1 Summary of the project

The project **GreenCityLabHuế** aims to strengthen the climate resilience of the city of Hue (Thua Thien Hue Province, Central Vietnam) through **nature-based solutions (NBS)** with a focus on heat adaptation and air quality improvement. It will 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 NBS, in the urban area of Hue. 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)**, **Thua Thien Hue Institute for Development Studies (HueIDS)**, and the **Faculty of Architecture of the University of Sciences/Hue 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 Hue, including proposals for specific measures of GBI implementation.

By providing information and scenarios based on qualitative research, multilayer GIS modelling, impact assessment, and the **Urban Learning Lab (ULL)** approach via the **Green City Lab Hue (GCLH)**, and the project website, the project will inspire stakeholders, and decision-makers in Hue and other Vietnamese cities to mainstream GBI development into their urban planning processes. Thereby, knowledge transfer, and participation of stakeholders and the public in scenario development and planning processes will create co-learning opportunities and build up capacities for co-creation among administration, science, and the public.

During its definition phase, the GreenCityLabHuế project compiled a typology on GBI elements and, based on this, first narratives and scenarios for GBI development in Hue, and conducted initial research on the current situation and preconditions for future developments of GBI in Hue, which were summarised in the project's status quo report. The generated knowledge resulted in advancements and adaptions of the project design for the Research and Development (R&D) phase in particular the specification of the project's focus towards heat adaptation and air quality improvement, the inclusion of practical showcases, and the involvement of additional Vietnamese partners. The R&D-phase will prioritise the revision of land-use change models, carry out an impact assessment, implement participatory co-design and co-learning processes combined with practical NBS showcases, and develop the **Green City Vision Hue** for future GBI development in the city. The integration of NBS and GBI into Hue's urban development will protect a wide range of ecosystem services, while strengthening the city's social and ecological resilience to the increasing effects of climate change. With its co-creation and co-learning approaches, the project will serve as a blueprint for inclusive and participatory urban planning, that will inspire Vietnamese cities to take a greener and more inclusive path of urban development.

2 Description of the problem

Urban areas are both drivers of global warming and especially affected by its impacts. In this context, NBS, and as such the enhancement and expansion of GBI, are gaining importance in strategic urban planning as measures for climate adaptation and mitigation. Additionally, access to GBI is linked to issues of well-being, environmental justice, and human health.

Vietnam is one of the most densely populated countries in the world (308 person/km²) with a population of 97 million living in an area of only 331,221 km². Strong demographic growth leads to rapid urbanisation with a rate of 35.9% per year. The urban population accounts for 35% across the nation, which will grow to a share of 50% by 2045 (The World Bank 2020), with an urban population of about 52 million already by 2025 (Anh et al. 2013). Moreover, Vietnam is one of the ten countries hit hardest by climate change impacts (Eckstein et al. 2017) and is increasingly contributing to global warming by rising greenhouse gas emissions. Due to its exposed geographical location, especially Central Vietnam, where Hue is located, suffers regularly from extreme heat waves, storms, and heavy rainfall events (UNDP 2008). The outcome of such extreme weather events are often infrastructure damages and casualties (Dang et al. 2016). Hue 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. A first assessment of climate change impacts in Hue prepared for the definition phase indicates future warmer weather conditions and an increasing total annual precipitation. These estimated impacts will likely exacerbate existing environmental challenges in Hue including increasing heat stress and flooding. Other pressing environmental challenges, especially in the densely built city centre and university area, are air and noise pollution.

In Hue, green space per capita is comparatively high, with about 12.9 m²/person. However, according to the results of the definition phase, green (and blue) spaces are not equally distributed across the city – with access to qualitative green areas being particularly limited in the historical city centre – increasing the need for new GBI implementation. The further enhancement and expansion of Hue's GBI has the potential to mitigate the aforementioned environmental challenges by improving the provisioning of ecosystem services. In its infancy, this has also been considered by the city administration in recent urban expansion planning, as Hue experiences trends of repopulation and urban growth that result in a high demand for additional living space and thus in the construction of new suburban residential areas. Policies indicate that these newly developed areas should have higher green space ratios compared to the current state for improving the overall proportion of green spaces in the city of Hue (Rösler et al. 2020). Further results of the definition phase indicated, the need to better preserve, maintain, and improve existing elements of GBI. For reaching this, the city administration already implemented first smaller measures, e.g., an initiative for the maintenance of the street tree density through annual tree planting campaigns, as particularly matured trees are vulnerable to damages from climate

change. However, despite these first small initiatives, results of the definition phase also showed that the majority of projects with links to NBS in the Thua Thien Hue Province address the problem of flooding, while projects dealing with urban heat stress and air pollution are rare, and have not received much attention. Furthermore, local financing mechanisms for environmental projects are limited. A greener and more sustainable city contributes not only to health and well-being of its inhabitants, but also to the cityscape and tourist attractiveness. However, the economic and societal benefits of GBI need to be targeted, including the positioning of Hue as a (eco-)tourism destination, the creation of job opportunities, the establishment of competitive advantages over other Vietnamese cities, the improvement of living standards through the creation of more qualitative public spaces, and the increase of public awareness towards the benefits of GBI.

According to the Vietnamese Government status, Hue is categorised as a top priority city. Its prominent position as official “grade 1” city within the Vietnamese Government’s city rating system and its outstanding historic and educational importance give Hue the status of a role model for the more than 65 other provincial capital cities (Prime Minister 2005). The combination of its high exposure to climate change impacts, its national reputation as the “city of culture and education” with many young and interested students and committed citizens, and its touristic importance make Hue an ideal location for the establishment of an ULL for suitable, innovative, and participatory concepts of GBI development for strengthening urban climate change mitigation and adaptation. The GCLH supports Hue’s path towards a greener and more sustainable future and at the same time develops an alternative model to high-density cities like Hanoi and Ho Chi Minh City.

3 State of the art of science and technology and results of the definition phase

Typology on GBI elements: There is a host of reflections on GBI (Langemeyer and Gómez-Baggethun 2018, Haase 2015, Breuste et al. 2013), and several typologies of GBI and NBS have been developed, e.g., by GREEN SURGE (Cvejic et al. 2015) or Nature4Cities (Nature4Cities 2018). The GBI typology for the GreenCityLabHuế project is based on this mostly Europe-centred research, but was subsequently co-created during the definition phase, i.e., reviewed, revised and extended involving Vietnamese partners based on their expertise and in consultation with local architects and urban planners to obtain a common understanding. Whilst most of the key elements are common in both (Central) Vietnam and Europe, some types were identified that are unique to Hue, including green-blue gardens, garden cafés, and garden houses. In addition, few land-uses, e.g., cemeteries, commonly considered as GBI in Europe were found to be of lower importance to local stakeholders. Moreover, based on existing case studies (Radic et al. 2019, Kowarik et al. 2016, Langemeyer et al. 2015) and project findings (Eisenberg et al. 2019), the devised typology was amended with impact indicators in the form of a qualitative ranking schema of assumed impacts on seven selected ecosystem services: evapotranspiration, shading, water infiltration, water retention, air purification, biodiversity, and amenity value function.

