



DISCUSSION PAPER

Increasing climate resilience in ASEAN cities through inclusive Nature-based Solutions

Developing projects to empower women and other
people in vulnerable situations

Anna Erbacher, Mathilde Wilkens (adelphi)

SUPPORTED BY



Federal Foreign Office

IN COOPERATION WITH



SUPPORTED BY



This paper was developed as part of the project “Building Inclusive Urban Resilience: Strengthening ASEAN Cities through Collaborative Action and Empowerment of Vulnerable Groups” and supported by a grant from the German Federal Foreign Office.

The analysis, results, recommendations and graphics in this paper represent the opinion of the authors and are not necessarily representative of the position of any of the organizations listed above. Please note that the content presented in this paper was primarily written in 2023 and has been used in a collaborative workshop with ASEAN cities on “Strengthening inclusive urban resilience in selected cities” in November 2023. The inputs from the workshops have also contributed to the paper.

All rights reserved. The content of the work created by adelphi and the work itself are subject to German copyright law. Third party contributions are marked as such. Duplication, revision, distribution and any kind of use beyond the limits of copyright require the written consent of adelphi gGmbH. The duplication of parts of the work is only permitted if the source is mentioned.

Suggested Citation: Anna Erbacher; Mathilde Wilkens 2024: Increasing climate resilience in ASEAN cities through inclusive Nature-based Solutions. Developing projects to empower women and other people in vulnerable situations. Berlin: adelphi research gGmbH.

Publisher: adelphi research gemeinnützige GmbH
Alt-Moabit 91
10559 Berlin
+49 (030) 8900068-0
office@adelphi.de
www.adelphi.de

Authors: Anna Erbacher, Mathilde Wilkens

Photo credits: Nicoleriegler79 / pixabay, Frontpage
Juelber Albert, Page 20
Souphithak Chanthavonghak, Page 21
igorovsyannykov / pixabay; JonnyBelvedere / pixabay, Page 22
Libby Hogan / DVB, Page 23

Status: January 2024

© 2024 adelphi

adelphi

adelphi is the leading independent think-and-do tank in Europe for climate, environment and development. We are some 300 strategists, thought leaders and practitioners working at the local and global levels to find solutions to the most urgent political, economic and social challenges of our time. As a policy consultancy, we support a just transition towards carbon neutrality and sustainable, liveable societies. Our work is grounded in transdisciplinary research, evidence-based consulting and stakeholder dialogues. With these tools we shape policy agendas, facilitate political communication, inform policy processes and support decision-makers.

Since 2001, we have successfully completed more than 1,000 projects worldwide for numerous international clients and partner organisations in the fields of **energy, climate, resources, finance, diplomacy and business**.

Sustainability is the basis of our internal and external conduct. We are **committed to a future fit for grandchildren**, reduce our CO2 emissions where we can and offset those that are currently unavoidable. We purchase 100 per cent green electricity, consistently rely on environmentally friendly and socially responsible procurement and use ethical financial services. Through our project work, we contribute to increasing positive environmental performance. The responsibilities and processes of our corporate environmental protection are certified according to the EMAS seal of approval, the highest European certification for a systematic environmental management system.

Dennis Tänzler

Director and Head of Programme Climate Policy

taenzler@adelphi.de

www.adelphi.de

Outline

This paper investigates the potential of inclusive NbS projects to increase the resilience of ASEAN cities to climate-related risks, while empowering people in vulnerable situations. A specific focus lies on inhabitants of informal settlements and women, as these are large population groups especially vulnerable to climate change impacts in cities. Nature-based Solutions (NbS) have increasingly gained attention over the last decades in the field of climate change adaptation, due to their potential to address climate risks while providing important economic, social and biodiversity benefits, often in a cost-effective way. However, although NbS are widely perceived as viable approaches, recent assessments stress that the actual use of NbS still remains limited. The paper briefly summarizes main drivers of vulnerability to climate change impacts in ASEAN cities and provides some relevant scientific background. It then discusses advantages of NbS over grey solutions in climate change adaptation and introduces concrete examples of urban NbS. Subsequently, the paper investigates key aspects of NbS projects aiming at empowering women and other people in vulnerable situations. The role of targeted analyses, participatory processes, inclusive NbS design, and of income generating activities and capacity building are explored in more detail. Finally, important entry points for mainstreaming inclusive NbS in urban settings are explored.

Table of Contents

Abbreviations	6
Introduction	7
1 Vulnerability to climate change impacts in ASEAN cities, focusing on informal settlements and gender aspects	9
1.1 Climate risks in ASEAN cities	9
1.2 Drivers of vulnerability and gender considerations	10
1.3 Informal settlements: high exposure and vulnerability to climate hazards	11
1.4 Strengthening resilience through inclusive approaches	12
2 Urban Nature-based Solutions for increased climate resilience	13
2.1 Nature-based Solutions advantages over grey solutions in climate change adaptation	13
2.2 Selected urban Nature-based Solutions: open green spaces, urban farming and river floodplains	14
3 Empowering women and vulnerable communities through Nature-based Solutions projects	16
3.1 Supporting transformative practices	16
3.2 Entry points for Nature-based Solution projects	16
3.3 Insights from ASEAN case studies	19
4 Mainstreaming inclusive Nature-based Solutions approaches: governance considerations to balance prevailing challenges	24
4.1 Strengthening cross-sectoral collaboration	24
4.2 Managing Nature-based Solutions trade-offs for communities: competing land uses, re-settlements and gentrification concerns	24
4.3 Ensuring continuity of Nature-based Solutions projects through local community governance	25
4.4 Potential next steps for regional and international cooperation	25
Publication bibliography	27

Abbreviations

ADB	Asian Development Bank
AF	Adaptation Fund
AMS	ASEAN Member State
AR6	6 th Assessment Report
ASEAN	Association of Southeast-Asian Nations
BMA	Bangkok Metropolitan Administration
CAF	Cancun Adaptation Framework
CBA	Community Based Adaptation
CCA	Climate Change Adaptation
GCF	Green Climate Fund
GEF	Global Environment Facility
ICI	International Climate Initiative
IPCC	Intergovernmental Panel on Climate Change
MoNRE	Ministry of Natural Resources and Environment
LAO PDR	Lao People's Democratic Republic
NAP	National Adaptation Plan
NbS	Nature-based Solutions
PAFO	Provincial Agriculture and Forestry Office
PESP	Payment for Environmental Services Program
PICT	Provincial Office of Information, Culture and Tourism
PoNRE	Provincial Office of Natural Resource and Environment
PPWT	Provincial Office of Public Work and Transport
SDGs	Sustainable Development Goals
SEA	South East Asia
SLR	Sea-Level Rise
UHI	Urban Heat Island
UN	United Nations
UNEP	United Nations Environment Program
USA	United States of America
WASH	Water, Sanitation and Hygiene

Introduction

ASEAN cities are growing. What for a long time has been seen to stand for a positive development and increasing human wellbeing might be at a turning point due to the increasing risks that cities are, and will be, exposed to from climate change (ASEAN 2022). In his video message related to the launch of the 6th Assessment Report from the Intergovernmental Panel on Climate Change (IPCC) in April 2022, United Nations (UN) Secretary-General António Guterres warned the international community, stating:

“We are on a fast track to climate disaster. Major cities under water. Unprecedented heatwaves. Terrifying storms. Widespread water shortages. The extinction of a million species of plants and animals. This is not fiction or exaggeration. It is what science tells us will result from our current energy policies.” (UN 4/4/2022)

There is an urgent need for the adaptation of cities to climate change, as costs of inaction are projected to be much higher than the costs for adaptation efforts (Depietri and McPhearson 2017). Cities face different pre-conditions than rural areas, giving rise to distinct challenges. High concentrations of people, urban infrastructure and valuable assets together with often exposed locations close to coastal areas and floodplains make cities especially vulnerable to the impacts of climate change (Depietri and McPhearson 2017). However, cities’ inhabitants are not impacted equally. Various factors including poverty, inequality and the lack of access to basic services, play a significant role in shaping the vulnerability of individuals and specific groups within the urban population, heightening their susceptibility to climate risks (Dodman et al. 2022a; Dodman et al. 2018; IPCC 2022). Here, gender is found to be an important determinant of vulnerability due to, among others, being intertwined with many socio-economic factors contributing to higher vulnerability (Alber 2011; ASEAN and UN Women 2022). Therefore, to leave no one behind, a special emphasis should be on focusing on groups in vulnerable situations within the urban population, being among others women, children, the elderly, indigenous people, low-income households, people with disabilities, and migrants (ASEAN 2021b; UN Habitat 2022; Shaw, R., Luo, Y. et al. 2022).

The resilience of groups in vulnerable situations to climate risks, including women and girls can be increased substantially if adaptation measures are conceptualized, designed and planned in an inclusive way. Ideally, these measures not only incorporate the adaptation to climate risks, but lead to an overall sustainable urban development with better and safer infrastructure solutions for all (OXFAM 2017; McPhearson et al. 2023) — in line with the Sustainable Development Goal (SDG) 11 “making cities and human settlements inclusive, safe, resilient and sustainable” (UN General Assembly 2015).

Nature-based Solutions (NbS) have increasingly gained attention over the last decades in the field of climate change adaptation (CCA), due to their potential to address climate risks while providing important economic, social and biodiversity benefits, often in a cost-effective way (Seddon et al. 2020). In an urban environment, examples of NbS include open green spaces, urban farming, or the renaturation of river floodplains. Implementing NbS can have various positive effects with regard to mitigating climate-related hazards, such as lowering the ambient air temperature in heat-affected areas, or increasing the water retention capacity, thereby reducing the flooding potential (McPhearson et al. 2023; World Bank Group 2021). Adding to that, NbS can create other co-benefits, such as providing space for recreational activities, having a positive effect on air-quality, enhancing biodiversity or increasing food security (Wolff et al. 2023; Tozer et al. 2023). However, although NbS are widely perceived as viable approaches, recent assessments stress that the actual use of NbS still remains limited (Kapos et al. 2019).

This paper investigates the potential of inclusive NbS projects to increase the resilience of the vulnerable population in the Association of Southeast-Asian Nations (ASEAN) cities to climate-related risks. A specific focus lies on inhabitants of informal settlements and women, as these are large population groups especially vulnerable to climate change impacts in cities. Even though we focus on women as a group in a vulnerable situation, we acknowledge the fact that gender is more complex than the binary system of men and women. Therefore, whilst talking about women, we include all gender identities and acknowledge intersectional vulnerabilities. Using inclusive approaches in the conceptualization of NbS projects should benefit groups in vulnerable situations as well as women and girls beyond the scope of adaptation to climate change. It can empower them in other realms of society, unlocking a transformative potential (World Bank Group 2023; Wolff et al. 2022). Furthermore, many of this paper’s findings on

conceptualizing inclusive projects can be applied to various climate adaptation projects, and are not necessarily restricted to NbS measures.

