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RESEARCH PAPER

Exploring community-based stewardship of nature-based solutions (NbS) in upgraded informal settlements:

the case of Bangkok, Thailand

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Abstract

Community gardens and canal revegetation are common urban nature-based solutions (NbS) initiated in informal settlements for climate resilience. Engaging with and tending to NbS through local stewardship efforts can become a source for psychological resilience and foster stronger social bonds in times of crisis. Despite the promising adoption of NbS for climate adaptation in informal areas, it has yet to be incorporated in the envisioning of informal settlement upgrading intervention. More importantly, empirical studies on how existing NbS are managed and cared for through community-driven stewardship within upgraded informal settlements remain sparse. This study explores community-based stewardship of urban NbS in a Bangkok upgraded informal settlement, Thailand. Using an in-depth case study of Rungmanee Patthana community, we employed transect walk, photo-elicitation interviews (with local residents) and semi-structured interviews (with urban professionals) to identify factors influencing local stewardship actions. Findings show that older adults, primarily women, are responsible for taking care and sustaining the green-blue spaces in their settlement. Factors such as agency and caring relations, and intergenerational knowledge facilitate community engagement in local stewardship efforts. Values of nature (particularly instrumental and relational) are another driver that motivates residents to manage and care for their local environment. However, invisible environmental care labor, disbenefits of nature, and fragmented governance are key determinants that can hamper the continuity of community-driven stewardship. The study posits the importance of acknowledging the role of residents in informal settlements and their potential contribution to enhance climate resilience in the city through the adoption of participatory and reflexive governance.

Keywords: Stewardship, care, resilience, governance, green-blue space, nature-based solutions, community gardens, co-production

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1. Introduction

As the global urban population is expected to increase to 60 per cent by 2030, cities are confronted with the pressing demand for urban infrastructure such as affordable housing and basic services to accommodate the needs of city dwellers (United Nations, 2015). More than one billion people have resorted to living in informal settlements – often situated in the Global South and disproportionately affected by the impacts of climate change (Greenwalt et al., 2023). Adopting the definition by the UN, informal settlements can be characterized as 1) unplanned settlements that exist outside the legality parameters – contested land tenure, which 2) tend to be disconnected from basic services and city infrastructure, and 3) do not conform with building codes and regulations (United Nation, 2015). Informal settlements are often constructed in ecologically sensitive sites and risk-prone areas such as low-lying deltas, along canals and dumpsites. These locations are likely to fall outside the interests of local government authorities and private developers – implying lower risks of eviction (Dodman et al., 2019). Given such locations and limited adaptive capacity to cope with extreme weather, residents are highly vulnerable to disaster-induced displacement (Kelman et al., 2017; Satterthwaite et al., 2020).

Since the late 1970s, various upgrading interventions have been introduced in cities of the Global South to address the precarious conditions of informal settlements (Turner, 1977; UN-Habitat, 2003). These have contributed to improved tenure security and live ability to some extent, but the envisioning of upgrading interventions remains largely decoupled from climate resilience goals (Jordan, 2020; Satterthwaite et al., 2020). The Baan Mankong city-wide upgrading program in Thailand exemplifies this gap despite its success in providing secure housing and tenure to socio-economically disadvantaged communities (Jordan, 2020). To help close this gap, nature-based solutions (NbS) are increasingly adopted by city actors (e.g. multi-lateral agencies and non-governmental organizations) as a promising strategy in building climate resilience and disaster preparedness while addressing the local priorities in informal settlements (Greenwalt et al., 2023; Mulligan et al., 2020). Implementing NbS in disaster-prone areas from early on can act as protective barriers for local communities and reducing their exposure to disaster risk and hazards (De Silva et al., 2022; Greenwalt et al., 2023).

NbS can be understood as “solutions that are inspired and supported by nature, which are cost-effective simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource efficient and systemic interventions (European Commission, 2016).NbS such as

constructed wetlands, riverbank revegetation, and mangrove restoration can mitigate flood risks and prevent soil erosion (Brown et al., 2018; McEvoy et al., 2023). Studies have shown that community gardens and green open spaces are key assets for food security and social resilience in informal settlements, especially during disaster recovery processes (Archer et al., 2020; Kelman et al., 2017; Wolff et al., 2023). To ensure successful and just implementation of NbS in cities, inclusive community participation and collaborative governance is key (A. Buijs et al., 2019; Mulligan et al., 2020; van der Jagt et al., 2023; Wolff et al., 2022).

Critical scholars have highlighted the potential disbenefits of NbS if implemented without meaningful community engagement or in tokenistic way – i.e. green displacement of marginalized inhabitants and maladaptation (Anguelovski et al., 2019; Doshi, 2019; Huq, 2024; Kiss et al., 2022). The nature of citizen engagement is also determined by the forms of NbS implementation. NbS can be implemented by external actors or internally developed by local communities (Seddon, 2022; Wolff et al., 2023; Woroniecki et al., 2022). Externally implemented NbS are often initiated and funded by multilateral agencies (i.e.- the UN, Rockerfeller Foundation and Asian Development Bank), private firms or charitable organizations in partnership with local government (ACCCRN, 2013; Greenwalt et al., 2023; Oliver et al., 2021; Tozer et al., 2020). In this sense, the external actors often have the power to determine who should participate and whose reality counts in decision-making (Kiss et al., 2022). For community-led NbS, the interventions are developed using local resources, knowledge and capacity which tailored to their everyday needs and priorities (Boossabong, 2018; Glemet & Bimson, 2022; Hernández-García & Caquimbo-Salazar, 2018; Risna et al., 2022).

1.1 Framing, knowledge production and values of NbS

Originating from the Global North, the framing of NbS is embedded in particular values and knowledge systems that might not resonate with ways of knowing in the Global South. The term 'Global South' here is not a simplistic territorial reference (North-South divide) but denotes variations in geopolitical significance and underlying power dynamics that could influence the transferability and long-term sustainability of NbS (Pauleit et al., 2021; Sud & Sánchez-Ancochea, 2022; Woroniecki et al., 2020). Centering the influence of Global North framing of nature within the NbS discourse is thus imperative (Chausson et al., 2024).

The envisioning of NbS has been problematized by critical scholars for the risk of advancing neoliberal narratives (e.g. commodification of nature) and reinforcing power asymmetries (Kotsila et al., 2021; Melanidis & Hagerman, 2022; Remme & Haarstad, 2022; Van Der Jagt et al., 2021). The concept of NbS often rests on the notion of ecosystem

services (ES) or natural capital that recognizes nature for its instrumental values through economic valuation (Lele et al., 2013). In this sense, nature is valuable because it provides a range of 'services' or 'assets' to society – e.g. food and spirituality (K. M. Chan et al., 2012). Although the ES framework is intended to ease the translation of scientific knowledge to non-experts in decision-making, critical scholars have argued that it distorts and reduces the values of nature to quantifiable benefits (including intangible ones) under monetary terms (Lele et al., 2013; Ludwig, 2000; Norgaard, 2010; Norton et al., 2020). This is problematic because other forms of values such as intrinsic and relational are incommensurable and could not be expressed by numbers (K. M. Chan et al., 2012).

Intrinsic value refers to the value of non-human entities worth protecting as ends in and of themselves - independent of values ascribed by human and its usefulness to society (Himes et al., 2024).For example, rights of non-human species to exist (Himes et al., 2024) and moral obligations towards ecosystems (Dion, 2000). Whereas relational values – i.e. preferences, principles and virtues – are used to articulate meaningful and (often) reciprocal human relationship with nature (K. M. A. Chan et al., 2016; Himes & Muraca, 2018). Place attachment and sense of identity (Gulsrud et al., 2023), care for natural landscape (Jax et al., 2018; Sampson et al., 2017), and cultural connection with landscape (Cockburn et al., 2019) exemplify relational values - important for having a good life (K. M. A. Chan et al., 2016). While relational and intrinsic values are distinct from each other, both are difficult to convey using numerical approaches and valuation (Himes & Muraca, 2018). Otherwise, it would reduce the core meaning of the values (L. Pereira & Bina, 2020). As argued by Preira and Bina (2020):

"The need to quantify something not quantifiable with the aim to provide a more pragmatic framing: to include something not quantifiable in econometric measure in order to demonstrate its value, is in fact, simultaneously, to withdraw value from it." (pg.327)

Not only does it reinforce a human-nature dichotomy, such instrumentalist and unidirectional approaches to nature can hamper just transformative change. Mattijsen et al (2020)flagged the danger of confining nature to only instrumental and intrinsic value in policy and decision-making as it could exclude and discourage individuals who undertake environmental actions motivated by their relationships with nature, with relational values being 'reflective of the largely intuitive ways that people make decisions, understand the world and decide what is right' (Klain et al., 2017, p. 2)The authors call for embracing relational values and plurality of urban nature in defining environmental stewardship in policy and practice (Mattijssen et al., 2020).

Chan et al. (2018, p. A1) describe relational values as "preferences, principles and virtues about human-nature relationships" in that they are 'non-substitutable' and exist between

instrumental and intrinsic values (Himes & Muraca, 2018). These can manifest through human-nature relationships in the form of sense of belonging, place attachment, and bio-cultural diversity (West et al., 2018). Relational values enable city actors to grasp what is regarded as important to people in relation to natural environment and its implication on stewardship actions (Mattijssen et al., 2020) Importantly, the adoption of relational values and the associated language in policymaking allow city-actors to re-think about the framing of nature beyond a 'services' approach (Himes & Muraca, 2018; Mattijssen et al., 2020). This includes establishing a common language and emotional bond that resonates with citizens' sentiments when communicating about human-nature relationships and the underpinning core values (Mattijssen et al., 2020).

From an environmental planning and management standpoint, the scientific community believes that the ES framework can be a promising tool to locate hotspots with potential for a range of 'services' to be delivered by NbS (Keeler et al., 2019). However, it can also be misappropriated by city actors to propose NbS in a location that could harm urban inhabitants and their property (Chausson et al., 2024; Keeler et al., 2019). The harm can happen, for example, when city actors want to eradicate informal settlements that are situated in biodiversity hotspots for the purpose of creating or restoring NBS (Adegun, 2018). These settlements and the everyday activities carried out by the inhabitants are perceived as the primary source of ecosystem degradation (Diep et al., 2019). As a result, relevant authorities tend to opt for eviction or physical displacement. In Mumbai, India for instance, mangrove protection and green space conservation were used as a strategy for slum eradication by middle-class environmental activists (Doshi, 2019). Without a context-sensitive approach, externally driven NbS projects can undermine pre-existing local stewardship efforts by residents of informal settlements.

1.2 Transferability of NbS concept to the context of informal settlements

In the context of informal settlements, previous attempts to incorporate urban NbS by local government or external organizations often clash with lived experiences on the ground (Diep, Parikh, et al., 2022; Rauf et al., 2024). Tensions center around misaligned preferences of urban nature, perceived benefits and disbenefits of ecosystems and expectations around maintenance responsibilities – demonstrated in the case studies of informal settlements in Africa (Diep, Mulligan, et al., 2022; Wessels et al., 2021) and Thailand (Rauf et al., 2024). This underrepresentation of the needs of local communities for urban nature in decision-making about informal areas reveals the urgency to find synergies between the priorities of delivering secure housing and bringing people closer to urban nature in cities (Rauf et al., 2024). This is imperative to avoid exacerbating existing

social inequities faced by historically disadvantaged groups – e.g. unpaid environmental labor (MacGregor et al., 2022) and displacing socio-cultural connection to urban nature (Huq, 2024).

Another challenge to NbS implementation despite its potential, is the origin and fluidity of the concept – how and by whom nature is framed and whose knowledge and values count in its conceptualization. For Welden et al. (2021), the framing of a particular issue could hamper or enable transformations as it shapes people's interpretations and knowledge production, including their responses to challenges and solutions. Understanding the framing of NbS narratives is key because knowledge producers have the power to exert control over the recognition of tacit knowledge in policy and practice (McFarlane, 2006). In this regard, narrative can be deployed as a political instrument to include or exclude particular voices and knowledge systems in defining challenges, responses and 'stewards of solutions' (Melanidis & Hagerman, 2022; Welden et al., 2021; Woroniecki et al., 2020). Therefore, the deployment of reflexive participatory approaches is crucial when co-producing NbS with residents of informal settlements - to create safe space that recognizes the plurality of knowledge systems which can lead to transformative outcomes (Diep, Mulligan, et al., 2022; Wiegleb & Bruns, 2025; Wolff et al., 2022).

The overarching goal of this project is to gain in-depth understanding of community-based stewardship of nature-based solutions (NbS) in upgraded informal settlements and how it can be supported by stakeholders in the city. First, it aims to identify both tangible and intangible factors influencing community-driven NbS stewardship and its continuity in informal settlements. It then seeks to explore alternative governance arrangements that support the mobilization of local NbS stewardship practices led by the community. The outcome of this project will be disseminated to facilitate horizontal learning exchange between city actors, academics and urban dwellers on improving local stewardship of NbS. Advancing this topic is crucial for improving the uptake of NbS in a challenging socio-environmental context with regard to the transferability of the concept to the Global South.

2. Literature Review

2.1 Introduction

Environmental stewardship has long been studied and applied in different contexts by scholars of varying disciplines, resulting in multiple interpretations and alternative terminologies (A. E. Buijs et al., 2016; Chapin et al., 2011; Cockburn et al., 2019; Dempsey et al., 2014; Enqvist et al., 2018; Mattijssen et al., 2017; Power & Chapin, 2010). Scholars also highlight a wide range of environmental stewardship benefits to humans and

ecosystems. According to sustainability science, stewardship action such as biodiversity conservation and landscape management can help to strengthen social-ecological resilience in cities to adapt with uncertainty (Chapin III et al., 2015; Mathevet, Bousquet, Larrère, et al., 2018). From a psychological standpoint, increased exposure to nature by engaging in stewardship activity could improve the cognitive well-being of an individual (Bratman et al., 2015; Dacks et al., 2021; Sampson et al., 2017). Additionally, stewardship creates opportunities for people to bond and foster a sense of collective identity in their locality through caring for urban nature (Gulsrud et al., 2023). However, stewardship can translate into the transferring of responsibilities from the state to citizens in the pursuit of neoliberal goals (Mathevet, Bousquet, & Raymond, 2018; Mattijssen et al., 2017; Rosol, 2012). As Tozer et al. (2020, p. 3) put it "Stewardship, then, is a mode of engagement with nature that can be used for both neoliberal and just outcomes, which means that stewardship is not necessarily more inclusive than other modes of engagement".

