Optimizing Ecosystem Services in Bangkok: A Framework for Integrating Informal Green Spaces on Wastelands within the Bangkok Metropolitan Administration's Green Space Policy

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Abstract

This research addresses climate change mitigation by closely examining the Green Space Policy of the Bangkok Metropolitan Administration (BMA). While the current projects focused on carbon absorption in green spaces incur significant costs and carbon footprints, this thesis proposes an innovative urban management plan. The plan aims to create cost-effective and eco-friendly green spaces by harnessing spontaneous vegetation on wastelands.

The central question of this research revolves around enhancing Bangkok's green space policy to incorporate wastelands, which play a crucial role in preserving urban ecosystems. The study employs a three-step methodology, involving a comprehensive review of the BMA's policy, an on-site public survey capturing perceptions of informal green spaces, and expert interviews to identify challenges and mechanisms of integration.

Contrary to initial negative perceptions, the public survey reveals that wastelands are perceived as essential for addressing environmental issues. Expert interviews underscore the importance of public-private collaboration due to limited government resources and private sector ownership of informal green spaces. However, there is a notable absence of legislative support for such collaboration.

In conclusion, the study highlights the potential of integrating wastelands as alternative green spaces in Bangkok. Informal green spaces offer advantages such as accessibility, distribution, low costs, and existing ecosystem services. The study emphasizes private sector collaboration as a strategic avenue for expanding green space. It provides a collaboration framework for informal green space policy guidelines aligned with the BMA's strategy. Future research should delve into mechanisms of public-private collaboration and assess urban residents' perceptions across diverse locations in Bangkok, aiming to formulate concrete strategies for seamlessly incorporating spontaneous nature into the cityscape.

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Statement of the authenticity of the material

This thesis contains no material which has been accepted for the award of any other degree or diploma in any institution and to the best of my knowledge, and belief, the research contains no material previously published or written by another person, except where due reference has been made in the text of the thesis.

_____ (Sorat Sitthidumrong)

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List of Abbreviations

AQI	Air Quality Index
BMA	Bangkok Metropolitan Administration
DBH	Diameter at Breast Height
DCDS	Direction of Sea Breeze
DTCP	Department of Town and Country Planning
FAR	Floor Area Ratio
GCR	Green Coverage Ratio
G&M	Governance and Management
GIS	Geographic Information System
HSA	Healthy Space Alliance
LST	Land Surface Temperature
LULC	Land Use and Land Cover
MLP	Multi-Layer Perceptron
MRT	Metropolitan Rapid Transit
NBS	Nature-Based Solutions
NDVI	Normalized Difference Vegetation Index
NGO	Non-governmental Organization
NSO	National Statistical Office of Thailand
ONEP	Office of Natural Resources and Environmental Policy and Planning
OSM	Open Street Map
PES	Payment for Ecosystem Services
POPS	Privately Owned Public Space
SUHI	Surface Urban Heat Island
TALA	Thai Association of Landscape Architect
UHI	Urban Heat Island
USGS	United States Geological Survey
UPE	Urban Political Ecology

1. Introduction

Bangkok, home to approximately 11 million people, has emerged as one of Southeast Asia's extensively urbanized cities in 2023. However, the rapid urbanization has taken a toll on the city's natural spaces, leading to severe ecological degradation. The sprawling urban landscape, fueled by a rapidly growing population, has encroached upon agricultural fields and natural habitats, resulting in a significant decline in ecological diversity over the past two decades. Despite these challenges, Bangkok has recently taken a commendable step forward by introducing the urban green movement policy. This policy aims to develop a climate change mitigation plan and transform the city into a carbon-neutral urban center. This initiative has sparked debate, attracting attention for its potential to enhance the environment and improve the city's overall image.

The primary focus of this thesis is to propose an approach for creating green infrastructure within Bangkok with the goal of enhancing urban nature. The study aims to identify ways to establish a sustainable ecosystem capable of providing essential ecological services. Nurturing such an ecosystem can create a healthier and more balanced urban environment, promoting environmental justice for all residents. The integration of urban nature into the cityscape will not only benefit the environment but also contribute to the well-being of its residents. Access to green spaces and nature has been shown to positively impact mental health and reduce stress levels among urban dwellers. By prioritizing green infrastructure, Bangkok can create a healthier and happier community, ultimately improving the overall quality of life.

1.1 Problem Statement

The degradation of natural spaces and ecological diversity in Bangkok over the past decade, driven by rapid urbanization, poses a critical challenge. Unchecked overdevelopment has resulted in urban sprawl, encroaching upon crucial agricultural fields, and depleting natural resources.

In response to the imperative of a climate change mitigation plan, Bangkok aspires to become a carbon-neutral city by 2065. To achieve this goal, the city has launched an urban green movement, aiming to enhance carbon absorption capacity and expand public green spaces. While this initiative appears promising for combating climate change, the redevelopment of urban green spaces entails substantial investments and contributes significantly to the carbon footprint. The Bangkok Municipal Administration (BMA) allocates a substantial budget to develop formal green spaces like public parks and pocket gardens. However, the construction and maintenance processes for these formal green spaces require substantial resources, including construction materials, electricity, and water supply. As a

result, the development of formal green spaces is likely to generate a substantial carbon footprint, creating a paradox by contradicting the initial goal of mitigating carbon emissions.

1.2 Research Questions and Hypothesis

The green urban movement, while promising for enhancing urban environments and ecological services, presents challenges, particularly concerning carbon footprint and extensive investments required for public parks' development. To address this, the BMA must explore innovative approaches for creating sustainable green spaces. ***This essay hypothesizes that wastelands, such as vacant lots, street verges, and brownfields, which already see public activity, hold potential for implementing sustainable ecosystems that reduce the need for excessive construction and maintenance budgets.***

The research question is ***how to enhance the green space policy guidelines in Bangkok, enabling wastelands to play an important role in conserving ecosystems in urban areas?*** The proposed question aims to improve the BMA's green policy and devise strategies to develop green spaces that consume a low budget and a low carbon footprint, allowing nature to regulate itself. To achieve BMA's green space enhancement, it is necessary, firstly, to determine the districts that urgently need more green space to support urban life. Moreover, this research needs to know the relationship between wastelands and urban communities, including perception and preference. Lastly, to understand the possibility of persuading wastelands to become urban green spaces, this research needs to find out what the policy mechanisms and management are to encourage public and private sectors to develop green space over wastelands.

To advance the enhancement of BMA's green space initiatives, the research will focus on three key aspects. *Firstly, identifying districts with urgent green space needs is crucial for supporting urban life effectively. Secondly, understanding the relationship between wastelands and urban communities, including perceptions and preferences, will provide insights into community engagement. Lastly, investigating the policy mechanisms and management strategies to encourage public and private sectors to develop green spaces over wastelands will shed light on the practical steps needed for successful implementation.* This holistic approach aims to refine the BMA's green policy and create strategies that prioritize low-budget, low-carbon-footprint green spaces, allowing nature to self-regulate within the urban landscape.

2. Literature Review and Theoretical Framework

The aim of the research is to improve green space policy in Bangkok by utilizing wasteland to conserve ecosystems within urban areas. Thus, the literature review chapter of the paper focuses on the multidisciplinary field involved in urban environmental issues. The paper explores the topic of urban nature to comprehend the composition and structure of ecosystems that have the potential to provide ecosystem services. This chapter also studies the relationship between urban nature and urban society to understand how people in the city interact with nature. Finally, this chapter highlights the practices of urban nature management that have been successful in urban areas worldwide. The outcome of this chapter establishes a theoretical framework for further research development.

2.1 Urban Nature Supply and Demand of Ecological Service

2.1.1 Urban Nature and Urban Ecology

The challenge of urban growth poses a significant hurdle in providing sufficient green space for public health, intensifying the strain on urban green areas and leading to a concerning loss of biodiversity(Rall *et al.*, 2017, p. 81; Bonthoux *et al.*, 2019, p. 164). Urban nature serves as a critical strategy for fostering sustainability within cities by offering ecosystem services, enhancing aesthetics, and providing recreational opportunities (Breuste, 2022, p. 83). This strategy can effectively harness the potential of underutilized and developed urban areas, with vegetation playing a central role. Urban nature emerges as a potent solution to combat the adverse effects of urbanization, such as urban heat islands, air pollution, and stormwater runoff, with elements like green roofs, walls, and vegetative cover effectively mitigating these impacts (Breuste, 2022, p. 283).

The intricate tapestry of urban nature is shaped by a complex interplay of human physical environments, activities, and historical influences, resulting in a landscape characterized by reduced species diversity and unique ecological conditions (Breuste, 2022, p. 23). However, sustainable urban nature is a crucial source of ecosystem services that directly contribute to human well-being, encompassing provisioning, regulating, cultural, and supporting services derived from ecosystems such as forests, wetlands, and oceans (Rall *et al.*, 2017, pp. 80-81). The dynamics and processes of urban nature find their roots in urban ecology.

Urban ecology, an interdisciplinary field, scrutinizes the intricate relationships between organisms and their environment in urban settings. It seeks to unravel the multifaceted effects of urbanization on biodiversity, ecosystem services, and human well-being while charting out strategies for sustainable urban development (Carreiro, Song and Wu, 2008, pp. 10-11). The

urban landscape ecology approach meticulously dissects how human activities, land use patterns, and ecological processes interweave to shape urban environments. It does so by considering ecological, social, and economic dimensions, ensuring that urban planning and management are sustainable and resilient (Carreiro, Song and Wu, 2008, p. 24). This collaborative approach relies on landscape ecology concepts to decipher the structure and function of urban ecosystems, underscoring the importance of cooperation to address intricate environmental challenges. Nevertheless, it has faced criticism for sometimes sidelining the ecological aspects of urban areas (Carreiro, Song and Wu, 2008, pp. 18-21).

The Four Natures framework delineates urban nature into four distinct categories based on their characteristics and origins: nature remnants, agrarian landscapes, designed urban greenspaces, and novel wild urban ecosystems (Breuste, 2022, p. 121). These categories span the spectrum from pristine, untouched ecosystems to novel environments forged by human activities, encompassing varying degrees of ecological novelty and non-native species abundance (Kowarik, 20183, p. 337)

Pickett *et al.* (2016, pp. 1-5) introduced two paradigms in the realm of urban ecology: "ecology of the city" and "ecology for the city." The former emphasizes the intricate interplay between social and bio-geophysical elements in urban ecosystems, underscoring the importance of mapping social features and variables for comprehensive integration (Pickett *et al.*, 2016, p. 9). It establishes a critical link between ecological science and civic processes, highlighting the necessity of stewardship and collaboration with citizens and decision-makers (Pickett *et al.*, 2016, pp. 5-8). The latter paradigm necessitates a transdisciplinary approach involving researchers, practitioners, decision-makers, and residents in dialogues about ecological knowledge. Stewardship, citizen engagement, and the pursuit of sustainability in urban systems emerge as pivotal factors in understanding urban ecosystems (Pickett *et al.*, 2016, pp. 5-6).

2.1.2 Ecosystem Services Supply and Demand

Natural ecosystem services are pivotal in enhancing human health and well-being, particularly in urban settings. Urban green spaces, for instance, offer an array of benefits, including the promotion of physical activity and stress reduction, as well as the purification of air and water, which can help prevent respiratory and other diseases (Breuste, 2022, p. 106). Moreover, conserving and restoring natural areas within urban environments can yield substantial reductions in healthcare costs (Breuste, 2022, p. 265). Overall, urban ecosystems offer an invaluable combination of services, encompassing clean air and water, climate regulation, and recreational opportunities, all essential for sustaining human life and enriching cultural experiences (Breuste, 2022, pp.124-125).

These ecosystem services can be broadly categorized into four distinct types: provisioning, regulating, supporting, and cultural (Breuste, 2022, pp. 102-115). Provisioning services involve extracting essential resources like food, water, and fuel from ecosystems. Regulating services arise from natural ecosystem processes, such as water purification and pollination (Breuste, 2022, p. 109). Supporting services are fundamental for producing other ecosystem services, facilitating nutrient cycling and soil formation (Breuste, 2022, p. 106). Lastly, cultural services provide non-material benefits, including aesthetic enjoyment and the acquisition of natural knowledge, enriching the human experience. The synergy among these four categories ultimately delivers significant advantages to human societies (Breuste, 2022, pp. 102-115).

Although urban ecosystems can provide a range of benefits, they are generally less efficient than self-regulating ecosystems (Breuste, 2022, p. 105). Factors such as habitat fragmentation, pollution, and land use changes influenced by social and cultural factors can impede their effectiveness (Breuste, 2022, p. 264). One pressing issue is transforming green areas into various land uses, sparking conflicts within urban green spaces. These conflicts can be triggered by clearing, reducing green spaces, increasing noise and disturbances, and competing interests among various user groups (Onose *et al.*, 2023, p. 557). Furthermore, the exploitation of weak legislative frameworks, limited public institutional capacity, and a lack of public interest by private investors can lead to the fragmentation and conversion of green spaces into residential, commercial, or office spaces (Onose *et al.*, 2023, p. 565).

To address these challenges, urban planners and policymakers must consider the "demand and supply" concept for ecosystem services (Breuste, 2022, p.114). Tools like mapping and GIS analysis can help identify mismatches between the demand and supply of these services (Wang *et al.*, 2023, p. 8). Accessibility to green spaces and environmental resources can serve as indicators for assessing the supply of ecosystem services. The availability of ecosystem services enhances the quality of life and creates economic opportunities by attracting visitors and increasing property values (Kowarik, 2018, p. 344). On the other hand, understanding the demand for ecosystem services requires considering factors like age, income, education level, and population density. Market segmentation can further help identify specific demands of various recreational groups based on individual characteristics and preferences (Wang *et al.*, 2023, p. 8). This approach allows for a more tailored approach to satisfying urban nature-related demands (Breuste, 2022, p. 115).

Urban authorities must prioritize providing ecosystem services that align with the demands of their residents. Unfortunately, many cities, particularly in developing countries, struggle to meet the growing demand for land in urban areas, reducing green spaces and ecosystem services that can adversely affect the health and well-being of urban residents (Breuste, 2022, p. 188). The ecological dimension is also crucial for enhancing urban planning

and governance approaches. Urban planners can focus their efforts more effectively by identifying the supply of natural areas or elements within cities that can fulfill ecosystem services demands from urban societies (Kowarik, 2018, p. 345).

Furthermore, taking into account the third dimension, which involves factors like height, volume, and shading effects of urban elements and greenery, “researchers can gain a deeper understanding of how these factors influence local and global ecological processes within urban environments” (Alavipanah *et al.*, 2017, p. 375). However, it is essential to note that while ecosystems can provide a local "cleaning effect," they should not be solely relied upon to mitigate negative effects or absorb pollutants; instead, urban ecosystems should prioritize reducing emissions at their source (Breuste, 2022, p. 110).

2.1.3 Environmental Justice

Urban green spaces require a more in-depth examination as their spatial and social features are not yet fully understood (Onose *et al.*, 2023, p. 557). Changes in urban land use can cause environmental conflicts that may affect vulnerable groups (Onose *et al.*, 2023, pp. 556-557). Unequal development in urban areas could lead to environmental injustice due to the uneven allocation of ecosystem services and overcrowding of populations (Rall *et al.*, 2017, p. 89). "Environmental justice" aims to “ensure that all people have equal access to a clean environment and protection from environmental harm,” regardless of their socio-economic factors. “Urban green spaces are crucial for promoting health, mental, and well-being,” particularly for low-income and minority residents in areas with higher levels of pollutants or undesirable land uses (Kabisch and Haase, 2014, p. 130). Therefore, there is a need to ensure that urban green spaces are fairly distributed among the various social groups to enhance urban health.

The principle of environmental justice can be a crucial criterion for shaping green infrastructure development. Researchers emphasize three dimensions of socio-environmental justice: fair distribution of green spaces among social groups, transparent and participatory decision-making, and fostering respectful relationships among stakeholders. This review highlights the consensus that integrating environmental justice principles into urban planning is essential for equitable green infrastructure development (Kabisch and Haase, 2014, pp. 130-131). "Formal green spaces refer to public parks and gardens that are well-organized and maintained,” may not be enough to serve residents in densely populated areas. Local governments may also lack the resources to develop new urban parks (Rupprecht *et al.*, 2015, p. 2). Enhancing sustainable green spaces on vacant land in neighborhoods with limited access to urban green spaces can address environmental inequities. Utilizing vacant land for cost-effective green space development can address environmental inequality and improve

the quality of life for disadvantaged communities (Riley *et al.*, 2018, p. 6). Vacant land enhancement not only has the potential to provide ecosystem services, such as tackling atmospheric pollutants and urban heat islands, but it can also enhance environmental justice by distributing access to green spaces to urban residents (Bonthoux *et al.*, 2019, p. 171). Furthermore, this can increase accessibility, promote social cohesion, and provide ecological and sociological benefits, ultimately leading to improved health outcomes and stronger community relationships (Riley *et al.*, 2018, pp. 7-9).

Uneven urban green space distribution may have negative consequences for urban residents, especially vulnerable groups like low-income individuals. Undersupplied green spaces can exacerbate health inequalities and contribute to social exclusion (Kabisch and Haase, 2014, pp. 132-134). "Green reparations," proposed by Draus *et al.* (2020, p. 2), aim to promote social fairness and combat environmental injustice. The approach involves identifying areas and communities that lack access to green spaces and improving such spaces on wasteland. The idea is to focus on areas and populations most affected by these issues, with a particular emphasis on frontline communities affected by industrial harm and pollution. This concept is often associated with demands for a "Green New Deal" (Draus *et al.*, 2020, p. 6). However, enhancing green space can lead to "green gentrification," negatively affecting local people, especially the most vulnerable groups. Therefore, it is crucial to consider the potential impacts of green space projects on different populations and develop strategies that promote social equity and environmental justice (Draus *et al.*, 2020, p. 14).

Horizontal policymaking can help avoid green gentrification by involving local communities in decision-making. Involving local communities in the planning process can also “build trust, social capital, and a sense of ownership and investment in the green space,” leading to increased use, maintenance, social cohesion, and community pride. Additionally, bottom-up policymaking can promote social and environmental equity by ensuring equitable distribution of green spaces across different neighborhoods and communities, addressing historical patterns of disinvestment and environmental injustice, and promoting access to green spaces for all community members (Draus *et al.*, 2020, p. 12).

2.2 Novel Ecosystems and Informal Green Space

2.2.1 Novel Ecosystem and Urban Wilderness

"Novel ecosystems" refer to human-influenced ecosystems that result from replacing non-native species in urban areas (Ioja and Qureshi, 2023, p. 194). Novel ecosystems can be considered 'urban wilderness' areas if they meet certain criteria. These ecosystems environments need to be considered in biodiversity conservation, with interventions to enhance human access and support populations of animals or plants of conservation concern.

Novel ecosystems can be integrated into the urban green infrastructure, including small plots of land and post-industrial landscapes, and can benefit cities (Kowarik, 2018, p. 339).

Novel ecosystems or urban wilderness is usually a non-human intervention that provides habitat for rare or endangered plant and animal species. 'Self-organization' is the ability of novel ecosystems to regulate themselves without external intervention. Self-organization is possible through interacting with ecosystem components without human interference (Kowarik, 2018, p. 339). The "natural succession" process involves creating self-organized states within urban environmental communities. This process comprises four stages: pioneer, early successional, mid-successional, and late successional. Each stage presents a unique mix of plant species, with the late successional stage having the highest biodiversity and ecological complexity level. Understanding these stages is crucial to effectively manage and preserve urban wilderness areas, which can ultimately develop into complex and diverse ecosystems with valuable ecological and cultural benefits (Breuste, 2022, pp. 112-121). The novel ecosystems can potentially support urban biodiversity, ecosystem services, ecological restoration, and conservation. Although novel ecosystems are often undervalued economically, there is growing recognition of the importance of preserving and promoting their ecological value to human inhabitants (Draus *et al.*, 2020, p. 13).

Ecologist Ingo Kowarik argued that novel ecosystems and urban wilderness can be valued and promoted in urban planning through urban wastelands. Novel ecosystems are an alternative concept of urban nature conservation, promoting the design and maintenance of wasteland parks to develop new urban promotion strategies (Lachmund, 2013, pp. 165-178). “Novel ecosystems are crucial for providing valuable ecosystem services such as carbon sequestration and air and water purification, and biodiversity.” Novel ecosystems also offer cultural ecosystem services like recreation, education, and spiritual renewal. However, these areas are often overlooked in international studies, limiting our understanding of their contribution to human well-being in cities (Breuste, 2022, p. 26).

Novel ecosystems and urban wilderness areas are essential components of urban nature due to their proximity to the population and the cultural ecosystem services they provide. They offer unique opportunities to experience nature differently than in parks and green spaces. However, local residents often reject them as a sign of decay and disorder, so it is vital to create acceptance for them in the community (Lachmund, 2013, p. 164). Providing physical and mental access to urban wilderness areas through planning, interactive acceptance development, and citizen participation is crucial. Integrating urban wilderness areas into green planning, green infrastructure, urban biodiversity strategies, and sustainable urban development can create liveable cities and reconnect urban dwellers with nature (Breuste, 2022, p. 286).

2.2.2 Opportunity of Wasteland for Urban Nature

Urban vacant land is often seen as wasted space due to a lack of knowledge about its potential uses and a failure to systematically categorize it. This view has led to limited design, planning, and management of these lands, resulting in a missed opportunity (Kim, Miller and Nowak, 2018, p. 145). Wasteland refers to land that is not being used to its full potential. Factors such as a lack of investment or incentives for redevelopment can cause wasteland to become abandoned. Abandoned buildings and dumpsites on vacant land can negatively impact residents and their community's image (Kim, Miller and Nowak, 2018, p. 154).

Wastelands can be valuable natural resources that benefit urban residents. They are not just empty spaces but contain dynamic ecosystems. Kowarik highlighted wastelands as unique natural resources and promoted authentically wild urban park spaces in Berlin (Draus *et al.*, 2020, p. 5). Restoring natural ecosystems and creating green infrastructure can improve abandoned wastelands and promote connectivity between urban wildlands, supporting city biodiversity conservation. Developing and maintaining novel ecosystem areas can also enhance living quality for urban residents and promote sustainable urban development (Breuste, 2022, pp. 284-302 ; Ioja and Qureshi, 2023, p. 198).

'Urban wastelands' can become novel ecosystem areas characterized by self-regulation in ecosystem processes and negligible human impact. In Germany, "stadtbrachen" refers to a vegetated urban wasteland that emerged in abandoned urban areas (Kowarik, 2018, p. 340). Berlin's landscape program assigns a high conservation value to stadtbrachen and considers them a vital biotope space to be preserved and developed into new green infrastructure. Stadtbrachen can support natural processes and contribute to urban biodiversity conservation (Kowarik, 2018, p. 345). Allowing vegetation to grow freely on wasteland can enhance urban ecological diversity and provide sanctuaries for wildlife, thereby having positive ecological impacts in urban areas (Kim, Miller and Nowak, 2018, p. 145). Although Abandoned land can undergo ecological succession, various factors need to be considered, such as contaminants, land use, and management choices (Nassauer and Raskin, 2014, p. 274).

"Verwilderung," a German concept of 'rewilding,' refers to developing novel ecosystems or wilderness in the wasteland (Kowarik, 2019, p. 15). Preserving wasteland areas in the inner city and designating them as nature reserves or publicly accessible open spaces is a great idea. Wasteland green space can serve as an experiment for developing new strategies for urban nature promotion. “An alternative place image can be created by aligning ecological representations with images of wilderness, historical memory practices, and new modes of visual and physical apprehension” (Lachmund, 2013, p.169-170).

Enhancing ecosystem services can lead to economic development in cities in the long term (Nassauer and Raskin, 2014, p. 246) and can serve as anti-gentrification buffers (Draus *et al.*, 2020, p. 13). Urban residents prefer intermediate natural succession stages in urban wastelands because they value the aesthetic and ecological qualities at that stage (Kowarik, 2018, p. 344). Novel ecosystem development projects can benefit from restoration ecology, rewilding approaches, and public participation. These approaches can help reintroduce species, restore environmental conditions, and increase public acceptance of restrictions in novel ecosystem areas (Kowarik, 2018, p. 336).

Developing urban forests on urban wastelands can support urban stormwater management, improve water quality, and mitigate climate change. However, it may also reduce perceived safety and increase crime rates (Kowarik, 2018, p. 338). Berlin made efforts to protect wasteland areas in 1974. The nature conservation law was approved in 1979 by the movement of activist-planner coalitions (Lachmund, 2013, pp. 168-169). Berlin launched the Green Belt Berlin (GBB) on an urban wasteland that serves as an ecological corridor and promotes biodiversity in the city (Kowarik, 2019, p. 13). Creating and maintaining wasteland green space in Berlin was an experiment for developing new strategies for fostering urban nature (Lachmund, 2013, p. 190).

2.2.3 Formal Parks vs Informal Green Spaces

"Formal green spaces" as defined by governing institutions or property owners, serve multiple purposes such as agriculture, forestry, gardening, recreation, and public parks (Rupprecht *et al.*, 2015, pp. 3-4). However, recent research suggests that these spaces may not fully meet the needs of residents, particularly in densely populated areas, and some people may struggle to access regional open spaces when local green space is insufficient (Rupprecht *et al.*, 2015, pp. 1-3). Moreover, the establishment and maintenance of formal green spaces can be costly (Breuste, 2022, p. 55). While they are seen as commercially oriented and can provide ecological and aesthetic benefits to urban residents (Breuste, 2022, p. 24), their tendency to prioritize showy non-native species over native ones can harm native biodiversity (Breuste, 2022, p. 277). This standardization of ornamental nature in urban areas results in a lack of diversity and homogenization of green spaces (Breuste, 2022, pp. 21-23). Aesthetic preferences often drive the selection of non-native species for their visual appeal rather than considering cultural or ecological significance (Rupprecht *et al.*, 2015; Breuste, 2022, p. 23).

"Informal urban green space" as defined by Riley et al. (2018, p. 2), refers to urban areas containing non-remnant spontaneous vegetation resulting from human disturbance (Riley *et al.*, 2018, p. 2). These spaces can also include ecosystems that have naturally

developed without a specific intended use, often used for activities like recreation (Breuste, 2022, p. 34). Such areas encompass vacant land, railways, power lines, green roofs, vertical structures, and riparian corridors (Riley *et al.*, 2018, p. 2). Informal urban greenspace has gained importance in urban greenspace research and can address residents' need for green areas (Rupprecht et al., 2015, pp. 2-4). A study by Rupprecht et al. (2015, p. 4) found that 31% of Sapporo residents use Informal urban green space for recreation, perceiving it as a neighborhood place-making space. These spaces offer benefits to both humans and wildlife, serve as anti-gentrification buffers, and represent examples of ruderal ecology and social resources for surrounding populations (Draus *et al.*, 2020, p. 13).

Formal and informal green spaces in cities offer ecosystem services and contribute to the urban environment's natural feel. However, maintaining formal green spaces can be resource-intensive and environmentally challenging. They often require extensive labor and budgets, sometimes relying on non-native plants for aesthetics, leading to increased carbon emissions due to varying climates (Strohbach, Arnold and Haase, 2012, pp. 222-221). The management of trees in these spaces can significantly affect their carbon sequestration potential. While green spaces can help with carbon sequestration, emissions from activities like fertilization, irrigation, and machinery pruning can offset their benefits for 5-24 years (Zhang *et al.*, 2022, p. 2). Urban horticulture practices may also have “negative impacts on the environment, public health, and social well-being” (Qureshi *et al.*, 2022, p. 1-2). City trees, though important, have limited capacity to sequester carbon, contributing less than 0.5% to climate change mitigation. This limitation is due to factors like high mortality rates, limited growing areas, unsupportive environments, and frequent rain storms (Hansen *et al.*, 2023, p. 216). Furthermore, the construction of formal green spaces can result in carbon emissions, as materials like cement and steel generate greenhouse gases during production by fossil fuels energy (Churkina *et al.*, 2020, p. 269-270). The transportation of large trees also contributes to carbon emissions in the overall life cycle of urban green spaces (Strohbach, Arnold and Haase, 2012, p. 223).

Informal green spaces, in contrast, offer advantages like lower maintenance requirements and cost-effective landscape management strategies (Hwang *et al.*, 2019, p. 166). These spaces can contribute to carbon absorption through simple development approaches, such as allowing spontaneous plant growth, reducing the need for mowing, watering, and fertilization, resulting in cost and time savings. Incorporating local plant species can support biodiversity and promote more sustainable and liveable cities (Hwang *et al.*, 2019, pp. 166-167). Informal green spaces, like vacant lands, have been found to exhibit high rates of carbon sequestration in vegetation, offering significant potential to mitigate climate change (Nassauer and Raskin, 2014, p. 247). Studies in Sapporo and Brisbane show that people prefer informal green spaces over traditional parks or gardens due to reduced crowding and

fewer usage restrictions, experiencing various benefits such as recreation, emotional well-being, environmental advantages, and ecosystem services (Rupprecht *et al.*, 2015, p. 29). Furthermore, residents perceive informal urban green spaces as "real" and "authentic" compared to traditional parks, which are seen as "fake" (Kowarik, 2018, p. 339).

2.2.4 Unintended Green Space with Spontaneous Vegetation

Urban biodiversity is shaped by human intervention and usage, prompting a need for redefined conservation concepts in urban areas (Breuste, 2022, p. 284). "Spontaneous vegetation" in urban settings refers to self-regulating plants that require no intentional horticultural effort, including natural colonization and dynamic plant communities (Kühn, 2006, pp. 46-47; Riley *et al.*, 2018, pp. 6-7). These spontaneous species, a mix of native and non-native plants, can rejuvenate degraded areas, forming urban green spaces with ecological benefits like carbon sequestration, stormwater management, wildlife habitat, and recreation opportunities (Bonthoux *et al.*, 2019, p. 164; Trentanovi *et al.*, 2021, p. 8).

Spontaneous vegetation as an alternative to traditional green spaces is gaining popularity due to its cost-effectiveness, low maintenance, and support for biodiversity (Kühn, 2006, pp. 46-47; Gandy, 2016, pp. 437-438). It enhances environmental justice and connects people to nature, creating informal green spaces and urban wilderness (Trentanovi *et al.*, 2021, p. 7). Urban spontaneous vegetation also contributes to regulating ecosystem services, aiding climate change adaptation, enhancing community cohesion, and improving human well-being (Gandy, 2016, p. 437; Riley *et al.*, 2018, pp. 6-7). However, it can sometimes lead to negative perceptions of an area and conflicts between humans and undesirable wildlife, posing ecological challenges (Riley *et al.*, 2018, pp. 1-3; Bonthoux *et al.*, 2019, p. 164). While non-native species often dominate, these areas can harbour rare or threatened species important for conservation (Bonthoux *et al.*, 2019, p. 164).

Despite potential aesthetic limitations, spontaneous vegetation can be used for ornamental purposes through design work, creating park-like woodlands with multiple benefits like natural environments, heat island mitigation, improved air quality, and recreational opportunities biodiversity (Kühn, 2006, p. 47; Gandy, 2016, pp. 437-438). Managing spontaneous vegetation requires specialized knowledge and skills but can result in unique and attractive urban landscapes tailored to local conditions (Gandy, 2016 pp. 436-438; Riley *et al.*, 2018, pp. 6-7).

2.3 Public Perception of Urban's Novel Ecosystems

2.3.1 Perception of Urban Green Spaces

The perception of urban green spaces is a complex issue influenced by various factors such as vegetation structure, space usage, maintenance, and accessibility (Hwang *et al.*, 2019, p. 174). People's preferences for vegetation vary based on context and canopy density. For instance, urban green spaces with diverse vegetation offer various ecosystem services that positively impact human well-being. The perceived naturalness of the vegetation also affects people's perception of green spaces. Therefore, the heterogeneity of vegetation improves the perception of the park (Szilassi *et al.*, 2023, p. 523). Age and education influence the perception of ecosystem services provided by urban green spaces, while social factors such as age, lifestyle, and health impact the usage of urban parks (Jim and Chen, 2006, p. 343). Understanding visitors' interactions with informal green spaces can help understand perceptions in different cultural settings (Szilassi *et al.*, 2023, pp. 524-525). Perception-based surveys are critical for designing urban green spaces that are well-received and sustainable (Qureshi *et al.*, 2022, p. 11). Urban natural features such as vegetation and artificial elements can influence attitudes towards urban green spaces (Szilassi *et al.*, 2023, pp. 522-523). Field surveys can assess people's perceptions of urban green spaces using mobile apps or cameras with GPS. Such surveys can explore the green space experience through all senses. However, human perception of the environment is subjective and varies among participants (Szilassi *et al.*, 2023, p. 522).

Informal green space in public wastelands can be seen negatively due to its association with neglect, disorder, and safety concerns (Riley *et al.*, 2018, p. 9). Abandoned areas can lead to decreased social cohesion, heightened stress, and insecurity. These spaces can also pose safety hazards (Nassauer and Raskin, 2014, p. 249). The wild appearance of informal green spaces shaped by urban spontaneous vegetation influences negative public perception. Management strategies for spontaneous urban vegetation must consider informal green spaces' sociological implications (Riley *et al.*, 2018, pp. 9-10). However, Rupprecht et al. (2015, p. 7) suggest that people perceive informal green spaces as positive and negative influences on their daily lives. Informal green spaces have become cultural and geographic factors in urban areas (Rupprecht *et al.*, 2015, p. 7). Although informal green spaces in urban wastelands are usually perceived as potential sites for criminal activity, recent studies show that green spaces, including informal green spaces, can reduce crime rates in urban areas (Riley *et al.*, 2018, p. 9). Planners should consider water, slope, size, human activity, vegetation openness, and naturalness to improve safety (Szilassi *et al.*, 2023, p. 523).

Insecure perception can be reduced by installing cues to care within informal public spaces, such as removing trash, partly mowing grass, and pruning trees (Riley *et al.*, 2018, p. 9).

Residents appreciate the unique qualities of informal green spaces, and traditional green space planning may not effectively manage them (Rupprecht *et al.*, 2015, p. 23). Several studies show that people value various cultural ecosystem services in urban green spaces, including aesthetics, natural experience, education, cultural heritage, and biodiversity (Rall *et al.*, 2017, p. 81). Over 80% of residents in Sapporo and Brisbane are aware of informal greenspace in their neighbourhoods, but littering is a perceived problem despite not being encountered by most users (Rupprecht *et al.*, 2015, p. 4). Residents in Guangzhou have a positive attitude towards urban green spaces and recognize their ecosystem services (Jim and Chen, 2006, p. 346). Singaporeans prefer urban green spaces with a higher level of wildness because they are visually appealing, calming, natural, and have higher ecological value (Hwang *et al.*, 2019, pp. 171-173). In Singapore, people generally accept moderately wilder urban greenery, and there is an optimum condition for each context (Hwang *et al.*, 2019, pp.171-173). Incorporating informal green spaces adds socio-ecological value to the city landscape (Hwang *et al.*, 2019, p. 174). Urban authorities should explore participatory approaches for managing informal greenspaces to incorporate nature into the urban area (Rupprecht *et al.*, 2015, p. 29). Understanding the value of informal green space and urban novel ecosystems is crucial for conservation efforts and quantifying ecological value in urban areas (Riley *et al.*, 2018, p. 10).

2.3.2 Public Preference of Urban Green Space

Urban green spaces have a significant role to play in the social and cultural aspects of a community. Urban authorities must understand 'public preferences' for urban green spaces to design and manage them responsibly. This approach can benefit people and the environment (Hwang *et al.*, 2019, p. 174). By studying residents' connection with urban green spaces, we can meet the recreational demands of growing urban populations (Rupprecht *et al.*, 2015, p. 30). Additionally, exploring user preferences for urban green spaces can help improve ecosystem services and guide the development of suitable public green facilities and services (Wang *et al.*, 2023, pp. 8-9).

According to Hofmann *et al.* (2012), grass, wildflowers, and trees are the most preferred vegetation types, while lawns are the most open but least natural. The perceived naturalness of vegetation affects people's perception of urban green spaces. Elements like water, human presence, slope, and vastness are vital in how people perceive urban green spaces (Szilassi *et al.*, 2023, p. 536). Wastelands with wild novel ecosystems can make people feel insecure due to their association with neglect and feelings of insecurity. A negative

relationship has been found between the well-being of residents and the proportion of wastelands in a neighborhood. However, it has been shown that managing naturalistic vegetation for scenic beauty and better usability can enhance green spaces (Kowarik, 2019, pp. 18-19). In Guangzhou, the naturalistic ecological style is preferred over the traditional or mainstream one (Jim and Chen, 2006, p. 326). Emphasizing natural processes and preserving nature in “urban areas can contribute to sustainable development in the long run” (Jim and Chen, 2006, p. 347). In Brisbane and Sapporo, informal greenspace is preferred over formal greenspace due to its proximity, diverse flora and fauna, and lack of use restrictions (Rupprecht *et al.*, 2015, p. 29).

To implement wilder urban ecosystems, landscape design and management must consider appropriate typologies and context-specific approaches (Hwang *et al.*, 2019, p. 174). In Singapore, a study on roadside vegetation found that maintained vegetation was slightly more preferred than wild urban roadside vegetation. This preference may be due to the vegetation structure and color in the images used in the study. Therefore, it's crucial to consider vegetation structure when designing and managing urban green spaces for public acceptability (Hwang *et al.*, 2019, p. 166). A study in Salzburg, Austria, found that forest and grove were the most preferred structural vegetation types among university students. Groves and water areas were aesthetically valued spontaneous vegetation (Szilassi *et al.*, 2023, p. 536). In a recent study, French respondents accepted the moderate presence of spontaneous vegetation on pavements. The study suggests that the previous use of herbicides to prevent plant growth on pavements should be reconsidered, and differentiated management strategies could be implemented to control plant growth (Bonthoux *et al.*, 2019, p. 171).