Simulation of land-use changes based on stakeholder narratives: The modelling of land-use changes based on stakeholder narratives is a multi-step process that includes the development of narratives and their operationalisation. Imaginative scenarios are based on narratives of likely or desirable futures, and thus aim to generate ideas and strategies, to inspire and to stimulate shifts in thinking of participating stakeholders. They pose qualitative storylines, i.e., non-numerical descriptions of changes grounded, e.g., in existing plans or visions, and are co-produced to incorporate a diverse range of viewpoints and expertise (Houet et al. 2016, Larondelle et al. 2016, Mallampalli et al. 2016). As part of scenario development, specific environmental or societal challenges, pathways including drivers of urban development, zoning restrictions, or other limitations as well as opportunities or barriers for urban development are commonly identified. Scenarios are operationalised by devising and subsequently simulating land-use change transition rules, i.e., formal specifications of land-use changes including conditions or probabilities, thereby coupling qualitative descriptions with quantitative methods. Mallampalli et al. (2016) review a host of suitable methods for simulating land-use changes, including system dynamics, fuzzy cognitive maps, agent-based modelling, cellular automata and GIS, Bayesian networks, etc.

In the definition phase, first, narratives were formulated for an initial set of four scenarios, based on stakeholder interviews and the review of relevant local plans and policies (See Table 1). The scenarios follow a gradient of increasing degree of intervention, from the status quo to a biophilic city, and foresee an increasing implementation of GBI elements within existing land-uses, as well as the co-creation of novel biophilic land-uses, e.g., woody public green spaces. The interventions will be based on co-selected elements of the GBI typology deemed favourable for local conditions in Hue to promote public acceptance. Second, to provide a basis for the actual simulation of land-use changes, land-use data provided by the Vietnamese partners was processed including spatial alignment, reclassification, grouping, quality control, the creation of a draft inventory of green and blue spaces, and the definition of spatial intervention zones, i.e., “citadel”, “inner city”, and “outer city”. For each narrative, and under consideration of the aforementioned spatial zones, transition rules were defined accordingly in the form of a land-use change matrix and including quantitative estimates of change rates based on local conditions and policy objectives. Third, for a set of four test sites, land-use changes were simulated according to the defined transition rules using a GIS-based approach. The test sites include one site within the citadel, one inner-city site, and two sites in the outer city. Fourth, an assessment of impacts of the simulated land-use changes on selected ecosystem services has been carried out based on the GBI typology’s impact estimation. As the impacts are based on a qualitative ranking, a procedure with references to weighted summation/multi-criteria analysis has been implemented for an area-weighted (pseudo-quantitative) impact estimation.

Table 1: Shortened narratives for the four scenarios that were devised in the definition phase.

Scenario A – Business-as-usual	**Scenario B – Small-scale improvements**
City growth and expansion result in continuous encroachment into natural and agricultural land that is converted into built-up land and few urban green spaces. No measures will be taken within the existing infrastructures.	City growth and expansion result in continuous encroachment into natural and agricultural land. However, to improve the sojourn quality and as aesthetical intervention, trees are being planted in the newly built-up areas. Still, only few green spaces are created. Within the inner city and the citadel, additional trees are planted to improve air quality.
Scenario C – Lager-scale improvements	**Scenario D – Biophilic city**
Encroachment into natural areas will be limited. Instead, most of the expansion of Hue is accommodated by agricultural areas. The new built-up land will be greened and existing infrastructures will be improved by additional trees, intensive/extensive greening, green verges, retention basins, or rain gardens. Woody public green spaces will be created within newly constructed areas. Existing green spaces will be enhanced by playgrounds.	Natural areas will be protected, and forest areas will be increased by afforestation. Agricultural areas and undeveloped land might be built. Newly constructed buildings and areas enable the greening of roofs and facades, and the high share of woody public green areas. Existing infrastructures will be improved by additional trees, intensive/extensive greening, green verges, retention basins, rain gardens or bioswales. Public green spaces will be enhanced by additional trees, woody elements and playgrounds.

For a more detailed assessment at city-level, especially for microclimatic impacts (temperature regulation) and air quality, in the R&D-phase research on the impacts of GBI elements under local climatic conditions will be furthered, and findings from the literature review incorporated accordingly. For a more specific assessment of the impacts of various GBI elements at site-level, ENVI-met will be used in the R&D-project (cf. T1.2). ENVI-met poses a computational fluid dynamics-based numerical simulator for the three-dimensional assessment of microclimatic and bioclimatic conditions under consideration of surface, plant and air interaction (Rui et al. 2019). It is frequently used for simulating spatial and temporal profiles of temperature, wind velocity, relative humidity, and thereby, thermal comfort. ENVI-met is also used for the assessment of PM10 concentrations and thus can be employed for the evaluation of impacts of NBS interventions on air quality (ibid.). ENVI-met has been used in a multitude of case studies, with a focus on Europe and Asia, particularly China (Tsoka et al. 2018).

Analysis of the policy framework for NBS in Hue: The preliminary analysis of the policy framework including legal documents and plans regarding NBS in Hue showed that reference points for NBS and GBI could only be found indirectly. A comprehensive integration and mainstreaming of approaches of NBS into the policy framework remains a task for future project phases. Moreover, climate change adaption and mitigation need to be further embedded at the local level. Overall, the planned development in Hue offers numerous possibilities to integrate NBS. Additionally, there is the political backing by the current leaders – the chairman of Thua Thien Hue Provincial People's Committee, Mr. Phan Ngoc Tho, and the mayor of Hue, Hoang Hai Minh – both being supporters of environmental and climate protection.

Stakeholder analysis for NBS in Hue: A stakeholder analysis comprises steps to systematically analysing interests and capacities of different stakeholders so that they can be considered when developing and/or implementing policies or programmes (Hemmati 2020, Schmeer 1999). The development of NBS is a crosscutting issue that requires a multidisciplinary and multi-stakeholder framework. Thus, an effective implementation of NBS strongly depends on the relation of

stakeholders from various disciplines and sectors that are usually not used to cooperate closely. This is also the case in Hue. During the definition phase, Hue's key stakeholders for the implementation of NBS were identified. However, key actors and their precise relations with each other need to be tested in practice and adapted accordingly. Nevertheless, already the initial stakeholder analysis revealed the large number of stakeholders and their diverse backgrounds, making an effective collaboration on NBS and GBI a challenging task. In addition, the knowledge transfer between science on the one hand public and administration on the other hand needs to be strengthened. It was pointed out that the diverse stakeholders don't have a common understanding of NBS and their knowledge and awareness of environmental planning differ largely or are generally lacking. Additionally, the overall public awareness of climate change varies, with local experts indicating limited states of awareness across the public. Therefore, more targeted information and education on climate change are recommended, especially as many people in Hue are affected by urban heat stress, and air and noise pollution. Nevertheless, first approaches of multi-stakeholder cooperation in an environmental context could be identified. The government is working with businesses and investors to upgrade the environmental quality system and as a result of the cooperation between the public administration and science, the App Hue-G for provincial leaders to monitor specific environmental data like air quality and water levels was developed.

