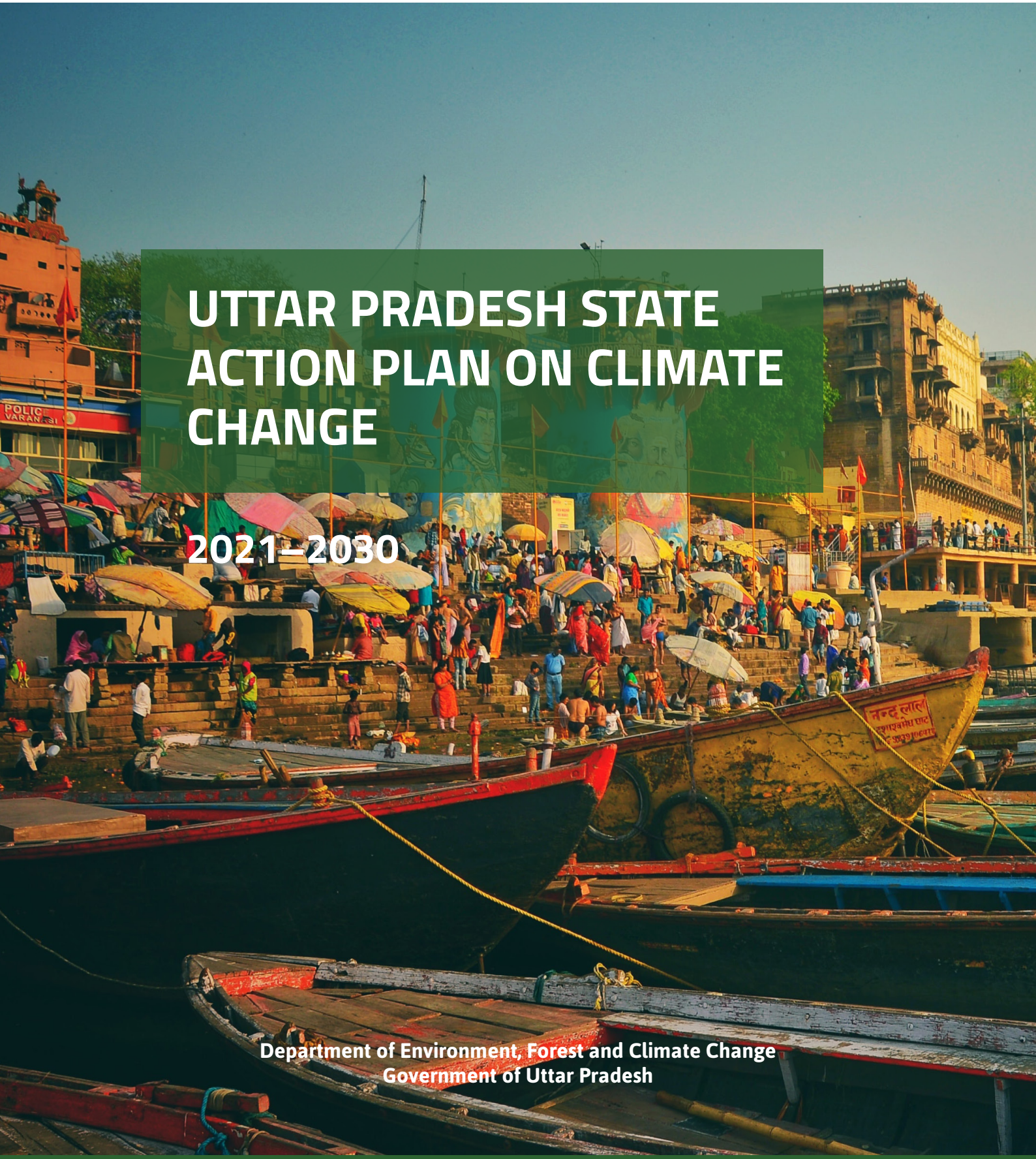

UTTAR PRADESH STATE ACTION PLAN ON CLIMATE CHANGE

2021–2030

Department of Environment, Forest and Climate Change
Government of Uttar Pradesh

Uttar Pradesh State Action Plan on Climate Change (UP SAPCC)

2021–2030

Prepared By

Department of Environment, Forest and Climate Change
Government of Uttar Pradesh(GoUP)

योगी आदित्यनाथ

मुख्य मंत्री
उत्तर प्रदेश

आज़ादी का अमृत महोत्सव

लोक भवन,
लखनऊ - 226001

संख्या-

06 APR 2023

संदेश

मुझे यह जानकर अत्यन्त प्रसन्नता की अनुभूति हो रही है कि पर्यावरण, वन एवं जलवायु परिवर्तन विभाग, उत्तर प्रदेश द्वारा राज्य के सभी संबंधित विभागों एवं हितग्राहियों के साथ विचार-विमर्श व समन्वय कर जलवायु परिवर्तन के प्रभावों के अनुकूलन व शमन हेतु **"उत्तर प्रदेश राज्य की जलवायु परिवर्तन कार्य योजना 2021-2030"** तैयार की गई है।

वैश्विक तापमान में वृद्धि के कारण मौसम चक्र में आ रहे परिवर्तन से उत्पन्न प्रभावों से प्रत्येक प्रदेशवासी विशेषकर समाज के निर्बल, निर्धन व वंचित वर्ग के सदस्य एवं कृषक वर्ग विषम परिस्थितियों का सामना कर रहे हैं। जलवायु संवेदी विकास के माध्यम से प्रदेश के विकास एवं जलवायु परिवर्तन के मध्य संतुलन बनाया जा सकता है। उ0प्र0 राज्य 01 ट्रिलियन डॉलर की अर्थव्यवस्था के लक्ष्य को सतत विकास के सिद्धांतों अनुरूप प्राप्त किये जाने हेतु अग्रसर है।

उ0प्र0 राज्य की इस कार्य योजना के अंतर्गत गठित 09 मिशनों के अंतर्गत निर्धारित कार्यबिन्दुओं अनुसार राज्य में जलवायु परिवर्तन के कारण मानव स्वास्थ्य पर पड़ने वाले प्रभाव का अनुकूलन मौसम की चरम घटनाओं जनित प्राकृतिक आपदाओं से निपटने हेतु लचीलापन, प्राकृतिक खेती के माध्यम से क्लाईमेट स्मार्ट कृषि प्रथाओं का अंगीकरण, नवकरणीय ऊर्जा व ऊर्जा दक्षता को प्रोत्साहन, जल संरक्षण एवं वृहद वृक्षारोपण आदि को समाहित करते हुए नीतिगत ढांचे के सुदृढ़ीकरण हेतु प्रभावी कार्यवाही की जा रही है। इस कार्य योजना के सफल क्रियान्वयन हेतु समस्त हितग्राहियों जैसे औद्योगिक इकाईयाँ, कारपोरेट्स, नवाचार, निर्माण एवं यातायात तथा आम-नागरिक की सक्रिय भागीदारी आवश्यक है।

कार्य योजना के अंतर्गत निर्धारित लक्ष्यों व कार्य बिन्दुओं के क्रियान्वयन के नियमित अनुश्रवण एवं मूल्यांकन को प्राथमिकता दी गयी है ताकि निर्धारित लक्ष्यों की ससमय प्राप्ति सुनिश्चित हो सके। इस कार्ययोजना के क्रियान्वयन हेतु केंद्र एवं राज्य सरकार की विभिन्न योजनाओं के कन्वर्जेंस के साथ-साथ बहुपक्षीय व द्विपक्षीय वित्तीय संस्थाओं के माध्यम से वित्तीय संसाधन की व्यवस्था इस कार्य योजना का सफल क्रियान्वयन सुनिश्चित करेगी।

मुझे पूर्ण विश्वास है कि **'उत्तर प्रदेश राज्य की जलवायु परिवर्तन कार्य योजना'** सभी संबंधित विभागों एवं हितग्राहियों की भागीदारी के माध्यम से अपने लक्ष्यों को प्राप्त कर जलवायु परिवर्तन के प्रतिकूल प्रभावों को न्यून करने में सहायक सिद्ध होगी।

(योगी आदित्यनाथ)

दूरभाष : 0522-2289017 / 2289010 / 2289167 फैक्स - 0522-2239234 ईमेल - cmup@nic.in

डा. अरुण कुमार

एम.बी. बी. इस. (लखनऊ)

डी.एन.बी., एफ.सी.जी.पी.

राज्य मंत्री (स्वतंत्र प्रभार)

वन पर्यावरण जंतु उद्यान एवं

जलवायु परिवर्तन विभाग

उत्तर प्रदेश

कक्ष संख्या – एफ ब्लॉक 1/2

प्रथम तल, बापू भवन,

उत्तर प्रदेश शासन, लखनऊ

कार्यालय : 0522–2237001

सी0 एच0 : 0522–2214800

संदेश

पर्यावरण, वन एवं जलवायु परिवर्तन विभाग, उत्तर प्रदेश द्वारा राज्य में जलवायु परिवर्तन के प्रभावों के अनुकूलन व शमन हेतु उत्तर प्रदेश राज्य की जलवायु परिवर्तन कार्ययोजना 2021-2030 तैयार की गई है। 09 मिशनों की उक्त कार्ययोजना को तैयार करने के लिए राज्य के सभी संबंधित विभागों एवं हितधारको के साथ विचार-विमर्श व समन्वय किया गया है।

पर्यावरण एवं विकास के मध्य अपेक्षित समन्वय का अभाव की वजह से जलवायु परिवर्तन की गंभीर स्थिति तक पहुँच चुका है। राज्य में भी समस्त समुदायों के सदस्य पर्यावरण परिवर्तन जनित प्रतिकुल प्रभावों के कारण विषम परिस्थितियों का सामना कर रहे हैं। जीवनशैली में परिवर्तन, प्रकृति में बढ़ते मानवीय हस्तक्षेप पर नियन्त्रण एवं कार्बन उत्सर्जन न्यून करने के प्रयासों से जलवायु परिवर्तन के प्रभाव को कम किया जा सकता है।

मानव स्वास्थ्य, प्राकृतिक आपदा, कृषि, हरित ऊर्जा व ऊर्जा दक्षता, जल संरक्षण एवं हरा-भरा प्रदेश तथा प्राकृतवासों पर जलवायु परिवर्तन के कारण उत्पन्न कठिनाइयों को कम करने एवं राज्य की जनता को उसके प्रभावों हेतु तैयार करने के उद्देश्य से विकसित राज्य की वृहद जलवायु परिवर्तन कार्ययोजना निश्चय ही बहुत उपयोगी सिद्ध होगी।

पर्यावरण, वन एवं जलवायु परिवर्तन विभाग, उत्तर प्रदेश द्वारा कार्ययोजना में निहित विभिन्न लक्ष्यों व कार्य बिन्दुओं के नियमित अनुश्रवण एवं मूल्यांकन की व्यवस्था एवं कार्ययोजना के कार्य बिन्दुओं के क्रियान्वयन हेतु वित्त की आवश्यकता, भारत सरकार व राज्य सरकार द्वारा संचालित विभिन्न योजनाओं द्वारा वित्त की उपलब्धता की मैपिंग कर कार्ययोजना को पूर्णतय क्रियान्वयन योग्य बनाने के लिए मैं विभाग की सराहना करता हूँ।

मुझे आशा है कि समस्त विभागों के सहयोग से आने वाले समय में उत्तर प्रदेश, जलवायु परिवर्तन के प्रतिकूल प्रभावों को कम करने की दिशा में अग्रणी स्थान हासिल करेगा।

शुभकामनाओं सहित

(डा0 अरूण सक्सेना)

के0 पी0 मलिक
राज्य मंत्री
वन पर्यावरण जंतु उद्यान एवं
जलवायु परिवर्तन विभाग
उत्तर प्रदेश।

कक्ष संख्या – एफ ब्लॉक 3/4
प्रथम तल, बापू भवन,
उत्तर प्रदेश शासन, लखनऊ
कार्यालय : 0522–2237001
मो0 नं0 : 9412224000 9756201121

संदेश

जलवायु एक ऐसा पहलू है जो दुनिया के हर इंसान के जीवन से जुड़ा हुआ है और जलवायु की दशा हमारे जीवन को बहुत प्रभावित करती है। जलवायु में हो रहे नकारात्मक परिवर्तन पृथ्वी पर रहने वाले सभी जीवों के लिए बहुत ही घातक सिद्ध हो रहे हैं। जलवायु परिवर्तन से जुड़े खतरों के प्रति सरकारें जागरूक हो रही हैं। पर्यावरण, वन एवं जलवायु परिवर्तन विभाग, उ0प्र0 ने राज्य की जलवायु परिवर्तन कार्ययोजना बना कर इस दिशा में सराहनीय कार्य किया है।

जलवायु परिवर्तन का पर्यावरण के सभी पहलुओं के साथ-साथ वैश्विक आबादी के स्वास्थ्य और कल्याण पर व्यापक प्रभाव पड़ रहा है। पर्यावरण प्रदूषण के कारण बढ़ते तापमान ने जलवायु परिवर्तन की स्थिति को और गंभीर बनाने का कार्य किया है। विकास को प्रमुखता देने के साथ-साथ पर्यावरण पर इसके प्रभावों के शमन की महती आवश्यकता है।

मुझे अत्यंत हर्ष है कि पर्यावरण, वन एवं जलवायु परिवर्तन विभाग, उ0प्र0 ने राज्य की जलवायु परिवर्तन कार्ययोजना बनाने हेतु सभी संबंधित विभागों एवं हितधारको से विचार-विमर्श किया है और इस कार्ययोजना को जलवायु परिवर्तन की राष्ट्रीय कार्ययोजना, सतत विकास लक्ष्यों एवं भारत सरकार के राष्ट्रीय स्तर पर निर्धारित योगदान (एन.डी.सी.) से संरेखित किया है।

मुझे पूर्ण विश्वास है कि उ0प्र0 राज्य की जलवायु परिवर्तन कार्ययोजना के क्रियान्वयन से राज्य में जलवायु परिवर्तन के प्रभावों के अनुकुलन एवं शमन के कार्य में अपेक्षित सफलता प्राप्त होगी।

शुभकामनाओं सहित

(के0पी0 मलिक)

FOREWORD

Durga Shanker Mishra (IAS)
Chief Secretary
Government of Uttar Pradesh

It is well understood that climate change is a global problem and it undermines achievements of Sustainable Development Goals (SDGs) and the country's own development objectives. There are studies on how changing climatic conditions are increasing the frequency and intensity of disasters and causing widespread adverse impact on infrastructure, livelihood and natural ecosystems. Climate change impacts the energy availability, availability of natural resources and food security adversely. The state of Uttar Pradesh has reason to be concerned about climate change, as we have a large population dependent on agriculture and forests and agri-forests for livelihood. The state's economy is dependent on agriculture and any adverse impact on these and allied sectors will negate our efforts to alleviate poverty and ensure sustainable livelihood for the population. This is an opportune time to integrate the concerns of climate change into our policies and ensure ultimate objective of sustainable development with inclusive growth. While engaging with national policies and programmes, it is important for us to develop well-researched and well-formulated mitigation and adaptation strategies specific to the state to respond effectively to the possible impacts of climate change. To address the changing climatic conditions, the **State Action Plan on Climate Change (SAPCC)** has been formulated by the Government of Uttar Pradesh.

The SAPCC has flagged important issues, which require attention. The action plan has highlighted key sectoral concerns and strategies for action in order to lead the way. The issue of climate change is multidisciplinary and demands cross-sectoral convergence, which requires interdepartmental coordination as well as constructive engagement with all the concerned stakeholders. The Government of Uttar Pradesh(GoUP) would continue to strive to mainstream climate change concerns across all sectors for achieving the objectives of sustainable development. Therefore, UP Climate Change Authority (UPCCA) has been constituted that will facilitate the implementation of the SAPCC.

l appreciate the extended support provided by Ministry of Environment, Forest and Climate Change, Gol in bringing out such an Implementation document and Department of Environment, Forest and Climate Change, GoUP with technical support from GIZ, India. I compliment the efforts of the entire team headed by Shri Manoj Singh, ACS, DoEFCC, GoUP for preparing this exhaustive State Action Plan on Climate Change, a roadmap for Uttar Pradesh.

MESSAGE

Manoj Singh (IAS)
Additional Chief Secretary

Department of Environment
Forest & Climate Change

Government of Uttar Pradesh

Climate change is the greatest global challenge today which through a multitude of impacts poses a risk to our ecology, economy and society. Observation shows that changes being experienced in the climate of Uttar Pradesh are over and above the natural climate variability prevailing in the region. Studies have shown that Uttar Pradesh falls within areas of greatest climate sensitivity, maximum vulnerability and lowest adaptive capacity. Already, water resources in the State are scarce and have a highly uneven distribution both temporally and spatially.

A threat such as climate change thus calls for timely and coherent policy response and action that will help reduce vulnerability and build resilience of the state to likely climate impacts. Government of India has launched eight missions as part of the National Action Plan on Climate Change in specific areas based on sectoral level assessment of the impact of climate change and required interventions needed to address these impacts. Under the guidance from MoEFCC, the state government prepared and adopted its First Action Plan on Climate Change in the year 2014-2015 and now the revision of SAPCC has been carried out following a comprehensive framework, as guided by MoEFCC, in line with the Updated Nationally Determined Contributions (U-NDC} and Sustainable Development Goals (SDGs).

I am pleased to see that the various departments of the Government of Uttar Pradesh, with the help of experts from different sectors have prepared the Uttar Pradesh Action Plan on Climate Change. The SAPCC has been prepared, so as to set up a common but shared agenda for climate change mitigation and adaptation. This State Action Plan is a document which aims to connect between evolving climate science, policies and practices. SAPCC is a dynamic document and would be subjected to periodic review so as to revisit the suggested nine mission-wise strategies and constantly refine them. On behalf of Department of Environment, Forest and Climate Change, GoUP, Lucknow, I convey our gratitude to the Ministry of Environment, Forest and Climate Change, GoI for providing the financial assistance to undertake the revision process of SAPCC and GIZ for providing technical support and guidance to bring out this scientific strategic document.

I extend my gratitude to Mr. Ashish Tiwari, Secretary, DoEFCC, GoUP for his commendable efforts to develop this mission-wise State Action Plan on Climate Change. I hope that the mission-wise priorities identified under the Climate Change Action Plan will lead to sound implementation of strategies that will help address the challenge of climate change in the state and ensure a future, in line with the vision of sustainable development.

ACKNOWLEDGEMENT

Sh. Ashish Tiwari (IFS)
Secretary

Department of Environment
Forest & Climate Change

Government of Uttar Pradesh

The world today is faced with the challenge of sustaining economic growth while ensuring environmental conservation. Climate change is a serious environmental threat to humanity and has implications for sustainable development. Climate change is ever evolving and dynamic phenomena and the response to adapt to the adverse effects, while reducing the greenhouse gases also has to be dynamic, evolutionary and in line with emerging threats, and national and international frameworks.
The individual framework, such as the Paris Agreement has led countries to make their individual arrangements to reduce emissions and take mitigation and adaptation measures expressed as NDCs.

In light of the fact that the State Action Plan on Climate Change (SAPCC) is a dynamic document, SAPCC has been revised to focus on broad state-specific traits, making use of available knowledge and understanding, through a process that was both, comprehensive and insightful. This document will surely help the state government in orienting their efforts in the relevant fields and sectors to cope and adapt with ensuing and potential impacts of climate change. The document will also be useful in prioritizing and implementing various kinds of mitigation measures in the state under overall guidance of MoEFCC, Government of India.

The plan would have never been complete without the sustained support of the team of Directorate of Environment including Mr. Devendra Singh, Deputy Director and Mr. Pankaj Arya, Consultant. I, wholeheartedly acknowledge the efforts put in by Mr. Kirtiman Awasthi, Senior Policy Advisor, GIZ and his team members namely Ms. Somya Bhatt, Advisor, Mr. Manas Dwivedi, Advisor, Ms. Nisha, Consultant.
The hard work of Dr. Sumana Bhattacharya, Senior Advisor, Climate Change, IORA and her entire team—namely Ms. Sriya Mohanti, Assistant Vice President, Climate Change; Ms. Swati Pillai, Manager, Climate Change; Ms. Pradnya Mathur, Manager, Climate Change; Ms. Garima Jasuja, Assistant Manager, Climate Change; Mr. Sujith Sourab Guntoju, Assistant Manager, Climate Change; Ms Gopalika Arora, Research Associate, Climate Change; and Mr. Varad Vatsal, Research Associate, Climate Change for revising and finalizing the document is highly appreciated and acknowledged.

I, on the behalf of Department of Environment, Forest and Climate Change, Government of Uttar Pradesh hereby acknowledge the contribution of Ministry of Environment, Forest and Climate Change, GoI for encouraging the state to bring out such an exhaustive state action implementation plan. I also appreciate the efforts of nodal departments, research institutions, individual experts who have contributed towards the development of the content of the Uttar Pradesh SAPCC. I deeply acknowledge the technical support provided by the experts of the department and GIZ, India.

CONTENT

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ABBREVIATIONS

AF	Adaptation Fund
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
ACZ	Agro-Climatic Zones
AWW	Anganwadi Worker
ANM	Auxiliary Nurse Midwife
ASHA	Accredited Social Health Activist
BCM	Billion Cubic Meter
BHU	Banaras Hindu University
BHS	Biodiversity Heritage Site
CAFRI	Climate Adaptation and Finance in Rural India
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CORDEX	Coordinated Regional Climate Downscaling Experiment
DRR	Disaster Risk Reduction
CS	Central Sector Scheme
CSR	Corporate Social Responsibility
CSS	Centrally Sponsored Scheme
CWC	Central Water Commission
DISCOM	Distribution Companies
DRR	Disaster Risk Reduction
DoAH	Department of Animal Husbandry
DoEF&CC	Department of Environment, Forest and Climate Change
DTR	Diurnal Temperature Range
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIM	Green India Mission
GoI	Government of India
GoUP	Government of Uttar Pradesh
GP	Gram Panchayat
GSDP	Gross State Domestic Product
GSVA	Gross State Value Added
IMD	India Meteorological Department

IPCC	Intergovernmental Panel on Climate Change
ISFR	India State of Forest Report
IUCN	International Union for Conservation of Nature
JF	January February
JJAS	June July August September
JJM	Jal Jeevan Mission
JICA	Japan International Cooperation Agency
KVK	Krishi Vigyan Kendra
LPG	Liquefied Petroleum Gas
MAM	March April May
MoEFCC	Ministry of Environment Forests and Climate Change
MGNREGS	Mahatma Gandi National Rural Employment Gaurantee Scheme
MOSPI	Ministry of Statistics and Programme Implementation
M&E	Monitoring and Evaluation
NABARD	National Bank for Agriculture and Rural Development
NAFCC	National Adaptation Fund for Climate Change
NAPCC	National Action Plan on Climate Change
NMSKCC	National Mission on Strategic Knowledge for Climate Change
NCEF	National Clean Energy Fund
NCEEF	National Clean Energy and Environment Fund
NDC	Nationally Determined Contributions
NDMA	National Disaster Management Authority
NDRF	National Disaster Response Fund
NGO	Non Governmental Organisations
NHP	National Hydrology Project
NMSA	National Mission on Sustainable Agriculture
NTFPs	Non-Timber Forest Produce
OF	Open Forest
OND	October November December
PRD	Panchayati Raj Department
PBR	People's Biodiversity Register
PMAY	Pradhan Mantri Awas Yojana
PMCCC	Prime Minister's Council on Climate Change
PPP	Public-Private Partnership
PWD	Public Works Department
RCP	Representative Concentration Pathways
SAPCC	State Action Plan on Climate Change
SDG	Sustainable Development Goals
SDRF	State Disaster Relief Fund
SDMA	State Disaster Management Authority
SC	Scheduled Caste
SWGB	State Groundwater Board
SIDBI	Small Industries Development Bank of India
SKMCC	Uttar Pradesh Strategic Knowledge Mission for Climate Change
SMCG-UP	State Mission for Clean Ganga, Uttar Pradesh
SS	State Sponsored Scheme
ST	Scheduled Tribe
SWaRA	State Water Resources Agency
ToF	Trees outside Forest
UDD	Urban Devlopment Department
ULBs	Urban Local Bodies
UNDP	United Nations Development Programme
U-NDC	Updated Nationally Determined Contributions
UP	Uttar Pradesh
UP CCA	Uttar Pradesh Climate Change Authority
UPERC	Uttar Pradesh Electricity Regulatory Commission
UPFC	Uttar Pradesh Forest Corporation
UPIWRD	Uttar Pradesh Irrigation and Water Resources Department
UPNEDA	Uttar Pradesh New and Renewable Development Agency

UPPCB	Uttar Pradesh Pollution Control Board
UPSAPCC	Uttar Pradesh State Action Plan on Climate Change
UP SAPCC	Uttar Pradesh State Action Plan on Climate Change
UP SAPCC 2.0	Uttar Pradesh State Action Plan on Climate Change 2022-2030
VDF	Very Dense Forest
VI	Vulnerability Index
WALMI	Water and Land Management Institute
WRM	Water Resource Management
WUA	Water User Association

Executive Summary

In 2008, the Government of India (GoI) recognised climate change as a significant global problem that has the potential to adversely impact natural resources, society and economy. As a result the Prime Minister's Council on Climate Change (PMCCC) was formulated, a body that was tasked with devising national action plans on assessment, adaptation and mitigation of climate change. Within the same year, the PMCCC along with relevant government departments formulated– the National Action Plan on Climate Change (NAPCC) that elucidated eight national missions to aid the climate change mitigation and adaptation strategies in the country.

Going forward, the NAPCC was decentralised and each state and union territory in the country was requested to prepare a State Action Plan for Climate Change (SAPCC) on the lines of the NAPCC while factoring in the socio-economic and geographic variations across these regions. With the view of centralising climate change in development planning, the formulation of SAPCCs has been a critical milestone in subnational climate policy in the country and these SAPCCs have become the guiding document for subnational planning on matters of climate change. A central aspect of the SAPCCs has been mainstreaming of climate change in the local level planning and policy formulation. It factors in the necessary consideration that mainstreaming climate change can have different meanings. Its understanding may depend on the contextual relevance of an action, and policy implementation could be graded from incremental action to transformative policies. This underscores the notion that for any developmental action to achieve its full potential, it is critical that climate change action be mainstreamed effectively, particularly in policy and planning at subnational level. During the period 2008 to 2015, 33 states and union territories published their respective first SAPCCs.

The Government of Uttar Pradesh notified its first Uttar Pradesh State Action Plan on Climate Change (UP SAPCC) in 2014, recognising and addressing 93 key climate change priorities under seven missions: (1) Sustainable Agriculture Mission (2) Solar Mission (3) Energy Efficiency Mission (4) Green UP Forestry Mission (5) Jal Mission (6) Strategic Knowledge Mission (7) Sustainable Habitat Mission. The plan had an indicative budget of Rs 46,946 Cr.

Revision of State Action Plan on Climate Change

In 2018, the Ministry of Environment, Forestry and Climate Change (MoEFCC) released the 'Common Framework for Revision of State Action Plan on Climate Change' underscoring the GoI's perspective that evolution in the science of climate change, a better understanding of the socio-economic impacts of the evolving crisis and the changes in national and international climate policy landscape necessitated a revision of SAPCCs. The Paris Agreement, which came into existence in 2015, committed to containing the global temperatures between 1.5 to 2°C. India, as party to the agreement, submitted its commitment for post 2020 action through the Nationally Determined Contributions(NDC). The revision in SAPCCs would allow the subnational climate actions identified under the SAPCCs to be synergised with India's Updated NDCs(U-NDC) as well as the Sustainable Development Goals (SDGs). A learning from the formulation of the first SAPCCs was also the critical need to identify the capacity needs at subnational level, particularly for transformative adaptation planning, implementation and effective M&E towards achieving the targets effectively. Therefore, the MoEFCC requested that the revisions to SAPCCs take strong cognizance of the commitments at the international (such as Paris Agreement, Sustainable Development Goals and Sendai Framework), the national (NDCs, NAPCC), and the state-level government priorities (SDG 2030 Vision document).

The overarching objectives of revising the Uttar Pradesh State Action Plan on Climate Change (UP SAPCC 2.0) has been outlined in the figure below:

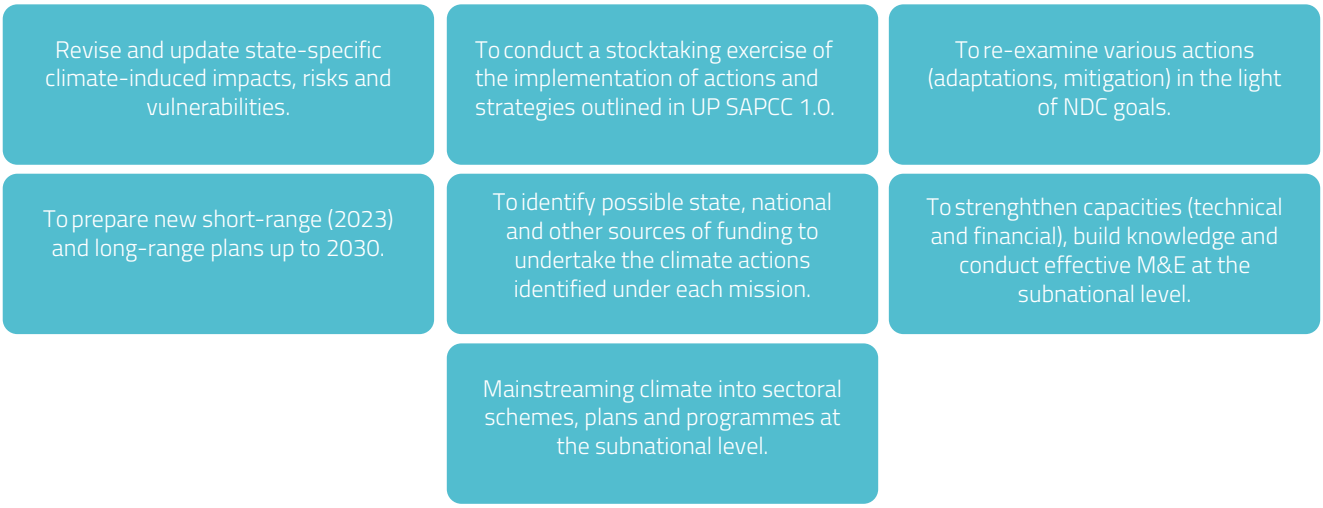


Figure i: Objectives of Revising UP SAPCC

Climate Profile

One of the most populous states in the country, and the fourth largest in terms of area (geographical area: 243,286 km^2), Uttar Pradesh is situated between 23° 52'N to 31° 28' N latitude and 77° 51' E and 84° 38'E longitude. It is landlocked and shares borders with nine other states– Himachal Pradesh, Haryana, Delhi, Rajasthan, Madhya Pradesh, Chhattisgarh, Jharkhand, Bihar, and Uttarakhand. Internationally, Uttar Pradesh shares its borders with Nepal on the north. The state can be divided into three main regions: Sub-mountainous region, the Ganga Plain region, and the Trans-Yamuna region.

The climate of Uttar Pradesh consists of predominantly sub-tropical monsoon, mild and dry winter and hot summer. The average temperature in the state can range anywhere between 12.5–17.5 °C (55–64 °F) in January to 27.5–32.5 °C (82–91 °F) in May and June. Depending on the elevation, there can be a variation in the weather conditions. Nearly 90% of the annual rainfall in Uttar Pradesh is concentrated in the southwest monsoon months of June to September. The increasing variability in rainfall has made certain parts of Uttar Pradesh prone to recurrent episodes of droughts leading to widespread crop failure, and therefore rural to urban migration.

The current report presents an analysis of observed temperature and precipitation trends and variability between 1980-2019. Daily gridded rainfall and temperature data sets available at a spatial resolution of 0.25°x0.25° and 1.0°x1.0° latitude and longitude respectively have been extracted from the IMD database for the grids pertaining to each of the 75 districts in Uttar Pradesh for the period of 1980-2019. In addition, climate projections have been derived for temperature and precipitation (both annual as well as seasonal) for two standardised forcing scenarios called Representative Concentration Pathways (RCPs), namely RCP 4.5 (mid-range emissions) and RCP 8.5 (high-end emissions) scenarios for Near-term (2011-2040), Mid-term (2041-2070) and End-Century (2071-2100) with respect to Baseline (1981-2010). The climate change projections have been derived from an ensemble average of 10 RCM outputs suitable for the Indian region. These RCM outputs are available at www.climatevulnerability.in. The following table outlines the results of the analysis of observed temperature and precipitation trends and variability between 1980-2019 for Uttar Pradesh.

Parameter	State-Level	Value (1980-2019)	Average Annual Change (+/-)
Temperature (°C)	Annual Average Maximum Temperature	31.41°C	+0.0074
	Annual Average Minimum Temperature	19.27°C	+0.0145
	Annual Average Diurnal Temperature Range (DTR)	12.13°C	-0.0071
Rainfall (mm)	Total annual rainfall	896.51 mm	-6.70
	Total seasonal rainfall (JF)	29.52 mm	+0.03
	Total seasonal rainfall (MAM)	36.49 mm	-0.19
	Total monsoon (JJAS) rainfall	792.33 mm	-5.83
	Total monsoon (OND) rainfall	38.26 mm	-0.70

Table i: Analysis Of Observed Temperature And Precipitation Trends and Variability Between 1980–2019

During 1980-2019, the annual average maximum temperature ranged between 30.2°C–32.3°C. The average minimum temperature during the same period ranged between 18.64°C–20.09°C. The district-level analysis also shows a consistent increasing trend for both average maximum and minimum temperature across all districts. Whereas the annual trend for DTR is decreasing over the period of analysis (for details, refer to the report). The highest average maximum temperature was recorded in Lalitpur at 32.74°C. On the other hand, the average minimum temperature during 1980-2019 was the highest in the district of Amethi at 19.24°C. Additionally, the district-level analysis for number of Extreme Heat Days and Severe Heat Days have also been conducted. Dry days have significantly increased in all parts of UP.

The seasonal rainfall analysis at the state-level indicates that nearly 88 % of the total rainfall was received in monsoon season (June, July, August and September) during the period 1980-2019. Rainy days during monsoon have progressively decreased across UP making almost all districts significantly drier in 2010 -2019 w.r.t. 1980 -89. A district-level analysis of rainfall for the period 1980-2019 indicates that the district of Maharajganj has received the highest annual rainfall. While there is a uniform decrease in annual rainfall in all districts between 1980 and 2019, there are three outlier districts indicating increase in rainfall namely Saharanpur (3.09mm), Shamli (0.08mm) and Kaushambi (1.09mm). In addition, a district-level decadal analysis has also been done for number of dry days, rainy days, heavy rainfall days as well as very heavy rainfall days for June-September, i.e. the monsoon period as per IMD definition.

- Maximum Annual Average Temperature has increased at a rate of 0.01 °C per year (between 1981-2019)
- Minimum Annual Average Temperature has increased at a rate of 0.02 °C per year (between 1981-2019)
- Annual Average Rainfall has decreased at a rate of 6.7 mm per year (between 1981-2019)
- Monsoon Rainfall has decreased at a rate of 5.8 mm per year (between 1981-2019)

Climate Projections: Climate projections indicate that the annual average maximum temperature in Uttar Pradesh is likely to rise by 1.04°C and 1.24°C by 2011-2040 under RCP 4.5 and 8.5 scenarios respectively. By mid-term (2041-2070) the annual mean maximum temperature may rise up to 1.75°C and 2.60°C under RCP 4.5 and 8.5 scenarios respectively. By 2011-2040, the annual average minimum temperature in the state is projected to increase up to 0.98°C and 1.20°C for RCP4.5 and RCP8.5 respectively. It may further rise up to 1.90°C to 2.98°C by 2041-2070 and up to 2.40°C and 5.01°C by 2071-2100, under RCP4.5 and 8.5 scenarios respectively. Annual average rainfall in Uttar Pradesh is projected to decrease by 5.37% and 4.36% towards near-term (2011-2040) under RCP4.5 and 8.5 scenarios respectively. As for mid-term (2041-2070), annual average rainfall is projected to decrease by 1.32 % under RCP4.5, but it is likely to increase by 1.56% under RCP8.5. In addition, the projections for seasonal maximum temperature (JF, MAM, JJAS, OND), seasonal minimum temperature (JF, MAM, JJAS, OND) and seasonal precipitation (JF, MAM, JJAS, OND) are also shown.

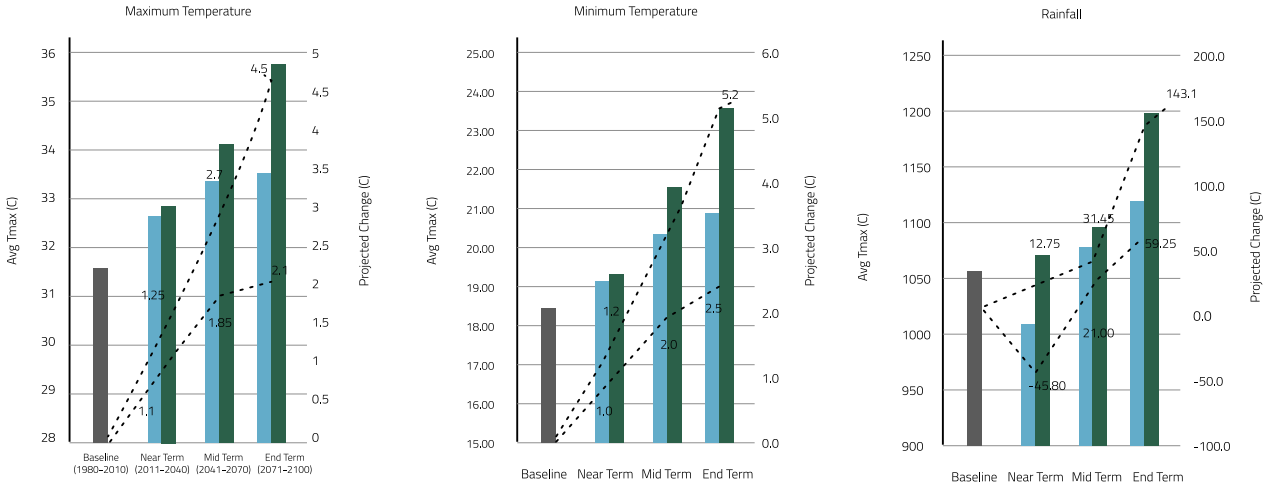


Figure ii: Climate Change Projections for Uttar Pradesh

In addition to an assessment of observed climate trends and future climate projections, the report also maps historical climate events that Uttar Pradesh faced between years 1969 to 2019. Uttar Pradesh is highly vulnerable to climate-induced disasters such as floods, droughts, cloud burst, flash floods, heat & cold waves, and hailstorms. These result in extensive loss of human and animal life, and cause damage to private and public property and the environment. Between 1969 and 2019, the state faced 2539 flood events, 17144 disastrous cold wave days , 6726 disastrous heat wave days and 720 lightning days (maps in figure below).

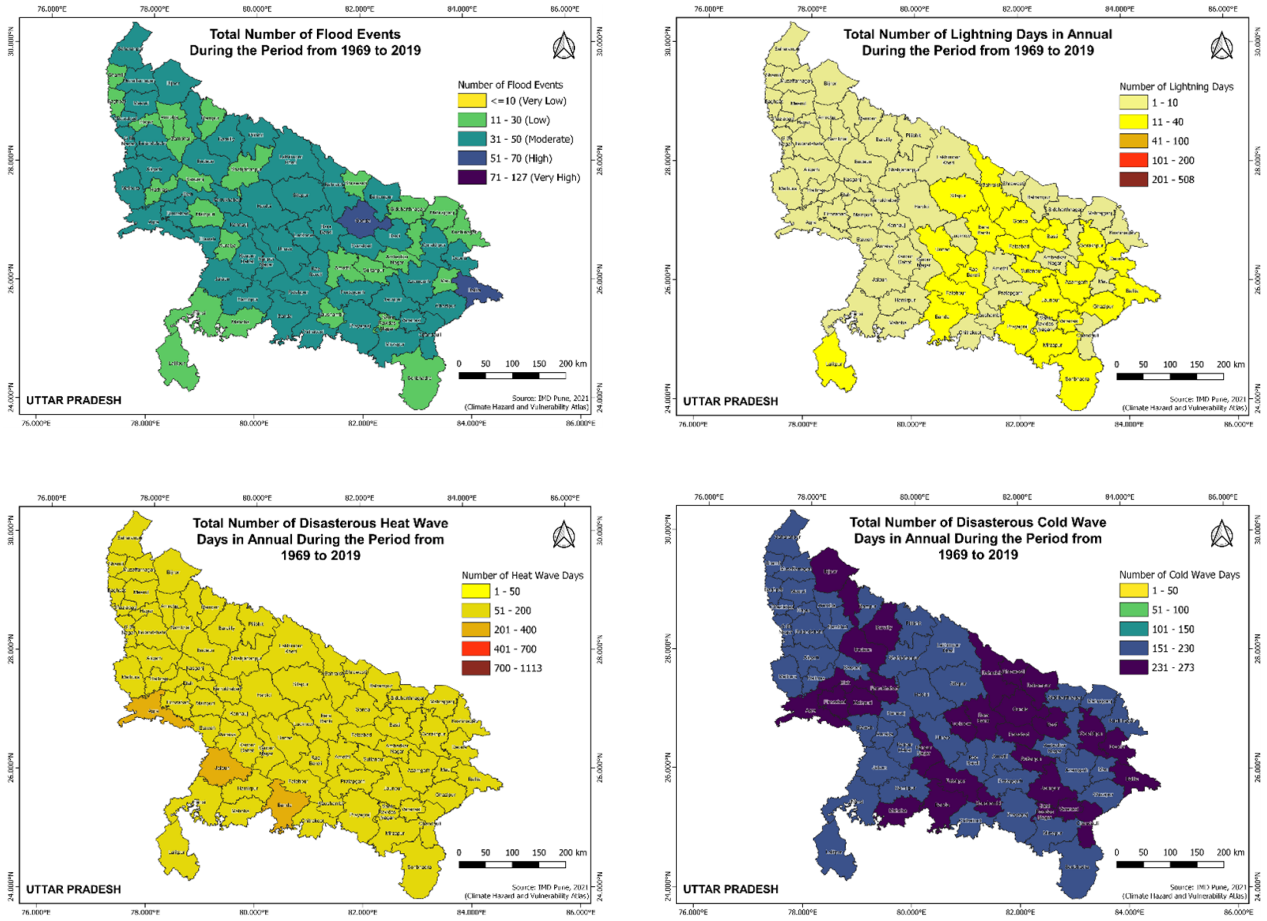


Figure Iii: Climate Hazard Events During the Period 1969–2019
Source: Prepared Using Hazard Atlas Data, IMD

Climate Vulnerability Assessment

A district-level, sectoral, vulnerability assessments was conducted for the state of Uttar Pradesh, using the IPCC AR5 methodology of vulnerability assessment. It also includes a composite vulnerability of the districts with respect to these SAPCC Missions. The missions and their respective sectors, covered for climate vulnerability assessments are specified below:

SAPCC Mission	Corresponding Sector
Sustainable Agriculture Mission	Agriculture
Jal Mission	Water
Green UP Mission	Forests
Energy Efficiency & Green Energy Mission	Energy
Sustainable Habitat Mission	Habitats (Rural and Urban)
Human Health Mission	Health
Disaster Management	Disaster Management

Across the sectors, the districts were classified into vulnerability scale of very-high to very-low i.e., Very High Vulnerability, High Vulnerability, Moderate Vulnerability, Low Vulnerability and Very Low Vulnerability. The following table provides the brief summary of the key districts found to be vulnerable above moderate vulnerability class across the sectors:

Sector/ Missions	Vulnerable Districts
Agriculture	Highest Vulnerable District: Mahoba Lowest Vulnerable District: Chandauli Top Five Vulnerable Districts: Mahoba, Banda, Chitrakoot, Balrampur, Bahraich
Water	Highest Vulnerable District: Agra Lowest Vulnerable District: Etawah Top Five Vulnerable Districts: Agra, Badaun, GautamBuddha Nagar, Sant Ravidas Nagar, Moradabad
Forest	Highest Vulnerable District: Mainpuri Lowest Vulnerable District: Sant Ravidas Nagar Top Five Vulnerable Districts: Mainpuri, Etah, Kannauj, Mathura, Kasganj
Energy	Highest Vulnerable District: Siddharthnagar Lowest Vulnerable District: Agra Top Five Vulnerable Districts: Siddharthnagar, Unnao, Shravasti, Kushinagar, Balrampur
Habitat	Vulnerability of Rural Habitat Highest Vulnerable District: Bahraich Lowest Vulnerable District: Bagpat Top Five Vulnerable Districts: Bahraich, Badaun, Shravasti, Siddharthnagar, Shahjahanpur Vulnerability of Urban Habitats Highest Vulnerable District: Aligarh Lowest Vulnerable District: Lucknow Top Five Vulnerable Districts: Aligarh, Bareilly, Muzaffarnagar, Meerut, Saharanpur
Health	Highest Vulnerable District: Badaun Lowest Vulnerable District: Etawah Top Five Vulnerable Districts: Badaun, Balrampur, Siddharthnagar, Shravasti, Shahjahanpur
Disaster Management	Highest Vulnerable District: Balrampur Lowest Vulnerable District: Kanpur Nagar Top Five Vulnerable Districts: Balrampur, Bahraich, Siddharthnagar, Shahjahanpur, Shravast

Table ii: District-Level Vulnerability Assessment Across Sectors

UP SAPCC 2.0 strategies and actions

The missions of the updated UP SAPCC are in line with the missions of the NAPCC. The strategies in the revised Uttar Pradesh SAPCC (UP SAPCC 2.0) are implementable through the period 2021 to 2030, and reflect a cognizance of the changing climate trends in the state, observed over the period 1989-2019. A newer set of climate projections, current sectoral vulnerabilities assessed across districts and probable extent of future climate risks have also been taken into account. The strategies have been finalised through multiple rounds of discussions with experts and departments with a focus to ensure sustenance of its natural resources in a changing climate, allowing Uttar Pradesh's economic and social development to proceed in a sustainable manner.

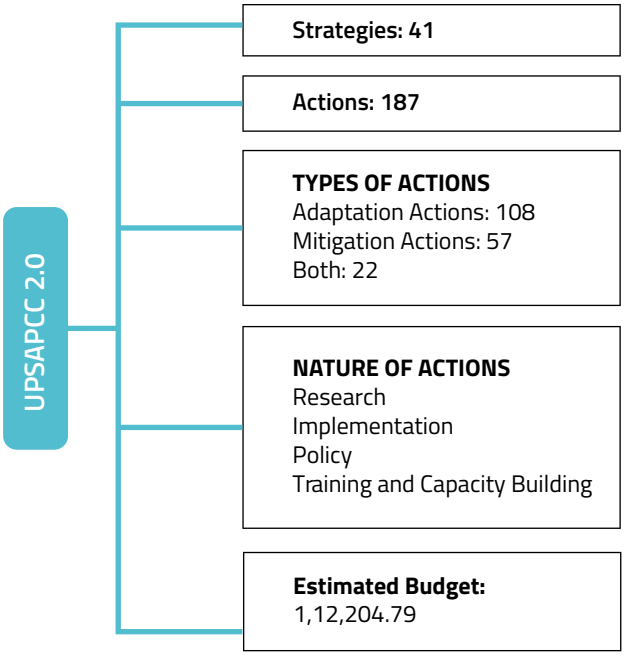
The prioritisation exercise of the strategies have been done to ensure that each contribute to the objectives and targets of updated 8 NDCs (refer to Fig 1, Chapter 1) focusing on contirbuting towards reducing the emission intensity of India's GDP and enhancing climate change

adaptation through involvement of public and private partnership while encouraging healthy and sustainable lifestyles at the individual level. Prioritisation exercise also took into account, the alignment of the strategies with various SDGs (indicated in the respective chapters). Further, mapping the convergence of each strategy with flagship programmes undertaken by Government of India and by the State Governments identified the available funds (See Annexure B). All these steps followed for prioritisation will enable the State of Uttar Pradesh to utilise existing funds for adaptation and mitigation of climate change and identify sources to bridge the gap funding enabling the State to manage its resources sustainably in the changing climate context, while meeting its developmental aspirations.

A total of 41 strategies, covering 187 actions have been proposed. These cover areas such as research, implementation, policy and capacity building. Of the 187 actions, 30 percent of the actions are mitigation actions across sectors that would lead to lowering of emission intensity of UP's state GDP. Apart from increasing the share of renewables in its total energy mix, the mitigation actions are also designed to improve the energy efficiency in industries, municipalities, and local body, and agriculture related energy operations. 58 percent of the actions are purely climate change adaptation actions designed to make UP's rural and urban areas climate resilient. Rest of the 12 percent of actions cover aspects of both adaptation and mitigation.

India's updated NDCs to UNFCCC, aim ro reduce emissions Intensity of its GDP by 45 percent by 2030 (from 2005 levels) and achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030. The updated NDCs also focus on Mission LiFE- a programme that aims to develop citizen centric approach to protect the environment .

Figure iv: Prioritisation Framework for UP SAPCC 2.0



The UP SAPCC 2.0 defines the state's key strategies across the eight missions:

(1) Sustainable agriculture mission
(2) Energy Efficiency Mission and Green Energy Mission
(3) Green UP Mission
(4) Jal Mission
(5) Sustainable Habitat Mission
(6) Human Health Mission
(7) Disaster Management mission
(8) Strategic Knowledge Mission.

A summary of key focus area across each of the eight missions is provided in the figure on the next page.

Figure v: Nature and Type of Strategies under UP SAPCC 2.0

Figure vi: Summary of Strategies Across Missions of UP SAPCC 2.0

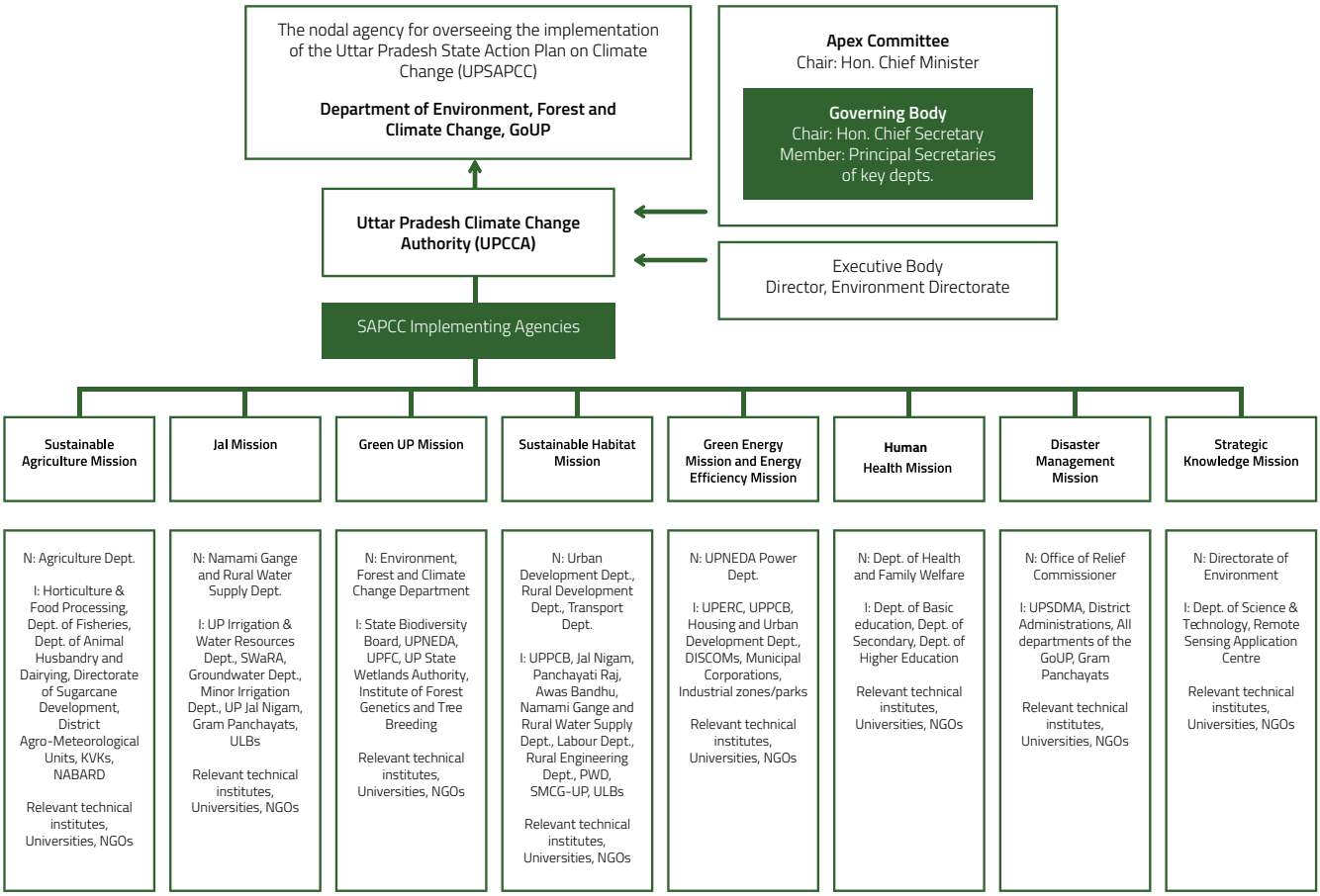


Figure vii: Institutional Mechanism of UP SAPCC

Institutional Mechanism

The Climate Change Authority, which is operating under the aegis of the Department of Environment, Forests and Climate Change, GoUP will be coordinating the implementation of the updated UP SAPCC with the guidance of the apex body on climate change chaired by the Chief Secretary of the State and with technical guidance from domain experts. A Climate Change Centre has been sanctioned by the DST for UP, which will in future be coordinating with the MoEFCC on SAPCC matters, including monitoring and evaluation to ensure convergence of the UP SAPCC with the updated NDCs and the NAPCC.

The institutional arrangement for implementing updated UPSACC is diagrammatically reproduced in the Figure vii above.

Proposed Budget

The total budget requirement to implement the UP SAPCC 2.0 is estimated to be Rs. 1,12,204.79 crores. Mission-wise detail of the budget is provided in the table below. A detailed finance gap assessment conducted for UP SAPCC 2.0 indicates that around 72.17 % of the estimated budget can be met from the ongoing central and state schemes and programmes.

There is a gap of 27.83 % in terms of finance for implementation of finance. The gap funding can be mobilised from:

- Bilateral/multi-lateral international organizations like World Bank, GIZ, SDC, GCF etc.
- National funds such as National Adaptation Fund on Climate Change (NAFCC)
- Private grants such as CSR funds
- Private finance through green bonds, voluntary markets, PPP models

Monitoring and Evaluation of the SAPCC

A three-tier Monitoring and Evaluation (M&E) framework has been designed to ensure successful implementation of the SAPCC. Tier 1 M&E looks at the UP SAPCC strategies and actions; Tier 2 M&E, at the missions and their achievements; and Tier 3 M&E, at the overall UP SAPCC 2.0. The M&E will be providing feedback into the system to ensure that the strategies meet the Updated NDC targets and also fulfill the objectives of the SDGs. M&E of the UP SAPCC will be carried out by the Climate Change Cell of the State in close coordination with MoEFCC.

Missions	No. of Strategies	No. of Actions	Financial Requirement for 2021–2030 (₹ in Crore)	Budget Available (₹ in Crore)	Budget Deficit (₹ in Crore)
Sustainable Agriculture Mission	5	19	29,797.73	22,980.01	6,817.72
Jal Mission	5	25	64,170.13	47,300.44	16,896.68
Sustainable Habitat Mission	9	35	8,326.75	6,008.80	2,317.95
Green UP Mission	5	20	6,292.68	3,427.71	2,864.97
Energy Efficiency and Green Energy Mission	6	37	3,127.55	1,053.76	2,073.79
Human Health Mission	5	31	171.50	171.50	0.00
Disaster Management Mission	2	10	305.70	38.70	267.00
Strategic Knowledge Mission	4	10	12.75	0.00	12.75
TOTAL (₹ in Crore)	41	187	1,12,204.79	80,980.92	31,304.86

Table Iii: Summary of Mission-Wise Fund Requirement for the Period 2022-2030, Available Budget From Existing State and Central Programmes and Deficit

Chapter 1

Introduction

1.1 BACKGROUND

In the context of the rising surface temperatures and the threat of extreme weather events across the globe, the recent IPCC 6th Assessment Report (AR6) notes that every inhabited region on earth is already affected by climate change. Global surface temperatures are projected to continue rising until at least mid-century. The global warming threshold of 1.5°C and 2°C are expected to be exceeded within the 21st century in the absence of swift and substantial actions to limit Greenhouse Gas (GHG) emissions in the coming decades. Consequently, the number of hot days, risk of droughts and precipitation deficits are expected to worsen as extreme weather events are projected to increase in both their frequency, as well as severity. The impacts of global warming are already evident- the catastrophic consequences can be observed on natural and human systems, compounded by consequent changes to many land and ocean ecosystems and the various physical and ecosystem services they provide (IPCC AR6 WGI, 2021).

India, within the global context is no different. As per the ND-GAIN Country Index, India ranks 121 out 181 countries globally assessed for adaptation. Exacerbated by its large population, the study also highlights that India is the 51st -most vulnerable country and the 79th least ready to adapt to climate crisis (ND-GAIN, 2020). These projections are further bolstered as per the SwissRe study on climate economics , which estimates that India could lose up to 35% of GDP by mid-century in a severe scenario if no further climate mitigation actions are taken (SwissRe Institute, 2021).

in 2008, the Prime Minister's Council on Climate Change (PMCCC) established the National Action Plan on Climate Change (NAPCC). Initially the council comprised of eight national missions i.e., National Solar Mission, National Mission for Enhanced Energy Efficiency, National Water Mission, National Mission on Sustainable Habitat, National Mission for Sustaining the Himalayan Ecosystem, Green India Mission, National Mission for Sustainable Agriculture, and National Mission on Strategic Knowledge for Climate Change. Following a review of the progress of these missions, the year 2015 saw the addition of four new missions on Climate Change, viz. the National Health Mission as part of National Action Plan for Climate Change & Human Health, National Mission on Waste to Energy Generation, National Mission on India's Coastal areas, and National Wind Mission as per the recommendation of the reconstituted PMCCC.

These national level missions were bolstered by the clear mandate given to all Indian States & Union Territories (UTs) to prepare their respective State Action Plan on Climate Change (SAPCC), consistent with the strategies outlined in the NAPCC. It was imperative that state-level variations in ecosystems, geographic conditions, socio-economic scenario and other factors be identified. It was also deemed necessary that the states and UTs integrate the diversity of state-level variations in ecosystems, geographic conditions, socio-economic scenarios and other such factors within the framework of NAPCC; to identify synergies with the existing policies, ongoing programmes and schemes under implementation. Unified under these guidelines, 33 states and union territories, between 2008 and 2015, have been notified by the Ministry of Environment Forests and Climate Change (MoEFCC) to publish their respective SAPCCs.

1.2 NATIONAL AND STATE CLIMATE POLICY REGIME

Being a party to United Nations Framework Convention on Climate Change (UNFCCC), India contributed to the development of the milestone Paris Agreement (PA) in 2015. The legally binding international treaty endeavours to limit the warming of global atmosphere to below 2°C by 2100 and preferably to 1.5°C compared to pre-industrial levels. Following the treaty, India undertook the formulation of its Nationally Determined Contributions (NDCs) that were ratified in 2016 (Government of India) with the aim of mitigating national emissions and adapt to the impacts of climate change. Figure 1 presents India's 8 NDC goals, to be implemented in the period between 2021–2030.

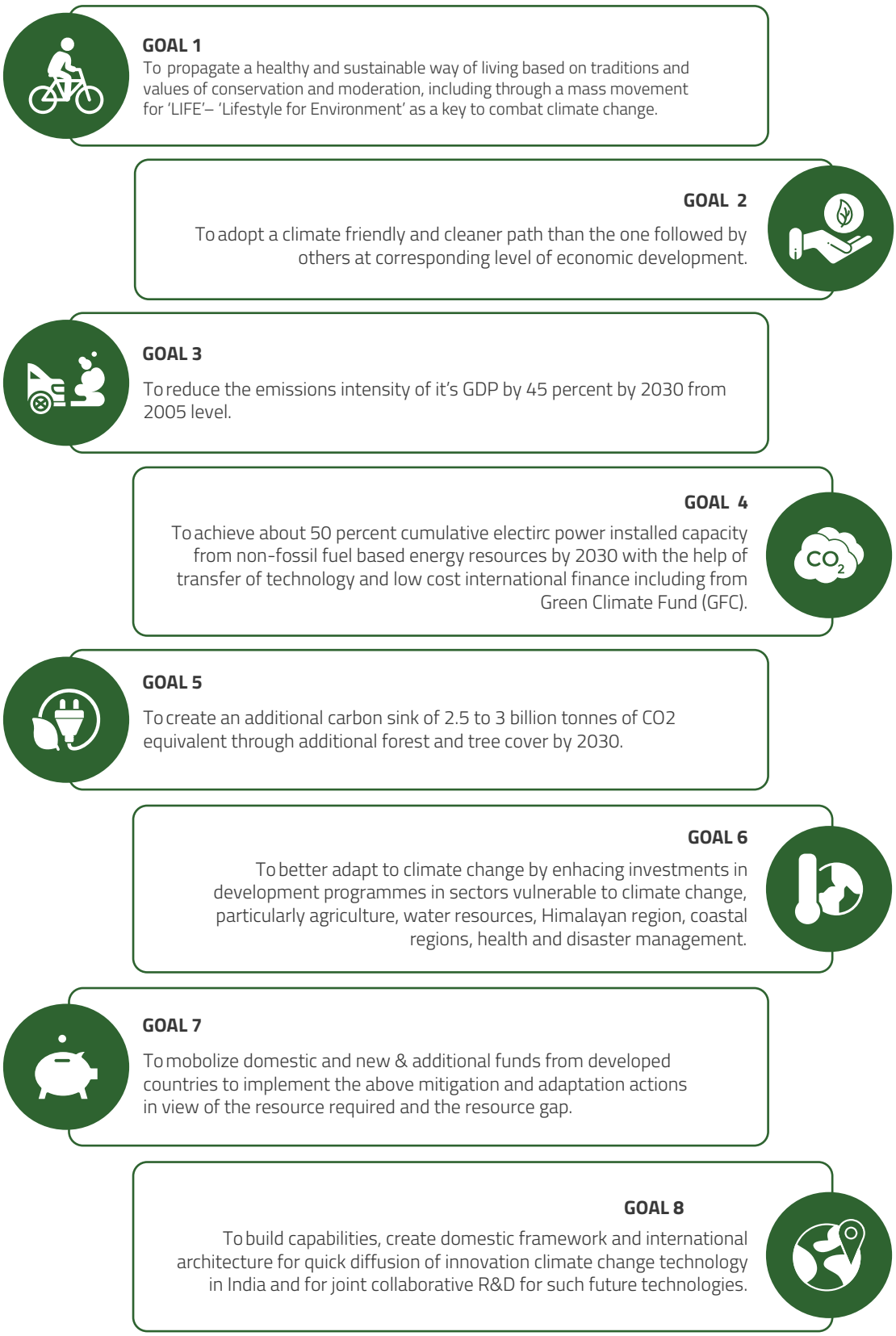


Figure 1: India's Updated NDCs
Source: Government of India (2022)

India's Updated NDCs are formulated keeping in mind the mandates of international treaties as well as national priorities and very well align with Sustainable Development Goals (SDGs).

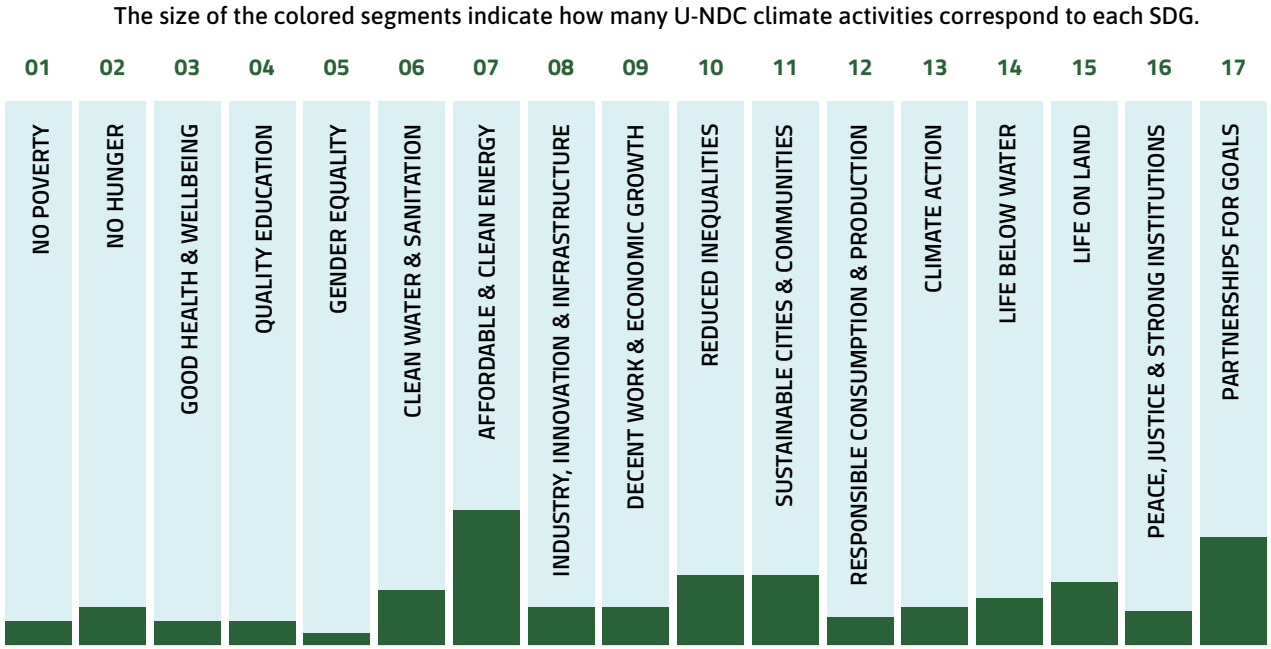


Figure 2: SDG-Updated NDC Linkages for India's Nationally Determined Contributions (Klimalog, 2022)

The figure above captures the number of NDC activities that correspond to each SDG. The figure shows that 18 climate activities in India's NDC are related to SDG 7, followed by 11 climate activities related to SDG 17 and 6 climate activities each related to SDG 6, SDG 11 & SDG 15.

Between 2008 and 2015, SAPCCs of 33 states and UTs were notified by the Ministry of Environment Forests and Climate Change (MoEFCC), Government of India (GoI). During this period, Uttar Pradesh notified its first State Action Plan on Climate Change (UP SAPCC) in 2014, which followed the outline of NAPCC's eight national missions, along with the state specific climate projections and vulnerability analysis. The initial SAPCC addressed key priorities of the state and provided pathway to adapt and mitigate the impacts of climate change in the state.

In January 2018, owing to rapid advancements in climate science, and nuanced understanding of risk, impact, and vulnerability assessment methodologies, MoEFCC directed all the states and Union Territories (UTs) of India to update their respective initial SAPCCs as per the common guiding framework. Subsequently, the Government of Uttar Pradesh has initiated the process of updating its SAPCC for the 2021–2030 period following the common guiding principles and framework.

1.3 STRUCTURE OF UP SAPCC 2.0

The revision of the Uttar Pradesh SAPCC is contingent upon the recommended structure elucidated by the MoEFCC. Additionally this endeavour is motivated by the desire to mainstream climate action in the developmental planning of the state for a green and climate-resilient Uttar Pradesh. While the first SAPCC focused on formulating mitigation and adaptation strategies spanning the National Action Plan on Climate Change (NAPCC), the revised version undertakes a sectoral approach with updated science and analytics to account for past developments and build upon the foundation of the first SAPCC to inform policies at the state-level till 2030. Figure 3 below below encapsulates the missions covering the various sectors identified under Uttar Pradesh SAPCC 2.0:

Figure 3: Missions Covered Under UP SAPCC 2.0

Additionally these missions are used as the backbone for formulating sectoral strategies and action-wise targets till 2030. These in turn are in synergy with India's NDC goals, SDGs and the state's development priorities informed by the updated vulnerability assessment. Figure 4 below gives an overview of the structure of the revised UP SAPCC.

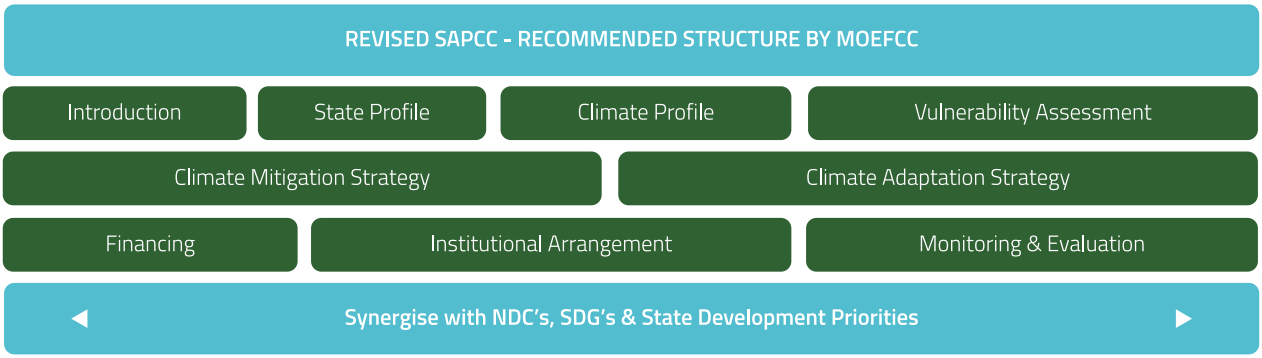


Figure 4: Structure of UP SAPCC 2.0

1.4 UP SAPCC 2.0 OBJECTIVES AND DEVELOPMENT PROCESS

The objective of the updated SAPCC is to revise and prioritize mitigation and adaptation strategies and mainstream them in development priorities. The revised plan has a well-developed implementation structure in place. It consists of a strong financing plan that identifies convergence opportunities with existing schemes and programmes; a robust institutional framework to ensure implementation and an effective monitoring and evaluation framework to provide feedback for continuous planning. The updated UP SAPCC includes:

- Analysis of observed climate variability and trends (temperature, precipitation) as well as projections
- Revision of climate vulnerability assessment (district-level) using IPCC AR5 methodological guidance
- Stocktaking implementation of the UP SAPCC 1.0
- Re-examination of various actions (adaptations, mitigation) in the light of U-NDC goals
- Preparation of new short-term and long-term plans

The development process followed to prepare UP SAPCC 2.0 is schematically captured in Figure 5 and Figure 6.

