Socio-Environmentally Just Nature-Based Solutions for Coastal Urban Resilience: Case Study of Mangrove Ecosystems in the Philippines.

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Table of Contents

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List of Abbreviations

BFAR	Bureau of Fisheries and Aquatic Resources
DA	Department of Agriculture
DENR	Department of Environment and Natural Resources
EBA	Ecosystem-based Adaptation
GI	Green Infrastructure
IPCC	Intergovernmental Panel on Climate Change
NBS	Nature-based Solutions
SLR	Sea Level Rise

Chapter 1: Introduction

1.1. Introduction of the Research Question

Adaptation to anthropogenically-induced climate change is humanity's most pressing challenge for achieving social equity. This is because climate change risks will impact historically marginalised social groups the most, based on the interaction between exposure to hazards, vulnerability to risks and capacity to adapt to risks. Vulnerability to climate change risks is a socially constructed concept, which manifests as a result of the interactions between social, economic, and political factors, such as gender, race, ethnicity, wealth/poverty, (dis)ability, and political inclusion/exclusion (Brooks, Adger, & Kelly, 2005). Chapter 2 takes an intersectional approach to gender in order to examine how gender shapes vulnerability to climate change risks, and to undercover how the interaction between social, economic, and political factors creates obstacles to equitable participation in the decision-making process, which hinders the ability to adapt to risks. Hence, it is crucial for climate change adaptation to acknowledge and tackle the obstacles that hinder the ability to equitably adapt to risks. This is because when adaptation is embedded in power imbalances, climate change adaptation risks to: i) reinforce existing vulnerability, ii) redistribute vulnerability, and iii) introduce new risks and vulnerability (Eriksen et al., 2021). Based on this, adaptation to climate change risks is ultimately a question of justice.

With the current rates of urbanisation and overall population growth, it is estimated that the proportion of the global population who live in urban centres will increase from 55% in 2018 to 68% in 2050, with 90% of this growth being expected to occur in Asia and Africa (UNDESA, 2018). Moreover, even though low elevation coastal zones only occupy 2% of the world's geographical area, coastal cities are home to 10% of the global population and 13% of the world's urban population who rely on coastal and marine ecosystems for nutrition, livelihood, and habitat (McGranahan, Balk, & Anderson, 2007). This high concentration of people, built environment and livelihood opportunities, makes coastal urban areas particularly exposed and vulnerable to climate change risks, such as rising sea levels, flooding, extreme weather events and extreme heat (Rahman et al., 2016). Hence, as

coastal cities and their residents are not prepared to withstand the impacts of climate change, the case of mangrove restoration for coastal protection is critical for addressing exposure and vulnerability to risks. Throughout this dissertation, mangrove restoration will be discussed as a specific example of how nature-based solutions (NBS) are implemented for coastal urban resilience.

Over the last two decades, the concept of NBS has been gaining attention in academic and political discourses as a tool for addressing climate change risks and contributing to the sustainability of urban areas (Kabish et al., 2017). NBS consists of a wide range of interventions, differing in terms of scope, scale and functions provided, which has led to the concept being framed and adopted in various ways by different actors. While most of the definitions provided within the literature define NBS by these three crucial elements: i) the protection, restoration, and sustainable management of an ecosystem, ii) aspiration towards a more transformative socio-ecological relationship, and iii) harnessing the power of nature to address socio-ecological issues, most of the conceptualisation of NBS have overlooked the questions of social justice. Additionally, there has been limited attention to how NBS are shaped by power dynamics, while critical analysis of how existing social injustices influence the equitability of NBS is lagging both conceptually and practically. Hence, there is a growing urgency for the incorporation of elements regarding social and climate justice at the core of NBS, and based on this, this dissertation aims to analyse how socio-environmentally just nature-based solutions can be achieved through the lens of mangrove restoration in the Philippines.

Following from this, through the adoption of an intersectional approach to gender, Chapter 2 will analyse how the interaction between social, economic, and political factors influence the equitability of the decision-making process and dictate the outcomes from climate change adaptation initiatives. Chapter 3 will analyse the potential of NBS, as a practical response to climate risk, to contribute to coastal urban resilience, and the limitations that arise because the implementation of NBS is embedded within power dynamics and existing systems and structures. Based on the framing of the concept of NBS as political, since the equitability of outcomes depends on who has the ability to participate and the power to influence the decision-making process, Chapter 4 will analyse the (in)justices that have

arisen as a result of the implementation of mangrove restoration initiatives in the Philippines and how socio-environmentally just outcomes can be facilitated.

Within this dissertation, the Philippines, an archipelagic country in Southeast Asia, will be examined as a case study location in order to illustrate how power dynamics have influenced the degradation and the restoration of coastal ecosystems, and how these developments impact the exposure and vulnerability to climate change risks. Mangrove ecosystems are one of the most important coastal resources in the Philippines, due to the multiple environmental, social, and economic benefits they provide. At the beginning of the 20th century, mangroves covered roughly 450,000 ha, and several coastal areas, including the country's capital city – Manila were named after mangrove species (Primavera &Esteban, 2008). However, neoliberal ideology has influenced the perception of mangroves as wastelands, which concealed their vital role in sustaining the livelihoods of coastal communities and fuelled the introduction of a national policy that encourages the conversion of mangrove ecosystems into fishponds with the aim to maximise the production of fish (Maliao & Polohan, 2008). This government-sponsored policy was facilitated through the provision of loans and has resulted in significant environmental degradation, amounting to the loss of 70% of the country's mangrove cover (Figure 1). Ironically, the neoliberal approach to increasing fish populations has led to the rapid decline of fish catch, because the biodiversity and abundance of aquatic species are highly dependent on the health of mangrove ecosystems, and has increased Philippines' exposure and vulnerability to climate change risks (Primavera & Esteban, 2008; Primavera, 2000; Melana, Melana, & Mapalo, 2005).

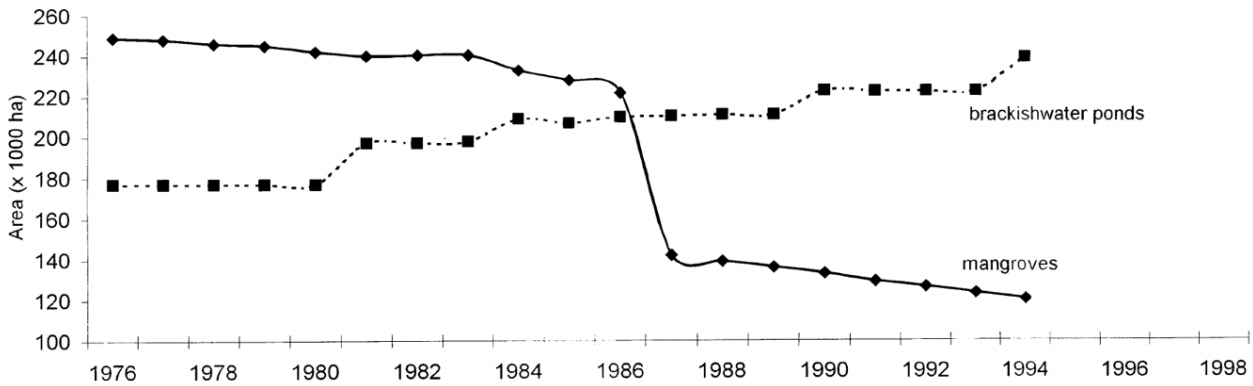

Figure 1. Change in mangrove and brackishwater pond area in the Philippines, 1976-1990. Source: (Primavera, 2000)

1.2. Methodology

This dissertation aims to analyse how NBS can lead to socio-environmentally just outcomes and contribute to urban coastal resilience. The answer to this research question will be fostered through qualitative research, due to its ability to provide an in-depth and nuanced understanding of complex and interconnected social and environmental challenges. Furthermore, the analysis will be drawn through a review of the available secondary data, because of the vast availability of literature in terms of scope and depth. This dissertation will adopt a case study approach, because it would allow to investigate the power imbalances that have led to environmental degradation, and whether if existing power dynamics and structures are unchallenged the implementation of NBS risks the replication of (in)justices.

