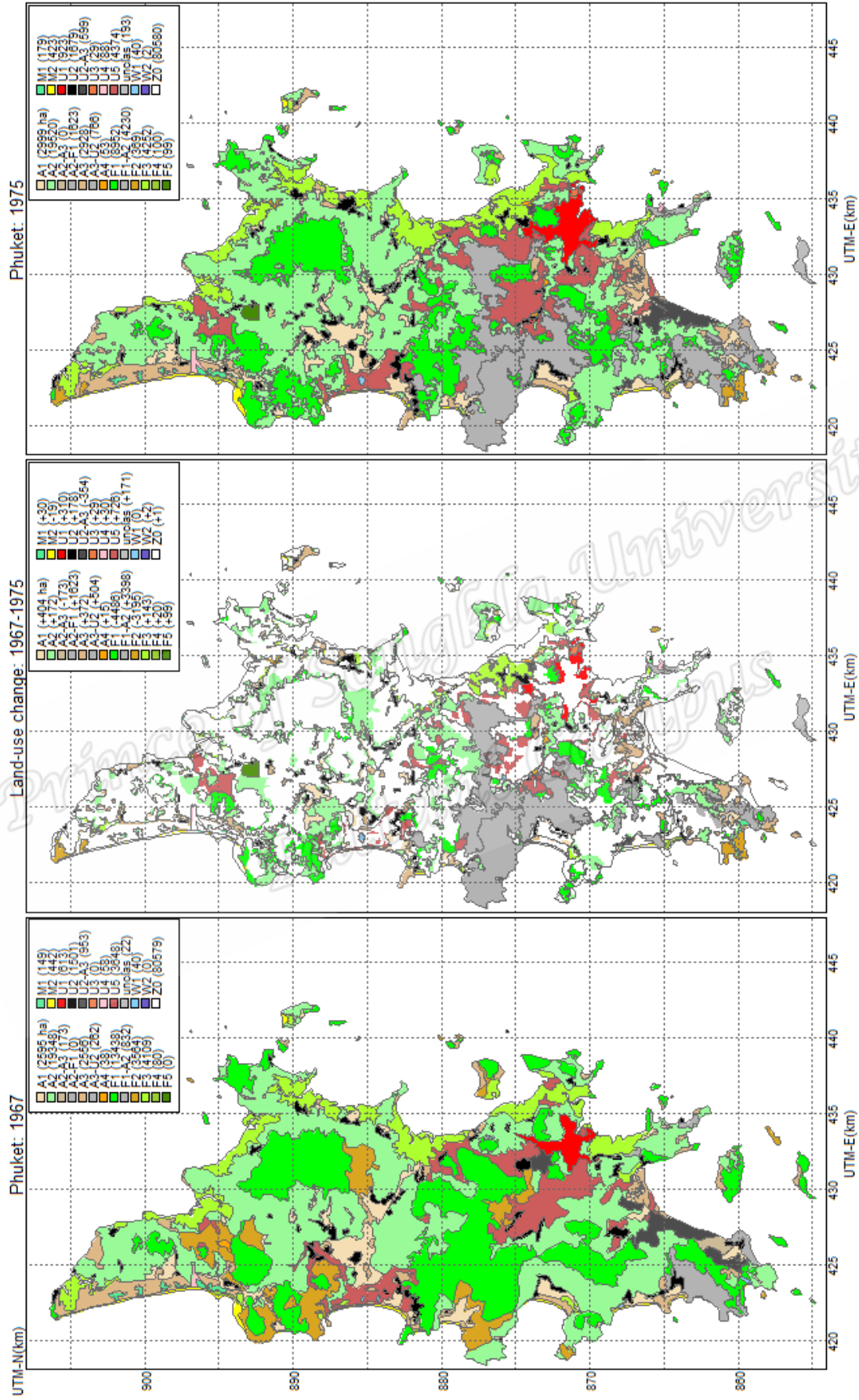


Figure 17 (a) Shows the output of grid-digitized method Note that the first panel demonstrates land-use in 1967 whereas right panel shows land-use in 1975 and middle panel shows loss from 1967-1975.

