



Deliverable D5

Stakeholders and residents' views on environmental and climate change challenges and GBI development in Huế

Results of the series of public events within the GreenCityLabHuế Project Work Package 3

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The joint research project GreenCityLabHuế – Strengthening climate resilience of urban regions in Central Vietnam through nature-based solutions for heat adaptation and air quality improvement, funded by Federal Ministry of Education and Research (BMBF) as part of the funding measure „Sustainable Development of Urban Regions" within the framework of the Strategy „Research for Sustainability" (FONA), started its Research and Development (R&D) phase in April 2021, following completion of the preceding definition phase. In the R&D-phase the project aims to strengthen the climate resilience of the city of Huế (Thừa Thiên Huế Province, Central Vietnam) through nature-based solutions (NBS) with a focus on heat adaptation and air quality improvement. To this end, a multidisciplinary research and experimental space will be created to develop, test, visualise, discuss, and implement ideas and concepts on the restoration and expansion of green-blue infrastructure (GBI), and thus for the promotion and implementation of NBS, in the urban area of Huế. In cooperation with stakeholders from science, politics, administration, and civil society, the international project consortium of Independent Institute for Environmental Issues (UfU), Humboldt-Universität zu Berlin (HUB), MienTrung Institute for Scientific Research (MISR), Thừa Thiên Huế Institute for Development Studies (HuếIDS), and the Faculty of Architecture of the University of Sciences/Huế University (HUSC) will generate joint knowledge for stakeholders and decision-makers on NBS, resulting in a city-wide vision – a strategy containing guiding principles and best-practice recommendations for a greener, more resilient, and sustainable urban development of Huế, including proposals for specific measures of GBI implementation.

Project website: www.greencitylabHuế.com



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Summary

The success of Nature-based solutions (NBS) and Green-blue infrastructure (GBI) development depends on the active involvement of local stakeholders and residents, who have invaluable knowledge about their neighborhoods, including vulnerabilities and community needs. Their participation ensures that adaptation measures are inclusive, equitable, and tailored to specific district requirements, fostering a sense of ownership and accountability and encouraging sustainable practices. Involving residents in GBI planning also promotes community empowerment and social cohesion, enhancing the effectiveness of adaptation strategies.

The GreenCityLabHuế Project organized a series of public events to create a dialogue and cooperation with city authorities, local residents, and civil society groups. These events aimed to identify challenges and needs and develop best-practice measures for the final Green City Vision Huế for NBS implementation. The events focused on gathering knowledge about local conditions regarding climate change impacts and air quality issues and co-developing ideas for specific GBI and NBS interventions, especially in the city districts of Phú Hội and Thủy Biều, which represent an inner-city and a suburban district, respectively. Three public discussion events were held between 2022 and 2023. The first event targeted representatives of civil society organizations and city and district administrations, covering the entire urban area of Huế. The other two events focused on residents of Phú Hội and Thủy Biều. All events began with technical presentations on the project objectives and main activities, followed by moderated small group discussions on specific guiding questions. Participants also marked potential locations for new green spaces on maps, identifying areas with a deficit of green spaces and existing spaces with enhancement potential. The discussions were recorded, written down, and evaluated, providing a basis for potential policy recommendations for future GBI and NBS developments in Huế.

Local stakeholders identified several critical challenges related to climate change impacts in Huế, including a deficiency of trees with large canopies, rising sea levels causing seawater intrusion, unpredictable weather conditions, inadequate wastewater treatment facilities, and poorly planned drainage systems. They also noted rapid urbanization, sealing of land, industrial emissions, and harmful agricultural practices impacting air and water quality. Existing green spaces were praised for their benefits like air quality improvement and noise reduction but faced issues like budget shortages, uneven distribution, and vulnerability to extreme weather conditions. The stakeholders recommended several measures, including targeted tree planting, weather-resilient GBI design, equal distribution of green spaces, sufficient financial resources for GBI implementation and maintenance, alternative funding sources, and raising public awareness for environmental protection. Residents of Phú Hội and Thủy Biều identified similar concerns regarding heat stress and air quality, with Phú Hội facing high-density construction and traffic, and Thủy Biều affected by burning straw, construction dust, and increased housing density. Both districts emphasized the need

for multifunctional public green spaces, adequate shading, and proper maintenance to enhance green space functionality and aesthetics.

The insights from stakeholders and residents highlight the need for comprehensive strategies to improve climate resilience through NBS and GBI in Hué. These strategies should prioritize community involvement, equitable distribution and maintenance of green spaces, and public awareness to ensure sustainable urban development and better quality of life for the city's residents.

1 Introduction

The project “GreenCityLabHuế – Strengthening climate resilience of urban regions in Central Vietnam through nature-based solutions for heat adaptation and air quality improvement” aims to strengthen the climate resilience of the city of Huế (Thừa Thiên Huế Province, Central Vietnam) through nature-based solutions (NBS) with a focus on heat adaptation and air quality improvement. It aims to create a multidisciplinary research and experimental space to develop, test, visualise, discuss and implement ideas and concepts on the restoration and expansion of green-blue infrastructure (GBI), and thus for the promotion and implementation of nature-based solutions NBS, in the urban area of Huế.

