

STUDY

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# Social-ecological Transformation in Thai Cities



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# **Social-ecological Transformation in Thai Cities**

Urban areas worldwide are increasingly recognizing the necessity of integrating social and ecological considerations into urban planning to foster sustainable and resilient cities. This approach, known as *social-ecological transformation*, emphasizes the interconnectedness of human societies and natural ecosystems within urban settings. Social-ecological transformation refers to societal changes that address social and environmental crises synergistically. This approach emphasizes the inseparability of social and ecological systems, aiming to rectify structural inequalities and environmental degradation simultaneously. In urban contexts, this involves reimagining cities as spaces where human well-being and ecological health are mutually reinforcing (Padawangi, 2022). In Thailand—particularly in cities like Bangkok—adopting such frameworks is crucial to address challenges arising from rapid urbanization, environmental degradation, and social disparities.

Urbanization in Thailand has led to significant environmental and social transformations. The increasing population, expansion of metropolitan areas, and industrialization have contributed to ecological degradation, resource depletion, and socio-economic disparities. This paper provides an in-depth analysis of key issues affecting Thai cities and strategies for sustainable urban development.

## Important Situations and Problems Related to the Social-ecological Transformation in Thai Cities

As Thailand continues to experience rapid urbanization, its cities—particularly Bangkok—face increasing challenges related to extreme temperatures and natural disasters. These challenges are significantly worsened by the impacts of climate change, land subsidence, and urban expansion. The combined effects of elevated temperatures and extreme weather events are putting urban areas at risk and threatening the livelihoods of millions of residents. This comprehensive article will examine in detail the situation surrounding temperature anomalies, the occurrence of natural disasters, and how these challenges are being exacerbated by urban development, while exploring

mitigation strategies through both local and global frameworks.

## Overview of the Situation of Urban Heat and Disasters in Thai Urban Areas

Figure 1 is a diagram illustrating the average maximum temperature in Bangkok between 1999 and 2019. It reflects a rising trend in Bangkok's average maximum temperature each year — phenomenon observed in many cities across Thailand. This temperature increase, combined with urban transformation and changes in land surfaces due to urban development, has contributed to the *Urban Heat Island (UHI)* effect. The UHI effect is one of the most pressing climate-related issues in Thailand's urban areas, especially in Bangkok. It refers to the phenomenon where urban regions experience significantly higher temperatures than surrounding rural areas due to human activities and changes in land cover. The UHI effect not only causes discomfort for residents but also increases energy consumption, worsens air quality, and poses public health risks. This health effect is termed *urban heat stress*, which may lead to *heat exhaustion, heat stroke, and heat cramps* as well as *emotional changes and physiological stress* (Arifwidodo and Chandrasiri, 2019: 1).

The intensity of UHI in Bangkok can reach up to 6–7°C during the dry season, with the city's mean temperature being about 0.8°C higher than the surrounding rural regions. Several factors contribute to this urban heat buildup:

→ **Land Use Changes:** Urbanization leads to the replacement of natural vegetation and water bodies with impervious surfaces such as concrete, asphalt, and buildings. These surfaces absorb more heat during the day and release it at night, leading to higher temperatures in urban areas. The rapid conversion of green spaces into urban infrastructure—which replaces natural surfaces with impervious materials—is identified as one of the main factors contributing to the UHI effect in Bangkok (Khamchiangta and Dhakal, 2019).

Figure 1. Average maximum temperature in Bangkok.  
Source: Ngamsiriudom and Tanaka (2023)

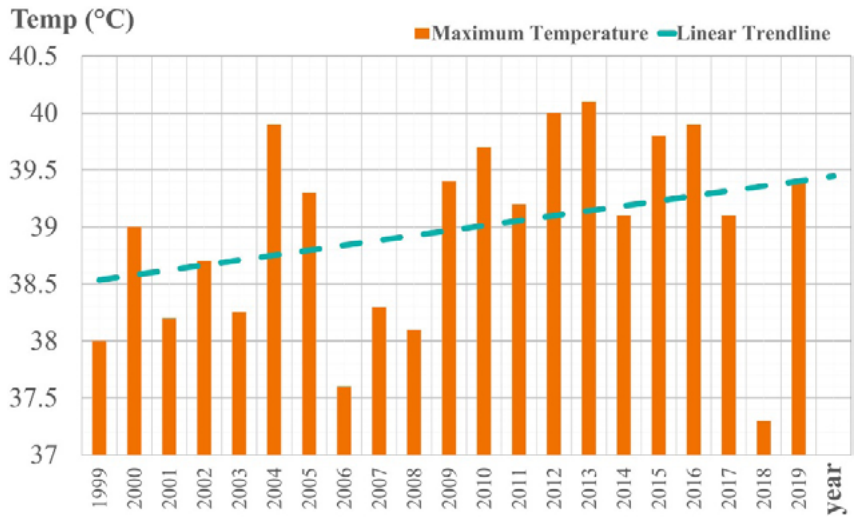
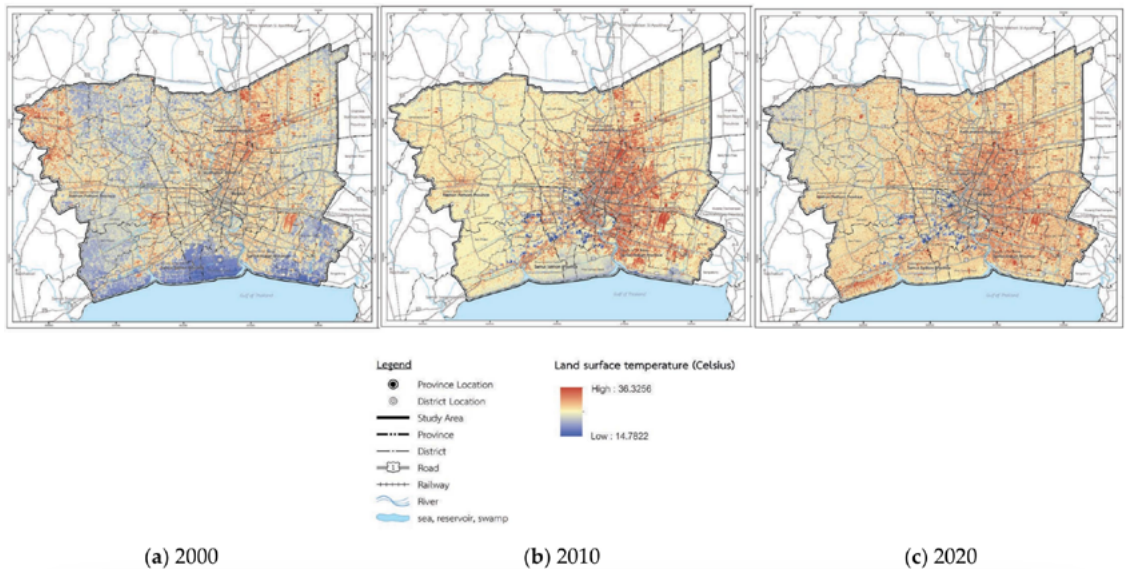


Figure 2. Land Surface Temperature (LST) of Bangkok Metropolitan Region in 2000, 2010, and 2020 respectively. Source: lamtrakul, Padon, Chaypong (2024: 11). The contrast clearly displays constant overall increases of LST, with relative difference between highly urbanized areas of Bangkok as the UHI, and the surrounding regions with fewer heated areas.