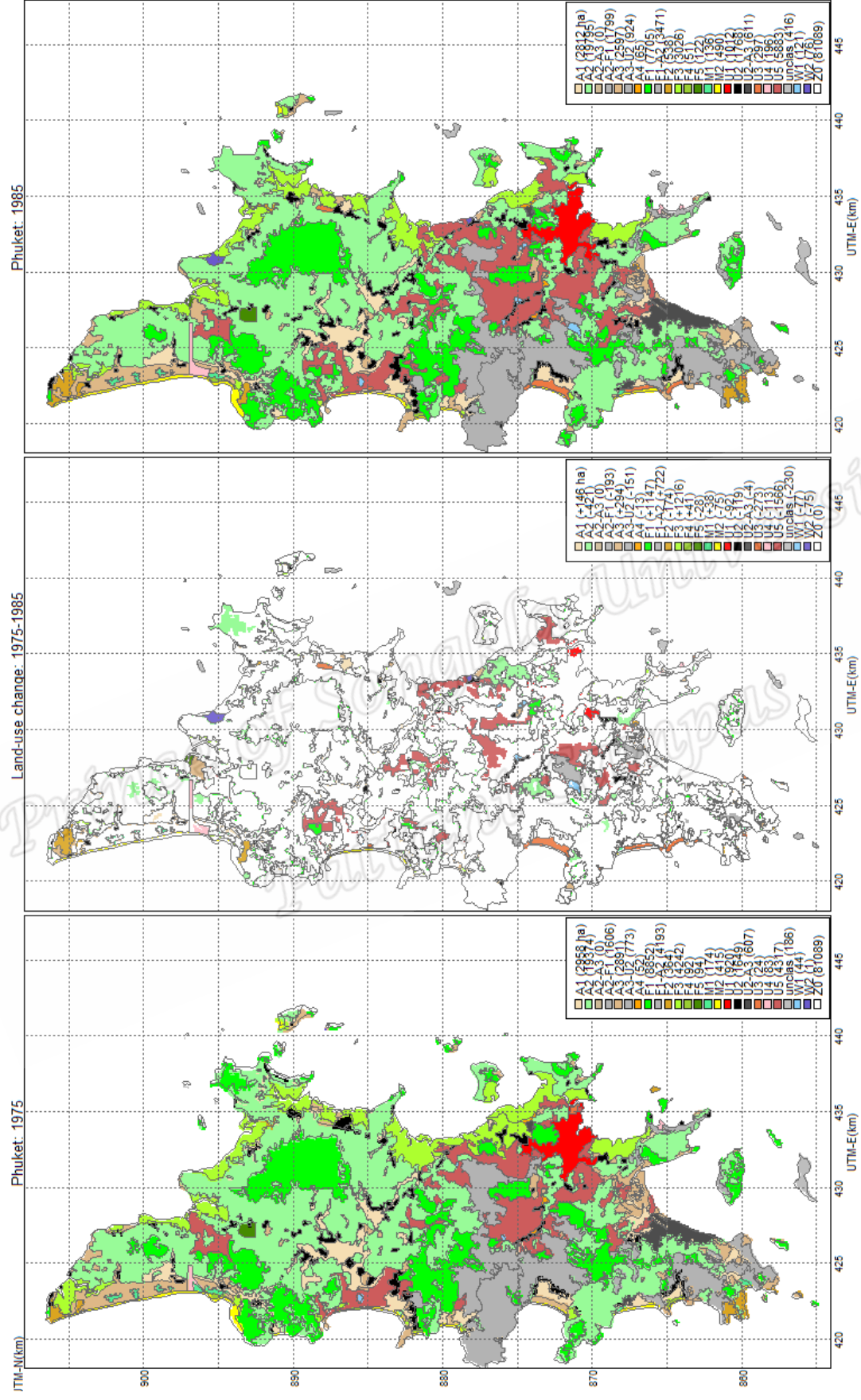


Figure 17 (b) Shows the output of grid-digitized method, Note that the first panel demonstrates land-use in 1975 whereas right panel shows land-use in 1985 and middle panel shows loss from 1975-1985.