Nature-based solutions (NBS) refer to approaches that use nature and natural processes to address various societal and environmental challenges. These solutions harness the power of ecosystems and biodiversity to provide sustainable and cost-effective ways to tackle issues related to climate change, biodiversity loss, water security, disaster risk reduction, and other environmental problems (Raymond et al. 2017). NBS can encompass a wide range of strategies and actions, including the development and enhancement of Green-Blue Infrastructure (GBI). This term includes developing and utilising natural features like green spaces, urban forests, and permeable surfaces to manage storm water, reduce urban heat island effects, and improve air quality in cities. It also includes integrating natural elements into urban planning, such as creating green corridors, parks, and rooftop gardens, to enhance resilience and improve quality of life. NBS are gaining attention globally for their ability to provide multiple benefits, including environmental sustainability, social well-being, and economic prosperity, often in a way that benefits both people and nature (Veerkamp et al. 2021). These approaches emphasise the importance of preserving and working with nature rather than against it to address pressing global challenges. GBI are particularly effective in the area of climate adaptation. In the face of accelerating climate change, cities worldwide are increasingly vulnerable to its adverse impacts. To mitigate these challenges, urban climate adaptation measures based on nature-based solutions have become imperative (Voskamp et al. 2021).

The success of those measures also relies on the active involvement of local stakeholders and residents. Local stakeholders and residents possess invaluable knowledge about their neighbourhoods, including vulnerabilities, socio-economic dynamics, and community needs (Mitincu et al. 2023). Their lived experiences provide unique insights into the specific challenges faced within their districts. For instance, in low-lying areas, residents might be more aware of flood-prone zones or areas susceptible to extreme heat. Such local knowledge is indispensable for designing targeted and effective climate adaptation strategies. When residents can contribute to the decision-making process, it ensures that their concerns, preferences, and needs are considered. This approach results in more inclusive, equitable, and sustainable adaptation measures tailored to the specific requirements of each district. Furthermore, the active involvement of residents in urban GBI planning fosters a sense of ownership and accountability. It facilitates behavioural changes necessary for the

adoption of sustainable practices (Lamond & Everett 2019). Stakeholders and residents can be encouraged to embrace environmentally friendly behaviours and support the implementation and maintenance of GBI.

Therefore, within the GreenCityLabHuế Project a series of public events was organised with the major objective of creating a dialogue and a form of cooperation with city authorities, local residents and representatives of civil society groups on the identification of challenges and needs and the development of best-practice measures that will be included into the projects's final Green City Vision Huế for the implementation of NBS in Huế. This process aims at co-creating knowledge about local conditions regarding climate change impacts and air quality issues and to co-develop ideas for specific GBI and NBS interventions. Therefore, identifying demand and preferences for specific problems regarding heat load, air quality and acceptance of certain NBS interventions and their implementation are of special importance. The events focused on a common collection of knowledge on specific needs and vulnerabilities and on the co-creation of ideas and visions for the implementation of NBS in Huế, especially in two selected city districts (wards): Phú Hội and Thủy Biều. These two districts were selected because they are representative for an inner city district (Phú Hội) and a suburban district (Thủy Biều) and because small-scale GBI measures are to be implemented in both districts as part of the project.

2 Methodical approach

A total of three public discussion events were held between 2022 and 2023. While the first event targeted in particular representatives of civil society organisations and representatives of various city and district (ward) administrations and the discussion covered the entire urban area of Huế, the other two events focused on local residents of the city districts (wards) Phú Hội and Thủy Biều and the scope of the discussions was limited to the areas of these two districts. All three events began with technical presentations in which the objectives and main activities of the project as well as inputs on the topics of climate change impacts, climate adaptation, GBI and NBS were given. The exhibition created as part of the project and the accompanying information brochure were also used to provide participants with in-depth information on the specific topics. In contrast to the two district-specific events in Phú Hội and Thủy Biều, during the cross-city event with stakeholders current initiatives and challenges in green space planning were also presented additionally by various district representatives. The input presentations were followed by moderated discussions in small groups (5-10 persons per group) at different tables in which specific guiding questions were discussed. The group discussions were facilitated by Vietnamese scientists from the project consortium.

During the city-wide event with stakeholders, the following three questions were discussed in the small groups:

1. What are Huế's major challenges regarding climate change and environmental degradation?
2. How do you evaluate the quality of existing green spaces in Huế? What are their major benefits and what are their shortcomings?
3. What are current challenges regarding GBI development in Huế?

During the two district-specific events with residents, the following questions were put up for discussion, which were tailored more to the target group and the specific circumstances of the respective districts:

1. What are the major threats in the neighbourhood regarding heat stress and air quality?
2. What are the major problems with public green spaces and urban green (e.g. street trees) in the neighbourhood (e.g. size, distribution, quality, accessibility)?
3. How would residents like to use public green spaces in particular (e.g. playing with children, sports, recreation, urban gardening/urban farming)?

Following the discussion rounds at all three events, participants were given the opportunity to mark potential locations for new green spaces on maps. To this end, the participants were asked to mark places that they felt had a deficit of green spaces as well as existing green spaces with potential for enhancement.

The discussions were recorded, written down and subsequently evaluated. The evaluation focused primarily on describing the contributions to the discussions, categorising them according to thematic

priorities and drawing conclusions from them as a basis for potential policy recommendations for future developments in the areas of GBI and NBS in Hué and the respective districts.

3 Description of the case study areas

3.1 Hué

The city of Hué is one of the oldest urban areas in Vietnam. The city encompasses an area of about 71 km² and is one of the most densely populated Vietnamese cities with 5,076 person/km². Being the former capital of Vietnam from 1802 to 1945 under the Nguyen Dynasty, Hué City is regarded as the national centre of culture, religion and education. The city has been inherited the cultural values and the magnificent buildings of the Imperial City and other monuments which were collectively recognised as World Cultural Heritage by the United Nations Educational Scientific and Cultural Organisation (UNESCO) since 1993.