While the use of a case study approach has facilitated the analysis of a synthesised framework within the context of mangrove restoration initiatives in the Philippines, there have been several limitations to the methods adopted. Since the analysis is solely based on secondary data, this has resulted in certain contextual information gaps regarding the case study, which has constructed the risk of researcher bias in terms of creating assumptions about the causal relationship between variables and potentially simplifying the conclusions. Nevertheless, this risk could have been mitigated through the integration of primary data into the mix of research methods, however, this was unfeasible due to time constraints and ethical considerations. Additionally, despite active efforts to equitably engage with both Global North and Global South-based secondary data, the majority of the articles and reports concerning NBS are authored by scholars based in the Global North, which represents a significant limitation of the methodology, because it hinders the achievement of epistemological justice.

Chapter 2: Gendered Climate Change Vulnerability

2.1. Introduction

Climate change risks are distributed unevenly between and within coastal urban areas and will affect people differently depending on the exposure to risks, vulnerability to risks and adaptive capacity (IPCC, 2014). The IPCC defines climate change vulnerability as "the propensity or predisposition to be adversely affected" (IPCC, 2014, p.5). However, it is vital to recognise climate change vulnerability as a socially constructed risk, shaped by social, economic, and political factors, such as race, gender, age, disability, class, income, and political inclusion (Brooks, Adger, & Kelly, 2005). MacGregor (2010) argues that without a holistic understanding of the underlying root causes of vulnerability, climate change adaptation strategies might exacerbate existing injustices while leaving climate change risks unaddressed. Based on this, this chapter will analyse how the social construct of gender shapes power dynamics and how the interaction of various social factors shape differing vulnerability to climate change risks. Following from this, adopting an intersectional approach will facilitate a nuanced in-depth analysis of the root causes of climate change vulnerability in the Philippines.

2.2. Gender and Intersectionality

Feminists state that gender refers to the socially constructed norms, roles, responsibilities, opportunities, and barriers, that define the everyday lived experiences of men and women (Bee, Rice, and Trauger, 2015). The concept of gender was further expanded on by feminist sociologists, who argue that gender should be conceptualised as a social system that distributes resources, responsibilities, power, and entitlements based on whether a person is regarded as male or female (Ridgeway & Correll 2004). Weber et al. (2019) argue that because most existing social systems are profoundly hierarchical, favouring male/masculine above female/feminine, gender is an important determinant of climate change vulnerability as it interacts with other social, economic, structural, and institutional factors. Socially constructed norms influence the gendered distribution of domestic duties and labour

opportunities, socially expected roles and responsibilities, as well as normalised behaviours. These socially constructed gender norms, roles and responsibilities create barriers to access to resources, information, employment opportunities, and decision-making power, which has led to women being in comparable terms economically disadvantaged and predominantly excluded from decision-making power. These factors have led to the construction of inequitable power dynamics that shape the everyday experiences of individuals and cause differing degrees of climate change vulnerabilities for men and women, as well as, differing capacity to adapt to climate change risks.

The majority of vulnerability discourses portray women as the vulnerable gender to climate change risks (Sultana, 2014). However, Arora-Jonsson (2011) argues that this conceptualisation is problematic because it promotes dichotomies that focus solely on the men-versus-women power dynamics, and frames women's identities as "fixed, centred and uniform" (Resurrección, 2013, p.1). The homogenisation of women's everyday realities and experiences is limiting, as it ignores crucial social factors, such as race, class, age, and income. Agarwal (2000) echoes this by emphasising the need for recognition of context-specific social identities. Agarwal (2000) states that the unique and significant knowledge generated by women who depend on natural ecosystems for their income and livelihoods is derived from the combination of the social factors shaping their everyday realities and the interaction of these characteristics with the social environment, within which these women are situated. Kaijser & Kronsell (2013) expand on the concept of situated knowledge by arguing that one of the main goals of adopting an intersectional approach is to prevent the simplification that creates the association of the knowledge generated by women whose everyday experiences lead to a high-level engagement with natural resources as a universal element of being a female.

Davis (2008, p.68) states that intersectionality is "the interaction between gender, race and other categories of difference in individual lives, social practices, institutional arrangements, and cultural ideologies and the outcomes of these interactions in terms of power". These social categorisations serve as grounds for inclusion and exclusion of who has access to decision-making power and whose knowledge is an integral part of the decision-making process. Therefore, by influencing the ability to participate and equitably engage in

the decision-making process, the interaction between social factors determines whose everyday experiences are shaping the political agenda, and whose vulnerabilities are addressed by climate change policy. Hegemonic knowledge systems fail to capture the wide range of complexities and social factors that shape everyday dynamics and experiences, leading to the misconceptualisation of the compound vulnerabilities that arise as a result of interlocking social systems of exclusion (Ridgeway & Correll, 2004). MacGregor (2010) argues that overlooking barriers, inequitable power dynamics, and uneven distribution of resources, rights, and responsibilities would result in maladaptation because it leaves climate change risks unaddressed while perpetuating existing injustices.

Based on the above, an intersectional approach to gender should be made an integral part of analysing the underlying causes of climate change vulnerability, because it would provide an understanding of how power structures emerge and interact. This would construct the foundation upon which policies and practices can holistically address risks and social injustices, without homogenising and portraying the everyday experiences of different social groups as fixed. While the majority of gender discourses focus on how the distribution of norms, responsibilities, and resources shapes differing vulnerabilities, re-framing the interaction between systems as three major obstacles: i) socio-cultural beliefs that restrict participation, ii) economic systems that limit the capacity to participate, and iii) political structures that limit political representation of specific social groups, would foster the visualisation of what barriers need to be taken into account and addressed to achieve socio-environmental justice. Based on this, the following section will examine how socio-cultural beliefs, economic systems, and historic political exclusion have shaped obstacles for holistic and equitable adaptation to the intersecting climate change vulnerabilities present in the Philippines.

2.3. Intersecting Climate Change Vulnerabilities in the Philippines

2.3.1. Socio-cultural Norms and Beliefs

During climate-related disasters, such as typhoons and flooding, women and girls are more likely to be killed than men and boys, as due to socio-cultural norms girls are less likely to be taught how to swim (Crease, Parsons, & Fisher, 2018). A study from the Philippines indicated a significant difference in swimming ability by gender, with 87% of men reporting swimming skills, in comparison to just 51% of women (Hunter et al., 2016). Also, the study identified that in 20% of households with both girls and boys, only the boys could swim (ibid.). Therefore, the socially constructed division of skills manifests in intergenerational climate change vulnerability. Additionally, the social construct of women as the household caretakers places the responsibility of domestic and caregiving duties upon them. This increases their vulnerability during disasters, because women are responsible for taking care of the family members, including the children and the elderly, and are more likely to remain in their households, protecting household assets, rather than evacuating to disaster shelters. Moreover, a socio-culturally constructed division of labour that binds women to reproductive responsibilities limits the economic, educational, and political opportunities that women have the time to engage with, because of time poverty. Gendered division of labour leads to the construction of hierarchies of work and values, providing breadwinners with greater bargaining power regarding decisions within the household while concealing the active contribution of caregiving duties to the well-being of the family (Meurs & Ismaylov, 2019). This affects the power dynamics between women and men within households and communities, hindering the bargaining power of women and constructing barriers that limit equitable participation in the decision-making process. For example, a study in the Philippines concluded that 20% of women were not involved in the decisions of loans and larger purchases (Rost & Koissy-Kpein, 2018). Therefore, gender norms hinder the ability of women to adapt to climate change risks, because by influencing decision-making power, gender norms shape whose needs, wants, and vulnerabilities are addressed.

2.3.2. Inequitable Access to Resources

Despite making progress towards gender economic equality, the Philippines remain a highly unequal society due to the significant income disparities and a high level of poverty (David, Albert, & Vizmanos, 2018). Due to gendered barriers, such as stereotypes, discrimination and limited access to training opportunities, women are facing a glass ceiling and are more likely to work in vulnerable jobs within the informal economy. Employment within the informal economy is characterised by limited opportunities for social security, and low-wage work, which results in precarious income (ibid.). The employment rate of women is still significantly lower compared to men (Figure 2), which can be explained by the socially constructed division of domestic duties (ADB, 2013). This results in an unequal share of unpaid work, which in combination with a precarious income further deepens the dependency of women on resources that can be derived from natural ecosystems.