Public participation in Hue: Stakeholder and citizen participation plays a crucial role in the effective implementation of NBS and enables public interests to be considered while strengthening a project through local knowledge, thereby increasing acceptance for the implementation of measures. As the results of the definition phase indicate, the level of public participation in Hue is rather low and often remains on the stage of providing information on planned urban developments to the public without giving the opportunity of taking influence on the planning. However, there is a social need and responsibility to involve local communities to generate (co-)benefits and acceptance. Therefore, in the R&D phase, the project will continue in-depth research on how to best embed public participation processes into planning and policy recommendations regarding NBS in a Vietnamese context. Thereby, the ULL approach will be used for the GCLH (cf. WP3) to support targeted and participatory planning of NBS.

4 Objectives, approaches pursued, and indicators of project success

The project has the overall objective to contribute to the increase and strengthening of social and ecological resilience in Hue and its surrounding province by promoting NBS and GBI approaches, including the promotion of protecting and enhancing existing urban ecosystems and the services they provide, as well as planning and implementing novel green spaces, and GBI. Thereby, the project especially focuses on active participation, and involvement of experiences and visions of local stakeholders, experts, and other knowledge holders such as citizens.

Explicitly, the project aims to ***model the implementation of land-use changes and NBS (objective 1)*** at city-level, and in more detail at specific sites within the city, to illustrate different pathways of future urban development and desired futures, e.g., based on policy goals and visions. To do so, the integration from the participatory co-design and co-learning process as well as local knowledge is considered crucial for successful scenario implementation. A further objective is the ***impact assessment of the modelled land-use changes and NBS interventions on the supply of selected ecosystem services (objective 2),*** for the identification of benefits and potential co-benefits of proposed NBS interventions. Furthermore, impact assessment takes (changes of/trends in) the demand for ecosystem services into account. In so doing, the project provides the basis for identifying best-practice measures and developing policy recommendations. The project aims at ***capacity building, education, and the promotion of co-learning opportunities and co-creation procedures of NBS interventions (objective 3)*** to engage and activate different interest groups to be aware of and participate in planning processes in their city and neighbourhoods. This will connect urban residents with professionals through public engagement with NBS to build awareness and ecological literacy. Furthermore, the project seeks to ***inspire other Vietnamese cities (objective 4)*** to integrate NBS approaches and co-learning and co-creation processes into their agendas. In addition, ***the basis for a subsequent implementation phase (objective 5)*** will be established, including a co-created and co-developed draft Green City Vision Hue for an effective implementation of NBS in Hue, a detailed concept and project plan for the implementation phase. Finally, the main objective of the R&D phase is the ***development of a city-wide vision document including proposals for a green and sustainable city in coordination with decision-makers, practitioners and the public (objective 6)***, to do both strengthen climate resilience and improve (micro)climatic conditions and air quality and thus the quality of life in the urban region. Thereby, the project will build on findings of the impact assessment of NBS interventions and the best-practice measures proposed, on policy recommendations for effective mainstreaming and implementation of NBS, on the evaluation of the pilot projects and feedback from the various stakeholders.

To reach the abovementioned objectives the following approaches will be applied: Through ***multilayer GIS (Geographic Information System) models*** and supporting (GIS-based) modelling technologies, different narrative-based scenarios, i.e. proposed NBS interventions for a greener and more sustainable city will be simulated at city-level. In order to provide more specific findings on NBS interventions, ENVI-met, a three-dimensional model incorporating computational fluid dynamics, will be deployed for scenario-based simulations at site-level. In preparation for the ***ENVI-met simulations***, on-site measurements of the microclimatic conditions will be carried out at the selected sites. In addition, an ***eco-assets accounting***, in the form of an ***impact assessment*** of the modelled land-use changes and NBS interventions on relevant ecosystem services, e.g. temperature regulation or air purification, will be carried out to evaluate the benefits, potential co-benefits and values of the ecosystem services provided by the proposed

NBS interventions. In this context, the supply of ecosystem services is contrasted with the demand for them, to identify potential gaps in ecosystem service provisioning within different city districts or for affected stakeholders. In the context of this project, the ***Urban Learning Lab (ULL)*** approach will be used for the GCLH (i) to motivate professionals and authorities to integrate GBI into their agendas, (ii) to promote best practices of NBS and GBI planning in official urban planning procedures, (iii) to encourage citizens to learn about and to participate in the planning of NBS in their cities, (iv) to develop specific proposals for measures of NBS implementation in Hue, and (v) to develop a "blueprint" of the above mentioned co-creation and co-production processes to inspire other cities in Vietnam and to stimulate a spill-over effect. ***Scenarios*** will be used as a tool towards targeted planning of future NBS development and learning multiple ways to go where (i) different NBS can be involved according to the local settings and resources (including analysis of barriers for the implementation); and (ii) different constellations of stakeholders can be involved in setting/outlining the targets. All applied approaches contribute to the development of the co-designed Green City Vision Hue (cf. WP5) and a subsequent implementation project.

The successful implementation of the project can be evaluated based on the indicators in the following table (Table 2):

Table 2: Indicators for the achievement of the project objectives.

Indicator objective 1:	Completion of modelling the implementation of land-use changes and nature-based solutions at city- and site-level and respective evaluation of city-scale and site-scale scenarios.
Indicator objective 2:	Completion of the impact assessment of modelled land-use changes and nature-based solution interventions on ecosystem services at city- and site-level to illustrate changes in the supply of ecosystem services and link them to the demand for ecosystem services.
Indicators objectives 3/4:	Number of decision-makers, relevant stakeholders, and citizens who took part in the participatory events and policy round tables, number of visitors of the GCLH, realisation of four small-scale NBS showcases, number of visitors of the project website, number of clicks on the short films, number of representatives from other Vietnamese cities and national stakeholders who took part in the final event and were informed about the project by the project team via targeted communication activities
Indicator objective 5:	A full project application and detailed project plan for a subsequent implementation project was submitted to the BMBF
Indicator objective 6:	Completion of the co-designed Green City Vision Hue for the implementation of nature-based solutions in the city of Hue.

5 Relevance of the project to the funding goals of BMBF

The project creates a space for the exchange of information, data, and ideas on NBS in Hue between stakeholders from science, politics, administration, practitioners, and civil society; and to experiment with different urban development scenarios. This international and multidisciplinary cooperation translates approaches and ideas of sustainable urban development into specific options for action and makes possible changes visible for the wider public. This allows not only the development of widely accepted, realistic and thought-out activities to improve socio-ecological conditions, climate change mitigation, and resilience in Greater Hue, it also strengthens the capacities of Hue's administrative-political decision-makers to translate general urban

development guidelines into practical and suitable measures and outputs by working together with scientists, citizens, and civil society representatives. Hue can serve as a model to transfer the described approaches to other decentrally governed, fast-growing and climate change-prone cities in Vietnam.

6 Planned research activities and the work program of the R&D-phase

WP1 Modelling the implementation of land-use changes and nature-based solutions (Lead: HUB)

WP1 will provide the GreenCityLabHuế project with a revised set of land-use and land-use change scenarios based on results of the definition phase including: (i) development of a co-created case study typology that identifies relevant GBI elements in the context of Hue, (ii) creation of narratives that capture visions on urban development of Hue; (iii) devising (pilot-kind) land-use change rules and interventions within existing land-uses that formalise the aforementioned narratives; and (iv) collection and systemisation of relevant GIS data. WP1 will heavily built on these findings in the R&D phase. However, WP1 will also extend and revise the proposed NBS interventions and scenarios following inputs of local stakeholders. This could also include the addition of novel data, e.g., the 2030 urban plan of Hue, depending on timely availability.