As inherited the urban structure from the last imperial Dynasty and French colonial architecture, Hué, owns a well-structured urban area, especially at the heart of its historic centre, with relatively big areas allotted for green spaces and water bodies in comparison to other Vietnamese cities. However, Hué faces increasing challenges from climate change, population growth, rapid urbanisation, social inequality, and environmental degradation that put the city at risk of repeating other cities' mistakes of uncontrolled urban development that exacerbates social and environmental problems. Due to its exposed geographic location along a flat coastal strip, bordered by the South China Sea to the east and separated from the rest of the mainland of the Indochinese peninsula by high mountain ranges to the west, central Vietnam, in particular, regularly suffers from extreme heat waves, storms, heavy rainfall events, and flooding. The consequences of such extreme weather events often include infrastructure damage and a not insignificant number of fatalities. The effects of climate change are also increasingly visible in Hué. The most obvious are extreme weather events such as typhoons with heavy rainfall leading to flooding in the city and the surrounding province, and extreme heat waves.

The project "GreenCityLabHué" has been implemented in the city since 2019. As part of this project, educational activities are carried out in the form of an exhibition and public events on the topic of nature-based solutions and their benefits for urban climate adaptation. Together with relevant stakeholders and citizens, visions for green urban development will developed in a co-design process and discussed with decision-makers on how the expansion of GBI can be integrated within existing urban development planning. In addition to a long-term sustainable integration of GBI into urban planning, solutions that can be implemented in the short term are also demonstrated, which can be implemented cost-effectively and quickly at various locations in the city. To promote residents' awareness and engagement in creating green spaces in Hué, the GreenCityLabHué project launched the "Hué Initiatives - Green Space, Green City" design competition. The competition provided an opportunity for young people and citizens of Hué to propose innovative ideas for transforming small-scale spaces within the city through nature-based solutions that will function in the future as places that enhance ecosystem services such as microclimate regulation, air

purification, transpiration, infiltration, retention, biodiversity, and recreation in their surroundings. Through the exemplary implementation of such small-scale solutions, such as the facade and roof greening on a cultural centre in the central city district (ward) Phú Hội, the greening of a sealed schoolyard through vertical garden elements in An Đông, which is located close to the city centre, the upgrading and replanting of small-scale public green spaces in Tây Lộc in the historic centre and Thủy Biều in the suburbs of Huế it will be shown that NBS can also be implemented with low financial resources. Phú Hội and Thủy Biều were also chosen as locations for the discussion events with local residents, as Phú Hội is a representative of an inner-city district and Thủy Biều is an example of a suburban district, reflecting the different views of inner-city and suburban residents.

3.2 Phú Hội

Phú Hội ward is located at the heart of Huế's modern city centre, spans approximately 110 hectares and accommodates around 12,300 residents. It serves as a hub for key city institutions, including national administrative offices, educational facilities, sports amenities, and popular tourist attractions like the Night Walking Street. Economically, Phú Hội is pivotal to Huế's tourism sector, housing approximately 200 businesses predominantly engaged in tourism and gastronomy. The development of the Night Walking Street, specifically along Chu Van An, Pham Ngu Lao, and Vo Thi Sau streets, has significantly bolstered the ward's economic landscape in recent years.

The urban structure of Phú Hội is characterised by a dense arrangement of midrise and high-rise buildings on relatively small and narrow lots. There has been rapid construction activity, leading to a decline in open green spaces. Despite well-developed infrastructure compared to other areas, much of the public open space is covered with impermeable surfaces like concrete. The limited availability of vacant spaces poses challenges for further green infrastructure development. With over 90% of the ward's land already developed for residential and mixed-use purposes, there are minimal prospects for new urban development projects in the near future. This scarcity of available land inhibits potential expansions.

Concerning climate change impacts, Phú Hội faces vulnerabilities due to its urban configuration. The lack of green spaces exacerbates the urban heat island effect, elevating temperatures within the ward. Additionally, the low-lying nature of the area exposes it to risks associated with rising sea levels and extreme weather events. The absence of ample green spaces hampers the ward's ability to mitigate heat, manage storm water runoff, and conserve biodiversity. As climate change intensifies, there's a pressing need for sustainable urban planning practices that prioritize resilience strategies, incorporate green spaces, and mitigate the urban heat island effect.

In summary, Phú Hội's urban structure, marked by dense construction and limited green spaces, poses challenges in combating the adverse effects of climate change. Addressing these issues requires a shift towards sustainable urban planning and resilience-building measures to secure a more sustainable future for the ward amidst climate uncertainties.

3.3 Thủy Biều

Thủy Biều ward is situated in the suburban periphery of Huế, spans a vast area of over 650 hectares, making it one of the largest wards in the city in terms of land surface. Despite its extensive area, the population density remains relatively low, totaling around 10,000 inhabitants.

Economically, about 30% of the local populace is engaged in the agricultural sector. Since 2008, Thủy Biều Ward has emphasized the development of ecotourism as a focal point for economic growth. Infrastructure development has been directed towards enhancing touristic amenities, particularly along the Huong River, with plans to embellish riverbanks and implement projects for recreational facilities. These initiatives have also prioritized environmental improvements. Notably, the implementation of the "Green City" project aimed to expand Huyen Tran Cong Chua and Bui Thi Xuan streets from Long Tho bridge to Luong Quan village. However, while public lighting and tap water systems are well-developed, substantial portions of the ward lack public infrastructure. Despite the focus on tourism, essential amenities such as public spaces, educational facilities, parks, and sports facilities for local residents remain deficient.