The paper is structured into four sections. In section 1, key drivers of vulnerability to climate change impacts in ASEAN cities are summarized, providing some relevant scientific background and explaining the focus on informal settlements and gender aspects. The section concludes by highlighting the importance of inclusive approaches to address the risks outlined. In section 2, the advantages of NbS over grey solutions in CCA are discussed and three concrete examples of urban NbS are introduced: open green spaces, urban farming and river floodplains. In section 3, the paper investigates key aspects of NbS projects aiming at empowering women and other people in vulnerable situations. The role of targeted analyses, participatory processes, inclusive NbS design, and of income generating activities and capacity building are explored in more detail. Finally, entry points for mainstreaming NbS to empower women and other people in vulnerable situations in urban settings are identified.

1 Vulnerability to climate change impacts in ASEAN cities, focusing on informal settlements and gender aspects

1.1 Climate risks in ASEAN cities

Cities across Asia, and South-East Asia (SEA) in particular, are considered to be high-risk locations from projected climate change (Shaw, R., Luo, Y. et al. 2022). Already today, flooding belongs to the most prevalent hazards in SEA (ASEAN Secretariat 2021). This will be exacerbated by climate change: increases in tropical cyclone storm surges, sea-level rise, and more frequent and intense extreme rainfall will amplify the number of affected people, affected area, and resulting damages from flood hazard (Dodman et al. 2022b). Coastal cities in the region face especially high climate-related risks. East Asia and SEA have the highest ocean-driven coastal risks to people, land, and infrastructure worldwide, even for climate scenarios leading to low levels of projected sea-level rise (Glavovic et al. 2022). For example, Ho Chi Minh City, Vietnam, is projected to have 9,2 million people exposed to coastal flooding by 2070 compared to 1,9 million in 2008 (an increase of 377%). Bangkok, Thailand, is projected to have 5,1 million people exposed to coastal flooding compared to 907,000 in 2008, corresponding to an increase of 466% (Dulal 2018). Urbanization processes are another important driver of risks from flooding (Dodman et al. 2022). In the case of Indonesia, rapid urbanization expected between 2000 and 2030 is projected to elevate flood risks by 76-120% for both river and coastal floods (Dodman et al. 2022).

According to the Intergovernmental Panel on Climate Change (IPCC), 'risk' is determined by the interactions between climate-related hazards, exposure and vulnerability of affected systems (IPCC 2022).

Hazard is defined as "the potential occurrence of a natural or human-induced physical event or trend that may cause loss of life, injury or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources (Lee and Romero 2023, p. 125)

Exposure is defined as "the presence of people; livelihoods; species or ecosystems; environmental functions, services, and resources; infrastructure; or economic, social, or cultural assets in places and settings that could be adversely affected" (Lee and Romero 2023, p. 124)

Vulnerability is defined as "the propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt" (Lee and Romero 2023, p. 130)

Vulnerability is driven by a combination of **sensitivity and adaptive capacity**. The higher the sensitivity to climate hazards together with a low adaptive capacity, the higher the vulnerability of systems and individuals (IPCC 2022).

Box 1 The concept of 'risk' according to IPCC AR6

Beyond flood-related risks, heat-related risks to human health are of high importance for the region. Tropical and sub-tropical regions typically experience elevated temperatures and high levels of humidity consistently throughout the year, rendering them particularly susceptible to risks associated with heat (Philipp and Chow 2020). Heat-induced mortality is already increasing in SEA, according to Vicedo-Cabrera et al. (2021). Findings from the study show that heat-related deaths have increased by 61% in Thailand, Vietnam, and the Philippines since the 1990s. This is particularly alarming for inhabitants of cities, as the urban heat island (UHI) effect is leading to a stronger increase in temperatures in cities. In Bangkok (Thailand), Jakarta (Indonesia), and Manila (Philippines), a study by Estoque et al. (2017) has shown that temperatures of sealed areas is about 3°C higher on average than temperatures of green spaces, or areas close to green spaces. In the future, more hot days and more intense heat-waves are projected to increase heat-related deaths in Asia (Shaw et al. 2022), especially affecting the elderly population (WHO 2016). Climate change further has the potential to exacerbate

health risks from air pollution, which are already today an important concern for the region (IQAir 2022). Air pollution concentrations are projected to be impacted by climate change, given its potential to alter the processes of pollutant formation and removal through changes in precipitation, temperature, and other meteorological conditions (Jacob and Winner 2009).

The exposure of cities and their inhabitants to climate hazards in the ASEAN region is exacerbated by a fast urbanization process. Almost 56% of the region's population (approximately 405 million people) is projected to live in cities by 2030 (ASEAN (2022)). This corresponds to an average urban population growth of 8,5% between 2015 and 2030. Even though the degree of urbanization varies between AMS, all of them are predicted to have growing cities, with Thailand and Vietnam being the states with the highest projected urban population growth (10%), followed by Lao People's Democratic Republic (PDR) and Indonesia (9%). Urbanization has long been associated with positive outcomes for the region, leading to development and prosperity. At the same time, growing cities pose challenges such as increased traffic, air pollution and the rising need for affordable housing options. Particularly the lack of affordable housing options in cities and the increase of rural-urban migration can be factors contributing to an increase in informal settlements (ASEAN 2022).

1.2 Drivers of vulnerability and gender considerations

Although climate hazards will impact ASEAN cities collectively, the consequences of impacts will not be distributed equally among inhabitants. One key reason is varying levels of vulnerability. Poverty has been identified as being one of the most important drivers of vulnerability in cities (Dodman et al. 2022a) together with migration, inequality, the lack of access to basic services, education, institutions, and governance capacities (Birkmann et al. 2022). These drivers are exacerbated through 'axes of disadvantage', as identified by ASEAN: gender, age, location, race, ethnicity, religion, citizenship status, disability, and sexual orientation (ASEAN 2021a). Therefore, the groups in most vulnerable situations in cities can be identified as women, people with non-conforming gender identities, children, the elderly, indigenous people, low-income households, socially marginalized ethnic minorities, people with disabilities, migrants, and refugees (ASEAN 2021b; UN Habitat 2022; Shaw, R., Luo, Y. et al. 2022). Furthermore, vulnerability factors can interplay with one another, creating groups in multi-vulnerable situations. For example, gender interplaying with disability (e.g. a woman with disabilities) can lead to an intensification of the risk of exclusion, marginalization, and vulnerability (OXFAM 2017; World Bank Group 2023).

Women in ASEAN are particularly vulnerable to the impacts of climate hazards. Their vulnerability is exacerbated by various factors, especially socio-economic conditions. Gender inequality in a society can be conceptualized as the result of expected roles of men and women influencing the socioeconomic status (e.g. income) and the degree of agency, often leading to negative consequences for women (World Bank Group and GFDRR 2021; Olufemi 2019). Women living in informal settlements are among the groups in the most vulnerable situations in cities. Some factors contributing to the vulnerabilities of women in urban climate change contexts according to Alber (2011) are:

- **Gender bias in power and decision-making** where women are underrepresented in urban climate policy
- **Gender division of labour** where women tend to spend more time on care work, unpaid work or work in the informal sector
- **Gender differentials in income and assets** with a gender gap in income and a gap in assets based on either formal legal constraints or established customary rights
- **Gender roles and cultural patterns** which affect mobility and education
- **Sex-related factors** causing an increased risk of women being impacted by sexual violence

Structural gender inequality prevails in the ASEAN region. This is demonstrated in the report 'ASEAN Gender Outlook. Achieving the SDGs for all and leaving no woman or girl behind' by ASEAN and UN Women (2021). For instance, 56% of women have a paid employment in ASEAN (with 67% working in the informal sector), compared to 79% of men. Additionally, on average only 21% of politicians on local and national level are women. Married women with children earn significantly less money than men, as the care responsibility lies predominantly with women, preventing them in most cases from full-time shifts or paid employment overall. Overall, rural women are more affected by gender inequality compared to urban women in ASEAN, except for urban women in informal settlements. Although no

overall trend can be identified among all ASEAN member states (AMS), women represent more than half of the population in informal settlements in certain AMS such as Myanmar (about 70%) and Cambodia (about 60%). Here, women are especially confronted with the lack of basic urban services, such as clean water. 21% of women in informal settlements in the Philippines have to walk more than 30 minutes to fetch water (ASEAN and UN Women 2022).

Impacts from climate-related natural disasters such as floods or storms can differ based on gender aspects. In the Global South, gender norms can keep women at home, reducing access to public shelters or limit mobility options, potentially leading to an increase in mortality among women. For example, 60% of the victims of typhoon “Haiyan” hitting the Philippines in 2013 were women (ASEAN and UN Women 2022). After disasters hit, women can be economically disadvantaged in several ways. As women are expected to stay close to home, migrating is often not possible. Therefore, increasing domestic tasks after a disaster leave women less opportunities to engage in other income-generating activities. Additionally, sexual violence can increase in case of relocation to a shelter due to family separations, the collapse of community protection systems, overcrowding and lack of security personnel. Unemployment and the additional care responsibility for children decrease the resilience of women-led households after a disaster, leaving women especially vulnerable for the next disaster (World Bank Group and GFDRR 2021).

Box 2 Post climate disaster gender-related vulnerabilities

1.3 Informal settlements: high exposure and vulnerability to climate hazards

All AMS are predicted to see growing cities in the future, with a considerably high share of urban inhabitants living in informal settlements. In ASEAN cities, between 22% and 55% of the population lives in informal settlements (ASEAN 2021a). According to UN-Habitat estimations, almost all AMS displayed a decreasing percentage of urban population living in slums by 2020 compared to 2000, except Myanmar where 58% of urban population is living in informal settlements in 2020 (the highest amount in all AMS) compared to 29% in 2000. Vietnam has the lowest share of urban population living in informal settlements, amounting to 5,8%. Indonesia displays the highest total number of people living in informal settlements with nearly 30 million people, followed by the Philippines with 19 million. No data was available for Brunei, Malaysia and Singapore (UN Habitat 2021a). Table 1 gives an overview of the share and total number of the population living in informal settlements in 2000 compared to 2020. Whereas these numbers show that significant progress has been made in the last decades to decrease the share of the population living in informal settlements, the total numbers indicate that the issue of informality and its implications still affect a large number of people in all AMS.

Country	Share (%) in 2000	Share (%) in 2020	Total number in 2000	Total number in 2020
Vietnam	45,3%	5,7%	8.868.833	2.117.687
Thailand	15,6%	6,7%	3.084.652	2.425.637
Indonesia	35,1%	19,4%	31.210.692	29.929.275
Lao PDR	54,4%	21,8%	637.152	566.829
Philippines	50,0%	36,6%	17.981.029	19.043.286
Cambodia	84,8%	39,7%	1.915.365	1.608.032
Myanmar	29,4%	58,2%	3.662.432	9.947.448

Table 1 Share and total number of inhabitants in informal settlements ¹ in 2000 and 2020 in ASEAN

¹ The terminology used in the source was « slum » which can be defined as “one in which the inhabitants suffer one or more of the following ‘household deprivations’: 1. Lack of access to improved water source, 2. Lack of access to improved sanitation facilities, 3. Lack of sufficient living area, 4. Lack of housing durability and, 5. Lack of security of tenure UN Habitat 2021b pg.4 In the estimation only households were counted where criteria 1 – 4 applied The term ‘informal settlement’ is used as a synonymous of ‘slum’ but with a stronger emphasize on the (in-)formal status of land UN Habitat 2021b. We will refer to these as ‘informal settlements’ in the following sections.

