MiSRaR

Good practice

Tipping Point - Mainstreaming Opportunity method applied for an urban stormwater system in Dordrecht (The Netherlands)

The Tipping Points - Mainstreaming Opportunity method starts with an analysis of adaptation tipping points, which are the points of reference where the magnitude of climate change is such that acceptable technical, environmental, societal or economic standards may be compromised. It extends the analysis of adaptation tipping points by including aspects from a bottom-up approach. The extension concerns the analysis of mainstreaming opportunities in the system of interest and closely related systems. The results from both analyses are used in combination to take advantage of cost-efficient mainstreaming opportunities. The proposed method has been applied to the management of flood risk for an urban stormwater system in Dordrecht (the Netherlands). The use of this method has enhanced the understanding of the robustness and adaptive potential of the urban stormwater system.

Background

Adaptation to climate change is usually assumed to require additional financial capacity to better deal with more severe climate conditions. The implementation of adaptive strategies at the local level is, however, constrained by a lack of financial resources in the short-term. As a consequence, enhancing resilience to climate change (or: climate proofing) should as much as possible be based on the incorporation of adaptation responses with normal investment projects, such as for the maintenance/modification/renewal of infrastructure, buildings and public spaces. This has been referred to as project-level adaptation mainstreaming.

In Europe, a steep increase in the proportion of capital investments in urban renewal and regeneration is being anticipated in the coming decades. Hence, there are significant opportunities to exploit these urban dynamics to better adapt infrastructure, buildings and public spaces to climate change and at the same time reduce adaptation costs.

ATP-AMO method

The Adaptation Tipping Point (ATP) - Adaptation Mainstreaming Opportunity (AMO) method provides a well-defined procedure for determining which responses and potential adaptations, where and when to incorporate into normal investment projects, such as for urban renewal and regeneration.

ATP-AMO starts with an analysis of ATPs, which is an effect-based approach for climate impact and adaptation assessment. This kind of approach starts by specifying an outcome (i.e., required performance) used to define acceptability thresholds to manage the impacts, and then assesses the likelihood of attaining or exceeding this outcome as a result of changing drivers. The

This project is cofinanced by the ERDF and made possible by the INTERREG IVC programme.

INTERREG IVC
INNOVATION & ENVIRONMENT
REGIONS OF EUROPE SHARING SOLUTIONS

European Union
European Regional Development Fund

ATP method examines the effects of increasing design loadings on the system performance. The benefit of ATP is that it is virtually independent of climate change scenarios, and in particular of probabilities of climate change. Climate change becomes relevant for adaptation-related decision making only if it would lead to the crossing of an acceptability threshold. The ATP method, therefore, requires a range of plausible scenarios that can be used to assess whether or not the system is likely to cross any acceptability threshold in the face of climate change. In this sense, the method is more dependent on stakeholder engagement to quantify the acceptability thresholds, to identify the potential options for adapting the system, and to select an adaptive strategy that is realistic and acceptable.

In the ATP method, the time window of an ATP will define when a change in the adaptive strategy will be needed. This assumes that climate change is the main driver of adaptation. In urban areas however, the maintenance/modification/renewal of infrastructure, buildings and public spaces could give an opportunity to reconsider the existing system from a different standpoint. Many adaptation responses can be implemented synergistically with the cycles of maintenance, modification and renewal and at next to no additional cost. From this perspective, these urban dynamics should be recognised and used as perhaps the most important driver of and opportunity for adaptation. Therefore, the analysis of ATPs has been extended by including aspects of the bottom-up approach. The extension concerns the analysis of AMOs in the system of interest and other closely related systems. The time windows of AMOs can in many cases be directly obtained from the existing plans for the normal investment projects in the area. For the analysis of AMOs it is crucial that all the major stakeholders share their plans for normal investment projects as well as the timing of these.

The results from both analyses are then used in combination to take advantage of cost-efficient AMOs. Where AMOs are expected to arise earlier than the critical ATPs, it could be economically worthwhile to move the potential adaptation responses forward in time, so as to incorporate them into normal investment projects. The costs of implementing adaptation responses synergistically with normal investment projects could be of the order of 50 to 80 % lower than the costs of implementing these responses as stand-alone adjustments. Whether (or not) project-level adaptation mainstreaming is likely to be cost-efficient will also depend on the length of the differential time period between the occurrence of the AMOs and the critical ATPs. With a longer differential time period, the potential cost savings from adaptation mainstreaming will be off-set by the cost savings from postponing adaptation responses until later, that is until the occurrence of the critical ATP. This is because later investments will be discounted more heavily than earlier investments.