The building structure in Thủy Biều Ward primarily comprises small, one or two-story houses. Its renown stems from various gardens and ancient houses that dot the landscape, adding to its distinct charm. Regarding urban development and land use, residential zones and agricultural lands dominate the area. Recent years have witnessed numerous touristic projects taking shape, with an additional 97 hectares earmarked for planned tourism expansions.

Climate change poses potential challenges to Thủy Biều Ward. Despite its emphasis on ecotourism and environmental enhancements, the limited public infrastructure, including green spaces and recreational facilities, may hinder its resilience against climate-related risks. The predominantly low-rise housing might offer less resistance to extreme weather events, and the reliance on agriculture exposes the ward to vulnerabilities related to changing climatic conditions.

In summary, while Thủy Biều Ward showcases potential for ecotourism and has made strides in developing touristic infrastructure, there remains a crucial need to fortify public amenities and infrastructure, especially in the face of climate change. Enhancing resilience measures, diversifying land use strategies, and bolstering essential public facilities are imperative for Thủy Biều to navigate the challenges of a changing climate while sustaining its economic growth.

4 Results

4.1 Stakeholder event on city-level

The stakeholders from Hué engaged in discussions focused on the city's environmental challenges and the state of green spaces.

4.1.1.1 Hué's major challenges regarding climate change and environmental degradation

In relation to the question of Hué's major challenges regarding climate change and environmental degradation, the following aspects were discussed: The participants highlighted numerous issues in different areas. Some wards, notably Hương Phong Ward, have problems with a lack of trees with substantial canopies, exacerbating hotter climate conditions due to changing climatic patterns. The impacts of climate change are becoming increasingly visible through sea level rise, leading to seawater intrusion affecting agricultural practices and causing coastal landslides, resulting in the loss of residential lands. Unpredictable weather conditions, including unseasonal rain, increasing droughts, and floods, significantly impact the health of local residents and hinder socio-economic development. According to the discussion, the city also faces inadequacies in wastewater treatment systems, poorly planned drainage systems causing temporary inundation in low-lying areas, and persistent issues with littering and waste disposal, particularly in industrial zones.

Factors like rapid urbanisation, increased sealing in residential areas, and increasing emissions from transportation further contribute to rising temperatures and environmental degradation. Harmful conventional practices in agriculture, such as burning straw and uncontrolled chemical usage, lead to air and water pollution, affecting human health, natural water sources and aquatic life.

Overview of challenges regarding climate change impacts in Hué identified by local stakeholders:

- Deficiency of trees with large canopies in certain wards leading to hotter temperatures
- Sea level rise causing seawater intrusion affecting agriculture and leading to coastal landslides and residential loss
- Unpredictable weather conditions (unseasonal rain, droughts, and floods) affecting health and socio-economic development
- Inefficient wastewater treatment and poorly planned drainage systems causing inundation in low-lying areas
- Lack of public awareness leading to littering and waste disposal issues
- Urbanisation, sealing, and industrial emissions contributing to increased temperatures and environmental degradation.
- Harmful agricultural practices such as burning straw and excessive chemical use affecting air and water quality

4.1.1.2 Evaluation of green spaces in Hué

Assessing the existing green spaces, stakeholders noted several advantages, including air quality improvement, noise reduction, and aesthetic enhancements. The participants recognised that compared to other Vietnamese cities, Hué has more and better quality green spaces. However, they highlighted various challenges, such as the reduction of agricultural lands within the urban area, budget shortages hindering maintenance and creation of green spaces, uneven distribution of green areas across different wards, and poor maintenance of green spaces, especially those in suburban river areas. Extreme weather conditions often damage these green spaces and affect historical monuments.

Identified areas lacking green spaces encompassed wards facing land allocation issues for green space creation, insufficient community green spaces, amusement parks, and playgrounds. Stakeholders emphasised the need for information provision about constructions, plant species, and environmental protection, along with increased financial support for land acquisition, equipment, and personnel for maintenance purposes. Moreover, there is a need for improved waste management practices, efficient agricultural waste treatment methods, and enhancements in the urban public transport system to reduce emissions from traffic.

These discussions underscored the urgency of adopting comprehensive strategies to address environmental challenges and develop green spaces strategically across different wards in Hué. According to the discussions, collective actions should focus on raising awareness, upgrading infrastructure, optimising resource management, and implementing thoughtful urban planning.

Overview of benefits and shortcomings of existing green spaces in Hué identified by local stakeholders:

- Advantages include air quality improvement, noise reduction, and aesthetic enhancement
- Hué's green spaces are relatively better than in other Vietnamese cities
- Disadvantages involve reduction of agricultural lands, budget shortages, uneven distribution of green spaces, and poor maintenance
- Extreme weather conditions negatively impact green spaces' sustainability and historical monuments.

4.1.1.3 Current challenges regarding GBI development in Hué

During the discussion on challenges regarding GBI development in Hué, representatives from various institutions articulated several crucial factors that are important for GBI development:

Representatives of the Department of Construction emphasised the significance of Hué's Green Growth Urban Development Plan. They highlighted ongoing efforts to review planning areas,

integrating green indices to combat climate change, and mobilising resources for implementation. The incorporation of green criteria into new urban areas remains a priority, although enforcement lacks efficient sanctions.