Informal settlements can be characterized by the following criteria (UN Habitat 2021b, p. 6):

- *Inhabitants have no security of tenure vis-à-vis the land or dwellings they inhabit, with modalities ranging from squatting to informal rental housing.*
- *The neighbourhoods usually lack, or are cut off from, formal basic services and city infrastructure.*
- *The housing may not comply with current planning and building regulations, is often situated in geographically and environmentally hazardous areas, and may lack a municipal permit.*

Inhabitants of informal settlements are particularly vulnerable to the impacts of climate hazards.

Many drivers of vulnerability previously discussed are especially prevalent amongst the inhabitants of informal settlements altogether increasing the risk of multidimensional poverty (ASEAN 2022). Inhabitants of informal settlements are among the most vulnerable to climate hazards due to their physical location often being in environmentally fragile areas such as steep slopes, floodplains, coastal shores or river banks, due to the fact that housing is often still affordable in such areas. Additionally, the sensitivity and adaptive capacity is negatively influenced by the socio-economic characteristics of the inhabitants. Poverty and illiteracy as well as political marginalization of informal settlements especially contribute to a lack of risk-reducing measures (Dodman et al. 2018).

According to Dodman et al. (2018), inhabitants of informal settlements are especially vulnerable to climate hazards, illustrated with the following examples of impacts from heat and riverine floods:

Heat: The increase in heat, indicated for instance through higher average temperatures, increases in hot days or heatwaves, has severe impacts due to a dense housing structure and poor building materials with no ventilation and insulation. Therefore, indoor temperatures are higher, leading to severe health risks for inhabitants.

Riverine floods: Floods can have severe effects on inhabitants of informal settlements as they are often located in flood-prone areas. The predominantly poor quality of the used building materials decreases the ability to withstand floods. Additionally, flood risk reducing infrastructure is not installed in most informal settlements. After the flood, inhabitants of informal settlements often lack the financial resources for rebuilding their homes in a resilient way and lack the resources for resettling in less impacted areas, making them more vulnerable for the next flooding event.

Box 3 The vulnerability of informal settlements to climate impacts

1.4 Strengthening resilience through inclusive approaches

Women and other groups who are especially vulnerable to impacts of climate change due to structural inequality can drive resilience building in communities and cities. Strengthening resilience in cities can take various forms, including vulnerability assessments of systems and sectors to climate hazards, early-warning systems, education and awareness-raising, technological innovations as well as directly reducing impacts from climate hazards to infrastructure, buildings, and inhabitants through built solutions (World Bank Group 2011). Including the specific needs and vulnerabilities of groups in vulnerable situations as well as women and girls in the conceptualization and design of adaptation measures while promoting their agency and ability to voice their concerns can release transformative potential for these groups as well as the whole community (Castelo et al. 2023), as will be discussed in section 4.

2 Urban Nature-based Solutions for increased climate resilience

2.1 Nature-based Solutions advantages over grey solutions in climate change adaptation

Nature-based Solutions (NbS) in the urban context can provide several co-benefits next to climate change adaptation (CCA) and are more cost-effective and adaptive than grey solutions. NbS can be defined as “(...) an umbrella concept that covers a range of ecosystem-based approaches and natural processes designed to protect, restore, or modify natural ecosystems to meet socioeconomic needs and build long-term environmental resilience” (World Bank Group 2023, p. 4). NbS are therefore not restricted to the field of CCA, but can also address other societal challenges, such as food security, income generation, the provision of urban infrastructure and cultural recreation. As cities need to manage several of these challenges at the same time, NbS can offer cost-efficient CCA solutions while additionally tackling other pressing challenges. NbS can further provide additional benefits in the form of biodiversity protection and ecosystem services, such as temperature regulation, stormwater retention or air purification, while being flexible and adaptive to changing environments and disaster impacts (Grimm et al. 2023; Knapp and Scott MacIvor 2023).

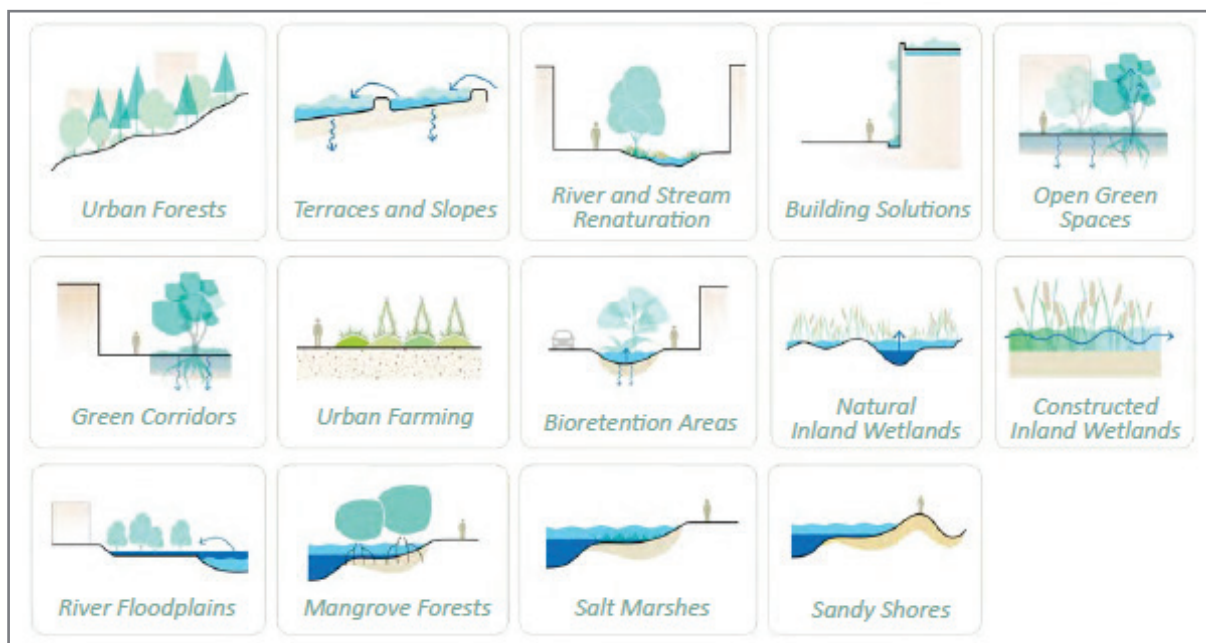


Figure 1 The 14 urban NbS families (World Bank Group 2021)

Grey or engineered solutions are often more cost-intensive, lack the ability to address multiple urban challenges simultaneously, and struggle to adapt to new conditions, as they were usually designed based on historic data (Seddon et al. 2020; Depietri and McPhearson 2017). This is especially problematic with regard to impacts from climate hazards, as they are projected globally to become more intense, while at the same time becoming less predictable and thus more erratic (Seneviratne et al. 2023). Examples of grey solutions for coastal and riverine flood management include dikes, floodgates, embankments and concrete sea walls, as well as drainage systems for storm water run-off management like pipes, sewers, or detention basins. Examples for grey solutions tackling extreme heat include air conditioning or urban cooling centres (Depietri and McPhearson 2017). In some cases, grey solutions can even create trade-offs, such as the emission of additional CO₂ emissions for their construction, interrupting natural ecological processes in ecosystems or limiting access for communities to natural resources (Guerry et al. 2023; Seddon et al. 2020).

2.2 Selected urban Nature-based Solutions: open green spaces, urban farming and river floodplains

The World Bank Group (2021) has identified 14 NbS families especially suited for urban environments (Figure 1). They share the ability to provide several co-benefits, while being space-efficient and tailored to urban challenges, such as the UHI effect or the provision of water and sanitation infrastructure. Describing each NbS family in detail would be beyond the scope of this paper. Therefore, selected NbS are introduced, based on the World Bank report, in more detail. These include open green spaces, urban farming/gardening, and river floodplains. The choice of these NbS for the ASEAN context is motivated by their multifaceted benefits of high relevance for cities in the ASEAN region, such as enhancing urban resilience to climate hazards, promoting food security and additional income sources through sustainable agriculture, and creating new public spaces. Additionally, these NbS align with the regional priorities for urban sustainable development, addressing issues related to both urbanization challenges and resilience to climate change within the ASEAN context.

Open green spaces can encompass public as well as private land, varying in sizes ranging from small pocket parks, residential gardens or natural playgrounds for children to large-scale parks. Unpaved areas can contribute to flood risk management through their capacities to absorb storm- or floodwater run-off, reducing the velocity of the run-off and reducing the amount of water entering the sewerage system. If combined with native plant species such as trees or shrubs, cooling through evapotranspiration and shading is provided, reducing urban heat. Additionally, they can improve biodiversity and carbon sequestration as well as mitigating air pollution.

Urban farming / gardening can be defined as the “(...) growing of plants or animals within and around cities and associated activities such as producing and delivering inputs as well as processing and marketing of agricultural products” (World Bank Group 2021, p. 127). It can vary spatially, encompassing roof-top farming, vertical farming, floating farming, conventional land-based farming or farming using special techniques such as raised beds or agroforestry. Through its unpaved land, water absorption is increased for storm- or floodwater run-off. Urban heat can be additionally reduced in cases with rich plant canopies or trees. If managed in an organic way, biodiversity can be increased as well as carbon sequestration. Through its ability to provide fresh and nutritious food it can increase food security and generate income.

River floodplain restoration is meant to give back space to the natural encroachment of a riverine system. One approach involves setting back a dyke, thereby enhancing the river bed's capacity to manage overflow during flooding events. This is achieved by encroaching into the available space, providing additional room for water regulation. Another strategy is the removal of concrete solutions and the restoration of the original river floodplain through revegetation. The expanded space created can effectively contain and absorb larger volumes of water. Simultaneously, the reintroduction of vegetation helps decrease the water's velocity, contributing to improved flood control. Downstream communities can profit from these measures, as their flood-risk can be reduced as well. Furthermore, urban heat can be reduced through the cooling effect of the water and the evapotranspiration and shade of the vegetation. If safe access is provided, the river floodplain can enhance the wellbeing of local communities and create additional public space.

In informal settlements, residents face specific challenges, such as a lack of basic services and uncertain land tenure, limiting social and economic opportunities. This often leads communities to rely on extractive practices, potentially conflicting with NbS that require the conservation of ecosystems (Wolff et al. 2023). Additionally, residents' perceptions of health, safety, and trust in institutions can depart from residents living in well-developed areas, and need to be better understood (Choudhury and Haque 2016; Diep et al. 2022).

Six NbS types have been identified which have already been implemented in informal settlements in SEA: constructed wetlands, green open spaces, community gardens, street trees, waterfront vegetation rehabilitation, and infiltration devices. Community gardens are the most used NbS, followed by waterfront revegetation (Wolff et al. 2023).



Motivations for the utilization of NbS in informal settlements vary, with improving climate resilience being a primary driver in projects initiated by international organizations (Wolff et al. 2023). Additionally, NbS have been instrumental in enhancing income and food security, particularly through the use of community gardens (Cashman 2018). Community gardens, along with green open spaces, demonstrated high versatility, addressing various motivations for NbS implementation. Sanitation and waste management can also be crucial considerations, especially in the context of large-scale NbS systems like constructed wetlands, where NbS can provide a nature-based alternative for sanitation in informal settlements, where conventional infrastructure systems are often lacking (Wolff et al. 2023).