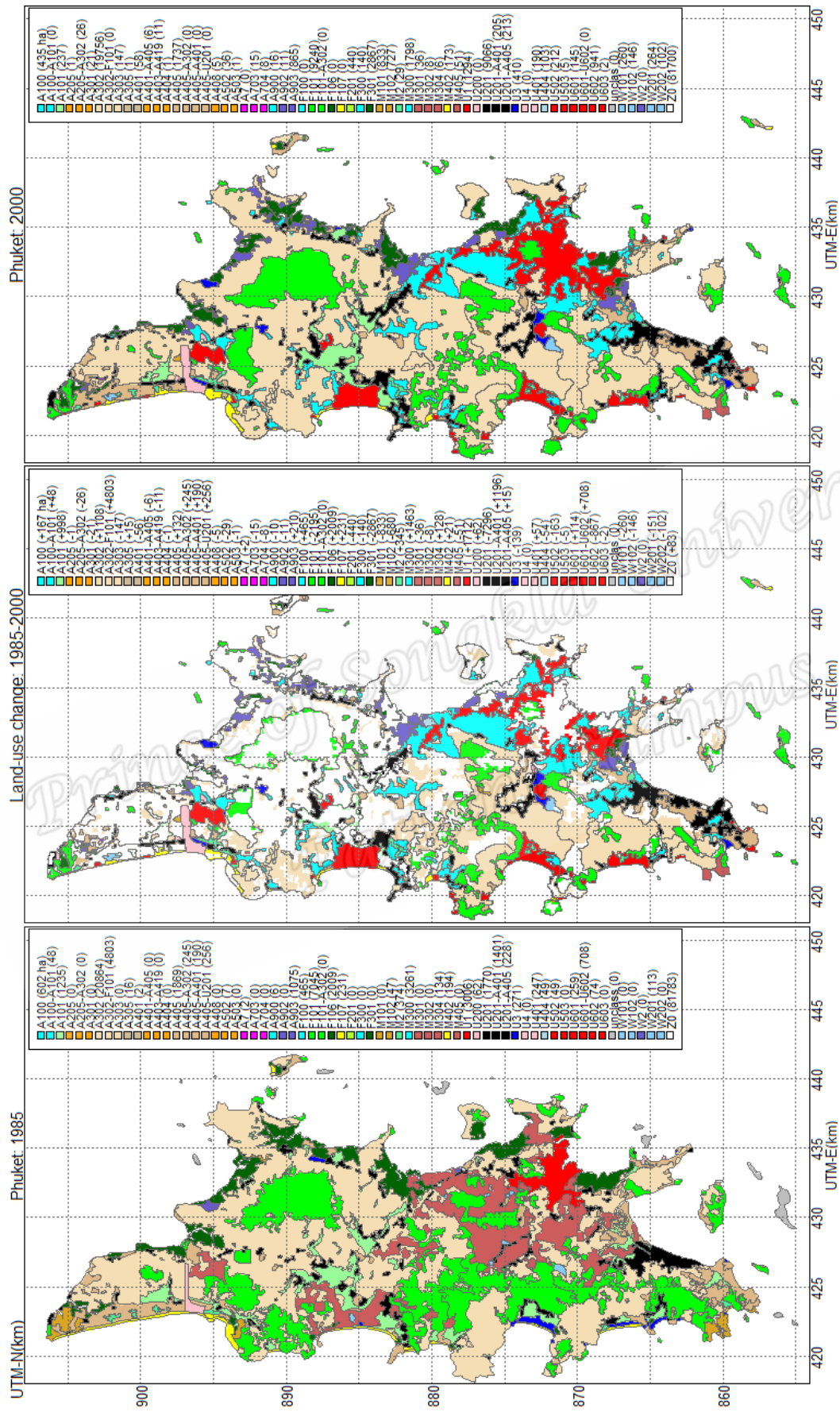


Figure 17 (c) Shows the output of grid-digitized method, Note that the first panel demonstrates land-use in 1985 whereas right panel shows land-use in 2000 and middle panel shows loss from 1985-2000.