Factors that would influence the outcome of environmental stewardship actions – i.e. motivation (extrinsic or intrinsic), capacity, assets, governance – have been widely discussed in the literature (Bennett et al., 2018; Cockburn et al., 2020; Dempsey et al., 2014; Enqvist et al., 2019; Power & Chapin III, 2010). Shortsighted planning, budget constraints and weak institutional support have emerged as common barriers to stewardship (Andersson et al., 2014; Kotsila et al., 2020; Nash et al., 2021; Tozer et al., 2020; Wessels et al., 2021). Whilst studies on these enabling factors are evident in rural and urban settings across the Global North and Global South (A. E. Buijs et al., 2016; Campbell et al., 2022; Cockburn et al., 2020; Eliyah Mngumi & Chen, 2022; Enqvist et al., 2019; Lachmund, 2022), few studies specifically address the context of informal settlements. Additionally, very few studies have explored the intangible factors relevant for understanding stewardship dynamics in informal settlements – e.g., human-nature connection/disconnection, cultural belief, and socio-spatial tensions in collective settings. Alternative governance arrangements, funding networks and policy mechanisms in place to support and facilitate community-led environmental stewardship in informal settlements remain also understudied.

Considering the ambiguity and fluidity of stewardship as a concept (Enqvist et al., 2018), various framings and conceptualizations have been applied to understand what stewardship entails at different scales (Bennett et al., 2018; McLeod et al., 2024). This has resulted in multiple interpretations of environmental stewardship and the emergence of alternative terminologies in the literature: 'ecosystem stewardship', 'place-based stewardship; 'landscape stewardship', 'nature-custodianship', 'landscape care', planetary stewardship', 'place-making and place-keeping', 'civic engagement' and 'active citizenship' (Andersson et al., 2014; Andersson, 2021; A. E. Buijs et al., 2016; Campbell et al., 2022;

Chapin et al., 2011; Chapin III et al., 2015; Cockburn et al., 2020; Dempsey et al., 2014; Mattijssen et al., 2017; Sampson et al., 2017).

The stewardship concept is often ingrained in, intertwined or interchangeably used with the notion of care. Such a framing approach is reflected in stewardship definitions established by scholars from the field of sustainability science (Bennett et al., 2018) and nature-based solutions. To Anderson (2021, p. 1367) for instance, stewardship is "a self-reinforcing combination of care, knowledge, motivation, agency and action that can nurture and be nurtured by ecologically rich urban green and blue infrastructure". Care in this study connotes "species activity that includes everything we do to maintain, continue and repair our 'world' so that we can live in it as well as possible. That world includes our bodies, ourselves and our environment, all of which we seek to interweave in a complex, life-sustaining web" (Fisher & Tronto, 1990, p. 40). Both concepts have overlapping characteristics which are deeply rooted in relational values - i.e. relationality, responsibility, interdependency and reciprocity (Fisher & Tronto, 1990; Papadopoulos et al., 2023a; Puig de La Bellacasa, 2017).

2.2 Stewardship of urban NbS in the context of urban informality.

Environmental stewardship is often positioned in a positive light to highlight the importance of strengthening and restoring human-nature relationships in a city. There is, however, a need to rethink the implications of stewardship on equity for historically marginalized communities in informal settlements. Critical scholars have raised concerns about how environmental stewardship supported by the state or external donors and/or multilateral agencies may promote a neoliberal agenda and 'green washing' (Carnell & Mounsey, 2023; Mathevet et al., 2018a; Rosol, 2012; Tozer et al., 2020). Since there is no uniform definition of stewardship, it is prone to misrepresentation and manipulation. Rosol (2012) argues that stewardship can be manipulated to validate the transferring of shared responsibilities from the state to the public members. In this regard, citizens "become the 'entrepreneurs' of their lives and the stewards of their system" (Mathevet et al., 2018a, p. 7). As local stewards, citizens are often expected to bear responsibilities including the development and maintenance aspects of stewardship efforts (Rosol, 2012). Without adequate resources and support from the local state such as funding and equipment, it can be burdensome for ordinary citizens who have limited capacity to maintain their stewardship efforts (Kotsila et al., 2020). Promoting environmental stewardship in cities where urban informality is common adds another layer of complexity as urban inhabitants are confronted with everyday challenges and have been historically marginalized from city-making processes (Diep, Mulligan, et al., 2022). Without accounting for local priorities

and everyday risks, stewardship of NbS can translate into the transferring of responsibilities from the state to citizens who are already under-resourced (Diep, Parikh, et al., 2022; Lambrou, 2024; Tozer et al., 2020). Therefore, there is a need to rethink its implications for equity in historically disadvantaged communities (Diep, Mulligan, et al., 2022; Lambrou, 2024).

3. Methodology

3.1 Context: Bangkok, Thailand

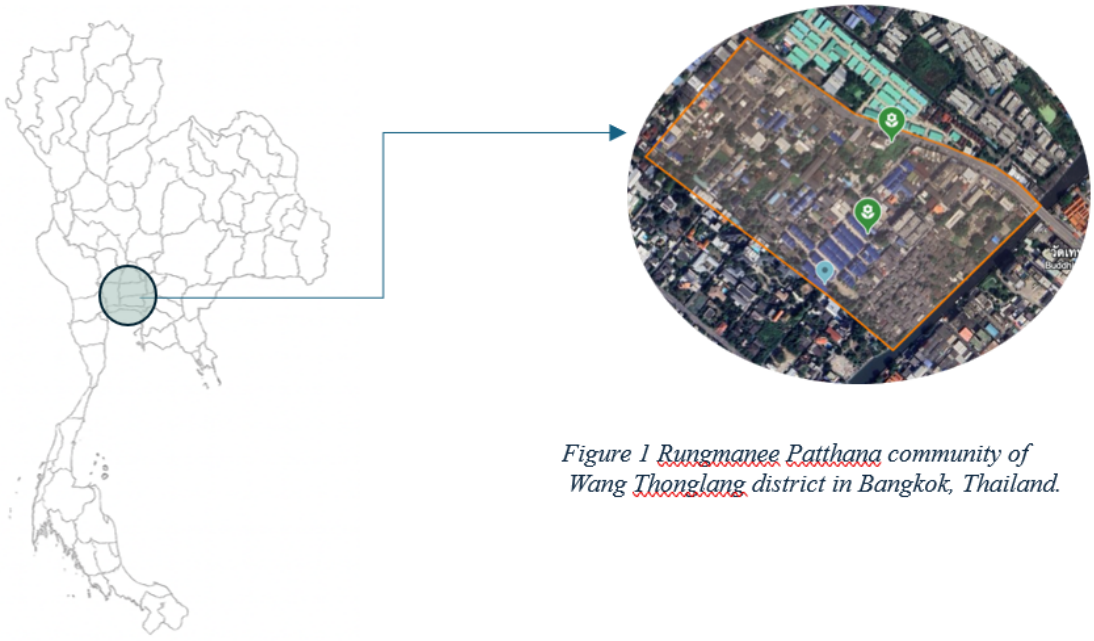


Figure 1 Rungmanee Patthana community of Wang Thonglang district in Bangkok, Thailand.

Figure 2 shows a map of Bangkok, Thailand.

Bangkok is the capital city of Thailand that has undergone rapid urban development over the past decades. As the city becomes highly urbanized, most of its natural landscape and urban fabric have been transformed into highly built-up areas with low green canopy cover (Nguyen & Chidthaisong, 2024). Responding to this, a new greening policy – the Green Bangkok 2030 – has been introduced by the Bangkok Metropolitan Administration (BMA), aiming to increase the city's green space provision ratio to 10 square meters per person (C40 Cities, 2020). Yet a study by Nguyen and Chidthaisong (2024) shows that Bangkok has been experiencing a significant reduction in its green space provision ratio from 7.6 m^2 in 2022 to 3 $m^{2.}$ per person in 2024. This is concerning because it remains below the World Health Organization (WHO) recommended standard – 9m^2 per person

(World Health Oganization, 2017). A densely packed city with low vegetation cover can increase the exposure of city inhabitants to urban heat, which then leads to the declining of human productivity and overall well-being (Grêt-Regamey et al., 2020; Marks & Connell, 2024). Given its location at the delta of Chao Phraya River, and lack of green space cover, Bangkok is extremely vulnerable to climate risks – i.e. flooding and severe heatwaves (BMA, 2017; Boossabong, 2017; Marks & Connell, 2024). Moreover, the growing number of urban inhabitants in Bangkok over the years has led to competing land use and created a pressing demand for affordable housing (UN-Habitat, 2023). To date, more than 20% of urban inhabitants still live in informal settlements in Bangkok, mainly along the canal-side areas without adequate basic infrastructure and lacking climate-proof structures (BMA, 2017). They are the most affected by the impacts of climate change due to the precarious living conditions and lack of adaptive capacity (Marks & Connell, 2024; Ramsay et al., 2024; Wolff et al., 2023).

Since the early 2000s, Bangkok has been exemplary for its city-wide informal settlement upgrading initiatives to provide access to secure housing and land tenure (Boonyabancha, 2005, 2009). The Baan Mankong (BMK) program has contributed to improved liveability and tenure security to disadvantaged groups and low-income communities in the city (Archer, 2012; Boonyabancha & Kerr, 2018). The BMK was first introduced in 2003 by the Community Development Organization Institute (CODI) - a semi-autonomous governmental agency and it adopts people-centered approach through co-production of knowledge (Boonyabancha & Kerr, 2018). Despite its remarkable success, the climate resilience goal is still absent and has yet to be integrated in the envisioning of BMK program (Jordan, 2020; Rauf et al., 2021, 2024). Siloed governance and the favoring of a hard-engineering approach to mitigating disaster risk present barriers to such integration (Satterthwaite et al., 2020). These challenges have garnered attention in the global climate discourse, which led to the strong push towards the adoption of nature-based solutions for building climate resilience in informal settlements due to its transformative potentials (Cities Alliance, 2021; Greenwalt et al., 2023). Nevertheless, the use of NbS in informal settlements as a key priority intervention are absent from Bangkok climate and planning policies – i.e. the Bangkok Resilience Strategy and Bangkok Masterplan on Climate Change 2013-2023 (BMA, 2017; BMA & JICA, 2013).

An initial case study by Rauf et al. (2024) of Bangkok (Thailand) found that previous attempts by the local authority and external organizations to incorporate urban nature in three Baan Mankong settlements often clashed with the lived experiences on the ground. Little attention had been paid to the situated needs for urban nature before its implementation by authorities. Residents expressed tensions around misaligned preferences for different types of urban nature, perceived benefits and disbenefits, and

expectations around maintenance responsibilities (Rauf et al., 2024). The study revealed that residents would discontinue their stewardship of NbS or replace externally implemented nature-based initiatives that are misaligned with local priorities and expectations (Rauf et al., 2024). On the other hand, areas of derelict land, landfill sites and abandoned railway tracks have been re-appropriated by communities as places for nature-based initiatives (ACHR, 2020; Boossabong, 2014). This has resulted in the creation of community garden networks that act as important social capital in times of climate crises when government support is often absent or delayed (Boossabong, 2014, 2018; Kelman et al., 2017). The significance of these networks was evident particularly during the major 2011 flood and the Covid-19 pandemic when households faced high unemployment and living circumstances became even more precarious (Boossabong, 2017; Wungpatcharapon & Pérez-Castro, 2022). In sum, it is critical to account for the situated needs of local community, their preferred types of urban nature, location for implementation and existing local stewardship practices (Diep, Mulligan, et al., 2022; Wolff et al., 2022).

3.2 Case study selection – Rungmanee Patthana community in WangThonglang district, Bangkok.

This research employs an in-depth case study approach to explore nature-based stewardship practices initiated by the Rungmanee Patthana community in the WangThonglang district of Bangkok, Thailand (Figure 3). The PI undertook a preliminary field work in Bangkok during the summer of 2024, resulting in the identification of Rungmanee Patthana community as a potential case study and a partnership with Kasetsart University around carrying out this fieldwork. The selection of Rungmanee Patthana community had been based on the following criteria: 1) an informal settlement that had participated in the Baan Mankong (BMK) upgrading program, 2) community-based stewardship of NbS was ongoing since the COVID-19 pandemic, and 3) availability of researcher connections with the local community. Prior to the BMK upgrading, Rungmanee Patthana was an informal settlement where the first-generation residents of various occupations (e.g. farmers, traders and construction workers) from other provinces without any official documentation and housing registration came to live on Crown Property Bureau (CPB) land in 1975 (National Geographic Thailand, 2025). Rungmanee Patthana residents participated in the BMK in 2004 to improve their living conditions and access to tenure security.

Figure 1: The transformation of Rungmanee Patthana settlement after joining the Baan Mankong program.

(Source: Rungmanee Patthana community members)

Rungmanee Patthana residents started joining the Baan Mankong program in 2004 and there are people who did not participate but managed to secure an official permit to stay on the land owned by CPB (National Geographic Thailand, 2025). As of today, there are 412 households overall participating in the BMK and 141 are directly leasing from the CPB (National Geographic Thailand, 2025). Since the upgrading, Rungmanee Patthana community has demonstrated a notable social transformation with concerted efforts to strengthen the informal social care support system and livelihoods through collective action in Wangthonglang district (Wungpatcharapon & Pérez-Castro, 2022). Their resilience and agency in extending caring support to others during the Covid-19 – through food growing initiatives, food donations, and community kitchen - has garnered recognition from city actors. The long-standing community-managed vegetable gardens of Rungmanee Patthana therefore represent a relevant case study to be learned from.

3.3 Methods for data collection and analysis.

Research objectives		**Methods**
Research objective 1	To identify both tangible and intangible factors influencing community-based stewardship of nature-based solutions and its continuity in informal settlements.	Transect walk and site observations. (Participant-driven) Photo elicitation interview

Research objective 2	To explore alternative governance arrangements that support the mobilization of community-based stewardship of nature-based solutions in informal settlements.	Photo elicitation interview Semi-structured interviews

Table 1: Methods used to address research objectives.