2.4 Ecosystems Management and Governance

2.4.1 Environmental Governance and Public Participation

"Environmental governance" encompasses the methods society uses to manage the environment (Driessen *et al.*, 2012, p. 144). Environmental problems are complex and require coordinated action from multiple sectors and levels of government. Collaboration and stakeholder participation in decision-making processes is crucial to address these issues, which include participation from governments, NGOs, businesses, and citizens (Driessen *et al.*, 2012, p. 152). Environmental governance is driven by changing societal needs and involves various trends, reflecting broader societal changes and necessitating new governance arrangements with diverse stakeholders (Jansson *et al.*, 2019, p. 953).

Environmental governance in urban settings should consider three types of inclusivity: cross-sectoral, epistemic, and multi-species. Cross-sectoral inclusivity involves diverse actors'

perspectives and interests. Epistemic inclusivity incorporates various knowledge sources, including local and Indigenous knowledge. Multi-species inclusivity recognizes the importance of other organisms' lives in NBS governance (Guerry *et al.*, 2023, p. 265). The framework for environmental governance categorizes modes into hierarchical, network, market, community, and hybrid based on institutional arrangements, policy instruments, and power relations. This framework serves as a descriptive tool to analyze and compare environmental governance modes over time, aiding the identification of commonalities and differences in addressing environmental issues (Driessen *et al.*, 2012, p. 152).

Environmental governance in cities must be inclusive to “avoid exacerbating existing inequalities and injustices or generating new unfair outcomes” (Guerry *et al.*, 2023, p. 285). The governance model should consider the context, including environmental issues, stakeholder needs, and social, economic, and political factors (Driessen *et al.*, 2012, p. 151). The environmental governance approach is more effective in achieving sustainable outcomes, but it can be challenging due to conflicting interests and power dynamics among stakeholders (Hansen *et al.*, 2023, p. 232). Environmental governance involves negotiating, formulating, and implementing policies and legislation and deals with accountability and legitimacy (Guerry *et al.*, 2023, p. 286).

Environmental governance arrangements have emerged, including “public-private partnerships, participatory environmental management, interactive policy-making,” adaptive management, transition management, “self-regulation, reflexive governance, earth system governance, and environmental policy arrangements” (Driessen *et al.*, 2012, p. 153-154). Multiple models of environmental governance can be used to address environmental problems and co-exist and complement each other. The aim is to enhance sustainable environmental policy by promoting collaboration, innovation, and adaptive management in response to changing environmental conditions (Driessen *et al.*, 2012, p. 157). Environmental governance can address broader discourses on urban and social-ecological justice. Planning and environmental governance require understanding their technical and ecological characteristics and their connection with “urban life and citizens” (Guerry *et al.*, 2023, p. 263).

Participatory planning and adaptive governance offer insights into creating supportive spaces for raising environmental justice concerns. Adopting an interdisciplinary approach can “lead to a shared understanding of working with nature to improve city social and ecological outcomes” (Guerry *et al.*, 2023, p. 263). Public participation in urban green spaces can enhance democracy and transparency but depends on governance structures (Jansson *et al.*, 2019, p. 953). Citizen involvement and activism can enhance environmental, institutional, and social resilience, particularly in recognizing spontaneous vegetation (Trentanovi *et al.*, 2021, pp. 2-3). Public participation in decision-making regarding urban green spaces is crucial to avoid mismatches between resident expectations and facility provision (Jim and Chen, 2006,

p. 339). Public-private partnerships and community-based organizations can protect the negative consequences of urban green development such as green gentrification, and strengthen community-government relations (Jansson *et al.*, 2019, p. 960). Controlled investments and stable legislative applications are essential to prevent conflicts among user groups (Onose *et al.*, 2023, p. 567).

Effective environmental governance can improve urban green spaces and gain community support (Jim and Chen, 2006, p. 347). Residents and municipal green space managers collaborate in co-management zones, where residents contribute ideas and local knowledge, and the government provides support (Jansson *et al.*, 2019, p. 960). Collaboration among different parties in governance can improve resource distribution and conflict resolution. Urban commons, involving shared management of resources, can promote community building, learning, and inclusion. Place-making and urban commons can also lead to cost-effective urban green space and social inclusion (Jansson *et al.*, 2019, p. 955). The "Governance and Management" (G&M) model differentiates decision-making power distribution among actors, emphasizing power relations, democracy, accountability, transparency, and co-development of urban green space (Jansson *et al.*, 2019, pp. 961-962). Co-management zones involve residents managing publicly owned urban green areas, promoting sustainable urban green space, community-government relationships, and social inclusion (Jansson *et al.*, 2019, pp. 960-961). In the Netherlands, urban environmental governance shifted from a top-down to a collaborative approach, emphasizing public participation, market-based mechanisms, and new governance models to involve multiple actors and improve governance effectiveness (Driessen *et al.*, 2012, p. 152). Sustainable urban development and community engagement can promote social capital and ecosystem services in abandoned urban landscapes (Nassauer and Raskin, 2014, p. 249).

2.4.2 Nature-Based Solution and Urban Natural Conservation Management

Urban Nature requires an integrated approach incorporating ecological principles into urban planning, emphasizing sustainable development and resilience (Carreiro, Song and Wu, 2008, pp. 22). Urban planning often overlooks the benefits of spontaneous urban woodlands. Incorporating wild vegetation into urban planning can promote high environmental standards and help with “climate change adaptation” (Trentanovi *et al.*, 2021, p.8). Naturalistic and spontaneous growth patterns in “urban green spaces can also reduce the urban heat island effect, improve air quality, and provide other ecosystem services” (Hwang *et al.*, 2019, p. 174). A study recommends using a context-specific approach to incorporate wildness into city management through landscape design and management. Policymakers and practitioners should use the findings to implement a degree of wildness in design and management,

potentially creating official guidelines for street planting designs and low-cost landscape management strategies (Hwang *et al.*, 2019, p. 174). The use of "novel ecosystems" could aid in the development of “Nature-Based Solutions (NBS) that are better suited to future climate conditions and support local biodiversity.” This approach could help alleviate environmental stress caused by drought, “reduced water availability, rising temperatures, and catastrophic events,” and promote a sustainable environment (Hansen *et al.*, 2023, p. 231).

"Nature-based solutions are proposed as an integrative concept and systemic approach to address urban sustainability and resilience in a holistic way.” Nature-based solutions involve protecting, managing, and restoring ecosystems to address societal challenges and benefit human well-being and biodiversity (Breuste, 2022, pp. 362-363). The planning and implementation of natural-based solutions requires consideration of how to preserve and restore existing urban green areas (Hansen *et al.*, 2023, p. 225). Nature-based solutions should provide multiple benefits in areas where they are needed most, including "novel ecosystems" and "climate analogs" that are “better adapted to future climate conditions” while supporting local biodiversity (Hansen *et al.*, 2023, p. 231). However, planning and implementing nature-based solutions in cities is challenging “due to their systemic Nature, requiring the inclusion of multiple actors' perspectives, knowledge, and expertise, as well as acceptance by various groups” (Guerry *et al.*, 2023, p. 266). To maintain sustainability and equity, long-term financing and maintenance must also be considered (Hansen *et al.*, 2023, p. 230). “Legal and political frameworks are needed to protect and implement nature-based solutions in urban areas.” Planning regulations are vital to prevent economic interests from overshadowing NBS provision. A monitoring-capable public administration is necessary to ensure nature-based solutions implementation and maintenance (Hansen *et al.*, 2023, p. 228). Planning should focus on preserving existing green areas and creating new solutions where needed most. Optimization of benefits should consider scale, design, and distribution (Hansen *et al.*, 2023, pp. 229-232).

Conserving novel ecosystems in urban areas involves protecting and establishing conservation areas. A cost-effective approach, known as the "zero option," allows spontaneous urban vegetation to evolve naturally within the ecological network (Trentanovi *et al.*, 2021, p. 8). Preserving and restoring urban green areas that mimic local biotopes can enhance carbon absorption and biodiversity while using fewer resources than high-maintenance lawns. Thoughtful design and maintenance of “nature-based solutions can optimize ecosystem services and sustainability” (Hansen *et al.*, 2023, p. 231). "Urban protected areas" or nature reserves in cities face challenges but offer opportunities for residents to connect with nature and contribute to environmental protection (Breuste, 2022, p.110). Rewilding restores natural ecosystems in cities, increasing biodiversity, enhancing quality of life, and promoting sustainable urban development (Breuste, 2022, p. 288). In the

1980s, Berlin activists pushed to preserve urban land as nature reserves or public spaces. The Nature Conservation Law of 1979 extended to protect spontaneous vegetation as a vital part of urban nature conservation (Lachmund, 2013, p. 193).

2.5 Theorical Framework

This research aims to improve BMA's green space policy by exploring the potential for a sustainable ecosystem on wastelands in Bangkok. To achieve this, the thesis takes a multidisciplinary approach to understanding the socio-ecological dynamics of the urban area. Theoretical frameworks for this thesis focus on three aspects of urban nature knowledge: urban ecosystem services, socio-environmental relationships, and urban environmental management.

Urban ecosystem service refers to the functioning and dynamics of city ecosystems. The idea of urban ecosystem service encompasses the 'supply and demand of ecosystems', as well as the effectiveness of distributing green spaces or promoting 'environmental justice' within urban areas. This concept can shed light on the environmental condition and the urban population's need for nature. Therefore, it is crucial for this concept to consider the 'novel ecosystem' and 'urban spontaneous vegetation area.' The arrangement of novel ecosystems is essential in reflecting the capacity of urban ecosystems, particularly for urban green spaces. Informal green spaces, also known as non-intervention green spaces, offer “an opportunity to establish a sustainable ecosystem in the city” (Breuste, 2022, p. 284-288), particularly on unused land like vacant lots, street verges, and brownfields. Studying this concept can create opportunities to enhance sustainable urban environments.

Socio-environmental relationships framework in this research examines the connections between local communities and urban green spaces, specifically informal green spaces. The study explores the multifaceted relationships between residents and their perceptions, preferences, and activities in these spaces. By using this framework, we can better understand the process of creating a "sense of place" within urban communities and encouraging sustainable ecosystems in the neighborhood. While there have been previous studies on the relationship between communities and green spaces, this particular study is lacking in Bangkok. Therefore, “understanding the perceptions and preferences of urban communities is crucial for researching urban nature in the city” (Guerry *et al.*, 2023, p. 261).

Urban environmental management framework for urban environmental management is crucial in enhancing the green space policy in Bangkok. This thesis focuses on management practices in three areas: "environmental governance," "nature-based solutions," and "urban natural conservation management." Environmental governance is the most significant aspect of urban environmental management. An environmental governance

framework emphasizes clear communication and accessible language to facilitate effective decision-making (Wang *et al.*, 2023, p. 8). Furthermore, urban and nature were previously viewed as conflicting, but the increase in ecological awareness has sparked interest in more-than-human understandings of people-nature relationships. Recognizing and involving other species as "co-participants in decision-making processes" is crucial for inclusive and legitimate environmental governance in cities (Guerry *et al.*, 2023, p. 261). Additionally, the framework of "nature-based solutions and urban natural conservation" can guide the management of sustainable green space on wasteland. The management of natural urban conservation can improve the policy guideline for Bangkok's sustainable ecosystem maintenance.

Through the use of these frameworks as a study guide, the research aims to achieve three key outcomes:

1. To gain an understanding of the potential of wastelands that contain spontaneous vegetation and novel ecosystems in Bangkok that can become the alternative green space for people with low maintenance and carbon footprint. Wasteland with spontaneous vegetation can provide an ecosystem service that is important for life habitation.
2. To understand the relationship and perception of urban residents on the novel ecosystems and spontaneous vegetation in wastelands. By understanding public perceptions and preferences, the research can gain insight into the solution to create a proper space and low intervention for human activity.
3. To provide guidelines mechanism and suggestions for enhancing the green space policy in the Bangkok area based on the environmental governance framework and urban natural conservation management.

These guidelines can help to integrate sustainable ecosystem practices on wasteland into the public green infrastructure in Bangkok.

3. Research Design and Methodology

The paper's literature review explores significant theories essential to the research. This process leads to the establishment of a theoretical framework that guides the research methodology. The following chapter focuses on the methodology based on this framework. The thesis utilizes mixed methodologies to collect and analyze data, combining quantitative and qualitative approaches using a structured and process-oriented method (Blaxter, Hughes and Tight, 2010). Quantitative research proves useful in analyzing urban structures, while qualitative studies are better suited for understanding social processes (Blaxter, Hughes and Tight, 2010).

The research process for this study is divided into three stages. Firstly, quantitative research methods are utilized to analyze the features of urban green spaces and ecosystems. This involves using document analysis, mapping techniques, and geographic information systems (GIS). Quantitative results can help to identify the supply and demand for ecosystem services in specific spatial locations (Wang *et al.*, 2023, p. 8). In addition, analyzing the spatial distribution of urban green spaces can help to identify natural disturbances that are crucial for focusing the research in a particular area (Pickett *et al.*, 2016, p. 3).

In the second stage, qualitative research methods are employed to understand the social processes in the targeted study areas. This involves conducting on-site field surveys, participatory mapping, and expert interviews. On-site field surveys help in measuring people's perceptions of urban green spaces in their neighborhood (Szilassi *et al.*, 2023, p. 523).

3.1 Research Design

Ultimately, the research aims to find the guideline mechanism that can utilised novel ecosystem and spontaneous vegetation on wasteland to become an alternative urban green space in Bangkok apart from conventional public park. Therefore, the research needs to explore the potential of wastelands to become an "*informal green space*", where is allowed natural self-regulation to happened with low human intervention. There are three steps of research method that need to be composited in this paper, which are *potential site finding*, *on-site public survey*, and *expert interview.* Each step of methods is designed to seek difference results, which can integrate to produce an outcome as a guideline mechanism for informal green space.

1. **Potential site finding**: The first step has an objective to find the potential study area for conducting the research in Bangkok, which consist of BMA's green space policy review and GIS analysis. The analysis is conducted on both macro and micro scales. The macro-scale will examine the green space supply and demand through out every district of Bangkok by using BMA's open data and Open Street map (OSM) data to identify the district that has low environmental justice situation. The micro scale analysis is finding a wasteland that contain spontaneous vegetation and novel ecosystem, by reviewing wasteland information and location in the district. The results are potential sites for conducting research as a potential site for 'informal green space'.

2. **On-site public survey:** The second step is a data collection of people perception on informal green space. The process of on-site public survey involves two parts starting with a green spaces workshop for inviting participants to the site and introducing them about site characteristic. After the workshop participants were handed a questionnaire

document to collect the data of their perception experiencing informal green space. The results aim to understand participants perception and preferences of green space in Bangkok, which can be a valuable information to incorporate with the guideline mechanisms for promote informal green spaces in Bangkok.

3. **Expert interview:** The final step is expert interviews which explore the possibility of policy mechanisms and frameworks regarding their practical work experience. Essentially, the result of the interview has an objective to seek a solution for incorporate informal green space, where develop from spontaneous vegetation wasteland, to be an alternative green space for people in Bangkok. The interview is a semi-structure interview mainly related to environments situation, and urban green spaces policy in Bangkok.

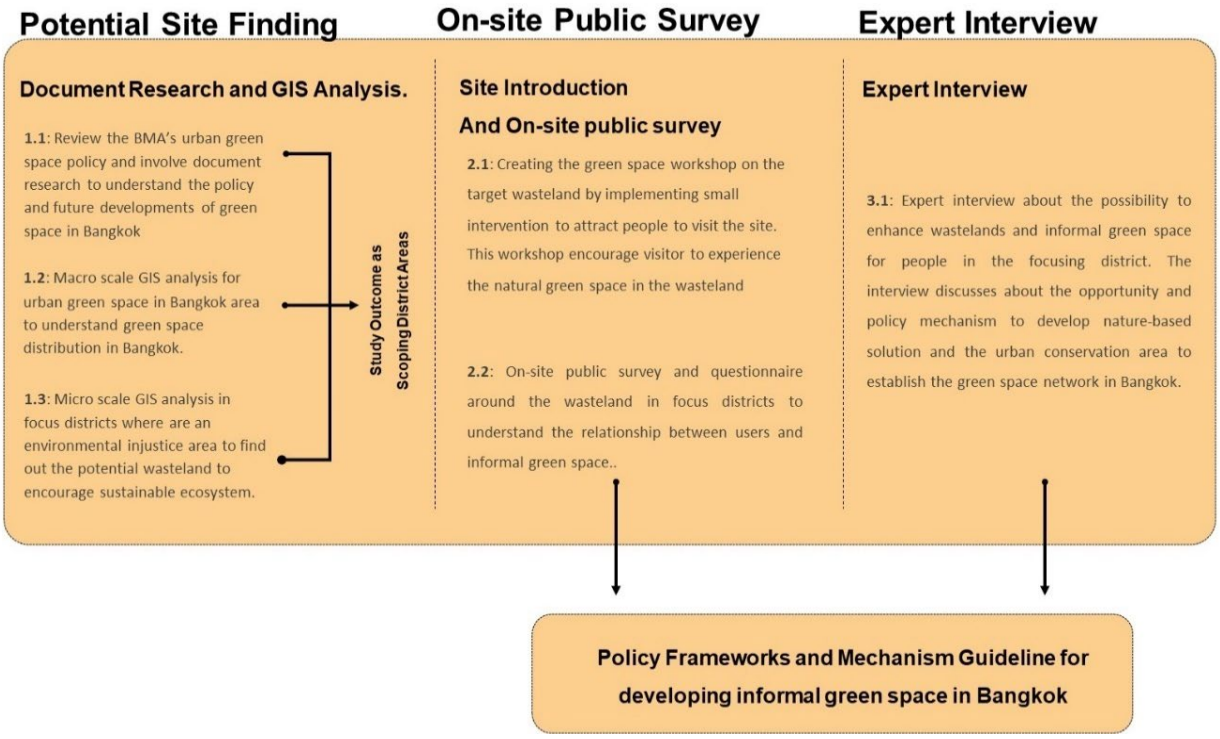


Figure 3-1: Research Design Methods

3.2 Data Collection Methods

According to the research design that contain three steps of studying, these three steps have three considerable data collection methods that need to be collaborated in the study to reach the answer to research question. Data collection methods can be divided into two groups regarding the type of data including primary data and secondary data. The research methods start with secondary data collection through BMA's policy documents and shapefile open data for GIS analysis. After that, the research collects primary data through public participatory process and expert interview. The results of data collection is analyzed to find

out the potential of wasteland to play a vital role in conserving ecosystem in urban area and become an alternative green space in the city.

3.2.1 Document Research

Secondary data research involves analyzing data that has already been collected and analyzed by others (Blaxter, Hughes and Tight, 2010). The purpose of this method is to comprehensively analyze the writings of practitioners and policy-makers (Blaxter, Hughes and Tight, 2010). In this thesis, document research is used to review the data and policy of urban green spaces launched by BMA. The document research results can help illustrate the fabric of urban green spaces in Bangkok, including green infrastructure, novel ecosystem areas, and wastelands. Additionally, the urban green space policy can provide insight into the environmental justice situation in Bangkok. The distribution of green spaces can be used as a criterion to select the districts for micro-scale studies.

3.2.2 Geographic Information System (GIS)

For site potential finding, the study of demand and supply of ecosystem service needs to be considered to find out the area where urgently require for green space development (Breuste, 2022, p. 340). GIS analysis is one of tools that can help to identify the mismatches between the demand and supply of ecosystem services (Wang *et al.*, 2023, pp. 8-9). GIS data collection and analysis aims to seek a study area where cover by spontaneous vegetation with novel ecosystem that have emerged in wasteland of Bangkok.

The analysis prioritize district that urgently desire for green spaces, which aim to point out the uneven urban green space distribution in Bangkok. Vulnerable group such as low-income individuals, undersupplied green spaces can exacerbate health inequalities and contribute to social exclusion (Kabisch and Haase, 2014, p. 130). Therefore, the result of GIS analysis is a district where contain limited access to green space with high-density residential areas that have marginalized population such as low-income, families, children, elderly, and expat. Two potential sites for conducting research are chosen from green space vulnerable districts where are in the inner city and the periphery. These two potential sites will be utilized for conducting public surveys exploring participants perception of using informal green space.

3.2.3 On-site questionnaire survey

Social perception of urban green spaces is a complex issue and challenges to determine individual's feeling (Hwang *et al.*, 2019, pp. 173-174), as it is subjective varies among participants (Szilassi *et al.*, 2023, p. 523). However, the perception of urban green spaces, especially informal green spaces on wasteland for this research can achieve by

perception-based surveys (Qureshi *et al.*, 2022, p. 2-5). In this research, on-site survey is conducted on the potential site to understand public perceptions of experiencing informal green space on the wasteland. Questionnaires is a main research technique in this methods as it helps to collect data on participants' opinions, experiences and characteristics (Blaxter, Hughes and Tight, 2010). This research method aims to study the perception and preferences of informal green spaces, including frequency of use, activities performed, problems encountered, and reasons for usage (Rupprecht *et al.*, 2015, p. 25). The result of social perception is vulnerable to incorporate with the guideline framework to create the suitable green space for all. On-site participatory process can initiate the environmental governance solution that lead to the inclusive framework to avoid inequalities and injustices green spaces outcomes (Guerry *et al.*, 2023, p. 266).

3.2.4 Expert Interview

Regarding environmental governance concept, promoting collaboration between stakeholders is important for enhancing environmental conditions (Driessen *et al.*, 2012, pp. 152-153). Urban green space planning require understanding their technical and ecological knowledge (Guerry *et al.*, 2023, p. 266). Therefore, expert interview for collaborate multidiscipline from difference expertise for promoting informal green space on wasteland in Bangkok is important. Embracing an interdisciplinary approach may foster a collective comprehension of collaborating with nature to enhance both social and ecological outcomes within urban settings. (Guerry *et al.*, 2023, p. 261). The objective of expert interview method is investigating the policy mechanism that can introduce informal green space to support BMA's green space policy. Interview's questions are involved in two dimension including green space management for providing ecosystem services, and policy frameworks for establishing urban green space in Bangkok. Expert's background that are invited for the interview are rage between three related disciplines, including urban planning, landscape architecture, and urban ecology. Due to the privacy of interviewees, the research does not reveal the name and their detail, but providing their career and position, including in the list below.

1. Naturist at Climate Life Coach
2. Data Analyst at More and Farmer
3. Researcher at More and Farmer
4. Academic Expert at Rethink Urban Space
5. President of Thai Association of Landscape Architect
6. Director and expert in regional and urban planning of Healthy Space Forum
7. Instructor of Landscape Architecture Department at Chulalongkorn University

8. Researcher and Community Landscape Architect at Refield Lab

The interview process is conducted by using semi-interviewing pattern. During the semi-structured interview, the prepared topic of discussion will revolve around the potential of informal green spaces to be developed into urban conservation areas that can enhance sustainable ecosystems in Bangkok. The interview will include the following structured questions:

1. What are Bangkok's principles and purposes for urban green space maintenance?
2. What is the current situation of natural spaces in Bangkok, and how can the urban environment be enhanced?
3. What can be done to encourage sustainable ecosystem services in Bangkok?
4. How can informal public spaces or wastelands be reserved as natural conservation areas in the urban landscape?
5. How can wastelands function as the ecosystem service of the city?
6. How can stakeholders and urban residents be incorporated into the decision-making process of urban green space enhancement?
7. How does BMA's current urban green space policy align with nature-based solution development in the city?
8. How can wastelands be integrated into the urban green space fabric or green infrastructure of Bangkok?

The result of semi-structured interview is utilized for green space mechanisms analysis to understand possibilities of promoting informal green space in Bangkok. The discussion with experts can create the approach to provide the policy framework and mechanism. The outcome of the interview will be synthesis and integrate with the literature review to create the tangible framework for introducing green space on wasteland.

3.4 Data Processing and Analysis

When conducting research analysis, it is essential to collect data using a systematic set of procedures aimed at addressing research questions. The data collection process is typically categorized into two types: quantitative and qualitative data collection. The following procedures are core components of the data collection process:

1. Data Mapping and Management: The collected urban green space data is mapped to manage its structure and location. This data is then organized for easy analysis and communication.

2. Reading and Summarizing: The data collected from government and academic sources is categorized into a common data typology and summarized for further analysis.
3. Data Synthesis and Interpretation: The collected data is synthesized and organized to present research results and findings. The data is then interpreted based on the research question and methodology objectives.
4. Data Representation and Diagrams: The research findings are utilized and rearranged into a research structure. The data and analysis are visualized as a diagram to represent the results of the research.

These procedures are employed to simplify and organize the data collection process. The data is framed according to the methodology, theoretical frameworks, and research objectives. By utilizing these procedures, a research analysis can be conducted in a more academic and systematic manner.

3.5 Limitation

Even though environmental issues and ecosystem services reservation are the global mega trend for combating with climate change, the awareness of ecosystem services and green space is limited in Bangkok. The discussion of green movement is limited to the certain group which not strong enough to make a movement in the society. Consequently, the data collection is more challenging compared to other regions such as Europe, North American, and East Asia. The communication about ecosystem services in Novel ecosystem, especially informal green space concept is hardly to be explained for participants to understand. Hence, it is taking time and a lot of patience to communicate with participants for the precise outcome, which number of results are not sufficient to apply in the research.

. Furthermore, the working timeframe is quite limited compared to research methods task to achieve the objective of the research question that aim to provide a framework for promoting informal green space in Bangkok. For example, the on-site public survey could have more participants, if there are more time. Also, the expert interview method can be included more people, especially BMA’s staff. The communication with government required long time for getting the reply. Nevertheless, most of planned research methods are complete by involving certain number of participants within the timeframe, due to the support of local NGO.

4. Bangkok Environmental Background and BMA’s Green Space Policy

In the third chapter of the thesis, the study methodology is thoroughly examined. It involves three distinct methods, combining quantitative and qualitative approaches. The methodology begins by scrutinizing the archival records of the Bangkok Metropolitan Administration's (BMA) green space policy. This sets the groundwork for an exploration of the environmental conditions in Bangkok, the focal point of the thesis.

Within this chapter, an analysis unfolds concerning BMA's and the central government's policies designed to improve the city's environmental quality. The discussion outlines the existing policies currently in effect, shedding light on their interrelationships and their implications for future environmental plans. A comprehensive review of these policies, documented across various government sources, is imperative to grasp their potential impact on the strategic landscape of urban green spaces. This chapter marks the foundational step in the methodological journey, playing a pivotal role in deciphering solutions to integrate informal green spaces into Bangkok's overarching green space policy. The primary aim is to foster a harmonious coexistence that preserves ecosystems within the city.

4.1 Bangkok’s Background and Influence of Urbanization

Bangkok, strategically positioned on a gentle rise within the lower Chao Phraya River delta, traces its roots to the Ayutthaya period when the area flourished as a productive landscape of mixed fruit orchards (Thaitakoo and McGrath, 2008, p. 33). This region, part of the Chao Phraya River basin, spans a flat terrain ranging from 1.08 to +3.12 meters above sea level, with the southern boundary meeting the Gulf of Thailand. Its tropical climate manifests in “three distinct seasons: summer (March–May), monsoon (June–October), and winter (November–February)” (Ngamsiriudom and Tanaka, 2023, p. 3). The transformation of Bangkok's traditional water-based urbanism commenced in the late nineteenth century, marked by the introduction of new canals serving as vital highways connecting the capital to surrounding market towns (Thaitakoo and McGrath, 2008, p. 33). However, the city faces challenges from May to October, with elevated river flow and rapid local runoff leading to frequent flooding. High tides further complicate drainage, necessitating the use of floodwalls and pumping stations (Thaitakoo and McGrath, 2008, p. 34). This convergence of river flow, tidal surges, and torrential rain has earned Bangkok the epithet "the city of three waters" (Thaitakoo and McGrath, 2008, p. 34). Amidst these challenges, the evolving urban landscape witnesses the fading of older forms of waterscape urbanism and the emergence of new landscape urbanism, contributing to a shifting perception of natural processes. This

transformation creates a growing disjunction between societal expectations and the evolving reality of Bangkok's urban environment (Thaitakoo and McGrath, 2008, p. 34).

In the early 20th century, the outskirts of Bangkok became the primary rice-producing region and economic center for the kingdom. Global food shortages after World War II led to World Bank loans, enabling the implementation of a modern irrigation system designed by van der Heide. This system allowed for human-controlled water management, aligning agricultural cycles with market demands rather than relying on seasonal precipitation (McGrath and Thaitakoo, 2005, p. 47). “Driving counterclockwise from the Eastern Ring reveals the perennial wet zone to the east of central Bangkok,” featuring freshwater streams, swamps, and fish-farming ponds. Adjacent to “Bangkok's new airport, surviving fish farms have diversified by adding restaurants and fishing pavilions to enhance their income” (McGrath and Thaitakoo, 2005, p. 47). On the west bank, “an orchard and vegetable garden showcase a distinctive corduroy pattern of small, dredged canals alternating with built-up mounds.” The deltaic mixed orchard boasts a layered tree canopy, including “betel nut and sugar palms, coconut palm, durian, mango, pomelo, jackfruit, rose apple, star fruit, mangosteen, guava, rambutan, banana trees, and orange saplings, highlighting the rich diversity of the region's flora” (McGrath and Thaitakoo, 2005, p. 48).

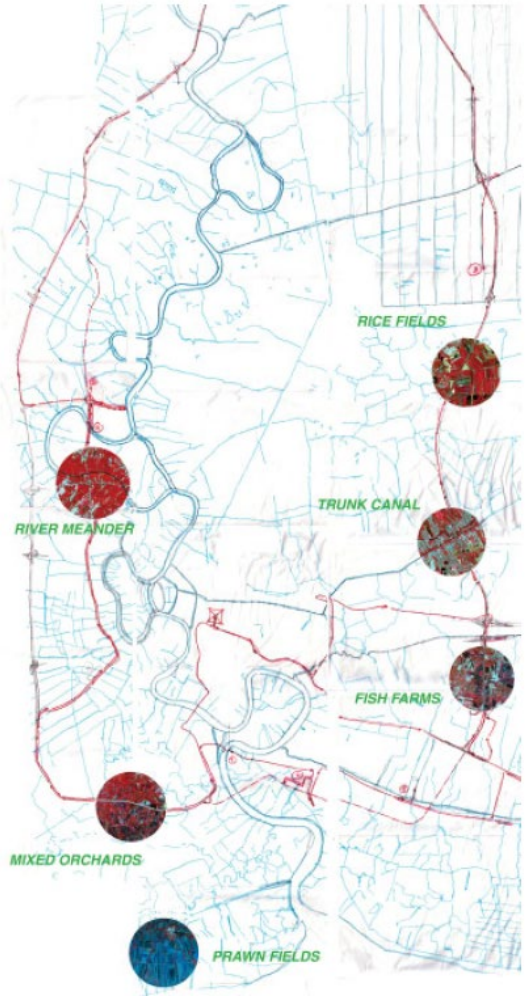


Figure 4-1: Exiting Bangkok’s Landscape Condition

Bangkok, Thailand's capital for over two centuries, stands as a significant economic hub and the largest city in the country (Ngamsiriudom and Tanaka, 2023, p. 2). With an unofficial population surpassing 10 million, Bangkok acts as an economic magnet, attracting individuals through rural-to-urban migration, contributing to continual population growth (Thaiutsa *et al.*, 2008, p. 220). As “the largest urban area in Thailand”, the city's 2010 census reported “over 9.6 million residents inhabiting 2,100 km^2” marked by a landscape “dominated by man-made structures and intentional cultivation of vegetation” (Stewart *et al.*, 2018, p. 3). The period from 2000 to 2020 witnessed substantial urban development in Bangkok, characterized by continuous expansion and a reduction in green spaces (Li *et al.*, 2022, p. 2). This urban sprawl, driven by rapid population increase, capital investment, and industrial growth, has led to the development of transportation networks, real estate markets, and escalating land valuations, expanding the city into peripheral domains (Ngamsiriudom and Tanaka, 2023, p. 2). World Bank data and the Statistical Report of Thailand (2020) reveal a significant surge in the nation's urban population ratio, escalating from 22% in 1972 to 52% in 2020 (Ngamsiriudom and Tanaka, 2023, p. 2). Additionally, Bangkok's population has more than doubled from 4.7 million in 1980 to over 10 million in 2016 (Ali, Pumijumnong and Cui, 2018, p. 471). These trends underscore the dynamic demographic and urban transformations that have shaped the landscape of Bangkok over the decades.

Urbanization poses a global challenge, with estimates projecting “over 65% of the world's population residing in urban areas by 2025” (Kamal, Imran and Tripati, 2017, p. 142). Bangkok, experiencing rapid urbanization since World War II, has expanded at the expense of cultivated land and its hydrological matrix, especially towards the east due to industrial and suburban development (Thaitakoo and McGrath, 2008, p. 33). This transformation culminated in the formation of the Bangkok Metropolitan Region (BMR), where over 70% of developed areas evolved from agricultural terrains in the past two decades (Ngamsiriudom and Tanaka, 2023, p. 2).

The unmanaged expansion of Bangkok since the 1960s has led to environmental challenges, including urban sprawl, occupation of recreational spaces, and insufficient infrastructure (Hara *et al.*, 2017, p. 1; Ali, Pumijumnong and Cui, 2018, p. 472). The city's expansion in all directions, except the southern part due to the Gulf of Thailand, has been notable (Estoque, Murayama and Myint, 2017, p. 350). Built-up areas, arising from the construction of transportation networks and infrastructure, have overtaken green spaces, prompting the need for strategic planning in mega-cities like Bangkok (Kamal, Imran and Tripati, 2017, p. 143). Bangkok's urban planning challenges, explored by Marks and Connell (2023, p. 18), are marked by a historical absence of an official development plan until 1992. The subsequent General Plan faced delays and remained in draft status for 15 years, lacking a concrete commitment to implementation and omitting crucial objectives such as preserving

open space and addressing urban heat reduction (Marks and Connell, 2023, p. 10). Delays, gaps in city plans, a lack of commitment to enforcement, and private-sector resistance collectively hindered the state's ability to control the shape and form of metropolitan expansion (Marks and Connell, 2023, p. 11). The 1992 plan, although officially adopted, was intended only as a guide to the city's development (Marks and Connell, 2023, p. 11). “The centralization of control under the Ministry of the Interior limited the Bangkok Metropolitan Administration's (BMA) power to curb urbanization, consequently impeding efforts to prevent the intensification of the Urban Heat Island (UHI) effect development” (Marks and Connell, 2023, p. 13). Furthermore, the decentralization challenges in Thailand reduced BMA's authority over development, allowing developers to circumvent zoning requirements by going directly to district offices instead of the City Planning Department development (Marks and Connell, 2023, p. 13). Complaints about low fines for breaching zoning requirements underscored the regulatory challenges in the enforcement of urban planning policies (Marks and Connell, 2023, p. 13).

The built-up areas in Bangkok continue to expand outward, converting green spaces and bare land into impervious surfaces (Li *et al.*, 2022, p. 2). Bangkok's current landscape reveals a juxtaposition, with slightly over 50% comprised of buildings, roads, and constructed surfaces, while 26% is dedicated to food production, primarily farmland and shrimp farms on the city's periphery (Thaiutsa *et al.*, 2008, p. 222). The city's allure for trade and tourism has attracted a diverse population seeking opportunities, leading to substantial changes and a decline in open green spaces, impacting the natural environment (Kamal, Imran and Tripati, 2017, p. 145). Understanding these dynamics is crucial for “developing sustainable plans to maintain the ecological balance and enhance the quality of life in Bangkok's evolving urban environment” (Kamal, Imran and Tripati, 2017, p. 143).

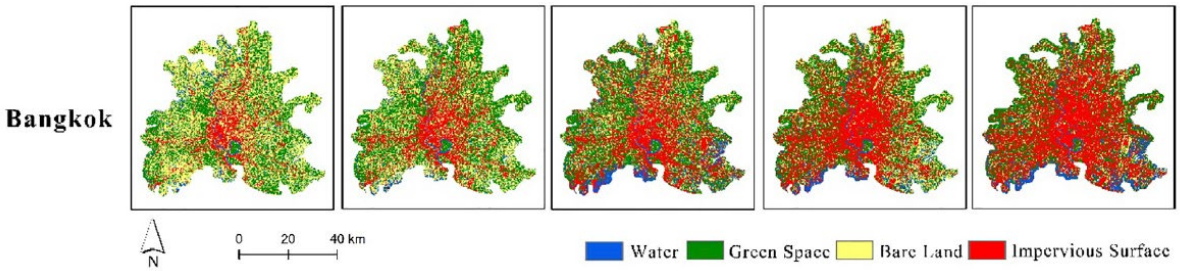


Figure 4-2: Evolution of Land use and Land Cover Change from 2000, 2005, 2010, 2015, 2020 respectively

Bangkok's ring roads, as observed by McGrath and Thaitakoo (2005, pp. 48-51), encapsulate diverse urban and natural landscapes. “The older, unlimited-access Western Ring Road epitomizes urbanization with a continuous stretch of malls, factories, and shops”. In contrast, the Outer Ring Road serves not only as a conduit for regional transportation but

also exposes travellers to peripheral factories, shopping centers, and housing estates, offering new perspectives as it traverses marginalized canal-based agri- and aquacultural landscapes. The amalgamation of three distinct highway types in Bangkok—the “limited-access surface Eastern Ring, the urbanized unlimited-access surface Western Ring, and the incomplete limited-access elevated Southern Ring”—creates a mosaic of traffic-land relationships. “This varied patchwork unfolds a narrative of geomorphic and hydrological properties shaped by historical human interventions.” McGrath and Thaitakoo (2005, p. 57) further highlight the profound connection between daily activities like eating, breathing, and drinking, emphasizing their role in fostering awareness of the sensory aspects of urban existence. These daily rituals provide valuable insights into comprehending Bangkok as an ecosystem, highlighting the intricate interplay between urban infrastructure, natural landscapes, and human experiences.

Urbanization in Bangkok, characterized by mixed urban–rural land use and landform transformation practices, has led to environmental challenges, including water pollution and seasonal submergence (Hara *et al.*, 2017, pp. 1-2). However, studies on landform transformation as a key element to comprehend the process of agricultural landscapes evolving into urban landscapes are limited (Hara *et al.*, 2017, pp. 1-2).