Employment Indicator	Philippines		
	Women	Men	Gap
Labor force participation rate			
2000	47.7%; 11.605 million	79.6%; 19.307 million	31.9%
2001	51.8%; 12.711 million	82.4%; 20.098 million	30.6%
2012	50.0%; 15.815 million	78.5%; 24.617 million	28.5%
Employment rate			
2000	42.1%; 10.259 million	70.9%; 17.913 million	28.8%
2012	46.7%; 14.757 million	72.9%; 22.850 million	26.2%
Vulnerable employment			
2001	48.6%; 5.946 million	43.0%; 7.707 million	5.6%
2004	46.3%; 5.551 million	40.6%; 7.988 million	5.7%
2011	44.5%; 6.503 million	39.0%; 8.797 million	5.5%
Low-wage work			
2004	17.6%	13.1%	4.5%
2009	18.6%	12.5%	6.1%
2010	18.2%	12.1%	6.1%
2011	17.7%	11.8%	5.9%

Figure 2. Employment indicators of women and men in the Philippines. Source: (ADB, 2013).

Furthermore, environmental degradation due to anthropogenic and climate-related drivers increases the time spent on domestic obligations, because women need to travel further to obtain resources, such as mud crabs whose abundance depends on the health of mangrove ecosystems. This increases their exposure to climatic risks, such as extreme heat, which has negative health and wellbeing consequences and reduces the time and capacity for income-generating activities (Resurrección et al., 2019). Therefore, women are disproportionally impacted by environmental degradation, due to their greater dependency on natural resources, which increases their vulnerability to poverty.

Regarding access to property, the Philippines has shown progress towards gender equality. Since the passing of new land legislation in 2001, 78% of land titles have been issued for joint ownership, a progressive step to guarantee that both men and women are acknowledged as owners (ADB, 2013). However, inconsistencies in policies reinforce gender inequality in access to land, because, in the event of legal disputes, the husband's decisions take precedence, despite the property being jointly owned (ibid.). Therefore, gender norms hinder the financial ability of women to adapt to climate change risks, while discriminatory policies hinder women's decision-making power, which reinforces the socially constructed vulnerability and limits the progress towards gender equality.

2.3.3. Historical Political Exclusion

Pollical dynasties have long been the feature of the Philippines political landscape, with the national electoral system in the Philippines has been functioning through patron-client relationship, which has facilitated the ". . .emergence of local 'bosses' whose constituencies remained trapped in webs of dependence and insecurity, and whose discretion over state resources, personnel, and regulatory powers provided enormous opportunities for private capital accumulation" (Hedman & Sidel, 2001, p.7). These networks have been marked by largesse in exchange for local votes once the elite has secured state power, resulting in significant democratic backsliding with prominent political and economic elites exerting influence over policymaking and legislation (Timberman, 2019). In the Philippines, the decentralisation of the governance structure began in 1991 intending to create a more responsive local government system that facilitates local autonomy and gives local

governments more power. However, governors and mayors continue to enjoy the power to suspend mayors and barangay captains who are directly under their control, as well as vetoing budget proposals (Yilmaz, Beris, & Serrano-Berthet, 2010). Therefore, the absence of a transparent local government system is reinforced by the abuse of power by higher-level government officials.

The political landscape in the Philippines is highly patriarchal with 78% of elected offices in 2016 being occupied by men, which indicates the limited representation of the needs and everyday experiences of women (David, Albert & Vizmanos, 2018). As a result of historical political exclusion, the prevalence of hegemonic knowledge has contributed to discriminatory policies that reinforce social injustices. For instance, one of the Gender and Development programmes implemented under the Department of Agriculture provided women with water pumps to improve access to water. The outcomes of the programme were evaluated by policymakers as an advancement towards gender equality, despite the fact that when power imbalances that stem from socially constructed gender norms are left unchallenged, initiatives deepen gender injustices by reinforcing the gendered distribution of responsibilities and reinforcing the obstacles that hinder access to decision-making power (Crease, Parsons, & Fisher, 2018). This will further exacerbate gendered climate change vulnerabilities because the lack of equitable and inclusive participation in the decision-making means that intersectional vulnerabilities would likely not be addressed by climate change adaptation policies.

Graziano et al. (2018) state that gender equality should be analysed in the context of whether women have the same ability to influence political decisions as men do, and Valente & Moreno (2014) argue that this contextualisation is important because of the numerous obstacles women in patriarchal societies need to overcome to influence political agendas. For example, gender norms reinforcing the consideration of leadership as a male strength, not only impacts the perception of the political candidate's competency but also leads to internalised misogyny among women (ibid.). Because of the structure of the electoral system, if political candidates do not self-finance their campaign, they need to be backed by stable political groups and power networks. However, gender stereotypes create obstacles to accessing political power, because political parties tend to fund male

candidates based on the perception that they have a better chance of winning the election (Labani, Kaehler, & Ruiz, 2009). Therefore, the election system is biased in favour of masculine structures and the country's most powerful economic classes. For instance, in the cases when women hold high government positions, they tend to be from elite families and/or political dynasties, but because of the knowledge systems that stem from these dynastic arrangements, most women in politics tend to support the family's political priorities and values, which may or may not coincide with a political agenda promoting women's rights(ibid.). Therefore, the interaction of social, economic, and political systems creates barriers for achieving inclusive access to decision-making, by upholding hegemonic knowledge practices.

Based on the above, it becomes evident that the interaction of social, economic, and political systems has manifested in the creation of continuously reinforces obstacles to achieving just climate change adaptation in the Philippines. Therefore, climate change adaptation strategies need to consider the interaction of the underlying obstacles in order to facilitate social inclusion, equitable distribution of resources and equitable access to decision-making power, because the presence of these conditions would facilitate the disruption of the vicious cycle of gender injustice.

2.4. Conclusion

In conclusion, gender is a crucial factor that determines the distribution of resources, rights, and responsibilities, because of the interaction between social, economic, and political systems. The power structures emerge as a result of these interactions, construct the differing climate change vulnerability among social groups, as well as the vulnerability of ecosystems. Therefore, there are three key reasons why an intersectional analysis of gender must be an integral part of all climate change strategies, policies, and initiatives: i) to challenge the homogenisation of women's everyday experiences, ii) to facilities the holistic understanding of the underlying root causes of vulnerability, and iii) to undercover how the interaction of social, economic, and political systems create challenges for achieving equitable access to decision-making power.

Chapter 3: The Contributions of Nature-based Solutions Towards Urban Coastal Resilience

3.1. Introduction

With environmental hotspots and urban disasters being disproportionately concentrated in low-lying coastal regions, coastal cities are becoming sites of opportunity, where responses to climate risks are establishing new practices to address the vulnerabilities of coastal communities (McGranahan, Balk, & Anderson, 2007; Gujjar, 2020). Advocates of NBS claim that NBS have the potential of reducing the impact of climate change risks and portray NBS as a cost-effective climate change adaptation and mitigation strategy due to the ability to simultaneously provide multiple co-benefits, such as carbon sequestration, enhanced biodiversity, and improved livelihoods (Fink, 2016). Furthermore, Frantzeskaki (2019) argues that due to the potential of NBS to tackle multiple socio-environmental challenges that are present in cities, and the significant role cities play in guiding sustainable societal transformation, urban areas are critical locations for the implementation of NBS. However, the concept of NBS is not a power neutral concept and the implementation of NBS can reduce the vulnerability of people and ecosystems to climate risks, but it also has the power to uphold the status quo by perpetuating existing injustices (Cousins, 2021). Following from this, this chapter will examine the differing ways in which NBS is framed and adopted by different actors. Secondly, the potential of NBS in contributing to coastal urban resilience will be analysed. Lastly, this chapter will evaluate the limitations of NBS and will outline the main principles of the implementation process that have the potential to strengthen the ability of NBS to contribute to coastal urban resilience.