Transect walk and site observation (RO1): A transect walk and site observation were conducted by the doctoral researcher, accompanied by two research assistants and with the support of two key informants from Rungmanee Patthana community. A transect walk is a group-walking activity that uses a pre-defined route within a community to observe everyday life practices and the local environment while simultaneously identifying the distribution of resources, underlying social-ecological problems, and how local people perceive such issues. It was first adapted in the participatory rural appraisal (PRA) method by Robert Chambers for community-based resource assessment (Chambers, 1996). The key informants are group leaders who not only have good knowledge of the neighborhoods but are also actively involved in local stewardship practices. The routes selected during the walk included both green and blue spaces that residents either cared for or disliked due to poor maintenance and neglect. The conversation during the walking activity identified underrecognized issues such as uneven distribution of labor, participation, and key agents for local stewardship in the community. The information was recorded in the form of fieldwork notes with audio recordings for transcription, translation, and coding purposes.

Photo Elicitation (RO1 and RO2): Photo elicitation was performed with 30 members of Rungmanee Patthana community. Photo elicitation refers to the use of photos in semi-structured interviews to evoke different kinds of insights grounded in participants' memories and lived experience (Collier, 1957; Harper, 2002). The method has long been deployed by both social and natural scientists to understand natural resource management, urban environments, and ecosystem services in the context of informal settlements (Berbés-Blázquez, 2012; Bignante, 2010; Lombard, 2013). Participant-driven photo elicitation was conducted with the community to understand the intangible factors that could not be expressed by words alone that are encouraging or discouraging stewardship practices. The participant recruitment was done using snowball sampling. On the first day, a briefing session about the study and photo-elicitation was organized with the presence of community leaders, representatives from each alley in the settlements, and several members who were interested in the study. The session includes the Q&A – e.g. inquiries around timeline, confidentiality, photo-taking techniques and outcome. Since we adopted a snowball sampling method, it is important to first establish rapport and explain the purpose of our research to these "gatekeepers" before recruiting participants(Ahern, 2014).

This is because they have access to community members and can help to facilitate the recruitment process by disseminating information about our study (Ahern, 2014). A photo-taking guide, participant information sheets, and consent forms that had been translated in Thai language were provided to the gatekeepers during the session. In the guide, the participants were asked to produce images based on the following prompts.

- Green spaces and/or spaces around water that you care about and important to you in your settlement.
- Green spaces and/or spaces around water that you dislike in your settlement.
- Green spaces and/or spaces around water that you would like to visit more frequently.

Recognizing that the term 'nature-based solutions' can be convoluted and jargony for a non-academic audience, I used the terms green spaces and water-related spaces in the guide to allow local community to relate to it and execute the task accordingly. The NbS concept originates from the Global North and might be perceived and translated differently in the context of Global South. Participants who did not have access to mobile phones or cameras had options to either take their own photos or select photos that may be available online or elsewhere (e.g. old photographs or newspaper cuttings) that represent their relationship with green and blue spaces in general. A group chat using LINEAPP was created as a communication platform for submitting photos, addressing any inquiries, and scheduling in-person interviews based on the availability of each of the participants. As for the participants who did not have mobile phones, they could come to the community center to meet the research team and share any concerns or inquiries they have. The community group leader will also visit them at their homes to ensure they encounter any issues or require assistance about the photo assignment. The snowballing process started after the group chat was joined by potential participants and they started to add the contact of other residents who might be interested to the chat room. When a contact is shared in LINEapp, only individual username will be visible, and no personal mobile number will be displayed. The photos shared by the participants were organized into individual password-protected folders with access strictly limited to the research team. During the interview-elicitation phase, I engaged with the participants to verbally elicit the significance, memories, and meanings of the images for them. A semi-structured interview guide was used to ensure that both research assistants who acted as translators were on the same page as the doctoral researcher when they elicited information from the participants. The guide was mainly intended for directive purposes rather than an exhaustive list of questions that needed to be covered. The research assistants from Kasetsart University played a key role in overcoming language and cultural barriers during the conversation.

Semi-structured interviews (RO1 & RO2): were conducted with 30 stakeholders from across local government, academia, private sector, non-governmental organizations (NGOs) and civil society, working in the domain of environmental stewardship, urban greening or housing upgrading in Bangkok. The rationale for the method selection was that it has a balanced structured and non-structured approach to address the research questions. This flexibility enables the exploration of new lines of inquiries and perspectives that emerge from conversation with urban professionals. It was important to allow some degree of flexibility in the interview process to counterbalance any presumptions that existed prior to the fieldwork(Ruslin et al., 2022) . For example, questions about their involvement in supporting community-based greening initiatives and the types of support they might provide (please refer to the appendix for the full list). Naturally, this led to the selection of semi-structured interviews over structured interviews because it provides rooms for exploration to elicit deeper information that is grounded in local realities.

The interviews were conducted virtually and in person. The recruitment of participants was done using non-probability purposive sampling method in which my collaborators at Kasetsart University and I reached out to Bangkok Metropolitan Administration (BMA), Wang Thong Lang district authority, Chulalongkorn University, Asian Coalition for Housing Rights, City Farm, We!Park Initiative, BigTrees, Community Organization Development Institute (CODI), Refield Lab, Stockholm Environment Institute (Asia) and SHMA Company Limited. This selection was made based on their previous involvement in supporting community-led greening initiatives by project partners (Archer et al., 2020; Rauf et al., 2024; Wungpatcharapon & Pérez-Castro, 2022). Each interview took approximately 40-60 minutes per participant. For urban professionals who were non-English speakers, the interviews were conducted with the support of the Thai research assistants. All the interviews were audio-recorded.

Translation and Transcription of interview recordings

All the audio recordings were transcribed in Thai and translation of the transcripts from Thai to English was done with support of the research assistants. The transcripts were then cross-checked to ensure that the Thai language and cultural nuances in the conversation were preserved.

Data Analysis approach

The choice of analytical lenses to structure the interview questions was informed by four key dimensions of the Policy Arrangement Approach (PAA) - actors, resources, discourses, and rules of the game - as developed by van Tatenhove et al. (2000). The PAA has previously been adopted to examine the success factors of communal gardens for social

resilience in the European context (van der Jagt et al., 2017). Although PAA has been widely adopted as an analytical lens, it has some limitations in terms of its applicability in the context of the Global South (Basile, 2023). The framework cannot account for complex relationships among its categories, the complex materiality of self-governance efforts, and on-going communities' connections with structural systems (Basile, 2023). The rigidity of the framework is insufficient to capture the assemblage of practices, infrastructures, and materiality in informal settlements (McFarlane, 2011). To make the framework relevant for this research, four interconnected domains from the PAA. (actors, resources, discourse and rules of the games) were then integrated with four elements from the stewardship framework by Enqvist et al. (2018), namely motivation, care, agency, and outcomes. Since informal settlements are grounded in local realities and everyday life practices, such a combination of analytical lenses is essential to explore the complexity of influencing community-based stewardship in the Global South. The information was recorded in the form of audio recordings for transcription, translation, and coding purposes.

A thematic analysis method by Braun and Clarke (2022) was adopted to analyze the dataset from the transect walk, photo-elicitation and semi-structured interview. Next, Nvivo14 coding software was used to generate initial codes and look for recurring patterns from the data (Braun & Clarke, 2022). During this process, we applied the combined domains from the PAA and stewardship frameworks to identify tangible and intangible factors influencing community-driven stewardship. Any recurrence of identified factors was clustered together to derive relevant codes and sub-themes. The codes were then used to identify potential themes that would address the research objectives. The analysis was an iterative process in that the identified potential themes had to be reviewed, refined, and reflected upon researchers' positionality to minimize potential bias. (Braun & Clarke, 2022). The finalized themes were then triangulated across the three methods to minimize potential bias and ensure the credibility of the findings.

Ethical consideration

An ethics approval was obtained from Heriot Watt University ethics committee prior to conducting the overseas fieldwork to protect the rights and confidentiality of the participants throughout the study (approval number: 2025-9590-1478).

4. Findings

4.1 Factors influencing community-based stewardship of green and blue spaces.

4.1.1 Agency and caring relations

The collective agency and capacity in Rungmanee Patthana community was not built overnight. The desire to improve the live ability and improve the socio-environmental conditions in the settlement was the main driver to the mobilization of collective action by the residents (Participant 3C1). The photo-elicitation interviews reveal that the natural environment in the settlement used to be pristine and have an abundance of wildlife and biodiversity (Table 2). Monitor lizards were present and could be seen swimming into their holes but hardly visible in the present days (Participant 1A5). The current site of Rungmanee Patthana used to be a big lotus pond surrounded by edible plants and many fishes can be seen from the clear canal water (Participant 3C4 in Table 2). She settled in the area 40 years ago and could still describe her past nature experience and landscape engagement. This is due to the dramatic landscape transformation of the area from having an abundance of nature and wildlife to the formation of unplanned settlements and environmental degradation. The uncontrolled movements of people from other provinces to settle in the area had resulted in overcrowding and crime-related issues such as drugs and thefts (Participant 1A5 and Participant 3C1).The precarious housing conditions - e.g. living above water, poor ventilation, the absence of drainage systems and fire risks from sharing electrical supply with multiple households - made the settlement hazardous for the inhabitants (Table 2).

Participant Code	Illustrative quotes
Participant 1A2	*"Yeah, now there are a lot more people. And people just slowly started building houses, kind of … informally. Building homes. Just like putting up bamboo huts or makeshift shacks. They just sort of quietly built one house, then more houses over time … Until people really started living here. And to get the land we have now… oh wow it was really difficult. All the palm trees and coconut trees were all cut down. Even tamarind and eggplant tree, all gone."*

Participant 3C1	*"We used to live in temporary shelters. Small houses like this, just like over here. On the opposite side, the area has not been cleared yet. One electricity or water meter was connected to 5,6 or even 10 households. Those caused fires, right? Because it exceeded the capacity. But now the proper houses have been built, each household has its own water and electricity meter. Being separated, with each having a direct lease agreement with the property is one of the things that makes everything more stable and lasting."*
Participant 3C4	"The environment here was very fertile in the past. During the flood season, we could catch fish from the pond and did not have to go to the market. There were Sesbania flowers and lots of edible plants. It was *really nice back then. Sometimes if I want to pick water plants, all I had to do was to walk over. Back then there were only a few houses, and the end of the alley had none, so, the air was really fresh. If I wanted to eat lotus stems, I would walk down and pick them. There were lots of morning glories and other vegetables too".*
Participant 4D3	*"Oh, in the past, the houses were unstable. The word "Baan Man Kong" (secure housing) makes me feel secure […] Before this, it was not secure in terms of safety… like you won't know when the fire would break and destroy our property. Or when thieves would break into our property. I have children, so I was afraid something would fall into the water."*

Table 2 shows the illustrative quotes of the precarious conditions of their houses in the past described by the participants.

The BMK program marked the turning point where residents realized that they have the capacity and power to mobilize resources in addressing their everyday challenges through collective action. The BMK core principle - *let people be the solution'*- has very much shaped people's capacity to act without waiting for the state support such as the establishment of community savings funds (Participant 3C1 and Participant 5E3). The exposure towards such a mindset since at the initial phase of the program has indirectly impacted how collective agency was manifested, nurtured and circulated in Rungmanee Patthana community (Participant 3C1 and Participant UP12). This was highly reflected in their attitude and sense of collective responsibility in improving and stewarding the green and blue spaces in the neighborhood. From the following quotes, it shows how residents remained intrinsically motivated and aspired about taking environmental actions even in the absence of the state's interventions and support (Figure 5).

Participant 8H1: "Anyway, both sides of this area used to be all mud and dirt—no walls, no barriers at all. Over time, leaves, soil, and stones would accumulate in the canal and pile up. We discussed what to do about it. We gathered the community during festivals like New Year's to come together and help clean the canal—clear out leaves and debris. Those who could contribute labor went into the canal to scoop out the sludge and clean it up."

Figure 2 shows the canal that used to be cleaned and maintained collectively by community members. (Source: Participant 8H1)

The embodied collective agency and sense of stewardship were proven to be intangible assets for the community to navigate difficult times during the Covid-19 pandemic. When the virus had spread across Wang Thong Lang district where Rungmanee Patthana community was situated, the community center was transformed into a temporary Covid-19 care center. It was equipped with quarantine facilities for bed-ridden senior patients that were trapped at homes, children center, and central kitchen for meal preparation (Participant 3C1). Instead of waiting for resources from local government, community members established their own savings groups and secured funds from community cooperatives (Participant 6F3). When the funding in the community started to run out, community members had to minimize their expenses in purchasing cooking ingredients for the central kitchen (Participant 3C1). Realizing that they can grow their own vegetables even with limited space availability, the community decided to develop an edible garden by utilizing the vacant space owned by the Crown Property Bureau.

Figure 3 Weekly food donation event to the poorest and stateless individuals-organized by Rungmanee Patthana community with Scholars Sustenance Foundation (SOS)

Participant 4D1: "Growing vegetables in Bangkok or in limited spaces—even when there's no land—we can still do vertical gardening. My real goal is for every household in the community to grow their own vegetables. It helps reduce family expenses because they can harvest and cook without needing to buy anything. I want to encourage everyone to try this … it might seem

small, but it can save money. A lot of people here don't see the value in it; they think it's a waste of time. But I want everyone to start growing vegetables. At the very least, it will make the area in front of their homes look greener and fresher, improving the neighborhood's environment. I want to invite everyone to try planting something at home. You can come see my house … I grow vegetables and flowers of all kinds. Having a green space like that really refreshes you. It makes your mind feel calm. And the produce can actually be used."

