Evaluation of Non-structural Flood Mitigation in Greater Dhaka
Marju Ben Sayed1, Shigeko Haruyama2

Graduate school of Bioresources, Mie University, 1577 Kurimamachiyacho, Tsu city, Mie Pref. Japan1, 2

Key words: Land use/land cover change, Satellite city, Greater Dhaka district, Remote sensing.

1 Introduction

The geographical location of Greater Dhaka district in the downstream section behind the Brahmaputra river basins along with the low lying topographic nature of the terrain makes vulnerable especially for flooding, cyclones with storm surges and deep inundation. Until now there are several prevention work has been done in the government and non-government level such as embankment and circle levee construction around the capital city Dhaka. Although the central government of Bangladesh has been implementing several risk reduction planning and “structural measures” in Greater Dhaka district to protect the urban city centre against sea level rise in global warming under the rapid population increasing with the limitation of land accelerated disaster risk. Considering this social problem related to disaster, however, in this study the author strongly recommend the “non-structural measures” as the risk reduction planning on this fluvial plain. The authors set the research objective to clarify: 1) the stage of disordered land use change to assess the socio-economic change, 2) to prove micro-landform effectiveness for flood mitigation in this fluvial plain after the establishment of “structure measure” in Greater Dhaka district and satellite city.

2 Data and Methodology

Satellite data between 1989, 1999, 2009 and DEM data are key data for clarifying the land-use change in recent 2 decades, and the fluvial process of the fluvial plain in this study area. The micro-landform classified utilized satellite data and topographic map was prepared for the ground truth. Arc Map 10 used for analysis of land cover, last 30 years statistical data for analysis of socio-economic factors, former disaster prevention planning documents and flood records with physical condition data are used for risk assessment.

3 Result

From land cover analysis, in 1995 agricultural land of the Greater Dhaka was 1,121km² and in 2015, the amount was 895km² under agriculture. The agricultural land use of Greater Dhaka has been decreased at a slower rate comparison to build up area. The agricultural land in low-lying area is susceptible to flood risk. The disordered urban land use in the capital city and adjacency has been expanded by 11% during 1989 to 1999, and 22% from 1999 to 2009 and urban sprawl pushed decreasing agricultural land use which resulted in losing flood buffer zone. The population of ignorant flood has been increased by 50% in urban area and the relationship between urban growth and population increasing was inspected for the finding of strong correlation.

The authors prepared Geomorphologic land classification map and proved that the fluvial factors such as the meandering paleo-channels, back swamps and depressions have played a pivotal role in built-up zones in Dhaka and adjacent area, and according to the calculation of flood return period by using precipitation pattern and discharge data, the following results were clarified that 1) 80% of a common flood, flood magnitude was four times greater in urban area than sub-urban area, 2) for 27% built up land use condition in 1989, 3) the percentage of average annual rainfall for 1-year return period was 136mm and for 47% built up land use condition in 1999, the percentage of average annual rainfall for 5-year return period was 198mm, 4) It was Observed that, in 2007 for 40-year return period it was 240mm. According to the calculation, the author found that, 5) Urban area had higher flood magnitudes up to the 2 year return period flood compared to sub-urban areas, and this trend continued for the 5 and 10 year return period floods. 6) Flood magnitude differences between urban and sub-urban areas diminished as return period increased. 7) At 80% of a common flood, flood magnitude was four times greater in the urban area than sub-urban area. 8) For 27% built up land use condition in 1989, the percentage of average annual rainfall for 1 year return period was 136mm and for 47% built up land use condition in 1999, the percentage of average annual rainfall for 5 year return period was 198mm. Furthermore, the farmland where is elevation ranging below 3 m has rapid disordered land use changing and increase built-up area is due to shrinkage of transformation into the residential and commercial zone in recent 30 years.

Reference