3.2. Potential and Limitations of Nature-based Solutions

3.2.1. Nature-based Solutions as an Umbrella Term

Advocates of NBS state that the concept consists of the provision of multiple social, cultural, environmental, and economic co-benefits while protecting and improving the state of the natural environment (Gujjar, 2020). This conceptualisation is based on the recognition that the health of ecosystems is critical for human welfare. Kabish et al. (2017) argue that NBS is an umbrella term because it sweeps up and builds upon all other concepts that utilise the power of nature, such as ecosystem services, green infrastructure (GI), ecosystem-based adaptation (EBA), and eco-engineering. However, Pauleit et al. (2017) highlight that re-labelling of NBS as an umbrella term hinders its effective use because it can lead to misconceptualisation of NBS. Dorst et al. (2019) build upon this statement by arguing that there is an unclear understanding of what distinguishes NBS as a strategy for sustainable urban planning from other comparable concepts, such as GI and EBA, and which characteristics are unique to NBS. Nesshöver et al. (2017) echo this statement by arguing that definitions of NBS tend to be broad and there is a need for a clearer articulation of the concept to avoid ineffective implementation, which would hinder the uptake of NBS by policymakers and communities.

As a response to this, Gujjar (2020) argues that the three main characteristics that distinguish and unifying the concept of NBS are: i) the interconnectedness and interdependency of human and natural environments, ii) the acknowledgement that people can learn from nature and should work with nature, rather than against it or without it because it would lead to more effective, sustainable, and culturally acceptable solutions to social issues, and iii) challenging the basis of human-nature relationships would improve the resilience of ecosystems and would increase human wellbeing. However, Cousins (2021, p.6) challenges these arguments by raising the vital questions of what nature is the solution to, and for whom nature is the solution, by considering the concept of NBS as "harnessing the power of nature and people to transform the social, political, and economic drivers of socio-

spatial inequality and environmental degradation into opportunities to create progressive, cohesive, antiracist, and social-ecologically sustainable communities".

Based on the above, it becomes clear that the concept of NBS is articulated in various ways by different actors. While most of the definitions provided within the literature highlight these three crucial elements: i) the protection, restoration, and sustainable management of an ecosystem, ii) aspiration towards a more transformative socio-ecological relationship, and iii) harnessing the power of nature to address socio-ecological issues, most of the conceptualisation of NBS have overlooked the questions of social justice raised by Cousins (2021). Greater emphasis needs to be placed on the fact that NBS are embedded within power dynamics in order to foster the implementation of NBS, which leads to socio-environmentally just outcomes. Within this dissertation, NBS would be conceptualised based on the three crucial elements outlined above and would be adopted through the elements of iv) inclusive participation, v) multidisciplinary knowledge co-production and vi) adaptive co-production of ecosystem services, because these elements shape the equitability of NBS, as discussed in Section 3.2.3. and in Chapter 4.

3.2.2. Multifunctionality Underpinning the Potential of Nature-based Solutions

According to Cutter et al. (2003), vulnerability to climate change risks such as floods, SLR, and droughts is determined by the interaction between biophysical conditions and the social, political, and economic contexts that shape structural inequalities. Within this, advocates for NBS portray the concept as a unique strategy for climate change adaptation, because of the multifunctional aspect of the interventions and the potential to address multiple social, economic, and environmental issues simultaneously (Meerow,2020).

NBS implemented for coastal protection and resilience have the potential to provide the following co-benefits. Firstly, NBS, such as mangrove restoration, have the potential to restore the functionality of degraded ecosystems and facilitate the improvement of biodiversity, while enhancing carbon sequestration. Secondly, by improving the biodiversity and resilience of the ecosystem, NBS can contribute to improving livelihood opportunities

for the communities that rely on them, as for example, restored mangrove ecosystems can improve the livelihood opportunities for fishers and contribute to the diversification of livelihood options by introducing new income sources. Thirdly, NBS can provide coastal communities with a natural defence that protects human settlements, infrastructure, and assets by minimising the impact of climate risks, such as typhoons and floods. Fourthly, NBS can improve human health and wellbeing, as for instance, mangrove ecosystems reduce the impact of climatic risks, such as extreme heat by providing shade and reducing temperatures, while improving access to nature, which has positive benefits on mental health and cognitive development (Kabish et al., 2017).

Even though the concept of NBS has emerged in predominantly Global North policy discourses, and the majority of the research remains focused on Global North cities, the application of NBS is not novel to the Global South, as the ideology of protection of and working with nature can be found deeply entrenched in Indigenous practises (Ferreira et al., 2020; Gujjar, 2020). Therefore, the potential to yield multiple co-benefits sets NBS apart from traditional climate change adaptation approaches and makes it an important concept to be examined within the Global South context, as this geographical region is more vulnerable to climate change risk due to its colonial past and inequitable development.

3.2.3. Nature-based Solutions for Whom?

Although the concept of NBS has been gaining traction in academic and policy discourses, it has been heavily romanticised. Cousins (2021) argue that this is because the concept is analysed uncritically, with questions concerning what nature is the solution to, and for whom NBS are, tend to be left unanswered. In its current structure, NBS remains apolitical, because it ignores uneven power relations and social injustices that dictate who has access to decision-making power (ibid.). Pelling et al. (2015) claim that nature should be critically examined as a site of power because NBS can perpetuate existing social injustices, if the priorities, rights, and knowledge of marginalised social groups are overlooked. Following from this, it is fundamental to recognise the concept of NBS as political, since the implementation of NBS results from social processes and decisions.

Haase (2017) argue that the NBS literature has contributed to the romanticisation of the concept by not acknowledging the fact that NBS are implemented within cities with existing socio-economic and socio-spatial injustices. This de-contextualisation of the spaces within which NBS are implemented risks ignoring barriers to equitable decision-making power that social groups may face, which would manifest in the invisibilization of justice-related trade-offs. As discussed in Chapter 2, individuals have differing abilities to influence what policies are adopted and how they are implemented because of the interaction between social, economic, and political factors, which hinders or enables access to decision-making power. Hence, the application of just NBS necessitates situating it within broader questions of social inclusion, because the recognition of social injustices, such as gender disparities within cities would allow for a nuanced understanding of power dynamics, and how the drivers of social inequality can be addressed. Moreover, Nesshöver et al. (2017) argue that the implementation of NBS is entrenched in socio-ecological and institutional contexts, and Berbés-Blázquez, González, & Pascual (2016) build upon the argument by stating that the concentration of benefits by actors with economic and political power, and the allocation of costs to marginalised actors, is the direct result of power disparities that emerge from formal and informal institutional structures.

Pauleit et al. (2017) argue that the equitability of outcomes that arise from the implementation of NBS directly depends on the level of participation and participatory governance. This statement is further echoed throughout gender and climate justice literature, because the outcomes of NBS are determined by who has the power to influence the decision-making process and whose knowledge, needs, and everyday experiences are included or excluded (Resurrección et al., 2019). Shi et al. (2016) argue that broadened participation can address distributional and procedural injustices and provide an equitable pathway to building urban resilience and social inclusion. Inclusive participation can facilitate the representation of the need, wants, and experiences of all stakeholders and provide a foundation upon which partnerships and collaboration across various stakeholders can blossom, which could result in innovative and previously unforeseen solutions. This is further echoed by Andreucci (2013) who argue that successful implementation of NBS depends on the integration of knowledge from multiple disciplines

as well as cross-disciplinary cooperation and coordination. However, based on the arguments raised in Chapter 2, multiple reinforcing obstacles to meaningful and equitable participation arise as a result of the interactions of social, economic, and political systems. Hence, while the majority of the literature recognises the benefits associated with inclusive participation, simply broadening participation cannot assure equity and would not halt the reproduction and reinforcement of social injustices. For instance, even though a mangrove restoration initiative in the Philippines has facilitated inclusive participation to decision-making for both men and women, the implementation of NBS has contributed to the inequitable distribution of costs, because by not addressing entrenched gender norms, the greater time spent by women managing the mangrove ecosystems instead of performing their socially-expected domestic duties there has translated into a rise in domestic gender-based violence (Bagsit & Jimenez, 2013). Based on this, social inequalities need to be challenged, and structures and processes reconstructed, otherwise, the implementation of NBS risks leading to maladaptation, which limits the restoration outcome and the equitable distribution of benefits.

NBS are not inherently equitable and based on this, NBS need to be strategically strengthened and developed to respond to gender and social inclusion issues. While the majority of the gender and NBS literature recognises that NBS needs to be strengthened through inclusive participation and knowledge co-production as it would ensure the representation of the voices of all stakeholders and would enable the exchange and integration of different knowledge systems, a greater emphasis needs to be placed on the process of fostering inclusive participation. A nuanced understanding of the context, power imbalances, and formal and informal structures that have led to the construction of vulnerabilities is the first step to designing mechanisms and principles that would allow NBS to disrupt social injustices and address the obstacles, which prohibit equitable access to decision-making power. Hence, an intersectional approach to climate change adaptation would play a crucial role in acknowledging and challenging existing power structures.