Bangkok, currently “one of the most vulnerable cities globally to rapid and unpredictable climate change”, has already started experiencing severe effects (Thaitakoo and McGrath, 2008, p. 30). Predictions for the city's near future include more hot days, longer summers, increased rain intensity, rising sea levels, and additional challenges such as the urban heat-island effect, flooding, drought, coastal erosion, and land subsidence (Thaitakoo and McGrath, 2008, p. 34). The expansion and urbanization processes contribute to increased carbon sources and decreased carbon sinks in Bangkok, leading to a significant rise in carbon emissions from 1987 to 2015, with a continuing downward trend in carbon sinks (Ali, Pumijumnong and Cui, 2018, p. 472). If these trends persist, green spaces and vegetation may nearly disappear by the next decade (Ali, Pumijumnong and Cui, 2018, p. 472).

Critical areas in Bangkok, serving as runoff recipients from the 50% constructed area, play a role in alleviating street flooding but pose management challenges during the dry season (Thaitakoo and McGrath, 2008, p. 34). These findings underscore the urgent need for effective urban growth control, especially considering the ongoing transformation and environmental threats faced by the city. The ecological theory of patch dynamics, as discussed by McGrath and Thaitakoo (2005, p. 51), signifies a paradigm shift in comprehending the interrelationships between society and nature within urban contexts, particularly in the greater Bangkok area. This approach advocates for a design methodology that “focuses on local monitoring, management, and design of air, water, and waste flows, emphasizing the importance of information flow from the local level to government officials and policymakers.”

Such a patch dynamic approach offers a holistic strategy to address the design challenges posed by the complex urban environment of greater Bangkok.

4.2 Bangkok's Green Space Situation

Rapid urbanization has a detrimental impact on urban forests and their ecosystem services. The structure of urban forests plays a crucial role in influencing urban ecosystem functions. Different habitats, such as agroecosystems, wetlands, and forests, contribute distinct ecosystem services, such as food production, nutrient capture, and carbon sequestration (Sommeechai *et al.*, 2018, p. 1). However, urban park studies often overlook unique physical and geographic dimensions of green spaces, including facilities, spatial distribution, landscaping, built and socio-economic context, and other environmental characteristics. This oversight hinders a comprehensive understanding of urban parks (Kongphunphin and Srivanit, 2021, p. 14). Bangkok, with a surface area exceeding 1500 km^2, encompasses substantial non-constructed areas, including agriculture and limited green space, with a relatively small portion designated as park space (Thaiutsa *et al.*, 2008, p. 224). Despite economic developments, maintaining a balanced urban ecosystem necessitates a blend of green spaces and architecture, alongside strategic urban planning to mitigate urban sprawl. The Bangkok Metropolitan Administration (BMA) faces challenges due to insufficient green spaces, and rapid urbanization heightens the city's vulnerability by encroaching on the natural environment (Ali, Pumijumnong and Cui, 2018, p. 472).

Urban public spaces play a crucial role in residents' lives by contributing to urban greening, providing opportunities for outdoor recreation and education, enhancing the city's image, and supporting sustainable urban development. The characteristics of public parks, including size, natural elements, recreational activities, and facilities, reflect their value in urban environments (Kongphunphin and Srivanit, 2021, p. 12). Bangkok boasts a total of 7831 parks covering 37.2 square kilometres or 9192 acres, underscoring the city's commitment to public green spaces (Kongphunphin and Srivanit, 2021, p. 3). However, despite these efforts, the Bangkok Metropolitan Administration (BMA) ranks among capital cities with the least green spaces and the smallest area per person ($3m^2$), emphasizing the pressing need to understand the relationship between urbanization and the decline in the city's green environment (Ali, Pumijumnong and Cui, 2018, p. 477). "The variation in population density contributes to skewed per capita green space values." The central Bangkok district groups, Ratanakosin, and Chaopraya, have an average per capita green space of only 2.8 m2, whereas the citywide average is 11.8 m2. While the per capita total green space in central Bangkok is lower than in some other large Asian cities, the city as a whole compares favorably to green space availability in other developing countries (Thaiutsa *et al.*, 2008, p. 223).

Maintaining semi-naturalized forested parks in Bangkok involves lower proportional costs compared to conventional turfgrass and flowerbed parks. The maintenance is primarily “limited to preventative pruning and weed control, with no irrigation during the monsoonal dry season. Approximately 22% of the proposed park area consists of seasonally flooded areas, suggesting the need for dredging to manage challenges during the dry season” (Thaiutsa *et al.*, 2008, p. 224). “Bangkok's street trees contribute to approximately 0.87 km2 of cover and shade, constituting a small fraction of the total tree cover in the city, which includes street trees but not park trees” (Thaiutsa *et al.*, 2008, p. 225). “Managing species selection for both semi-naturalized parks and street trees” poses a significant challenge due to “the potential for water stress during the monsoonal dry period” (Thaiutsa *et al.*, 2008, p. 228). In categorizing green public spaces in Bangkok, two prevalent methods come into play: typology and classification. Typology delves into the visual and aesthetic aspects, shapes, forms, and patterns of spaces like squares, plazas, streets, and parks. On the other hand, classification hones in on the practical use and value of public spaces, examining their roles, purposes, and how green spaces are utilized within the unique contexts of Bangkok (Kongphunphin and Srivanit, 2021, p. 2). Zooming in on public parks in the Bangkok area, their classification typically revolves around three key approaches: catchment hierarchy, function, and landscape environmental characteristics (Kongphunphin and Srivanit, 2021, p. 2). When delving into this classification, internal factors, such as park size, water features, and recreational facilities, play a pivotal role. Meanwhile, external factors encompass influences from the park's surroundings, such as population density, traffic convenience, and the variety of available recreational facilities (Kongphunphin and Srivanit, 2021, p. 2).

Considering the specifics of Bangkok's urban landscape, the location and surroundings of public parks, including factors like building density, land use, and the availability of services and facilities, are closely intertwined with the city's unique features of urban density, compactness, and mixed-use spaces (Kongphunphin and Srivanit, 2021, p. 5). In this bustling metropolis, the catchment hierarchy considers users influenced by geographical areas, size, level of use, and significance. The function of parks, reflecting roles shaped by real usages like recreation, sport, and nature, is crucial. Lastly, the landscape environment characteristics capture the essence of shapes, forms, and contexts, influenced by factors like park size, the presence of facilities, and the spectrum of available activities in the vibrant city of Bangkok (Kongphunphin and Srivanit, 2021, p. 2).

The Green Bangkok 2030 Project, launched in October 2019, aims to enhance urban sustainability and improve the quality of green spaces in Bangkok. Objectives include increasing green spaces to 10 square meters per person, expanding public green spaces by at least 50 percent in all districts to be accessible within 400 meters or a 5-minute walk from residential areas, and extending the urban tree canopy to cover 30 percent of Bangkok

(Kongphunphin and Srivanit, 2021, p. 3). Despite these goals, challenges arise due to the increasing cost of land in the urbanized environment, making it difficult for the Bangkok Metropolitan Administration (BMA) to acquire land for creating green spaces or public parks. Limited land availability has historical roots, with most existing parks coming from occasional donations from the royal family or the private sector (Marks and Connell, 2023, p. 14). Allocation of green infrastructure impacts financial and ecological sustainability. Balancing expensive turf-flower ornamental landscapes with cost-effective and environmentally adaptable trees is crucial (Thaiutsa *et al.*, 2008, p. 220). The BMA, despite having a substantial budget for various purposes, tends to lease rather than purchase land for park development. This approach is attributed to the dominance of the Public Works Department, which prioritizes infrastructure projects like roads and bridges over parks. The bureaucratic process and regulatory complexities involved in land acquisition further contribute to the BMA's tendency to lease rather than buy land for parks (Marks and Connell, 2023, p. 14). Critics argue that the BMA has failed to prioritize purchasing land for green spaces, with concerns raised about transparency, conflict of interest, and the need for public justification in using tax money for land acquisition. The challenge is exacerbated as land is lost to housing development, making it imperative for the BMA to retain or repurchase land to develop significant public green spaces, as highlighted by research emphasizing the importance of large green spaces to mitigate rising temperatures in the city (Marks and Connell, 2023, p. 14).

Normalized Difference Vegetation Index (NDVI) serves as a tool to distinguish vegetated from non-vegetated areas in image data, with values typically ranging from -1 to +1. Vegetated pixels generally exhibit NDVI values from 0.5 to 0.8 or higher, while values close to zero signify non-vegetated regions (Kamal, Imran and Tripati, 2017, p. 145). Kamal *et al.* utilized NDVI in their study to investigate land use changes in Bangkok through remote sensing and GIS analysis. Vegetation indices, which transform spectral bands into digital data, are crucial for characterizing Earth's features and monitoring dynamic variations in biophysical parameters through remote sensing (Kamal, Imran and Tripati, 2017, p. 145). In the context of mega-cities like Bangkok, comparing multi-date remote sensing images proves valuable for detecting land use changes, especially in the shift towards built-up areas. This analysis aids in implementing short or long-term developmental plans, while observed land use changes may indicate the success or failure of planning efforts due to design or implementation issues. Based on GIS data from the Bangkok Metropolitan Administration (BMA), observed land use changes are interpreted as human-induced, driven by factors like population growth, urbanization, development of suburban hubs, and tourism (Kamal, Imran and Tripati, 2017, p. 143). Results from the study by Kamal *et al.* reveal a notable conversion of greenery into built-up land, particularly in the city's suburbs and along transportation routes. The observed changes exceed predictions from the Multi-Layer Perceptron (MLP) model. The emergence of

new built-up areas is concentrated in suburban and transportation route zones, driven by constructions near the central business district, Western areas of transportation routes, and the banks of the Chao Phraya River. These urban expansions are anticipated to lead to significant reductions in greenery, potentially inducing river meandering by 2030 (Kamal, Imran and Tripati, 2017, p. 151).

Urbanization is generally expected to adversely impact pollinators, leading to greater habitat isolation, reduced pollinator movement, and increased rates of selfing in plants (Stewart *et al.*, 2018, p. 2). Surprisingly, in the highly urbanized context of Bangkok, pollinator abundance was found to be unexpectedly high (Stewart *et al.*, 2018, p. 12). The study revealed that overall pollinator richness and abundance, including focal taxa, did not significantly differ between native and exotic plant species (Stewart *et al.*, 2018, p. 13). “While some studies reported higher pollinator visitation rates to native plant species,” others indicated equal “preference between native and exotic species” for certain pollinators. “Commonly observed plant species in Bangkok included Ruellia simplex C. Wright, Cassia fistula L., and Caesalpinia pulcherrima (L.) Sw.” Additionally, “Gustavia gracillima Miers, Nymphaea nouchali Burm.f., and Nelumbo nucifera Gaertn. were identified as attracting the most pollinator individuals per flower” (Stewart *et al.*, 2018, p. 5). The study's pollination network analysis revealed that “Tetragonula, three Apis species, and Xylocopa aestuans were not only the most common pollinators but also visited a high diversity of plant species” (Stewart *et al.*, 2018, p. 10). The low observed richness in the study may be attributed to the difficulty of classifying common taxa to a more specific level in the field. The observed plant species in Bangkok, often consisting of hedges and lawns, differ from “natural, uncultivated vegetation encountered in previous studies.” Despite these differences, pollinators in Bangkok, with generalized diets, showed no clear “preference between native and exotic plant species.” “Exotic plants, prevalent in Bangkok, may play a crucial role in sustaining the city's pollinator populations” (Stewart *et al.*, 2018, p. 13). The study underscores that the term "green area" extends beyond “traditional public parks, as other patch types with high floral abundance can support urban pollinators” (Stewart *et al.*, 2018, p. 13).

4.3 Environmental Injustice and Urban Heat Island

Megacities in tropical regions of Asia, characterized by dense population density, are anticipated to face more frequent and intense heatwaves in the coming decades (Li *et al.*, 2022, p. 2). Bangkok, in particular, stands out for having the least amount of green space among major Asian cities, with only around three square meters per person, in stark contrast to Singapore's 66 square meters per person (Marks and Connell, 2023, p. 14). The Bangkok Metropolitan Administration (BMA) suggests a slightly higher figure at approximately 6.9 square meters per person (Marks and Connell, 2023, p. 9).

The rapid and unplanned growth of Bangkok, expanding along major transportation routes without designated green spaces, has led to a scarcity of green areas (Marks and Connell, 2023, p. 7). This expansion lacked basic land use planning, resulting in “the blending of various urban land uses, including individual houses, housing estates, and commercial and industrial buildings” (Marks and Connell, 2023, p. 9). The construction of 28,000 houses in the eastern greenbelt was allowed due to nonadherence to zoning regulations. Some developers resorted to bribery to obtain housing permits in these areas (Marks and Connell, 2023, p. 10). The haphazard urban planning and unauthorized developments have significantly diminished the city's green space. Despite urban planning efforts being described as a "highly symbolic modernistic ritual," they are deemed impotent in effectively shaping policy (Marks and Connell, 2023, p. 10).

The Urban Heat Island (UHI) phenomenon, with “its adverse impacts on the urban ecological environment and overall liveability of cities, has become a major research focus in fields such as urban climatology, urban ecology, urban planning, and urban geography” (Estoque, Murayama and Myint, 2017, p. 350). In Bangkok, the UHI has worsened over the past five years due to rapid housing developments, particularly condominiums and high-rise buildings, outpacing the development of green spaces. This imbalance between building development and green space investment contributes to the escalating UHI effect in the city (Marks and Connell, 2023, p. 13). The Surface Urban Heat Island (SUHI) in Bangkok has gradually expanded east and west from 2000 to 2020, correlating with the spatial pattern of urban expansion. Over this period, the urban surface temperature in Bangkok increased by 4.47°C, with a background temperature increase of 3.74°C (Li *et al.*, 2022, p. 8). However, despite these concerning trends, there is a perceived lack of BMA policy and action to address the UHI issue (Marks and Connell, 2023, p. 14).

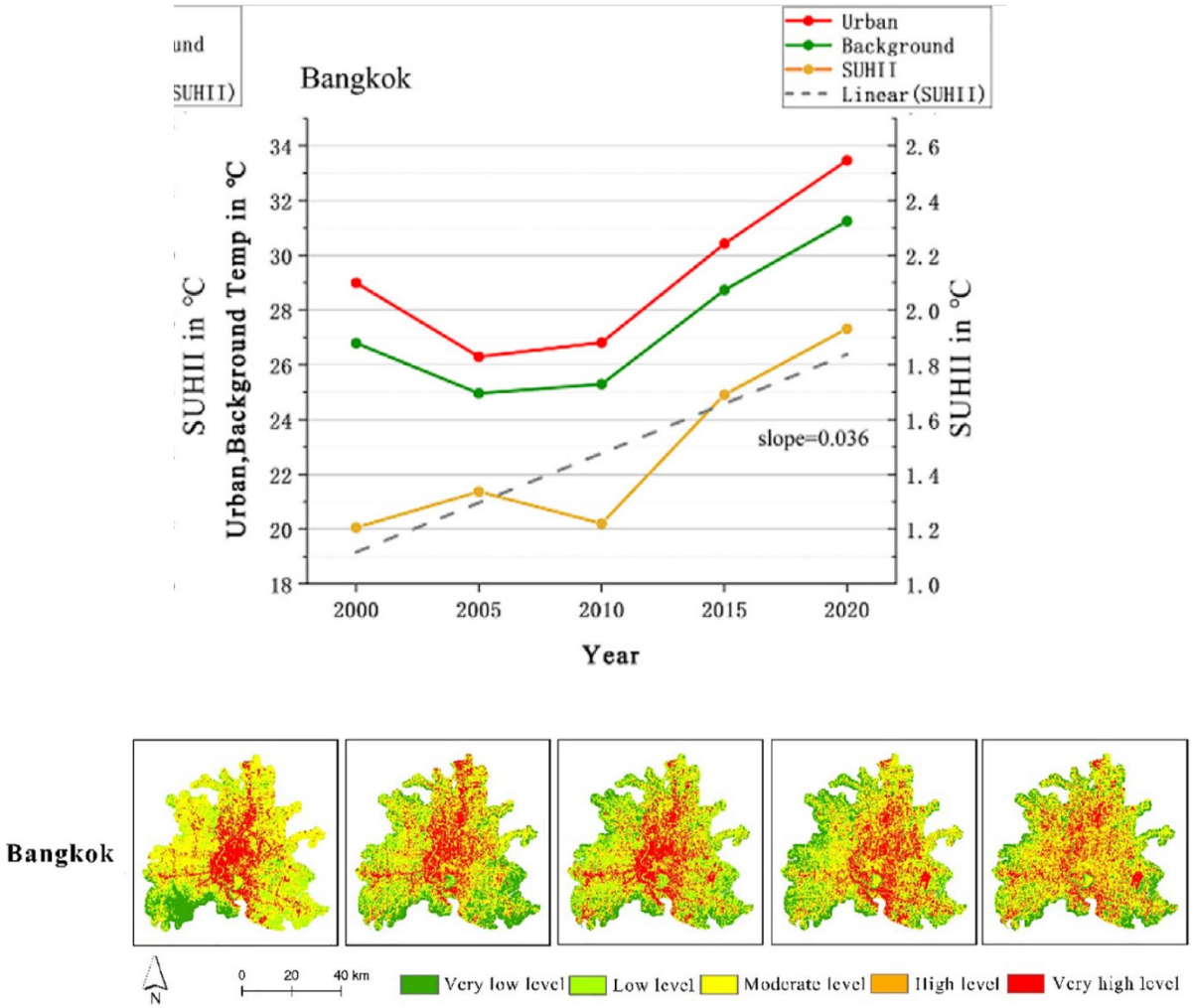


Figure 4-3: Evolution of The Surface Urban Heat Island (SUHI) from 2000, 2005, 2010, 2015, 2020 respectively

The BMA's Department of Environment officials emphasize that a significant portion of their time is spent on approving projects, with only a smaller fraction dedicated to design and construction. Additionally, there is a perception among government staff that UHI is merely a buzzword, with no clear BMA policy addressing it (Marks and Connell, 2023, p. 14).

The uneven distribution of the UHI impact is highlighted, with wealthier groups experiencing fewer consequences than poorer groups in Bangkok. This disparity is attributed to the city's limited parks, with areas characterized by large low-rise buildings and a dense mix of buildings lacking nearby green spaces being the hottest. Notably, low-income communities often reside in these hotter spaces in Bangkok (Marks and Connell, 2023, p. 15).

Bangkok exhibits the highest percentage of impervious surfaces relative to the study area, contrasting with Manila, which has the lowest percentage of impervious surfaces but the highest percentage of green space among the studied cities (Estoque, Murayama and Myint, 2017, p. 350). Despite having the highest impervious surface percentage, “Bangkok's mean

Land Surface Temperature (LST) peaks around 9 km from the city center before gradually decreasing along the urban-rural gradient." The study reveals that "the zones closest to the city center do not consistently have the highest mean LST due to the significant correlation between LST and the density of impervious surfaces and green spaces" (Estoque, Murayama and Myint, 2017, p. 350).

Bangkok faces severe "urban climate challenges associated with the Urban Heat Island (UHI) phenomenon, but there has been limited attention from planners and stakeholders towards implementing mitigation strategies" (Li *et al.*, 2022, p. 8). Notably, impervious surface density drops around 2 km along the urban-rural gradient where green space density remains consistently high for all cities studied. Areas between 3 km and 12 km along this gradient are generally warmer, confirming that impervious surfaces have a more significant impact on LST than green spaces (Estoque, Murayama and Myint, 2017, p. 356).

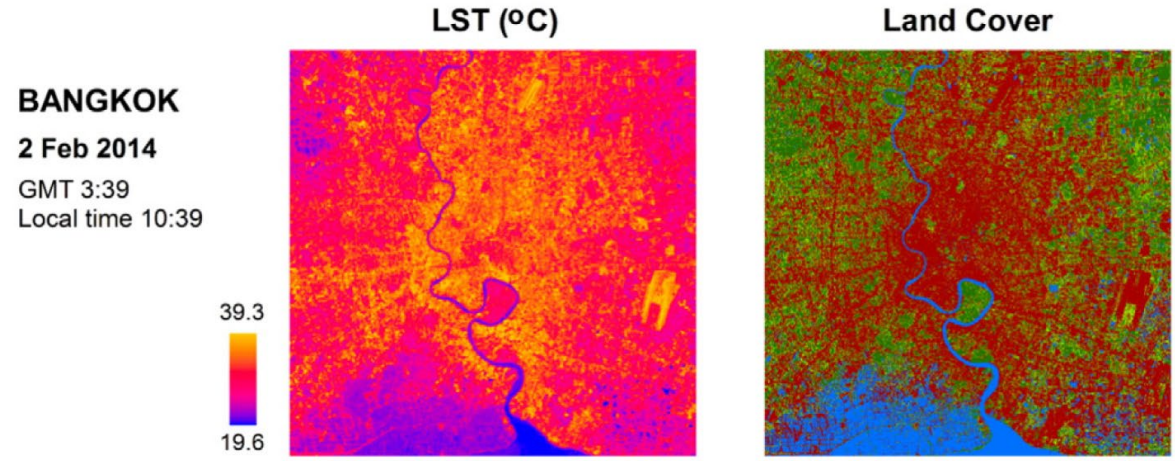


Figure 4-4: Comparing Land Surface Temperature with Land Cover

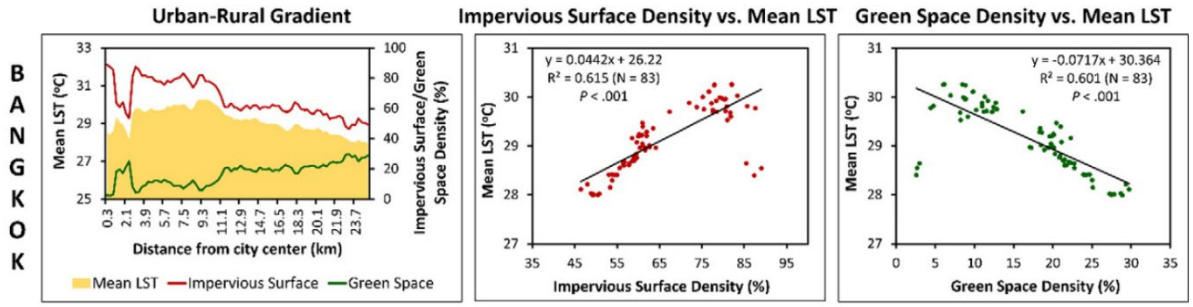


Figure 4-5: Relation between LST and Types of Land Surface

The Department of Town and Country Planning (DTCP), responsible for national-level land use planning, has been criticized for prioritizing economic over environmental concerns, with a focus on concrete-centric urban development. In a 2013 land use plan, the City Planning Department provided a floor-to-area ratio bonus for developers incorporating green spaces, including public parks (Estoque, Murayama and Myint, 2017, p. 358).

The urban climate dynamics in Bangkok, as investigated by Thaiutsa *et al.* (2008, p. 220), highlight the distinctive influences on temperature variations. “The monsoonal climate intensifies temperatures during the dry period from December to April,” due to the urban heat island effect. Urban and core areas exhibit lower ventilation efficiencies with slower nocturnal wind speeds compared to rural regions. The study emphasizes the significance of spatial environmental factors, particularly the Distance from the Coastline in the Direction of Sea Breeze (DCDS), in shaping the diurnal distribution of maximum temperatures (Tmax) during summer. Additionally, the Green Coverage Ratio (GCR) impacts the nocturnal distribution of minimum temperatures (Tmin), with urban areas experiencing higher Tmin values than rural areas. This research underscores the complexity of environmental factors and their interconnected effects, emphasizing the importance of considering both regional and provincial influences on temperature patterns in Bangkok (Thaiutsa *et al.*, 2008, p. 220).

“Green spaces play a crucial role in mitigating urban heat,” as they provide shading that prevents direct heating of land surfaces from solar radiation (Estoque, Murayama and Myint, 2017, p. 350). The increase in green space is associated with a decrease in Land Surface Temperature (LST) due to the cool island effects generated by evapotranspiration, emissivity, and lower thermal inertia compared to impervious surfaces (Estoque, Murayama and Myint, 2017, p. 352).

Results indicate statistically significant correlations between impervious surface density, green space density, and mean LST across various grid sizes in the study of Bangkok. Mean LST is found to be positively correlated with impervious surface density and negatively correlated with green space density along the urban-rural gradients, reflecting a typical Urban Heat Island (UHI) profile (Estoque, Murayama and Myint, 2017, p. 356). This correlation strengthens with larger grid sizes, highlighting the impact of impervious surfaces on temperature (Estoque, Murayama and Myint, 2017, p. 356). The study consistently finds that impervious surfaces contribute to higher LST, about 3 °C higher on average than green spaces, providing evidence for the heat island effects of impervious surfaces and the cooling effects of green spaces (Estoque, Murayama and Myint, 2017, p. 356). “The cooling effect of green spaces is more pronounced in closer proximity,x explaining the decreasing correlation trend between green space density and mean LST as the grid size increases” (Estoque, Murayama and Myint, 2017, p. 356).

Bangkok experiences a significant Urban Heat Island (UHI) intensity, reaching approximately 6–7°C during the hot season, as measured by the temperature difference between urban and nonurban (less than 25% built-up area) points (Marks and Connell, 2023, p. 4). The UHI in Bangkok is notably uneven, and there is a lack of consideration in the existing literature on Thailand's political economy regarding how urban changes influence the UHI, particularly in terms of access to green space (Marks and Connell, 2023, p. 5).

The adverse effects of this UHI are substantial, with over 80% of Bangkok's inhabitants reporting that heat negatively impacts their daily activities. This, in turn, contributes to adverse physical and mental health conditions and reduces overall life satisfaction in the city (Marks and Connell, 2023, p. 17).

“The impact of Urban Heat Islands (UHIs) in Bangkok is analyzed through a political ecology perspective, highlighting the scarcity of studies on this topic in Asia” (Marks and Connell, 2023, p. 17). Access to green space in the city remains highly unequal, with few large parks concentrated in the city center where land prices are highest and wealthier residents reside (Marks and Connell, 2023, p. 15). The Bangkok Metropolitan Administration (BMA) lacks a policy to provide green space for low-income communities, leading to disparities in heat stress experiences among different income groups (Marks and Connell, 2023, p. 15).

Living in areas with limited green space, high crime levels, and restricted public amenities may increase the vulnerability of certain groups, such as the elderly and ethnic minorities, to heat waves (Marks and Connell, 2023, p. 3). Wealthy individuals typically have better access to public parks or private green spaces in residential housing estates and condominiums (Marks and Connell, 2023, p. 3). New green spaces in high-end developments, such as condominiums and hotels, mainly serve aesthetic purposes and micro-cooling within those spaces, rather than significantly addressing the city's UHI (Marks and Connell, 2023, p. 15).

The urban political ecology (UPE) perspective is deemed valuable for examining UHIs, emphasizing the historical and socio-spatial factors that contribute to the uneven distribution of vulnerability, risk, and ecological breakdown in cities (Marks and Connell, 2023, p. 17). UHI intensifies the effects of heatwaves, and vulnerable populations often reside in neighborhoods with the highest UHI intensity (Marks and Connell, 2023, p. 3). Access to new green space is limited to the privileged who can afford exclusive properties, while the BMA's reluctance to acquire land for parks and the high cost of land contribute to the overall scarcity of public green space in Bangkok, particularly beyond central areas (Marks and Connell, 2023, p. 9).

The distribution of green space in Bangkok is uneven, prompting government initiatives to address the situation. Since April 2021, landowners with undeveloped plots must pay a vacant land tax, leading many to offer their land to the Bangkok Metropolitan Administration (BMA) to avoid the tax. The BMA, restricted in its authority, can manage certain infrastructure but faces challenges in public transport and traffic control. Collaborations between the BMA and groups like WePark aim to address the lack of parks. However, weaknesses in local governance, administrative fragmentation, and limited private sector involvement have contributed to Bangkok's Urban Heat Island (UHI) effect. Political ecology has played a role in shaping urbanization, making it challenging to reverse the increasing UHI.Those profiting from urban development, such as real estate developers, experience fewer consequences of the

UHI compared to low-income communities who contribute less to the problem but are more vulnerable. The study suggests that urban thermal environments are not easily resolved through planning and engineering measures, emphasizing the role of social and political processes over decades. It highlights the need to address the UHI's social implications and vulnerabilities, rather than merely focusing on building resilience to climate risks (Marks and Connell, 2023, p. 18).

The recommendation for urban planners and policymakers is to optimize urban landscapes by clustering vegetation and dispersing built surfaces. Attention should be given to areas 3 km to 12 km from city centers, where mean Land Surface Temperature (LST) is high and green space density is low. “The study emphasizes the importance of the green space-to-impervious surface ratio, suggesting a need for a significantly larger vegetation cover compared to impervious surfaces, especially in megacities.” Urban planners and policymakers are encouraged to consider the abundance and spatial pattern of green space in landscape and urban planning, promoting the clustering of vegetation while dispersing built structures. (Estoque, Murayama and Myint, 2017, p. 358).

4.4 Government’s Green Definition and goals in Bangkok

In Bangkok, the Department of Environment under BMA is responsible for maintaining urban green spaces. The Public Park Office is responsible for planning, developing, and maintaining trees, park lawns, mini parks, street islands, roadside areas, and other green spaces (BMA, 2009, p. 5). According to Bangkok's green spaces master plan in 2003, green spaces are primarily defined as 'public parks.' BMA states that:

> “Public Park is a park that is composed of a fence around the park’s parameter which is under the control of the BMA’s staff or security guards. Public Park must have a definite opening and closing time, which is enforced by law Bangkok’s regulation. Public Parks contain various kind of vegetation and plant flowers and ornamental plants throughout the year” (BMA, 2023, n.p.).

“BMA defines green spaces as primarily referring to public parks in urban areas, which are categorized into seven types: pocket parks, neighborhood parks, community parks, district parks, city parks, street parks, and special purpose parks.” Each type of park serves different users and areas with varying purposes and characteristics. For example, pocket parks are small, covering approximately 3.6 hectares and serving a radius of one kilometer, while city parks are large, covering more than 800 hectares and serving the entire city.

Public Park Types	Sizing	Service Radius	Purpose
Pocket Park	< 3.6 ha	1 km	Pocket Park is distributed around the city and located within walking distance. The park is suite for the residential area which contain a function for playground, exercise, and leisure for multi aging group.
Neighborhood Park	3.6 ha-40 ha	1-3 km	Neighborhood Park is located among the community for members to enjoy the green space. This kind of park provides more function than pocket park as it services more people.
Community Park	40 ha-200 ha	3-8 km	Community Park contain more public facilities than the first and second type of public park especially a sport stadium. The park includes aesthetic element such as ornamental flowers.
District Park	200 ha-800 ha	>8 km	District Park services urban residents that commute by walking and public transportation. The park includes public facilities that dismiss in other smaller type of park such as large flower garden, water pond, bike track, and fishing area.
City Park	>800 ha	Bangkok Area	City parks contain cultural functions during national events and festivals. The park has potential to services people throughout Bangkok that seek a place for their leisure. The park has various activity which focus on active recreation.
Street Park	Not Specific	-	Street Park is a green area along the traffic and circulation such as linear park along bicycle lane, street island, and roundabout.
Special Purpose Park	Not Specific	-	Special purpose park is a green space that beyond other type of park such as a green space at the monument, historical park, and cultural park.

Figure 4-6: BMA's seven types of green space

The definition of green space according to BMA is limited to public parks. However, ONEP (Office of Natural Resources and Environmental Policy and Planning) provides a broader definition of green space in their "Work Practice Document for Sustainable Green Space Management Phase 2". ONEP's definition includes natural areas and is more extensive than BMA's definition.

> “Natural areas or areas that are created or defined by humans in the city or the community. Green space is mainly covered by vegetation, which is benefit to the environment, ecology, and living quality of people” (ONEP, 2022, p. 4).

Furthermore, ONEP differentiates sustainable green space from general green space.

> “The green area that contain diversity of vegetations in terms of quality and quantity, which has large tress as the main component. Sustainable green spaces are maintained for the proposed for the balance of ecology, environment, aesthetic, and wellbeing. Sustainable green spaces can benefits living standards of urban residents, communities, and visitors that enhance economic and social” (ONEP, 2022, p. 4).

The green space ratio in Bangkok is currently 3 m^2 per person, but ONEP aims to increase it to 10 m^2 per person and increase the green space percentage to more than 10 percent in the metropolitan area by 2027. To achieve this goal, ONEP has set out a strategy in their working practices document, which consists of four main aspects.

Firstly, they plan to build public awareness about the importance of sustainable green spaces by creating green space prototypes and supporting green space development to mitigate the impact of industrial and commercial operations. Secondly, they want to utilize sustainable green spaces to build food security, mitigate the impact of natural disasters, and support the community's green economy by enhancing ecosystem services. Thirdly, they aim to develop legitimacy and economic mechanisms that will help increase green spaces and incentivize green space management. They also plan to build databases and use technology for data collection. Lastly, ONEP plans to apply local wisdom and knowledge about green space management for natural conservation. They also aim to create local social networks to enforce green space operation.

It's important to note that ONEP's green space strategy is not just applicable in Bangkok but is relevant to the entire country. Their green space standard can be used as a framework to improve the green space situation in Thailand.

ภาพที่ ๒ สรุปสาระสำคัญของแนวทางปฏิบัติงานเพื่อขับเคลื่อนการจัดการพื้นที่สีเขียวอย่างยั่งยืน ระยะที่ ๒ (พ.ศ. ๒๕๖๖ - ๒๕๗๐)

Figure 4-7: ONEP's green space strategy (Diagram in Thai)

Developing and managing green spaces in a complex city like Bangkok is an enormous challenge because there is a lack of baseline data on urban forest structures. Furthermore, the urban forest situation in Bangkok is not healthy due to the city's complexity and limitations. A study conducted by Intasen *et al.* in 2017 examined Bangkok's urban forest by collecting a random sample of trees in 184 plots. The research revealed that the tree population in Bangkok mainly consists of small-diameter trees, with an average diameter at breast height (DBH) of only 14.6 cm. Additionally, 69.6% of the tree population had a DBH of less than 23 cm. Moreover, most of the trees in Bangkok's urban forest are alien species, with only 14% being native Asian species.

Despite the inclusion of urban forestry in Thailand's national legislation, green spaces in Bangkok still suffer from poor quality. The urban forest in Bangkok can store around 738 metric tons of carbon annually (0.008 metric tons per hectare), whereas the city's greenhouse gas emissions in 2020 reached approximately 46.44 million tons. Therefore, the situation of Bangkok's urban forest highlights the need for practical solutions to enhance the green space policy launched by the Bangkok Metropolitan Administration (BMA) and the national government.

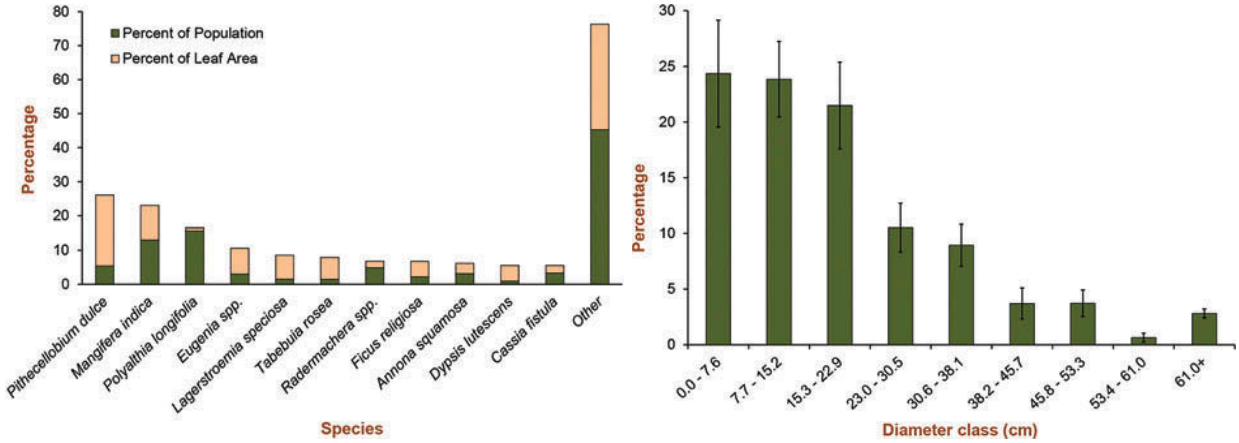


Figure 4-8: Typical trees species and average trunk diameters

4.2.1 Governor's Environment Policy and Open Space Planning

Recently, Bangkok elected a new governor, Chatchart Sitthiphan, after the previous governor was appointed under the dictatorship regime. Under Governor Chatchart's supervision, the Bangkok Metropolitan Administration (BMA) seems to be more aware of the environmental crisis. Several policies have been implemented to improve the environmental situation and create a healthier Bangkok. One of the most notable policies introduced by Governor Chatchart is the "15 Minutes Parks" initiative. This policy aims to improve the accessibility of green spaces within an 800-meter radius around urban communities (Sitthipan, 2022, p. 72). To achieve this goal, the BMA is exploring potential vacant spaces in private and public property to develop pocket parks. These newly developed pocket parks allow urban residents to access green spaces that are distributed around the city. The BMA is also actively promoting the development of green spaces over private property through the "privately owned public space" (POPS) model (Sitthipan, 2022, p. 73). This model incentivizes private property owners to develop public green spaces by offering tax deductions for public benefits. Under this model, new associations collaborate with the BMA to define an agreement for public space management, including providing maintenance services on private property.