Oct 2020	Inception meeting with all key departments
Nov 2020 - Feb 2021	Observed climate trends (1981 - 2019) and future projections (till 2100); District-level sectoral vulnerability assessment
Mar 2021 - Jan 2022	Review UP SAPCC 1.0 implementation; Action-wise mapping of potential targets; Estimation of financial requirements and alignment with NDCs & SDGs; Mapping relevant funding sources (schemes, etc) and implementing entities
Feb 2022	Final workshop for action plan validation and approval by all departments
Mar-Apr 2022	Approval by State Steering Commitee and submission to MoEFCC

Figure 5: Process Followed for the Update of UP SAPCC 2.0

Missions	Department	VCs Conducted to Discuss Longlist of Strategies
Sustainable Agriculture Mission	Agriculture Department	5th August 2021
	Horticulture & Food Processing	13th August 2021
	Fisheries Department	12th August 2021
	Animal Husbandry	8th September 2021
Jal Mission	Irrigation & Water Resources Department and State Water Resources Agency - SWARA	23rd August 2021
	Groundwater Department	18th August 2021
	Minor Irrigation Department	18th August 2021
	Jal Nigam	10th September 2021
	Namami Gange Gramin Jalapurti Vibhag	5th October 2021
Sustainable Habitat Mission	Urban Development Department	16th August 2021
	Rural Development Department	3rd September 2021
	Transport Department	19th August 2021
	UP PCB	2nd September 2021
	Jal Nigam	16th August 2021
	Panchayati Raj	29th July
Energy efficiency Mission and Renewable Energy Mission	UPNEDA	6th August
	Invest UP (Udyog Bandhu)	27th October 2021
Human Health Mission	Medical Health & Family Welfare Department	25th August 2021
Disaster Management Mission	Relief Commissioner	20th September 2021
Green UP Mission	Forest Department	3rd August 2021
Strategic Knowledge Mission	Review meeting was held on November 2021	

18th January 2021; 13 November 2021; 3 December 2021	Sustainable Agriculture Mission
9 December 2021	Jal Mission
15 December 2021	Green Energy Mission & Energy Efficiency Mission
4 December 2021	Human Health Mission
16 December 2021	Disaster Management Mission
11 December 2021	Sustainable Human Habitat Mission
2 December 2021	Green UP (Forestry) Mission
February/March 2022	Consultation with all the Principal Secretaries of departments related to each of the 8 missions on the Updated UP SAPCC. Inputs were also provided by the Chief Secretary, UP on these consultations.

Figure 6: A Snapshot of Stakeholder Consultations

Chapter 2

State Profile

2.1 STATE OVERVIEW

Uttar Pradesh is located within the Gangetic plains between 23°52'N to 31°28'N latitude and 77°51'E and 84°38'E longitude, covering an area of 243286 km^2. It is the fourth largest state as well as the most populous state in India, occupying 7.33% of the total area of the country with 19.98 crore people. It extends from Himalayan foothills in the north to the Vindhya ranges in the south, and is surrounded by the states of Uttarakhand, Haryana, Delhi, Rajasthan, Bihar, Jharkhand, Madhya Pradesh and the country Nepal. The state is blessed with fertile soils, and the great Himalayan Rivers Ganga and Yamuna flow through the state (Ashok Gulati, 2021).

Population
19.98 Crore

Area:
2,43,286 km^2

Forest Cover
14,818 km^2

Urbanisation Rate
22.3%

Per Capita GSDP
Rs. 73791.77

Literacy Rate:
67.7%

In terms of population, India is the seventh largest country in the world. Almost one-sixth of that population resides in Uttar Pradesh. Thus the economy of the state and its development play a crucial role in the overall development of India. The state has a strong agricultural base that has developed over the years as well as diverse industries with excellent learning centres. Despite this the key demographic indicators and economic performance of the state suggest that Uttar Pradesh has scope for further development. The state ranks 29th in the country in terms of literacy rate (Niti Aayog, 2011). As per Census 2011, the literacy rate in the state was 67.7 %. There is a gap of 26.6 % in literacy rate by sex in the state. Table 1 outlines a glimpse of Uttar Pradesh's performance across the key demographic indicators. The state has witnessed an increase in the population density

Particulars	2001	2011
Population	16,61,97,921	19,98,12,341
Population density (per km^2)	690	829
Decadal Growth of Population (%)	25.85	20.09
Average Annual Exponential Growth Rate of Population	2.33	1.85
Sex Ratio (Females per thousand males)	898	908
Literacy Rate (%)	56.27	69.72

Table 1: Key Demographic Indicators for Uttar Pradesh

Source: Census (2011)

from 690 persons per km^2 (Census, 2001) to 829 persons per km^2(Census, 2011).

Uttar Pradesh is a cradle for social, economic and political development in the country. In the 2011-16 period, the Gross State Domestic Product (GSDP) of Uttar Pradesh (at current prices) has grown at a rate of 10%. For the year 2021, the GSDP (at current prices) of the state is Rs 17,05,59,337 lakh with a per-capita GSDP of Rs 73791.77 (MOSPI, 2021).

Based on the revised estimates for the year 2021-22, the state's total revenue stands at Rs 4,20,672 crore, an annual increase of 6% over 2019-20 and total expenditure stands Rs 5,50,271 crore, a 20% annual increase over the 2019-20 expenditure (RBI, 2020). The revenue surplus for 2021-22 is estimated to be Rs 23,210 crore, which is 1.07% of the GSDP, while the fiscal deficit for 2021-22 is targeted at Rs 90,730 crore, or 4.17% of GSDP (RBI, 2021).

Even though the state fares well in the spheres of economic and cultural well-being, there is a scope of improvement in terms of development indicators. Figure 8 and Figure 9

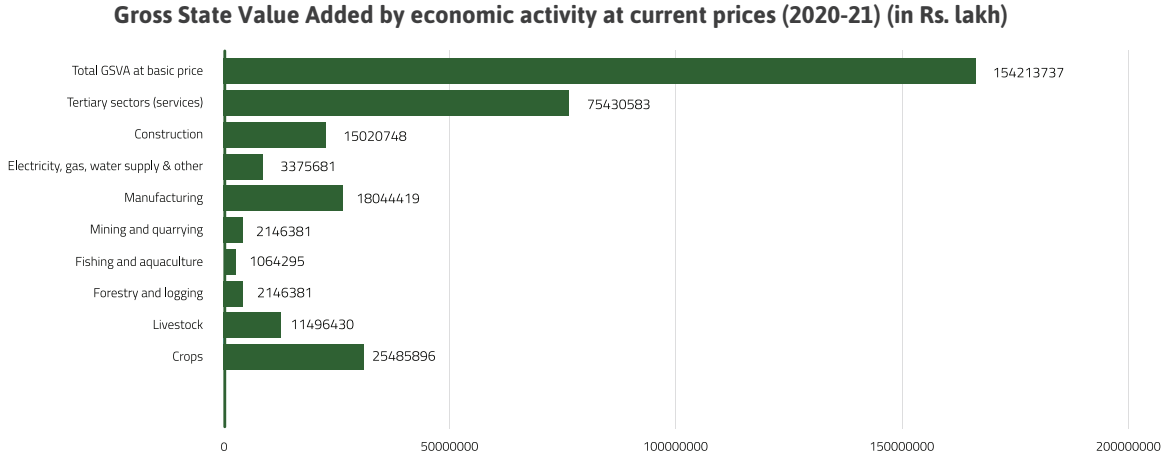
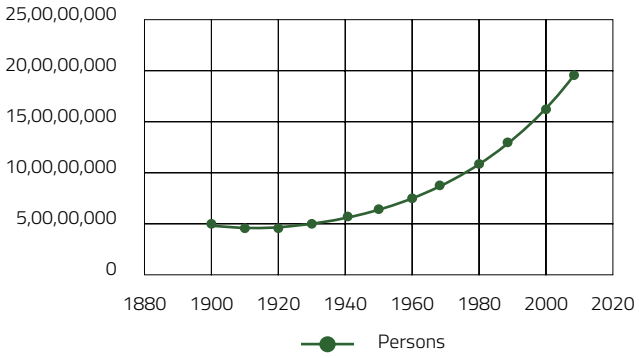
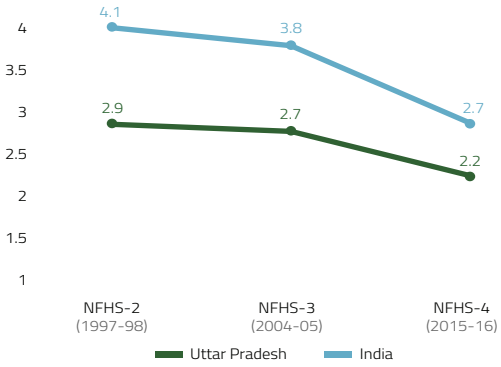


Figure 7: GSVA by Economic Activity at Current Prices (2020-21) Source: MOSPI (2021)



Source: Census (2011)

Figure 8: Decadal Variation in Population in Uttar Pradesh



Source: Census (2011)

Figure 9: Total Fertility Rate (Children Per Woman)

below indicate the decadal variation in population and total fertility rate in UP.

Nearly 53.5% of the population in the age group of 15-59 years make up the workforce in the state. Approximately, 55% of the total workforce in the state depends upon agriculture whereas the sector contributes only 27.5% to the GSDP.

In lines with national trends, the growth rate of employment decreased from 2.4% per annum between 1993-94 and 2004-05 to 0.7% between 2004-05 and 2011-12. In terms of the overall structure of employment, nearly 62.2% of the workforce in the state was self-employed in various economic activities during the year 2011-12 (ILO, 2017).

Expanding economic opportunities for employment generation is one of the major challenges that the state faces in redressing poverty and expanding inclusive growth (ILO, 2017). Regional trends in labour force participation rates in Uttar Pradesh has been outlined in Table 2 below.

Region	1993-94			2004-05			2011-12		
	Male	Female	Person	Male	Female	Person	Male	Female	Person
Western	89.46	22.33	57.97	86.53	28.08	59.61	82.44	16.33	51.73
Central	88.18	23.42	58.41	87.11	35.23	62.65	85.29	28.52	58.38
Eastern	87.42	39.94	63.72	85.04	40.25	62.33	80.92	33.16	55.57
Southern	88.19	42.79	67.33	85.53	53.57	70.67	75.82	19.43	51.22
All	88.42	30.41	60.70	86.06	35.45	61.76	82.05	25.13	54.23

Table 2: Regional Trends in Labour Force Participation Rates in Uttar Pradesh

Source: Computed from NSSO unit level data, various rounds (ILO, 2017)

	Geographical advantages (Roads and Railways)	The state is well connected to its nine neighbouring states and other parts of India through 48 national highways. The state has the biggest railway network in the country with a density of 40 km per 1000 km^2 of area.
	Rich labour pool	With a population of 228.1 million, Uttar Pradesh has a large pool of semi-skilled and unskilled labour.
	Favourable business environment	Uttar Pradesh ranked second in implementing the Business Reform Action Plan in 2019.
	Hub of IT services and the semiconductor industry	The state has become a hub for the semiconductor industry with offices and R&D centres in Noida.

Source: Computed from NSSO unit level data, various rounds (ILO, 2017)

2.2 SECTORAL OVERVIEW

The following section provides brief outline of key statistics, trends, development progress of the seven sectors covered under study i.e., Agriculture & Allied, Water Resources, Forest and Biodiversity, Energy, Urban & Rural Habitats, Human Health and Disaster Management, Knowledge Management in Uttar Pradesh. Figure 10 below depicts the key components addressed under each of the sectors.

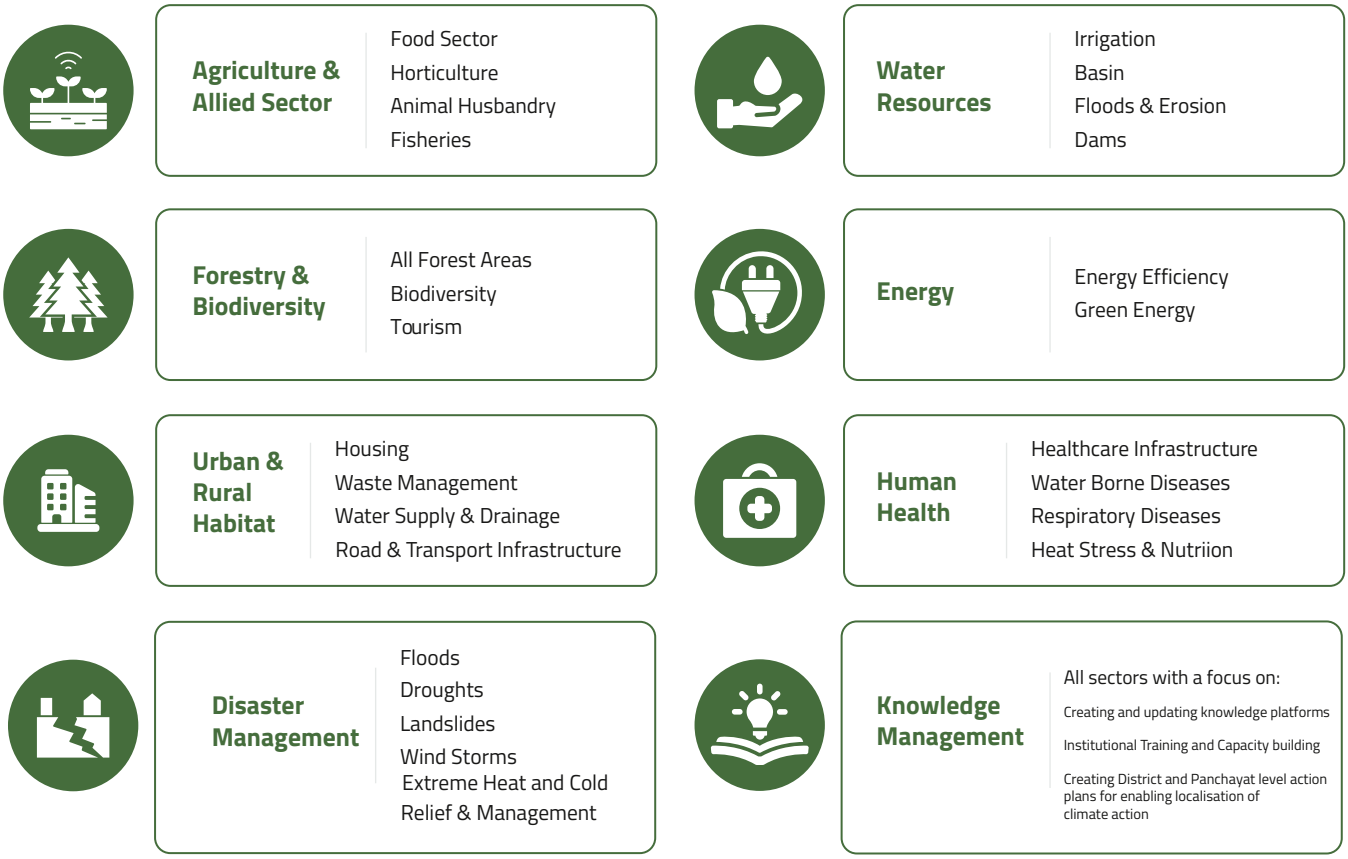


Figure 10: Sectoral Overview

2.2.1 Agriculture and Allied Sector

Uttar Pradesh is an important agricultural state in the country, with agriculture and allied activities accounting for 22.94% of the total Gross State Value Added (GSVA) in 2020-21. (MoSPI, 2021) The GSVA by agriculture and allied activities at constant (2011-12) prices during 2020-21 was estimated to be Rs. 2,24,69,159 lakh. In 2020-21, the state allocated 2.7% of its expenditure towards agriculture and allied activities, as compared to the average allocation of 7.1% by other states (PRS, Uttar Pradesh Budget Analysis 2020-21, 2020).

Food Crops

Uttar Pradesh is an agro-climatically diverse state, known for various food grains, cash crops and horticultural crops. Dominant food grains produced in the state are rice, wheat, maize, millet, gram, pea and lentils. Wheat is largely grown across the districts of Meerut, Bulandshahr, Saharanpur, Agra, Aligarh, Muzaffarnagar, Moradabad, Etawah, Kanpur, Farrukhabad and Fatehpur. Rice is largely grown across the Terai region and in the districts of Pilibhit, Maharajganj, Deoria, Gonda, Bahraich, Basti, Rae Bareli, Ballia, Lucknow, Varanasi, Gorakhpur and Shahjahanpur (MoSPI, 2020). In 2020-21, the state produced 58.32 MT of foodgrains, the highest in the country. (Choudhary, Kumar, & Kumar, 2020)

In cash crops, Uttar Pradesh is the largest producer of sugarcane accounting for 44.50% of the national production during 2020-21. In addition, it is the second-largest producer of sugar. Over the years, sugarcane production has been increasing steadily, from 115 MT in 2002-03, to 133.4 MT in 2014-15, and to 179.71 MT as per the estimates for 2018-19 (Directorate of Economics & Statistics, DoAC&FW, 2020). Sugarcane is an essential crop for the state, since it provides employment to a large part of the rural population. It is mostly grown across the Terai Belt, with Muzaffarnagar being the largest producer of sugarcane in the state.

Horticulture

Horticulture is considered to be one of the most critical sub-sectors in the state as it provides higher productivity per unit area of land and contributes to improving rural employment opportunities. Area under horticulture (fruits, vegetables, spices, aromatic & medicinal plants) has increased over the years from 16,73,386 hectares in 2014-15 to 18,80220 hectares in 2019-2020. The state recorded the highest horticultural production in the country during 2018-19 at 387.47 lakh tonnes after, which it fell to 386.42 lakh tonnes. (Department of Horticulture and Food Processing, 2019). In addition, UP produced 15% of the total vegetables in India, which was the highest vegetable production in the country during 2017-18, and in the subsequent year it contributed 28% of the country's total potato production. During the year 2017-18, Uttar Pradesh was also recorded as the third largest fruit producing state, producing around 10% of the country's fruits, 4% of the flowers, and 3% of the spices (DoAC&FW, 2018). Fruits and vegetables combined have contributed to 8.5% growth in agriculture in the state between 2000-01 and 2013-14 (Verma, Gulati, & Hussain, 2017).

Animal Husbandry and Dairy Farming

Livestock and dairy farming are important sectors due to their role as a supplementary source of income for small and marginal farmers, many of whom make up Uttar Pradesh's labour force. An analysis of the Livestock Census of 2019 shows that Uttar Pradesh has the largest livestock population in the country. Within this sector, it ranks the highest in milk and meat production, with a contribution of 16.3% and 15.1% respectively to the national production. The state has witnessed a significant increase in the production of milk and eggs over the years. The production of meat was 14,18,000 tonnes at its peak in 2015-16 but declined to 11,51,000 tonnes in the year 2017-18, before increasing again to 12,27,000 tonnes in 2018-19.

Some of the native cattle breeds found in Uttar Pradesh are Gangatiri, Hariana, Kenkatha, Kherigarh, Mewati, and Ponwar, whereas Holstein Friesian and Jersey are the crossbreed cattle found in the state (DoAH, 2019). Uttar Pradesh also has the highest buffalo population in the country (MoFAH&D, 2019). Analysis of the data from the 2012-2019 period indicates a decline in the population of indigenous cattle across the state by 19%, and an increase in exotic cattle by 64% (DoAH, 2019).

Fisheries

Uttar Pradesh is known for its freshwater fish landings, amounting to a total of 6,28,700 tonnes. While the Ganga and Yamuna contain 265 inland fish species, 92 of them are found in the district of Allahabad Kali (Department of Fisheries, 2019). Inland fish production in Uttar Pradesh has been steadily increasing over the last 15 years since 2004-05. In 2014-15, fish production was at 4,94,27,000 tonnes, and grew to an estimated 6,32,22,000 tonnes by 2018-19. The number of fish seeds produced has also grown over the years, from 1476.4 million fry during 2011-12 to 2712.87 million fry during 2018-19. Hardoi district has the largest water spread area in the state, approximately 6666.29 hectares followed by Balrampur with area of approximately 5961.19 hectares. The total amount of fish captured and cultured in 2019-20 is 4259.07 tonnes and 15418.1 tonnes respectively, which is significantly more than the 565.46 tonnes and 97986.83 tonnes fish respectively captured and cultured in 2018-19

Component	Highlights
Workforce engagement	1.90 crore cultivators, of which 81% are male and 19% are female; 1.99 crore labourers, of which 69% are male and 31% are female
Landholdings	2.38 crore operational agricultural landholdings (As of 2015-2016)
Agro climatic zones	9 Agro-climatic Zones: Bhawar and Tarai, Western Plain, Mid-Western Plain, South-Western Semi-Arid Plains (Western sub-tropical), Central Plain, Bundelkhand zone, North-Eastern Plain zone, Eastern Plains, Vindhyan
Landholdings	In 2015-16, the state had approximately 2.38 crores operational agricultural landholdings, out of which 80% were marginal landholdings
Soil Profile	Alluvial, Arawali, Rakar, Parwa, Kabar, Maar
Gross cropped area	26,203 thousand ha (As of 2015-2016)
Net sown area	16,469 thousand ha (As of 2015-2016)
Cropping intensity	159.1% (As of 2015-2016)
Crops grown in the state	Rice, wheat, maize, sugarcane, chickpea and pigeonpea
Major crop	Food grains
Area under major crop	19.49 million ha (As of 2018-19)
Area under irrigation (%)	80.1 (As of 2015-2016)

Table 3: Sectoral Highlights for Agriculture & Allied

Source: (Agriculture Census Division, 2019), (Directorate of Economics & Statistics, DoAC&FW, 2020), (DoAH, 2019).

Component	Highlights
Horticulture crops grown in the state	Fruits, vegetables, flowers, spices, Medicinal and Aromatic Plants (MAPs)
Area under Horticulture Crops	18,80220 hectares (As of 2019-2020)
Livestock reared	Cattle (Exotic/Indigenous), Buffalo, Sheep (Cross bred/Indigenous), Goat, Pig(Exotic/Indigenous)
Milk production	305,19,000 tonnes (As of 2018-19)
Meat production	12,27,000 tonnes (As of 2018-19)
Inland fisheries resources	4.32 lakh ha
Inland fish production	6,32,22,000 tonnes (As of 2018-19)
Fish Captured	565.46 tonnes (As of 2018-19)
Fish Cultured	97986.83 tonnes (As of 2018-19)

Table 3: Sectoral Highlights for Agriculture & Allied

Source: (Agriculture Census Division, 2019), (Directorate of Economics & Statistics, DoAC&FW, 2020), (DoAH, 2019).

(Department of Fisheries, 2019). Sectoral profile of the state is highlighted in Table 3.

2.2.2 Water Resources

The total available water resources (surface and groundwater) of Uttar Pradesh is estimated to be about 179 BCM (109.19 BCM surface water and 69.92 BCM groundwater). However, usable water is much less due to various constraints such as the non-feasibility of surface storage because of flat terrain. About 92.2% of water is currently supplied for irrigation, 5.2% for domestic uses and 2.6% is given for industrial and commercial activities. The current trend in increase in water demand has outstripped the available water supply. The total demand from all users is 105.96 BCM while the total supply is 77.99 BCM. There is a wide gap between the irrigation potential created and utilized. The surface water potential created is 95.2 lakh ha and potential utilized is 65.3 lakh ha. The total groundwater recharge in the state is estimated to be about 70 BCM while the total extraction is estimated to be about 53 BCM. The demand side projections indicate that in the business as usual scenario, irrigation demand will increase from 97.8 BCM to 109.46 BCM. Compared to the annual replenishable groundwater resources in India (432 BCM), Uttar Pradesh ranks first with a 16.2% share of replenishable groundwater resources in the country (CWC, 2019). Moreover, the state has 830 assessment units, comprising 820 blocks and 10 cities, 91 are categorized as 'over exploited', 48 are 'critical, 151 are 'semi-critical' and 540 are 'safe'. In terms of groundwater, Uttar Pradesh has 132 dams, 20 barrages and a total of 33,848 tube wells with an irrigation capacity of 29, 05, 750. The demand for water in the state mainly comes from agriculture and domestic sectors, whereas industrial water usage has not been drafted as per a CWC report (2021). Out of the total current annual groundwater extraction of 46.03 BCM, 4.95 BCM is used for domestic and industrial purposes. Having the highest population in the country, and a population density of 649 people per km^2, the demand for domestic water is extremely high in the state. Out of Uttar Pradesh's total current annual groundwater extraction (45.84 BCM), 40.89 BCM is used for irrigation, which is one of the main factor in the depletion of groundwater in the state (Sinha, 2021).

Despite rich resources, Uttar Pradesh faces challenges such as groundwater depletion, poor water quality and weak water governance. The Uttar Pradesh government is trying to focus more on water resources through various schemes and capacity

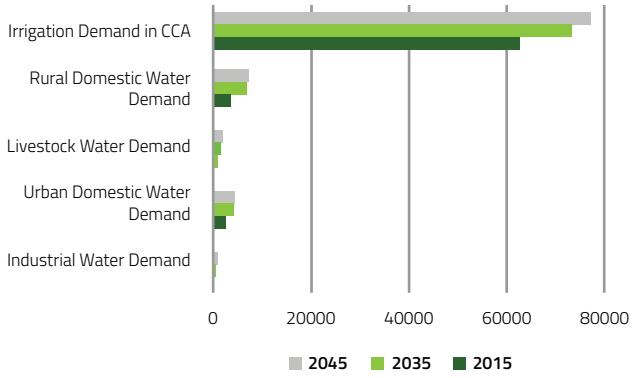


Figure 11: Uttar Pradesh Water Demand

UP Water Demand (in MCM)

Component	Highlights
Physiography	Uttar Pradesh can broadly be divided into two physiographic units, the Central Ganga Plain and the Bundelkhand and Vindhyan Plateau.
Drainage	The state forms a part of the Ganga basin. The master drainage of the state is the river Ganga and its tributaries. The Ramganga, Ghagra and Gomti are the main left-bank tributaries, while the Yamuna is the main right-bank tributary.
Total Natural Discharges (in BCM)	5.32 BCM
Annual Extractable Groundwater Resource (in BCM)	66.88 BCM
Net Groundwater Availability for future use (in BCM)	21.53 BCM
Current Annual Groundwater Extraction (in BCM)	46.03
Stage of Groundwater Extraction (%)	68.83%
Total recharge-worthy area (in km^2)	229657.75 km^2
Groundwater Quality Problems	
Contaminants	Districts affected
Salinity (EC > 3000 µS/cm at 25°C)	Agra, Hathras, Mathura
Fluoride (>1.5 mg/l)	Agra, Aligarh, Etah, Firozabad, Jaunpur, Kannauj, Mahamaya Nagar, Mainpuri, Mathura, Maunath Bhanjan
Chloride (> 1000 mg/l)	Mathura, Agra
Iron (>1.0 mg/l)	Azamgarh, Balia, Balrampur, Etawah, Fatehpur, Gazipur, Gonda, Hardoi, Kanpur Dehat, Kanpur Nagar, Lakhimpur, Lalitpur, Mau, Siddarthnagar, Unnao
Nitrate (>45 mg/l)	Agra, Aligarh, Allahbad, Ambedkar Nagar, Auraiyya, Badaun, Baghpat, Balrampur, Banda, Barabanki, Bareilly, Basti, Bijnour, Bulandsahar, Chitrakoot, Etah, Etawa, Fatehpur, Firozabad, GB Nagar, Ghaziabad, Ghazipur, Hamirpur, Hardoi, Jaunpur, Jhansi, Kannauj, Kanpur Dehat, Lakhimpur, Mahoba, Mathura, Meerut, Moradabad, Muzaffarnagar, Raibarelli, Rampur, Sant Ravidas Nagar, Shajahanpur, Sitapur, Sonbhadra, Sultanpur, Unnao
Arsenic (>0.05 mg/l)	Agra, Aligarh, Balia, Balrampur, Gonda, Gorakhpur, Lakhimpur Kheri, Mathura, Muradabad

Table 4: Sectoral Highlights for Water Resource

Source: Sinha (2021)

building programmes.

2.2.3 Forest and Biodiversity

The forests in Uttar Pradesh belong to five forest-type groups, which are further divided into 28 Forest Types, as per the Champion & Seth Classification of Forest Types (1968). The state has a forest cover of 14,817.89 km^2, which is 6.15% of the state's geographical area. In terms of forest canopy density classes, the state has 2626.61 km^2 under Very Dense Forest (VDF), 4029.37 km^2 under Moderately Dense Forest (MDF) and 8161.91 km^2 under Open Forest (OF). In addition, trees occurring in patches of size less than 1 ha including scattered trees are assessed through sampling based methodology. Tree cover in Uttar Pradesh has been estimated to be 7,421 km^2. Tree cover of Uttar Pradesh has increased by 79 km^2(ISFR, 2021) as compared to the previous assessment report in ISFR 2019. Furthermore, the Gross State Value Added (GSVA) by economic activity at constant (2011-12) prices for the forestry and logging sector has increased to Rs 21,46,381 lakh (MOSPI, 2021).

The forest cover change matrix as prepared by ISFR (2021) suggests that there has been an overall increase across all

categories, with the Total Forest Cover increasing by 79 km^2 as compared to 2019. The reason for the increase in forest cover is attributed to plantation and conservation activities in the state. District-wise analysis indicates that districts with the highest forest cover is Sonbhadra with a total forest cover area of 2,436.75 km^2 (35.29% of its geographical area), followed by Chandauli (21.78%), Chitrakoot (19.64%), Pilbhit (18.60%), Shravasti (17.40%) and Mirzapur (16.94%). The district with the lowest forest cover is Bhadohi with total forest cover area of 3.71 km^2 (0.37% of its geographical area). In addition, districts Mainpuri (0.49%), Deoria (0.60%), Budaun (0.62%), Mau (0.64%), Ballai (0.74%) and Moradabad (0.75%) are also amongst the districts recording one of the lowest forest cover in the state (ISFR, 2021).

Uttar Pradesh has one national park and 26 wildlife sanctuaries, that together constitute the protected area network of the state, covering 11.82% of its geographical area. Total wetlands >2.25 ha in the state are 23890, Ramsar wetlands sites are 8 and 59,407 BMCs.

Uttar Pradesh has seen a significant increase in bamboo bearing area within forest area of the state from 1,235 km^2 in 2019 to 1,832 km^2 in 2021 (Table 5).

The total carbon stock of forests in Uttar Pradesh is 117.241 million tonnes (equivalent to 429.88 million tonnes of CO_2), comprising 1.6% of the total forest carbon of India. There has been an increase in the carbon stock in the state as compared to 2019, when it was 115.69 million tones. Further, people living in villages close to forests are dependent on forest resources for fuel wood, fodder, small timber and bamboo. These are also drivers of forest deforestation and degradation in the state, with fodder extraction and fuelwood being the major causes. Plantations and planting of trees outside forests together can support growth of forests while contributing to the increasing demand of

Growing Stock (GS)	Bamboo bearing area
Bamboo bearing area inside RFA/Green Wash	1832 km^2
Total number of culms (in millions)	310

Table 5: Growing Stock of Bamboo in Uttar Pradesh

Source: Sinha (2021)

Component	Highlights
Total forest cover (in km^2) [ISFR 2021]	14,817.89
Percentage of state area under forest [ISFR 2021]	6.15
Area under VDF (Very Dense Forest) (in km^2) [ISFR 2021]	2626.61
Area under MDF (Moderately Dense Forest) (in km^2) [ISFR 2021]	4029.37
Area under OF (Open Forest) (in km^2) [ISFR 2021]	8161.91
Scrub Forest (in km^2) [ISFR 2021]	563.38
Total protected area in the state (%)	11.82
Reserved forests (in km^2)	12,070
Total tree cover (in km^2)	7,421
Total carbon stock in forests (in '000 tonnes)	117.241
Extent of water bodies within forests (in Ha)	13,43,375
Altitudinal strata of forest (in km^2)	14,806
Recorded forest area (in km^2) [2019-20]	16,582
Encroached area (in km^2) [2021]	27325.17
National Park (in Nos.)	1
Wildlife Sanctuaries (in Nos.), 2019-20	26

Table 6: Sectoral Highlights for Forest & Biodiversity

Source: (ISFR, 2021)

NTFPs.

2.2.4 Energy

Installed Capacity, Energy Mix and Consumption

As of January 2022, out of UP's current 29090 MW installed capacity, renewable energy sources only account for 5101 MW (as per the latest data received from UPPCL). The percentage distribution across sources is still heavily reliant upon thermal sources (Figure 18).

Apart from thermal, the renewables, hydroelectric and nuclear sources account for 14.2%, 11.5% and 1.03% respectively (ibid). The installed capacity in the state has been steadily increasing and per capita consumption figures have risen from 502 kWh in 2014-15 to 629 kWh in 2019-20 (Central Electricity Authority, 2021a). Primarily dependent upon thermal installations, the state has managed to produce a revenue surplus of 0.56 compared to the national average of 0.52 (PFC India, 2020). Eight thermal plants have a PLF over the national average of 55.99% thus ensuring lower costs per unit (Central Electricity Authority, 2020). According to the report on performance of state power utilities, the highest share of electricity was provided to the domestic sector (44.87%), followed by industry (18.58%), agriculture (18.28%), commercial (9.31%) and other sectors (8.96%) (PFC India, 2020).

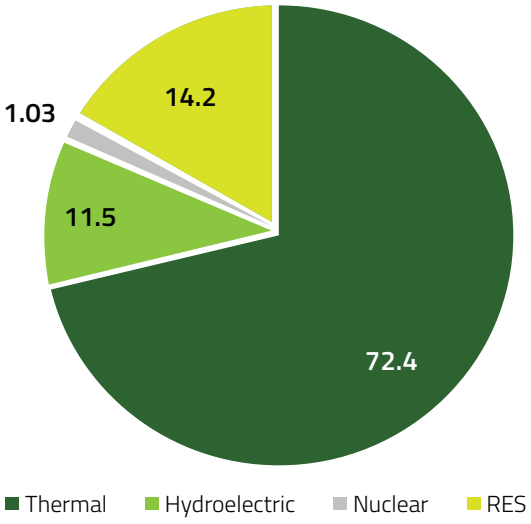


Figure 12: Percentage distribution of various energy sources in Uttar Pradesh

Source: Central Electricity Authority (2021c)t

Supply & Demand

As of March 2018, all 97813 villages in the state of Uttar Pradesh have been electrified (Ministry of Power, 2021a). While the energy sector shows robust performance and quantifiable improvements across variables, as of March 2022, the energy requirement in Uttar Pradesh was 8830.63 MU and actual supply was 8725.87 MU, indicating a deficit of 104.76 MU. During the same period, average peak demand was 16987 MU (Central Electricity Authority, 2020, 2021b).

Green Energy

Uttar Pradesh is estimated to possess 2.7% of the country's total renewable capacity at 27,061 MW (Ministry of Power, 2019). Solar alone accounts for 22.83 GWp of renewable energy potential of the state with 10.63 MW cumulative capacity already installed under the off-grid SPV programme (Ministry of New and Renewable Energy, 2021). Apart from Solar, the renewable potential of the state for wind, biomass and small hydro stands at 100 MW, 1600 MW and 500 MW respectively (NITI Aayog, 2021). Additionally, biogas derived biofuel is also an important component of the state's energy composition, especially in the winter months (Central Electricity Authority, 2021a).

Energy Efficiency

A multi-pronged approach has been taken in India to improve energy efficiency. It has promoted innovative programmes such as PAT (Perform Achieve and Trade) scheme, Standard & Labelling, UJALA scheme, Energy Conservation Building Code, Electric Vehicle Mission, Smart Metering etc. These target industries, domestic sector, agriculture, transport, commercial sector and municipalities.

As per the 2018-19 report on performance of state power utilities, the Aggregate Technical and Commercial Losses or AT&C losses in Uttar Pradesh were of the order of 33.15%, the national average for the same year being 22.01% (PFC India, 2020). It was an improvement over 2017-18, when the AT&C losses were at 37.80%. This is a positive achievement compared to that of 13 very high performing states whose AT&C performances slipped during the same period. Currently, further progress has been made in this regard and the current AT&C losses stand at 27.85% a substantial improvement from 2016-17 when they accounted for 40.91% (Ministry of Power, 2021b) The state's AT&C loss in lhe year 2021-22 is 29.68 percent. (As per the data received from UPPCL).

For DISCOMs to make their services sufficient, efficient and financially viable, the Union government initiated "UDAY" (Ujwal DISCOM Assurance Yojana) in 2015. It envisaged reforms and hence efficiency in generation, transmission, distribution, coal, and energy efficiency (ibid). The following table represents key highlights for the energy sector.

Component	Highlights
Installed Capacity (MW) [as on Jan 2022]	State Share – 6902.20 Private – 14030.80 Central – 8197.01 Total- 29130
Modewise break up of Installed Capacity in MW [as on Jan 2022]	Thermal – 20413.84 Nuclear – 298.48 Renewable – 7877.20
Gross Unit Generation (MU)	31278.118 (26/03/2022)
Energy Requirement (MU) [provisional]	8830.63
Energy Availability (MU) [provisional]	8725.87
Peak Demand (MW)	16987
Peak Demand Met (MW)	16987
T & D Losses (MUs)	24.20%
Aggregate Transmission and Commercial losses (%)	29.68% (2021-2022)
Sector Wise Electricity Consumption (in MU) [%] – 2019-20	
• Industrial	18.58%
• Agriculture	18.28
• Domestic	44.87%
• Commercial	9.31%
• Other	8.96%
Renewable Energy Installed	4353.12
• Solar PV Pumpset (till 2019-20)	9908
• Smart street lighting project in identified urban areas during 2019-20	2100
• Grid Connected Rooftop Solar Power Plant with battery backup at different govt. buildings (2018-19)	251

Table 7: Sector Highlights for Energy Sector

Source: (Ministry of Power, 2022), (Central Electricity Authority, 2020, 2021b)

2.2.5 Urban and Rural Habitats

Based on the current population projection studies, India is expected to grow from 121.1 crore to 151.8 crore in the 2011-2036 period. Nineteen percent of the total population increase in India of 30.7 crore during 2011-36 is anticipated to occur in Uttar Pradesh alone (Ministry of Health & Family Welfare, GoI, 2019). As a result, there is increasing pressure on both urban as well as rural habitats across Uttar Pradesh. Furthermore, the success of sustainable rural development depends on, inter alia, developing and implementing comprehensive strategies for dealing with climate change, drought, desertification and natural disaster.

UP SAPCC 1.0 notified in 2014, does not cover rural habitat as a separate component for study under habitat mission. Today, as we understand that climate change has a dramatic impact on our natural resources, economic activities, food security, health and physical infrastructure (including sanitation). Out of the total population of Uttar Pradesh, around 77.72% reside in rural areas, whereas 22.27% people live in urban regions. Considering that sustainable rural habitats are equally important as urban habitats, there is a need to build safe, inclusive, sustainable and resilient communities across Uttar Pradesh. A growing emphasis is also being placed on the nexus approach to sustainable rural development, seeking to realize synergies from the links between development factors such as energy, health, education, water, food, gender, and economic growth. These areas of importance have also been considered in the context of rural habitat under UP SAPCC 2.0

The following table presents habitat-wise highlights for UP.

Habitat	Sub-Component	Key Highlights
Rural Habitat	Housing	• A high percentage of rural households live in kuccha houses (44 percent); 36 percent live in semi-pucca houses and the rest in pucca houses (Census of India, 2011). • Since 2014 provision of housing in rural areas has been one of the focus areas of state intervention and has recorded significant progress in the last decade.
	Drinking Water	• As per SDG India 2020 report, 20.35 percentage of rural population is getting safe and adequate drinking water within premises through Piped Water Supply (PWS); 99.63% of rural population has access to improved source of drinking water (Census of India, 2011). • As on 26th Sep 2021, the top five districts in the state with household (HH) tap connections are Baghpat (43.02% of total households), Hapur (35.94%), Shamli (34.28%), Ghaziabad (29.87%), Gorakhpur (27.49%). While bottom five districts with lowest percentage of HH tap water supply connections are Sitapur (2.99%), Shahjahanpur (3,45%), Ayodhya (3.54%), Jaunpur (3.65%), Amethi (4.11%).
	Sewerage and Sanitation	• Solid and Liquid Waste Management (SLWM) is one of the key components of the Swachh Bharat Mission- Gramin (SBM-G), launched with the objective of bringing improvement in cleanliness, hygiene and general quality of life in rural areas. •Detailed Project report (DPR) for SLWM work is prepared in 1,061 gram panchayats along the banks of Ganga and their implementation is in progress in 958 gram panchayats. 242 villages in Uttar Pradesh reported direct effluents discharge in the form of grey water, out of which 150 places have been addressed.
	Road Infra and Transportation	• According to Statistical Diary- Uttar Pradesh 2020, total surfaced roads maintained by PWD are 254895 kms- 3635 kms of National highway, 8322 kms of State Highway and 235160 kms of other district roads as of 2019 -20. • As per SDG India 2020 report, 99.99 percent of targeted habitations are connected by all-weather roads under the Pradhan Mantri Gram Sadak Yojana (PMGSY). • ·Currently, the UPSRTC has average buses fleet of 11738 (April-Jun 2021), while average number of on-road buses were 11021 (93% of on-road buses to total buses held) (UPSRTC, 2021)
· Urban Habitat [Uttar Pradesh has the largest population as well as the largest number of urban local bodies in India] .	Housing	• Under PMAY Scheme (affordable housing for EWS), the state has set a target of constructing 1 lakh buildings through partnership model in the financial year 2017 -2018.
	Drinking Water	• The data from AMRUT cities shows that the coverage of water supply services ranges between 32%-78% in Municipal Corporations (Nagar Nigam). • The coverage of water supply services in Nagar Palika Parishads ranges from 17% to 72%.
	Sewerage and Sanitation	• A sanitation snapshot of urban Uttar Pradesh shows that households with onsite sanitation systems like septic tanks (47%) far exceed those with sewer connections (28%).
		• According to the State Annual Action Plan 2017-20, most cities have reported more than 80% coverage of latrines. Although out of the 60 AMRUT cities, 34 have reported zero efficiency regarding collection and treatment of sewage. • The total solid waste generated in urban areas is approximately 15,500 tonnes per day (TPD), of which 57.48% is processed/ recycled scientifically; at present 12 compost based processing plants are functional in the state.

Table 8: Key Highlights for Rural and Urban Habitat in Uttar Pradesh

Habitat	Sub-Component	Key Highlights
	Road Infrastructure and Transportation	• Uttar Pradesh has 63,722 km (12.10%) of total urban road network, ranking second in India after West Bengal as on March, 2017. (Basic Road Statics of India, 2017) • The length of railway routes across the Indian state of Uttar Pradesh was over 8,000 kilometres. (Railway route length in Uttar Pradesh India FY 2003-2019, 2019) • Currently Uttar Pradesh has 6091 electric vehicles, which the government plans to boost through the EV Policy (2018) by augmenting infrastructure, availing charging stations etc. • The Upper Ganga Canal Expressway Project contains some proposals related to navigation facility in the NCR sub-region.

Table 8: Key Highlights for Rural and Urban Habitat in Uttar Pradesh

2.2.6 Human Health

The health statistics of Uttar Pradesh indicate a reduction in birth rate from 2011 to 2019. However, the birth rate remained higher than the national figures from 2011 to 2019. Similarly, the death rate decreased from 2011 to 2019 but also remained higher than the national average. The Uttar Pradesh Health Policy-2018, notes that healthcare services in the state are largely delivered through a private healthcare system. As per the 2014 report of National Sample Survey Organization, approximately 80% of all outpatient visits and about 60% of all hospital episodes occur in the private sector. However, critical public health services such as immunization, provision of maternal and child health services, prevention of communicable diseases programmes, management of outbreaks, epidemics and disasters and surveillance are carried out largely through the public health system. (Uttar Pradesh Health Policy-2018).

The impact of climate change on human health in Uttar Pradesh is exhibited in either a direct or an indirect manner. Certain direct impacts of climate change include heat and cold waves, rainfall variability, floods, storms and drought. Indirect impacts, on the other hand, include incidence of certain vector borne, water borne, zoonotic diseases, respiratory and air borne diseases, and malnutrition. The sector profile of the state along with disease incidence is highlighted in the Table 9 below.

Health Statistics	
Birth Rate (%)	25.4 (As of 2019)
Death Rate (%)	6.5 (As of 2019)
Total Fertility Rate (number of births per woman)	2.3 (As of 2017)
Infant Mortality Rate (IMR) (per 1000 live births)	33 (As of 2017) 41 (As of 2019)
Health Infrastructure	
Primary Health care centres	3473 (As of 2020)
Community Health care centres	723 (As of 2020)
Sub-centres	20778 (As of 2020)
District hospitals	168 (As of 2020)
Urban	Rs. 2,686 crore (As of 2015-16)
Rural	Rs. 4,378 crore (As of 2015-16)
Disease Incidence	
Vector borne	• Malaria cases declined in the initial years from 2010 to 2017 but increased significantly in the years 2017-2019. • As of 2017, 36% of India's Acute Encephalitis cases in India were recorded in Uttar Pradesh. • Cases of Japanese Encephalitis and Dengue were also rising in 2019. • The highest cases of Dengue were recorded in 2016 at 15,033; the numbers peaked again in 2019 at 10,557 cases.

Table 9: Sectoral Profile and Disease Incidence

Source: MOHFW (2020), CBHI (2020) and MOSPI (2021)

	Disease Incidence
Water borne	• 11,65,332 acute diarrhoeal cases recorded in 2019. • 8,54,331 cases of typhoid recorded in 2019.
Respiratory	• Acute respiratory infection cases increased from 2010 (9, 63,261) to 2018 (29, 99,014)
Zoonotic	• The highest number of COVID-19 cases, 17,09,494, recorded in Uttar Pradesh were in September 2021; 22,863 deaths were reported. • Prayagraj, Lucknow, Varanasi, Kanpur and Gorakhpur were the worst hit districts in 2021

Table 9: Sectoral Profile and Disease Incidence

2.2.7 Disaster Management

The Composite Risk Index presented in a 2019 study by GoI-UNDP identifies Uttar Pradesh as one of the states with a high disaster-risk index owing to its high vulnerability and low capacity index (MHA & UNDP, 2019). Uttar Pradesh is highly vulnerable to climate-induced disasters such as floods, droughts, cloud burst, flash floods, heat and cold waves, and hailstorms. These result in loss of human and animal life, and cause damage to public and private property as well as the environment. The 2021 study published by NIDM and GIZ that maps climatic and biological disasters in India for the period of 1995-2020, finds that Uttar Pradesh records the highest number (combined) of human deaths for the four climatic disasters (floods, droughts, heat waves and cold waves). The state also records the highest mortality in select biological disasters. The total damage due to natural extreme events in Uttar Pradesh in 2017-18 was 110 human lives (lost), 101 cattle lives (lost), 21,545 houses damaged and 3.96 lakh ha cropped area being affected. The 2018-19 period saw 105 human lives lost, 140 cattle lives lost, 28,063 houses damaged and 2.9 lakh ha being affected (MOSPI, 2021).

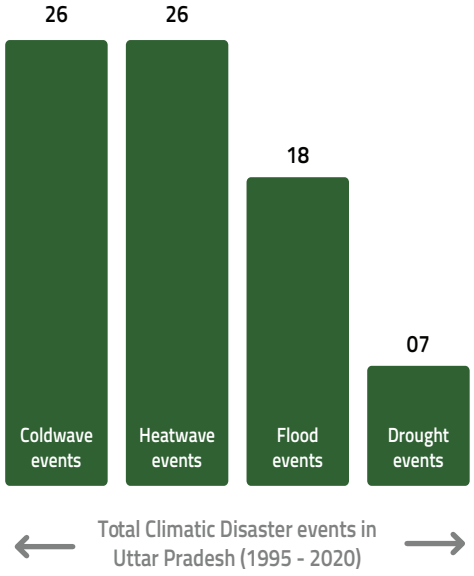


Figure 13: Climatic Disaster events in Uttar Pradesh (1995-2020)

Source: Gupta et al. (2021)

Uttar Pradesh is one of the top-ranking states anticipated to face the impacts from increased frequency and intensity of climatic disasters, particularly floods and cold waves. The resultant effects will be further exacerbated by the existing vulnerabilities of the state (Gupta et al., 2021). Historically, the eastern part of the state has always been prone to flooding. Total damages to crops, houses and public utilities due to floods between 2007-2017 amounted to Rs 2,822.805 crore. Heavy rains in September 2019 caused the deaths of 93 persons mainly due to collapsing of houses(FloodList News, 2019).

The Bundelkhand and Vindhya region in UP have always been drought-prone. Recurrence period of droughts in the state have reduced from six to eight years to approximately every three years in the region. The drought in 2009 affected 59 districts of the state, 43 districts were affected in 2014, 29 districts in 2015 and 56 districts were affected by drought in 2019.

Source: MOHFW (2020), CBHI (2020) and MOSPI (2021)

2.2.8 Knowledge Management

UP climate change cell has launched a portal to bring climate researchers, policymakers on one platform. It seeks researchers to upload their peer reviewed papers on the site for easy access to such papers and hence climate chnage knowledge. Every year since 2021, it has also been holding a climate conclave that brings together researchers, policy makers across India and abroad. It is interacting with various agencies to develop detailed pathways for implementation of the UP SAPCC updated action plan.

Key Hazard Profile	
Total Geographical Area (in km²)	243,286 lakh hectares
Earthquake prone Area (% to geographical area)	
• Less (Zone-II)	• 20.94
• Moderate (Zone-III)	• 48.32
• High (Zone – IV)	• 30.74
• Severe (Zone – V)	• 0.00
Total Flood Prone Area in km² (% to geographical area)	73.06 lakh hectares
Average Annual Flooding in km² (% of geographical area)	26.89 lakh hectares (6.92%)
Maximum Annual Flooding in km² (% of geographical area) – 'Year of max. flooding'	1978
Total drought prone area in km²	35698
Total lightning mortalities (between 2001 - 2015)	2934
Year of preparation of state Disaster Management(DM) Plan	2016
Years of revision of state DM Plan	No revision
No of districts prepared District DM Plans	75

Table 10: Disaster Management Highlights

Source: MOSPI (2021) and UNDP (2019)

2.3 State Development Performance and Priorities for Uttar Pradesh

According to SDG India Index 2020-21 of National Institution for Transforming India (NITI) Aayog, Uttar Pradesh ranks 25th out of 28 states in India with a composite score of 60 and is classified as a Performer state. Table 11 depicts SDG goal wise score and respective performance class.

Number	Goal	Score	Performance Class
Goal 1	No Poverty	44	Aspirant
Goal 2	Zero Hunger	41	Aspirant
Goal 3	Good Health and Well Being	60	Performer
Goal 4	Quality Education	51	Performer
Goal 5	Gender Equality	50	Performer
Goal 6	Clean Water and Sanitation	83	Front Runner
Goal 7	Affordable and Clean Energy	100	Achiever
Goal 8	Decent Work and Economic Growth	53	Performer
Goal 9	Industry Innovation & Infrastructure	42	Aspirant
Goal 10	Reduced Inequalities	41	Aspirant
Goal 11	Sustainable Cities & Communities	77	Front Runner
Goal 12	Ensure Sustainable Consumption & Production Pattern	79	Front Runner
Goal 13	Climate Action	39	Aspirant
Goal 15	Life on Land	61	Performer
Goal 16	Peace, Justice and Strong Institution	79	Front Runner
	Composite Score	60	Performer

Table 11: Performance of the State Under Key SDGs

Source: (NITI Aayog , 2021)

There are several pathways that link the above-mentioned sectors to various SDGs in Uttar Pradesh. Table 12 given below highlights the gaps and challenges faced by the state to improve its performance under key SDGs.

Mission	Goal	Gaps and challenges	State Development Priorities
Sustainable Agriculture	No Poverty	• In 2015-16, the state had approximately 2.38 crores operational agricultural landholdings, of which 80% were marginal landholdings. • 60% of the farmers in the state are small and marginal farmers.	• Livestock promotion with insurance among the small and marginal households, with emphasis on dairy, fisheries and other agro-related activities • Inputs for improved farming practices, crop and livestock insurance as well as promotion of horticulture. • Strengthening the sectoral value chains of agricultural crops, dairy, fisheries and horticultural crops such as medicinal and aromatic plants • Climate adaptation and livelihood diversification strategies through strengthening value chains of climate resilient and economically more profitable horticultural crops such as Medicinal and Aromatic Plants(MAPs) • Promotion of post-production processing and value-addition services for agricultural and horticultural crops in rural areas
	Zero Hunger	• More than 92% of the farmers are small and marginal landholders, hence improving agriculture productivity is critical to ensure food security. • Insufficient measures for conservation of germplasm of plants and animals • Lack of centralized facilities for biotechnological research	• Enhancing food grain and fish production by 770.26 lakh metric tonnes and 24 lakh metric tonnes respectively. • Approximately 24 crore population of the state will be covered under NFSA to receive food grain. • Promoting multi-cropping, including MAPs in the Bundelkhand region • Establishing seed banks in more vulnerable areas. • Encourage rain-water harvesting within the watershed/village area • Promote research for development of climate resilient varieties specially wheat and rice • Develop a knowledge-based decision-support system for translating weather information into management practices • Develop pests and disease forecasting system • Establish gene banks
	Decent work and economic growth	• Low levels of growth and crop yields • Low levels of income and high input cost	• Strengthen schemes like MNSA, Bhoomi Sena Yojana • Establish seed production, storage, processing and certification centres • Promote micro irrigation technology

Table 12: State Development Priorities Under Key SDGs

Source: (GoUP, Sustainable Developement Goals- Vision 2030, 2019)

Mission	Goal	Gaps and challenges	State Development Priorities
Sustainable Agriculture			• Improvement in quality of fodder • Disease surveillance mechanism. • Diversification to more climate-resilient agricultural and horticultural crops and promotion of use of organic fertilizers • Sustainable utilization of fisheries
	Responsible consumption & production	• High climate sensitivity of agriculture in the state • Extreme weather events affect riverine fisheries	• Promote organic agriculture and sustainable practices for crop production and activities in allied sectors. • Biofuels will be promoted as the chief source of fuel for food processing. Producing biofuels enables food-processing plants to expand operation and build new biodiesel plants.
	Climate Action	• For Medicinal and Aromatic Plants(MAPs) climate change induced decline in productivity is expected to the extent of 25% in irrigated areas and up to 50% in rain-fed areas. • Monsoons variability and water scarcity affected crop yields, area and livestock in Bundelkhand region, in the the last four to five years	• Mission on Sustainable Agriculture as a part of State Action Plan on Climate Change • Climate-resilient agriculture-management practices
	Life on Land	• Increasing population and decreasing size of land-holdings has made agriculture non-profitable. • Land degradation threatens agriculture sustainability.	• Land consolidation programme to reverse the declining of landholding size • Promotion of khet talabs and renovation of ponds for storing rainwater and recharging groundwater • Promotion of agroforestry by targeting planting of one crore saplings every year across the state under the National Agriculture Mission

Table 12: State Development Priorities Under Key SDGs

Source: (GoUP, Sustainable Developement Goals- Vision 2030, 2019)

Mission	Goal	Gaps and challenges	State Development Priorities
Forest	Decent Work and Economic Growth	• Deficit employment in rural areas needs to be checked. • Plantation works can create 'Decent work for all', focusing on marginalized communities • Agriculture sector employs 59%of the state's population; additional workforce can be absorbed by promoting agroforestry.	• Promotion of green manuring, social forestry, agro forestry • Promoting economic generation activities through use of natural resources such as– forestry, bee keeping, lacqer production, handicraft, and sericulture • Increased land banks for industrial purposes by using of barren/unusable lands for industry and plantation of bioenergy source • Notification of the Uttar Pradesh Unorganised Worker's Social Security Rules (2016) ensures welfare of workers in the unorganized sector including plantation workers
	Sustainable cities and communities	• Per capita availability of open public space in 1 lakh plus cities ranges from 2.13 m^2 to 0.01 m^2, which is much lower than benchmark of 3 m^2 per capita.	• Increase open spaces and the green cover in urban areas by implementing provisions in the building by-laws as per UP Open Spaces and Playground policy 1975 • Increase the green cover by planting trees in open spaces and developing children's parks under AMRUT
		• Focus on providing access to open spaces and increasing green cover in urban areas	• Open spaces for women, children and persons with disabilities; enabling access through dedicated entries and ramps • About 1,20,000 plants will be planted in 2016-2024 (15,000 plants per year).
	Climate Action	• Out of the 752 forested grids in Uttar Pradesh, climate change will impact 7.04 % (53)	• Mass afforestation programmes with development of nurseries on climate resilient varieties
	Life on Land	• Increasing population in the state (current population density is at 890 persons per km^2) is exerting pressure on land resources • Of the total geographical area, the state has recorded 6.15% forest cover as against the target of 33% (ISFR, 2019)	• Promotion of agroforestry by targeting planting of 1 crore saplings every year across the state • Promote participatory forest management in reserve forest and protected forest areas; capacity building of local level institutions • Use of improved nursery management techniques in all nurseries and plantations • Support LPG distribution and biogas promotion schemes to reduce pressure on fuelwood use by the poor • Mapping of degraded community lands and extension of land reclamation/ soil improvement activities • Effective implementation of Biological Diversity Act 2002, Biodiversity Rules 2004 and Guidelines on Access to Biological Resources and Associated Knowledge and Benefits Sharing Regulations (2014) at Gram Sabha level/grassroots level

Table 12: State Development Priorities Under Key SDGs

Source: (GoUP, Sustainable Developement Goals- Vision 2030, 2019)

Mission	Goal	Gaps and challenges	State Development Priorities
Water	No Poverty	Since 2005, poverty has declined rapidly in both rural and urban areas. Yet the World Bank estimation is that out of the 200 million (approx.) people in the state, 60 million are still poor, which makes UP home to the largest number of poor in the country (2012). No ward level information available in public domain regarding status of identified common natural resources.	• Mapping of the available natural resources: ponds, streams, forest areas, barren land, uncultivated and unirrigated land • Ensure equal access to natural resources
	Zero Hunger	It is projected that by 2030 Uttar Pradesh will achieve 770.26 lakh metric tonnes of food grain production and will comfortably be in a surplus position. However this projection does not account for the challenges faced by the agriculture sector such as degrading natural resources (land, water, energy)	• Undertake soil and water conservation programmes in hunger-afflicted areas • Planning and supporting irrigation
	Good Heath and well being	As per the National Vector-Borne Disease Control Programme (NVBDCP) data, there were 2.16 lakh cases of malaria and no malaria-related deaths in Uttar Pradesh from 2014 to October 2018. During the same period, 45.39 lakh cases and 1,510 deaths were reported in India.	Prevention of water-borne and vector borne diseases, especially elimination and attainment of malaria-free status at the panchayat level
	Clean Water and Sanitation	As per Census 2011, the percentage of households with no toilet facilities reduced to 63% from 68.57% in 2001; disaggregated figures reveal that in rural areas 69.3% households are yet to have toilets whereas in urban areas, the corresponding figure is 18.6%.	• Ensure availability of safe drinking water in school and anganwadi centres • End open defecation in and around Gram Panchayat • Ensure provision and use of toilets for all households and institutions • Management of solid and liquid wastes • Rationalization of water use

Table 12: State Development Priorities Under Key SDGs

Source: (GoUP, Sustainable Developement Goals- Vision 2030, 2019)

Mission	Goal	Gaps and challenges	State Development Priorities
Water	Life on Land	Uttar Pradesh faces major challenges with respect to the sustainability of natural resources. The state covers an area of 243,286 km^2, i.e., about 7.4% of the total area of India, but is home to almost 16.5% of the country's population. Thus in the context of land resources, there is a compelling case for planning and investing in its conservation, restoration and sustainable utilization	• Conservation and management, prevention of loss and restoration, and sustainable use of wetlands • Intensive and continuous public campaigns for awareness on all water-related aspects, the real worth of water, health and economic losses due to pollution of water, wastages and shortages
Energy	No Poverty	• As per government figures, the state is completely electrified, yet the per capita electricity consumption was only about 400 kilowatt-hours (kWh); the national per capita consumption stands at 960 kWh (FY2018). This reveals a low level of industrialization and electricity usage. • Lack of basic services and efforts towards their procurement are challenges perpetuating poverty.	• Access to basic services and amenities through efficient modern appliances and technologies • Distribution of solar power packs, lights, etc to avoid dependence on other fuels. • Promote village level livestock-based methane digesters

Table 12: State Development Priorities Under Key SDGs

Source: (GoUP, Sustainable Developement Goals- Vision 2030, 2019)

Mission	Goal	Gaps and challenges	State Development Priorities
Energy	Access to affordable, reliable, sustainable and modern energy for all	• Due to higher demand than the local supply, the state requires an import of electricity from the national grid • Low access to clean cooking fuels in rural parts of the state as opposed to their urban counterparts • Despite initiatives by the state, at present, less than 30% of the electricity generation is achieved through renewable sources	• Reducing transmission and distribution losses • Establish an industry-wise monitoring system to track energy demand for industries • Assist adoption of smart metering technologies • Strict enforcement of ECBC and labelling of energy efficiency of consumer appliances • Farmer capacity building on bioenergy crops cultivation and supply • The use of innovative applications like solar dryers and solar based pumping and irrigation for agriculture as a replacement of diesel and electrical pumps • Promote solar water-heaters as a back-up system to reduce the usage of conventional power • Strengthen solar street-lighting systems for use in institutions, communities and especially rural areas with no access or little access to conventional power • Promote off-grid small rooftop solar systems for rural households • Support solar rooftop power generation in urban areas that have large potential in commercial, industrial and residential buildings
	Resilient infrastructure, promote sustainable industrialization and foster innovation	Poor reliability of supply and load shedding causing delays and losses in terms of productivity	• Investments in energy efficiency measures and climate resilient infrastructure to provide uninterrupted access to energy at affordable rates
	Inclusive, safe, resilient and sustainable cities	• Dependence upon conventional energy to meet increased demand for cooling. • Vulnerability of power systems to cope with extreme weather events • Inefficient public transport infrastructure.	• Revising building codes for energy efficiency and setting up mechanisms for retrofitting for older structures. • Promoting electric vehicles and charging infrastructure for public fleets and personal transport • Promoting investments in mini-grid and micro grid solutions
	Sustainable consumption and production patterns	• Inefficiencies in production, transmission and consumption of electricity • Poor supply of electricity resulting is use of conventional fuels for bridging the gap	• Structure a 'green tariff' to incentivize the production of clean energy • Improve estimates of potential energy savings from energy efficiency measure across industries to limit the energy consumption • Promotion of off grid solutions in remote areas difficult to service by DISCOMs • Use of hybrid solutions in flood prone areas or areas with frequent interruptions in supply

Table 12: State Development Priorities Under Key SDGs

Source: (GoUP, Sustainable Developement Goals- Vision 2030, 2019)

Mission	Goal	Gaps and challenges	State Development Priorities
Habitat	Make cities and human settlements inclusive, safe, resilient and sustainable	• Lack of infrastructure in the department, paucity of funds • Information related to urban poverty as well as housing requirements in urban areas need to be verified • Increasing slum population, acute shortage of affordable housing, inadequate potable drinking water supply, environmental problems like air, water and noise pollution, lack of sanitation, increasing pressure on land, encroachments, haphazard urban growth and lack of mass transport, etc • Fund requirement for improving and upgrading the sewerage system in 652 ULBs	• Creating adequate urban infrastructure is priority for the government • Financial sustainability of ULBs and parastatal agencies • The execution of solid waste management projects of towns, producing solid waste between 25 and 130 TPD. • 24x7 water supply is proposed in certain pockets of Smart Cities • Street lighting in ULBs is being converted to LED on PPP basis • Disaster management system proposed to be developed at all public transport facilities such as bus stations, petrol pumps and parking places • The state has constituted State Disaster Mitigation Fund, which will be further strengthened to address economic losses of families. • Solid waste management is proposed to be undertaken phase-wise in all 652 towns in the state. • The ULBs are also increasing the green cover by planting trees in open spaces and developing children's parks under AMRUT. • The state aims to increase the tree cover substantially depending upon the availability of land for plantation and financial resources.
	End hunger, achieve food security and improved nutrition and promote sustainable agriculture	• The most vulnerable sections of society suffer from imbalanced diet due to poverty. • There is a critical lack of inter-departmental coordination and convergence in the existing programmes addressing nutritional security. • Lack of support in logistics and supply chain for the agriculture sector, institutional mechanisms for extension support, value addition to farm products are identified as critical gaps. • Rational and scientific water and soil management, organic farming practices are also critical gaps. • Lack of infrastructure in emerging areas of research in agriculture • Managing solid and liquid waste	• Create infrastructural facilities especially in the field of biotechnology, molecular biology, food processing, information technology, precision farming, nano technology, etc. in SAUs. • Channelize the funding of area- specific research as per the expertise and area specific needs of the SAUs • Promote private- sector participation in advanced research, e.g., GM (Genetically Modified) crops with adequate safeguards, nano technology. • All households in gram panchayats to have 24 X 7 access to safe and adequate drinking water • The state will adopt the strategy of ODF gram panchayats to ensure every household has a toilet. • The state will prioritizse efforts to ensure sanitation facilities (with availability of water) in public institutions such as community halls, panchayat bhawans, schools and anganwadis.

Table 12: State Development Priorities Under Key SDGs

Source: (GoUP, Sustainable Developement Goals- Vision 2030, 2019)

Mission	Goal	Gaps and challenges	State Development Priorities
Habitat		• Non-availability of land and technological options for landfill management.	• Waste management in rural areas (both solid waste and liquid waste) will be the priority for the state and provisions under Swachh Bharat Mission (SBM) will be expanded to cover villages with local and innovative solutions for managing waste. • Develop partnership with all stakeholders (including private sector/civil society) to create mass awareness of improved sanitation and hygiene and encourage water conservation and improved water- management systems
	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	• Affordable housing, especially to the urban poor • Housing for economically weaker sections and low-income families • Urban water supply, sanitation, waste and sewage management • Inadequate transport infrastructure and its sub-optimal use, lack of integration between land use and transport planning • Lack of mass transport system	• The state government will prioritize increased access of rural markets to major districts and urban areas through development of expressways, state highways and four lane widening of roads connecting district headquarters. • To foster inclusiveness and enable equitable access to markets and basic services, the state will integrate rural markets with major districts and urban counterparts. It will develop Major District Roads (MDRs) to link rural roads and state highways and connect semi-urban and urban areas.