4.1.2 Knowledge production

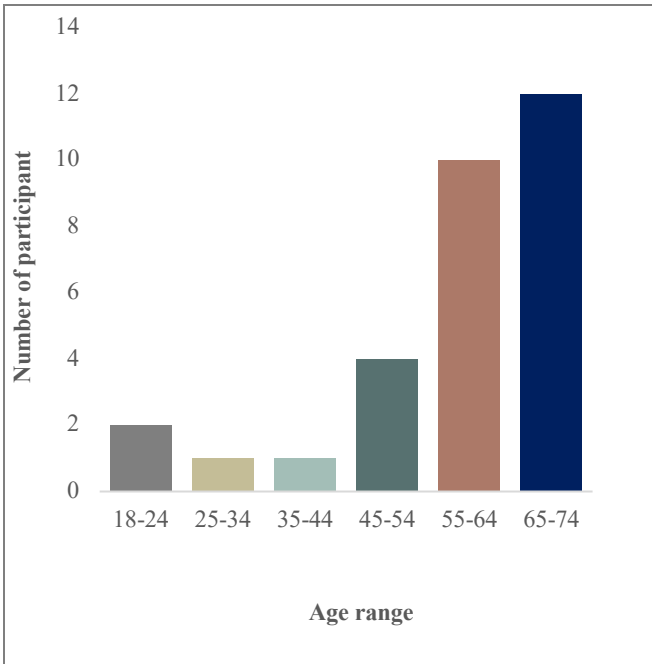


Figure 4 indicates the age range of photo-elicitation participants.

The diverse ecological knowledge systems such as, intergenerational, traditional and technical were identified as one of the fundamental enablers to undertake local stewardship actions in Rungmanee Patthana community. As shown in (Figure 6), most of the participants of photo-elicitation were older adults aged between 55 and 74. They possessed agricultural knowledge that had been passed down from their ancestors living in the countryside. This knowledge was then circulated among community members to facilitate the caring praxis of communal gardens and extend the greening efforts to their individual households. When we asked if the participants already possessed gardening knowledge prior to their involvement in caring for the community garden, Participant 3C1 shared:

"Yes, the women already possessed considerable knowledge about gardening. Most of them originated from the Northeastern region of Thailand, where farming and gardening are common

livelihoods – rice fields, plantations, gardens. So, they already had a strong foundation of practical knowledge. In our language, we call them - 'ปราชญ์ (Prach) which means a 'wise or local knowledge keeper' specifically 'ปราชญ์ชาวบ้าน' (village or community sage). These are individuals recognized in the community as wise elders or experts who have deep practical knowledge through years of practice. We involve them to perform roles that suit their strongest skills, especially the ability to pass on their knowledge to others. This knowledge already exists naturally within them, but previously, there were no opportunities or platforms for them to share and transfer it widely. Therefore, by initiating this project, we provide a way for them to extend and disseminate their knowledge further."

Figure 5 shows a group of older adults exchanging knowledge and local wisdom to improve the garden.

The sharing of intergenerational knowledge also occurred informally or spontaneously through social encounters between older adults and children in the neighborhood. For instance, Participant 8H1 shared that many children often visited his front yard because there were a few ornamental trees, such as double Jasmine. He took the opportunity during the social encounter to educate the children about tree planting, how they should take care of flowering plants – i.e. asking them to refrain from plucking the flowers to preserve the scent of the Jasmine tree so that everyone can enjoy the benefits (Participant 8H1). However, it is important to note that not everyone inherited intergenerational knowledge or is already equipped with traditional agricultural knowledge. Engaging in nature-based caring practices can be challenging without any prior gardening or relevant agricultural knowledge. When we asked Participant 6F2 if he finds it challenging to create the planting pots by himself, he shared that:

"*It is not difficult for someone who knows how to do it, but it is difficult for someone who doesn't [….] because they don't know what to do. This came from my idea. I will arrange them into planting beds. One bed will be this wide and this long, and we will use a certain number of beds, and we will measure the area. The reference for its size came from our thoughts – as in we have this much space, so our beds must be this size.*"

We also found that technical knowledge shared by professors from local universities to be a valuable support for residents in undertaking appropriate stewardship actions for different NbS types. For blue space stewardship practices, residents learned from the professor at NIDA University how to produce Effective Microorganism (EM) balls, which serve as a biological barrier against harmful bacteria while improving the water quality (Participant 2B1). A professor at Kasetsart University introduced the use of the crop rotation technique to enhance agricultural productivity of the community gardens during the rainy season and taught residents how to manage pest attacks using an organic approach. Participant 8H1 on the other hand shared that the community found it useful to learn about waste conversion and compost production from the Department of Agriculture because they have limited knowledge on environmental sustainability practice. He further explained:

"They said some of it is already like compost because there are large trees planted here that provide shade, even though at that time the trees were not fully grown yet. Initially, the sludge was black and smelly, and we were afraid the trees (Figure 8) would die but actually, it turned out to be excellent fertilizer. When you dig properly, you'll see worms and other organisms appearing within about 4-5 days, just as they said. You don't even have to mix anything, and it becomes good compost naturally."

Figure 6 shows the location of big trees next to the canal area. (Source: Participant 8H1)

The community members had been proactively acquiring new knowledge to improve their existing stewardship efforts by conducting study visits to other provinces to exchange ideas. The production of knowledge in this way has proven to be beneficial for residents to realize their own capacity and the possibility of transforming small patches of land for food-growing activity. A vertical planting technique with raised beds for instance was adopted from the study visit in Rayong provinces and retrofitted to the site of the second community garden to minimize the use of space (Participant 2B1). The older residents in particular were receptive of the space-saving garden layout and vertical planting

technique because they do not have to bend down and can protect their fragile back and knees from injury while gardening (Participant 1A5). Participant 6F2 on the other hand, felt that his learning trip to Saraburi and Samut Sakhon about self-sufficient economic-based agricultural practices was insightful as the new information can be circulated back to the community and applied to their existing green space.

Participant 6F2: "So, we had to learn and exchange ideas. People in the city can grow vegetables too […] I still have one of their discs—about galangal, lemongrass, kaffir lime leaves. It was really useful. We shared that information with residents and applied it. Even in concrete buildings, people can grow kitchen herbs. We used pots. We also learned how to sprout mung beans. We learned so many things. I brought it all back to build on here."

Figure 7: The creation of the second community garden as a result of social learning experience. (Source: Participant 2B1)

Figure 8 shows the Executive Director of the UN-Habitat Anacláudia Rossbach (on the left of the picture) visited Rungmanee Patthana community centre to learn about their BMK experience.

Numerous visitors (both local and international) visited the garden sites to learn about sustainable community-driven agricultural practices and green space management under

resource-constraint conditions. As seen in Figure 10, the Executive Director of UN-Habitat Anacláudia Rossbach (on the left in yellow shirt) visited the community to learn about their participation in the Baan Mankong program and the gardens. The circulation and (re)production of knowledge systems also happened at school level in that local kindergartener and primary school students acquired hands-on-learning experience on soil caring and vegetation planting techniques (Participant 3C1).

4.1.3 Values and (dis)values of different types of NbS

The results revealed that plural values of nature, namely, instrumental, intrinsic, and relational, shaped residents' engagement and connectedness to the green and blue spaces in Rungmanee Patthana neighborhood. Most participants expressed their connection to the community garden instrumentally – in that the products can be harvested, shared, and sold as an income-generating activity. Residents grow vegetables and take care of the gardens because the products are edible, can be used to generate income, and reduce household costs for buying cooking ingredients in times of crises (Participant 4B1). These exemplified instrumental values are frequently mentioned by residents during the photo-elicitation process. Here, it implies that the monetary benefits provided by nature (e.g. food cost savings) and its practical usefulness in everyday life matter to the community because they can directly reduce their household burden when facing financial struggles. Examples of edible plants planted by residents include cucumbers, noni, winter melon, jackfruit, and bananas. Holy basils, kaffir lime tree and lemongrass for instance, were highly preferred by residents because these are the key ingredients for cooking Thai traditional cuisine such as Tom Yum Goong – a daily staple for Thai people (Participants 3C1 and 2B1). The flowers of Agastya, Thai Copper pod tree, and papaya tree (Figure 11) were other examples of cooking ingredients to prepare Gaeng Som (sour curry) (Participants3C1, 3C2, 3C3).

The embeddedness of instrumental values in community-led NbS stewardship was demonstrated through the adoption of the crop rotation method to enhance agricultural productivity, given that Thailand is prone to extreme weather events – i.e., floods and heatwaves. Crop choices will be changed every season to adapt to changes in soil conditions, so residents can harvest the products. This suggests that instrumental values can influence the life cycles of vegetation and continuity of stewardship practices. The interview with Participant 4D1 (see Table 3) indicates that once a local greening initiative stops producing desirable benefits (in this case, the pumpkin), it is no longer regarded as valuable. Thus, it is prone to discontinuation or replacement by other vegetation that is likely to boost crop productivity. A few participants also valued medicinal herbs instrumentally because they cognizant of the healing properties of the plants that could

benefit human well-being – e.g., the use of Rang Jued plant (Thunbergia laurifolia) to detoxify the body system (Participant 7G2).

Participant Code	Illustrative quotes and photo evidence
Participant 3C1	*"These are papaya trees. Papaya grows thickly in the first 6–7 months, but during the rainy season, there's flooding. The water collects and the roots rot, so the plants die. We'll replant again".*  *Figure 9: Papaya trees in community garden one*

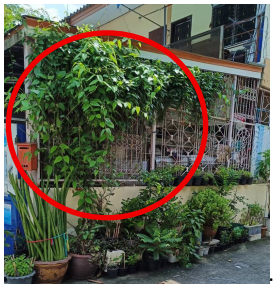
Participant 4D1	*"This photo was taken from inside, looking out toward the gate. It shows that even this corner of the space is being put to good use. We don't let any space go to waste — we make full use of it. Right here, there's Thai eggplant. Now I've planted a hog plum, a starfruit tree, and a lime tree. Once they grow, I don't know how cramped it's going to be in this small area. Just yesterday I told my aunt that the pumpkin vines aren't producing anymore. I'm going to take them out because they're not bearing fruit. My goal was to get pumpkins, but they only grow vines. When they finally start fruiting, the fruits just wilt and die. I think it's because the seeds we used came from big pumpkins we bought and planted the seeds. They might've been genetically modified not to produce viable fruit. So, no matter how we plant them, we don't get to eat the pumpkins — only the shoot."*  *Figure 10: A little corner with edible potted plants including pumpkin vines that have stopped bearing fruits in the community garden 2.*
Participant 7G2	*"I took it because this plant is called Rang Jued (Thunbergia laurifolia) because it helps detoxify the body."*  *Figure 11: Rang Jued plant circled in red*

Table 3 presents illustrative quotes and photo evidence on how NbS were valued instrumentally by residents.

Based on the images submitted by the participants, we found that intrinsic values of nature particularly, spiritual connections, personal belief, and aesthetics, influenced the extent of human-nature connectedness and stewardship engagement with green spaces in Rungmanee Patthana. The deep apprehension and appreciation of these elements signify their intimate and intangible relations, which cannot be merely quantified or reduced to numerical sense. Ornamental plants and flowering trees such as Yellow Elder (Tecoma stans), Frangipani tree, Flamboyant tree (Delonix Regia) and Bougainvillea were highly favored for their aesthetic appeal, which made people happy and content (Participants 4D2 and 7G3).

Participant Code	Illustrative Quotes	Photo Evidence
Participant 4D2	*"This is the same, next to the house. The bougainvillea flowers were beautiful, so I took a picture. The bougainvillea was blooming then. But it's not beautiful now because the owner cut it back. Good thing I took a picture before."*	
Participant 7G3	*"That's a Peacock Flower (Caesalpinia pulcherrima). It blooms once a year and when it does, it looks really beautiful and refreshing. And this one is a picture of jackfruit tree. I took it because jackfruit (Khanun in Thai) symbolizes prosperity and success."*	
Participant 3C3	"Planting this sacred tree bring peace of mind. I feel connected to it as it brings peace to mind, happiness and prosperity depending on each person's belief."	

Table 4 shows illustrative quotes and photo evidence from participants about instrumental values of urban nature in Rungmanee Patthana.

Based on the photo submitted by the participants, they seemed to have a deeper personal relationships and connections with the green spaces in their neighborhood facilitated by relational values of nature. Place attachments, urban memory, and sense of belonging exemplified these values and are critical for shaping moral responsibilities of each resident in appreciating and caring for their natural environment. The narratives used by participants to describe their favored green space and its personal significance were often associated with their memory which deeply embodied in the place that they reside in or used to inhabit. For example, Participant 7G2 shared his thoughts on why the big tree matters to him:

"It has been here since before my old house was demolished. My old house used to be right there. I don't know what kind of tree it is, but it has pink blossoms that bloom during certain seasons. I do feel attached to the tree as I've seen it since I was a kid […] pretty much since I was born. That's why I took a photo of it, so I can always remember it. Every year, in certain seasons, the pink flowers would fall so it was really noticeable. But lately, it hasn't been shedding as much. I think it might be dying now because it's mostly just the trunk left."

Figure 12 shows meaningful old big tree for the participant in the settlement. (Source: Participant 7G2)

When we asked if the participants ever felt stewardship practices such as sweeping leaf litter in their alleyways and watering the plants burdensome and exhausting, most participants responded otherwise. A commonality in their response is that everything they do to maintain and care for their neighborhood, including the environment, is voluntary as it is part of human responsibility. They expressed that engaging in stewardship actions such as sweeping leaf litter and tending to communal gardens allows them to foster social bonds and socialize with each other. A well-established friendship was cited by some participants as a fundamental factor that motivates them to engage and undertake local stewardship efforts collectively. Participant 3C4 for example, felt encouraged to participate whenever she saw her friends working together in the community garden.

Participant 3C4:" I don't think participating in the community garden is a burden. It's fun and I enjoy it. I don't overthink it. It is just about joining in and helping out. Yes, I get to connect with people. I have friends around my age. We talk and become close. Everyone enjoys it."

With regards to blue spaces, the connection and attachment to the canals (within the community) and (the primary canal opposite Wat Thep Leela) had dissipated over time– based on the photo elicitation responses. This is because the dramatic transformation of urban landscape and waterways has significantly altered the city's fabric in terms of how space is used and experienced by inhabitants. Living with water has been the Thai traditional mode of living and used to be the primary mode of transportation and trades (Participant 1A4). The interviews residents of Rungmanee Patthana used to live above water and had to use boat or paddle to get to their destinations – commuting to work, meeting neighbors, going to hospital and making-merits at nearby Wat (Temple).

Figure 13 shows the traditional 'pontoon' dock and modern boat used by residents. Source: Participant 5E2 (left) and Participant 4D2 (right).