Representatives of the Institute of Planning underscored the manifold benefits of GBI for Hué, citing its role in climate change mitigation and adaptation. GBI were emphasised for their multifaceted contributions, including biological regulation, drainage, urban greening, and improving public health. The institute is currently formulating long-term green planning orientations up to 2065 to increase Hué's resilience.

Representatives of the Hué Environmental Protection Company (HEPCO) mentioned the need for GBI integration into daily life, advocating for public engagement and awareness to foster community participation in constructing green spaces for recreation and leisure.

Some participants of the discussion proposed strategic expansion plans for the city, emphasising the creation of additional green spaces, such as Thuy Tien Lake and Rú Chá Mangrove forest, intended for amusement parks and recreational areas. Furthermore, the necessity of interconnected green spaces spanning from mountains to sea were proposed.

Consistency between development projects and planning was questioned, highlighting the scarcity of parks for public use. Some participants suggested increasing greenery quotas and fostering collaboration among relevant authorities.

The Green City Action Plan 2 focused on environmental embellishment, canal system revitalisation, and the creation of small green spaces. Participants suggested updating Hué city's boundaries and exploring the integration of green roofs and façades in public buildings. However, considering feasibility, the representatives of the Department of Construction favoured green façades over green roofs due to lower maintenance and effective sunshade benefits, especially for west-facing buildings. Challenges regarding investment costs and maintenance difficulties due to Hué's climate were noted for green roofs. Additionally, the current method of calculating tree ratios based on construction area poses limitations for incorporating greening of façades and roofs. Encouraging investments in green façades, shortening permitting times, and updating project boundaries were recommended for effective implementation.

Overview of challenges regarding GBI development in Huế identified by local stakeholders:

- Insufficient land allocation for green spaces, especially in newly merged wards
- Lack of community green spaces, amusement parks, and playgrounds in certain areas
- Need for green patches and embellishments on streets, especially within the Citadel area
- Absence of information about constructions, plant species, and environmental protection
- Financial limitations for land purchase, equipment, and personnel for maintenance

4.2 Events with residents on district level

In the following, the results of the group discussions in Phú Hội and Thủy Biều are first presented in a descriptive manner. Subsequently, overlaps across the individual groups are identified and statements that are relevant for the respective district are derived and summarised.

4.2.1 Public event in Phú Hội

4.2.1.1 Major threats regarding heat stress and air quality

With regard to the question "What are the biggest threats in the neighbourhood in terms of heat stress and air quality?", the following aspects were discussed in Phú Hội:

Group 1 highlighted the impact of the high density of constructions on the local environment. They expressed concerns about the greenhouse effect and the subsequent rise in temperatures due to this density, exacerbating the lack of green spaces and public open spaces. Moreover, the heavy traffic, attributed to an increase in migrants seeking job opportunities and healthcare services in the city centre, was identified as a significant contributor to air pollution. The emissions from vehicles and untreated waste from markets along the river were noted to adversely influence public health, especially among children and the elderly. Infrastructure-related problems such as poor drainage leading to urban inundation and power outages further compounded the environmental challenges faced by the residents.

Group 2 highlighted the direct health impacts of the environment on the residents. Their concerns extended to the physical consequences of living in an environment characterised by high temperatures and poor air quality. They emphasised the potential health risks, including fatigue, skin problems, respiratory issues, and the increased vulnerability of children and the elderly to various diseases. Additionally, they were worried about the decline in air quality leading to environmental disasters such as fires, water shortages, and droughts, impacting the quality of life and potentially contributing to power outages.

Group 3 shed light on the negative effects of construction-related activities on the environment and public health. Dust and smog generated from construction and traffic were identified as major contributors to air pollution, leading to respiratory diseases and adversely affecting the quality of life,

particularly in terms of sleep and eating habits. Furthermore, concerns were raised about the hotter climate, water scarcity, and the impact on humans, animals and plants, which led to challenges in maintaining a sustainable and healthy environment.

Cross-group aspects:

All groups shared concerns about air pollution, health implications due to rising temperatures, and the scarcity of green spaces or proper urban infrastructure. The concerns mentioned by residents across the groups indicate a shared worry about the impact of heat stress and air quality on health and overall neighbourhood well-being. The residents' worries highlight the need for comprehensive urban planning strategies addressing infrastructure shortcomings, mitigating pollution sources, mitigating urban heat, and fostering a healthier living environment.

Overview of major threats regarding heat stress and air quality in Phú Hội identified by local residents:

- High density of constructions and increasing traffic
- Lack of green spaces and playground shortage
- Environmental pollution and urban infrastructure issues
- Health impacts due to temperature rise and decline in air quality, especially among vulnerable populations like children and the elderly
- Risks of fires, water shortages, and droughts
- Quality of life decline

4.2.1.2 Major problems with public green spaces and urban green

In relation to the question "What are the main problems with public green spaces and urban greenery (e.g. street trees) in the neighborhood (e.g. size, distribution, quality, accessibility)?" the three groups in Phú Hội discussed the following aspects:

Group 1 expressed contentment with the planning of urban green spaces and public areas. However, they noted the uneven distribution of green spaces, identifying some streets that still lacked sufficient trees. They emphasised the necessity of integrating green points into the existing urban planning of specific wards, namely An Dong and Xuan Phu, to address these disparities.

Group 2 highlighted several pressing issues with public green spaces and urban greenery. They identified areas where concrete fences should be replaced by non-concrete green fences adorned with diverse plant species. One concern was the delayed implementation of public places and parks, resulting in unattractive parks with sparse distribution and limited tree variety. The quality of green spaces was identified as unreliable due to insufficient shading, negatively impacting ecosystem services like cooling effects. Accessibility to green spaces was noted to be high but some green

spaces were identified as being underutilised by citizens. Furthermore, inadequate facilities for children, vulnerability to strong winds, and plant species inappropriate to the region's climate were identified as problems affecting green areas' functionality and aesthetics.