In the R&D phase, two Tasks will streamline scenario development as described below: T1.1 will focus at the city-level, whereas T1.2 focuses at specific sites within the city, to model NBS interventions in more detail. To do so, a co-design approach is deemed crucial, to allow for a proper consideration of local conditions, e.g., regarding zoning restrictions or building codes. Therefore, WP1 is firmly embedded within the participatory co-design and co-learning process (cf. WP3). The results obtained in WP1 will be fed into the impact assessment carried out in WP2.

T1.1 Land-use change modelling at city-level: Using a multilayer GIS model and supporting (GIS-based) modelling technologies, T1.1 will provide a revised model of land-use changes and NBS interventions within existing land-uses at city-level for the whole of Hue. This mapping of changes and interventions is based on the narratives developed in the definition phase of the GreenCityLabHuế project and the associated transformation rules that will be applied to a dataset of current land-uses prepared in the definition phase. The effects of drivers on local conditions that were identified through interviews in the definition phase, for example, ongoing urbanisation or population growth, will furthermore be incorporated into the scenarios, e.g., by means of regression of trends regarding population count or urban densities. The modelled interventions build upon the GBI typology devised in the definition phase, and are modelled within sector-specific land-uses, e.g., residential land, commercial and industrial land, or transportation land uses, and with those GBI elements being considered that are deemed most suitable per sectoral land use. In this context, the embedding of T1.1 with the co-design and co-learning process of the GCLH is crucial: Preparatory scenarios at city-level (M1.1) will be fed into WP3 to incorporate

multiple viewpoints and a range of expertise in the modelling process, with feedback considered in the finalisation of scenario models at city-scale (M1.2). By exploring possible future land-uses under different scenario conditions, these models will subsequently enable the assessment of city-wide impacts (cf. WP2), inform policy making, support urban planning, and provide a further basis for the co-design and co-learning process in form of the GCLH (cf. WP3).

M1.1: *Pilot-type land-use change models are implemented (PM 6)* | ***M1.2:*** *Land-use change scenarios are completed (PM 12)* | ***D1:*** *City-scale scenarios evaluated, and report completed (PM 15)*

T1.2 Nature-based solutions modelling at site-level: T1.2 adapts the scenario modelling performed in T1.1 at the level of co-selected sites and localities within Hue. However, by increasing the spatial scale to the level of city blocks or individual building ensembles, T1.2 will be able to provide more specific models of NBS interventions, thereby representing the implementation of GBI elements in more detail. To do so, we adopt ENVI-met, a three-dimensional model incorporating computational fluid dynamics that is deemed particularly suitable for the modelling of urban microclimates and urban atmospheric processes at site-scale. T1.2 will implement these ENVI-met simulations for the selected sites. First, status quo simulations of site-specific conditions will be prepared, which requires gathering site-specific data regarding built-up geometries, sealing, surface textures, vegetation properties, etc., analogous to the status quo land-use dataset used in T1.1. Second, to allow simulation of local conditions, ENVI-met requires calibration to local (subtropical) conditions. This calibration requires on-site measurements including air temperature, solar radiation, wind speed, and relative humidity that is to be carried out or supervised by Vietnamese project partners. Third, scenario-specific ENVI-met simulations will be implemented. Analogous to T1.1, these simulations incorporate NBS interventions based on the previously developed narratives and the GBI typology. Similar to T1.1, a feedback loop through the co-design and co-learning process (cf. WP3) is also considered for T1.2. Thereby, stakeholders and decision-makers are involved in the co-creation of the ENVI-met simulations. The findings of T1.2 will provide the foundation for the modelling of impacts of GBI elements on microclimatic and atmospheric conditions in WP2.

M1.3: *ENVI-met models are implemented (PM 9)* | ***M1.4:*** *ENVI-met models are completed (PM15)* | ***D2:*** *Site-scale scenarios evaluated, and report completed (PM 18)*

WP2 Land-use change and nature-based solutions impact assessment (Lead: HUB)

WP2 builds on the scenarios and models implemented in WP1 and uses these findings to assess the actual impacts of the modelled land-use changes and NBS interventions on ecosystem services. More specifically, WP2 will evaluate how the proposed interventions affect the types and conditions of urban ecosystems, and how these changes affect the quantity, quality, timing and location of ecosystem service supply and its relation with ecosystem service demand. WP2

will therefore identify relevant ecosystem services, e.g., temperature regulation, air purification, or recreation, and estimate both baseline (status quo) conditions and the impacts (changes) in the provisioning of these services to account for ecosystem service supply. Here, potential co-benefits for other socio-environmental challenges identified for Hue, e.g., regarding flooding, water quality, or biodiversity, shall be identified. To account for ecosystem service demand, the benefits of NBS interventions will be attributed to affected stakeholders. Similar to WP1, this assessment is two-fold, and conducted on the scale of the whole city of Hue (cf. T2.1), as well as on the level of the co-selected sites (cf. T2.2). A subsequent comparison of scenarios will then provide the basis for identifying best practice measures and for developing policy recommendations (cf. WP4).

T2.1 Assessment of impacts on ecosystem services at city-level: T2.1 is based on T1.1 and will assess impacts on ecosystem service supply and demand at city-level, and within co-defined, larger areas of interest (such as the citadel/central city as a whole, as well as the urban periphery). It uses the mapped scenarios from T1.1 as input for an indicator-based GIS-based estimation of changes in ecosystem service supply at land-use level, wherein specific values for ecosystem service indicators, e.g., cooling performance or recreational area per capita, will be applied for the assessment (Schwarz et al. 2011). Additionally, findings from a competition on designing the proposed interventions (cf. T3.5) will be incorporated. In the assessment, a special focus is given to those land-uses for which NBS interventions are foreseen. However, co-identified land-uses of interest may also be investigated more closely; for example, cemeteries have been identified in the definition phase of the project as under-appreciated GBI elements, for which awareness of ecosystem service supply should be raised. The estimated changes in ecosystem service supply are subsequently contrasted with ecosystem service demand to identify actual improvements through NBS interventions, as well as possible intervention gaps, e.g., by also employing spatial hot spot/cold spot analysis. Based on the mapped scenarios, differences in landscape metrics will be evaluated to identify linkages of the proposed NBS interventions with biodiversity and habitat provisioning, and to support urban green planning (Walz 2011, Seto and Fragkias 2005). Interim results of T2.1 will be discussed within the co-design and co-learning process, and feedback of local stakeholders and the interested public will inform the finalisation of the impact assessment.

