

**GOVERNMENT OF MEGHALAYA  
OFFICE OF THE CHIEF ENGINEER, P. W. D. (ROADS)  
LOWER LACHUMIERE: MEGHALAYA, SHILLONG.**

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**REQUEST FOR EXPRESSIONS OF INTEREST**

**(Consulting Services – Quality and Cost Based Selection (QCBS))**

**INDIA: MEGHALAYA INTEGRATED TRANSPORT PROJECT (MITP).  
Project ID: P-168097**

**Assignment Title: Consultancy Services for Preparation of Climate Resilience and Green Growth Strategy and Vulnerability Assessment for Meghalaya Integrated Transport Project (MITP) funded by the World Bank.**

**Reference No: IN-PWD-CRGGT&VA-CS-QCBS**

Government of Meghalaya has received a loan from the World Bank (IBRD) under its Meghalaya Integrated Transport Project (MITP) and intends to apply part of the proceeds for consulting services.

The Meghalaya Infrastructure Development and Financing Corporation (MIDFC) through Meghalaya Public Works Department (Roads), wish to engage a consultant for the preparation of **Climate Resilience & Green Growth Strategy and Vulnerability Assessment** for the state of Meghalaya.

The Meghalaya Public Works Department (Roads), Government of Meghalaya now invites eligible consulting firms (“Consultants”) to indicate their interest in providing the Services. Interested Consultants should provide information demonstrating that they have the required qualifications and relevant experience to perform the Services. The short listing criteria are defined in the Eligibility Criteria in the Term of reference (TOR).

The TOR for the activity is also enclosed.

The employer intends to engage the services of a consultant for the aforementioned works.

The attention of interested Consultants is drawn to paragraph 3.17 of the World Bank’s *Procurement Regulations for IPF Borrowers, July 2016- Revised November 2017 and August 2018* as amended from time to time [under IBRD Loans and IDA Credits & Grants] by the World Bank Borrowers, setting forth the World Bank’s policy on conflict of interest.

Consultants may associate with other firms in the form of a joint venture or a sub consultancy to a maximum of **2(Two) firms** to enhance their qualifications.

A Consultant will be selected in accordance with the Quality and Cost Based Selection (QCBS) method set out in the Consultant Guidelines of the World Bank.

Further information can be obtained at the address below during office hours i.e., 11:00 am to 03:00 pm.

Expression of interest comprising letter of motivation and detailed CV must be received at the email addresses below no later than **10<sup>th</sup> January 2023 at 16:00 hours local time.** **No extension will be granted after the last date. No EOI will be accepted after the date and time specified above. The Department will not be responsible for any delay of the EOI sent by registered post/speed post/courier etc.**



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## **TERMS OF REFERENCE**

### **Preparation of Climate Resilience and Green Growth Strategy and**

#### **Vulnerability Assessment for**

#### **Meghalaya Integrated Transport Project(MITP)**

### **INTRODUCTION**

Meghalaya is a relatively small hilly state situated in the country's North-East region. It is lagging in development compared to the rest of the country due to its poor transport infrastructure, difficult hilly terrain and climatic conditions, tenuous communication, poor market access, low agriculture productivity, and low industrialization.

The government of Meghalaya has received a loan from the World Bank (IBRD) under its Meghalaya Integrated Transport Project (MITP) for the up-gradation of the transport infrastructure in the State. Meghalaya Integrated Transport Project (MITP) has the objective of improving transport connectivity and efficiency and enhancing transport sector management in Meghalaya. For the management & administration of the project, a dedicated Project Management Unit (PMU) has been established in MIDFC at Shillong, headed by a Project Director and supported by other staff responsible to implement the project.

### **BACKGROUND**

#### **Climate Change and Transport Infrastructure**

Climate change puts many of the investments to date in transport infrastructure and systems at risk. Extreme weather events like extreme rain, floods and landslides are expected to increase in frequency and intensity with detrimental impacts to transport infrastructure and services. At the same time, transport plays a crucial role in building climate-resilient communities by providing connectivity to exit disaster areas and providing access to disaster relief.