Chatchart is responsible for developing working guidelines to enhance the quality of existing green spaces. In Bangkok, the sports field is planned to have more vegetation added to improve the distribution of green spaces - which are currently available in around 1,034 public places (Sitthipan, 2022, p. 73). The locations of parks that can be reached within 15 minutes are planned to be documented as open data, allowing people to easily find green spaces in their neighborhoods. The management of green spaces will also be improved, and their numbers increased. Park opening hours will be adjusted to better suit the needs of the

local community through a public participation process. The facilities in public parks, such as toilets, shower rooms, changing rooms and fitness equipment, will be improved to better match the needs of park users (Sitthipan, 2022, p. 74). Chatchart is also proposing to allocate trading spaces (hawker centers) for hawker stalls in public parks, ensuring they are managed in a hygienic and orderly manner. Finally, the accessibility of public parks will be improved by adding signage and public transport connections to accommodate park visitors (Sitthipan, 2022, p. 74).

In an effort to improve green spaces in Bangkok, Chatchart has developed a strategy to maintain urban trees. The Million Trees policy aims to increase the tree population in Bangkok by planting 400 trees in each district every week, with the goal of reaching one million trees in just four years (Sitthipan, 2022, p. 68). This policy is expected to mitigate air pollution, provide shading, and promote urban ecology, making it a key solution to environmental problems in the city. To ensure the effective maintenance of these urban trees, horticulturists play a vital role, and the BMA is organizing training sessions to improve their working procedures across every district (Sitthipan, 2022, p. 70).

Chatchart has implemented an environmental policy that aims to tackle environmental challenges and prepare for the potential impacts of climate change. The policy aligns with the 2013 open space master plan, which aims to preserve open spaces as ‘green linkages’ for recreation and to maintain environmental quality. The plan includes six types of green linkages, which will run along streets, canals, and rivers (Sitthipan, 2022, p. 72).

1. Open space for recreation and maintain environment quality
2. Open space for preserving environment quality along the street
3. Open space for preserving the quality of the environment along rivers and canals
4. Open space to preserve natural drainage conditions
5. Open space for water reservoir and flood protection
6. Open space to conserve and restore the coastal environment

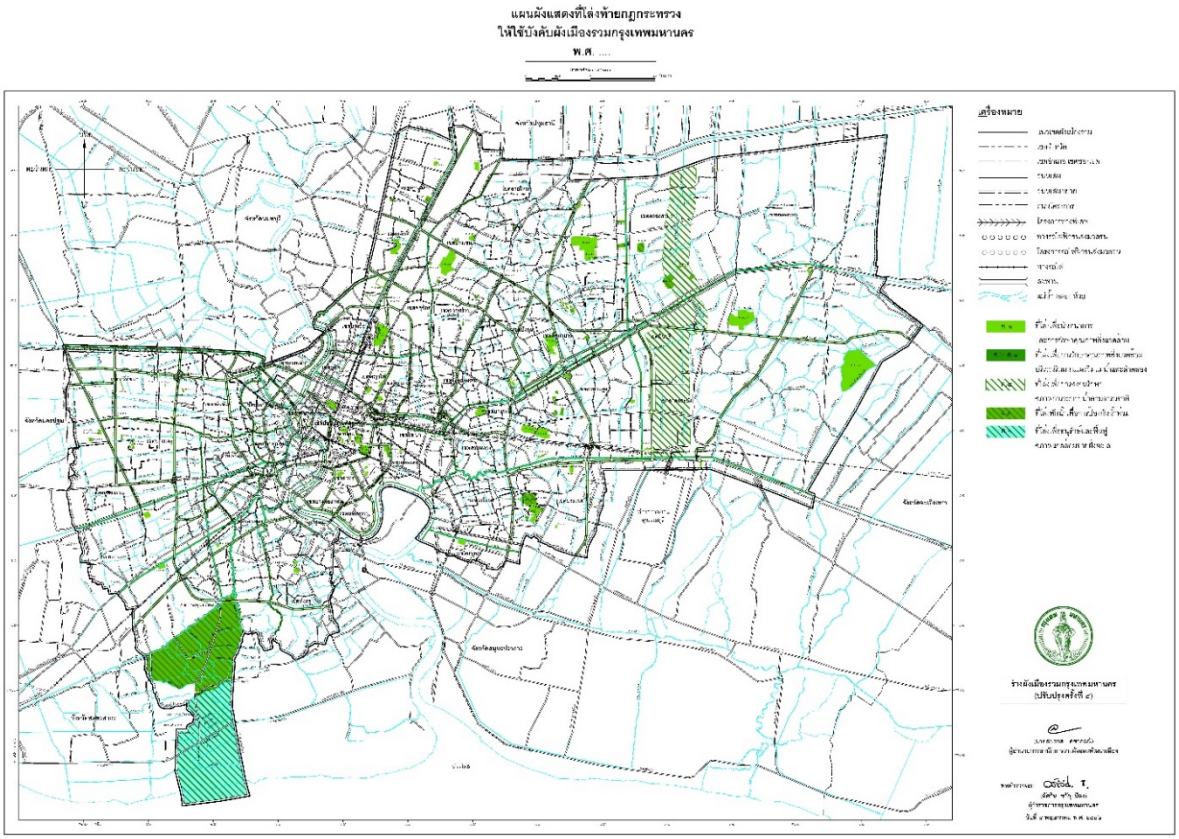


Figure 4-9: Bangkok’s open space mapping

There are several criteria used by BMA to categorize environmental spaces in Bangkok, including six types of open space and seven types of public parks. However, the most relevant criterion for the environmental situation is the "Green Space for a Good Urban Environment in Bangkok" which was included in Bangkok's green space masterplan in 2003. This criterion classifies Bangkok's green spaces into nine types based on their characteristics and geography, including outdoor sport fields, golf courses, water bodies, lowlands, vacant spaces, tree-covered spaces, agricultural land, aquaculture areas, and miscellaneous land. This classification is more likely to aid the governor in enhancing the environment, as it provides a tool to categorize areas based on their unique characteristics and geography (Sitthipan, 2022, p. 72).

4.2.2 Green Bangkok 2030 and Bangkok’s 20 years development plan

Bangkok's Green 2030 policy aims to increase the number of green spaces in the city by expanding the green areas by 30%, despite several limitations such as land acquisition, land maintenance, and activity conflicts (Asawakowitwong, 2021, p. 3). The Bangkok Metropolitan Administration (BMA) usually develops green spaces over public lands or royal properties as they need to save the budget for infrastructure investments. However, the BMA

does not have enough public lands to create more green spaces. Currently, land acquisition is the only approach to creating green spaces in Bangkok. However, land acquisition for green spaces on private property is usually a long-term contract for a certain period of around 10 years, which is a limitation for increasing green spaces due to the expensive land price (Asawakowitwong, 2021, p. 3). Therefore, these limitations indicate that the government's action alone is not an effective approach to achieving Green Bangkok 2030 (Asawakowitwong, 2021, p. 3).

In a study conducted by Asawakowitwong in 2021, the mechanism to increase green space in Thailand through policy dialogue between government organizations, civil society, local communities, and private organizations was explored. Asawakowitwong proposed three frameworks to achieve Green Bangkok 2030: privately-owned public spaces, economic management mechanisms and incentive creation, and co-creation.

The concept of privately-owned public space involves promoting collaboration between private organizations and public sectors to create green spaces. Private organizations can help overcome limitations that the government may face in terms of land, expertise, and management potential. By providing more flexibility in terms of services and management, private sectors can help create and manage public spaces more efficiently and effectively. Collaboration between public and private sectors can be achieved in four ways: public green spaces managed by public sectors, public green spaces managed by private sectors, private green spaces managed by public sectors, and private green spaces managed by private sectors.

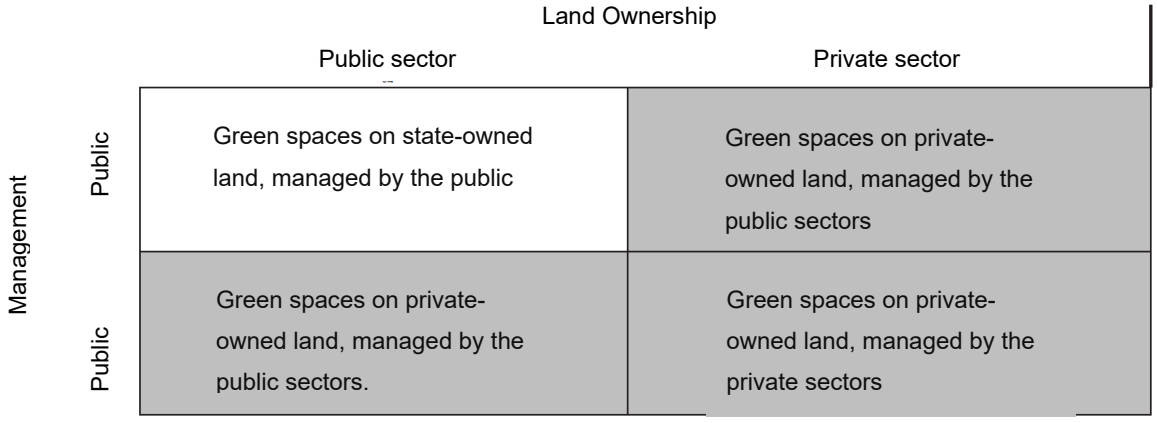


Figure 4-10: Asawakowitwon’s Framework

The concept of economic management mechanisms and incentive creation is aimed at encouraging the private sector to participate in the creation of green spaces. This concept is divided into two parts. Firstly, it aims to create motivation for the private sector to develop or allocate the land or empty spaces it owns for recreational purposes, which can be used as public green spaces in the city. Secondly, it provides opportunities for the private sector to

manage these areas more efficiently, given the flexibility in adjusting management strategies in green spaces. Incentive mechanisms can be implemented in various ways, such as increasing the benefits of floor area ratio in development or reducing tax measures. However, these incentives alone are not enough to maintain the quality of green spaces generated. Therefore, it is crucial for government authorities to assess the worthiness of investment and cooperation procedures before collaborating with private sectors (Asawakowitwong, 2021, p. 5).

Co-Creation is a concept that involves co-decision and co-design of activities and programs related to green spaces. It is a tool that enables the creation of green spaces that cater to the needs of all stakeholders. This process allows all interested parties to present their ideas and work together to take responsibility. The fundamental principle of the Co-Creation process is to design activities that promote an open and inclusive environment and actively listen to diverse needs, concerns, and possibilities. The goal is to create a shared vision collectively. Co-Creation serves as a tool to generate questions and programs in designing the environment, formulating details, and developing mechanisms for managing space based on empathy (Asawakowitwong, 2021, p. 6).

It is clear that the three frameworks introduced by Asawakowitwong are closely linked to both the 'G&M' framework and the Co-management framework introduced by Jansson *et al.*, 2019. These frameworks promote collaboration among different actors to address the challenges of resource distribution and conflict resolution. Furthermore, the Frameworks for Green Bangkok 2030 are aligned with the 20-year development plan for Bangkok, which is a policy of the BMA. The second strategy in the 20-year development policy includes green space enhancement (Asawakowitwong, 2021, p. 6).

> “Sub-strategy 2.2 focuses on green spaces for a healthy and sustainable environment by international standards. It aims to guide the development direction of green spaces in Bangkok, considering.
> 1. the development of new green spaces in collaboration with various stakeholders and
> 2. the enhancement of existing green spaces to accommodate:
> 2.1. Environmental system services and urban carbon reduction,
> 2.2. Mitigation of natural disaster impacts,
> 2.3 Recreational use for relaxation, mental well-being, education, design, and architecture,
> 3. Improvement and development of the city's green network to create connectivity among urban green spaces, including green areas along main roads.” (BMA, 2018)

Over the course of the next 20 years, the environmental policy will be centered around two key strategies - creating an inclusive city and mitigating the effects of climate change. Specifically, sub-strategy 2.2.1 will focus on encouraging the participation of the community and private sector in managing green spaces (BMA, 2018, p. 112). This will involve

establishing a green space development fund for investing in creating and maintaining green spaces. The process of monitoring and evaluating the development of these green spaces will be supported by open data to aid in decision-making (BMA, 2018, p. 113). Sub-strategies 2.2.2 and 2.2.3 will be focused on ecosystem services related to urban natural conservation that benefits the living standards of urban residents. The Bangkok Metropolitan Administration (BMA) will be responsible for developing green spaces for recreational purposes, improving the environmental situation within the city, and building a climate adaptation city that is well-prepared to handle the crisis of climate change. Ultimately, the aim is to elevate Bangkok to a climate resilience city (BMA, 2018, p. 121).

5. Key Finding and Data Analysis

After providing insights into Bangkok's environmental context and examining policies directly influencing the trajectory of urban green spaces, Chapter four delves into the evidential foundation concerning Bangkok's issues tied to rapid urbanization, environmental injustice, and the urban heat island phenomenon. The current focus of governmental initiatives in the urban domain predominantly centres on enhancing traditional green spaces like public parks and pocket gardens, with no explicit attention given to novel ecosystems. This governmental policy review marks the initial step in the threefold research design.

The subsequent chapter, Chapter five, systematically unveils the entire research process and its outcomes. The chapter commences with a macro-scale Geographic Information System (GIS) analysis to pinpoint potential research sites. Subsequently, it delves into the outcomes of on-site surveys, capturing the perspectives of participants with first-hand experience of the sites. Finally, the chapter delves into the findings from expert interviews, exploring the prospects of integrating informal green spaces and novel ecosystems into Bangkok's green space policy.

5.1 Macro GIS Analysis and Potential Sites Identifying

As mentioned in chapter four, Bangkok’s surface area is around 1500 m^2 with the population around 10 million people. Hence, the estimated population density in Bangkok should be roughly around 6,600 people per square kilometre. Bangkok Metropolitan Administrator (BMA) divide the city into 50 districts, which can be categorized as three group including inner city, intermediate city, and outer city (BMA, 2013, p. 3). The figure 5-1 shows names and locations of each district in Bangkok. Potential site seeking method, use the information of these 50 districts for GIS analysis to find high green spaces demanded district to implement the research. The shapefile data that are utilized for the analysis is the BMA’s open data integrating with Open Street map (OSM) data.

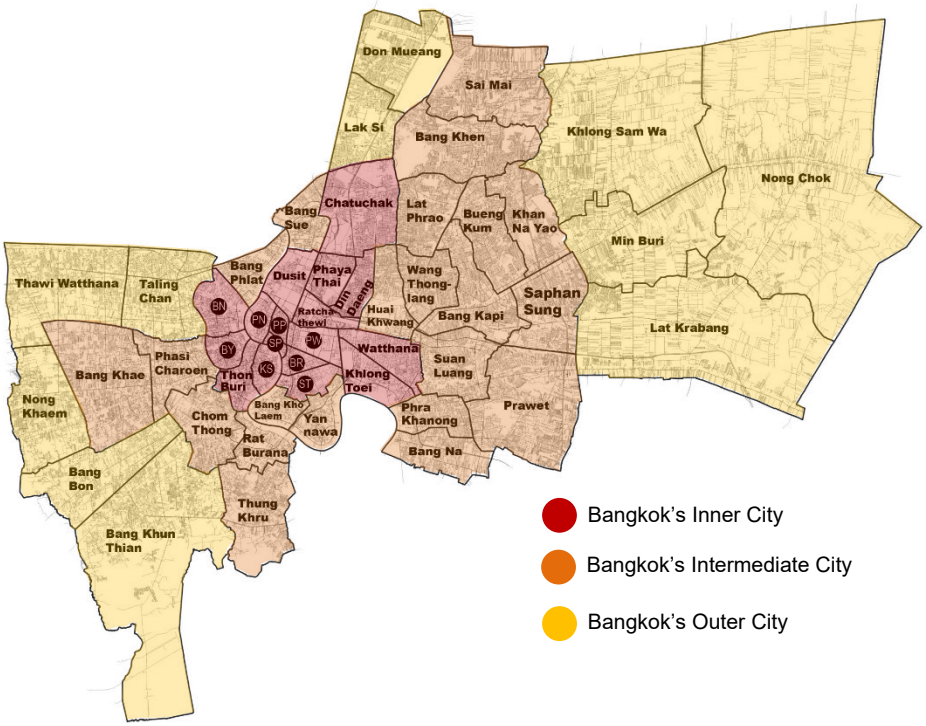


Figure 5-1: Bangkok's 50 districts

List of Districts' Name				
1: Phra Nakhon (PN)	11: Samphanthawong (SP)	21: Nong Khaem (NK)	31: Khlong Toei (KT)	41: Khan Na Yao (KN)
2: Dusit (DS)	12: Phaya Thai (PT)	22: Rat Burana (RB)	32: Suan Luang (SL)	42: Saphan Sung (SS)
3: Nong Chok (NC)	13: Thon Buri (TB)	23: Bang Phlat (BP)	33: Chom Thong (CT)	43: Wang Thonglang (WT)
4: Bang Rack (BR)	14: Bangkok Yai (BY)	24: Din Daeng (DD)	34: Don Mueang (DM)	44: Khlong Sam Wa (KSW)
5: Bang Kapi (BKA)	15: Huai Khwang (HK)	25: Bueng Kum (BKU)	35: Ratchathewi (RC)	45: Bang Na (BN)
6: Pom Prap Sattru Phai (PP)	16: Klong San (KS)	26: Sathon (ST)	36: Lat Phrao (LP)	46: Thawi Watthana (TW)
7: Phra Khanong (PK)	17: Taling Chan (TC)	27: Bang Sue (BS)	37: Watthana (WA)	47: Thung Khru (TK)
8: Min Buri (MB)	18: Bangkok Noi (BN)	28: Chatuchak (CC)	38: Bang Khae (BK)	48: Bang Bon (BB)
9: Lat Krabang (LK)	19: Bang Khun Thian (BT)	29: Bang Kho Laem (BKL)	39: Lak Si (LS)	49: Bang Khen (BKH)
10: Yan Nawa (YN)	20: Phasi Charoen (PC)	30: Prawet (PR)	40: Sai Mai (SM)	50: Pathum Wan (PW)

Figure 5-2: List of Districts' Name

The method for identifying potential research sites focuses on districts with the highest vulnerability in green space across three dimensions: *'spatial analysis', 'economic vulnerability analyses, and 'social vulnerability analyses*. However, given the constrained timeframe for the research, the consideration of potential wastelands in each district must align with the level of

investment in green spaces. As discussed in Chapter three, urban green spaces in Bangkok predominantly comprise conventional public parks. Consequently, this chapter's evaluation of informal green spaces will diverge from the seven types of green spaces criteria and instead adopt the BMA's nine types of green spaces criteria (BMA, 2023, n.p.). While these criteria are not widely referenced, they are particularly relevant to this research, pertaining to wastelands featuring spontaneous vegetation in the city. Despite their limited usage, these criteria prove highly effective for evaluating spontaneous vegetation and novel ecosystems that can give rise to informal green spaces. Further details on the nine types of green spaces criteria can be found in Figure 5-2.

BMA's Nine Types of Green Spaces Criteria	
Green Space Types	Purpose
Public parks and Open Sports Fields	Refers to open sports fields of all types with an area of 500 square meters or more each, aimed at supporting sports and related activities that benefit public health and physical activity. .
Golf Courses	Encompasses all golf courses to promote golf activities and develop areas that provide golf-related services.
Water Sources	Includes water features such as ponds, marshes, and basins with flooding lasting more than 6 months per year, each with an area of 500 square meters or more. This is to promote water treatment and resource management.
Low-Lying Area	Green areas associated with flooded depressions covered with plants, such as grassy areas, with a size of 500 square meters or more each, to reduce flooding and promote plant growth.
Wastelands	Refers to open or vacant spaces with an area of 1 acre or more and a size of 500 square meters or more each. These areas could be public spaces or open spaces that benefit the community.
Tree-Canopy Area	Green areas dominated by groups of trees covering at least 1 acre, including tree orchards, to create aesthetically pleasing green spaces that benefit the environment.

Agricultural Area	Green areas associated with agriculture, such as rice fields and grass cultivation, to support agricultural activities.
Aquaculture Areas	Green areas related to aquaculture, including fishponds, to support aquaculture activities and water resource management.
Miscellaneous Areas	Refers to areas with potential for development into green spaces for recreation and environmental improvement, such as canal banks, areas under or along expressways, etc. This emphasizes the importance of diverse and efficient development of green areas.

Figure 5-3: BMA's nine types of green space criteria

5.1.1 Urban Green Spatial Analysis

Initiating the spatial analysis, the examination of green spaces entails exploring the correlation between vulnerable green district and population density. Various data fields are employed for this urban green spatial analysis, encompassing population density, housing numbers, green space ratio, green space size, and the count of green spaces. Each dataset is sourced from reputable outlets. Population density and housing data for Bangkok are derived from Thailand's Open Government Data (data.go.th). Additionally, information on green spaces is referenced from both the Geographic Information Division and the Department of Environment within the Bangkok Metropolitan Administration (BMA). The objective is to pinpoint districts characterized by low green space coverage and high population density. This analysis is facilitated using QGIS through a classification process. The various data fields undergo sorting with the assistance of the "Sort Ascending" plugin, culminating in a map that highlights districts exhibiting the lowest green space and the highest population density.

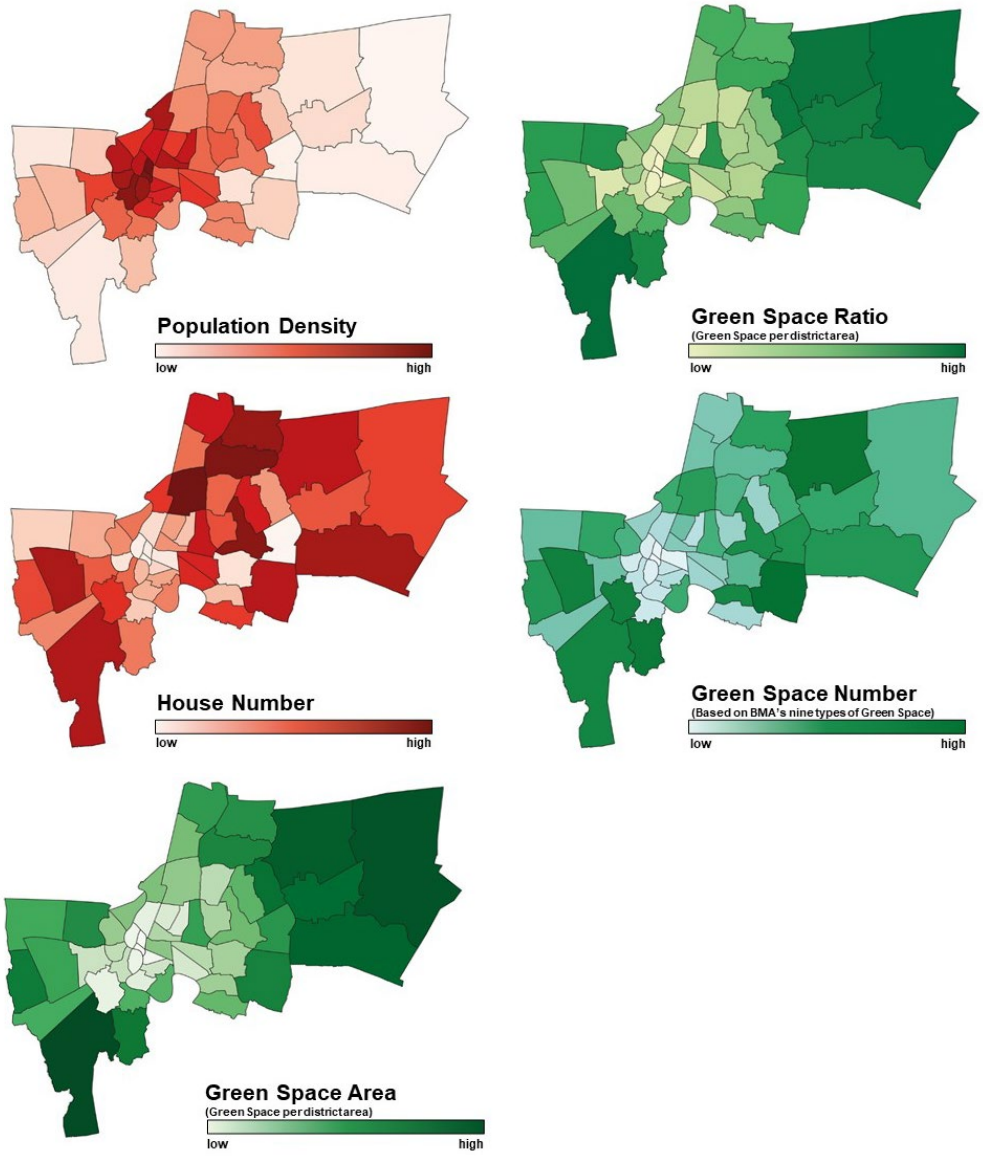
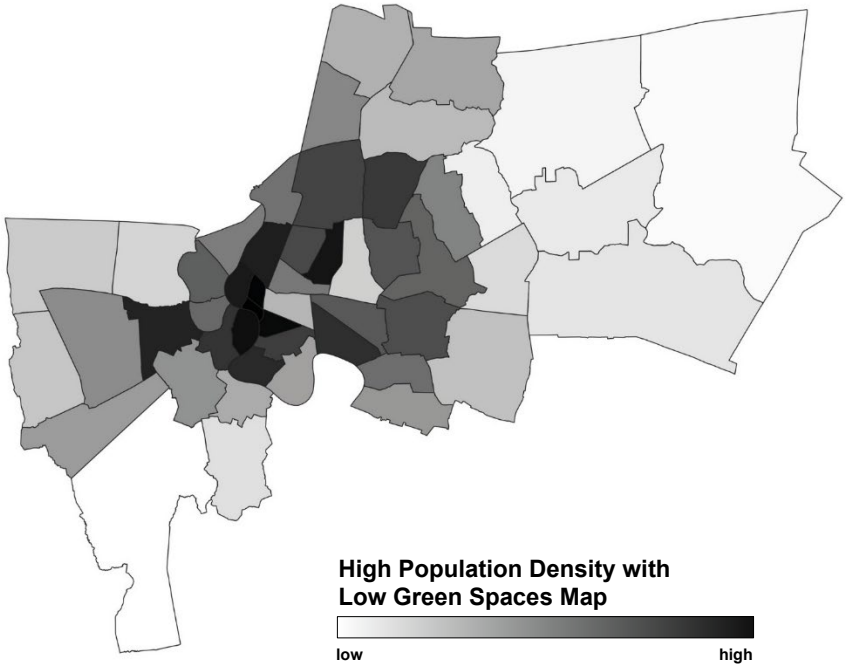


Figure 5-4: Map of Criteria for Urban Green Spatial Analysis

In Figure 5-4, the illustration depicts the outcomes of the green space criteria analysis presented in the form of a heat map. The results of individual criteria analyses are overlaid and organized using the "Sort Ascending" plugin in QGIS, ranging from 1 to 50 based on the green space criteria data. The outcome reveals areas identified as the most vulnerable green spaces, characterized by limited green coverage but experiencing high population density range from low to high from 1 to 50 respectively. The district that rages number one is the most green space vulnerable, and the district that rage number fifty is the less green space vulnerable.



Top Ten Green Vulnerable
1: Samphanthawong (SP)
2: Pom Prap Sattru Phai (PP)
3: Bang Rak (BR)
4: Khlong San (KS)
5: Din Daeng (DD)
6: Phra Nakhon (PN)
7: Dusit (DS)
8 Phasi Charoen (PC)
9: Bang Kho Laem (BKL)
10: Khlong Toei (KT)

Figure 5-5: High Population Density with Low Green Spaces Map

As a result, the map depicting high population density with low green spaces reveals districts grappling with a situation of green vulnerability. According to the map, areas with limited green spaces are concentrated around the inner-city zone along the Chao Praya River. Among the top ten ranked districts, as shown in figure 5-5, Samphanthawong emerges as the most green-vulnerable district in Bangkok.

5.1.2 Economic Vulnerability Analysis

In the literature review and exploration of Bangkok's environmental context, the paper highlighted the uneven distribution of urban green spaces in the city. As noted by Kabisch and Hasse (2014, p. 130), this disparity in green space availability can lead to adverse impacts on health and exacerbate social inequalities, particularly among low-income individuals. Additionally, Marks and Connell (2023, p. 14) posit that low-income communities often become urban heat island hotspots in Bangkok. Consequently, economic considerations become a crucial criterion for identifying potential research sites.

Adopting a methodology akin to the green space vulnerability analysis, the economic vulnerability analysis follows the same process to identify districts in Bangkok susceptible to economic challenges. The analysis incorporates three economic criteria: the poverty ratio, the number of slum communities, and the income rate. Economic information for Bangkok's districts is sourced from the Bangkok Metropolitan Administration's (BMA) administrative division and the National Statistical Office of Thailand (NSO). This data is integrated into the attribute table of each district using QGIS software. Subsequently, the analysis employs QGIS's map categorization feature to generate an economic vulnerability heat map for each criterion.

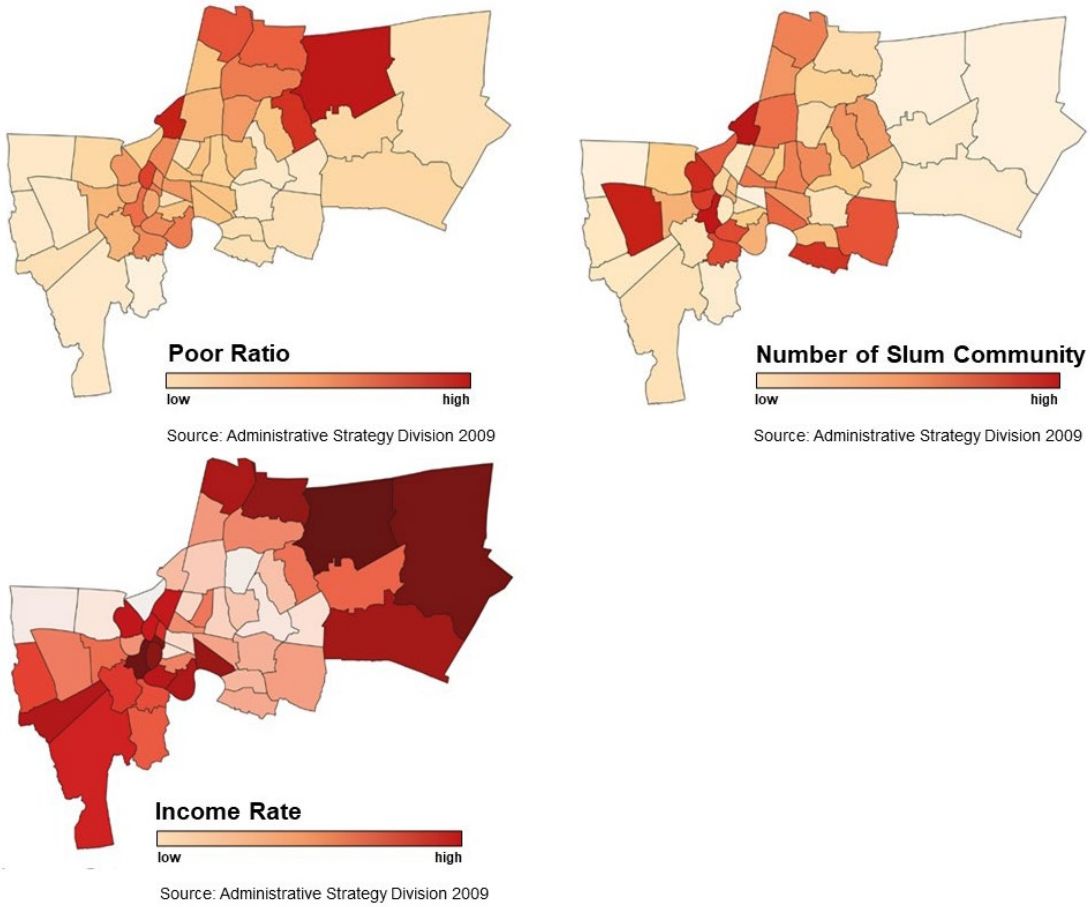
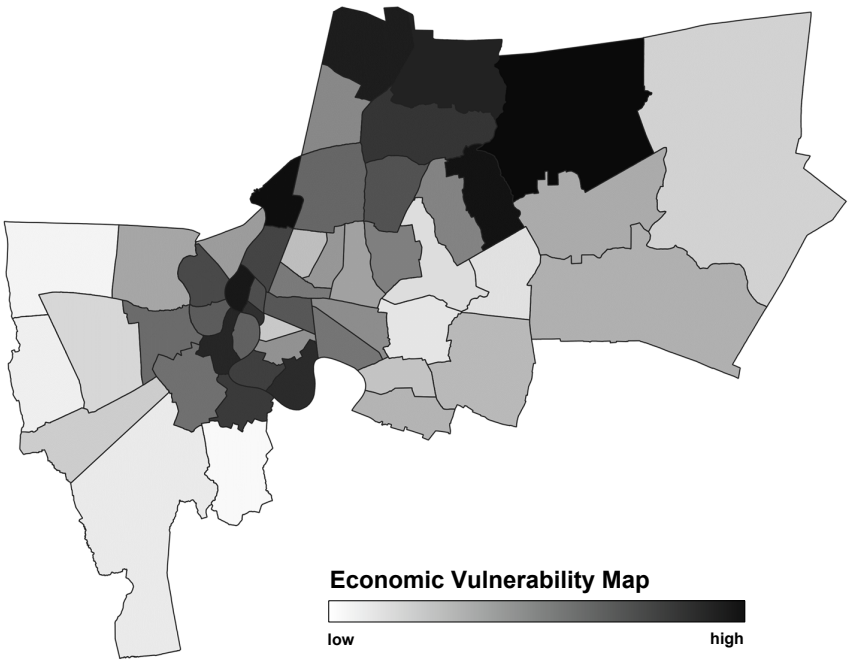


Figure 5-6: Heat Maps of Economic Vulnerability's Criteria

The results of the heat maps are overlaid and sorted across three criteria to analyze districts with economic vulnerability. Utilizing the 'Sort Ascending' plugin in QGIS, the method assigns rankings from 1 to 50, providing a clear delineation of the economic vulnerability spectrum. Consequently, the findings depict the economic landscape of each district, identifying areas grappling with low-income situations, as illustrated in figure 5-6.



Top Ten Economic Vulnerability
1: Khlong Sam Wa (KSW)
2: Bang Sue (BS)
3: Khan Na Yao (KN)
4: Phra Nakhon (PN)
5: Don Mueang (DM)
6: Sai Mai (SM)
7: Thon Buri (TB)
8: Yan Na Wa (YN)
9: Samphanthawong (SP)
10: Bang Khen (BK)

Figure 5-7: Economic Vulnerability Map

In figure 5-7, the results reveal a concentration of economic vulnerability in both the inner-city zone and the outer-city in the east-northern region. Figure 5-7 highlights the top ten economically vulnerable districts, with Khlong Sam Wa leading the list, followed by Bang Sue, situated in the upper right area. Notably, inner-city districts like Phra Nakhon, Thon Buri, and Samphanthawong are also featured in the top ten rankings for economic vulnerability.

5.1.3 Social Vulnerability Analysis

In Chapter Two, it is evident that urban environments and green spaces have a profound impact on social well-being, particularly for urban residents. Urban green spaces play a crucial role in promoting health and well-being, especially among vulnerable groups such as the elderly, children, and expatriates (Kabisch and Haase, 2014, pp. 130-131). Enhancing urban green spaces, particularly on wastelands in neighborhoods with limited green space accessibility, can address environmental inequality and enhance overall quality of life. Consequently, the research incorporates a consideration of socially vulnerable groups, including children, the elderly, and expatriates, into the potential site exploration process.

Data pertaining to children and the elderly is sourced from the Bangkok Metropolitan Administration's (BMA) Administrative Strategy Division, which conducted the population census in 2023. For the purpose of this study, children are defined as individuals aged 1-12 years old, while the elderly are considered to be individuals aged 60 and above. Information

on expatriates is referenced from the Office of Foreign Workers Administration, Minister of Labour. The populations in each criterion have been calculated to identify socially vulnerable populations in each category, utilizing the following equation.

$$\text{Vulnerable Density} = \frac{\text{Vulnerable Population}}{\text{Districts Area}}$$

Applying the equation, which involves dividing the vulnerable populations by the district's area, yields the vulnerable density results for each category, encompassing the elderly, children, and expatriates. These vulnerable density values are then integrated into the attribute data of the Bangkok Metropolitan Administration's (BMA) district shapefile.

