Improving flood resilience in Plaine Wilhems using nature-based solutions

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SUMMARY

Abstract

The impacts of Climate change, amplified by excessive anthropogenic activities, is unleashing its consequence through the alteration of weather patterns. The frequency of high intensity rainfall is escalating at an alarming rate, impacting many countries worldwide. Mauritius, despite being a small island, is no exception to the menacing forces of nature. Every year, the island faces severe flood events, resulting in notable property losses and even deaths. The worrying state of the climate in Mauritius is exacerbated by urbanization, and the absence of retrofitting green solutions in their developments with the goal to combat flooding. This, in turn, puts sensitive catchments at risk of flooding. This study aimed at an in-depth analysis of causes of flood for a more effective management of flood problems.

Morphometric analyses were conducted at both sites, to highlight their relative vulnerability, by virtue of their geomorphology. A rainfall runoff model using the softwares HEC-HMS, HEC-RAS and SWIMM, was simulated together with nature-based solutions (NBS), for one of the most extreme rainfall event recorded in Mauritius. The analysis incorporated flood attributes like, land use, soil type, and topographical data to determine how these factors influence surface runoff and flood vulnerability on both basins.

The morphometric analysis identified the most vulnerable subbasin, governed most by the dominant relief aspect. The hydraulic modelling supported these findings, by noting that this particular sub-basin experienced a relatively much greater extent of inundation. The study also noted that urban basins have limited capacity to absorb and manage excess water and this led to faster runoff and higher flood peaks, making it more susceptible to flooding compared to the rural basin. NBS

simulations demonstrated varying levels of effectiveness across the different interventions. Bio retention cells were the most efficient, showing a reduction of 31.6% in runoff depth and 113.0% in peak discharge. In contrast, green roofs, while being a cost-effective and sustainable measure, displayed limited impact on flood mitigation due to design constraints. Rain barrels and rain gardens also showed moderate effectiveness in reducing runoff.

This study showed a detailed flood vulnerability analysis at sub-basin level is important for better management of flood waters and a series of small NBS can altogether play a crucial role in alleviating flood urban areas. This study highlights the importance of adopting NBS in regions susceptible to flooding as part of a comprehensive, sustainable flood management strategy in the face of climate change.