INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

Name of the Student	:	**AMRUTHA SURESH**
Roll Number	:	**166104025**
Programme of Study	:	**Ph.D.**
Thesis Title	:	**Urban Flood Modeling and Evaluation of Mitigation Measures Considering Land Use and Climate Changes**
Name of Thesis Supervisor(s)	:	**Dr. Sreeja Pekkat**
Thesis Submitted to the Department/ Center	:	**Civil Engineering**
Date of completion of Thesis Viva-Voce Exam	:	**05-Feb-2024**
Key words for description of Thesis Work	:	Climate change, Copula, Effective impervious area, Urban flood Imperviousness, Intensity duration frequency curve, Land use land cover change, Low impact developments

SHORT ABSTRACT

Urban flooding and its associated fury have become very common in this century. Unplanned and indiscriminate urbanization and climate change are considered as the major causes of urban flood. Many studies have been done to quantify the impact of land use and climate change on various hydrological processes like streamflow, snow melt, soil moisture, droughts, etc. However, not many studies have been reported on the impact of land use and climate change on urban flooding (especially for Indian catchments). Therefore, the present study aims to quantify the impacts of climate change and land use on urban flooding for an urban catchment in northeast India. Climate change has resulted in drastic changes in rainfall patterns and their extremes, thereby making cities and major infrastructure more vulnerable to flooding. Extreme rainfall is incorporated in the design of hydraulic infrastructure through the intensity duration frequency (IDF) curve. In this study, a copula-based IDF curve is developed incorporating climate change. This study enlists recommendations for incorporating the influence of climate change while designing hydraulic infrastructure. For near-future climate change and infrastructure with a design life of <50 years, the RCP 6.0 scenario would yield the critical IDF curve. For long-term planning with a design life of > 50 years, it is desirable to consider the IDF curve based on the RCP 8.5 scenario. Quantification of imperviousness is essential for urban hydrological analysis and urban flood management. A semi-automated direct method was used to estimate the effective impervious area (EIA) from fine-resolution satellite images. An increase in built-up area was observed from 1980 to 2022 (2.85% to 50.56%), and watershed 3 showed the highest percentage of imperviousness. Climate change and urbanization have contributed to an increase in surface runoff in the city. The analysis indicates that EIA-related changes from 2011 to 2022 have resulted in 1.3 times increase in peak runoff, and climate change will result in 3.6–6.1 times more runoff in the future compared to the historical period. Low impact developments (LIDs) have gained wide acceptance as a sustainable and effective technique for mitigating urban flooding. It was found that among the four LIDs considered (green roofs, permeable pavements, infiltration trenches, and rain barrels), the green roof showed the highest percentage reduction in runoff characteristics. However, it was observed that climate change will increase the intensity of rainfall, and hence hybrid methods of flood mitigation may be needed, and the same needs to be explored in detail.