Group 3 voiced concerns about the inadequate distribution of trees in the neighbourhood. Despite the presence of lakes, they noted a lack of trees surrounding these lakes, leading to insufficient shade, overcrowding and potential security issues. Certain streets were identified for insufficient tree coverage or low-quality trees, affecting the aesthetics and functionality of these spaces. The location of some green spaces close to main roads led to exposure to vehicle emissions, impacting air quality and health of trees. However, they positively acknowledged the 3/2 Park as a well-designed space with good quality trees and high accessibility for residents and visitors alike.

Cross-group aspects:

Common aspects emerged across all three groups were uneven distribution of green spaces, insufficient tree coverage in certain areas, and issues with the variety and quality of plants. While Group 1 appreciated the planning efforts, all groups highlighted the need for better integration of greenery into urban planning to address disparities and improve the overall quality of public spaces. Of particular note were issues such as unreliable ecosystem services due to a lack of shading, mix of incompatible plant species, and challenges in maintenance due to insufficient staff. Moreover, traffic emissions negatively affecting green spaces and the underutilisation of green spaces despite their accessibility emerged as notable concerns. In conclusion, the combined feedback from the three groups emphasises the significance of equitable distribution, quality maintenance, and diverse plant selection in public green spaces.

Overview of major problems with public green spaces and urban green in the neighbourhood identified by local residents in Phú Hội:

- Uneven distribution of green spaces and need for better integration of green spaces in certain neighbourhoods
- insufficient tree coverage in specific streets
- need for improvement of green space quality
- importance of diverse plant selections
- need for proper maintenance of green spaces

4.2.1.3 Desired use of public green spaces

The question "How do residents want to use public green spaces in particular (e.g. playing with children, sports, recreation, urban gardening/urban farming)?" was discussed in Phú Hội as follows:

Group 1 emphasised the importance of utilising small-scale green spaces for decorative purposes in smaller streets or neighbourhoods. They highlighted specific areas like the 3/2 Park, the walking path along Huong river banks, and the wooden bridge as popular gathering spots for citizens. Additionally, the Cultural and Information Centre served as a playground for children during the night. However, they noted that wards with higher population density lacked sufficient public spaces, leading residents to seek sports activities in adjacent wards like An Dong and Phú Hội.

Group 2 presented a diverse array of desired activities in public green spaces, including club activities, picnics, outdoor exercises, sports activities like swimming, dancing practices, entertainment, outdoor learning, and community gatherings. However, they also mentioned issues such as illegal activities like markets without licenses, concerns about social problems in gathering spots for young people, and the need for better-regulated spaces.

Group 3 highlighted various uses of green spaces, including early morning exercises, entertainment for children, club activities, relaxation, picnics, outdoor learning for different age groups, and gathering spots for young people to study. They also pointed out the income-generating potential for licensed businesses, community activities like “Green Sunday for tree care”, and the role of green spaces in purifying the air and creating a healthy environment.

Cross-group aspects:

Across the groups, common issues emerged such as the desire for diverse activities encompassing relaxation, exercise, entertainment, learning, and community gatherings. There were also concerns raised about the need for better-regulated spaces to prevent illegal activities, littering, and social issues. Residents expressed a number of wishes for public green spaces and emphasised the need for diverse facilities for different age groups and activities, while also highlighting the importance of cleanliness and safety in these areas.

Overview of desired uses of public green spaces and urban green in the neighbourhood identified by local residents in Phú Hội:

- Residents seek diverse activities like relaxation, exercise, and learning in public green spaces
- Concerns about illegal activities, littering, and social issues require attention for better-regulated spaces

4.2.2 Public event in Thủy Biều

4.2.2.1 Major threats regarding heat stress and air quality

With regard to the question "What are the biggest threats in the neighborhood in terms of heat stress and air quality?" the following aspects were discussed in Thủy Biều:

Group 1 identified several threats impacting heat stress and air quality in the neighbourhood. Climate change was acknowledged as a significant influencer. Furthermore, concerns were raised about burning straws in the fields despite warnings, contributing to reduced air quality. Additionally, increasing traffic in Thủy Biều ward was highlighted as a major factor affecting air quality and public health. The high density of construction, coupled with an underdeveloped road system, resulted in dust from ongoing construction work, particularly in Bui Thi Xuan Street. The rise in temperature negatively impacted agricultural productivity, particularly affecting the growth of cultivated crops. Crops and animals required more care due to increased temperatures, impacting productivity and health. Animals were observed suffering from heat strokes, showing the need for heat shields and shady trees. In contrast, the ward's comparative cooler climate in comparison to the inner city districts was noted as a positive aspect, also attributed in part to the closing of the lime factory which used to emit a lot of emissions. However, increased electricity and water usage for cooling led to higher ambient temperatures and increased costs.

Group 2 emphasised the reduction in air quality due to increased CO₂ levels caused by various factors, including tree cutting to widen roads, leading to decreased shade and increased CO₂ levels. Concerns were also raised about waste disposal into ditches, rivers, and lakes, along with unpleasant odours and black smoke from lard cooking. The high density of housing construction and insufficient tree cover within residential areas were mentioned as contributors to poor air quality.