#### **Meghalaya Context and Challenges**

The recent report released by the Government of India under the project initiative of Climate Vulnerability and Risk Assessment for Indian Himalayan Region using a common framework, observes Meghalaya as moderately vulnerable under the influence of the south-west monsoon, north-east winter wind and characterized by a temperate climate. The average rainfall varies from 1400 mm to 11,500 mm with the maximum rainfall occurring over the southern slopes of the Khasi Hills. Temperatures range between 2<sup>0</sup>C to 35<sup>0</sup>C, depending on the location.

The vulnerability of the state to water-induced disasters because of its location in the eastern Himalayan periphery, fragile geo-environmental setting and economy under development. The mighty hydrological and monsoon regimes of the state, especially the Brahmaputra and the Barak (Meghna) river system which is also important livelihood and economic resources (power) often turns out to be the source of vulnerability.

Climate change as projected might result in increasing mean annual temperature, variability of rainfall pattern and seasonal shift in weather pattern which is likely to result in a destructive effect on agriculture as well as infrastructure, especially roads.

### **Need for Climate Risk Assessment**

The entirety of Meghalaya is highly prone to earthquakes which cause damage to road infrastructure due to surface fault rupture, soil liquefaction, settlement, slope failure, landslides and rockfalls in mountainous regions. Some parts of Meghalaya are also prone to floods/flash floods which are known to wash away bridges and stretches of roads. Heavy rainfall often leads to mudslides in the state, and significant once also wash away roads and utility components along with it. This leads to significant losses in terms of the additional cost of repair and rehabilitation of roads and utilities, loss to the economy due to the temporary disconnection of the area from the mainland, and at times loss of life.

Keeping this in mind, the Meghalaya PWD intends to analyze the climate risk of a 500 km of core roads network across the state of Meghalaya, such that it is more or less the representation of the whole state covering all relevant climate-induced hazards. The risk assessment should cover the following hazards: Geological hazards: Landslides, Earthquake,; Hydro-meteorological hazards: Floods/Flashfloods, Storm Surge, Temperature variation (Heatwave/Coldwave), & exposure to Waterlogging and Submergence.

### **OBJECTIVE**

The main objectives of the proposed analytical work are to prepare a climate resilience green-growth strategy for Meghalaya's transport network, with special focus on roads (only state roads). The work also includes analyzing the policy, institutional, planning and financing framework of the state in the transport sector in light of the inclusion of climate consideration and suggesting needed reforms to enhance the resilience of the sector.

### **SCOPE OF ACTIVITIES**

The Consultant will conduct the following activities:

#### **A) Climate Change and Natural Hazards Risk Assessment**

As per IPCC AR5<sup>1</sup> Climate Risk is a function of hazard (h), exposure (e), and vulnerability (v),  $R(h*e*v)$ , wherein vulnerability is again a function of sensitivity (s) and adaptive capacity (a),  $V = (s*a)$ . This study would try to follow the same approach as far as possible keeping in mind the possible data gaps.

- i. **Understanding the multi-hazard profile of the State's Road network**- As a first step, the consultant should develop an understanding of the climate-induced hazards across the that the State's transport network faces. This component should be drawn in consultation with PWD and other relevant stakeholders (to be identified by the consultant) and maximize by using their archival data on disaster events/ repair & rehabilitation work. Also, there are available secondary information which could form the basis of such understanding. The studies/ assessments that could provide relevant data and information for this component are listed in Annexure 1.

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<sup>1</sup> IPCC – Intergovernmental Panel on Climate Change Assessment Report 5