However, research findings also demonstrate the use of NbS as a justification for the resettlement of disadvantaged communities, which raises ethical concerns (Wolff et al. 2023). The potential for exploitative or uni-directional projects underscores the importance of meaningful resident participation in decision-making processes related to NbS implementation (Wolff et al. 2022; Wolff et al. 2023). This is stressed by IUCN guidelines for NbS implementation, which advocate for the acknowledgment of communities' rights over natural resources (IUCN 2020). As project developers navigate NbS in these settings, prioritizing community engagement and ethical considerations is crucial for sustainable and inclusive development.

Box 4 NbS for informal settlements in ASEAN

3 Empowering women and vulnerable communities through Nature-based Solutions projects

3.1 Supporting transformative practices

Differences in vulnerability to climate change impacts are multi-layered, complex, and context-specific, and adversely affect different marginalized groups, of which women and girls are the largest. MacArthur et al. (2023) developed a gender-integration framework, differentiating between four gender-integration categories (Figure 2).

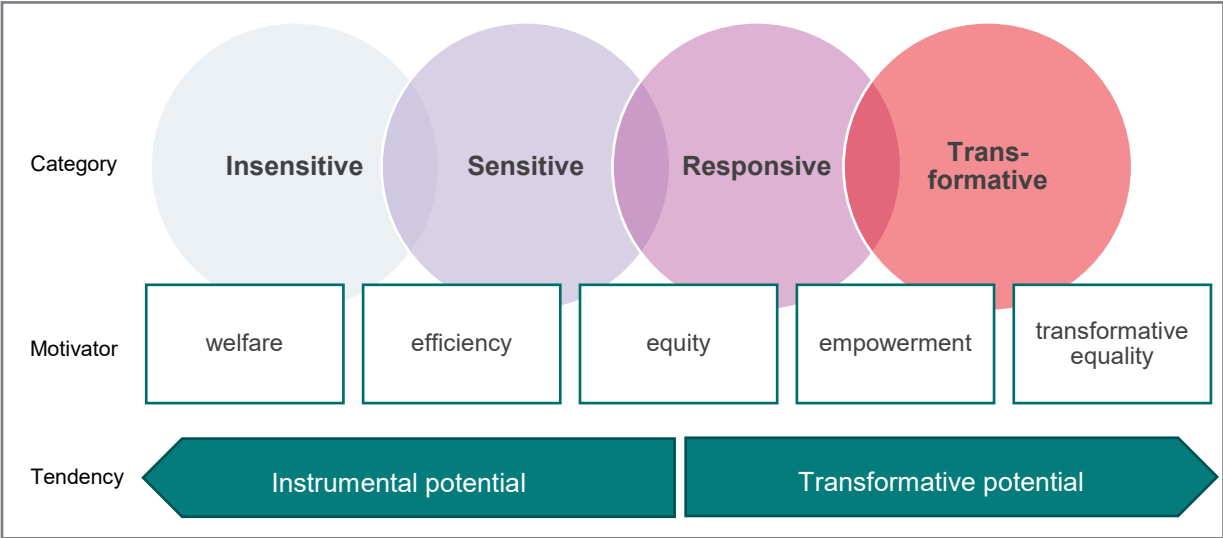


Figure 2 Gender-integration framework, adapted from MacArthur et al. (2023)

Gender-insensitive approaches do not consider gender dimensions. Such approaches often uphold the status quo, perpetuating or worsening social inequalities and fostering damaging stereotypes.

Gender-sensitive approaches recognize gender dynamics in interventions but operate within existing structures. They address differential needs based on gender, but changing existing divisions of resources, responsibilities and capabilities is not at the core of such measures.

Gender-responsive approaches aim to empower individuals without addressing wider structural barriers. Such approaches can, for example, emphasize meaningful participation, decision-making, and leadership for specific gender groups.

Gender-transformative approaches explicitly aim to change unjust conditions with regard to gender. Such approaches actively seek to transform gender norms, structures, and dynamics, explicitly addressing inequalities. They aim for an egalitarian distribution of resources and opportunities across genders. Transformative strategies engage individuals of different genders separately and together, addressing intersecting aspects of marginalization.

Gender-transformative action is a long-term endeavour and cannot be achieved in short projects. The "preliminary stages" of gender-sensitive and gender-responsive approaches can therefore be considered as valid first steps to be implemented in short- to medium-term projects. Gender-transformative approaches, however, are important as an overarching vision: only coordinated, long-term action can bring about fundamental change.

3.2 Entry points for Nature-based Solution projects

3.2.1 Social and gender-based analysis

To make sure that implementing NbS projects does not sub-consciously replicate existing inequalities, both from a gender and social perspective, an analysis of the social and gender

context before implementation is necessary. The World Bank Group (2023) offers an approach specifically designed for NbS projects. First, groups at risk of exclusion from the benefits of NbS must be identified, as well as analysing how certain groups might be negatively affected (section 4.2.). This is most effectively done via participatory and consultative community actions such as interviews, workshops or public meetings. Such activities are also important to further identify the groups that have to be consulted and included throughout project implementation (section 3.2.2). Second, understanding why these groups might be excluded can reveal barriers to inclusion such as societal norms or physical barriers. This analysis then lays the ground for aspects to be addressed in the project design stage (section 3.2.3 and 3.2.4).

3.2.2 Strengthening participation and ownership

The participation and active decision-making of communities in the conceptualization, design, and implementation of NbS has several advantages over traditional top-down CCA initiatives, especially for groups in vulnerable situations as well as women and girls. Both groups in vulnerable situations as well as women and girls are often underrepresented in traditional decision-making processes (UNDP 2015; Kirkby et al. 2017; GCA 2022). For example, the involvement of inhabitants of informal settlements in NbS “greening” initiatives is still rare, although the call for participatory approaches is increasing (Kiss et al. 2022). According to Wolff et al. (2022), community involvement in NbS projects can mean informing, consulting or co-designing the process. However, the most sustainable and long-lasting potential is released if transformative approaches are applied. Transformative approaches rely on local engagement and social-ecological knowledge and refer to the “reorientation of society’s capacity toward proactive, transdisciplinary, multi stakeholder initiatives that foster the development of novel solutions” (Wolff et al. 2022, p. 2). One approach that can be used to achieve this is community-based adaptation (CBA).

The main objective of the community-based adaptation (CBA) approach is to generate context specific adaptation by identifying and addressing local vulnerabilities, utilizing local adaptive capacity and strongly involving local stakeholders, ideally combining scientific and local knowledge. CBA projects can be either grassroots projects, emerging from local communities who want to address specific needs, or can be mainstreamed into existing development projects to ensure local participation (Kirkby et al. 2017). In the case of CCA in informal settlements, upgrading measures can have undesired outcomes such as non-acceptance of the measures in the communities up to eviction or relocation of inhabitants. Those can be addressed or avoided through the integration of CBA approaches in urban planning, increasing ownership of the projects and leading to longer-lasting and more sustainable outcomes (GCA 2022). Additionally, gender-mainstreaming in the CBA process is crucial to ensure that women’s voices are heard and specific needs are addressed properly. The active participation of women in CBA projects can have transformative effects on their role in society if practices contributing to inequality are consciously avoided to be replicated and root-causes of inequality are addressed (UNDP 2015).

Box 5 Community-based adaptation (CBA)

3.2.3 Inclusive NbS design

In the early stage of project development, inclusive NbS design features need to be taken into consideration. This includes considering accessibility, appropriate social infrastructure, safety, location, as well as cultural and recreational use. Mal-designed NbS risk the exclusion of certain groups from the benefits of the NbS.

Accessibility and social infrastructure: Some groups in vulnerable situations might face physical mobility challenges, such as persons with disabilities or elderly people, limiting their ability to access public spaces. Possible design features to tackle those accessibility challenges include ramps, an increased width and layout of paths and lightning through the provision of streetlights (European Environment Agency 2022). Beyond that, including social infrastructure such as seats, accessible toilets, and drinking fountains can increase the well-being and usability of NbS (World Bank Group 2023). Including safe playgrounds for children is another important social infrastructure in NbS used as public spaces. These can provide safe and healthy environments for children to play (Candiracci et al. 2022) and make the space more attractive for women and their families.

Addressing safety concerns: Public street lighting, trimming bushes, and having security guards after certain hours can increase the safety for groups in vulnerable situations such as women and girls, and enable the safe usage of NbS like open green spaces (World Bank Group 2023; Mayen Huerta and Utomo 2022).

Location: Groups in vulnerable situations, in particular low-income households and inhabitants of informal settlements, tend to have less access to green spaces. Therefore, ensuring a just distribution of NbS across the city is key in the initial stages of an inclusive design process (Tozer et al. 2023). Beyond that, ensuring good connectivity to transport infrastructure is crucial to guarantee accessibility to NbS in cities (Chen and Chang 2015).

Functional public space: NbS can additionally serve as a platform to promote culture and recreational activities, or as a functional public space serving multiple purposes. Green open spaces in informal settlements for example serve as multifunctional public areas including tourism, sports, and food production. This is again especially relevant for informal settlements, as they tend to have fewer public open spaces that are accessible and usable for social connection and recreation (Wolff et al. 2023; Tozer et al. 2023).

3.2.4 Income generating activities and capacity building

Considering income generation and capacity building in the design of NbS can provide important economic opportunities for groups in vulnerable situations as well as women and girls, contributing to reducing their vulnerability to climate risks. The implementation of NbS projects is already fostering employment globally. Approximately 75 million people are currently engaged in NbS-related work, with the potential to increase to 95 million by 2030. Presently, the majority of NbS employment is concentrated in rural areas within the agricultural and forestry sectors, as indicated by ILO et al. (2022). However, urban NbS initiatives also present opportunities for job creation and income-generating activities. For example, employment prospects in the construction sector for establishing and maintaining NbS can create openings for traditionally marginalized groups and women, who typically face limited opportunities in these industries. Moreover, providing job and technical skill training can pave the way for future employment opportunities for groups in vulnerable situations as well as women and girls while enhancing their capacity-building (World Bank Group 2023). These skills include proficiency in trade and land management, expertise in professional finance, law, management, and engineering, along with strong social engagement and communication abilities (ILO et al. 2022). Particularly for women, possessing an independent source of income plays a pivotal role in reducing vulnerability to climate change and disasters by enhancing access to coping mechanisms such as finance and savings, thereby empowering women to build resilience (World Bank Group and GFDRR 2021). However, it is crucial for policymakers to ensure equitable and fair working conditions in NbS to prevent an increase in employee vulnerability. Integrating just and decent work conditions for groups in vulnerable situations as well as women and girls can be incorporated into the project design process, presenting itself as an employment opportunity (WWF and ILO 2020).

To release the transformative potential of projects, it is important to understand and address the reasons why women (or other marginalized groups) might not take up job opportunities. These can include the location of the workplace (too far away from their homes) (Olufemi 2019), the danger of not being able to profit from earnings due to family structures, employment being not well-regarded in the community, or feeling unsafe because of the elevated risk of (sexually) violent behaviour at the workplace (ILO 2009).