Table 12: State Development Priorities Under Key SDGs

Source: (GoUP, Sustainable Developement Goals- Vision 2030, 2019)

Mission	Goal	Gaps and challenges	State Development Priorities
Health	Good Health and Well Being	• Poor ambient air quality • 80% of the households use solid fuel (crop residue, firewood, coal and cow dung) for cooking • The emergence of diseases in the state, which are beyond the usual, like COVID-19	• Identification of high endemic pockets and establishment of special interventions for them • GIS mapping of malaria cases • More eco-friendly preventive technologies will be adopted and scaled up • Promote use of biogas and LPG • Reducing the incidence of communicable diseases of epidemic potential to a minimum level through effective surveillance and response • Promotion of telemedicine and tele-consultation from tertiary health care centres to lower levels of facilities • Ensure access to generic medicines to all by establishing Jan Aushadhi Kendras in all district Hospitals and all Community Health Centres • Ensure safe drinking water through piped water supply in endemic areas
	Climate Action	• UP has a high incidence of vector borne, air borne and water borne diseases mostly caused by climate change induced hazards. • Epidemiological transition in terms of prevalence of certain diseases and their association with climate indicators in impoverished states like UP is not mapped. • Poor health is an outcome of regional disparity in poverty in UP; the concentration of poverty is high in central and eastern UP.	• Establishing functional Climate Change Cells in all departments • Reduce the number of casualties in case of climate related disasters by strengthening of Disaster Management Authority in district offices for climate integrating into Disaster Management Plan • Setting up of Early Warning Systems about climate advisories • Integrating climate change into all UP health schemes with adequate funding and infrastructure • Ensure implementation of action plans related to air and water pollution control and monitoring • Expand the coverage of National Health Protection Scheme for the poor • Make health insurance a part of the job contract/work arrangements in all sectors

Table 12: State Development Priorities Under Key SDGs

Source: (GoUP, Sustainable Developement Goals- Vision 2030, 2019)

Mission	Goal	Gaps and challenges	State Development Priorities
Disaster Management	No Poverty		• Disaster Risk Reduction (DRR): Initiate measures for developing institutional capacity and resources (human and material) to address disasters and preparedness (to minimize the effect of disasters and to decrease the loss of property) through training and awareness programmes • Use updated technology to minimise vulnerabilities and disaster risks of the poor or to limit the adverse impacts of hazards within the broad context of sustainable development; IT enabled early warning system till the last mile will be implemented • Establishment of mechanisms to collect, analyse and use remote sensing (ISRO), GIS and weather (IMD) data that will be shared with farmers • Training and awareness raising of stakeholders will be taken up in mapped out areas (disaster-prone). • The state shall strengthen resilience and adaptive capacity to climate related hazards and natural disasters. The poorest and most vulnerable people are likely to be the most affected. The state will be integrating climate change adaption measures in disaster management plans and accordingly build the capacity of stakeholders concerned to enhance readiness to combat the adverse impact of climate change.
	Zero Hunger	• Poor nutrition status of women and children • Lack of support in logistics and supply chain for the agriculture sector • Lack of infrastructure in emerging areas of research in agriculture, lack of trained manpower in majority of the faculties in state agricultural universities and lack of funds for research are some of the critical gaps in relation to promotion of agricultural research in the state.	• Promote Resource Conservation Technologies (RCT) to improve the efficiency of inputs, i.e., fertilizers and irrigation through land levelling and adoption of conservation agronomic practices • Drought management, including contingent cropping strategy, promotion of drought and flood tolerant varieties and establishing seed banks in more vulnerable areas to save cropped area for required food production • Encourage rainwater harvesting within the watershed/village territories to reduce loss of productive soil through erosion • Recharge groundwater particularly in declining groundwater and rain-fed areas and recycle harvested water for irrigation purposes • Initiation of flood control and drainage programmes to manage the water flowing from rivers in Nepal and utilize it for creating reservoirs and generating power • Frame long-term contingent plan for various natural calamities

Table 12: State Development Priorities Under Key SDGs

Source: (GoUP, Sustainable Developement Goals- Vision 2030, 2019)

Mission	Goal	Gaps and challenges	State Development Priorities
Disaster Management	Zero Hunger		• Develop genotypes for biotic (diseases, insects etc.) and abiotic (drought , flood, heat, cold, salinity) stress management either by traditional plant breeding or genetic modification • Enhance research on applications of short, medium and long range weather forecasts for reducing production risks • Develop knowledge-based, decision support system for translating weather information into operational management practices • Develop system for integrated management of rainwater, surface, and groundwater
	Clean water & Sanitation	• The biggest challenge for the state is non-availability of land and technological options for landfill management. • Growing demand and unregulated use of groundwater has led to unsustainable over extraction and subsequent lowering of groundwater levels in both rural and urban areas.	• Promote efficient irrigation techniques, encourage low water consuming crops through appropriate changes in the cropping system, promote soil moisture conservation, and promote demand side management and other water management methods. • To reduce the current level of groundwater withdrawal in urban areas, need-based drinking water requirement be assessed and accordingly groundwater resources be exploited; Rostering (schedule based) can be considered for controlled exploitation of groundwater. • To conserve surplus run-off that currently goes waste in monsoon; Pavement storm water harvesting will be introduced wherever feasible. • Promoting technologies, such as drip irrigation that help conserve water. • Promote and encourage practices for in-situ moisture conservation to ensure 'Khet Ka Pani Khet Me, Gaon ka Pani Gaon Me'
	Sustainable cities & communities	• Lack of adequate data, clarity in rules and procedures, implementation difficulties are being reported for eg., enforcing earthquake resistance norms for multistoried buildings/structures is also a challenge due to lack of adequate human resources. • Lack of public awareness: For eg., public encroachment near protected monuments is a major issue that creates operational difficulties for the departments.	• An Emergency Operations Centre (EOC) has been set up at the state-level and is being set up in all districts as well. EOC is the nerve centre to provide support, coordinate and monitor disaster management activities at the district-level. • The state has constituted State Disaster Mitigation Fund, which will be further strengthened to address economic losses of families.

Table 12: State Development Priorities Under Key SDGs

Source: (GoUP, Sustainable Developement Goals- Vision 2030, 2019)

Mission	Goal	Gaps and challenges	State Development Priorities
Disaster Management	Sustainable cities & communities	• The main challenges are increasing slum population, acute shortage of affordable housing, inadequate potable drinking water supply, environmental problems like air, water and noise pollution, insanitation, increasing pressure on land, encroachments, haphazard urban growth and lack of mass transport, etc.	
	Climate Action	• The state is highly diverse in weather patterns (extremes of temperature and precipitation) and water resources (dry to flood-prone areas). Climate change threatens to amplify climate variability, resulting in amplification of extremes in temperature, rainfall, forest cover, etc. • Farming and fishing communities have low awareness levels, even less resources and thus their poor adaptive capacity.	• Establishing functional Climate Change Cells in all departments • Reduce the number of casualties in case of climate related disasters by strengthening Disaster Management Authority in district offices, integrating climate linked aspects into Disaster Management Plan • Setting up of Early Warning Systems about climate advisories • Soil conservation, water conservation programmes in most climate vulnerable areas • Pollution monitoring in all districts including GHG inventories and dissemination of data • Setting up of State Climate Change Authority • Setting up of Climate Change cells in each mission department • Fully functional climate field schools and early warning stations network • Public awareness through eco-clubs in school
	Life on Land		• Mapping of degraded community lands • Extension of land reclamation/soil improvement activities to all degraded land areas in 25 selected districts. • Increasing agricultural production and productivity by improving input use efficiency and soil health • Reduce cost of cultivation by way of better crop management, use of cost effective locally available inputs and adoption of new technologies • Promoting agriculture based industries in order to make landless labour self-dependent and decrease dependency on agriculture

Table 12: State Development Priorities Under Key SDGs

Source: (GoUP, Sustainable Developement Goals- Vision 2030, 2019)

Chapter 3

Climate Profile

Globally each of the last four decades has been successively warmer than any decade that preceded it since 1850. As per IPCC Special Report on Global Warming of 1.5°C, human activities have been estimated to cause approximately 1.0°C of global warming above pre-industrial levels, with a likely range of 0.8°C to 1.2°C. In addition, global warming is likely to reach 1.5°C between 2030 and 2052, if it continues to increase at the current rate. The number of hot days is projected to increase in most land regions along with increasing risk from droughts and precipitation deficits. The impacts of global warming have already been observed on natural and human systems, as many land and ocean ecosystems as well as the ecosystem services they provide have already changed due to the warming (IPCC, 2018).

The recent IPCC AR6 Working Group I Report outlines that human-induced climate change is already affecting weather in every region across the globe. Evidence of observed changes in extreme weather conditions such as heatwaves, heavy precipitation, droughts and their attribution to human influence, has strengthened since AR5 (IPCC AR6, 2021). Global surface temperature will continue to rise until at least the mid-century across all emissions scenarios considered. Unless deep reductions in CO_2 and other greenhouse gas emissions are made in the coming decades, global warming of 1.5°C and 2°C will be exceeded during the 21st century. The report also states that from a physical science perspective, limiting human-induced global warming is essential and to do that to a specific level, it is essential to limit cumulative CO_2 emissions, along with reductions in other greenhouse gas emissions.

The landlocked state of Uttar Pradesh is situated between latitudes 23.87° N and 30.40° N and longitudes 77.08° E and 84.63° E, and on the basis of its physical features the state can be divided into three broad regions: Sub-mountainous region, Ganga Plain region and Trans-Yamuna region. Climate of the state is predominantly sub-tropical monsoon, mild and dry winter and hot summer. The average temperature in the state can range anywhere between 12.5–17.5 °C (55–64 °F) in January to 27.5–32.5 °C (82–91 °F) in May and June. Variation to the weather conditions happen, depending on the elevation. Nearly 90% of the annual rainfall in Uttar Pradesh is concentrated in the Southwest monsoon months of June to September, which leads to the recurrent floods and resultant widespread damage to standing crops, life and infrastructure. The flooding events are more pronounced in Eastern UP where the Himalayan-origin rivers flow with a very low north-south gradient. The increasing variability in rainfall have made certain parts of Uttar Pradesh prone to recurrent episodes of droughts, leading to widespread crop failure and therefore rural to urban migration.

This chapter focuses on state and district-level analysis of climate trends and future projections for Uttar Pradesh. It presents the analysis of observed temperature and precipitation trends and variability over the time period between 1980-2019, which helps in understanding the localised changes in climate that have been witnessed by the state. In addition, climate projections have been derived for temperature and precipitation (both annual as well as seasonal) for two standardised forcing scenarios called Representative Concentration Pathways (RCPs), namely RCP 4.5 (mid-range emissions) and RCP 8.5 (high-end emissions) scenarios for Near-term (2011-2040), Mid-term (2041-2070) and End-Century (2071-2100) with respect to Baseline (1981-2010). The analysis helps identify the most vulnerable districts to the changing climate in Uttar Pradesh, which can be prioritised for implementation of climate change adaptation actions, as has been outlined in the subsequent chapters of the report.

3.1 METHODOLOGY

3.1.1 Observed Climate Variability and Trend Analysis

Daily gridded rainfall and temperature data sets, available at a spatial resolution of 0.25°x0.25° and 1.0°x1.0° latitude and longitude respectively, have been extracted from the IMD database for the grids pertaining to each of the 75 districts in Uttar Pradesh for the period of 1980-2019 (IMD, Open Gridded Data, 1965-2005).
Figure 14 shows the flow of analysis and Table 13 lists the parameters that have been analysed at the state and district-level for Uttar Pradesh.

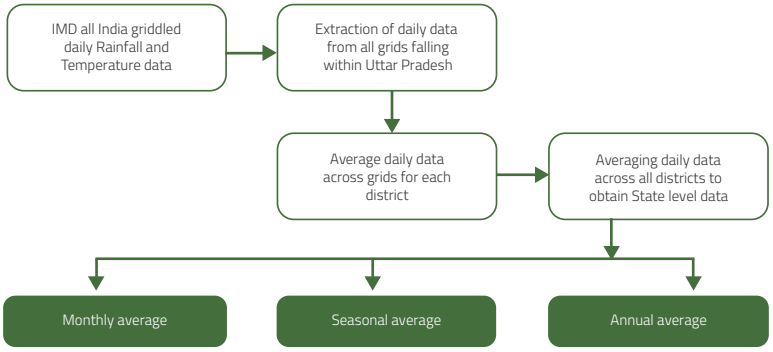


Figure 14: Flow of Climate Data Analysis

	State-Level	District-Level
Temperature (°C)	• Annual Average Maximum Temperature(°C) • Annual Average Minimum Temperature(°C) • Annual Average DTR(°C)	Annual Average Maximum Temperature(°C)
Rainfall (mm)	• Total annual rainfall (mm) • Total seasonal rainfall (JF, MAM, JJAS, OND)* (mm)	• Total annual rainfall (mm) • Total seasonal rainfall (JF, MAM, JJAS, OND) (mm) • Number of rainy days (decadal, during JJAS months) • Number of dry days (decadal, during JJAS months) • Number of heavy rainfall days (decadal, during JJAS months) • Number of very heavy rainfall days (decadal, during JJAS months)

*JF – January, February; MAM-March, April, May; JJAS – June, July, August and September; OND- October, November, December

Table 13: Parameters analysed at State-Level and District-level

3.1.2 Climate Change Projections

The climate change projection data for the Indian region is publicly available at http://cccr.tropmet.res.in/home/esgf_data.jsp. The data sets have been generated by the Coordinated Regional Climate Downscaling Experiment (CORDEX) conducted for South Asia. The CORDEX South Asia dataset includes dynamically downscaled climate change daily projections at 50 km x 50 km resolution using 3 RCMs with 17 ensemble members. For Uttar Pradesh, the climate change projections have been derived from ensemble average of 10 of these RCM outputs suitable for the Indian region, which are available at http://climatevulnerability.in.

The future projections in this report are based on two standardised forcing scenarios called Representative Concentration Pathways (RCPs), namely RCP 4.5 (mid-range emissions) and RCP 8.5 (high-end emissions) scenarios. Each scenario is a time series of emissions and concentrations of the full suite of GHGs, aerosols and chemically active gases, as well as land use changes through the twenty-first century, characterized by the resulting Radiative Forcing in the year 2100. RCP 4.5 is an intermediate stabilization pathway that results in a Radiative Forcing of 4.5 W/m^2 in 2100 and RCP 8.5 is a high concentration pathway resulting in a Radiative Forcing of 8.5 W/m2 in 2100. The present chapter outlines the change in climate in Near-term (2011-2040), Mid-term (2041-2070) and End-Century (2071-2100) with respect to Baseline (1981-2010).

3.2 OBSERVED CLIMATE TRENDS

3.2.1 Temperature: State-level analysis

The analysis of temperature for the period 1980-2019 indicates a rising trend in annual average maximum and minimum temperature in Uttar Pradesh. Annually, the maximum temperature has increased at the rate of 0.007°C and the minimum temperature has increased at the rate of 0.021°C. The annual average Diurnal Temperature Range (DTR) shows a decreasing trend, the decrease being 0.014°C per annum.

During 1980-2019, the annual average maximum temperature was 31.41°C. It ranged between 30.2°C - 32.3°C, where the highest maximum annual average temperature was recorded in the year 1987. The average minimum temperature during the same period was 19.27°C and it ranged between 18.64°C - 20.09°C. The highest average minimum temperature was recorded in the year 2010. The annual average Diurnal Temperature Range (DTR) was 12.13°C and it ranged between 11.64°C - 12.64°C, the highest being recorded in the year 2012. As shown in Figure 15, all the three indicators show seasonality throughout the time period.

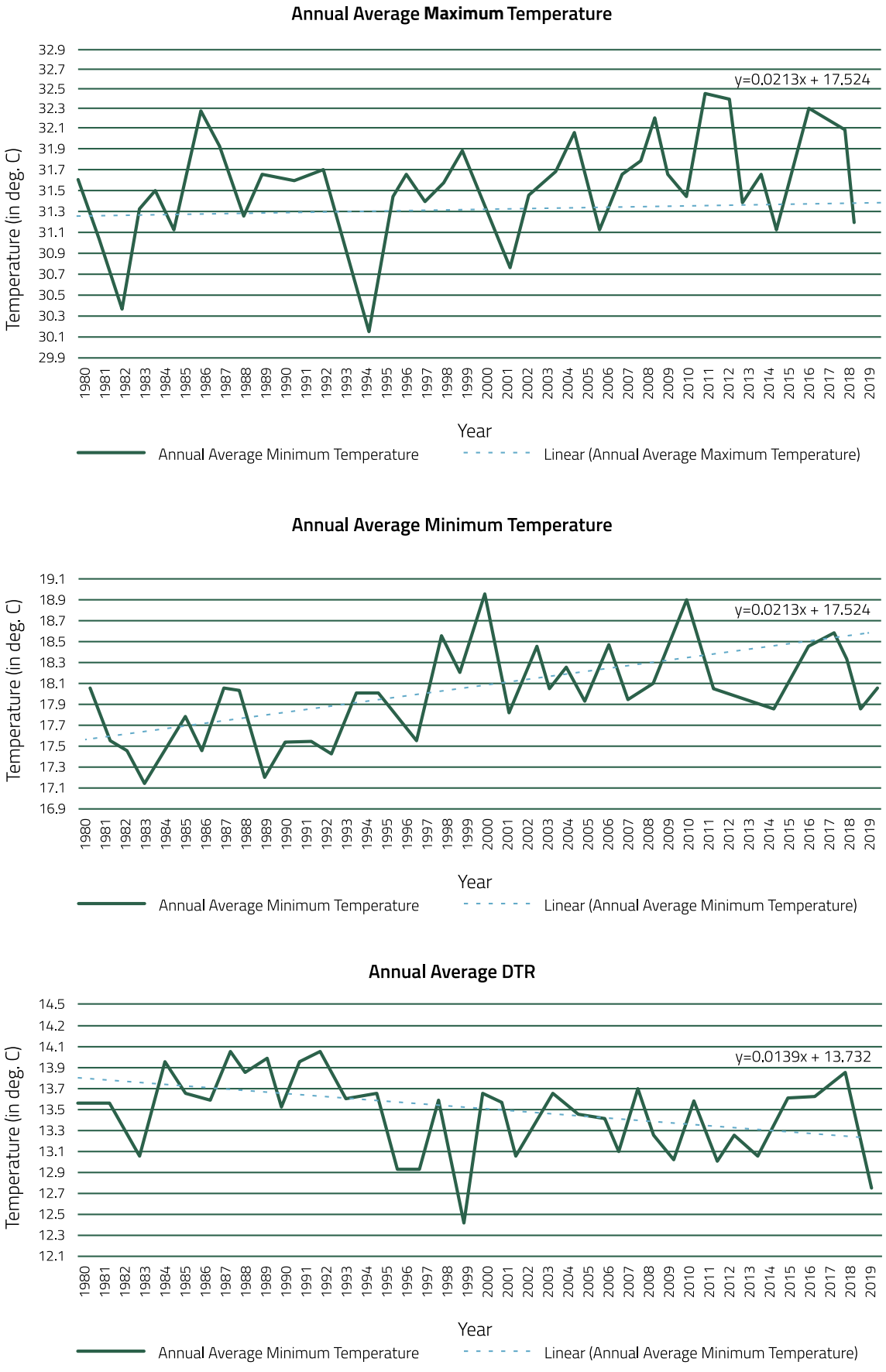


Figure 15: Trends of (A) Annual Average Maximum Temperature, (B) Minimum Temperature And (C) Diurnal Temperature Range in Uttar Pradesh Between 1980-2019

3.2.2 Temperature: District-level analysis

The district-level analysis of temperature carried out for the period 1980-2019 indicates that during this period the highest average maximum temperature was recorded in Lalitpur at 32. 74°C (See Figure 16) while the lowest average maximum temperature was recorded in Bijnor (26.75°C). On the other hand, the average minimum temperature during 1980-2019 was the highest in the district Amethi at 19.24°C (See Figure 16). The highest average DTR during this period was recorded in Lalitpur district (14.22°C).

The district-level analysis also shows a consistent increasing trend across all districts for both average maximum and minimum temperature, whereas the annual trend for DTR is decreasing over the period of analysis. It is worth noting that the trend is consistent with state-level analysis. The detailed data outlining results of district-level analysis has been presented in Table 74 in Annexure.

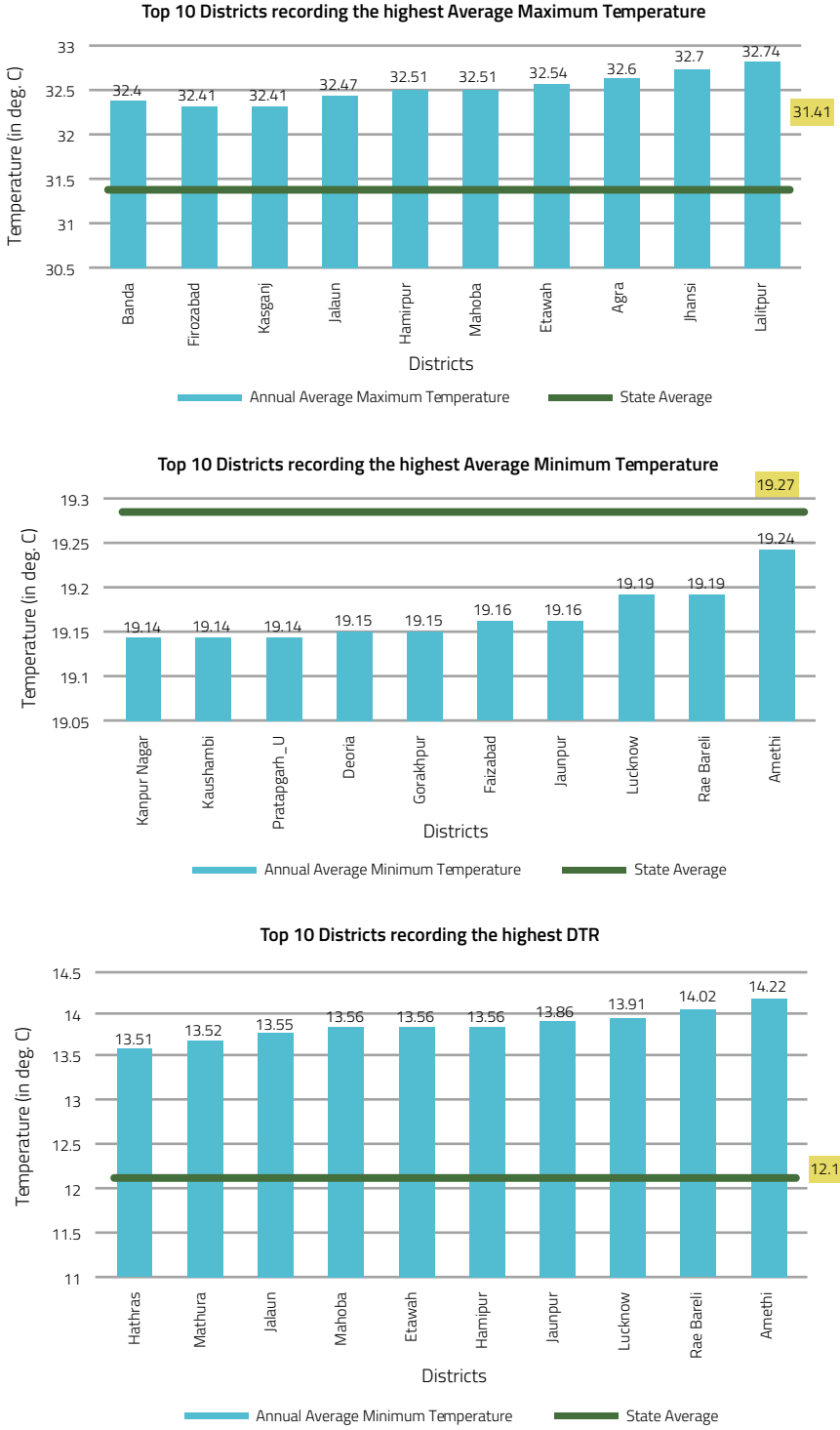


Figure 16: Districts Recording the Highest (A) Annual Average Maximum Temperature, (B) Annual Average Minimum Temperature and (C) Annual Average DTR in Uttar Pradesh Between 1980-2019

The district-level analysis for number of Extreme Heat Days and Severe Heat Days have been conducted for the state. As per the NDMA, heat wave is considered when maximum temperature of a station is recorded equal to or greater than 45°C in plains and severe heat wave is considered when maximum temperature of a station is recorded equal to or greater than 47°C (NDMA, 2019).

The analysis shows that Jhansi has recorded maximum number of extreme heat days (with maximum temperature >=45°C) between 1980 and 2019, i.e., 163 extreme heat days followed by 159 extreme heat days recorded in Agra. The districts recording the highest number of extreme days have been presented in Figure 17. The districts Kasganj and Firozabad have recorded the maximum number of severe heat days (with maximum temperature >=47°C), i.e., 8 severe heat days in each district followed by 4 severe heat days recorded each in Agra and Jhansi between 1980-2019 (Table 75 in Annexure).

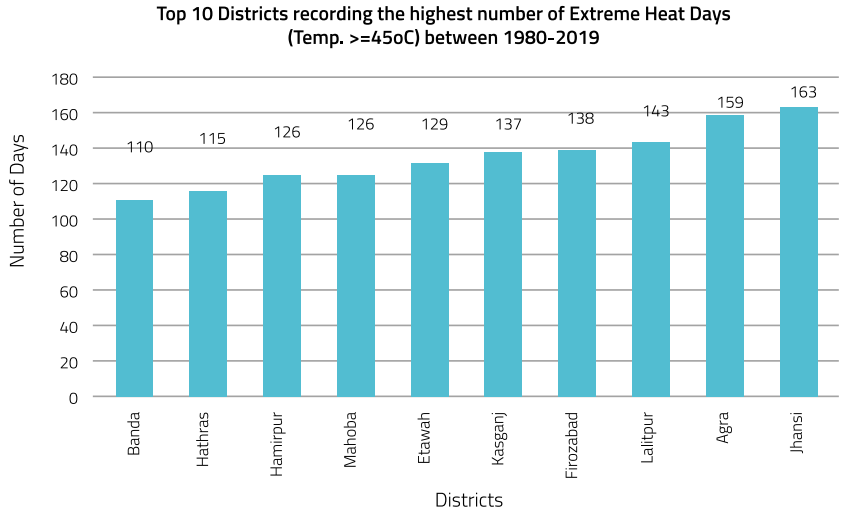


Figure 17: Districts ecording Maximum Number of Extreme Heat Days in Uttar Pradesh Between 1980 and 2019

3.2.3 Precipitation: State-level Analysis

Analysis of the rainfall data for the period 1980-2019 indicates that on an average Uttar Pradesh received around 896.51mm rainfall annually during this period. The highest amount of annual rainfall of the order of 1188.69mm was received in the year 1983 and the lowest amount of annual rainfall of the order of 611.79mm was received in the year 1997. Between 1980 and 2019, the annual rainfall has shown a decreasing trend by approximately 6.8mm (annually) as has been shown Figure 18.

The seasonal rainfall analysis has also been carried out at the state-level. The seasons are meteorological seasons as defined by IMD. Winter season comprises of the months of January and February; Pre-monsoon season covers the months of March, April and May; Monsoon season occurs in the months of June, July, August and September; Post-Monsoon season covers October, November and December. Figure 19 below, indicates the season wise average rainfall received in Uttar Pradesh and share of the seasonal rainfall in total annual rainfall.

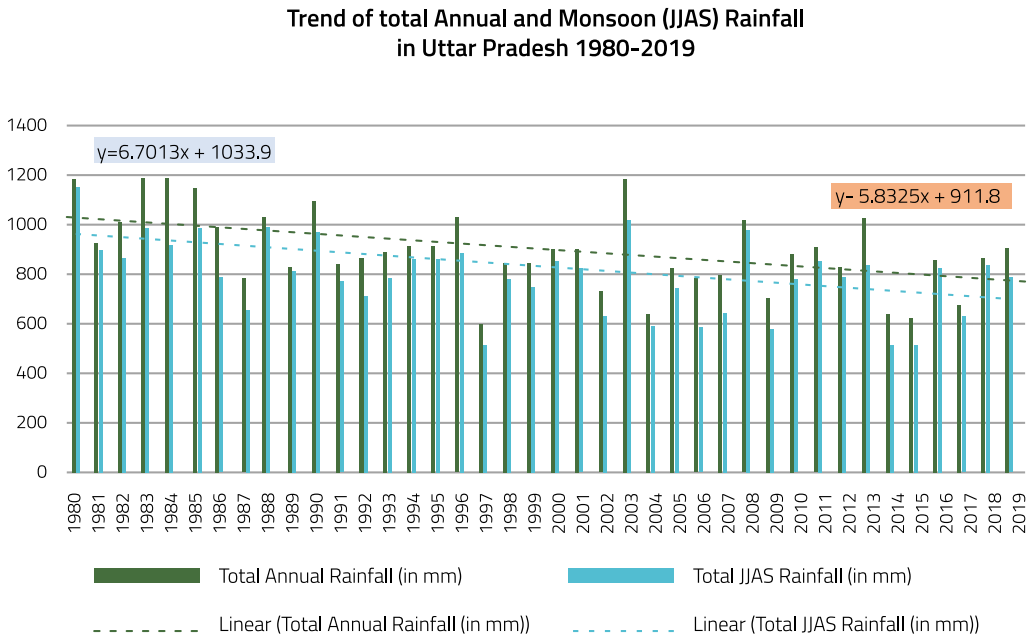


Figure 18: Trend of Total Annual and Monsoon (JJAS) Rainfall In Uttar Pradesh from 1980-2019

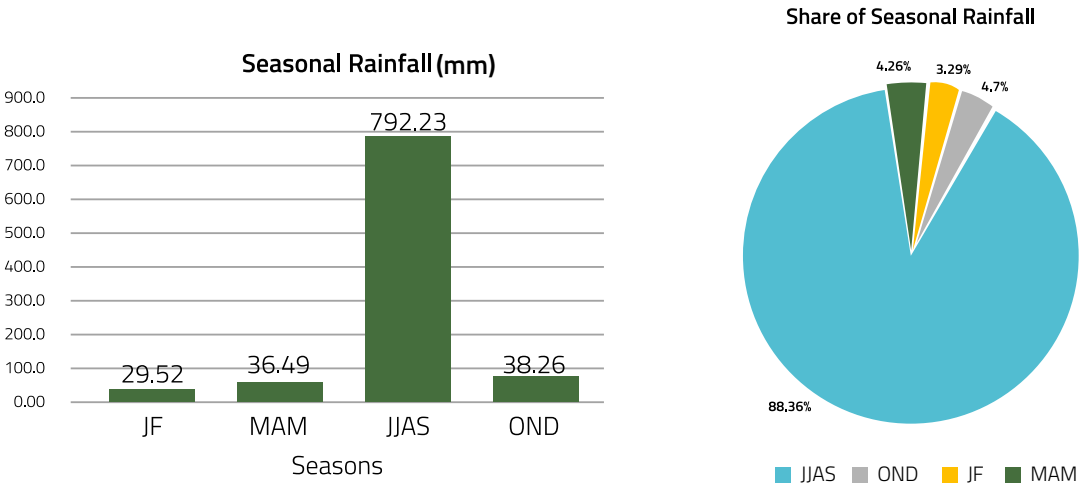


Figure 19: Seasonal Mean Rainfall Between 1980 And 2019 and
their Share in the Total Annual Rainfall in Uttar Pradesh

3.2.4 Precipitation: District-level analysis

A district-level analysis of rainfall for the period 1980-2019 indicates that Maharajganj district has received the highest annual rainfall followed by Sant Kabir Nagar, Shravasti, Pilibhit and Saharanpur as presented in Figure 20. While there is a uniform decrease in annual rainfall in all districts between 1980 and 2019, however, there are three outlier districts indicating increase in rainfall namely Saharanpur (3.09mm), Shamli (0.08mm) and Kaushambi (1.09mm). The highest amount of decrease in annual rainfall over the period 1980-2019 is seen in Kushinagar (19.836mm).

As far as monsoon rainfall is concerned, all districts show a decrease in rainfall over the time period except three districts Saharanpur (4.16mm), Shamli (0.95mm) and Pilibhit (0.52mm). During the monsoon season between the period 1980-2019, Maharaganj has received the highest rainfall (1133mm), followed by Sant Kabir Nagar (1095mm) and Shrawasti (1037mm). District Gautam Buddha Nagar has received the lowest rainfall recorded at 447mm. The district-level analysis of mean annual and seasonal rainfall in Uttar Pradesh during the period 1980-2019 is outlined in Table 76 in Annexure.

A district-level decadal analysis has also been done for number of dry days, rainy days, heavy rainfall days as well as very heavy rainfall days for June-September i.e. monsoon period as per IMD definition (IMD, Met Glossary). The number of dry days have been defined as number of days in the monsoon months (June, July, August and September), which received 0 mm rainfall whereas number of days in the monsoon months, which received more than 2.5 mm rainfall have been considered as rainy days. Similarly, number of days in monsoon months, which received rainfall between 64.5 mm to 124.4 mm rainfall are considered as heavy rainfall days and, which received rainfall between 124.5 mm to 244.4 mm are considered as very heavy rainfall days.
The result shows that Ghaziabad district has recorded 2650 dry days between 1980-2019, which is the highest across the state followed by 2522 dry days recorded in Shamli, 2381 dry days in Gautam Buddha Nagar, 2367 dry days in Baghpat and 2225 dry days in Hapur. Similarly, Rampur district has recorded the highest number of rainy days, i.e., 2623 rainy days between 1980-2019, followed by 2553 rainy days in Saharanpur, 2546 Sonbhadra, 2456 rainy days in Mirzapur and 2445 rainy days in Kushinagar. The district-level decadal variation in dry days and rainy days has been shown in Figure 21 below.

Figure 21 shows the increasing number of districts seeing a rise in dry days and a decline in rainy days over the decades during 1980-2019. In addition to this, the analysis for heavy rainfall days shows that district Sant Kabir Nagar has recorded a total of 94 heavy rainfall days between 1980-2019, which is the highest across the state, followed by 87 heavy rainfall days recorded in Maharajganj and 83 heavy rainfall days in Shrawasti. As for very heavy rainfall days, 12 days have been recorded in Shrawasti, followed by 11 days in Sant Kabir Nagar and 9 each in Baharaich, Pilibhit and Maharajganj. Table 76 in Annexure outlines the district-level decadal analysis for heavy rainfall days and very heavy rainfall days.

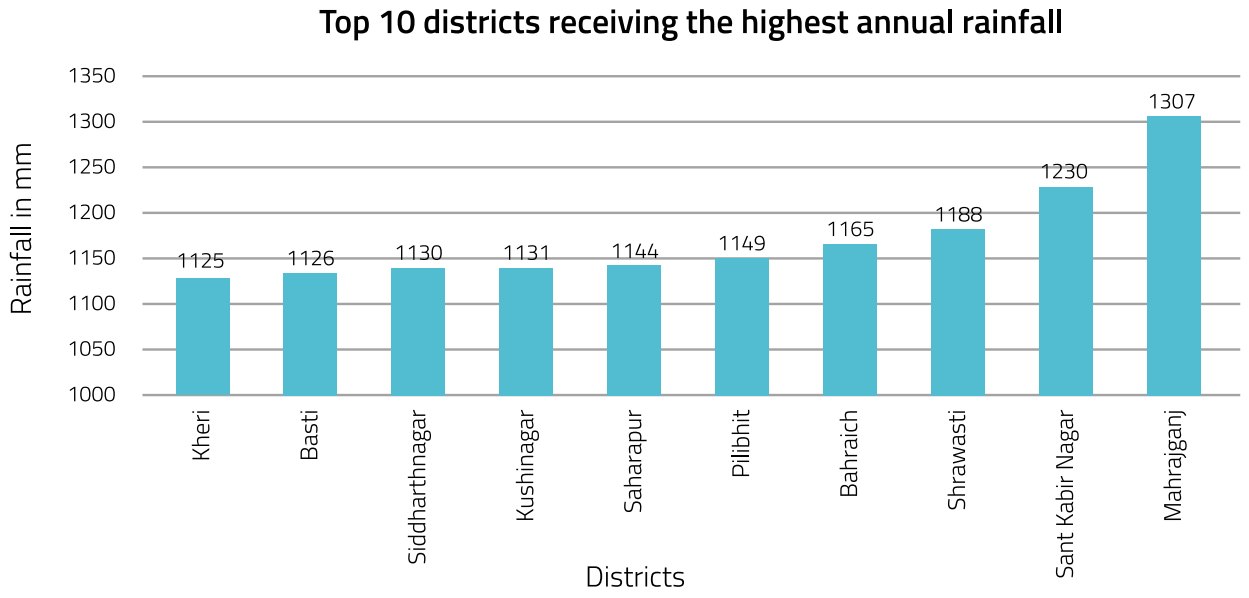
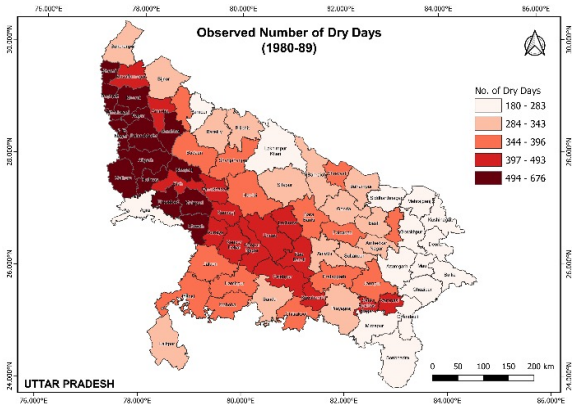
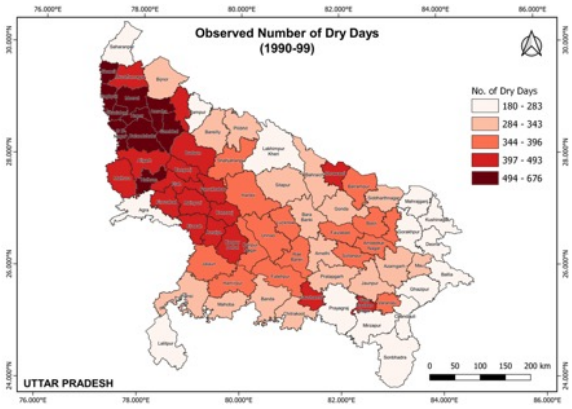


Figure 20: Districts Receiving the Highest Annual Rainfall in Uttar Pradesh Between 1980 and 2019

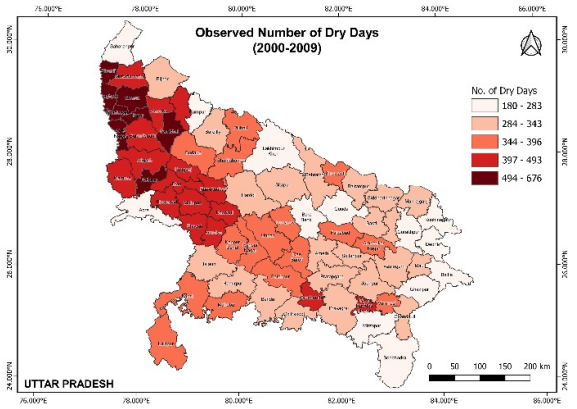
Number of Dry Days (1980-89)



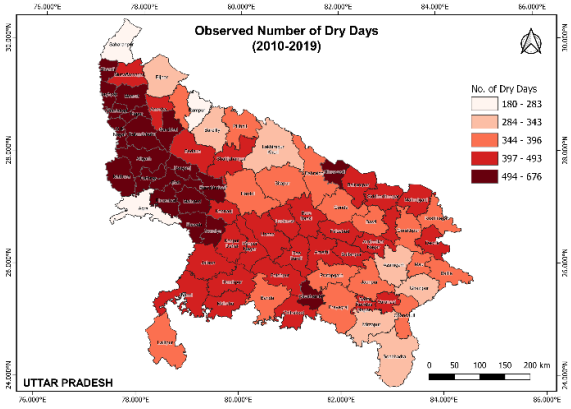
Number of Dry Days (1990-99)



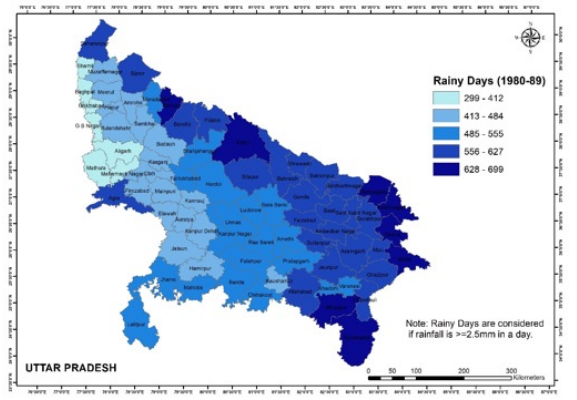
Number of Dry Days (2000-09)



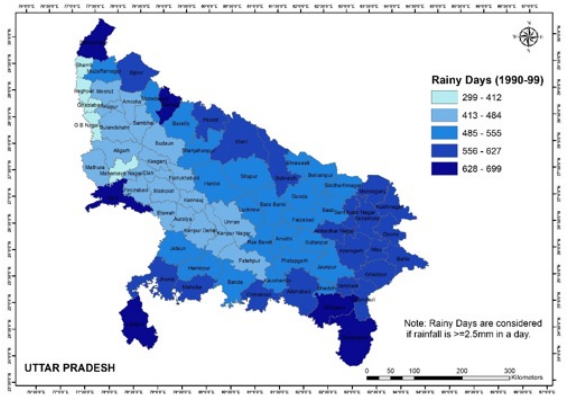
Number of Dry Days (2010-19)



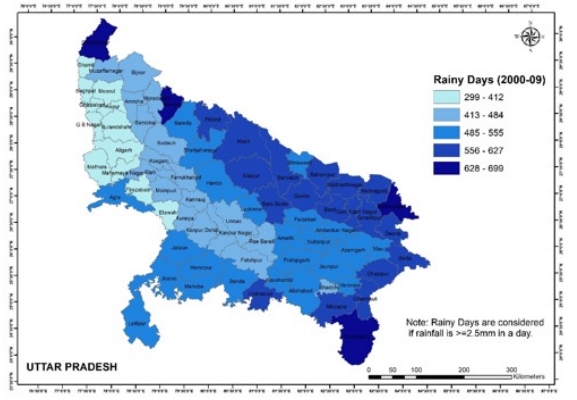
Number of Rainy Days (1980-89)



Number of Rainy Days (1980-89)



Number of Rainy Days (2000-09)



Number of Rainy Days (2010-19)

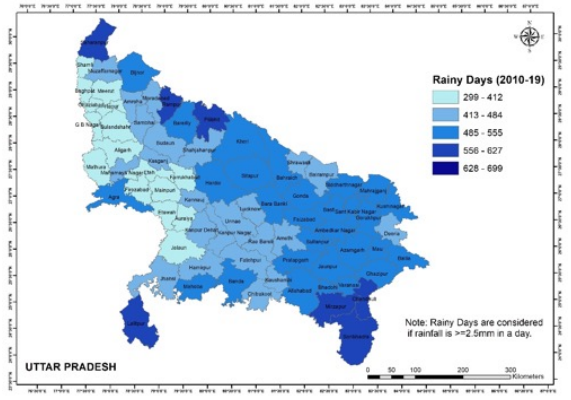


Figure 21: District-wise Decadal Analysis of Number of Dry Days and Rainy Days in Uttar Pradesh Between 1980-2019

3.3 CLIMATE PROJECTIONS

3.3.1 Temperature and Precipitation projections

The annual average maximum temperature in Uttar Pradesh is likely to rise by 1.04°C and 1.24°C by 2011-2040 under RCP 4.5 and 8.5 scenarios respectively. By mid-term (2041-2070), the annual mean maximum temperature may rise up to 1.75°C and 2.60°C under RCP 4.5 and 8.5 scenarios respectively. As for the end-century (2071-2100), annual average maximum temperature is likely to rise by 2.06°C and 4.37° C under RCP 4.5 and 8.5 scenarios respectively. Figure 25 maps the annual mean maximum temperature across the districts for baseline (1981-2010), near-term (2011-2040), mid-term (2041-2070) and for end-century (2071-2100). Table 14 captures the assessment of Maximum Temperature Trends over baseline till end century for Uttar Pradesh. Figure 22 highlights the annual mean maximum temperature across the districts for baseline (1980-2010), near-term (2011-2040), midterm (2041-2070) and for end-century (2071-2100).

The annual average minimum temperature in the state is projected to increase up to 0.98°C and 1.20°C for RCP4.5 and RCP8.5 respectively by 2011-2040. It may further rise up to 1.90°C to 2.98°C by 2041-2070 and up to 2.40°C and 5.01°C by 2071-2100, under RCP4.5 and 8.5 scenarios, respectively. Table 15 and Figure 23 show the district-level projections that are likely to occur in annual average minimum temperature in Uttar Pradesh.

Annual average rainfall in Uttar Pradesh is projected to decrease by 5.37 % and 4.36 % towards near-term (2011-2040) under RCP4.5 and 8.5 scenarios respectively (Figure 27). As for mid-term (2041-2070), annual average rainfall is projected to decrease by 1.32 % under RCP4.5 but it is likely to increase by 1.56 % under RCP8.5. By end-century (2071-2100), annual average rainfall is projected to increase under both RCP4.5 and 8.5 scenarios by 4.73 % and 10.23 %, respectively.

Figure 28 shows the projections for seasonal precipitation (monsoon season; JJAS) for .baseline (1981-2010), near-term (2011-2040), mid-term (2041-2070) and for end-century (2071-2100). In addition, the projections for seasonal maximum temperature (JF, MAM, JJAS, OND), seasonal minimum temperature (JF, MAM, JJAS, OND) and seasonal precipitation (JF, MAM, OND) are shown in Annexure (Figure 84 to Figure 94).

Tmax (deg C)	Baseline (1981-2010)	Near Term (2011-2040)	Mid-term (2041-2070)	End-Term (2071-2100)
RCP 4.5	29.4 - 32.9	30.5 - 34 (↑1.04)	31.3 - 34.7 (↑1.75)	31.5 - 35 (↑2.06)
RCP 8.5		30.6 - 34.2 (↑1.24)	32.1 - 35.6 (↑2.60)	34 - 37.3 (↑4.37)

Table 14: Comparative Assessment of Maximum Temperature Trends Over Baseline Till End Century for Uttar Pradesh

Source: Modified from ClimateVulnerbility.in

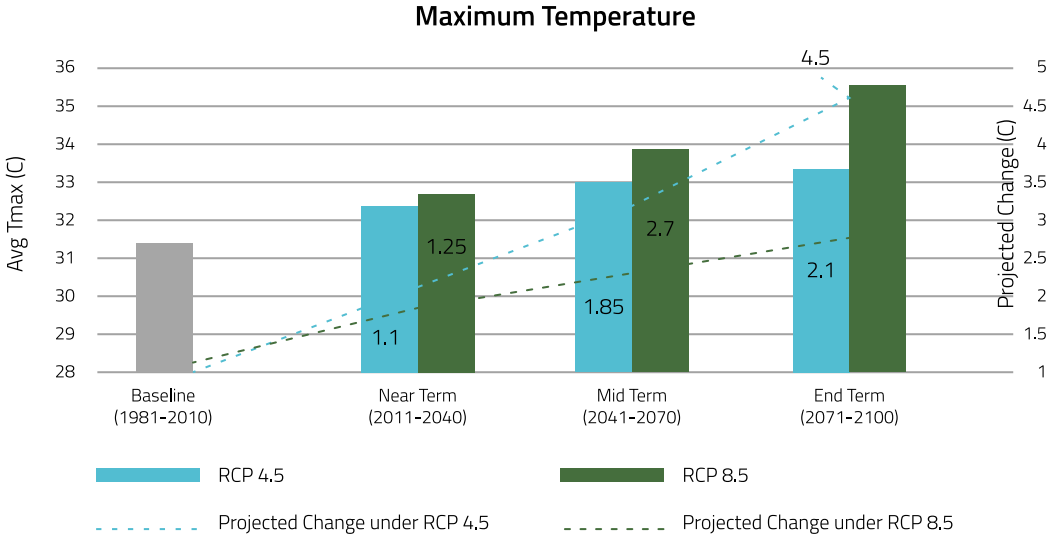


Figure 22: Annual Mean Maximum Temperature Across the Districts for Baseline (1980-2010), Near-Term (2011-2040), Mid-Term (2041-2070) and for End-Century (2071-2100)

TmIN (deg C)	Baseline (1981-2010)	Near Term (2011-2040)	Mid-term (2041-2070)	End-Term (2071-2100)
RCP 4.5	16.9 - 19.9	17.9 - 20.9 (↑0.98)	18.9 - 21.9 (↑1.90)	19.4 - 22.4 (↑2.40)
RCP 8.5		18.1 - 21.1 (↑1.20)	20 - 23 (↑2.98)	21.9 - 25.3 (↑5.01)

Table 15: Comparative Assessment of Minimum Temperature Trends Over Baseline Till End-Century for Uttar Pradesh

Source: Modified from ClimateVulnerbility.in

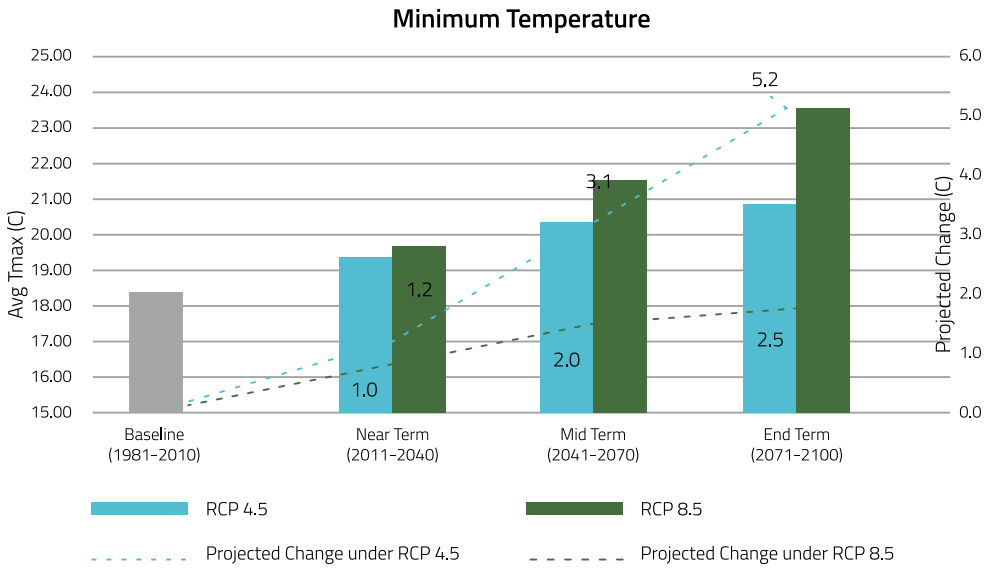


Figure 23: Annual Mean Minimum Temperature Across the Districts for Baseline (1980-2010), Near-Term (2011-2040), Mid-Term (2041-2070) and for End-Century (2071-2100)

Annual Rainfall (in mm)	Baseline (1981-2010)	Near Term (2011-2040)	Mid-term (2041-2070)	End-Term (2071-2100)
RCP 4.5	597.2 - 1515.3	565.5 - 1455.1	568.6 - 1585.6	631.8 - 1598.9
RCP 8.5		557 - 1580.5	605.9 - 1569.2	691.9 - 1706.5

Table 16: Comparative Assessment of Annual rainfall Trends Over Baseline Till End Century for Uttar Pradesh

Source: Modified from ClimateVulnerbility.in

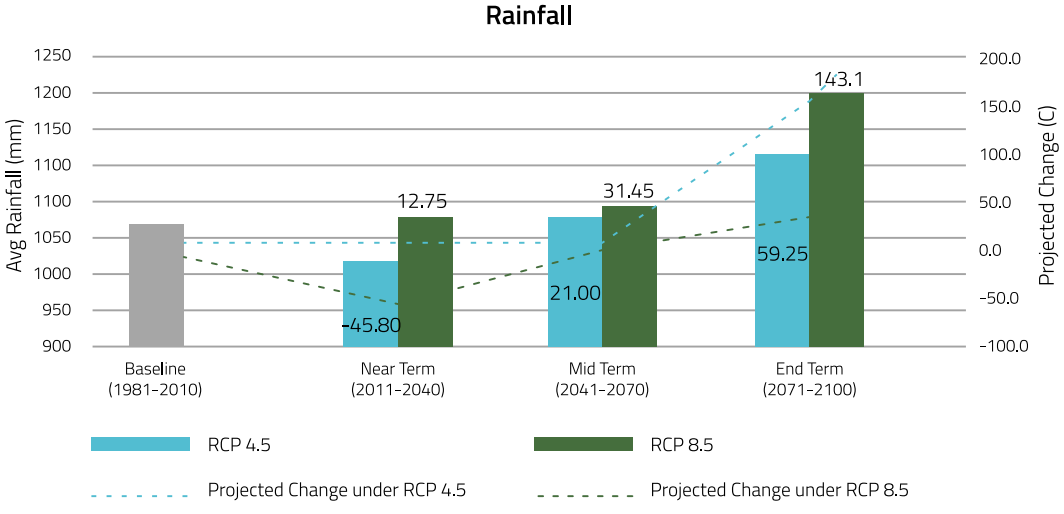
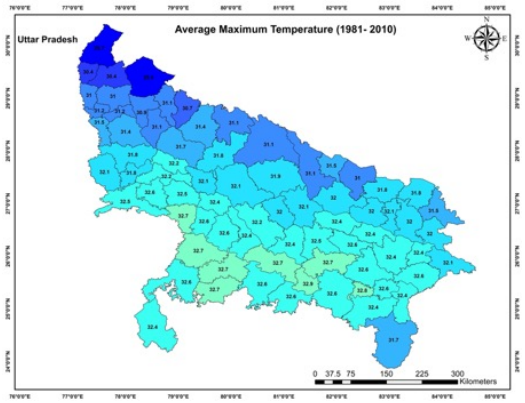


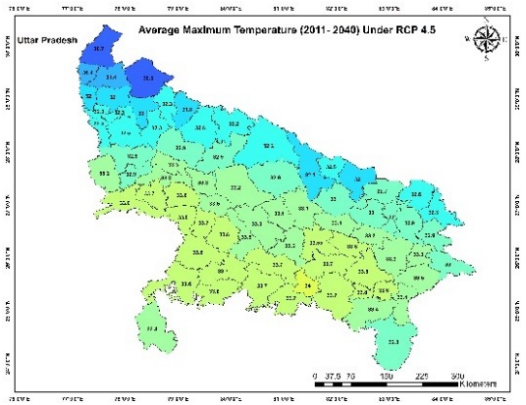
Figure 24: Annual Mean Minimum Temperature Across the Districts for Baseline (1980-2010), Near-Term (2011-2040), Mid-Term (2041-2070) and for End-Century (2071-2100)

The projections for Annual Average Maximum Temperature are outlined in Table 78 in Annexure. The average annual maximum temperature during the baseline is recorded at 31.97°C. All the districts except Bijnor, Muzzafarnagar, Rampur and Saharanpur are expected to record higher maximum temperature in near-term under RCP 4.5 scenario than the annual average maximum temperature recorded during baseline. Under RCP 8.5 scenario, both Muzzafarnagar, Rampur are also expected to record higher temperature than the annual average temperature recorded during baseline. Districts that are projected to record higher temperature than the annual average temperature recorded during baseline in mid-term and end-century under RCP 4.5 and RCP 8.5 scenario are presented in Table 78 in Annexure. The average annual minimum temperature during the baseline is recorded at 19.14°C. Similarly, Table 79 in Annexure highlights the districts that are projected to record higher minimum temperature in near-term, mid-term and end-century under RCP 4.5 and RCP 8.5 scenario than the annual average minimum temperature recorded during baseline. In near-term, all the districts are projected to record higher minimum temperature under RCP 4.5 and RCP 8.5 scenario than the annual average minimum temperature recorded during baseline except for Saharanpur and Bijnor. The maps for the projections are presented below.

Baseline (1981-2010)



Near-term (2011-2040) under RCP 4.5



Near-term (2011-2040) under RCP 8.5

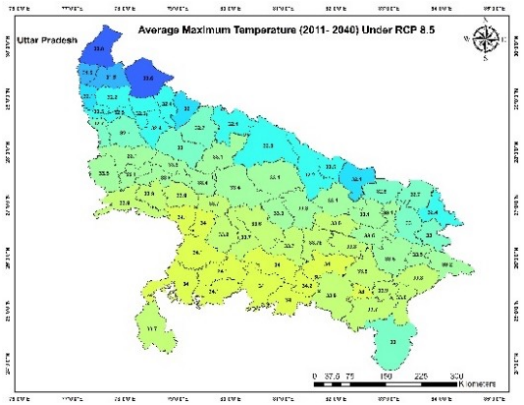
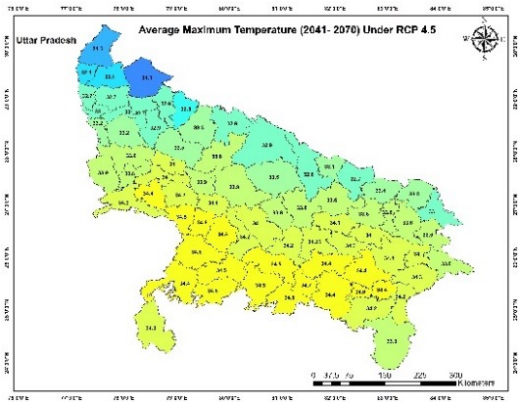
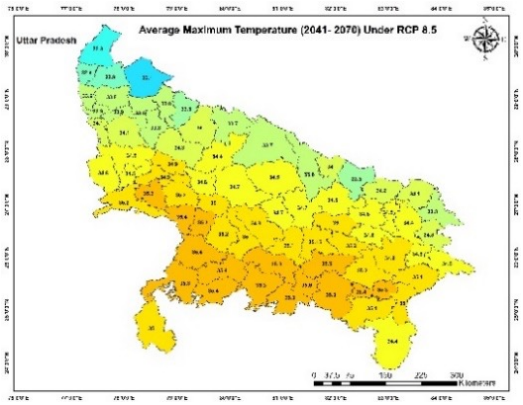


Figure 25: Annual Maximum Temperature for Baseline (1981-2010) and its projection in Near-term (2011-2040), Mid-term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.5

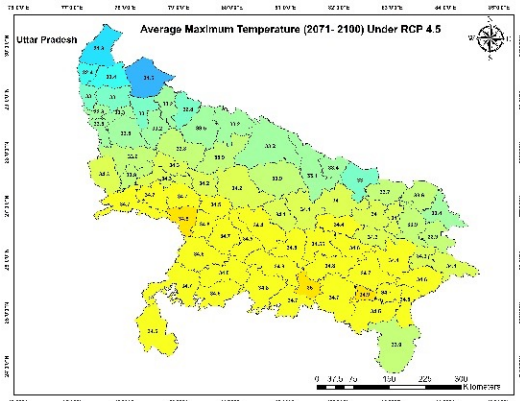
Mid-term (2041-2070) under RCP 4.5



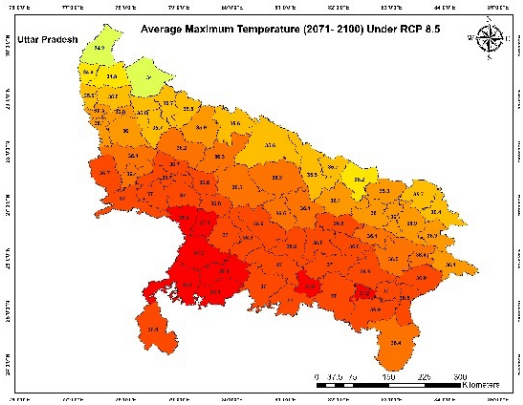
Mid-term (2041-2070) under RCP 8.5



End-Century (2071-2100) under RCP 4.5



End-Century (2071-2100) under RCP 8.



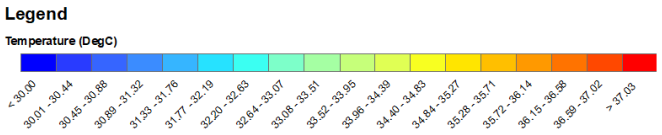
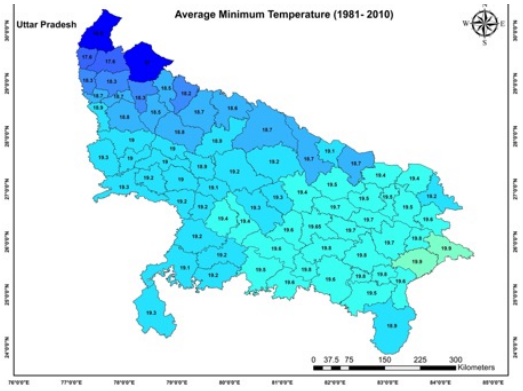


Figure 25: Annual Maximum Temperature for Baseline (1981-2010) and its Projection in Near-term (2011-2040), Mid-term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.5

Baseline (1981-2010)



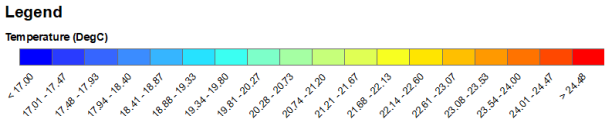
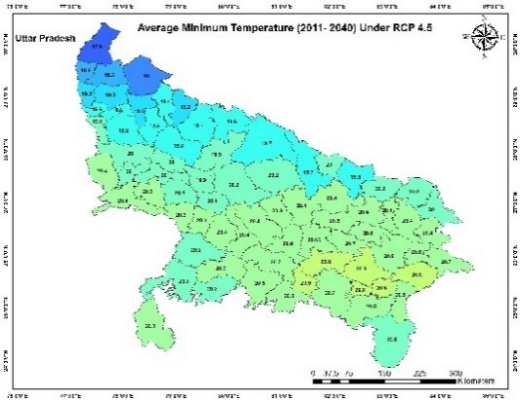
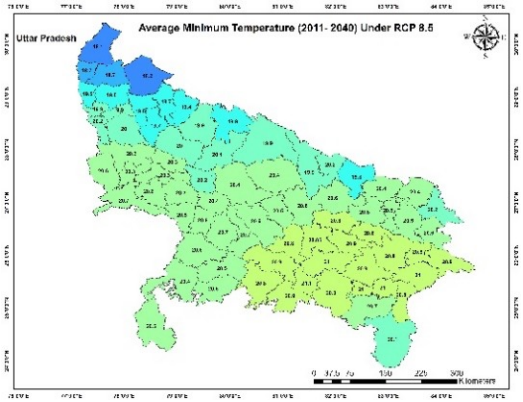


Figure 26: Annual Minimum Temperature for Baseline (1981-2010) and its Projection in Near-term (2011-2040), Mid-term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.

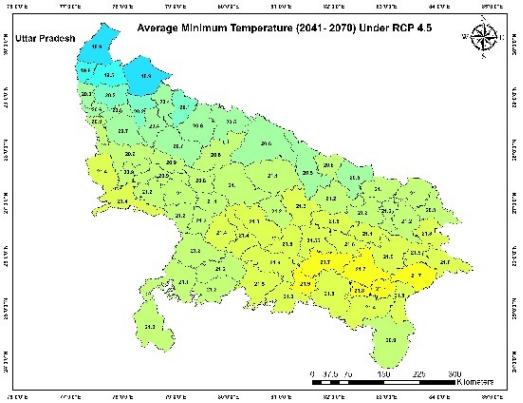
Near-term (2011-2040) under RCP 4.5



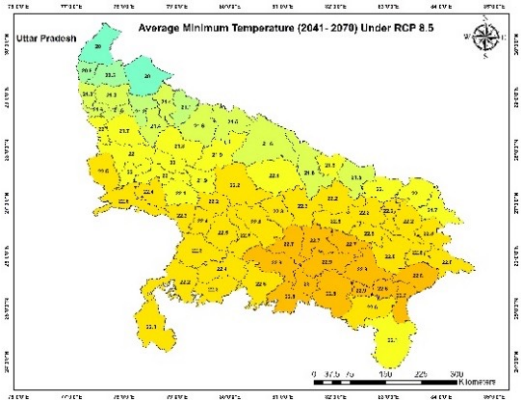
Near-term (2011-2040) under RCP 8.5



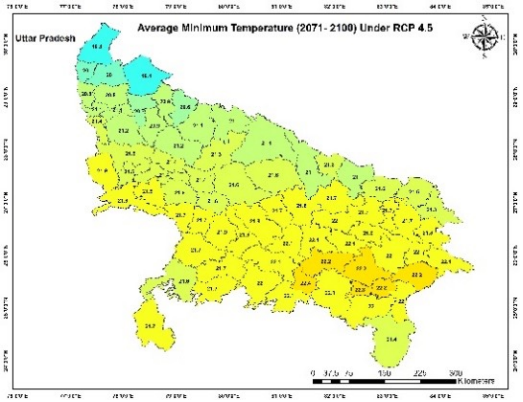
Mid-term (2041-2070) under RCP 4.5



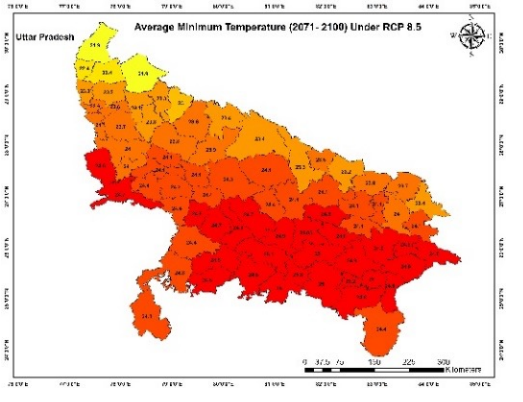
Mid-term (2041-2070) under RCP 8.5



End-Century (2071-2100) under RCP 4.5



End-Century (2071-2100) under RCP 8.5



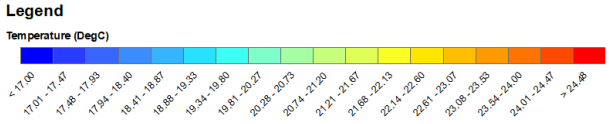
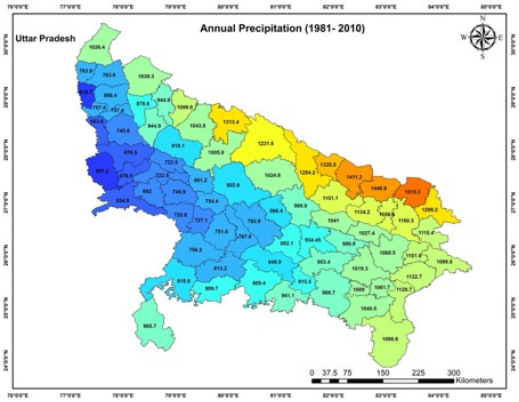
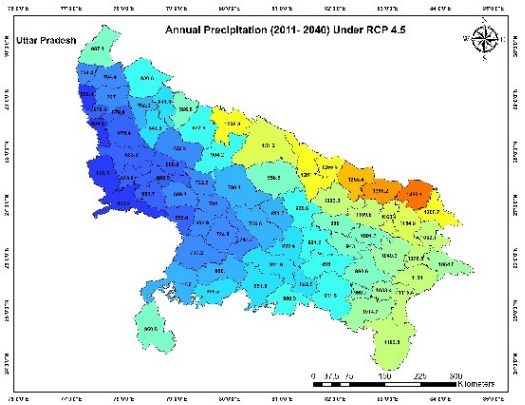


Figure 26: Annual Minimum Temperature for Baseline (1981-2010) and its Projection in Near-term (2011-2040), Mid-term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.

