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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 India

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

Urban green and blue infrastructure refer to the interconnected network of green spaces and water bodies within urban areas that provide various environmental, social, and economic benefits to residents. In India, the importance of urban green and blue infrastructure is increasingly recognized as cities struggle with issues such as air and water pollution, climate change, urban heat islands, and poor quality of life for residents.

One of the primary benefits of urban green and blue infrastructure is their role in mitigating the effects of climate change. Trees and vegetation absorb carbon dioxide from the atmosphere, helping to reduce greenhouse gas emissions and mitigate the impacts of global warming. Green spaces also provide shade, reducing the urban heat island effect and making cities more comfortable for residents during hot summer months.

Another important benefit of urban green and blue infrastructure is their role in improving air and water quality. Trees and vegetation act as natural air filters, removing pollutants such as nitrogen dioxide, sulfur dioxide, and particulate matter from the air. Green spaces also help to reduce stormwater runoff, preventing pollutants from entering water bodies and reducing the risk of flooding.

Urban green and blue infrastructure also have important social benefits. Green spaces provide opportunities for recreation and exercise, improving the physical and mental health of residents. Parks and other green spaces can also serve as community gathering places, promoting social cohesion and reducing social isolation.

Despite the many benefits of urban green and blue infrastructure, there are also significant challenges to their implementation in India. One major challenge is the rapid pace of urbanization, which often results in the destruction of green spaces and water bodies to make way for new development. In addition, many cities lack the necessary infrastructure and resources to maintain green spaces and water bodies, leading to their neglect and degradation. Another challenge is the lack of awareness among policymakers and the general public about the importance of urban green and blue infrastructure. Many people view green spaces and water bodies as luxury amenities, rather than essential components of a healthy and sustainable city. This can lead to underinvestment in green and blue infrastructure and a focus on short-term economic gains at the expense of long-term sustainability. There are also challenges related to the design and management of urban green and blue infrastructure. For example, green spaces must be designed to be resilient to climate change, able to withstand extreme weather events such as floods and droughts. Water bodies must be managed to prevent pollution and maintain their ecological health, while also providing recreational opportunities for residents.

Despite these challenges, there are also many opportunities for improving and expanding urban green and blue infrastructure in India. Some of them are presented 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 have 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 India

### 2.1 An Overview of National Circumstances

India faces several challenges in developing and maintaining urban green and blue infrastructure. Here are a few key ones:

- Limited space for green infrastructure: India's urban areas are highly densely populated, and there is limited space available for creating green infrastructure. This makes it challenging to create new parks, gardens, and green spaces, which are essential for the health and well-being of city dwellers.
- Limited financial resources: Developing green and blue infrastructure requires significant investment, which can be a challenge for many urban local bodies in India. Many cities struggle to find the necessary financial resources to invest in green infrastructure projects.
- Insufficient public knowledge: The general public has a limited understanding of the significance of green and blue infrastructure. Numerous individuals are unaware of the advantages associated with having green spaces in urban environments, which presents challenges in gaining public backing for green infrastructure initiatives.
- Pollution: Urban areas in India are highly polluted, which poses a significant challenge to the development of green and blue infrastructure. Pollution can damage greenery and harm wildlife, and it can also discourage people from using outdoor spaces.
- Water scarcity: India faces a severe water shortage, and this can be a significant challenge for the development of blue infrastructure such as lakes and ponds. There is a need to develop innovative solutions for water conservation and management to overcome this challenge.

The development of urban green and blue infrastructure in India requires a comprehensive approach that takes into account these and other challenges. It is essential to involve all stakeholders, including the public, in the planning and implementation of green infrastructure projects to ensure their success. Further on we suggest an overview of specific challenges for urban green and blue infrastructure in the locations of URGENT partner institutions.

### 2.2 Ahmedabad

Ahmedabad, like many rapidly growing cities, faces a number of challenges related to the development and maintenance of green and blue infrastructure. Green infrastructure refers to natural and semi-natural areas, such as parks, forests, wetlands, and green roofs, while blue infrastructure includes water bodies and the infrastructure related to water management, such as canals and stormwater drains. Here are some of the challenges related to green and blue infrastructure in Ahmedabad:

- Urbanization and land-use change: Rapid urbanization and land-use change have led to the conversion of green and blue infrastructure to built-up areas, resulting in a loss of ecosystem services such as flood control, carbon sequestration, and recreation.
- Water scarcity: Ahmedabad faces severe water scarcity, and the demand for water is projected to increase with population growth and urbanization. This puts pressure on water bodies and the need for efficient water management systems.

- **Pollution:** Rapid industrialization and urbanization have resulted in high levels of pollution, which can have detrimental effects on both green and blue infrastructure. Pollution can lead to reduced air and water quality, soil contamination, and loss of biodiversity.
- **Climate change:** Climate change is leading to increased frequency and intensity of extreme weather events such as floods, droughts, and heatwaves, which can impact both green and blue infrastructure. For example, heavy rainfall can cause flooding and damage to green infrastructure, while prolonged droughts can lead to water scarcity and stress on blue infrastructure.
- **Maintenance and management:** Adequate maintenance and management of green and blue infrastructure is critical to ensure their effectiveness and sustainability. However, this can be a challenge in a rapidly growing city like Ahmedabad, where resources may be limited, and the demand for infrastructure and services is high.

Addressing these challenges will require a coordinated and integrated approach to urban planning, infrastructure development, and environmental management. Strategies such as promoting green roofs and walls, restoring degraded ecosystems, and improving water management systems can help enhance the resilience of green and blue infrastructure in Ahmedabad.

### 2.3 New Delhi

New Delhi, like many cities around the world, faces significant challenges related to green and blue infrastructure. Here are some of the challenges:

- **Air Pollution:** New Delhi is one of the most polluted cities in the world, with air pollution being a major public health issue. The city's green infrastructure, such as parks and trees, can help to reduce air pollution by absorbing harmful pollutants and providing oxygen. However, the city needs to increase its green cover to combat air pollution effectively.
- **Water Scarcity:** New Delhi faces severe water scarcity due to rapid urbanization, population growth, and climate change. The city's blue infrastructure, such as lakes, ponds, and wetlands, can help to conserve and manage water resources. However, many of these water bodies are heavily polluted, and the city needs to take steps to restore them.
- **Flooding:** New Delhi is prone to flooding during the monsoon season, which can cause extensive damage to infrastructure and property. The city's blue infrastructure, such as drainage systems and water retention ponds, can help to manage floodwaters. However, many of these systems are inadequate, and the city needs to invest in upgrading and expanding its infrastructure.
- **Urban Heat Island Effect:** New Delhi experiences the urban heat island effect, where urban areas are significantly warmer than surrounding rural areas due to the lack of greenery, high levels of concrete, and other urban factors. The city needs to increase its green cover, especially in urban areas, to reduce the urban heat island effect.
- **Biodiversity Loss:** New Delhi has lost much of its biodiversity due to urbanization, habitat loss, and other factors. The city needs to prioritize the conservation of its remaining green and blue spaces to protect its biodiversity.