- **Anthropogenic Heat:** Bangkok, as a bustling metropolis, consumes vast amounts of energy, particularly for air conditioning, industrial activities, and transportation. These activities emit additional heat into the environment. In fact, studies have shown that air conditioning systems in large buildings contribute significantly to local heat emissions (Khamchiangta and Dhakal, 2019).
- **Limited Green Spaces:** While Bangkok does have some parks and green areas, the city's overall green coverage is still quite limited in comparison to its rapidly expanding urban sprawl. It is reported that green areas in Bangkok have plummeted from 1053.78 km<sup>2</sup> in 2000, to 641.21 km<sup>2</sup> in 2020 (Iamtrakul, Padon, Chaypong, 2024). This reduction limits the city's capacity to utilize natural cooling mechanisms, such as shade from trees, evapotranspiration from plants, and the natural cooling of water bodies.
- **Climate Variability:** The effect of UHI is further intensified by climate variability. Bangkok's climate is characterized by hot and humid conditions, which are exacerbated during the dry season. The combination of high ambient temperatures and intense heat from anthropogenic sources creates a dangerous heat feedback loop, making it even more difficult for residents to cope.

In addition to the issue of climate change affecting UHI in the area, climate change issues also have a significant impact on natural disasters—especially floods and land subsidence—in many cities in Thailand. This situation is extremely serious not only in cities in the central plains of the country and the capital, Bangkok, but also in other regions. In 2024, long periods of continuous rain in the north and south of Thailand led to flash floods affecting areas of major cities in the north such as Mae Sai, Chiang Rai, and Chiang Mai, etc., and cities in the south such as Yala and Pattani.

Thailand's geographical location and climate make it particularly vulnerable to flooding, with urbanized areas facing increasing challenges due

to climate change and rapid development. This presentation examines major flooding events affecting Thai cities from 2014 to 2024, analyzing patterns, impacts, and adaptation strategies. However, Thai urban areas face a variety of natural disaster risks, with flooding being the most common and destructive. The 13th National Economic and Social Development Plan (2022: 113) states that “in 2017, which was the year in which the accumulated rainfall throughout the country was higher than normal in a 67-year period, [the flood problem] caused damage valued at 1,050.3 million baht, with 3.6 million people affected.” Other hazards, such as typhoons and land subsidence, are also prominent in areas like Bangkok, which are particularly vulnerable due to geographical and environmental factors. Climate change is exacerbating these risks, making it even more crucial to address these challenges in urban planning. In recent years, various municipalities across Thailand have experienced significant flooding events, leading to substantial impacts on local communities, economies, and infrastructures. “These events have prompted extensive studies to understand their causes and effects and to develop effective mitigation strategies.

For example, Hatyai—a major city in Songkhla Province—has faced recurrent flooding, notably in 2000 and 2010. While the city center has been relatively protected in recent years, peripheral areas continue to experience localized floods. A study highlighted those changes in land use—such as the reduction of agricultural and forested areas due to urban expansion—have altered natural water flow patterns, exacerbating flood risks. Additionally, increased rainfall intensity, possibly linked to climate change, has contributed to the city's vulnerability. The study emphasizes the need for sustainable urban planning and community preparedness to mitigate future flood impacts. (PSE Broadcast, 2024).

Moreover, in 2023, Ubon Ratchathani, located in northeastern Thailand, experienced severe flooding due to prolonged heavy rainfall. The floods affected multiple districts, leading to the displacement of thousands of residents and significant

damage to agricultural lands. The provincial authorities, in collaboration with national agencies, implemented emergency response measures, including evacuations and the establishment of temporary shelters. Post-flood assessments indicated the necessity for improved early warning systems and infrastructure enhancements to prevent future occurrences (DDPM, 2023).

- **Historical Flood Events:** The 2011 floods were among the most catastrophic in recent history, affecting millions of people. Heavy monsoon rains, combined with ineffective drainage systems and the overflowing of the Chao Phraya River, caused severe flooding in many areas. With over 800 fatalities, and an economic impact was estimated over 1.4 trillion baht, making it one of the costliest disasters in Thai history. The 2011 floods underscored the urgent need for enhanced flood prevention and mitigation systems.
- **Drainage System Inefficiencies:** Despite efforts to improve drainage, much of Bangkok still suffers from inefficient and outdated infrastructure that cannot cope with the heavy rainfall and rising sea levels. The city's drainage system is often overwhelmed during the monsoon season, leading to prolonged flooding—especially in low-lying areas. Similarly, many Thai municipalities, such as Hat Yai in Songkhla Province, grapple with outdated and inefficient drainage that become overwhelmed during heavy monsoon rains. The situation is further exacerbated by rapid urban expansion, which alters natural waterways and reduces permeable land areas, further challenging existing drainage capacities.
- **Climate Change and Flooding:** Climate change has intensified the frequency and severity of flooding across Thailand. Increased rainfall intensity and altered monsoon patterns have led to more frequent and severe flood events. For instance, in 2024, Typhoon Yagi caused devastating floods in northern provinces like Chiang Rai and Chiang Mai, resulting in numerous fatalities and displacing thousands. Rising sea levels due to global warming also threaten coastal and riverine areas (Kaikam, 2021), increasing the

vulnerability of cities like Hat Yai and Songkhla to both riverine and coastal flooding.

- **Land Subsidence:** Land subsidence, the gradual sinking of the ground, is a significant issue affecting several Thai cities. In regions like the Chao Phraya Delta, excessive groundwater extraction for industrial, residential, and agricultural purposes has led to alarming subsidence rates. This phenomenon exacerbates flooding, as the sinking land becomes more prone to water accumulation during heavy rains and high tides. The impact on infrastructure is profound, with buildings, roads, and sewage systems experiencing cracks and damage due to unstable foundations. The added pressure of urban infrastructure on the already sinking ground further intensifies the issue, necessitating urgent attention to sustainable groundwater management and urban planning.

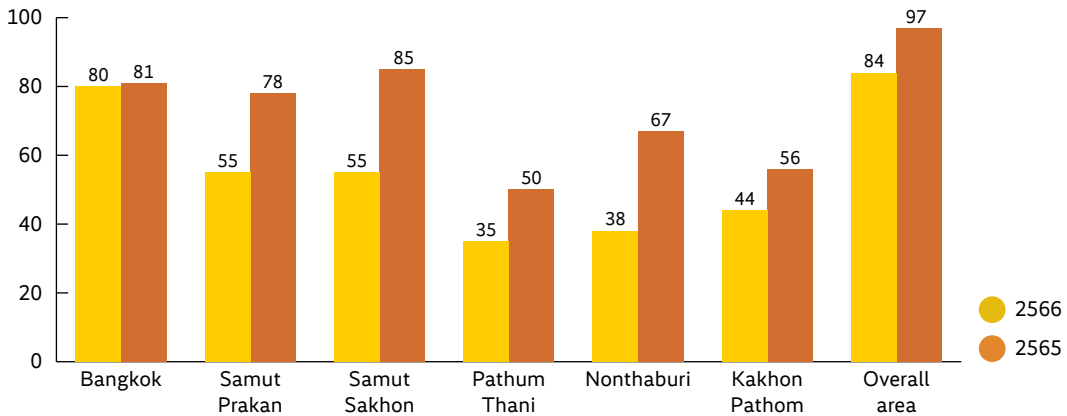
In summary, the challenges posed by flooding and land subsidence in various Thai municipalities highlight the critical need for comprehensive urban planning (Reulom, 2013), infrastructure modernization, and proactive environmental management (Manorom, 2021) to mitigate the adverse effects of these natural and human-induced phenomena.

### **Overview of the PM2.5 Situation and Its Impact on Thai Urban Populations**

PM2.5 refers to particulate matter with a diameter of 2.5 micrometers or smaller, which is about 30 times thinner than a human hair. Due to its microscopic size, PM2.5 can enter the lungs, bloodstream, and even affect the brain, causing serious health problems. This pollution is primarily caused by industrial emissions, vehicle exhaust, agricultural burning, and natural factors such as dust storms. In urban areas of Thailand, where industrial activity and heavy traffic are concentrated, PM2.5 levels are particularly concerning—especially during the dry season.