Gender-transformative approaches actively work towards changing gender norms, structures, and dynamics that are driving inequalities. NbS projects should harness their potential to be gender-transformative, pursuing equality strategically, as a goal in its own right. Since NbS projects have a significant impact on communities and are ideally designed collaboratively with them, they offer an ideal context for dialogue and reflection on roles and structures. An example for a gender-transformative approach in the field of water, sanitation and hygiene (WASH) is the use of community-based gender monitoring processes to monitor strategic gender change through WASH programs in Vietnam (Leahy et al. 2017). This involved integrating structured monitoring activities into the programs, designed to actively explore gendered relations through facilitated community dialogues. The goal was to enhance community awareness regarding gender roles and relationships in the context of WASH, offering opportunities for both women and men to engage in discussions about gender relations and set their own agendas for change.

Gender-sensitive and gender-responsive project components, however, can be important first steps towards more transformative approaches. Gender-sensitive design of NbS sites can include the provision of accessible and free sanitary facilities, equipped changing rooms for children and disposal options for menstrual hygiene products in green spaces. Additionally, it can address safety concerns with the provision of safety-enhancing infrastructure, such as street lights or security patrols. Additionally, as women are mainly responsible for child-care, including family-friendly design features can increase the usage of the NbS for women and children (World Bank Group 2023; European Environment Agency 2022). Time-poverty due to women's care responsibility can restrict their ability to make use of NbS in their day to day life (Olufemi 2019). Ensuring a manageable distance for women to access the NbS is therefore crucial (Mayen Huerta and Utomo 2022).

Income generating activities and capacity building are key factors of gender-responsive NbS projects to not only avoid harm from NbS for women but release transformative potential. To ensure gender-sensitive working conditions, day-care facilities together with maternity leave protection and health care are important to consider (ILO et al. 2022; World Bank Group 2023). If this is not feasible, working conditions and location should at least facilitate the combination of work with domestic tasks. This is also relevant in the case of the implementation of urban farming, as it can contribute to women's empowerment if the fields or facilities are close enough for women to combine with domestic tasks. As women are sometimes excluded from the conventional work market due to cultural or social norms, being self-employed such as in urban farming offers the possibility to generate income nevertheless (Olufemi 2019).

Promoting gender-equality, however, is not only important with regard to concrete measures which are to be implemented as part of the project, but must also be considered for the project team and project concept, ideally mainstreaming gender-sensitivity into all project stages. This can encompass promoting women's leadership in decision-making positions within the project team, including a gender-parity goal for the project team, the training of project implementers on gender-sensitivity and the inclusion of strategies to ensure the participation of women such as women-only meetings (Salcedo-La Viña et al. 2023).

Box 6 Promoting gender-transformative NbS projects

3.3 Insights from ASEAN case studies

The following case studies were selected to illustrate ongoing implementations of urban NbS in the context of CCA which specifically address the needs of certain groups in vulnerable situations as well as women and girls in Malaysia and Laos (interview-based) and Thailand and Myanmar (desktop-based). Beyond that they show how different NbS can be combined such as open green spaces and bioretention areas and urban farming together with street trees and grey infrastructure. Most importantly they show that NbS where the needs of groups in vulnerable situations as well as of women and girls are already considered in the design process in ASEAN.

Case study 1: Tagal Innovation under Fishery Department of Sabah (Albert 11/27/2023)	
<p>Location Ranau, Malaysia</p> <p>Number of Inhabitants (district) 85.077</p> <p>Size of project area 9.000 ha (district), with 123 micro-locations</p> <p>Start of official implementation 2004</p> <p>Co-benefits by NbS</p> <ul style="list-style-type: none"> • Biodiversity • Income generation • Women empowerment • Cultural heritage promotion <p>Climate-related risks addressed</p> <ul style="list-style-type: none"> • Risk of degradation of ecosystems due to climate change, including change in structure, functioning, and loss of biodiversity • Risk of loss of livelihoods due to the degradation of livelihood assets <p>Funded by</p> <ul style="list-style-type: none"> • Department of Fisheries Malaysia • District Office of Ranau (Rural Department) District Council of Ranau (Local Government – Urban / Rating Area) 	<p>The <i>tagal/bombon</i> system is a traditional, community-led river management and conservation system, practiced by the indigenous peoples of Sabah (state of Malaysia located in North Borneo). This traditional concept has been adopted by the Sabah Fisheries Department and since the early 2000s, the official authorities in Ranau district (district in Sabah) started to support and integrate this practice into their environmental management strategy of the area.</p> <p>The <i>tagal/bombon</i> system involves shared responsibilities and management of the river ecosystem and other natural resources by the community. It includes ecosystem monitoring practices based on bio-indicators such as specific species of aquatic insects, plants, or freshwater fish in determining the water quality. It further includes the adoption of rules and regulations to protect the ecosystem, which are dynamically adapted by the community based on the ecosystem’s health status. Such rules can include, for example, demarcated areas where access is prohibited, the prohibition of specific fishing practices, or the fishing restrictions for certain species within the non-fishing season. It can further comprise measures to improve the health of the river ecosystem, such as through the repopulation of fish or restoring river shores with native species. The <i>tagal/bombon</i> system further supports cooperation across communities, as the head of villages along a river traditionally cooperate in case a decrease in ecosystem health is detected.</p> <p>The <i>tagal/bombon</i> system has proven effective in sustainably managing the river ecosystems, leading to increased fish numbers, which are crucial for the livelihoods of the local communities in Ranau. Healthy ecosystems are also more resilient to climate change risks – an important factor, as communities have reported changes in precipitation patterns and temperature increases. By fostering community structures and traditions, the <i>tagal/bombon</i> management method additionally promotes the dissemination of knowledge of the elderly towards the younger generation, promotes local solutions, and can contribute to the empowerment for women as they actively participate in the management system and take over additional activities. Beyond that, the <i>tagal/bombon system</i> has fostered local eco-tourism activities in Ranau, by including tourism activities during the annual fish-festival, or generating income through offered services such as a ‘fish-spa’, sightseeing’ and even a home-stays for the tourist or visitor.</p> <p>So far, the <i>tagal/bombon system</i> is mainly applied in villages in Ranau district. However, transferring this management system to the more urban setting of Kundasang, a town in the district of Ranau, is planned in the near future and first discussions with the town council committee have taken place.</p>
	
<p><i>Releasing of fish for river repopulation in a local community of Ranau.</i> <i>Pictures by Juelber Albert, Majlis Daerah Ranau.</i></p>	

<p>Location Maung Xay, Oudomxay province, Lao PDR</p> <p>Number of Inhabitants (city) 85.332</p> <p>Size of project area 97 villages, city centre 64-100km² district 2.817km²</p> <p>Duration of project 2018 - 2023</p> <p>Co-benefits by NbS</p> <ul style="list-style-type: none"> • Biodiversity • Income generation • Recreation <p>Climate-related risks addressed</p> <ul style="list-style-type: none"> • Risks of damages to property and infrastructure, and risks to health, due to river flooding • Risk of increasing poverty due to climate change hazards <p>Supported by</p> <ul style="list-style-type: none"> • Department of Climate Change, Ministry of Natural Resources and Environment (MoNRE) • Provincial Office of Natural Resource and Environment (PoNRE) • Provincial Agriculture and Forestry Office (PAFO) • Provincial Office of Public Work and Transport (PPWT) • Provincial Office of Information, Culture and Tourism (PICT) <p>Funded by UNEP</p>	<p>Case study 2: Building Climate Resilience of Urban System through Ecosystem-based Adaptation in the Asia-Pacific Region Project, a case study of Xay district, Oudomxay province, Lao PDR (Chanthavonghak 12/7/2023)</p> <p>The project on Ecosystem-based Adaptation in Xay district, Oudomxay province (Lao PDR) was initiated by the United Nations Environment program (UNEP) in 2018 and consists of four main activities: 1) improving flood management by building a canal in the city center of Xay District, 2) generating income for vulnerable households by planting vegetable in the greenhouse (tree nursery) and supporting reforestation activities through tree planting, 3) waste management and green school projects in four schools in the city center (Huaykhoun, Donexay, Ethnics School, Technical Vocational College), and 4) introducing eco-tourism activities (Kat village). The project is scheduled to end in 2023. However, a prolongation is intended by the local project partners. As this paper focuses on NbS for groups in vulnerable situations, only activity 1) and 2) will be described in more detail.</p> <p><i>1) Improving flood management of Xay district through building and improvement of canal in city center:</i> Over the last decade, residential areas in the city center increasingly expanded into the flood plains along the water stream increasing the risk of flooding. The project therefore built a canal through the city center to manage the water stream using a green-gray approach: while certain parts of the canal were built out of concrete, other parts used green infrastructure. Additionally, the walk sides were re-naturalized using native tree and grass species. The residents were involved in the process through participatory design elements. This included the involvement of the village committees and head of the villages, who disseminated the knowledge of the project steps to affected households and held community meetings. Challenges included the necessity of the local communities to change habits to more sustainable practices, and the management of negative trade-offs for local residents owning land parcels through which the new canal would run.</p>  <p><i>Channel improvement from Cheng village to Nongmengda village, Xay district. Pictures by Souphithak Chanthavonghak, PoNRE, Oudomxay province.</i></p> <p><i>2) Generating income for vulnerable households through tree nursery:</i> For this activity, the households in most-vulnerable situations in ten nearby villages were identified. They included women-led households, the elderly, low-income households as well as households with many children and handicapped members. These households were selected to participate in an activity consisting of running a tree nursery. The households were in charge of growing seedlings, which are then bought by the project to be planted in the Phu Hippi national park and along the new canal in the city center (activity 1), creating a stable income for these households. The project provided the basic infrastructure for the tree nursery and necessary resources such as soil, seeds, seedling bags and a water tank.</p>  <p><i>Seedling production at Houykhoun village nursery station, Xay district. Pictures by Souphithak Chanthavonghak, PoNRE, Oudomxay province.</i></p>
--	--

<p>Location Bangkok, Thailand</p>	<p>Case study 3: Redesigning Lumpini Park, inclusive climate action park in Bangkok, Thailand (UNA 2023a)</p>
<p>Number of Inhabitants (city) 10.539.000</p>	<p>The re-designing process of the Lumpini Park was initiated in 2022 by The Environment Department, Bangkok Metropolitan Administration (BMA) and will be ongoing until approximately 2025. It is divided into three phases: 1) renovating infrastructures like roads and water management systems, 2) construction of green and learning areas, and 3) further developing underused areas.</p>
<p>Project area 576000 m2</p>	
<p>Duration of project 2022 – ongoing</p>	<p>As the park will celebrate its 100th anniversary in 2025, a key goal of the project is to preserve and display the culture and history associated with it. The project is using a “universal design” approach and will address the specific needs of certain groups in vulnerable situations through targeted actions. To achieve this, the design is including community and citizen participation. The park is also intended to be a climate action park, implementing different - biodiversity NbS for climate change adaptation. Specific design measures will include improved access for the elderly and people with disabilities through safe pathways, walkways with benches for resting, as well as genderless toilets. Climate adaptation measures include the improvement of existing ponds with additional canals and open space management to increase water retention. Open spaces will be planted to increase soil infiltration capacity, using native vegetation to pre-filter the water before getting released into the canalization nearby. All measures will contribute to heat reduction as well as increasing the resilience to pluvial flooding and drought. Co-benefits that will be achieved include improvements in air quality, biodiversity, and increasing the health and wellbeing of residents.</p>
<p>Co-benefits by NbS</p> <ul style="list-style-type: none"> • Air quality improvement • Biodiversity • Increasing health and wellbeing of residents • Recreation 	
<p>Climate-related risks addressed</p> <ul style="list-style-type: none"> • Risks of damages to property and infrastructure, and risks to health, due to river flooding • Heat-related risks to health and wellbeing 	
<p>Key implementors Bangkok Metropolitan Administration (BMA) and Environmental Department</p>	<p><i>Lumpini Park, current status.</i> <i>Picture left by igorovsyannykov / pixabay; Picture right by JonnyBelvedere / pixabay.</i></p>