Group 3 highlighted the adverse effects of rising temperatures on public health, causing discomfort and frustration. Hotter weather was identified as a potential trigger for local fires, especially in areas like Vong Canh Hill with bushy vegetation. The struggle of trees to survive and grow in the changing climate was noted, impacting local ecosystems and organisms. Additionally, the drying up of reservoirs exacerbated temperature increases in specific areas, resulting in imbalanced ecosystems.

Cross-group aspects:

Common topics across the groups included concerns about climate change, construction-related dust, reduced air quality due to CO₂ increase, improper waste disposal affecting water bodies, and the adverse impact of temperature rise on agriculture, ecosystems, and public health.

Overview of major threats regarding heat stress and air quality in Thủy Biều identified by local residents:

- Concerns about reduced air quality due to burning straws, construction dust, and increased traffic, waste disposal, and housing density
- Negative impacts of climate change on agriculture
- Adverse effects of rising temperatures on public health and cooling costs

4.2.2.2 Major problems with public green spaces and urban green

In relation to the question "What are the main problems with public green spaces and urban greenery (e.g. street trees) in the neighbourhood (e.g. size, distribution, quality, accessibility)?" the three groups in Thủy Biều discussed the following aspects:

Group 1 highlighted several shortcomings concerning public green spaces and urban greenery in Thủy Biều ward. They noted that only certain places such as schools have green spaces, but these areas are inaccessible to the public. The lack of planting spaces on sidewalks, absence of public parks for community activities, narrow streets with inadequate street trees, and encroachment of houses onto pavements and streets were mentioned as problems. Street widening necessitated tree removal, and there was a lack of shaded riverside walkways and sports facilities. Additionally, limitations in budget and planning hindered the creation of more green spaces, aggravated by urbanisation processes that left no vacant areas for planting trees.

Group 2 expressed concerns about the declining forest area and tree numbers, mentioning mismanagement and poor maintenance in some forested areas. They noted the high density of trees that are mostly privatised and the lack of public parks or community gardens. Road construction affected tree planting areas and community spaces, while a lack of street trees, limited sports facilities, and poor-quality trees that easily break during storms were also highlighted.

Group 3 acknowledged favourable soil conditions along the Huong riverbanks, promoting healthy tree growth and creating a clean, fresh environment suitable for community activities. Despite this, they noted limitations in current public green spaces, inadequate playgrounds for children, and a lack of proper public parks. They mentioned areas like An Hoa orchard being used for recreation but also posing risks due to its proximity to a national route. However, they appreciated the presence of trees in the streets at sufficient densities and the comfort offered by riverbank parks.

Cross-group aspects:

Common topics across the groups included concerns about the scarcity of public green spaces and parks, lack of playgrounds, inadequate street trees, encroachment of houses on streets, and limitations in space for planting due to urbanization and road construction.

Overview of major problems with public green spaces and urban green in the neighbourhood identified by local residents in Thủy Biều:

- Limited green spaces, mainly confined to schools, inaccessible to the public.
- Lack of sidewalk planting spaces for street trees, public parks, community gardens, and sports facilities
- Road construction impacting tree density
- Poor-quality trees prone to storm damage

4.2.2.3 Desired use of public green spaces

The question "How do residents want to use public green spaces in particular (e.g. playing with children, sports, recreation, urban gardening/urban farming)?" was discussed in Thủy Biều as follows:

Group 1 expressed a desire for various uses of public green spaces but noted the limited availability of such areas. While there was only one football field currently, residents wished for green spaces to serve as places for relaxation, exercise (especially for the elderly), playgrounds for children, gathering spots, meeting places, and venues for recreational activities like playing ping pong, badminton, reading, and entertainment. The elderly particularly appreciated these spaces as places to spend time in nature.

Group 2 emphasised the need for diverse amenities within green spaces. They highlighted the importance of playgrounds for children and creating living spaces suitable for all age groups, especially the elderly. Vong Canh Hill was identified as a diverse location for tourism, exercise, and community activities. Residents expressed interest in using green spaces for sports, exercising, picnics, pet walks, swimming in the river, organizing parties, and other recreational activities.

Group 3 described a range of activities residents engage in within green spaces. They highlighted the need for providing spaces for sports, exercises, relaxation, and children's activities. Residents incorporated these spaces into their daily routines, with morning and evening exercises, cycling, or walks to Vong Canh Hill. They emphasised its attractiveness for tourists, and the potential for integration of An Hoa orchard into new public green spaces. They also mentioned the significance of green spaces in education and public health improvement.

Cross-group aspects:

Common topics across the groups included a desire for diverse activities within green spaces such as exercise, sports, recreational activities, playgrounds for children, and spaces for relaxation and community gatherings.

- **Overview of desired uses of public green spaces and urban green in the neighborhood identified by local residents in Thủy Biều:**
- Desire for varied uses including relaxation, exercise, playgrounds, gatherings, and recreational activities
- Need for playgrounds and spaces suitable for all age groups
- Utilisation of Vong Canh Hill for various activities

5 Conclusions

Local stakeholders in Hué have identified several critical challenges related to climate change impacts in the city. One important aspect is deficiency of trees with large canopies in specific wards, resulting in hotter climates. This heat exacerbates various problems. Furthermore, rising sea levels have caused seawater intrusion, negatively impacting agriculture and leading to coastal landslides and residential loss. Moreover, the city faces unpredictable weather conditions, such as unseasonal rain, droughts, and floods, which have adverse effects on both public health and socio-economic development. These issues need to be considered in strategies for developing GBI within the city. Inadequate wastewater treatment facilities and poorly planned drainage systems have led to inundation in low-lying areas. Additionally, a lack of public awareness has contributed to littering and waste disposal issues. The rapid urbanisation, sealing of land, and industrial emissions are major contributors to increased temperatures and environmental degradation in the city. Furthermore, harmful agricultural practices, such as burning straw and excessive chemical use, have been identified as factors impacting both air and water quality.