The PM2.5 problem affecting both cities and people in Thailand is primarily caused by the following factors:

Figure 3. Number of Days with PM 2.5 Levels Exceeding the Standard in Bangkok and Metropolitan Areas: A Comparison Between 2022 and 2023.  
Source: PCD (2024b: 103)

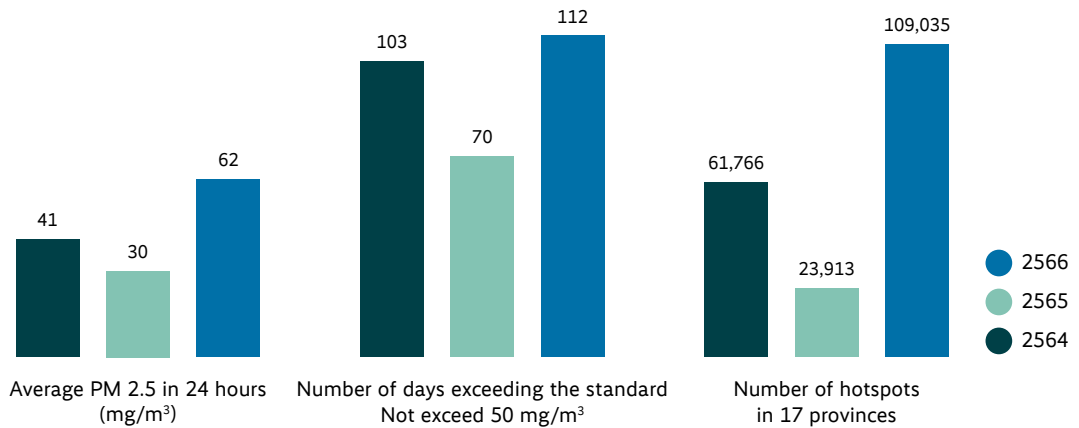


→ **Vehicle Emissions:** In cities like Bangkok, Chiang Mai, and Nakhon Ratchasima, traffic congestion significantly contributes to PM2.5 pollution. Bangkok, with over 10 million people and 7 million vehicles, is one of the world’s most traffic-congested cities. Emissions from cars, motorcycles, and trucks spew large amounts of particulate matter into the air. A study in Chiang Mai showed that the concentration of PM2.5 in some parts of the city was linked directly to traffic density, especially during peak hours. Vehicles using older engines and the lack of maintenance also contribute to higher emissions.

→ **Industrial Emissions:** Industrial zones in cities like Rayong, Chonburi, and Samut Prakan produce significant amounts of PM2.5. These cities house large manufacturing plants, including petrochemical industries and factories that burn coal and other fuels. In Rayong—a major industrial hub in Thailand—factory emissions, including particulate pollution, have been known to cause severe air quality problems. In Chonburi, where the industrial sector is expanding, PM2.5 concentrations are often dangerously high, especially in industrial areas near residential zones.

→ **Agricultural Burning:** The practice of agricultural burning—specifically the burning of crop residues after harvest—contributes heavily to PM2.5 pollution in rural areas of Northern Thailand. Chiang Mai and Chiang Rai are especially affected during the dry season (typically from February to April). Thousands of acres of farmland are burned to clear the land for the next planting season, releasing vast quantities of smoke and particulate matter into the atmosphere. In 2023, Thailand’s northern provinces experienced a significant surge in burned areas, totaling approximately 9.769 million rai—a staggering 207% increase from the previous year. The five provinces most affected were Mae Hong Son (1,761,039 rai), Tak (1,406,010 rai), Chiang Mai (1,168,624 rai), Lampang (767,100 rai), and Nan (708,367 rai). These figures exclude burned areas in the central and north-eastern regions of the country. The extensive burning has substantially elevated PM2.5 levels, adversely affecting air quality, particularly in urban areas of central and northern Thailand. The escalation in burned areas has been linked to various factors, including agricultural practices, forest clearing, and land-use changes. The increase in PM2.5 pollutants poses significant

Figure 4. PM2.5 dust data in all 17 northern provinces, compared between 2021-2023, including the average PM2.5 in 24 hours, the number of days exceeding the standard, and the number of hotspots in 17 provinces  
Source: PCD (2024b: 107)



health risks, contributing to respiratory issues and other health complications among the urban population. Addressing this pressing issue requires comprehensive strategies that encompass stricter enforcement of anti-burning regulations, promotion of sustainable agricultural methods, and active community engagement to mitigate the adverse effects of such environmental challenges. (PCD, 2024b: 107) The 2025 burning season in Chiang Mai saw PM2.5 levels in the region reach hazardous thresholds, with government reports showing a direct correlation between agricultural burning and poor air quality.

→ **Construction Activities:** Construction and development —particularly in urban centers like Bangkok, Phuket, and Khon Kaen —produce substantial dust and fine particulate matter. In Bangkok, urban development is taking place rapidly, leading to increased construction activities, especially in residential and commercial sectors. Heavy machinery, digging, and demolitions stir up dust that contributes to elevated levels of PM2.5, with this pollution often concentrated around construction zones.

Exposure to PM2.5 is linked to a variety of serious health issues. This pollution poses the greatest risk to vulnerable groups such as children, the elderly, and those with preexisting respiratory or cardiovascular conditions.

→ **Respiratory and Cardiovascular Problems:** Studies show that the population of Bangkok and Chiang Mai —where PM2.5 concentrations are among the highest in the country—are at higher risk of respiratory diseases such as asthma, chronic bronchitis, and chronic obstructive pulmonary disease (COPD). For instance, a report from the Thailand National Health Profile revealed that respiratory diseases in urban areas are significantly higher during peak pollution months, with the number of hospital visits for respiratory issues more than double during peak pollution periods. Cardiovascular conditions, such as hypertension, heart attacks, and strokes, are also exacerbated by prolonged exposure to PM2.5.

→ **Increased Mortality Rates:** The 2011 study by the Health Systems Research Institute (HSRI) found that PM2.5 was a significant contributor to increased mortality rates due to both res-

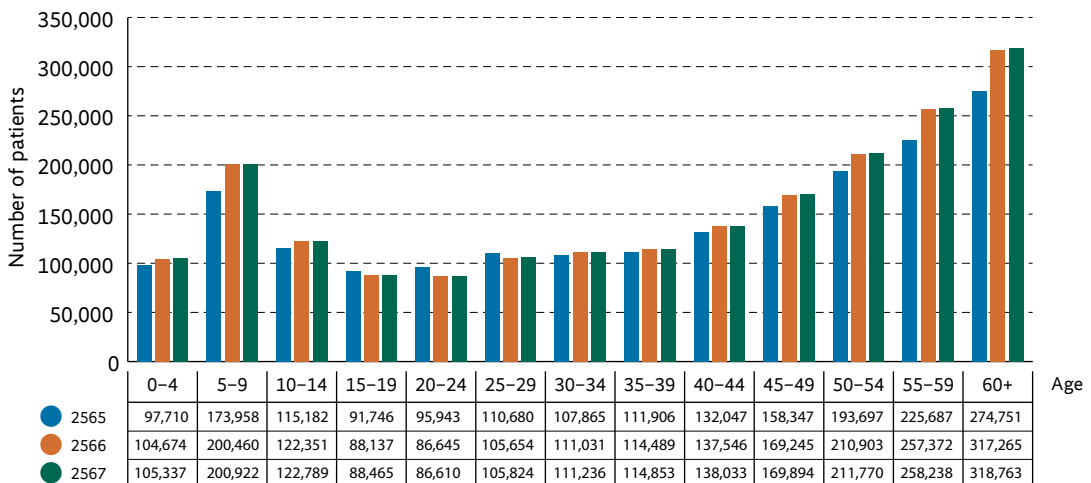
piratory and cardiovascular diseases in urban areas like Bangkok and Chiang Mai. The study estimated that about 1,800 premature deaths could be attributed to exposure to particulate pollution each year in Bangkok alone. In Nakhon Ratchasima and Khon Kaen, mortality rates related to air pollution have also risen, with a clear pattern emerging as PM2.5 levels spike during the dry season.