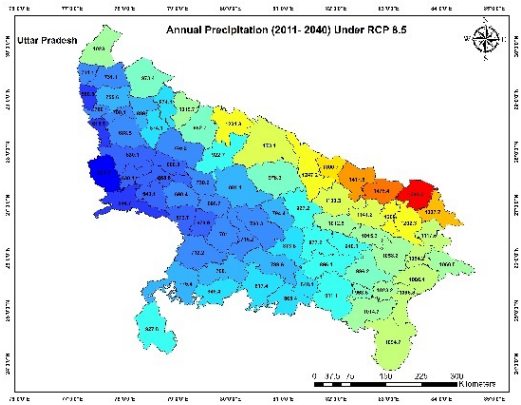
Baseline (1981-2010)



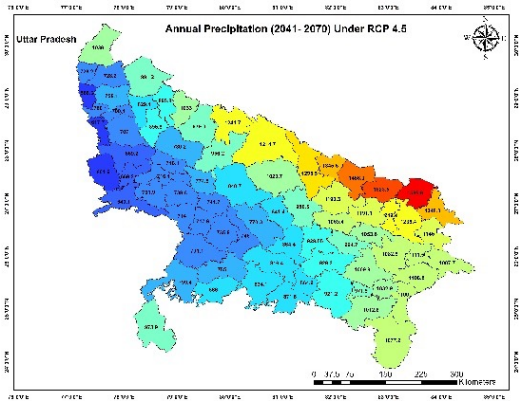
Near-term (2011-2040) under RCP 4.5



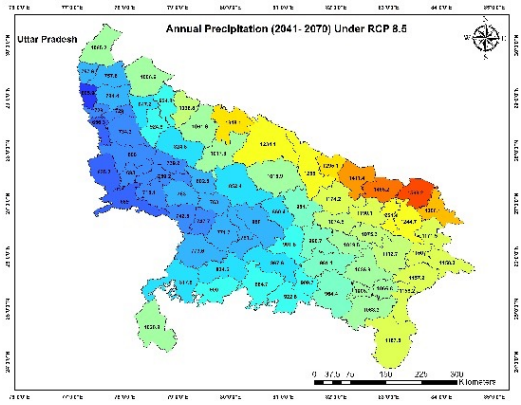
Near-term (2011-2040) under RCP 8.5



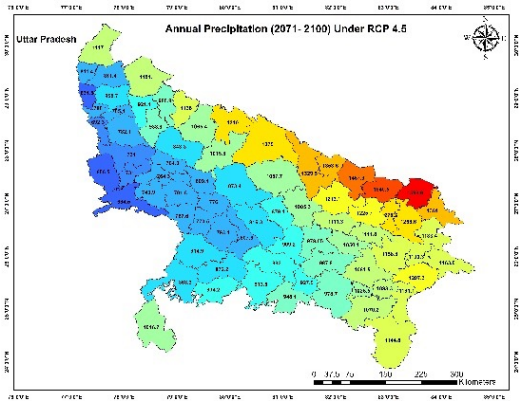
Mid-term (2041-2070) under RCP 4.5



Mid-term (2041-2070) under RCP 8.5



Mid-term (2041-2070) under RCP 4.5



Mid-term (2041-2070) under RCP 8.5

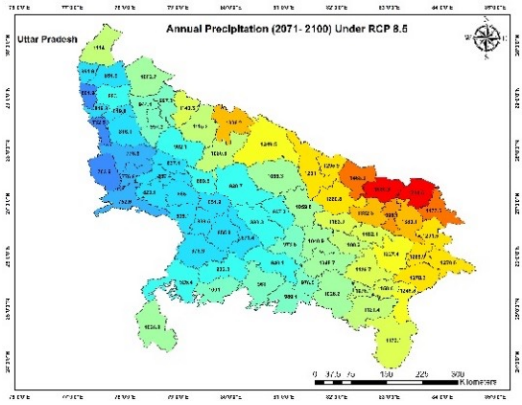


Figure 27: Annual precipitation for Baseline (1981-2010) and its projection in Near-term (2011-2040), Mid-term (2041-2070) and End-Century (2071-2100) under RCP 4.5 and RCP 8.5

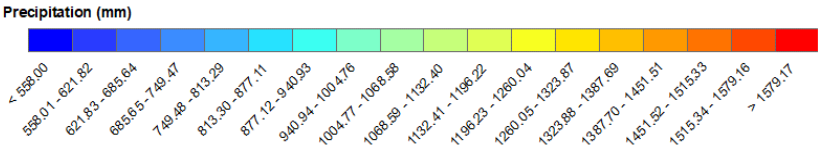
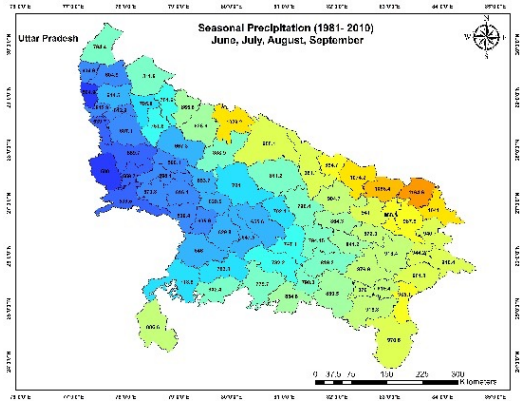
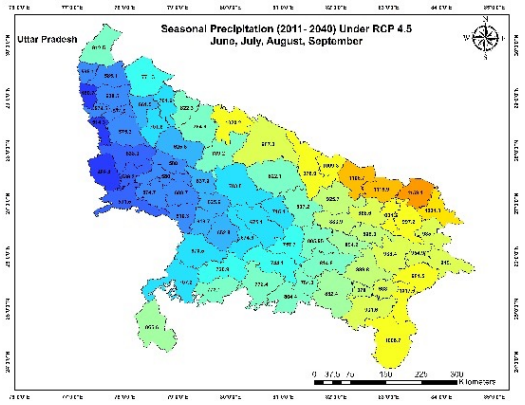


Figure 27: Annual Precipitation for Baseline (1981-2010) and its Projection in Near-term (2011-2040), Mid-term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.5

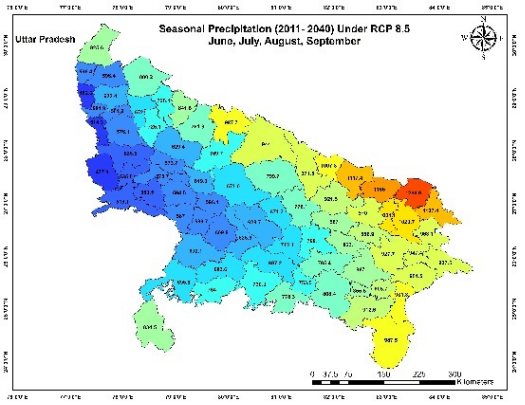
Baseline (1981-2010)



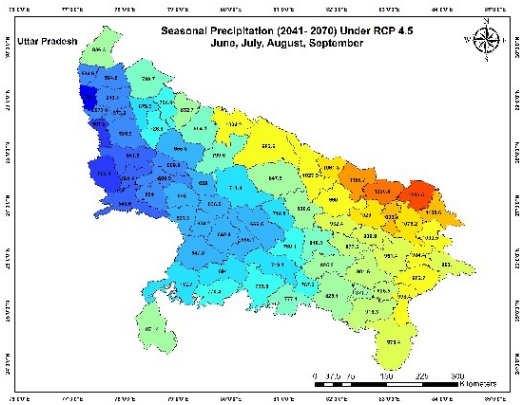
Near-term (2011-2040) under RCP 4.5



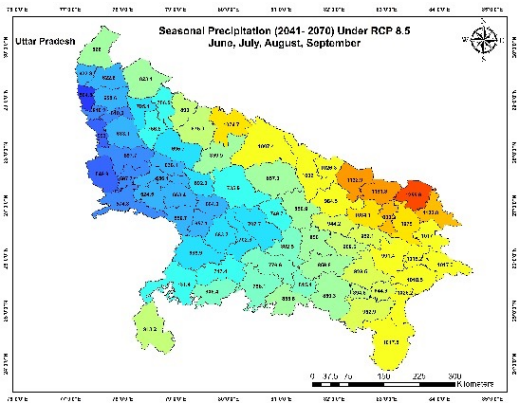
Near-term (2011-2040) under RCP 8.5



Mid-term (2041-2070) under RCP 4.5



Mid-term (2041-2070) under RCP 8.5



Near-term (2011-2040) under RCP 4.5

Near-term (2011-2040) under RCP 8.5

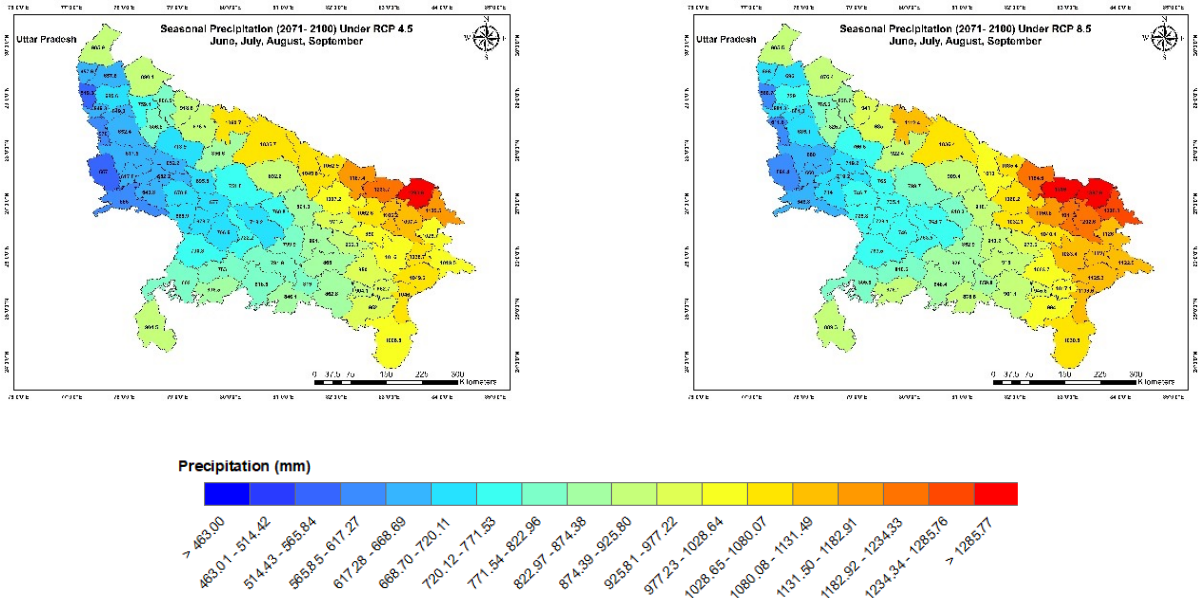


Figure 28: Seasonal Precipitation (JJAS) for Baseline (1981-2010) and its Projection in Near-term (2011-2040), Mid-term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.5.

Chapter 4

Climate Vulnerability Assessment

Risk or impact of climate change is determined by the interaction of "Hazard – Exposure – Vulnerability". Among the three factors, governments and development agencies can address climate change by reducing vulnerability. Thus, there is a need to assess the vulnerability of natural ecosystems and socio-economic systems to develop adaptation and mitigation policies, strategies and practices. This chapter focuses on understanding the vulnerability of the seven missions covered under UP SAPCC 2.0. Both the vulnerability of each sector covered under the SAPCC missions across districts of the state of UP as well as the composite vulnerability of the districts with respect to these SAPCC missions have been assessed.

4.1 VULNERABILITY FRAMWORK & METHODOLOGY

4.1.1 Concept

As per IPCC in the Fifth Assessment Report (IPCC 2014), severity of the impacts of extreme and non-extreme weather and climate events depends strongly on the level of vulnerability and exposure to these events. Therefore, study of the nature of vulnerability and extent of exposure are critical to manage the risk and enhance resilience. The vulnerability of a system is one of three components of risk.

Risk = F (Hazard, Exposure, Vulnerability)

Hazard:

Hazard usually refers to climate-related physical events or trends or their physical impacts. This may not be always an extreme weather phenomenon but could be a trend e.g. dry spells, wet days, etc., derived from climate trends.

Exposure:

Exposure refers to the inventory of elements in an area where hazard events may occur (Cardona, 1990; UNISDR, 2004, 2009b). Hence, if population and economic resources were not located in (exposed to) potentially dangerous settings, no problem of disaster risk would exist.
However, it is possible that a certain area is exposed but not vulnerable. In fact, when we consider developing resilient infrastructure or systems, their vulnerability may reduce. It means either their sensitivity to certain level of hazards or exposures have reduced or their adaptive capacity has increased or both. Therefore, vulnerability has two elements - sensitivity and adaptive capacity.

Vulnerability:

Vulnerability = F (Sensitivity, Adaptive Capacity)
Vulnerability profiles can be constructed that take into consideration sources of environmental, social, and economic marginality (Wisner, 2003). Socio-economic systems further have a bearing on the adaptive capacity. Similarly, environmental factors are affected by bio-physical systems. Holistic perspectives on vulnerability aims to go beyond technical modelling approach. It attempts to embrace a wider and comprehensive explanation of vulnerability. These approaches differentiate exposure, susceptibility (i.e., sensitivity) and societal response capacities as causes or factors of vulnerability.

IPCC defines:

Vulnerability as, "the propensity or predisposition to be adversely affected". Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

Sensitivity is, "the degree to which a system or species is affected, either adversely or beneficially by climate variability or change". The effect may be direct (e.g., change in crop yield in response to a change in the mean, range, or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea level rise). Sensitivity refers to those factors that directly affect the consequences of a hazard. Sensitivity may include physical attributes of a system (e.g., house-type, soil type, irrigation type, cropping intensity, etc.), and

Adaptive capacity is, "the ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences", arising out of climatic or anthropogenic causes.

The risk management framework adopted by the IPCC in the Fifth Assessment Report (IPCC 2014) depicts the interaction of hazard, exposure and vulnerability resulting in risk within the overall climatic and non-climatic physical and socio-political environment (Figure 29).

The present assessment has adopted this framework and has considered only sensitivity and adaptive capacity as the two factors that determine vulnerability.

4.1.2 Methodology

Conducting a vulnerability assessment is a multi-step exercise and requires identification of clear set of goals and objectives, which will determine the type of vulnerability assessment, scale, tier, indicators, and methods to be adopted.
As the objective of this study is to identify, rank and prioritise the most vulnerable districts for each of the specified sectors in the State of Uttar Pradesh under current climate, an integrated vulnerability assessment system has been employed- using a tier 1 method that quantifies indicators and uses secondary sources of information at the district-level.

A Vulnerability Index (VI), which is a metric that characterizes the vulnerability of a system has been used. Values of VIs will lie between 0 and 1, where 0 stands for lowest vulnerability and 1 for highest vulnerability. Arrangement of

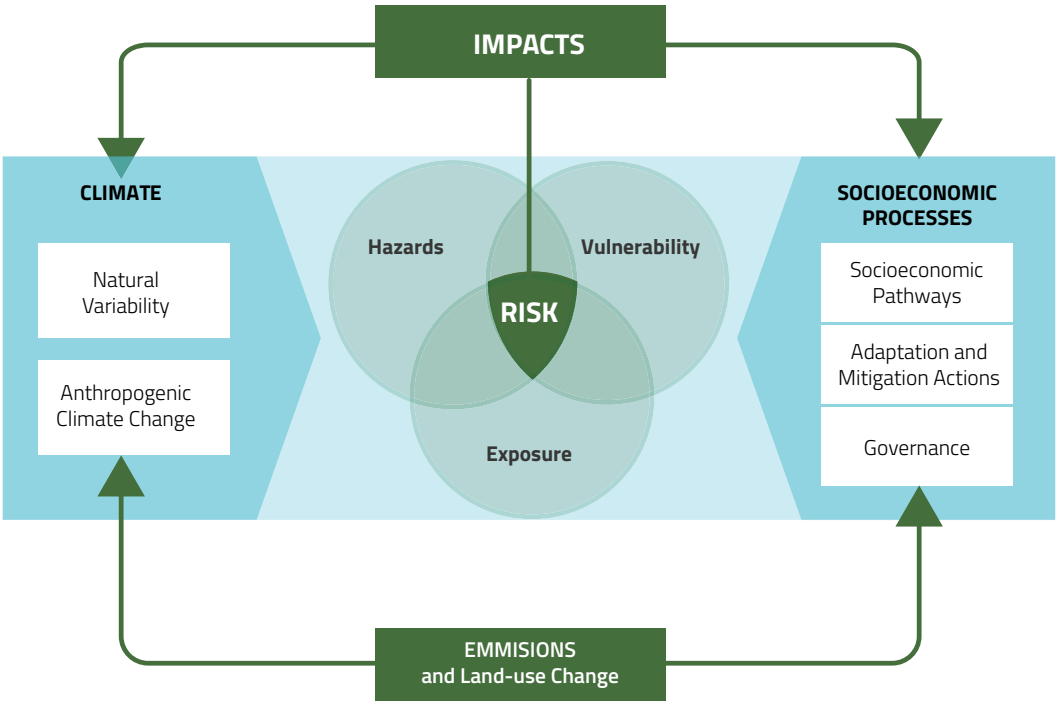


Figure 29: IPCC AR5 Risk Management Framework

the assessed VI values in decreasing or increasing orders allows for ranking of the sectors and districts. It must be noted that the vulnerability index value only provides a sense of quantified status of vulnerability and remains largely conceptual in its utility, as this value does not have any stand-alone practical significance. Figure 30 presents the broad approach and steps to vulnerability assessment and Table 17 presents the details of the assessment conducted in a stepwise manner.

A Tier 1 methodology has been adopted to assess vulnerability. This entailed the use of secondary sources of information to quantify indicators with assignment of equal weights to indicators.

Vulnerability Index (VI) is a metric that characterizes the vulnerability of a system or as the case may be a district with respect to sectors identified. It is very important to note that VI values only provide a quantified perception of the status of vulnerability of a system and does not have any stand-alone significance. It largely remains conceptual in its utility, unless the VI value is used for ranking/prioritizing systems, which is the case here. VI values lie between 0 and 1, where a value closer to 1 means higher vulnerability relative to the other districts of the State. VI values have been ranked from on a 5-point scale of very high, high, moderate, low and very low vulnerability.

1. Scoping and objectives of vulnerability assessment
2. Selection of type of vulnerability assessment
3. Selection of Tier method
4. Selection of sector, spatial scale, community/ system and period for assessment
5. Identification, definition and selection of indicators for vulnerability assessment (secondary literature and stakeholder consultations)
6. Quantification and measurement of indicators
7. Normalisation of indicators
8. Assigning weights to indicators (equal weights)
9. Aggregation of indicators and development of vulnerability index
10. Representation of vulnerability profiles and index: spatial maps, charts and/or tables
11. Vulnerability ranking of districts for each Sector/Mission
12. Identification of drivers of vulnerability for adaptation planning

Figure 30: Broad Approach and Steps to Conduct a Vulnerability Assessment

Table 17: Approach And Methodology Adopted For Vulnerability Assessment

S.No.	Steps in vulnerability assessment	Details
1	Scoping of vulnerability assessment	To identify and rank vulnerable districts respective to different sectors, along with a composite inherent vulnerability assessment at the district-level for the state of Uttar Pradesh ; owing to the availability of data, 71 districts as listed in Census 2011 have been considered for the current assessment; it is to be noted that post 2011, 4 new disticts have emerged from the existing districts in Uttar Pradesh (Footnote No. 2)
2	Selection of type of vulnerability assessment	Sectoral vulnerability assessment at the district-level and an Integrated, composite vulnerability assessment using indicators representing the specified sectors - including both bio-physical and socio-economic characteristics of the districts
3	Selection of Tier methods	Tier 1
4	Selection of spatial scale and period for vulnerability assessment	Spatial scale: District-level assessment for the state of Uttar Pradesh Period – Based on availability of data (2011-2019)
5	Identification, definition, and selection of indicators for vulnerability assessment	Indicators were selected based on availability of district-level data for each sector; potential indicators were selected based on the existing national secondary studies on climate vulnerability such as (DST, 2019), IHCAP (2018), (NICRA, 2020) -Climate Risk and Vulnerability Assessment for Agriculture etc. Post quantification of indicators, a correlation matrix was constructed and indicators with high correlation (r2>0.75) were excluded from the assessment. The results of the Correlation Matrix for each of the sectoral indices are included as in their respective sections. List of selected indicators, rational for selection along with their functional relationship is provided for each sector in the sections below. Similarly, indicators selected for construction of a composite vulnerability index at the district-level, representing each of the selected sectors is also provided. A few indicators have been considered repetitively for the computation of different sectoral vulnerability indices as these indicators have a significant influence on more than one sector. For example, road connectivity is essential for the prosperity of many sectors, such as agriculture, sustainable rural and urban development, etc.
6	Quantification and measurement of indicators	All indicators were quantified using secondary sources of data. Sources used to quantify the selected indicators are provided for each sector below.

7	Normalization of indicators	Indicators were normalized based on their functional relationship with vulnerability. Two types of functional relationships are possible: **Positive relationship** - vulnerability increases with increase in the value of the indicator. The following formula was used when the indicator had a positive relationship: $$x_{ij}^{P} = \frac{Xij - Min\ i\ \{Xij\}}{(Max\ i\ \{Xij\} - Min\ i\ \{Xij\}}$$ **Negative relationship** - vulnerability increases with decrease in the value of the indicator. The following formula was used when the indicator had a negative relationship: $$x_{ij}^{N} = \frac{Max\ i\ \{Xij\} - Xij}{Max\ i\ \{Xij\} - Min\ \{Xij\}}$$ where Xij is the variable that is being normalised and has the value of jth indicator for ith region, xPij¬ (for positive relationship) and xnij (for negative relationship) are the normalised values, which lie between 0 and 1. Outliers were excluded from the normalisation process.
8	Assigning weights to indicators	Equal weights were assigned to all indicators for the preliminary analysis.
9	Aggregation of indicators and development of vulnerability index	With assignment of equal weights, an average of normalized indicator values was taken for aggregation of Vis that did not consider indicators with sub-indicators. For those Vis computed using indicators with sub-indicators, aggregation was done by simply taking a summation of the normalized scores multiplied by their respective weights. The formula is given below: $$VI = \sum_{j}(x_{ij} \times w_{j})$$ where VI is the vulnerability index of region i, xij are normalised values of jth sub-indicators in ith region and wj are the equal weights assigned to jth indicator/sub-indicators.
10	Representation of vulnerability	Vulnerability has been represented in the form of maps, tables and graphs.
11	Vulnerability ranking	Districts have been ranked on a scale of very high vulnerability to very low vulnerability for each of the selected sectors and for the composite vulnerability assessment.
12	Identification of drivers of vulnerability for adaptation planning	Drivers of vulnerability have been represented in the form of a radar plot and a table explaining the major drivers for the districts in the different vulnerability classes (very high to very low).

Table 17: Approach And Methodology Adopted for Vulnerability Assessment

4.2 SECTORAL VULNERABILITY PROFILES AND RANKING OF DISTRICTS

Across the seven SAPCC sector, total 9 indices were developed, one each for seven sectors while habitat was sub-divided into two indices i.e., Urban Development Vulnerability Index (UDVI) and Rural Development Vulnerability Index (RDVI) and one index on inherent composite vulnerability constituting one indicator from each of the seven sectors (refer Figure 31).

The sub-sections below provide the list of indicators selected for the construction of each sectoral vulnerability index, the ranking of districts on a vulnerability scale of very-high to very-low vulnerability, and the drivers of vulnerability for each sector.

4.3 AGRICULTURAL VULNERABILITY

4.3.1 Indicators Selected

A total of fourteen indicators were considered to assess agricultural vulnerability at the district-level. Of the fourteen, two indicators (access to agricultural inputs and access to information and technology) were composed of 4 sub-indicators each. Table 18 on the page ahead provides the list of indicators selected, the rationale for their selection, their functional relationship with vulnerability and the sources used to quantify them.

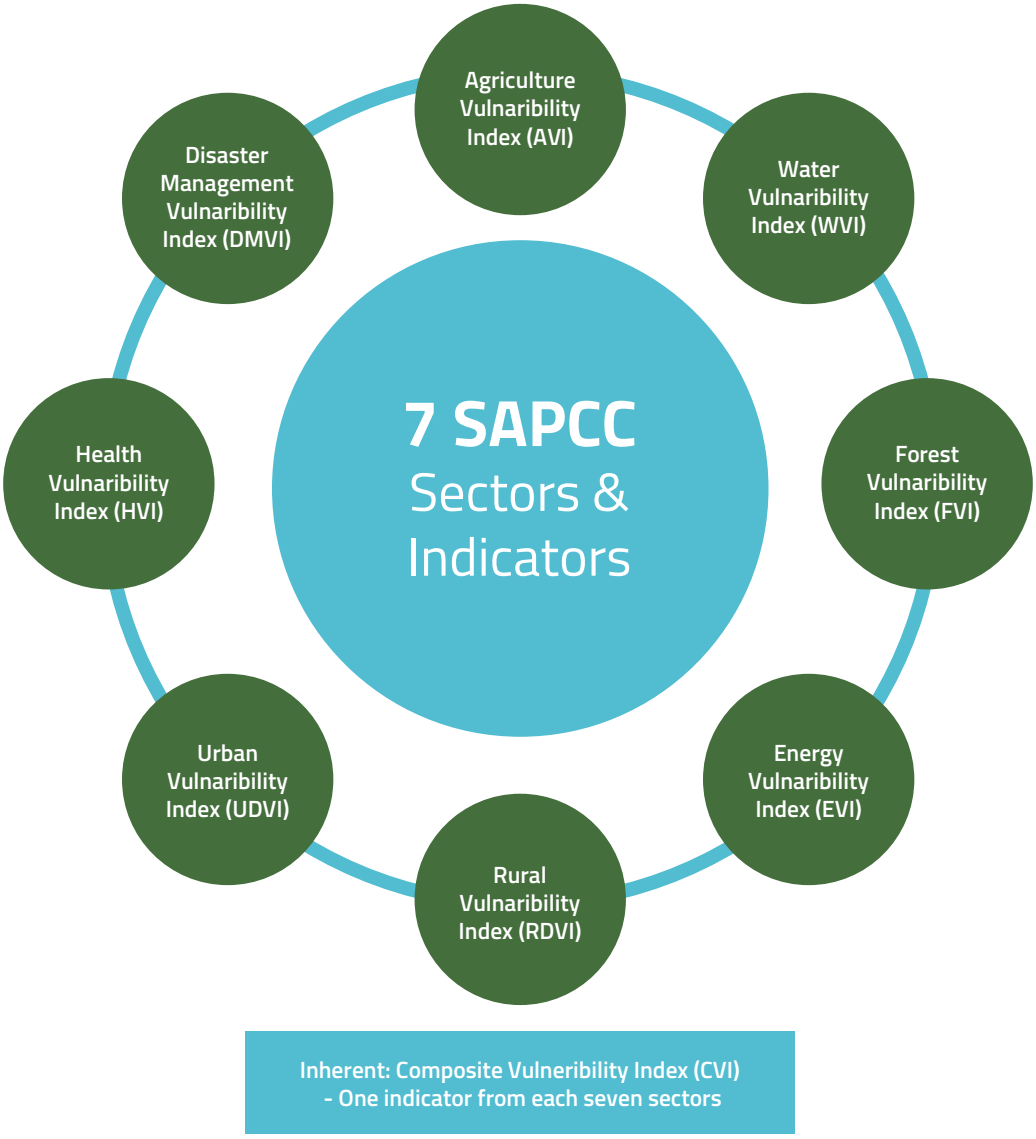


Figure 31: Nine Vulnerability Indices Across Seven Sectors Under UP SAPCC 2.0 and Number of Indicators

Indicators	Rationale for selection	Sensitivity or Adaptive Capacity	Functional relationship with Vulnerability	Data Source
Crop (major cereals) yield variability (coefficient of variation)	The coefficient of variation of the yield of food grains or major cereals and directly reflects the sensitivity of crop production to climate variability, especially the variability of rainfall and temperature and can also capture impacts of floods.	Sensitivity	Positive	Crop Yield Variability - assessed for 15 years (2005-19) considering yield of major cereals cultivated in the state; data was compiled using the Area Production and Yield Information System, a database set up by the Ministry of Agriculture and Farmers Welfare (District-wise crop production statistics - https://aps.dac.gov.in/APY/Index.htm)
Food security (crop yield - major cereals/ population) (kg/person)	Access to safe, nutritious, adequate and a stable food supply is a basic human right. This indicator measures the average per capita availability of major cereals at the district-level over a 10-year period (2010-2019).	Adaptive Capacity	Negative	Crop production data was compiled using the Area Production and Yield Information System, a database set up by the Ministry of Agriculture and Farmers Welfare (District-wise crop production statistics - https://aps.dac.gov.in/APY/Index.htm). Average of 10 years (2010-2019) was considered. Census 2011 was used for Population data.
Percentage net area cultivated under horticulture trees	A more resilient source of farm-based income, as tree crops are hardier than field crops to climate variability- particularly rainfall variability and droughts; farmers cultivating horticulture tree crops thus are less sensitive than farmers who cultivate only field crops.	Adaptive Capacity	Negative	Land Use Statistics Information System (2017-18) https://aps.dac.gov.in/LUS/Index.htm

Table 18: List of Indicators for Agricultural Vulnerability Assessment at the District-level, Rationale for Selection, Functional Relationship With Vulnerability and Sources of Data

Indicators	Rationale for selection	Sensitivity or Adaptive Capacity	Functional relationship with Vulnerability	Data Source
Livestock per 1,000 rural population	Livestock provide an alternate source of income and assists in crop production. Sale of livestock during distress provide households with a coping strategy.	Adaptive Capacity	Negative	20th Livestock Census 2019 (http://www.animalhusb.upsdc.gov.in/en/livestock-census-2019)
Stray cattle density (per km^2)	Stray Cattle are known to cause damage to crop. Regions with higher stray cattle density can have severe impact on crop yields, farm incomes, food security and general natural resource degradation.	Sensitivity	Positive	20th Livestock Census 2019 (http://www.animalhusb.upsdc.gov.in/en/livestock-census-2019)
Percentage change in area under wastelands	To highlight the impact of anthropogenic stress and various climate hazards on the agriculture sector; increase in the area classified under 'degraded' and 'wastelands'; lower productivity and area available for cultivation	Sensitivity	Positive	Wasteland Atlas of India 2019 (https://dolr.gov.in/sites/default/files/Rajasthan_0.pdf; https://dolr.gov.in/sites/default/files/Uttar%20Pradesh.pdf)
Percentage of workforce primarily employed in Agriculture	Agriculture is a highly climate sensitive sector. Sole dependence on crop production as a source of household income make these households acutely vulnerable, with very low adaptive capacities. Diversification of income or income from non-climate sensitive jobs is paramount for households to better cope with impacts of climate hazards.	Sensitivity	Positive	Census 2011
Percentage of area under rainfed agriculture	Irrigation provides an essential buffer to crops against climate hazards. Lack of irrigation, or solely rainfed agriculture is extremely sensitive to delayed rainfall or droughts.	Sensitivity	Positive	Land use Statistics Information System (https://aps.dac.gov.in/LUS/Index.htm) (2017-18)

Table 18: List of Indicators for Agricultural Vulnerability Assessment at the District-level, Rationale for Selection, Functional Relationship With Vulnerability and Sources of Data

Indicators		Rationale for selection	Sensitivity or Adaptive Capacity	Functional relationship with Vulnerability	Data Source
Percentage change in small and marginal landholdings		Small and Marginal farmers are known to have low social and economic capital and agriculture production on small and marginal landholdings are known to be sub-optimal, increasing the sensitivity of these farmers and agricultural production to climate hazards.	Sensitivity	Positive	Agriculture Census 2011 and 2006
Access to agricultural inputs	Access to Transport and Road connectivity	Measured as the percentage of villages in a district with access to transportation and roads, which broadly indicates integration with the economy and the associated spread effects of development. This is an indexed value as it considers availability of both transport and roads and is thus unitless.	Adaptive Capacity	Negative	Census 2011
	Access to Market	Timely access to quality agricultural inputs is essential for optimal, if not enhanced crop production. Transport and road connectivity, access to markets, seed banks and mechanisation can provide insight into the farming community's adaptive capacity in terms of access to agricultural inputs. This indicator is measured as the percentage of villages in a district that have mandis/regular market and weekly haats. These two were combined as an indexed value and thus this indicator is unitless.	Adaptive Capacity	Negative	Census 2011
	Percentage area under certified seeds	Certified seeds are of higher quality, which is a prerequisite for farmers seeking to achieve higher yields, and therefore higher profits.	Adaptive Capacity	Negative	Input Survey 2011

Table 18: List of Indicators for Agricultural Vulnerability Assessment at the District-level, Rationale for Selection, Functional Relationship With Vulnerability and Sources of Data

Indicators		Rationale for selection	Sensitivity or Adaptive Capacity	Functional relationship with Vulnerability	Data Source
	Percentage of households owning mechanized farming implements	Mechanization can help increase land productivity by facilitating timeliness and quality of cultivation; it alleviates the burden of labour shortage and also provide households owning these implements with an alternate source of income.	Adaptive Capacity	Negative	SECC 2011
Access to information and technology	Literacy (Secondary school and above)	Determines the extent of access to information enabling proactive adaptation to climate variability, as well as a gateway for non-climate sensitive skill development and employment for transformational adaptation	Adaptive Capacity	Negative	SECC 2011
	Access to electricity for agriculture	Access to electricity has been known to have a correlation with the access to mobile phones and the internet. This implies access to information, agromet services, early warning services and relief measures or funds available to mitigate impacts of climate hazards; measured as percentage of villages electrified and the average number of hours of electricity provided for agricultural use.	Adaptive Capacity	Negative	Census 2011
	Percentage of households with mobile phones	Access to information can help farming communities to design strategies to anticipate, prepare against and/or recover from climate change impacts. Mobile phones and computers can be used to access the internet for information. Furthermore, KVKs and other insurance agencies provide agro-met services via SMS or other applications.	Adaptive Capacity	Negative	District-wise Statistics | NITI Aayog, (National Institution for Transforming India), Government of India
	Percentage of households with computers and internet				

Table 18: List of Indicators for Agricultural Vulnerability Assessment at the District-level, Rationale for Selection, Functional Relationship With Vulnerability and Sources of Data

Indicators	Rationale for selection	Sensitivity or Adaptive Capacity	Functional relationship with Vulnerability	Data Source
Crop insurance coverage	Implies access to banks, cooperative societies and insurance providers. Provides a safety net in case of crop failure due to hazards. This indicator is measured as the percentage of gross cropped area that is covered under the crop insurance scheme Pradhan Mantri Fasal Bima Yojana (PMFBY) for both Kharif and Rabi, 2019	Adaptive Capacity	Negative	Pradhan Mantri Fasal Bima Yojana - Dashboards (https://pmfby.gov.in/ceo/dashboard?error=true); Data was collected for Rabi and Kharif seasons (2019) and standardized using gross cropped area reported for each district
On-farm development and water resource management assets created under MGNREGS	MGNREGS provides farmers with the opportunity to implement soil and water conservation work on their own land in order to improve productivity. Percentage of such work undertaken to the total work implemented in the district provides insight into the awareness and willingness of farmers to take up such land-rejuvenating work that is essential for sustainable crop production given climate variability.	Adaptive Capacity	Negative	MGNREGS MIS (2014-2019)
Percentage of total culturable area covered under Sustainable Agriculture Mission	Adoption of integrated farming systems and natural resource conservation measures under the Sustainable Agriculture Mission can significantly enhance the resilience of farming communities and the agriculture sector.	Adaptive Capacity	Negative	National Mission for Sustainable Agriculture (dac.gov.in)

Table 18: List of Indicators for Agricultural Vulnerability Assessment at the District-level, Rationale for Selection, Functional Relationship With Vulnerability and Sources of Data

Out of the 71 districts, 3 districts (Banda, Chitrakoot & Balrampur) were ranked as having very-high vulnerability; 9 districts (Bahraich, Mahoba, Gonda, Ballia, Kanpur Dehat, Fatehpur, Shravasti, Hamirpur & Hardoi) were ranked as highly vulnerable; 29 districts were ranked as having moderate vulnerability; 17 districts were ranked as having low vulnerability and the remaining 13 districts (Chandauli, Meerut, Etah, Baghpat, Lucknow, Sant Kabir Nagar, Etawah, Amroha, Firozabad, Bulandshahr, Hathras, Rampur & Gautam Buddha Nagar) were ranked as having very-low vulnerability. This is presented as a map (Figure 32) below.

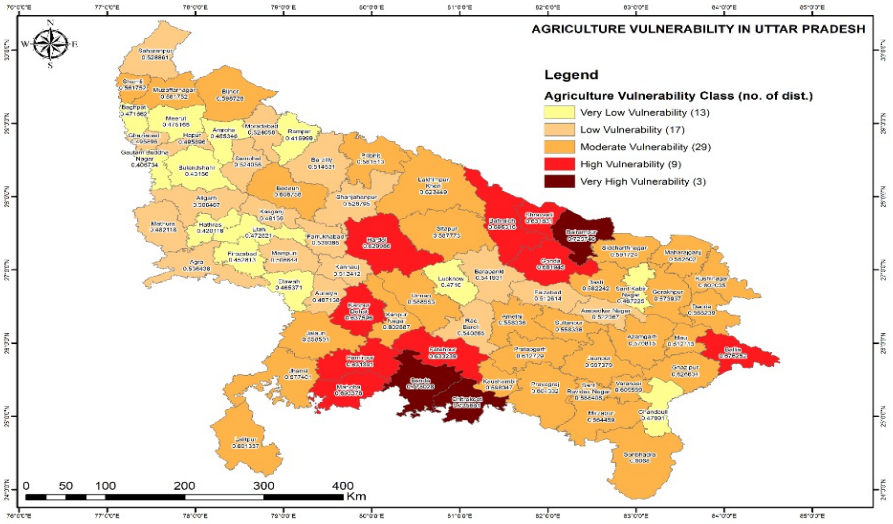


Figure 32: Spatial distribution of district-wise agriculture vulnerability in UP

Vulnerability Class	Districts	Major Drivers
Very High	Banda, Chitrakoot & Balrampur	• High percentage of area under rainfed agriculture • Less area under horticulture trees • High dependence on income from agriculture • High crop yield variability • Increased land fragmentation • Increased land degradation • Less on-farm development and WRM assets created under MGNREGS • Low access to agricultural inputs • Low access to information and technology • High stray cattle density • Low food security • Low crop insurance coverage

Table 19: Drivers Of Agricultural Vulnerability for the Districts in Different Vulnerability Classes (Percentage Contribution ≥0.035)

Vulnerability Class	Districts	Major Drivers
High	Bahraich, Mahoba, Gonda, Ballia, Kanpur Dehat, Fatehpur, Shravasti, Hamirpur & Hardoi	• Less area under horticulture trees • High dependence on income from agriculture • High percentage of area under rainfed agriculture • Less on-farm development and WRM assets created under MGNREGS • Less coverage under NMSA • Increased land degradation • Low access to agricultural inputs • Low access to information and technology • High stray cattle density • Low livestock holdings • High crop yield variability • Low food security • Increased land fragmentation
Moderate	Ghazipur, Lakhimpur Kheri, Pratapgarh, Mau, Varanasi, Sonbhadra, Badaun, PrayagRaj, Kanpur Nagar, Kushinagar, Lalitpur, Bijnor, Kaushambi, Jaunpur, Siddharthnagar, Unnao, Sant Ravidas Nagar, Sitapur, Basti, Pilibhit, Jhansi, Gorakhpur, Azamgarh, Deoria, Mirzapur, Maharajganj, Muzaffarnagar, Jalaun & Sultanpur	• Less coverage under NMSA • Less area under horticulture trees • Increased land degradation • High dependence on income from agriculture • Less on-farm development and WRM assets created under MGNREGS • Low livestock holdings • Low crop insurance coverage • Low access to agricultural inputs • Low food security • Increased land fragmentation • High crop yield variability • Low access to information and technology
Low	Barabanki, Rae Bareli, Farrukhabad, Agra, Saharanpur, Shahjahanpur, Moradabad, Ambedkar Nagar, Bareilly, Faizabad, Kannauj, Mainpuri, Aligarh, Ghaziabad, Auraiya, Mathura & Kasganj	• Less coverage under NMSA • Less on-farm development and WRM assets created under MGNREGS • Less area under horticulture trees • Low crop insurance coverage • High dependence on income from agriculture • Low access to agricultural inputs • Low livestock holdings • Increased land fragmentation
Very Low	Chandauli, Meerut, Etah, Baghpat, Lucknow, Sant Kabir Nagar, Etawah, Amroha, Firozabad, Bulandshahr, Hathras, Rampur & Gautam Buddha Nagar	• Low crop insurance coverage • Less coverage under NMSA • Increased land degradation • Low access to agricultural inputs • Less area under horticulture trees • Low food security

Table 19: Drivers Of Agricultural Vulnerability for the Districts in Different Vulnerability Classes (Percentage Contribution ≥0.035)

4.4 WATER VULNERABILITY

4.4.1 Indicators Selected

A total of five indicators were considered to assess water vulnerability at the district-level. Since only five indicators were considered, all indicators were used for the computation of Water Vulnerability Index (WVI).

Table 20 below provides the list of indicators selected, the rationale for their selection, their functional relationship with vulnerability and the sources used to quantify them.

Indicators	Rationale for selection	Sensitivity or Adaptive Capacity	Functional relationship with Vulnerability	Data Source
Stage of Groundwater Extraction (2017)	Stage of groundwater extraction indicates scope to harness groundwater resources for irrigation and domestic use. A higher relative draft means less scope for development or over-exploitation of this essential resource and hence higher sensitivity.	Sensitivity	Positive	National Compilation on Dynamic Groundwater Resources of India, 2017 (http://cgwb.gov.in/GW-Assessment/GWRA-2017-National-Compilation.pdf)
Percentage of Households having tap connection within premises (as of date)	Access to potable water is a basic human right. It has serious implications for human health and gender inequalities. Safe and readily available water is important for public health, whether it is used for drinking, domestic use, food production or recreational purposes. Improved water supply and sanitation, and better management of water resources can boost a country's economic growth and can contribute greatly to poverty reduction.	Adaptive Capacity	Negative	Jal Mission Dashboard 2020 https://ejalshakti.gov.in/jjmreport/JJMState.aspx
Percentage of total minor irrigation schemes in use (2013-14), weighted by the percentage of irrigation potential utilized	Loss of investment in creating irrigation infrastructure due to damage caused by floods, siltation, etc., lowers the irrigation potential that these infrastructures are supposed to achieve. Better placement, quality construction and regular maintenance of these structures are essential to maintain irrigation potential and prevent loss of investment. This indicator also measures water use efficiency - districts with high percentage of MI schemes in use and a high percentage of irrigation potential utilization indicates efficient use of water resources and management of water sources.	Adaptive Capacity	Negative	Minor Irrigation Census, State-level Statistical tables http://164.100.229.38/sites/default/files/statewise/up_3.pdf

Table 20: List of Indicators for Water Vulnerability Assessment at the District-level, Rationale for Selection, Functional Relationship With Vulnerability and Sources of Data

Indicators	Rationale for selection	Sensitivity or Adaptive Capacity	Functional relationship with Vulnerability	Data Source
Percentage of Water conservation assets created under MGNREGS (2015-19)	Construction of rainwater (surface runoff) conservation works, and groundwater recharge structures are pivotal for the sustainability of water resources in any region. With an ever-increasing population and human demand, coupled with climate variability and change, it is even more crucial now to save every drop of fresh water to meet growing demand. This indicator measures a districts' awareness, prioritization, and achievement with regard to water conservation utilizing MGNREGS. Higher the proportion, greater is the importance given to water conservation work by the people of the district.	Adaptive Capacity	Negative	MGNREGA MIS (2015-2019)
Baseline Water Stress	Baseline water stress measures total annual water withdrawals (municipal, industrial, and agricultural) expressed as a percentage of the total annual available flow. Higher values indicate more competition among users.	Sensitivity	Positive	WRI Aqueduct; 2013. Download: http://www.wri.org/resources/data-sets/aqueduct-global-maps-20

Table 20: List of indicators for water vulnerability assessment at the District-level, rationale for selection, functional relationship with vulnerability and sources of data

Out of the 71 districts, 10 districts (Agra, Badaun, Gautam Buddha Nagar, Sant Ravidas Nagar, Moradabad, Saharanpur, Firozabad, Hardoi, Aligarh & Kasganj) were ranked as having very-high vulnerability; 23 districts were ranked as highly vulnerable; 19 districts were ranked as having moderate vulnerability; 12 districts were ranked as having low vulnerability and the remaining 7 districts (Etawah, Siddharthnagar, Hamirpur, Deoria, Kushinagar, Jalaun & Lalitpur) were ranked as having very-low vulnerability. This is presented as a map (Figure 33) below.

For districts classified as having very high and high vulnerability, all indicators maybe considered as major drivers of water vulnerability. However, some have a higher value (magnitude) and thus have a higher influence in driving vulnerability. These have been listed from most significant driver to less significant driver in Table 21 on the adjacent page. Percentage contribution of an indicator to vulnerability index for each vulnerability class was obtained by considering the average normalized indicator values for each vulnerability class.

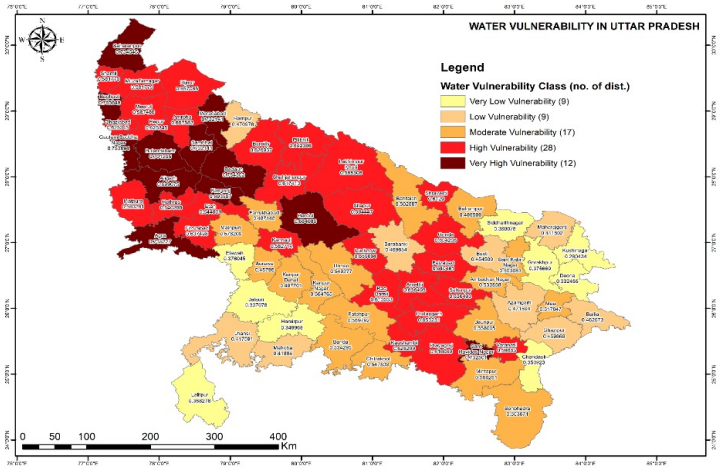


Figure 33: Spatial Distribution of District-wise Water Vulnerability in UP

Vulnerability Class	Districts	Major Drivers
Very High	Agra, Badaun, Gautam Buddha Nagar, Sant Ravidas Nagar, Moradabad, Saharanpur, Firozabad, Hardoi, Aligarh & Kasganj	• High baseline water stress • Over extraction of groundwater • Fewer households connected with water taps • Fewer water conservation assets created under MGNREGS, and • Low percentage of total minor irrigation schemes efficiently in use
High	Amroha, Pratapgarh, Bulandshahr, Etah, Lucknow, Varanasi, Hathras, Faizabad, Bijnor, Rae Bareli, Ghaziabad, Shahjahanpur, Pilibhit, Bareilly, Sultanpur, PrayagRaj, Shravasti, Gonda, Sitapur, Mathura, Meerut, Kaushambi & Muzaffarnagar	• High baseline water stress • Fewer water conservation assets created under MGNREGS • Fewer households connected with water taps • Low percentage of total minor irrigation schemes efficiently in use, and • Over extraction of groundwater
Moderate	Jaunpur, Kanpur Nagar, Mainpuri, Ambedkar Nagar, Mirzapur, Lakhimpur Kheri, Unnao, Fatehpur, Kannauj, Bagpat, Banda, Farrukhabad, Sant Kabir Nagar, Mau, Bahraich, Chitrakoot, Ghazipur, Kanpur Dehat & Basti	• Fewer water conservation assets created under MGNREGS • Fewer households connected with water taps • High baseline water stress
Low	Ballia, Balrampur, Auraiya, Barabanki, Azamgarh, Mahoba, Sonbhadra, Maharajganj, Rampur, Jhansi, Gorakhpur & Chandauli	Fewer households connected with water taps
Very Low	Etawah, Siddharthnagar, Hamirpur, Deoria, Kushinagar, Jalaun & Lalitpur	Fewer households connected with water taps

Table 21: Drivers of Water Vulnerability for the Districts in Different Vulnerability Classes (Normalized Indicator Value ≥ 0.5)

4.5 FOREST VULNERABILITY

4.5.1 Indicators Selected

Three indicators were considered to assess forest vulnerability at the district-level. Since only 3 indicators were considered, all indicators were used for the computation of Forest Vulnerability Index (FVI). Table 22 on the next page provides the list of indicators selected, the rationale for their selection, their functional relationship with vulnerability and the sources used to quantify them.

Out of the 71 districts, 15 districts (Mainpuri, Etah, Kannauj, Mathura, Kasganj, Sitapur, Rae Bareli, Sant Kabir Nagar, Shahjahanpur, Badaun, Gorakhpur, Mau, Banda , Azamgarh & Hardoi) were ranked as having very-high vulnerability; 19 districts were ranked as highly vulnerable; 21 districts were ranked as having moderate vulnerability; 12 districts were ranked as having low vulnerability and the remaining 4 districts (Muzaffarnagar, Saharanpur, Lucknow & Chandauli) were ranked as having very-low vulnerability. This is presented as a map (Figure 34) below.

Percentage contribution of an indicator to vulnerability index for each vulnerability class was obtained by considering the average normalized indicator values for each vulnerability class. Major drivers of vulnerability for the districts in different vulnerability classes are presented in Table 23.

For districts classified as having very-high and high vulnerability, all indicators maybe considered as major drivers of water vulnerability. However, some have a higher value (magnitude) and thus have a higher influence in driving vulnerability. These have been listed from most significant driver to less significant driver in Table 23 ahead.

Indicators		Rationale for selection	Sensitivity or Adaptive Capacity	Functional relationship with Vulnerability	Data Source
Access to forests resources	Percentage change in forest area (2017-2019)	Forests are an important source of alternative livelihood and food during crop failure. Forests also provide important ecosystem services that are essential for the sustainable productivity of rural economies. This indicator is quantified by three sub-indicators.	Adaptive Capacity	Negative	ISFR 2017 and 2019
	Forest area (in ha)/1,000 (SC/ST) rural population		Adaptive Capacity	Negative	ISFR 2019 and Census 2011
	Percentage of Households using firewood for cooking		Sensitivity	Positive	Census 2011

Table 22: List of indicators for Forest vulnerability assessment at the District-level, rationale for selection, functional relationship with vulnerability and sources of data

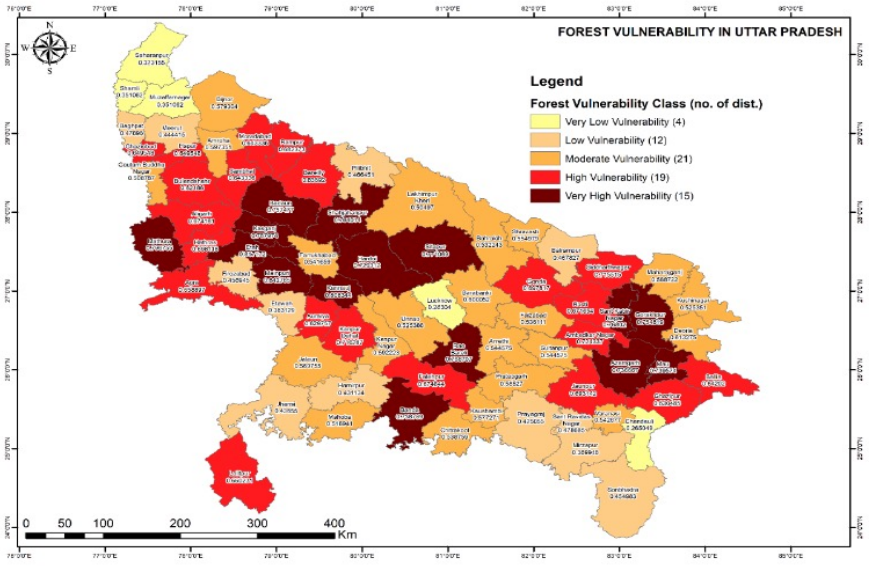


Figure 34: Spatial Distribution of District-wise Forest Vulnerability in UP

Vulnerability Class	Districts	Major Drivers
Very High	Mainpuri, Etah, Kannauj, Mathura, Kasganj, Sitapur, Rae Bareli, Sant Kabir Nagar, Shahjahanpur, Badaun, Gorakhpur, Mau, Banda, Azamgarh & Hardoi	• Low per capita availability of forests • Reduction in forest area • High per capita consumption of firewood
High	Ambedkar Nagar, Kanpur Dehat, Siddharthnagar, Hathras, Gonda, Jaunpur, Rampur, Fatehpur, Aligarh, Basti, Lalitpur, Agra, Ghaziabad, Moradabad, Ballia, Bareilly, Ghazipur, Auraiya & Bulandshahr	• Low per capita availability of forests • Reduction in forest area • High per capita consumption of firewood
Moderate	Deoria, Barabanki, Amroha, Kanpur Nagar, Maharajganj, Pratapgarh, Bijnor, Kaushambi, Jalaun, Shravasti, Sultanpur, Varanasi, Farrukhabad, Chitrakoot, Faizabad, Bahraich, Unnao, Kushinagar, Mahoba, Gautam Buddha Nagar & Lakhimpur Kheri	• High per capita consumption of firewood • Low per capita availability of forests
Low	Sant Ravidas Nagar, Bagpat, Balrampur, Pilibhit, Firozabad, Sonbhadra, Meerut, Jhansi, Hamirpur, PrayagRaj, Mirzapur & Etawah	No major drivers
Very Low	Muzaffarnagar, Saharanpur, Lucknow & Chandauli	No major drivers

Table 23: Drivers of Forest Vulnerability for the Districts in Different Vulnerability Classes (Normalized Indicator Value ≥ 0.5)

4.6 ENERGY VULNERABILITY

4.6.1 Indicators Selected

Two indicators were considered to assess energy vulnerability at the district-level, and both were used for the computation of Energy Vulnerability Index (EVI). Table 24 ahead provides the list of indicators selected, the rationale for their selection, their functional relationship with vulnerability and the sources used to quantify them. The indicator 'Access to electricity' was quantified by consolidating several parameters and is a unit less indexed value. As such this indicator was not normalized.

Out of the 71 districts, 11 districts (Siddharthnagar, Unnao, Shravasti, Kushinagar, Balrampur, Badaun, Bahraich, Barabanki, Kanpur Dehat, Gonda & Sant Kabir Nagar) were ranked as having very-high vulnerability; 40 districts were ranked as highly vulnerable; 12 districts were ranked as having moderate vulnerability; 4 districts were ranked as having low vulnerability (Kanpur Nagar, Varanasi, Hathras & Meerut) and the remaining 4 districts (Agra, Ghaziabad, Gautam Buddha Nagar & Lucknow) were ranked as having very-low vulnerability. This is presented as a map (Figure 35) on the next page.

Percentage contribution of an indicator to vulnerability index for each vulnerability class was obtained by considering the average normalized indicator values for each vulnerability class. Major drivers of vulnerability for the districts in different vulnerability classes are presented in Table 25 in the next pages.

Indicators	Rationale for selection	Sensitivity or Adaptive Capacity	Relationship with Vulnerability	Data Source
Access to clean cooking fuels	Use of clean fuels such as LPG or biogas has implication for the health and welfare of women, as well as the entire family; measured as the percentage of households using LPG/Electricity/Biogas for cooking	Adaptive Capacity	Negative	Census 2011
Access to electricity	Access to electricity has been known to have significant correlation with the access to mobile phones and the internet. This implies access to information, agro-met services, early warning services and relief measures or funds available to mitigate impacts of climate hazards. Measured as the percentage of villages electrified and the average number of hours of electricity provided for domestic, agricultural and commercial use.	Adaptive Capacity	Negative	Census 2011

Table 24: List of Indicators for Energy Vulnerability Assessment at the District-level, Rationale for Selection, Functional Relationship With Vulnerability and Sources of Data

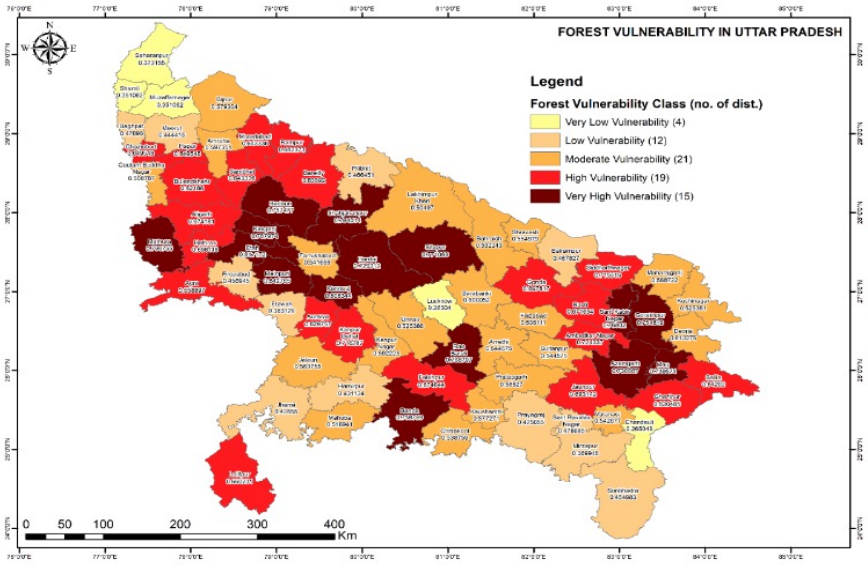


Figure 35: Spatial Distribution of District-wise Energy Vulnerability in UP

Vulnerability Class	Districts	Major Drivers
Very High	Siddharthnagar, Unnao, Shravasti, Kushinagar, Balrampur, Badaun, Bahraich, Barabanki, Kanpur Dehat, Gonda & Sant Kabir Nagar	• Poor access to clean cooking fuels • Poor access to electricity
High	Fatehpur, Kasganj, Ballia, Ghazipur, Auraiya, Maharajganj, Kaushambi, Sonbhadra, Mahoba, Pilibhit, Basti, Farrukhabad, Sitapur, Kannauj, Chandauli, Azamgarh, Deoria, Sant Ravidas Nagar, Mirzapur, Lakhimpur Kheri, Ambedkar Nagar, Rae Bareli, Shahjahanpur, Lalitpur, Hardoi, Jaunpur, Hamirpur, Bijnor, Etah, Mainpuri, Rampur, Amroha, Sultanpur, Banda, Gorakhpur, Jalaun, Pratapgarh, Faizabad, Mau & Chitrakoot	Poor access to clean cooking fuels
Moderate	Bareilly, Etawah, Saharanpur, Muzaffarnagar, Bulandshahr, Moradabad, Jhansi, PrayagRaj, Bagpat, Aligarh, Firozabad & Mathura	Poor access to clean cooking fuels
Low	Kanpur Nagar, Varanasi, Hathras & Meerut	No major drivers
Very Low	Agra, Ghaziabad, Gautam Buddha Nagar & Lucknow	No major drivers

Table 25: Drivers of energy vulnerability for the districts in different vulnerability classes (Average normalized indicator value ≥ 0.5)

4.7 HABITAT VULNERABILITY

4.7.1 Vulnerability of Rural Habitats

4.7.1.1 Indicators Selected

A total of fourteen indicators were considered to assess vulnerability of rural habitats at the district-level. Table 26 below provides the list of indicators selected, the rationale for their selection, their functional relationship with vulnerability and the sources used to quantify them.

Indicators	Rationale for selection	Sensitivity or Adaptive Capacity	Relationship with Vulnerability	Data Source
Proportion of total population living in rural areas	Higher the population density in rural areas, higher is the competition for finite natural resources and fewer are the opportunities for employment in non-climate sensitive sectors.	Sensitivity	Positive	Census 2011
Change in number of pucca houses (PMAY)	Access to adequate and affordable housing is a basic human right. Assisting rural poor with construction of pucca homes enhances their social and financial capital. The indicator considers the increase in number of pucca houses constructed for rural poor under convergence of PMAY and MGNREGS from 2014 to 2019.	Adaptive Capacity	Negative	MGNREGS MIS (2014-2019); SECC 2011

Table 26: List of Indicators for Rural Habitat Vulnerability Assessment at the District-Level, Rationale for Selection, Functional Relationship With Vulnerability and Sources of Data

Indicators	Rationale for selection	Sensitivity or Adaptive Capacity	Relationship with Vulnerability	Data Source
Percentage of rural households at risk to damage by wind, flood and earthquakes	Poor construction materials used for housing increases the risk of loss and damage by wind (50-55 m/s), extreme rainfall during thunderstorms and earthquakes. This could lead to unforeseen costs for reconstruction or even displacement of households, increasing their vulnerability.	Sensitivity	Positive	BMTPC Vulnerability Atlas of India (2019); SECC 2011
Percentage of rural households below the poverty line - adjusted for inequalities	Higher the proportion of rural population below the poverty line, higher is the sensitivity of the people in that district. It is measured as the number of rural households (SC, ST, women headed households and households with members living with a disability) having monthly income (of the highest earning household member) of less than Rs 5000.	Sensitivity	Positive	SECC 2011
Access to basic amenities (safe drinking water, sanitation and wastewater drainage)	Safe sanitation systems are fundamental to public health. This indicator considers the presence of toilets and bathrooms within household premises and the management of wastewater. It also has gender implications, as lack of safe and private sanitation systems are known to disproportionately affect women.	Adaptive Capacity	Negative	Census 2011
Percentage of households with kitchens inside the house and use of clean fuels for cooking	This is a gender sensitive indicator. Cooking predominantly falls to women and having a kitchen within the house eases the difficulty of this chore. Furthermore, use of clean fuels such as LPG, biogas or electricity has implication for the health and welfare of women, as well as the entire family. Having a kitchen within the house could also highlight financial capacity of the household.	Adaptive Capacity	Negative	Census 2011
Literacy (secondary school and above)	This determines the extent of access to information, which enables proactive adaptation to climate variability, as well as a gateway for non-climate sensitive skill-development and employment for transformational adaptation; an indirect measure of distance/ access to schools and colleges; measured as the proportion of population that has secondary and/or higher education.	Adaptive Capacity	Negative	SECC 2011

Table 26: List of Indicators for Rural Habitat Vulnerability Assessment at the District-Level, Rationale for Selection, Functional Relationship With Vulnerability and Sources of Data

Indicators	Rationale for selection	Sensitivity or Adaptive Capacity	Relationship with Vulnerability	Data Source
Access to an alternate employment source (MGNREGS)	MGNREGS is an important source of alternate income to rural households and provides relief during climate hazards enhancing a household's adaptive capacity; measured as the average person-days per household employed under MGNREGS.	Adaptive Capacity	Negative	MGNREGA MIS (2015-2019)
Women participation in the labour force	Women are amongst the most vulnerable to the impacts of climate risks. An increased participation of women in the labour force implies access to information, empowerment at the household level, social and financial capital, that would in turn contribute to their adaptive capacity.	Adaptive Capacity	Negative	Census 2011
Dependency ratio	This used to represent social pressures on productive sections of the population, measured as the proportion of young, old and unemployed members of the community; higher the pressure, higher is the sensitivity of the community to the impacts of climate hazards; indirectly indicates the employment opportunities available.	Sensitivity	Positive	Census 2011
Access to functional health care facilities	Access to functional health care facilities is an essential indicator of adaptive capacity as climate hazards have severe implications on human health.	Adaptive Capacity	Negative	Census 2011
Prioritization of natural resource management works under MGNREGS	Rural economies are strongly dependent on natural resources. Development and management of natural resources are essential for a sustainable and prosperous rural economy.	Adaptive Capacity	Negative	MGNREGA MIS (2015-2019)
Access to electricity	Access to electricity has been known to have significant correlation with the access to mobile phones and the internet. This implies access to information, agro-met services, early warning services and relief measures or funds available to mitigate impacts of climate hazards; measured as the percentage of villages electrified and the average number of hours of electricity provided for domestic, agricultural, and commercial use in rural areas.	Adaptive Capacity	Negative	Census 2011

Table 26: List of indicators for rural habitat vulnerability assessment at the district-level, rationale for selection, functional relationship with vulnerability and sources of data

Indicators	Rationale for selection	Sensitivity or Adaptive Capacity	Relationship with Vulnerability	Data Source
Access to transport and road connectivity	This is measured as the percentage of villages in a district with access to transportation and roads, which broadly indicates integration with the economy and the associated spread of effects of development; may be computed as an indexed value combining available transportation infrastructure (percentage of villages with public and private bus services, auto, car and van taxi services) and road connectivity (percentage of villages with National Highways, State Highways, Major District Roads, Other District Roads, Black Topped (pucca) Roads and All-Weather Road connectivity)	Adaptive Capacity	Negative	Census 2011

Table 26: List of indicators for rural habitat vulnerability assessment at the district-level, rationale for selection, functional relationship with vulnerability and sources of data

Out of the 71 districts, 10 districts (Bahraich, Badaun, Shravasti, Siddharthnagar, Shahjahanpur, Lakhimpur Kheri, Pilibhit, Balrampur, Sitapur & Hardoi) were ranked as having very-high vulnerability; 17 districts were ranked as highly vulnerable; 28 districts were ranked as having moderate vulnerability; 12 districts were ranked as having low vulnerability and the remaining 4 districts (Bagpat, Meerut, Jhansi & Gautam Buddha Nagar) were ranked as having very-low vulnerability. This is presented as a map (Figure 36) below.

Percentage contribution of an indicator to vulnerability index for each vulnerability class was obtained by considering the average normalized indicator values for each vulnerability class. Major drivers of vulnerability for the districts in different vulnerability classes have also been presented in the Table 27.

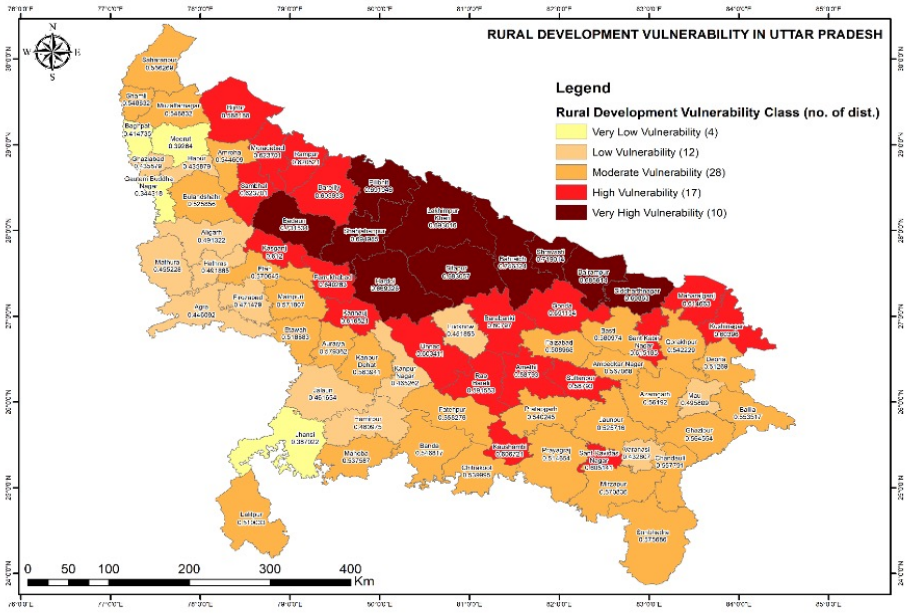


Figure 36: Spatial Distribution of District-wise Rural Development Vulnerability in UP

Vulnerability Class	Districts	Major Drivers
Very High	Bahraich, Badaun, Shravasti, Siddharthnagar, Shahjahanpur, Lakhimpur Kheri, Pilibhit, Balrampur, Sitapur & Hardoi	• High percentage of socially vulnerable households below the poverty line • High proportion of population living in rural areas • Poor access to functional health care facilities • Low access to basic amenities • Low literacy (secondary school and above) • Fewer households with kitchens inside the house using clean fuels for cooking • Inadequate increase in number of pucca houses (PMAY) • High percentage of households at risk to damage by wind, flood, and earthquakes • High dependency ratio • Low prioritization of NRM works under MGNREGS
High	Gonda, Farrukhabad, Moradabad, Rampur, Kannauj, Sant Kabir Nagar, Maharajganj, Kasganj, Barabanki, Kaushambi, Sant Ravidas Nagar,	• High percentage of socially vulnerable households below the poverty line • High proportion of population living in rural areas • Low access to basic amenities
	Kushinagar, Bareilly, Unnao, Rae Bareli, Bijnor & Sultanpur	• Inadequate increase in number of pucca houses (PMAY) • Fewer households with kitchens inside the house using clean fuels for cooking
Moderate	Basti, Auraiya, Sonbhadra, Mainpuri, Mirzapur, Etah, Ambedkar Nagar, Saharanpur, Ghazipur, Kanpur Dehat, Azamgarh, Fatehpur, Chandauli, Ballia, Muzaffarnagar, Banda, Amroha, Gorakhpur, Pratapgarh, Chitrakoot, Mahoba, Bulandshahr, Jaunpur, Etawah, PrayagRaj, Deoria, Lalitpur & Faizabad	• High percentage of socially vulnerable households below the poverty line • High proportion of population living in rural areas • Low access to basic amenities • Inadequate increase in number of pucca houses (PMAY) • Fewer households with kitchens inside the house using clean fuels for cooking
Low	Mau, Hathras, Aligarh, Hamirpur, Firozabad, Kanpur Nagar, Jalaun, Mathura, Lucknow, Agra, Ghaziabad & Varanasi	• High percentage of socially vulnerable households below the poverty line • Inadequate increase in number of pucca houses (PMAY) • Low access to basic amenities • Fewer women employed in the workforce
Very Low	Bagpat, Meerut, Jhansi & Gautam Buddha Nagar	• High percentage of households at risk to damage by wind, flood, and earthquakes • High percentage of socially vulnerable households below the poverty line • Inadequate increase in number of pucca houses (PMAY) • Fewer women employed in the workforce

Table 27: Drivers of Vulnerability of Rural Habitats for Districts In Different Vulnerability Classes (Average Normalized Score ≥0.5)

4.7.2 Vulnerability of Urban Habitats

4.7.2.1 Indicators Selected

Based on data availability, a total of eight indicators were considered to assess vulnerability of urban habitats. Twelve districts with an urban population ≥1,000,000 were selected for this assessment. Table 28 below provides the list of indicators selected, the rationale for their selection, their functional relationship with vulnerability and the sources used to quantify them. One indicator, 'Access to functional health care facilities', was quantified by two sub-indicators. Out of the 12 districts selected (with urban population ≥ 1,000,000), two districts (Aligarh & Bareilly) were ranked as having very-high vulnerability; two districts (Muzaffarnagar & Meerut) were ranked as highly vulnerable; four districts (Saharanpur, Moradabad, Ghaziabad & Agra) were ranked as having moderate vulnerability; one district (Varanasi) was ranked as having low vulnerability and the remaining three districts (Lucknow, Kanpur Nagar & Allahabad) were ranked as having very-low vulnerability. This is presented as a graph map (Figure 37) in the pages ahead.