To address these challenges, New Delhi needs to invest in improving and expanding its green and blue infrastructure, such as parks, trees, lakes, ponds, wetlands, drainage systems, and water retention ponds. The city also needs to focus on reducing air pollution, conserving water resources, managing floodwaters, and protecting its biodiversity.

## 2.4 Pondicherry

Pondicherry, also known as Puducherry, is a union territory in India located on the east coast. Like many urban areas, Pondicherry faces various challenges related to green and blue infrastructure. Here are some of the challenges in Pondicherry:

- **Water pollution:** Pondicherry has many water bodies like ponds, lakes, and canals that are heavily polluted due to the discharge of untreated sewage and industrial waste. This pollution poses a threat to the aquatic life and human health.
- **Encroachment:** Many water bodies in Pondicherry have been encroached upon by individuals and organizations. This has resulted in the loss of valuable wetlands and habitats for flora and fauna.
- **Stormwater management:** During the monsoon season, Pondicherry often experiences severe flooding due to inadequate stormwater management systems. This leads to waterlogging, traffic congestion, and damage to infrastructure.
- **Lack of green spaces:** Pondicherry has a low percentage of green cover, which results in the urban heat island effect and reduced air quality. There is a need for more parks, gardens, and other green spaces in the city.
- **Coastal erosion:** Pondicherry's coastline is facing severe erosion due to rising sea levels, illegal sand mining, and climate change. This threatens the livelihoods of local communities and puts infrastructure at risk.

To address these challenges, Pondicherry needs to implement a comprehensive green and blue infrastructure plan that includes measures like wastewater treatment, wetland restoration, flood management, green space development, and coastal protection. The government, civil society, and local communities need to work together to create sustainable solutions that promote the health and well-being of the city's residents and ecosystems.

## 2.5 Srinagar

Srinagar, the capital city of Jammu and Kashmir in India, faces several challenges related to both green and blue infrastructure. Although Srinagar under Smart Cities Mission is getting a makeover, yet a lot needs to be done to make it resilient, livable and sustainable in the long run. Here are some of the key challenges:

### Green Infrastructure:

- **Limited green cover:** Srinagar has a limited green cover due to urbanization, population growth, and encroachments on green spaces.
- **Lack of maintenance:** The existing green spaces in the city are poorly maintained, and there is a lack of community involvement in maintaining them.
- **Inadequate urban planning:** Srinagar lacks a comprehensive urban planning framework that integrates green infrastructure into the city's development; the situation is however moving to the best with adopting Srinagar Metropolitan Region Master Plan 2035 (<https://sdasrinagar.jk.gov.in/planning/MasterPlan>).

### Blue Infrastructure:



- Flooding: Srinagar is prone to flooding due to its location in a low-lying area and the changing climate.
- Pollution: The Jhelum River, which flows through Srinagar, is heavily polluted due to the discharge of untreated sewage and solid waste into it.
- Inefficient drainage system: Srinagar's drainage system is outdated and inadequate to handle the volume of rainwater during monsoons.

Addressing these challenges requires a multi-pronged approach that involves the government, local communities, and other stakeholders. The solutions could include promoting green roofs, rainwater harvesting, sustainable urban planning, waste management, and river restoration initiatives. Additionally, there needs to be greater community participation and awareness campaigns to ensure the sustainability and success of these initiatives.

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

The development of urban green and blue infrastructure in India has a long history dating back to ancient times when cities were designed with gardens, parks, and water bodies as integral components of the urban fabric. However, with the rapid pace of urbanization and industrialization in the post-independence era, urban green spaces and water bodies have been steadily shrinking and degrading due to land use changes, pollution, and encroachment.

To address this issue, several policies and regulations have been introduced at the national and local levels to support the development of urban green and blue infrastructure. One of the key policies in this regard is the National Action Plan on Climate Change (NAPCC), which was launched by the Indian government in 2008. The NAPCC includes a specific target to increase the country's forest cover to 33% of its total land area, which has led to the launch of various afforestation and reforestation programs in urban areas.

Another important national programme is the Smart Cities Mission, which was launched in 2015 to promote sustainable urban development and improve the quality of life in urban areas. Under this mission, green and blue infrastructure are identified as critical components of urban development, and several initiatives have been launched to develop parks, gardens, wetlands, and other green and blue spaces in cities.

At the local level, many cities have also introduced their own policies and regulations to support the development of urban green and blue infrastructure. For example, the Chennai Metropolitan Development Authority has introduced a policy to promote the development of rooftop gardens, while the Ahmedabad Municipal Corporation has launched an initiative to develop the Sabarmati Riverfront as a green and blue corridor.

Overall, the policies and regulations supporting the development of urban green and blue infrastructure in India reflect a growing recognition of the importance of these resources for promoting sustainable urban development and improving the quality of life in cities. While there is still much work to be done to ensure their effective implementation, these policies represent an important step towards creating more livable, resilient, and sustainable cities in India. Further on we offer an overview of key regulation and policies calling for the development of urban green and blue infrastructure in India.

#### 3.1 The National Urban Greening Scheme (NUGS)

The National Urban Greening Scheme (NUGS) is a program implemented by the Government of India aimed at promoting the creation of urban green spaces across the country. The scheme was launched in 2014 by the Ministry of Housing and Urban Affairs, with the objective of improving the quality of life in urban areas and making cities more sustainable.

The need for such a scheme was felt due to the rapid urbanization that India has witnessed in recent years, which has led to an increase in pollution levels, loss of biodiversity, and a decline in the availability of green spaces. The scheme aims to address these challenges by promoting the creation of parks, gardens, and other green spaces in urban areas.

