

Sustainable climate change adaptation of urban water management in compliance with the UN SDGs

Adaptation durable au changement climatique de la gestion des eaux urbaines conformément aux ODD des Nations Unies

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RÉSUMÉ

L'adaptation durable de la gestion des eaux urbaines au changement climatique apporte souvent, au-delà de la gestion de l'eau, une multitude de services à la société et est souvent utilisée comme levier pour transformer les villes dans une direction plus vivable, verte et résiliente. Ces mesures doivent être reconnues comme faisant partie des services découlant des mesures d'adaptation, une part qui pourrait potentiellement pousser la société en général dans une direction plus durable. Nous avons identifié ces services et les avons classés dans quatre catégories différents : la gestion des eaux pluviales, la gestion des ressources naturelles, la qualité de vie urbaine et la transition et l'innovation. Les objectifs et indicateurs ODD (Objectifs de Développement Durable) pertinents ont été appariés à chaque service, et des indicateurs pertinents au niveau du projet ont ensuite été formulés afin de cibler l'ODD concerné, et si possible, compléter l'indicateur ODD associé au niveau mondial ou national. Les ODD de l'ONU constituent un cadre pertinent permettant de considérer la durabilité des efforts d'adaptation au changement climatique, mais ils nécessitent une évaluation approfondie des services attendus de chaque mesure d'adaptation avant que celle-ci ne soit mise en œuvre.

ABSTRACT

Climate change adaptation of urban water management often, on top of handling water, delivers a multitude of other services to society; it is often used as a levee for transforming cities in a more liveable, green, and resilient direction and these measures should be acknowledged as part of the services provided; a part that potentially can push society at large in a more sustainable direction. We identified such services and categorized them into four domains: stormwater management, natural resources management, urban liveability, and transition and innovation. Relevant SDG targets and indicators were matched to the individual services, and indicators relevant at project level then formulated to serve the intention of the related SDGs, and where possible, to serve as input to the related SDG indicator at global or national level. The UN SDGs is a relevant framework for considering the sustainability of climate change adaptation, but requires a thorough assessment of which services a given climate change adaptation measure is expected to deliver before it can be operationalized.

KEYWORDS

Climate change adaptation, Indicators, Sustainability, United Nations Sustainable Development Goals, UN SDGs

1 INTRODUCTION

Water is the only resource to have received a goal of its own in the UN SDGs, SDG6. Hence, SDG6 is often the main focus for water professionals. However, the purpose of urban water management is much broader than what is covered by SDG6 and is reaching far into other targets as for instance SDG11 on resilient cities and SDG13 on climate change (United Nations, 2015).

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2 METHODOLOGY

2.1 Identifying relevant services

Within four identified overall domains, we identify services that climate change adaptation may deliver to society (Madsen et al., 2018). Not all services are relevant in all cases, and some are conflicting; this calls for prioritization and custom-made solutions. The four domains are:

- *Stormwater management*: Often seen as the primary goal of climate adaptation as the water cycle is changing, calling for new and smarter solutions, especially for protections against extremes.
- *Natural resources management*: How climate adaptation change the large non-extreme water flows can greatly influence groundwater recharge and the quality and quantity of stormwater runoff to receiving waters. In addition, materials and land are used for construction of climate adaptation measures and the resulting effects on ecosystems and the environment at large are relevant to quantify.
- *Liveability for people*: Climate change adaptation requires great physical transformation of our cities. Ideally, this transformation process should lead to more liveable urban spaces.
- *Transition and innovation*: The transition towards more sustainable cities has only just begun. A climate adaptation projects value with respect innovation and providing insight into how to best continue this transition is crucial.

These domains hold multiple attributes, and several services can be identified within each of them.

2.2 Matching with relevant SDG targets and indicators

For each identified service, relevant SDG targets and associated indicators were mapped. Based on this mapping, the most relevant SDG target/indicator pair(s) at project and planning level were selected. Indicators that can be measured at project level and at the same time inform the global/national SDG indicators were formulated for each identified target/indicator pair. In this way it was secured that the matching is not only vaguely related at the overall level, but actually matches the intention of the SDGs at the target and indicator level.

