

**Guidelines:**

- This Request Submission Form should be completed by the organisation requesting technical assistance from the Climate Technology Centre & Network (CTCN) in collaboration with the National Designated Entity (NDE) of the country in question
- The Form must be signed by the NDE. Please see updated contact list of NDEs here: <http://unfccc.int/ttclear/support/national-designated-entity.html>
- The Form can be submitted as a Word file containing a digital signature or as a signed and scanned PDF file in combination with an un-signed Word file
- For requests submitted by multiple countries, all the NDEs of the respective countries shall sign identical Forms before official submission to the CTCN
- NDEs have the opportunity to submit CTCN requests in collaboration with National Designated Authorities (NDAs) for the Green Climate Fund (GCF) if targeting the GCF Readiness Programme.

<b>Requesting country or countries:</b>	Liberia
<b>Request title:</b>	Increase urban resilience through the use of blue-green infrastructure in the city of Monrovia and the city of Paynesville by installing rain gardens to capture and harvest runoff/storm water
<b>NDE</b>	Environmental Protection Agency of Liberia Mr. Christopher B. Kabah <a href="mailto:kabahchristopher@gmail.com">kabahchristopher@gmail.com</a> or <a href="mailto:ckabah@epa.gov.lr">ckabah@epa.gov.lr</a>
<b>Request Applicant:</b>	Ministry of Public Works

**Climate objective:**

- Adaptation to climate change

**Geographical scope:**

- Community level
- Sub-national

**Problem statement related to climate change (up to one page):**

Liberia has a 570 km long coastline and is vulnerable to climate variability and change including more extreme weather events such as heavy rains and rising sea levels. Liberia is one of the wettest countries in the world, with the heaviest rainfall occurring from May to October. Rainfall is highest along the coast, where a number of Liberia's urban cities and settlements are located, including the capital Monrovia. It is impacted by the West African Monsoon with relative humidity reaching 90 to 100 %

during the rainy season and 60-90 % during the dry season according to the World Bank.

Due to its high number of rivers, catchments and aquifers as well as its low-lying coastal zone, changes to precipitation rates will likely result in high-risk flooding scenarios, including both urban and coastal flooding according to analysis done by the World Bank. Heavy rains, storm surges, sea level rise and increased erosion will put both urban and rural infrastructures at risk.

Approximately 51.6 % of the population currently live in urban areas and, according to a World Bank report in 2021, this is projected to increase to 57.3% and 68.2% in 2030 and 2050, respectively. In the Greater Monrovia area alone, a predicted 16 cm sea level rise by 2030 would put 675,000 people and 9,500 hectares of land at risk. A great number of informal settlements in the urban areas of the city will be particularly impacted and increasing rainfall and flooding will bring with it several diseases such as Malaria, Cholera and diarrheal diseases. As Liberia is highly dependent on agriculture, the impacts of heavy rain due to soil runoff will be particularly damaging.

Given Paynesville's proximity to Monrovia (approximately 10 kilometers east, often considered a suburb), and the significant interconnectivity between the two cities, this project will benefit both. Paynesville, with its extensive coastline and population exceeding 300,000, experiencing rapid economic growth and a high density of livelihood activities, is particularly vulnerable to coastal hazards. Recent flooding reports indicate a higher concentration of flooding hotspots in Paynesville compared to Monrovia, despite both cities experiencing flooding.

This coastal area is also home to valuable ecosystems and habitats, supporting significant fishing communities, tourism (including hotels and beaches), and socio-economic activities. Coastal erosion, flooding, and storm surges regularly disrupt these ecosystems, livelihoods, property, and displace residents. To effectively mitigate these impacts in vulnerable coastal areas of Paynesville, the project proposes constructing rain gardens to manage stormwater runoff.

The country is ranked 167 out of 181 countries on the ND-GAIN Country Index rank with a high vulnerability score and low readiness score. According to ND-GAIN, it has both a great need for investment and innovations to improve readiness and a great urgency for action. Liberia is the 30<sup>th</sup> most vulnerable country and the 166<sup>th</sup> readiest country.