The specific objectives of the scheme include:

- Increasing the green cover of urban areas: The scheme aims to increase the green cover of urban areas by promoting the planting of trees, shrubs, and other greenery.
- Improving the air and water quality: NUGS aims to improve the air and water quality in urban areas by promoting the creation of green spaces that can help absorb pollutants and filter rainwater.
- Promoting biodiversity: The scheme aims to promote biodiversity by creating habitats for birds, insects, and other wildlife in urban areas.
- Enhancing the aesthetics of urban areas: NUGS aims to enhance the aesthetics of urban areas by promoting the creation of green spaces that are visually appealing and provide a sense of tranquility.
- Providing recreational spaces: The scheme aims to provide recreational spaces for residents of urban areas, such as parks and gardens, where they can relax and enjoy nature.
- Enhancing the resilience of urban areas: NUGS aims to enhance the resilience of urban areas to climate change and natural disasters by promoting the creation of green spaces that can mitigate the impact of extreme weather events.

The scheme is implemented through state governments, and the budget and funding rules vary from state to state. However, here is an overview of the budget and funding rules of NUGS:

- Budget Allocation: The Government of India allocates a certain amount of budget for NUGS each year. The budget allocation for the scheme is subject to change from year to year, and the amount allocated for each state also varies depending on the size of the state and the scope of the scheme implementation.
- State Share: The state government is also required to contribute a share of the total project cost. The state share varies depending on the state, but it is usually around 10% to 20% of the total project cost.
- Central Assistance: The Government of India provides central assistance to the state governments for implementing the scheme. The central assistance covers up to 90% of the total project cost, while the remaining cost is borne by the state government.
- Implementation Agency: The scheme is implemented through the State Forest Department, State Urban Development Department, or any other relevant agency designated by the state government. The implementing agency is responsible for the implementation of the scheme, including the allocation of funds and monitoring of the project.
- Funding for Different Components: NUGS has various components, such as tree plantation, park development, and biodiversity conservation. The funding for each component varies, and the implementing agency allocates the funds accordingly.
- Utilization of Funds: The funds allocated for NUGS must be utilized as per the guidelines issued by the Government of India. The implementing agency must ensure that the funds are utilized efficiently and effectively and that the project is completed within the stipulated time.

In summary, the budget and funding rules of NUGS require both the central and state government to contribute to the scheme's implementation. The funds allocated are utilized as per the guidelines issued by the Government of India, and the implementing agency is responsible for the efficient and effective utilization of the funds.

Several studies have highlighted the positive impact of NUGS on the development of urban green and blue infrastructure in India. For instance, a report by the Indian Institute of Technology (IIT) Delhi found that NUGS has helped to increase the green cover in urban areas and improve the quality of life of residents.

Another study by the Centre for Science and Environment (CSE) noted that NUGS has contributed to the conservation of urban water bodies and the revival of traditional water management systems in cities like Chennai and Delhi.

Overall, it can be concluded that NUGS has played an important role in promoting the development of urban green and blue infrastructure in India. However, there is still a need for greater awareness and participation among urban local bodies and citizens to fully realize the potential of NUGS in enhancing the sustainability and livability of urban areas in India.

### 3.2 The Smart Cities Mission

The Smart Cities Mission is a flagship program launched by the Government of India in 2015 with the aim of developing 100 smart cities across the country. The idea behind the mission is to leverage technology and innovation to make cities more sustainable, livable, and efficient.

The concept of smart cities has been around for several decades, but it gained significant momentum in the early 2000s with the advent of the internet and digital technologies. The term "smart city" refers to the use of information and communication technologies (ICTs) to enhance the quality and performance of urban services, reduce costs and resource consumption, and improve the overall quality of life for citizens.

In India, the idea of smart cities was first proposed in the Union Budget for the year 2014-15. The government then launched the Smart Cities Mission in 2015, as part of its larger agenda to modernize India's urban infrastructure and promote sustainable development.

The Smart Cities Mission is based on a four-pillar strategy: institutional, physical, social, and economic. The institutional pillar involves setting up a Special Purpose Vehicle (SPV) for each smart city, while the physical pillar focuses on improving urban infrastructure and services. The social pillar aims to improve the quality of life for citizens, while the economic pillar is designed to create new opportunities for businesses and attract investments.

The specific objectives of the Smart Cities Mission include:

- **Economic growth:** To promote economic growth and improve the quality of life for citizens by creating a vibrant and sustainable urban ecosystem.
- **Sustainable development:** To promote sustainable development by adopting smart solutions that reduce the impact on the environment and conserve resources.
- **Citizen participation:** To encourage citizen participation in the planning and development of smart cities, and to create a sense of ownership and responsibility among citizens for the success of the mission.
- **Improved infrastructure:** To develop and upgrade infrastructure in urban areas, including roads, public transport, water supply, waste management, and other civic amenities.

- Digital technologies: To leverage digital technologies to enhance the quality of life and improve the efficiency of urban services, including e-governance, e-health, and e-education.
- Safety and security: To ensure the safety and security of citizens by implementing smart solutions for disaster management, crime prevention, and emergency services.
- Quality of life: To improve the quality of life for citizens by creating clean, healthy, and livable urban spaces that are inclusive and accessible to all.

Here are some of the key performance indicators for the Smart Cities Mission:

- Citizen satisfaction index: This measures the satisfaction level of citizens with respect to the services provided by the city.
- Smart solutions deployed: This indicates the number of smart solutions that have been deployed in the city, such as smart traffic management systems, smart waste management systems, and so on.
- Investment attraction: This measures the amount of investment that has been attracted to the city as a result of the Smart Cities Mission.
- Employment generation: This measures the number of jobs that have been created as a result of the Smart Cities Mission.
- Energy consumption: This measures the amount of energy consumed by the city, and the reduction in energy consumption as a result of the implementation of smart solutions.
- Traffic congestion: This measures the reduction in traffic congestion in the city as a result of the implementation of smart traffic management systems.
- Waste management: This measures the reduction in waste generated by the city, and the efficiency of waste management systems.
- Water management: This measures the efficiency of water management systems, including the reduction in water wastage.
- Green cover: This measures the increase in green cover in the city, and the efforts made towards sustainability and environmental conservation.
- Digital connectivity: This measures the availability and quality of digital connectivity in the city, including access to high-speed internet and other digital services.