<p>Location Yangon, Myanmar</p>	<p>Case study 4: Yangon’s Alley Gardens Project in Yangon, Myanmar (UNA 2023b; UAP n.d.)</p>
<p>Number of inhabitants (city) 5.160.000</p>	<p>This project was initiated from an informally organized grassroots group of local residents, now called ‘Doh Eain’, who started transforming a back alley in Yangon to a permaculture garden. The back alleys in Yangon were originally designed to protect residents from flood risks by providing an emergency escape and open gutters with underground sewers, but also as recreational space for the inhabitants. These functions were lost in recent years as they were used predominantly as informal waste dumps. In 2017 the locally-led grassroots project-team started cleaning one alley up and transformed it to fulfil various functions. Now the project encompasses a total of 12 alleys with gardens, playgrounds, street art, seating areas and outdoor exercise equipment.</p>
<p>Project area 15000 m2</p>	<p>Through the introduction of small green spaces (plants in pots, urban gardens) as well as through the cleaning of the original grey infrastructure for flood risk management, the capacity for water retention is improved. Additionally, the local residents are trained to produce their own compost through the “bokashi method” contributing to the waste-management of the area. The urban gardens fertilized with it additionally provide cooling through shading and a recreational space for residents. Additionally, the alleys provide a safe and cool space for children to socialize. The project design is emphasizing the participation and empowerment of women and young girls as well as people with disabilities and the elderly. As the community is actively engaged in the management of the project, ownership is created to maintain it. The social enterprise ‘Doh Eain’ intends to extend the project to further town areas in the future.</p>
<p>Duration of project 2017 – 2019</p>	
<p>Co-benefits by NbS</p> <ul style="list-style-type: none"> • Biodiversity • Food security • Recreation • Waste management 	
<p>Climate-related risks addressed</p> <ul style="list-style-type: none"> • Risks of damages to property and infrastructure, and risks to health, due to river flooding • Heat-related risks to health and wellbeing 	
<p>Key implementors</p> <ul style="list-style-type: none"> • Social Enterprise, Doh Eain • Community-led 	<div style="display: flex; justify-content: space-around;">   </div> <p style="color: #008080; font-style: italic;">Before (left) and after (right) the project implementation. Pictures by Libby Hogan / DVB.</p>

4 Mainstreaming inclusive Nature-based Solutions approaches: governance considerations to balance prevailing challenges

4.1 Strengthening cross-sectoral collaboration

NbS can be an opportunity to catalyse cross-sectoral collaboration between a variety of actors.

These can include local communities, city governments, ministries, national governments, non-government organizations, research centres, and the private sector. Here, different project phases (from conceptualization to implementation to maintaining and monitoring) require different actors to collaborate (World Bank Group 2021). Within the city governance system, different urban sectors such as water-management, transport, or housing can be involved. Additionally, many NbS necessitate cross-sectoral collaboration beyond the city administration, involving actors from various disciplines such as urban planning, engineering, or ecology, operating on different scales such as region, city or neighbourhood. Questions of governance and responsibility should not be dealt with in silos of only specific ministries or agencies (Frantzeskaki et al. 2023). Instead, the transformative nature of NbS should be maintained through the mainstreaming of inclusivity and participatory approaches with local communities into all project stages as well as through cross-sectoral and interdisciplinary collaboration (Castelo et al. 2023).

4.2 Managing Nature-based Solutions trade-offs for communities: competing land uses, re-settlements and gentrification concerns

Despite their various benefits, negative or undesired consequences might emerge from the implementation of NbS for local communities if they are not properly considered and integrated throughout the project cycle. It is therefore highly important to perform an analysis of the social and gender context previous to project implementation, and analyse potential project implications (section 3.2.1).

Competing land-uses or conflicts can be observed in cities where there is limited land, thus creating conflicts around the needs that are to be fulfilled by it. Common land-uses include residential, commercial, agricultural, industrial, conservation, or recreational uses. In most cases, using land for one purpose excludes it from benefitting other purposes, especially if one land use needs unsealed ground whereas another land-use needs sealing (such as buildings or infrastructure). Therefore, the implementation of NbS can conflict with the need of the population or other actors to use the land, for example for residential purposes (Masoudi et al. 2021). According to Wolff et al. (2023), land-use conflicts often exist in informal settlements. The implementation of space-consuming NbS such as urban parks can lead to the relocation of inhabitants of informal settlements to create space for the implementation, which is then benefitting middle- and high-income neighbourhoods.

Increasing evidence can be found that urban greening projects and NbS have the potential to lead to 'green gentrification' caused by increased housing costs and property values due to the improved conditions of the greened area. Eventually, these processes can again lead to the relocation of inhabitants from former informal settlements or low-income neighbourhoods to environmentally vulnerable areas due to unaffordability of housing (Wolch et al. 2014; Tozer et al. 2023). CBA or other participatory approaches as outlined above have strong potentials to prevent or mitigate those trade-offs through an involvement and co-design of affected groups in vulnerable situations as well as women and girls. Policy-makers should be encouraged to include the management of potential trade-offs in urban planning. Reports on successful management of those risks in the Global South are scarce, but evidence from the United States of America (USA) shows that measures such as rent control or including anti-displacement policies in their urban planning can help counteract potential negative trade-offs for local communities (Rigolon and Christensen 2019).

4.3 Ensuring continuity of Nature-based Solutions projects through local community governance

Local community governance to ensure acceptability and ownership contributes to the longevity of projects. The active participation of groups in vulnerable situations as well as women and girls in the conceptualization and design of NbS projects is crucial to release its transformational potential (section 4.1). Co-produced NbS with local communities have shown to increase ownership of the project, which in return increases the longevity and continuity of the project. Incorporating NbS governance into existing community governance mechanisms and local urban planning policies can further support longevity (Tozer et al. 2023; Wolff et al. 2023). This includes valuing different kinds of knowledge, sometimes referred to as “local” knowledge or “traditional” knowledge (Olazabal et al. 2021). Given that knowledge about climate change adaptation and related solutions often originate from sources outside the direct experiences of vulnerable communities, it's crucial to avoid perpetuating top-down approaches. Special attention should be paid to understanding the specific needs of local groups, including those in vulnerable situations, as well as women and girls. By integrating various forms of knowledge alongside established, science-based systems, local ownership and, consequently, the project's long-term success can be ensured (Olazabal et al. 2021).

Ensuring inclusive long-term financing is key. Financing NbS can often be challenging for local communities, since maintenance and spatial constraints (where NbS lock-in valuable land permanently) can overburden them. This is especially the case if implemented in low-income neighbourhoods such as informal settlements. Ensuring inclusive financing is crucial to avoid excluding low-income households. For example, using property taxes and high entry fees to finance NbS can contribute to gentrification and exclusion (Tozer et al. 2023). New approaches to financing NbS are emerging, such as ‘tax increment financing’, where neighbourhoods can take loans on expected future tax income (Seddon et al. 2020). This is based on the assumption of a positive future economic development surrounding the implemented NbS. Although this has currently only been implemented on a larger scale in the USA, the Asian Development Bank (ADB) is interested in exploring such financing tools in the future (ADB Institute 2023). Another interesting case from Costa Rica finances NbS projects by collecting taxes on fossil fuel in the Payment for Environmental Services Program (PESP), feeding into a fund. Members of the local community are paid from that fund to protect and restore the forest, including applying agroforestry techniques (ILO et al. 2022).

Monitoring and evaluation is crucial for project steering and to generate learnings for future projects. To evaluate benefits, trade-offs, and overall project success, monitoring NbS projects is crucial, both during the project and after the initial project phase is over. Good monitoring and evaluation also supports the generation of knowledge and best-practices for future NbS implementation (Wolff et al. 2023). This can be especially helpful to support the dissemination of NbS and their mainstreaming into local policy processes. The monitoring and evaluation process should be gender-sensitive, by collecting both quantitative and qualitative sex-disaggregated data, the latter including women's perception of the project's direct and indirect effects on women empowerment. This is crucial to better understand how the project is impacting not only the community collectively, but what differences can be observed between gender groups (Salcedo-La Viña et al. 2023).

4.4 Potential next steps for regional and international cooperation

Increase international climate finance towards NbS. Overall, the amount of financial flows directed towards the implementation of NbS for climate adaptation by international development finance is difficult to assess, as there is no universally accepted definition of the concept as well as a lack of distinctive financial reporting features of most bi-lateral or multi-lateral actors concerning NbS. However, estimations according to SEI (2022) suggest that only a fraction of climate adaptation finance goes into NbS related projects. Even though the concept of NbS receives increasing attention in academic spheres and is anchored in several international climate policies, the implementation on the ground by international organizations seems to be lagging behind. Developing universally accepted definitions and distinctive reporting features seems to be necessary to track NbS implementation and gather data on the outcomes and impacts of NbS projects. This would also facilitate further mainstreaming of NbS into international climate adaptation efforts and adaptation finance (SEI 2022).

Consider NbS systematically in the National Adaptation Plan (NAP) processes. As part of international efforts to increase climate resilience, countries are asked to prepare and implement NAPs – an approach which was established under the Cancun Adaptation Framework (CAF) and re-

emphasized in the Paris Agreement. NAPs present a strategic window to raise the profile of NbS-related activities. They provide a framework for NbS implementation at scale as well as an important reference point for international climate finance. According to assessments by the NAP Global Network, a lion's share of existing activities related to NAPs already include a nature or ecosystem-based perspective – additional guidance is available by the Global Network (Terton and Greenwalt 2021). UN Habitat (UN Habitat 2019) offers further recommendations on how to ensure a gender-sensitive, participatory and fully transparent approach, taking into consideration people in vulnerable situations, including women and girls, and local communities.

Mainstream inclusive urban NbS project design in international climate finance. International climate finance entities such as the Green Climate Fund (GCF), Adaptation Fund (AF), the Global Environment Facility (GEF) or the International Climate Initiative (ICI) (the latter financed by the German government) already have gender-sensitive as well as vulnerable-groups sensitive project design guidelines in place (AF 2022; IKI n.d.; GCF 2021, 2019; GEF 2017). However, the majority of NbS projects are so far implemented in the rural area. Therefore, further efforts are required to expand the share of inclusive, urban NbS projects to make sure that cities are not left behind. Additionally, raising ambition and including gender-transformative approaches in project guidelines should be considered.