In the past, the canals were used for Thai Buddhist almsgiving by boat called Tak bat Heau (Participant 2C4). It is a centuries old Thai religious-cultural tradition where monks in boat-paddle canals to receive food and rice offerings from community (Participant 2C4). The participant shared, such practice has become less common these days as monks would use the road instead of the waterways to receive offerings. Regarding blue spaces, residents engaged with the main canal side opposite Wat Thep Leela (a local temple) because of its therapeutic and calming landscape (Participants 1A2 and 1A3). They also appreciated the ornamental plants along the canal-side walk for their aesthetic value and mood-enhancing qualities. However, they did not actively participate in managing or maintaining the canal, as they felt this responsibility should fall under local government (Participants 1A2 and 1A3).

Nevertheless, the disvalues of urban nature had prevented some residents from engaging with and growing certain types of NbS. During the site observation, we noticed that big trees were scarce in the neighborhood. Residents explained that big trees were not favored in the community because the trunks often interfered with the wire lines, and the roots led to building-faults (Participant 7G1 in Table 5). Although they recognized that big trees could help to regulate thermal comfort, residents find it challenging to plant because of spatial constraints. Some participants cited perceived fear of venomous animal species such as centipede and snake had prevented them from engaging with the community garden (Participant 2B2). Young children were not allowed to roam and play at the community garden without adult supervision due to injury concern and fear of being attacked by animals.

Participant Code	Illustrative Quotes

Participant 7G2	*"It used to be better taken care of. This is in front of my house. The banana trees weren't always this many. Bananas grow easily because you just plant one and they multiply. Now there are too many, and just last month there was a problem with the power lines -one tree leaned on the cables and caused a short because it bore fruit. Honestly, it needs to be cleared out properly. If anyone's going to clear it, it'll probably have to be me."But the big tree keeps leaning more and more because it takes up a lot of space. I have to keep moving it forward since its roots are starting to break through the concrete."*
Participant 7G1	*"Big tree is important, but we also need to consider the area where we're planting it, whether it's suitable. Before, we planted large trees, but they were planted too close to the house. While they provide coolness, the downside is the roots. The neighbour had problems because of They used to have a Black Afara tree, and its roots spread everywhere. It was too rooted in the ground and caused subsidence".*
Participant 2B2	*"Or cut off the dry leaves. It would be better. I'm afraid of snakes and scorpions. There are people living in this area, but they don't do anything. It's dangerous. There are centipedes and millipedes and things like that. Prevention is better than cure."*

Table 5 presents illustrative quotes related to the disvalues of urban nature.

4.1.4 Labor of environmental stewardship and time commitment.

In the case of Rungmanee Patthana, time can be both an enabler and a hindrance to advancing localized NbS stewardship. Since more than half of the active stewards were retired older adults in Table 6, they were likely to have more time to look after the community gardens. For the retirees, time is not an impediment but for residents with full-time jobs, they have expressed time commitment as a major challenge to their participation in local stewardship efforts. A resident shared that she needs to negotiate her time to join others in taking care of the garden because she is a full-time business owner and has a complementary income activity as an airline ticket booking agent (Participant 4D3). Although her business is home-based, her capacity to fully participate was limited by her nature of work. As she further explained: *"Before, I worked in a hotel, and then COVID happened, so I started working from home [...] That's why I have free time to do gardening and help society. Sometimes it's not exactly free time because we have to divide our time"* (Participant 4D3).

Gender	Number of participants	Gender proportion (%)
Women	25	83%
Men	5	17%

Table 6: The gender proportion of participants involved in the photo-elicitation.

Since most of the local stewards were women older adults (Table 6), this suggests that nature-based stewardship is gendered in Rungmanee Patthana community. The high involvement of older women likely reflects their role as 'community sages' or 'local knowledge keepers' – elders with deep practical agricultural experience (as described by Participant 3C1 in Section 4.1.2 on knowledge production). Additionally, the vocabulary used by Participant 3C1 in the following excerpt seemed to suggest that the act of caring, including providing environmental care beyond individual household, was still perceived as feminine traits among community members. Thus, women were likely to be expected to participate and undertake the caring responsibilities for the community gardens.

Participant 3C1: "Yes, because more women tend to get involved in this work. You know why? Because women tend to be gentler and more flexible in decision-making. Men are more rigid and direct, while women are softer, more understanding. That's why more women take on these roles. They have more reasoned approaches [...] in their work. That's why you see more women. Because when making decisions, women are more flexible and analytical. Men tend to analyze less and be more rigid."

The shortage of manpower and detachment of youth groups were reported as another barrier to the upkeeping of the gardens and canals in Rungmanee Patthana community (Table 7). Competing life priorities in search of better employment and life of opportunities in other place had caused the youth to discontinue their engagement in helping older adults with stewardship actions – leading to shortage of manpower (Participant 3C1). Consequently, it will be time-consuming and laborious for older adults to perform gardening tasks such as mowing, clearing overgrown grass and tree pruning (Participants 4B1 and 2B1). Under hot weather, older adults have to reschedule the plant watering task in the morning because it would be less hot than in the afternoon (Participant 2B2). Such challenges imply that improving the working conditions of older adults through locally adapted garden design is crucial to reduce their physical burdens and sustain long-term engagement in stewardship practices. Participants 1A5 and 5E2 were happy with the implementation of raised planter beds and vertical planting technique because it reduced the need for the elders to squat down given their back and knee pain. (Table 7)

Participant Code	Illustrative Quotes/ Photo Evidence
Participant 3C1	*"They are not really interested because they are focused on survival, right? Like yourself, if you get a high-paying job, you will go and do that, won't you? Back then, I even set up a youth group so that they could start saving, planning for the future younger generation. I thought the kids would help us with things like community savings and financial management. And they did actually. When they*

	were 15,16, still in high school, they were involved and even started their own savings group. But once they graduated and started earning salaries, they left".
Participant 4D1	*"The biggest obstacle was really people […] sometimes we want to do something, but there's no one available to help".*
Participant 5E2	*"This is Uncle Somboon's vegetable plot (community garden 2), the raised bed one. I like this one too because you don't have to bend down, and it's convenient. Dogs that come in don't make it very dirty. It's easy to clean. When picking vegetables, you don't have to bend down. It's convenient for watering too".*
Participant 2B2	*"It would be good to have young people, but there aren't many. Some things are beyond what old people can do, but sometimes we do gather to remove excess. It's just once in a while. If it's too tiring. We don't go. And it's also hot during the day".* 

Table 7 shows illustrative quotes representing invisible labour of environmental stewardship faced by residents.

4.1.5 Fragmented governance of urban NbS the city level

Based on the semi-structured interviews with urban professionals, the fragmented governance of urban NbS at the city level was cited as a major impediment to advancing and supporting community-led stewardship efforts in upgraded informal settlements. For urban green spaces (UGS), the existing governance structure is still very much decentralized with multiple departments under the Bangkok Metropolitan Administration (BMA) – i.e. Department of Environmental Office, Green Space Policy Committee, Public Park Department and Green Space Management Office - have been working in siloed (Participants UP4 and UP27). Additionally, each of the fifty sub-district offices in Bangkok has been operating separately from the central district office in managing and maintaining their respective green spaces in the absence of a centralized/ systematic monitoring plan (Participant UP24). To our knowledge, what count as urban green spaces officially in

Bangkok context remains unclear as various terminologies – green open space, parks, pocket parks and pocket garden – were used interchangeably throughout the interviews.

The absence of a uniform UGS definition, systematic typologies and spatial requirements has posed a practical challenge for city actors in monitoring the performance, maintenance quality and benefits delivered by UGS to local communities (Participants UP26 and UP1). When being asked about which greening policy used to inform the visioning of their organizations, professionals working in the private sector and non-governmental organizations had developed their own principles and definition of urban green spaces to guide future NbS-related projects due to the absence of institutional guidelines. This was done by integrating their personal values and understanding of urban nature with relevant principles derived from precedent greening policies developed in other global cities – i.e. Singapore, Melbourne and Amsterdam (Participants UP15, UP23 and UP26). Actors working in the public sector on the other hand, shared their roles and on-going projects in supporting community-driven stewardship efforts (i.e. food growing activity) were primarily informed by the Green Bangkok 2030 and 15-minute park that seek to increase the park provision ratio of green spaces in Bangkok. This indirectly mirrors the underlying fragmentation and lack of policy coordination within the UGS governance structure.

As a result of the absence of relevant policy instruments in combination with the lack of policy streamlining, local authorities and urban greening professionals of various sectors had been experiencing ambiguity around their roles and responsibilities, including the expectations around caring and maintenance of public green open space – i.e. pocket parks (Participants UP13, UP26 and UP27). Following up, we enquired who should be responsible for stewarding green spaces developed locally within upgraded informal settlements and whether adequate support was made available to potential stewards. Interestingly, some professionals felt that community members should be solely responsible for caring and maintenance tasks– but did not explicitly indicate how such stewardship actions and necessary resources can be sustained in the long run (Participants UP11 and UP12). These professionals believe that communities should be supported at the initial phase and 'let go' once they become capable of managing their own green space. In a similar vein, Participant 12 pointed out that community members are the local experts and more knowledgeable about their environment. Thus, not much intervention is needed from city actors to support them.

Land ownership, territorial jurisdiction and conflicting interests were underscored by urban professionals as underlying factors that would complicate the prioritization of resources for NbS stewardship efforts initiated by communities on the ground. These are deeply intertwined with the perceived values of nature of urban professionals, such that

they determine which types of NbS will get adequate environmental protection or be eradicated in Bangkok (Participant UP27 in Table 8). Each of the urban professionals we interviewed has a spectrum of interpretations and convictions regarding the NbS concept. Professionals who were proponents of NbS were likely to support community-led NbS stewardship initiatives. They believed that caring for nature is an essential part of city-making processes and achieving this would require meaningful collaborations between urban actors and local communities. Their receptivity to NbS was deeply influenced by socio-cultural factors, as 'working with nature' has always been part of Thai ways of living since the reign of King Rama 9 (Participants UP20, UP26 and UP27).

On the contrary, local authorities responsible for blue space management and maintenance still favor a hard-engineering approach over nature-based interventions. Several professionals reported that the use of concrete walls and embankments for flood control is pervasive despite their long-term ineffectiveness and destructive effects (Participants UP14, UP29 and UP30). The interviewees further explained that many city actors are either unaware or somewhat skeptical of the adoption of nature-based solutions (NbS) for urban water management for various reasons, such as its effectiveness is not immediately visible and lack of technical knowledge for maintaining different NbS types (Participants UP14 and UP29). In her projects, Participant UP29 shared that the flood walls were implemented along the riverine area was carried out without engaging affected communities in the decision-making process, whose livelihoods rely heavily on fishing and shrimp farming. Its ecological implications on the health of the riverine and aquatic animals were also overlooked (Participant UP29). Participant UP14 has called for the use of evidence-based data to address the top-down and technocratic approach to decision-making process (See Table 8).

Dimension	**Sample quotes from the interviews with urban professionals.**
Policy instrument	Participant UP15: *"Our company vision is not shaped by any nature-based solutions policy because there are no policies at all on urban green space management".*
Top-down	Participant UP14: *"I think in Thailand we work still top-down so I just think that how we do […] inclusion into the policymaking especially the evidence and data that shows nature-based solutions play a role in urban area, in the border, in the village. We may need some data that connect the evidence from that area to that nature-based solutions. And we can use that evidence to push the policymakers and for people who are in-charge […] because if you don't do the top down along with the bottom up, it won't work. They should try to understand and see the benefits off working with nature and community"*
Values of nature and competing priorities.	Participant UP 27: *"There's no separate tree ordinance, like in many other cities. There are guidelines, but there are no like, you know, hard and fast rule as to what's legal and not legal when it comes to managing trees. So that's a big problem for Bangkok and all cities in Thailand".*

	That's a big gap. So, when a government agency decides to cut down a whole tree, like the number one organization that does that is the Highway Department. When you go to the nearby provinces to Bangkok, sometimes trees cut down like by half its height or sometimes completely because they want to. They are removed completely to widen the roads. *"The Highway Department would say, I can cut down these trees because I actually planted them. And they always cite the problem of traffic, you know, accidents. So, we need, you know, more lanes on both sides. And they would write to the Forestry Department for permission if it's like a protected species. And Forestry Department would just give permission so easily."*
Environmental awareness and transparency in decision-making.	Participant UP27: *"Well, there are, yeah, there's BMA, but there's, I guess the other organization would be a government agency is the electricity. They're called Metropolitan Electricity Authority of Bangkok because the power lines are in the same, you know, as the trees. Yeah. And so, they, because they have to protect the power lines. So, they always, they have the jurisdiction over the trees as well. And they're the ones who ignore us. You know, they don't care about what they think because they think, yeah, power lines come first and trees have to be, you know, like at least one meter shorter than the power lines. So, when they cut the trees, yeah, a lot of times they cut off all the branches."*

Table 8 shows some sample quotes by urban professionals indicating fragmented NbS governance at city level.

4.2 Governance arrangement for stewardship of green and blue spaces in Rungmanee Patthana community

In this section, the findings were structured using the four domains of Policy Arrangement Approach (PAA) framework – i.e. actors, rules of the game, resources, and discourses. These domains were applied during the coding process and thematic analysis to unpack how NbS stewardship is governed by the Rungmanee Patthana community.

4.2.1 Stewardship governance of green spaces (community gardens)

Actors: The governance structure of the community gardens (Figure 16 and 17) can be described as self-organized, and each garden has a community group leader who was responsible for overseeing the progress, management, role distribution and residents' participation. Self-organized in this context implies that the community organized themselves into a group to negotiate with local authority in accessing the available vacant lot for food-growing activity. For a context, communal garden 1 was initiated by using the funds from the community savings group and applying for formal permission to use the

vacant land owned by the Crown Property Bureau for growing vegetables. For the second garden (Figure 17), it was developed on community cooperative land, thus the community group leader had to seek official permission to use the space. Other supporting actors involved in providing access to resources were the Crown Property Bureau (CPB), Thai Health Promotion Foundation, National Health of Security Office (NHSO), CODI and Wang Thong Lang District Office. These actors were not involved in the day-to-day governance of the gardens as they only supported (usually) one-off resources.

Figure 14: Community Garden 1 in Soi 5 Ramkhamhaeng 39 Road.