The Smart Cities Mission has a total budget allocation of INR 48,000 crore (approximately USD 6.5 billion) for the period 2015-2023. This budget is shared between the central and state governments, with the central government contributing 60% of the funds and the state government contributing the remaining 40%. The funding for the Smart Cities Mission is based on a 50:50 model, where the central and state governments contribute equally to the project cost. However, in the case of cities that have a population of less than one million, the central government's share is capped at INR 500 crore (approximately USD 68 million), and the state government's share is capped at INR 250 crore (approximately USD 34 million).

The selection of cities for the Smart Cities Mission is done through a competitive process, where cities are evaluated based on their past performance, their ability to plan and implement projects, and their citizen engagement initiatives. The top-ranked cities are then selected for funding under the Smart Cities Mission. The projects under the Smart Cities Mission are funded through a combination of sources, including the central government, state government, and private sector participation. The central government provides funding for the Smart Cities Mission through grants, while the state governments

are expected to raise additional funds through various sources such as municipal bonds, public-private partnerships, and other innovative financing mechanisms.

The implementation of the Smart Cities Mission is closely monitored and evaluated by the Ministry of Housing and Urban Affairs. The progress of the projects is regularly reviewed, and corrective measures are taken wherever necessary to ensure that the projects are completed within the stipulated timeframe and budget.

The Smart Cities Mission has encouraged the development of green and blue infrastructure in several ways. Firstly, it has provided funding to cities to undertake green and blue infrastructure projects, such as the development of parks, urban forests, and water bodies. Secondly, it has encouraged citizen participation in the planning and implementation of these projects, ensuring that the needs and preferences of local residents are taken into account. Finally, the Mission has promoted the use of technology to monitor and manage green and blue infrastructure, ensuring their long-term sustainability.

As a result of the Smart Cities Mission, several cities in India have developed innovative green and blue infrastructure projects. For example, the city of Pune has developed a network of urban forests that act as carbon sinks and provide recreational opportunities to residents. The city of Bhopal has developed a lake conservation plan that has restored several degraded lakes and improved the water quality of others. The city of Visakhapatnam has developed a green corridor along a major road, which has improved air quality and reduced traffic congestion.

In conclusion, the Smart Cities Mission has played a crucial role in the development of urban green and blue infrastructure in India. The Mission has provided funding, encouraged citizen participation, and promoted the use of technology to ensure the long-term sustainability of these projects. As a result, several cities in India have developed innovative green and blue infrastructure projects that provide multiple benefits to urban residents.

### 3.3 The National Biodiversity Act

The National Biodiversity Act of India was enacted in 2002 to provide for the conservation of biological diversity, sustainable use of its components, and fair and equitable sharing of benefits arising out of the use of biological resources. The Act has a significant role to play in the development of urban green and blue infrastructure in India.

The National Biodiversity Act provides a framework for the protection and conservation of biological diversity, which is essential for the development of green and blue infrastructure. The Act establishes National Biodiversity Authority and State Biodiversity Boards, which are responsible for the implementation of the Act and the protection of biodiversity in their respective jurisdictions.

One of the key provisions of the Act is the requirement for prior informed consent and benefit-sharing for the use of biological resources. This provision ensures that local communities and indigenous people are consulted and involved in the decision-making process regarding the use of biological resources, including those that are used in the development of green and blue infrastructure.

Some specific examples of its role are:

- Protection of biodiversity: The Act mandates the protection and conservation of biodiversity, including the flora and fauna of India. This ensures that urban green and blue infrastructure development takes into account the conservation and preservation of the local biodiversity.
- Promotion of sustainable development: The Act promotes the sustainable use of biodiversity and the equitable sharing of benefits arising out of its use. This encourages the development of urban green and blue infrastructure in a way that is sustainable and benefits local communities.
- Regulation of access to biological resources: The Act regulates access to biological resources and associated knowledge, which are often used in the development of urban green and blue infrastructure. This ensures that the use of such resources is done in a responsible and sustainable manner.
- Establishment of biodiversity management committees: The Act mandates the establishment of biodiversity management committees at the local level. These committees are responsible for the conservation and sustainable use of biodiversity in their respective areas. They can play a crucial role in the development of urban green and blue infrastructure by providing guidance and expertise.

Overall, the National Biodiversity Act helps to ensure that urban green and blue infrastructure development in India is done in a way that is sustainable, equitable, and respectful of local biodiversity.

### 3.4 The Forest Conservation Act (FCA)

The Forest Conservation and People of India has co-existential relationship since the ages. Forest conservation in form of enactment was introduced with Indian Forest Act, in the year 1965. Since then it has evolved from its inception with reintroduction and amendments. The First reintroduction was in the year 1927. In Independent India, an Act was introduced to conserve the forest called the Forest Conservation Act and came in the year 1980.

The Forest Conservation Act has the objective to maintain ecology and to preserve the forest of our country. It is also the object of this act to regenerate the forests by planting trees and increase the forest growth in our country. Further to this, act has wider vision as under:

- To protect the forest, its flora, fauna and other diverse ecological components. To protect the integrity, territory and individuality of the forests.
- To protect the forests and prevent deforestation that will lead to land erosion and subsequent degradation of the land.
- To prevent the loss of forest biodiversity.
- To prevent the conversion of forests into agricultural lands, or grazing lands, or building of business or residential units.

Forest conservation act regulates the non-forest use within the forest and uses the compensatory afforestation as a mechanism to tradeoff the loss in tree cover within stipulated timeline. In this way, non-forest areas

### 3.5 The National River Conservation Plan

The National River Conservation Plan (NRCP) is an initiative by the Government of India aimed at conserving and restoring the health of the country's rivers. The plan was launched in 1985, and it has

since been implemented in several phases. One of the key goals of the NRCP is to improve the quality of water in the country's rivers and to protect their ecosystems.

In recent years, there has been a growing recognition of the importance of urban green and blue infrastructure in promoting sustainable urban development. Green infrastructure refers to the network of natural and semi-natural areas, such as parks, gardens, and wetlands, that provide ecosystem services in urban areas. Blue infrastructure refers to the network of waterways, including rivers, lakes, and canals, that can be used for recreational purposes and as habitats for aquatic species.

The NRCP has played a critical role in the development of urban green and blue infrastructure in India by providing funding and technical assistance for the restoration of river ecosystems. The plan has supported several projects aimed at improving the quality of water in urban rivers and creating green and blue spaces along their banks.