The NAPA process in 2004 revealed that Liberia was already experiencing adverse effects of climate change and extreme events. Liberia's revised NDC from 2021 recognizes the crucial role of adaptation in ensuring the resilience of communities and natural systems and includes a cross-cutting target for urban green corridors within the nine key sectors of its NDC (agriculture, forests, coastal zones, fisheries, health, transport, industry, energy and waste). The NDC asks for increased urban resilience through use of blue-green infrastructure in the five cities of Monrovia, Paynesville, Buchanan, Gompa and Gbarnga by increasing the volume of runoff/storm water captured by at least 10 % annually to 2030 and by increasing the number of rain garden and cistern/rainwater harvesting installations in urban areas by 15 % annually by 2030.

#### References:

1. University of Notre Dame Global Adaptation Initiative (ND-GAIN) on Liberia [Liberia | ND-GAIN Index](#) (accessed on 4.11.2024)
2. Climate Risk Profile: Liberia (2021): The World Bank Group. [15917-WB Liberia Country Profile-WEB \(1\).pdf \(worldbank.org\)](#)
3. UNCT Liberia Common Country Analysis (2022). [COMMON COUNTRY ANALYSIS \(CCA\) REPORT 2022 | United Nations in Liberia](#)

4. Liberia's Revised Nationally Determined Contribution (NDC) (2021). [Liberia's Updated NDC RL FINAL \(002\).pdf \(unfccc.int\)](#)

**Past and on-going efforts to address the problem** (up to half a page):

Liberia's National Disaster Management Policy from 2012 is the guiding document to deal with natural and manmade disaster across governmental agencies. It has as a stated goal to increase resilience to increased risk of natural hazards, extreme events and to reduce the vulnerability of local communities and institutions. However, Liberia suffers from financial constraints and limited institutional capacities to effectively respond to climate hazards, particularly with regards to increasing the resilience of the urban population in response to flooding and excessive rain fall such as evidenced in the extreme and continuous rainfall between 28 June to 1 July 2024, which lead to flash, coastal and river basin flooding in Monrovia and neighboring areas. 10,000 households (51,000 persons) were affected and the Liberia Refugee Repatriation and Resettlement Commission (LRRRC) had to set up eight temporary shelters for IDPs according to an IFRC flood response operation. Liberia has faced recurrent flooding in 2023, 2022, 2017, 2003, and 2002 partly as a result of inadequate drainage infrastructure.

Responses to date have centred around immediate emergency responses to recurring extreme weather events and to enhance the capacity of disaster and emergency actors such as the National Disaster Management Agency, the Liberia National Red Cross Society, the Environmental Protection Agency, and the Ministry of Internal Affairs, and have not focused on increased resilience of urban settlements.

The "HOT" project has trained and conducted mapping to track flooding in rural Liberia to strengthen disaster risk reduction and emergency responses including early warning systems.

However, blue-green infrastructure to strengthen urban resilience in response to flooding has not been implemented in Liberia and is a key missing element in Liberia's adaptive capacities.

References:

1. Reliefweb: Liberia Flood Response 2024. [Liberia Flood 2024 DREF Operation \(MDRLR008\) - Liberia | ReliefWeb](#)
2. [Tracking Flooding in Rural Liberia | Humanitarian OpenStreetMap Team \(hotosm.org\)](#)

**Specific technology<sup>1</sup> barriers** (up to one page):

Liberia has limited resilience and adaptive capacity to combat the effects of climate change. The low adaptive capacity is exacerbated by climate change impacts and Liberia still suffers from resource gaps and policy barriers to effectively tackle climate change. Its rapid urbanization has resulted in cities such as Monrovia which have large informal settlements located on the coast with inadequate resilience of the population to respond to adverse weather events, insufficient grey infrastructure which can lead to groundwater pollution during flooding events, and no green spaces to improve the health, mental wellbeing, and community gathering spaces of urban developments.

- 1. Inadequate resilience of urban communities to flooding:**  
Barrier: vulnerable communities lack access to protection against storm water  
Solution: rain gardens preserve storm water and reduce runoff
- 2. Inadequate urban planning and grey infrastructure to cope with flooding**  
Barrier: increased urbanization has translated into informal settlements and a lack of sewage

<sup>1</sup> "any equipment, techniques, practical knowledge and skills needed for reducing greenhouse gas emissions and adapting to climate change" (Special Report on Technology Transfer, IPCC, 2000)

infrastructure leading to disease during flooding

Solution: Rain gardens, as a nature-based solution, filter wastewater and prevent groundwater pollution caused by sewage contamination

**3. Inadequate sources of freshwater in urban settlements**

Barrier: increased urbanization has led to lack of freshwater for urban dwellers

Solution: Rain gardens collect rainwater and through bioretention filter pollutants from stormwater. This contributes towards maintaining sources of freshwater for urban communities.