Promote long-term, locally developed projects. Large projects characterized by standardized external frameworks, often overseen by organizations from the Global North, ought to be conceived by organizations or initiatives deeply rooted in the local context and involving local groups. Alternatively, large projects can be subdivided into smaller project units facilitate alignment and integration into local structures. Prioritizing collaboration with civil society is crucial and can be accomplished through means such as issuing smaller, more accessible calls for proposals. This should be incorporated into long-term programs specifically designed for fostering such collaboration.

Publication bibliography

- ADB Institute (2023): Retrofitting Cities in the Global South: Achieving Low-Carbon Pathways by Bolstering Municipal Finances in G20 Countries. Available online at <https://www.adb.org/sites/default/files/publication/887526/adbi-retrofitting-cities-global-south-achieving-low-carbon-pathways-bolstering-municipal-finances.pdf>.
- AF (2022): Updated Gender Guidance Document for Implementing Entities on Compliance with the Adaptation Fund Policy. Available online at https://www.adaptation-fund.org/wp-content/uploads/2022/10/AF-gender-guidance_Sep-2022.pdf.
- Alber, G. (2011): Gender, Cities and Climate Change. Thematic report prepared for Cities and Climate Change Global Report on Human Settlements. UN Habitat. Available online at https://www.researchgate.net/publication/228969056_Gender_Cities_and_Climate_Change.
- Albert, Juelber (2023): Interview Case Study Inclusive NbS Ranau, Malaysia. Zoom Call to Anna Erbacher and Mathilde Wilkens. Online, 11/27/2023.
- ASEAN (2021a): ASEAN Development Outlook. Inclusive and Sustainable Development. Available online at https://asean.org/wp-content/uploads/2021/07/ASEAN-Development-Outlook-ADO_FINAL.pdf.
- ASEAN (2021b): ASEAN State of Climate Change Report. Current status and outlook of the ASEAN region Toward the ASEAN climate vision 2050. Available online at https://asean.org/wp-content/uploads/2021/10/ASCCR-e-publication-Correction_8-June.pdf.
- ASEAN (2022): ASEAN Sustainable Urbanisation Report. Sustainable Cities towards 2025 and Beyond. Available online at <https://asean.org/book/asean-sustainable-urbanisation-report/>.
- ASEAN; UN Women (2021): ASEAN Gender Outlook. Achieving the SDGs for all and leaving no woman or girl behind. Available online at <https://data.unwomen.org/publications/asean-gender-outlook>.
- ASEAN; UN Women (2022): State of Gender Equality and Climate Change in ASEAN. Stockholm Environment Institute (SEI). Available online at https://asean.org/wp-content/uploads/2022/08/State-of-Gender-Equality-and-Climate-Change-in-ASEAN_FINAL-1.pdf.
- ASEAN Secretariat (2021): ASEAN State of Climate Change Report 2021. Association of Southeast Asian Nations (ASEAN). Available online at <https://asean.org/wp-content/uploads/2021/10/ASCCR-e-publication-Final-12-Oct-2021.pdf>.
- Birkmann, J.; Liwenga, E.; Pandey, R.; Boyd, E.; Djalante, R.; Gemenne, F. et al. (2022): Chapter 8: Poverty, Livelihoods and Sustainable Development. In IPCC (Ed.): Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp.
- Candiracci, S.; Heinisch, L. M.; Moschonas, D.; Robinson, S. (Eds.) (2022): Nature-based Play. Fostering connections for children's wellbeing and climate resilience. Available online at https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiakOuwz_iCAxVpV0EAHerYBJYQFnoECA4QAw&url=https%3A%2F%2Fwww.arup.com%2F%2Fmedia%2Ffarup%2Ffiles%2Fpublications%2Fn%2F20220714_nature-based-play.pdf&usg=AOvVaw010FwKxo1-DTxlo_z-1RQw&opi=89978449.
- Cashman, K. (2018): Community Gardening in Mathare, Nairobi. Opportunities to Improve Food Security and the Right to the City. Available online at https://www.static.tu.berlin/fileadmin/www/40000121/Masterarbeiten/2018_Cashman_Community_Gardening.pdf.
- Castelo, S.; Amado, M.; Ferreira, F. (2023): Challenges and Opportunities in the Use of Nature-Based Solutions for Urban Adaptation. In *Sustainability* 15 (9), p. 7243. DOI: 10.3390/su15097243.
- Chanthavonghak, Souphithak (2023): Interview Case Study Inclusive NbS. Zoom to Anna Erbacher and Mathilde Wilkens. Online, 12/7/2023.

- Chen, Jiayu; Chang, Zheng (2015): Rethinking urban green space accessibility: Evaluating and optimizing public transportation system through social network analysis in megacities. In *Landscape and Urban Planning* 143, pp. 150–159. DOI: 10.1016/j.landurbplan.2015.07.007.
- Choudhury, Mahed-Ul-Islam; Haque, C. Emdad (2016): “We are more scared of the power elites than the floods”: Adaptive capacity and resilience of wetland community to flash flood disasters in Bangladesh. In *International Journal of Disaster Risk Reduction* 19, pp. 145–158. DOI: 10.1016/j.ijdr.2016.08.004.
- Depietri, Y.; McPhearson, T. (2017): Chapter 6: Integrating the Grey, Green, and Blue in Cities: Nature-Based Solutions for Climate Change Adaptation and Risk Reduction. In Nadja Kabisch, Horst Korn, Jutta Stadler, Aletta Bonn (Eds.): *Nature-Based Solutions to Climate Change Adaptation in Urban Areas*. Cham: Springer International Publishing, pp. 91–109.
- Diep, Loan; Parikh, Priti; Duarte, Barbara Pozzan dos Santos; Bourget, Anaïs Figueiredo; Dodman, David; Martins, José Rodolfo Scarati (2022): “It won’t work here”: Lessons for just nature-based stream restoration in the context of urban informality. In *Environmental Science & Policy* 136, pp. 542–554. DOI: 10.1016/j.envsci.2022.06.020.
- Dodman, D.; Archer, D.; Mayr, M. (2018): Addressing the most Vulnerable First. Pro-Poor Climate Action in Informal Settlements. Edited by UN Habitat. International Institute for Environment and Development (IIED). Nairobi, Kenya. Available online at https://unhabitat.org/sites/default/files/2019/05/pro-poor_climate_action_in_informal_settlements-.pdf.
- Dodman, D.; Hayward, B.; Pelling, M.; Castan Broto, V.; Chow, W.; Chu, E. et al. (2022a): Chapter 6: Cities, Settlements and Key Infrastructure. In IPCC (Ed.): *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp.
- Dodman, D.; Hayward, B.; Pelling, M.; Castan Broto, V.; Chow, W.; Chu, E. et al. (2022b): Cities, Settlements and Key Infrastructure. In H.-O. Pörtner, D. C. Roberts, M. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegria et al. (Eds.): *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Pörtner, H.-O.; Roberts, D. C.; Tignor, M.; Poloczanska, E. S.; Mintenbeck, K.; Alegria, A.; Craig, V.; Langsdorf, S.; Löschke, S.; Möller, V.; Okem, A.; Rama, B. (eds.)]. Available online at https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_FinalDraft_Chapter06.pdf.
- Dulal, H.B (2018): Cities in Asia: how are they adapting to climate change? In *Journal of Environmental Studies and Sciences*. Available online at <https://doi.org/10.1007/s13412-018-0534-1>.
- Estoque, Ronald C.; Murayama, Yuji; Myint, Soe W. (2017): Effects of landscape composition and pattern on land surface temperature: An urban heat island study in the megacities of Southeast Asia. In *The Science of the total environment* 577, pp. 349–359. DOI: 10.1016/j.scitotenv.2016.10.195.
- European Environment Agency (2022): Who benefits from nature in cities? Social inequalities in access to urban green and blue spaces across Europe. Available online at <https://www.eea.europa.eu/publications/who-benefits-from-nature-in>.
- Frantzeskaki, N.; Wijsman, K.; Adams, C.; Kabisch, N.; Malekpour, S.; Pineda Pinto, M.; Vandergert, P. (2023): 11. Governance of and with nature-based solutions in cities. In Timon McPhearson, Nadja Kabisch, Niki Frantzeskaki (Eds.): *Nature-Based Solutions for Cities*.
- GCA (2022): *Locally Led Planning. A Guide for Building Climate Resilience in Urban Informal Settlements*. Available online at <https://gca.org/reports/locally-led-planning-a-guide-for-building-climate-resilience-in-urban-informal-settlements/>.
- GCF (2019): *Gender policy*. Available online at <https://www.greenclimate.fund/document/gender-policy>.
- GCF (2021): *Revised Environmental and Social Policy*. Available online at <https://www.greenclimate.fund/document/revised-environmental-and-social-policy>.
- GEF (2017): *Policy on Gender Equality*. Available online at https://www.thegef.org/sites/default/files/documents/Gender_Equality_Policy.pdf.

Glavovic, B.; R. Dawson; W. Chow; M. Garschagen; M. Haasnoot; C. Singh; A. Thomas (2022): Cross-Chapter Paper 2: Cities and Settlements by the Sea. In: *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Lösschke, V. Möller, A. Okem, B. Rama (eds.)]. Edited by Cambridge University Press. In Press.

Grimm, N.; Kim, Y.; Sauer, J.; Elser, S. (2023): 2. Nature-based solutions and climate change resilience. In Timon McPhearson, Nadja Kabisch, Niki Frantzeskaki (Eds.): *Nature-Based Solutions for Cities*.

Guerry, A.; Lonsdorf, E.; Nootenboom, C.; Remme, R. P.; Griffin, R.; Waters, H. et al. (2023): 12. Mapping, measuring, and valuing the benefits of nature-based solutions in cities. In Timon McPhearson, Nadja Kabisch, Niki Frantzeskaki (Eds.): *Nature-Based Solutions for Cities*.

IKI (n.d.): Naturbasierte Lösungen in der Internationalen Klimaschutzinitiative (IKI). Available online at <https://www.international-climate-initiative.com/ueber-die-iki/iki-jahresberichte/iki-jahresbericht-2022/naturbasierte-loesungen-in-der-iki/-based-adaptation-eba/>.

ILO (2009): Providing safe and healthy workplaces for both women and men. Available online at https://www.ilo.org/wcmsp5/groups/public/---dgreports/---gender/documents/publication/wcms_105060.pdf.

ILO; UNEP; IUCN (2022): Decent Work in Nature-based Solutions 2022. Available online at https://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_863632/lang--en/index.htm.

IPCC (Ed.) (2022): *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp. Available online at doi:10.1017/9781009325844.

IQAir (2022): World Air Quality Report 2021. Region & City PM2.5 Ranking. Available online at <https://www.iqair.com/world-most-polluted-cities/world-air-quality-report-2021-en.pdf>.

IUCN (2020): IUCN Global Standard for Nature-Based Solutions: A User-Friendly Framework for the Verification, Design and Scaling up of NbS. Edited by International Union for Conservation of Nature. Available online at <https://portals.iucn.org/library/sites/library/files/documents/2020-020-En.pdf>.