One example of the NRCP's impact on urban green and blue infrastructure is the Yamuna Action Plan, which was launched in 1993 to improve the water quality of the Yamuna River in Delhi. The plan involved the construction of sewage treatment plants, the rehabilitation of wetlands and floodplains, and the creation of parks and recreational areas along the riverbank.

The NRCP has also supported the development of similar initiatives in other cities across India, such as the Ganga Action Plan in Varanasi and the Sabarmati Riverfront Development Project in Ahmedabad.

The NRCP has played a crucial role in promoting the development of urban green and blue infrastructure in India by providing funding and technical assistance for the restoration of river ecosystems. The plan has supported several projects aimed at improving the quality of water in urban rivers and creating green and blue spaces along their banks, which has had a positive impact on the overall health and sustainability of urban areas in India.

### 3.6 The National Lake Conservation Plan

The National Lake Conservation Plan (NLCP) plays a significant role in the development of urban green and blue infrastructure in India. The NLCP was launched in 2001 by the Ministry of Environment and Forests with the aim of conserving and restoring the country's lakes and wetlands. The plan focuses on improving the water quality and biodiversity of these natural resources and promoting sustainable use of their ecosystem services.

The NLCP has contributed to the development of urban green and blue infrastructure in India by:

- Restoring and conserving lakes and wetlands: The NLCP has funded numerous lake and wetland restoration projects across the country, which have helped to improve the water quality and biodiversity of these ecosystems. These restored natural areas provide important ecosystem services such as flood control, groundwater recharge, and carbon sequestration, as well as recreational and cultural opportunities for nearby communities.
- Promoting sustainable urban planning: The NLCP has encouraged sustainable urban planning practices that integrate green and blue infrastructure into the urban landscape. This includes creating parks and green spaces, preserving and enhancing existing natural areas, and incorporating blue infrastructure elements such as green roofs and rain gardens into building designs.



- Raising awareness and promoting citizen engagement: The NLCP has engaged with communities across the country to raise awareness about the importance of lake and wetland conservation and to promote citizen participation in conservation efforts. This has helped to build a sense of ownership and responsibility among communities towards their natural resources, leading to greater involvement in conservation and restoration efforts.

Here are some specific cases of the role of the NLCP in the development of urban green and blue infrastructure in India:

- Hussain Sagar Lake, Hyderabad: The NLCP has played a significant role in the conservation and restoration of the Hussain Sagar Lake in Hyderabad. The lake, which is a major tourist attraction in the city, was facing issues such as pollution, siltation, and encroachment. The NLCP provided funding for various projects, such as the construction of sewage treatment plants and the development of a park around the lake, to address these issues.
- Sukhna Lake, Chandigarh: The NLCP has also supported the development of the Sukhna Lake in Chandigarh, which is a man-made lake that serves as a recreational and ecological hotspot in the city. The plan has provided funding for various projects, such as the construction of a water treatment plant, the removal of silt and weeds from the lake, and the development of a walking and cycling track around the lake.
- Ulsoor Lake, Bangalore: The NLCP has supported the conservation and restoration of the Ulsoor Lake in Bangalore, which is one of the largest lakes in the city. The lake was facing issues such as pollution, encroachment, and a decline in biodiversity. The plan provided funding for various projects, such as the construction of a sewage treatment plant and the removal of invasive species from the lake, to address these issues.
- Pashan Lake, Pune: The NLCP has also played a role in the conservation and restoration of the Pashan Lake in Pune, which is a natural lake that provides important ecosystem services to the city. The lake was facing issues such as pollution, encroachment, and a decline in biodiversity. The plan provided funding for various projects, such as the construction of a wetland park and the removal of invasive species from the lake, to address these issues.

The NLCP has been instrumental in promoting the development of urban green and blue infrastructure in India by restoring and conserving lakes and wetlands, promoting sustainable urban planning, and engaging communities in conservation efforts. These efforts have not only improved the environmental and ecological health of these areas but have also provided numerous social and economic benefits to nearby communities.

### 3.7 National Action Plan on Climate Change (NAPCC)

The National Action Plan on Climate Change (NAPCC) is a comprehensive plan developed by the Government of India to address the challenges posed by climate change. The plan includes several initiatives to promote sustainable development, including the development of urban green and blue infrastructure. The NAPCC recognizes the importance of urban green and blue infrastructure and includes several initiatives to support its development in India. These initiatives include:

- The National Mission for Sustainable Habitat: This mission aims to promote sustainable urban planning and development, including the development of green and blue infrastructure.

- The National Mission on Sustainable Agriculture: This mission aims to promote sustainable agriculture practices, which can help to reduce the need for urban expansion and preserve natural areas.
- The National Water Mission: This mission aims to promote the sustainable use and management of water resources, including the development of green and blue infrastructure to improve water quality and reduce flood risks.
- The National Mission for Enhanced Energy Efficiency: This mission aims to promote energy-efficient buildings and infrastructure, which can incorporate green and blue infrastructure to improve energy efficiency and reduce carbon emissions.

The National Action Plan on Climate Change (NAPCC) in India identifies the development of green and blue infrastructure in urban areas as a key component of the country's efforts to mitigate and adapt to climate change. Specifically, the plan calls for the following actions to promote green and blue infrastructure in India's urban areas:

- Promoting the use of green infrastructure such as parks, green roofs, and urban forests to reduce the urban heat island effect, improve air quality, and reduce energy consumption for cooling.
- Developing blue infrastructure such as water bodies, wetlands, and green corridors to improve water management, reduce flooding, and enhance biodiversity in urban areas.
- Encouraging the use of sustainable transport modes such as walking, cycling, and public transport to reduce greenhouse gas emissions and promote active lifestyles.
- Improving waste management practices in urban areas by promoting recycling and composting, and reducing waste sent to landfills.
- Promoting the use of renewable energy in urban areas to reduce greenhouse gas emissions and enhance energy security.

Overall, the NAPCC recognizes the critical role that green and blue infrastructure can play in mitigating and adapting to climate change in India's rapidly urbanizing areas. The plan emphasizes the importance of integrating green and blue infrastructure into urban planning and development, and promoting public participation and awareness to support these efforts.