→ **Children and Vulnerable Populations:** In cities like Bangkok and Chiang Mai —where pollution levels regularly exceed safe thresholds —the elderly and children are particularly vulnerable. Figure 5 is a diagram illustrates a clear upward trend in the number of patients diagnosed with air pollution-related diseases from 2022 to 2024. This increasing pattern signals a growing public health concern, particularly in urban areas where pollution levels are consistently high. The most affected demographic groups include late working-age individuals who are over 50 years old, the elderly, and children. These groups are especially vulnerable due to weaker immune systems, pre-existing health conditions, and prolonged exposure to harmful pollutants such as PM2.5 and other fine particulate matter.

(MOPH, 2024: 13). Research indicates that long-term exposure to air pollution can hinder lung development, increase childhood asthma risk, and affect cognitive function. Pregnant women are also at heightened risk, with studies showing PM2.5 exposure can lead to low birth weight, premature birth, and developmental issues. For example, in Chiang Mai, where the air quality deteriorates sharply during the burning season, local hospitals report an increase number of cases of preterm births and respiratory issues among infants.

→ **Economic Impact:** The economic costs associated with PM2.5 pollution in Thai urban areas are substantial. In Bangkok, the pollution-related healthcare burden costs the government millions annually, as it must allocate resources for hospital treatments, respiratory disease management, and lost productivity due to sick days. Studies have estimated the economic cost of air pollution to Thailand at over THB 200 billion annually. Another report from Kasikorn Bank (Srirattana, 2025) proposed that, as the number of people with respiratory problems exceeds 12.3 million in 2023, PM2.5 can cause financial loss more than THB 3 billion, exclu-

Figure 5. The number of patients with respiratory problems classified by ages in 2022, 2023, and 2024. Source: MOPH (2024: 13).



sively for the medical expenses of the Bangkok residents. This includes direct medical costs as well as the broader impact on labor productivity, particularly in urban centers where workers are most affected by the toxic air.

## Overview of Waste, Waste Risks, and Waste Management in Thai Urban Areas

Thailand's rapid urbanization has led to significant challenges in waste generation and management, particularly in cities like Bangkok, Chiang Mai, and Phuket. Effective waste management is crucial to mitigate environmental pollution, protect public health, and promote sustainable urban development (Ministry of Natural Resources and Environment, 2018; Energy Policy and Planning Office, 2021). Currently, Thailand is facing a continuously increasing solid waste problem. Especially in large urban areas, effective waste management is essential to protect both the environment and public health (Thailand Smart City Initiative, 2021).

In 2023, Thailand generated approximately 26.95 million tons of solid waste — averaging 73,840 tons per day, equivalent to 1.12 kilograms per person per day. Bangkok produces the highest amount of garbage at 12,748 tons per day. In urban areas outside Bangkok —although comprehensive municipal or city-level waste volume data is unavailable —provincial-level waste data indicates that provinces with high urbanization rates tend to generate the highest waste volumes in the country. For example, Chonburi generates 3,374 tons of waste per day, followed by Samut Prakan (3,465 tons/day), Nakhon Ratchasima (2,588 tons/day), Nonthaburi (2,065 tons/day), Pathum Thani (2,060 tons/day), Songkhla (1,599 tons/day), and Ubon Ratchathani (1,514 tons/day). The substantial waste volumes in these provinces have led to significant challenges and disputes regarding waste disposal. (PCD, 2024a: 30-34)

For instance —in Chiang Mai Municipality —where daily waste generation reaches 320-340 tons — waste must be transported over 100 kilometers to Hot District for disposal (Chiang Mai Municipality, 2021). This results in high collection and transpor-

tation costs, with transport fees of 200 THB per ton and additional waste collection fees ranging from 700-800 THB per ton. Furthermore, disputes have arisen between local residents and waste management authorities regarding the designated disposal sites (Thai PBS, 2023).

Similarly, Phuket continues to face an escalating waste crisis, with daily waste generation reaching 1,100 tons, while the province's sole waste incineration facility has a maximum capacity of only 700 tons per day (Phuket Provincial Office, 2021). Excess waste must therefore be landfilled. Without immediate improvements in waste management efficiency —including strategies for value-added processing of organic waste—which accounts for more than half of total daily waste and is particularly challenging to manage—there is a risk of waste accumulation leading to environmental contamination. In the absence of effective intervention, unmanaged waste may eventually overflow into marine ecosystems, causing unpredictable environmental consequences (The Active, 2025).

## Risks Associated with Waste Accumulation

The rapid accumulation of waste in Thai urban areas presents several risks, including environmental pollution, public health concerns, and socio-economic impacts.

- **Environmental Risks:** The improper disposal of waste leads to air, water, and soil contamination. Landfilling remains the dominant waste disposal method, but many landfill sites are poorly managed, leading to leachate leakage and groundwater pollution (UNEP, 2019). Unregulated waste burning releases toxic pollutants, including dioxins and furans, contributing to air pollution and climate change. Additionally, plastic waste frequently ends up in rivers and oceans, threatening marine ecosystems and biodiversity (Jambeck et al., 2015).
- **Public Health Risks:** Unmanaged waste accumulation can lead to various public health issues. Open dumping sites attract rodents, insects, and other disease-carrying vectors,

increasing the risk of vector-borne diseases such as dengue fever and leptospirosis (WHO, 2020). Additionally, improper disposal of hazardous and electronic waste (e-waste) exposes urban populations to toxic substances such as heavy metals, which can cause serious health complications, including respiratory illnesses and neurological disorders.

- **Socio-Economic Impacts:** Inefficient waste management affects the economy in several ways. The high cost of waste collection, transportation, and disposal places a financial burden on local governments. Poor waste management can deter tourism, an essential industry for Thailand's economy, as polluted urban environments diminish the attractiveness of tourist destinations (Tourism Authority of Thailand, 2021). Moreover, conflicts frequently arise between residents and waste management authorities regarding the siting of waste disposal facilities.

## National and Local Policies and Policy Mechanisms Related to Social-ecological Transformation in Thai Cities

In the context of Social-ecological Transformation in Thai Cities, related policies are divided into two levels: **1) National-level policies and policy mechanisms**, including national strategies, national plans, and national agencies responsible for overseeing and managing, and **2) Local-level policies and policy mechanisms**, where local administrative organizations such as provincial administrative organizations and municipalities are responsible for overseeing and managing.

Figure 6 reviews the policy structure, policy implementation mechanisms, and various agencies involved in public administration at both national and local levels, particularly in relation to social-ecological transformation. It highlights the complexity and overlap within Thailand's policy framework, where national-level policy implementation is directly managed by ministries or central agencies under the administration of provincial

governors appointed by the Ministry of Interior. Meanwhile, local administrative organizations, such as Provincial Administrative Organizations (PAOs) and municipalities, operate with decentralized authority and responsibilities delegated from the central government. These local entities develop their own strategies, plans, and mandates. However, this structure can sometimes lead to policy implementation challenges, where different initiatives may conflict or fail to align with local contexts due to the top-down approach in national policy formulation, which applies uniform measures across diverse regional conditions.