The stakeholders have also identified both benefits and shortcomings associated with the existing green spaces in the city. According to the stakeholders, these green spaces offer several advantages, including the improvement of air quality, noise reduction, and aesthetic enhancement. In comparison to other Vietnamese cities, Hué's green spaces are relatively better maintained, providing a positive environment for its inhabitants. However, budget shortages have hindered proper maintenance and development of these green spaces. Moreover, there is an uneven distribution of green areas across the city, leading to disparities in accessibility and availability for different communities. The lack of adequate maintenance further exacerbates this issue.

The sustainability of existing green spaces is also threatened by extreme weather conditions, which negatively impact their maintenance and pose risks to historical monuments within these areas. The vulnerability of these spaces to severe weather events diminishes their resilience.

The local stakeholders have identified several challenges concerning GBI development in the city that require attention and solutions. One significant issue is the inadequate allocation of land for green spaces, particularly in newly merged wards. This scarcity of allocated space hampers the potential expansion and creation of vital green areas within these developing regions. Another notable challenge is the absence of community green spaces, amusement parks, and playgrounds in certain areas. The local stakeholders have also highlighted the lack of available information regarding construction of green spaces, plant species, and environmental protection measures. This absence of information hinders the implementation of sustainable practices and GBI.

In Conclusion, financial limitations pose a significant hurdle to GBI development in Hué, particularly concerning land purchase, procurement of necessary equipment, and hiring personnel for maintenance purposes. Insufficient funds restrict the ability to acquire necessary resources and

manpower essential for the establishment and maintenance of green spaces. The identified benefits of existing green spaces in Huế underscore the positive impacts of green spaces on the environment and human well-being, while the noted shortcomings highlight the challenges that need to be addressed, such as budget constraints, maintenance issues, and the need for more equal distribution and sustainable management to maximise the potential benefits of these areas in Huế. Addressing these challenges requires comprehensive strategies, including improved land allocation, the creation of community-oriented recreational areas, better information dissemination on environmental issues, and securing adequate financial resources for sustainable GBI development.

Aspects that should be addressed when developing policy recommendations based on the stakeholder's input:

- Implementation of targeted tree planting in areas with deficient tree canopies to combat urban heat islands and improve air quality
- Design and implementation of weather-resilient GBI, including improved drainage systems, to mitigate the effects of unpredictable weather conditions
- Paying attention to equal distribution of green spaces across the city to improve accessibility
- Allocation of sufficient financial resources for the implementation of new GBI and the maintenance and further development of existing green spaces
- Finding alternative funding sources to overcome financial limitations in GBI development
- Raising public awareness to educate residents on proper waste disposal, discourage littering, and promote environmental protection

At the district level, further important points were identified by local residents that should be taken into account in the planning and implementation of GBI in Huế. In Phú Hội, an inner city district, and Thủy Biều, a suburban district, local residents identified similar concerns regarding heat stress and air quality. Both areas face challenges related to air quality and climate change impacts. Phú Hội struggles with high-density construction and traffic, whereas Thủy Biều faces reduced air quality due to burning straws, construction dust, increased traffic, waste disposal, and increasing housing density. While both districts face air quality challenges from different sources, urban congestion in Phú Hội and diverse pollution sources in Thủy Biều, the shared concerns health impacts from air pollution and the need for sustainable solutions emphasise the necessity for comprehensive strategies to address these issues in both urban and suburban settings.

Residents in Thủy Biều specifically highlighted the adverse effects of climate change on agriculture, impacting local livelihoods and food production, while this concern was not explicitly mentioned in Phú Hội. Both areas experience negative health effects from rising temperatures, affecting

vulnerable populations like children and the elderly. Additionally, increased cooling costs due to higher temperatures pose financial burdens for residents, a concern highlighted in Thủy Biều.

Addressing these concerns through holistic urban planning approaches that prioritise varied plant species, adequate shading, and proper maintenance could significantly enhance the functionality and aesthetics of green spaces, promoting their utilisation and improving overall liveability. Overall, residents envision multifunctional public green spaces tailored to diverse age groups and activities, emphasising the importance of cleanliness and safety within these areas.

Based on the insights from the stakeholders and the residents of Phú Hội and Thủy Biều recommendations for decision-makers and urban planners in Huế should address the following issues:

Aspects that should be considered when developing policy recommendations based on the input from residents

- Enhancement and conservation of existing green spaces to ensure better air quality and better temperature regulation
- Renovation and expansion of existing green spaces while ensuring equal distribution within the city
- Allocation of more publicly accessible green spaces and parks in the suburban city districts, especially in areas where residents reported insufficient public green spaces
- Involvement of residents in green space planning and management to consider their needs and preferences
- Ensuring proper maintenance of existing green spaces to enhance the quality of urban green spaces
- Providing diverse recreational facilities and activities in public green spaces, incorporation of multifunctional spaces for various age groups, such as playgrounds, recreational areas, and spots for community gatherings
- Establishing safe and accessible recreational areas, ensuring safety for all users
- Tackling issues related to urbanisation, such as encroachment of houses on streets and green spaces and the reduction of planting areas due to road construction
- Inclusion of more green spaces and other GBI elements into new urban development projects

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