Indicators	Rationale for selection	Sensitivity or Adaptive Capacity	Relationship with Vulnerability	Data Source
Population Density (person/km^2)	Higher the population density in towns and cities, higher is the competition for finite resources and housing and employment opportunities. It also has implication for waste creation and pollution.	Sensitivity	Positive	Census 2011
Percentage of households at risk to damage by wind, extreme rainfall and earthquakes	Poor construction materials used for housing increases the risk of loss and damage by wind (50-55 m/s), extreme rainfall during thunderstorms and earthquakes. This could lead to unforeseen costs for reconstruction or even displacement of households, increasing their vulnerability.	Sensitivity	Positive	BMTPC Vulnerability Atlas of India (2019); SECC 2011
Access to basic amenities (safe drinking water, sanitation and wastewater drainage)	Safe sanitation systems are fundamental to public health. This indicator considers the presence of toilets and bathrooms within household premises and the management of wastewater. It also has gender implications, as lack of safe and private sanitation systems are known to disproportionately affect women.	Adaptive Capacity	Negative	Census 2011

Table 28: List of Indicators for Urban Habitat Vulnerability Assessment at the District-Level, Rationale for Selection, Functional Relationship With Vulnerability and Sources of Data

Indicators		Rationale for selection	Sensitivity or Adaptive Capacity	Relationship with Vulnerability	Data Source
Women participation in the labour force		Women are amongst the most vulnerable to the impacts of climate risks. An increased participation of women in the labour force implies access to information, empowerment at the household level, social and financial capital that would contribute to their adaptive capacity.	Adaptive Capacity	Negative	Census 2011
Dependency ratio		This indicator used to represent social pressures on productive sections of the population, measured as the proportion of young, old and unemployed members of the community. Higher the pressure, higher is the sensitivity of the community to the impacts of climate hazards; indirectly indicates the employment opportunities available.	Sensitivity	Positive	Census 2011
Female Literacy Rate		Women are amongst the most vulnerable to the impacts of climate risks. Literacy of women in a community provides insight into the literacy rate of the entire community; determines the extent to which access to information can enable proactive adaptation to climate variability, as well as a gateway for non-climate sensitive skill-development and employment for transformational adaptation.	Adaptive Capacity	Negative	Census 2011
Access to functional health care facilities	Number of doctors & health workers available per 1,000 population	Access to functional health care facilities is an essential indicator of adaptive capacity as climate hazards have severe implications on human health. This indicator may be measured using two sub-indicators: number of primary healthcare facilities available per 1,000 population; and number of doctors & health workers available per 1,000 population.	Adaptive Capacity	Negative	Census 2011
	Number of doctors & health workers available per 1,000 population				

Table 28: List of Indicators for Urban Habitat Vulnerability Assessment at the District-Level, Rationale for Selection, Functional Relationship With Vulnerability and Sources of Data

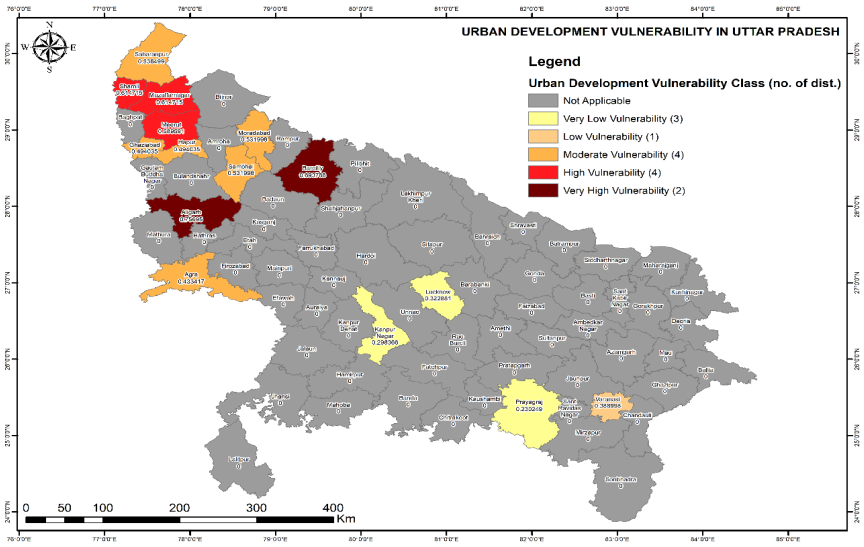


Figure 37: Spatial Distribution of District-wise Urban Development Vulnerability In UP

Vulnerability Class	Districts	Major Drivers
Very High	Aligarh & Bareilly	• Low road density • Fewer literate women • High percentage of households at risk to damage by wind, extreme rainfall, and earthquakes • High population density • Poor access to functional health care facilities • Poor access to basic amenities • Fewer women in the workforce
High	Muzaffarnagar & Meerut	• High percentage of households at risk to damage by wind, extreme rainfall, and earthquakes • Poor access to functional health care facilities • Fewer women in the workforce • Low road density • Fewer literate women
Moderate	Saharanpur, Moradabad, Ghaziabad & Agra	• High percentage of households at risk to damage by wind, extreme rainfall, and earthquakes • Fewer women in the workforce • Fewer literate women
Low	Varanasi	• Poor access to functional health care facilities • High population density
Very Low	Lucknow, Kanpur Nagar & Allahabad	Poor access to functional health care facilities

Table 29: Drivers of Vulnerability of Urban Habitats for Districts in Different Vulnerability Classes (Weighted Normalized Score ≥0.07)

4.8 VULNERABILITY OF HEALTH SECTOR

4.8.1 Indicators Selected

A total of nine indicators were considered to assess the vulnerability of the health sector at the district-level. Of these nine, one indicator (Disease incidence) is composed of three sub-indicators (water borne disease, vector borne diseases and respiratory disease). Table 30 below provides the list of indicators selected, the rationale for their selection, their functional relationship with vulnerability and the sources used to quantify them.

Out of the 71 districts, six districts (Badaun, Balrampur, Siddharthnagar, Shravasti, Shahjahanpur & Bahraich) were ranked as having very-high vulnerability; nine districts (Sitapur, Pilibhit, Lakhimpur Kheri, Bareilly, Kasganj, Hardoi, Moradabad, Farrukhabad & Muzaffarnagar) were ranked as highly vulnerable; 25 districts were ranked as having moderate vulnerability; 26 districts were ranked as having low vulnerability and the remaining five districts (Etawah, Ghaziabad, Kanpur Nagar, Jhansi & Gautam Buddha Nagar) were ranked as having very-low vulnerability. This is presented as a graph map (Figure 38).

Indicators		Rationale for selection	Sensitivity or Adaptive Capacity	Relationship with Vulnerability	Data Source
Access to functional health care facilities		Access to functional health care facilities is an essential indicator of adaptive capacity as climate hazards have severe implications on human health.	Adaptive Capacity	Negative	District-wise data RHS 2019
Infant Mortality Rate (IMR)		Infant mortality rate is an important indicator of the overall health status of a community. High infant mortality rates are generally indicative of unmet human health needs in sanitation, medical care, nutrition, and education.	Sensitivity	Positive	AHS 2012-13
Households with any usual member covered by a health scheme or health insurance (%)		Health insurance assists households in meeting emergency expenses brought on by illness or accidents. It highlights the capacity of households to plan and mitigate losses using financial schemes and safety nets. This is essential in light of a changing climate and increased incidence of climate hazards.	Adaptive Capacity	Negative	National Family Health Survey, NFHS-4 (2015-16)
	Water Borne Disease	With a changing climate, temperature and rainfall variations are projected to increase vector borne diseases. Extreme rainfall and flooding have the potential to increase water-borne disease incidence. Also, high occurrence of these diseases implies poor quality of life and reduced access to quality healthcare services.	Sensitivity	Positive	AHS Factsheets 2011
	Vector Borne Diseases				Annual-Report-2018.pdf (nvbdcp.gov.in)
	Respiratory Disease				AHS Factsheets 2011

Table 30: List Of Indicators for Health Vulnerability Assessment at the District-Level, Rationale for Selection, Functional Relationship With Vulnerability and Sources of Data

Indicators	Rationale for selection	Sensitivity or Adaptive Capacity	Relationship with Vulnerability	Data Source
Literacy	This determines the extent to which access to information can enable proactive adaptation to climate variability, as well as a gateway for non-climate sensitive skill-development and employment for transformational adaptation; an indirect measure of distance/access to schools and colleges; measured as the proportion of population that has secondary and/or higher education.	Adaptive Capacity	Negative	SECC 2011
Population Density (person/km^2)	Higher the population density, higher is the risk of spreading communicable diseases.	Sensitivity	Positive	Census 2011
Percentage of Population <6 and >60 years of age	Children and older people have weak immune systems, making them highly vulnerable to infectious diseases.	Sensitivity	Positive	Census 2011
Percentage of households at risk to damage by wind, flood and earthquakes	Poor construction materials used for housing increases the risk of loss and damage by wind (50-55 m/s), extreme rainfall during thunderstorms and earthquakes. This could lead to unforeseen costs for reconstruction or even displacement of households, increasing their vulnerability.	Sensitivity	Positive	BMTPC Vulnerability Atlas of India (2019); SECC 2011
Percentage of rural households below the poverty line - adjusted for inequalities	Higher the proportion of rural population below the poverty line, higher is the sensitivity of the people in that district. It is measured as the number of rural households (SC, ST, women headed households and households with members living with a disability) having monthly income (of the highest earning household member) of less than Rs 5000.	Sensitivity	Positive	SECC 2011
Access to basic amenities (safe drinking water, sanitation, and wastewater drainage)	Safe sanitation systems are fundamental to public health. This indicator considers the presence of toilets and bathrooms within household premises and also the management of wastewater. It also has gender implications, as lack of safe and private sanitation systems are known to disproportionately affect women.	Adaptive Capacity	Negative	Census 2011

Table 30: List Of Indicators for Health Vulnerability Assessment at the District-Level, Rationale for Selection, Functional Relationship With Vulnerability and Sources of Data

Indicators	Rationale for selection	Sensitivity or Adaptive Capacity	Relationship with Vulnerability	Data Source
Percentage of households with kitchens inside the house and use of clean fuels for cooking	This is a gender sensitive indicator. Cooking is predominantly the responsibility of women and having a kitchen within the house eases the difficulty of this chore. Furthermore, use of clean fuels such as LPG or biogas has implication for the health and welfare of women, as well as the entire family. Having a kitchen within the house could also highlight financial capacity of the household.	Adaptive Capacity	Negative	Census 2011

Table 30: List Of Indicators for Health Vulnerability Assessment at the District-Level, Rationale for Selection, Functional Relationship With Vulnerability and Sources of Data

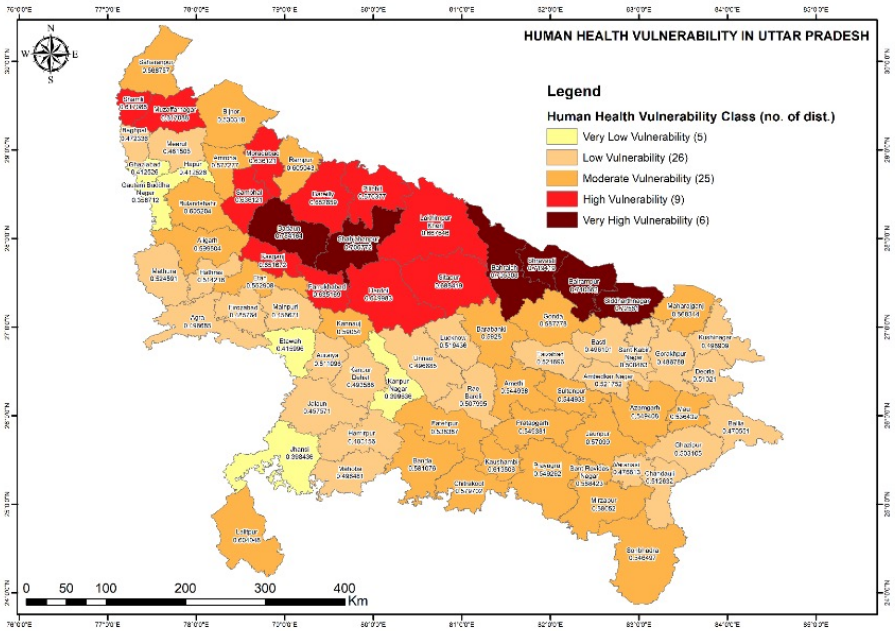


Figure 38: Spatial Distribution of District-wise Human Health Vulnerability in Uttar Pradesh

Vulnerability Class	Districts	Major Drivers
Very High	Badaun, Balrampur, Siddharthnagar, Shravasti, Shahjahanpur & Bahraich	• Low literacy • High percentage of population below 6 and over 60 years of age • High incidence of poverty • High percentage of households at risk to damage by wind, flood and earthquakes • High infant mortality rate • Poor access to basic amenities

Table 31: Drivers of Health Vulnerability for the Districts In Different Vulnerability Classes (Weighted Normalized Values ≥0.075)

Vulnerability Class	Districts	Major Drivers
High	Sitapur, Pilibhit, Lakhimpur Kheri, Bareilly, Kasganj, Hardoi, Moradabad, Farrukhabad & Muzaffarnagar	• High incidence of poverty • Low literacy • Low health insurance coverage • High percentage of house-holds at risk to damage by wind, flood and earthquakes
Moderate	Kaushambi, Bulandshahr, Rampur, Lalitpur, Aligarh, Barabanki, Kannauj, Sant Ravidas Nagar, Gonda, Banda, Mirzapur, Chitrakoot, Amroha, Jaunpur, Saharanpur, Maharajganj, Etah, Azamgarh, Pratapgarh, PrayagRaj, Sonbhadra, Sultanpur, Fatehpur, Mau & Bijnor	• High incidence of poverty • Low health insurance coverage • Poor access to basic amenities
Low	Mathura, Ambedkar Nagar, Faizabad, Lucknow, Hathras, Chandauli, Auraiya, Deoria, Rae Bareli, Ghazipur, Sant Kabir Nagar, Agra, Kushinagar, Unnao, Mahoba, Basti, Kanpur Dehat, Gorakhpur, Firozabad, Hamirpur, Varanasi, Bagpat, Ballia, Meerut, Jalaun & Mainpuri	• Poor access to function-al health care facilities • High population density
Very Low	Etawah, Ghaziabad, Kanpur Nagar, Jhansi & Gautam Buddha Nagar	Poor access to function-al health care facilities

Table 31: Drivers of Health Vulnerability for the Districts In Different Vulnerability Classes (Weighted Normalized Values ≥0.075)

4.9 VULNERABILITY OF DISASTER MANAGEMENT SECTOR

4.9.1 Indicators Selected

A total of seven indicators were considered to assess the vulnerability of the disaster management sector at the district-level. Of these seven, one indicator (insurance coverage) was composed of two sub-indicators (crop and health insurance coverage). Table 32 on the next page provides the list of indicators selected, the rationale for their selection, their functional relationship with vulnerability and the sources used to quantify them.

Out of the 71 districts, 10 districts (Balrampur, Bahraich, Siddharthnagar, Shahjahanpur, Shravasti, Badaun, Kasganj, Lakhimpur Kheri, Sitapur & Bareilly) were ranked as having very-high vulnerability; 19 districts were ranked as highly vulnerable; 22 districts were ranked as having moderate vulnerability; 16 districts were ranked as having low vulnerability and the remaining four districts (Kanpur Nagar, Jhansi, Gautam Buddha Nagar & Ghaziabad) were ranked as having very-low vulnerability. This is presented as a graph map (Figure 39).

Indicators		Rationale for selection	Sensitivity or Adaptive Capacity	Relationship with Vulnera-bility	Data Source
Insurance coverage	Crop	Implies access to banks, cooperative societies and insurance providers; provides a safety net in case of loss and damage due to hazards	Adaptive Capacity	Negative	Pradhan Mantri Fasal Bima Yojana - Dashboards (2019)
	Health				National Family Health Survey, NFHS-4 (2015-16)

Table 32: List of Indicators for Disaster Management Vulnerability Assessment at the District-Level, Rationale for Selection, Functional Relationship With Vulnerability and Sources of Data

Indicators	Rationale for selection	Sensitivity or Adaptive Capacity	Relationship with Vulnera-bility	Data Source
Access to an alternate employment source (MGNREGS)	MGNREGS is an important source of alternate income to rural households and provides relief during climate hazards enhancing a household's adaptive capacity; measured as the average person-days per household employed under MGNREGS.	Adaptive Capacity	Negative	MGNREGA MIS (2015-2019)
Percentage of households at risk to damage by wind, extreme rainfall and earthquakes	Poor construction materials used for housing increases the risk of loss and damage by wind (50-55 m/s), extreme rainfall during thunderstorms and earthquakes. This could lead to unforeseen costs for reconstruction or even displacement of households, increasing their vulnerability.	Sensitivity	Positive	BMTPC Vulnerability Atlas of India (2019); SECC 2011
Literacy	This indicator determines the extent to which access to information can enable proactive adaptation to climate variability, as well as a gateway for non-climate sensitive skill-development and employment for transformational adaptation; an indirect measure of distance/access to schools and colleges; measured as the proportion of population that has secondary and/or higher education.	Adaptive Capacity	Negative	SECC 2011
Percentage of Population <6 and >60 years of age	Children and older people are more vulnerable/sensitive to climate extremes and hazards.	Sensitivity	Positive	Census 2011
Percentage of rural households below the poverty line - adjusted for inequalities	Higher the proportion of rural population below the poverty line, higher is the sensitivity of the people in that district. It is measured as the number of rural households (SC, ST, women headed households and households with members living with a disability) having monthly income (of the highest earning household member) of less than Rs 5000.	Sensitivity	Positive	SECC 2011

Table 32: List of Indicators for Disaster Management Vulnerability Assessment at the District-Level, Rationale for Selection, Functional Relationship With Vulnerability and Sources of Data

Indicators	Rationale for selection	Sensitivity or Adaptive Capacity	Relationship with Vulnera-bility	Data Source
Access to basic amenities (safe drinking water, sanitation and wastewater drainage)	Safe sanitation systems are fundamental to public health. This indicator considers the presence of toilets and bathrooms within household premises and also the management of wastewater. It also has gender implications, as lack of safe and private sanitation systems are known to disproportionately affect women.	Adaptive Capacity	Negative	Census 2011

Table 32: List of Indicators for Disaster Management Vulnerability Assessment at the District-Level, Rationale for Selection, Functional Relationship With Vulnerability and Sources of Data

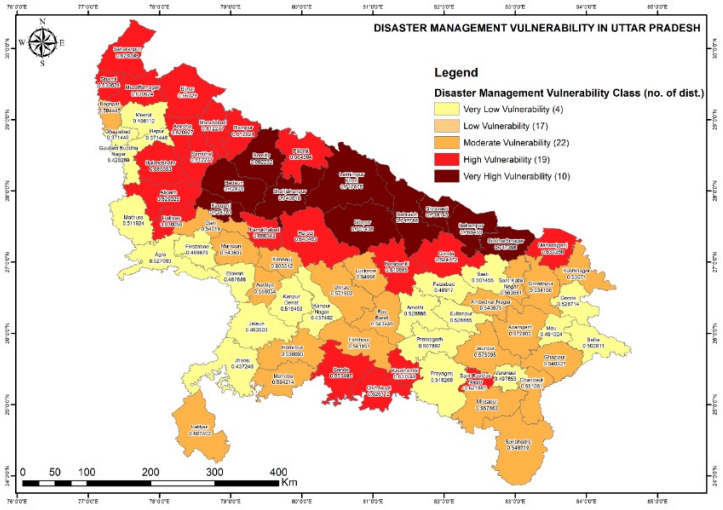


Figure 39: Spatial Distribution of District-wise Disaster Management Vulnerability In UP

Major drivers of vulnerability for the districts in different vulnerability classes are presented in Table 33.

Vulnerability Class	Districts	Major Drivers
Very High	Balrampur, Bahraich, Siddharthnagar, Shahjahanpur, Shravasti, Badaun, Kasganj, Lakhimpur Kheri, Sitapur & Bareilly	• Low literacy • High percentage of population below 6 and over 60 years of age • High incidence of poverty • High percentage of households at risk to damage by wind, flood and earthquakes • High infant mortality rate • Poor access to basic amenities

Table 33: Drivers of Disaster Management Vulnerability for the Districts in Different Vulnerability Classes (Weighted Normalized Values ≥0.075)

Vulnerability Class	Districts	Major Drivers
High	Bulandshahr, Saharanpur, Farrukhabad, Pilibhit, Bijnor, Banda, Hardoi, Kaushambi, Hathras, Muzaffarnagar, Maharajganj, Aligarh, Chitrakoot, Gonda, Sant Ravidas Nagar, Amroha, Rampur, Moradabad & Barabanki	• High incidence of poverty • Low insurance coverage • Low literacy • High percentage of households at risk to damage by wind, flood and earthquakes
		• Poor access to basic amenities • Reduced participation in MGNREGS
Moderate	Lalitpur, Kannauj, Bagpat, Mahoba, Jaunpur, Azamgarh, Unnao, Sant Kabir Nagar, Fatehpur, Auraiya, Mirzapur, Chandauli, Lucknow, Sonbhadra, Mainpuri, Ambedkar Nagar, Rae Bareli, Ghazipur, Etah, Hamirpur, Gorakhpur & Kushinagar	• High incidence of poverty • Poor access to basic amenities • High percentage of population below 6 and over 60 years of age • Low insurance coverage
Low	Sultanpur, Deoria, Agra, Kanpur Dehat, PrayagRaj, Mathura, Pratapgarh, Ballia, Basti, Varanasi, Meerut, Mau, Faizabad, Etawah, Firozabad & Jalaun	• High incidence of poverty • Poor access to basic amenities • Low insurance coverage
Very Low	Kanpur Nagar, Jhansi, Gautam Buddha Nagar & Ghaziabad	• High incidence of poverty • High percentage of households at risk to damage by wind, flood and earthquakes

Table 33: Drivers of Disaster Management Vulnerability for the Districts in Different Vulnerability Classes (Weighted Normalized Values ≥0.075)

4.10 INHERENT, COMPOSITE VULNERABILITY

The composite vulnerability index (CVI) broadly captures the overall inherent vulnerability of districts.

4.10.1 Indicators selected

Indicators that represent all the sectors covered above were selected for the construction of Composite Vulnerability Index. Table 34 ahead provides the list of indicators selected for the computation of CVI. Rationale for selection, and sources of data have been provided in previous sections.

4.10.2 Composite Vulnerability Index

Out of the 71 districts, nine districts (Kanpur Nagar, Agra, Badaun, Kannauj, Mainpuri, Mathura, Lalitpur, Etah, Sonbhadra) were ranked as having very-high vulnerability; 12 districts were ranked as highly vulnerable; 32 districts were ranked as having moderate vulnerability; 17 districts were ranked as having low vulnerability and the remaining one district (Baghpat) was ranked as having very-low vulnerability. This is presented as a graph (Figure 40) and map (Figure 41) below.

Major drivers of vulnerability for the districts in different vulnerability classes are presented in Figure 42 and Table 35 respectively.

Sector	Indicator
Agriculture	Crop yield variability
Water Resources	Baseline water stress
Forests	Percentage change in forest area (2017-2019)
Socio-economic Development (rural and urban)	Access to basic amenities (safe drinking water, sanitation, and wastewater drainage)
Energy	Access to electricity
Health	Access to functional health care facilities
Disaster Management	Percentage of households at risk to damage by wind and extreme rainfall

Table 34: Indicators Selected for the Construction of Integrated, Composite Vulnerability Index at the District-Level

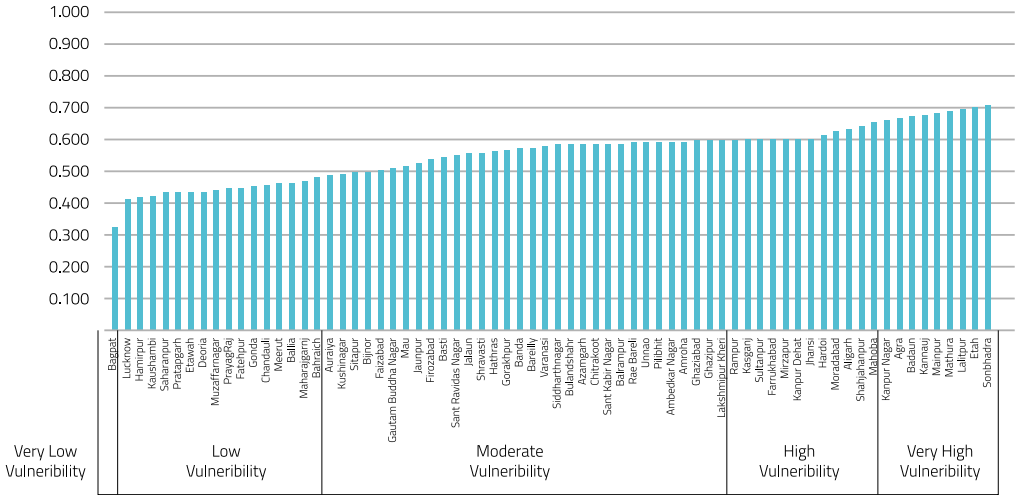


Figure 40: Ranking of Districts based on a Composite Vulnerability Index From Very-Low to Very-High Vulnerability

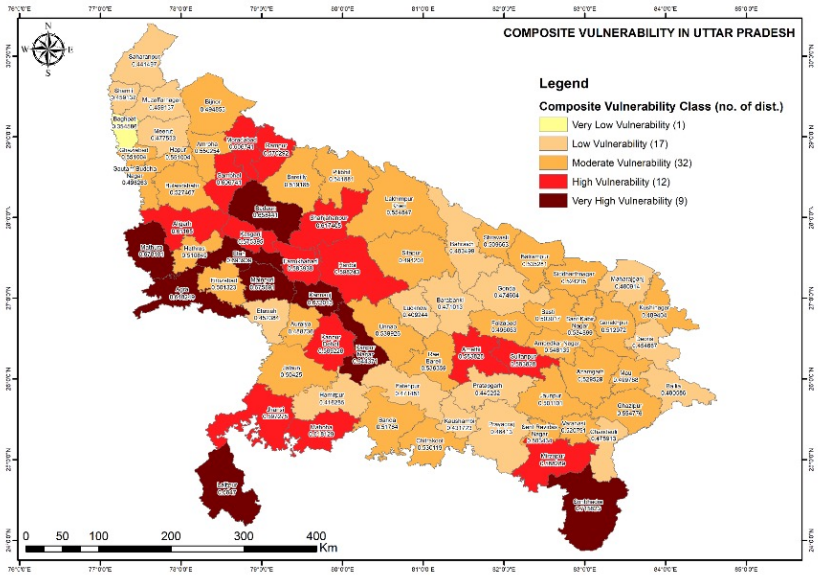


Figure 41: Spatial Distribution of District-wise Composite Vulnerability in UP

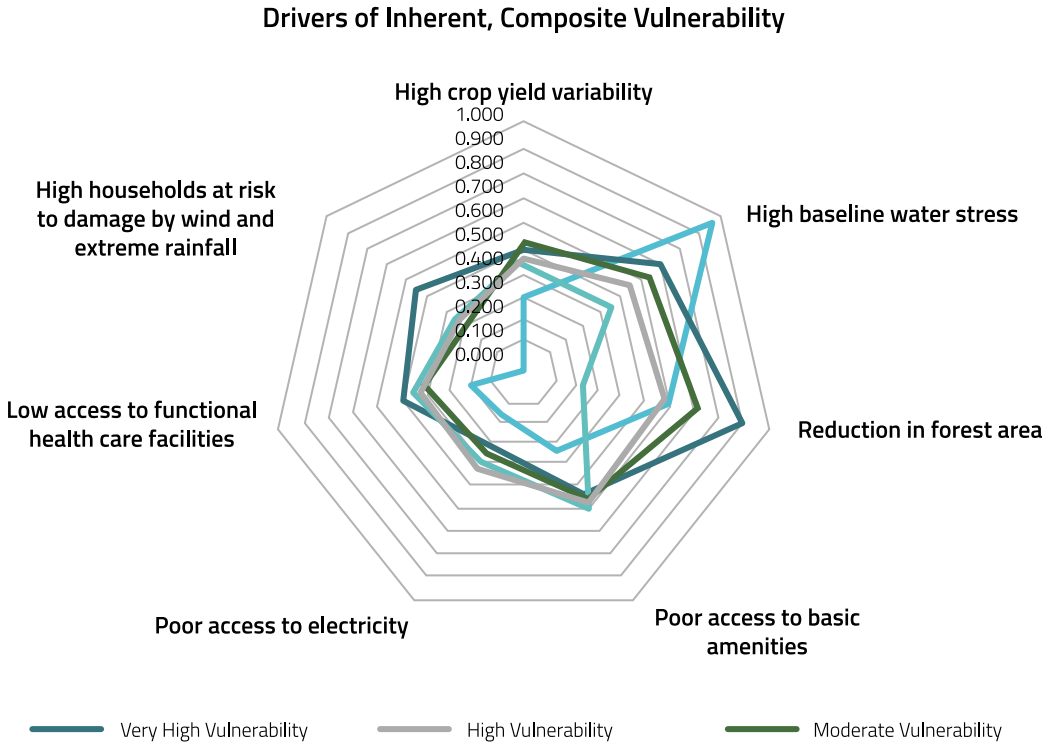


Figure 42: Drivers of Composite Vulnerability Represented as a Radar Plot

Major drivers of vulnerability for the districts in different vulnerability classes are presented in the Figure 42 and Table 35 respectively

Vulnerability Class	Districts	Major Drivers
Very High	Sonbhadra, Etah, Lalitpur, Mathura, Mainpuri, Kannauj, Badaun, Agra, Kanpur Nagar,	• Reduction in forest area • Poor access to basic amenities • High baseline water stress • High households at risk to damage by wind and extreme rainfall • Low access to functional healthcare facilities • High crop yield variability
High	Mahoba, Shahjaanpur, Aligarh, Moradabad, Hardoi, Jhansi, Kanpur Dehat, Mirzapur, Farrukabad, Sultanpur, Kasganj, Rampur	• High baseline water stress • High crop yield variability • Reduction in forest area • Poor access to basic amenities • Low access to functional healthcare facilities • Poor access to electricity
Moderate	Lakhimpur Kheri, Ghazipur, Ghaziabad, Amroha, Ambedkar Nagar, Pilibhit, Unnao, Rae Bareli, Balrampur, Sant Kabir Nagar, Chitrakoot, Azamgarh, Bulandshahr, Siddhathnagar, Varanasi, Bareilly, Banda, Gorakhpur, Hathras, Shravasti, Jalaun, Sant Ravidas Nagar, Basti, Firozabad, Jaunpur, Mau, Gautam Buddh Nagar, Faizabad, Bijnor, Sitapur, Kushinagar, Auraiya	1. High baseline water stress 2. Poor access to basic amenities 3. Low access to functional healthcare facilities 4. Reduction in forest area 5. Poor access to electricity

Table 35: Drivers of Inherent, Composite Vulnerability for the Districts in Different Vulnerability Classes (Weighted Normalized Values ≥0.5)

Vulnerability Class	Districts	Major Drivers
Low	Bahraich, Maharajganj, Balia, Meerut, Chandauli, Gonda, Fatehpur, Barabanki, Prayagraj, Muzaffarnagar, Deoria, Etawah, Pratapgarh, Saharanpur, Kaushambi, Hamirpur, Lucknow	1. Poor access to basic amenities 2. Low access to functional healthcare facilities 3. Poor access to electricity
Very Low	Baghpat	1. High baseline water stress 2. Reduction in forest area

Table 35: Drivers of Inherent, Composite Vulnerability for the Districts in Different Vulnerability Classes (Weighted Normalized Values ≥0.5)

Chapter 5

Sustainable Agriculture Mission

Climate Change is causing widespread disruption in every region of the world with just 1.1 degree celsius of warming. Droughts, extreme heat and record floods threaten food security and livelihood of millions of people. The IPCC projects that these risks will compound one another as multiple hazards occur at the same time in the same regions. The combined effects of heat and droughts will lead to significant losses in agricultural yields. This will further lower incomes and raise food prices—a combination that will threaten food security and exacerbate health risks like malnutrition. (WGI, IPCC AR6, 2021)

Sustainable Agriculture Mission follows the outline of the initial UP SAPCC and also derives its mandate from National Mission on Sustainable Agriculture as outlined under National Action Plan on Climate Change (NAPCC). Indian agriculture has seen significant progress in the recent years. However, agriculture being a biological production process is more prone to the projected change in climate, which can have severe ramifications on sustainability of production and livelihoods of people dependent on agriculture(Rao, 2016). Climate is the most important determinant of crop productivity, particularly in country like India, where about 2/3rd of the cultivated area is rainfed. Therefore climate change is of serious concern, having large-scale impacts, directly and indirectly, on agriculture.

Agriculture sector is the prime driver of economic growth in Uttar Pradesh. Majority of the population relies on agriculture for its livelihood. Given the large size of the state and its diverse geography, there are wide climatic variations across the nine agro-climatic zones—while Bundelkhand is drought prone, eastern UP experiences frequent floods and waterlogging. This chapter explores varied climate risks and opportunities across the sector, takes stock of climate adaptation and mitigation interventions and provides a list of climate adaptation strategies/actions for the sector.

Climate Risk	Crops/livestock affected	Findings and recent incidents	References
Rainfall variability	Sugarcane, rice	• High rainfall leads to poor root respiration and nutrient loss for sugarcane. • Water logging leads to low sugar recovery at ripening stage.	Mall et. al. (2016); Bhatt et al. (2019)
Temperature variability	Rice, Sugarcane, Horticulture (Vegetables)	• Rise in minimum temperature can lead to decline in rice yield. • Temperature below 25°C and above 35°C and 40°C leads to decline in the sugarcane yield. • High temperature has reduced the marketable grade yield of potatoes in UP by 10-20%.	Bhatt et al. (2019); Mall et. al. (2016); NABARD 2018
Flood Proneness	Crops, livestock	• Rise in minimum temperature can lead to decline in rice yield. • Temperature below 25°C and above 35°C and 40°C leads to decline in the sugarcane yield. • High temperature has reduced the marketable grade yield of potatoes in UP by 10-20%.	Sankhala et. al. (2016)
Drought Proneness	Livestock	• Increased temperature and insufficient fodder availability leads to dehydration in animals further resulting in reduced milk yield and even death. Farmers avoid travelling large distances for grazing to save animals from temperature rise during drought.	Mall et. al. (2016)

Table 36: Evidence-based Mapping of Climate Risks and Impacts on Agriculture Sector

5.1 RISK ASSESSMENT AND MITIGATION OPPORTUNITY

5.1.1 Climate Risks and Impacts

Uttar Pradesh being an agro-climatically diverse state, is known for various food grains, cash crops and horticultural crops. Uttar Pradesh is the second largest producer of rice in the country (produced 15.27 million tonnes in 2021-22; Economic Survey, 2023). Rainfall and temperature variability have a significant impact on the yield of this crop. Uttar Pradesh has also distinguished itself as the largest producer of sugarcane (produced 177.43 million tonnes in 2021-22; Economic Survey, 2023). Climate variability plays an important role in the growth and productivity of this crop. In terms of animal husbandry. Uttar Pradesh has the largest population of buffaloes in the country. The sector is also highly vulnerable to climate change, with factors such as heat distress, water scarcity and insufficient fodder affecting the health, growth and productivity of livestock (NABARD, 2018). Furthermore, a decrease in the indigenous variety of cattle also has long-term repercussions. This trend has been observed in Uttar Pradesh over the last ten years. Indigenous breeds adjust better to adverse climatic conditions, food inadequacy, and have a higher resilience to regional diseases. Many of the exotic or crossbred animals take longer to adapt to this environment, and are therefore less resilient to the impacts of extreme events such as drought, decreased crop yields, low forage quality and reduced production (Khurana, 1997). Table 36 highlights the climate indicators affecting certain crops and livestock in Uttar Pradesh.

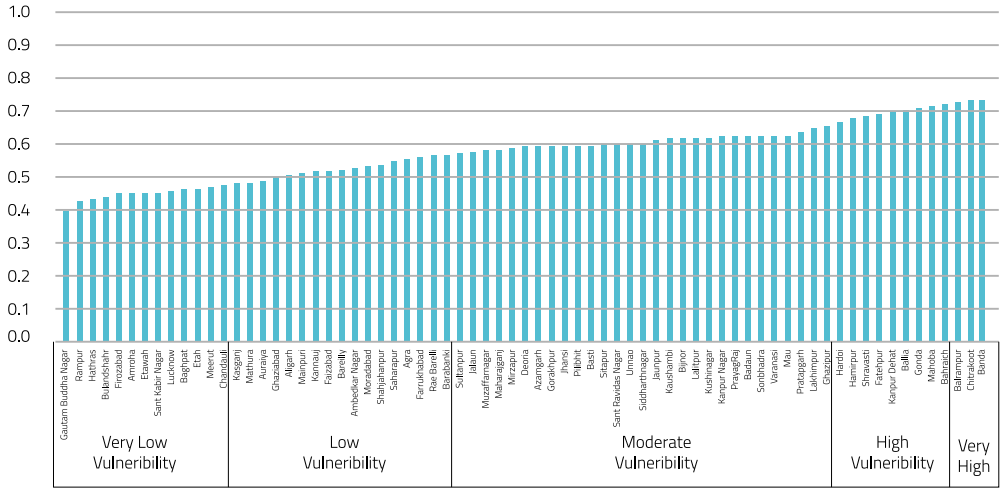


Figure 43: Ranking of Districts Based on an Agricultural Vulnerability Index From Very-Low to Very-High Vulnerability

5.1.2 Inherent Vulnerability

A total of fourteen indicators were considered to assess agricultural vulnerability at the district-level. The vulnerability assessment of the agriculture sector conducted for all the districts of Uttar Pradesh, using the IPCC AR5 methodology, identified 41 districts were ranked as moderately to very highly vulnerable. The dominant drivers of vulnerability for districts falling under the very high to moderate vulnerability classes were recognized as: high percentage of area under rainfed agriculture, less area under horticulture trees, high dependence on income from agriculture, high crop yield variability, increased land fragmentation, increased land degradation, less on-farm development and WRM assets created under MGNREGA, low access to agricultural inputs, low access to information and technology , high stray cattle density , low food security, low crop insurance coverage, less coverage under NMSA, increased land degradation, low livestock holdings, among others.

The ranking of the districts based on Agriculture Vulnerability Index ranging from very low to very high vulnerability is given in Figure 43 (**Ranking of districts based on an Agricultural Vulnerability Index from very-low to very-high vulnerability**) and Figure 44 (**Ranking of districts based on an Agricultural Vulnerability Index from very-low to very-high vulnerability**).

While all districts are vulnerable, vulnerability is a relative measure. This means that some districts are more vulnerable than others. The contribution of each indicator to the value of AVI was computed as the average weighted-normalised values of indicators within each vulnerability class. This is represented as a radar plot (Figure 44), where the spokes of the plot represent the magnitude of each indicator in driving vulnerability. Further away from the centre of the plot, more strongly does the indicator drive vulnerability.

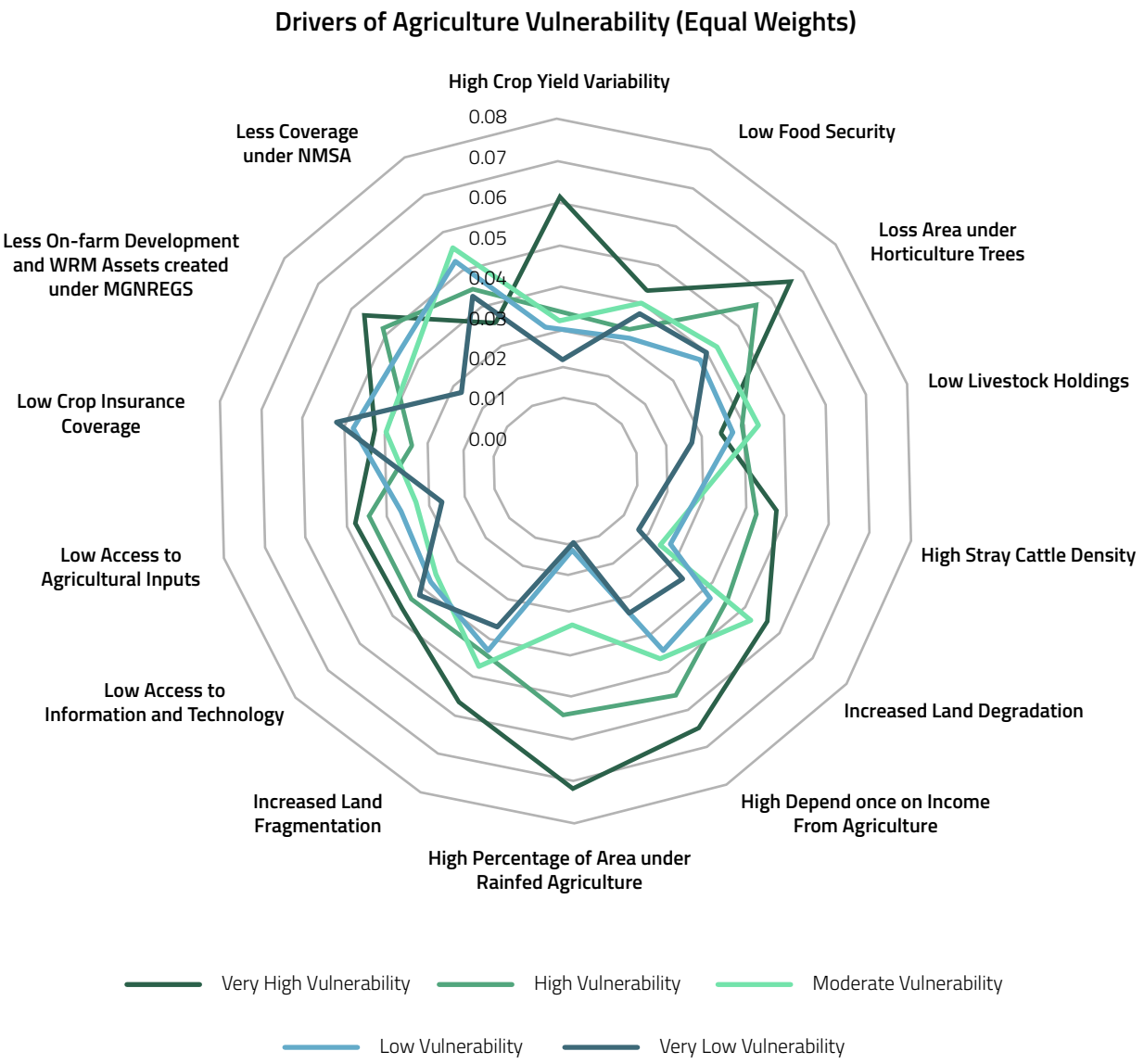


Figure 44: Drivers of Agriculture Vulnerability Represented as a Radar Plot

5.1.3 Mitigation Opportunity

Agriculture sector results in GHG emissions from enteric fermentation in livestock sector, use of nitrogenous fertilizers, rice cultivation, fuel-use in agriculture pump-sets and crop residue burning. In the year 2016, agriculture emitted 4,07,821 GgCO2 eq., which amounted to around 14% of the emissions of India for that year, registering a decrease of 2.25% since 2014 (MOEFCC, 2021). Sector-wise distribution shows that enteric fermentation (livestock sector) contributed 8% (2,22,655 GgCO2 eq.) to the country's total GHG emissions and 55% to the total emissions from the agriculture sector. This was followed by emission from rice cultivation (3%~ 71,322 GgCO2 eq.) and agricultural soils (3%~ 77,781 GgCO2 eq.).

As per the latest livestock census 2019, Uttar Pradesh has the highest livestock population of 67.8 million in India. Resulting in the highest emissions from the secto, i.e., 46 MtCO2e in 2019 (see figure 1). Subsequently, it is one out of the five major rice producing states in the country, contributing 12% to the country's total rice production, resulting in 13.9 MtCO2e emissions from 5.8 million ha (2019 estimates). Additionally, UP also shows higher emissions from wheat and cotton production compared to other major crop producing states such as Punjab, MP and Haryana (Tek B.Sapkota, 2019).

A predominantly agriculture-based economy of Uttar Pradesh makes it one of the highest diesel consuming state in the agriculture sector. Contributing to 25.56% of the total retail diesel consumption in the state are agriculture pump sets, tractors and other agri-implements (Petroleum Planning and Analysis Cell, 2013). Additional factors such as groundwater depletion are further aggravating the situation resulting in a greater financial cost to the state.

In view of the high GHG emissions from the agriculture sector of UP, the government has been implementing various schemes and programmes that help facilitate reduction in agriculture-related GHG emissions. UP has initiated the process for mandating the EE pump-sets in the state. Under the Agriculture Demand Side Management Programme, about 79,000 nos. pumps have been installed in the states of Andhra Pradesh and Uttar Pradesh. This has resulted in estimated energy savings of 204 million kWh per year (Ministry of Power, 2021).

Studies estimate the technical mitigation potential of crop production in India to be 55.5 MtCO2e per year. Uttar Pradesh is identified to have the highest mitigation potential through reduced fertilizer consumption through precision nutrient management of 3.15 MtCO2e. While in case of water management of rice, it has the potential to save between 0.42 and 0.84 MtCO2e emissions. A 2020 study suggests that Machine-Transplanted rice has potential of reducing GHG emissions under 0.95 MtCO2e(Hom Gartaula, 2020). GHG mitigation options in Agriculture Sector are given in Figure 46.

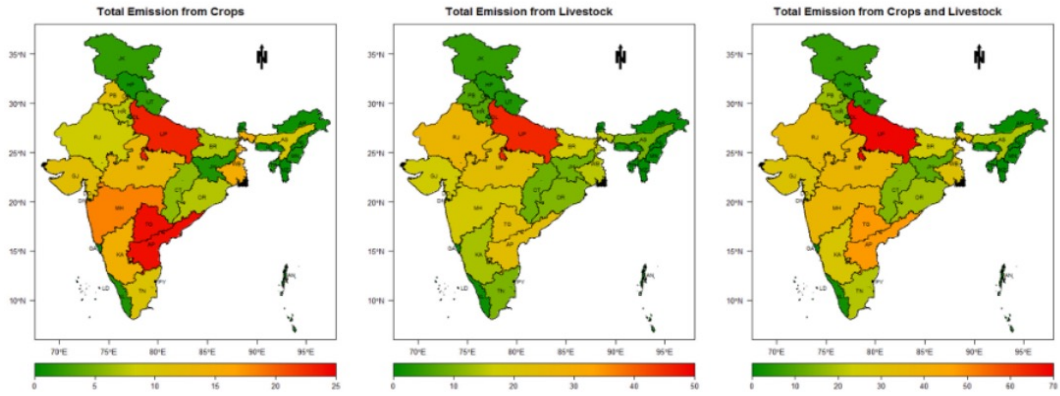


Figure 45: Distribution of total GHG emissions (MtCO2e) from crops, livestock and crop plus livestock combined

Livestock Management

- Green fodder supplements for large ruminants
- Increased concentrate feeding for large ruminants
- Improved diet management
- Biogas from large ruminants' manure

Crop Production

- Improved water management in rice
- Adoption of zero-tillage
- Adoption of sprinkles/micro-sprinklers
- Stop residue burning

Fertilizer Consumption

- Precision Farming

Figure 46a: GHG Mitigation Options in Agriculture Sector
Source: (Tek B.Sapkota, 2019)

5.2 SUSTAINABLE AGRICULTURE MISSION STOCKTAKING AND KEY RELEVANT POLICIES IN UP

Key interventions undertaken towards climate change adaptation and mitigation include:

- Under Gramin Krishi Mausam Seva Scheme, a total of 50 AWS in Uttar Pradesh are already working at different designated place in every district. 17 additional stations have been installed under this scheme at block level in 2021 (Press Information Bureau, 2021).
- Under Paramparagat Krishi Vikas Yojana (PKVY), from the year 2015-16 till 2020, a total of 620 organic clusters are formed covering 31,000 farmers and 12400 ha of area (Ministry of Agriculture and Farmers Welfare, 2020).
- UPSOC has been established in 2014 and from 2016. it has started its functioning with regard to registration and organic certification (U. P. State Organic Certification Agency, 2021).
- In order to promote resource conservation technologies, the Minor Irrigation Department reported the following progress:

  - Irrigation potential created through major, medium and minor irrigation projects: area increased from 262.36 thousand ha in 2013-14 to 328.91 thousand ha in 2019-20.

- To promote climate resilient crops in the state, Sugar Industry and Cane Development Department reported the following progress:

  - Under District Sugarcane Development Plan, distribution of seeds doubled from 2013-14-2019-20

  - Trainings were conducted under NFSM

- More than 230 hatcheries have been constructed for fish farmers by private sector enterprises, with government assistance. At present, 40% subsidy is provided for general category with 60% beneficiary component and 60% subsidy is provided for SC/ST with 40% beneficiary component, for a unit cost of Rs. 25 lacs per hatchery. As per the latest update, the state has established 134 mobile fish parlors.
- Under Agriculture Demand Side Management Programme, a total of 9 drinking water pumps have been replaced with Energy Efficient pumps. Up to March 2019, electric pump sets replaced by energy efficient pump sets are 1025 and by May 2020 are approx.1850. (Ministry of New and Renewable Energy ,2021)

The central, state policies and schemes linked to climate adaptation and mitigation in agriculture and allied sector that are being implemented are as follows:

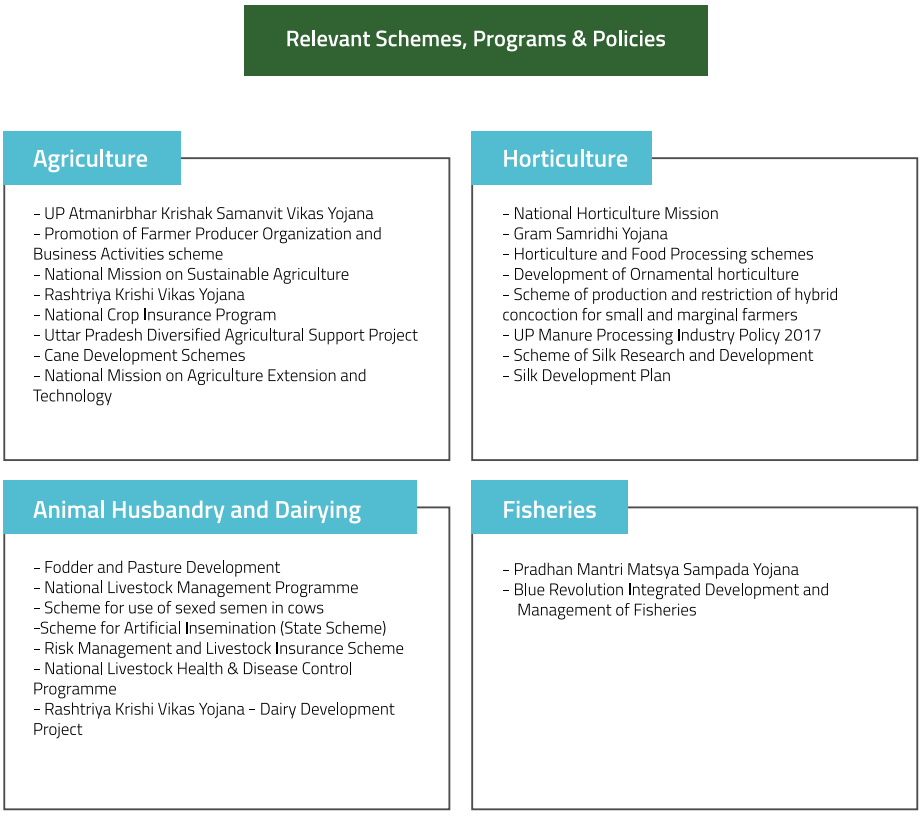


Figure 46b: Relevant Schemes, Programmes and Policies Being Implemented in UP in the Agriculture Sector

5.3 PROPOSED STRATEGIES, ACTIONS AND IMPLEMENTATION SCHEDULE

Based on identified climate risks, vulnerability along with the consultations with stakeholders and experts a total of five strategies have been evolved to deal with impacts of climate change in Agriculture and Allied Sector. Across the five strategies, a total of 19 action/sub-actions are proposed to be implemented till 2030 with an estimated budget of ₹29,798 crores (See Table 37a).

All proposed actions under the above-mentioned strategies are further categorized into two classes based on their type of climate actions i.e., adaptation centric, mitigation centric or both; and based on the nature of actions i.e., implementation, policy, research, and capacity building. A total of 39 percent of total proposed actions are under capacity building activities, followed by implementation activities i.e., 28 percent of total 19 actions. Also, considering the importance of adaptation to the extreme weather events and building climate resilient agriculture in Uttar Pradesh, 83 percent of total 19 actions are adaptation centric.

Strategy	Number of Actions	Estimated Budget Requirement (₹ In Crores)	Key Nodal and Implementing Agencies
Generate high-resolution weather forecasts. Ensure access to weather forecasts and agro-met services by all farmers.	2	510.00	Agriculture Department, Agriculture Universities, DAMU's (District Agro-Meteorological Units), KVKs, IMD
Undertake wide spread training of FPO farmers on climate smart practices, techniques and tools to help them understand and address the impacts of climate change	3	119.00	Agriculture Department, NABARD
Mainstream climate smart adaptation practices and technologies through implementation of pilots covering all agro-climatic zones in UP	3	26,041.00	Agriculture Department, Agriculture Universities, Animal husbandry department, Horticulture department and Agroforestry unit
Improve water use efficiency in agriculture with a focus on rice and sugar cane	5	2,530.00	Agriculture Department, Agriculture Universities, KVKs, NABARD, Fisheries Department, Indian Institute of Sugarcane Research, Agriculture Universities, Directorate of Sugarcane Development
Enable enhanced access to risk sharing measures for farmers in a changing climate regime	6	598.00	Department of Animal Husbandry, State & District Administration
Total Budget (₹. in Cr)		29,798.00	

Table 37a: A snapshot of proposed strategies, number of actions, Estimated Budget and Key Agencies for Agriculture Mission

Figure 47: Distribution of Type and Nature of Actions proposed under Agriculture Mission

A summary of proposed strategies, actions, targets and other relevant information is outlined below. For a detailed list of strategies, refer to Table 77 in Annexure.

Strategy 1: Generate high resolution weather forecasts. Ensure access to weather forecasts and agro-met services by all farmers.

Strategy alignment with SDGs: SDG 2 | SDG 8 | SDG 13
Strategy alignment with NDCs: NDC 06

Climate change induced decline in productivity is expected to the extent of 25% in irrigated areas and up to 50% in rain-fed areas of UP. Monsoon's variability and water scarcity has significantly affected the crop yields, area and livestock in Bundelkhand region during the last 4-5 years (Planning Department,Government Of Uttar Pradesh). The effective use of weather information services contributes to resilience by enabling farmers to better manage the negative impacts of weather-related risks in poor seasons. There is a need to disseminate customised weather information based on high resolution and agro advisory (Rupan, 2018). This strategy focuses on establishing a network of Automatic Weather Stations at finer resolutions and provide customised information to farmers including extreme weather forecasts and pest & disease related forecasts via SMS.

Strategy 2: Undertake wide spread training of FPO farmers on climate smart practices, techniques and tools to help them understand and address the impacts of climate change

Strategy alignment with SDGs: SDG 2 | SDG 8 | SDG 13
Strategy alignment with NDCs: NDC 06

Extreme weather events adversely impact crop yields, livestock and riverine fisheries in the state. In addition, farming and fishing communities have low awareness, resources and adaptive capacity (Planning Department,Government Of Uttar Pradesh). Hence, there is an urgent need for capacity building of small farmers, including women by providing hands on training about climate smart agriculture consisting different adaptive techniques like water smart practices including micro irrigation techniques, drip irrigation, SRI, direct seeding etc. and certain soil smart (soil nutrient management, improving soil fertility, soil carbon sequestration) and cultivar smart practices (adoption of climate resilient seed varieties). This strategy is particularly essential to empower women in agriculture by making systematic investments to enhance their knowledge and increase their access to agricultural information and training and subsequently create and sustain agriculture-based livelihoods of rural women (World Bank, 2019).

Strategy 3: Mainstream climate smart adaptation practices and technologies through implementation of pilots covering all agro-climatic zones in UP

Strategy alignment with SDGs: SDG 2 | SDG 8 | SDG 13
Strategy alignment with NDCs: NDC 06

Agriculture Sector in UP is highly sensitive to weather aberrations. There is a need for preparedness and real time implementation towards sustainable agriculture production systems in the events of extreme climatic events. A ready reckoner for line departments and farming community on prevailing farming systems and climate smart technological interventions to manage various climatic events addressing different sectors of agriculture including horticulture, livestock, poultry, fisheries is essential (ICAR, 2016). This strategy focuses on enhancing climate resilience in agriculture production systems through series of activities at village level. The strategy's implementation schedule envisages to identify barriers towards uptake of climate smart activities, pilot climate smart adaptation technologies and practices across all 75 districts and develop village level contingency plans encompassing analysis of historical climate data and future climate projections, analysis of water availability and soil health, etc.

Strategy 4: Improve water use efficiency in agriculture with a focus on rice and sugar cane

Strategy alignment with SDGs: SDG 2 | SDG 8 | SDG 13

Strategy alignment with NDCs: NDC 06

Due to growing demand of water for various uses and erratic rainfall, the water availability for crop production is declining at a faster pace in different regions of Uttar Pradesh. In addition, scanty rainfall especially in Bundelkhand region impedes irrigation development. There is a need for incentivization and promotion of water conservation technologies especially in water scarce regions of the state (Maina Kumari, 2017). Therefore, this strategy focuses on extensive capacity development of farmers via Farmer Producer Organizations. It is envisaged that providing technical support and training to farmers will enable them to adopt water conservation techniques like shifting to cultivation of coarse grains and other horticulture crops, cultivation of flood resilient varieties of rice, adoption of tank fisheries technologies, and adoption of drip, furrow and skip irrigation for sugarcane.

Strategy 5: Enable enhanced access to risk sharing measures for farmers in a changing climate regime

Strategy alignment with SDGs: SDG 2 | SDG 8 | SDG 13
Strategy alignment with NDCs: NDC 06

During the year 2015-16, the state had approximately 2.38 crores operational agricultural landholdings, out of which 80% were marginal landholdings. In addition, 60% of the farmers in the state are small and marginal farmers. Decreasing farmer's income and livelihood insecurity is a major threat (Planning Department,Government Of Uttar Pradesh). Therefore, this strategy focuses on strengthening crop and livestock insurance in the state. In addition, it also focuses on capacity building and popularizing risk management solutions in agriculture.

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹ in Crores)
1. Generate high resolution weather forecasts. Ensure access to weather forecasts and agro-met services by all farmers.			
1.1	Establish a network of Agro-Automatic Weather Stations (AWSs) at a finer resolution of 10kmx10km grid. Integrate the ones installed by IMD under its Gramin Krishi Mausam Sewa (about 2433 to be installed across India)	Agriculture Department, Agriculture Universities, IMD	50.00
1.2	Analyse and disseminate weather information based on high resolution and agro-advisory. Info package for dissemination to include: • 3 to 7 days weather forecasts to farmers via SMS • Extreme weather forecasts • Pest and Disease forecasts for crops and animals, • Other Agriculture advisory services (Farmers registered under PM KISAN in UP to be covered. As of 2021 around 2,81,75,093 farmers are registered)	Agriculture Department, DAMU's (District Agro-Meteorological Units), KVKs & AU, IMD	459.80
2. Undertake wide spread training of FPO farmers on climate smart practices, techniques and tools to help them understand and address the impacts of climate change			
2.1	Develop FPOs specific training, including for women farmers (under the MKSP scheme) and PRI members; trainings to cover all aspects of climate smart agriculture approaches and technologies relevant for various food crops, pulses, oil seeds, horticulture crops, livestock and livestock produce, and Fisheries in UP	Agriculture Department, NABARD	5.00
2.2	Create a pool of Master Trainers on Climate Smart Agriculture approaches and technologies. (Two trainings in each of the 69 KVKs)	Agriculture Department, NABARD	13.80
2.3	Organize FPO wise training for farmers registered in the FPO's in the State. (At least 4 trainings annually, 7 day each, for all the FPOs)	Agriculture Department, NABARD	100.00

Table 37b: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹ in Crores)
3. Mainstream climate smart adaptation practices and technologies through implementation of pilots covering all agro-climatic zones in UP			
3.1	Undertake a baseline survey in UP across nine Agro-Climatic Zones (ACZs) to take stock of current agriculture practices and identify barriers towards uptake of climate smart practices and technologies propagated by various government schemes including adoption of micro and drip irrigation systems (27 Rapid assessments (3 across each 9 ACZs)	Agriculture Department, Agriculture Universities	2.70
3.2	Pilot climate smart adaptation technologies and practices appropriate for all 75 districts to tackle issues of real-time rainfall contingencies (delayed rainfall, mid-crop rainfall, drought, floods etc.), post-harvest management and value chains, and Institutional, knowledge and policy requirements for making agriculture in UP climate resilient. This is to encompass climate smart strategies for crops, livestock, horticulture, agroforestry and fisheries (for all 75 districts)	Agriculture Department, Agriculture Universities	23100.00
3.3	Develop Village level agriculture contingency plans for 97941 populated villages incorporating • Analysis of historical climate data and future climate projections to define the climate contingencies of the villages • Current and future impact analysis on natural resources within each village (water availability, soil health etc.) • Development of impact outlooks on agriculture crops, horticulture crops, livestock and fisheries prevalent within the villages • Enumeration of management alternatives considering weather contingencies for crops, livestock and fisheries	Agriculture department, Animal husbandry department, horticulture department and agroforestry unit, Fisheries Department, agriculture universities and technical institutes	2938.23
4.	**Improve water use efficiency in agriculture with a focus on rice and sugar cane**		
4.1	Provide technical and market linkage support to enable transition of rice and wheat growing areas to more climate resilient and economically viable crops such as coarse grains, pulses, horticultural crops growing areas; this is proposed in districts where groundwater levels have gone down from zero to 6 m below ground in the last 10 years. Establish FPOs, agriculture marts and other support including training to farmers enabling shift to cultivation of coarse grains, horticulture crops and other crops of lesser duration. (Cover 50 districts that show groundwater depth from 0-6 below ground)	Agriculture department, NABARD	220.00
4.2	Enable capacity of farmers to shift to flood resilient rice varieties in flood prone districts of UP (Eastern UP districts prone to floods covering an area of 7.34 million ha (flood prone area in UP); Undertake wide scale awareness programmes on flood resilient varieties of rice available and their productivity and farming practice, establish relevant seed marts and provide training to farmers on the best practices for cultivation of flood resilient varieties of rice.	Agriculture department, KVKs, NABARD	1000.00

Table 37b: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹ in Crores)
4.3	Train farmers on artificial tank fishery technologies to conserve water and develop FPOs for enabling market access. (8800 ha)	Agriculture department, Fisheries Department	290.00
4.4	Train sugarcane farmers to: • Adopt water conservation techniques (skip, furrow and drip irrigation) • Cultivate water stressed tolerant varieties • Transplant young seedlings (25-35 days old) • Maintaining spacing(5X2 feet) • Retaining sufficient moisture and avoiding inundation of water • Encouraging organic method of nutrient and plant protection measures. • Practicing intercropping for effective utilization of land • Undertake wide scale awareness programmes to motivate farmers to shift to water stress tolerant varieties and adopt water conservation techniques • Establish nurseries for growing saplings of the stated variety • Establish seed marts for water stress tolerant varieties of sugar cane such as CoLk94184 and other short duration sugarcane varieties (Cover entire sugarcane area in UP (23.12 lakh ha)	Agriculture department, Indian Institute of Sugarcane Research, Agriculture Universities, Directorate of Sugarcane Development, NABARD	800.00
4.5	Bring more area under drought resilient food crops (Rice to Millets in GW stressed areas) Cover 50 districts that show groundwater depth from 0-6 below ground)	Agriculture department, Agriculture Universities, KVKs, NABARD	22.00
5. Enable enhanced access to risk sharing measures for farmers in a changing climate regime			
5.1	Extend Restructured Weather Based Crop Insurance Scheme to all farmers registered under PMKSY. (As of 2021: 2,81,75,093 farmers registered under PM KISAN) (Coverage so far: 46.947 lakhs as of FY 2019 2020; 61.270 lakhs as of FY 2018 2019)	Agriculture department, Banks	530.00
5.2	Extend genetic up-gradation of all indigenous female domestic cattle by superior Indian breeds through artificial insemination to increase milk productivity of the indigenous cattle stock. (64.5 lakh indigenous female cattle in the state (2019 livestock census))	Dept. of Animal Husbandry (DoAH), Veterinary institutes and hospitals, NGOs	11.00
5.3	Sensitize livestock owners to take up livestock insurance cover for their superior breed indigenous cattle : • Extensive IEC on benefits of insurance • Implementation of livestock insurance scheme	DoAH, Banks	78.00

Table 37b: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹ In Crores)
5.4	Undertake a study and implement pilots to explore the feasibility of weather indexed livestock and fisheries insurance for insuring farmers against sharp loss in milk yields, morbidity and mortality due to extreme weather conditions and due to pest and disease attacks. (One pilot in each of the 9 ACZs)	DoAH, Veterinary Research Institutes	0.90
5.5	To generate sustainable farmer's income, undertake a feasibility study to explore the possibility of aggregation of marginal landholdings to be taken on rent/lease applicable for only 5 years. The farmer gets the lease rent every month, share of profit from sales of his produce and nominal daily wages for the days he/she works on the land. The institution (government or private company) that leases the land will take care of all farming inputs and climate smart agriculture practices (Marginal landholdings (80%) with clear ownerships (2021-2023))	Agriculture Department, Agriculture Universities and technical Institutes,	5.00
5.6	Set up partnership mode for research, capacity building and popularizing risk management solutions in agriculture.	Agriculture Department, NABARD	50.00

Table 37b: Summary of Proposed Actions and Estimated Budget Required

Chapter 6

Jal Mission

Uttar Pradesh receives on average, an annual precipitation of about 228.28 billion cubic meter (BCM), out of which only about 118.47 BCM is utilizable through the present strategies (Uttar Pradesh State Water Policy, 2020). With 39,542 Km (MOSPI, EnviStats India, 2021) combined river and canal length, 29 major and medium lift canals, 254 minor lift canals and 69.92 BCM groundwater recharge, Uttar Pradesh stands as one of the most water resource rich states of India.

However, water is a finite and unevenly distributed natural resource, which needs to be appropriately managed, developed and utilized. Water availability is a constraint in drought prone regions of Uttar Pradesh, areas which are highly vulnerable to weather abberations. There is also a rising trend of groundwater extraction in almost all the user sectors. With current rate of extraction, the projected gross extraction in the state may reach upto 70 BCM or more by the year 2030 and is expected to cross the rechargeable/ extractable limit that might take the entire state to the stage of overdraft. Declining rainfall has been impacting the natural recharging of aquifers and is making the situation worse (Sinha, 2021).

Based on selected performance indicators, Uttar Pradesh's ranking in all major domains of water sector development is as follows: Groundwater Source Augmentation (-1.51); Watershed Development – Supply Side Management (-3.21), Demand Side Management Participatory Irrigation Practices (-0.01), Demand Side Management Sustainable on-farm Water Use Practices (-0.88), Rural Drinking Water (-0.53) and Urban Water Supply and Sanitation (-0.70) (NITI Aayog, 2018). Considering all these parameters, this chapter highlights the key action points that need to be focused on in the upcoming years in order to reduce losses and sustain water resources.

6.1 CLIMATE RISK AND IMPACTS

Numerous studies have been carried out in different regions of Uttar Pradesh in order to see the climate change impacts on water resources. The major risks posed by Uttar Pradesh in terms of climate change variables like rainfall and temperature are frequent floods, dying rivers, droughts, vanishing wetlands and declining groundwater.

State wise examination of flood frequency data for 1986-2003 and 2006-2016 showed that in the Ganga River basin, floods are most common in Uttar Pradesh, Bihar and Gangetic West Bengal, areas that have experienced the highest number of flood events in the past (Shelar & Nandargi, 2018). During the monsoon season, these flooded rivers cause damage to crops, property, human and animal lives. As per data from 2018, the total damage caused due to floods in Uttar Pradesh amounted to Rs. 547.42 crore, with 105 human lives lost, 149 cattle lost, 28063 houses damaged, and 0.38 Mha of crops damaged, affecting a total population of 0.59 million (CWC, 2019).

It has also been found that almost 75% of the glaciers are retreating, with an average shrinkage of 3.75 km in the last 15 years (Naresh, Manas, Gupta, & Dwivedi, 2017). This could affect the waterflow in the rivers originating from these glaciers, and concurrently the populations that are dependent on them (Asian Development Research Institute). Studies conducted on river Ganga have projected that the mean annual runoff of the river will increase by 5% in the years 2070 – 2100. Another study has suggested that the river will become a seasonal river in the future. Ganga being the main river in Uttar Pradesh, climate change poses a high risk on water availability in Uttar Pradesh.

Wetlands are under imminent threat from both, global warming as well as human activities such as, encroachments and reclamation of wetlands for farming and settlement. Along Indo-Gangetic plains, wetlands have receded by more than half their size in the last 50 years. The study conducted on the wetlands of Lucknow show exponential decline in the last few decades. From 1972 to 2016 the percentage change in wetland area is calculated to be 91.44 percent (Imdad & Khan, 2017).

Prolonged and recurrent droughts that are being experienced in India and various parts of South Asia are the manifestation of climate change, partly caused by human interventions. Drought has been one of the primary reasons for widespread poverty and environmental degradation including deteriorating water quality and water security especially in the regions like Bundelkhand and Vindhyachal of Uttar Pradesh (IWP, 2020).

Another major water source, i.e., groundwater systems are largely influenced by rainfall variability. in Varanasi district, a research study was conducted to check the correlation between rainfall and groundwater. The study showed a declining trend in annual rainfall, rainy days and groundwater fluctuation. The frequent fluctuations in rainfall anomaly and water table fluctuations were found to be related to wider global events such as El Nino and La Nina. The intense cultivation of water intensive crops as well as rainfall variation was found to be one of the major causes behind the water table fluctuation in the study area (Dey, Mall, & Bhatt, 2020).

While climate risk and impacts are yet to be studied at various regional levels in the state, there are few evident risks, which are mapped in following table:

Climate Risk	Water source Impacted	Findings	Source
Rainfall variability	Surface and groundwater	• High rainfall leads to more floods damaging human life and crops • Frequent droughts in the region like Bundelkhand and Vindhyachal • Reduction in rainy days and thus less recharge in groundwater	S.S. Nandargi, A. Shela 2018 Dey, Mall, & Bhatt, 2020
Temperature variability	Surface water	• From 1972 to 2016 the percentage change in wetland area in Lucknow is calculated to be 91.438%. • Less water availability in rivers throughout the year	Imdad & Khan, 2017 Manas, Gupta, & Dwivedi, 2017

Table 38: Evidence-based Mapping of Climate Impacts on Water Resources

The above climate risk and impacts provide the potential for building resilience across the water sector.

6.1.1 Inherent Vulnerability

A vulnerability assessment of the water sector was conducted across districts using the IPCC AR5 methodology. The assessment, conducted using a set of five indicators, identified 52 out of 75 districts of the state as falling under moderate to very high vulnerable class. The key drivers of vulnerability for the sector in these districts have been underscored as: high baseline water stress, over extraction of groundwater, fewer households connected with water taps, fewer water conservation assets created under MGNREGA, low percentage of total minor irrigation schemes efficiently in use, high baseline water stress , fewer water conservation assets created under MGNREGA, fewer households connected with water taps, low percentage of total minor irrigation schemes efficiently in use, and over extraction of groundwater.

Vulnerability is approached as a relative measure, meaning that some districts are more vulnerable than the others. The percentage contribution of an indicator to vulnerability index for each vulnerability class was obtained by considering the average normalized indicator values for each vulnerability class. The result is presented as a graph (Figure 48) ahead. This is also represented as a radar plot (Figure 49), where the spokes of the plot represent the magnitude of each indicator in driving vulnerability- further away from the centre of the plot, more strongly does the indicator drive vulnerability. A detailed sectoral vulnerability assessment can be referred to in Section 4.3 of Chapter 4.