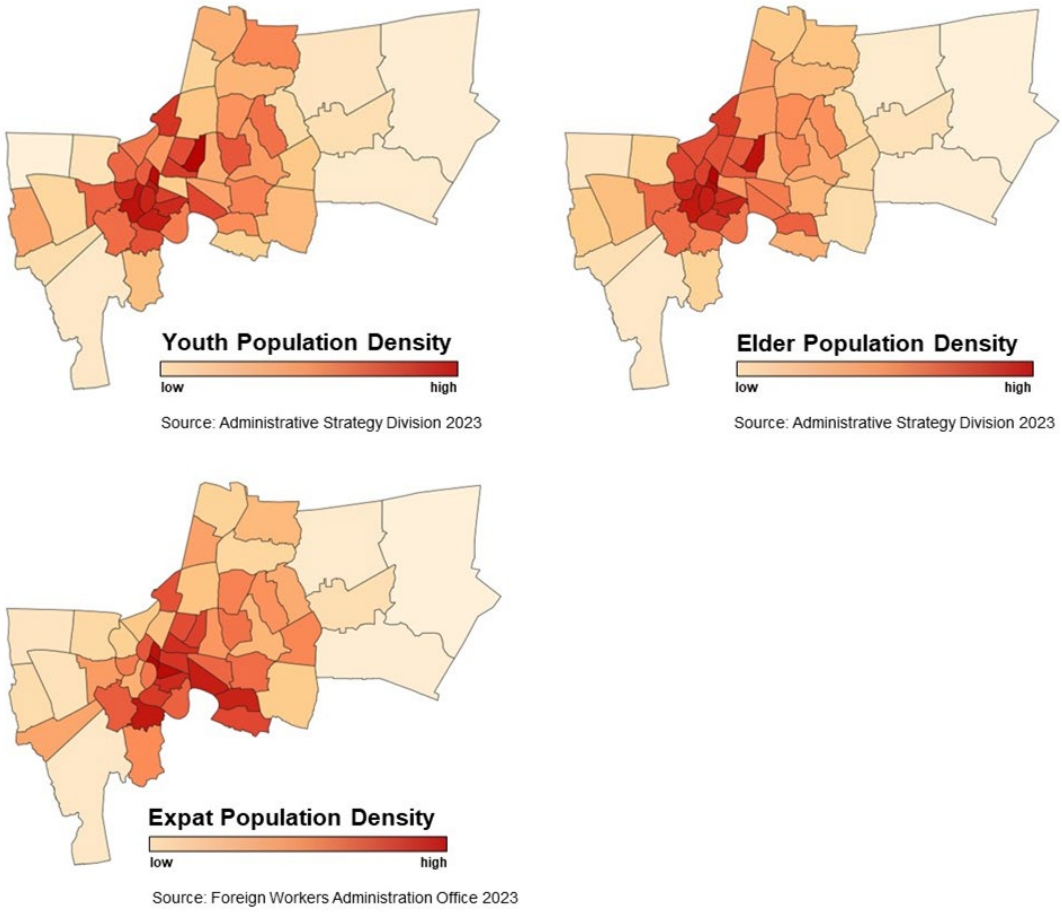
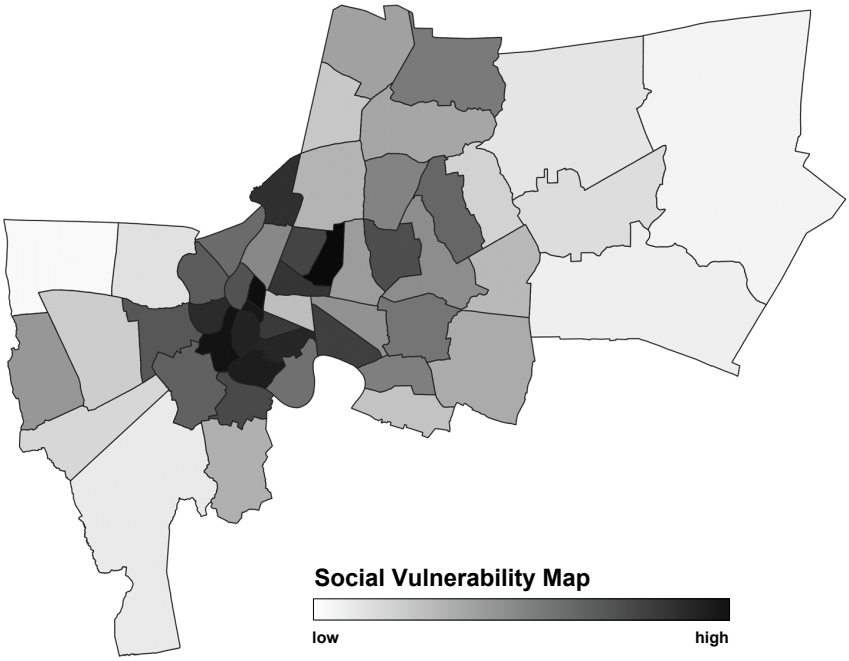


Figure 5-8: Heat Maps of Social Vulnerability's Criteria

The results of the heat maps for each criterion are superimposed and arranged to analyse social vulnerability across districts. This process involves employing the 'Sort Ascending' plugin in QGIS, which ranks economic vulnerability on a scale from 1 to 50, effectively identifying the spectrum of economic vulnerability situations. As a result, the

findings depict the social landscape of each district, highlighting areas with a high concentration of vulnerable populations, as illustrated in figure 5-8.



Top Ten Economic Vulnerability
1: Din Daeng (DD)
2: Pom Prap Sattru Phai (PP)
3: Thon Buri (TB)
4: Samphanthawong (SP)
5: Bang Kho laem (BKL)
6: Khlong San (KS)
7: Bangkok Yai (BY)
8: Yan Na Wa (YN)
9: Bang Sue (BS)
10: Ratchathewi (RT)

Figure 5-9: Social Vulnerability Map

In figure 5-9, the findings expose a clustering of social vulnerability primarily within the inner-city zone. The figure emphasizes the top ten districts with high social vulnerability, with Dindang taking the lead, followed by Pom Prap Sattru Phai. However, as emphasized earlier in this section, the research necessitates consideration of the quantity of wasteland and the allocation of the green space budget in each area. This additional information is vital in facilitating the research to identify potential sites more efficiently.

5.1.4 Wasteland Number and High-Budget Maintenance District

The final two factors to be considered are the quantity of wasteland and districts with a high budget allocation for garden maintenance. The number of wastelands holds significance in the research as it streamlines the identification process. The thesis focuses on exploring the potential of transforming wastelands into informal green spaces, utilizing spontaneous vegetation as an alternative for urban residents. Districts with a substantial number of wastelands should be prioritized as target areas, as they facilitate easier and more efficient research, particularly within a limited timeframe.

Refer to the literature, potential site for informal urban green space is the area where contain spontaneous vegetation which include ecosystem that naturally developed without a specitic intended (Riley *et al.*, 2018, p. 3-6; Breuste, 2022, p. 354). The green space category

that relates to this definition in the BMA's nine types of green space criteria are low-lying area, wastelands, tree-canopy area, and miscellaneous area. These types of green space need to be considered for potential districts assessment.

Furthermore, the rate of green space consumption constitutes another pivotal factor. Given the focus of this paper on alternative green spaces for Bangkok, it is essential to consider districts with a high budget allocation for traditional green spaces to formulate a strategy for cost reduction. Informal green spaces offer lower maintenance and more cost-effective landscape management in comparison to conventional green spaces (Hwang *et al.*, 2019, p. 174). Consequently, informal green spaces can serve as a tool to mitigate the maintenance and construction costs of green spaces in Bangkok. The data on green space budgets is sourced from the Bangkok Metropolitan Administration's Department of Environment. Distribution maps depicting the number of wastelands and the consumption of green space budgets are presented in figure 5-10.

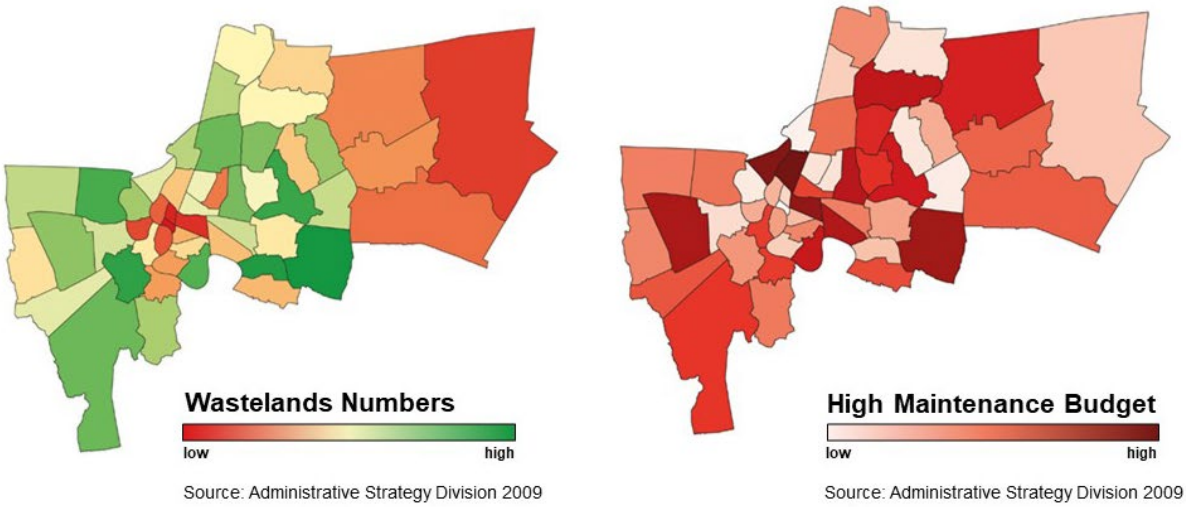
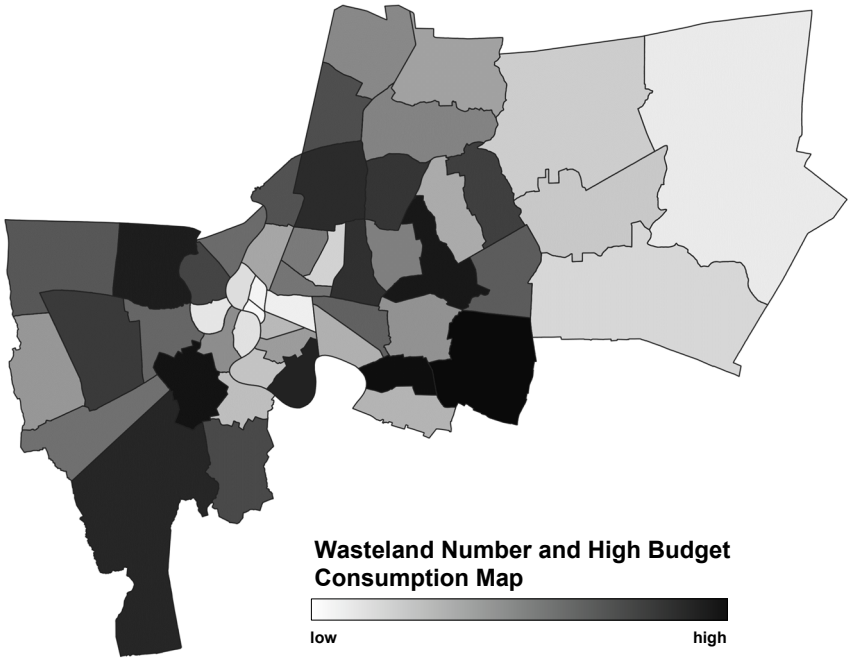


Figure 5-10: Distribution Map of Wastelands Number and High Green Space Maintenance Budget District

The 'Sort Ascending' plugin in QGIS is employed to organize these two fields for the conclusive criteria assessment. Each district is assigned a ranking from 1 to 50, consistent with the early factors' identification method. The district with the highest number of wastelands and the district with the highest budget consumption both receive a ranking of one, whereas their counterparts are ranked as 50. Figure 5-11 is a map illustrating the districts suitable for research.



Top Ten Wasteland Number and High Budget Consuption
1: Pra Wet (PW)
2: Phra Khanong (PK)
3: Chom Thong (CT)
4: Bang Kapi (BK)
5: Taling Chan (TC)
6: Yan na wa (YN)
7: Bang Khun Thain (BKT)
8: Chatu Chak (CC)
9: Huai Khwang (HK)
10: Lat Phrao (LP)

Figure 5-11: Wasteland Number and High Budget Consumption Map

As a result, Prawet emerges as the district with robust potential for identifying research sites. Within Prawet, the presence of a considerable number of wastelands, coupled with a notable consumption of the government budget, positions it as a prime area for further investigation. The combination of these factors not only underscores the district's relevance but also signifies its suitability for an in-depth exploration of the research objectives.

5.1.4 Sites Identification

After analysing criteria for potential site finding process including green spatial analysis, economic vulnerability analysis, social vulnerability analysis, and the district where contain high wasteland number with high budget consumption analysis. This analysis will be weighting and integrating to by the high potential district by using attribute data calculations methods. The following equation is utilized for the attribute data calculations by using the sum of ranking that is the result from sort ascending plugin. The number of rankings is represented score of each district, the highest score district is the highest green space demanding, which require urgent solutions for adding more green space.

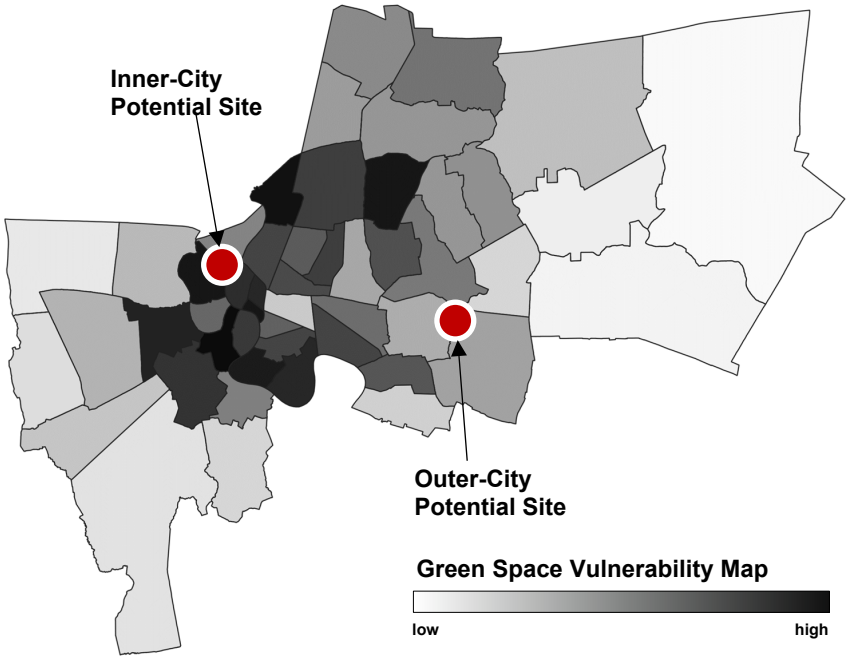
Green Space Vulnerable District = Field A + Field B + Field C + Field D

Field A = Green Spatial Analysis

Field B = Economic Vulnerability Analysis

Field C = Social Vulnerability Analysis

Field D = Waste Space Number and Maintenance Budget Analysis



Top Ten Green Space Vulnerable District
1: Thon Buri (TB)
2: Bang Sue (BS)
3: Lat Phrao (LP)
4: Bangkok Noi (BN)
5: Samphanthawong (SP)
6: Bang Kho laem (BKL)
7: Phasi Charoen (PC)
8: Yan Na Wa (YN)
9: Pom Prap Sattru Phai (PP)
10: Phra Nakhon (PN)

Figure 5-12: Potential Sites in The Inner-City and Outer-City area

Report the amount of garden information, 9 types (as of 01-12-2023 05:02:05)

Search for information — Type information

Area size between: farm to: farm search

Year data: Choose a year — District : Prawet District

Garden type: Select garden type

Found 253 places

number	Area code	Year information	garden name	Garden type	farm	work	Wa	District area	Responsible agency
1	19944	2023	Private fish pond, Soi Phatthanakan 73	Aquaculture area	0	0	0.00	Prawet District	I don't know the owner.
2	19951	2023	Desolate green space	vacant land	3	0	24.43	Prawet District	Prawet District
3	19983	2023	wilderness	vacant land	5	3	7.64	Prawet District	Owner unknown
4	20058	2023	Low-lying area in Soi On Nut 88/1	marshland	6	2	46.72	Prawet District	Owner unknown
5	19945	2023	banana plantation	agricultural area	0	0	0.00	Prawet District	Owner unknown
6	20044	2023	Desolate land, Soi 8, Sukhapiban 2	vacant land	1	1	26.67	Prawet District	Owner unknown
7	19954	2023	wilderness area Baramet Village Soi	vacant land	45	2	61.04	Prawet District	Prawet District
8	20004	2023	Common area of Phattra Village	Other areas	5	2	73.22	Prawet District	Pattra Village Juristic Person
9	19985	2023	teak garden	Perennial area	1	0	75.29	Prawet District	Owner unknown
10	19984	2023	Guava garden	agricultural area	6	0	12.00	Prawet District	Owner unknown
11	20067	2023	Banana garden opposite Ratchadamri School	agricultural area	2	3	35.88	Prawet District	name unknown
12	20061	2023	fish pond	Aquaculture area	5	3	54.37	Prawet District	name unknown
13	20000	2023	Pond under high voltage power lines	Water source	3	0	26.00	Prawet District	Electricity Generating Authority
14	19502	2022	Empty space at the village entrance, Connect 33, Kanchanaphisek parallel road.	vacant land	0	1	54.11	Prawet District	private
15	19518	2022	private agricultural area	agricultural area	0	1	19.96	Prawet District	Prawet District
16	19499	2022	Water source between Soi Kanchanaphisek 30-32, Kanchanaphisek Road 01	Water source	1	2	4.75	Prawet District	Department of Highways

Figure 5-13: Nine Types Green Spaces Data Base

Consequently, the results of the calculations are depicted in Figure 5-12, showcasing districts in Bangkok vulnerable to green space challenges. The map reveals a concentration of green space vulnerable districts primarily in the inner-city zone, characterized by a darker color compared to the peri-urban zone. Notably, top-ranking green space vulnerable districts, such as Thon Buri, Bang Sue, Bangkok Noi, and Samphanthawong, are predominantly situated in the inner-city zone (Figure 5-12). In line with the research methodology, two potential research sites have been identified, focusing on wastelands within these aforementioned districts as indicated in the green space database of Bangkok (Figure 5-13).

Regrettably, *'the first selected research site'* does not align with the highest-ranked green space vulnerability district, Thon Buri. Instead, the chosen site within the inner-city zone lies in Bangkok Noi, adjacent to the Chao Phaya River. This decision is motivated by the site's ownership by the Bangkok Metropolitan Administration (BMA), making it government property and earmarked for future green space development. This strategic choice facilitates the process of obtaining research permissions.

Furthermore, a site in the outer-city zone is essential for data collection and research. Opting for different zones in data collection enhances the breadth of data, capturing the overall perception of Bangkok's residents. Prawet, a district in the outer-city zone exhibiting a dark grey shade on the map, is chosen for its high number of wastelands. The *'second selected research site'*, situated near the boundary of Prawet, is also government property owned by BMA, slated for transformation into a public park in line with the governor's 15 minutes park policy. This deliberate selection ensures a comprehensive and diverse dataset for a more nuanced understanding of green space dynamics in Bangkok.

The two research sites undergo a verification process with additional data to ensure their suitability for the thesis. This involves cross-referencing using NDVI (Normalized Difference Vegetation Index) and service radius analysis. The NDVI map is generated by analyzing Landsat 8 satellite images from the USGS database, utilizing the near-infrared band (Band 4) and the red band (Band 5) for calculation. In QGIS, the raster calculation feature is applied to produce a land-use classification map according to the following equation:

$$\text{NDVI} = \frac{\text{Near Infrared (Band 4)} + \text{Red (Band 5)}}{\text{Near Infrared (Band 4)} - \text{Red (Band 5)}}$$

Mapping the geolocation of potential sites alongside the NDVI map in QGIS reveals that the site area is encompassed by built-up areas (refer to Figure 5-14). This signifies that the location is situated in an area with a pressing need for additional green space, and informal spaces play a crucial role in enhancing the neighborhood.

Furthermore, the study employs the isochrone calculation feature in QGIS to generate maps evaluating accessibility to public parks and transportation. This analysis is pivotal to the research, confirming that the chosen sites are situated in areas with a pressing need for urban green spaces. The data utilized for isochrone calculation includes Bangkok street shapefiles, the locations of main public parks in Bangkok, and metro station locations, drawing from data provided by Bangkok's open data and OpenStreetMap (OSM). The results presented in Figure 5-14 reveal that these potential areas extend beyond the effective service radius for both public park and transportation accessibility, encompassing approximately 800 meters around public parks, equivalent to a 15-minute walking distance.

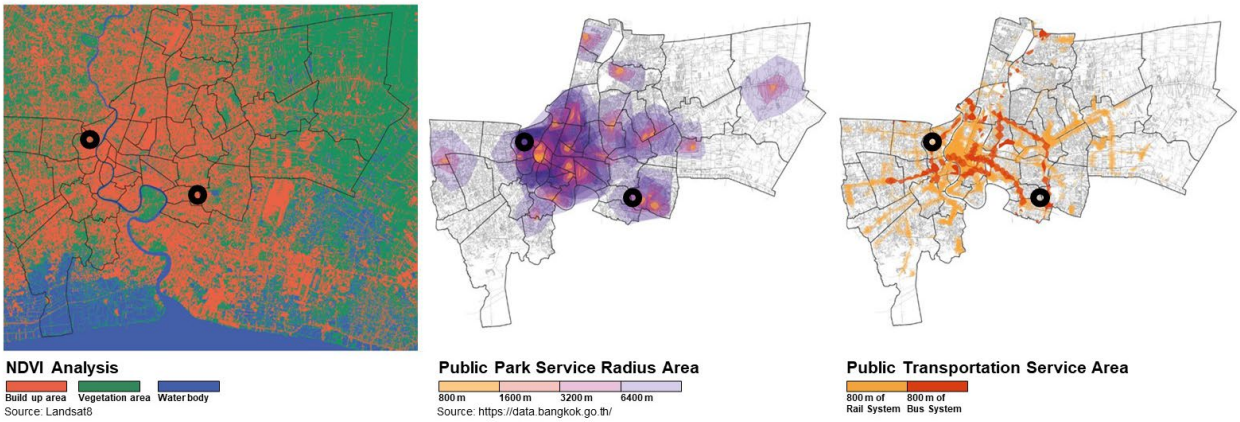


Figure 5-14: Site Location with NDVI and Public Facility Service Area

5.2 On-Site Public Survey and The Perception of Informal Green Space

Advancing research on the identified potential sites aligns with the initiatives of a local non-governmental organization known as the Healthy Space Alliance (HSA). This organization operates as a network of social enterprises dedicated to fostering public spaces within the city of Bangkok. The identified sites represent collaborative efforts with HSA's workshop project, titled "Reclaim & Reconnect." The primary goal of this project is to stimulate public engagement on wastelands, transforming them into vibrant and usable spaces. Leveraging social media platforms, the project has been actively promoted to invite individuals to partake in the experience of reimagining wastelands as functional public areas, as depicted in Figure 5-15.

Figure 5-15: Poster and Public Relation Post in social media

5.2.1 Potential Site Characteristics

Within the framework of the "Reclaim & Reconnect" project, five distinct teams are actively engaged in various districts across Bangkok. Specifically, the potential research sites under consideration are situated in the Bangkok Noi and Prawet districts. These locations are managed by two specific teams, namely the Suansang team overseeing the Bangkok Noi district and the Wadi team responsible for the Prawet district. It's noteworthy that the Wadi team is directly affiliated with the author of this paper, adding a personal connection to the research endeavor.

The research zone in Bangkok Noi (refer to Figure 5-16) is located in the heart of the inner city, bordering the significant Bangkok Noi canal. This canal plays a crucial role in the city's infrastructure. Additionally, the site close proximity to the esteemed Suwannaram Temple, a distinguished royal Buddhist temple in Thailand, adding cultural and historical value to the area. Despite these favorable attributes, it's essential to consider that the accessibility from public transportation is approximately 900 meters from the nearest MRT station. While the site's strategic location and cultural richness make it an attractive prospect, the distance from the MRT station underscores the need for public transportations accessibility.

The potential area in the Prawet district (refer to Figure 5-17) is situated not directly within the district but on the border shared with Suanluang district. As a result, most visitors approach the site from the Suanluang side. The site is approximately one and a half kilometers

away from the nearest MRT station. It's worth noting that the surroundings consist mainly of residential areas. Furthermore, this particular tract of land is under the ownership of the Bangkok Metropolitan Administration (BMA), with plans in place for its eventual transformation into a public park.

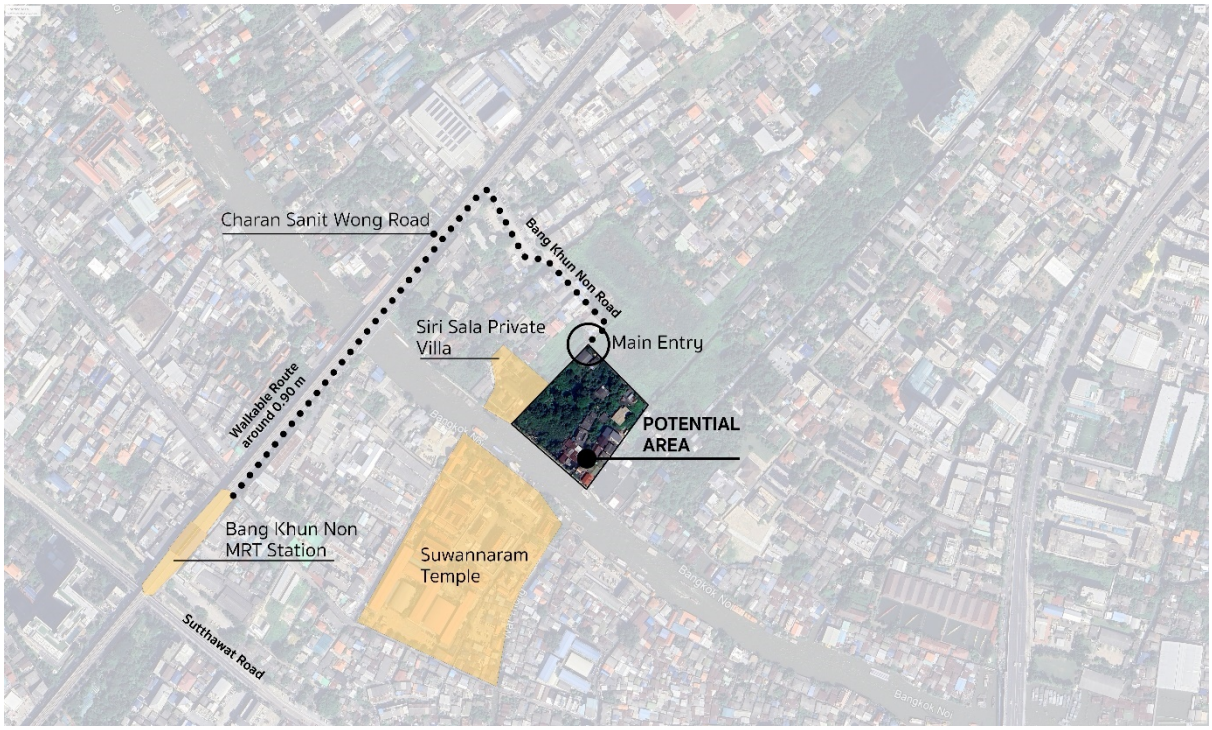


Figure 5-16: Bangkok Noi Potential Site

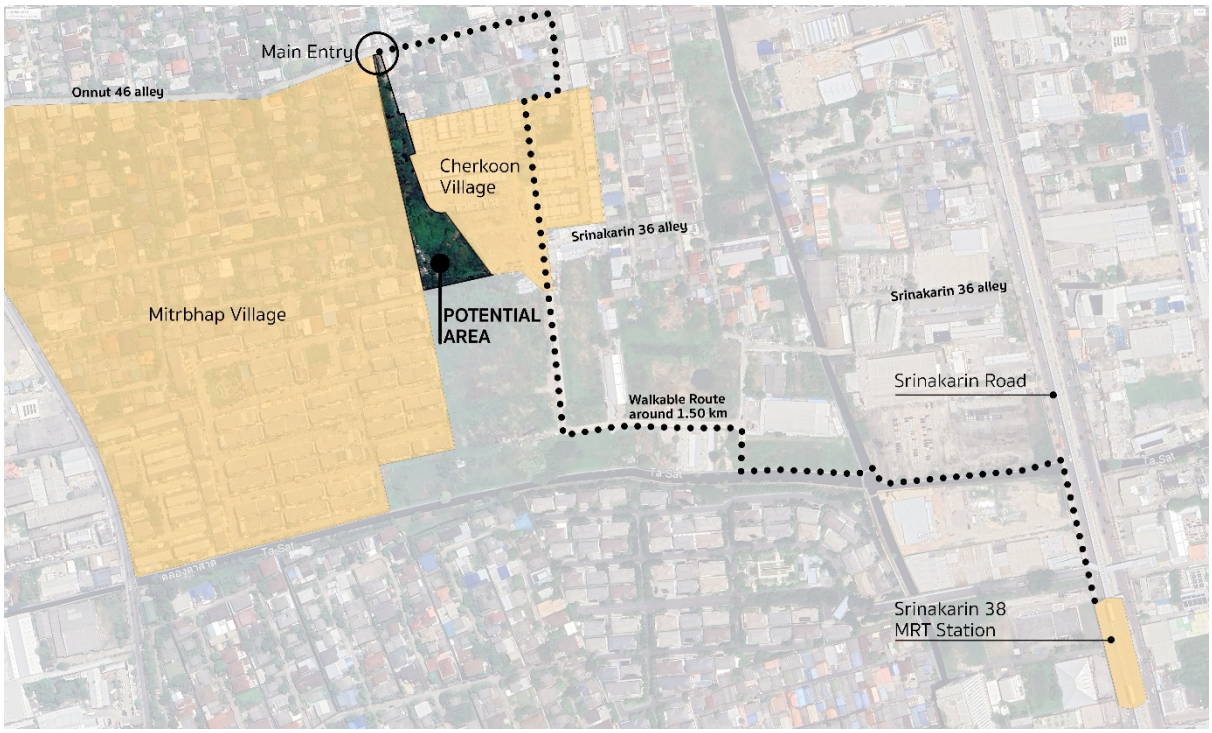


Figure 5-17: Prawet Potential Site

The expanses identified as wasteland in Bangkok Noi epitomize a riparian wetland ecosystem, positioned in close proximity to the riverbank. Its distinctive flora predominantly features ferns, alocasia, and other plant species adapted to riparian environments. Due to its wetland characteristics, the pedestrian infrastructure necessitates a timber framework, a communal undertaking by local residents. Despite the Bangkok Metropolitan Administration (BMA) holding ownership of the land, an encroachment predicament persists, marked by unauthorized occupants inhabiting the area. Significantly, the locale is frequented by an older demographic, drawn to its serene ambiance, ideal for unhurried strolls and contemplation of its natural attributes, as illustrated in Figure 5-18.

Similarly, the prospective site near Prawet mirrors the characteristics of the Bangkok Noi region, representing a wetland adjacency to the Ta Sat canal. The botanical landscape is predominantly marked by Typha augustifolia, Ipomoea aquatica, Senna alata, and Sesbania javanica. While the local community engages in fishing activities within the area, its challenging topography, characterized by tall grasses, diminishes its appeal for casual visitation. Importantly, the site is designated as public property under the purview of the Bangkok Metropolitan Administration (BMA), yet unauthorized encroachment, as depicted in Figure 5-19, has been observed.

Figure 5-18: Bangkok Noi's Site Characteristic

Figure 5-19: Prawet's Site Characteristic

5.2.2 Wasteland Workshop for Wasteland Introducing

Study site in Bangkok Not and Prawet is organized a site introduction workshop to generate an activity in the wasteland within the framework of "Reclaim&Reconnect" project. However, the workshop on these study sites are different regarding to the character of the site and organizing team.

The "Suansang" team, as part of their community engagement initiative, meticulously organized an enlightening "ecowalk" activity within the environs of Bangkok Noi, leaded by naturalist. The overarching goal was to immerse participants in the distinctive urban nature of the area, fostering a heightened awareness of the geographical and ecological intricacies that define Bangkok. The participants, representing both the local community and diverse districts of Bangkok, engaged in an enriching experience that transcended conventional urban settings. Throughout the activity, the attendees were meticulously informed about the geological underpinnings of the Bangkok Noi wasteland, delving into the intricacies of its natural succession processes. The endeavor sought not only to disseminate knowledge but also to instill a profound appreciation for the dynamic ecosystems within an urban landscape. By providing insights into the evolving nature of the wasteland, the "ecowalk" aimed to bridge the gap between residents and their surroundings, promoting a sustainable and informed relationship with the environment, as shown in Figure 5-20.

Figure 5-20: Wasteland Workshop Activity in Bangkok Noi

The Prawet study site, under the guidance of the author, requires intervention due to its neglected state and prolonged lack of maintenance. Immediate attention and restoration efforts are essential before initiating any activities on the site. Adopting a "Zero option" procedure, a cost-effective approach facilitating the spontaneous evolution of urban vegetation within their ecosystems (Trentanovi *et al.*, 2021, p. 8), aligns with the low-intervention design and maintenance philosophy. This approach enhances the site's secure perception and suitability for various activities, including trash removal, partial grass mowing, and tree pruning (Riley *et al.*, 2018, p. 9; Hansen *et al*., 2023, p. 228).

As depicted in Figure 5-21, the land adjustment process incorporates elements such as grass mowing, fabric railing, and a fabric shelter designed to ensure visitors' protection and security. Notably, the land adjustment process incurs a modest budget of approximately 520 euros, funded by the Healthy Space Alliance (HSA). The facilitation of the land adjustment process, including the construction of the shelter and railing, is overseen by the Bangkok Metropolitan Administration's (BMA) Suanluang district office.

Figure 5-21: Workshop Organizing Incorporating with Suanluang district Office

Subsequent to the successful implementation of land adjustment in Prawet's wasteland, our team has taken proactive steps to curate and facilitate a series of diverse activities on the site for two days from 25-26 November 2023. The overarching objective is to experiment with and showcase the potential of this transformed space as an informal green area. Our target audience comprises not only the local community residing in close proximity but also visitors hailing from neighboring districts.

These workshops and activities serve as dynamic platforms for engagement. An 'ecowalk' has been organized to foster a deeper connection with the natural elements within the site, offering participants an immersive experience of its unique ecosystem. Complementing this, an 'outdoor gallery' has been established as a vibrant venue for art exhibitions, further enhancing the site's cultural appeal. For those inclined towards artistic expression, the 'natural sketches' activity encourages participants to capture the scenic beauty

of the reclaimed area through their drawings. Simultaneously, 'aerobic dance' sessions have been introduced, promoting physical well-being and active participation.

This holistic approach to generating activities not only adds vitality to the site but also serves as a model for the potential transformation of wastelands into vibrant community spaces. The multifaceted nature of these engagements ensures inclusivity, catering to a wide spectrum of interests and fostering a sense of shared ownership among participants. Figure 5-22 visually encapsulates the dynamic and diverse nature of these activities.

Figure 5-22: Informal Green Space Experimental Activity

Upon the completion of activities in both Bangkok Noi and Prawet, participants were administered a questionnaire designed to gauge their perceptions of utilizing informal green spaces within each respective wasteland site. The survey, employed for a master's thesis research on urban management at Technische Universität Berlin (TU Berlin), comprised three integral sections.

The first segment elicited information pertaining to participants' demographics, encompassing variables such as gender, age, education, and income. Subsequently, the second section involved an assessment of participants' perceptions of the wasteland, structured on a scale ranging from one to five, representing degrees of disagreement to agreement. Lastly, the third section solicited participants' opinions on the potential of the wasteland, exploring both its perceived advantages and disadvantages to urban society.

Noteworthy, the sample size for participants in Bangkok Noi totaled n=17, while Prawet encompassed n=27 individuals. Each completed questionnaire was meticulously analyzed utilizing the Google Form application to derive comprehensive results.

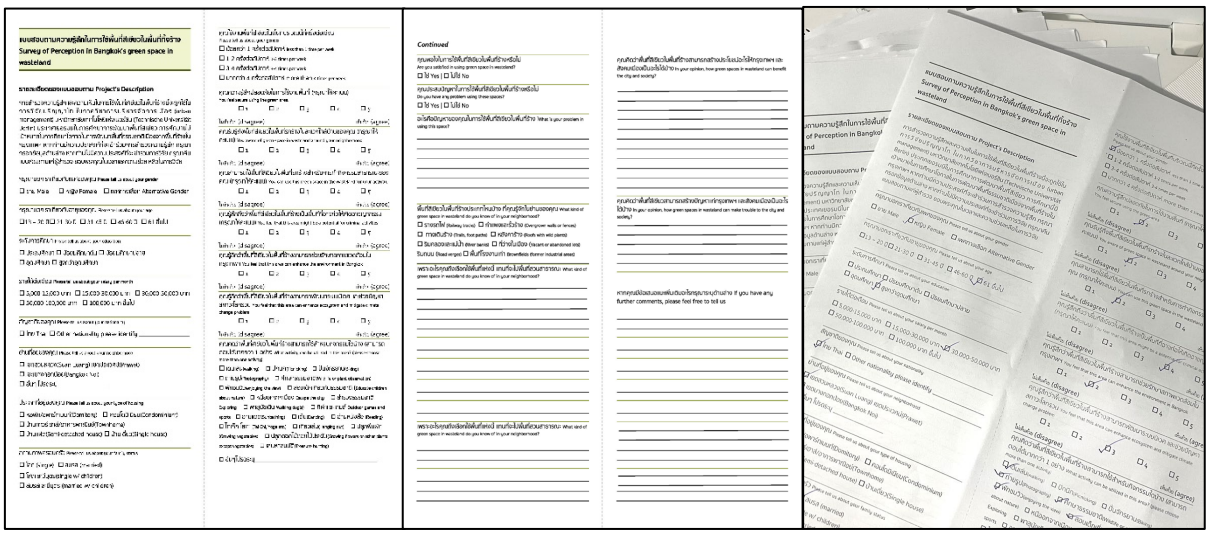


Figure 5-23: Questionnaire Form

5.2.2 On-site Survey and Participants' Perception on Informal Green Space

Despite the total number of participants in the "Reclaim & Reconnect" project's wasteland workshop reaching approximately 60 individuals, the questionnaires deemed to possess sufficient quality for research purposes amounted to 44 papers (17 from Bangkok Noi, 27 from Prawet). While the participant count may not be extensive, the information gleaned from the questionnaires holds substantive value, establishing meaningful connections with the literature discussed in Chapter Two.

Initiating the inquiry into participant characteristics, the questionnaire methodically captures data on gender, age, education, income, nationality, family status, and type of accommodation. This questionnaire design aligns with Szilassi *et al.*'s (2023, p. 523) perspective, acknowledging that perceptions of vegetation naturalness vary among individuals and that understanding these perceptions across diverse cultural settings contributes to insights into interactions with informal green spaces. Notably, Jim and Chen contend that factors such as age, education, and lifestyle significantly shape people's perceptions of informal green spaces. Therefore, the incorporation of the mentioned questions was intentional, aiming to comprehensively grasp the diverse range of participant characteristics involved in the research.

