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Nature-based solutions applied in urban drainage systems: a case study using GIS hydrological based modelling

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INTRODUCTION & AIM

Nature-based Solutions (NbS), can help to mitigate the effects of urbanization on the hydrological behavior of the basin and minimize the use of natural resources (UNEP (2023),

This work aims to present a case study in which NbS scenarios were tested using computational modelling to verify the effectiveness of such systems as an alternative for solving flooding problems in urban areas.

METHOD

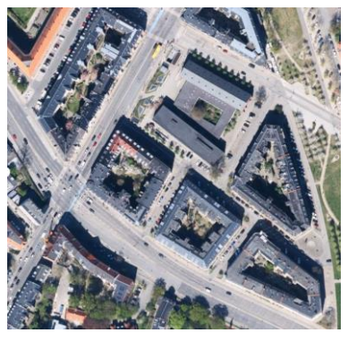
This case study corresponds to a central area in the city of Frederiksberg, a municipality located in Denmark. 3 scenarios for NbS were considered.

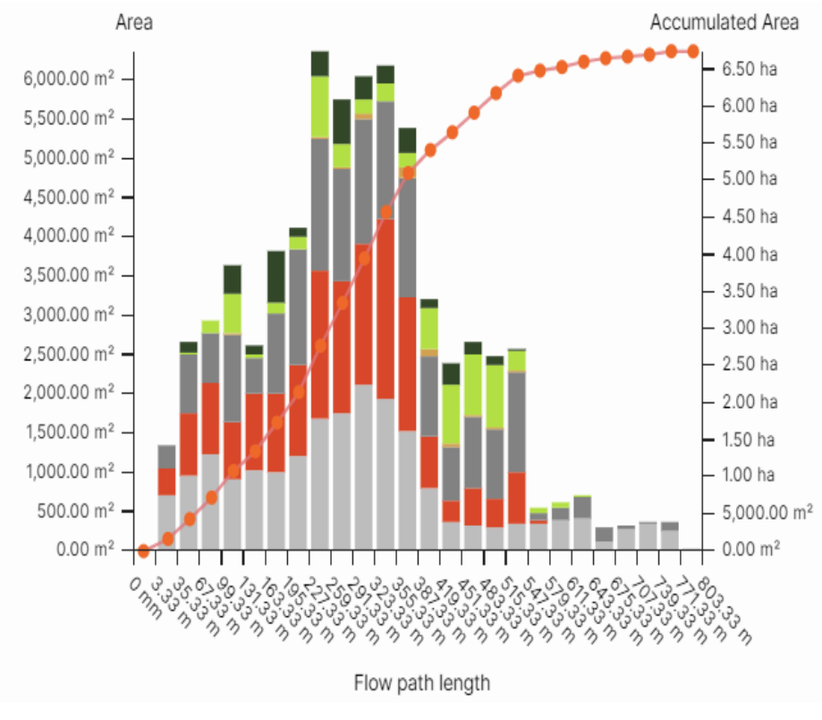
- Scenario 1 — increasing vegetation cover.
- Scenario 2, — infiltration trenches and linear gardens
- Scenario 3 — rain gardens

For hydrological modeling, the Scalgo software was used, which combines Georeferenced Information System (GIS) tools with an analysis of flood spots based on the amount of precipitation, local topography, and infiltrated water.

The flood spot analyses were carried out based on an intense rainfall event, resulting in a total rainfall of 50 mm. Water infiltration into soil was estimated based on the type of soil and type of coverage (paved or natural) using Horton's equation.

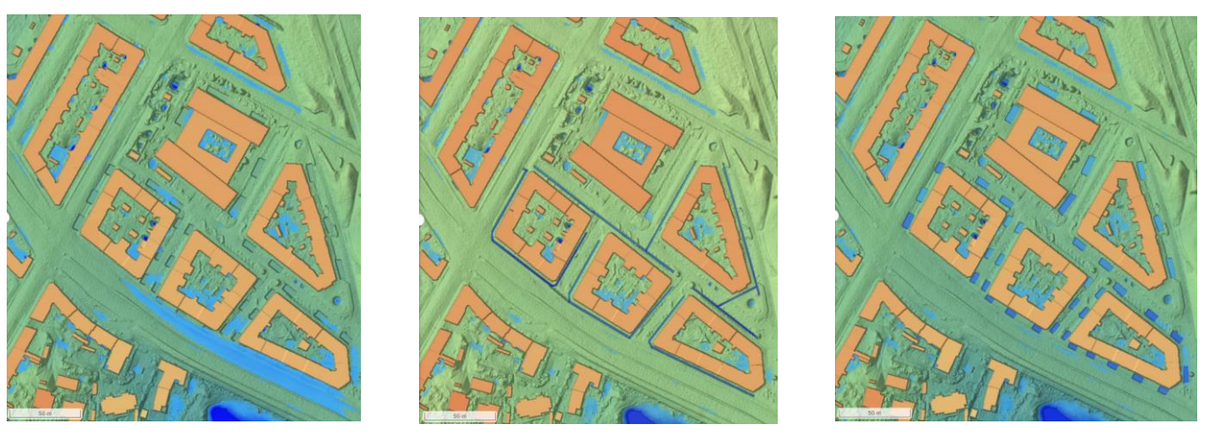
RESULTS & DISCUSSION





Contour lines and catchment area histogram for case study

In the case of scenario 1, a reduction of 50 m^3 of runoff was achieved, but it was not enough to mitigate the flooded area, whose total flooded volume was 286 m^3. Scenarios 2 and 3, in turn, were able to efficiently avoid flooding of the main road, with no flooding spots being observed.



(a) (b) (c)

Blue spots results for the three scenarios

CONCLUSION

The results of this study indicate a possible approach to be followed to compare different NbS with a view to its use as a measure of rainwater management.

REFERENCES

UNITED NATIONS ENVIRONMENT PROGRAMME (2023). Nature-based Solutions: Opportunities and Challenges for Scaling Up. Nairobi, UNEP, 40p.