M2.1: *Interim impact assessment at city-level is completed (PM 12)* | ***M2.2:*** *Impact assessment at city-level is completed (PM 18)* | ***D3:*** *Impact assessment at city-level evaluated, and report completed (PM 21)*

T2.2 Impact assessment on ecosystem services at site-level: T2.2 is based on the ENVI-met scenarios modelled in T1.2, i.e., models of small-scale NBS interventions at site-level. Task 2.2 uses these models for a specific assessment of the impacts of the modelled NBS interventions on ecosystem services in comparison to the status-quo, i.e., concerning changes in microclimatic

and bioclimatic conditions, e.g., heat stress, or air quality. T2.2 will visualise identified impacts, for example, using three-dimensional, interactive visualisations, or short animations. Initial findings of T2.2 will be fed into the co-design and co-learning process and feedback will inform potential revisions and the finalisation of the impact assessment at site-level. Moreover, and similar to T2.1, findings from a competition on designing NBS interventions (cf. T3.5) will be incorporated in the assessment. Due to the spatial scale of Task 2.2, this task will be able to model changes in ecosystem service supply in more detail when compared to T2.1. Interim results of T2.2 can thus also serve as an important feedback for improving the city-level assessment carried out in T2.1.

M2.3: *Interim impact assessment at site-level is completed (PM 15)* | ***M2.4:*** *Impact assessment at site-level is completed (PM 21)* | ***D4:*** *Impact assessment at site-level evaluated, and report completed (PM 24)*

WP3 Establishment and coordination of the participatory co-design and co-learning process – the Green City Lab Hue (Lead: UfU)

WP3 comprises the establishment and coordination of the GCLH. It is designed as an ULL and conceptualised as a publicly accessible venue for information, open exchange, and learning on NBS and GBI in Hue. The ULL approach is based on a systemic transformation methodology to offer local stakeholders research-based expertise and to actively involve them with their local and specialist knowledge in urban planning processes. This ensures that knowledge is exchanged and not only transferred in one direction, and that co-creation and co-production of urban development measures are made possible (van der Jagt et al. 216). The ULL approach also enables and promotes the exchange of experience and knowledge between Vietnamese cities.

The GCLH will serve as a source of information and point of contact for NBS in Hue. It is geared towards the interested public and stakeholders in the field of NBS and GBI (decision-makers, business, practitioners, scientists, students, etc.). Its programme will include participatory events with citizens and relevant stakeholders, policy round tables with decision-makers, a regularly updated exhibition on potential NBS for Hue and specific project results, and practical showcases of small-scale NBS implementation at selected spots in the city. All these activities will be accompanied by the dissemination of information materials (flyers, brochures, etc.) tailored to specific target groups. In addition, the GCLH will serve to create an active network of relevant stakeholders in the Thua Thien Hue Province and across the country, which is pivotal for the future development of NBS and as such GBI in Hue, and for the implementation phase of the project. The overall objectives of the GCLH are (i) to inform the public and relevant stakeholders about the project while initiating a co-design and co-learning process about NBS planning and its effects on Hue, (ii) to discuss NBS and implemented interventions in order to create a knowledge transfer and generate vital input for shaping Hue's NBS , and (iii) to exhibit (interim) project results. As a result of the definition phase, it is planned to set up the GCLH on the premises

of HueIDS, open for the public during opening hours, and jointly operated by staff from the MISR and HueIDS. The activities at the GCLH will be accompanied and supplemented by the project website (cf. WP6).

T3.1 Setup of the co-design and co-learning space: Green City Lab Hue: After the preparation and provisional set up of the GCLH during the definition phase, a comprehensive concept for its implementation and operation will be elaborated. The content design will be derived from results of the project definition phase and coordinated with the project consortium in dialogue with local actors. Within the concept, the different target groups, the interested public and actors in the field of NBS and GBI, including gender aspects will be considered and edited accordingly. To supplement the concept, administrative and organisational preparations are being made to set up and open the GCLH as a permanent venue on-site.

M3.1: *Concept on implementing and operating the Green City Lab Hue is completed (PM 6)* | ***M3.2:*** *The Green City Lab Hue is set up and ready for opening (PM 12)*

T3.2 Public opening of the Green City Lab Hue and co-design workshop event: With the aim to raise awareness for the GCLH and to inform about its concept and future events, a public opening event will be prepared and conducted. In addition, the first co-design workshop will be conducted in T3.2 as part of the GCLH concept. The workshop will serve to present and evaluate the results from the modelling of land-use changes at city-level and the corresponding land-use change scenarios as well as the modelling of NBS at site-level, using ENVI-met models (cf. WP1) to various stakeholders. Moreover, the workshop aims to identify priority sites for further modelling.

M3.3: *Public opening event held and co-design workshop conducted (PM 12)*

T3.3 Operating the Green City Lab Hue: Promotion of capacities and forms of participation: Based on the developed concept (cf. M3.1), the GCLH will offer an appealing programme to its audience, primarily consisting of two participatory events with citizens, four policy round tables with decision-makers and key stakeholders, and a closing event (cf. T3.4). Conducting a series of events, the GCHL intends to promote an ongoing dialogue on NBS in Hue. To complement these activities, within the framework of the GCLH, four practical showcases in Hue will be conducted (cf. T3.5).

T3.3.1: Green City Lab Hue activities with the public: A series of public participatory events will be organised with the major objective of creating a dialogue and a form of cooperation with citizens and representatives of civil society groups on the development of best-practice measures and thus the final Green City Vision Hue for the implementation of NBS in Hue (cf. WP5). Therefore, identifying demand and preferences for and acceptance of certain NBS interventions and their implementation are of special importance. The events will focus on a participative collection of ideas and visions for the implementation of NBS in Hue. Therefore, participatory

methods will be applied inspired by formats such as open space, planning workshops, and planning for real. To obtain representative results for participation on the Green City Vision Hue and to include also other citizens who are not directly involved in the participatory events (especially less well represented groups like women, children, and people of the poorer social classes), students from the Faculty of Architecture of HUSC will conduct an additional survey on the topic. Both participatory events will be evaluated jointly by UfU and MISR. Their results and those of the survey will be compiled as a collection of ideas and visions to be further developed in subsequent steps of the project.

M3.4: *First participatory event held (PM 15)* | ***M3.5:*** *First batch of ideas and suggestions by the public collected (PM 24)* | ***M3.6:*** *Second participatory event held (PM 27)* | ***M3.7:*** *Second batch of ideas and suggestions by the public collected (PM 30)* | ***D5:*** *Report on the Green City Lab Hue findings on the participatory co-design and co-learning process completed (PM 33)*

T3.3.2: Green City Lab Hue activities with decision-makers and key actors: As the research results from the definition phase revealed, in the context of urban planning, coordination between different departments involved needs to be harmonised and environmental planning needs to be better integrated into urban planning to be effective. To address these issues, a series of round tables with decision-makers and key stakeholders regarding NBS and GBI in Hue will be established as annually scheduled consultative meetings. The round tables will be set up in the form of a continuous council of selected key persons with clearly defined tasks and responsibilities. The major tasks of the round tables are (i) establishing a common working culture, (ii) identifying leverage points for the integration of NBS into current and future urban developments (iii), discussing on how to integrate demands, ideas and visions from the public into NBS planning, (iv) discussing different modes of financing, i.e. public-private partnerships (public sector) and local funding (private sector), and (v) evaluating and further developing project outcomes (scenarios, impact assessment, showcases, guidelines, draft Green City Vision Hue). The round tables will be jointly convened by HueIDS and UfU supported by MISR.

