



# 学位論文要旨

専攻名 共生環境学 専攻

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## 題目 **Landform Effectiveness Assessment for Flood Mitigation in Flood Plain behind the Brahmaputra River** (ブラマプトラ川の氾濫原低地における災害軽減に向けた地形効果アセスメント)

The floodplain formed by the fluvial process of the Brahmaputra River was suffered by huge cyclones with storm surges and deep inundation. Greater Dhaka and surroundings have been affected by the severe water-related disaster, and the flood risk vulnerability is still now high because of fluvial plain in their geomorphologic location. In the view of engineering prevention works such as embankment and circle levee construction around the capital city, the central government of Bangladesh has been implementing risk reduction planning in Greater Dhaka to protect the urban core 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, "structure measures" as disaster prevention with early warning system was strongly recommended for regional planning, however, risk reduction planning is still needed on this fluvial plain. The re-evaluation of both "structure measures" and "non-structure measures" for disaster prevention is demanded in this study area. Reviewed the previous research papers of disaster risk assessment and prevention, the new flood mitigation method should be the necessity of "non-structure measures".

The author set the research objective to clarify the stage of disordered land use change at first, to assess socio-economic change in secondly, and at finally to prove micro-landform effectiveness for flood mitigation in this fluvial plain after the establishment of "structure measure" in Greater Dhaka and satellite city behind the Brahmaputra River.

Methodology and data of the study are as followings;

Remote Sensing 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 was prepared for the ground truth. Arc Map 10 used for analysis of land cover, last 30years 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.

The research results of the study are as followings,

Land covers change in the study area:

The disordered urban land use in the capital city and adjacency has been expanded by 12% 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 under huge cyclone and storm surges. The population of ignorant disaster has been increased by 50% in urban land use area and the relationship between urban growth and population increasing was inspected for the finding of strong correlation.

The relationship between landform and flood risk in the study area:

The author prepared "Geomorphologic land classification map showing flood affected area" and proved that the fluvial factors such as the meandering paleo-channels, patched back

swamps and depressions have played a pivotal role in built-up zones in Dhaka and adjacent area, and urbanization initially occurred in the elevated areas. Secondly the author clarified that, once all the elevated positions had been developed, the land rising demand in urban sprawl expansion has been generated by transformation of low-lying farmlands and water surface, flood magnitude differences between urban and sub-urban areas have been diminished as return period increased after calculated flood return period in the study area. After the flood return period calculation 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.

#### Socio-economic change:

The author assessed the past development project for strengthening against disaster with "structure measure" and got the following problems that although Greater Dhaka has its flood management policies which are involved in "structural measures" such as construction of embankments, floodwalls, pumping stations and land use in capital core and satellite cities without appropriate capacity of pumping flood water. In this study, the socio-economic status of living people inside and outside of floodwall in Greater Dhaka has been analyzed after infrastructure establishment. Regarding new disaster risks by advanced these construction achieved, the author found that disaster prevention and mitigation should be needed the new regional planning "non-structural measures" including the new land use policy to strengthening society against the flood. In conclusion, the author indicated that the appropriate land use policy for mitigation should be needed for regional linkage with satellite cities.

**Keywords:** Greater Dhaka district, Geomorphological land classification map, Land use/ Land cover, Flood return period, Urbanization.