**4. Insufficient urban infrastructure to adapt to climate change**

Barrier: increased urbanization and an increase in average temperatures over time has led to an urban heat dome

Solution: rain gardens mitigate the urban heat island effect through the temperature difference between green and urbanized spaces.

Reference :

1. European Commission: Directorate-General for Research and Innovation and Calfapietra, C., *Nature-based solutions for microclimate regulation and air quality – Analysis of EU-funded projects*, Publications Office of the European Union, 2020,

**Sectors:**

Please indicate the main sectors related to the request:

- |   |   |  |   |
|---|---|--|---|
| <input checked="" type="checkbox"/> Coastal zones | <input type="checkbox"/> Early Warning and Environmental Assessment | <input checked="" type="checkbox"/> Human Health | <input checked="" type="checkbox"/> Infrastructure and Urban planning |
| <input type="checkbox"/> Marine and Fisheries     | <input checked="" type="checkbox"/> Water                           | <input type="checkbox"/> Agriculture             | <input type="checkbox"/> Carbon fixation                              |
| <input type="checkbox"/> Energy Efficiency        | <input type="checkbox"/> Forestry                                   | <input type="checkbox"/> Industry                | <input type="checkbox"/> Renewable energy                             |
| <input type="checkbox"/> Transport                | <input type="checkbox"/> Waste management                           |  |   |

Please add other relevant sectors:

**Cross-sectoral enablers and approaches:**

Please indicate the main cross-sectoral enablers and approaches

- |   |  |  |   |
|---|--|--|---|
| <input checked="" type="checkbox"/> Communication and awareness | <input type="checkbox"/> Economics and financial decision-making | <input type="checkbox"/> Governance and planning | <input checked="" type="checkbox"/> Community based |
| <input type="checkbox"/> Disaster risk reduction                | <input checked="" type="checkbox"/> Ecosystems and biodiversity  | <input type="checkbox"/> Gender                  |   |

**Technical assistance requested (up to one page):**

Within the framework of Green Urban Infrastructure (GUI), suitable nature based solutions (NBS) in

combination with traditional grey infrastructure, such as drainage pipes, should be adopted to adapt to increased flooding. NBS can simultaneously support human health, reduce disaster risks, mitigate heat waves, improve surface water quality and promote sustainability of natural resources. To increase Liberia’s urban population’s resilience to flooding as an adaptive response and by supporting the use of blue-green infrastructure in urban settings, rain gardens will be piloted in the city of Monrovia. Rain gardens, as a nature-based solution, have manifold benefits as an urban planning tool including storm water preservation, reduction of runoff and flood protection, groundwater pollution prevention, biodiversity enhancement and microclimate control reducing urban heat islands. Various types of rain gardens can be created depending on locations such as geohydrology or to address pollution events such as unsuitable sewerage systems being flooded. They create permeable pavements to restore water balance by capturing, retaining and improving the infiltration capacity in urban areas. They treat storm water runoff, restore groundwater levels, increase soil moisture to alleviate drought impacts, lower temperatures by evapotranspiration, heat island effect mitigation, and biodiversity enhancement.

Small-scale nbs like rain gardens are not an effective measure against extreme events, which require large-scale nbs and grey infrastructure, but are effective against persistent rainfall such as during the rainy season in Liberia.

Overall, the CTCN's technical assistance will complement national efforts by overcoming technology barriers through technology transfer, capacity building, and collaboration. By addressing these barriers, Liberia will increase its resilience towards adverse weather events through the use of blue-green infrastructure.

**References:**

1. L. Sciuto, F. Licciardello, V. Scavera, D. Verde, E.R. Giuffrida, G.L. Cirelli, The role of Nature-Based Solutions for the water flow management in a Mediterranean urban area, *Ecological Engineering*, Volume 208, 2024.
2. Kasprzyk, Magda (08/2022). "Technical solutions and benefits of introducing rain gardens – Gdańsk case study". *The Science of the total environment* (1879-1026), 835 , p. 155487.

