CHAPTER V
CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The objective of this study is to classify, to predict land use change, and to assess flood risk area assessment in Nakhon Si Thammarat by using Geographic Information System (GIS) integrated with CA-Markov and Potential Surface Analysis (PSA).The result of this study was concluded as follows:

5.1.1 Land use and land cover

Land use and land cover in the year of 1994, 2005 and 2011 were concluded as follows:

In 1994; Orchard and Para-rubber covered the largest area of 27.02% total area followed by agricultural area (24.70%), forest (18.71%), marsh and swamp (16.53%), aquaculture and water body (7.98%), built up area (4.11%), and mangrove (0.95%) respectively.

In 2005; Orchard and Para-rubber still covered the largest area of 38.99% total area, followed by agricultural area (26%), forest (16.72%), marsh and swamp (8.38%), built up area (5%), aquaculture and water body (4.12%), and mangrove (0.95%) respectively.

In 2011; Orchard and Para-rubber still covered the largest area of 40.95% total area, followed by agriculture area (26.87%), forest (13.60%), built up area (7.36%), marsh and swamp (5.42%), aquaculture and water body (4.68%), and mangrove (1.12%) respectively.

5.1.2 Land use prediction

Land use prediction in 2005 and 2011 was applied with MARKOV model to predict land use in 2017. The result of this prediction showed orchard and Para-rubber will cover the largest area of 37.16% total area, followed by agricultural

area (28.75%), forest (13.39%), built up area (7.54%), aquaculture and water body (5.9%), marsh and swamp (5.54%), and mangrove (1.73%) respectively.

5.1.3 Land use change

Land use change between 1994-2005, 2005-2011 and 2011-2017 was concluded as follows:

During year of 1994-2005; Orchard and Para-rubber was the largest increasing area by 1,196.16 km^2, followed by agricultural area (129.40 km^2), and built-up area (88.86 km^2) respectively. Meanwhile, marsh and swamp was the largest decreasing area by 814.01 km^2, followed by aquaculture and water bodies (385.22 km^2), forest (198.31 km^2) and mangrove (16.87 km^2) respectively.

During year of 2005-2011; Built-up area was the largest increasing area by 235.92 km^2, followed by orchard and Para-rubber (195.30 km^2), agricultural area (86.86 km^2), aquaculture and water body (55.78 km^2), mangrove (34.05 km^2) respectively. Meanwhile, forest was the largest decreasing area by 311.86 km^2, followed by marsh and swamp (296.03 km^2).

During year of 2011-2017; agricultural area was the largest increasing area by 187.89 km^2; followed by aquaculture and water bodies (122.4 km^2), mangrove (60.43 km^2), built-up area (18.23 km^2), and marsh and swamp (11.72 km^2) respectively. Meanwhile, Orchard and Para-rubber was the largest decreasing area by 378.96 km^2, followed by forest (21.71 km^2).

To conclude, land use change in Nakhon Si Thammarat province during 1994-2017 found that agricultural area, built-up area, orchard and Para-rubber tended to be constantly increased while forest, marsh, and swamp were constantly decreased. This indicated that forest area, marsh, and swamp have a greater sensitivity to land use change than the other areas. This might be the effects of overpopulation and economic growth requiring huge demand for land use conversion from forest, marsh, and swamp to agriculture and built-up area.

5.1.4. Flood risk area

The result of flood risk area in 2001 and 2017 applied with Potential Surface Analysis (PSA) was shown as follows.

In 2011; The flood risk results in normal case (normal daily rainfall) found in Nakhon Si Thammarat Province has 2,088.89 km^2 of High risk, 4,261.50 km^2 of Moderate risk, 1,180.27 km^2 of Low risk and 2,461.44 km^2 of Non risk. In addition to extreme event (maximum daily rainfall) result found that High risk increased to 4,089.97 km^2 (40.93%) of the total area, followed by 2,672.40 km^2 of Low risk, 2,339.96 km^2 of Moderate risk and 889.77 km^2 of Non risk.

In 2017; The flood risk results in normal case (normal daily rainfall) found in Nakhon Si Thammarat Province has 2,378.31 km^2 of High risk, 4,359.56 km^2 of Moderate risk, 1,131.44 km^2 of Low risk and 2122.79 km^2 of Non risk. In addition to extreme event(maximum daily rainfall) result found that High risk increased to 4,202.15 km^2 (42.05%) of the total area, followed by 2,727.47 km^2 of Low risk, 2,358.53 km^2 of Moderate area and 703.95 km^2 of Non risk.

To conclude, flood risk area in Nakhon Si Thammarat province during 2011-2017 found that High risk and Moderate risk tended to be constantly increased, as a result of various anthropogenic activities for example, inappropriate land use (forest area conversion to rubber plantation area). Therefore, higher rate of water quickly flowing from mountainous area to lowland area increased where there is also a heavy rain fell in that area. Moreover, swamp areas were continuously decreased because of land conversion to building and transportation. This is one of the factors that could decline drainage systems ability.

5.1.5. Landslide area

The result of landslide hazard area in Nakhon Si Thammarat Province was shown as follows.

The result of landslide hazard in normal case (average daily rainfall) found that Non risk area covered 5699.82 km^2 (57.04 %) of the total area, followed by Low risk area, Moderate risk area, High risk area covered 2,533.49 km^2 (25.35%), 1,705.28 km^2 (17.07 %), and 53.51 km^2 (0.54 %) of the total area, respectively.

In addition to extreme event (maximum daily rainfall) result found that Low risk area covered 5419.41km^2 (54.24 %) of the total area, followed by Non risk area, Moderate risk area, High risk area which covered areas of 2,142.35 km^2 (21.44%), 1,625.2 km^2 (16.26 %), and 805.14 km^2 (8.06 %) respectively.

The result of landslide hazard area found that most of landslide area located at Nakhon Si Thammarat mountain range where the land form was high steep area. Land use of this area has been changed from forest to Para-rubber and orchard resulted in landslide occurrence and rain prolongation.

5.2 Recommendation

5.2.1 Satellite images in this study have cloud covered almost in every scenes, because the southern part of Thailand has rainfall throughout the year. This makes difficulty in classifying land use pattern.

5.2.2 Land use classification in 1994 and 2005 could not ground truth survey for training area. Training areas are set up base on 2012 ground truth survey.