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Urban Resilience and Adaptation for India and Mongolia:

curricula, capacity, ICT and stakeholder collaboration to support green & blue infrastructure and nature-based solutions
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National and Local Circumstances, Challenges and Opportunities for the Capacity Building for Better Urban Green and Blue Infrastructure in Mongolia

An analytical overview

This report has been based on the materials collected during the preparation of the proposals for the Erasmus+ CBHE project URGENT in September-December 2019. It has been further updated and refined by the working group of URGENT scholars as a part of URGENT project preparation activities under its work package 1.

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1. Introduction

Mongolia, like many other countries, is facing significant environmental challenges, particularly in its urban areas. These challenges include air pollution, inadequate water supply and sanitation, waste management, and the loss of natural habitats. However, there are also opportunities to address these challenges through the development of green and blue infrastructure.

Green infrastructure refers to the network of natural and semi-natural areas, features, and green spaces, such as parks, forests, wetlands, and gardens, that provide multiple environmental, social, and economic benefits. Blue infrastructure refers to the network of water bodies and their associated features, such as rivers, lakes, canals, and reservoirs, that also provide a range of benefits. In Mongolia, the development of urban green and blue infrastructure faces several challenges. One of the biggest challenges is the lack of capacity among urban planners, engineers, and other professionals to design and implement green and blue infrastructure projects. This includes a lack of understanding of the ecological and social benefits of green and blue infrastructure, as well as the technical skills required to design and manage such projects. Another challenge is the lack of public awareness and engagement in green and blue infrastructure initiatives. Without sufficient public support and participation, it can be difficult to secure funding and political will for these projects.

However, there are also significant opportunities for the development of green and blue infrastructure in Mongolia. These include the country's vast natural resources and biodiversity, as well as its strong cultural connection to the environment. By investing in capacity for urban planners, engineers, and other professionals, as well as engaging the public and stakeholders, Mongolia can create more sustainable, resilient, and livable cities that provide multiple benefits for its citizens and the environment. This is very much addressed by the Erasmus+ CBHE project URGENT. Its capacity building impact for enhancing higher educational provision and research in this field will be important for creating the national expertise in the field. This report is providing an overview of national and local circumstances concerned with the implementation of URGENT. Project activities are organized along the six cross-cutting themes. The report is concluding with summaries of implementation challenges in relation to these themes.

This report has been based on the materials collected during the preparation of the proposals for the project URGENT in September-December 2019. The input data included the summaries of expert discussions (both stakeholder and academic), as well as structured interviews with key representatives of the world of profession. The outcomes of this preparatory study has been used for deciding on URGENT cross-cutting topics, and was further used as a reference document for suggesting new and revised disciplines for the URGENT curriculum development program in India. The report has been further updated and refined by the working group of URGENT scholars as a part of URGENT project preparation activities under its work package 1.

2. Challenges and Background Conditions for the Development of Urban Green and Blue Infrastructure in Mongolia

2.1 An Overview of National Circumstances

Mongolia is a country that faces a unique set of challenges when it comes to urban green and blue infrastructure. Here are some of the main challenges:

- **Harsh Climate:** Mongolia has a harsh climate, with long, cold winters and short, hot summers. This makes it challenging to maintain green and blue infrastructure year-round, as extreme temperatures and weather conditions can damage plants and structures.
- **Water scarcity:** Mongolia is a landlocked country with limited water resources, and this scarcity of water can make it difficult to maintain green and blue infrastructure that requires irrigation.
- **Rapid urbanization:** Mongolia's urban population is growing rapidly, and this is putting pressure on the country's green and blue infrastructure. As cities expand, they can cause fragmentation and loss of natural habitats, leading to decreased biodiversity.
- **Lack of funding:** Mongolia is a developing country with limited financial resources. This can make it challenging to invest in the development and maintenance of green and blue infrastructure.
- **Limited awareness:** Many people in Mongolia are not aware of the importance of green and blue infrastructure for the environment and human health. This can make it challenging to build support for initiatives that aim to create or maintain these resources.

To address these challenges, Mongolia can focus on promoting sustainable urban planning practices that integrate green and blue infrastructure into the design of cities. This can involve creating green spaces, such as parks and gardens, that help to mitigate the urban heat island effect and provide habitats for wildlife. Additionally, it can involve developing blue infrastructure, such as water harvesting and management systems, that help to address the water scarcity issue. Finally, efforts to raise public awareness and education campaigns can help to build support for these initiatives and increase understanding of their importance.