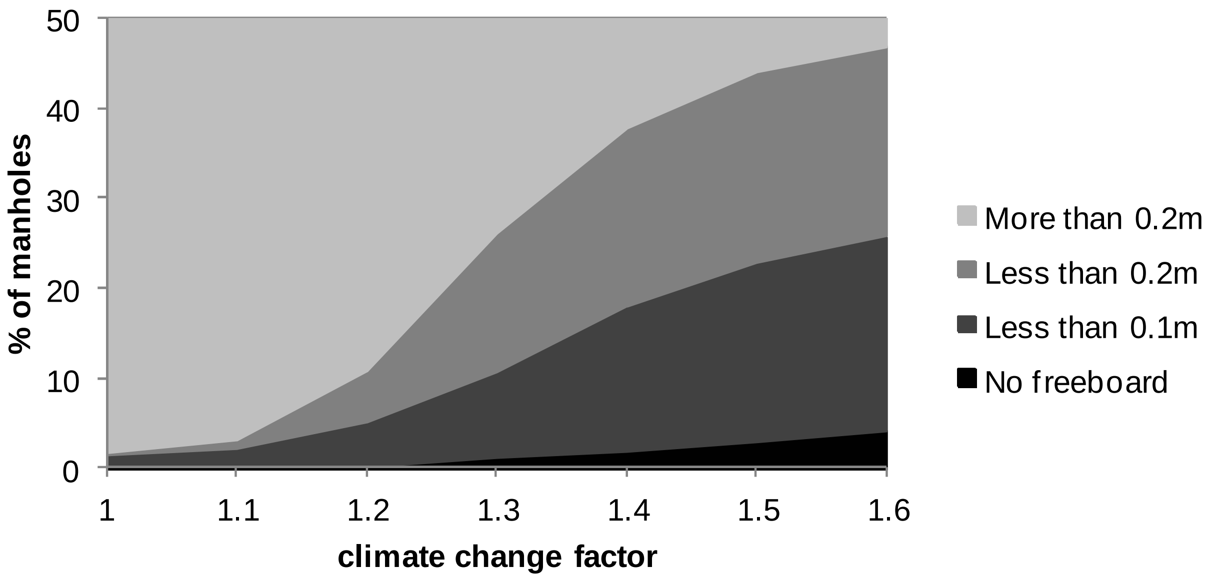
Application for the sewer system of Wielwijk

Wielwijk is a post-war neighbourhood in Dordrecht (the Netherlands) that is being regenerated. The regeneration project is occurring for various reasons, mainly social: an isolated and ill-used park, traffic nuisance, little diversity in neighbourhoods and water quality problems as a result of inadequate open water circulation. The municipality of Dordrecht and the housing corporation, in collaboration with residents, have proposed a plan for a neighbourhood regeneration project to address these problems. This plan is referred to as the Urban Vision 1.0.

The Urban Vision 1.0 incorporates many spatial changes. Approximately 800 homes will be demolished, 600 homes will be reconstructed, schools will be renovated and the edges of the area will get a facelift. Another important change is the diversion of the access road in the south to the edge of Wielwijk. This makes it possible to create a green park zone in the centre of the neighbourhood. A new structure of open watercourses is expected to help improve the open water quality through stronger circulation. According to the plan, the neighbourhood regeneration involves three phases: Reddersbuurt plus Westervoeg in 2010-2013;WielwijkZuid in 2012-2016; and Wielwijkpark plus WielwijkNoord in 2016-2019. These phases were identified as the mainstreaming opportunities for adapting the sewer system to climate change.

The sewer system of Wielwijk is part of the larger sewer system of Dordrecht Centrum, which is pumped to a sewage treatment plant by a main pumping station. The objective for the sewer is to minimise the occurrence of water on the streets due to manhole flooding. In Dordrecht, the sewer system is designed for a 1 in 2 year event, which is specified in the Municipal Sewer Plan. The ATPs for the sewer system of Wielwijk have been analysed using a 1D hydraulic model (SOBEK). The 1D model has been used to assess the boundary conditions (i.e., the possible future design loadings) under which the system performance becomes unacceptable. This was done by applying a series of climate change factors (cc factors) for rainfall intensities. A cc factor is a simple but useful method to describe the potential change in rainfall intensity due to climate change. It has been defined as the ratio between the future and present value of a hydro-climatic variable. According to the modelling results, which give the freeboard between the manhole water level and the street level under possible future design loadings, the sewer system performance will be reduced to an unacceptable level when the rainfall intensity increases by about 25%. Under the high climate change scenario of the KNMI (Royal Dutch Meteorological Institute) this would occur around 2055.