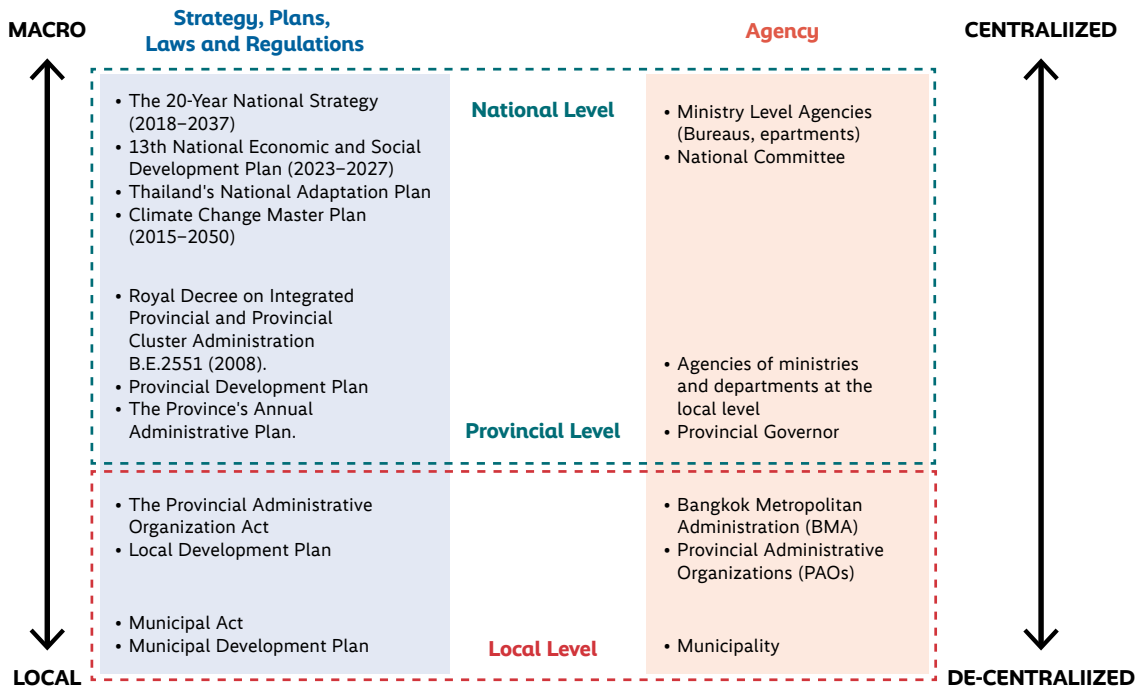
## Overview of national policies related to Social-ecological Transformation in Thai Cities

Thailand has been actively pursuing policies to address the intertwined challenges of urbanization, social equity, and environmental sustainability. These efforts are encapsulated in several national strategies and plans aimed at fostering social-ecological transformation in Thai cities. This article examines key national policies, including the 20-Year National Strategy, the 13th National Economic and Social Development Plan, and the National Adaptation Plan, highlighting their roles in promoting sustainable urban development.

### *The 20-Year National Strategy (2018–2037) of Thailand*

Thailand's 20-Year National Strategy (2018–2037) is a long-term development framework designed to guide the country toward sustainable growth, stability, and global competitiveness. Rooted in the *Sufficiency Economy Philosophy*, it aims to balance economic progress, social equity, and environmental conservation. The strategy was developed in response to challenges such as economic volatility, environmental degradation, and social disparities. It consists of six core elements, including national security, competitiveness, human capital development, social equality, environmental sustainability, and good governance. By aligning policies across government sectors, it seeks to enhance resilience, foster innovation, and ensure long-term prosperity for all citizens. Serv-

Figure 6: Policy Structure, Policy Implementation Mechanisms, and Relevant Agencies in Thailand for Public Administration at the National and Local Levels.  
Source: Author



ing as a comprehensive framework guiding the country's development towards sustainability, the strategy focuses significantly on social-ecological transformation in urban areas. This strategy aims to balance economic growth with environmental conservation and social equity, ensuring that urbanization processes contribute positively to both human well-being and ecological health. In Thailand's 20-year national strategic plan, there are key components related to social-ecological transformation in Thai cities, as detailed below (NESDC, 2017).

→ **Ecological Zoning and Urban Planning:** Emphasizing the development of ecological zoning plans to guide the harmonious development of urban, rural, agricultural, industrial, and conservation areas. This approach ensures that urban expansion aligns with the ecological potential and suitability of each region, promoting sustainable land use and minimizing environmental degradation.

→ **Development of Eco-Friendly Urban and Rural Areas:** The core objective is to transform urban and rural spaces into eco-friendly zones. This involves implementing sustainable practices in agriculture and industry, managing pollution effectively, and preserving cultural heritage and local lifestyles. The strategy advocates for the creation of urban and rural environments that are not only economically vibrant but also environmentally sustainable and culturally rich.

→ **Pollution and Waste Management:** Addressing environmental pollution is critical for social-ecological transformation. The strategy outlines measures to manage pollution, including waste and wastewater, to meet international standards. This includes reducing air and water pollution, promoting waste reduction and recycling, and ensuring that industrial activities do not compromise environmental quality.

- **Promotion of Green Spaces:** The expansion and maintenance of green spaces within urban areas are prioritized to enhance environmental quality and public well-being. Green spaces serve as natural air filters, recreational areas, and habitats for urban biodiversity, contributing to the ecological balance and aesthetic appeal of cities.
- **Community and Urban Development Organizations:** Encouraging the establishment and support of organizations dedicated to urban and community development. These entities play a pivotal role in mobilizing local resources, fostering public participation, and ensuring that development projects align with the needs and aspirations of the community.
- **Sustainable Water and Energy Management:** Ensuring the sustainability of water and energy resources is essential for urban resilience. The strategy promotes integrated water resource management and the development of energy systems that are environmentally friendly. This includes enhancing water use efficiency, investing in renewable energy sources, and reducing the carbon footprint of urban infrastructure.
- **Climate Change Mitigation and Adaptation:** Recognizing the impacts of climate change, the strategy includes measures to reduce greenhouse gas emissions and adapt to climate-related challenges. This involves promoting low-carbon urban development, enhancing urban green cover to sequester carbon, and implementing policies that increase the resilience of urban communities to climate-induced hazards.

The successful implementation of these components requires a collaborative approach involving government agencies, local communities, the private sector, and civil society organizations. By integrating ecological considerations into urban development, Thailand aims to create cities that are livable, resilient, and sustainable. The anticipated outcomes include improved quality of life for urban residents, preservation of natural ecosys-

tems, and a balanced relationship between urban development and environmental stewardship.

In summary, the 20-Year National Strategy provides a holistic blueprint for social-ecological transformation in Thai cities, ensuring that urban growth contributes positively to both societal well-being and environmental sustainability.