2.2 Ulaanbaatar

Ulaanbaatar, the capital city of Mongolia, faces several challenges related to green and blue infrastructure. Here are some of them:

- **Air pollution:** Ulaanbaatar has one of the highest levels of air pollution in the world. The burning of coal and wood for heating during the winter months is a major contributor to this problem. Green infrastructure can help to absorb pollutants and improve air quality, but the city's limited green spaces make this difficult.
- **Water scarcity:** Ulaanbaatar experiences water scarcity due to its dry climate and rapidly growing population. The city relies on groundwater sources, which are being depleted at an unsustainable rate. Blue infrastructure, such as rainwater harvesting systems and wetland restoration projects, could help to increase the city's water supply.
- **Urban heat island effect:** Ulaanbaatar experiences a significant urban heat island effect, with temperatures in the city center being several degrees higher than in surrounding rural areas. Green infrastructure, such as parks and green roofs, can help to reduce temperatures and improve the urban microclimate.

- Flooding: Ulaanbaatar is prone to flooding, particularly during the summer months when heavy rainfall can overwhelm the city's stormwater management systems. Blue infrastructure, such as constructed wetlands and green roofs, can help to absorb and manage stormwater.
- Lack of public space: Ulaanbaatar has limited public space, with only a few small parks and plazas in the city center. Green infrastructure can help to create new public spaces and improve the quality of existing ones, providing opportunities for recreation and social interaction.

Addressing these challenges will require a combination of policy changes, investment in infrastructure, and community engagement.

2.3 Khovd

The city of Khovd, located in western Mongolia, faces a number of challenges related to green and blue infrastructure. Here are some of the key issues:

- Limited access to clean water: Khovd's population relies on the Khovd River for water, which is contaminated with pollutants and bacteria. The lack of access to clean water has health implications for residents, particularly children.
- Deforestation and soil erosion: The city has experienced significant deforestation in recent years, which has led to soil erosion and the degradation of natural habitats. This has contributed to desertification and decreased agricultural productivity.
- Limited green spaces: Khovd has a limited number of parks and green spaces, which reduces opportunities for recreation and negatively impacts air quality.
- Climate change: Like many other cities, Khovd is vulnerable to the impacts of climate change, including increased frequency and intensity of extreme weather events such as droughts, floods, and dust storms.
- To address these challenges, the city could invest in green infrastructure such as:
- Water treatment facilities: The city could invest in infrastructure to treat the Khovd River water to make it safe for drinking and other uses.
- Reforestation and soil conservation: The city could work to plant trees and implement soil conservation practices to prevent soil erosion and desertification.
- Parks and green spaces: The city could invest in creating new parks and green spaces, as well as improving existing ones, to increase opportunities for recreation and improve air quality.
- Climate resilience measures: The city could implement measures to increase its resilience to climate change impacts, such as improving water management and implementing drought-resistant agricultural practices.

Addressing the green and blue infrastructure challenges in Khovd will require a concerted effort from the city government, local businesses, and residents.

2.4 Choybalsan

Choybalsan is a city located in the eastern part of Mongolia. It is not a home of any formal URGENT partners, however it is hosting important stakeholder partners, and it is a focus city for URGENT dissemination in Mongolia. Like other cities in Mongolia, it faces several challenges related to the management and development of its green and blue infrastructure. Here are some of the challenges specific to Choybalsan:

- **Water scarcity:** Choybalsan faces water scarcity due to its location in a semi-arid region. The city relies on a few small rivers and wells for its water supply. Therefore, it is essential to manage and develop its blue infrastructure effectively to ensure the availability and quality of water for the city's residents.
- **Soil erosion and degradation:** The city's landscape is characterized by steep slopes and valleys, which make it prone to soil erosion and degradation. The lack of vegetation cover exacerbates this issue. The city needs to implement measures such as reforestation and terracing to mitigate soil erosion and improve soil quality.
- **Lack of green spaces:** Choybalsan has limited green spaces, such as parks and public gardens. This limits the opportunities for residents to enjoy nature and engage in recreational activities. The city needs to develop more green spaces and ensure that they are accessible and well-maintained.
- **Air pollution:** Choybalsan experiences high levels of air pollution, mainly due to its reliance on coal for heating and cooking. This has negative impacts on both human health and the environment. The city needs to promote cleaner energy sources and implement measures to reduce air pollution.
- **Climate change:** Choybalsan is vulnerable to the impacts of climate change, such as more frequent droughts and extreme weather events. The city needs to develop its green infrastructure, such as green roofs and rain gardens, to mitigate the impacts of climate change and increase its resilience.