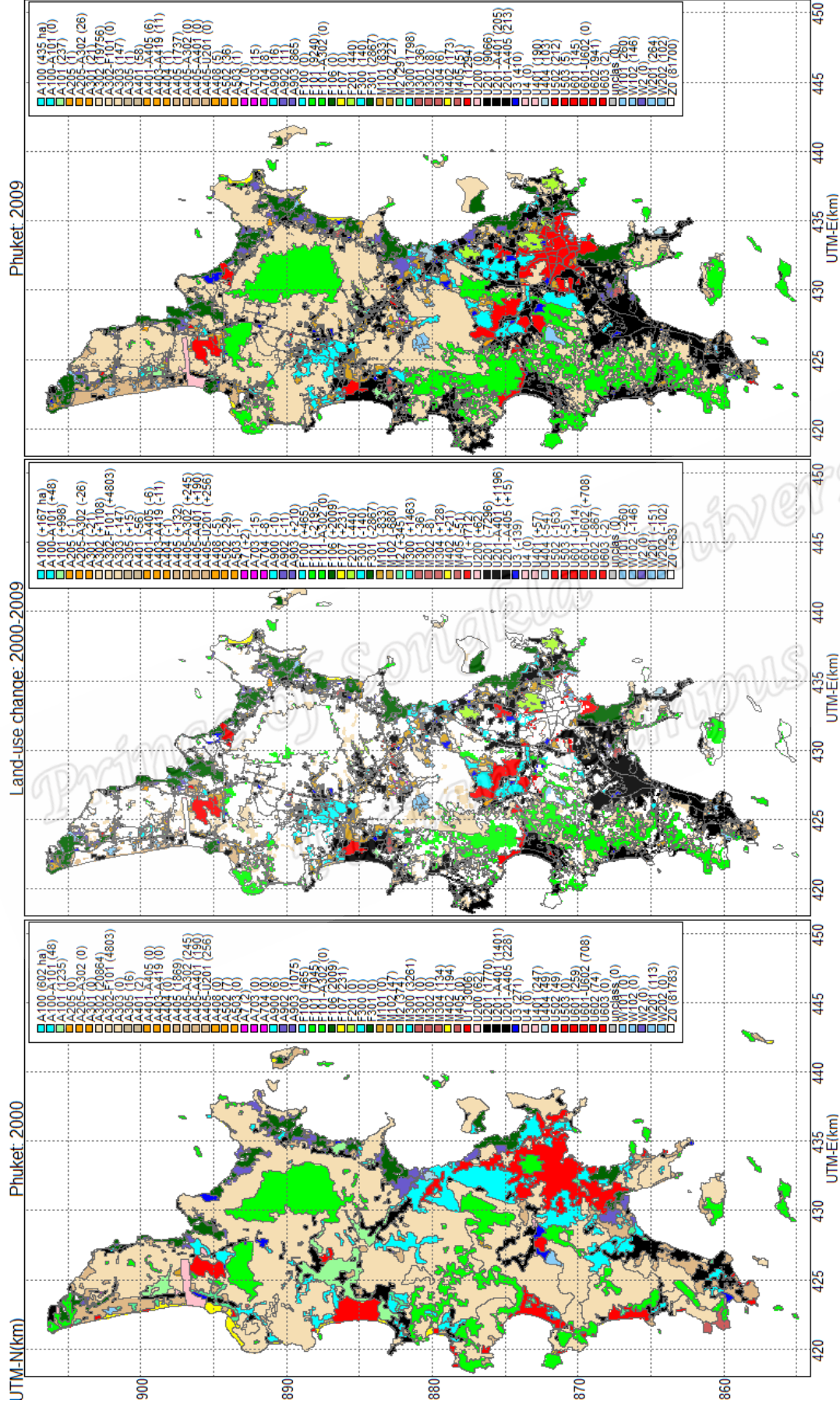


Figure 17 (d) Shows the output of grid-digitized method, Note that the first panel demonstrates land-use in 2000 whereas right panel shows land-use in 2009 and middle panel shows loss from 2000-2009.

