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La gestion durable des risques d'inondation – Qu'est-ce qui est durable ?

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RÉSUMÉ

La gestion durable du risque d'inondation doit être atteinte car la protection contre les inondations est un service fondamental de la société que nous devons assurer. En nous basant sur les réflexions émanant des domaines de la gestion des risques et de la gestion durable de l'hydrologie urbaine, nous élaborons sur la nécessité d'évaluer la durabilité de la gestion des risques d'inondation et nous proposons une méthodologie d'évaluation. Nous soutenons la nécessité d'inclure des mesures quantitatives de durabilité dans la gestion des risques d'inondation afin d'exclure les solutions non durables. De plus, nous utilisons le concept de durabilité absolue pour discuter des perspectives de maintenir les niveaux de services actuels sans compromettre le droit des générations futures à ces services. Des débats sur la durabilité des différents schémas généraux de gestion des risques d'inondations doivent avoir lieux. De tels changements fondamentaux d'approche exigent des changements fondamentaux dans les mentalités des praticiens, mais aussi des législateurs, des politiciens et du grand public, ce qui va inévitablement prendre un certain temps. À l'heure actuelle, l'important est d'établir un planning basé sur la durabilité pour qu'elle soit quantifiée et évaluée lors de la gestion des risques d'inondation.

ABSTRACT

Sustainable flood risk management has to be achieved since flood protection is a fundamental societal service that we must deliver. Based on the discourse within the fields of risk management and sustainable urban water management, we discuss the necessity of assessing the sustainability of flood risk management, and propose an evaluation framework for doing so. We argue that it is necessary to include quantitative sustainability measures in flood risk management in order to exclude unsustainable solutions. Furthermore, we use the concept of absolute sustainability to discuss the prospects of maintaining current service levels without compromising future generation's entitlement of services. Discussions on the sustainability of different overall flood risk schemes must take place. Fundamental changes in the approaches will require fundamental changes in the mind-sets of practitioners as well as lawmakers, politicians and the general public, which inevitably will take some time. Right now, the importance lies in setting an agenda where sustainability is important and needs to be quantified and assessed when managing flood risk.

KEYWORDS

Flood, LCA, Management, Risk, Sustainability

1 INTRODUCTION

Flood protection is usually planned using risk management frameworks, as this is a fundamental societal service with high priority where costs can be quantified and evaluated. In general, protecting society from floods seems like a good idea, since it can save lives and preserve assets. But are the usual solutions sustainable?

This study provides a discussion of the necessity of assessing the sustainability of flood risk management, and proposes a possible evaluation framework to use in the assessment.

1.1 Sustainable urban water management

Fletcher et al. (2015) review international development in the terminology associated with urban stormwater management. Common for all the terms is that they do not cover all aspects of sustainability. For instance, “The UK National Standards for SUDS” (Sustainable Urban Drainage Systems) (Department for Environment Food and Rural Affairs, 2011) does not mention any sustainability indicators as part of selecting SUDS. Only very few studies quantify the environmental impact of urban water management systems by performing e.g. a life cycle assessment (LCA). It seems that systems and technologies are considered sustainable based on a common assumption that anything greener or closer to the natural water cycle is per definition also more sustainable than traditional urban drainage.

Brudler (2015) sums up the literature within LCA of stormwater management and describes some of the key challenges. In general, LCA is being used to compare different stormwater management solutions; often “grey” and “green” alternatives. However, the systems do not only provide functions directly related to managing stormwater (e.g. amenity value). Thus problems arise to assure that the alternatives are actually comparable by providing the same service.

Belmeziti et al. (2015) review which functions a sustainable urban water management system should provide. They present a comprehensive list of urban water management service functions that together cover the original definition of sustainability in urban water management given by Larsen and Gujer (1997). In total 13 functions is listed, flood protection being one of them.

1.2 Flood risk management

Flood risk is typically handled through flood risk assessment and management frameworks, where the risk is quantified and translated into a societal cost, and alternative solutions are defined and ranked against the expectation of the total cost (Zhou et al., 2012; Åström et al. 2014). Merz et al. (2014) delineate challenges in flood risk management, which illustrates that even traditional flood risk management requires handling of many aspects related to considerations on sustainability, as also mentioned by Belmeziti et al. (2015). Fischer et al. (2013) show how social indicators can be used as limiting factors in a risk optimization setting, and highlights that important factors include an assessment of which costs to include, how to discount them and what time frame to consider. Similarly, the framework proposed in Åström et al. (2014) aims at stabilizing the flood risk over the technical lifetime of the system, ensuring inter-generational equity by providing flexible solutions based on continuous investments.

1.3 Risk assessment and sustainability

As pointed out by Belmeziti et al. (2015), sustainability is often divided into economic, social and environmental sustainability. The economic and social sustainability can be assessed through e.g. the framework proposed by Fischer et al. (2013), but the environmental sustainability is most often quantified using LCA, even though this is not the case in sustainable urban water management (Belmeziti et al. 2015).

Harder et al. (2015) provide a review on applications where risk assessment and LCA have been brought together for environmental cases; clearly showing this is not a trivial task, but none the less an important thing to be able to do. Integration of risk assessment and LCA into one framework is what is suggested by Hauschild et al. (in prep.) as this is a fundamental basis for provision of decision support incorporating both.

This study explores how this general decision support framework can be populated and used in an urban flood risk management perspective and how this use challenges the general understanding of the meaning of sustainable urban water management.