- ii. **Selection of 500km transport network<sup>2</sup>for study**—As the outcome of the study is to arrive at Climate Resilient Green Growth Strategy based on which the State shall be able to strengthen the resilience of its transport network and thereby climate-proof its transport infrastructure (to the extent possible with acceptable residual risk), thus a network sample needs to be selected and studied based on which works program and other system reforms can be recommended.  
On the basis of the findings on multi-hazard profile of the State's transport network, and in consultation with the PWD, the consultant must select 500km of road stretches (including bridges and other critical transport infrastructures such that it has a mix representation of the state's core road network, as well as some non-core roads that maybe strategic. It should cover some of the Urban roads, Tourism roads, Roads connecting to agricultural hubs/ important markets, industrial corridors, critical infrastructures such as hospitals, educational institutions, etc. Additionally, the team should ensure that the selection also cover the significant climate-induced hazards that the roads of the state often face.
- iii. **Determining the Exposure** –the likelihood of occurrence of an event and its intensity plays a critical role in determining how vulnerable is the infrastructure/ systems (systemic and socio-economic elements) are. The exposure from a climate-induced event should be arrive at by considering current as well as projected climate information. There are available scientific studies carried out by the State and independent researches defining the current as well as projected climate for the State at district or further unit level. Same can be referred to maximise time and effort. If useful an exposure ranking can also be developed based on likelihood of occurrence and its severity. It is up to the consultant to define the approach keeping in mind that same would be followed by the State for rest of the transport network. Keeping is simple, easy to adopt yet serving the right objectives should be the main purpose here.
- iv. **Vulnerability Assessment** - The purpose of this component is to assess the vulnerabilities of the transport infrastructure, systems and services ofthe State (keeping in view of the 500km network been selected). The detailed vulnerability assessment should include physical, systemic and socio-economic elements of transportation highlighting the degree of impacts such as damage state and loss of monetary value for physical assets, disrupted transport service, and or loss of life at varying levels of hazard intensity. The indicators to be used to define physical, systems and services vulnerability should be determined appropriate to the State and features of the transport network being studied.Knowledge of PWD should be applied to maximize the work value.
- v. **Determine a Risk Matrix and Prioritise Works Program** – Based on the above analysis of hazard, exposure, and vulnerability, determine a risk matrix (high, medium and low) of the transport assets that helps to prioritize the works program. The consultant is expected to generate base data in GIS including capturing all other road and road furniture attributes. The consultant should generate & incorporate all road inventory and condition data bases along with the hazard and risk maps on a Web GIS decision support platform. The decision support platform should be developed to visualize all the key layers of hazard, asset information along with a query module. In addition to this, the platform should have the ability to generate risk reports for various sections of the rural road infrastructure at the block level.

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<sup>2</sup>Excluding National Highways and other infrastructure those that are not under the control of the State

## **B) Development of Prioritized Works Program**

- i. Identify potential adaptation options that respond to the assessed vulnerabilities and that are technically feasible and appropriate in the context of the state. The analysis should include:
  - a. Specific interventions at high-risk locations; and
  - b. Measures that can be taken to reduce vulnerabilities and enhance the resilience of the transport network, as described in the following tasks.
  - c. Identify specific sites for nature-based solutions or bio-engineering measures
- ii. Develop a prioritized program of investments at specific locations of study areas to improve the resilience of the transport network, and define the general nature of each of the proposed investments. The priority investments should be grouped into time bands (such as immediate, by next 3 years, and by next 5 years/ long-term) taking into account the urgency of the required response and the design life of the proposed investment. For the immediate measures detailed works program should be developed for at-least 500kms distributed across various location depending on frequency and severity of impact.
- iii. Provide typical drawing and cost estimates for such engineering climate resilient design options.
- iv. Discuss the Draft Work Program with PWD, MIDFC, DPR Consultants for MITP and all other relevant stakeholders in the state for inclusion of climate resilient measures in the work contracts.
- v. Provide guidance on engineering, resource efficiency, nature based solutions and bioengineering measures to counter climate impacts on pavements, surfacing, bridges, earthworks and drainage structures.
- vi. Provide suitable examples of resource efficiency, nature-based interventions and bio-engineering works as good international / national practices or case studies.

## **C) Development of Climate Strategy for Maintenance Management System**

- i. Provide strategy for integrating climate consideration into Maintenance Management Systems- This task should be largely informed by the previous Tasks: what type and format of data and for which assets (roads (and its various classifications), bridges, footpaths, etc.) should be collected, and what collection methods should be used, whether the data needs to be geo-tagged etc. The Consultant will provide the recommendations on the following:
  - a. Data type and format for a given asset: The Consultant will define the data to be collected at a project and network levels, and will define the structure of the data in a format;
  - b. Data collection: The Consultant will define the data collection methods, frequencies, responsibilities, and budget. The Consultant will clarify which of the determine data is collected by other government agencies and will advise on how that data could be integrated in the existing system;
  - c. Data analysis and recommending resilience measure: The Consultant will define the methodology to analyze the data and report results to facilitate the selection of the most suitable resilience measures from alternative design options including bio-engineering solutions and inform PWD's multi-year and annual planning processes.
  - d. Define performance indicator for long-term maintenance contract: The Consultant should suggest performance indicators those that are relevant to climate change

and disaster mitigation to be in build into long-term third-party contract for asset maintenance.