Taking the case where mainstreaming opportunities occur within the regeneration project, a number of responses were then developed for climate-proofing the regeneration of Wielwijk. The responses were developed based on the existing sewer system, but with the inclusion of disconnections, diversions and extra green and blue areas in the public space. These responses were identified in a series of collaborative design workshops attended by urban designers, architects, sewer managers, water managers



completely disconnected. The latter volume of stormwater is stored locally (either on the surface or underground) before being released gradually into the sewer network.

The adaptive potential of the sewer system was quantified by analysing the ATPs for the modified plan for the neighbourhood regeneration. The outcome of the ATP analysis for the modified plan showed that the performance of the sewer system performance will become acceptable up to a 45% increase in rainfall intensity. This ATP will occur around 2100 under the high climate change scenario.

(including the water board), regeneration planners, scientists, and inhabitants. Through collaboration with the urban designers and architects, it has been possible to incorporate these responses into the neighbourhood regeneration project. This is referred to as the Urban Vision 2.0.

The approach taken for the sewer system was to plan to reduce the volume of stormwater entering the combined sewer and to accommodate it elsewhere. This includes disconnecting roofed areas of public buildings and paved areas (such as streets and parking lots). The flows from most of these areas were diverted to the open water system via a new sewer for stormwater as space was not available in the street profile for surface conveyance. Where diversion to the open water system was impractical due to long distances, the stormwater was diverted to adjacent public green spaces. This required a lowering of the green spaces to allow for temporary surface storage, including underground storage. Such temporary surface storage provides spatial amenities for most of the time, and fills up in a controlled manner during intense rainfall events. This technique has been chosen for the park zone in the centre of the neighbourhood. Using this approach, 28% of the total roofed area and 57% of the total paved area were considered redirected to the open water system and 7% of the total roofed area and 9% of the total paved area were considered to be

Lessons learnt

The following lessons have been learned about the method:

- Within the current economic and political context it is unlikely for cities to implement stand-alone responses for climate change adaptation. Therefore, the implementation of adaptation responses should be part of mainstreaming with normal investment projects. The ATP-AMO approach works with adaptation opportunities arising from urban dynamics, and delivers valuable input for climate-proofing cities without dependency on changing scenarios.
- The degree of resilience to climate change ca be made explicit by the ATP-AMO method. The collaborative design workshops showed that climate change related ambitions can be combined with other ambitions in the city. It has been demonstrated, for example, that responses to deal with flood risk can also address problems with air quality, heat stress, drought, energy supply and even social problems. In all cases, the local characteristics and sensitivities are crucial for the selected responses in an area. The ATP-AMO method is a supportive tool for this design process.
- The method can support the dialogue between the different actors involved. In this respect it contributes to better cooperation at the local level, by which local interests and knowledge feed the decision making process. The method also supports communication about climate change adaptation.
- Finally, the method has an important role in promoting the transition from sector-based to integrated water management in urban areas.

Gersonius, B., Nasruddin, F., Ashley, R., Jeuken, A., Pathirana, A. & Zevenbergen, C. 2012. Developing the evidence base for mainstreaming adaptation of stormwater systems to climate change. Water Research. Available at: http://dx.doi.org/10.1016/j.watres.2012.03.060

The MiSRaR project

The MiSRaR project is about Mitigation of Spatial Relevant Risks in European Regions and Towns. The project is a cooperation between seven partners in six EU member states:

- *the Safety Region South-Holland South, The Netherlands (lead partner)*
- *the city of Tallinn, Estonia*
- *the region of Epirus, Greece*
- *the province of Forlì-Cesena, Italy*
- *the municipality of Aveiro, Portugal*
- *the municipality of Mirandela, Portugal*
- *the Euro Perspectives Foundation (EPF), Bulgaria.*

The goal of the project is to exchange knowledge and experiences on risk mitigation in spatial policies. The project will result in a handbook in which the lessons on the mitigation process are described and the good practices from the partners are presented. The Risk Assessment and Mapping Guidelines for Disaster Management of the European Commission will be implemented in the handbook.

The MiSRaR project is cofinanced by the European Regional Development Fund and made possible by the INTERREG IVC programme.

www.misrar.eu

Contact information

Nico van Os, general project manager MiSRaR,
Safety Region South-Holland South,
The Netherlands
n.van.os@vrzhz.nl

Berry Gersonius, Lecturer Urban Flood Resilience
UNESCO-IHE Institute for Water Education,
The Netherlands
b.gersonius@unesco-ihe.org

See also: Gersonius, B. 2012 : "The resilience approach to climate adaptation applied for flood risk"