In addition, ongoing developments in Hue like the extension of the urban area, the strategies “Hue – 4 seasons of flowers”, “Hue – Cycling City” and “Hue - Smart City” will be subjects of the round tables in order to integrate the topic of NBS at an early stage of current developments. The results of the round tables will be used for the development of recommendations for best-practice measures, decision support, policy recommendations (cf. WP 4), and especially to formulate the Green City Vision Hue (cf. WP5). The substantive work of the annually round tables will be complemented by additional regular consultations between the round table participants and HueIDS to enable continuous flow of information and coordination with decision-makers and other relevant stakeholders. Additionally, experts from other (international) projects will be invited for further exchange (e.g. FloodAdaptVN). The round tables will be designed and conducted to

promote its continuation beyond the subsidised project period with the desired objective to establish a strong coordination mechanism for the implementation of NBS in Hue.

M3.8: *First policy round table conducted (PM 15)* | ***M3.9:*** *Second policy round table conducted (PM 27)* | ***M3.10:*** *Third policy round table conducted (PM 33)* | ***M3.11:*** *Fourth policy round table conducted (PM 42)*

T3.4 Closing event of the R&D phase and presentation of results: At a final event of the GCLH, all project results, in particular, the Green City Vision Hue (cf. WP 5), will be presented officially to all involved stakeholders and the general public, including representatives from other Vietnamese cities and the national level, in order to disseminate the project results and provide an opportunity for knowledge transfer to other Vietnamese cities.

M3.12: *Closing event of the R&D phase including presentation of the co-designed Green City Vision Hue is completed (PM 48)*

T3.5 Showcases for the implementation of nature-based solutions in Hue: In T3.5, first small-scale NBS interventions at site-level, so-called showcases, will be implemented. They aim to test and demonstrate the effects of NBS on local environmental conditions and human well-being. The integration of such a practical module into the project has been strongly recommended by the local partners and stakeholders identified during the definition phase.

In preparation for the showcases, a competition with local architecture, urban planning, and/or environmental science students on designing small-scale NBS interventions for pre-selected sites will be conducted by MISR and HUSC, supported by UfU and HUB. Four NBS projects will be selected for exemplary implementation by a jury, consisting of Vietnamese and German experts, and representatives of local communities and civil society. Subsequently, the four selected showcase designs will be implemented at the pre-selected locations throughout the city under participation of the involved students and voluntary residents of the sites. Findings of the design competition will be incorporated into the impact assessment (cf. WP2). The showcases will cover different types of NBS related to selected ecosystem services, e.g., air purification, or temperature regulation, and different forms of stakeholder involvement. This variety of projects provides a broad insight in different NBS and their effects on mitigating heat stress and improve local air quality. The showcases will be scientifically accompanied by HUB, MISR and HUSC, including measurements of their effects, which will allow the results from the impact assessment to be validated. The scientific evaluation allows general conclusions to be drawn for the development of best-practice measures and policy recommendations (cf. WP4) and thus the Green City Vision Hue (cf. WP5). Furthermore, the showcases will be publicly accessible and complemented by information boards that describe their purpose and effects and inform an interested audience about the GCLH. This makes the activities of the GCLH visible for the public in different parts of the city and contributes to environmental education and awareness-rising for NBS among

citizens. Additionally, some on-site events will be organised by the local GCLH team to inform interested citizens and stakeholders about the showcases. Moreover, each showcase will be portrayed by a short film (3-4 minutes, bilingual), accessible via the project website, making it easy to understand the (complex) project approaches and to disseminate the ideas of the project regionally, nationally, and globally.

M3.13: *Design competition is completed and four winning designs selected (PM 12)* | ***M3.14:*** *Four showcases implemented (PM 36)* **|** ***M3.15****: Scientific support and evaluation of the showcases is completed (PM 39)*

WP4 Decision support and policy development (Lead: HUB, UfU)

WP4 addresses the decision support and policy development in the form of a guideline on effective implementation and best practices along with policy recommendations to support decision-makers and practitioners in the implementation of NBS. While T4.1 focuses primarily on proposing specific best-practice measures to improve relevant ecosystem services, T4.2 aims to develop recommendations and guidelines for the mainstreaming of NBS into the policy framework of Hue and for the implementation of NBS in practice. Combined, both tasks cover a natural science, and social and political science perspectives on NBS in Hue, thus ensuring a holistic approach for an effective implementation of NBS in the city. The results of WP4, among others, are supposed to form the basis for the subsequent development of the Green City Vision Hue (cf. WP5).

T4.1 Development of recommendations for nature-based solutions actions: T4.1 is based on the results from the impact assessment (cf. WP2) and the ideas, and feedback expressed by the public, decision-makers and key actors during the various participatory events and the policy round tables (cf. T3.3). The recommendations will propose best-practice measures to improve specific ecosystem services, or a combination of such services, to benefit either (i) microclimatic conditions, e.g., temperature regulation; (ii) air quality; (iii) bioclimatic conditions, e.g., heat stress; or (iv) all or a combination of these factors, specifically considering (additional) co-benefits. These best-practice guidelines will be made accessible through a decision support tool that will be developed as part of T4.1. This decision support tool shall aid decision-makers and practitioners in making informed decisions on the selection of NBS interventions. The tool will enquire selected parameters, e.g., desired environmental impact (urban heat, air quality, bioclimate), available size for implementation, or current land-use. Based on the input, specific NBS interventions are recommended by the decision support tool. It also illustrates co-benefits of the proposed best-practice measures, e.g., for recreation, biodiversity, water quality and flooding. The recommendations will include a choice of tree species selected according to their acceptance by the inhabitants and their climate resilience, and a guidance on tree requirements and planting.

D6: *Recommendations for planners and decision-makers completed (PM 36)*

T4.2 Development of recommendations for policy and practice to mainstream and implement nature-based solutions – support material for policy and practice: With the objective to provide recommendations for the mainstreaming of NBS into the current policy framework and for the implementation of NBS on-site, sound support material for policy and practice will be compiled. This material will be based on the findings of the impact assessment (cf. WP2), the co-creation and co-learning processes (cf. WP3), the recommendation for NBS interventions (cf. T4.1) and supplemented by further analysis and research. The support material for policy makers and key stakeholders will contain an in-depth policy analysis and stakeholder analysis in relation to NBS and GBI in Hue, an analysis of the financing and participatory instruments to realise NBS projects, and screening of past, current and future projects related to NBS, along with specific policy recommendations to mainstream NBS into the local and regional plans, strategies and policies. The support material for practitioners (like representatives from companies, NGO's, planning offices, housing communities, etc.) will contain guidelines, good practices, and checklists for an effective implementation of nature-based solutions in form of a practical handbook.

D7: *Policy recommendations for an effective mainstreaming and practical manual for an effective implementation of nature-based solutions completed (PM 36)*

WP5 Development of the Green City Vision Hue (Lead: HUB, UfU)

WP5 will develop a co-designed comprehensive strategical document, the **Green City Vision Hue**, combining the recommendations for NBS actions, the policy recommendations and the practical handbook from WP4 with co-designed actions for implementation of NBS in Hue resulting from the participatory events and the round tables from WP3. Hence, in WP5, the project application for the following implementation phase will be formulated accordingly. In this phase, parts of the co-designed Green City Vision Hue are to be put into practice with German and/or local Vietnamese support.