#### **D) Development of Climate Resilience and Green Growth Strategy**

Based on the analysis from the vulnerability assessment the Consultant will then prepare a Climate Resilient and Green Growth Strategy for Meghalaya Transport Sector. The strategy should (i) outline a general climate change adaptation policy framework and objectives for the transport sector; (ii) propose specific policy reforms required to provide a foundation for climate change adaptation and to address natural hazard vulnerability in the transport sector. This can be achieved through following activities:

- i. Review current transport planning processes, the institutional and legal framework for the roads sector (e.g., relevant legislation), national and international construction standards for climate works, maintenance (routine, periodic and emergency) methods, and related processes and assess their adequacy in the light of projected climate change and natural hazard vulnerability. Recommend suitable reforms, such as (but not limited to):
  - a) Embedding consideration of climate change and disaster risk management issues into road planning processes and its integration with other modes to reduce risks;
  - b) Suggest Draft Design Standards for Climate works based on review of national and international codes, manuals and practices;
  - c) Employing new approaches to maintenance that take into account climate change and natural hazards; and
  - d) Mainstreaming climate change adaptation and disaster risk management into the road sector from infrastructure and operational perspectives.
- ii. Review the institutional and legal framework as relevant to the implementation of Climate Change Adaptation and Disaster Risk Management, and recommend specific reforms needed to:
  - a) Improve management of traffic and access to road infrastructure during and following natural disasters.
  - b) Enhance quick response procedures to ensure that assets are repaired and restored quickly following severe weather damage.
- iii. Suggest an optimal climate risk management and disaster and climate financing framework for transport network in the state.
- iv. Prepare “Draft TORs” for conducting vulnerability assessment of road/ bridges/ other assets projects for the DPR Consultants including study of floods maps, hydrological data of the catchment areas, assessment of rainfall data, alternate design analyses, landslide and related geotechnical/geo-morphological analyses.
- v. Suggest the following:
  - a) type and format of data needed for the climate change vulnerability assessment for different asset;
  - b) methods for mapping, preferably GIS-based ones, of infrastructure assets in vulnerable areas, and inventory of critical assets that are susceptible to climate change impacts;
  - c) methods for monitoring of asset condition in conjunction with environmental conditions (e.g., temperature, precipitation, geology, wind to determine of climate change affects performance;

- d) methodology for prioritization of risk areas and assets and identification of high-risk areas and highly vulnerable assets as carried out Task A;
- e) Methodology to apply different Climate Resilient Design Standards/Specifications for different climate risks and hazards;
- f) Methodology for the development of a work program of priority climate resilience measures for vulnerable roads and other assets at risk areas.

#### **E) Development of User’s guide and Capacity Building of local Staff**

The consultant should develop a User’s guide for using Web-GIS based road risk platform and conduct workshops for concerned stakeholders in using Web-GIS based road risk platform.

The Consultant will organize a knowledge dissemination initiative (at-least 5 Nos Workshops) to be attended by PWD Engineers and other relevant stakeholders from the state and others. During the study, the Consultant will hold several workshops to present preliminary results of each task to seek feedback and recommendations of PWD and other stakeholders, prior to the finalization of its main outputs. At the workshop, the Consultant will present:

- the results of the vulnerability assessment and work program of priority measures;
- demonstrate how to use the developed assessment methodologies for the vulnerability assessment, climate works engineering design standards and methodology for climate resilience engineering design audits;
- policy, institutional and financial reforms recommended;
- the climate resilient and green growth strategy; etc.

#### **DELIVERABLES, TIMELINES AND PAYMENTS**

It will be a lump-sum contract for 9(nine)months. Payments will be linked with acceptance of deliverables.