**Expected timeframe:**

It is estimated that the technical assistance will take up to 12 months.

**Anticipated gender and other co-benefits from the technical assistance:**

Women were consulted with and took ownership during the revision of the NDC, which established urban green corridors as a cross-cutting sector and within this the use of rain gardens as an adaptation measure.

Female-headed households have the highest levels of food insecurity in Liberia and especially so in urban settlements like Monrovia with large informal settlements which are highly vulnerable to shocks such as flooding and storms. According to an IFCR assessment on Flood Response operations, about 68% of people affected by floods and storms in Liberia are women, children, and other vulnerable groups. Rain gardens offer an adaptive urban solution towards protection from flooding which women are particularly vulnerable to.

Studies show that urban gardens serve “as a catalyst for women’s participation in community and environmental preservation giving them a sense of agency and influence” (Angeles, 2024). It

contributes towards skills development, environmental stewardship, social networking, educational opportunities, improved health and well-being, and advocacy.

Rain gardens improve freshwater sources within the city to accommodate the predominantly female chore of collecting water to the household. By providing more access to freshwater sources, lengthy trips for freshwater collection are no longer needed.

Increased biodiversity:

A well-planned rain garden provides fruits, seeds, and nectar and is a valued food source year-round. Migrating birds will find refuge, food, and shelter, as well as insects leading to increased biodiversity.

References:

ANGELES, IMELDA T., Urban Gardening: A Catalyst for Women's Empowerment, Community Engagement, and Environmental Awareness. Available at SSRN: <https://ssrn.com/abstract=5004710> or <http://dx.doi.org/10.2139/ssrn.5004710>

For more information you can find guidelines on the CTCN's website here:

<https://www.ctc-n.org/technologies/ctcn-gender-mainstreaming-tool-response-plan-development>

Further reading on gender can be found on the CTCN website here:

<https://www.ctc-n.org/technology-sectors/gender>

**Key stakeholders:**

Please list the stakeholders who will be involved in the implementation of the requested CTCN technical assistance and describe their role during the implementation (for example, government agencies and ministries, academic institutions and universities, private sector, community organizations, civil society, etc.).

Stakeholders	Role to support the implementation of the technical assistance
National Designated Entity	Ensure alignment with National climate change policies and regulations. Monitor and appropriate implementation processes
Request Applicant	<b>Ministry of Public Works:</b> The role of the Ministry of Public Works in Liberia as the applicant for the project is to support its implementation by ensuring compliance with zoning regulations, promoting quality construction, and overseeing the maintenance of the garden.
<b>Environmental Protection Agency</b>	Ensuring that the TA complies with environmental laws and regulations regarding water management and land use; monitor the TA's impact on urban resilience, water quality, and ecosystem health, and evaluating its success in reducing runoff and improving stormwater management.
<b>Monrovia City Corporation</b> <b>Paynesville City Corporation</b>	Overseeing the overall implementation of the TA, ensuring that all activities are aligned with local priorities and conditions; Identifying suitable locations for rain gardens and preparing these sites for installation, ensuring they are effective in capturing and managing stormwater.
<b>Liberia Water and Sewer Corporation:</b>	Overseeing the construction, maintenance, and upgrading of water

supply and sewage systems.

**Alignment with national priorities** (up to 2000 characters including spaces):

Please describe how the technical assistance is consistent with national climate priorities such as: Nationally Determined Contribution, national development plans, poverty reduction plans, technology needs assessments, Low Emission Development Strategies, Nationally Appropriate Mitigation Actions, Technology Action Plans, National Adaptation Plans, sectorial strategies and plans, etc.

Reference document (please include date of document)	Extract (please include chapter, page number, etc.).
Nationally Determined Contribution (NDC)	Rain gardens are mentioned on page 38 of the NDC as a measure to increase the urban resilience and adaptability of five cities in Liberia.
Technology Needs Assessment	The TNA identified the coastal zone sector, particularly coastal erosion and flooding, for adaptation but the focus of the TNA was the energy sector for mitigation.
National Adaptation Plans	The NAP mentions flooding as one of the most frequent climate hazards and on page 63 states that flooding has led to drainage problems in Monrovia and under cross-cutting issues it suggests to fast track the integration of Ecosystem-based Adaptation (EbA) approaches into Liberia's overall adaptation response to climate change.
NPRSCC from 2018	Develop and implement a program for climate-proofing new investments in infrastructure (roads, sewers, water supplies, and other infrastructure) in coastal settlements and rural areas to protect continuous access to livelihoods, health care, and education.