T5.1 Development of the proposal for the implementation phase: In T5.1 a detailed plan for the subsequent project (implementation phase) based on the recommendations for practitioners and decision-makers (cf. T4.1), the developed support material for policy and practice (cf. T4.2) and the feedback from the public, decision-makers and key actors (cf. WP3) will be developed. Together with the draft Green City Vision Hue (cf. T5.2) it will serve as a key element for the project application. The project proposal will be prepared by the project consortium in parallel to the related project activities and a draft will be presented to and discussed with the Vietnamese partners to include their input and ideas. On this basis the draft will be adapted, and the final project application will be completed.

D8: *Project proposal for the implementation phase completed and submitted (PM 42)*

T5.2 Development of co-designed actions – the Green City Vision Hue: As an overall result of the project, the Green City Vision Hue will be developed. In the form of a comprehensive blueprint, the document will contain guiding principles as well as specific measurements for a greener and more sustainable urban development of Hue. Therefore, in the context of NBS and GBI, analyses along with resulting recommendations will be presented based on the impact assessment of land-use changes and NBS, the policy framework, administrative structures, stakeholder management, and public participation. Particular attention will be paid to developing a strategy that is intertwined with local and regional strategies and plans and also serves to mainstream the promotion and implementation of NBS into Hue's general policy framework. The co-designed vision will be developed by the project team in an iterative process involving decision-makers and key stakeholders during the round tables and the public during the participatory events (cf. WP3). Relevant project results, such as the evaluation of the showcases (cf. T3.5), the decision support and policy development, and the handbook for practitioners (cf. WP4) will be incorporated. Finally, the Green City Vision Hue will give a specific selection of proposals for the implementation of measures for the implementation phase of the project. In a last co-creation activity, the draft document will be presented to decision-makers and relevant stakeholders and opened for their comments and evaluations. These will be considered and integrated into the document during the finalisation of the Green City Vision Hue.

M5.1: *Draft Green City Vision Hue is completed (PM 42)* | ***D9:*** *Co-designed Green City Vision Hue is completed (PM 45)*

WP6 Communication, knowledge transfer and dissemination (Lead: UfU, Co-Lead: HUB)

T6.1 Communication: For external communication, the project consortium will use different channels tailored to different target groups. The GCLH (cf. WP3) will serve as the central point of contact for local stakeholders and the public in the Thua Thien Hue Province by providing target-group specific information. The local team of the GCLH will also actively address, invite, and involve local decision-makers, further relevant stakeholders, and the public regarding specific project activities. Another central instrument for external communication, also beyond the borders of the Thua Thien Hue Province, will be the project website (www.greencitylabhue.com), which was already set up in the definition phase and will be further developed in the R&D phase of the project. In addition to its function as the central medium for reporting all project news, such as announcements and coverage of project events, reporting on interim results, the website will be also used as the virtual counterpart and addition to the GCLH by making all information materials available online. Therefore, the existing content of the project website will be updated with recent information and the website will be further developed technically, giving more possibilities for displaying project results in an interactive way and addressing both the Vietnamese and the international audience. As UfU is carrying out further projects in Vietnam, two UfU staff members are permanently based in Hanoi and further UfU employees from Germany travel regularly to the

Vietnamese capital. UfU will use these synergies for reporting on the GreenCityLabHuế project to relevant decision-makers and stakeholders at national level, thereby increasing interest and support for the development of NBS as a measure to strengthen climate resilience of cities throughout the country.

T6.2 Knowledge transfer: For reaching long-term embedding of project results into local research and decision-making, knowledge transfer from German experts to Vietnamese partners and stakeholders will be organised. This will be achieved through a series of small workshops for Vietnamese project partners and other relevant local stakeholders on specific techniques and measures of data processing, scenario development, NBS and GBI planning, and civil society participation. The workshops aim to support local stakeholders to independently drive research, planning, and implementation of NBS also beyond the project duration. The workshops can be conducted online or as part of visits by German experts to Hue at the premises of MISR.

T6.3 Dissemination: Apart from the communication activities described in T6.1, the project results and knowledge gained in the scientific and participatory co-design and co-learning processes (cf. WP3) will ideally be disseminated following the open science approach. This task will address dissemination into the science, practice, policy, and public spheres. Not only academics and researchers, but also local authorities and decision-makers, the public, influential media, interested practitioners, and higher-education students will be the targeted audience. For practitioners in the architecture, planning, landscape, and urbanism fields, NBS will be pushed as part of a smart and sustainable city concept at relevant workshops, conferences, and/or project events. As part of the dissemination process, project results will be published in scientific journals and presented at national and international conferences. Further central parts of the dissemination are the short films about the four showcases (cf. T3.5) and the co-designed Green City Vision Hue (cf. WP5), which are intended to ensure knowledge transfer to other Vietnamese cities and seek to inspire them to take action to implement NBS.

WP7 Coordination and project management (Lead: UfU, Co-Lead: HUB)

T7.1 Coordination: For the duration of the R&D project, the main project partners from the project consortium are in permanent contact via mail, phone, or videoconferencing, e.g., MS Teams, Skype and Zoom. Periodical project meetings are organised, both smaller project meetings on a two-month basis in Germany with the German project partners, in which the extended consortium partners MISR, HueIDS, and HUSC participate occasionally via videoconferencing, and larger project meetings at least once a year with the extended project consortium in Hue during the visits of German project partners. This enables a constant exchange of information on current project issues between the partners. As required, further smaller videoconference meetings on specific WP will be organised individually in small teams depending on their involvement in the respective WP.

T7.2 Project Management: UfU as the leading project partner is mainly responsible for the overall project management. This includes the main reporting to the BMBF and the project carrier, the supervision of project activities, the central collection of produced project results, the monitoring of the compliance with deadlines and terms and the control of the completion of the milestones and deliverables. Due to its broad network and years of experience in the implementation of projects in Vietnam and its Vietnamese employees located in Hanoi, UfU serves as the main link between Germany and Vietnam. It is therefore responsible to monitor project activities in Vietnam. UfU will also coordinate the dates for project meetings, travels, and events with all project partners and the BMBF. The HUB supports UfU in project management, i.e. in reporting to the BMBF and the project carrier as well as meeting milestones and deliverables. Its main responsibility is the scientific monitoring of the project and ensuring the scientific quality of project results. The sub-contracted MISR in cooperation with HueIDS is responsible for organisational procedures onsite, in particular for the organisational preparation of project events and meetings in Hue, and establishing and running the GCLH on site.

M7.1: *The project has started (PM 1)* | ***M7.2:*** *The project is completed (PM 48)*

7 Planned cooperation and work sharing

Institutions and entities involved in the GreenCityLabHuế project can be divided in three groups regarding the intensity of their involvement and their responsibilities in the project (see Figure 1).

