URBAN AND AGRICULTURAL LAND USE CHANGE ON FLOOD IN DIFFERENT DELTA REGIONS

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1. INTRODUCTION

In the last three decades, an extreme flood occurred in delta regions (Ayeyarwaddy, Chaophraya, Mekong) of south east asia countries causing loss of human lives and financial damages. The Intergovernmental Panel on Climate Change (IPCC) singled out deltas as some of the most vulnerable systems in the world. Global warming is projected to intensify the hydrological cycle and increase the magnitude and frequency of intense precipitation which may lead to more intense and frequent river flooding. (Rutger Dankers et al.2008) As many deltas lie in the path of cyclones, they are expected to increase in intensity of flood risk. Flood risk is defined as the product of flood probability or hazard, exposure of capital and population, and vulnerability to the effect of flooding. Landuse change associated with human activity may change the hydrological process and flood risk. Urban and agricultural land use change are the two most important factors govern on flood. As population is growing up in each area, urbanization and agricultural lands increase in delta. In Myanmar, Ayeyarwaddy delta faced with the huge flood in 2008 and it is the worst flood disaster in our history (Post Nargis Joint Assessment). In Thailand, Chaophraya delta was also affected by remarkable flood in 1995 and this is the 20 years recurrence intervals of their history(INWEPF 2007). The 2000 flood in Vietnam Mekong delta is also the serious event in the past 45 years of data recording(Human development report 2007/2008). The flood phenomenon is needed to understand for the future disaster prevention, environmental conservation and development.

2. STUDY AREA

Ayeyarwaddy delta in Myanmar is situated approximately between Lat 15˚ 40′ and 16 30′ and long 94˚ 15′ and 95˚ 15′. Ayeyarwaddy delta is mostly alluvial plain and the main type of soil is gleyey clay soils. The richness of the alluvial and clay soil in delta subject to the decrease in infiltration and encourage the foods by monsoon rains. The extent of population in this area and cultivating the paddy field in delta which drives on flood and cause the severe economic damage and loss of human life.

Chao Phraya delta in Thailand is situated aproximately between lat 13˚ 27′ and 15˚ 50′N and Long 100˚ 05′ and 101˚ 24′. Thailand is also a warm, tropical climate affected by an annual monsoon, with a rainy season from June to October. The lower central plain of Chaophraya is flat, low-lying and mostly alluvial that increase the drainage of water and encourage flooding. The Chao Phraya Delta in Thailand is also one of the rice growing area in Asian monsoon area. The agriculture and urbanization are the two most important factors govern on flood.

Mekong delta in Vietnam is situated between lat 9˚ 42′ and 10˚ 19′ and long 105˚ 10′ and 106˚ 51′. The south of vietnam(mekong) is hot year round and it has only hot and wet seasons. The Mekong delta is also a low-level plain by a complex system of canals and rivers. The principal soil types in the Vietnamese portion of the delta are alluvium soil. The alluvium soil reduces the rate of infiltration drives to increase in frequency of flood risk. The intense in population and growing the agricultural land areas drive on flood in the Mekong delta region.

3. METHODOLOGY

Remotely sensed images from (Earth Science data interface) of the periods 1990, 1995 and 2005 of related the study areas were used as reference in my study. All images are available to download from the USGS and global land cover facility http://glcfapp.glcf.umd.edu:8080/esdi/index.jsp. The landsat Enhanced Thematic Mapper plus data ETM+ and USGS images were used and the three thermal bands band 5, band 4, band 2 were used for land use land cover classification. By combination of these three bands, we can see the natural color and we can analyze land cover types easily. The six groups of land cover types(agriculture, non-agriculture, water, urban, bareland, forest) are classified in each study area and period. The supervised classification method was used to classify the land cover types in each study areas. In classification process, supervised classification foremost depends on the spectral values of the pixels were selected to serve as training pixels in sample with maximum likelihood classifier. The annual maximum water level data of each study area around (1978-2007) was collected to estimate the flood event. Thirty years maximum water level data of Thailand, Ban Phai Lom station (from irrigation department of Thailand), water level data of Myanmar Pathein station are from Meterology and Hydrology department in Myanmar and data for Mekong delta My Tho station from Mekong river commission were employed to determine the return period for extreme flood events.