#### *13th National Economic and Social Development Plan (2023–2027)*

Thailand's National Economic and Social Development Plan (NESDP) serves as a comprehensive roadmap for the country's economic and social advancement, first introduced in 1961 and updated every five years to address emerging challenges, global trends, and national priorities. The plan focuses on sustainable economic growth, social well-being, infrastructure development, and environmental conservation. It also promotes innovation, competitiveness, and regional integration to strengthen Thailand's position in the global economy. Through a structured policy framework, the NESDP ensures balanced and inclusive development across all sectors. The concept of livable cities and social-ecological transformation appeared in Thailand's National Economic and Social Development Plan (NESDP) in the 9th Plan (2002–2006), which emphasized sustainable urban development and environmental conservation. It gained further prominence in the 10th Plan (2007–2011), integrating urban planning with climate resilience and green spaces. The 11th Plan (2012–2016) introduced smart growth strategies, promoting eco-friendly infrastructure and public transportation. By the 12th Plan (2017–2021), urban sustainability became a core focus, aligning with global frameworks such as the SDGs and the Paris Agreement. The 13th Plan (2023–2027) now fully embraces smart cities, green infrastructure, and the *Bio-Circular-Green (BCG) Economy*, aiming for holistic social-ecological transformation. Thailand's 13th National Economic and Social Development Plan (2023–2027) provides a comprehensive framework for promoting sustainable urban development and advancing social-ecological transformation in Thai cities. This plan prioritizes the integration of economic progress, environmental

conservation, and social inclusivity, ensuring that urbanization contributes positively to both human well-being and ecological sustainability. The 13th National Economic and Social Development Plan (2023–2027) has important matters related to social-ecological Transformation in Thai Cities as follows (NESDC, 2022):

→ **Promotion of Green and Resilient Urban**

**Infrastructure:** The plan advocates for the development of urban infrastructure that is both environmentally friendly and resilient to climate change. This includes the expansion of green spaces, enhancement of public transportation systems, and the adoption of sustainable building practices. Such initiatives aim to reduce urban carbon footprints and improve the quality of urban life.

→ **Implementation of the Bio-Circular-Green**

**(BCG) Economy Model:** A significant aspect of the plan is the transition towards a BCG economy, which integrates biological resources, circular economic practices, and green technologies. This model promotes sustainable production and consumption patterns in urban areas, encouraging waste reduction, resource efficiency, and the use of renewable energy.

→ **Enhancement of Urban-Rural Linkages:**

Recognizing the interdependence between urban and rural areas, the plan emphasizes strengthening these linkages to ensure balanced regional development. This involves improving transportation networks, facilitating the flow of goods and services, and promoting equitable access to resources and opportunities across regions.

→ **Community Engagement and Inclusive Development:**

The plan underscores the importance of community participation in urban development processes. By involving local populations in decision-making, the plan aims to ensure that urban transformation aligns with the needs and aspirations of residents, thereby fostering a sense of ownership and social cohesion.

→ **Adoption of Smart City Initiatives:** To modernize urban management, the plan supports the integration of digital technologies in city governance. Smart city initiatives include the use of data analytics for efficient service delivery, implementation of intelligent transportation systems, and enhancement of public safety through technological solutions.

*Thailand's National Adaptation Plan (NAP)*

Thailand's National Adaptation Plan (NAP) serves as a strategic framework to enhance the country's resilience against climate change impacts, particularly within urban environments. The NAP emphasizes the integration of social and ecological considerations to foster sustainable urban development, aligning closely with the principles of social-ecological transformation in Thai cities. The NAP includes key aspects related to social-ecological transformation as outlined below (Ministry of Natural Resources and Environment, 2023):

→ **Human Settlements and Security:**

The NAP aims to enhance the adaptive capacity of individuals, communities, and urban areas to effectively respond to climate change impacts. This involves promoting sustainable urban planning and infrastructure development that consider both social well-being and ecological health.

→ **Natural Resources Management:**

The plan advocates for the sustainable management of biodiversity and natural resources to mitigate climate change effects. This includes implementing *nature-based solutions (NbS)* such as urban green spaces, wetlands, and green roofs, which contribute to urban resilience and ecological balance.

→ **Community Engagement and Capacity**

**Building:** Recognizing the importance of public participation, the NAP encourages community involvement in climate adaptation initiatives. This participatory approach ensures that adaptation strategies are context-specific and socially inclusive, empowering local populations to take active roles in transforming their urban environments.

### *The Climate Change Master Plan (2015–2050)*

The Climate Change Master Plan (2015–2050) of Thailand outlines a comprehensive framework to guide the nation towards sustainable, low-carbon growth and enhanced climate resilience by 2050. This strategic plan is structured around three primary components (Ministry of Natural Resources and Environment, 2015):

- **Climate Change Adaptation:** This component focuses on integrating climate resilience into national development policies across all sectors and governance levels. The goal is to ensure that Thailand can effectively adapt to the impacts of climate change by implementing measures that address vulnerabilities in areas such as water resources, agriculture, public health, tourism, natural resources, and human settlements.
- **Mitigation and Low Carbon Development:** This strategy aims to establish mechanisms for reducing greenhouse gas (GHG) emissions, thereby promoting sustainable, low-carbon economic growth. Key initiatives include increasing the share of renewable energy in the national energy mix, enhancing energy efficiency across industries, and promoting sustainable transportation systems to reduce emissions from the transport sector.
- **Enabling Environment for Climate Change Management:** This component seeks to enhance the capacity and awareness of all stakeholders involved in climate action. It emphasizes the development of robust databases, the advancement of climate-related research and technology, and the establishment of supportive legal and economic instruments to facilitate effective implementation of climate change policies.

The Master Plan delineates specific goals and targets across short-term (by 2016), medium-term (by 2020), and long-term (by 2050) horizons. These targets are designed to systematically advance Thailand’s climate resilience and low-carbon development objectives (Ministry of Natural Resources and Environment, 2015).

In the context of social-ecological transformation in Thai cities, the Master Plan’s strategies are particularly pertinent. Urban areas are encouraged to adopt *nature-based solutions*, such as creating urban green spaces and restoring wetlands, to enhance resilience against climate-induced challenges like flooding. Moreover, the emphasis on community engagement ensures that urban development projects are inclusive, addressing both ecological sustainability and social equity. By integrating these approaches, Thai cities can transform into sustainable urban environments that are well-equipped to navigate the complexities of climate change.

### **Overview of Local/Area Related Policies Social-ecological Transformation in Thai Cities**

At the local policy level, the issue of social-ecological Transformation appears to resemble other policy areas where there is an overlap between the policies and mechanisms of “regional agencies” at the provincial level, which operate as extensions of national ministries, and “local government organizations”, including Provincial Administrative Organizations (PAOs) and municipalities. While these local government entities are granted specific responsibilities, powers, and administrative autonomy under the principle of decentralization, this autonomy exists, at least in theory, because there remains a degree of functional and operational overlap between provincial-level regional agencies and local governance structures.

In Thailand, provincial administration operates through “regional agencies” affiliated with various ministries, with the Provincial Governor serving as the central government’s representative in each province. The Governor’s responsibilities include coordinating and overseeing the operations of governmental agencies within the province. According to Section 52/1 of the State Administration Act, the Provincial Governor is empowered to: 1) Implement state missions and government policies to achieve tangible outcomes, 2) Ensure the enforcement of laws, 3) Promote local development.

In 2008, the government established the Integrated Provincial Administration Committee (IPAC) under the Royal Decree on Integrated Provincial and Provincial Cluster Administration B.E. 2551 (2008). In this structure, the Provincial Governor serves as chairperson. The committee's duties encompass formulating development strategies, setting policies, and coordinating among various agencies within the province. Studies have highlighted that the IPAC plays a significant role in driving provincial development and translating central government policies into local initiatives through inter-agency collaboration and public participation (Puengsamrong, 2021). Additionally, the Integrated Provincial Administration Committee (IPAC) plays a crucial role in formulating and providing input on both the Provincial Development Plan and the province's Annual Administrative Plan. This involvement ensures that development strategies are tailored to local needs and are effectively implemented (Chandra, 2022).

Similarly, Thai Municipalities and Provincial Administrative Organizations (PAOs) also play a crucial role in shaping social-ecological transformation within urban areas. However, the legal framework governing their responsibilities does not explicitly define their role in this transformation. There is no direct reference to the concept within the statutes outlining their duties and powers.