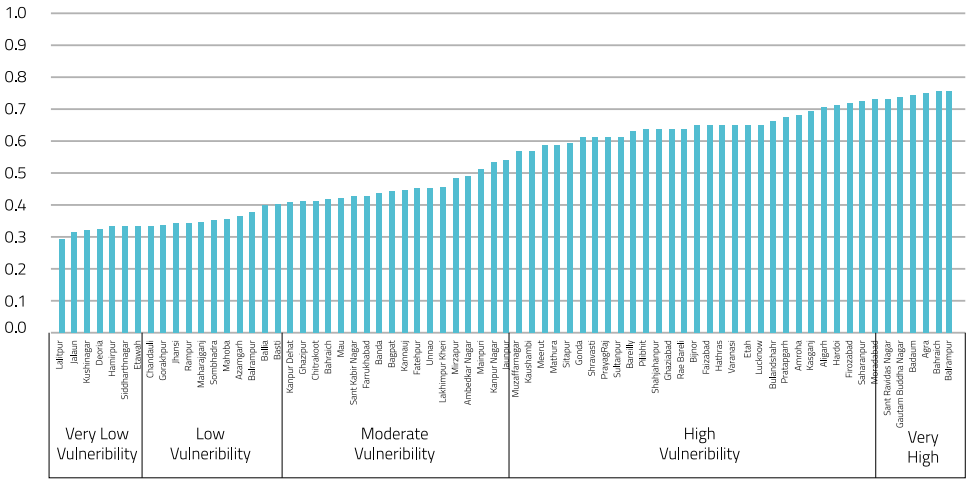


Figure 48 A: Ranking of Districts Based on a Water Vulnerability Index from Very-Low to Very-High Vulnerability.

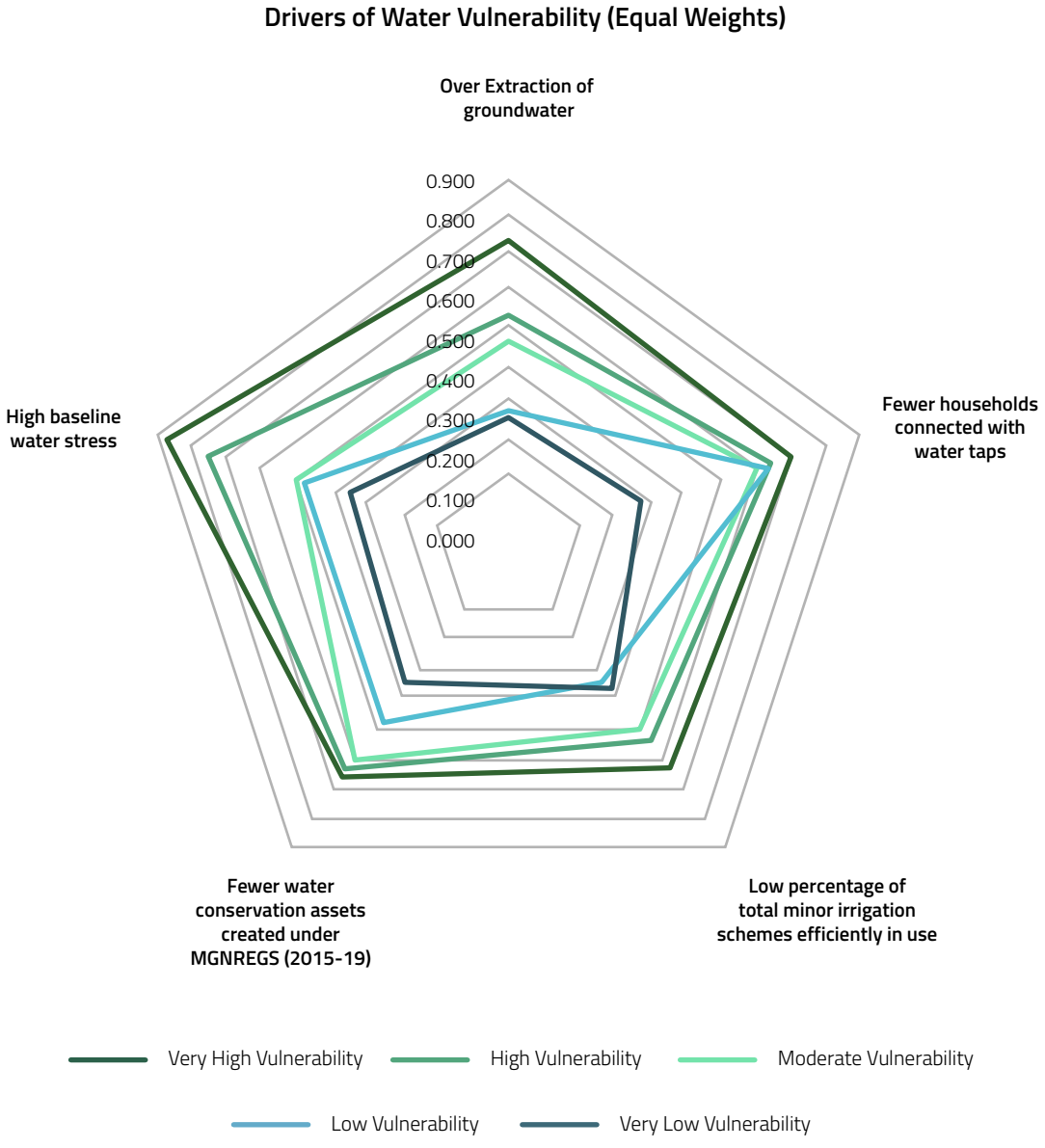


Figure 48 B: Drivers of Water Vulnerability Represented as a Radar Plot

It is clear that water demand is likely to rise across sectors as temperatures rise. While decrease in rainfall in the near future and instensification of extreme precipitation events, will lead to higher surface runoff and lower groundwater recharge across UP. The rainfall is likely to continue to fall erratically across space and time. This situation is most likely to pan out beyond the state boundaries as well.

6.2 JAL MISSION STOCKTAKING AND KEY CLIMATE RELEVANT POLICIES IN UTTAR PRADESH

In the past five years, the government of Uttar Pradesh has taken key steps towards climate change adaptation in the water sector. Some of the key actions taken are listed below:

- State government has launched an ambitious project to provide pure and safe piped drinking water to all the settlements of the rural areas of Bundelkhand/Vindhya region covering 4513 villages with total scheme cost of Rs. 10322.42 Cr.
- Groundwater projects under Jal Mission in the state:
  - Water conservation and Rain water harvesting structures – Rs 525.6 Cr during 2020-21
  - Renovation of Traditional and other Water Bodies/ Tanks – Rs 354.88 Cr during 2020-21
  - Reuse and Recharge Structures – Rs 17.61 Cr during 2020-21
  - Watershed Development – Rs 1966.72 Cr during 2020-21
  - Intensive Afforestation – Rs 192.84 Cr during 2020-21
- Implementation of Jal Mission in the state: Central Government allocated Rs. 10,870 Crore to Uttar Pradesh under Jal Mission in 2021-22
- UP Water Sector Restructuring Project– Phase II aimed to strengthen the institutional and policy framework for integrated water resources management for the entire state, and to increase agricultural and water productivity by supporting farmers in targeted irrigation areas. The total budget of the project was US$515 million, including $155 million from the UP government and $360 million from the World Bank.
- National Groundwater Management Improvement Programme (NGMIP) aims to develop robust and resilient systems to ensure long-term sustainability of groundwater resources.
- The total budget estimate for major irrigation projects, major and medium irrigation projects, minor irrigation projects and flood control and water Development projects is Rs 3209.10 Cr. The amount has been sanctioned in 2017-18.
- Command area development scheme of Rs 600 Cr was sanctioned in 2017-18, out of which 8.94 Cr were spent in 2020-21.
- Rs 0.26 Cr were spent on preparing basin plans of eight basins during 2019-20.
- Shallow, medium and deep tube well scheme was implemented under restoration project with budget of Rs 1448.12 Cr during 2013 -2020.
- Check dams under minor irrigation scheme were implemented for around Rs 440 Cr during 2013-20.

The central and state policies and schemes linked to climate adaptation and mitigation in water sector that are being implemented are as follows:

Figure 49: List of State and Central Policies and Schemes Being Implemented in UP Towards Climate Change Adaptation And Mitigation in the Water Resources Sector

6.3 PROPOSED STRATEGIES, ACTIONS AND IMPLEMENTATION SCHEDULE

Based on identified climate risks, vulnerability along with the consultations with stakeholders and experts a total of five strategies have evolved to deal with impacts of climate change in 'water sector' to deal with impacts of climate change. Across the five strategies water sector, a total of 26 action/sub-actions are proposed to be implemented till 2030 with an estimated budget of ₹ 64170.13 Cr. Details are depicted in the following table.

40 percent of proposed 25 actions are implementation activities whereas 40 percent are policy driven, resulting in the creation of holistic climate smart water strategies. In addition, considering water is a local issue, 84 percent of actions proposed are adaptation centric.

Strategy	No. of Actions	Estimated Budget (₹. in Cr)	Key Implementing and Nodal Agencies
Enhanced monitoring and research to establish water budgets and manage water at micro-watersheds	5	174.81	SWaRa, UPIWRD, Groundwater Department, National Hydrology Project (NHP), Implementation Support Agency (ISA) under JJM, Namami Gange and Rural Water Supply Department, Urban Development Dept (JJM-U), Gram Panchayats and Urban Local Bodies (ULBs), research institutes
Strengthening water sector infrastructure to adapt to climate change	3	12765.50	UPIWRD, SwaRa, WALMI UP, Minor Irrigation Department,
Enhanced water use efficiency across sectors to reduce dependency on surface water and groundwater	9	37772.37	Infrastructure and Industrial Development Dept., MSME and Export Promotion Dept, Groundwater Dept, Namami Gange, UP Jal Nigam, Industries Dept, Agri Dept., Horti Dept, NGOs, GPs, Urban Local bodies, WUA, UDD (JJM-U),
Enhanced efforts towards groundwater recharge	6	13457.45	Groundwater Dept, ., Namami Gange Agri Dept., Rural Development Dept., Fisheries Dept., Urban Dept., UPIWRD, research institutes, Local body associations
Building readiness for frequent and unprecedented floods at even non-traditional flooding regions and months	2	0.00	UPIWRD , Flood Management Information System Centre , SDMA, SDRF, IMD
Overall Estimated Budget for Jal Mission (₹. in Cr)		64170.13	

Table 39: A Snapshot of Proposed Strategies, Number of Actions, Estimated Budget and Key Agencies for Jal Mission

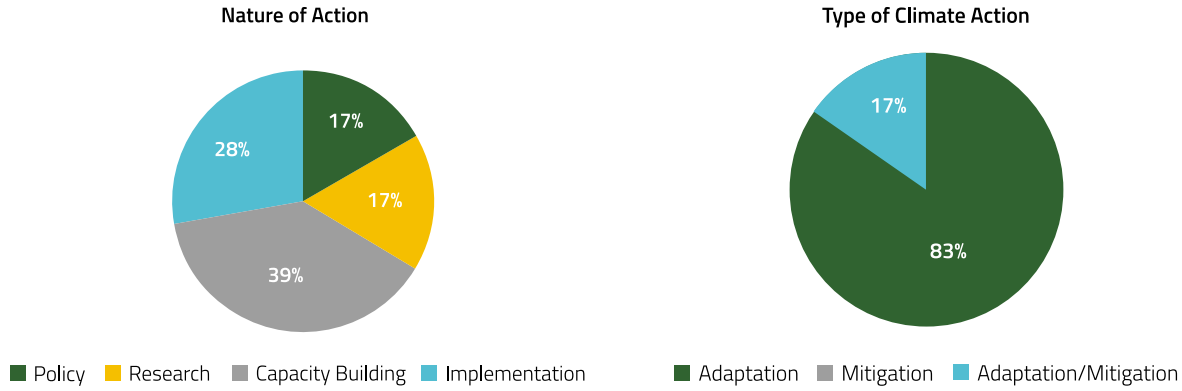


Figure 50: Distribution of Type and Nature of Actions Proposed Under Jal Mission

A summary of proposed strategies, actions, targets and other relevant information is outlined below. For a detailed list of strategies, refer to Table 82 in Annexure.

Strategy 1: Enhanced monitoring and research to establish water budgets and manage water at micro-watersheds

Strategy alignment with SDGs:	SDG 1 | SDG 2 | SDG 3 | SDG 6 | SDG 15
Strategy alignment with NDCs:	NDC 01 | NDC 06

Water availability and accessibility are the most significant factors for crop production. Addressing this issue is indispensable for areas affected by water scarcity. Annual average rainfall in Uttar Pradesh is projected to decrease by 5.37 % and 4.36 % towards near-term (2011-2040) under RCP4.5 and 8.5 scenarios respectively. Some basin studies indicate that there has been decrease in rainfall pattern since 1987. However, there are very limited studies on district rainfall trends and variability of Uttar Pradesh state (IMD Pune, 2020). To design local adaptation practices, micro watershed level studies are critical as they will help yield better empirical data and crucial contextual information. Water budgeting serves as a tool to manage the water sustainably in water stressed situation. To execute water budgeting at local level, one needs to set up hydro met monitoring stations, piezometers, and analysis centres. As the strategy focuses at the local level, gram panchayat and community's involvement is a must to develop an understanding towards judicious use of water.

Strategy 2: Strengthening water sector infrastructure to adapt to climate change

Strategy alignment with SDGs:	SDG 1 | SDG 2 | SDG 3 | SDG 6 | SDG 15
Strategy alignment with NDCs:	NDC 06

Almost 75% of the glaciers are retreating, with an average shrinkage of 3.75 km in the last 15 years (Naresh, Manas, Gupta, & Dwivedi, 2017). This could severely affect the waterflow in the rivers originating from these glaciers, and concurrently the populations that are dependent on them (Asian Development Research Institute). Studies conducted on the Ganga have projected that the mean annual runoff of the river will increase by 5% in the years 2070 – 2100. In order to build resilience of the existing dams, barrages, canals and check dams, there is a need to retrofit them to accommodate extreme rainfall as per future projections. For proper planning and execution of appropriate retrofitting exercises, it is necessary to develop the capacity of engineers working on these projects and sites. Capacity building can be done by designing certain courses for these personnel and one could make climate change and its impact on water resources an integral part of these courses.

Strategy 3: Enhanced water use efficiency across sectors to reduce surface water and groundwater dependency

Strategy alignment with SDGs:	SDG 1 | SDG 2 | SDG 3 | SDG 6 | SDG 15
Strategy alignment with NDCs:	NDC 01 | NDC 06

Groundwater systems are largely influenced by rainfall variability, which is considered the principal source of recharge. A research study was conducted to check the correlation between rainfall and groundwater in the district of Varanasi. The district experienced an annual rainfall average of 876 mm during the study period. In the recent decade (2003–2014), the amount of annual rainfall and rainy days declined by 42 mm and 8 days, respectively, when compared with previous decade (1992–2002). The water table fluctuation had also shown a decreasing trend in the recent decade, when compared with the previous decade (Dey, Mall, & Bhatt, 2020). Out of the total current annual groundwater extraction of 45.84 BCM, 4.95 BCM is used for domestic and industrial purposes (CWC, 2019). The extraction done by industries has not been specifcally measured in the state, and hence special focus should be given the water use by water intensive industries like

thermal power plants, textile, leather industries, Paper and pulp, sugar and ethanol industries, hotels, beverage, dairy, and steel mills . There should be benchmarking for use of water in the industries and best practices for enhancing water use efficiency should be promoted. There is a need to develop and implement policy for waste water reuse in water intensive industries, to promote micro-irrigation in water intensive crops and to universalise water meters and promote rooftop rainwater harvesting at household level. Emphasis should be given on educating children to enhance water use efficiency at domestic level.

Strategy 4: Enhanced efforts towards groundwater recharge

Strategy alignment with SDGs:	SDG 1 | SDG 2 | SDG 3 | SDG 6 | SDG 15
Strategy alignment with NDCs:	NDC 06

According to a report by Niti Aayog on the Composite Water Resources Management, Uttar Pradesh has mapped only 20% of overexploited and critical wells, and has not constructed appropriate recharge infrastructure (NITI Aayog, 2018). Groundwater recharge zones are often blocked and polluted as a result of poor land use planning, impacting river health and aquifers. This poses a problem on river water source and hence needs an integrated groundwater restoration plan at the state-level (Uttar Pradesh State Water Policy, 2020). Special attention needs to be paid to develop and implement groundwater recharge plans in industrial clusters in overexploited and critical blocks. Action plans to limit groundwater use should be in place especially in those districts where there is problem of water quality. Under Jal Mission, particular attention needs to be given to conserving recharge sources, especially where drinking water is largely drawn from groundwater.

Strategy 5: Readying for frequent and unprecedented floods at even non-traditional flooding regions and months

Strategy alignment with SDGs:	SDG 1 | SDG 2 | SDG 3 | SDG 6 | SDG 15
Strategy alignment with NDCs:	NDC 06

State wise examination of flood frequency data for 1986-2003 and 2006 to 2016 showed that in the Ganga River basin, floods are most common in Uttar Pradesh, Bihar and Gangetic West Bengal (Shelar & Nandargi, 2018). During the monsoon season, rivers in Uttar Pradesh cause floods and damage crops, property, and human and animal lives. As per data from 2018, the total damage caused due to flood in Uttar Pradesh amounted to Rs. 547.42 crore, with 105 human lives lost, 149 cattle lost. 28063 houses damaged, and 0.38 Mha of crops damaged, affecting a total population of 0.59 million (CWC, 2019). An integrated plan on real time flood forecasting should be in place to reduce the losses caused by flash floods. A proper communication channel and timely coordination plan needs to be established between the neighbouring states to get accurate information on flood warnings for all rivers and their tributaries that flow through Uttar Pradesh. It has become essential to develop a system of hydro-meteorological observations and transmission of real time data through automatic sensors and satellite based transmissions between the shared transboundary river basins of India and Nepal. This will help one take appropriate decisions for downstream regions in the face of unprecedented floods.

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹. in Crores)
1. Enhanced monitoring and research to establish water budgets and manage water at micro-watersheds			
1.1	Study impacts of climate change on water resources in UP. Study at 10km X 10km resolution. Assessment to be completed by 2025.	UPIWRD, Minor Irrigation, research institutes (e.g. IITs, BHU)	2.50
1.2	Setup hydro-met monitoring stations to capture the high spatial variability in rainfall observed across UP; targeted installation of 50 % of all instruments to be completed in phases (till 2025 and till 2030): 200 Soil Moisture Sensor, 15 Automatic Water Quality Sensor (AWQS), 20 Water Quality Analyser	UPIWRD, Minor Irrigation	1.50
1.3	Increase the density of piezometer and observation wells to measure groundwater levels in each micro-watershed (21278); 4,062 piezometers, i.e. 100% installation, to be completed by 2025.	Groundwater Department, Minor Irrigation	42.31

Table 40: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹. in Crores)
1.4	Estimate water budget for baseline and future climate projections & development needs (for the entire state); assessment to be completed by 2025	UPIWRD, Implementation Support Agency (ISA) under JJM	2.50
1.5	Involve Gram Panchayats(GP) and urban communities and stakeholders to develop their own local water budgets for judicious use across sectors; all gram panchayats and urban centres to be covered; Cover 3,894 urban centres as per 2011 census; Gram Panchayat level water budgets for 29,582 out of 59,163 GPs till 2025; complete the rest by 2030	Namami Gange (JJM-R) and Urban Development Dept (JJM-U),Groundwater Department, Department of Panchayati Raj and ULBs	126.00
2. Strengthening water sector infrastructure to adapt to climate change			
2.1	Develop guidelines for building climate resilient large dams, barrages, canals and check dams and for retrofitting exiting ones in the state to accommodate extreme rainfall as per the future projections; develop courses on the guidelines to study the impacts of climate change on water resources in UP; all engineers in the public and private sectors involved in these works will be encouraged to take the courses and will get certified. Course Design to be completed within 2021-22, and thereafter trainings to start and to be continued.	UPIWRD, SWaRa, WALMI (UP)	1.00
2.2	Correction of system deficiencies for equity of canal water by restoring the canal/drain section for present availability of rainwater, surface water, groundwater and specifically study existing cropped areas, cropping intensity and future possible trends	UPIWRD	12761.00
2.3	Map the retrofit requirement of check dams constructed as per the future projections of rainfall , to make them climate resilient; Undertake retrofitting- there are over 3,567 check dams in the State.	Minor Irrigation Dept.	3.50
3. Enhanced water use efficiency across sectors to reduce surface water and groundwater dependency			
3.1	Study water use in water intensive industries in UP (the top water intensive industries); thermal power plants, textile, leather industries, paper and pulp, sugar and ethanol industries, hotels, beverage, dairy, and steel mills	Groundwater Department , Industries, Universities and technical institutes	5.00

Table 40: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹. in Cr)
3.2	Catalogue best practices in improving water use efficiency to optimize productivity by industry type; undertake wide dissemination through dialogues with industries to set roadmaps to improve water use efficiency in the industries to the best possible level; set level of water use by industries, especially water intensive industries in the state, like thermal power plants, textile, leather industries, paper and pulp, sugar and ethanol industries, hotels, beverage, dairy, and steel mills	Infrastructure and Industrial Development Dept., MSME and Export Promotion Dept. , Groundwater Department, Industries, Universities	1.80
3.3	Based on benchmarking the best practices in water intensive industries fix their limit of groundwater extraction; monitor water use through smart water meters to enforce regulation as and when necessary; cover all basins with development of policy (to be completed by 2025) and implementation (to be done by 2030)	Groundwater Dept.	--
3.4	Develop and implement policy for waste water re-use in water intensive industries; Cover all basins with development of policy (to be completed by 2025) and implementation (to be done by 2030)	Namami Gange, UP Jal nigam, Urban Development Dept., Industries Dept	--
3.5	Promote micro irrigation practices (such as sprinkler, drip irrigation) in agriculture; cover 11,79,871.5 ha in all basins; Drought-prone districts to be covered by 2025 and the rest to be covered by 2030	UPIWRD, Agriculture Dept, Horticulture Dept	5177.87
3.6	Design and undertake Information, Education and Communication(IEC) for efficient water use for domestic use (school education/women self-help groups); to target households with direct to home water access in rural and urban areas; IECs to be designed and implemented by 2025, and thereafter to be continued with	Namami Gange (JJM-R) and UDD (JJM-U), NGOs, GPs, Urban Local bodies, WUA.	2.00
3.7	Universalize water meters at the household level – both rural and urban with differentiated pricing mechanisms fixed by a regulator; Cover 100 % of total households (2,64,27,705) in UP, with urban areas to be covered by 2025 and rural areas to be covered by 2030	Namami Gange (JJM-R) and UDD (JJM-U)	26427.70
3.8	Promote reuse and recycle of wastewater in residential societies (all residential societies generating wastewater greater than 0.5 MLD); Integrate this within permission for building plans and completion certificates	Urban Development Dept., Jal Nigam, ULBs	--
3.9	Ensure rooftop rainwater harvesting in existing and planned institutional (Govt. /Semi-govt.) and commercial buildings in rural and urban areas with plot sizes greater than 300 m^2 (integrate it within permission for building plans and completion certificates); cover urban areas by 2025 and the rural areas of the state by 2030	Urban Development Dept and Namami Gange Dept , Jal Nigam, ULBs	6158.00
4. Enhanced efforts towards groundwater recharge			
4.1	Develop and implement groundwater recharge plans in industrial clusters; all industrial clusters located in overexploited and critical blocks to be covered	Groundwater Dept	21.50

Table 40: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹. in Cr)
4.2	Develop action plans for limiting Groundwater(GW) extraction for irrigation and domestic use in 35 districts reporting salinity, nitrate pollution, heavy metals, and bacterial development; action plans to be developed by 2025 and implementation to happen thereafter	Groundwater Dept, Agriculture Dept, Urban Development Dept	--
4.3	Conduct assessment to identify potential sites for GW recharge by flood water in over-exploited and critical GW areas of UP (inter river and canal transfers) such as eastern districts of UP like Deoria, Mau, Ballia, Ghazipur, Jaunpur, Varanasi etc; feasibility study to be completed by 2025, thereafter pilot study to be scaled up in other sub basins with surplus flood water	Groundwater dept., UPIWRD, Research institutes, Local body associations	1.00
4.4	Design and implement GW recharge mechanism appropriate for all existing and upcoming GW based water supply systems (existing and under pipeline) in UP, both rural and urban; overexploited and critical blocks to be covered by 2025, and critical and safe blocks to be covered till 2030	Groundwater Dept.	7134.95
4.5	Develop and implement holistic wetland recharge measures across UP also covering channels feeding into it (95876.33 ha in all 8 basins); major basins like Ganga, Yamuna, Rapti to be covered till 2025; other basins to be covered by 2030	Forest Department, Wetland Board, Groundwater Dept	6300.00
4.6	Form Wetland User Association Bodies at local level for management and governance (community ponds and lakes) in all basins; major basins like Ganga, Yamuna, Rapti to be covered till 2025; other basins to be covered by 2030	Forest Department, Wetland Board	--
5. Readying for frequent and unprecedented floods in non-traditional flooding regions and months			
5.1	Initiate coordination between Indian neighboring states to access rainfall and flash flood data on a real time basis for all the rivers and their tributaries that flow into Uttar Pradesh; relevant MoUs between all neighbouring states and all relevant river basin agencies to be finalised, and implementation of plan, dissemination of data to downstream local bodies and public to be ensured till 2030	UPIWRD, Flood Management Information System Centre	--
5.2	Developing a system of hydro-meteorological observations and transmission of real time data through automatic sensors and satellite based transmission between the transboundary river basins (like Gandak, Ghagra, Gomti and Rapti) between India and Nepal in order to take appropriate decisions for downstream regions for unprecedented floods; develop mechanism for transboundary data sharing by 2025 and thereafter ensure implementation of plan and dissemination of data to downstream local bodies	UPIWRD, SDMA, IMD	--

Table 40: Summary of Proposed Actions and Estimated Budget Required

Chapter 7

Green UP Mission

Climate change poses significant threat to wildlife, biodiversity, flora and fauna, many of which are already threatened by extinction. However, Uttar Pradesh targets conservation and sustainable utilisation of its land, forest, wetland and biodiversity resources. The Vision 2030 document outlines that Uttar Pradesh endeavors to adopt forest management and conservation practices for large scale plantations with an objective to increase green cover of the state while supporting sustainable harvesting of goods and services from biological resources (Sustainable Developement Goals- Vision 2030).

Green UP Mission derives its mandate from National Mission for Green India (GIM). The mission covers forest and biodiversity conservation-related aspects along with enhancement of livelihood of forest dependent communities and reducing pressure on forest resources. The objective is to safeguard biological resources and the associated livelihoods within the state from the adverse effects of climate change. This chapter throws light on climate risks and mitigation opportunities across forestry sector, takes stock of the ongoing interventions and provides a list of climate adaptation and mitigation actions for the sector.

7.1 RISK ASSESSMENT AND MITIGATION OPPORTUNITY

7.1.1 Climate Risks and Impacts

Climate is one of the most important determinants of vegetation patterns globally and has significant influence on the distribution, structure and ecology of forests. Moreover, several climate vegetation studies across the globe have shown that certain climatic regimes are associated with particular plant functional types (Thornthwaite, 1948; Ravindranath, Joshi, Sukumar, & Saxena, 2005). A larger study within the country has carried out an assessment about the inherent vulnerability of forests under current climate, using four indicators, namely biological richness, disturbance index, canopy cover, and slope. The results suggest that 40 % forest grid points in India show high or very high inherent vulnerability. These results of inherent vulnerability assessment have been studied in combination with climate change impact projections simulated within the Integrated Biosphere Simulator Dynamic Global Vegetation model. The results suggest that 46 % forest grid points show high, very high, or extremely high vulnerability under future climate in the short term (2030s) under both RCP 4.5 and 8.5, whereas 49 % and 54 %, grid points in the long term (2080s) (Sharma, et al., 2017).

Another phenomenon that is being spurred by the warming effects of climate change are wildfires. In the summer months, they are becoming increasingly frequent across the country. ISFR (2021) has mapped climate hotspots across states. The projections under RCP 4.5 and RCP 8.5 outline that 890 km^2 and 8526 km^2 of forest cover, respectively, will become climate hotspots in the state of Uttar Pradesh (ISFR, 2021). Forest fires result from a combination of natural and social factors. Seasonal weather patterns influence the onset, duration, and severity of the fire season. Additionally, shifts in climate caused by anthropogenic pressures may further alter Uttar Pradesh's forest landscape and fire regime. Fuel loads within the forests, such as grasses, ground litter, small shrubs, living and dead trees, and decomposing humus in soils also determine the potential for fires to ignite, grow, intensify and spread (the World Bank, 2018). ISFR (2021) outlines that approximately 1.41 % of total forest cover in Uttar Pradesh is extremely fire prone, an area of 209.30 km^2.

There is also an increasng risk of forest fragmentation, amongst others. The isolated forest fragments tend to lose carbon through fires, edge-related mortality as well as the loss of large-bodied dispersal agents. With significant local impacts, the forest fragments affect climate through their biophysical impacts on land-surface processes. In addition, the gaps between fragments reduces the ability of forest species to track climate change by movements along climate gradients (Corlett, 2014). Tree mortality has been observed as one of the key risks and has been attributed in some cases to direct climate effects and indirect effects due to pests and diseases. Dead trees further increase the risk of forest fires as well. (IPCC, WG II- Chapter 4- Terrestrial and Inland Water Systems, 2014). In addition, increased variability of rainfall, rising average temperatures, increased frequency and severity of storms, increased atmospheric greenhouse gas concentrations, and rising sea level, not only makes way for invasive species but can also enhance their invasive potential. Table 41 outlines key climate risks to forestry and biodiversity sector, the systems impacted and the recent indications from literature.

Climate Risk	System Impacted	Findings and Recent Incidents	Source
Increasing Temperature; High Temperature Variability	Forest grids (including vegetation) Forest type Biodiversity	• By 2030, it is projected that, out of the 752 forested grids in Uttar Pradesh, 53 forested grids will be impacted by climate change. • Change in forest types is projected in the southern part of Chandauli, Chitrakoot and Mirzapur, north-western part of Kheri, Sonbhadra and parts of Pilibhit, Agra and Lalitpur districts • Pre-monsoon season is the peak fire seaon in Uttar Pradesh; an increase in forest fire incidence due to projected increase in pre-monsoon maximum temperature by 1.35^{0}C under RCP 4.5 • Fragmentation of forests, changes in species composition and decrease in biodiversity, and an increase in invasive species	Sustainable Developement Goals- Vision (2030); Satendra & Dev Kaushik (2014)
Uneven Precipitation; Intense Rainfall Spells	Species composition (both flora and fauna) Wildlife habitat Wetlands	• Diminishing ecosystem services provided by tree cover, such as CO_2 sequestration • Alteration in hydrology, biochemistry and functions of wetlands; loss of aquatic biodiversity • Changes in species composition and decrease in biodiversity • Increase in invasive species	Corlett (2014); (Salimi, Almuktar, & Scholz, 2021)
High Temperature and Precipitation Variability causing Drought like situation	Pasturelands	Occurrence of drought and flood are regular features in many districts of the state, aggravating the deficit of feed and fodder	ICAR-IGFRI (2021)

Table 41: Evidence-based Mapping of Climate Risks and Impacts on Forestry Sector

7.1.2 Inherent Vulnerability

A vulnerability assessment of the forest sector was conducted at district-level using the IPCC AR5 methodology. Three indicators were considered to assess forest vulnerability and were designated either as sensitivity indicators or as adaptive capacity indicators , along with a provision of their rationale. Based on the assessment, 55 districts districts of the state were classified as falling under moderate to very high vulnerable class. The dominant drivers fueling vulnerability being high per capita consumption of firewood, reduction in forest areas and low per capita availability of forests.

As a relative measure, the assessment implies that some districts are more vulnerable than others. The percentage contribution of an indicator to vulnerability index (for each vulnerability class) was obtained by considering the average normalized indicator values. The result is presented as a graph (Figure 51) below. In the radar plot (Figure 52) the spokes of the plot represent the magnitude of each indicator in driving vulnerability- further away from the centre of the plot, more strongly does the indicator drive vulnerability. A detailed sectoral vulnerability assessment can be referred to in Section 4.4 of Chapter 4.

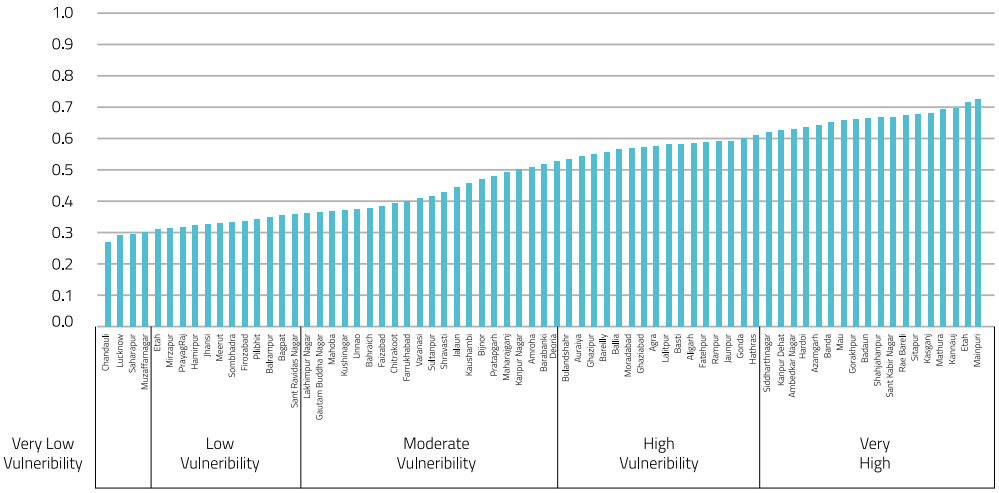


Figure 51 a : Ranking of Districts Based on a Forest Vulnerability Index From Very Low to Very High Vulnerability

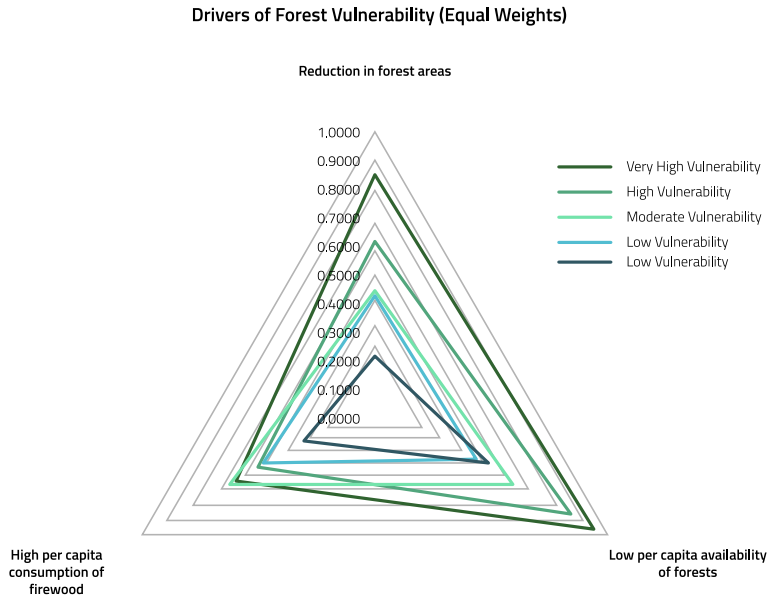


Figure 51 b: Drivers of Forest Vulnerability Represented as a Radar Plot

7.1.3 Mitigation Opportunity

The LULUCF sector, which includes GHG emissions and removals associated with forestry and land-use change, is the only sector that consistently absorbs CO_2 in the country, making it one of the most relevant for its mitigation potential. This sector removed 15% of the country's carbon dioxide emissions in 2016. In the same year, its emissions reached -3,07,820 GgCO2 eq., increasing its status as a sink by 2.2% since 2014. Studies suggest that Uttar Pradesh has a potential carbon sink of 104.91-177.69 million tonnes CO_2 eq. (FSI, 2019).

As per ISFR 2021 assessment, Uttar Pradesh has a forest cover of 14817.89 sq. km. Reporting a marginal increase of 0.08% from 2019 assessment (14805.65 sq.km area). The total carbon stock reported in Uttar Pradesh is 117,241 thousand tonnes recording an increase of 1.34% from 115690 thousand tonnes in assessment year 2019, meaning addition of a total sink of 5.68 MtCO2e . Uttar Pradesh has undertaken various plantation drives in the state under various schemes such as the National Afforestation Programmes, CAMPA, etc. The Harit Path (Green Way) Mobile app has also been made operational from 21 August 2020. Uttar Pradesh reported the maximum number of plantations done in a state within the country- over 0.5 million plants. Additionally, 620 ha of area was planted under the national mission for clean Ganga in 2017-18. GHG mitigation options in Forestry Sector are given in Figure 53.

7.2 GREEN UP MISSION STOCKTAKING AND KEY RELEVANT POLICIES IN UP

Key interventions undertaken towards climate change adaptation and mitigation include:

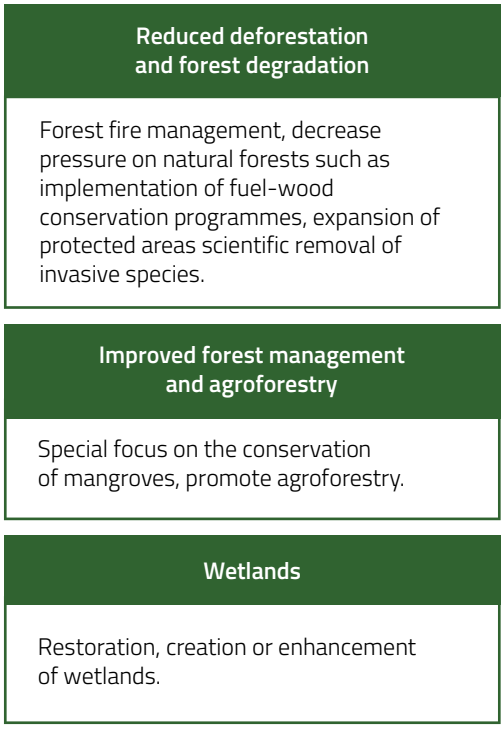


Figure 52 : GHG Mitigation Options in Forestry sector

- As per information shared by Department of Environment, Forest and Climate Change , the following programmes have been implemented in the state with an objective to increase areas under forest: Social Forestry, Social Forestry in Urban areas, Nursery Management Plan, Sub-Mission on Agroforestry, National Bamboo Mission, Namami Gange, NAFCC Project, CAMPA, Vanavaran Sanvardhan Pariyojna, Total Forest Cover Plan, Intensification of Forest management, UP Participatory Forest Management & Poverty alleviation Project (JICA), Green Belt development Plan, National Afforestation Plan, Forest Fire Prevention and Management Scheme, etc.

- SDG Vision 2030 report of Uttar Pradesh outlines that Over 10 lakh saplings were planted at ten locations in the state in 'Clean UP, Green UP' campaign launched during November, 2015. In addition, during July 2016, the state entered the Guinness World Recording for planting 50 million trees on a single day, including 80 species (Sustainable Developement Goals- Vision 2030)

- Forest Fire Prevention and Management Scheme is a central scheme that has been implemented in the state to minimise forest fire incidences and assist in restoring productivity of forests in affected areas. Under the scheme, a total of Rs. 128 lakhs have been allocated to Uttar Pradesh during the year 2017-18 (MoEFCC, 2018).

- A total 1,29,59,693 LPG connections have been released as on 22-05-2019, to BPL households under PM Ujjwala Yojana. Recently, PM Ujjwala 2.0 Yojana has been launched by Prime Minister Narendra Modi from Mahoba, Uttar Pradesh on 10 August 2021 (MoPNG, 2019)

- As per information shared by Department of Environment, Forest and Climate Change , the following programmes have been implemented in the state: National Plan for Conservation of Aquatic System and Wetland Development. Between 2013-14 to 2019-20, conservation of 13 wetlands in Forest area/ Protected area has been done.

- At present, the state has a total of 59407 BMCs formed, which is the highest in the country (NBA, 2021)

- **In Uttar Pradesh, achievement under National Bamboo Mission during 2019-20 is outlined as follows :**

Districts	Physical Achievement (ha)	Financial (Amount in ₹.)
2019-20		
Mirzapur	1	16,00,000
Sonbhadra	23	42,00,400
Total	24	58,00,400

Source: Achievement Under National Bamboo Mission (2019)

The central and state policies linked to climate adaptation and mitigation in Forestry and biodiversity sector that are being implemented are as follows:

- Sub-Mission on Agro-forestry
- National Bamboo Mission
- State Forest Policy (2017)
- Uttar Pradesh Eco-Tourism Policy (2014)
- CAMPA
- Social Forestry Scheme
- Social Forestry in Urban Areas Scheme
- Van Mahotsav
- Tree Plantation Scheme
- Forest Conservation Development and Sustainment Scheme
- Development and Strengthening of Forest Parks Scheme
- Nursery Management Plan
- Integrated Development of Wildlife Habitat Scheme
- Project Tiger
- Project Elephant

Figure 53 : Central and State Policies Being Implemented that are Linked to Climate Adaptation and Mitigation in Forestry And Biodiversity Sector

7.3 PROPOSED STRATEGIES, ACTIONS AND IMPLEMENTATION SCHEDULE

A total of 5 strategies have been evolved in consultation with stakeholders and experts for Green UP Mission, based on identified climate risks, vulnerability. Across the 5 strategies, a total of 20 actions are proposed to be implemented till 2030 with an estimated budget of ₹ 6,292.68 crore Table 42.

Strategy	No. of Actions	Estimated Budfet (₹. in Cr)	Key Implementing and Nodal Agencies
Restore & improve quality of forest cover and increase area of Trees Outside Forest (ToF)	6	4128.97	Department of Environment, Forest and Climate Change
Enhance tree cover in Urban and Peri-Urban areas (including institutional lands)	2	334.76	Department of Environment, Forest and Climate Change
Improve incomes of forest dependent population through agroforestry and food forests in private and community land	4	700.25	Department of Environment, Forest and Climate Change , Agriculture Department, Horticulture Department, Animal Husbandry Department, UPFC
Conservation of wetlands	1	753.20	Department of Environment, Forest and Climate Change , State Forest Research Institute, State Biodiversity Board and U.P State Wetlands Authority
Biodiversity Conservation	7	375.50	Department of Environment, Forest and Climate Change and State Biodiversity Board
Overall Estimated Budget for Green UP Mission (₹ in Cr)		**6292.68**	

Table 42: A Snapshot of Proposed Strategies, Number of Actions, Estimated Budget and Key Agencies for Green UP Mission

The proposed activities are categorized into two classes, based on their type of climate actions i.e., adaptation centric, mitigation centric or both; and based on the nature of actions i.e., implementation, policy, research, and Capacity building. Figure 54 shows that 50 percent of the proposed actions are mitigation actions, 20 percent are adaptation actions and 30 percent are both mitigation/adaptation actions. Further, 60 percent of the proposed actions are implementation actions, 20 percent are policy actions, 15 percent are research-oriented actions and 5 percent of the actions are for capacity building.

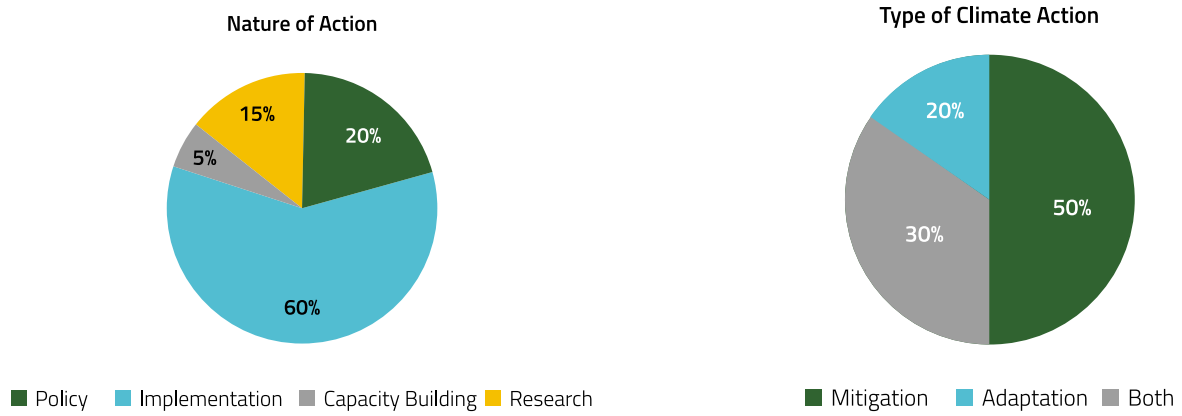


Figure 54: : Distribution of Type and Nature of Actions Proposed Under Green UP Mission

A summary of proposed strategies, actions, targets and other relevant information is outlined below. For a detailed list of strategies, refer to Table 81 in Annexure.

Strategy 1: Restore & improve quality of forest cover and increase area of Trees Outside Forest (ToF)

Strategy alignment with SDGs: SDG 13 | SDG 15
Strategy alignment with NDCs: NDC 01 | NDC 05| NDC 06

Climate change is resulting in degradation of forests and impacts biodiversity due to changes in temperature and rainfall patterns. Therefore, there is a need to ensure forest conservation by increasing the tree cover substantially depending upon the availability of land for plantation and financial resources. The strategy will focus on restoring and enriching moderately dense and open forest cover, protected areas, gullied and ravinous area reclamation and provision of clean cooking fuels. This will include plantation of indigenous species and/or regeneration of root stock along with indigenous grasses and shrubs. Natural regeneration should be initiated once moisture retention and percolation status is improved. Such areas will be subjected to gap plantation of multi-purpose tree species. Technology based plantations of fuel-wood, fodder, NTFPs, artisanal raw material and small timber yielding species should be promoted on a three-tier basis. It has also been suggested during the workshop that restoration should include three aspects, i.e., natural regeneration, assisted natural regeneration and artificial regeneration. Seed based regeneration also needs to be considered. This should also be accompanied with an effective community-based forest management, where participation of women is encouraged. In most forest dependent communities, women are the primary collectors of forest produce. Thus their familiarity with the terrain, lived and traditional knowledge of the forests can help the government in sustainably managing these forests.

Strategy 2: Enhance tree cover in Urban and Peri-Urban areas (including institutional lands)

Strategy alignment with SDGs: SDG 13|SDG 15
Strategy alignment with NDCs: NDC 01 | NDC 05| NDC 06

There is a need to ensure mass afforestation programmes in non-forest area. For this purpose, it is essential to undertake large scale plantations for increasing the green cover and strengthen the infrastructure in terms of hi-tech nurseries to ensure the supply of quality planting material. The actions under this strategy include plantations on non-forest lands and strengthening of nursery infrastructure.

Strategy 3: Improve incomes of forest dependent population through agroforestry and food forests in private and community land

Strategy alignment with SDGs: SDG1 | SDG2 | SDG 13 | SDG 15
Strategy alignment with NDCs: NDC 05

Given the impacts of climate change on forest productivity and forest-dependent communities, there is a need to not only ensure conservation and restoration of green cover, but also encourage participation of local communities, especially women, to achieve broad-based benefits. The

strategy focuses on sustainable practices such as agro-forestry plantations (including poplar plantation), setting up food forests, cultivation of medicinal and aromatic plants, certification of forest produce, engagement with carbon markets as well as setting up MSP for various produce,

Strategy 4: Conservation of wetlands

Strategy alignment with SDGs: SDG 1|SDG 7|SDG 15
Strategy alignment with NDCs: NDC 01 | NDC 05| NDC 06

Climate change is resulting in degradation of wetlands, impacting aquatic biodiversity. In order to achieve its goal of protecting, restoring and promoting sustainable use of terrestrial ecosystems, the state needs to target conservation and sustainable utilisation of wetlands and conservation of aquatic biodiversity resources. The strategy focuses on documenting the status of wetlands in terms of water resources, including aquatic biodiversity as well as site specific restoration.

Strategy 5: Biodiversity Conservation

Strategy alignment with SDGs: SDG 1|SDG 7|SDG 15
Strategy alignment with NDCs: NDC 01 | NDC 05| NDC 06

Climate change poses significant threat to wildlife, biodiversity, flora and fauna, many of which are threatened by extinction. The Convention on Biodiversity has linked biodiversity conservation to the development process, fair and equitable sharing of benefits from sustainable use of genetic resources. The strategy proposes to work towards halting biodiversity loss and conserve endangered species (flora and fauna), ex-situ conservation, restoration plans for areas infested by invasive species, training of BMCs and backing up of PBRs by scientific surveys.

S.No.	Strategies/ Actions	Nodal & Implementing Agencies	Estimated Budget Requirement (₹ in Cr.)
1. Restore & improve quality of forest cover and increase area of Trees Outside Forest (ToF)			
1.1	Enhance quality of Open Forest cover and ecosystem services in Uttar Pradesh. A total of 4081 sq.km area to be restored in the following manner: a) Demarcate area to be restored around villages subjected to intense biotic pressure and unsustainable extraction of forest produce b) Assess extent of drivers of degradation and deforestation; root stock density situation c) Design appropriate restoration plans d) Undertake restoration of at least 25% of the demarcated area (1020 km^2) e) Undertake restoration in the remaining 75% of the demarcated area (3061 km^2)	Department of Environment, Forest and Climate Change	1306.00
1.2	Undertake conservation and sustainable management of moderately dense forest areas showing degradation; a total of 4029 km^2 area to be restored	Department of Environment, Forest and Climate Change	604.00
1.3	Enrich protected areas; for this 50% of the protected area, i.e., 3221 km^2 needs to be covered	Department of Environment, Forest and Climate Change	1030.00
1.4	Enable assisted migration of tree species having conservation, economic, and social values to conducive locations; at least 5 species in each of the 9 agro-climatic zone (total 45 species) for plantation/ propagation needs to be identified, in consultation with in-house research and other research organisations	Department of Environment, Forest and Climate Change and State Forest Research Institute	8.00

Table 43: Summary of Proposed Actions and Estimated Budget Required for Green UP Mission

S.No.	Strategies/ Actions	Nodal & Implementing Agencies	Estimated Budget Requirement (₹ in Cr.)
1.5	Continue gullied and ravinous area reclamation to stop further ingress of ravines into the non-ravine farmland. A total of 1065 sq. km of wasteland area to be targeted in Chitrakoot, Banda, Mahoba, Hamirpur, Jalaun, Jhansi and Lalitpur	Department of Environment, Forest and Climate Change	745.50
1.6	Ensure access to clean cooking fuels such as LPG/ biogas/ solar cooker /electric convection stoves to fuelwood dependent households. All households(HHs) in forest fringe villages of the state need to be covered (18,93,358 HHs)	Environment, Forest and Climate Change Department and UPNEDA	435.47
2. Enhance tree cover in urban and peri-urban areas (including institutional lands)			
2.1	Undertake tree plantation along avenues, in private land including households and institutional land. In the UP SDG Vision 2030, an overall target of 150000 tree plantations has been put forward	Environment, Forest and Climate Change Department and Urban Development Department	0.79
2.2	Develop high-tech and satellite nurseries for generating quality plant material for tree plantations outside forests	Department of Environment, Forest and Climate Change	333.97
3. Improve incomes of forest dependent population through agroforestry and food forests in private and community land			
3.1	Support agro-forestry plantations on farmer and community land and link it to established carbon markets to supplement farmers' incomes; a total of 8 Cr. saplings need to be planted	Environment, Forest and Climate Change Department, Agriculture Department, Horticulture Department, Animal Husbandry Department	560.00
3.2	Encourage food forests in marginal farmers' land to ensure harmonious integration of landscape and people — providing their food, energy, shelter, and other material and income needs in a sustainable way; a total of 2 Cr. saplings need to be planted	Department of Environment, Forest and Climate Change , Agriculture Department, Horticulture Department	140.00
3.3	Fix Minimum Support Price (MSP) for different agro-forestry species produce (NTFP, wood); set the MSP pricing policy for 10-15 remunerative agroforestry species, including teak, eucalyptus and poplar, along with buy-back arrangement with UPFC	Environment, Forest and Climate Change Department and UPFC	0.25
3.4	Ensure compliance with NCCF-STD-01 Forest Management Certification Standard of all forest divisions in UP; Currently, the scope of certification has been identified across 41 forest divisions covering terrestrial and social forestry areas extending over 450408 ha; rest of the 13 forest land under forest divisions to be covered	UPFC and Department of Environment, Forest and Climate Change	-

Table 43: Summary of Proposed Actions and Estimated Budget Required for Green UP Mission

S.No.	Strategies/ Actions	Nodal & Implementing Agencies	Estimated Budget Requirement (₹ in Cr.)
4. Conservation of wetlands			
4.1	Map, restore, conserve and monitor all natural wetlands. Under this action, all natural wetlands, covering lakes and ponds need to be focused	Department of Environment, Forest and Climate Change , State Forest Research Institute, State Biodiversity Board and U.P State Wetlands Authority	753.20
5. Biodiversity Conservation			
5.1	Conserve endangered species in UP as per the IUCN Red List. Biodiversity conservation to be done through preparation of Endangered Species Recovery Plans, in the following manner: a) Prepare the priority list of endangered species (2022) b) Develop Endangered Species Recovery Plans (2022-2024) c) Implement plans (2026 onwards)	Department of Environment, Forest and Climate Change and State Biodiversity Board	10.00
5.2	Promote conservation of biodiversity on common lands in rural areas; training of all 59407 BMCs to be done in the following manner: a) Develop training modules for BMCs in 2022 b) Continue training 2023 onwards	Department of Environment, Forest and Climate Change , State Biodiversity Board and Urban Development Department	59.00
5.3	Ensure ex-situ conservation via multiplication of rare, endangered and endemic tree species; this will include identification of at least 5 species in each of the 9 agro-climatic zone (total 45 species) for plantation/ propagation, in consultation with in- house research and other research organisations	Department of Environment, Forest and Climate Change and Institute of Forest Genetics and Tree Breeding	The budget will be subsumed from the activity designed and mentioned above for assisted migration of tree species
5.4	Develop Restoration Plan for area infested by invasive alien species; build capacity of locals to harvest and recycle invasive in UP forests to useful products such as briquettes; cover total recorded area for invasive species (ISFR 2019): 1,24,800 ha	Environment, Forest and Climate Change Department and NABARD	17.00
5.5	Periodic scientific surveys to supplement PBRs (59407 in total)	Department of Environment, Forest and Climate Change and State Biodiversity Board	118.00
5.6	Conservation of Biodiversity Heritage Sites (BHS); Conservation funding through eco-tourism in these sites; this needs to be done in the following manner: a) Priority BHSs identification (2021) b) Development of BHSs (2022-2026) c) Ecotourism model development for BHSs conservation (2022-2026) d) Generate revenue and undertake BHSs conservation	Department of Environment, Forest and Climate Change and State Biodiversity board	50.00
5.7	Conserve climate resilient seeds grown in community owned open field seed banks. The proposed target is to set up 3 field seed banks in each of the 9 agro-climatic zones	Forest Department and State Biodiversity board	121.50

Table 43: Summary of Proposed Actions and Estimated Budget Required for Green UP Mission

Chapter 8

Enhanced Energy Efficiency and Green EnergyMission

8.1 A BRIEF ON THE ENERGY SECTOR IN UTTAR PRADESH

Uttar Pradesh is the most populous state in India with about 16.5% of the national population, consuming about 8% of electricity generated in the country. In fiscal year (FY) 2019, Uttar Pradesh procured 108.3 terawatt-hours (TWh) of electricity and peak demand reached 20,062 megawatts (MW). Electricity sales reached 88.6 TWh, representing distribution losses of 18.2% of purchased electricity. Per capita electricity consumption in Uttar Pradesh is about 400 kilowatt-hours (kWh), compared with national per capita consumption of 960 kWh in FY2018. The cumulative average growth rate of quantity of electricity purchased (8.7%), electricity sales (6.7%), and peak demand (11.0%) grew notably from FY2015 to FY2019 (Central Electricity Authority, 2021).

The total installed capacity for generating electricity in Uttar Pradesh as of March 2021 was 30042.60 MW, of which the share of electricity generated from fossil fuel was around 73%, the rest 3878.86 MW was from hydro, solar, bioenergy and nuclear. According to the Report on Performance of State Power Utilities, the highest share of electricity was provided to the domestic sector (44.87%), followed by Industry (18.58%), Agriculture (18.28%), Commercial (9.31%) and Others (8.96%) (PFC India, 2020).

8.2 CLIMATE RISK AND VULNERABILITY

Analysis of climate data for Uttar Pradesh for the period 1981-2019 indicates that the temperature in the state has risen by 0.6°C. Climate projections indicate further rise in temperature, with increase in extreme heat days, extreme cold, flooding, increasing frequency of droughts etc. These conditions are highly likely to affect fossil fuel based

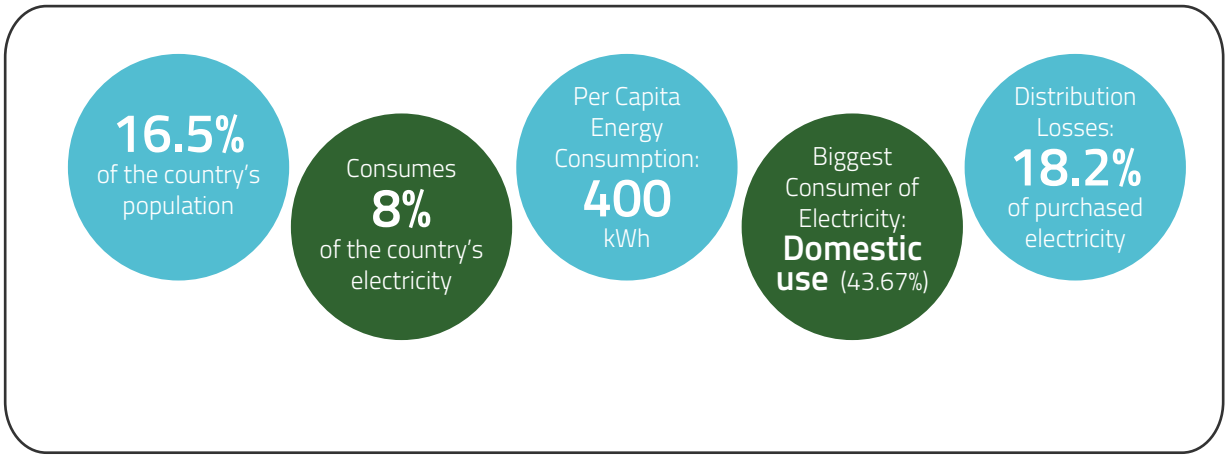


Figure 55: Energy Snapshot of the State of Uttar Pradesh

Power supply position in 2019-20 in state of Uttar Pradesh (a) Energy demand and supply and (b) Peak demand and supply

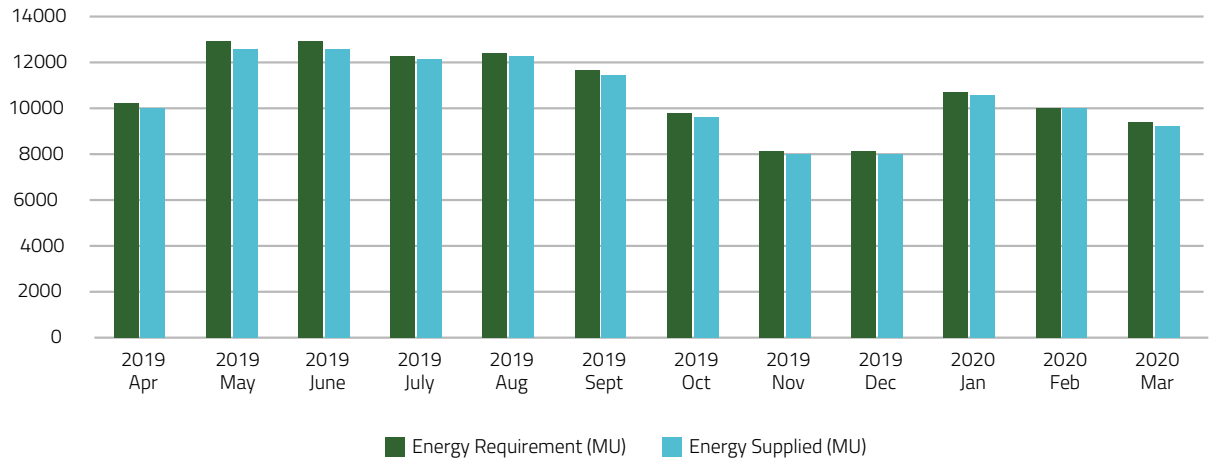


Figure 56: Month-wise Actual Power Supply Position of States/ UTs During the Year 2019-20 (in terms of Energy)

Source: CEA, Annual Report 2019-20 (2020)

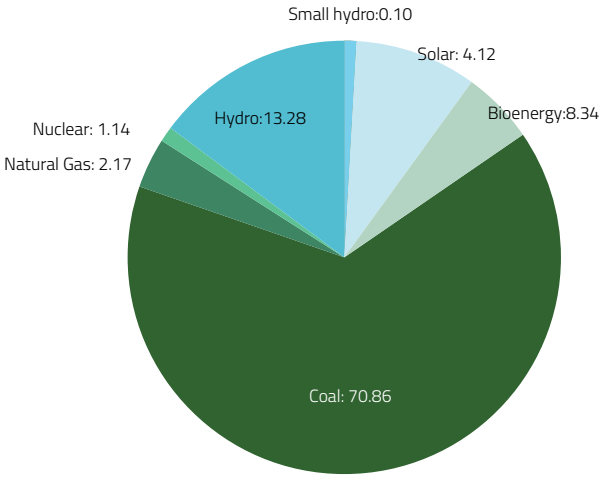


Figure 57: Source-wise Share in Total Installed Power Capacity Of Uttar Pradesh

Source: CEA (2019)

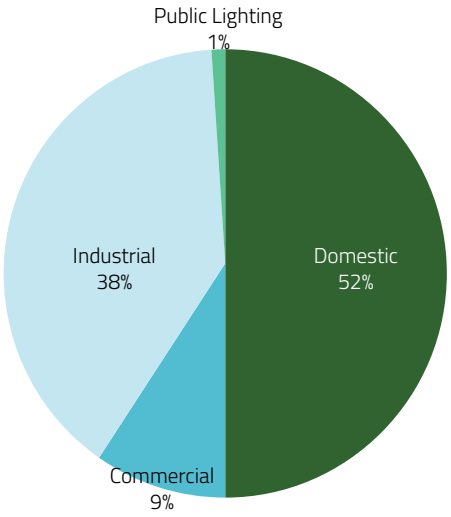


Figure 58: Electrical Energy Sales to Ultimate Consumers (GWh) in Uttar Pradesh

and biomass based power generation and electricity distribution systems, while creating unprecedented demand of electricity for cooling.

A vulnerability assessment done at district-level using the IPCC AR5 methodology, considers two key indicators, one for sensitivity and the other one to indicate adaptive capacity. The assessment identified 63 out of 75 districts of the state as falling under moderate to very high vulnerability class. The dominant drivers of vulnerability for districts falling under the very high to moderate vulnerability classes were poor access to clean cooking fuels and poor access to electricity. The result is presented as a bar plot (Figure 59). Figure 60 illustrates the magnitude of each indicator in driving vulnerability. A detailed sectoral vulnerability assessment can be referred to in Section 4.5 of Chapter 4.

Climate Driver	Impacts	References
Increase in water temperature	Increasing temperatures will lead to higher rates of evaporation of water sources that currently generate electricity, especially a problem for areas where water availability is already low	Arent, D. J., Tol, R. S., Faust, E., Hella, J. P., Kumar, S., Strzepek, K. M., ... & Ngeh, J. (2015); Johnston, P. C. (2012); Solaun K, Cerda E (2017)
Increase in air temperature	Increase in air temperature can reduce the power generation capacity as well as add stress to power generation due to increased cooling demands of consumers. The heat can reduce efficiency and even damage transmission and distribution infrastructure, as temperatures reach extremes.	Spalding-Fecher R, Chapman A, Yamba F, Walimwipi H, Kling H, Tembo B, et al (2014); TAYLOR, M. R. H., Baglee, A. A., Harjanne, A., & Jiménez-Alonso, E. (2020)
Change in precipitation pattern	Changing precipitation pattern can affect the availability of water in drought prone areas for hydro-power generation. It can also affect the water availability required for cooling in nuclear and thermal power plants.	Mukheibir P. (2013); Turner SWD, Hejazi M, Kim SH, Clarke L, Edmonds J (2017)
Extreme weather events	Storms, cyclones and other extreme events such as heat waves and heavy rainfall can adversely affect the electricity grid system as well as availability of fuel required for power generation.	Subramanian N, Nilsson U, Mossberg M, Bergh J.(2019);
Change in cloud cover and wind speed	Change in cloud cover can affect the generation of electricity from solar sources and change in wind speed can affect the generation through wind.	Pryor SC, Barthelmie RJ. (2013); Kabir E, Kumar P, Kumar S, Adelodun AA, Kim KH. (2018); Miu LM. (2015)

Table 44: Evidence-based Mapping of Climate Risks and Impacts on Energy Sector

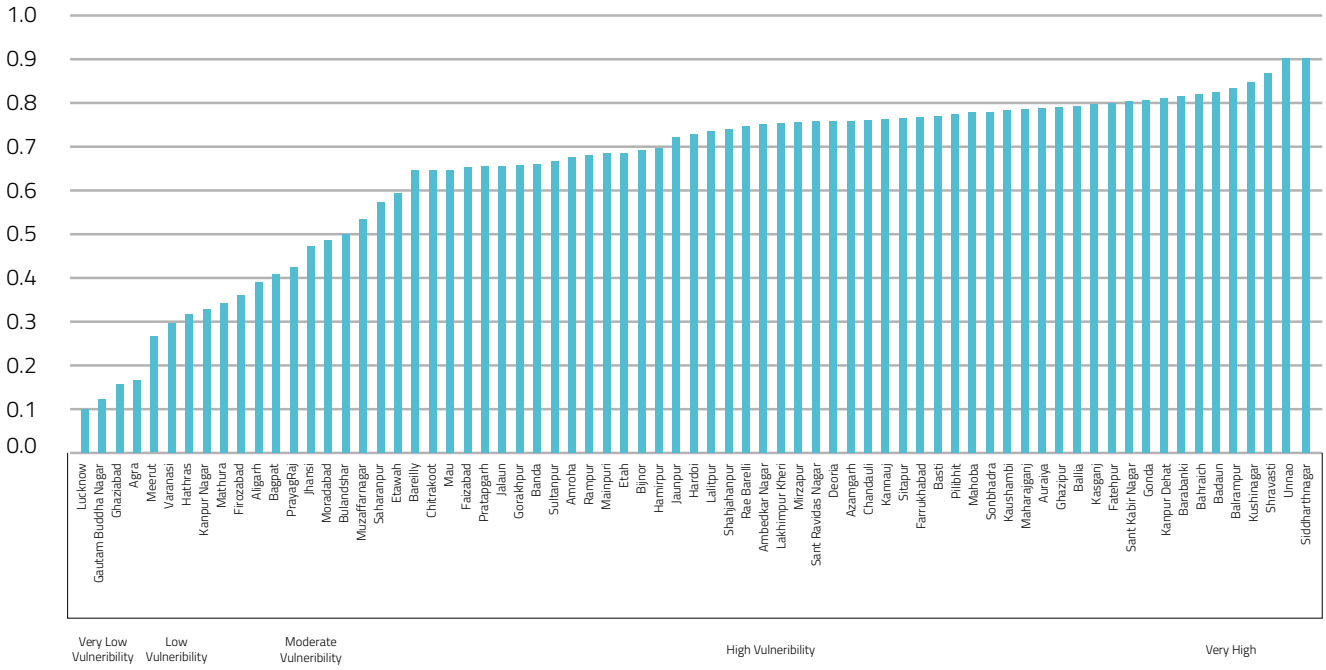


Figure 59: Ranking of Districts Based on an Energy Vulnerability Index From Very Low to Very High Vulnerability

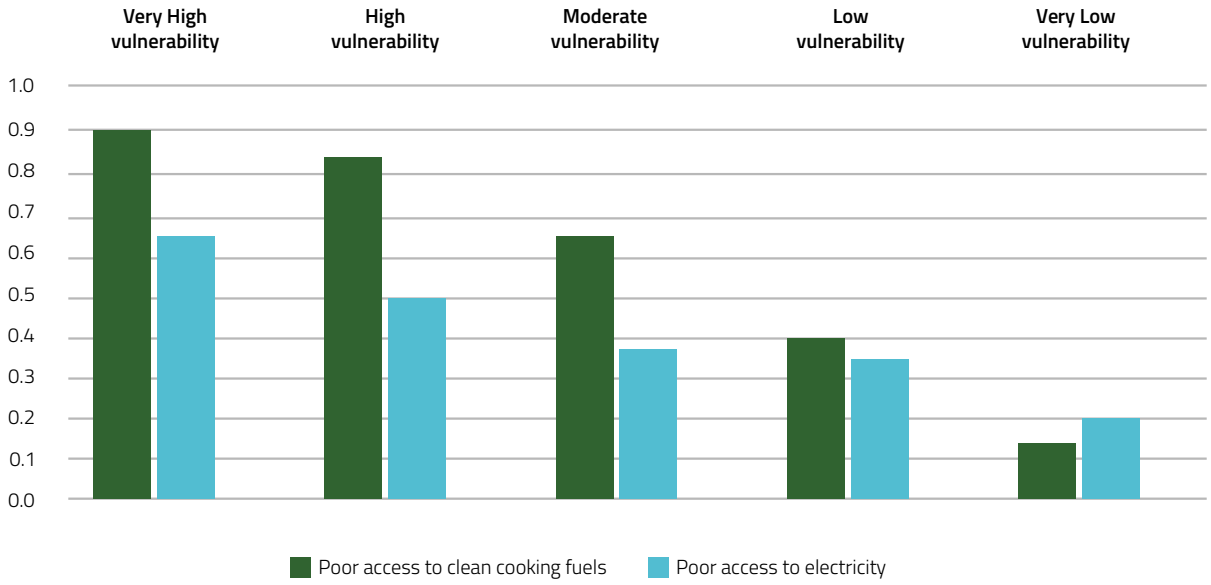


Figure 60: Drivers of Energy Vulnerability

8.3 STOCKTAKING

8.3.1 Energy Efficiency

The State through its designated authority (UPNEDA) for enabling energy efficiency is already undertaking various measures for improving energy efficiency in collaboration with Bureau of Energy Efficiency, and a description of the same is provided in the table on the next page.