3.3. Conclusion

In conclusion, NBS are an important element for achieving coastal urban resilience, and the process of implementing NBS has a significant impact in determining the equitability of outcomes. As NBS are entrenched in institutional structures and uneven power dynamics, the concept of NBS carries the risk of replicating processes that have constructed socio-environmental injustices. This is represented by the case of mangrove ecosystems in the Philippines, as discussed in Chapter 1 and Chapter 4, where the lack of inclusive participation and knowledge co-production have initially led to rapid environmental degradation of mangroves and have later resulted in the failure to restore the ecosystems. Furthermore, as discussed in Chapter 2, the interaction between social, economic, and political systems creates obstacles to equitable participation, which manifest in differing degrees of climate change vulnerability, which if left unaddressed would reinforce systems of exclusion and would further marginalise the social groups, who are most vulnerable to risks. Hence, as NBS are weak in ecological, social, and political dimensions in their current state, the concept needs to be straightened in four key elements: i) inclusive participation, ii) multidisciplinary knowledge co-production, iii) co-production of ecosystem services, and iv) intersectional approach to climate change justice, to contribute to urban resilience.

Chapter 4: Framework for Socio-Environmentally Just Nature-based Solutions

4.1. Introduction

The Philippines is an archipelago of 7,107 islands, 1,000 of which are inhabited, located in Southeast Asia (GFDRR, 2011). The country is situated on a typhoon belt, and its archipelagic geography and 36,289 km coastline make the Philippines highly susceptible to climate change risks, such as SLR and extreme weather events (ibid.). With a total population amounting to 109,035,343 in 2020, 60% of the country's population is concentrated in coastal areas, while 51% reside in urban areas (PSA, 2021; PSA, 2019). The uneven development of the country has contributed to the densification of urban areas and the proliferation of informal settlements, which currently accommodate 45% of the Philippines' urban population (The World Bank, 2013). Development deficits have contributed to the high concentration of people, who lack access to high-quality housing and risk-reducing infrastructure and services in coastal areas. Coastal communities are highly exposed and vulnerable to climate change risks due to the environmental degradation of protective ecosystems, as a result of uneven power relations and neoliberal policies, as discussed in Chapter 1. Additionally, the Filipino population is heavily reliant on healthy marine and coastal ecosystems, because around 50 million Filipinos depend on coastal ecosystems for food security, income, and livelihoods (Graziano et al., 2018). Nevertheless, coastal ecosystems, such as mangroves, are vulnerable to climate change risks. Hence, further environmental degradation of coastal ecosystems will exacerbate the existing vulnerabilities of coastal communities due to their dependency, which would further hinder the ability to adapt to climate change risks, as fishing communities have the highest poverty rate in the country (NSCB, 2012).

Mangrove ecosystem restoration is a specific example of how NBS are implemented for coastal resilience because it has the potential to contribute to climate change mitigation through carbon sequestration, and climate adaptation by reducing the exposure and vulnerability to risk, while simultaneously improving biodiversity (Chow, 2018). However, as

analysed in Chapter 3, the outcomes of the implementation of NBS are not inherently socially just as NBS are embedded within power relations, and as exemplified in Chapter 2, social factors, such as gender lead to inequitable power dynamics, which hinder the ability to equitably participate in the decision-making process. Following from this, the chapter will examine the benefits derived from mangrove ecosystems for coastal urban resilience. Secondly, this chapter will analyse how the lack of participation and knowledge co-production has resulted in inadequate restoration of mangrove ecosystems, and how by embedding NBS in existing power imbalances, NBS carries the risk of replicating processes that have constructed socio-environmental injustices. Based on this, a framework will be proposed to guide the implementation of socio-environmentally just NBS for coastal urban resilience.

4.2. Mangrove Ecosystems for Coastal Urban Resilience

Mangroves are coastal ecosystems that grow at land-sea interfaces in the tropics and subtropics. Mangrove ecosystems are distributed within 120 countries (Figure 3), but the majority of mangroves are prevalent in Global South countries, where development deficits and inequitable policies have constructed a disproportionate vulnerability to climate change risks (Chow, 2018). Nevertheless, despite being distributed within 120 counties, 46% of mangrove ecosystems are concentrated in Asia, and this region hosts the most biodiverse mangrove ecosystems (Figure 4).

Figure 3. Geographical distribution of the mangrove ecosystems for the year 2000. Source: (Giri,2016)

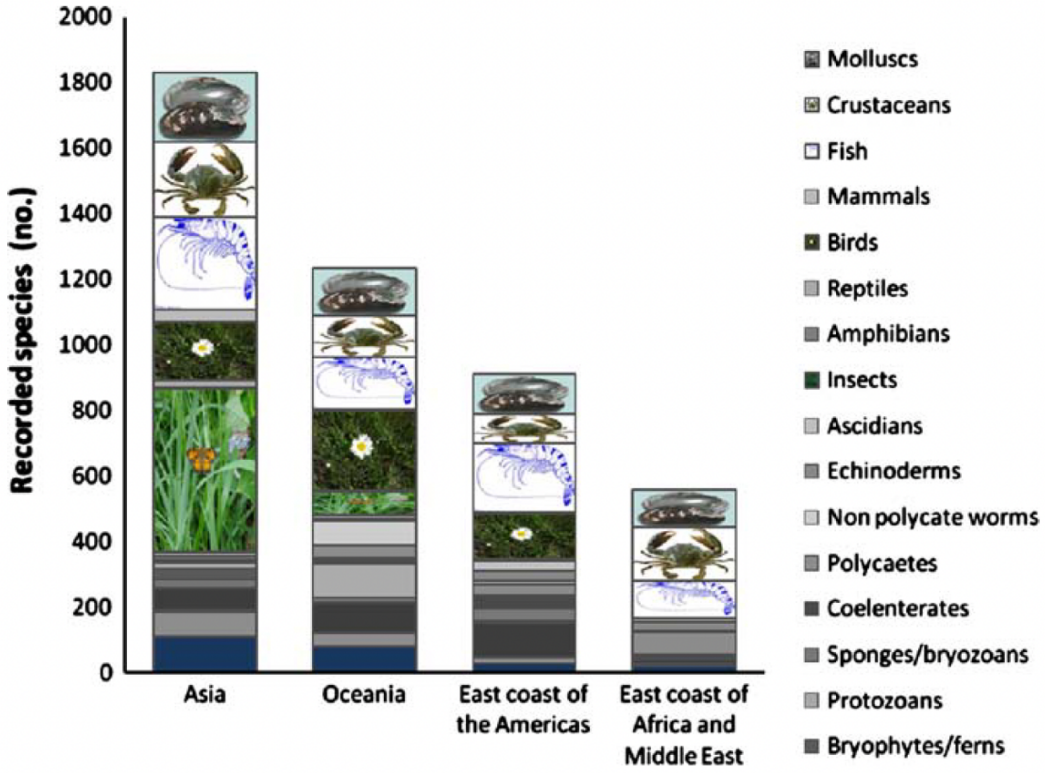

Figure 4. Regional Distribution of Mangrove Biodiversity. Source: (Biswas et al., 2009)

Mangrove ecosystems are rapidly degrading due to the combined effect of i) anthropogenic activities, such as the conversion of land for aquaculture, agriculture, and coastal development and ii) natural disasters, such as hurricanes and typhoons (Gandhi & Jones, 2019). Additionally, mangrove ecosystems are also vulnerable to the impacts of climate change, and further environmental degradation of the mangrove ecosystems will contribute to the vulnerabilities of coastal communities that depend on them for protection, resources, nutrition, and livelihoods. Mangrove ecosystems are highly dependent on freshwater availability, therefore, decreases in mean precipitation is a significant hazard to the health and survival of mangrove ecosystems (ibid.). On the other hand, global temperature increase contributes to favourable conditions for the expansion of mangrove ecosystems (Cummings & Shah, 2017).