The **extended project consortium** consists of UfU, HUB, and the three Vietnamese project

partners MISR, HueIDS and HUSC, which will be sub-contracted by UfU. The extended project

consortium will jointly develop the contents of events, publications, and the final project report, as well as the project design and the selection of suitable measures for the subsequent implementation phase of the project. UfU is the project's lead partner and will therefore be responsible for project management and communication with the BMBF and the project carrier. Furthermore, UfU will be responsible for the internal and external communication with project partners in Vietnam and Germany and the public in both countries, the supervision and co-ordination of project activities, the design, implementation and evaluation of project events, and the coordination of the joint content-related development of project reports. The communication within the project consortium will be ensured according to WP7. The joint database that was already established during the definition phase gives all project partners the opportunity to easily access and share important information. HUB will be mainly responsible for the scientific monitoring of the project, ensuring the scientific quality of project results, and for the implementation of activities of modelling land-use changes and NBS (cf. WP1), impact assessment (cf. WP2), and proposing best-practice measures (cf. WP4). MISR will coordinate project activities between Vietnamese project partners and further stakeholders. Furthermore, MISR will contribute its scientific expertise and local knowledge to support UfU and HUB in generating Hue- and Vietnam-specific scientific results. HueIDS will be the main link of the project consortium to local decision-makers and will be responsible for encouraging local stakeholders to support the project. It will coordinate project activities with the representatives of Thua Thien Hue Provincial People's Committee, and ensure their participation in project events and their cooperation in the elaboration of the final Green City Vision Hue. Furthermore, HueIDS will be responsible for aligning project outcomes with other local urban development plans and strategies, for consulting relevant decision-makers and stakeholders in the selection of potential measures to be implemented in the subsequent implementation phase of the project, and for acquiring local financial contributions for this purpose. HUSC will be responsible for the design, planning, and implementation of showcases (cf. WP 3) and will contribute to the development of the Green City Vision Hue with its expertise in architecture and urban planning.

Further Vietnamese project partners are the Environmental Protection Agency of the provincial Department of Natural Resources and Environment (DONRE), the Hue Institute of Construction Planning (HPI), the provincial Department of Agriculture and Rural Development, the Hue Monuments Conservation Centre (HMCC), the Hue Urban Environment and Pubic Works Joint Stock Company (HEPCO), the Green Tree Company, the Institute for Community Health Research of the Hue University of Medicine and Pharmacy/Hue University, the Faculty of Environmental Science of the University of Sciences/Hue University, the Kim Long Farmer Association, and the Centre of Development and Social Work (CODES). These are institutions and organisations with important influence and expertise regarding local urban development, GBI planning, urban ecology, and socioeconomic issues in the Thua Thien Hue Province. They collaborate with the extended project consortium selectively on specific tasks, for which they will

be subcontracted by MISR. These tasks include among others participating as council members in the policy round tables, supporting in the organisation of the participatory events, and providing support in the selection of sites for and in the implementation of the showcases. In addition, they will provide information and data that is necessary to complete the project successfully and will participate in the major project meetings. Furthermore, **information partners,** as among others the Association of Cities Vietnam (ACVN), are persons and organisations with important influence and knowledge on urban development in Vietnam. They contribute to the development of the Green City Vision Hue by sharing their ideas, information and views without being direct project partners. Moreover, interested citizens, and students (especially in T3.5) play a crucial role to the success of the project and will be involved in many project activities. At all project activities, inclusiveness and a balanced composition of stakeholders and participants regarding gender will be ensured and actively promoted.

8 Expected results, application potential and envisaged utilisation of results

In Hue, the GCLH is intended to be used as permanent joint exchange and workspace as well as database for the realisation of the planned tasks and activities of the R&D-project. During the R&D-phase, it will provide local knowledge on and insights into NBS in Hue and will also be fed by the results of the various WP. It will later be used for the implementation of strategies and activities developed in the R&D-project phase. The developed database, blueprints and scenarios for a possible implementation of NBS in the city of Hue will serve as a basis to define and prioritise activities to realise these positive visions and as a guideline for local stakeholders and decision-makers. The visualisation of scenarios at city-level, and in more detail at specific sites within the city, as well as four short films of the showcases (cf. T3.5) on the project website are intended both to broaden the range of information available on the website and to trigger simple and broad dissemination of the approaches developed for implementing NBS. The following table gives an overview over the planned utilisation of the project results and illustrates the **utilisation plans of the partners** of the project consortium.

Table 3: Utilisation plan of project results.

	HUB	**UfU**
Prospects of economic success	Testing and application of methods and tools developed at the HUB lab in the city of Hue and thereby enriching these methods with the local knowledge of the experts in Hue city. Establishing contacts to the Hue scientists and planners for future projects.	Extension of UfU's sphere of action in Central Vietnam through further establishment and strengthening of relations to local Vietnamese decision-makers and scientific experts. Enabling particularly the MISR, HueIDS and HUSC to expand their profile as a partner for international projects and cooperation.
Prospects of scientific success	Further developing the modelling and scenario building capacities, especially with regards to ENVI-met, in the HUB lab. Further developing capacities to develop recommendations for best-practice measures and decision support based on scientific findings and co-design.	Further development of its scientific profile regarding climate adaptation, implementation of NBS and participatory processes in an urban context in Vietnam. Strengthening contacts and collaboration with the Central Vietnamese scientific community to enrich UfU's network of Vietnamese partners (historically predominantly based in Hanoi and Northern Vietnam).

	The HUB lab will facilitate knowledge sharing and capacity building with the Vietnamese partners, particularly MISR, HueIDS and HUSC.	
Scientific and economic applicability	The GCLH is an excellent application case for the models and tools developed at the HUB lab. A range of scientific publications will result from this project. Strengthen Vietnamese local capacities (particularly MISR, HueIDS and HUSC) for NBS implementation and management. Pursue further cooperation with Vietnamese partners through new projects.	The GCLH serves as a base to establish and strengthen contacts with stakeholders and decision-makers that will be used for follow-up projects. The project database serves as valuable data source for further projects in the region. Help establishing follow-up assignments and projects between local and regional Vietnamese and international partners.

10 Contribution of international partners

Contributions that the Vietnamese partners bring to the project, which are not financed by the project funding, include the provision of premises for the envisioned GCLH. In April, HueIDS received the decision from the provincial government to establish the Hue Innovation Hub, a centre for facilitating and supporting enterprises and start-up businesses and developing strategies to promote the development of Thua Thien Hue. In this context, HueIDS has offered to provide space for the establishment of the GCLH in the Hue Innovation Hub. MISR will co-host the design competition and will be mainly responsible for organisational procedures onsite, e.g. providing the venue for a potential award ceremony or contacting potential jury members. In addition to the events planned in WP3, MISR will organise workshops to discuss the expansion and enhancement of NBS with experts and local people. In general, MISR is able to provide premises for various GCLH events and will provide furnishings and technical equipment to the GCLH. Further contributions cover (scientific) publications by the Vietnamese partners and the involvement of students to support the project and its tasks, e.g. bachelor and master theses or study projects that carry out small research activities relevant to the implementation of the WP. With regard to the latter, MISR will guide and work with students from different faculties of the Hue University, e.g., Faculty of Environmental Sciences, Faculty of Public Health or Faculty of Geography, to complete their theses by providing them with measuring devices or equipment or connecting them to the MISR youth network and the GCLH.