Kapos, V.; Wicander, S.; Salvaterra, T.; Dawkins, K.; Hicks, C. (2019): The Role of the Natural Environment in Adaptation. Background Paper for the Global Commission on Adaptation. Edited by Global Commission on Adaptation. Available online at <https://gca.org/reports/the-role-of-the-natural-environment-in-adaptation/>.

Kirkby, P.; Williams, C.; Huq, S. (2017): Community-based adaptation (CBA): adding conceptual clarity to the approach, and establishing its principles and challenges. In *Climate and Development*. Available online at <http://dx.doi.org/10.1080/17565529.2017.1372265>.

Kiss, Bernadett; Sekulova, Filka; Hörschelmann, Kathrin; Salk, Carl F.; Takahashi, Wakana; Wamsler, Christine (2022): Citizen participation in the governance of nature-based solutions. In *Env Pol Gov* 32 (3), pp. 247–272. DOI: 10.1002/eet.1987.

Knapp, S.; Scott MacIvor, J. (2023): 5. Nature-based solutions and biodiversity: synergies, trade-offs, and ways forward. In Timon McPhearson, Nadja Kabisch, Niki Frantzeskaki (Eds.): *Nature-Based Solutions for Cities*.

Leahy, Caitlin; Winterford, Keren; Nghiem, Tuyen; Kelleher, John; Leong, Lee; Willetts, Juliet (2017): Transforming gender relations through water, sanitation, and hygiene programming and monitoring in Vietnam. In *Gender & Development* 25 (2), pp. 283–301. DOI: 10.1080/13552074.2017.1331530.

Lee, H.; Romero, J. (2023): Annex I: Glossary. In A. Reisinger, D. Cammarano, A. Fischlin, J. S. Fuglestedt, G. Hansen, Y. Jung et al. (Eds.): *Climate Change 2023. Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*.

- MacArthur, Jess; Carrard, Naomi; Mott, Jose; Raetz, Stuart; Siscawati, Mia; Willetts, Juliet (2023): Gender equality approaches in water, sanitation, and hygiene programs: Towards gender-transformative practice. In *Front. Water* 5, Article 1090002. DOI: 10.3389/frwa.2023.1090002.
- Masoudi, Mahyar; Tan, Puay Yok; Fadaei, Marjan (2021): The effects of land use on spatial pattern of urban green spaces and their cooling ability. In *Urban Climate* 35, p. 100743. DOI: 10.1016/j.uclim.2020.100743.
- Mayen Huerta, C.; Utomo, A. (2022): Barriers affecting women's access to urban green spaces during the COVID-19 pandemic. Available online at <https://www.research.ed.ac.uk/files/352264844/MayenHuerta2022LandBarriers.pdf>.
- McPhearson, Timon; Kabisch, Nadja; Frantzeskaki, Niki (Eds.) (2023): Nature-Based Solutions for Cities. Available online at <http://dx.doi.org/10.4337/9781800376762>.
- Olazabal, Marta; Chu, Eric; Castán Broto, Vanesa; Patterson, James (2021): Subaltern forms of knowledge are required to boost local adaptation. In *One Earth* 4 (6), pp. 828–838. DOI: 10.1016/j.oneear.2021.05.006.
- Olufemi, D. B. (2019): The role of urban agriculture in empowering urban women farmers in the city of Lagos. In *Afro Asian Journal of Social Sciences* Volume X, No.10.4 Quarter IV 2019. Available online at <http://www.onlineresearchjournals.com/aaajoss/art/335.pdf>.
- OXFAM (2017): Gender Justice in Resilience. Enabling the full performance of the system. Available online at <https://policy-practice.oxfam.org/resources/gender-justice-in-resilience-enabling-the-full-performance-of-the-system-620376/>.
- Rigolon, A.; Christensen, J. (2019): Greening without Gentrification: Learning from Parks-Related Anti Displacement Strategies Nationwide. Available online at <https://www.ioes.ucla.edu/project/prads/>.
- Salcedo-La Viña, C.; Trivedi, A.; Grace, K. (2023): Enabling rural women as key actors in nature-based solutions. World Resource Institute. Available online at doi.org/10.46830/wriwp.21.00164.
- Seddon, Nathalie; Chausson, Alexandre; Berry, Pam; Girardin, Cécile A. J.; Smith, Alison; Turner, Beth (2020): Understanding the value and limits of nature-based solutions to climate change and other global challenges. In *Philosophical transactions of the Royal Society of London. Series B, Biological sciences* 375 (1794), p. 20190120. DOI: 10.1098/rstb.2019.0120.
- SEI (2022): Assessing finance for nature-based solutions to climate change. Available online at <https://www.sei.org/wp-content/uploads/2022/11/sei-wp-assessing-finance-nature-based-solutions-2022.pdf>.
- Seneviratne, S. I.; Zhang, X.; Adnan, M.; Badi, W.; Dereczynski, C.; Di Luca, A. et al. (2023): Chapter 11: Weather and Climate Extreme Events in a Changing Climate. In IPCC (Ed.): *Climate Change 2021: The Physical Science Basis. Contribution Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*: Cambridge University Press.
- Shaw, R.; Luo, Y.; Cheong, T.S; Abdul Halim, S.; Chaturvedi, S.; Hashizume, M. et al. (2022): Asia. In H.-O. Pörtner, D. C. Roberts, M. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría et al. (Eds.): *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Pörtner, H.-O.; Roberts, D. C.; Tignor, M.; Poloczanska, E. S.; Mintenbeck, K.; Alegría, A.; Craig, V.; Langsdorf, S.; Lösschke, S.; Möller, V.; Okem, A.; Rama, B. (eds.)]. Available online at https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_FinalDraft_Chapter10.pdf.
- Shaw, R., Luo, Y.; Cheong, T. S.; Abdul Halim, S.; Chaturvedi, S.; Hashizume, M.; Insarov, G. E. et al. (2022): Chapter 10: Asia. In IPCC (Ed.): *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp.
- Terton, A.; Greenwalt, J. (2021): Building Resilience With Nature: Maximizing Ecosystem-based Adaptation through National Adaptation Plan Processes. Guidance Note. Edited by NAP Global Network. Available online at <https://napglobalnetwork.org/resource/building-resilience-with-nature/>.

Tozer, L.; Nagendra, H.; Anderson, P.; Kavonic, J. (2023): 3. Towards just nature-based solutions for cities. In Timon McPhearson, Nadja Kabisch, Niki Frantzeskaki (Eds.): *Nature-Based Solutions for Cities*.

UAP (n.d.): Doh Eain. Available online at <https://www.urbanagendaplatform.org/best-practice/doh-eain-renewing-yangon>, checked on 11/18/2023.

UN (4/4/2022): Secretary-General Warns of Climate Emergency, Calling Intergovernmental Panel's Report 'a File of Shame', While Saying Leaders 'Are Lying', Fuelling Flames. United Nations Press Releases. Available online at <https://press.un.org/en/2022/sgsm21228.doc.htm>, checked on 11/23/2023.

UN General Assembly (2015): Transforming our world : the 2030 Agenda for Sustainable Development. A/RES/70/1. Available online at <https://www.refworld.org/docid/57b6e3e44.html>.

UN Habitat (2019): Addressing Urban and Human Settlement Issues in National Adaptation Plans. A Supplement to the UNFCCC Technical Guidelines on the National Adaptation Plan Process. With assistance of L. Fee, M. Mayr, Y. Wang.

UN Habitat (2021a): Housing, slums and informal settlements. Slum estimates 2000 - 2020. Available online at <https://data.unhabitat.org/pages/housing-slums-and-informal-settlements>.

UN Habitat (2021b): SDG indicator metadata. Available online at <https://unstats.un.org/sdgs/metadata/files/Metadata-11-01-01.pdf>.

UN Habitat (2022): World Cities Report. Envisaging the Future of Cities. Available online at https://unhabitat.org/sites/default/files/2022/06/wcr_2022.pdf.

UNA (2023a): Lumpini Park สวนลุมพินี. Available online at <https://una.city/nbs/bangkok/lumpini-park>, checked on 12/10/2023.

UNA (2023b): Yangon's Alley Gardens Project ရန်ကုန်မြို့နောက်ဖေးလမ်းကြားဥယျာဉ်များစီမံကိန်း. Available online at <https://una.city/nbs/yangon/yangons-alley-gardens-project>, checked on 12/10/2023.

UNDP (2015): Gender, Climate Change and Community-based Adaptation. A guidebook for designing and implementing gender-sensitive community-based adaptation programmes and projects. Available online at <https://www.undp.org/publications/gender-climate-change-and-community-based-adaptation-guidebook>.

Vicedo-Cabrera, A. M.; Scovronick, N.; Sera, F.; Royé, D.; Schneider, R.; Tobias, A. et al. (2021): The burden of heat-related mortality attributable to recent human-induced climate change. In *Nature climate change* 11 (6), pp. 492–500. DOI: 10.1038/s41558-021-01058-x.

WHO (2016): Climate and Health Country Profiles - 2015. Available online at <https://www.who.int/publications/>.

Wolch, Jennifer R.; Byrne, Jason; Newell, Joshua P. (2014): Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough'. In *Landscape and Urban Planning* 125, pp. 234–244. DOI: 10.1016/j.landurbplan.2014.01.017.

Wolff, E.; Rauf, H.; Hamel, P. (2023): Nature-based solutions in informal settlements. A systematic review of projects in Southeast Asian and Pacific countries. In *Environmental Science and Policy* (145), pp. 275–285. Available online at <https://www.sciencedirect.com/science/article/pii/S1462901123001156#bib73>.

Wolff, Erich; Rauf, Hanna A.; Diep, Loan; Natakun, Boonanan; Kelly, Kris; Hamel, Perrine (2022): Implementing participatory nature-based solutions in the Global South. In *Front. Sustain. Cities* 4, Article 956534. DOI: 10.3389/frsc.2022.956534.

World Bank Group (2011): Guide to Climate Change Adaptation in Cities. Available online at <https://climate-adapt.eea.europa.eu/en/metadata/guidances/guide-to-climate-change-adaptation-in-cities/11237802>.

World Bank Group (2021): A Catalogue of Nature-based Solutions for Urban Resilience. Available online at <https://documents1.worldbank.org/curated/en/502101636360985715/pdf/A-Catalogue-of-Nature-based-Solutions-for-Urban-Resilience.pdf>.

World Bank Group (2023): Integrating Gender and Social Inclusion in Nature-Based Solutions. Guidance Note. Available online at <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099060123165042304/p1765160ae46bb0aa0aefa0235601f9d0c6>.

World Bank Group; GFDRR (2021): Gender Dimensions of Disaster Risk and Resilience. Existing Evidence. With assistance of Alvina Erman, Sophie Anne De Vries Robbé, Stephan Fabian Thies, Kayenat Kabir, Mirai Maruo. Available online at <https://www.thegpsc.org/knowledge-products/gender-and-cities/gender-dimensions-disaster-risk-and-resilience-existing>.

WWF; ILO (2020): Nature Hires. How NbS can power a green jobs recovery. Available online at https://wwf.panda.org/wwf_news/?943816/Nature-based-solutions-jobs-report.