### 3.8 Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

The Atal Mission for Rejuvenation and Urban Transformation (AMRUT) is a flagship program launched by the Government of India in June 2015. The program is aimed at transforming urban infrastructure and services in 500 select cities and towns across India. The AMRUT program was launched to replace the Jawaharlal Nehru National Urban Renewal Mission (JNNURM), which had been launched in 2005. JNNURM was primarily focused on providing basic urban services like water supply, sanitation, and housing for the urban poor.

The AMRUT program was launched with a focus on comprehensive development of urban areas and infrastructure. The program has a total outlay of Rs. 1 lakh crore (\$14 billion) for five years starting from 2015-16 to 2019-20. The central government provides 50% of the project cost for cities with a population of less than 10 lakhs and one-third of the project cost for cities with a population of more than 10 lakhs.

The key objectives of the AMRUT program are to ensure that every household has access to tap water and a sewerage connection, improve public transport, and create green spaces in urban areas. The program also focuses on promoting citizen participation in urban planning and development.

Under the AMRUT program, the development of green and blue infrastructure is seen as a way to improve the livability of cities and enhance the quality of life for their residents. Specifically, the program aims to create new green and blue spaces, as well as improve existing ones, in order to:

- Promote healthy living: Green and blue spaces provide opportunities for physical activity and outdoor recreation, which can improve public health.
- Enhance biodiversity: Urban green spaces can provide habitats for wildlife and help to support biodiversity.
- Mitigate climate change: Trees and other vegetation can help to reduce urban heat islands, which can mitigate the effects of climate change.
- Improve water management: Blue infrastructure can help to manage stormwater runoff and improve water quality.

To achieve these objectives, the AMRUT program provides funding to cities for the development of green and blue infrastructure projects. This includes the construction of new parks and gardens, the restoration of water bodies, and the creation of green corridors along roads and other public spaces.

Overall, the AMRUT program recognizes the importance of green and blue infrastructure for creating more livable and sustainable cities in India. The AMRUT 2.0 scheme was launched on 01 October, 2021 for the period of 05 years i.e. from the financial year 2021-22 to the financial year 2025-26 with an allocation of ₹2,99,000 crore including Central outlay of ₹76,760 crore for five years

### 3.9 Swachh Bharat Mission (Clean India Mission)

The Swachh Bharat Mission, also known as the Clean India Mission, was launched by the Indian government on October 2, 2014, to commemorate the 150th birth anniversary of Mahatma Gandhi, the father of the Indian nation. The goal of the mission was to make India a clean and open-defecation-free country by October 2, 2019.

The Swachh Bharat Mission was a massive cleanliness drive launched to eliminate open defecation, improve solid waste management, and promote hygiene and cleanliness across the country. The mission was aimed at achieving the vision of a "Clean India" by creating a culture of cleanliness and sanitation in the country. The campaign was launched with the goal of building over 100 million toilets in five years, with a focus on rural areas, to end open defecation. The government also aimed to create a nationwide infrastructure for solid waste management and implement policies to encourage better waste disposal practices.

The Swachh Bharat Mission was a flagship program of the Indian government, and it was supported by various stakeholders, including NGOs, corporate houses, media, and citizens. The campaign was launched with the hope of creating a sustainable and healthy environment for all Indians. As of October 2, 2019, the Swachh Bharat Mission had achieved significant success, with over 100 million toilets built across the country and the open defecation rate dropping from 39% to less than 5%. The mission has since been expanded to focus on maintaining the gains achieved and ensuring sustainable sanitation and hygiene practices across the country.

One of the key objectives of the mission is to promote the development of urban green and blue infrastructure. The Swachh Bharat Mission recognizes the importance of urban green and blue infrastructure in promoting sustainable development and improving the quality of life in urban areas. To achieve this, the mission has called for the following measures:

- **Tree planting:** The mission has emphasized the need for planting more trees in urban areas to increase green cover, mitigate the heat island effect, and improve air quality.
- **Water conservation:** The mission has emphasized the need for conserving water resources, including promoting rainwater harvesting and preventing water pollution.
- **Waste management:** The mission has called for the proper management of solid and liquid waste, including promoting the segregation of waste at source, promoting composting and recycling, and constructing waste treatment facilities.
- **Green and blue spaces:** The mission has emphasized the need for developing green and blue spaces in urban areas, including parks, gardens, and waterfronts, to provide recreational opportunities and improve the overall aesthetic of the city.

The Swachh Bharat Mission recognizes that urban green and blue infrastructure can play a critical role in promoting sustainable development and improving the quality of life in urban areas. By implementing the measures outlined above, the mission seeks to create cleaner, greener, and more sustainable cities in India.

The SBM-Urban 2.0 was launched on 1st October 2021 for a duration of 5 years till 2025-26 with a budget allocation of ₹1,41,600 crore.

### 3.10 Deendayal Antodaya Yojana-National Urban Livelihoods Mission (DAY-NULM)

The DAY-NULM is a flagship program of the Ministry of Housing and Urban Affairs, Government of India, aimed at reducing poverty and vulnerability of urban poor households by enabling them to access gainful self-employment and skilled wage employment opportunities.

The program was launched in September 2013, replacing the earlier scheme, Swarna Jayanti Shahari Rozgar Yojana (SJSRY), which was in operation since December 1997. The primary objective of NULM is to provide sustainable livelihood opportunities to the urban poor through skill training, financial assistance, and access to credit facilities, with a focus on women and marginalized communities.

The DAY-NULM program aims to address the urban poverty by providing basic services and infrastructure, shelter and housing, financial inclusion, and skill development to the urban poor. The program is implemented through a network of urban local bodies, state-level agencies, and community-based organizations.

The key features of DAY-NULM include mobilization of the urban poor into Self-Help Groups (SHGs), provision of skill training and capacity building, credit and finance assistance, social security, and housing. The program also emphasizes convergence with other government programs and private sector initiatives to enhance its impact and sustainability.

Overall, DAY-NULM seeks to promote inclusive and sustainable urban development by addressing the livelihood needs of the urban poor, enhancing their economic and social well-being, and strengthening their participation in the urban development process.