Addressing these challenges requires a comprehensive approach that involves the government, civil society, and the private sector. It is essential to prioritize the sustainable management and development of green and blue infrastructure in Choybalsan to ensure a healthy and livable environment for its residents.

3. The Policy and Regulatory Framework for the Development of Green and Blue Infrastructure in Mongolia

The policy and regulatory framework is based on the principles of sustainable development and seeks to enhance the livability and resilience of Mongolian cities through the integration of green and blue infrastructure into urban planning and development. The framework emphasizes the need for multi-stakeholder collaboration, public participation, and the use of innovative and sustainable practices.

The policy and regulatory framework comprises several components, including those relevant to the cross-cutting themes of the URGENT project:

Urban Green and Blue Infrastructure Strategy: The strategy outlines the vision, objectives, and actions for the development of green and blue infrastructure in urban areas. The strategy emphasizes the need to conserve and enhance existing green and blue spaces, create new ones, and promote their integration into the urban fabric.

National Green Development Policy: Mongolia has adopted a National Green Development Policy, which provides a framework for sustainable development and aims to reduce the country's carbon footprint. The policy includes measures to promote green energy, sustainable agriculture, and eco-tourism, among other initiatives.

Planning and Design Guidelines: The guidelines provide a framework for integrating green and blue infrastructure into urban planning and design. The guidelines cover topics such as site analysis, landscape design, stormwater management, and biodiversity conservation.

Regulatory Framework: The regulatory framework includes zoning and land-use regulations that promote the development of green and blue infrastructure. The framework also includes standards and guidelines for the construction and maintenance of green and blue infrastructure.

Financing Mechanisms: The framework includes financing mechanisms to support the development and maintenance of green and blue infrastructure. These mechanisms include public-private partnerships, green bonds, and other innovative financing mechanisms.

Monitoring and Evaluation: The framework includes monitoring and evaluation mechanisms to track the implementation of the policy and regulatory framework and assess its impact on the development of green and blue infrastructure in urban areas.

The policy and regulatory framework for the development of urban green and blue infrastructure in Mongolia seeks to create sustainable, livable, and resilient cities by promoting the integration of green and blue infrastructure into urban planning and development.

4. URGENT cross-cutting themes – how the address the challenges

Further on we suggest an overview of six URGENT cross-cutting themes (<https://urgent-project.net/en/php/page.php?p=79&head>) in terms of their relevance and connection to the challenges of the development of urban green and blue infrastructure in India.

4.1 Urban Forestry

Urban forestry plays a crucial role in creating sustainable and livable urban environments. It helps to mitigate the negative effects of urbanization, such as air and water pollution, urban heat island effect, and loss of biodiversity. In Mongolia, with its rapidly urbanizing cities, there is a growing need for better education and training in urban forestry to ensure that urban green and blue infrastructure is effectively managed and maintained. Here are some capacity needs for better education in urban forestry for better urban green and blue infrastructure in Mongolia:

- Knowledge of local ecology: Understanding the local ecology is important in planning and designing urban green spaces. It is essential to know the native flora and fauna, as well as the ecological processes, such as water cycles, nutrient cycling, and soil processes. This knowledge can inform the selection of appropriate tree and plant species and the development of sustainable management practices.
- Technical skills: Urban forestry requires technical skills in tree planting, pruning, and maintenance. It is also essential to have skills in designing and implementing green infrastructure projects, such as green roofs, rain gardens, and bioswales. Technical skills can be acquired through formal education, on-the-job training, and apprenticeships.
- Interdisciplinary knowledge: Urban forestry is a multidisciplinary field that requires knowledge of various disciplines, such as ecology, horticulture, landscape architecture, urban planning, and engineering. It is important to have interdisciplinary knowledge to effectively plan, design, and manage urban green and blue infrastructure.
- Community engagement: Urban forestry projects require community engagement to ensure their success. It is important to involve local communities in the planning and decision-making process, as well as in the maintenance and management of urban green spaces. Community engagement can also help to raise awareness about the benefits of urban forestry and promote a sense of ownership and pride in local green spaces.
- Sustainable management practices: Sustainable management practices are essential for the long-term success of urban forestry projects. This includes practices such as proper pruning techniques, composting, and integrated pest management. It is important to develop and implement sustainable management practices to ensure the health and longevity of urban green spaces.

To improve urban green and blue infrastructure in Mongolia, there is a need for better education and training in urban forestry. This should include a focus on local ecology, technical skills, interdisciplinary knowledge, community engagement, and sustainable management practices.