Mangrove ecosystem services produce a wide range of environmental, social and economic benefits, and their contribution to coastal urban resilience is outlined in Table 1. However, it is important to note that the conceptualisation of ecosystems services and the portrayal of NBS as a provision of multiple co-benefits has been criticised as utilitarian and anthropocentric because it depicts nature as a commodity and reinforces dysfunctional exploitative human-nature relationships where nature is portrayed as a 'good' to be utilised for human gain (Chong, 2014).

Type of benefits	Benefits derived from mangrove ecosystems that contribute to coastal urban resilience
Environmental	• Enhances biodiversity • Provides natural protection to surrounding ecosystems • Improves functionally and resilience of surrounding ecosystems • Provides natural habitat for aquatic organisms • Removes damaging land-derived nutrients, sediment, and anthropogenic pollution through filtration – lessening the environmental degradation of the ocean • Water filtration lowers the turbidity of coastal waters, which allows more light to reach seagrasses and corals and stimulates growth • Carbon sequencing – approximately 2-4 times more carbon compared to mature tropical forests (Giri, 2016).
Social	• Stabilises sediment • Reduces land erosion • Provides natural defence from climate change risks, such as SLR, flooding and extreme weather events • Reducing the impacts of extreme heat by lowering land temperatures • Minimises the rate of mortality associated with flooding and extreme heat • Preventing the damage of critical infrastructures and human settlements • Access to green space improves mental health and cognitive development
Economic	• Enhanced biodiversity improves livelihood opportunities • Improving food security • Supplies building materials that essential for the construction of shelter and boats

Table 1. Environmental, Social, and Economic Derived from Mangrove Ecosystems Source: Adapted from (Ogden, Nagelkerken, and Mclvor, 2014; Yates et al., 2014; Giri, 2016; Cummings and Shah, 2017; Glaser, 2003).

4.3. Restoration of Mangrove Ecosystems in the Philippines

After the natural resources management failure caused by the conversion of mangroves into fishponds in the Philippines, government-sponsored and World Bank-funded mangrove restoration activities began in the 1980s (Primavera & Esteban, 2008). Governments and international agencies are important actors in the implementation of NBS, as they can funnel the funds and resources necessary for the facilitation of wide-scale mangrove restoration initiatives. However, top-down initiatives often reflect the agenda of those in power and portray local people as mere receivers, rather than co-producers of restoration efforts. As a result, most mangrove restoration initiatives in the Philippines have followed and replicated the same trajectories of limited participation and concertation of decision-making power at the top, as the national policy that has led to the environmental degradation of mangrove ecosystems.

Within the institutional landscape in the Philippines, the Department of Environment and Natural Resources (DENR) is legally responsible for mangrove management, while the Bureau of Fisheries and Aquatic Resources (BFAR), a line agency under the Department of Agriculture (DA), oversees the management of fishponds. However, the lack of horizontal integration between DENR and DA–BFAR has created policy inconsistencies regarding mangrove management (Primavera, 2000). The DENR's centralised nature in comparison to the decentralised DA has enabled the local elite to pressure municipal and provincial executives to grant pond licences in mangrove areas, notwithstanding their categorization as permanent forest (ibid.). Thus, as a result of the lack of cross-ministerial dialogue and lack of political will to regulate mangrove areas and fishpond, Primavera (2000) has estimated that approximately 30% of fishponds do not have legal clearance approval from DENR, nor a BFAR permit. Additionally, as of 1982 mangrove cutting has been prohibited by law. However, this national law is underregulated, especially when conflicting with the priorities of the national government in sustaining economic growth and increasing spending on infrastructure (Timberman, 2019). In 2018, San Miguel Corporation, a for-profit company with the largest revenue turnover in the Philippines, has allegedly cleared more than 600 mangroves to convert the land into an airport complex – a project introduced and granted to the company by the government (Chavez & Agbayani, 2020). Investigations conducted by

the DENR have not been able to conclude who is responsible for this action, which emphasises that national laws regarding the protection of mangrove ecosystems are poorly enforced and regulated or tend to be overlooked when economic interests are involved (ibid.). Nevertheless, there are solid grounds in the Philippines upon which mangrove restoration can be strengthened. The introduction of the Community-Based Forest Management Agreement by DENR, which consolidated previous tenure instruments, has constructed a foundation for the long-term management of natural resources, as it has granted coastal communities the ability to gain long-term legal land tenure security of restored areas (Primavera & Esteban, 2008).

As a result of the historical concentration of political power in the hands of the elite and the exclusion of communities from the decision-making process, mangrove restoration initiatives have resulted in inadequate outcomes. Despite that top-down restoration projects have been heavily funded, the survival rate of mangroves in restored areas has amounted to approximately 10%. The main factor contributing to that failure has been the lack of engagement with the local communities and the lack of integration of multidisciplinary knowledge, as mangrove species were planted irrespective of site, situation, anthropogenic pressures and the wants, needs, and the lived realities of the surrounding communities (Datta, Chattopadhyay, & Guha, 2012). After recent Asian tsunamis and typhoons, the Philippines government has become more aware of the function of the mangrove ecosystem as a natural defence (Walter et al., 2006). As of 2011, there has been growing enthusiasm and government uptake of blue carbon programmes, which have mirrored global practices of carbon accounting and scientific-based strategies. As a result, coastal blue carbon initiatives in the Philippines have mostly been restricted to including technical and scientific knowledge, with little attempts to integrate local ecological knowledge and livelihood aspirations of local communities (Song et al., 2021). These developments represent a shift in the framing of mangroves from wastelands to their technocratic perception as blue carbon. Thus, it is not surprising that the majority of restoration initiatives have been environmentally unsustainable and socially unjust because even though there has been progress in the protection of the ecosystems, a fundamental change in the human-nature relationship, and in the way restoration initiatives are implemented has not occurred. Therefore, this calls for a holistic and comprehensive

framework, that accounts for power imbalances, to guide the implementation of socio-environmentally just NBS in coastal areas.

4.4. Socio-Environmentally Just Nature-based Solutions in Coastal Areas

Biswas et al. (2009) argue that NBS should be approached through a holistic framework that integrates the social and economic challenges of coastal communities with the ecological challenges of the ecosystem, while Broeckhoven & Cliquet (2015) state that environmental interventions should place significant attention to the interactions of social, economic, and political systems, especially on gender as it is often neglected, in terms of the distribution of decision-making power, inputs, and outcomes. Moreover, the climate justice literature shines a light on the argument that unjust outcomes of climate change adaptation are the result of the lack of at least one of the three interconnected pillars of justice: procedural justice (the equity in accessing the decision-making process), distributional justice (the equitable distribution of the outcomes), and recognition justice (recognising and tacking the socially constructed differences that shape unjust decision-making processes and outcomes) (Mohtat & Khirfan, 2021).

NBS has the potential to contribute to coastal urban resilience, but it needs to be strengthened to foster equitable and sustainable outcomes. Based on this, the framework for guiding socio-environmentally just NBS will be comprised of four interconnected pillars: 1) intersectional analysis of power dynamics for fostering climate justice, 2) inclusive participation and multidisciplinary knowledge co-production, 3) tackling recognition injustices by challenging gender norms, and 4) adaptive co-production of ecosystem services. Their significance will be discussed below through the lens of mangrove restoration initiatives in the Philippines.

4.4.1. Pillar 1: Intersectional Analysis of Power Dynamics for Fostering Climate Justice

Power dynamics shape the distribution of benefits and costs and influences who has access to decision-making power. As discussed in Chapter 2, the interactions between social, economic, and political factors have resulted in the emergence of uneven power dynamics that create obstacles for marginalised social groups to equitably influence the political agenda and the implementation of NBS. Hence, social inequity has an impact on climate change adaptation and if these power imbalances are not considered, then NBS risks being ineffective and/or deepening existing vulnerabilities. Kuhl et al. (2020) argue that adaptation initiatives have been lagging on the evaluation of the impact of social vulnerability on outcomes, and internationally funded interventions have instead been focused on economic or technical objectives. The lack of nuanced understanding of the socio-political structure has led to adaptation intervention goals and priorities being frequently determined from the top down by relatively privileged groups rather than by the intended beneficiaries, resulting in a skewed distribution of benefits in favour of local elites.