### 3.2 Land- use change Phuket Island 1967-2009

The diagrams below show land-use for Phuket Island since 1967-2009 depicted in four panels of mapping, which were conducted through digitization interpretation. Land-use categories were classified by the type of land-use. LUCC had been classified by thematic land-use map into four categories such as natural (F) (mainly forest, grassland and beach), farm (A) (including agricultural and fish farming), and development (U) (including the city, villages, institutional and recreational land and (M) mines.

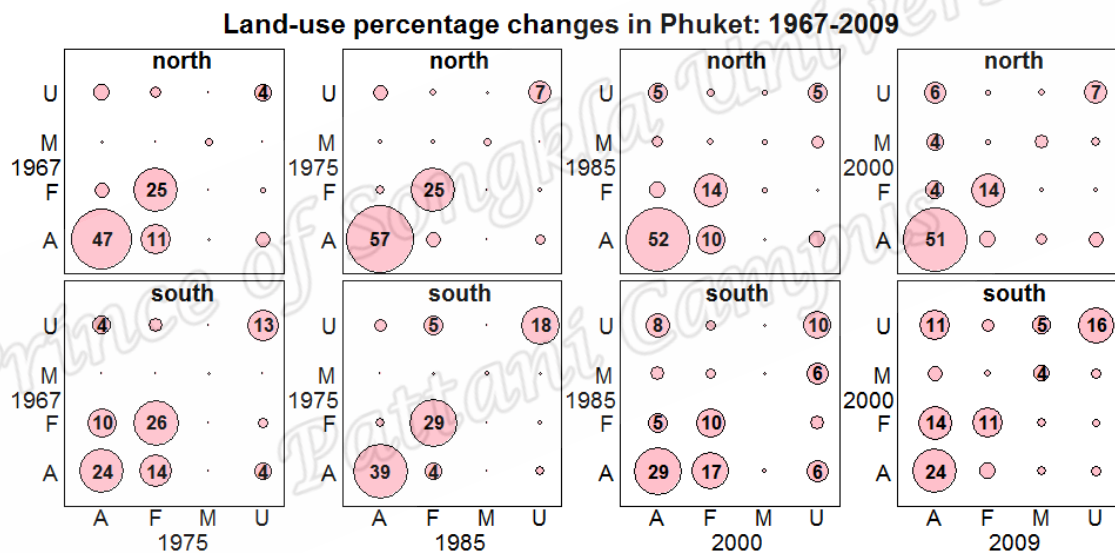


Figure 18. Summary of occupation of land-use type of Phuket Island from 1967 to 2009 in the four types of groups (compare between North and South)

The land in 1967, was found to be covered by forest and decreased in the successive years. The agricultural areas increased in the following years: 1975, 1985, 2000. And in 2009, the agricultural area decreased because from 1985 to 2000, the majority of agricultural areas started changing to urban areas, while some mining areas were also converted to abandoned mining areas. Other land-use categories such as urban areas were small in number and growing especially in the south. The urban areas increased

from 1975 to 1985 and had a slight decrease between 1985 and 2000. This was caused by the change in the urban (village) area due to an increase of farm land and rubber plantations. Thematic map of this result is shown in appendix (Figure 6-9 of paper 2).

### 3.3 Urbanization of Phuket Island

Based on grid-digitized data, the objectives of this study are thus as follows:

Target population: Land-use in the province of Phuket.

Samples: Land-use on Phuket Island in 1967, 1975, 1985, 2000 and 2009.

Data source: Land-use data recorded by the Department of Land Development.