4.2 Landscape Architecture and Phytodesign

To improve education in Landscape Architecture and Phytodesign for better urban green and blue infrastructure in Mongolia, the following capacity needs should be considered:

- Curriculum Development: The curriculum should be developed to provide students with the necessary knowledge and skills required to design, implement, and maintain green and blue infrastructure in urban areas. The curriculum should include courses in ecology, botany, hydrology, soil science, urban design, and sustainability.
- Faculty Development: To deliver quality education, faculty members need to be trained and have experience in landscape architecture and phytodesign. Capacity building programs such as training workshops, seminars, and conferences can be organized to enhance the knowledge and skills of faculty members.
- Infrastructure Development: The development of infrastructure such as research facilities, laboratories, and computer labs can enable students and faculty members to conduct research, experimentation, and analysis to develop innovative solutions for urban green and blue infrastructure.
- Partnerships and Networking: Collaboration with industry professionals, governmental agencies, and non-governmental organizations can provide students with opportunities to engage in real-life projects and gain practical experience.
- Outreach and Public Awareness: Outreach and public awareness campaigns can increase the awareness and understanding of the importance of urban green and blue infrastructure in promoting sustainable urban development. Students can be involved in these campaigns to gain experience in communication and advocacy skills.

By addressing these capacity needs, the education system in Landscape Architecture and Phytodesign can be enhanced to provide students with the necessary knowledge and skills to create sustainable urban green and blue infrastructure in Mongolia.

4.3 Urban Permaculture

Urban permaculture involves designing and managing urban spaces to mimic natural ecosystems and promote sustainable living practices. It can play an important role in enhancing urban green and blue infrastructure, which refers to the interconnected network of green spaces and water bodies in cities.

To improve education in urban permaculture and promote better urban green and blue infrastructure in Mongolia, several capacity-building needs should be addressed. These include:

- Training programs: Developing training programs that cater to the needs of different audiences, such as urban planners, architects, landscape designers, community leaders, and the general public, is essential. These programs should cover topics such as urban agriculture, water management, waste reduction, biodiversity conservation, and sustainable living practices.
- Curriculum development: Incorporating urban permaculture into the curricula of universities and schools can help to create a generation of professionals who are well-equipped to design and manage sustainable urban spaces. Developing relevant course materials and textbooks, and training faculty members to teach urban permaculture courses, is necessary.
- Demonstration sites: Establishing demonstration sites, such as urban gardens, green roofs, and rainwater harvesting systems, can serve as models for sustainable urban design and management. These sites can be used for training, research, and educational purposes, and can also help to raise awareness and build community support for urban permaculture.
- Research and development: Conducting research on the benefits of urban permaculture, such as its potential to reduce urban heat island effects, improve air quality, and increase biodiversity,

can help to build a stronger case for its adoption. Developing new technologies and techniques for sustainable urban design and management can also contribute to the advancement of the field.

- Networking and collaboration: Creating networks and platforms for sharing knowledge, experiences, and best practices among stakeholders, such as government agencies, non-governmental organizations, academic institutions, and community groups, can foster collaboration and collective action towards sustainable urban development.

Addressing these capacity-building needs can help to promote better education in urban permaculture and enhance urban green and blue infrastructure in Mongolia.

4.4 Integrative Smart Green and Blue urban planning

Integrative Smart Green and Blue urban planning requires a combination of knowledge and skills from different disciplines, including urban planning, environmental science, engineering, and social science. To improve urban green and blue infrastructure in Mongolia, the following capacity needs may be necessary:

- Interdisciplinary training: Professionals involved in urban planning and management in Mongolia should receive interdisciplinary training on smart green and blue urban planning. This training should cover topics such as ecological systems, green infrastructure, water management, and community engagement.
- Technical skills: Professionals should have technical skills in using geographic information systems (GIS), remote sensing, and other tools for data analysis and modeling of urban green and blue infrastructure. Technical skills are also needed in the design and construction of green and blue infrastructure.
- Stakeholder engagement: Urban planning professionals should have skills in stakeholder engagement and community participation. This involves understanding the needs of different stakeholders, engaging them in the planning process, and building consensus around green and blue infrastructure projects.
- Monitoring and evaluation: There should be capacity building in monitoring and evaluating the performance of green and blue infrastructure projects. This involves measuring the ecological, social, and economic impacts of these projects and using the data to improve future planning and management.
- Policy development: There is a need for professionals with skills in policy development for smart green and blue urban planning. These professionals should have an understanding of national and local policies and regulations related to green and blue infrastructure, and be able to develop policies that promote sustainable urban development.
- Financing mechanisms: There should be capacity building in developing financing mechanisms for green and blue infrastructure projects. This involves understanding different funding sources, such as public-private partnerships, and developing strategies for securing funding for these projects.