To begin with the participants' character, more than half of the participants, around 61.4% are females, following by 34.1% of Male. Unfortunately, there are only small number of participants who are an alternative gender (LTBGQ+) around 4.5%. The dominant age group among participants are 21-30 years old at 40.9%, the other age group that have a huge portion is 46-60 years old at 31.8%. A majority of the participants are undergraduate degree holders, accounting for 40.9%, followed by those with a higher qualification at 31.8%. The income of the participants is distributed similarly across three sections, which are 5,000-15,000 THB, 15,000-30,000 THB, and 30,000-50,000 THB. However, a small percentage of participants, around 6.8%, did not disclose their salary.

The study results indicate that the majority of participants are of Thai nationality, while only a small percentage, 2.3% (n=1), are British. The most common type of accommodation among the participants is a single house, which accounts for 47.7% of the sample. These houses have enough space to build a garden. On the other hand, around a quarter of participants live in condominiums and apartments, making it challenging to create private green space. In terms of family status, the majority of participants are single, accounting for 54.5% of the sample, while only 20.4% have children. However, more than half of participants visit the area less than a time per week at 54.5%.

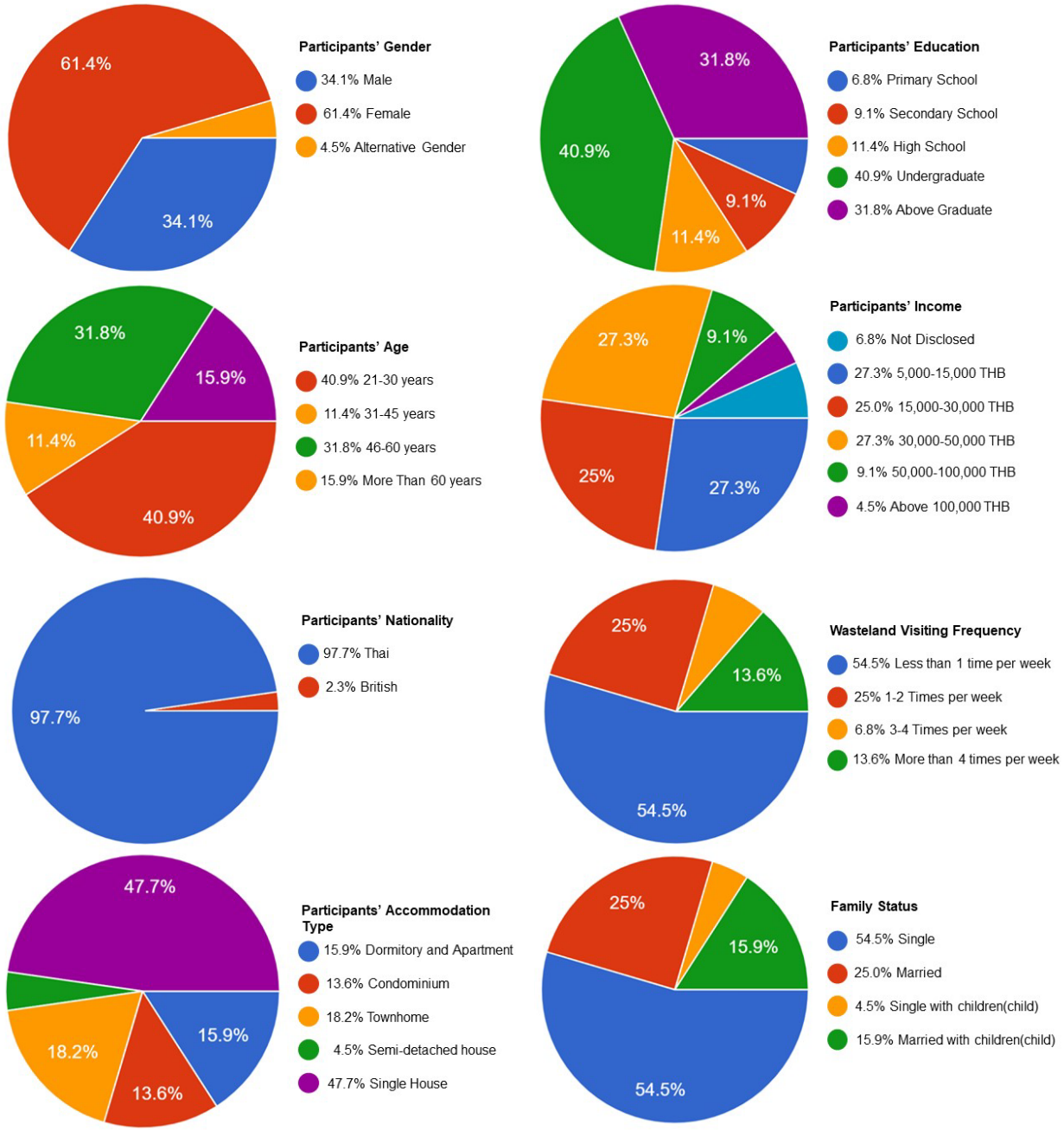


Figure 5-24: Participants' Character Pie Chart

Neighborhood participants mostly live nearby the study site, 16.3% in Bangkok Noi, and 45.45% in Suanlung. This information shows that more than 50% of participants are people who live in local neighborhoods where study sites are located. Moreover, when the result of the questionnaire is mapped, it shows that generally visitors live near the focus district. There are few people(n=4) who live in far areas including Nong Chok, and other provinces (Nontaburi, Bang Phli, Samrong). Figure 35 illustrate the portion of participants' neighborhood in Bangkok.

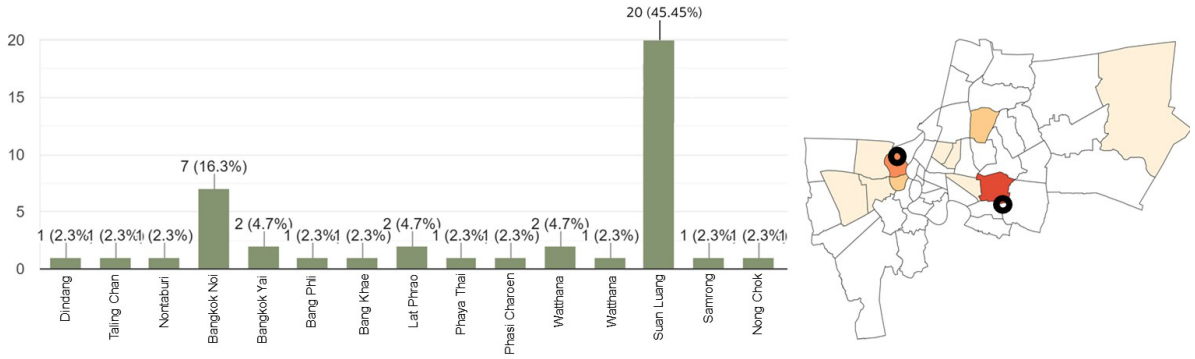


Figure 5-25: Participants' Neighbourhood Chart and Map

In the second part of the study, research was conducted on how people perceive wastelands. Participants were asked to rate their level of security when using green areas in wastelands. The results showed that around 44.2% (n=19) scored three or below, indicating that people feel insecure when using wastelands. In addition, participants were asked to rate the extent to which they believe a wasteland can cause criminal activity. 36.4% of participants gave a score of three, while another 36.4% scored above three.

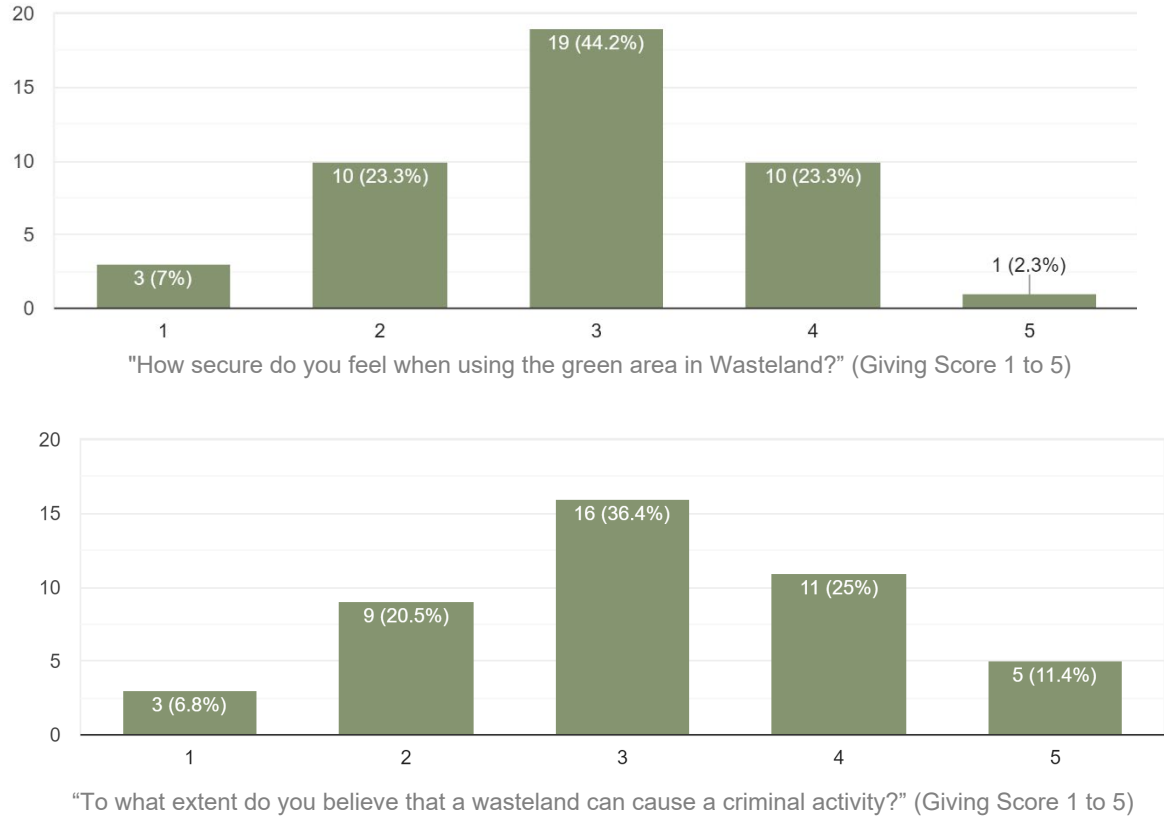
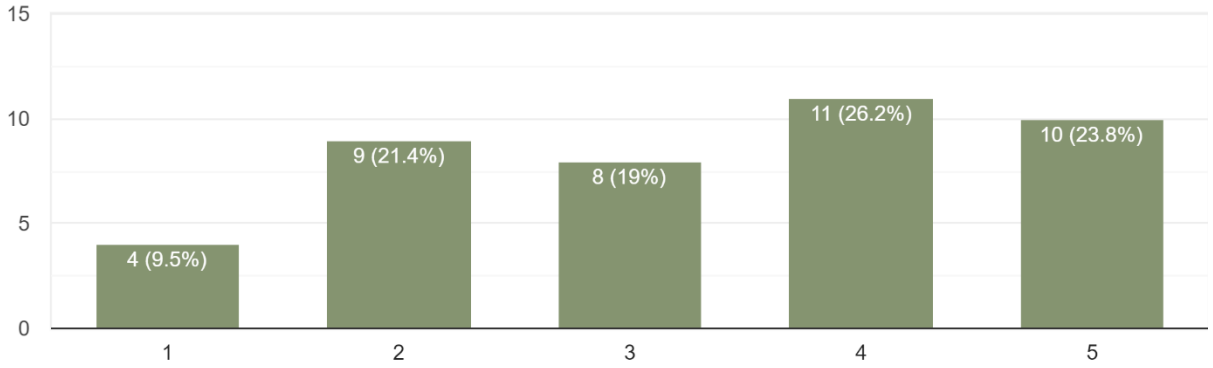
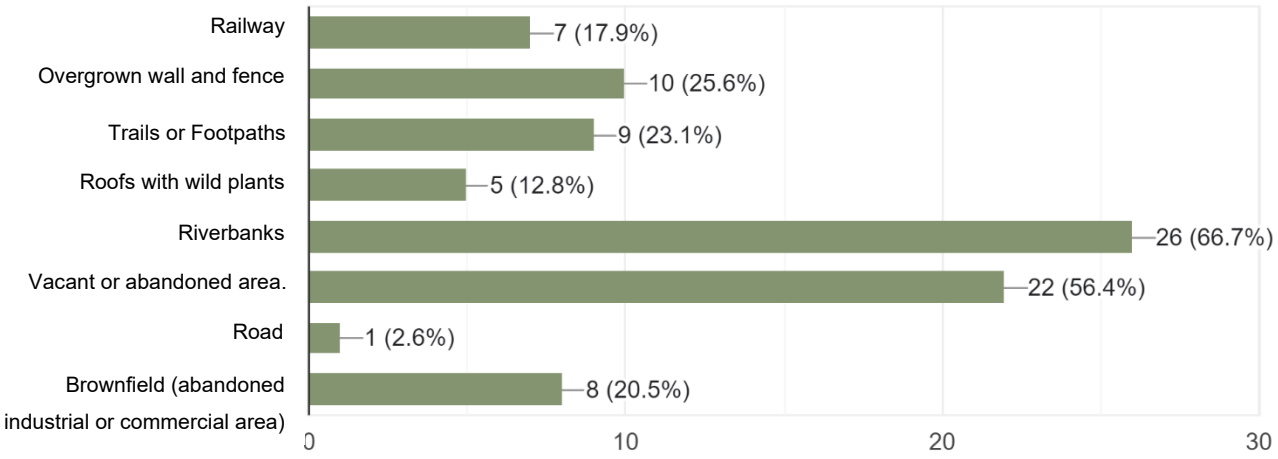


Figure 5-26: Perception of Security and Criminal Activity Charts

Regarding the question aimed at studying the understanding of wastelands, the results fluctuated between each score. However, more than half of the participants scored not less than three, at 69%. Thus, it can be assumed that most of the participants are aware of wastelands in their neighborhood. Vacant areas and riverbanks are mostly perceived as wastelands in their neighborhood, at 66.7% and 56.4% respectively.



"Are you aware of any Wastelands in your neighborhood?" (Giving Score 1 to 5)



"What kind of wasteland do you recognize in your neighborhood?"

Figure 5-27: Participants' Wasteland Awareness Chart's

Based on the survey results, it is evident that the majority of participants believe that wasteland can be utilized for public activities. Only 11.4% (n=5) scored it as unsuitable for any activity. The survey further reveals that 95.3% of participants are of the opinion that it can be an area for walking, while around 70% believe that it can also be used for photography, wildlife observation, and enjoying the view. These findings suggest that the participants recognize the potential of wasteland to serve as a public space.

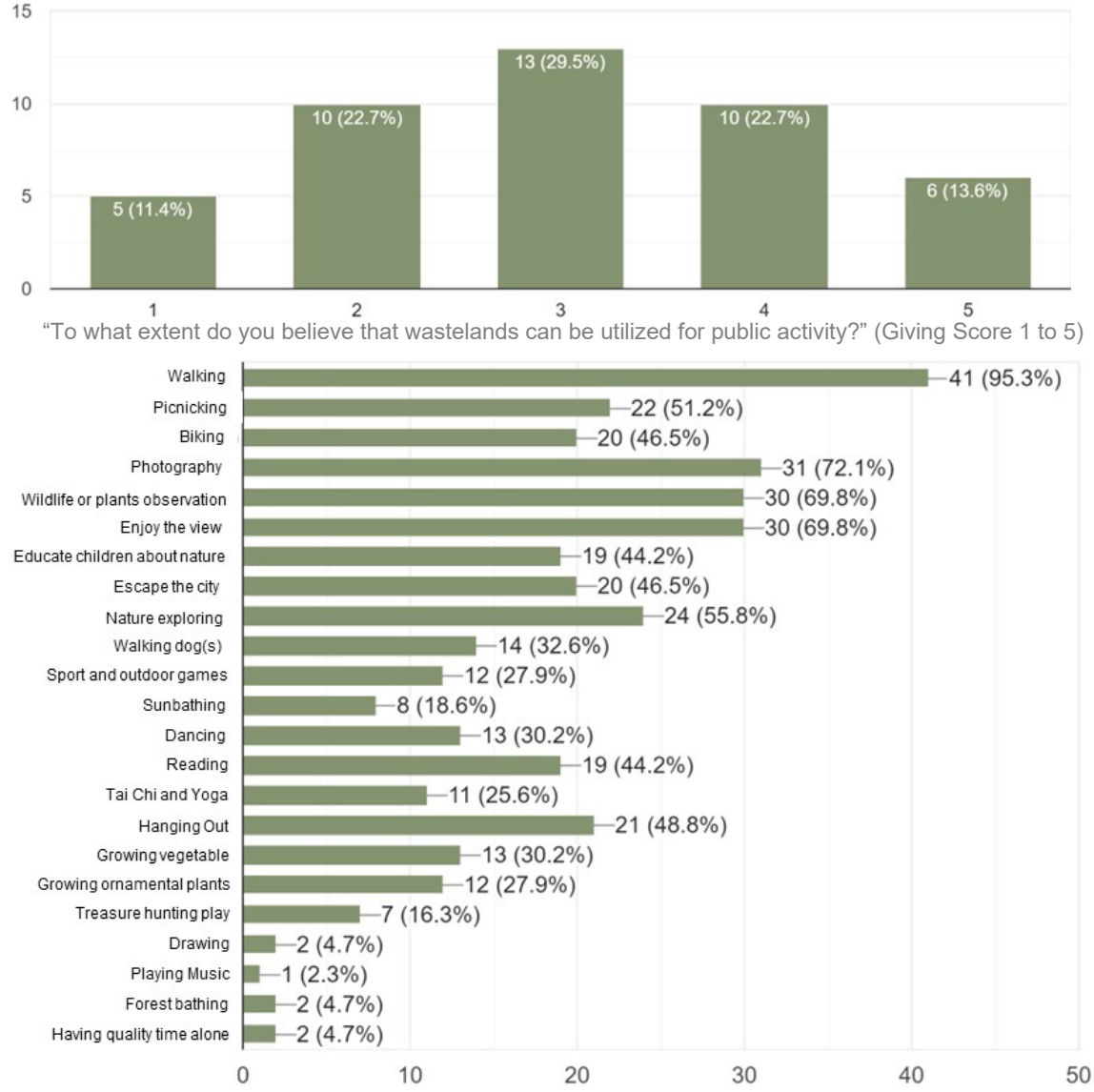


Figure 5-28: Participants' Perception of Activity on Wasteland

Based on participant feedback, there is a prevailing perception that wasteland areas may serve as potential sites for criminal activities. Notably, only 6.8% (n=3) of respondents explicitly disagreed with this notion, while a substantial majority of 72.8% concurred, providing an agreed score higher than three on the assessment scale. Figure 5-29 indicates a noteworthy consensus among participants regarding the perceived association between wasteland areas and the likelihood of criminal incidents.

Conversely, in the context of environmental considerations (see figure 5-30), the survey reveals that a significant proportion of participants (69.7%) believe that wastelands possess the potential to positively contribute to the environmental enhancement of Bangkok. Furthermore, a majority of participants (72.7%) expressed the opinion that wastelands can play a role in improving the overall urban ecosystem. These findings reflect a generally

optimistic outlook among participants regarding the environmental benefits that repurposing wasteland areas could bring to the urban landscape.

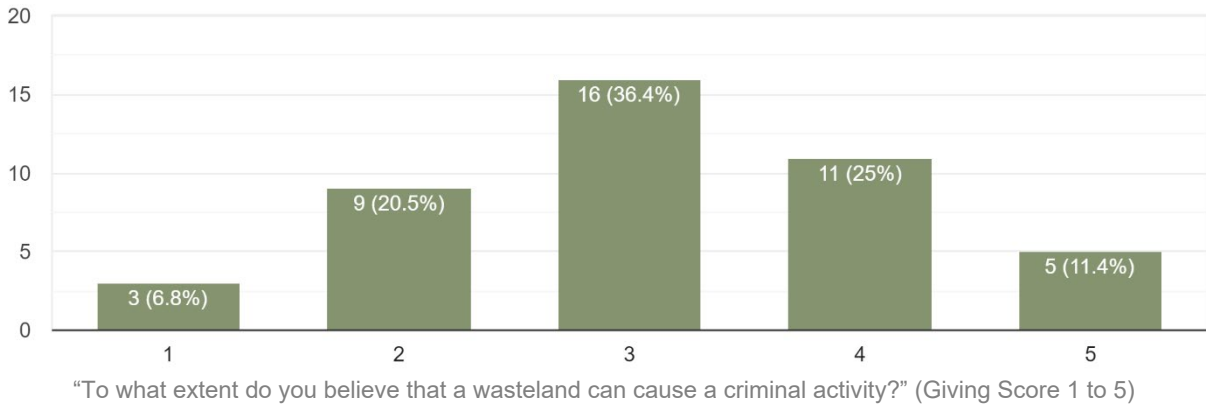
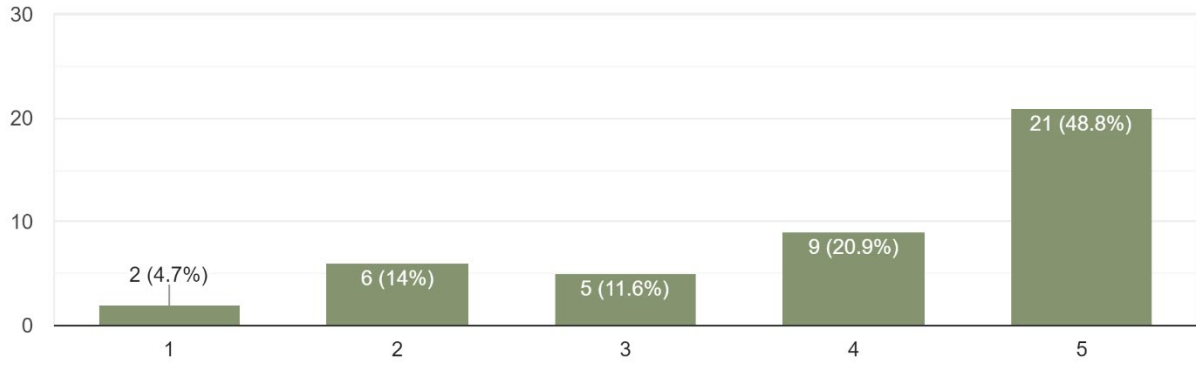


Figure 5-29: Participants' Perception of Criminal Incident



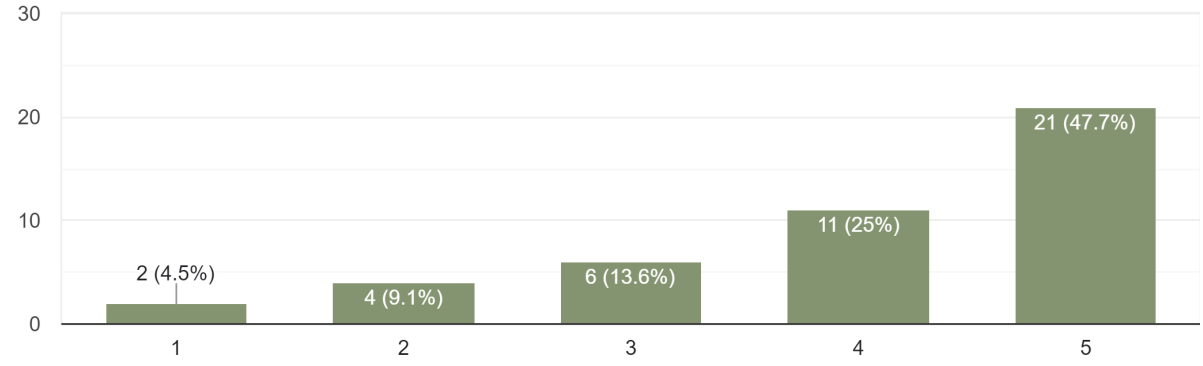


Figure 5-30: Participants' Perception of Environment Enhancement

Ultimately, when participants were queried about their satisfaction and encountered challenges during their wasteland visits (see figure 5-31), a noteworthy trend emerged. A substantial majority, constituting 84.1% of respondents, expressed satisfaction with their wasteland visiting experience, opting for the 'yes' option. Nonetheless, it is noteworthy that nearly 35.7% of participants encountered challenges during their visits to the wastelands. Remarkably, over half of the participants did not report facing any difficulties while utilizing the green space. This dual perspective highlight both the prevalent satisfaction with the wasteland experience and the recognition of challenges faced by a significant subset of participants during their visits.

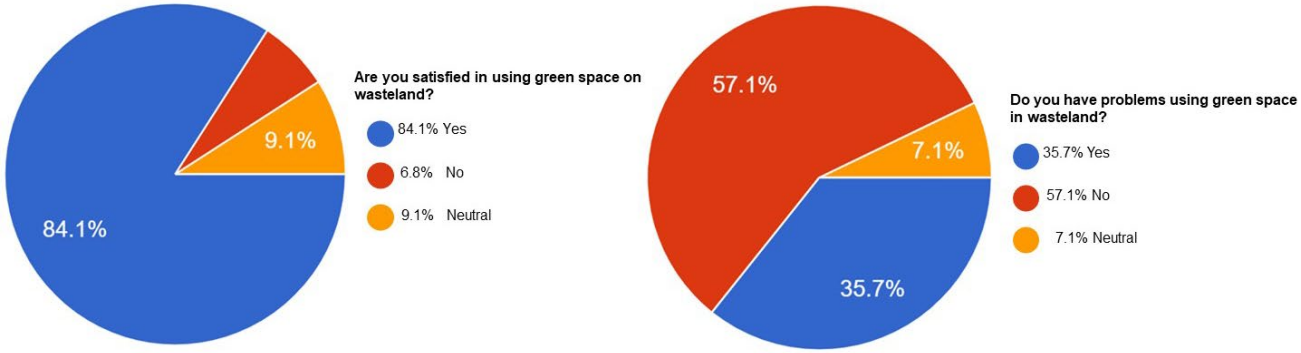


Figure 5-31: Satisfactory and Usage Problems Queries

In the third segment of the questionnaire, participants are tasked with responding to brief inquiries pertaining to their perceptions of informal green spaces subsequent to their engagement in the workshop activities. The qualitative data extracted from the concise responses in the questionnaire is subjected to analysis using Speak Ai. This analytical tool is employed to identify the most frequently reiterated words, which are then utilized to generate a word cloud. This visual representation illustrates the predominant themes and considerations emphasized by the participants, offering valuable insights into their perspectives following their participation in the workshop activities.

To begin with the query, "What is your primary concern when utilizing green space on wastelands?" The analysis underscored safety as the foremost concern for participants (n=10), as shown in figure 5-32. Subsequently, participants cited the insufficiency of lighting, alongside apprehensions related to the presence of wildlife such as mosquitoes and reptiles. Additionally, concerns were articulated regarding limited access to and the necessity for improved public communication regarding the utilization of wasteland spaces.

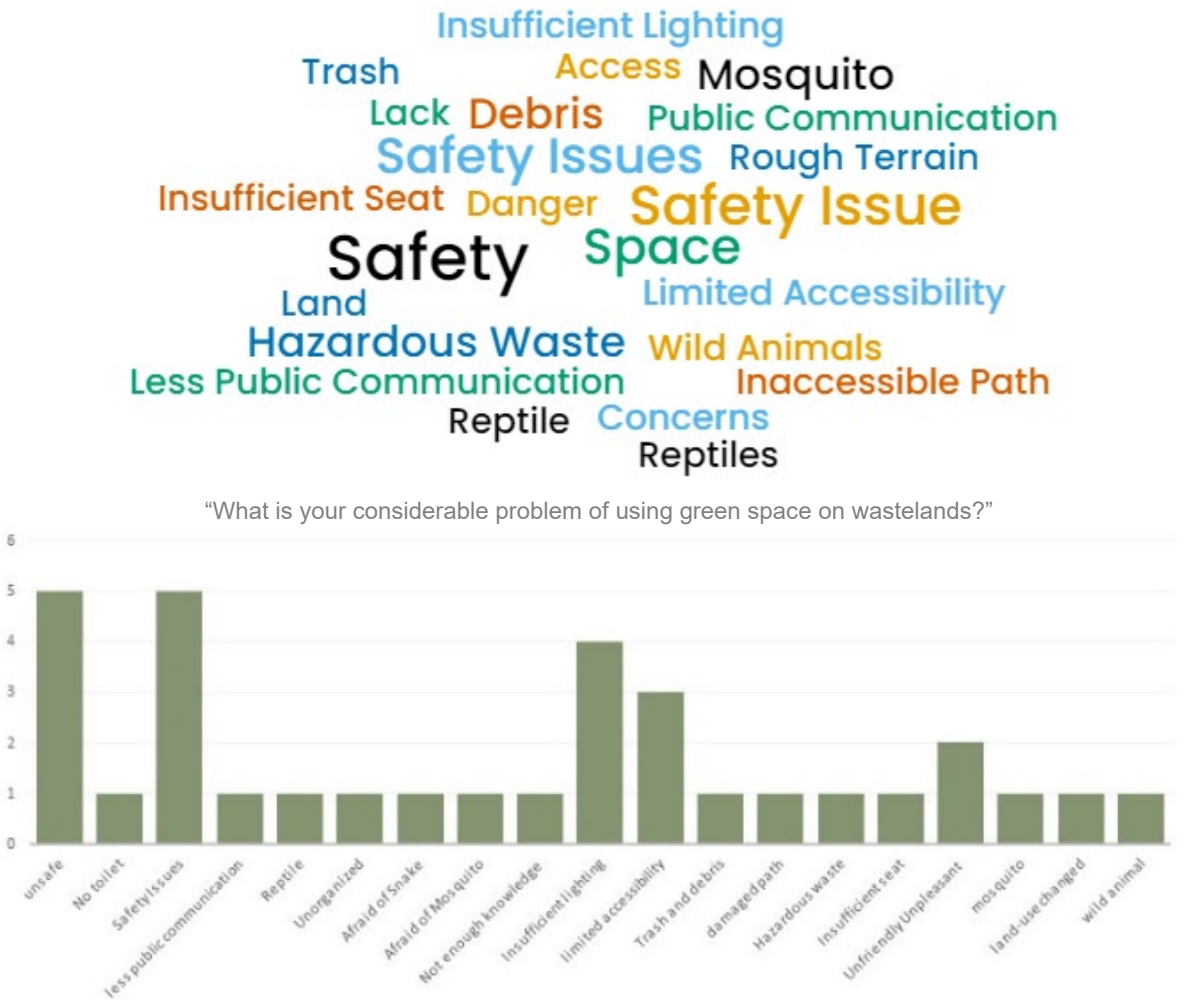


Figure 5-32: Words Cloud for Considerable Problem

In addition, when respondents were prompted with the question, 'What factors lead you to favor the use of green space on wastelands over formal public parks?' the outcomes of a word cloud analysis illuminated environmental considerations as the predominant motivation (see figure 5-33). Participants articulated that the inherent authenticity of the natural habitat in wastelands surpassed that of formal public parks. Furthermore, accessibility emerged as a notable factor, with participants expressing that green spaces on wastelands are conveniently situated in close proximity to their residences.

This preference inclination is notably linked to another inquiry regarding, 'How do you believe the existence of green spaces in wastelands can positively impact both the city and society?' Participants underscored the potential of wastelands to contribute to urban nature and serve as valuable green spaces (see figure 5-34). The perceived benefits encompassed the provision of a serene setting for recreational activities and, notably, the facilitation of a natural learning environment for children. This attests to the multifaceted advantages

participants associate with the incorporation of green spaces within wastelands, reinforcing their positive impact on both the urban landscape and societal well-being. However, it is noteworthy that there is one participant express a distinctive perspective which is “If there is a public park, I will never visit this place.”

“What reason can make you prefer to use green space on wasteland instead of formal public park?”

Figure 5-33: Words Cloud for Reasons for preferring wasteland.

“How can the presence of green spaces in wastelands benefit both the city and society in your opinion?"

Figure 5-34: Words Cloud for Benefits of Wastelands

The final inquiry in the questionnaire addresses the potential issues associated with wastelands (see figure 5-35). Despite participants acknowledging the potential for wastelands to improve the urban environmental situation, they express concerns about certain drawbacks. Primarily, participants highlight apprehensions about criminal activities or drug trafficking occurring in these areas. Additionally, there is a shared discomfort regarding the presence of dangerous animals or unfamiliar wildlife. Participants express a sense of insecurity in utilizing the space, associating wastelands with squatters, vandalism, and homelessness. Finally, participants find wastelands unappealing due to the prevalent issue of trash and littering within these areas.

"In your opinion, how can green spaces in wasteland cause problems for the city and society?"

Figure 5-35: Words Cloud for Problems Caused by Wastelands

The final inquiry in the questionnaire addresses the potential issues associated with wastelands. Despite participants acknowledging the potential for wastelands to improve the urban environmental situation, they express concerns about certain drawbacks. Primarily, participants highlight apprehensions about criminal activities or drug trafficking occurring in these areas.

The utilization of the questionnaire method proves essential in gauging public perceptions regarding spontaneous vegetation on wastelands or informal green spaces. These perceptions serve as valuable insights guiding the formulation of guidelines and frameworks, aligning with the theoretical underpinning of the social-environment relationship. The conceptual foundation of the framework rests on environmental governance principles, emphasizing the imperative of inclusive urban development to mitigate exacerbation and inequalities that may result in unjust outcomes. Collaborative efforts and active participation

in decision-making processes, particularly involving urban citizens, are deemed crucial for effectively addressing local environmental challenges.

The findings derived from the questionnaire method will be thoroughly examined in Chapter Six, where they will contribute to the formulation of suggestions for an informal green space guidelines framework within the scope of this thesis. However, as a precursor to that, the subsequent step involves employing the expert interview method to ascertain the mechanisms and potential avenues for integrating informal green spaces with the Bangkok Metropolitan Administration's (BMA) green space policy.

5.3 Expert Interview Exploring Mechanisms of Incorporating Informal Green Space

In the final phase of the research methodology, experts closely associated with urban green spaces and the strategic planning of Bangkok are interviewed. The interviewees comprise multidisciplinary experts actively engaged with Bangkok's policies and mechanisms affecting its environment, as detailed in Chapter three. These interviews draw upon the participants' extensive work experience and opinions. Consequently, there may be variations in information due to potential conflicts between different interviewees.

5.3.1 Bangkok’s Green Space Situation

Initiating the expert interview process on the environmental situation in Bangkok, Naturist emphasized the manifold benefits of urban nature for human well-being, encompassing emotional and educational aspects. However, the president of Thai Association of Landscape Architect (TALA) countered, highlighting the city's unfavourable environmental status due to the insufficient integration of biodiversity into the urban landscape. This sentiment resonated with insights from the landscape architecture instructor, who underscored the near absence of natural spaces in Bangkok, attributing it to lax development control. The landscape architecture instructor stressed the urgency of establishing a land use mechanism that preserves green spaces aligned with nature, advocating for a balance between conservation and urban development. This aligns with the community landscape architect's concern that extensive modifications have depleted nature in the city, leaving limited semi-natural spaces, often reduced to remnant patches. The collective expert viewpoint emphasized the necessity of green infrastructure development to fortify environmental systems and benefit communities, with a specific focus on wildlife conservation and natural growth promotion.

Despite a growing awareness of green initiatives, rewilding, and ecosystem services, discussions remain confined, encountering challenges like homeowner resistance. To forge an eco-friendly city in Bangkok, the consensus is on the pivotal role of changing perceptions

through gradual awareness incorporation, fostering a positive societal mindset shift, and encouraging increased community involvement in environmental dialogues and solutions. The urban planning professor added another layer to the discourse, pointing out a misalignment in the Bangkok Metropolitan Administration's (BMA) green space design and maintenance goals. This misalignment impedes the development of high-quality green areas. The community landscape architect echoed this sentiment, highlighting that the current principles guiding green space development primarily focus on creating recreational areas without specific goals related to environmental systems or ecosystem services. The collective expert opinion underscores the need for a comprehensive approach to urban planning that considers both recreational and ecological objectives for sustainable and vibrant green spaces in Bangkok.

5.3.2 Bangkok's Green Space and Uneven Distribution

Addressing green space accessibility and environmental justice, the Naturalist draws from his experiences in urban walks and ecowalk activities in Bangkok, highlighting a significant portion of the population lacking access to green and natural spaces. Individuals with lower incomes, burdened by long work hours, often find themselves with limited opportunities to unwind in nature, constrained by financial limitations and a lack of social support. Despite the inherent importance of nature accessibility for well-being, these financial and social barriers make it challenging for many in Bangkok to connect with the natural environment. The Naturalist advocates for an improved distribution of green spaces, making it more accessible for people of all income groups, particularly those with lower incomes, to enjoy nature. Additionally, the Naturalist underscores the unequal distribution of urban green space, cautioning against measuring urban prosperity solely through economic indicators. The exclusive focus on economic development, he argues, may overshadow essential aspects of human development, societal progress, and the well-being of urban dwellers. This imbalance can result in neglecting the intrinsic value of nature and the diverse living entities coexisting with humans. He calls for a shift in perspective, emphasizing that natural areas have the right to exist and persist, advocating for societal learning about nature to raise awareness about its ongoing role in our lives.

The Urban Researcher at More and Farmer further supports this perspective, illustrating that the current development of green spaces often stems from financial motives to attract people and generate profits. However, this approach may limit accessibility, especially for those with lower incomes. To address this, the researcher proposes a multidimensional, collaborative approach involving various sectors, such as social, business, and experts, to efficiently distribute green spaces. This becomes particularly crucial when Bangkok faces resource limitations for development. In essence, both the Naturalist and the Urban

Researcher highlight the need for a paradigm shift in urban planning, promoting equitable access to green spaces and recognizing the intrinsic value of nature beyond economic considerations.

In their research, More and Farmer, urban researchers, identified areas in Bangkok that urgently need green spaces based on accessibility, population density, normalized difference vegetation index (NDVI), land surface temperature (LST), and air quality index (AQI). The red area shown in figure 5-36 indicates the locations that require green spaces to improve the environment. More and Farmer's map is more detailed than the GIS findings in this research as it is generated from on-site data instead of political boundaries. However, More and Farmer's map correlates with the green space vulnerability map in this research. The inner city is the area that urgently requires more green space to enhance its environment. These maps demonstrate that Bangkok has an uneven distribution of green spaces.