Figure 15: Community Garden 2 in Soi 3 Ramkhamhaeng 39 Road.

Rules of the games: The caring practices and maintenance of the gardens are mainly governed by formal and informal rules. Informal rule refers to unwritten rule that was done verbally through mutual agreement and negotiation between community members based on Thai culture and customs. For instance, an internal fine system was established by the community group leaders to encourage participation of residents in community-based activities including environmental stewardship initiatives (Participant 2B1). The rule was not intended to force people to participate because they could still negotiate some flexibility and exemption before it got to the actual fine payment (Participant 2B1). As reflected in the excerpt:

"They probably aren't always busy. We don't want problems because if someone can't participate, they have to pay a fine. We don't want them to pay a fine. If someone has a real urgent matter, they can ask for leave. Like, if they can't attend the meeting, they don't pay a fine."

Buying drinks for other members who have participated exemplifies another informal rule strongly tied to local culture - it signifies respect and token of appreciation for their time (Participant 2B1). There was also an unspoken rule about asking permission prior to collecting and sharing the vegetables with other people even if the products were accessible to everyone to avoid conflicts (Participants 1A2, 1A5 and 3C3). Based on Tatenhove et al (2000) , formal rules constitute written documents or authorized regulations introduced by actors involved to mobilize a particular political discourse or agenda. In the context of Rungmanee Patthana, there are two forms of formal rules: 1) established internally by community leaders after reaching mutual consensus with other members and 2) required by certain external funders for monitoring and knowledge transfer purposes.

Having a written record of gardening transactions enables the community to keep track of their budget and prepare themselves to secure external funding before they run out of money. When they apply for additional funding from external actors, their eligibility and continuity of the support is subject to certain requirements. The community garden 1 for example (Figure 18), the garden manager was required to produce a formal report indicating the types of vegetables that have been planted, the quantity of the produce, expenses for purchasing gardening materials and key lessons (Urban Professional 21). This requirement is fundamental not only for monitoring purposes but also for communities to demonstrate their capacity, readiness and commitment to manage their own green space in the long-term (Urban Professional 21).

Figure 16: A youth volunteer was updating the record of vegetables recipients (Source: Participant 8H2)

Resources: More support and resources were accessible for the maintenance and stewardship of the gardens than for the canals such as seed, soil, fertilizers, and financial capital. In terms of knowledge resources, academics from Kasetsart University and Thai Health Promotion Foundation representative visited the community to share knowledge about gardening technique and pest attack management. These resource provisions, however, are often short term in nature, one-off and have specific requirements that

might deter certain groups or individuals from accessing the resources. The short-term nature of the funding implies that community members would have to rely on their own income or collective financial capital to maintain their nature-based initiatives once the funding has stopped, thus indirectly imposing additional burdens to people who are already under-resourced. The participants expressed:

Participant 15A: "For the construction costs of the community garden, we received some funding for it. When the funds run out, we continue our own."

Participant 4D1: "Yes, […] budget is an obstacle because we need funds to buy equipment. When we don't have a budget, the garden ends up like this (neglected). Before, we used to grow vegetables as part of the project. When we had funds, we planted a lot of different things and shared the harvest with the neighbors."

4.2.2 Stewardship governance of blue spaces (canals)

Figure 17 Polluted canals with poor maintenance in Rungmanee Patthana (Sources: Participant 3C1)

Actors: The governance structure of the canal stewardship is fragmented and deeply intertwined with existing territorial and spatial conflicts. Although the Drainage department is responsible for maintaining the canals and drainage systems in the Rungmanee Patthana community, it has not provided support or resources to the community. The lack of its official involvement is reflected in the poor canal conditions and polluted water. Moreover, residents expressed their frustration over the lack of support and cooperation from the Drainage Department Office when they sought assistance to improve \canal conditions.

Figure 18: Community-produced map of poorly maintained canals in WangThonglang district.

Rules of the game: The ambiguity around who should be responsible for blue-space maintenance, what should be done, who the community should report to, and formal regulations by local/municipal government create barriers to local stewardship practices.

Resource: Residents did not receive as much support and resources for canal management as for the community gardens. Aside from a previous partnership with Rajabhat Institute and Wang Thong Lang district office for a big canal cleaning event, other city actors have not been involved. In terms of technical knowledge, only one academic from NIDA University visited the community to share expertise on how to make bio-ferment water to improve canal water quality. After the expert left, the community stopped using the bio-ferment water for the canals due to worsening drainage conditions that reduced its effectiveness. To add, encroachment on the canal-sidewalk by residents from nearby communities has limited the extent of residents' engagement to take care of the canal. Some residents felt that the maintenance responsibilities are not theirs, especially if they do not live close to the canal or contribute to the problems. For older adults, caring and managing the canal is labor-intensive and requires additional manpower (Participants 6F3 and 2B1).

Participant 4D1: "Back when we started taking care of the canals in 2019–2020, this canal was even dirtier. We organized efforts to get local residents involved in cleaning and contacted the district office. They came and helped dismantle the existing system. At that time, we partnered with Ratjabhat Institute and brought in professors to help survey the canal and assess the development potential. Tree branches had fallen all over the canal. […] You see this tree? It's cleaner now. But afterwards, the maintenance didn't continue. The district came, collected the branches, and took them away. The canal was cleaned from the entrance of the alley all the way to the main intersection during a Big Cleaning Day event. After that, it was left neglected again, so it returned to the same poor condition."

The disconnectedness of residents with the canals in their settlement is apparent in the wordings they used to describe the photos of blue spaces that they had submitted. The choice of words such as 'fix', 'maintain', 'repair, 'solve', and 'responsible for' signal the neglect of the underlying social-environmental problems associated with and declining conditions of the canals. One participant expressed the feelings of despair at not being able to 'fix' the root of the problem even after community members identified and mapped all the problematic canals in Wang Thong Lang district (Figure 17).

Participant 3C1: "We haven't been able to fix anything related to the canals. I've been trying to work on this issue for years. There are about 17 or 18 canals in Wang Thong Lang - small canals, klong Lam Pradongs, and such. We've mapped them all out, but it's all under the Drainage Department. When we talk to the district office, they say it's not under their control […] it depends on the Drainage Department. They control the release of water, but they don't communicate with us. When they don't release the water, it stagnates and becomes polluted. But when they do release it, things flow. The problem is they don't have a schedule, and they don't coordinate with the community. That's a key issue: the Drainage Department doesn't work alongside us on canal maintenance. So, we end up with wastewater problems in every neighborhood. We can't fix it […] it's blocked by their rules."

5. Discussion

5.1 Collective agency and circulation of caring practices in mending the broken ecologies of informal settlements.

Earlier, we underscored a collective agency as one of the fundamental intangible factors that facilitate community engagement in localized nature-based stewardship activities. In the case of the Rungmanee Patthana community, their past relationships with the land and natural environment have a profound impact on the manifestation of collective agency and the ethics of moral responsibilities for neighborhood improvements. The sense of urgency to participate in the BMK upgrading program stemming from this, though not directly about addressing the natural environment, signifies reparative and restorative acts embodied in the notion of care (Mattern, 2018; Papadopoulos et al., 2023b). As identified by Enqvist et al (2018), the interweaving of care and agency is integral for shaping the motivation and outcomes of stewardship actions. It was evident that the caring relations and collective agency established prior to the BMK upgrading times have been extended and circulated in the community through NbS stewardship practices – e.g. canal-cleaning and food-growing initiatives. The formation of community-based network facilitated by such collective agency has enabled Rungmanee Patthana residents to cope with the economic downturn caused by the Covid-19 pandemic and rely on each other for

immediate support without having to wait for government help (ACHR, 2022; National Geographic Thailand, 2025; Wungpatcharapon & Pérez-Castro, 2022).

Participants believed that caring relations established in the midst of hardship can be extended to the poorest and vulnerable groups in the neighborhood via food-growing initiatives to ensure they have access to nutritious food during difficult times. The harvests were also used by the central community kitchen during meal preparation for donation. In this sense, the community garden is an 'everyday care space' that facilitates and extends caring practices beyond its physical structure and ecological functions to sustain life conditions. This resonates with Conradson (2003, p. 508), who describes spaces of care as "organizational spaces that disclose care and facilitate practices of caring for, about and with others both human and non-human". It can be deduced that sense of collective agency and caring relations that are deeply rooted in Rungmanee Patthana community members is one of the primary enablers to local stewardship actions (Enqvist et al., 2018)

Collective agency, however, is subject to change over time as its magnitude can be strengthened or threatened by the support and resource availability provided by other actors (Krishna, 2001a; Ling & Dale, 2014). Against the backdrop of the Rungmanee Patthana community, the performance and contributions of collective agency to the outcomes and motivations for stewardship practices vary between green and blue spaces. For the communal gardens, for instance, a combination of collective agency with external support from city actors such as the Thai Health Promotion Foundation and Wang Thong Lang District Office has proven to be helpful in sustaining the community-led NbS stewardship effort. This is not to downplay the capacity and local leadership of community members, but rather to underscore the importance of governmental institutions and other actors being held accountable for their roles in supporting localized stewardship efforts (Kotsila et al., 2020; Lachmund, 2022). We are cognizant of the strong leadership possessed by the community group leaders in co-managing the gardens alongside other members.

The canal stewardship practices, on the other hand, exemplify how collective agency and local stewardship efforts had become paralyzed in the absence of support from local government. Although the community-led canal mapping symbolizes a strong sense of agency and residents' awareness of the 'broken' ecological condition of the canals, their efforts and local knowledge become invisible through the detachment of the Drainage Department from co-producing solutions with the community. Maintaining and managing green and blue spaces in ecologically challenging settings cannot be done in isolation regardless of the level and strength of collective agency in a community. This is because each community is heterogenous and has varying capacities to undertake the full

responsibilities of environmental stewardship in the city (Krishna, 2001b). A locally adapted mosaic governance arrangement that incorporates inclusive partnership is needed to prevent 'the rolling back the state to citizens" often euphemized under the name of volunteering (A. Buijs et al., 2019; Rosol, 2012; Van Der Jagt et al., 2017).

Other factors such as restricted land access and the temporal nature of land-use permissions for reappropriating vacant land, were reported as structural barriers to place-keeping efforts and community-led NbS stewardship in the neighborhood. The expressions used to describe the conditions of vacant spaces, such as 'messiness', 'eyesore' and 'overgrown lawn', mirror a certain degree of negligence and the absence of humans to care for the landscape which, Nassauer (1988, 1995, 2011) coined it as 'cues to care'. On the one hand, it also indicates feelings of frustration and a suppressed desire to provide environmental care and improve the poor state of the vacant spaces. Community members were aware of the legal implications of breaching the property rules (Figure 19). The fear of being accused of trespassing superseded their motivations and willingness to take care of the vacant lots, suggesting that there is a need to rethink the flexibility in the land use regulation in the context of upgraded informal settlements to support localized environmental stewardship.

Figure 19 shows a banner by the Crown Property Bureau, saying, "If anyone enters and places objects or businesses that disturb the rights and obstruct the use of this land, if they violate this law, the CPB will take further legal action." (Source: Hanna A.Rauf)

When reflecting on what the future holds for community-led NbS stewardship efforts in Rungmanee Patthana, the temporality aspect underpinning the land use permission for food-growing activity becomes an immediate concern. While the permission granted by the Crown Property Bureau to use the land can be interpreted as 'supportive', the lease agreement can be nullified or retracted if the garden site is subject to land speculation by private developers (Participant 3C1 and Participant UP30). This will not only discourage stewardship engagement but also disrupt the ongoing ecological reparation and soil restoration. This echoes Andersson et al (2014), who posit that differences in property rights and land tenure can influence the types of stewardship practices, people's motivations, and their willingness to learn about ecosystem management. Additionally,

land speculation can contribute to a volatile land market and 'displaceability risks' of localized nature-based caring practices to make room for urban development especially, when the level of informality is prominent (Lipietz & Comelli, 2025; UN-Habitat, 2022). Displaceability in this context denotes "the structural conditions of vulnerability or insecurity that may not result in immediate displacement through such interventions that signal a growing susceptibility to displacement – often invisible or latent until it is too late" (Lipietz & Comelli, 2025, p. 5). Under such conditions, not only is the physicality of nature-based interventions is susceptible to displacement but also the sense of agency and socio-cultural identity rooted in the traditional agricultural practices and local stewards' knowledge (Huq, 2024). The multi-faceted challenges of land tenure in advancing nature-based stewardship practices call for a more grounded, reflexive and collaborative approach to urban NbS governance – e.g. formal recognition of local needs for natural spaces in areas where informality exists (A. E. Buijs et al., 2024; Lipietz & Comelli, 2025; Wolff et al., 2022).

5.2 Advancing community-led stewardship of nature-based solutions through knowledge production.

An integrated knowledge system comprising intergenerational, traditional, and technical knowledge lays out the foundation for mobilizing localized environmental stewardship practices in the Rungmanee Patthana community. In stewardship practices, knowledge is not merely an instrument that facilitates the undertaking of sustainability actions and ecological reparation but also shapes the interplay of power dynamics in decision-making (Woroniecki et al., 2022). This is because knowledge is inherently political, hierarchical and never neutral – its production and circulation dictate whose voice matters, what counts as knowledge and what is not (Elden, 2016; Wade, 2009; Wiegleb & Bruns, 2025).

Based on the findings, intergenerational knowledge and local wisdom play a crucial role in building community resilience during the pandemic and climate-induced crisis – i.e. addressing food insecurity through communal gardens (Delina et al., 2025; Enqvist et al., 2018; Erwin et al., 2023; Petz, 2024). The passing down of agricultural and horticultural knowledge has enabled the circulation of caring practice for more than non-humans and the environment (Papadopoulos et al., 2023b; Puig de La Bellacasa, 2017). In this sense, it provides first-hand experience to community members on ways of relating to and caring for the natural environment, including maintaining soil-health. Since many first-generation residents engaged in agricultural activities when they lived in other provinces, the intergenerational knowledge they possessed is embodied in the memories and place-identities of their origins (Koyoo & Breed, 2024). By sharing such knowledge with other members, it enables older residents to establish intergenerational relations with other

members while preserving their cultural identity and place attachment (Woolrych et al., 2020, 2022). In this regard, the community-based stewardship of vegetable gardens provides a medium for older residents to sustain social participation and connectedness within their community, which benefits their well-being (Kabisch et al., 2023; Moriggi et al., 2020). Such relational experience is imperative for supporting older adults to ageing-in-place and combating negative symptoms of ageing – e.g. loneliness, dementia and social isolation (West et al., 2024; Woolrych et al., 2020). As highlighted by Bowden et al (2025, p. 4), supporting positive ageing experience allows "older people to maintain autonomy, stay connected to the established social networks and remain living in a familiar environment."