Sector	Programme/Scheme	Achievement
Building Efficiency (Commercial)	ECBC compliance	121 buildings ECBC compliant as of March 2019
Buildings (residential)	UP Eco-Niwas Samhita	Notified
Demand Side Management	Unnat Jyoti by Affordable LEDs and Appliances for All (UJALA)	26295635 LEDs distributed till March 2023
	Municipal Demand Side Management Demonstra-tion Program	04 stretches of Ghaziabad Development Authority has been identified and around 822 street lights has been replaced by LED Street Lights
	Agriculture Demand Side Management Programme	Upto March 2019, Electric pump sets replaced by en-ergy efficient pump sets are 1025 and by May 2020, 1850 efficient pumpsets were installed.
Energy Efficiency in Large Industries	Peform Achieve and Trade (PAT)	Cycles 2012-13 to 2020-23, a total of 1567 designated con-sumers targeted
Student capacity building programme	Energy clubs in schools	238 schools across UP
	Training on energy efficiency	
Workshops for capacity building	Workshops conducted on energy efficiency in various sectors	About 24 conducted since 2015 till 2021
Public awareness on energy efficient appliances	Demonstration Projects	For demonstration on energy efficiency, the Sachivalay in Lucknow has been turned into the most energy efficient build-ing
Energy efficiency measures by DISCOMs	Capacity building of DIS-COMS	
	Training to DISCOMs on Load managment, development of DSM action plan and training on implementation of DSM activities	
Improve energy efficiency of SME sector	BEE SME programme	Mixed cluster including Brick kilns in Varanasi, Faridabad Mixed cluster, Ceramics in Khur-ja
Electrical Appliances	Star rating programme	Covers 26 appliances so far
Vehicles	FAME	Promotion of E-Vehicles and charging stations
UDAY (as of Mar' 2023)	Feeder metering	Target 2370 Installed 10034
	DT metering Urban	Target 18816 Installed 148864
	DT metering Rural	Installed 48104

Table 45: Energy Efficiency Policies and Programmes Operational in UP

Source: UPNEDA

Sector	Programme/Scheme	Achievement
UDAY (as of Mar' 2023)	Feeder segregation	Target 1868 Installed 3487
	Rural feeder audit	Target 1500 Installed 231507
	Electricity access to unconnected HH	Targete 22.95 lakh Installed 116.4 lakh

Table 45: Energy Efficiency Policies and Programmes Operational in UP

8.3.2 Green Energy

The installed capacity of renewable energy (off grid and grid connected) in Uttar Pradesh as of 2019-20 is indicated in Tables below. The Programmes that are powering the renewable energy penetration in the state are also listed below.

Cumulative Installed Capacity of Off-Grid	SPV Pumps	Street Lighting	Home Lighting	Solar lantern	Power plants	Biogas Plants	Waste to energy
Unit	Nos in lakhs	Nos in lakhs	Nos in lakhs	Nos in lakhs	KWP	Nos in lakhs	MW
Up till 2019 - 20	14,696	2,55,783	2,35,909	5,23,306	10638.3	4.41	49.81

Table 46 a: Cumulative Installed Capacity of off-Grid renewable energy in Uttar Pradesh up till 2019-20

Source: Ministry of New and Renewable Energy

Cumulative Installed Capacity of Grid Connected Renewable Power	Solar	Wind	Small Hydro power	Biomass power/ Cogeneration	Waste to energy
Unit	MW	MW	MW	MW	MW
Up till 2019 - 20	1095.1	0	25.1	2115.51	0

Table 46 b: Cumulative Installed Capacity of Grid connected renewable energy in Uttar Pradesh up till 2019-20

Source: Ministry of New and Renewable Energy

Sector	Programme/Scheme	Achievement
Solar thermal	Ground mounted	273.12 MU
	Solar Rooftop	4300 MW
Small Hydro	Installed	31.31 MU
Bagasse	Co generation	0
Non-Bagasse	Captive	3.34 MU
Waste to Energy programme	Installed	5.59 MU
Hydrogen	Hydrogen policy in place	
PM KUSUM	Feeder level solar sanctioned	400000

Table 47: Green Energy Policies and Programmes Operational in UP

Source: UPNEDA

Sector	Programme/Scheme	Achievement
PM KUSUM	Stand alone pumps sanc-tioned/installed (numbers)	66842/ 17614
Hydrogen	UP State's Hydrogen Policy	Published Green Hydro-gen Poli-cy (2022)

Table 47: Green Energy Policies and Programmes Operational in UP

8.4 PROPOSED STRATEGIES, ACTIONS AND IMPLEMENTATION SCHEDULE

The updated NDC of India focuses on enhanced energy efficiency across sectors and provides a target for increasing the share of new and renewable sources of energy in the total energy mix to 50% by 2030. This section provides a review of existing measures undertaken by the state for improving energy efficiency across sectors and enhancing the mix of renewable energy mix. The next section presents the strategies that align with the updated NDCs, finalised through multiple rounds of discussions with UPNEDA, taking into account the vulnerability and risks of the energy sector in the State.

Across the two missions and six strategies, a total of 37 action/sub-actions are proposed to be implemented till 2030 with an estimated budget of ₹ 3,127.55 Cr details depicted in Table 48.

Strategy	No. of Actions	Estimated Budget (₹. in Cr)	Key Implementing and Nodal Agencies
Green Energy Mission			
Solarize conventional energy based private and public water pumping works	2	-	Agriculture Department, Power Department, Jal Nigam
Set up off-grid solar power plants on waste land in rural UP thus increasing farmers income	1	665.00	Agriculture Department, UPNEDA,
Energy Efficiency Mission			
Minimise AT&C losses in transmission and distribution of electricity	12	414.68	Power Department, DISCOMs, UPERC, Namami Gange, Agriculture Department, UPNEDA, PVVNL, MVVNL, KESCO
Make SME clusters energy efficient	2	42.00	UPNEDA, Directorate of MSME (GoUP) , Leather manufacturing units, Foundry Association, Power loom Associations, Ceramics research institutes, Glass manufacturer's associations, Horticulture and Food Processing Departments, UP Rice Mills Association, UP Paper & Packaging Association
Create enabling environment for market penetration of efficient cooling systems	17	360.75	UPNEDA, Agri Dept, Horti Dept, Animal Husbandry Dept, Health Dept, Skill Development Mission, DST
Enable significant transition to EVs in cities by 2030	3	1645.12	UDD, Invest-UP, Transport department
Overall Estimated Budget for Energy Sector (₹ in Cr)		**3127.55**	

Table 48: A Snapshot of Proposed Strategies, Number of Actions, Estimated Budget and Key Agencies for Enhanced Energy Efficiency and Green Energy Mission

The proposed activities are categorized into two classes, based on their type of climate actions i.e., adaptation centric, mitigation centric or both; and based on the nature of actions i.e., implementation, policy, research, and capacity building. Figure 61 shows that 86 percent of the proposed actions are mitigation actions, 11 percent are adaptation actions and 3 percent are both mitigation/adaptation actions. Further, 62 percent of the proposed actions are implementation actions, 22 percent are policy actions, 8 percent are research-oriented actions and 8 percent of the actions are for capacity building.

A summary of proposed strategies, actions, targets and other relevant information is outlined below. For a detailed list of strategies, refer to Table 84 in Annexure.

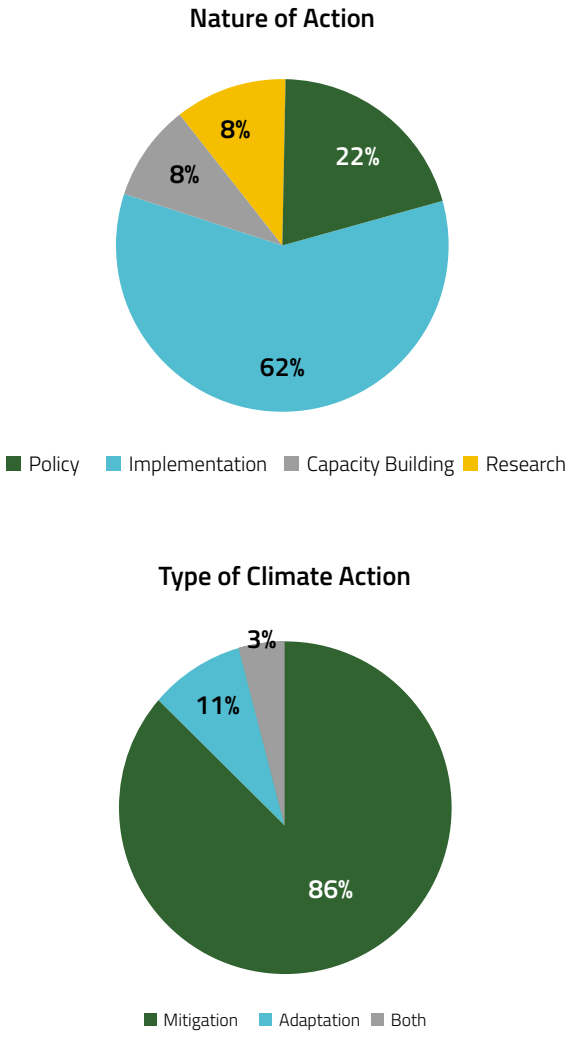


Figure 61: Distribution of Type and Nature of Actions Proposed Under Enhanced Energy Efficiency and Green Energy Mission

(A) Green Energy Mission

Strategy 1: Solarize conventional energy based private and public water pumping works

Strategy alignment with SDGs:	SDG 1 | SDG 2 | SDG 7 SDG 9 | SDG 11 | SDG 12
Strategy alignment with NDCs:	NDC 03 | NDC 04

Uttar Pradesh currently suffers from an energy deficit necessitating the import of energy from other states. Presently about 13.96 lakh pumps are working in the state, and their connected load is approximately 8525.5 MW and on an annual basis 6800 GWh electricity will be consumed. Therefore, solarizing of all agriculture pumps and feeders can help avoid 5.44 million tonnes of carbon emissions. (As per the data received by UPPCL). Additionally, the private and municipal pumping requirement, form part of the 41.3% of the domestic consumption, the largest share of energy consumption in the state (ibid). As the state with the largest population, offsetting the generation requirement from conventional to renewable sources can provide the much-needed impetus to transition to cleaner energy to meet this deficit. While the state has already managed to solarize 29,668 pumps as of FY 2019-20, substantial progress remains to be made in this regard (UPNEDA, 2021).

Strategy 2: Set up off-grid solar power plants on wasteland in rural UP thus increasing farmers income

Strategy alignment with SDGs:	SDG 1 | SDG 2 | SDG 7 SDG 9 | SDG 11 | SDG 12
Strategy alignment with NDCs:	NDC 03 | NDC 04

Population pressures on land resources limit the availability of space for large scale solar deployments. Smaller interventions aimed at improving livelihoods and access to energy can improve the quality and availability of clean energy to the masses. Utilizing land that is not productive for farming or supporting other livelihoods can accelerate the adoption of clean sources of energy especially amongst the rural poor. UP has around 3716 sq. km of wasteland covering scrub land, land affected by salinity, and degraded plantation land which can be utilised for this purpose. These barren swathes of land can be utilized by farmers and agricultural collectives under the PM KUSUM scheme, allowing them to set up decentralized, ground mounted, grid-connected solar power plants of up to 2 MW capacity, from which the power generated will be purchased by the DISCOMs at feed-in tariffs determined by SERCs.

(B) Energy Efficiency Mission

Strategy 3: Minimise AT&C losses in transmission and distribution of electricity

Strategy alignment with SDGs: SDG 1 | SDG 2 | SDG 7 SDG 9 | SDG 11 | SDG 12
Strategy alignment with NDCs: NDC 03 | NDC 04

Given the existing energy deficit and increasing requirement of energy in the future from the growing population, measures to conserve energy can act in tandem with the transition to renewables. Building up energy saving mechanisms in the transmission and distribution infrastructure will enable greater access while meeting the projected demand. At present, the five DISCOMs in the state, PVVNL, DVVNL, KESCO, MVVNL and UPPCL suffer from 26.65%, 33.43%, 12.4%, 26.22% and 27.91% of AT & C losses respectively (MoP, 2022). Rising temperatures affect the efficiency of power lines carrying electricity across long distances (Chandramowli & Felder, 2014). Additionally, as of December 2019, only 58 % of the rural consumers were billed on the basis of metered-units (MU) (UPERC, 2020). Inadequate allocation of meter readers, poor understanding of tariffs and their sub division and incomplete tagging of connections are cited as some of the main reasons for poor familiarity with energy saving measures in the state (ibid).

Strategy 4: Make SME clusters energy efficient

Strategy alignment with SDGs: SDG 1 | SDG 2 | SDG 7 SDG 9 | SDG 11 | SDG 12
Strategy alignment with NDCs: NDC 03 | NDC 04

The share of energy consumption for the industrial sector in FY(Financial Year) 2015-16 stood at 22.7% of the total consumption. While the industrial consumption is dwarfed by domestic consumption, an increasing trend can be seen over the past few years with CAGR (Compound Annual Growth Rate) of 5.01% in FY 2015-16 due to higher industrial sales as well as an increased availability of power over the years. The total sales (MU) for small and medium power of up to 100 HP (75 kW) accounts for 3071.08 MU (GoUP, 2017). These small industries do not come under the ambit of the Perform, Achieve and Trade (PAT) scheme of BEE,- a programme that promotes energy efficiency. Given the increasing energy demand from the sector, interventions need to be planned to enable SME clusters in the state to become energy efficient, including actions towards post-production processing and value addition technologies..

Strategy 5: Create enabling environment for market penetration of efficient cooling systems

Strategy alignment with SDGs: SDG 1 | SDG 2 | SDG 7 SDG 9 | SDG 11 | SDG 12
Strategy alignment with NDCs: NDC 03 | NDC 04

Surface temperatures continue to rise due to the effects of climate change. There is an increasing requirement for cooling solutions and technologies ensuring thermal comfort. As a result, the projected demand for cooling and thermal comfort are set to skyrocket and so is the demand for electricity. As per the projections made under the India Cooling Action Plan, by 2037-38, Total Primary Energy Supply (TPES) required for cooling will need to go up by 4.5 times the current rates (2017-18 baseline, MoEFCC, 2019). The associated energy demand therefore is also likely to increase, necessitating early adoption of energy efficient cooling solutions so as to ensure that the increased energy demand is offset. Similarly, when compared to the 2017-18 baseline, the aggregated countrywide cooling demand, measured in Tonnage of Refrigeration (TR), is expected to expand by about 8 times, by 2037-38. Building cooling demand will rise about 11 times more than the baseline; the cold-chain and refrigeration sectors will grow to 4 times their current size and transportation, air-conditioning will grow around 5 times more than the baseline (ibid). Additionally, as temperatures rise, investments will also be needed for cold chain infrastructure and interventions towards thermal comfort for Economically Weaker Sections (EWS) and Low-Income Groups (LIG).

Strategy 6: Enable significant transition to EVs in cities by 2030

Strategy alignment with SDGs: SDG 1 | SDG 2 | SDG 7 SDG 9 | SDG 11 | SDG 12
Strategy alignment with NDCs: NDC 03 | NDC 04

With rising population and incomes, the demand in the transportation sector is bound to go up. Although to arrest global rising temperatures to less than 2.0°C, one needs to take urgent actions to decarbonize transportation, just like every other sector. Electric mobility can become a key pivot in this transformation. Increasing the deployment of electric vehicles tackles not only the issue of emissions but also that of pollution, something that is plaguing all major Indian cities. With roughly 16.5 percent of India's population, the state has great potential as a market for e-mobility. Currently, Uttar Pradesh ranks third in terms of the number of automobiles registered. Between 2010 and 2015, the state accounted for the maximum number of vehicle registrations, showcasing an increase of almost 81% (Invest-UP, 2019). Proximity to the National Capital region and industrial corridors such as Lucknow (pilot project site for Multi Modal Electric Public Transport under FAME) and Noida Industrial Area make it well-suited as a possible hub of EV and EV components manufacturing in the nation (ibid).

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹. in Cr)
1. Green EnergyMission			
1. Solarize conventional energy based private and public water pumping works			
1.1	Continue solarizing new standalone and grid connected agriculture Pumps sets. Target LMV5 consumers, and cover 50% of the pumps connected to all DISCOMs in UP till 2025 and till 2030, respectively (the total number of consumers as per Tariff Order 2021-22 for UP State DISCOMs is 12,50,368).	UPNEDA, Power Department, Agriculture Department	--
1.2	Solarizing water pumps of rural and urban water distribution systems. While nine municipalities have started putting in place solarised water pumping systems for their water distribution, the target is; 50% of LM7, LMV8 and HV4 consumers by 2025 and the rest by 2030 (25,938 consumers (LMV 7), 35233 consumers (LMV8), and 134 consumers (HV-4))	Power Department, Jal Nigam	--
2. Set up off-grid solar power plants on waste land in rural UP thus increasing farmers income			
2.1	Setting up of 500 kW to 2 MW Renewable energy based power plants (REPP) and feeding into grid connection on degraded farm land. UP has around 3716 km^2 of wasteland (covering scrub land, land affected by salinity, and degraded plantation land) which can be utilised for this purpose; By 2025, create enabling environment and identify land parcel as per farmers choice. Disaggregated power generation to be undertaken in 35 districts during the period, and the other 40 districts to be taken up by 2030.	Agriculture Department, UPNEDA	665.00
2.	**Energy Efficiency Mission**		
3. Minimise AT&C losses in transmision and distribution of electricity			
3.1	Separation of agriculture feeders; Cover all mixed feeders in the state (2000), with 50% mixed feeders to be covered till 2025, and the rest within the period 2026-2030	Agriculture Department, Power Department, DISCOMS	100.00

Table 49: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹. in Cr)
3.2	Setting up of Prepaid Smart Metering & System Metering for; - For all domestic consumers in the state. Since of the 27,551,094 domestic consumers (LMV1), smart metring of 6,083,877 consumers will be completed till March 2022 in AMRUT cities, the target would be to cover 21,467,217 of the remaining connections by 2025. - For state tube wells and pumps: all state tube wells and pumps to be covered till 2030, i.e. 35,233 consumers (LMV8) as per UP State Tariff Order for DISCOMs 2021-22. (17615 consumers will be covered in the 1st phase and 17616 consumers in the 2nd phase) - For public water works: There are 25938 consumers (LMV7) in this category as per UP State Tariff Order for DISCOMs 2021-22, off which 12,969 consumers to be covered by 2025 and 12,969 by 2030. - For private tube wells: Target metering of tube wells used by Large contract farming areas formed by big corporations. Cover all contract farming areas till 2025. - For all government offices, block level and above government institutions. There are 91,874 consumers (LMV3) as per UP state Tariff order 2021-22 for DISCOMs, and they have to be covered by 2025.	Power Department, DISCOMS, Namami Gange and Gramin Jalapurti Vibhag, PVVNL, MVVNL and KESCO	314.68
	-For industries: Large and heavy power consumers, consuming above 100 bHP /75kW. There are 13,125 consumers as per UP State Tariff Order for DISCOMs 2021-22, and all of them to be covered by 2025. Small and medium power consumers, up to 100 HP/75kw. There are 176,389 consumers (LMV6) and 100,389 consumers to be covered by 2025, 76,000 consumers to be covered by 2030. - UPERC in consultation with DISCOMs to set up differential tariff rates by time of day use for each DISCOM circle for different consumers. Declare tariff rates by 2023 - Install Communicable AMI meters to all feeders to enable energy accounting. All feeders to be covered by the PVVNL by 2025, and all feeders in the areas to be covered by DVVNL, MVVNL, PUVVNL and KESCO by 2030. - Install communicable AMI metres on all Distribution Transformers for facilitating energy accounting. While All DTs in the state to be covered by 2025, all DTs in the areas covered by PVVNL & MVVNL by 2030. - SCADA/DMS in towns having population > =1 Lakh; all DISCOM areas to be covered		

Table 49: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹. in Cr)
4. Make SME clusters energy efficient			
4.1	All clay brick making units to be converted into zig-zag technology & perforated brick making technology. The target here would be to map clay brick units still operating on FCBTK technoloy across all 10 clusters, by accessing finance for converting to zig-zag and implementing the same by 2025.	UPPCB	10.00
4.2	Training on the best practices of environmentally friendly and energy efficient technologies across supply-chain for all type of Industries including but not limited to: (1) Leather manufacturing & goods, (2) Foundry, (3) Power loom and textiles, (4) Ceramics, (5) Glass products, (6) Rice Mills, (7) Packaging material, (8) Mint Oil, (9) Perfumery and essential oils, (10) Service Industries, (11) Carpet Industries, (12) Sugar and Ethanol Production. - by 2025, benchmark and adopt best available energy efficient technologies by units; Bring in notification to enforce uptake of clean technology.Implementation by 2030.	Directorate of MSME (GoUP), UPNEDA, Foundry Association, Horticulture and Food Processing Departments, Leather manufacturing units , Power loom Associations,	32.00
		Ceramic Research Institutes, Glass manufacturers associations, UP Rice Mills Association, UP Paper & Packaging Association, Buyer companies to ensure energy efficiency	
5. Create enabling environment for market penetration of efficient cooling systems			
5.1	Ensure thermal comfort in new and existing buildings in UP by; - Develop a cooling action plan for UP in line with India Cooling Action Plan, to cover all cooling sectors (space cooling in buildings, cold chains and refrigeration, passenger transport air conditioning, and refrigerants) including an operational roadmap for sustainable cooling. The plan to be developed in one year. - Implement residential building codes for thermal comfort (new buildings) (Eco Niwas Samhita) for the entire state; all social and government housing, particularly covering EWS and LIG residences, to be covered till 2025. This is to be continued for other residential buildings till 2030. - Retrofit existing government buildings in accordance with UP-ECBC 2018 to ensure energy efficiency and thermal comfort. This should include all existing government buildings with a connected load, with 50% of the government buildings in cities to be covered by 2025 and the rest of the 50% by 2030.	UPNEDA, Power Dept., UDD, Department of Health, Transport Department, DST, UP Skill Development Mission, INVEST-UP, Housing and Urban development Department, Municipal Corporations, Industrial zones/parks	6.00

Table 49: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹. in Cr)
5.1	- Build awareness for adoption of appropriate Heating, Ventilation, Air Conditioning (HVAC) systems having right-size and ensuring thermal comfort with emphasis on energy efficient performance and least lifecycle costs. Target all architects and builders. Ensure preparation of IEC material and dissemination through print, TV and digital platform. -Enabling the use of BLDC fans in the state: (1) Mandate use of BLDC fans in government buildings and social housing programmes., (2) Undertake IEC for awareness amongst public, and (3) Manufacture BLDC fans in UP. This is to be done for all government buildings and social housing throughout the state		
5.2	Explore and pilot other new and innovative space cooling options for enabling thermal comfort of UP's population, by; - Assess feasibility of DCS and trigeneration in the State and initiate three pilots accordingly; a state wide feasibility assessment to be completed within 2021-23 and three DCS to be piloted in the state by 2030. - Assess, shortlist & pilot feasible thermal storage technologies, available globally, that prepare ice for cooling at off-peak hours (for residential & commercial buildings) - Enable public procurement of highest star rated energy efficient cooling appliances having low/zero GWP refrigerants; to be done in line with Ministry of Finance's Financial Rules (GFR) (Office Memorandum No. 26/6/12-PPD43) regarding mandatory procurement of energy efficient electrical appliances and equipments; Issue public procurement guidelines for highest star rated energy efficient, with low-GWP, options for the state; Guidelines to be notified by end of 2021-25, and implementation to start thereafter -Develop and implement Demand Side Management programmes with DISCOMS (namely, PVVNL PUVVNL DVVNL MVVNL KESCO) to replace inefficient and HFC cooling systems (of commercial, institutional and residential buildings) with new star rated EE systems based on new and innovative technologies. Feasibility studies to be carried out by 2025, followed by implementation of DSM programmes	UPNEDA, Finance Department, DISCOMS , companies dealing in District cooling technologies, Companies manufacturing cooling systems	27.00

Table 49: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹. in Cr)
5.3	Build capacity to adopt new generation energy efficient and new coolant based technologies for cold chains; - Undertake techno-economic evaluation of energy efficient, low GWP refrigerant based new & evolving technologies that can be adopted for retrofitting and in new cold chain infrastructure and refrigerators within UP.; Map suppliers and cover assessment within 2022-24 for pack-houses, reefer transport, cold storage, ripening chambers, cold chain vaccine management, milk chillers, commercial refrigerators, household refrigerators - Standardize the design, construction and associated specifications for small, medium and large cold-chain infrastructure components. Commission demonstration projects for cold chain elements. Notify standardization and Implement pilot project to demonstrate clean and low GWP technologies for cold chain infrastructure and refrigeration - Trainings & Capacity Building: (1) cold chain operators and service technicians to ensure efficient O&M, (2) farmers on better management of produce both pre-harvest and post-harvest using cold chain infrastructure (Conduct annual FPO training, and cover all FPOs, for each agriculture produce that is stored and supplied through cold chain infrastructure). The coverage of FPOs to be undertaken upto 50% in each phase (till 2025, and till 2030). -Undertake extensive IEC for enabling adoption of energy-efficient, renewable energy/ alternate energy and low/zero GWP refrigerant designs in cold chains. Develop and disseminate IEC material in the entire state, during both phases (till 2025, and till 2030)	UPNEDA, Technical Institutes , Agriculture Department, Horticulture Department, Uttar Pradesh Skill Development Mission	116.75
5.4	For Household & Commercial refrigeration; - Facilitate market penetration of star rated energy efficient and low GWP refrigeration systems through IEC. Develop and disseminate IEC material in the entire state during both phases (till 2025, and till 2030). - Train service technicians (20 technicians for each district) on installation and maintenance of low GWP based refrigeration systems including effective recovery, recycling and reclamation of refrigerants. Training modules to be developed on aspects such as installation and maintenance of refrigeration plant, energy efficient operation, safe installation, management, disposal and recycling norms. Updated training to be imparted in the 2nd phase (till 2030).	UPNEDA, civil society organizations, Uttar Pradesh Skill Development Mission	6.00

Table 49: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹. in Cr)
5.5	Enable adoption of energy efficient alternate coolant based (alternate to HFCs) cooling systems in transport sector in UP; - Explore and shortlist feasible low GWP refrigerant based technologies and replace existing air conditioning units in public buses. 100% air conditioning units in state bus fleets to be replaced with energy efficient units having low GWP/no GWP, with pubic bus fleets of 10 smart cities to be covered in 1st phase and other cities with population > 1 million to be taken up in 2nd phase - Develop State R&D funds for hosting challenges to develop sustainable cooling solutions across sectors in line with Global Cooling Prize; there maybe one challenge each year and the target would be IITs, Firms incubated/being incubated at IITs, Engineering colleges, Universities and Private companies	UPNEDA, Department of Science and Technology (Uttar Pradesh), , State bus transport Department	205.00
6. Enable significant transition to EVs in cities by 2030			
6.1	While targeting all AMRUT cities (including SMART cities), assess annual growth rates that should occur (2W, 3W, 4W, buses) to register 100% presence of EVs on city roads by 2030 by: -Assessing average trip length per day -Assessing electricity demand -Mapping EV charging locations at commercial spaces, institutional areas, along colony roads , along state roads within petrol pumps or next to bus stops , along highways within the state , -Assessing charging capacity requirements and the number and location of fast and slow charging stations to match requirement across battery capacity of different vehicle types -Assessing number of charging stations that will directly be connected to grid or to stand alone solar power generation units on highways -Assessing the fund requirement and developing the PDD for the same	UPNEDA, Invest-UP, DISCOMs	0.50
6.2	Set up solar-based EV charging network in the 10 most populated cities, with the first five to be covered by 2025	Infrastructure and Industrial Development , Invest-UP	73.62
6.3	Replace all city buses (all 12400 of its fleet) with E-Buses, with a target of 1000 buses in each phase.	Urban Development Department, Transport Department	1571.00

Table 49: Summary of Proposed Actions and Estimated Budget Required

Chapter 9

Sustainable Habitat Mission

Increasing number of extreme weather and slow-onset events such as floods, droughts and storms, along with the rise in the spread of tropical diseases,have together been having a costly impact on basic services, infrastructure, housing, human livelihoods and health. At the same time, a carbon intensive urban lifestyle as well as some rural livelihoods are all contributors to climate change-essentially anthropogenic activities that are major sources of greenhouse gas emissions (IPCC AR6 WGI, 2021).

As per the National Action Plan on Climate Change, the National Mission for Sustainable Habitat (NMSH) is one of the eight key missions on climate action. The mission seeks to promote sustainability of habitats through improvements in energy efficiency in buildings, urban planning, improved management of solid and liquid waste including recycling and power generation, modal shift towards public transport and conservation. It is important to note that urban habitat has been the primary focus under NMSH. It does not comment or engage on the subject of rural habitat, an oversight that is also reflected in the first UP SAPCC. The Draft National Urban Policy Framework 2020 also envisions urban areas with distinct identity, providing ease of living, responsive governance, sustainable environment, rapid

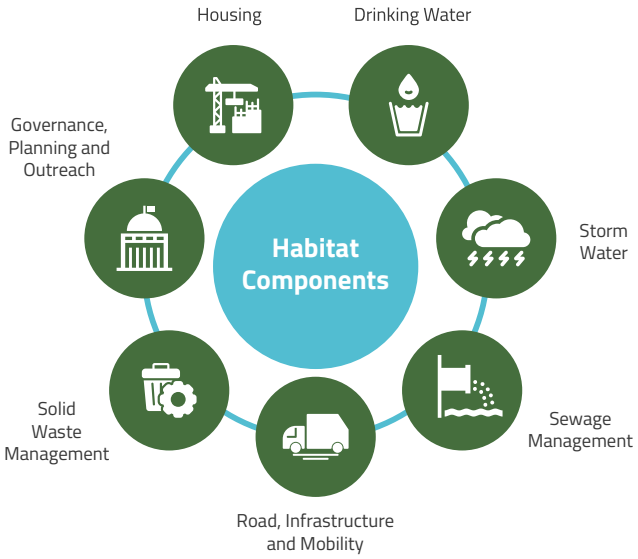


Figure 62: Components under Sustainable Habitat Mission for urban and rural settlements

economic growth and livelihood opportunities for citizens. Considering the socio-economic importance of rural habitats (78% of population reside in rural areas) in UP, the current report studies both urban and rural comprehensively to shape up a holistic UP Sustainable Habitat Mission under UP SAPCC 2.0. Further, Figure 62 highlights the components that would be looked at under the Sustainable Habitat Mission.

9.1 RISK ASSESSMENT AND MITIGATION OPPORTUNITY

9.1.1 Climate Risk and Impacts

Extreme weather events such as heatwaves, cold waves, floods, droughts and storms, are brought about by climate impact drivers, such as high variability of precipitation and temperature. These have a huge impact on both urban and rural habitat (Dasgupta, et al., 2014).

Further, these drivers can have a multi-step causal chains of impacts on patterns of settlement, livelihoods, and incomes in rural areas. Typically, those chains will be of two kinds. One will involve extreme events, such as floods and storms, and their impact on rural infrastructure and the direct loss of life. The other involves impacts on agriculture or on ecosystems that rural populations depend on.

In urban areas, these drivers do not just affect the patterns of livelihoods, and economy but also have a huge impact on human health. Due to frequent extreme weather events, the infrastructure is more exposed to damage. Cities source their water supply from faraway places, often outside the urban limits. In the event of a flood or drought in the region, the entire water supply and demand disturbance can, and does create water woes. With increasing temperatures across the country, there is also a rise in cooling demands, in turn pushing the demand for energy (WEF, 2021). This further impacts the pollution level in cities, worsening the air quality (IPCC AR6, 2021) as well as the heat island effect in these cities. High year-to-year rainfall variability and increase in frequency and intensity of flooding events causes damage to all critical infrastructure as well as housing.

Latest global science clearly highlights that while the development sector is a key contributor to climate change, it will also be impacted by various extreme weather variabilities. In case of urban habitats, three main factors contribute to amplify warming (IPCC AR6, 2021):

• Urban geometry: Tall buildings that are close to each other absorb and store heat and also reduce natural ventilation.

• Human activities: Heat released from domestic and industrial heating or cooling systems, running engines, and other sources.

• The materials that make up cities: Most of these materials are very good at absorbing and retaining heat and then re-emitting that heat at night. The urban heat island effect is further amplified in cities that lack vegetation and water bodies.

Repeated extreme weather events can add additional pressure on cities due to distress migration from rural areas.

These patterns of migration may be either temporary or permanent. A slow onset disaster, like drought, can cause water shortages, food demand fluctuations, disruption of hydroelectricity and further fluctuations in migration from rural areas. Although, the degree to which these impacts cause damage still needs to researched more widely in the context to Uttar Pradesh. Table 50 provides a collective picture of climate risk and impacts faced by the rural and urban habitat sectors based on the available literature and increasing prevalence of these risks.

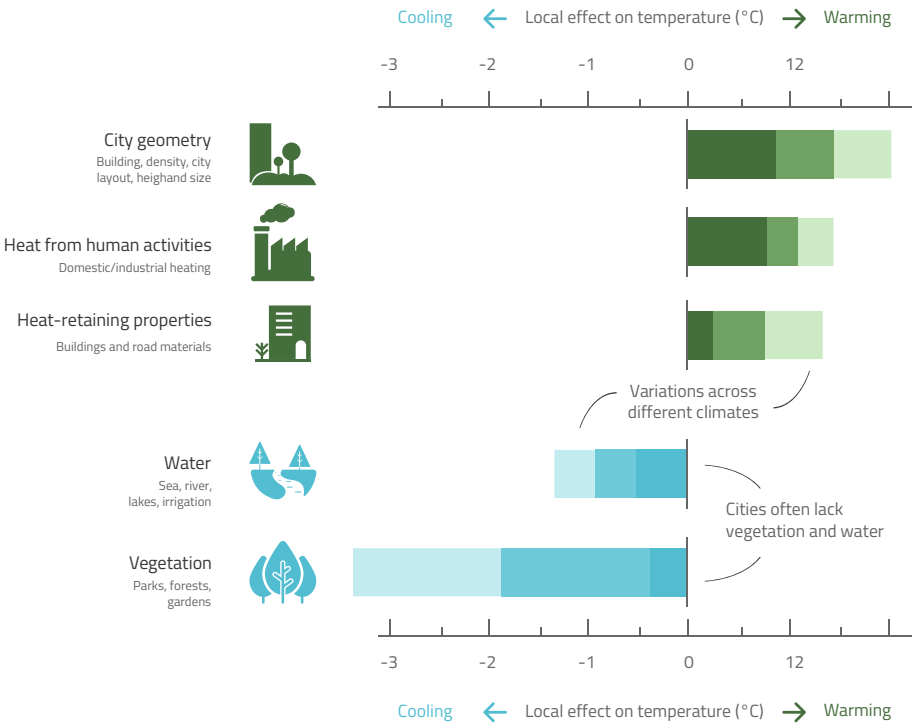


Figure 63: Cities as Hotspots of Global Warming

Source: IPCC AR6 (2021)

Climate Risk	Habitat System Impacted	Findings and Recent Incidents	Source
Rural Habitat and Urban Habitat			
Increasing Temperature / Extreme Heat	Housing Drinking Water Supply and demand Road Infrastructure & Transportation	Increased incidence of heatwave condition is witnessed across rural and urban settlements in U.P. [a] Studies found that with the increase in temperature alone, rate of reaction increases and BOD is reduced. Due to urbanization and setting up of infrastructure along water bodies, such as the barrage constructed upstream of Ankinghat, there is reduced water flow downstream in regions such as Kanpur and Shahzadpur; with increasing temperatures and reduced streamflow, BOD is found to be increasing in water downstream, affecting the drinking water availability and quality. [b]	[a]https://cdkn.org/2018/10/heat-stress-rural-india/?loclang=en_gb FAQ_heat_wave.pdf (imd.gov.in) https://www.ndma.gov.in/sites/default/files/2021-08/HeatWave_Workshop_2021_Final%20Proceedings.pdf https://www.livemint.com/news/india/imd-says-severe-heatwave-to-continue-for-next-4-5-days-in-this-part-of-india-11625129162642.html

Table 50: Evidence-based Mapping of Climate Impacts on Urban and Rural Habitats

Climate Risk	Habitat System Impacted	Findings and Recent Incidents	Source
		A study by CEEW done in Mathura and Bareilly, reports that increasing temperatures cause a rise in demand for cooling (air conditioner/ space cooling) that in turn increases energy consumption [c]; For a project of road construction in the state of U.P. a total of about 4% ($12.51,000,000 of the civil works cost of ($312,000,000) were spent on addressing (adaptation) climate change risks.[d]	[b]http://civil.iisc.ac.in/~pradeep/wp-content/uploads/2020/10/Sneha_NSP.pdf [c]https://www.ceew.in/sites/default/files/CEEW%20-%20What%20Can%20Smart%20Meters%20Tell%20us%20Report%2017Feb20_compressed.pdf [d]RRP Supplementary Appendix B: Project Climate Risk Assessment and Management Report (adb.org)
High Temperature Variability/ cold wave	Housing	Cold wave to severe cold wave conditions occurred at isolated places over eastern UP and cold day conditions were recorded at isolated places in western parts of the state [e] [f].	[e]https://www.business-standard.com/article/current-affairs/severe-cold-wave-in-few-places-of-up-dense-fog-in-some-parts-of-state-121013000781_1.html [f]https://internal.imd.gov.in/press_release/20201220_pr_962.pdf
High Precipitation/ Intense Rainfall Spells causing floods	• Housing • Drinking water supply and demand • Sanitation • Road infrastructure and transportation	Eastern UP is inherently prone to floods due to its physiography. [g] In 2021, Manpur Karhiya, a village situated near Sharda river in UP, with a population of 20,000 witnessed floods in June after 20 years.[h] During Aug 2021, over 600 villages were affected by floods; 110 of these were cut off from all connectivity, as several districts in Uttar Pradesh continued to face heavy rain with major rivers, like Ganga and Yamuna flowing over the danger mark.[i] During Aug 2020, 16 districts were affected by floods in Uttar Pradesh, and major rivers such as Sharda, Rapti and Saryu were flowing above the danger mark affecting a total of 777 villages, of which 282 were inundated.[j] Flooding causes sedimentation on transportation lines and damage roads and bridges.[k]	[m]http://upsdma.up.nic.in/stateprofile.htm [n]https://www.firstpost.com/india/severe-water-crisis-in-uttar-pradeshs-gopipur-leaves-bachelors-in-chitrakoots-parched-village-without-brides-6818241.html [o]https://sandrp.in/2021/03/31/2021-summer-north-india-staring-at-severe-water-crisis/ [p] UTTAR PRADESH_2018 1.pdf (bmtpc.org) [q] https://ndma.gov.in/Natural-Hazards/Cyclone https://www.bbc.com/news/world-asia-india-43987209 https://www.preventionweb.net/files/51574_policybrief1.pdf
High Temperature and Precipitation Variability causing drought like situation and water scarcity	•Drinking Water Supply and demand •Sanitation	Bundelkhand and Vindhya Regions of U.P are historically drought prone areas.[m] "Gopipur village has seven hand pumps, installed by the government long ago, but not a single one of them works owing to the decline in the groundwater level."[n] "Out of 75 districts of UP, 42 districts in East Uttar Pradesh division got below normal rain by 37%, 83% and 45% causing water scarcity." [o]	http://upsdma.up.nic.in/stateprofile.htm [n]https://www.firstpost.com/india/severe-water-crisis-in-uttar-pradeshs-gopipur-leaves-bachelors-in-chitrakoots-parched-village-without-brides-6818241.html [o]https://sandrp.in/2021/03/31/2021-summer-north-india-staring-at-severe-water-crisis/

Table 50: Evidence-based Mapping of Climate Impacts on Urban and Rural Habitats

Climate Risk	Habitat System Impacted	Findings and Recent Incidents	Source
Increasing frequency of storms and wind hazards	• Housing	As per BMTPC's Vulnerability Atlas 2019 report, 53.4 percent of total areas in the state are prone to high-risk winds, while 43,2 percent are prone to very high-risk winds [p] and are high damage zone due to wind hazards [q]. "In 2018, at least 73 people died in Uttar Pradesh - more than half of them of them in the district of Agra, due to dust storms. Many of the dead were sleeping when their houses collapsed after being struck by intense bursts of lightning. The Uttar Pradesh government has also announced that amilies of the dead will receive ₹. 400,000 ($6,000; £4,400) as compensation."[q]	[p] UTTAR PRADESH_2018 1.pdf (bmtpc.org) [q] https://ndma.gov.in/Natural-Hazards/Cyclone https://www.bbc.com/news/world-asia-india-43987209 https://www.preventionweb.net/files/51574_policybrief1.pdf

Table 50: Evidence-based Mapping of Climate Impacts on Urban and Rural Habitats

The above climate risk and impacts provide the potential for building resilience across the various sub-components of habitat mission.

9.1.2 Inherent Vulnerability

Rural Habitat

A total of fourteen indicators were considered to assess vulnerability of rural habitats at the district-level. The vulnerability assessment of the rural habitats, using the IPCC AR5 methodology, identified 55 districts as falling under moderate to very highly vulnerable category. The key drivers fueling vulnerability of rural habitat sectors are *low literacy (secondary school and above), high percentage of socially vulnerable households below the poverty line, high proportion of population living in rural areas, poor access to functional health care facilities, high percentage of households at risk to damage by wind, flood, and earthquakes, fewer households with kitchens inside the house using clean fuels for cooking, high dependency ratio, fewer women employed in the workforce, low access to basic amenities, low prioritization of NRM works under MGNREGA and inadequate increase in number of pucca houses (PMAY).*

Vulnerability is approached as a relative measure and some districts are more vulnerable than others.The percentage contribution of an indicator to vulnerability index was

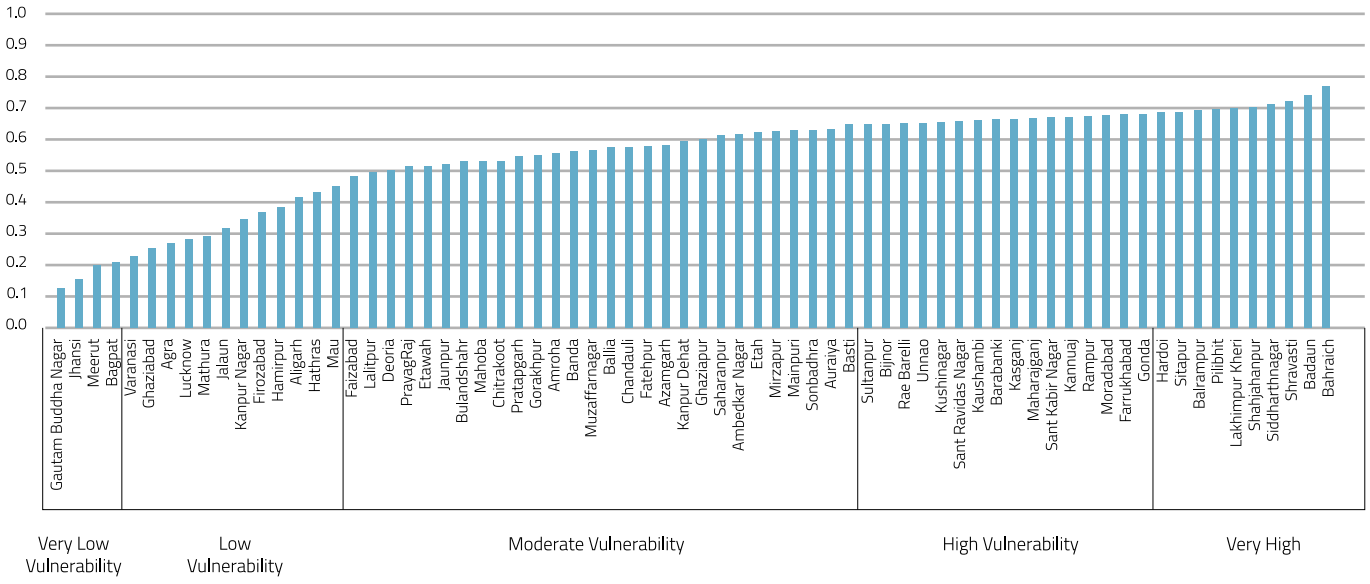


Figure 64: Ranking of Districts Based on an RHVI From Very-Low to Very-High Vulnerability

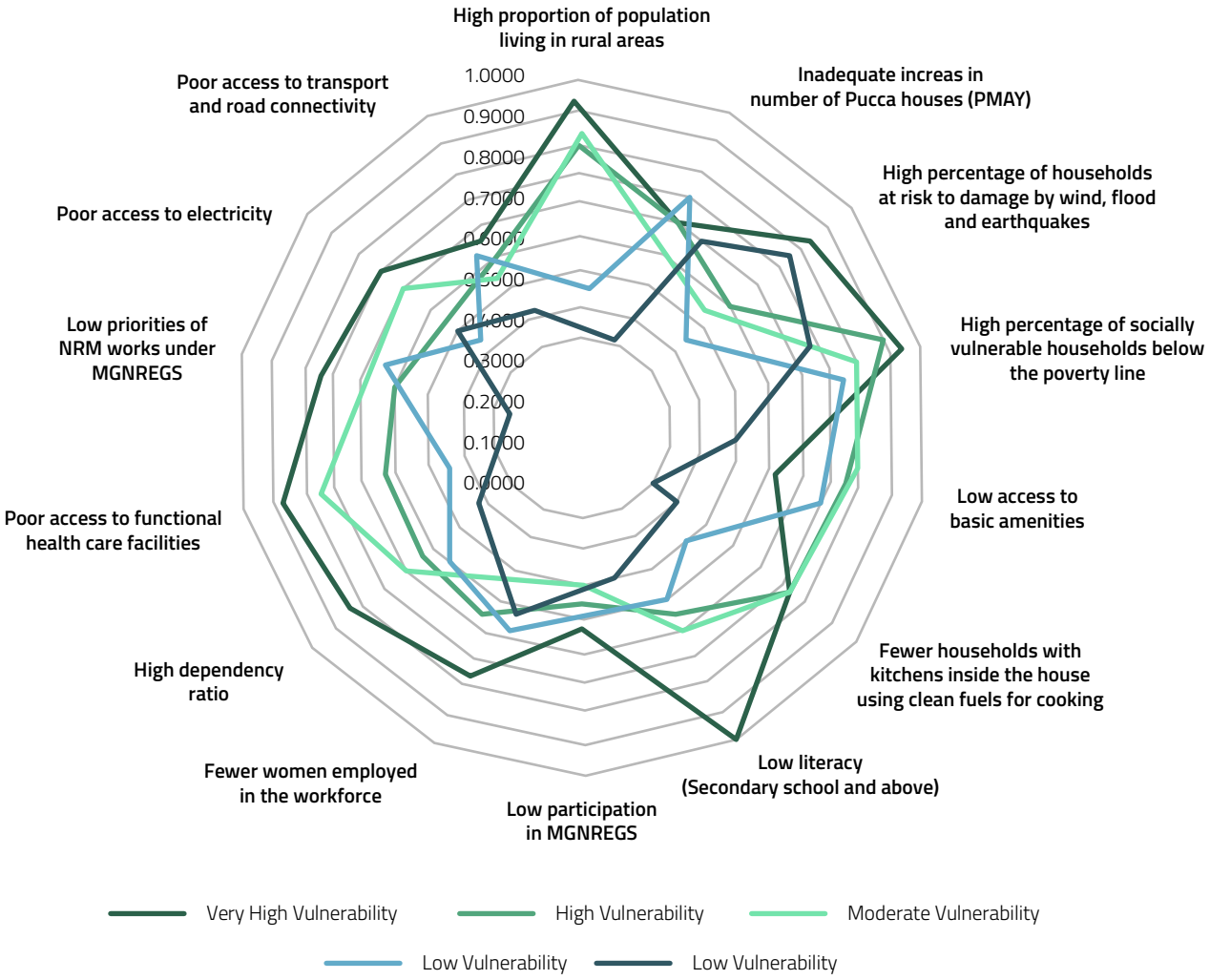


Figure 65: Drivers of Vulnerability of Rural Habitat Represented as a Radar Plot

obtained by considering the average normalized indicator values for each vulnerability class. The result is presented as a graph (Figure 64). The magnitude of each indicator in driving vulnerability is represented in the radar plot (Figure 65), where the further away a spoke is from the centre of the plot, the more strongly does the indicator drive vulnerability. A detailed assessment of vulnerability assessment for rural habitat can be accessed in section 4.6 of chapter 4.

Urban Habitat

The vulnerability assessment of the urban habitats was conducted using the IPCC AR5 methodology. A total of eight indicators were identified to assess vulnerability of urban habitats at the district-level. 12 districts with an urban population ≥1,000,000 were selected for this assessment. Out of the 12 districts selected (with urban population ≥ 1,000,000), eight districts were categorised under moderate to very high vulnerable class. The key drivers of the vulnerability in the eight districts, categorised as moderate to very highly vulnerable is underscored as *low road density, fewer literate women, high percentage of households at risk to damage by wind, extreme rainfall, and earthquakes, high population density, poor access to functional health care facilities, poor access to basic amenities, and fewer women in the workforce*.

Vulnerability is approached as a relative measure, where some districts are more vulnerable than others. The percentage contribution of an indicator to vulnerability index was obtained by considering the average normalized indicator values for each vulnerability class. The result is presented as a graph (Figure 66). The magnitude of each indicator in driving vulnerability is represented in the radar plot (Figure 67), where the further away a spoke is from the centre of the plot, the more strongly does the indicator drive vulnerability. A detailed assessment of vulnerability assessment for urban habitat can be accessed in section 4.6 of Chapter 4.

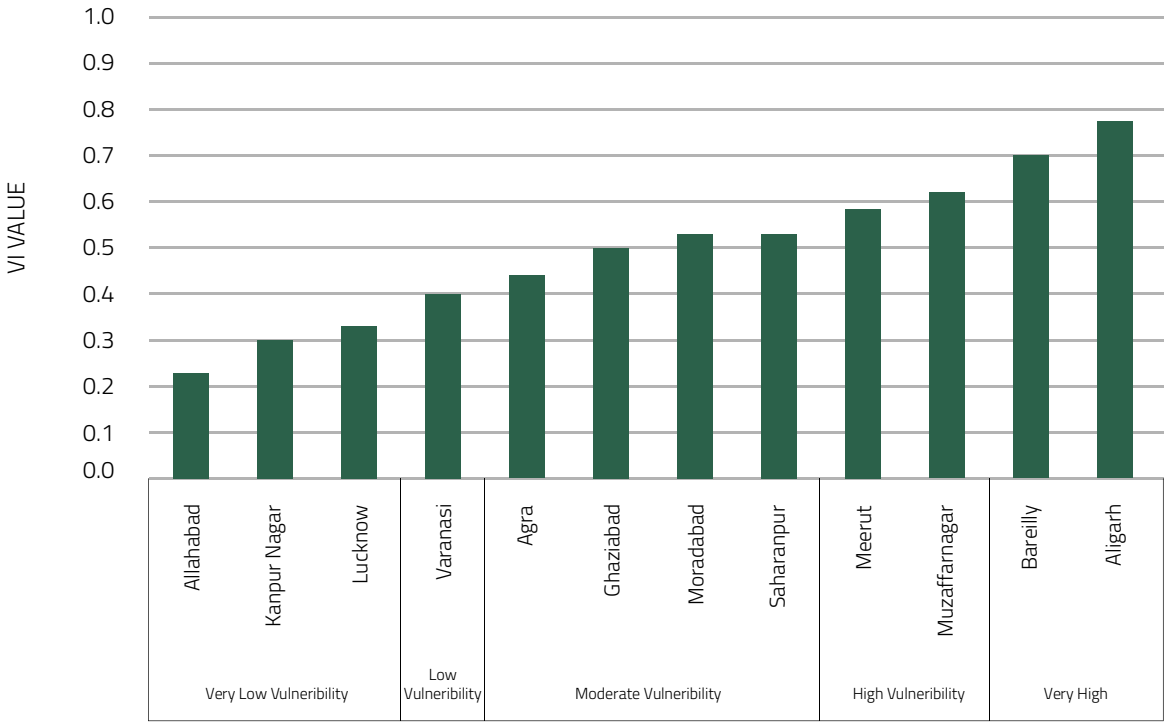


Figure 66: Ranking of Districts Based on an UHVI From Very-Low to Very-High Vulnerability

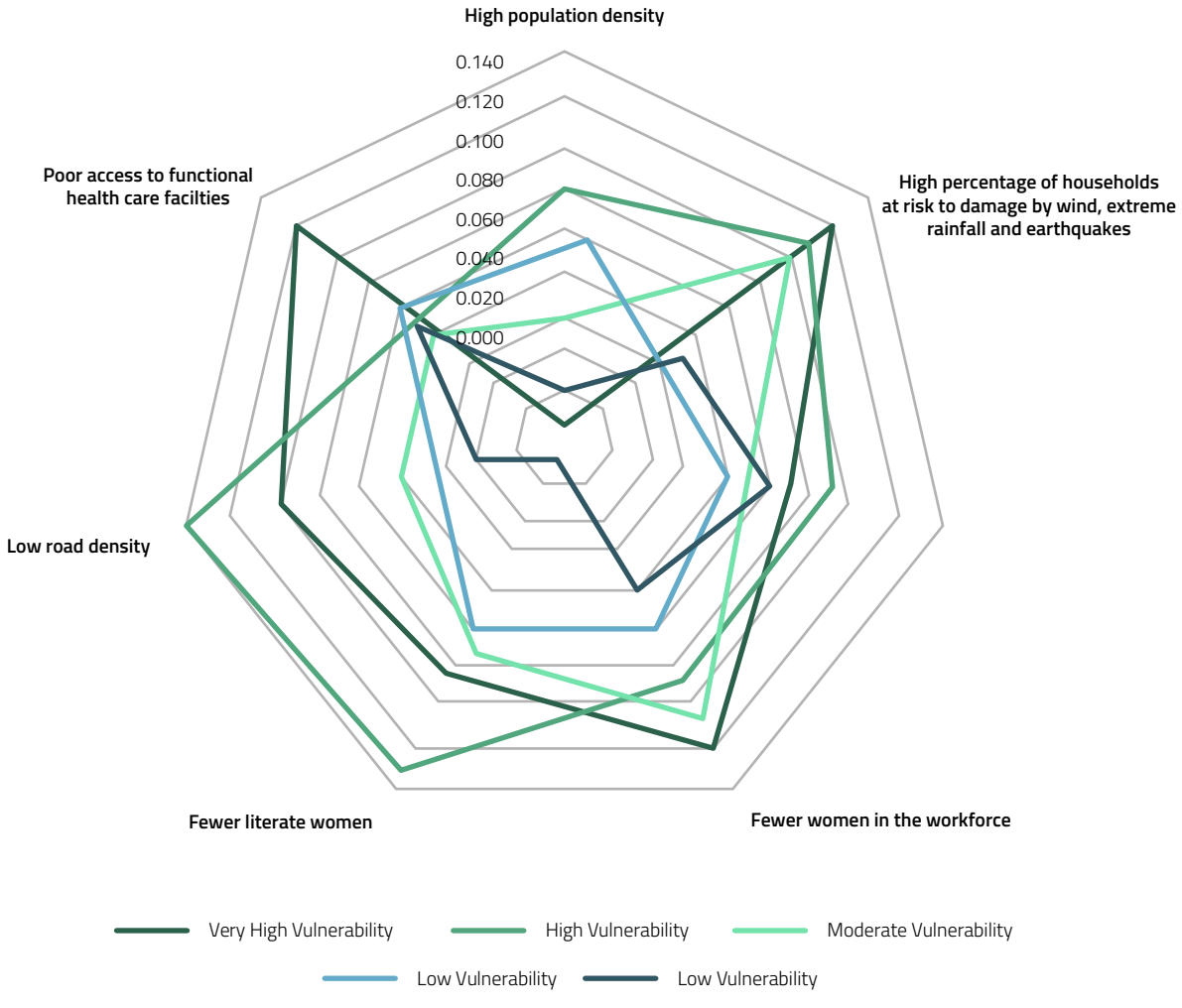


Figure 67: Drivers of Vulnerability of Urban Habitats Represented as a Radar Plot

9.1.3 Mitigation Opportunity

Globally cities are responsible for more than 70 percent of the GHG emissions (IEA (2012); IIASA (2012)). As per the Third Biennial Update (MOEFCC, 2021), the critical GHG gases emitted by various habitats are CO_2, CH_4, and N_2O, primarily from sectors such as Transportation, Land Use Change, and Waste (solid and liquid) Management.

GHG Source and Sink Categories in Habitats	CO2 Emissions	CO2 removal	CH4	N2O	CO2 Equivalent	Percentage of total CO2 equivalent with LULCF
Energy (Fuel Combustion Activities)						
Transport	269975.76	-	41.19	11.59	274433.69	10.84
Residential	126942.39	-	4.07	0.82	127282.50	5.03
Commercial/Institutional	68653.23	-	0.94	0.98	68975.54	2.73
Land Use, Land-Use Change and Forestry						
Settlements	-	1790.45	-		-1790.45	
Waste						
Solid waste disposal on land	-	-	753.90	-	15831.84	0.63
Waste-water handling	-	-	2066.00	51.66	59400.60	2.35

Table 51: Habitat and GHG Emission (in Gg) Scenario in India

Waste Management

The waste sector, which includes GHG emissions from microbiological processes such as anaerobic degradation of organic matter in solid waste, and the anaerobic treatment of domestic and industrial wastewater, represented 2.65% of GHG emissions in 2016. In the same year, its emissions were 75,232 GgCO2 eq., decreasing by 3.83% since 2014 (MOEFCC, 2021).

As of December 2021, out of total 14,861 metric tonnes per day total waste generated across the urban areas in UP about 78 percent of the waste generated is treated, while the rest is untreated (MoHUA, 2021). Both treated waste and untreated waste are critical to understand the amount of GHG emissions generated from the waste sector specifically in the urban areas. Further, a municipal solid waste energy inventory study identifies Uttar Pradesh to be one of the most heavily methane emitting states contributing a share of 10.8 per cent to the total Indian CH_4 emissions (Choudhary, Kumar, & Kumar, 2020). This highlights the increasing need to scientifically manage the waste at urban scale and build actions to simultaneously reduce the GHG emissions. One of the most promising climate mitigation action to reduce the methane emission generated from waste sector at the urban scale is to explore the waste to energy potential which is projected to increase upto 150.9 MW by 2030 from the current potential of 74.3 MW as of 2020 (Choudhary, Kumar, & Kumar, 2020).

Uttar Pradesh has already implemented Solid waste management and handling rules. Other key schemes and programmes include Swacch Bharat Abhiyan, etc.

Transport

54.35 % of the total diesel consumption in the state was by the transport sector in 2014 (PPAC, 2013). Uttar Pradesh has rolled out its draft EV policy which will entail the mitigation option (Refer strategy 5 under urban habitat).

Urban Green spaces

While green spaces act as sinks in the cities, per capita availability of parks and green places in municipal corporations and nagar palikas in Uttar Pradesh ranges from 2.13 sq mts to 0.01 sq mts (UDD, 2015). However WHO prescribes 9 sq.mts. of green space per capita in urban areas. There are a few initiatives taken by the state government in this regard. For eg., under the Green Highways Policy, stretches of 24.69 lakh plants have been planted in the state (PIB, 2022). Creation of such green spaces in urban areas requires supportive policies.

Some programmes like Smart Cities and Atal Mission for Rejuvenation and Urban Transformation (AMRUT) are aiming to provide ample job opportunities with the support of efficient service infrastructure. In addition, Government of India is implementing the Nagar Van Scheme or the Urban Forest Scheme with the aim of to develop. Urban Forests across the country in next five years with a renewed focus on people's participation and collaboration between Department of Environment, Forest and Climate Change , Municipal bodies, NGOs, corporates and local citizens.

9.2 HABITAT MISSION STOCKTAKING AND KEY CLIMATE RELEVANT POLICIES IN UP

The government of Uttar Pradesh in the past five years has taken key steps that are towards climate change adaptation and or mitigation. Some of the key actions taken are listed below:

• Under 'Urban Drinking Water District Scheme', re-bore/ installation of new hand pumps, expansion of pipe lines and re-bore of tube wells are done with the approval of district magistrate. In the FY 2019-20 total ₹ 100.00 crores have been released for the schemes approved under General and S.P.C. in all the 75 districts of the state.

• Since 2015, under AMRUT mission across sectors total size of SAAP estimated to be ₹ 4239.24 crores, and amount released till 2020 is ₹1581.47 crores.

• As per the Building by-laws 2018 (Draft), Section 3.11.6 mandates that the buildings such as hospitals, nursing homes, hotels, guest houses, rest houses, hostels, universities/institutions, army/solider barracks and any building more than 500 m^2 plot area, are to install solar water heaters, as per the norms mentioned under annex-3 of the by-laws

• City mobility plans were prepared during 2008-10 by UMTC. City mobility plan for Lucknow is underway. Mobility plan for metro is being prepared for Lucknow, Kanpur, Varanasi and Agra.

• In terms of green building projects, state has put in place more than 570 such projects covering over 1,400 million sq ft area, according to the Indian Green Building Council (IGBC).

• Total solid waste generated in urban areas in the state is approximately 15,500 tonnes per day (TPD), of which 13 % is processed scientifically at present in 9 urban local bodies (ULB).

The central and state policies linked to climate adaptation and mitigation in Habitat Sector that are being implemented are as follows:

Urban Habitat	Rural Habitat
• Smart City Mission (SCM) • Swachh Bharat Mission (SBM-U) • Atal mission for Rejuvenation and Urban Transformation (AMRUT) • Deendayal Antyodaya Yojana-National Urban Livelihoods Mission (DAY-NULM) • Jal Jeevan Mission (Urban) • Pradhan Mantri Awas Yojana – Urban (PMAY-U) • Urban Lake, Pond, Water Bodies Protection Scheme • Lake Conservation Scheme • River pollution Control Programme • Urban Infrastructure Development Scheme for Small and Medium Towns • Pandit Deendayal Upadhyaya Adarsh Nagar Panchayat • Adarsh Nagar Vikas Yojana • Chief Minister Urban Underdeveloped and Slum Development Scheme	• Jal Jeevan Mission (Rural) • State Groundwater Conservation Mission • Dr. Ram Manohar Lohia Community Tubewell Scheme • Community Mini Green Tubewell Scheme • Chief Minister RO Drinking Water Scheme (C.O.) • Pradhan Mantri Awas Yojana – Rural (PMAY-G) • Chief Minister Housing Scheme (Rural) • Swarna Jayanti Gram Swarozgar Yojana • National Rural Livelihood Mission • Shyama Prasad Mukherji Rurban Mission (SPMRM) • MGNREGA • Pradhan Mantri Gram Sadak Yojana • Rashtriya Gram Swaraj Yojana

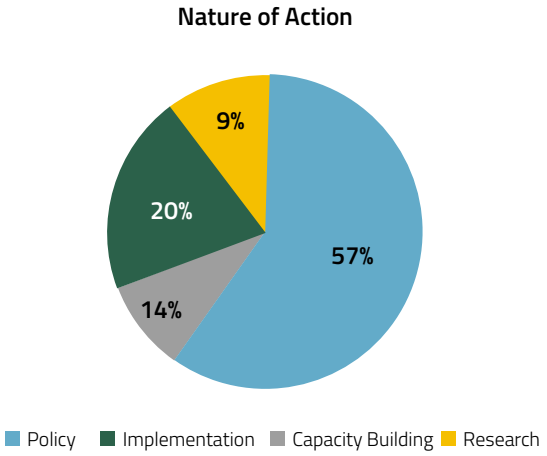
9.3 PROPOSED STRATEGIES, ACTIONS AND IMPLEMENTATION SCHEDULE:

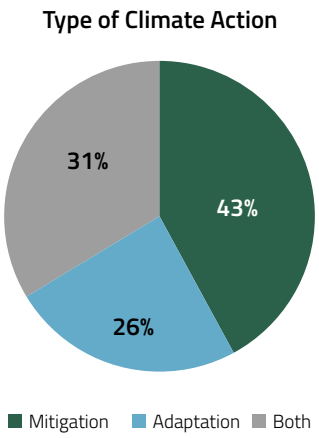
Based on identified climate risks and vulnerabilities, and subsequent consultations with stakeholders and experts, a total of five strategies have been arrived at to deal with impacts of climate change in urban habitats. Similarly four strategies have been arrived at to deal with impacts of climate change in rural habitats. Across the nine strategies under urban and rural habitats, a total of 35 action/sub-actions are proposed to be implemented till 2030, with an estimated budget of ₹ 8,327 Cr details depicted in Table 52.

Strategy	No. of Actions	Estimated Budget (₹. in Cr)	Key Implementing and Nodal Agencies
Component A: Urban Habitat			
Mainstreaming Climate Resilience and Pollution Mitigation actions into Urban Governance	1	26.00	Urban Development Department, UPPCB
Building Climate Resilient Housing Infrastructure	5	1.90	Urban Development Department, Housing and Planning Department, Awas Bandhu and Groundwater Department
Developing Climate Resilient Urban Water infrastructure and Storm water drainage	4	1377.75	Urban Development Department, State Disaster Management Authority (SDMA), Jal Nigam, PWD, ULBs and Directorate of Local Bodies
Developing Climate resilient waste management infrastructure	5	2520.75	Dept. of Namami Gange and Rural Water Supply, SMCG-UP, Urban Development Department, and Uttar Pradesh Pollution Control Board (UPPCB), SMCG-UP
Building Climate Resilient Road Infrastructure and Low Carbon mobility options	5	992.00	Urban Development Department, PWD, SDMA, ULBs, UPPCB, Transport Dept., Urban Transport Directorate, Department of Environment, Forest and Climate Change , Metro Rail Coprporation
Total Component A Budget (₹. in Cr)		4918.00	
Component B: Rural Habitat			
Mainstreaming climate change in rural governance and planning	5	110.75	Panchayati Raj Department (PRD), Rural Development Department (RDD), Panchayati Raj Training Institute (PRIT), Environment Forest and Climate Change Department
Building Climate resilient rural housing	2	6.50	PRD, RDD, Housing and Urban Planning Department, Directorate fo Environment, UPNEDA, Skill Development Mission
Developing climate adaptation integrated approach to rural skills development and diversification of livelihood Opportunities	5	41.10	RDD, UP Skill Development Mission (UPSDM), Labour Department, MSME, Institutional Finance
Building climate resilient road and climate smart waste infrastructure	3	3250.00	PWD, RDD, Uttar Pradesh Rural Road Development Agency, Swachh Bharat Mission (Rural)
Total Component B Budget (₹. in Cr)		3408.35	
Overall Estimated Budget for Habitat Mission (₹ In Cr)		**8327**	

Table 52: Summary of Strategy wise number of actions, estimated budget and key agencies of Sustainable Habitat Mission

Across the mission, all proposed actions are categorized into two classes, based on the type of climate actions, i.e., adaptation centric, mitigation centric or both. These actions are further classified based on the nature of actions, i.e., implementation, policy, research, and capacity building. Owing to the state's priority to improve the climate policy landscape, of the 32 proposed actions, 57 percent are under policy activities and 20 percent under implementation activities. Considering the importance of adaptation to extreme weather events and building resilient infrastructure and lifestyles in urban and rural areas of the state, 43 percent of the 32 actions are adaptation centric.





Com mit

Figure 68: Distribution of Type and Nature of Actions Proposed Under Sustainable Habitat Mission

A summary of proposed strategies, actions, targets and other relevant information are outlined below. For a detailed list of strategies, refer to Table 85 in Annexure.

Component A: Urban Habitat Strategies and Actions:

Strategy 1: Mainstreaming Climate Resilience and Pollution Mitigation actions into Urban Governance and Policy Planning

Strategy alignment with SDGs: SDG 11 | SDG 13
Strategy alignment with NDCs: NDC 06

Nineteen percent of the total population increase in India, i.e. , an increase of 30.7 crores during 2011-36 is anticipated to occur in Uttar Pradesh alone. To mitigate and adapt to climate change induced extreme weather events and slow onset events, creation of climate sensitive urban policies is a proactive step to build safe, inclusive, sustainable and low carbon cities in UP.

Strategy 2: Building Climate Resilient Housing Infrastructure

Strategy alignment with SDGs: SDG 09 | SDG 11 SDG 13
Strategy alignment with NDCs: NDC 06

Between 2012-2017, urban housing shortage across India was at 18.78 million houses. With increasing urban population, high density settlements and squatter settlemnets has been a huge challenge for urban areas. With increasing extreme weather events, it is imperative to build climate resilient housing infrastructure across UP.