3 RESULTS

3.1 Identified relevant services

Services were identified within the four identified domains as illustrated in Table 1. These services are commonly identified in literature and practise as being important for climate adaptation measures. They span from the main target of climate change adaptation (flood risk management) to services that has only little to do with water but more so with people (local participation) or nature at large (biodiversity).

Table 1 Identified services.

Stormwater management	Natural resources management	Liveability for people	Transition and innovation
Flood risk management	Water resources management	City greening	Local participation
	Water quality protection	Reduction in urban heat island effects	Documentation and monitoring plans
	Material use and carbon footprint	Enhancing social-cultural values	Economy
	Biodiversity support		

3.2 Matching selected services to relevant SDG targets

All services are matched to relevant targets from all SDGs. Table 2 lists relevant targets identified for the service regarding flood risk management with underlining to highlight why the match is made. Relevant targets are identified under five different SDGs, highlighting the necessity of reading through all targets for the matchmaking and not limit oneself to SDGs that intuitively seems relevant.

Table 2 SDG targets relevant for flood risk management.

Target	Target text from United Nations (2015)
1.5	By 2030, build the resilience of the poor and those in vulnerable situations and <u>reduce their exposure and vulnerability to climate-related extreme events</u> and other economic, social and environmental shocks and disasters
9.1	<u>Develop quality, reliable, sustainable and resilient infrastructure</u> , including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all
9.4	By 2030, <u>upgrade infrastructure</u> and retrofit industries <u>to make them sustainable</u> , with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities
11.4	Strengthen efforts to <u>protect and safeguard the world's cultural and natural heritage</u>
11.5	By 2030, <u>significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters</u> , with a focus on protecting the poor and people in vulnerable situations
11.B	By 2020, <u>substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters</u> , and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels
13.1	<u>Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries</u>
15.3	By 2030, combat desertification, <u>restore degraded land</u> and soil, <u>including land affected by desertification, drought and floods</u> , and strive to achieve a land degradation-neutral world

Similar tables are constructed for each of the services listed in table 1. For each of these tables the associated indicators from the SDGs were then mapped and possible indicators at project level discussed. For flood risk management it becomes clear that indicator 11.5.2: “*Direct economic loss in relation to global GDP, damage to critical infrastructure and number of disruptions to basic services, attributed to disasters*” (United Nations, 2018) is the one that most easily translates to how flood risk is often quantified (Löwe et al., 2018).

The presentation will highlight both where there are obvious link and where links between the project level and the SDG level are difficult to establish because indicators are different or not developed (yet).

4 CONCLUSIONS

The UN SDGs is a relevant framework for considering the sustainability of climate change adaptation, but to be operational it requires:

- That specific services that climate change adaptation measures can deliver are formulated
- That these services are matched broadly with SDG targets and indicators
- That relevant indicators are formulated at project level while respecting the intention of the relating targets and ideally informing relevant SDG indicators.

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LIST OF REFERENCES

- Belmeziti, A., Cherqui, F., Tourne, A., Granger, D., Wery, C., Le Gauffre, P. and Chocat, B. (2015). Transitioning to sustainable urban water management systems: how to define expected service functions? *Civ. Eng. Environ. Syst.* 1–19. doi:10.1080/10286608.2015.1047355.
- Löwe, R., Urich, C., Kulahci, M., Radhakrishnan, M., Deletic, A., & Arnbjerg-Nielsen, K. (2018). Simulating flood risk under non-stationary climate and urban development conditions - Experimental setup for multiple hazards and a variety of scenarios. *Environmental Modelling & Software*, 102, 155-171. DOI: 10.1016/j.envsoft.2018.01.008
- Madsen, H.M., Andersen, M.M., Rygaard, M. & Mikkelsen, P.S. (2018). Definitions of event magnitudes, spatial scales, and goals for climate change adaptation and their importance for innovation and implementation. *Water Research*. 144, 192-203. doi:10.1016/j.watres.2018.07.026.
- United Nations. (2015). General Assembly. Transforming our world: the 2030 Agenda for Sustainable Development A/RES/70/1.
- United Nations. (2018). Resolution adopted by the General Assembly on Work of the Statistical Commission pertaining to the 2030 Agenda for Sustainable Development, Annex II. A/RES/71/313 E/CN.3/2018/2.