The establishment and circulation of local knowledge are integral because they enable the uptake of appropriate environmental care actions and prepare local stewards to identify and respond to changes in the socio-ecological and technical systems of the NbS being stewarded (Enqvist et al., 2018; McPhearson et al., 2022). Engaging in nature-based stewardship practices can be challenging and discouraging in the absence of experiential knowledge and know-how on gardening (Bennett et al., 2018; A. Buijs et al., 2019). Participant 6F2 for instance, was cognizant of this challenge for beginners and admitted that it was easier for him due to his prior gardening experience in the countryside. He can simply recall his thought process to explain the design rationale and measurements of the raised planting beds during the interview. The participant also believed that the challenge is manageable as people without prior knowledge or exposure to nature-based caring activities can enroll in the workshop or capacity building program organized by the District Office or Thai Health Promotion Foundation. This suggests that while alternative sources of knowledge are not necessarily inaccessible, there is a need to rethink about the extent to which potential local stewards are willing to acquire relevant knowledge prior to their engagement in nature-based stewardship practices, given their everyday priorities and time commitments. Motivation for stewardship here is required not only for undertaking an action but also for the process of acquiring knowledge needed to perform the action.

Although local knowledge is invaluable, it has some limitations that need to be complemented with technical knowledge to enhance ecological performance, especially under unpredictable weather conditions. For instance, managing pest attacks from unfamiliar insect species. The presence of external actors was beneficial in encouraging pro-environmental behavior through sustainable agricultural practices. The bio-water, for example, though it was no longer used for canal water improvement, residents still find it useful for watering the plants – exemplifying agency and self-efficacy in knowledge production. The successful maintenance of communal gardens in Rungmanee Patthana community was also contributed to by the technical knowledge shared by external actors

– i.e. Kasetsart University and Thammasat University (Participant 3C1, Participant 2B1 and Participant 4D1). The presence of external actors, however, should be treated with care and sensitivity due to the risks of perpetuating existing unequal power relations between 'experts' and 'non-experts' (Georgalakis & Siregar, 2023). This is because the process of knowledge transfer is prone to skewed narratives, such as technical/scientific expertise is mainly derived from the Global North and transferred to the South (Kamilla, 2024; Wiegleb & Bruns, 2025). The portrayal of the Global South communities as passive knowledge beneficiaries can undermine their agency and contributions in shaping environmental governance (Espinosa Garcés, 2025; Georgalakis & Siregar, 2023). Moreover, imbalanced power dynamics can lead to the disempowerment of the local community, thus discouraging them from stewarding nature-based solutions (Woroniecki et al., 2020).

In the context of upgraded informal settlements, accounting for diverse knowledge systems is integral for restoring previously degraded land and enhancing the socio-environmental benefits of environmental stewardship. The past alteration of the natural landscape in Rungmanee Patthana, such as the extensive removal of big trees and other vegetation to make room for human settlement without any alternative replanting strategy, is concerning. It reflects limited awareness and knowledge of disparities among city actors about the significance of caring for nature and its contribution to the social-ecological resilience of a city against climate impacts. This demonstrates that local knowledge is integral for enabling nature-based caring practices at the community level and informing decision-makers about the benefits of environmental stewardship in the city.

5.3 Recognizing (dis)values of urban nature alongside its benefits to improving local stewardship.

The findings point to the importance of instrumental, intrinsic and relational values of urban nature as intangible factors influencing stewardship engagement with green and blue spaces in the Rungmanee Patthana community. While it is important to recognize plural values of nature including negative values associated with it, the coverage of the disbenefits of urban nature within informal settlements remains underreported in the mainstream literature and local policies (Anderson et al., 2025; Lliso et al., 2022; L. Pereira & Bina, 2020). The intention for centering disbenefits of urban nature in environmental and housing discourse is not to discourage future greening initiatives or devalue nature's contributions to people. But instead, informing an inclusive decision-making process on the types and features of nature that may cause unpleasant experiences to the local

community and hamper their engagement in local stewardship practices(Adegun, 2018; Wessels et al., 2021).

Our study suggests that nature-based stewardship practices and environmental attitudes of Rungmanee Patthama residents are linked to how different NbS types are prioritized, valued and regulated at the national and city levels. For example, the absence of integrated NbS maintenance and monitoring guidelines, as well as tree ordinances at the city level, has contributed to the excessive cutting down of big trees by local authorities, without proper pruning and removal methods. This is often done to make room for urban development. This challenge was frequently mentioned by urban greening professionals in Bangkok during our interviews (see Table 8). At the community level, competing uses of space, falling branches into canals and roots have been used to justify the removal of big trees in informal settlements. However, such actions are often performed without the support of local arborists or suitable vegetation replacements, leading to a reduction in green canopy cover.

The absence of replanting plans in local stewardship practices can thus contribute to increased exposure to extreme temperatures and other climate risks within upgraded informal settlements. This highlights the importance of external support from local environmental organizations such as Big Trees Group to inform community-based stewardship practices for more sustainable and ecologically sound outcomes in Bangkok (Lai, 2024). Demystifying misconceptions about negative values of varying types of nature can help to increase environmental awareness of local stewards and promote better nature stewardship in the city (Frantzeskaki, 2019)

5.4 Addressing the nexus between time, environmental stewardship and gender for promoting more inclusive NbS implementation.

Residents in informal settlements are always assumed to be available or will make themselves available to participate in local environmental efforts – just because their source of income tends to be revolved around the informal economy. In reality, however, many residents do have full time employment in formal sectors and thus, time commitment to caring for community gardens is a matter of negotiation and not assumed availability. Although in the previous section some residents demonstrated a strong sense of ethics and moral responsibilities to participate in taking care of their green and blue spaces, it is important to note that the environmental care they provided is still a form of unpaid care labor (MacGregor et al., 2022). Environmental care labor is performed by people (either individually or as a community) and tends to be discounted in economic

evaluation despite the long-term duration spent on the tasks (the UN Women, 2023). In the context of the Global South, nature-based stewardship actions introduced by external stakeholders, such as multilateral agencies in pursuit of sustainability and climate resilience, become problematic when they neglect environmental care labor and the additional burdens borne by historically marginalized communities (Lambrou, 2024).

As pointed out by the UN-Women: *"Unfortunately, many projects related to climate change mitigation and adaptation such as reforestation, land rehabilitation, waste management among others, count on women and their unpaid labor as "sustainability saviors". Such approaches assume that women's time is "infinitely elastic" and an unlimited resource to sustain people and environments, often ignoring or overlooking women's own health and well-being and the many competing demands on their time."* (2023, p. 14).

The UN's argument was reflected in the case of Rungmanee Patthana, as the majority of the residents who participated in the study were women (n=25). During the photo-elicitation process, we tried to recruit male participants through the gatekeeper to balance the gender distribution, but only five men were available and engaged in the activity. In the result section, it was evident that women's participation in extending environmental care beyond the individual household was naturally expected because the conception of care within the community is still very much gendered. Such gender stereotyping can add burdens on women who are already occupied with other responsibilities, such as managing the households and child rearing (Esquivel, 2014). Although Participant 4D3 did not explicitly mention that caring for the community garden is burdensome, her statement about having to "make time" and "it is not exactly free time "subtly reflects her feelings about people's expectation of her participation.

While women's participation in environmental stewardship actions is significant, their involvement in "environmental care does not necessarily address the structural nodes of gender inequality or lead to greater gender equality" (the UN Women, 2023, p. 14). As feminist ethics of care argues, extending care to other than non-humans is not a feminine activity, but instead it is a life-sustaining practice that humans perform through the act of maintaining and repairing the world (including the environment) integral for the well-being of society (Fisher & Tronto, 1990). Therefore, acknowledging environmental care labor as one of the key components of nature-based stewardship in policy and practice is vital, because it enables city actors to grasp the types of resources and alternative arrangements needed to alleviate the burdens of local stewards in informal settlements, especially when most of the population is aging older adults.

While having older adults as active local environmental stewards would mean that they have more time to dedicate to garden care and maintenance, this does not reduce the fact

that the labor of NbS stewardship can be physically demanding and exhausting. For the construction of the garden, residents dedicated their time and physical labor to develop planter beds, prepare soil, and compartmentalize the gardening areas. The integration of raised planting beds demonstrates how locally informed design plays an integral role in enabling inclusive and age-friendly working conditions for older adult members to sustain their participation in co-managing the edible garden. Rather than being externally imposed or informed by westernized design principles, this decision stemmed from within the community, grounded in the everyday reality of who uses the space and what physical adjustments are needed to accommodate their needs. Though this may seem like common sense that comes naturally, such a user-centric consideration shows that stewardship is not merely confined to the physical maintenance of green space, but also about co-creating and repairing it in ways that mirror the local experience of community members. In this regard, the raised beds embodied a material reflection of plural knowledge systems, care, and collective agency.

5.5 The influence of fragmented urban NbS governance at the city level on the community-driven stewardship of green and blue spaces.

The fragmented urban governance of green and blue spaces presents a major barrier to the successful implementation and maintenance of NbS in Bangkok as reflected in our findings. While the fragmentation in the governance of urban waterscapes in Bangkok has been widely documented by scholars, systematic studies on urban green space governance, management and maintenance in the urban Thai context remain underexplored, including its implications on local communities (Cinderby et al., 2021; Limthongsakul et al., 2017; Marks, 2015, 2019; Marks & Elinoff, 2020; Numsuk & Dempsey, 2024). Existing green space studies are mostly concentrated in the disciplines of ecosystem services, quantitative nature valuation, feasibility studies, and flood modelling (Linh et al., 2022; Nguyen & Chidthaisong, 2024).

Firstly, the absence of a standardized definition, spatial requirement, typology, maintenance and monitoring guideline, has serious implications on how each type of NbS is prioritized, managed and cared for by both local authorities and communities. Although the importance of green spaces in the city has gained traction in Bangkok urban planning and climate resilient policies (BMA, 2017; BMA & JICA, 2013), a comprehensive institutional guideline of urban green space management, maintenance and monitoring guidelines at varying scales is not yet developed. This can trigger ambiguity among local authorities in undertaking and prioritizing environmental actions, including causing policy dissonance. It was evident from the quotes in Table 8 that the decisions to cut big trees to

make room for infrastructure development (e.g., highway lines and roads) by several governmental agencies were mainly driven by limited knowledge and not informed by any institutional policies. The protection of big trees only happens if the species is regarded as 'valuable' (instrumental values) and aligned with personal interests of the local authorities but not necessarily based on the socio-ecological benefits that it might provide to communities and the environment. This is also consistent with findings from existing studies on stakeholders' perceptions and valuation of urban nature in Bangkok (Rauf et al., 2024).

In the case of the Metropolitan Electricity Authority of Bangkok, the cutting down and pruning of big trees were done without a proper tree care and management regime in place. Instead of working in partnership with local arborists, this action was performed by external contractors with limited knowledge of handling large trees (UP27). The refusal to integrate their term of reference (TOR) with the latest tree care and management methods due to internal political conflicts will only disrupt the circulation of new knowledge to the hired contractors and communities on the ground, thus aggravating the underlying systemic challenges to urban green space stewardship in Bangkok. As shown in the excerpt from Table 8, the feeling of entitlement towards tree removals by the Highway Department just because they initiated the planting, it warrants for a formal recognition on the rights of nature to exist, thrive and protected from exploitation or exploitative practices (K. M. A. Chan et al., 2016; Mathevet et al., 2018b; McPhearson et al., 2022; L. Pereira & Bina, 2020). The lack of resistance and disapproval from other relevant authorities towards such irresponsible environmental behaviour suggests the presence of power imbalance and transparency issues within the governing structure. Overcoming this, therefore, would require a shift towards caring and relational approach in environmental stewardship governance in Thailand (Ressiore C. et al., 2025). As Jax et al (2018, p. 6) argue, advancing a caring perspective in science-based management and decision-making provides an avenue for challenging dominant policy discourse "to foreground emotional bonds between humans and nature which tend to be ignored based on instrumental reason only."

The impacts of the absence of urban green space management and maintenance guidelines on stewardship practices at the community level were apparent how Rungmanee Patthana residents managed big trees in their neighborhoods – hiring external contractors to remove them or manage the overgrown trunks. The lack of environmental care and poor maintenance continues to persist. The fragmented governance of urban green space at the city level has influenced the priority areas of resource allocation, and the preferred types of NbS get to be implemented at the local level. In this case, more resource allocation and support were made accessible by external actors for food-growing

initiatives (i.e. community garden creations) than for big trees planting and caring activities. For big trees, the management and maintenance responsibilities lie entirely on the community, including hiring external contractors. As for the blue spaces, it can be said that the dilapidated conditions of the canals, scarce resources and maintenance support by relevant local authorities are living proof of the implications of fragmented governance of urban waterscapes in Bangkok. More importantly, the resentment towards the Drainage Department, stemming from poor communication, suggests that decision-making for blue space stewardship and maintenance has always been top-down and exclusionary. Such an imbalance in power dynamics leaves residents with little room to negotiate their needs and concerns. Scholars have warned that such a top-down governance approach not only hampers the uptake of NbS and other non-structural measures for climate adaptation but also disempowers residents who have been traditionally oppressed in urban planning processes (Diep, Mulligan, et al., 2022; Rauf et al., 2021). Without meaningful collaboration between the local authority and the community, there is a risk that community-led stewardship becomes a transfer of state responsibilities to citizens. The absence of long-term support and resources can threaten and diminish the sense of collective agency, which is important for building resilience in times of adversity.