<b>Sl. No.</b>	<b>Deliverables</b>	<b>Due date for submission from the start date of contract signing (Days)</b>	<b>Payment Schedule</b>
<b>1</b>	Inception report that summarizes the methodological approach and the study plan that is proposed,	Within 15 days of the commencement of the assignment.	Acceptance of this report would account for 10% of the contract amount.
<b>2</b>	Interim report (I) that provides the summary of findings of the risk assessment and preliminary conclusions of the study and all that is included in <b>TASK A</b>	Within four (4) months of the commencement of the assignment.	Acceptance of this report would account for 30% of the contract amount;
<b>3</b>	Interim Report (II) shall present outputs of all that is expected to be completed under <b>TASK B &amp; C</b> including (a) Work Program of priority climate resilience measures, and (b) Maintenance Management Strategy.	Within seven (7) months of the commencement of the assignment.	Acceptance of this report would account for 30% of the contract amount;



4	Draft Final report cover all that is included in <b>TASK D, &amp; E</b> , to be submitted.	Within nine (9) months of the commencement of the assignment	Acceptance of this report would account for 30% of the contract amount.
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#### Eligibility Criteria:

#	Eligibility Criteria	Supporting Documents to be submitted
1.	The bidder should be a single Business Entity. (Any kind of consortium is not allowed). For the purpose of this EoI, a Business Entity shall mean a company registered in India under the Companies Act 1956, and operating for the last 10 years as of March 31, 2019.	Self attested copy of Incorporation / Registration Certificate of the company
2.	a) The bidder should have a minimum annual turnover of <b>INR 50 Crores</b> in each of the last three financial years (FY 2016-17,2017-18 & 2018-19)	Certificate from a registered Chartered Accountant (CA) certifying the turnover of the company as required for Para 2(a)
3.	The bidder should have a positive net worth during each of the previous three financial years (FY 2016-17,2017-18 & 2018-19)	Certificate from a registered Chartered Accountant (CA)
4.	Experience in undertaking vulnerability assessment projects:  a) The bidder must have completed at least 2 projects for providing Advisory/Consultancy services for vulnerability and risk assessment of road infrastructure, projects funded by World Bank, Asian Development Bank or any other external funding agency.  b) Details of proposed key experts with their qualification and experience.	Copy of the work order, completion certificate to be given by the client with details of consultancy project cost.(preferably State Governments/Government of India, or State/Central Government Undertakings, Government-owned enterprises or institutions etc.) CV's/Resumes of proposed key staff should be attached for evaluation w.r.t Para 5. g).
5.	Experience in the following works:  <ul style="list-style-type: none"> <li>• Detailed Road Engineering Design and technical specifications;</li> <li>• Climate change hazard assessment and mitigation;</li> <li>• Extensive international experience on road projects;</li> <li>• Solid knowledge of the institutional and policy process required in the implementation of climate</li> </ul>	Copy of the work order, completion certificate to be given by the client with details of consultancy project cost.(preferably State Governments/Government of India, or State/Central Government Undertakings,

	<p>change adaptation measures;</p> <ul style="list-style-type: none"> <li>• Excellent ability to consult with key decision makers and stakeholders in the road sector; relevant ministries, municipalities, environmental agencies, NGOs, and communities; and</li> </ul> <p>Knowledge of and fluency of the local languages will be an added advantage.</p>	Government-owned enterprises or institutions etc.) with details of consultancy project cost.
6.	The bidder should not have been blacklisted by any State / Central Government / PSUs in India as on bid submission date for corrupt, fraudulent or any other unethical business practices or for any other reason.	Self certificate to be given on the company's letter head by its authorized signatory.

### Manpower requirements and eligibility criteria of Key Personnel/Specialists

It is expected that the firm or team of Consultants will include, but not limited to, persons with the following roles:

Key Staff	Qualifications	Experience	Envisaged Time Inputs
<b>Team Leader (1)</b>	The candidate must be a Ph.D. in Civil engineering/ Geology/ Geophysics/ Hydrology/ Hydraulics or equivalent	The candidate must have at least 20 years of work experience in disaster risk assessment and modeling in projects, with at least 5 years' experience of leading such projects. The candidate should have completed at least 2 projects for providing Consultancy services for vulnerability and risk assessment of road infrastructure.	9
<b>Dy. Team Leader (1)</b>	The candidate must be a post graduate in Transport Engineering/ Pavement Engineering/ Urban Planning or equivalent	The candidate must have at least 20 years of work experience in Road Transport Engineering projects funded by international financing institutions having experience in economic risk assessment aspects of disruption of road transport network	9
<b>Disaster Risk Assessment Specialist/ climate change specialist (2)</b>	Bachelor's degree in Civil Engineering, Road Planning, Geology or other relevant Disaster Management subject required as well as a relevant post graduate qualification.	15 Years or more experience in Environment and/or Climate Change. He/she should have at least 10 years of experience in the fields of natural disaster assessment, mitigation and remediation; At least should have experience with a developing country or any of the Indian states which has developed Climate Adaptation/Resilience Strategy for Roads/Transport Infrastructure.	8