As part of its mandate, the DAY-NULM calls for the development of urban green and blue infrastructure to create sustainable and livable urban environments. To specifically promote the development of UGBI, the NULM provides financial support to city governments for projects that aim to create and maintain green and blue spaces. This includes projects such as:

- Creation of parks and open spaces: The DAY-NULM supports the development of parks, gardens, and other open spaces that promote biodiversity, provide recreational opportunities, and improve air quality in cities.
- Urban forestry and tree planting: The DAY-NULM provides funding for urban forestry projects that involve planting trees in public spaces, along roadsides, and on rooftops to create green cover, mitigate heat islands, and reduce air pollution.
- Rainwater harvesting: The DAY-NULM supports the implementation of rainwater harvesting systems that capture and store rainwater for later use, which reduces the pressure on the city's water supply and improves groundwater recharge.
- Wastewater treatment and reuse: The DAY-NULM promotes the development of decentralized wastewater treatment systems that can treat and reuse wastewater for non-potable purposes such as irrigation and toilet flushing.
- Restoration of water bodies: The DAY-NULM supports projects that aim to restore and rejuvenate water bodies such as lakes and ponds, which can improve water quality, create habitats for aquatic life, and provide recreational opportunities.

In summary, the DAY-NULM provides financial support to city governments to promote the development of urban green and blue infrastructure projects that create sustainable and livable urban environments.

### 3.11 National Clean Air Program

National Clean Air Program (NCAP), a national strategy for reducing the level of air pollution at both the regional and urban areas to reduce air pollution by 20-30% within mid-term five (5) years action plan to begin with keeping 2019 as base year. This program is expandable to 20-25 years in long-term after mid-term review of the outcomes. This program is the follow up action towards the National commitment to create clean environment, pollution free air and water and obligations to environmental conservation and protection within the ambit of the targeted goals on environmental sustainability under the Sustainable

Development Goals (SDGs). The ethos for preserving and nurturing environment is also enshrined in the constitution of India.

This program is enforced in the year 2018 by the Central pollution control Board under the aegis of Ministry of Environment, Forests & Climate Change. The primary objective of the NCAP are: 1) stringent implementation of mitigation measures for prevention, control and abatement of air pollution; 2) augment and strengthen air quality monitoring network across the country; 3) Augment public awareness and capacity building measures.

The implementation of the NCAP involves multi-sectoral & stakeholders' collaboration along with drawing synergy in resource capitalization from the existing policies and schemes. The NCAP

encompasses mitigation actions in sectors such as Industry, Agriculture, Transport & Mobility, Urban planning & management and waste management.

The NCAP recognizes the capacity of the leaf stomata i.e. pores on the outer “skin” layers of the leaf in absorbing particulate and gaseous pollutant. NCAP also embraces the fact that, one of the efficient and effective options for preventing air pollution hazards and as well as for enhancing the environmental quality, including enrichment of human microbiome that reduces health risks and public health burden is the development of native vegetation filter strips and biodiversity Parks.

Action Points on Plantation Drive:

- Plantation along the roads, highways to clean the air originating from the point source pollution
- Biodiversity parks in cities/urban areas to serve as filters for nonpoint source air pollution
- Development of plantation plans for the non-attainment cities/towns.
- Execution of city-specific plantation plans
- Plantation target to be indicated in city-specific plantation plans
- Scheme on agroforestry to be prioritized and strengthened

Vegetation filter strips of a 100-m long stretch and 5–12 m wide with three storied community with a 8–12 m high canopy is effective in dust trapping and also in assimilating air pollutants, including polycyclic Aromatic Hydrocarbons (PAHs), prevent flooding of roads and recharging groundwater. Such filter strips also make cities climate resilient.

This program draws the corpus from the National Mission for Green India; initial corpus of over Rs 6,000 crore has been earmarked for the programme through the Compensatory Afforestation Management and Planning Authority (CAMPA) to commence work.

## 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

India is a rapidly urbanizing country, and as a result, the importance of urban forestry has become more prominent in recent years. However, the development of national expertise in urban forestry in India faces several challenges, including:

- Lack of awareness and understanding: Despite the growing importance of urban forestry, there is still a lack of awareness and understanding of its benefits and best practices among policymakers, urban planners, and the general public.
- Limited institutional capacity: The institutional capacity for urban forestry in India is limited, with only a few organizations dedicated to this field. As a result, there is a shortage of trained professionals and resources for research, development, and implementation of urban forestry projects.
- Inadequate funding: Urban forestry projects often require significant funding for initial investment and maintenance, which can be a challenge to secure, especially in developing countries like India.
- Poor coordination and governance: Urban forestry involves multiple stakeholders, including local governments, communities, private organizations, and NGOs. However, there is often poor coordination and governance among these stakeholders, leading to ineffective implementation and maintenance of urban forestry projects.
- Climate change impacts: Climate change is exacerbating existing challenges to urban forestry, such as increasing heat stress, water scarcity, and pest infestations. Addressing these challenges will require new strategies and technologies, which may require significant investments and expertise.

Addressing these challenges will require a coordinated effort by multiple stakeholders, including policymakers, urban planners, researchers, and the public. Improving awareness and understanding of the benefits of urban forestry, enhancing institutional capacity and funding, promoting effective coordination and governance, and developing strategies to address climate change impacts can all help to build national expertise in urban forestry in India.

### 4.2 Landscape Architecture and Phytodesign

There are several challenges for the development of national expertise in Landscape architecture and phytodesign in India, including:

- Lack of Awareness: There is a lack of awareness among people about the importance of landscape architecture and phytodesign, which results in a lack of demand for these services. This makes it difficult for professionals to establish themselves in the industry and for the industry to grow.

- **Limited Resources:** Landscape architecture and phytodesign require a significant investment in resources such as land, plants, and equipment. However, many individuals and organizations in India may not have the necessary resources to invest in these services.
- **Regulatory Framework:** The regulatory framework for landscape architecture and phytodesign is not well-defined in India. This leads to confusion and uncertainty among professionals and clients about the legal requirements and standards for these services.
- **Limited Training and Education:** There is a shortage of qualified professionals in the field of landscape architecture and phytodesign in India. This is because there are limited opportunities for training and education in this field.
- **Traditional Mindset:** The traditional mindset of many people in India is focused on utilitarianism and practicality, rather than aesthetics and design. This can make it difficult to generate interest in landscape architecture and phytodesign, which are seen as less important than other disciplines.
- **Lack of Research:** There is a lack of research and development in the field of landscape architecture and phytodesign in India. This limits the innovation and growth of the industry, as well as the ability of professionals to provide cutting-edge solutions to clients.