The tendency of overlooking vulnerabilities and power imbalances has been present in government-led mangrove restoration in the Philippines, where the implementation of NBS has been embedding within the same power imbalances that have led to the environmental degradation of coastal ecosystems. The concentration of decision-making power by political dynasties has resulted in procedural and recognition injustices, which have manifested through the lack of acknowledgement of the differing needs and wants of various stakeholders and the exclusion of the communities that depend on the mangrove resources from impacting the process of implementation. These power imbalances have led to the construction of hegemonic knowledge, which has influenced the ineffective restoration outcomes, as mangrove species were planted irrespective of site, situation, anthropogenic pressures and the wants, needs, and the lived realities of the surrounding communities (Datta, Chattopadhyay, & Guha, 2012). The lack of nuanced understanding of existing power dynamics, and how they shape the ability to influence the implementation of NBS and the distribution of costs and benefits has left coastal communities, and other historically marginalised social groups in the Philippines, excluded from the process of implementation of NBS. As a result of embedding NBS within power imbalances, government-led mangrove

restoration initiatives have reproduced injustices by leaving climate change risks unaddressed. Hence, the recognition that socio-political structures disproportionately favour some while denying others of rights and resources, and that the accumulated history of institutionalised oppression produces inequitable access to decision-making power, is the first step to designing context-specific mechanisms that would foster procedural, distributional, and recognition justice (Shi et al., 2016).

4.4.2. Pillar 2: Inclusive Participation and Multidisciplinary Knowledge Co-Production

Inclusive participation and multidisciplinary knowledge co-production are vital for shaping the equitability and sustainability of NBS because they ensure that the needs, wants, and aspirations of all actors are an integral part of all stages of the design, implementation, and management of NBS. According to climate justice literature, inclusive participation can facilitate procedural justice through the inclusion of different needs and wants, because it enables the voices of all actors to be involved in the decision-making process (Shi et al., 2016). Berbés-Blázquez, González, & Pascual (2016) states that adopting a participatory approach provides equitable ability to influence the decision-making process and to manage negative consequences, that otherwise arise from the hegemonic practices that prioritise some objectives at the expense of others, resulting in winners and losers. Hence, equitable participation in decision-making and negotiations influence distributional justice.

Additionally, inclusive participation would provide the space for exchange and integration of local, traditional, and scientific knowledge between various stakeholders. The presence of this pillar is crucial for mangrove restoration because as argued by Walton et al. (2006), the lack of information about real mangrove uses at the local level and lack of ecological knowledge regarding the geographic typology and native species is a major impediment to the implementation of socio-environmentally just NBS. Hence, Datta, Chattopadhyay, & Guha (2012) argue that the design of mangrove restoration needs to begin with the mapping of appropriate sites and species, as well as mapping of the differing needs and wants of all stakeholders. Moreover, Andreucci (2013) argues that successful implementation depends on the integration of knowledge and experiences from multiple disciplines and stakeholders, because this exchange facilitates a platform that enables a

constructive dialogue, which is the first step towards collaboration. Nevertheless, inclusive participation should be viewed from an intersectional perspective to avoid the homogenisation of communities and social identifies as argued by Arora-Jonsson (2011). The interaction between social, economic, and political systems shape power relations among coastal communities and influences the level and quality of participation, which shapes how mangrove restoration is carried out and how benefits and costs are distributed. Hence, it is critical to recognise power dynamics, and the socially constructed differences in needs, values, and perceptions.

Siar (2003) argues that gender influences a differential perception and use of mangroves resources in various socio-economic contexts. This is demonstrated by the mangrove restoration initiative in Cogtong Bay, Philippines, where uneven power dynamics have influenced the dominating perception of mangroves as crucial for sustaining fishing, a livelihood activity that is socially perceived as masculine. As a result of the framing of mangroves as complementary to male livelihoods activities, the community organisation process was established in a matter that didn't critically engage with gender, or with the crucial role women play in the fishing value chain. Instead, the community mobilisation process favoured the involvement of fishermen and fishing associations, which has resulted in the lack of inclusive participation, as women accounted for only 15% of participants (Siar, 2003). Even though the community has benefited from the contribution of restored mangroves to fish abundance, the benefits have been inequitably distributed, as the process of implementation has excluded the needs and aspirations of women and has prohibited them from leadership positions and decision-making power. The project evaluation by Maliao & Polohan (2008) has demonstrated how the lack of inclusive participation and critical engagement with gender has manifested in gender disparities in both household income and perceived access to mangrove resources. Hence, as socio-political marginalisation shapes vulnerability, the process of planning and implementing NBS initiative needs to not only give space to socio-politically marginalised groups and their needs, but also recognise their socially constructed differences, in order to avoid exacerbating marginalisation.

Based on this, recognition of socially constructed vulnerabilities and barriers is a critical element for informing the process of fostering inclusive participation in the Philippines. Persson & Remling (2014) argue that adaptation interventions need to be designed to take into account how social factors, such as gender, race, and age shape the exercise of power. For instance, by recognising the socially constructed differences, such as women's caregiving responsibilities or social norms that may prevent them from participating, adaptation initiatives would be able to respond and tackle these barriers through situation-specific mechanisms, such as determining appropriate meeting locations and times, adapting meetings to women's schedules, and bringing training to the community (Elias et al., 2021). Hence, recognising the root causes of vulnerabilities can foster the process of participation by opening space for contestation and negotiation of knowledge.

4.4.3. Pillar 3: Tackling Recognition Injustices by Challenging Gender Norms

As discussed above, inclusive participation is a crucial element in the implementation of just NBS, because it enables equitable participation in the decision-making process. Additionally, as discussed in Chapter 2, socially constructed norms and perception, manifest in barriers to achieving and sustaining inclusive participation, which then results in the inequitable distribution of benefits and costs. Nevertheless, despite efforts in improving the equitability of outcomes, many projects have been specifically targeted at women rather than challenging existing gender relations (Bosold, 2012). There needs to be a shift from focusing on solely increasing the participation of women in a project to challenging existing power hierarchies that have constructed the barriers to participation. Based on this, Wilson (2014) argues that in order to overcome the status quo that constructs vulnerability, adaptation initiatives may need to be disruptive, while Crease et al. (2018) argue that participatory processes need to recognise power imbalances and gendered norms and actively address the socially constructed difference. Hence, overcoming procedural and distributional injustices necessitates the removal of barriers that exclude some social groups from fully participating in decision-making, and the first step towards this is recognition of the socially constructed differing roles and responsibilities.

The lack of recognition justice risks the implementation of NBS to lead to maladaptation, and/or reinforcement of existing vulnerabilities. For instance, in the mangrove restoration initiative in Iloilo, Philippines, the majority of members responsible for implementing the initiative were women. The reason behind this was that men, for whom fishing tends to be the main livelihood opportunity, perceived mangroves as a waste of time as they didn't gain a direct economic benefit from engaging in the restoration efforts (Bagsit & Jimenez, 2013). This demonstrates how socially constructed division of livelihoods and undervaluation of the role of ecosystems in supporting livelihoods have manifested through the uneven distribution of input and have caused the implementation of NBS to replicate social inequalities. As a result, gendered division of roles and responsibilities has been constructed, with the majority of the responsibilities regarding the planting, maintenance and monitoring of the mangroves being allocated to women (Figure 5), which has exacerbated the socially constructed burden that women face. Additionally, the implementation of NBS has contributed to the inequitable distribution of costs, because by not addressing entrenched gender norms, the greater time spent by women managing the mangrove ecosystems instead of performing their socially-expected domestic duties there has translated into a rise in domestic gender-based violence (Bagsit & Jimenez, 2013).Therefore, without addressing existing power hierarchies, NBS risks placing the burden on women, while constructing obstacles to access to equitable participation in leadership positions as represented by the case of Cogtong Bay.