Implications

Overall, the insights from this study suggest that community-based stewardship of NbS can be adopted as a supporting strategy and streamlined in climate adaptation policies that seek to build resilience in informal settlements. Local communities possess valuable social capital (e.g. traditional horticultural knowledge), and they are capable of making meaningful contributions to resilience-building efforts in the city through their nature-based caring efforts. To materialize this in practice, formal recognition is required of their significant roles and contributions as local environmental stewards by the government and other city actors working at the nexus between climate-care, urban greening and housing. Secondly, fragmented governance can undermine existing local environmental stewardship efforts and can lead to a lack of interest in community engagement. For instance, the disengagement of the Drainage Department from the community even after they have proactively mapped all the problematic canal conditions in Wang Thong lang district has triggered frustration to continue their stewardship efforts. Such frustration can instill the feeling of being uncared for, unimportant, and invisible in the minds of community members. As a result, it can threaten the psychological resilience of the community in times or when facing climate-related disasters. These insights also suggest the need for the formation of a learning alliance among city actors that would help in overcoming differences and misaligned priorities to support community-based greening efforts within upgraded informal settlements.

Potential limitations of the study

While this research provides rich insights into community-based stewardship of urban NBS in the context of informal settlements, there are several limitations that should be taken into consideration.

Since the research adopts an in-depth case study approach in Bangkok, Thailand, the generalizability of its findings to other urban informal settlements might be constrained as stewardship practices are context specific. Each settlement is subject to its own social-ecological and technological conditions.

Cultural background of the researchers and language barriers might lead to a researcher interpretation bias when analyzing and interpreting data despite going through triangulation processes – the researcher may unconsciously impose their own understanding and presumptions onto the data.

The use of qualitative methods such as photo-elicitation and semi-structured interviews might produce social desirability bias in that participants would provide photos and responses that depict them in a positive light.

The time constraints of the PhD fieldwork and visa requirement for international students in the UK may have limited the opportunity to be fully immersed in observing and exploring other practical challenges of community-based stewardship.

6. Conclusions

This study underscores the significance of community-led stewardship in advancing the implementation of nature-based solutions (NbS) for building climate resilience within upgraded informal settlements. The findings demonstrate that community-based greening efforts such as tending to community gardens not only help to restore soil health but also serves as important social infrastructure of care to sustain human well-being including in times of crisis (Wungpatcharapon & Pérez-Castro, 2022). Such a stewardship initiative creates spaces of collective care - deeply grounded in relational values, community bonds and intergenerational knowledge exchange (Conradson, 2003; Enqvist et al., 2018). Values of nature (mainly instrumental and relational) and co-benefits of NbS are among the key drivers that motivate residents to engage in local stewardship actions. Other factors such as access to resources – i.e. knowledge, funding and time – can influence the extent of community involvement and continuity of local greening efforts. Major deterrents such as fragmented governance, weak support from local government and environmental care labor (especially for women) can disrupt the mobilization of stewardship actions and discourage

people from caring for their local environment. This points to the need for an equitable and gender-responsive approach in supporting nature-based caring practices in informal settlements (Chopra & Krishnan, 2022; the UN Women, 2023). City actors should embed future nature-based interventions in local realities and aspirations to prevent the erasure of on-going community-based stewardship efforts and minimize risks to disadvantaged communities (MacGregor et al., 2022). Understanding existing stewardship capacity and arrangements is critical not only for unlocking the multi-functional potential of NbS but also to prevent the intervention from becoming a “white elephant (or even a liability) for the communities that it is intended to benefit” 4/20/26 11:03:00 AM.This includes identifying how local stewards have been maintaining and intend to take care of urban nature within their settlements (Diep, Mulligan, et al., 2022). To ensure the continuity of local stewardship efforts, it is imperative for city actors to adopt a reflexive governance model that is ingrained in caring and relational approach which can then be integrated in environmental and housing upgrading policies (Ressiore C. et al., 2025; Van Der Jagt et al., 2021; West et al., 2024).

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Appendices

Appendix A: Guideline for photo-taking activity

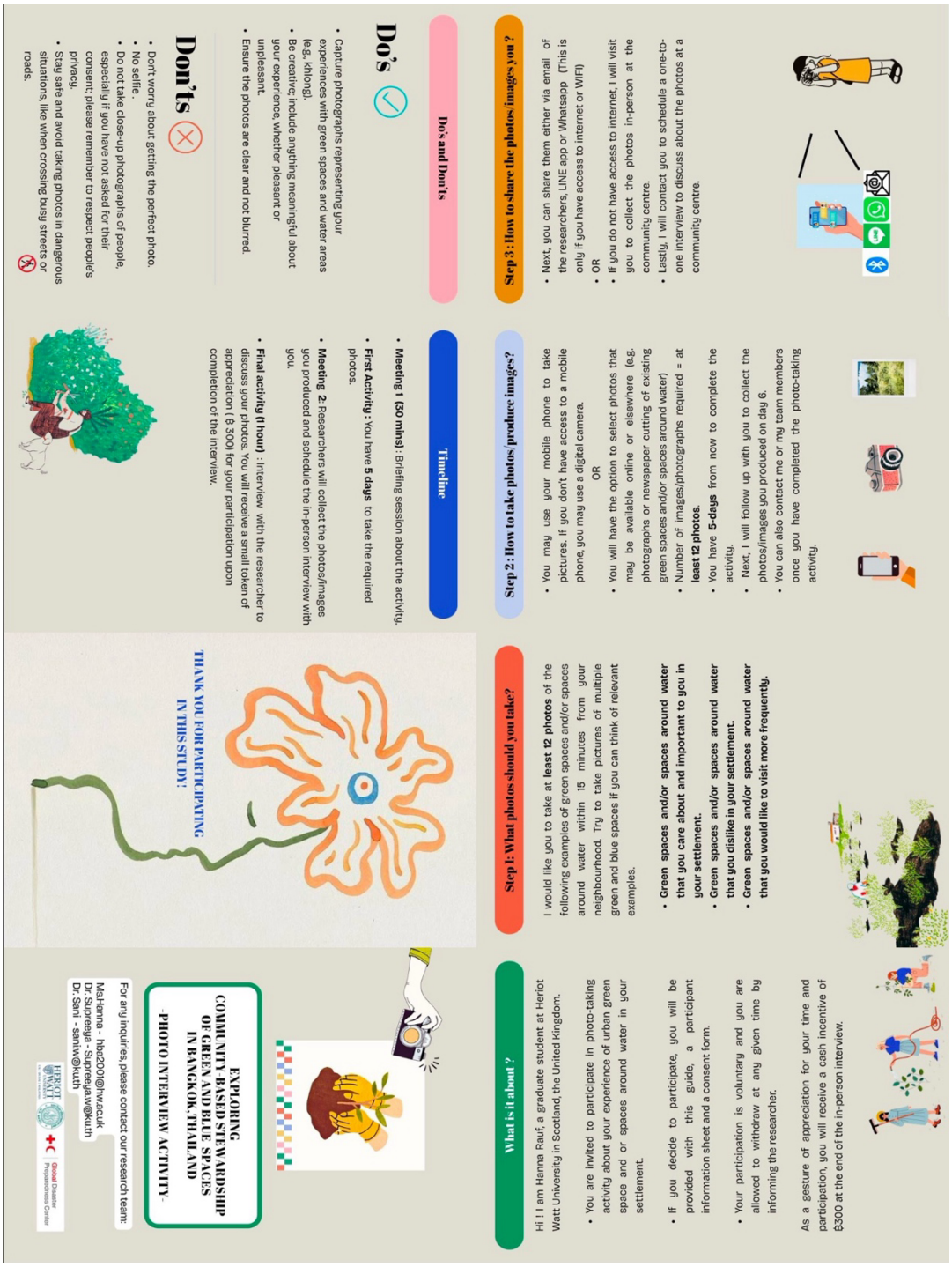

Figure 20: Photo-elicitation guide (English version)

Figure 21: Photo- elicitation guide (Thai version)

Figure 22: Photo-elicitation guide in final zine form (Thai version)

Appendix B: (Photo-elicitation: Interview questions)

Research objectives	RO1: To identify both tangible and intangible factors influencing community-based stewardship and its continuity.	RO2: To explore alternative arrangements that support the mobilisation of community-based stewardship	RO3: To facilitate a horizontal learning exchange between multiple stakeholders on improving local stewardship of NbS
Analytical lens	Actors, Resources, Rules of the game, Discourse + Motivation, Ethic, Action Outcome | Knowledge, care and agency?		

The choice of analytical lenses to structure the interview questions was informed by four key dimensions of the Policy Arrangement Approach (PAA) - actors, resources, discourses, and rules of the game - as developed by Van Tatenhove et al. (2000). These lenses were then integrated with four elements from the stewardship framework by Enqvist et al. (2018), namely motivation, care, agency, and outcomes. The PAA has previously been adopted to examine the success factors of gardens for social resilience in the European context (Van der Jagt et al., 2017). Since informal settlements are grounded in local realities and everyday life practices, such a combination of analytical lenses is essential to explore the complexity of influencing community-based stewardship in the Global South.

Prompts for taking photographs

Green and/or blue spaces that you care about and are important to you in your settlement.

Green and/or blue spaces that you dislike in your settlement.

Green spaces and/or spaces around water that you would like to visit more frequently.

Step 1: Opening questions

Ask participant to reflect on the photos (SHOWeD method adapted from Wang,1999, p.1888)

Why did you take this photo?

What does this show?

Step 2: Proceed with the follow-up questions

Care =Motivation + Ethic

Why are the greenspaces /canal-side spaces in these photos important to you?

What makes you dislike the greenspaces /canal-side spaces in these photos? Why do you feel that way?

Have you ever felt connected to plants, animals, or land in any of these spaces? How would you describe that connection?

How frequently do you visit and use these spaces? Why is that?

Ethic

How have you been using and maintaining the greenspaces /canal-side spaces in these photos?

Do you see yourself as having a responsibility towards these spaces? Why/Why not?

Action

What actions have community members taken to engage with and care for these spaces?

What factors have influenced community involvement in such action?

Actors (roles and responsibilities –e.g. fundraising, lobbying, engaging community)

Who else is involved in this initiative, and what are their roles?

Which stakeholders have recognized and supported the efforts of community members in caring and maintaining these spaces? What were their roles?

Rules of the game (e.g. interaction, participation, and decision-making rules)

Who owns the spaces shown in the photos, and how was the land access for greening activity obtained from the landowners?

How does the community decide who gets to use the space and manage the space?

Have there ever been situations when how community operates the initiative was different from what the government or authorities expected? If yes, how did the community deal with that?

What approach was implemented to navigate potential conflicting interests among community members (e.g. the use of shared space or management preference).

Resources (e.g. material, financial, knowledge, training)

What materials and equipment are needed to maintain the spaces in these photos? (*Materials refer to seed, fertilizers, soil, watering/irrigation tools, plant container and garden beds, gardening tools, wheelbarrows)*

How have the costs for materials, tools and maintenance been supported or funded, and by whom?

What major challenges does your community face in accessing these resources?

Can you explain how people learn about which materials and techniques to use in maintaining these spaces?

Have there been any training or workshop about managing greenspaces provided by external organizations for community? If yes, could you please elaborate on this?

Are there any incentives for people to initiate or engage in managing and maintaining the greenspace/canal-side spaces in your neighborhood? (Why/Why not?)

Discourse (shared ideas, meanings and narratives within the initiatives)

What is the vision for the initiative?

How do people in your community feel about participating in these green initiatives?

How do the visions on the initiative of the community members differ from those of external actors/groups (such as NGOs, universities, donors or local government)?

Outcomes (e.g. social, environmental, well-being)

What are the benefits of engaging with and caring for the greenspaces /canal-side spaces in your settlement?

Have you noticed any improvements in your local environment and overall well-being as a result?

Can these benefits be evidenced in any way?

Closing questions

Is there anything else you would like to add/share about your experience of the greenspaces /canal-side spaces in the settlement that we have not covered.

Appendix C: Interview guide for urban professionals/practitioners

Version 1: (If the participant/organization is involved in supporting community-based initiative)

Examples of profession/organization: BMA/CODI/NGOs

Introduction:

Could you briefly describe your role and responsibilities within your organization?

Does your organization support vulnerable/low-income communities with their initiatives focusing on caring for green spaces or canal-side areas?

Could you name these initiatives?

How and why did they start?

Follow-up questions:

How has your organization supported these communities? What projects or programs has your organization implemented to support or facilitate such initiatives?

What is the vision and goal of the project/program?

What regulations and policy mechanisms have been in place to guide this project?

What has your role and contribution been in the project/ program?

Who are the key actors involved in shaping the project or program?

What key resources or support are being provided to community members?

Have you ever encountered situations where community members' visions and expectations differed from those of your organization when supporting their initiatives?

Have you or your organization faced any challenges or barriers in supporting community-based initiatives? How were these overcome?

Upon completion of the projects or programs, have there been any monitoring efforts to ensure the continuity of the community-based greening initiatives?

Do you see any value or benefits in working alongside these communities to promote the engagement and management of blue-green spaces in their settlements?

Closing:

Before we finish, is there anything else you'd like to add — anything we haven't covered that you think is important?

Version 2 – (If participant is not involved in supporting community-based initiatives)

Example: Private sector/social enterprise/ civil society/ researcher

Introduction:

Could you briefly describe your roles and responsibilities in your organization?

What projects or programs has your organization implemented to support/promote urban greening efforts in Bangkok?

How and why did it start?

In these projects/programs that you just mentioned, how has the progress/benefits experienced by the users been monitored/assessed?

Follow-up questions:

Does your organization also get involved in supporting vulnerable communities with their greening initiatives that focus on caring for green spaces or canal-side areas? E.g. (creation of community gardens/pocket parks/ /river revegetation)

Potential response: No

Proceed to the following questions:

Are you aware of any successful/unsuccessful community-based greening initiatives involving urban green space/canal-side areas? Could you share a few examples of these?

What makes you think that these initiatives have been successful or unsuccessful?

In your opinion, who are the key actors involved in enabling and shaping community-based greening initiatives?

What role do you think your organization could play in supporting or facilitating such community-based initiatives in the future?

Do you see any possibilities for your organization to support low-income communities/vulnerable communities -such as the Baan Mankong communities - in their greening initiatives?

If yes: In what ways?

If no: What factors or barriers might prevent it?

In your opinion, what are the values or benefits of working alongside communities to promote the management of blue-green spaces?