Addressing these challenges will require a concerted effort by the government, industry associations, educational institutions, and professionals to promote the importance of landscape architecture and phytodesign and to provide the necessary resources and support for their development.

### 4.3 Urban Permaculture

Urban permaculture is the practice of creating sustainable, self-sufficient ecosystems in urban areas by utilizing principles of permaculture, a design system that aims to mimic natural ecosystems. In India, the development of national expertise in urban permaculture faces several challenges, including:

- **Lack of awareness and understanding:** Despite the increasing interest in sustainable living, many people in India are still unaware of permaculture and its principles. There is a need to raise awareness and educate people about the benefits of permaculture and how it can be applied in urban settings.
- **Limited availability of resources:** Permaculture requires resources such as land, water, seeds, and compost. However, in urban areas, these resources are often limited and expensive. The lack of availability and affordability of these resources can hinder the development of urban permaculture.
- **Lack of policy support:** There is currently no specific policy or framework in India to support the development of urban permaculture. This can make it difficult for individuals or organizations to get the necessary support and funding to start permaculture projects.
- **Socio-cultural barriers:** Permaculture often involves changing traditional farming practices and adopting new ways of growing food. This can be challenging in India, where agriculture has a strong cultural significance and traditional practices are deeply ingrained.
- **Limited access to training and expertise:** There is a lack of training and expertise in permaculture in India, particularly in urban areas. This can make it difficult for individuals or organizations to implement permaculture projects effectively.



To overcome these challenges, there is a need for concerted efforts from various stakeholders, including the government, civil society organizations, and communities. This could involve creating awareness campaigns, developing policy frameworks to support permaculture, increasing the availability and affordability of resources, and providing training and expertise to individuals and communities.

#### 4.4 Integrative Smart Green and Blue urban planning

Developing national expertise in Integrative Smart Green and Blue urban planning in India faces several challenges, including:

- Limited awareness and understanding: There is a lack of awareness and understanding of the concept of Integrative Smart Green and Blue urban planning among the general public, policymakers, and even urban planners. This creates a barrier to the adoption of these concepts.
- Limited institutional capacity: India has a limited institutional capacity to develop and implement Integrative Smart Green and Blue urban planning. The capacity of local governments, urban planning departments, and other relevant organizations needs to be strengthened to enable them to implement these concepts.
- Inadequate funding: Integrative Smart Green and Blue urban planning requires significant investments in infrastructure and technology. However, there is a shortage of funds allocated for such projects.
- Limited technical expertise: There is a lack of technical expertise in the field of Integrative Smart Green and Blue urban planning in India. This results in a lack of understanding of the technology and design needed to implement such projects.
- Policy and regulatory challenges: The absence of clear policies and regulations on Integrative Smart Green and Blue urban planning poses a significant challenge. This leads to confusion about the roles and responsibilities of different agencies and stakeholders involved in planning and implementation.
- Data availability and quality: The availability and quality of data on various aspects of urban planning, including environmental and socio-economic factors, are crucial for successful implementation. However, there is a shortage of reliable data, making it challenging to make informed decisions and develop effective strategies.
- Community engagement: Integrative Smart Green and Blue urban planning requires significant community engagement and participation. However, there is often limited community participation in the planning process, resulting in a lack of ownership and support for projects.

#### 4.5 Observation

Developing national expertise in observation for the monitoring of urban green and blue infrastructure in India can be a challenging task. Some of the challenges that need to be addressed are:

- Lack of Standardized Protocols: There is a lack of standardized protocols for observation. This makes it difficult to compare data from different cities and regions, making it challenging to develop national expertise in the field.
- Limited Resources: Developing expertise in monitoring urban green and blue infrastructure requires significant resources, including personnel, equipment, and funding. However, many cities and regions in India may lack the resources to invest in these areas.

- **Limited Institutional Capacity:** There may be limited institutional capacity at the national, state, and local levels to implement and manage monitoring programs for urban green and blue infrastructure. This can result in gaps in data collection and analysis.
- **Data Management:** Collecting and managing data from monitoring programs can be a significant challenge, particularly in developing countries like India. There may be limited capacity to store and manage data effectively, making it difficult to analyze and interpret the results.
- **Lack of Awareness and Training:** There may be a lack of awareness and training among stakeholders, including local authorities, researchers, and community groups, about the importance of monitoring urban green and blue infrastructure. This can result in a lack of support for monitoring programs and limited participation in data collection efforts.

To overcome these challenges, it is essential to invest in capacity building, standardization of protocols, and institutional strengthening at all levels. Collaborative efforts between government, civil society, and the private sector can also help in developing expertise in monitoring urban green and blue infrastructure in India.

#### 4.6 Information and Communication

The development of national expertise in information and communication for the monitoring of urban green and blue infrastructure in India faces several challenges, including:

- **Limited Awareness:** There is a lack of awareness among policymakers and the general public about the importance of monitoring urban green and blue infrastructure. Without a clear understanding of the benefits, it is difficult to build support for investing in the necessary technology and expertise.
- **Insufficient Data:** Data on the extent and quality of urban green and blue infrastructure in India is limited. Without accurate data, it is challenging to develop effective monitoring systems and to evaluate the impact of interventions.
- **Technical Capacity:** There is a shortage of experts with the necessary technical skills to design and implement monitoring systems for urban green and blue infrastructure. Building this capacity will require significant investment in education and training.
- **Limited Resources:** Developing and implementing effective monitoring systems requires significant resources, including funding, staff, and technology. In India, competing priorities and limited resources may make it difficult to prioritize investment in this area.
- **Coordination:** Monitoring urban green and blue infrastructure is a complex task that requires coordination between different government agencies, NGOs, and community groups. Building the necessary partnerships and collaboration can be challenging, especially in a context where there are multiple stakeholders with different agendas.

Addressing these challenges will require a concerted effort from policymakers, technical experts, and civil society organizations to build awareness, develop technical capacity, mobilize resources, and foster collaboration.

## 5. Conclusions

Urban green and blue infrastructure in India faces a range of challenges, including insufficient policy frameworks, inadequate funding, limited public participation, and competing land use demands. However, several solutions are being implemented to address these challenges, including promoting public-private partnerships, leveraging technology, establishing community-led governance models, and integrating nature-based solutions into urban planning. Additionally, raising awareness and promoting education about the benefits of green and blue infrastructure can also help in achieving sustainable urban development in India.

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 in India, and provide a structured view on capacity building needs.