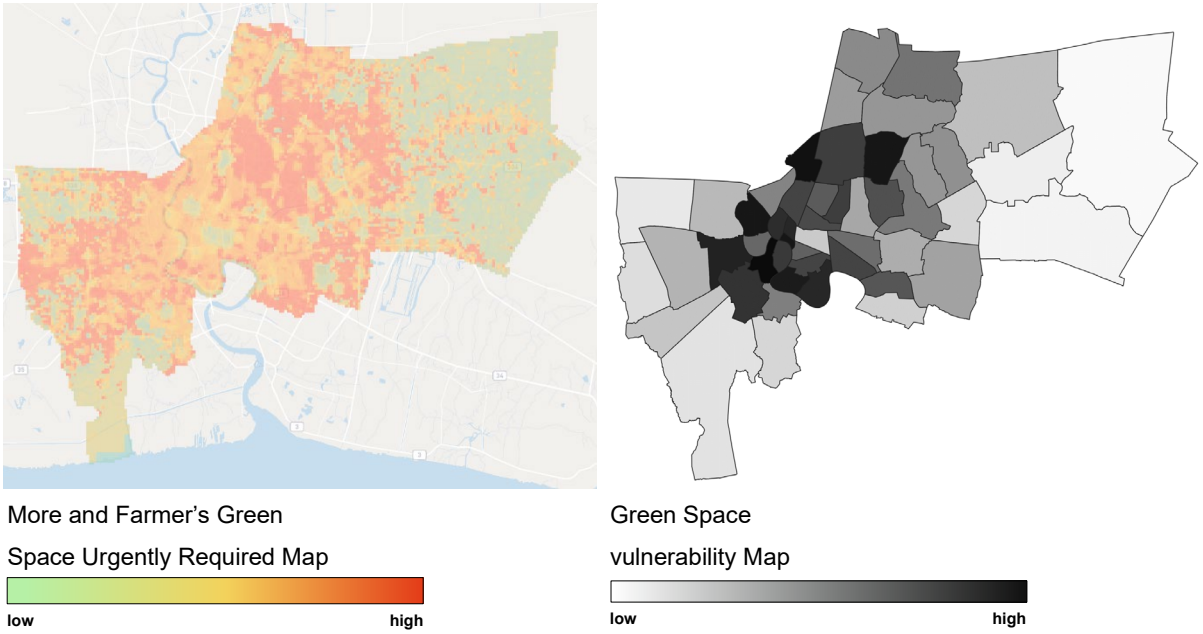


Figure 5-36: More and Farmer's Green Space Urgent Required Map

5.3.3 Bangkok's Green Space Policy

The interview delves into the intricacies of Bangkok's green space policies, with the Naturalist asserting that the current policy lacks clear direction and objectives, relying heavily on numerical targets without tangible outcomes. This deficiency is attributed to the historical view of green spaces as mere decorations, a perspective now evolving towards recognizing their role in creating an environmental system and promoting well-being. Despite this realization, the development of green spaces focuses on quantity rather than establishing qualitative criteria.

The data analyst highlights challenges in achieving green space goals, citing issues in data collection, duplication, and a lack of strategic direction. The Data Analyst underscores the need for a true goal in managing green spaces, suggesting a shift from focusing solely on public parks to a broader approach. To address this, continuous monitoring through databases and remote sensing is recommended to prevent data mix-ups between public parks and green areas.

The President of TALA identifies a classic problem—lack of coordination between policy and implementation sectors. This results in an emphasis on increasing the quantity of green spaces without promoting creation where lacking, leading to inconsistency in translation at the district level. The President notes a misalignment between the governor's vision and implemented policies, driven by insufficient budget allocation. This lack of funding hampers expert hiring, resulting in the deterioration of green spaces, contributing to a significant carbon footprint and a cycle of low-quality construction.

To remedy these issues, the Naturalist suggests a collaborative starting point, emphasizing research and stakeholder involvement. The development of green spaces must align with efficient budget management, redirecting funds towards grassroots communities and integrating expertise for effective results. The Urban Professor introduces We!park as an intermediary fostering collaboration between private and public sectors, emphasizing the need for increased coordination among organizations. The Park Coaching project, backed by the Thai Health Promotion Foundation, aims to enhance the efficiency of green space development in Bangkok by collaborating with experts. Finally, the Director of Healthy Space Forum advocates for collective responsibility, suggesting that managing green spaces should not rest solely on the Bangkok Metropolitan Administration (BMA) but involve contributions from all government agencies. In summary, the interviews underscore the need for a strategic shift towards qualitative development, effective coordination, and increased collaboration among various stakeholders to create a sustainable and vibrant urban green landscape in Bangkok.

5.3.4 Urban Green Space Collaboration and Incentive

Following the discussion on Bangkok's green space policy, a pivotal issue emerges—establishing a mechanism for effective collaboration between the public and private sectors to address environmental challenges in the city. The Urban Researcher at More and Farmer suggests that this collaboration could take various forms, involving mutual dialogues for envisioning development or allowing the private sector to take the lead while the government facilitates. The TALA’s president, however, highlights the absence of a legal mechanism for internal government coordination and collaboration with the private sector. The existing

system often mandates public sector coordination before engaging with the private sector, creating coordination challenges. Currently, the primary mechanism for government and external organization coordination is limited to public hearings.

To expedite decision-making and enhance transparency, design competitions are suggested as an approach, as explained by the TALA's president. This method helps overcome obstacles, streamlines negotiation processes, and elevates the quality of public spaces. Similarly, the Urban Professor emphasizes the coordination challenges due to the absence of formal laws mandating discussions among stakeholders. The lack of such laws can hinder communication between organizations, relying on informal practices within a limited circle. Formal laws facilitating communication could broaden participation, encouraging diverse ideas for urban development.

The Urban Planning Professor sheds light on stakeholder management, categorizing characteristics into public, private, and civil sectors. Decision-making in the public sector involves discussions among executives, while the private sector focuses on agreements related to benefits and returns. The civil sector prioritizes community-oriented outcomes like safety, illumination, and easy accessibility. However, private entities' reluctance to lease land for public spaces stems from concerns about recording such leases on land title deeds, potentially diminishing the land's aesthetic appeal and marketability. To foster increased collaboration, the government is urged not only to highlight the economic value of leasing land but also to address minor details, including document-related processes. In essence, developing a structured and legal framework for collaboration is essential for fostering effective partnerships between the public and private sectors in Bangkok's urban green space development. Furthermore, the director of Healthy Space Forum elucidates on the mechanism for multi-player collaboration, emphasizing the need to incentivize the private sector to actively participate in preserving green spaces for urban development projects. While suggesting that Bangkok could assist the private sector in maintaining green spaces, he underscores that the primary responsibility for expanding green areas in the city rests with the government. Policies aimed at enlarging green spaces and addressing environmental concerns should initiate by managing underutilized public land. For instance, large green spaces owned by the army could be repurposed and opened to the public as urban green areas. The urban researcher at More and Farmer delves deeper into the incentive for the private sector, highlighting the critical role of government motivation in unlocking collaboration opportunities. By leveraging the private sector's strengths, including land, financial resources, and a passion for area development, meaningful partnerships can be forged. Aligning government benefits with the private sector's interests, particularly in environmental development, can yield positive effects on local areas, generating beneficial occupations for communities and fostering connections.

Examining the perspective of investors and the economy, the researcher acknowledges that economic value may be a priority for investors transforming vacant land into profitable green spaces. The development of green spaces, therefore, needs to showcase clear economic benefits to attract investor interest. Demonstrating the economic value of green space development and providing satisfactory answers from an investor's viewpoint can underscore the urgency and worthiness of such projects. Drawing from case studies in countries like South Korea and Japan, the urban researcher emphasizes the economic impact of developing green spaces, asserting that Bangkok should create a vision for urban development with a clear purpose for green space development and expected outcomes. Recognizing the direct impact on the economy, including increased land value and economic activities within green areas, can solidify the importance of such initiatives. The landscape instructor adds that coordination among stakeholders is crucial for creating green spaces. However, discussions often veer into unrelated issues or specialized knowledge not directly relevant to ecosystem conservation. Even authorities in Bangkok may not fully grasp the concept of ecosystem services, limiting the integration of nature into urban planning and green space management. Addressing these knowledge gaps is pivotal for effective collaboration and the successful integration of green spaces into urban development.

However, the president of TALA highlights the success stories arising from the harmonious collaboration between the public and private sectors. Emphasizing the significance of active participation in the creation of green spaces, he underscores the importance of providing input to policymakers to ensure informed and transparent development, allowing for effective monitoring. Several notable projects in Bangkok, such as pedestrian pathways in Silom, green spaces near CentralWorld shopping center, and public parks along Wireless Road, stand as testaments to the potential of successful partnerships between the public and private sectors in bolstering the city's green infrastructure. According to TALA’s president, such collaborations not only showcase successful projects but also enhance the efficiency of public spaces. Many private entities in Bangkok recognize the value of contributing to the improvement of public spaces, aiming to enhance overall land value. This collaboration proves instrumental in overcoming bureaucratic hurdles faced by the government, allowing for expert input in green space development, from design to studies. A prime example is the transformation from Phu Pha Saw to Mahanakhon, where collaboration with the Crown Property Bureau ensured funding, design, and subsequent handover to the Bangkok Metropolitan Administration for construction and maintenance budget allocation.

Amidst the mechanisms proposed by urban and landscape architects, the naturalist introduces the positive concept of Payment for Ecosystem Services (PES) as a means to restore nature, the environment, and ecosystems. PES involves generating income for landowners in exchange for maintaining essential ecosystem services. This model

incentivizes landowners to conserve environmental services like carbon sequestration areas, biodiversity hotspots, watershed protection zones, and scenic landscapes. Financial support from the government encourages landowners to transition towards preserving natural resources, aligning economic interests with environmental conservation. This approach promotes sustainable land use practices, fostering a balance between urban development and nature conservation, contributing to a more environmentally friendly urban landscape.

Moreover, the naturalist advocates for a change in Bangkok's position, emphasizing the need for the city and its districts to shift roles towards overseeing and managing projects with accountability checks from the government. Acting as the income manager of the city and managing budget resources can pave the way for developing an environmentally appropriate and robust infrastructure, stimulating future economic development. For instance, cleaner water sources in Bangkok could boost the cultivation of economically valuable species like prawns, creating economic value and promoting tourism in the future.

Lastly, the urban planner professors stress that addressing environmental issues in Bangkok surpasses the capacity of local organizations. Collaboration with the central government is essential to create policies that effectively tackle environmental problems. Both the country and the city need new platforms to coordinate with various stakeholders, making environmental development goals achievable. The challenge lies in decision-makers not prioritizing environmental problem-solving or creating green spaces in the city. Urgent issues may take precedence, making effective communication crucial to help decision-makers understand the necessity of environmental development and facilitating successful collaboration in this endeavour.

5.3.5 Wastelands Management

The exploration of wasteland emerged as a focal point in the interview, centering around its potential to transform into informal green spaces in Bangkok. The urban researcher from More and Farmer highlighted the diverse possibilities for developing vacant areas into green spaces, emphasizing the need for a varied strategy aligned with human activities. Proposing an innovative approach, he suggested experimenting with cost-effective methods to rapidly develop green spaces in vacant areas, fostering harmony with nature and optimizing budget utilization. The aim is to create safe and accessible spaces, particularly for children and families. However, challenges arise in the varied interpretation of "budget-friendly" within the Bangkok Metropolitan Administration (BMA), with district offices perceiving green space creation as a maintenance burden, leading to an emphasis on concrete areas over green spaces.

Additionally, TALA's president shed light on wasteland management in Bangkok, underscoring safety as a top priority. The prevalent approach prioritizes spaces deemed easy

to maintain and budget-friendly, often involving the removal of trees and vegetation in favor of concrete. TALA's president emphasized that the development of green spaces from wastelands is intricately tied to urban politics, with public spaces serving as political achievements for gaining popularity. Addressing the needs of urban residents becomes a crucial variable in promoting green space development, requiring a shift in public perception from associating green spaces with concrete structures to understanding their environmental and well-being benefits.

Furthermore, the president stressed the importance of effective communication and knowledge dissemination to promote the conservation of green spaces in wastelands. Creating a network of individuals who recognize the significance of developing green spaces is essential, and while not feasible everywhere, selecting areas with development potential is key. Urban planner professors highlighted the challenge of providing green spaces in privately-owned wastelands, citing bureaucratic and financial constraints. The unclear definition of "wastelands" and their varied reasons for existence, often driven by economic factors, further complicate public use suitability, emphasizing the need for revenue generation for self-maintenance.

TALA's president acknowledged the potential collaboration between the private sector and the government for developing green spaces from wastelands in Bangkok. However, operational mismatches arise due to a lack of a bridge connecting public and private sectors, compounded by internal coordination challenges within government organizations. Budget allocations and a focus on concrete development over green spaces perpetuate the perception that the former equals progress, while the latter is considered less impactful and costly. Efficient budget utilization, preventing unnecessary concrete development, and prioritizing meaningful, fair, and transparent allocation are crucial to shift the prevailing mindset within government agencies and local authorities.

5.3.6 Urban Ecosystems Strategy

The exploration of ecosystems presents a captivating dimension aligned with the research's goal of reinstating urban ecosystem services in Bangkok. According to the Director of Healthy Space Forum, Bangkok is not lacking in green spaces as evidenced by satellite images, yet accessibility is constrained due to private ownership. The Director emphasizes the distinction between public spaces and green spaces for carbon sequestration, underscoring potential conflicts, especially in areas like sports fields that require concrete. While not entirely endorsing ecosystem restoration, the Director suggests leveraging legal and city planning mechanisms to mandate developers allocate vacant land as green spaces, citing the successful FAR bonus model in Japan's Roppongi Hills district.

In contrast, TALA's President advocates the conservation of spontaneously emerging natural patches across Bangkok to enhance environmental well-being. The proposal involves interconnecting green spaces through ecological corridors, utilizing existing urban infrastructure. Despite the potential, the Community Landscape Architect emphasizes the challenges in urban ecosystem development and urges the government to set clear targets for desired ecosystem services. The Naturalist stresses interdisciplinary collaboration with experts in environmental science, hydrology, and natural sciences to foster a scientifically informed approach to urban nature development. This collaboration, as proposed by the Landscape Architecture Professor, is currently limited in Bangkok compared to Japan, which integrates urban development plans with educational systems to cultivate ecosystem development professionals.

Highlighting the impact of land tax on urban ecosystems, the Naturist criticizes current laws that disrupt natural harmony and incentivize landowners to convert natural areas into orchards to avoid taxes. Advocating for a shift in approach, the suggestion is to encourage green space creation rather than imposing punitive tax measures. This sentiment aligns with the Urban Researcher's proposal for new land tax measures to facilitate private sector contributions to environmental conservation. This might involve supporting private entities in opening undeveloped areas for public use, creating diverse green spaces without burdening the budget.

In contrast, the Director of Healthy Space Forum argues that land tax is not a direct tool for expanding green areas, serving instead to align land use with urban planning. Challenges arise in enforcing uniform tax rates, leading to inappropriate outcomes like widespread cultivation on private lands to circumvent higher tax rates. To address limited public green spaces, the Director suggests allowing public access to state-owned resources, viewing land as a collective asset accessible to the public. Urban planning measures and building control laws, according to the Director, can be tools to increase green spaces on private land.

The Landscape Architecture Instructor criticizes the BMA's green space policy, emphasizing a focus on recreation rather than developing environmental benefits within the ecosystem. The recommendation is to integrate recreational spaces with ecosystems for mutual benefits, citing Japan's Komaba Park as a successful model. The importance of the Land Use and Land Cover (LULC) policy is stressed for controlling and preserving natural areas within the city.

5.3.7 Urban Nature Based Solution

The conclusive segment of the interview delves into the contentious urban strategy of nature-based solutions (NBS), with the naturalist highlighting potential challenges in implementing NBS in Bangkok. One major hurdle lies in the limitations of the Thai language at the organizational level, hindering effective communication. Furthermore, the sustainable nature of NBS, relying on low-cost initiatives grounded in natural mechanisms, conflicts with internal organizational interests that may prefer conventional budget allocations. This poses a potential reluctance among government officials to invest in this innovative urban development approach. Aligning with this perspective, the community landscape architect notes a lack of understanding regarding the true goals of environmental development in Bangkok, emphasizing the urgency and depth often overlooked. Despite a nascent understanding of NBS in the city, there's optimism about Bangkok's open-mindedness to develop and improve this knowledge.

The landscape architect stresses the necessity of integrating nature into urban development plans and policies, urging strong advocacy and high-level support. Acknowledging the limitations in restoring the original environmental state, the focus should shift towards preventing further destruction and preserving existing conditions as much as possible. Regarding green infrastructure, the community landscape architect points out the challenge posed by predominantly private landownership, necessitating government reliance on incentives for green space development through legal and tax mechanisms. The landscape architecture professor contends that abandoned areas already constitute green infrastructure, emphasizing the need for accessibility and suitability for human utilization and development.

Although Bangkok's green space policy includes efforts to implement NBS, the landscape architecture professor deems its effectiveness insufficient. Proposing a holistic approach to environmental development, the emphasis shifts from mere quantity increase to preserving and enhancing ecosystem quality. TALA's president aligns with this perspective, advocating for a shift in Bangkok's development outlook—moving from immediate benefits to multifaceted infrastructure development, combining environmental sustainability with recreational spaces, such as water management areas.

The data analyst concludes the discussion by emphasizing the importance of post-development scrutiny and continuous evaluation processes. Referencing data collection and analysis, the suggestion is to ensure sustainable urban environment development in Bangkok. This approach aims to maintain a balance between growth and environmental preservation.

6. Discussion and Conclusion

The research outcomes, derived from a comprehensive investigation involving GIS analysis, on-site surveys, and expert interviews, signify a promising potential for the integration of spontaneous vegetation on wastelands into the Bangkok Metropolitan Administration's (BMA) green space policy. Commencing with the GIS analysis and a thorough review of the BMA's green space policy, the study unveils insights into the management of green spaces in Bangkok, shedding light on their distribution patterns.

The on-site survey contributes valuable information regarding the local populace's perceptions, revealing a growing acceptance of informal green spaces. This acceptance is intricately linked to the environmental conditions in Bangkok, as discerned through a participatory public process. Notably, the findings underscore a notable trend in favor of informal green spaces, aligning with the prevailing environmental dynamics of the city.

Expert interviews further illuminate the policy mechanisms that could facilitate the integration of informal green spaces within the framework of the BMA's green space policy. Chapter six delves into a comprehensive discussion, elucidating the implications of these findings in relation to the prospect of incorporating informal green spaces into the BMA's policy landscape.

Moreover, the research introduces a guidelines framework in this section, aimed at formulating tangible solutions for the development of informal green spaces. Recognizing the critical role of informal green spaces in enhancing urban ecosystem services, the proposed framework serves as a vital tool for fostering sustainable urban development in Bangkok. This strategic approach not only outlines the potential benefits but also provides a roadmap for the practical implementation of policies to augment the city's green infrastructure.

6.1 BMA’s Policy Review and GIS Finding Discussion

Initiating the review of the green space policy, it becomes evident that Bangkok is overlooking the incorporation of spontaneous vegetation at the vision level. The examination, particularly in the context of Kowarik's urban nature frameworks encompassing nature remnants, agrarian landscapes, designed urban green spaces, and wild urban ecosystems (Breuste, 2022, p. 120), highlights a conspicuous emphasis within the BMA's definition of green space. The focus predominantly centers on artificial green areas such as public parks and pocket parks, neglecting policy measures pertaining to spontaneous vegetation on wastelands.

In contrast, the central government organization, ONEP, adopts a broader definition of green space that encompasses biodiversity and sustainability. While ONEP is committed to conserving remnant urban nature on the outskirts of Bangkok, this approach has limited direct

benefits for the city's inhabitants. Consequently, it appears that the government's attention is not directed towards novel ecosystems, specifically referring to spontaneous vegetation emerging on wastelands.

Drawing from insights presented in chapter two, Breuste (2022, p. 288) underscores the vital role played by novel ecosystems in providing essential ecosystem services like carbon sequestration, air and water purification, and the enhancement of urban biodiversity. Arguably, the preservation of novel ecosystems can be viewed as a novel strategy to elevate Bangkok's urban environmental conditions. Therefore, it is imperative to advocate for the inclusion of measures that specifically address the preservation of novel ecosystems within the framework of the BMA's green space policy. This proactive approach aligns with the broader goal of enhancing the city's environmental resilience and sustainability.

Furthermore, despite the multitude of strategies aimed at enhancing the environment in Bangkok, the governor's policy lacks clarity regarding implementation scenarios. For instance, initiatives like the "15 Minutes Parks" and the "Million Trees" policy are inherently ambiguous in delineating specific action areas. While the projects' objectives hold great promise, the practical details for implementation at the administrative level remain challenging. Consequently, the ambitious goals outlined in Green Bangkok 2030 and the city's 20-year development plan, which targets a 30% increase in green space, face significant hurdles due to the absence of clear targets and action plans for physical implementation.

The research study delves further into the urgent need for green spaces in Bangkok, employing GIS analysis to identify areas requiring immediate attention. The outcomes of the GIS analysis highlight the perplexing nature of the Bangkok Metropolitan Administration's (BMA) green space strategy. Notably, the distribution of green space in Bangkok is startlingly uneven, with the inner-city zone experiencing severe environmental injustice that aligns with socio-economic vulnerabilities. A disconcerting revelation emerges from the research, indicating a contradiction between the analysis of the main public park service areas and other green space assessments, such as green spatial and NDVI analyses. Despite a concentration of public park services around the inner city, the area itself urgently requires green spaces, as evidenced by the NDVI analysis, which reveals a predominance of built-up areas.

While there are arguments about differentiating between conservation green spaces and public parks, I contend that an exclusive focus on conventional green spaces, like public parks, may lead to a mismatch between the supply and demand for green spaces in the city. In essence, the Bangkok government must urgently incorporate strategies for informal green spaces to infuse and integrate nature, particularly in the inner-city zones. This shift in approach is crucial for fostering a more balanced and resilient urban environment.

6.2 On-site Survey Finding Discussion

The incorporation of on-site survey data is crucial to this research, representing a primary link to Bangkok's civil society. The method's primary objective is to delve into participants' perceptions of informal green spaces. Participants, encompassing diverse characteristics such as gender, education, age, nationality, income, and family status, offer a comprehensive representation of Bangkok's population. Notably, the majority of participants reside in close proximity to the study sites, aligning with the concept of environmental governance, which involves society and local users in managing their neighborhoods (Driessen *et al.*, 2012, pp. 152-153).

The research findings align with the literature in chapter two, particularly discussions on urban residents' perceptions of wastelands. Riley *et al.* (2018, p. 9) posit that informal green spaces in public wastelands often garner negative perceptions due to disorderliness and safety concerns. The wild appearance shaped by spontaneous vegetation contributes to these negative perceptions (Riley *et al.*, *2018*, p. 9-10). Confirming Riley's suggestions, the research reveals that participants perceive informal green spaces as insecure, citing issues such as insufficient lighting, wild animals, hazardous waste, rough terrain, littering, and associations with criminal activities such as drug trafficking and squatting.

Contrary to these negative sentiments, a substantial number of participants express satisfaction with their experiences in informal green spaces, with many being aware of such spaces in their neighborhoods. This aligns with arguments by Rupprecht *et al.* (2015, p.13) and Rall *et al.* (2017), asserting that urban residents value ecosystem services in green spaces, including aesthetics, natural experiences, education, and biodiversity. The on-site survey supports this argument, indicating that a considerable number of participants appreciate the natural environment influenced by informal green spaces. Some believe that minimal intervention in these spaces can regulate ecosystems and alleviate environmental issues, presenting opportunities for relaxation and environmental education.

While the on-site survey highlights negative perceptions, it also underscores the potential of informal green spaces to offer alternative green spaces for Bangkok's residents. Riley *et al.* (2018, p. 2-3) suggests that small interventions, such as waste removal, partial grass mowing, and tree pruning, can enhance urban residents' perceptions. Rupprecht *et al.* (2015, p. 25) propose exploring participatory approaches for managing informal green spaces, integrating nature into urban areas, while Hwang *et al.* (2019, p. 174) argue that incorporating informal green spaces enhances socio-ecological value in city landscapes.

In conclusion, the analysis of this research method indicates that informal green spaces hold the potential to serve as alternative green spaces for people in Bangkok. However, action by the Bangkok Metropolitan Administration (BMA) is essential to improve the appearance of informal green spaces and eliminate insecure perceptions. The "zero

option" cost-effective approach suggested by Trentanovi *et al.* involves minimal intervention in green spaces, optimizing usage areas while preserving conservation areas. Implementing such strategies could enhance perceptions of informal green spaces and contribute to preserving urban nature in Bangkok.

6.3 Expert Interview Finding Discussion

The third step of my research methodology, aimed at assessing opportunities and mechanisms for incorporating information into the Bangkok Metropolitan Administration's (BMA) green space, involves expert interviews. This method leverages a multidisciplinary approach, engaging diverse expertise to delve into the economic and legislative mechanisms influencing urban nature generation in Bangkok. The findings underscore a concerning reality—the environmental situation in Bangkok is far from optimal, primarily due to the absence of effective measures to control urbanization.

At present, Bangkok lacks preserved urban nature, with only semi-natural spaces remaining. This decline in urban nature is a consequence of the BMA's misconception of green space and urban nature. The BMA traditionally views urban green spaces as areas designated for leisure and relaxation, often overlooking the crucial ecosystem services that these spaces can provide. Our expert interviews reveal a significant gap in understanding, indicating that the dismissal of urban nature in Bangkok stems from the BMA's limited appreciation of the broader benefits associated with green spaces. By recognizing urban green spaces solely as recreational areas, the BMA has inadvertently overlooked their potential to contribute essential ecosystem services, exacerbating the city's environmental challenges.

Consequently, there are pressing issues of green space accessibility and environmental justice in Bangkok. As the current conventional green space often prioritized financial motive, the lower incomes are often lacking access to green spaces due to financial constraints and limited social support. To address this, the researcher proposes a collaborative, multidimensional approach involving various sectors to ensure efficient green space distribution, especially in the face of resource limitations. Both perspectives highlight the need for a paradigm shift in urban planning, emphasizing equitable access to green spaces and recognizing the intrinsic value of nature beyond economic considerations.

Although the BMA’s environmental policy is expected to overcome current environmental problems, the result of expert interviews emphasizes an unclear direction and objective of the environment measures. Moreover, BMA is also shortage of resources including budget and manpower. Even though one expert suggests that expanding green spaces is the responsibility of the governments, others expert insist that stakeholder management and collaboration between public and private sectors is the solution in engage with the green space shortage situation. Moreover, the civil society sector can provide the

community-oriented outcome to achieve sustainable management relied on local communities.

The interviews highlight the need for effective collaboration between the public and private sectors to address environmental challenges in Bangkok. Coordination challenges and the absence of legal mechanisms for collaboration are identified. Design competitions and formal laws facilitating communication are proposed to streamline decision-making and enhance transparency. Stakeholder management and incentivizing the private sector are crucial for successful partnerships, with economic benefits emphasized. Successful collaborations, such as pedestrian pathways and public parks, showcase the potential of public-private partnerships in enhancing green infrastructure. Payment for Ecosystem Services (PES) is introduced as a positive concept, incentivizing landowners to conserve environmental services. The naturalist advocates for a shift in Bangkok's role towards overseeing projects with government accountability checks. Collaboration with the central government is deemed essential for creating effective environmental policies. Effective communication base on financing is crucial to help decision-makers understand the necessity of environmental development and facilitate successful collaboration in addressing urgent issues.

In the discussion on wastelands and informal green spaces, the interview underscores the potential for transforming wastelands into green spaces in Bangkok. The urban researcher proposes cost-effective methods for rapid development, prioritizing safety and accessibility. Challenges within the Bangkok Metropolitan Administration stem from diverse interpretations of "budget-friendly," leaning towards concrete rather than green spaces. TALA's president highlights safety and the political dimension of green space development, advocating for a shift in public perception. Effective communication is crucial, especially in privately-owned wastelands facing bureaucratic and financial constraints. While acknowledging collaboration potential between the private sector and government, the interview recognizes operational mismatches and coordination challenges. To reshape prevailing mindsets in government agencies and local authorities, efficient budget utilization and fair allocation take on pivotal importance.

The interview explores the urban ecosystems strategy for reinstating urban ecosystem services in Bangkok. Different perspectives are presented, including leveraging legal mechanisms to allocate vacant land as green spaces, interconnecting natural patches through ecological corridors, and critiquing the impact of land tax on urban ecosystems. The need for interdisciplinary collaboration, integration of recreational spaces with ecosystems, and a holistic approach to environmental development are highlighted. The discussion also delves into the challenges and potential reluctance in implementing nature-based solutions (NBS) due to language limitations and conflicting organizational interests. Despite the optimism about

Bangkok's openness to developing knowledge about NBS, the importance of strong advocacy, high-level support, and continuous evaluation processes for sustainable urban environment development is emphasized.

In summary, the experts suggest that spontaneous vegetation on wasteland holds the potential to offer ecosystem services in the city, serving as a natural area that functions as green infrastructure. Developing green space on wasteland proves to be a cost-effective solution for creating accessible green areas in Bangkok. The collaboration between the public and private sectors is crucial for this urban green space development, despite challenges posed by legislative and economic frameworks in government procedures. Integrating informal green spaces into the BMA's environmental strategy requires active involvement with civil society. While raising public awareness about ecosystem services in informal spaces takes time, it proves to be a practical approach for negotiating and persuading the government, particularly politicians. Establishing incentives for the private sector, such as FAR bonuses, tax measures, and Payment for Ecosystem Services (PES), is a crucial aspect of implementation. However, the increasing trend of private sectors developing their own green spaces may lead to uneven accessibility. Therefore, effective communication emphasizing the ecosystem benefits of informal green spaces for both civil society and the private sector is a top priority. The BMA can play a supervisory role in overseeing the process of establishing informal green spaces. Making informal green spaces a clear goal in Bangkok's green space policy is a viable step forward.

6.4 Finding Integration Discussion and Informal Green Space Framework

6.4.1 Finding Integration Discussion

The results of each step of research method provide the significant strategy to endorse the integration of informal green spaces in Bangkok. Starting with the policy review that cannot effectively indicate the urgent need for green spaces. Therefore, the research utilizing GIS analysis to identify areas in urgent demand for green spaces. Findings reveal a concerning environmental imbalance in the distribution of green spaces, particularly in the inner-city, highlighting socio-economic vulnerabilities. A contradiction emerges in the analysis of public park services and other assessments, necessitating attention to address the mismatch between supply and demand. The study advocates for a shift in the city's approach, urging the incorporation of strategies for informal green spaces to foster balance and resilience.

Despite negative perceptions, the on-site survey highlights participants' satisfaction with informal green spaces, aligning with the value urban residents place on ecosystem services. Small interventions, such as waste removal and tree pruning, are proposed to enhance perceptions and integrate nature into urban areas. The analysis suggests that

informal green spaces hold potential as alternative areas for residents, provided there is action by the Bangkok Metropolitan Administration (BMA) to enhance their appearance and dispel negative perceptions. A "zero option" cost-effective approach is recommended, emphasizing minimal intervention to optimize usage and preserve conservation areas.

Experts propose leveraging spontaneous vegetation on wasteland as green infrastructure, offering a cost-effective solution. Collaboration between the public and private sectors is crucial, requiring active involvement from civil society. Public awareness and incentives for the private sector, including FAR bonuses and tax measures, are essential for successful implementation. However, caution is urged to prevent private sector dominance, ensuring equitable accessibility. Effective communication emphasizing ecosystem benefits is a priority, with the BMA playing a supervisory role in establishing informal green spaces as a clear goal in Bangkok's green space policy.

6.4.1 Informal Green Space Framework

As a result, the findings suggest that the creation of informal green spaces can be successfully implemented in Bangkok, particularly by allocating green spaces to areas with urgent demands. The on-site public survey results also reflect positive feedback from urban residents, indicating that such spaces could improve the overall city environment. Despite some negative perceptions surrounding informal green spaces, the pressing environmental concerns outweigh these reservations, emphasizing the need to promote and embrace informal green spaces in Bangkok.

The collaboration approach between the public and private sectors is explored, with the Urban Planning Professor emphasizing stakeholder management by categorizing characteristics into public, private, and civil sectors. Decision-making processes differ among these sectors, with the public sector focusing on discussions among executives, the private sector on agreements related to benefits and returns, and the civil sector prioritizing community-oriented outcomes. The director of Healthy Space Forum discusses the mechanism for multi-player collaboration, highlighting the need to incentivize private sector involvement in preserving green spaces for urban development. More and Farmer's urban research underscores the critical role of government motivation in unlocking collaboration opportunities, proposing meaningful partnerships by leveraging the private sector's strengths in land, financial resources, and a passion for area development. Aligning government benefits with private sector interests, especially in environmental development, is seen as a way to positively impact local areas, creating beneficial occupations and fostering connections. In essence, developing a structured and legal framework for collaboration is essential for fostering effective partnerships between the public and private sectors in Bangkok's urban green space development.

Therefore, the collaboration framework for informal green spaces should be established on supportive systems involving three key pillars: the public sector, private sector, and civil society. These pillars synergistically reinforce each other, anticipating reciprocal benefits aligned with their respective expectations. Asawakowitwong suggests a collaboration spectrum focusing on land ownership and management, while Jansson *et al.* (2019, p. 961) offer practical frameworks for urban open spaces, particularly relevant to informal green spaces, as discussed in Chapter Two.

Jansson *et al.* (2019, p. 961) introduced the Governance & Management (G&M) model to facilitate exploring co-governance networks between the public and private sectors (see figure 6-1). The model concentrates on environmental governance with three key elements: 'private actors,' 'public actors,' and urban open space (or informal green space in this research), ranging from private to public and creating a continuum of physical spaces with different arrangements. It includes four interdependent dimensions: rules of the game, actors, discourses (communication between users and administration), and resources and power relations.

This adaptable model considers power relations among various actors influencing the development of informal green spaces. The thickness of arrows represents power levels, where a combination of private and public actor power results in different governance modes. For example, a thick arrow for private actor power and a thin arrow for public actor power describe a self-governance arrangement, while equally thick arrows indicate a co-governance arrangement with a more balanced power distribution. Despite its simplicity, the model serves as a visual tool for communicating interrelationships and differences in governance arrangements for urban open spaces, although its details should be explored in specific case analyses.

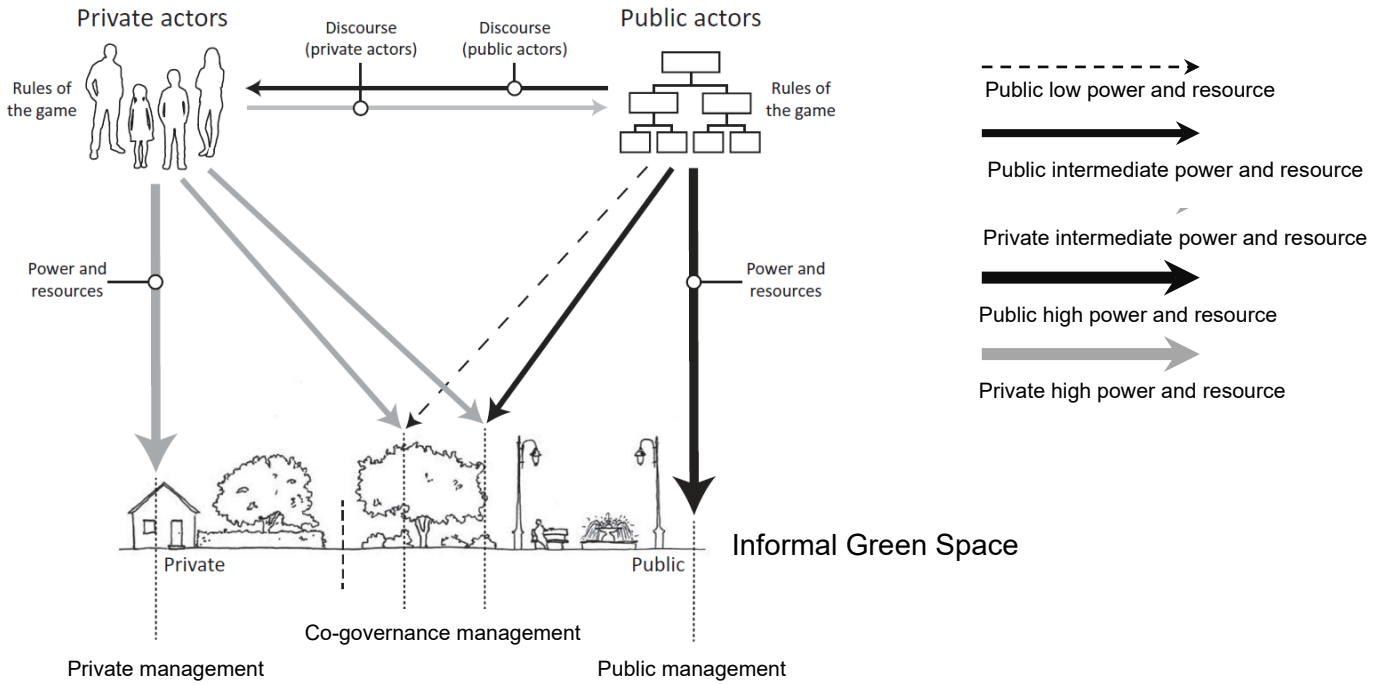


Figure 6-1: G&M model applying with Informal Green Space

The research methodology yields a guideline framework derived from its findings, advocating for the improvement of informal green spaces, particularly focusing on districts with urgent demands for such spaces. The significance of identifying both the supply and demand for green spaces in Bangkok is emphasized, providing essential guidance for their distribution in urban areas. The subsequent step involves identifying potential sites in each area or district that exhibit characteristics of informal green spaces, with a specific focus on locations vulnerable in terms of green space.