Nevertheless, some alignment can be found in Sections 50 and 51 of the Municipal Act, which provide a legal foundation for municipalities to promote sustainable urban development, public welfare, and environmental management. These provisions empower local governments to enhance quality of life and urban resilience while addressing socio-ecological challenges in municipal areas. Similarly, the Provincial Administrative Organization Act, B.E. 2540 (1997) includes provisions that relate to social-ecological transformation, particularly in Section 45, which defines the responsibilities and powers of Provincial Administrative Organizations (PAOs). These responsibilities spanning environmental protection, waste management, and urban planning, indirectly contribute to broader efforts in social-ecological transformation, reinforcing the

role of local governance in fostering sustainable urban environments.

However, considering the current roles of local administrative organizations, including municipalities and Provincial Administrative Organizations (PAOs), it is evident that many have actively engaged in social-ecological transformation initiatives. These efforts encompass a range of activities aimed at promoting sustainable development, environmental conservation, and enhancing the quality of life within their communities. For instance, local governments have implemented policies focused on effective resource allocation and collaborative efforts to combat climate change. (Kiatadisorn, 2023) Additionally, addressing social inequalities and ensuring equitable access to resources have been integral components of their strategies to foster holistic social-ecological transformation. (Suwanmongkol, 2019) It is evident that many have actively engaged in social-ecological transformation initiatives, as highlighted in the following aspects:

- **Urban Planning and Infrastructure Development:** Municipalities such as the Bangkok Metropolitan Administration (BMA) are at the forefront of creating sustainable urban environments. BMA has introduced initiatives like the “Green Bangkok 2030” plan, which aims to enhance green spaces, improve urban mobility, and promote energy-efficient building practices. For example, the expansion and upgrade of parks like Lumpini Park and the development of dedicated bicycle lanes contribute to a healthier, more livable city. Additionally, improvements in public transportation—such as investments in electric buses and mass transit systems—help reduce traffic congestion and lower carbon emissions. (Department of Local Administration, 2019)
- **Environmental Management and Climate Resilience:** In response to recurring environmental challenges, many local governments are implementing robust climate resilience strategies. In flood-prone areas like Bangkok, the BMA has deployed advanced drainage systems, reten-

tion basins, and early warning mechanisms to mitigate flood risks during the rainy season. In Chiang Mai, local authorities have promoted community-based waste management programs and renewable energy projects to combat

air pollution and encourage sustainable tourism practices. These measures not only protect the environment but also enhance public health and safety (World Bank, 2020).

Box 1

## *From Policy to Practice: Local and Urban Innovations Driving Socio-Ecological Transformation*

**Koh Tao Subdistrict Municipality (Thailand):** In 2019, Koh Tao became one of Thailand's first local governments to implement a formal environmental fee for tourists, charging THB 20 (approximately US \$0.60) per visitor upon arrival. Developed in collaboration with the UNDP's Biodiversity Finance Initiative (BIOFIN), the mechanism was designed to address the island's mounting waste and marine degradation issues. Within just 18 months, the program generated over US \$450,000 in revenue, which was reinvested into coral reef restoration, community-based waste management, and education campaigns (BIOFIN, 2022). The governance of the fund is participatory, involving local stakeholders such as fishers, boat operators, and women's groups, making Koh Tao a model for sustainable tourism finance in small island contexts (UNDP, 2023).

**Surabaya Municipality (Indonesia):** Surabaya's innovative approach to community-based solid waste management has drawn global attention. Since 2004, the city has collaborated with Japan's KITA NGO to promote household composting, distributing over 19,000 compost bins and establishing 14 compost centers by 2009. In parallel, Surabaya launched a city-wide "waste bank" initiative in 2008, enabling residents to exchange recyclable materials for cash. These efforts, supported by social entrepreneurs and international donors, have significantly reduced waste sent to landfills while generating local economic benefits (Wijayanti & Suryani, 2015; Global Covenant of Mayors, 2019; Dhokhikah et al., 2015).

**Penang Island City Council (Malaysia):** Penang is a leading Malaysian example of subnational climate action. Since adopting the Low Carbon Cities Framework (LCCF) in 2011, the city has introduced multiple initiatives including carbon emissions inventories, low-carbon zones, and urban green corridors. The Penang Green Agenda and Island Green City Action Plan (GCAP), developed with ICLEI and ADB support, promote integrated actions such as bike-sharing, nature-based solutions, and zero single-use plastic campaigns (Lim, 2025; MGTC, 2024; ICLEI South Asia, 2025). These measures are supported by strong citizen engagement and institutional commitment to sustainable urban development.

**Hat Yai Municipality (Thailand):** Hat Yai's participation in the Asian Cities Climate Change Resilience Network (ACCCRN), supported by the Rockefeller Foundation and WWF, exemplifies climate-resilient urban planning in secondary Thai cities. Since 2009, the city has developed multi-stakeholder working groups, conducted local vulnerability assessments, and implemented flood-resilience strategies such as early-warning systems and adaptive infrastructure. Learning centers have also been established to promote climate awareness. Hat Yai's efforts earned international recognition, including selection as a WWF City Challenge finalist in 2015 (ACCCRN, 2010; WWF, 2015; PPPHAT, 2018).

- **Community Engagement and Social Inclusion:** Municipalities are increasingly involving citizens in the planning and decision-making process. Local governments in cities like Pattaya and Chiang Mai hold regular public forums and participatory budgeting sessions, ensuring that the voices of residents—including marginalized communities—are heard. This inclusive approach helps address social inequities while supporting ecological initiatives, such as upgrading local infrastructure to be more accessible and sustainable (UNDP, 2021; Fung, 2006).
- **Collaborative Partnerships and Multi-Level Governance:** To achieve their sustainability goals, Thai municipalities frequently collaborate with national agencies and international organizations (Ansell and Gash, 2007). For instance, BMA works closely with the Ministry of Natural Resources and Environment to align local strategies with national policies on climate change and sustainable development. Moreover, partnerships with global institutions like the UNDP provide technical and financial support, ensuring that local projects are both innovative and resilient (UNDP, 2021).

## The challenges of the Social-ecological Transformation in Thai Cities

Social-ecological transformation in Thai cities presents multifaceted challenges that significantly impact urban planning, environmental sustainability, and social inclusivity. This analysis delves into five critical areas: the impact on vulnerable groups, urban population migration, demographic shifts, urban expansion versus the decline of smaller cities, and cross-border disasters affecting urban areas.

- **Impact on Vulnerable Groups:** Vulnerable populations, including low-income communities, the elderly, and children, are disproportionately affected by environmental and social changes in urban settings.
- **Urban Heat Island Effect:** Cities like Bangkok experience elevated temperatures due to *urban*

*heat island effect*, exacerbating health risks for the elderly and those with pre-existing conditions. Studies have shown that urban expansion intensifies these effects, leading to increased heat-related illnesses among vulnerable groups (Gullette *et al.*, 2022). Similarly, high levels of PM2.5 in cities such as Bangkok and Chiang Mai contribute to respiratory and cardiovascular diseases, particularly affecting children and the elderly. The integration of peripheral areas into expanding urban networks often results in rapid disjointed transformations, leading to increased pollution and health challenges (Gullette *et al.*, 2022). Moreover, low-income residents in informal settlements are also more susceptible to flooding due to inadequate infrastructure. The rapid urban expansion into rural peripheries reshapes political economies, often leaving these communities without sufficient flood defenses (Gullette *et al.*, 2022).