Activities	Men	Women
Mangrove nursery development and maintenance		
1. Preparing planting materials		✓
2. Preparing nursery area		✓
3. Potting seedlings/propagules		✓
4. Cutting bamboo stakes (for the fence)	✓	
5. Fencing	✓	
6. Purchasing polybags and other materials for the nursery		✓
Mangrove planting		
7. Transfering of mangrove seedlings/propagules to the planting area		✓
8. Digging holes prior to planting		✓
9. Planting mangroves		✓
Mangrove management, protection and maintenance		
10. Attending meetings		✓
11. Planning	✓	✓
12. Decision-making	✓	✓
13. Coordinating with other agencies/organization		✓
14. Sales		✓
15. Monitoring		✓
16. Clean-up of mangrove area		✓
17. Accounting of income and expenses		✓
18. Safekeeping of funds		✓
19. Installing sign boards		✓

Figure 5. Gender roles in the mangrove reforestation project. Source: (Bagsit and Jimenez, 2013)

Moreover, Tanner et al. (2009) argue that participatory approaches tend to fail at understanding the composition and heterogeneity of local communities, with children often being portrayed and perceived as passive victims to climate change risk without acknowledgement of their potential and capacity to be active agents of change. As a response to this, a mangrove restoration initiative in Teguis, Philippines has had a novel aspect on inclusive participation by involving children in the implementation process. The strong partnership of the communities in Teguis with the local and municipal authorities has provided a foundation upon, which the involvement of children in the mangrove restoration can be enabled. Due to this active involvement, children have gained access to additional training opportunities, and the establishment of this collaborative relationship has improved children's agency and empowered them as active agents of change. This example has demonstrated the ability to link community projects with skill development and awareness-raising, while emphasising that children's ability to mobilise and collaborate can be a crucial factor for scaling up their participation. However, within this mangrove restoration, it has been predominantly girls who have participated in the planting process, as the boys would go fishing with their fathers instead of participating (Tanner et al., 2009). This demonstrates how the distribution of roles and responsibilities is socially learned from a young age, and how children are socialised in perceiving fishing as a male activity and the care for mangroves are a female activity, which reinforces gender norms. Nevertheless, this suggests that the participation of children in mangrove restoration is not only crucial for the long-term sustainability of projects, because it contributed towards the creation of intergenerational knowledge and capacity building, but additionally, it signifies an opportunity to challenge the perception of gendered divisions of labour, roles and responsibilities from a young age, especially considering that gender beliefs are socially constructed and are mainly learned from social cues.

Overall, the lack of this pillar would hinder the progress towards climate justice, because without recognising and addressing existing power structures, there is a risk of replicating inequitable outcomes and ongoing exclusion from decision-making power, which would create a vicious cycle of inequitable distribution of benefits and costs. Moreover, ongoing monitoring and evaluation of how adaptation initiatives address the root causes of vulnerability and how those manifests into procedural, recognition, and distributional

(in)justices is necessary as it would allow for learning from the progress and would enable to adaptively evaluate what initiatives, policies and legislation can further contribute to achieving gender equality.

4.4.4. Pillar 4: Adaptive Co-Production of Ecosystem Services

In the face of constant change and uncertainty, Gann et al. (2019) argue that adaptive co-production should be the baseline for all ecological restoration because it allows decision-making processes to adapt as context changes. Ellison et al. (2020) argue that monitoring and evaluation should be made a fundamental aspect because it would enable flexibility and ability to learn and adapt as social, cultural, environmental, economic, and political factors change. The process of adaptive co-production needs to be grounded within the presence of Pillars 1, 2 and 3 in order to contribute to an equitable outcome and defuse the risks of maladaptation. This is because an acknowledgement of uneven power dynamics within stakeholders would allow for context-specific mechanisms to tackle recognition injustices, which would foster equitable collaboration and co-management.

Moreover, in the context of ongoing change and ongoing evaluation, the participatory process needs to be sustained through adaptive co-production, otherwise, it risks constructing inequitable distribution of benefits and risks. For the mangrove restoration project in Kalibo, Philippines, ongoing adaptive co-production is the crucial reason behind the sustainability of the initiative and the expansion from 50 to 220 hectares over 30 years (Aguirre, 2020). The implementation process of the mangrove restoration has begun through a multidisciplinary exchange of knowledge between local academics, as a result of which, it has become clear that there are appropriate sites for ecological restoration as the area has been coved with mangroves before the national push towards mangrove-to-fishpond conversion. This knowledge has provided the foundation for negotiations between the local government and DENR. However, the involvement of DENR in the co-production of the mangrove restoration through the provision of technical assistance and compensations for those involved in the planting process was met with scepticism from the local community, due to the lack of trust towards the governmental agency. Nevertheless, due to strong political will and adaptive response, this obstacle was overcome through the

incorporation of a local NGO, which assisted with community organisation and increasing trust towards DENR, resulting in the formation of Kalibo Save the Mangrove Association. As a result of restoration efforts, the community has significantly benefited from natural protection, which has minimised the impact of risks, such as typhoons that have impacted the rest of the province that lacks mangrove coverage.

Furthermore, ongoing adaptive co-production has enabled the formation of a partnership with universities and research institutions, which have played a crucial role in generating multidisciplinary knowledge. For example, in 2008, in the aftermath of typhoon Frank, a significant amount of mud has been moved to the mangrove area, which an investigation conducted by the University of the Philippines concluded has resulted in soil incompatibility with certain mangrove species (Aguirre, 2020). Thus, ongoing evaluation and collaboration have created a strong foundation upon which mangrove conservation can be sustained and restoration activities continued. Flexible knowledge co-production is an important element in achieving resilience, as it allows for the system to be adaptive accordingly to changing ecological conditionals and climate change risks, as well as the changing needs of communities.

4.5. Conclusion

In conclusion, the existing socio-political structures in the Philippines has caused unjust and unsustainable outcomes from the implementation of NBS, characterised by the low survival rate of planted mangroves, inequitable distribution of benefits and costs, and exacerbated gender injustices. Based on this, this chapter has identified the underlying reasons for maladaptation and has synthesised a framework with four key pillars that can guide the implementation of socio-environmentally just NBS. The presence of the four pillars contributes to i) an acknowledgement of intersectional power imbalances, ii) fostering procedural justice through the process of inclusive participation and multidisciplinary knowledge co-production, iii) fostering recognition justice through tackling the socially constructed obstacles that create the unjust distribution of benefits and costs and hinder

access to decision-making, and iv) fostering distributional justice through adaptive co-production.

Chapter 5: Conclusion

In conclusion, NBS need to be conceptualised critically by acknowledging the political manner of climate change adaptation initiatives in order to avoid the romanticisation of NBS that stems from its potential to generate multiple benefits simultaneously. The case study of mangrove ecosystems in the Philippines has showcased the significant role power dynamics and existing structures play in dictating outcomes. Achieving climate justice through the implementation of mangrove restoration initiatives in the Philippines has been hampered because NBS have been embedded within the same power dynamics and socio-political systems that have led to the construction of climate change vulnerabilities, which has led mangrove restoration outcomes to replicate injustices. Hence, NBS need to be strengthened in social, political, economic, and ecological dimensions, otherwise, NBS risks i) reinforcing existing vulnerability, ii) redistributing vulnerability, and iii) introducing new risks and vulnerability, instead of contributing to urban coastal resilience.

In order to avoid maladaptation, and the replication and reinforcement of injustices, this dissertation proposes a framework comprised of four interconnected pillars: i) intersectional analysis of power dynamics for fostering climate justice, ii) inclusive participation and multidisciplinary knowledge co-production, iii) tackling recognition injustices by challenging gender norms, and iv) adaptive co-production of ecosystem services, to guide the implementation of socio-environmentally just NBS. Firstly, NBS need to be grounded within an intersectional understanding of the root causes of climate change vulnerability, because the recognition of how the interaction between social, economic, and political factors constructs power imbalances is the first step towards designing context-specific mechanisms that would foster procedural, distributional, and recognition justice. Secondly, inclusive participation and multidisciplinary knowledge co-production shape the procedural justice of NBS by ensuring that the needs, wants, and aspirations of all actors are an integral part of all stages of the design, implementation, and management of NBS. Thirdly, based on the findings generated through the adoption of an intersectional approach

to gender, socially constructed norms and perception, manifest in barriers to achieving and sustaining inclusive participation, which then results in the inequitable distribution of benefits and costs. Hence, participatory processes need to recognise power imbalances and gendered norms and actively address the socially constructed difference in order to overcome procedural and distributional injustices. Fourthly, in the face of constant change and uncertainty, adaptive co-production of ecosystem services would foster collaboration and flexibility, which in combination with the other three framework pillars outlined above would contribute to achieving socio-environmentally just outcomes.

Nevertheless, despite the rapid increase of research generated in the area of NBS in the last two decades, this dissertation calls for further research into the incorporation of climate justice at the core of NBS and systematic responses to gender inequalities through the implementation of NBS.

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