2 RESULTS AND DISCUSSION

Based on the framework proposed by Åström et al. (2014), options where sustainability can be assessed are identified (See Figure 1). Sustainability has to be quantitatively assessed (e.g. through LCA as in Brudler et al. (2015)) and incorporated into risk assessment at two levels: 1) decision level, when selecting possible decision alternatives; 2) cost/benefit optimization level as an overall constraint on the utility function to assure the selection of the optimal alternative. In this way, we can assure that:

- In case that the economic differences between scenarios is small, the most sustainable solution is chosen.
- In case the difference in sustainable impact between scenarios is small, the most economical solution is chosen.
- In case of large economic and sustainable variation between scenarios, an assessment is made to secure the most beneficial solution for society.
- Or look at it from a fundamentally different perspective, and secure that a certain minimum level of sustainability is introduced as constraint for the economic optimization (as with the societal indicators in Fischer et al. (2013)).

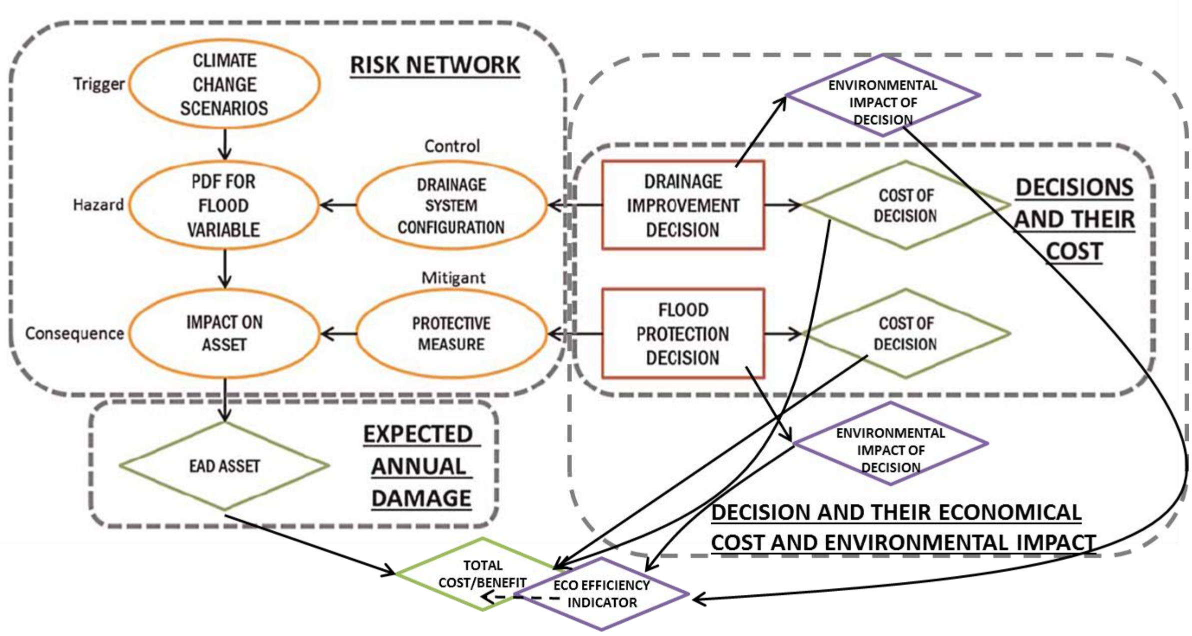

Figure 1 Flood risk management framework modified from Åström et al (2014) to include specific sustainability 'cost' notes.

The two first cases are easily solved as there in both cases are obvious best solutions. The third case really poses the greatest difficulty as the weighing between economy and sustainability is a difficult matter that often involves very subjective assessment methods and does not guarantee a sustainable solution (e.g. when trade-off are assessed by expert judgment of a majority of business stakeholders, discarding the societal preference over sustainability). This is why the fourth option is really the central one. Flood risk management is a necessary part of society and we cannot choose not to do it. Hence, we need to find solutions that are truly sustainable, i.e. sustainable in the absolute form, where they could in principle be introduced worldwide and operated for eternity without compromising human society's ability to sustain itself and the world it resides in.

Bjørn et al. (2015) introduced the concept of "Absolute Sustainability", where scenarios are not weighed against one another, as is often the case in LCA (see e.g. Brudler 2015), but against a scaled measure of the global carrying capacity. Put simply, it can be calculated which emissions a person is allowed per year to be sustainable. A fraction of these emissions can then be assigned to protecting the person from floods; not more than 100% and more likely a rather small fraction as many other fundamental needs have to be covered as well.

Using this as a limiting factor in risk management will raise new challenges as we might be unable to provide sustainable solutions to the current threats with the current infrastructure and tools. Also, it opens a debate on whether it is possible to design sustainable solutions that can provide the service level we expect today, or if this has to be lowered to secure absolute sustainable solutions.

To be able to use sustainability as an active design measure in the scenario building phase, an inventory where the emissions and other non-water related impacts associated with all possible components of an urban water management system has to be developed. Also tools where these impacts are aggregated on planning scale are important for scenario developers to easily be able to support the choice of more sustainable solutions on all scales from the lot scale over the catchment scale to the national and super-national policy scale.

3 CONCLUSION

Today we are getting used to only protect assets that are worth protecting based on a cost-based risk assessment. In the future, we will have to adopt a worldview where we cannot uphold the current service level. Fewer assets will be worth protecting and more places will become inhabitable. The environmental burden of protecting them today is simply too high. It may not be sustainable.

Fundamental discussions on the sustainability of different overall flood risk schemes must take place. Fundamental changes in the approaches taken will require fundamental changes in the mind-sets of practitioners as well as lawmakers, politicians and the general public, which inevitably will take some time. Right now, the importance lie in setting an agenda where sustainability is important and where it is something that has to be quantified and assessed when flood risk management takes place.

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