- **Migration of the Urban Population:** Internal migration patterns significantly influence urban development and social dynamics in Thailand. Cities like Bangkok, Chiang Mai, and Phuket attract individuals from rural areas seeking employment opportunities. This influx leads to challenges such as inadequate housing and strained urban services. The expansion of urban areas into rural peripheries often results in rapid and disjointed transformations, creating new challenges for agrarian families and contributing to socio-economic disparities (Gullette *et al.*, 2022). Similarly, economic downturns, environmental concerns, and high living costs have prompted some urban dwellers to return to rural hometowns, impacting both urban economies and rural demographics. This movement reflects the complex socio-economic dynamics influencing migration patterns in Thailand (Gullette *et al.*, 2022).
- **Changing Demographic Structure:** Thailand faces significant demographic shifts, notably an aging population and declining birth rates, affecting urban planning and services. Projections indicate that by 2030, over 30% of Thailand's population will be aged 60 and above. This shift

necessitates urban infrastructure that accommodates the elderly, including accessible transportation and healthcare services. The evolving demographic landscape requires cities to adapt to the needs of an aging society (Phalakamarn and Kamolvej, 2024). Furthermore, a reduced working-age population may lead to labor shortages, influencing economic productivity and increasing reliance on automation or migrant labor. This demographic change poses challenges to sustaining economic growth and requires strategic planning to address potential workforce gaps (Phalakamarn and Kamolvej, 2024).

- **Expansion of Large Cities and Shrinkage of Medium/Small Cities:** Urbanization in Thailand is marked by the rapid growth of major cities and the decline of smaller urban centers. Bangkok's continuous expansion leads to urban sprawl, environmental degradation, and increased demand for resources. The city's growth often comes at the expense of green spaces and contributes to challenges such as traffic congestion and pollution (Gullette *et al.*, 2022). In the same way, mid-sized cities like Phitsanulok and Nakhon Sawan face population declines as residents migrate to larger urban areas, resulting in economic stagnation and reduced investment. This trend highlights the need for balanced regional development to ensure the vitality of smaller cities (Gullette *et al.*, 2022).
- **Cross-Border Disasters and Their Impact on Cities:** Transboundary environmental issues pose significant risks to Thai urban centers. Upstream activities in neighboring countries can exacerbate flooding in Thai cities, necessitating international cooperation for effective water management. Collaborative efforts are essential to mitigate the impact of cross-border water-related disasters (Phalakamarn and Kamolvej, 2024). Moreover, the seasonal haze from agricultural burning in neighboring nations severely affects air quality in northern Thai cities, leading to health crises and economic disruptions. Addressing this issue requires regional policies and collaborative environmental management strategies (Phalakamarn and Kamolvej, 2024).

Addressing the challenges of social-ecological transformation in Thai cities requires comprehensive strategies that consider vulnerable populations, manage migration effectively, adapt to demographic changes, balance urban development, and engage in regional cooperation to mitigate cross-border environmental impacts.

## Policy Gap Analysis Related to Social-Ecological Transformation in Thai Cities

A review of current situations, relevant documents, and interviews, along with an analysis of Thailand's efforts to drive social-ecological transformation in cities, reveals that both national and local agencies recognize the importance of planning for social and environmental changes. This awareness stems from the increasing risks and impacts of environmental changes on urban areas, local communities, and diverse social groups. However, despite this recognition, there are significant gaps and limitations in the policy implementation process, as outlined below.

- **Gaps and Limitations in Policy Integration and Implementation:** One of the critical challenges in advancing social-ecological transformation is the need for multi-sectoral engagement due to its inherently cross-cutting nature. Over the past decade, Thailand has established various committees and integrated plans to address issues related to social-ecological transformation in cities. Nevertheless, some of these committees appear to function merely as 'policy-setting mechanisms without authority', lacking real integration with operational agencies (Friend *et al.*, 2016).

This disconnect can be attributed to the rigid and siloed structure of Thailand's public administration, particularly at the national level. Government agencies tend to operate within distinct administrative frameworks, each with its own specific action plans and management systems. This institutional fragmentation limits the effectiveness of policy linkages and hinders the ability to drive social-ecological transfor-

mation in a cohesive and systematic manner.

Strengthening horizontal and vertical coordination mechanisms is vital to overcoming institutional silos. While integrated provincial committees (IPACs) exist, their effectiveness is often constrained by overlapping mandates and unclear lines of accountability. A more integrated approach, such as the establishment of regional social-ecological transformation task forces comprising representatives from central ministries, local authorities, and civic organizations could foster synchronized action. Moreover, digital governance tools, including shared dashboards and interoperable planning systems, may enhance real-time coordination and reduce redundancy across agencies.

- **Policy Gaps of National and Local Agencies:** Thailand’s central policies addressing social-ecological transformation often exhibit a “one-size-fits-all” and “top-down” approach. This methodology leads to action plans that fail to reflect the unique characteristics of specific areas, lacking flexibility to adapt to rapidly changing social-ecological issues. For instance, cross-border disasters necessitate bilateral cooperation and early warning systems, yet clear mechanisms for such collaboration remain underdeveloped. The absence of localized, context-specific strategies hampers effective responses to environmental challenges, underscoring the need for policies that are both adaptable and inclusive of local contexts.
- **Limitations in the Authority and Responsibilities of Local Administrative Organizations (LAOs):** Local Administrative Organizations (LAOs), particularly municipalities and city municipalities, are the closest entities to the realities of social-ecological challenges and play a crucial role in urban management. While various legal frameworks, including the Municipal Act, the Decentralization Act, and multiple regulations issued by the Decentralization Committee, formally recognize LAOs’ roles in social-ecological transformation, their actual capacity to execute these responsibilities

remains limited. Several key constraints hinder LAOs’ effectiveness in driving social-ecological transformation:

- 1) Resource Allocation Deficiencies** – Insufficient decentralization of financial and material resources prevents LAOs from effectively implementing policies at the local level.
- 2) Policy and Operational Limitations** – Despite the legal framework, LAOs’ decision-making and implementation powers remain highly constrained by central government oversight and directives, limiting their ability to develop context-specific urban strategies. And,
- 3) Lack of Skilled Personnel** – Many LAOs lack personnel with the necessary expertise and capacity to address complex social-ecological transformation challenges, further impeding their ability to respond to emerging urban issues.

These limitations highlight the need for a more robust decentralization framework that empowers LAOs with adequate resources, autonomy, and expertise to effectively manage and drive social-ecological transformation in Thai cities.

#### **The Absence of Mechanisms for Civil Society and the Non-Governmental Sector Participation:**

The advancement of policies, measures, and actions to address social-ecological Transformation necessitates the establishment of participatory mechanisms and processes for civil society and the non-governmental sector. These mechanisms are crucial for enhancing inclusivity, resilience, and the overall effectiveness of implementation. However, existing policy frameworks and operational mechanisms—both at the national and local levels—often fail to provide an institutionalized and structured space for these sectors to participate in a meaningful and sustained manner (Ostrom, 1996; Bäckstrand, 2006).

Currently, policy implementation mechanisms at both the central government and local administrative levels do not adequately integrate civil

society and non-governmental actors into decision-making processes. While there are instances where cities and municipalities engage with civil society organizations and non-governmental entities, these interactions are often informal and based on personal relationships rather than being embedded within official governance structures. As a result, participation lacks continuity and institutional support, making it difficult to drive long-term transformation in addressing *Social-Ecological Challenges*, which are inherently complex and require multi-sectoral collaboration.

To advance meaningful social-ecological transformation, civil society and local communities must not only be seen as stakeholders but as co-creators in policy framing. International experiences high-

light that inclusive governance structures, such as participatory urban planning boards or local sustainability councils can significantly enhance responsiveness and legitimacy (Bäckstrand, 2006; Ostrom, 1996). In the Thai context, expanding formal mechanisms that empower civil society organizations (CSOs) to co-develop urban environmental policies would help bridge the current disconnect between policy formulation and ground-level realities. This may include mandating citizen representation in provincial development boards or establishing legally recognized local forums with decision-making authority, thus moving beyond consultation towards genuine co-governance (Ansell and Gash, 2008).

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# Social-ecological Transformation in Thai Cities

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