Variables: The variables for this study are as follows:

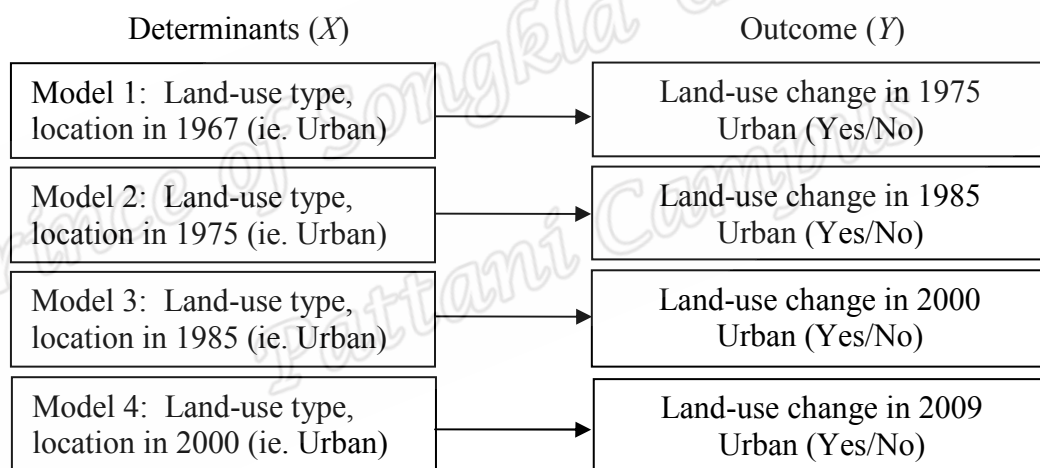


Figure 19. Path diagram of conceptual framework for analysis of land-use change

The logistic regression model analyzes land-use change and shows a prediction for testing correct percentage. The classification shows the predicted value given by all the independents on the 1985 land-use map, for example. There were 1,563 points of actual value 1 (urban) classified in to 0 (non-urban), with an accuracy of 83.9% (Table 4). For each year, the percentages of correct predictions were as follows: 1975 was 88.92 %, 2000 was 78.54% and 2009 was 83.45%.

Table 4. Classification

Observed		Predicted <i>Y</i>		Percentage Correct
		non-urban (0)	Urban (1)	
<i>Y</i>	non-urban (0)	40416	1562	96.3
	urban (1)	1563	8130	83.9
Overall Percentage				94.0

The results: this study considers the area of Phuket Island for the study of urbanization. Land-use in Phuket has been separated into two areas, North and South. Table 4 shows the results from logistic regression, for example, from land-use 1967-1975 which corresponds to the bar chart in Figure 20. Looking at the length of confidence interval of estimated odds (OR), the non-urban growth to urban in the south in 1975 was 6.685 times higher than the north in 1967. The 95% confident interval  $Y=1$  (probability of urban growth) is 70.19% with a range of 80.87% upper and 59.74% lower.

Table 5. Result from logistic regression (when  $Y=1$  is urban 1975)

Determinant ( <i>x</i> )	$\beta$	SE.	Z	P-value	OR	%( $Y=1$ )	95%CI ( $Y=1$ )	
							Lower	Upper
Constant.	-1.052	0.016	-62.43	0.000	0.349	-	-	-
Land-use 1967 (urban in North)	-	-	-	-	-	5.304	3.535	8.886
Land-use 1967 (urban in South)	-1.233	0.023	-51.92	0.000	0.291	10.230	8.307	15.316
Land-use 1967 (non-urban in North)	1.155	0.036	31.53	0.000	3.174	53.592	56.092	69.303
Land-use 1967 (non-urban in South)	1.900	0.028	67.58	0.000	6.685	70.194	59.773	80.868



Table 6. Result from logistic regression (when Y=1 is urban 1985)

Determinant (x)	$\beta$	SE.	Z	P-value	OR	%(Y=1)	95%CI (Y=1)	
							Lower	Upper
Constant.	-0.333	0.021	-62.43	0.000	0.717	-	-	-
Land-use 1975 (urban in North)	-	-	-	-	-	4.35	2.54	9.45
Land-use 1975 (urban in South)	-2.839	0.031	-69.13	0.000	0.058	10.02	6.45	18.52
Land-use 1975 (non-urban in North)	-1.872	0.027	-51.92	0.000	0.154	82.92	72.21	89.06
Land-use 1975 (non-urban in South)	1.85	0.044	31.53	0.000	6.35	92.08	85.45	96.34