<b>Road Engineer (2)</b>	Bachelor's degree in civil engineering, with post-graduate qualification in roads-related discipline.	20 years or more experience in the field of road engineering, out of which minimum 7 years post-graduate experience in roads and drainage design in small island states, preferably in South Asia, South East Asia would be an advantage. Some CCA and/or DRM-related project experience preferred	8
<b>Economist (1)</b>	Master's degree in Economics required. Preference would be given to PhD	At least 12 years of experience in micro-economics. Experience with statistical modelling; designing, implementing household, commercial properties, etc. surveys; and performing complex econometric analysis strongly preferred. At least 3 years of experience in similar studies.	3
<b>GIS Mapping Specialist (2)</b>	Masters of Computer Science or Engineering Degree required	Minimum of 5 years of GIS experience and experience working with various data formats such as CAD, GPS, etc. Knowledge of environmental resource management, transportation, or geography strongly preferred.	2
<b>Geo-technical engineer (2)</b>	At a minimum a Bachelor's degree in engineering discipline with Post Graduate in Geotechnical Engineering	At least 10 years of experience in positions requiring proficiency with the analysis of landslide and slip circle failures, geo-technical and bio-engineering applications for road and bridge protection works. Some CCA and/or DRM-related project experience preferred. Experience in hill roads and bridges.	8
<b>Engineering Hydrologist</b>	Bachelor's degree in Hydrology, Physical Geography, Earth Science, Engineering, or Environmental Science required with a strong focus on hydrology. Preferably master degree.	At least 10 years' relevant experience in engineering hydrology including 3 years of experience of hydrodynamic analyses and modelling, flood risk assessment with hydrologic modelling software. Some CCA and/or DRM-related project experience preferred. Some CCA and/or DRM-related project experience preferred.	6
<b>Climate Change Expert (1)</b>	The candidate must be a post graduate in Geophysics/ Hydrology/ Hydraulics/	The candidate must have at least 20years of experience in Climate Change related aspects modeling for hydro- meteorological	6

	Environmental Engineering/ Oceanography or equivalent		
<b>IT Expert cum System Integrator (1)</b>	The candidate must be a post graduate in Computer Science/Information Technology	The candidate must have at least 15 years of experience in development of Catastrophe Risk Assessment software with GIS integration for complex projects using open source technology . The candidate must have developed at least 02 such platforms.	8
<b>GIS Specialist (1)</b>	The candidate must be a post-graduation Remote Sensing & GIS/Geography or equivalent	The candidate must have at least 10 years of experience in the application of remote sensing and GIS for hazard and exposure data development	8

Additionally, time inputs for 3 Support Staff can be considered. Each support staff may have 6 months of time Inputs in the study period. The support staff should have a Degree in Civil Engineering with at-least 5 years in Road engineering design experience.

### **Annexure 1**

The possible sources of such information could be State Disaster Management Plan<sup>3</sup>, District Disaster Management Plans<sup>4</sup>, as well as State's Climate Action Plan<sup>5</sup>. Consultant may wish to refer to other research publications but not limited to: Climate Vulnerability Assessment for the Indian Himalayan Region Using A Common Framework<sup>6</sup>; Disaster Vulnerability Assessment of Shillong, Meghalaya<sup>7</sup>, etc.

<sup>3</sup><http://msdma.gov.in/sdmp.html>

<sup>4</sup><http://msdma.gov.in/ddm-plans.html>

<sup>5</sup><https://meghalayacc.org/wp-content/uploads/2019/03/Meghalaya-State-Action-Plan-on-Climate-Change-1.pdf?x84496>

<sup>6</sup>[https://dst.gov.in/sites/default/files/IHCAP\\_Climate%20Vulnerability%20Assessment\\_30Nov2018\\_Final\\_aw.pdf](https://dst.gov.in/sites/default/files/IHCAP_Climate%20Vulnerability%20Assessment_30Nov2018_Final_aw.pdf)

<sup>7</sup><https://irade.org/Disaster%20Vulnerability%20Assessment.pdf>