Recognizing the characteristics of informal green spaces, where spontaneous vegetation emerges on wastelands, is crucial for preserving the ecosystem services inherent in this self-organized ecosystem. The third step involves evaluating the land ownership status, influencing the subsequent step. The application of the G&M model is then linked to the ownership of the land, which is based on a co-governance structure—a collaboration among different actors to address challenges in resource distribution and conflict resolution. The co-governance structure, consisting of public, private, and civil society pillars, is suggested by expert interviews.

The G&M structure is adapted to the site conditions based on power and resources. For example, if the land is government-owned, the main power lies with the government, incorporating resources from the private sector. Conversely, if the land is privately owned, the main power is held by the private sector, supported by incentives from public organizations.

The civil society sector, while not typically the owner of the property, plays a crucial role as a user and project driver.

The fifth step involves implementing an optimized intervention to preserve ecosystem services on the site, usually involving minor changes such as security upgrades and enhancing the perception of the site to create a welcoming atmosphere for visitors. The last step revisits the G&M model, focusing on the management procedure within the co-governance structure. The responsibility for site management may vary based on agreements among actors, with the management strategy built on support from the government or private sector. In some cases, civil society may establish a committee to operate the informal green space.

Following these six steps, informal green space guidelines can contribute to enhancing the green space policy in Bangkok, aligning with research findings and the theoretical framework. The proposed guidelines address challenges in Bangkok's green space policy and enhance the environmental status within urban areas.

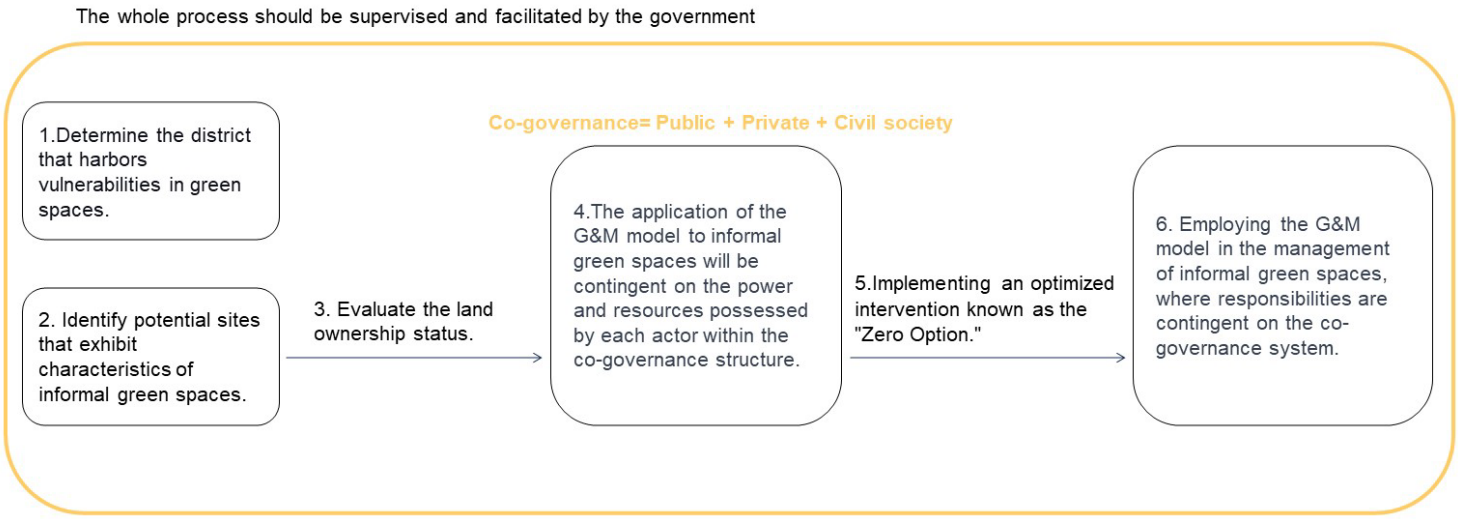


Figure 6-2: Informal Green Space Guidelines

6.5 Conclusion

The research embarks on a journey focused on climate change mitigation. The Green Space Policy implemented by the Bangkok Metropolitan Administration (BMA) influences various projects aimed at carbon absorption in green spaces. However, many urban green space projects incur significant costs and result in substantial carbon footprints. Hence, this thesis proposes a novel solution—an urban management plan—for providing green space in the city with a minimal budget and carbon footprint. The research hypothesis suggests leveraging spontaneous vegetation areas that emerge on wastelands as an opportunity to

establish low-impact green spaces in the city. The central question guiding this research is, "How can the green space policy guidelines in Bangkok be enhanced to enable wastelands to play a vital role in conserving ecosystems in urban areas?" This question has prompted the implementation of several methods to address the complexity of the policy guidelines and the multidisciplinary aspects of urban management. To address the research question and policy guidelines, the theoretical framework is built upon three foundational areas of knowledge: urban ecosystem services, socio-environmental relationships, and urban environmental management. Consequently, the research method is carefully designed to align with the theoretical framework, aiming to explore solutions for integrating spontaneous vegetation on wastelands, referred to as informal green space, into Bangkok's policy guidelines.

The exploration of the research question relies on a three-step methodology. The process begins with a review of the Bangkok Metropolitan Administration's (BMA) green space policy and the identification of potential research sites. This initial step uncovers the loopholes and pain points within the BMA's policy, highlighting the challenges in addressing green space issues in Bangkok. Furthermore, the insights gained from the first method guide the selection of study areas for the subsequent step in the research. The on-site public survey, integral to the socio-environmental relationship framework, elicits information regarding public perceptions of informal green spaces. Despite a prevalent negative perception of wastelands, the survey reveals that people believe these areas can be instrumental in addressing environmental issues in Bangkok. The final method involves expert interviews, focusing on the pain points of the BMA's green space policy and mechanisms for integrating informal green spaces into the overall green space strategy. During data analysis, interviewees were apprised of findings from the first two steps to facilitate discussions about the feasibility of integrating informal green spaces into the BMA's policy. While there were some conflicting opinions, the overall consensus among interviewees is that public-private collaboration is a crucial mechanism for integrating informal green spaces into the policy framework. This collaboration is deemed essential due to the government's limited resources, especially considering that most informal green spaces are owned by private sectors. However, it is noted that the collaborative efforts between public and private entities lack adequate support from legislative frameworks in Bangkok, requiring a long-term plan for development. Additionally, the civil society, often represented by local communities, emerges as a key player in motivating such projects, given their role as the primary stakeholders in informal green space initiatives.

In conclusion, the research findings demonstrate the potential of integrating wastelands as an alternative green space in Bangkok, termed as informal green space. This emerging concept holds promise as a new green space measure for several reasons. Firstly, informal green space is easily accessible and can be distributed throughout Bangkok, featuring spontaneous vegetation, as revealed in GIS analysis. Secondly, urban residents tend

to view spontaneous vegetation on wastelands as a practical initiative for addressing environmental concerns, as indicated by research participants. Thirdly, expert interviews suggest that informal green space incurs low costs and requires minimal maintenance, leveraging existing green space. Fourthly, the spontaneous vegetation on wastelands already provides ecosystem services, acting as a pre-established green infrastructure, as highlighted in expert interviews. Lastly, as emphasized by the president of TALA, the private sector's growing awareness of environmental issues and climate change mitigation presents an opportunity for collaboration with the government, positioning informal green space as a strategic avenue for expanding green space in the future.

In addition, this research contributes by providing a collaboration framework derived from the literature review and research methodology, offering insights for informal green space policy guidelines that align with the Bangkok Metropolitan Administration's (BMA) green space strategy. Acknowledging the time constraints, it's important to note that this study may not comprehensively address all issues essential for constructing the policy strategy. Rather, it serves as an inaugural research initiative highlighting the potential and opportunity to seamlessly integrate informal green space into urban policy.

As a stepping stone for future research, it suggests a more in-depth exploration of the public-private collaboration mechanism and urban residents' perceptions in alternative sites around Bangkok. A deeper understanding of the cultural context and the nature of the BMA will be pivotal in formulating tangible strategies for incorporating spontaneous nature into the artificial cityscape.

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Figure 5-1: Bangkok's 50 districts,
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Figure 5-2: List of Districts' Name,
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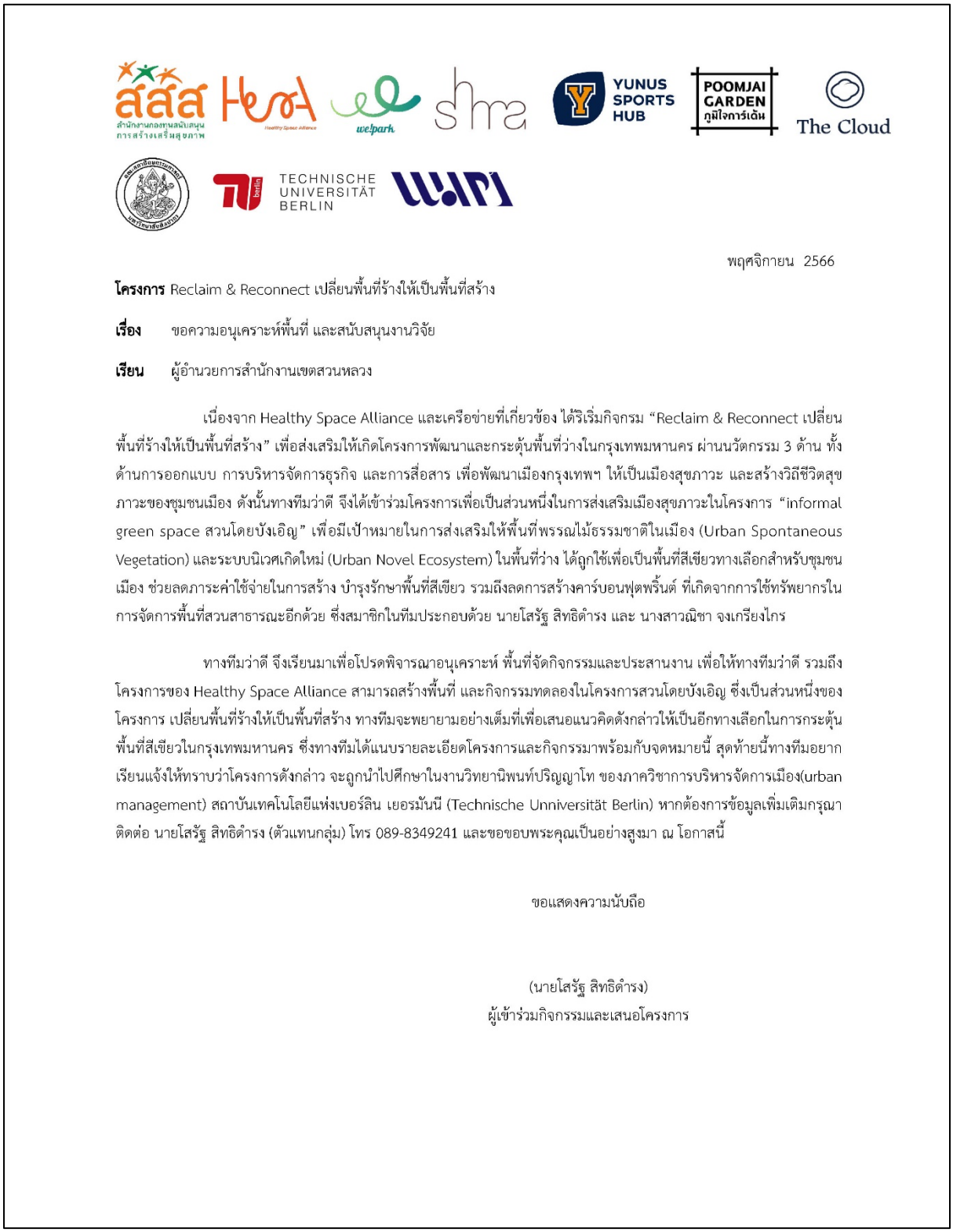
Appendix

Figure 1: Sample of project proposal letter that was sent through the urban development organization networks, requesting for the support on experimental wasteland project.



พฤศจิกายน 2566

โครงการ Reclaim & Reconnect เปลี่ยนพื้นที่ร้างให้เป็นพื้นที่สร้าง

เรื่อง ขอความอนุเคราะห์พื้นที่ และสนับสนุนงานวิจัย

เรียน ผู้อำนวยการสำนักงานเขตสวนหลวง

เนื่องจาก Healthy Space Alliance และเครือข่ายที่เกี่ยวข้อง ได้ริเริ่มกิจกรม “Reclaim & Reconnect เปลี่ยนพื้นที่ร้างให้เป็นพื้นที่สร้าง” เพื่อส่งเสริมให้เกิดโครงการพัฒนาและกระตุ้นพื้นที่ว่างในกรุงเทพมหานคร ผ่านนวัตกรรม 3 ด้าน ทั้งด้านการออกแบบ การบริหารจัดการธุรกิจ และการสื่อสาร เพื่อพัฒนาเมืองกรุงเทพฯ ให้เป็นเมืองสุขภาวะ และสร้างวิถีชีวิตสุขภาวะของชุมชนเมือง ดังนั้นทางทีมว่าดี จึงได้เข้าร่วมโครงการเพื่อเป็นส่วนหนึ่งในการส่งเสริมเมืองสุขภาวะในโครงการ “informal green space สวนโดยบังเอิญ” เพื่อมีเป้าหมายในการส่งเสริมให้พื้นที่พรรณไม้ธรรมชาติในเมือง (Urban Spontaneous Vegetation) และระบบนิเวศเกิดใหม่ (Urban Novel Ecosystem) ในพื้นที่ว่าง ได้ถูกใช้เพื่อเป็นพื้นที่สีเขียวทางเลือกสำหรับชุมชนเมือง ช่วยลดภาระค่าใช้จ่ายในการสร้าง บำรุงรักษาพื้นที่สีเขียว รวมถึงลดการสร้างคาร์บอนฟุตพริ้นต์ ที่เกิดจากการใช้ทรัพยากรในการจัดการพื้นที่สวนสาธารณะอีกด้วย ซึ่งสมาชิกในทีมประกอบด้วย นายโสรัฐ สิทธิดำรง และ นางสาวณิชา จงเกรียงไกร

ทางทีมว่าดี จึงเรียนมาเพื่อโปรดพิจารณาอนุเคราะห์ พื้นที่จัดกิจกรรมและประสานงาน เพื่อให้ทางทีมว่าดี รวมถึงโครงการของ Healthy Space Alliance สามารถสร้างพื้นที่ และกิจกรรมทดลองในโครงการสวนโดยบังเอิญ ซึ่งเป็นส่วนหนึ่งของโครงการ เปลี่ยนพื้นที่ร้างให้เป็นพื้นที่สร้าง ทางทีมจะพยายามอย่างเต็มที่เพื่อเสนอแนวคิดดังกล่าวให้เป็นอีกทางเลือกในการกระตุ้นพื้นที่สีเขียวในกรุงเทพมหานคร ซึ่งทางทีมได้แนบรายละเอียดโครงการและกิจกรรมาพร้อมกับจดหมายนี้ สุดท้ายนี้ทางทีมอยากเรียนแจ้งให้ทราบว่าโครงการดังกล่าว จะถูกนำไปศึกษาในงานวิทยานิพนท์ปริญญาโท ของภาควิชาการบริหารจัดการเมือง(urban management) สถาบันเทคโนโลยีแห่งเบอร์ลิน เยอรมันนี (Technische Unniversität Berlin) หากต้องการข้อมูลเพิ่มเติมกรุณาติดต่อ นายโสรัฐ สิทธิดำรง (ตัวแทนกลุ่ม) โทร 089-8349241 และขอขอบพระคุณเป็นอย่างสูงมา ณ โอกาสนี้

ขอแสดงความนับถือ

(นายโสรัฐ สิทธิดำรง)
ผู้เข้าร่วมกิจกรรมและเสนอโครงการ

Figure 2: Sample of expert interview letter that was sent to request for the participation in the research methodology

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โครงการ วิทยานิพนธ์ การส่งเสริมธรรมชาติเมืองในกรุงเทพมหานคร: กรอบการอนุรักษ์ระบบนิเวศในพื้นที่ร้าง
Enhancing Urban Nature in Bangkok: A Framework for conserving ecosystems in wastelands

เรื่อง ขอความอนุเคราะห์ในการสัมภาษณ์เพื่อประกอบการวิจัยวิทยานิพนธ์
Requested Interview for the Thesis's Research

เรียน ผู้อำนวยการสำนักงานสวนสาธารณะ
ผู้อำนวยการสำนักสิ่งแวดล้อม

เนื่องจากสถานการณ์สิ่งแวดล้อมของกรุงเทพฯที่เข้าขั้นวิกฤติ ประกอบกับสภาวะโลกรวนในปัจจุบัน ทำให้กรุงเทพมหานครจำเป็นอย่างยิ่งที่ต้องเพิ่มปริมาณพื้นที่สีเขียวเพื่อผ่อนคลายปัญหาสิ่งแวดล้อม และสร้างสุขภาวะที่ดีให้แก่ชุมชนเมือง อย่างไรก็ตามด้วยความซับซ้อนและความหนาแน่นของเมือง ทำให้การเพิ่มปริมาณพื้นที่สีเขียวมีความท้าทายอย่างยิ่ง งานวิจัยวิทยานิพนธ์ชิ้นนี้ จึงตั้งคำถามถึงแนวคิดการพัฒนาพื้นที่สีเขียวในเมือง ว่ากรุงเทพฯจะสามารถพัฒนาแนวคิดพื้นที่สีเขียวอย่างไร ถึงจะสามารถใช้งบประมาณและคาร์บอนเครดิตได้อย่างมีประสิทธิภาพ และการใช้ประโยชน์ของพื้นที่ร้างและการสร้างกรอบการอนุรักษ์ระบบนิเวศ เป็นวิธีหนึ่งในการพัฒนาพื้นที่สีเขียว สร้างธรรมชาติเมือง และส่งเสริมให้เกิดระบบนิเวศบริการที่เป็นประโยชน์ต่อสิ่งมีชีวิต ดังนั้นผมนายโสรัฐ สิทธิดำรง นักศึกษาปริญญาโท ภาควิชาการพัฒนาเมือง (Urban Management) สถาบันเทคโนโลยีแห่งเบอร์ลิน (Technische Unniversität Berlin) จึงอยากรบกวนขอความอนุเคราะห์ในการสัมภาษณ์เพื่อประกอบการวิจัยวิทยานิพนธ์ การสัมภาษณ์นี้จะไม่เปิดเผยชื่อ และตำแหน่ง เพื่อความเป็นส่วนตัวของผู้ถูกสัมภาษณ์ และรักษาจริยธรรมในการวิจัย หากท่านมีข้อสงสัย หรือต้องการข้อมูลเพิ่มเติมกรุณาติดต่อที่เบอร์ 0898329241 ขอขอบพระคุณเป็นอย่างสูงมา ณ โอกาสนี้

Bangkok is facing an environmental crisis due to the degradation of its environment and the impact of climate change. To mitigate this crisis, it is essential to increase the number of urban green spaces in the city. Urban green spaces are a crucial tool for promoting well-being in urban communities. However, given the complexity and density of Bangkok, developing these green spaces poses a significant challenge. This thesis aims to explore the Bangkok Metropolitan Administration's (BMA) concept of green space development, its budget for green spaces, and its carbon footprint. The hypothesis is that the conservation of wasteland and ecosystem can help enhance ecosystem services that benefit urban life. As part of this research, I would like to invite you for an interview. The interview will not disclose your name or any personal details to ensure privacy and research ethics. If you have any questions, please contact me at 0898349241. Thank you.

ขอแสดงความนับถือ

(นายโสรัฐ สิทธิดำรง)
นักศึกษา Graduate Student

Figure 3: Expert interview's question that was attached with the letter.

3.2.4 Expert Interview

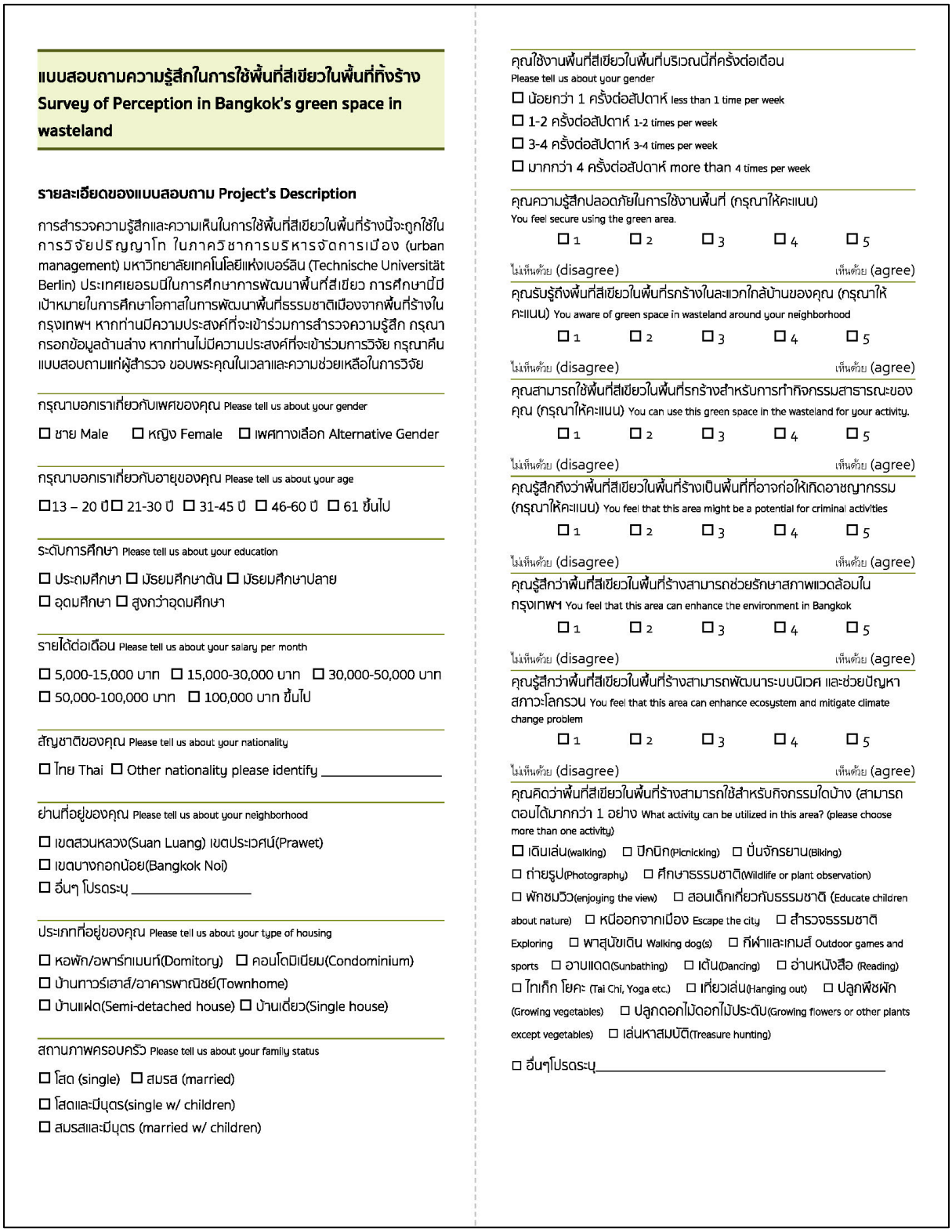
The micro-scale study conducted in two districts within Bangkok's inner city and suburbs will provide data to be processed during a semi-structured interview with five urban green space experts. These experts include the director of We! Park, an NGO organization working to enhance green spaces in Bangkok; the director of the Department of Environment at Bangkok Metropolitan Administration (BMA); the founder of Mor and Farmer, an NGO organization focused on urban data analysis in Bangkok; as well as an urban planning professor and a landscape ecology professor.

During the semi-structured interview, the prepared topic of discussion will revolve around the potential of informal green spaces to be developed into urban conservation areas that can enhance sustainable ecosystems in Bangkok. The interview will include the following structured questions:

1. What are Bangkok's principles and purposes for urban green space maintenance?
2. What is the current situation of natural spaces in Bangkok, and how can the urban environment be enhanced?
3. What can be done to encourage sustainable ecosystem services in Bangkok?
4. How can informal public spaces or wastelands be reserved as natural conservation areas in the urban landscape?
5. How can wastelands function as the ecosystem service of the city?
6. How can the field survey results reflect the future development of green spaces in Bangkok?
7. How can stakeholders and urban residents be incorporated into the decision-making process of urban green space enhancement?
8. How does BMA's current urban green space policy align with nature-based solution development in the city?
9. How can wastelands be integrated into the urban green space fabric or green infrastructure of Bangkok?

The semi-structured interview will provide suggestions and guidance on how to incorporate sustainable ecosystems on wastelands into the urban green space policy of BMA. This cross-cutting process will measure the possibility of enhancing sustainable ecosystems on wastelands in Bangkok.

Figure 4: Sample of public survey sheets that was handed to the participants for the on-site public survey after the wasteland workshop



แบบสอบถามความรู้สึกในการใช้พื้นที่สีเขียวในพื้นที่ทิ้งร้าง
Survey of Perception in Bangkok's green space in wasteland

รายละเอียดของแบบสอบถาม Project's Description

การสำรวจความรู้สึกและความเห็นในการใช้พื้นที่สีเขียวในพื้นที่ร้างนี้จะถูกใช้ในการวิจัยปริญญาโท ในภาควิชาการบริหารจัดการเมือง (urban management) มหาวิทยาลัยเทคโนโลยีแห่งเบอร์ลิน (Technische Universität Berlin) ประเทศเยอรมนีในการศึกษาการพัฒนาพื้นที่สีเขียว การศึกษานี้มีเป้าหมายในการศึกษาโอกาสในการพัฒนาพื้นที่ธรรมชาติเมืองจากพื้นที่ร้างในกรุงเทพฯ หากท่านมีความประสงค์ที่จะเข้าร่วมการสำรวจความรู้สึก กรุณากรอกข้อมูลด้านล่าง หากท่านไม่มีความประสงค์ที่จะเข้าร่วมการวิจัย กรุณาคืนแบบสอบถามแก่ผู้สำรวจ ขอบพระคุณในเวลาและความช่วยเหลือในการวิจัย

กรุณาบอกเราเกี่ยวกับเพศของคุณ Please tell us about your gender

☐ ชาย Male ☐ หญิง Female ☐ เพศทางเลือก Alternative Gender

กรุณาบอกเราเกี่ยวกับอายุของคุณ Please tell us about your age

☐13 – 20 ปี ☐ 21-30 ปี ☐ 31-45 ปี ☐ 46-60 ปี ☐ 61 ขึ้นไป

ระดับการศึกษา Please tell us about your education

☐ ประถมศึกษา ☐ มัธยมศึกษาต้น ☐ มัธยมศึกษาปลาย
☐ อุดมศึกษา ☐ สูงกว่าอุดมศึกษา

รายได้ต่อเดือน Please tell us about your salary per month

☐ 5,000-15,000 บาท ☐ 15,000-30,000 บาท ☐ 30,000-50,000 บาท
☐ 50,000-100,000 บาท ☐ 100,000 บาท ขึ้นไป

สัญชาติของคุณ Please tell us about your nationality

☐ ไทย Thai ☐ Other nationality please identify _____

ย่านที่อยู่ของคุณ Please tell us about your neighborhood

☐ เขตสวนหลวง(Suan Luang) เขตประเวศน์(Prawet)
☐ เขตบางกอกน้อย(Bangkok Noi)
☐ อื่นๆ โปรดระบุ _____

ประเภทที่อยู่ของคุณ Please tell us about your type of housing

☐ หอพัก/อพาร์ทเมนท์(Domitory) ☐ คอนโดมิเนียม(Condominium)
☐ บ้านทาวน์เฮาส์/อาคารพาณิชย์(Townhome)
☐ บ้านแฝด(Semi-detached house) ☐ บ้านเดี่ยว(Single house)

สถานภาพครอบครัว Please tell us about your family status

☐ โสด (single) ☐ สมรส (married)
☐ โสดและมีบุตร(single w/ children)
☐ สมรสและมีบุตร (married w/ children)

คุณใช้งานพื้นที่สีเขียวในพื้นที่บริเวณนี้กี่ครั้งต่อเดือน
Please tell us about your gender

☐ น้อยกว่า 1 ครั้งต่อสัปดาห์ less than 1 time per week
☐ 1-2 ครั้งต่อสัปดาห์ 1-2 times per week
☐ 3-4 ครั้งต่อสัปดาห์ 3-4 times per week
☐ มากกว่า 4 ครั้งต่อสัปดาห์ more than 4 times per week

คุณความรู้สึกปลอดภัยในการใช้งานพื้นที่ (กรุณาให้คะแนน)
You feel secure using the green area.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

ไม่เห็นด้วย (disagree) เห็นด้วย (agree)

คุณรับรู้ถึงพื้นที่สีเขียวในพื้นที่รกร้างในละแวกใกล้บ้านของคุณ (กรุณาให้คะแนน) You aware of green space in wasteland around your neighborhood

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

ไม่เห็นด้วย (disagree) เห็นด้วย (agree)

คุณสามารถใช้พื้นที่สีเขียวในพื้นที่รกร้างสำหรับการทำกิจกรรมสาธารณะของคุณ (กรุณาให้คะแนน) You can use this green space in the wasteland for your activity.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

ไม่เห็นด้วย (disagree) เห็นด้วย (agree)

คุณรู้สึกถึงว่าพื้นที่สีเขียวในพื้นที่ร้างเป็นพื้นที่ที่อาจก่อให้เกิดอาชญากรรม (กรุณาให้คะแนน) You feel that this area might be a potential for criminal activities

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

ไม่เห็นด้วย (disagree) เห็นด้วย (agree)

คุณรู้สึกว่าพื้นที่สีเขียวในพื้นที่ร้างสามารถช่วยรักษาสภาพแวดล้อมในกรุงเทพฯ You feel that this area can enhance the environment in Bangkok

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

ไม่เห็นด้วย (disagree) เห็นด้วย (agree)

คุณรู้สึกว่าพื้นที่สีเขียวในพื้นที่ร้างสามารถพัฒนาระบบนิเวศ และช่วยปัญหาสภาวะโลกรวน You feel that this area can enhance ecosystem and mitigate climate change problem

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

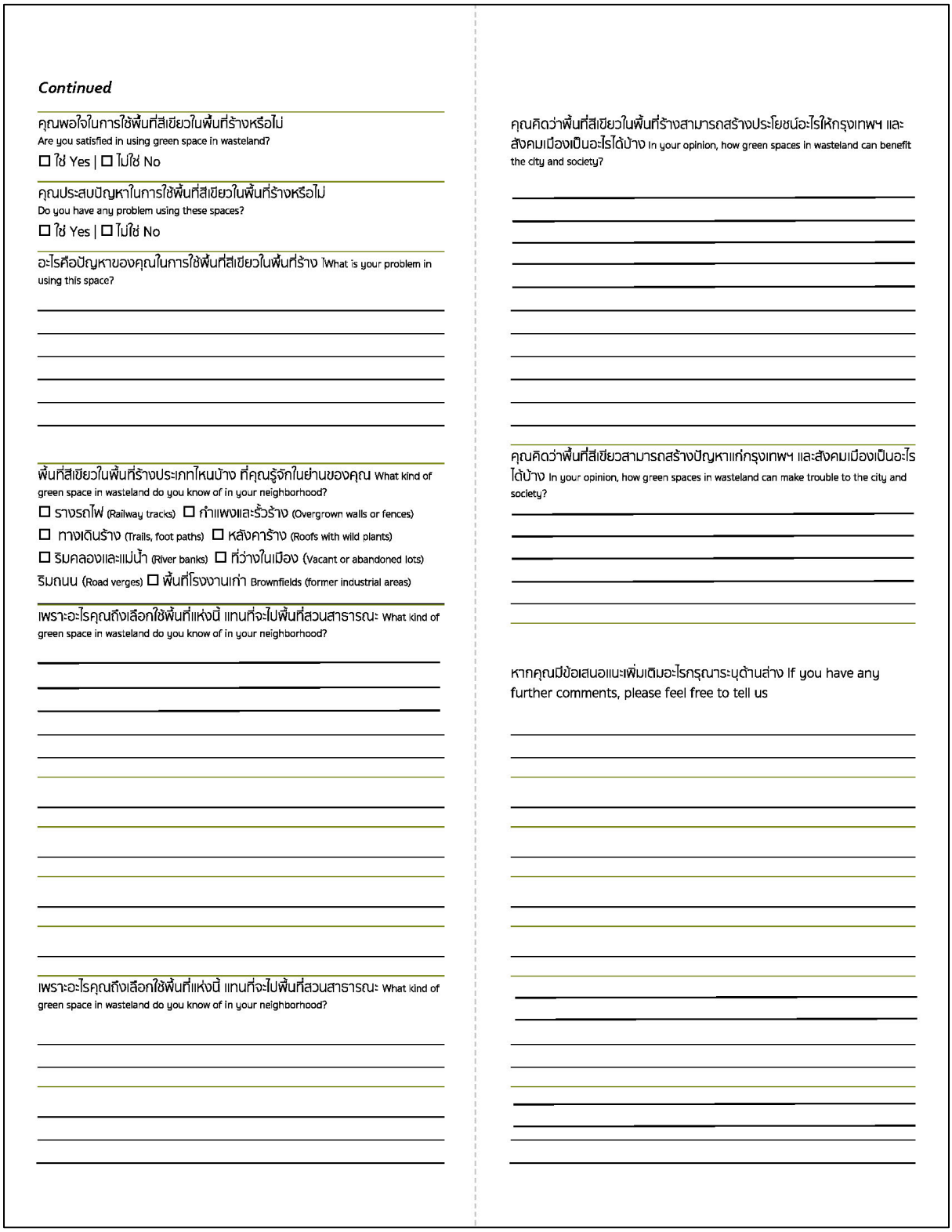
ไม่เห็นด้วย (disagree) เห็นด้วย (agree)

คุณคิดว่าพื้นที่สีเขียวในพื้นที่ร้างสามารถใช้สำหรับกิจกรรมใดบ้าง (สามารถตอบได้มากกว่า 1 อย่าง What activity can be utilized in this area? (please choose more than one activity)

☐ เดินเล่น(walking) ☐ ปิกนิก(Picnicking) ☐ ปั่นจักรยาน(Biking)
☐ ถ่ายรูป(Photography) ☐ ศึกษาธรรมชาติ(Wildlife or plant observation)
☐ พักชมวิว(enjoying the view) ☐ สอนเด็กเกี่ยวกับธรรมชาติ (Educate children about nature) ☐ หนีออกจากเมือง Escape the city ☐ สำรวจธรรมชาติ Exploring ☐ พาสุนัขเดิน Walking dog(s) ☐ กีฬาและเกมส์ Outdoor games and sports ☐ อาบแดด(Sunbathing) ☐ เต้น(Dancing) ☐ อ่านหนังสือ (Reading)
☐ ไทเก็ก โยคะ (Tai Chi, Yoga etc.) ☐ เที่ยวเล่น(Hanging out) ☐ ปลูกพืชผัก (Growing vegetables) ☐ ปลูกดอกไม้ดอกไม้ประดับ(Growing flowers or other plants except vegetables) ☐ เล่นหาสมบัติ(Treasure hunting)

☐ อื่นๆโปรดระบุ_____

Figure 5: Sample of public survey sheets that was handed to the participants for the on-site public survey after the wasteland workshop



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คุณพอใจในการใช้พื้นที่สีเขียวในพื้นที่ร้างหรือไม่
Are you satisfied in using green space in wasteland?
☐ ใช่ Yes | ☐ ไม่ใช่ No

คุณประสบปัญหาในการใช้พื้นที่สีเขียวในพื้นที่ร้างหรือไม่
Do you have any problem using these spaces?
☐ ใช่ Yes | ☐ ไม่ใช่ No

อะไรคือปัญหาของคุณในการใช้พื้นที่สีเขียวในพื้นที่ร้าง What is your problem in using this space?

พื้นที่สีเขียวในพื้นที่ร้างประเภทไหนบ้าง ที่คุณรู้จักในย่านของคุณ What kind of green space in wasteland do you know of in your neighborhood?
☐ รางรถไฟ (Railway tracks) ☐ กำแพงและรั้วร้าง (Overgrown walls or fences)
☐ ทางเดินร้าง (Trails, foot paths) ☐ หลังคาร้าง (Roofs with wild plants)
☐ ริมคลองและแม่น้ำ (River banks) ☐ ที่ว่างในเมือง (Vacant or abandoned lots)
ริมถนน (Road verges) ☐ พื้นที่โรงงานเก่า Brownfields (former industrial areas)

เพราะอะไรคุณถึงเลือกใช้พื้นที่แห่งนี้ แทนที่จะไปพื้นที่สวนสาธารณะ What kind of green space in wasteland do you know of in your neighborhood?

เพราะอะไรคุณถึงเลือกใช้พื้นที่แห่งนี้ แทนที่จะไปพื้นที่สวนสาธารณะ What kind of green space in wasteland do you know of in your neighborhood?

คุณคิดว่าพื้นที่สีเขียวในพื้นที่ร้างสามารถสร้างประโยชน์อะไรให้กรุงเทพฯ และสังคมเมืองเป็นอะไรได้บ้าง In your opinion, how green spaces in wasteland can benefit the city and society?

คุณคิดว่าพื้นที่สีเขียวสามารถสร้างปัญหาแก่กรุงเทพฯ และสังคมเมืองเป็นอะไรได้บ้าง In your opinion, how green spaces in wasteland can make trouble to the city and society?

หากคุณมีข้อเสนอแนะเพิ่มเติมอะไรกรุณาระบุด้านล่าง If you have any further comments, please feel free to tell us

Figure 5: Sample of the writing note on application good note in Ipad for expert interview