Building capacity in Integrative Smart Green and Blue urban planning requires a multi-disciplinary approach that involves professionals from different sectors, including government, academia, and the private sector. By investing in capacity building, Mongolia can improve its urban green and blue infrastructure, enhance its ecological resilience, and improve the quality of life of its citizens.

4.5 Observation

To improve the education in observation techniques for better urban green and blue infrastructure in Mongolia, several capacity-building needs must be considered. Here are some of the key areas to focus on:

- **Training on observation techniques:** There is a need to train people on various observation techniques used in urban green and blue infrastructure planning, implementation, and monitoring. This training should include basic knowledge of remote sensing, geographic information system (GIS), and other data analysis tools.
- **Environmental education:** It is essential to create awareness among the public, policymakers, and practitioners on the importance of urban green and blue infrastructure for sustainable urban development. Environmental education can help people understand the benefits of green and blue infrastructure and the consequences of neglecting them.
- **Building institutional capacity:** Government agencies, local authorities, and civil society organizations involved in urban planning and management need to build their capacity in green and blue infrastructure planning, implementation, and monitoring. This requires the development of human resource and organizational capacity through training, technical assistance, and exchange programs.
- **Collaboration and partnership:** Collaboration and partnership among different stakeholders are essential to ensure the sustainable development of green and blue infrastructure. These stakeholders include government agencies, private sector, civil society organizations, and academic institutions.
- **Data collection and analysis:** To plan, implement, and monitor urban green and blue infrastructure effectively, reliable and up-to-date data are necessary. There is a need to establish systems for data collection, analysis, and management, including standardization of data, sharing of data among stakeholders, and using data to inform decision-making.
- **Evaluation and monitoring:** Evaluation and monitoring are crucial to determine the effectiveness of green and blue infrastructure interventions. There is a need to establish monitoring and evaluation systems that provide regular feedback on the performance of green and blue infrastructure, identify gaps, and inform decision-making.

Addressing these capacity-building needs can help improve education in observation techniques for better urban green and blue infrastructure in Mongolia.

4.6 Information and Communication

To improve education on Information and Communication for better urban green and blue infrastructure in Mongolia, the following capacity needs should be considered:

- **Knowledge of ICT Tools:** Educators and students need to be trained on the use of information and communication technologies (ICT) tools. This includes GIS mapping software, remote sensing tools, and other software relevant to urban green and blue infrastructure planning.
- **Environmental Sciences:** Understanding environmental sciences such as ecology, hydrology, and botany are important for designing and managing urban green and blue infrastructure. Educators and students should be equipped with knowledge and skills in these areas.

- **Design Thinking:** A creative and innovative approach to designing urban green and blue infrastructure is essential. Educators and students need to be trained in design thinking, an approach that emphasizes empathy, ideation, prototyping, and testing.
- **Community Engagement:** Urban green and blue infrastructure projects should involve community members, and it is important to educate educators and students on community engagement techniques.
- **Policy and Governance:** Understanding policy and governance is crucial for effective urban green and blue infrastructure planning and management. Educators and students should be equipped with knowledge and skills in policy and governance analysis.
- **Data Analysis:** To design and manage urban green and blue infrastructure, data analysis skills are necessary. Educators and students should be trained on data analysis techniques such as statistical analysis, machine learning, and data visualization.
- **Interdisciplinary Collaboration:** Effective urban green and blue infrastructure planning and management requires interdisciplinary collaboration. Educators and students should be taught to work in interdisciplinary teams, to learn from each other, and to integrate diverse perspectives.
- **Project Management:** Managing urban green and blue infrastructure projects requires project management skills. Educators and students should be trained in project management techniques such as planning, scheduling, budgeting, and monitoring.

By addressing these capacity needs, educators and students in Mongolia can be better equipped to design, manage and maintain effective urban green and blue infrastructure, which can contribute to a more sustainable and livable urban environment.

5. Conclusions

Urban green and blue infrastructure refers to the network of natural and semi-natural features in urban areas, including parks, green spaces, water bodies, and other natural elements. It plays a crucial role in providing various ecosystem services, such as air purification, water regulation, climate regulation, and biodiversity conservation. However, the development and maintenance of urban green and blue infrastructure require adequate capacity building and institutional arrangements.

In recognition of the challenges and opportunities, Erasmus+ CBHE project URGENT provides a set of activities in the field of higher education and research to support the development of urban green and blue infrastructure in India. URGENT cross-cutting themes reflect on the nature of UGBI situation and India, and provide a structured view on capacity building needs.