**Development of the request** (up to 2000 characters including spaces):

This technical assistance application is spearheaded by the Ministry of Public Works, ensuring adherence to safety and garden standards. The proposed technology concept was developed in close collaboration with the Ministry, leveraging its expertise and responsibilities.

Additionally, the concept was developed in collaboration with the Liberia Water and Sewer Corporation (LWSC), a corporation responsible for the complete lifecycle of water and sewage services across Liberia—from development and construction to operation, maintenance, and distribution of related materials and equipment.

Finally, the Monrovia and Paynesville City Corporations are key collaborators, responsible for implementing and enforcing municipal regulations to ensure a supportive environment for project implementation within their respective jurisdictions. The collaborative nature of this technology concept draws upon the combined expertise and authority of these three crucial Liberian entities.

**Background documents and other information relevant for the request:**

- University of Notre Dame Global Adaptation Initiative (ND-GAIN) on Liberia [Liberia | ND-GAIN Index](#) (accessed on 4.11.2024)
- Climate Risk Profile: Liberia (2021): The World Bank Group. [15917-WB Liberia Country Profile-WEB \(1\).pdf \(worldbank.org\)](#)
- UNCT Liberia Common Country Analysis (2022). [COMMON COUNTRY ANALYSIS \(CCA\) REPORT](#)

[2022 | United Nations in Liberia](#)

- Liberia's Revised Nationally Determined Contribution (NDC) (2021). [Liberia's Updated NDC\\_RL\\_FINAL \(002\).pdf \(unfccc.int\)](#)

### OPTIONAL: Linkages to Green Climate Fund Readiness and Preparatory Support

The CTCN is collaborating with the GCF in order to facilitate access to environmentally sound technologies that address climate change and its effects, including through the provision of readiness and preparatory support delivered directly to countries through their GCF NDA. These actions are in line with the guidance of the GCF Board (Decision B.14/02) and the UNFCCC, particularly paragraphs 4 and 7 of 14/CP.22 that addresses Linkages between the Technology and the Financial Mechanisms<sup>2</sup>.

The CTCN is therefore implementing some of its technical assistance using GCF readiness funds accessed via the country's NDA. Any application for GCF support, including the amount of support provided, is subject to the terms and conditions of the GCF and should be developed in conjunction with the NDA.

Please indicate whether this request has been identified as preliminarily eligible by the NDA to be considered for readiness support from the GCF.

Initial engagement: The GCF NDA of the requesting country has been engaged in the design of this request and the NDA will be involved in the further process leading to an official agreement for accessing GCF readiness support.

Advanced engagement (preferred): The GCF NDA of the requesting country has been directly involved in the design of this request and is a co-signer of this request, the signature indicating provisional agreement to use readiness national funds to support the implementation of the technical assistance.

NDA name:

Date:

Signature:

### Monitoring and impact of the assistance:

By signing this request, I affirm that processes are in place in the country to monitor and evaluate the technical assistance provided by the CTCN. I understand that these processes will be explicitly identified in the CTCN Response Plan and that they will be used in the country to monitor the implementation of the technical assistance following standard CTCN procedures.

I understand that, after the completion of the requested assistance, I shall support CTCN efforts to measure the success and effects of the support provided, including its short, medium and long-term impacts in the country.

<sup>2</sup> Please see:

[https://unfccc.int/files/meetings/marrakech\\_nov\\_2016/application/pdf/auv\\_cop22\\_i8b\\_tm\\_fm.pdf](https://unfccc.int/files/meetings/marrakech_nov_2016/application/pdf/auv_cop22_i8b_tm_fm.pdf)

**Signature:**

NDE name: Christopher B. Kabah

Date: December 2, 2024

Signature:



**THE COMPLETED FORM SHALL BE SENT TO THE [CTCN@UNEP.ORG](mailto:CTCN@UNEP.ORG)**

The CTCN is available to answer all questions and provide guidance on the application process.