Table 7. Result from logistic regression (when Y=1 is urban 2000)

Determinant (x)	$\beta$	SE.	Z	P-value	OR	%(Y=1)	95%CI (Y=1)	
							Lower	Upper
Constant.	-1.307	0.014	-91.96	0.000	0.270	-	-	-
Land-use 1985 (urban in North)	-	-	-	-	-	7.642	4.506	10.687
Land-use 1985 (urban in South)	-0.623	0.020	-29.75	0.000	0.536	12.667	8.715	18.056
Land-use 1985 (non-urban in North)	1.147	0.030	37.82	0.000	3.148	57.020	47.379	58.907
Land-use 1985 (non-urban in South)	0.812	0.022	35.97	0.000	2.252	82.885	72.772	87.658

Table 8. Result from logistic regression (when Y=1 is urban 2009)

Determinant (x)	$\beta$	SE.	Z	P-value	OR	%(Y=1)	95%CI (Y=1)	
							Lower	Upper
Constant.	-0.416	0.015	-27.36	0.000	0.659	-	-	-
Land-use 2000 (urban in North)	-	-	-	-	-	8.393	6.551	11.694
Land-use 2000 (urban in South)	-0.844	0.019	-43.85	0.000	0.430	22.102	15.512	31.482
Land-use 2000 (non-urban in North)	0.879	0.031	28.07	0.000	2.408	61.373	54.788	68.567
Land-use 2000 (non-urban in South)	1.938	0.030	64.31	0.000	6.944	82.092	79.094	84.744

Figure 20 is a bar chart that shows percentages of urban land which denote 95% result by using logistic regression. For example, probability of urban growth from non-urban to urban in the south was 6.685 times when comparing in the north, whereas it

seems that urban growth occurs more than what was expected. The probability of urban growth in the south was 0.291 times from 1967 to 1975.

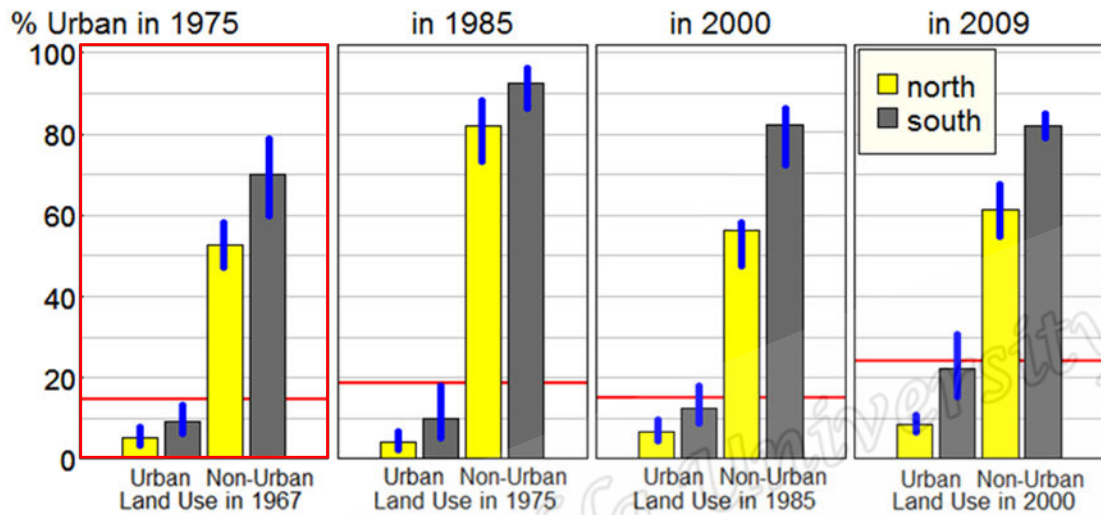


Figure 20. The bar chart shows percentages of urban land which denote 95% confident interval from logistic regression model, the prediction of urban growth of north and south for Phuket Island