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In this study, gumbel distribution method is used to estimate the return period of water level in each area.

Probability density function

$$f(x) = a\exp(-a(x-b) - e^{-a(x-b)})$$

Probability distribution function

$$F(x) = \exp(-e^{-a(x-b)})$$

a = scale parameter

b = location parameter

Exceeded Probability

$$W(x) = 1 - F(x)$$

Return Period

$$T = 1/W(x)$$

Thirty years annual maximum water level data of each region are analyzed by using the probability density function, probability distribution function and exceeded probability to estimate the flood event and related return period.

4. RESULTS AND DISCUSSIONS

According to the analyzing of the annual maximum water level data, the return period distribution map is derived. The urban and agricultural land use types effect on the annual maximum flood event is considered in this study.

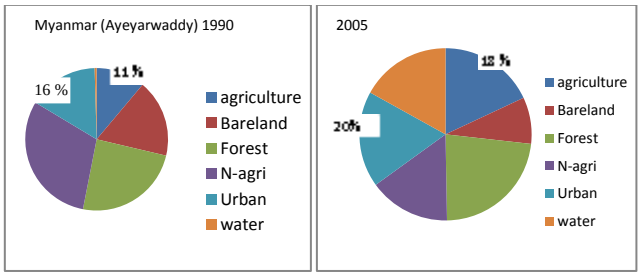

Fig -1 Land use types in Myanmar 1990&2005 related with RP1

The above figure shows the land use land cover change in Myanmar during 1900 to 2005 according to the one year return period. In 2005, the increase in agricultural land and urban area and the decrease in Bareland and forest were observed.

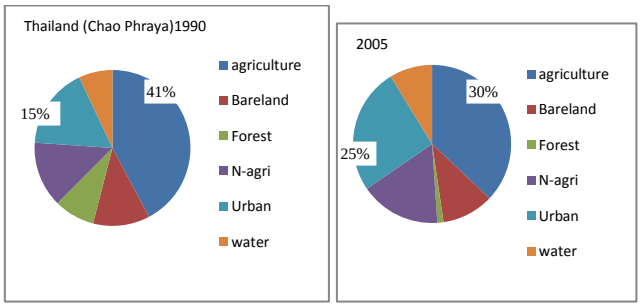

Fig-2 Land use types in Thailand 1990&2005 related with RP1

In Chao Phraya delta, Thailand the agricultural land and forest decrease in the interval of 1990-2005 due to the intense of urbanization and industrialization which drives the frequent flood.

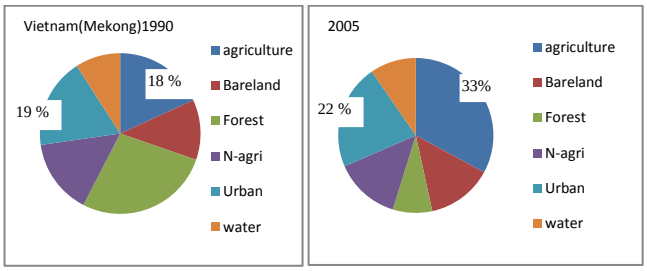

Fig-3 Land use types in Vietnam in 1990&2005 related with RP1

In comparison of 1990 and 2005 in Vietnam (Mekong), the agricultural land has resulted in twice during the period because of the losses of most of the forest area. Vietnam(Mekong) has the intense population and also the social economic area, the urbanization and agricultural area replaced in the deforestation area.

5. CONCLUSIONS

We analyzed the statistical properties of annual maximum water levels in the different deltas using probability density functions and compared the land use types according to the distribution map. The deltas are dominated by low lying topography, characterized by high social economy and is heavily populated. All these factors combine to make these regions prone to flood hazards. The annual floods were occurred by the deforestation of each delta replaced by urban and agricultural lands. It should be noted that, the increase in urban and agricultural lands that subject to the frequent flood risks in the deltas.

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