Strategy 3: Strategy 3: Developing Climate Resilient Urban Water infrastructure and Storm water drainage

Strategy alignment with SDGs: SDG 06 | SDG 09 SDG 11 | SDG 13
Strategy alignment with NDCs: NDC 02 | NDC 06

Critical infrastructure such as water supply lines and storm drainages are increasingly under pressure of shocks and stress created by the extreme weather events. This disrupts the normal flow of demand and supply in a major way and hence needs to be addressed.

Strategy 4: Developing Climate Resilient Waste Management Infrastructure

Strategy alignment with SDGs: SDG 06 | SDG 11 SDG 12 | SDG 13
Strategy alignment with NDCs: NDC 02 | NDC 06 | NDC 07

As of December 2021, of the 14861 MT/D of waste generated in UP 11592 is treated while 3269 is untreated. A recent MSW energy inventory identifies Uttar Pradesh to be one among the most heavily CH_4-emitting states contributing 10.8% of total Indian CH_4 emissions. The future (2040) energy potential across the state has been computed to be 150.9 MW. Hence, waste management (both solid and liquid) is a critical mitigation opportunity for the state, to achieve the NDC goals along with SDGs.

Strategy 5: Building Climate Resilient Road Infrastructure and Low Carbon Mobility options

Strategy alignment with SDGs: SDG 07 | SDG 09 SDG 11 | SDG 13
Strategy alignment with NDCs: NDC 02 | NDC 03 | NDC 06

Disruption of road network and impacts on mobility is seen across the state during extreme event such as floods, wind hazards, storm etc. Also, 10.84% of total CO_2 emissions within LULCF is by the transport sector in India. Thus, potential for transitioning to a low carbon mobility with resilient road infra is higher for UP owing to its highest vehicle registration (i.e., 4.01 crores till 2022) and highest population than other states.

Component B: Rural Habitat Strategies and Action Snapshot:

Strategy 6: Mainstreaming climate change in rural governance and planning

Strategy alignment with SDGs: SDG 6 | SDG 11 | SDG 13
Strategy alignment with NDCs: NDC 06

Governance and institutional architecture play a critical role in building and effective implementation of any policy, scheme, programme. Therefore, building their awareness, institutional capacities and training is crucial for enhancing institutional resilience to tackle climate change in rural UP.

Strategy 7: Build climate resilience in rural housing

Strategy alignment with SDGs: SDG 11 | SDG 13
Strategy alignment with NDCs: NDC 06

Rural housing are exposed to extreme weather events such as floods, storms, lightning etc. Hence, the strategy aims to build climate resilience and increase use of sustainable material for creating an ecosystem for green buildings in rural UP.

Strategy 8: Developing climate adaptation integrated approach to rural skills development and diversification of livelihood opportunities

Strategy alignment with SDGs: SDG 04 | SDG 08 SDG 11
Strategy alignment with NDCs: NDC 06

To create a just transition towards building a carbon neutral state and to this end, enhance skills and livelihood opportunities of individuals. COVID-19 highlighted the vulnerabilities faced by rural migrants and its impact on their livelihoods. Therefore the strategy aims to build capacities of rural populations and address their skilling needs in order to create safe, inclusive, green and resilient livelihood opportunities.

Strategy 9: Building climate resilient road and waste infrastructure

Strategy alignment with SDGs: SDG 06 | SDG 09 SDG 11 | SDG 13
Strategy alignment with NDCs: NDC 06

Both transport and waste are critical sectors to manage the GHG emissions of the state. Hence, a holistic management of buildings, road infrastructure and waste (both liquid and solid) is critical for climate mitigation.

S.No.	Strategies/ Actions	Nodal & Implemening Agencies	Estimated Budget Requirement (in Cr.)
	(A) Urban Habitat		
1.	Mainstreaming Climate Resilience and Pollution Mitigation actions into Urban Governance and Policy Planning		
1.1	Preparation of comprehensive city climate action plans for the urban areas in U.P • Undertake urban climate risk assessment and identify extent of vulnerability for each urban centre above 50,000 population (Medium, Large, Metropolitan, and Megapolis cities) • GHG Emission Inventory • Ensure preparation of Heat Response Action Plan for all cities/towns [similar to Gorakhpur] • Conservation of existing city forests and devise a policy to create zone wise city forests • Ensure preparation of water scarcity and drought contingency plans, flood management plans • Conserve and rejuvenate urban wetlands and other waterbodies (incl. traditional) of all sizes • Prepare and ensure implementation of Air and Noise Pollution Action plans (micro plans) for all cities • Scale up Installation of Continuous Ambient Air Quality Monitoring stations (CAAQMS), particularly across smaller cities and towns in the state	Urban Development Department, UPPCB,	

Table 53: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/ Actions	Nodal & Implemening Agencies	Estimated Budget Requirement (in Cr.)
	• Upgrade manual units for air quality monitoring to automatic monitoring units • Assess area under crop residue burning in peri-urban areas in U.P., develop a scheme to spray bio-decomposer to avoid air pollution and conduct wide-scale awareness for farmers to apply the spray post harvesting. • Develop and implement action plan for mitigating noise pollution in cities (tackle honking, create vegetation buffers/barriers along roads etc.) To be taken up for all cities in UP with more than a 100,000 population		
2.	Building Climate Resilient Housing Infrastructure		
2.1	Mapping and identifying low lying housing societies in all flood prone cities (urban and river flooding) such as Moradabad, Prayagraj, Varanasi, Kanpur, Agra, Gorakhpur, Ayodhya, Ghazipur. Urban Level Spatial Maps to be prepared by 2025 and mapping of city wise flood prone housing risks by 2025	Urban Development Dept, Awas Bandhu	1.15
Research, Policy and Departmental Convergence Actions			
2.2	Develop a policy to ensure retrofitting of existing buildings that make them flood resilient (into urban housing schemes)	Housing Department, Urban Development Department, Groundwater Dept	1.90
2.3	Ensure adherence to green building norms by Institutional and commercial buildings		
2.4	Ensure implementation of IEC 62305 BIS norms for lightning proof skyscrapers/tall buildings		
2.5	Ensure implementation of rain water harvesting construction norms at housing societies, and institutional building (are more than 300 sq.m).		
3. Developing Climate Resilient Urban Water infrastructure and Storm water drainage			
3.1	Identify critical water supply facilities (treatment plants, supply lines) whose services can be potentially interrupted during extreme weather events (floods). This is to be done for all flood Prone Cities above 5 lakhs population	Urban Development Dept., SDMA, Jal Nigam	2.75
3.2	Ensure consideration of climate change and rainfall variability in design of new water supply facilities in flood prone areas	-	-
3.3	Retrofit the vulnerable water supply facilities by 2030	Urban Dept., PWD, Jal Nigam	625
3.4	Retrofit old and build new separate storm water drainages by 2030 to accommodate draining of the enhanced volume of water in projected extreme rainfall events scenarios	Urban Dept., PWD, Jal Nigam	

Table 53: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/ Actions	Nodal & Implemening Agencies	Estimated Budget Requirement (in Cr.)
4. Developing Climate resilient waste management infrastructure			
4.1	Management of solid waste through • Setting up of Waste processing facilities • Creating value chains for waste recycling and reuse (Waste to energy and any other) • Supporting entrepreneurs for city waste collection and reuse • Setting up of sanitary landfill • Bioremediation/capping of old landfills (legacy waste)	Directorate of Local Bodies, Urban Development Department, UPPCB, ULBs	750
4.2	Ensure Management of construction and demolition waste [NOIDA, Ghaziabad, Lucknow, Agra, Varanasi, Kanpur, Prayagraj has C&D processing plants in place]. New Construction of C&D processing plants to be had at Meerut, Bareilly, Aligarh, Moradabad, Saharanpur, Gorakhpur, Jhansi	Urban Development Department, UPPCB, ULBs	12.75
4.3	Ensure E-waste, Hazardous and Plastic Waste management and reuse protocols in all cities and Towns	UPPCB and Urban Dept	0.5
4.4	Policy formulation for in-situ waste water treatment, recycling, and re-use generated at neighborhood level including (cluster of housing societies, commercial complexes and institutional buildings) producing at least 0.5 MLD of wastewater for economic viability and ensure implementation in cities with pop. above 5 lakhs. [As on 2021, Total wastewater treatment capacity gap is 659 MLD]. It may be targeted that 25 % of treatment gap be reached at local level and rest at macro or city level, by 2030	Urban Development Department, UPPCB	1750
4.5	Encourage preparation of Faecal Sludge and Septage Management Plans in towns that have population below 5 lakhs.	Urban Development Department, UPPCB, SMCG-UP	7.5
5. Building Climate Resilient Road Infrastructure and Low Carbon Mobility options			
5.1	Identify and map critical road infrastructure within the cities susceptible to extreme weather events (such as floods, extreme heating and cooling) • Design and implement norms for constructing heat, cold and flood resilient green roads in respective identified areas. All cities and towns above 1 lakh pop. to be targeted.	Urban Development Department, PWD, SDMA, ULBs	12.5

Table 53: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/ Actions	Nodal & Implemening Agencies	Estimated Budget Requirement (in Cr.)
5.2	Develop comprehensive mobility plans that integrates GHG mitigation actions in all Saharanpur, Moradabad, Bareilly, Lucknow, Kanpur, Prayagraj, Varanasi, Jhansi, Agra, Aligarh, Meerut, Ghaziabad, Ayodhya, Firozabad, Mathura, Vrindavan and Shahjahanpur • Enhanced coverage of pedestrian walkability and cycling tracks across the cities • Smart Traffic Management Systems to ease congestion, smoothen traffic flow • Enhance infrastructure to promote non-motorized transport modes such as bicycles and rickshaws	Urban Development Dept. (Urban Transport), Public Works Dept., UPPCB, ULBs, Transport Dept., Metro Rail Corporation	4.5
	• Study the current share of different transportation modes and design required modal shifts to enable reduction in traffic congestion • Study Sustainable mass rapid transit and public transport to shift from private transport modes options - Promote Bus Rapid Transit (BRTS) based on feasible pphpd routes. - Increase routes, frequency and night services; Increase the number of bus stops; priority lanes; - Promote fuel-efficient bus driving and reduce idling; provide more bus shelters; bus priority at traffic lights - Plan metro rail development for Saharanpur, Moradabad, Bareilly, Aligarh, Ayodhya, Firozabad, Mathura, Vrindavan and Shahjahanpur as well based feasibility		
5.3	Implement the policy of vehicle scrapping for phasing out of old vehicles, in all cities, as per national policy	Transport Dept., UPPCB, Urban Transport Directorate	--
5.4	Implement EV policy roadmap in all major cities with population > 5 lakh by; • Setting up for adequate EV charging stations aligned with EV growth (NITI Aayog , 2021) • Procurement of EV public buses under UPSRTC (700 buses) through PPP (Gross Cost Contracts) and FAME subsidy. • Fiscal incentives to general public (private ownership) for buying EVs (MoHUA, Amendments in Model Building by-laws (MBBL - 2016) for Electric Vehicle Charging Infrastructure, 2019) Modification Building Bye Laws to incorporate EV charging infrastructure norms as per MoHUA Amendment to model bye laws 2019	Urban Development Department , UPPCB, Urban Transport Directorate	950
5.5	Ensure plantation and maintenance of tree line along arterial roads in all cities in UP	Urban Development Department, PWD, Environment, Forest and Climate Change Dept, ULBs.	25

Table 53: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/ Actions	Nodal & Implemening Agencies	Estimated Budget Requirement (in Cr.)
	(B) Rural Habitat		
6. Mainstreaming climate change in rural governance and planning			
6.1	Large awareness and training of PRIs representatives (5000 – 10000 trainees/ year) and the targeted beneficiaries at block level on climate impacts on rural areas and resilience practices (100 % of all block in the state to be covered by 2030).	Panchayat Raj Department (PRD)	15
6.2	Policy to mandate the inclusion of climate change vulnerability assessment in GPDPs (All GPs)	PRD and Rural Development Department (RDD)	--
6.3	Promote incentivization of gram panchayats for showcasing climate resilient best practices (e.g. provide 10% additional funds to annual budget))	PRD	--
6.4	Scale-up Rural Mission Activities across the state [15 -16 new clusters]; implementation of all new cluster by 2026	RDD	95
6.5	Ensure strict adherence to no development policy in ecologically sensitive areas (river flood plains, waterbodies, forests areas etc.). 100% of villages to be covered by 2023 • Illegal construction demolitions • No development awareness drives	RDD, PRD	0.75
7. Build Climate Resilience rural housing			
7.1	Promote awareness on climate resilient and green building designs under PMAY. • Training of trainers and specially mistries (i.e., construction masons) • All blocks to be covered by 2030	PRD, RDD, UPNEDA., Skill Development Mission	6.5
7.2	Flood Resilient housing policy (for all GPs) • Identification, Demarcate and notify flood and/or landslide prone areas in each village panchayat and map the land use plan • Ensure no construction in the notified flood prone areas (including on dariya land) • Ensure flood resilient building norms/bye laws are enforced in existing and future buildings	PRD, RDD, Housing Department, PWD, Department of Environment, Forest and Climate Change	--

Table 53: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/ Actions	Nodal & Implemening Agencies	Estimated Budget Requirement (in Cr.)
8. Developing climate adaptation integrated approach to rural skills development and diversification of livelihood Opportunities			
8.1	Generate awareness among target groups (such as SC/ ST in all villages, unemployed youth and women) about the benefit of skill development, employment and learning opportunities for alternate livelihoods (Farming + MGNREGA) • Promote employment under MGNREGA to all unemployed persons in villages • Strengthen alternate livelihoods to vulnerable sections such as SC/ST • Provide individual assets for livelihood generation • Promoting gender equality by providing more women off-season wage employment • Formation of new SHGs	RDD/ Skill Development Mission	0.75
8.2	Livelihood and rural labor capacity needs assessment: • To identify inherent skills of local community to strengthen alternate skill development opportunities • By mapping of skills of migratory labour All districts (with share of rural population above 50%) to be covered, and assessment to be completed by 2023	RDD, MSME, Institutional Finance	0.35
8.3	Strengthen coordination and collaboration with the private sector in skill-development, both to increase the relevance of training, and to improve and facilitate its delivery	RDD, Labour Department, Skill Development Mission	--
8.4	Ensure promotion of micro credit facility for promotion of alternate livelihood opportunities	RDD/Labour Department	--
8.5	Set up skill development centers at village and block level (all blocks) to provide skill development opportunities to local communities as well as to act as one-stop kiosks with information on the local labor market/ employment, vocational learning opportunities and support schemes; All blocks to be covered by 2030	Labour Department/ RDD/UPSDM	40

Table 53: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/ Actions	Nodal & Implemening Agencies	Estimated Budget Requirement (in Cr.)
9.	Building climate resilient road and waste infrastructure		
9.1	Mainstreaming climate resilience into PMGSY • Technical assistance to understand climate change impacts at micro-level for road construction and planning. • Special treatment for flood-affected ar eas through adequate waterways and submersible roads to allow easy passage of water, use of concrete block pavements, and improved drainage; • Use of environmentally optimized road designs and new technologies that use local and marginal materials and industrial by-products such as sand, local soils, fly ash, brick kiln wastes, and other similar materials in place of crushed rocks; • Innovative bridges and culverts through use of pre-fabricated/ pre-cast units for roads and bridges having better ability to withstand earthquakes and water forces such as continuous beams, bearing free construction, and river training works; Outputs will be Research reports/ study plans/policy/guidelines/G.O.	RDD, PWD, Uttar Pradesh Rural Road Development Agency	--
9.2	Develop all weather roads access to all remaining villages (if any) by 2026, in all villages (based on habitation)	PWD, RDD	
9.3	Gram panchayat level waste management programmes • GP level Solid Waste Management (SWM) • GP level Liquid Waste Management (LWM) • Construction of Community Soak Pits • Construction of drainage Channels, institutional soak pits • Community Managed Sanitary Com- plex (CMSC) to be constructed	RDD , Swachh Bharat Mission (Ru- ral) Department	3250
	• Construction of Functional Communty Toi- lets/Alternate low-cost toilets All GPs to be covered by 2026		

Table 53: Summary of Proposed Actions and Estimated Budget Required

Chapter 10

Human Health Mission

The impact of climate change and extreme weather on human health whether direct or indirect, is indisputable as proven by the (IPCC , 2022) report (Climate Change 2022: Impacts, Adaptation and Vulnerability). The report underlines with high confidence, the increasing morbidity and mortality associated with rising temperatures and heatwaves especially amongst those identified as the most vulnerable group. It also finds strong attributions to malnutrition, increased instances of diseases (water borne and vector borne) due to climate induced extreme weather events and rising temperatures.

Certain direct impacts of climate change include heat and cold waves, rainfall variability, floods, storms and drought. Indirect impacts, on the other hand, include incidence of certain vector borne, water borne, zoonotic diseases, respiratory and air borne diseases, and malnutrition (MoH&FW, 2016). Over the years, several instances of heat waves, cold waves and floods have been recorded in Uttar Pradesh- an increase in which could potentially be damaging for the state's population. Erratic rainfall patterns as a result of the changing climate can affect fresh water supply, causing water scarcity. This in turn can increase the risk of water-borne diseases like diarrhoea (National Health Portal, 2019). Moreover, the intensity and amount of floods are also increasing, which can potentially contaminate freshwater and further increase the risk of water-borne diseases like cholera. This is worse in regions with already poor sanitation facilities. (WHO, 2018). The 2021 GIZ and NIDM study, Mapping Climate and Biological Disasters in India, states that there has been an increase in both hydro-meteorological and biological disasters (JE and Dengue) across the country between 1995 and 2020 and identifies Uttar Pradesh as one of the states that has experienced more than 20 outbreaks of JE and Dengue during the said period. Table 54 below maps the prevalence of the related diseases across the State.

Disease	Districts with disease prevalence
Heat Stress and Cardio vascular Failure	Western and southern districts of UP
Dengue	Endemic in all districts[5]
Malaria	API 0-1 in 80% of the districts API 5-53 in Bareilly, Badaun, Kasganj, Aligarh, Gautam Buddh Nagar[6]
Chikungunya	Jaunpur and Lucknow[7]
Scrub Typhus	Faizabad,Unnao, Lucknow, Kanpur[8] , Gorakhpur[9]
Japanese Encephalitis	Gorakhpur, Maharajganj, Deoria, Kushinagar, Basti, Sant Kabir Nagar and Sidharth Nagar constitute (86% of total cases in UP)[8]; Hardoi, Lakhimpur Kheri, Lucknow, Raebareli, Sitapur and Unnao (6%)[8]; Baharaich, Balrampur, Sharawasti and Gonda (4%)[8] Faizabad division (2%)[8] ; Azamgarh division (1%)[8] ; Varanasi, Moradabad, Bareilly and Jhansi (<1%)[8]
Kala-azar	Kushinagar, Deoria, Balia[10]
Diarrhoea (Cholera), Typhoid, Hepatitis A & Food poisoning	Hotspots for diarrhoea include 80% of districts in UP[11]
Seasonal Influenza, COPD, Asthma, Rhinitis, Sinusitis	Percentage of deaths due to acute respiratory diseases: 9% (15-39 age group), 18.8% (40-69 age group), 21.1% (70+ age group)[12]
Malnutrition & Anaemia	0-5 years old: 46.2% children stunted, 17.9% wasted, 39.5% underweight, 63.2% anaemic[13] 25.43% women in the age group of 15-49 years having a BMI <18.5 are nutritionally deficit or are anaemic 16.5% women in the age group of 15-49 years having a BMI <18.5 are nutritionally deficit or are anaemic

Table 54: Weather linked priority diseases identified for climate change adaptation consideration in UP and their current prevalence

[5] https://main.mohfw.gov.in/sites/default/files/05Chapter.pdf

[6] https://www.pib.gov.in/PressReleasePage.aspx?PRID=1677601

[7] https://ncdc.gov.in/WriteReadData/l892s/27505481411548674558.pdf

[8] https://www.newindianexpress.com/nation/2021/sep/03/mystery-fever-spreads-to-other-districts-in-up-experts-call-it-vector-borne-scrub-typhus-2353884.html

[9] https://ncdc.gov.in/WriteReadData/linkimages/Annual%20report2016-17.pdf

[10] https://ncdc.gov.in/WriteReadData/l892s/6207694327163230 5324.pdf

[11] https://pubmed.ncbi.nlm.nih.gov/30470208/

[12] https://www.healthdata.org/sites/default/files/files/Uttar_Pradesh_-_Disease_Burden_Profile%5B1%5D.pdf

[13] https://main.mohfw.gov.in/sites/default/files/HealthandFamilyWelfarestatisticsinIndia201920.pdf

The complex disease burden associated with climate change requires a robust health infrastructure to be prepared. While private healthcare services in the State is a ubiquitous presence, critical public health services such as immunization, provision of maternal and child health services, prevention of communicable diseases programmes, management of outbreaks, epidemics and disasters and surveillance are carried out largely through the public health system. (Uttar Pradesh Health Policy, 2018). Uttar Pradesh has a three-tier public healthcare infrastructure, comprising primary health centres, health units, community health centres and sub-centres. As on March 2020, there are 20778 Sub-Centres, 2880 Primary Health Centres, and 711 Community Health Centres functioning in rural areas. However, there is still a 41% shortfall of Sub-Centres, 51% shortfall of PHCs and 51% shortfall of CHCs in the rural areas of the state. In terms of tertiary institutions, UP has 21 government medical colleges, 29 private medical colleges. These colleges are concentrated in Western and Central region of the state with majority around Varanasi (MOHFW, 2020).

The strategies and sub-action for the Human Health Mission in UP SAPCC 2.0 takes due cognizance of the visions of key policy pillars; the Uttar Pradesh Health Policy (2018), the National Programme on Climate Change and Human Health (2019), State Programme on Climate Change and Human Health and the UP-SDG Vision 2030.

10.1 CLIMATE RISK AND IMPACTS

Analysis of climate data for Uttar Pradesh for the period 1981-2019 indicates that the temperature in the state has increased by 0.6°C. Rainfall, which is highly variable spatially, varying from a maximum of 1307 mm in Maharajganj to a minimum of 519 mm in GautamBuddha Nagar, has decreased by 6.7 mm annually. Significant decrease in number of rainy days and increase in dry days has also been recorded, along with a significant increase in heavy rainfall days. Future projections made based on ensemble average of 10 AOGCMS run for the South Asia Coordinated Experiment (CORDEX) for RCP 4.5 and RCP 8.5 indicates that the temperature in the State is likely to increase by 1.9°C and 2.9°C by 2041 to 2070 under RCP 4.5 and RCP 8.5[15] scenarios respectively. Whereas the rainfall is likely to decrease in the period 2011 to 2040 by -45.8 mm under RCP 4.5 scenario and increase by +21 to 31.45 mm in the period 2041 to 2070 under RCP 4.5 and RCP 8.5 scenarios respectively.

Uttar Pradesh has seen uneven patterns of temperature and rainfall between 2016 and 2019, with high levels of humidity in 2019, which could have potentially affected the number of malaria cases in the state. Kala azar is a parasitic disease which is present in 4 Indian states, Uttar Pradesh being one of them. A study by Vaghela & Mangal (2018) suggests that the re-emergence of Kala Azar in north India could potentially be due to climate change. Additionally, there was a major viral outbreak of encephalitis in Gorakhpur (Eastern Uttar Pradesh) showing an increase in cases of both Acute and Japanese Encephalitis in the region, both of which peaked in 2017.

Higher air temperature influences the level and concentration of air pollutants, which can increase the incidents of airborne allergens. This can also lead to higher number of cardiovascular and respiratory diseases, like asthma. Approximately 22.5 million people are annually displaced and forced to migrate as a result of climate change, which is likely to increase in the future. Extreme climate events such as floods, storms, drought, and wind hazard are already causing loss of life and physical and mental injuries, population displacement and damage to property, in addition to the increased risk of spread of infectious diseases (NHP, 2019). Table 55 highlights the relation between climate indicators and disease incidence in Uttar Pradesh.

Climate Hazard	Impact	Disease	Study
Rainfall Variability	• Water scarcity • Water borne diseases • Water contamination due to floods • Vector borne diseases • Respiratory diseases	• Heavy rainfall and poor drainage system is UP leads to sewage water getting mixed with drinking water supply. This can increase the incidence of diarrhoea. • High precipitation during monsoons aids to a breeding ground for mosquitos and proliferation, increasing the incidence of Japanese Encephalitis (JE) in Eastern UP. • Heavy rainfall influenced the breeding of mosquitos, increasing the cases of malaria and dengue in Ghaziabad, UP. • Humidity leads to dissemination of tuberculosis and further development of dust particles.	(Singh, Singh, & Mall, 2020) (Mall, Singh, Prasad, Tompkins, & Gupta, 2017) (Rani, Gupta, Nagpal, & Mehta, 2018)

[15] RCP ^{4,5} scenario indicates stabilization of radiative forcing at ^{4,5} W/m^2 square in the year ^{2100}

RCP ^{8,5} scenario indicates stabilization of radiative forcing at ^{8,5} W/m^2 square in the year ^{2100}

Table 55: Evidence-based Mapping of Climate Risks and Impact on Health Sector

Climate Hazard	Impact	Disease	Study
Temperature Variability	• Vector borne diseases • Respiratory diseases • Cardiovascular	• One unit increase in average temperature and minimum temperature increased the average transmission of JE by 22.23% in Eastern UP. • High temperatures in winters and spring lead to early pollination causing Asthma and Obstructive Pulmonary Disorders. • Increase in winter temperature increases the incidence of cardiovascular diseases.	(Singh, Singh, & Mall, 2020) (Mall, Singh, Prasad, Tompkins, & Gupta, 2017)
Flood Proneness	• Water borne diseases • Vector borne diseases	• Prevalence of diarrhoea is very high among the under-five children of the Fakharpur Block of Bahraich district, which is highly flood prone • Due to floods in Bahraich district 57.7% of the people fell ill, out of which 33% had fever, 18% suffered from influenza 2% from malaria..	(Joshi, et al., 2011) (Kaushal, Joshi, & Khatri, 2010)

Table 55: Evidence-based Mapping of Climate Risks and Impact on Health Sector

Key interventions in Health sector in Uttar Pradesh are outlined below:

• In order to expand the health coverage in the state, UP government launched Mukhyamantri Jan Arogya Abhiyan in 2019. A total of 8.43 lac families are covered under the scheme. The state envisages to cover 40.79 lakhs ration card holding families in various districts and provide health cover of ₹. 5 lakhs per family each year. (GoUP, 2022)
• A state-wide surveillance drive was launched by GoUP in 2021 to combat water borne and vector borne diseases prevalent in Firozabad, Mainpuri, Etah, Mathura, Kanpur, Agra, Gonda districts.
• GoUP operationalised 16 new government medical colleges since 2017. Under the 'one district one medical college' scheme, the state aims to establish one private or government medical college in each of the 75 districts. (Gupta, 2021)
• Real time, web enabled electronic health information system called Integrated Health Information Platform (IHIP) was launched in the state in 2020. (DoH&FW, 2020)

Some key programmes for health sector in the state as identified in the State Health Action Plan on Climate Change and Human Health are:

• Integrated Disease surveillance programme (IDSP)
• National Vector Borne Disease Control Programme (NVBDCP)
• Revised national Tuberculosis Control programme (RNTCP)
• Tobacco Control programme
• Non-Communicable Disease (NCD) Control Programme
• National Mental Health Programme
• Leprosy Control programme

10.1.1 Inherent Vulnerability

A total of nine indicators were considered to assess vulnerability of the health sector at the district-level. The vulnerability assessment of the health sector, using the IPCC AR5 methodology, identified 40 districts as falling under moderate to very highly vulnerable category. The key drivers of the vulnerability in the 40 districts, categorised as moderate to very highly vulnerable is underscored as; low literacy, high percentage of population below 6 and over 60 years of age, high incidence of poverty, high percentage of households at risk of damage by wind, flood and earthquakes, high infant mortality rate , poor access to basic amenities, and low health insurance coverage.

Vulnerability is approached as a relative measure, with some districts more vulnerable than the other, the percentage contribution of an indicator to vulnerability index for each vulnerability class was obtained by considering the average normalized indicator values for each vulnerability class. The result is presented as a graph (Figure 69) below. The magnitude of each indicator in driving vulnerability is represented in the radar plot (Figure 70), where the further away a spoke is from the centre of the plot, the more strongly does the indicator drive vulnerability. A detailed assessment of vulnerability assessment for the rural habitat can be accessed in section 4.7 of chapter 4

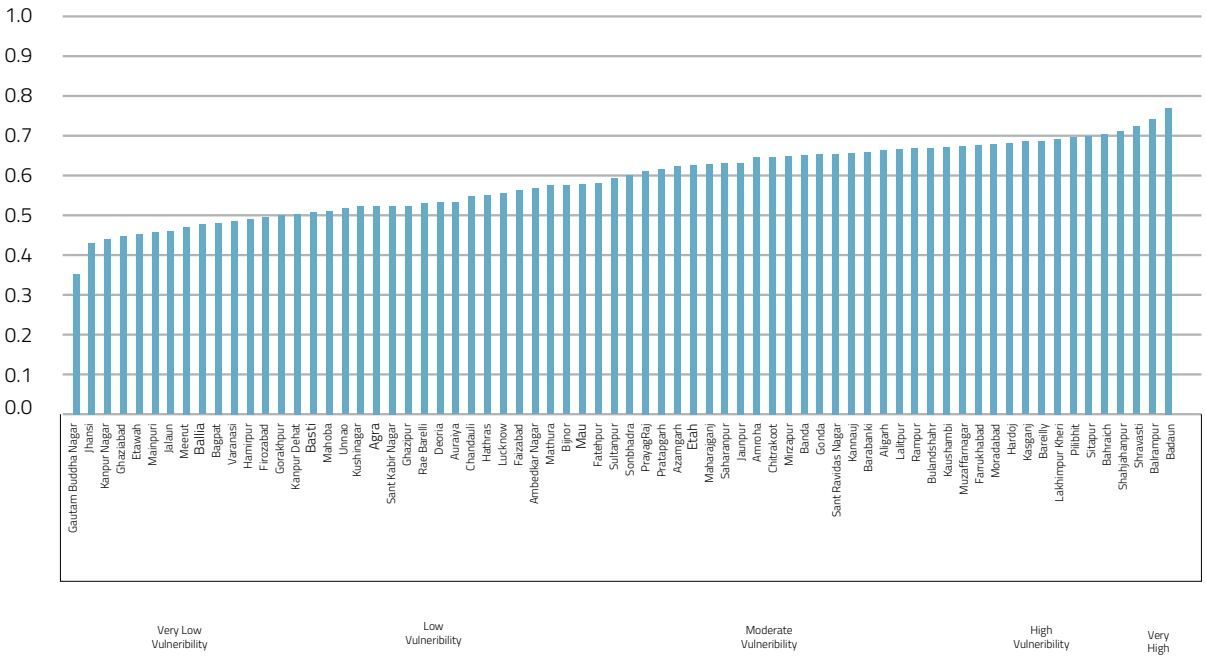


Figure 69: Ranking of Districts Based on a Health Vulnerability Index From Very-Low To Very-High Vulnerability

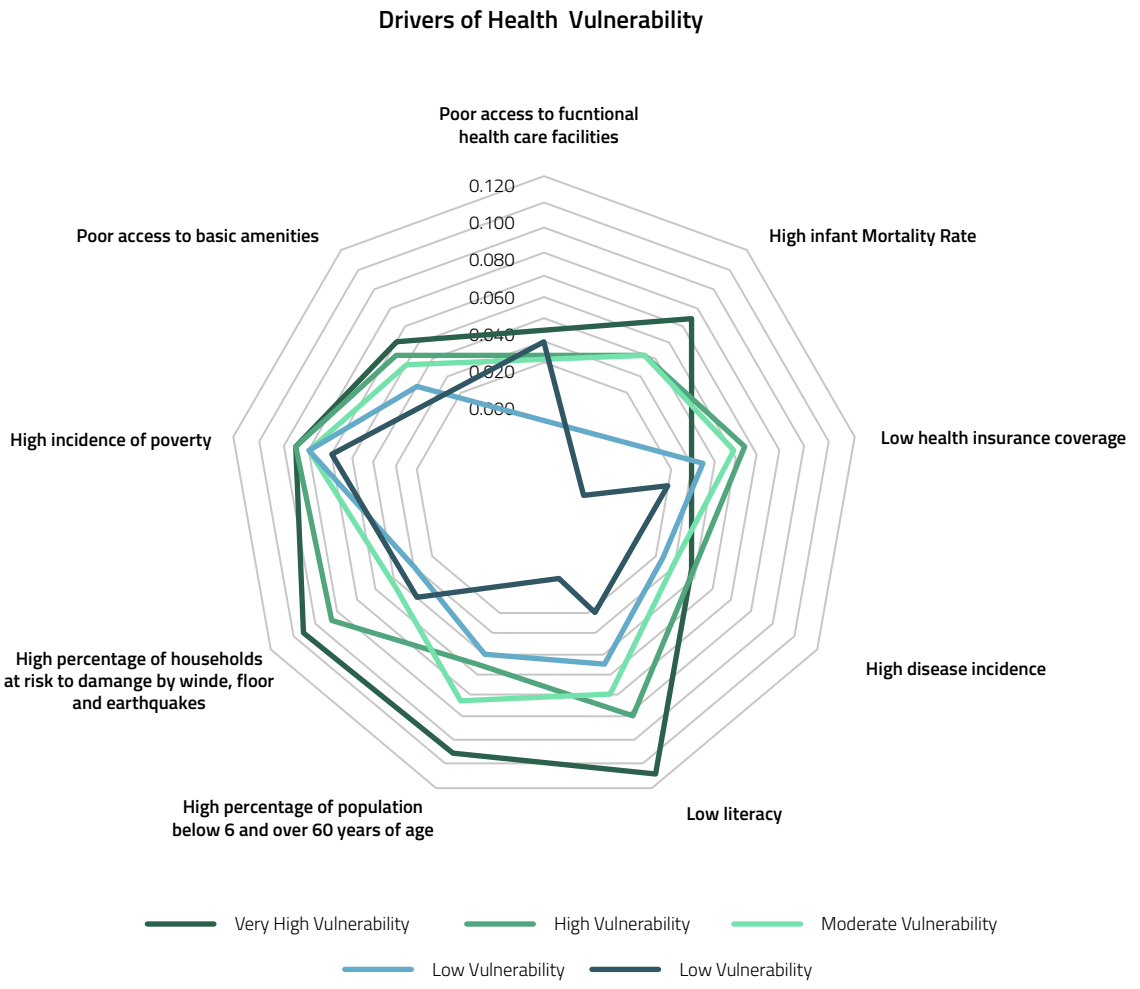


Figure 70: Drivers Of Health Vulnerability Represented as a Radar Plot

10.2 PROPOSED STRATEGIES, ACTIONS AND IMPLEMENTATION SCHEDULE:

Given the observed and projected changes in climate, and refined further through consultations with the health department, public health experts and climate change researchers, the Human Health Mission in UPSAPCC 2.0 compiles 3 key strategies and 13 sub-actions with an estimated budget of ₹ 171.5 Cr. A summary of the strategies has been presented in the table below.

Based on the state priorities, identified through consultative processes, the Human Health Mission in Uttar Pradesh is purely adaptation centric. The actions have also been identified based on the nature of actions as falling under one of the following; implementation, policy, research, and Capacity building. The nature of actions is primarily research, followed by capacity building and policy action.

Strategy	No. of Actions	Estimated Buget (₹. in Cr)	Key Implementing and Nodal Agencies
Assess extent of spatial spread of health risks due to current and future climate change (temperature, precipitation, humidity, air quality amongst others) in the state at highest possible resolution to facilitate location specific adaptation actions	5	18.00	Dept of Health and Family Welfare
Develop Early Warning and Alert Response System (EWARS) for predicting disease outbreaks.	9	56	Dept. of Health and Family Welfare, Technical Institutes and universities
Enable behavioural change in public to avoid climate linked disease epidemics	9	97.5	Dept. of Health and Family Welfare, Dept. of Basic education, Dept. of Secondary Education, NGOs working on nutrition and health , Dept. of Rural Development , Gram Panchayats, ULBs
Design Green health Infrastructure including energy efficient lighting systems, solar roof top, rainwater harvesting as per IPHS standards and undertake energy auditing	5	-	Key Implementing agency: Public Works Department and Rural development, Gram Panchayats,ULBs Nodal agency: Department of Health
Design and construct climate resilient new health infrastructure and retrofit existing to withstand the extreme climate events such as floods, extreme heat and cold.	3	-	
Overall Estimated Budget for Human Health Mission (₹ In Cr)		171.5	

Table 56: A Snapshot of Proposed Strategies, Number of Actions, Estimated Budget and Key Agencies for Health Mission

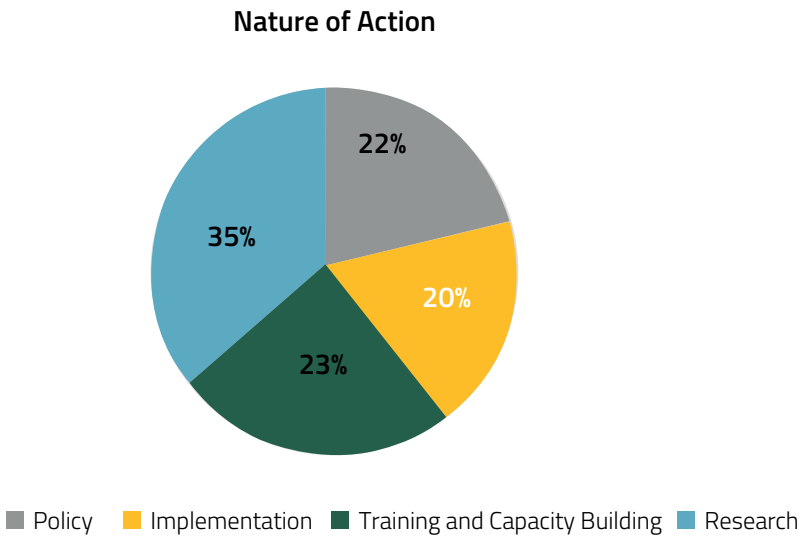


Figure 71: Distribution of Nature of Actions Proposed Under Health Mission

A summary of proposed strategies, actions, targets and other relevant information is outlined below. For a detailed list of strategies, refer to Table 86 in Annexure.

Strategy 1 : Assess extent of spatial spread of health risks due to current and future climate change (temperature, precipitation, humidity, air quality amongst others) in the state at highest possible resolution to facilitate location specific adaptation action.

Strategy alignment with SDGs:	SDG 2 | SDG 3 | SDG 6 | SDG 13
Strategy alignment with NDCs:	NDC 06

Unexpected disease outbreaks due to changing climate leads to widespread morbidity and mortality. It becomes crucial to identify high endemic pockets for the purpose of introducing special interventions. Disease epidemic can lead to not just widespread risk to human health (morbidity and mortality) but also have severe social and economic consequences. Effective surveillance and response can reduce incidence of communicable diseases (vector-borne, water-borne, respiratory diseases) of epidemic potential to a minimum level, as well as track the expanse of incidences of malnutrition, anaemia, and heat stress. It does so through a resultant better understanding of the 'burden of epidemics, their co-occurrence and the key biological, ecological, economic, health system and governance determinants' (WHO, 2016).x

Strategy 2 : Develop Early Warning and Alert Response System (EWARS) for predicting disease outbreaks.

Strategy alignment with SDGs:	SDG 2 | SDG 3 | SDG 6 | SDG 13
Strategy alignment with NDCs:	NDC 06

Effective surveillance and response can reduce incidence of diseases with epidemic potential to a minimum level. A realistic analysis of the current level of collation of health statistics, availability of high resolution climate data (real time, short term forecasts) and pollution levels in the State and assessment of gaps therein is required to develop a climate-linked disease forecasting system. This collation of data will allow timely and accurate forecasts for decision makers and all players involved in health service delivery, for developing effective preparedness.

Strategy 3 : Enable behavioural change in public to avoid climate linked disease epidemic.

Strategy alignment with SDGs:	SDG 3 | SDG 13
Strategy alignment with NDCs:	NDC 01 | NDC 06

Changing pattern of disease manifest with changing climate adn pollution levels. It is necessary that linkages of health and climate change with the role of food and nutrition, hygiene and santitation be actively be disseminated in order to induce positive behavioural change. This can be done in myriad ways, starting from inclusion in school curriculum, and trainings imparted to change-makers at grassroot level (ASHA workers and SHGs) to active dissemination of vulnerability assessments through ULBs and Panchayats for a wider reach.

Strategy 4: Transform all health Infrastructure (buildings) into green infrastructure

Strategy alignment with SDGs:	SDG 13
Strategy alignment with NDCs:	NDC 02| NDC 03

To contribute to the overall NDC goal to reduce India's emission intensity and improve energy efficiency of its economy over time while adpating to climate change, it is proposed that all buildings used for health services in UP follow national norms for energy efficiency such as switching to LED lighting, solar roof tops, undertake rainwater harvesting as per IPHS standards etc., and undertake energy auditing.

A circular/notification to that effect will need to be issued by the health department.

Strategy 5: Design and construct disaster resilient new health infrastructure and retrofit existing ones to withstand the extreme climate events such as floods, extreme heat and cold.

Strategy alignment with SDGs:	SDG 13
Strategy alignment with NDCs:	NDC 02| NDC 03

Considering that increase in intensity of extreme weather events is being observed and is projected to increase further due to continued warming of the atmosphere, its imperative that the infrastructure providing health services should be climate resilient. It is therefore proposed to issue notification and provide guidelines by the Health Department of the State directing the construction of climate resilient buildings to protect the patients from impacts of extreme events. Note that existing buildings will need to be retrofitted while the new buildings will follow the climate resilient design norms while being constructed.

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹ in Cr)
1. Assess extent of spatial spread of health risks due to current and future climate change (temperature, precipitation, humidity, air quality amongst others) in the stateat highest possible resolution to facilitate location specific adaptation actions			
1.1	Assessment to be completed by 2025 and repeated every 5 years for all vector borne diseases such as; Dengue, Malaria, Chikungunya, Scrub Typhus , Japanese Encephalitis , Kala-azar	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare	6.00
1.2	Assessment to be completed by 2025 and repeated every 5 years for all Water borne disease; Diarrhoea (Cholera), Typhoid , Hepatitis A , Food poisoning	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare	4.00
1.3	Assessment to be completed by 2025 and repeated every 5 years for all respiratory diseases ; Seasonal Influenza, COPD, Asthma, Rhinitis, Sinusitis	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare	4.00
1.4	Assessment to be completed by 2025 and repeated every 5 years for Malnutrition and anaemia	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare	2.00
1.5	Assessment to be completed by 2025 and repeated every 5 years for heat stress	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare	1.00
2. Develop Early Warning and Alert Response System (EWARS) for predicting disease outbreaks.			
2.1	Analyse gaps in data collation system to develop disease forecasting capacities; Enable easy access for researchers to develop data retrieval system which allows real-time capture of disease incidence data (incl other required data) from existing data collection platforms of the state. For the purpose, data sources may be mapped, MoUs signed for data retrieval if necessary and develop retrieval system till 2025	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare, Technical Institutes and universities	2.00

Table 57: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹ in Cr)
2.2	Undertake real-time analysis and spatial visualization to assess temporal progress of the causal agent and disease spread; All vector-borne diseases, water- borne, respiratory diseases, Malnutrition and anaemia, heat stress to be included in the assessment	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare, Technical Institutes and universities	10.00
2.3	Develop standardized short-, medium- and long-term forecasting for all priority climate linked diseases. This may be done through organization of challenges. The forecasts made should realistically indicate location of occurrence, location specific timing of peak incidences, maximum weekly incidences, total number of cases in a transmission season, maximum hospitalization requirements; - Vector borne disease challenges (5 separate challenges, one each annually for all 6 vectors to be arranged. To be repeated every year for next 4 years to achieve standardization) - Water borne disease challenges (4 separate challenges, one each annually for all diseases to be separately arranged. To be repeated every year for next 4 years to achieve standardization) - Respiratory disease challenges (5 challenges, one each annually for all respiratory disease to be separately arranged. To be repeated every year for next 4 years to achieve standardization) - Malnutrition and anaemia (one challenge each annually to be arranged. To be repeated every year for next 4 years to achieve standardization) - Heat stress (one challenge to be arranged annually, and to be repeated every year for next 4 years to achieve standardization)	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare	34.00
2.4	Establish institutional mechanisms for enabling forecasts to reach to decision makers and all players involved in health service delivery at district/block/gram panchayat level in the state to enable preparedness. Institutional mechanism to be mapped and pilot forecast to be delivered in the 3rd year onwards (web platform/mobile app/sms)	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare Facilitated by: Dept. of Environment, Forest and Climate Change	10.00

Table 57: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹. in Cr)
3. Enable behavioural change in public to avoid climate linked disease epidemics			
3.1	Annual exposure workshop for children from nursery to std 12, to ensure behavioural change towards adopting good practices to prevent climate linked diseases	NA: Dept. of Basic education, Dept. of Higher Education IA: Dept. of Basic education, Dept. of Secondary Education, Dept. of Higher Education, NGOs working on nutrition and health	--
3.2	Develop and implement school curriculum that children need to pass at +2 level compulsorily to enable internalization of benefits of balanced diet intake, exercising, personal hygiene, community hygiene, etc. to avoid; Vector borne diseases, Water borne diseases, Respiratory diseases, Malnutrition and anemia, Heat stress; - Curriculum to be developed within 1st year -Train teaching methods to teachers in the same year -Curriculum to be made functional for the 11th standard from the 2nd year of implementation of action, -Examination to be held for 11th and 12th, in 2nd and 3rd year onwards -Curriculum to be updated as necessary		5.00
3.3	Develop and implement a curriculum on 'climate and health' for students in nursery to class 5. - Curriculum to be developed within 1st year -Train teaching methods to teachers in the same year -Curriculum to be made functional for classes, nursery to class 5, from the 2nd year of implementation of action, -Curriculum to be updated as necessary		5.00
3.4	Design a communication plan and develop targeted training modules, wherever necessary, with objectives of inducing behavioural change towards combating climate change impacts. -Member of Legislative Assembly (MLA) to communicate the vulnerability assessment of their local area for them to influence policy on climate change and health adaptation (annual communication) - ASHA/ANM/AWW: Training modules targeting behavioural change towards combating climate change impacts to be imparted by trained master trainers - Women SHGs: Training modules to be imparted by master trainers - Rural and Urban water and sanitation Utilities: Annual communication of reports on vulnerability assessments -Panchayats: Communicate impacts of climate change on human health for them to integrate adaptation action in their planning	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare, Dept. of Rural Development , Gram Panchayats, ULBs	88.00

Table 57: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹. in Cr)
4:.Transform all health Infrastructure (buildings)into green infrastructure			
	Ensure installation of energy efficient lighting systems	NA: Department of Health IA: UPNEDA, PWD. Gram Panchayats, ULBs	--
	Introduce solar roof top systems		
	Procure only CFC free cooling systems,		
	Undertake rainwater harvesting.		
	Undertake regularly green building auditing *All actions be undertaken as per Indian Public Health Standards (IPHS, 2022).*		
5.	**Design and construct disaster resilient new health infrastructure and retrofit existing ones to withstand the extreme climate events such as floods, extreme heat and cold.**		
5.1	Identify the climate hot spot districts and the vulnerable infrastructure	NA: Department of Health IA: PWD, Water resource department, Gram Panchayats, ULBs	--
5.2	Undertake retrofitting for protection from extreme heat, and extreme floods		
5.3	Ensure water availability during droughts by linking rainwater harvested systems and other sources		

Table 57: Summary of Proposed Actions and Estimated Budget Required

Chapter 11

Disaster Management

Climate change exacerbates the inherent vulnerabilities of systems and when coupled with the intersecting and multiplication of varied risks- there are overwhelming consequences on countries, communities, livelihoods, eco-system, and infrastructures. The IPCC Sixth Assessment Report, underscores with high confidence the humanitarian crises emanating due to the interaction of climate hazards with the pre-existing vulnerabilities in the society as well as the resulting high economic and social costs across national boundaries (IPCC AR6 WGI, 2022).

There is an overwhelming rise in climate-induced disasters in the last few decades, between 2000 and 2019 with "26% more storms than the annual average of 102 events, 23% more floods than the annual average of 163 events, and 18% more flood deaths than the annual average of 5,233 deaths". India (321 events) itself recorded one of the highest numbers of disaster incidences globally, with the human impact of 14.9 million people (CRED & UNISDR, 2020). Thus, underlining the importance of national and subnational strategies for disaster risk responses.

11.1 CLIMATE RISK AND IMPACTS

The Composite Risk Index presented in a 2019 study by GoI-UNDP identifies Uttar Pradesh as one of the states with high disaster risk index owing to its high vulnerability and low capacity index (MHA & UNDP, 2019). Uttar Pradesh is highly vulnerable to climate-induced disasters such as floods, droughts, cloud burst, flash floods, heat & cold waves, and hailstorms, resulting in loss of human and animal life, property and causing damage to the environment. The 2021 study published by NIDM and GIZ that maps climatic and biological disasters in India for the period of 1995-2020, found that Uttar Pradesh records the combined highest number of human deaths for the four climatic disasters; Floods, Heat Waves and Cold Waves (NIDM & GIZ, 2021) . The state also records the highest mortality on select biological disasters. The report also anticipates that Uttar Pradesh will continue face the impacts from increased frequency and intensity of climatic disasters, particularly floods and cold waves, the impacts of which will be further exacerbated by the existing vulnerabilities of the state.

Table 58 below presents state wise observed extreme climate events for the period 1995-2020. Uttar Pradesh emerges as the state with the fourth-highest incidences of extreme events (cold waves, floods and heat waves).

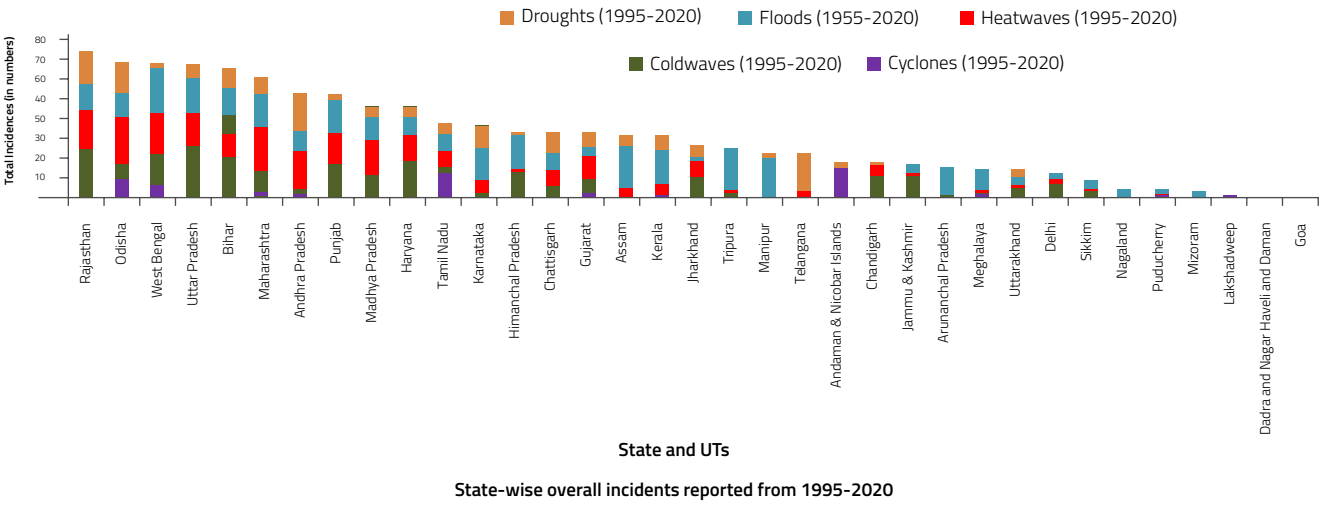


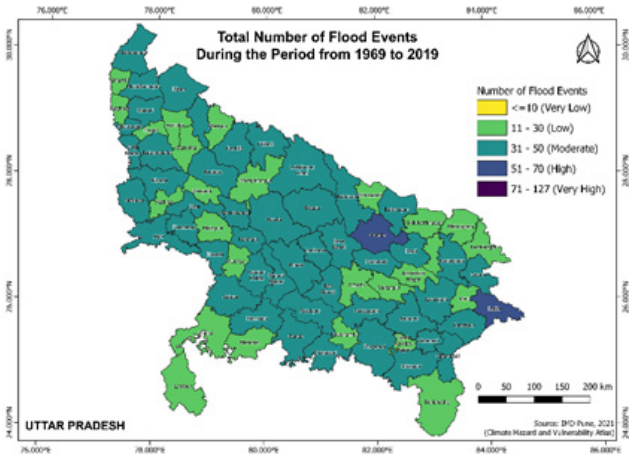
Figure 72: State-wise Overall Incidents Reported From 1995-2020

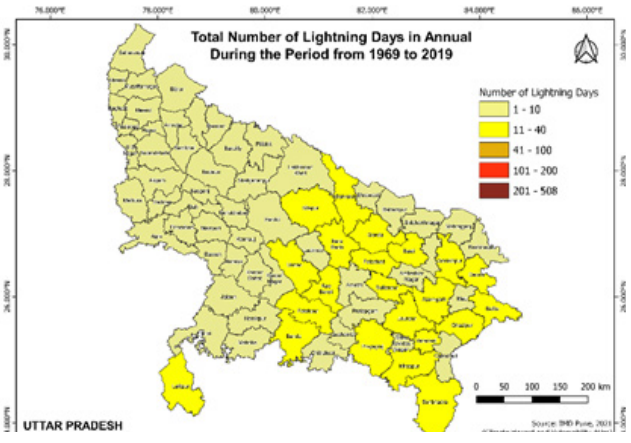
Source: Gupta et al., 2021

Climate Risk	Impacts
High Precipitation/ Intese rainfall spells	Floods: Floods have become an annual occurrence in UP with districts in Eastern UP highly vulnerable to floods as compared to the districts in the Western region (Usama, 2015). Above-average rainfall, during the Southwest monsoon season between the months of June to September often triggers flooding. The reported fatalities are often caused due to drowning, buildings or walls collapse, lightning strikes and also because of being bitten by snakes in floodwaters. The affects are exacerbated due to lack of natural and artificial drainage often leading to inundation and damage (NITI Aayog , 2021)

Climate Risk	Impacts
	Uttar Pradesh witnessed a total of 2539 annual flood events in the period 1969 to 2019, and nearly 63% of the total districts in the state reported annual flood incidences between 31 to 50, in number (Figure 2)
High Temperature/ Precipitation variability leading to drought and drought-like conditions	Drought and Drought like conditions: Drought, a frequent occurrence in Uttar Pradesh, is a 'complex hazard' owing to its slow onset characteristic and widespread risk and cascading impacts. Between 1981 to 2018, all districts of the Bundelkhand region saw an average of nine severe drought events, with the drought event of (1983–1985) in Jalaun district being the most severe (Pandey, Srivastava, Singh, Petropoulos, & Mall, 2021) (Pandey et al, 2021). The paper also found an increasing severity of meteorological drought in the area, during the post monsoon period. The direct and indirect economic cost of drought is longer-term and range from crop damage, loss of soil moisture and nutrition, livelihood loss, increased mortality and morbidity in humans and livestock, forced migration etc (NIDM, 2021) The increased vulnerability of Uttar Pradesh to drought and drought-like conditions, is because of a high dependence on agriculture and allied sector as the source of livelihood (two-third of rural population). This when combined with the high prominence of rainfed agriculture and small operational holdings, increase the climate vulnerability of particularly the rural population (UPSDMA, 2016)
High Temperature and Precipitation Variability/	Heat Wave and Cold Wave: Uttar Pradesh experiences majority heatwave incidences in the month of May with a magnitude of around 4–8 °C for most parts of the state, and a coverage of 30–45% of the total area under heatwave (Das, 2021) (Das et al., 2020). The same research also shows that Uttar Pradesh saw a decreasing trend of heatwave incidences between 1979 and 2017. However, between 2015 and 2020, deaths associated with heatwaves have increased in Uttar Pradesh (NIDM & GIZ, 2021). UP recorded 6726 total number of disastrous heatwave days between the period of 1969-2019. Agra, Jalaun and Banda were the districts that recorded more than 200 such events during the said period. Thunderstorms, Lightning, Squall, Hailstorm and Dust Storm: There are increasing scientific evidence linking the increased warming of the atmosphere and growth in urban centres with increase in thunderstorm and lightening incidences (Pandey K. , 2021). The article also quotes another journal article to say that India is expected to face an increased frequency (10-25%) and intensity of lightening strikes (15-50%) by the end of century. Between 1969 and 2019, Uttar Pradesh recorded a total of 720 lightening days annually. The district of Gonda recorded the highest number of annual lightening events (n=30) during this period[15] (Figure 2).

Table 58: Evidence-based Mapping of Climate Risks and Impacts of Disaster Management





[15] Extracted from https://imdpune.gov.in/hazardatlas/index.html

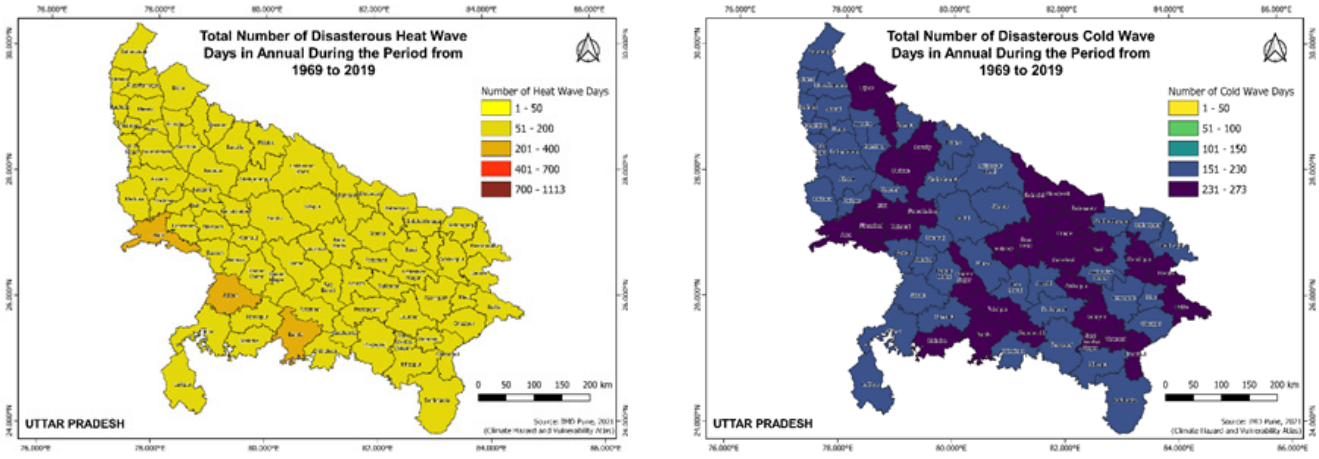


Figure 73: Climate Hazard Events During the Period 1969-2019

Source: Prepared using Hazard Atlas data, IMD

The key interventions undertaken in disaster management by the state of Uttar Pradesh are outlined below:

- Flood Control Centres were established in critical flood prone districts of the state in order to gather information and immediate remedial measures, such as repair of embankment etc.
- Flood Management Information System (FMIS) was created by a GO in year 2014 and serves as the technical secretariat for flood management in UP. FMIS was created with the intent to coordinate activities such as flood forecast, river/embankment surveys, improvement of hydrological observation, collating and disseminating necessary data for flood management in the state, liasoning with other critical national, state and district-level stakeholders etc.
- National Agricultural Drought Assessment and Monitoring System, initiated by the Dept. of Space provides fortnightly bulletins based on interpretation and analysis of NOAA (National Oceanic and Atmospheric Administration) satellite data
- Crop Weather Watch Group: The committee looked at assessment medium-term weather forecast, assessment of area-wise crop sown, preparation of weather contingency plans for crops

11.1.1 Inherent Vulnerability

A total of seven indicators were considered to assess vulnerability of the disaster management sector at the district-level. The vulnerability assessment, using the IPCC AR5 methodology, identified 51 districts as falling under moderate to very highly vulnerable category. The key drivers of vulnerability of these 51 districts, were identified as the following factors; low literacy, high incidence of poverty, high percentage of households at
risk to damage by wind, flood and earthquakes, low insurance coverage, high percentage of population below 6 and over 60 years of age, poor access to basic amenities, reduced participation in MGNREGA, and low insurance coverage.

Percentage contribution of an indicator to vulnerability index for each vulnerability class was obtained by considering the product of its weight and normalized value. The result is presented as a graph (Figure 74) below. Major drivers of vulnerability for the districts in different vulnerability classes are presented in the radar plot in Figure 75. The further away a spoke is from the centre of the plot, the more strongly does the indicator drive vulnerability. A detailed assessment of vulnerability assessment for the rural habitat can be accessed in section 4.8 of chapter 4.

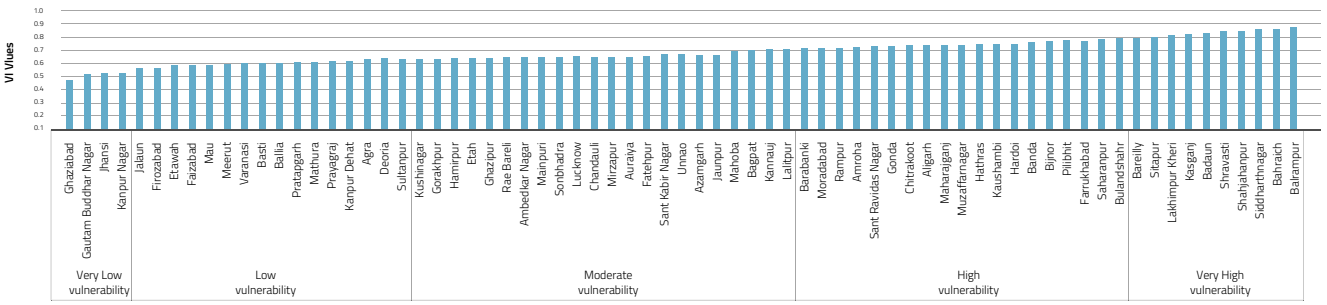


Figure 74: Ranking of Districts Based on a Disaster Management Vulnerability Index From Very-Low to Very-High Vulnerability

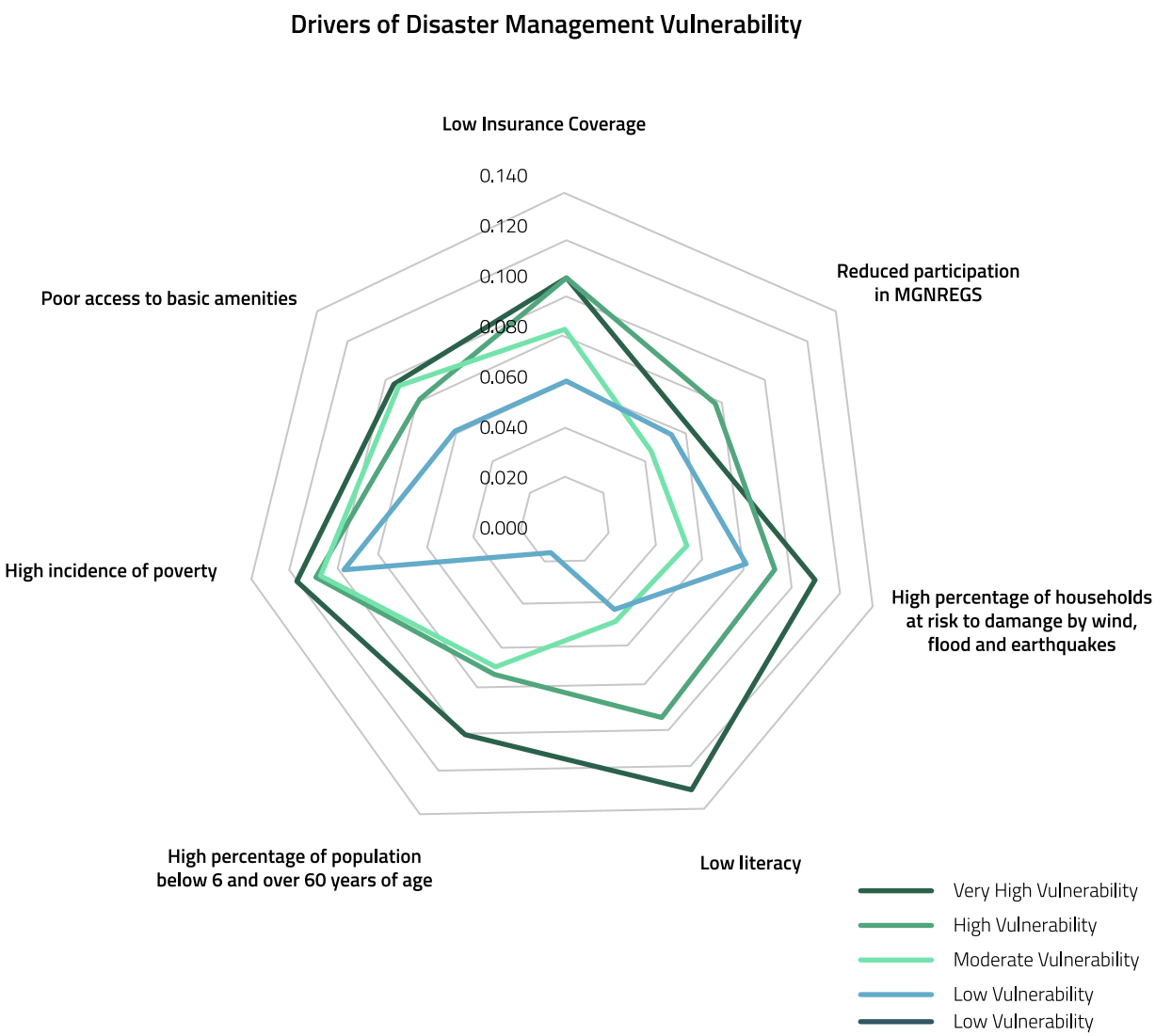


Figure 75: Drivers of Disaster Management Vulnerability Represented as a Radar Plot

11.2 PROPOSED STRATEGIES, ACTIONS AND IMPLEMENTATION SCHEDULE

Based on hydro-meteorological hazard trends in the state, historical and future climate analysis, it is likely that UP will face enhanced impacts of intense extreme hydro-meteorological events as their numbers and intensities are projected to increase. An assessment of loss and damages will add value to the risk management and financial consideration required to address the impacts of slow and rapid onset of events. Based on inputs from review of secondary literature, further validated through engagements with key government departments and sector experts, two prioritised strategies comprising of 10 sub-actions have been proposed for the Disaster Management Mission. The estimated budget for the mission is ₹ 305.7 Cr.

All actions proposed as part of the Disaster Management Mission is Adaptation centric. In terms of the nature of activities, Figure 76 shows that 56% of the actions are policy-centric while research-based actions account for 33% and 11% of the actions are core implementation based.

Strategy	No. of Actions	Estimated Budget (₹. in Cr)	Key Implementing and Nodal Agencies
Enhancing capacities for building institutional resilience towards climate change induced extreme and slow onset disasters.	8	295.2	UPSDMA , Office of Relief Commissioner, Irrigation and Water Resources Department, Other departments in GoUP, UP Flood Management Information Centre, Insurance companies. Gram Panchayats, ULBs, DDMAs
Build climate resilience through creation of related knowledge products, policies and guidelines.	2	10.5	UPSDMA, Office of Relief Commissioner, Directorate of Environment
Total Budget (₹ In Cr)		305.7	

Table 59: Summary of Strategy-wise Number of Actions, Estimated Budget and Key Agencies for Disaster Management Mission

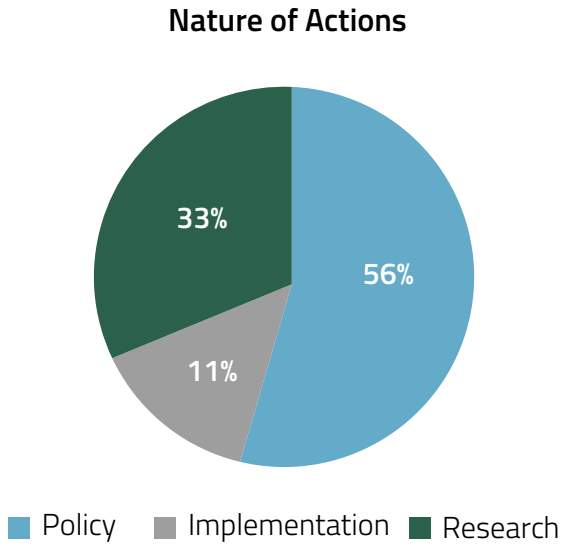


Figure 78: Distribution of Type and Nature of Actions Proposed Under Disaster Management Mission

A summary of proposed strategies, actions, targets and other relevant information is outlined below. For a detailed list of strategies, refer to Table 87 in Annexure.

Strategies and Actions for Disaster Management Mission

Strategy 1 : Enhancing capacities for building institutional resilience towards climate change induced extreme and low onset disaster.

Strategy alignment with SDGs: SDG 6 | SDG 11 |SDG 13
Strategy alignment with NDCs: NDC 06

Uttar Pradesh has been witnessing annual large scale losses & damages due to increasing frequency and intensity of climate hazards. This necessitates the development of institutional capacities for better mitigation, real-time tracking of climate parameters, and for also effectively leveraging national and international resources. Improved real-time tracking of key hydromet hazards (Flood, Drought, Thunderstorm, coldwave, heatwave) and slow onset disasters (desertification, epidemic diseases) will build on the current mechanism to better assess sector-wise loss and damage and ensure a move towards improved policy measures to build climate resilience.

Strategy 2 : Build climate resilience through creation of related knowledge products, policies and guidelines.

Strategy alignment with SDGs: SDG 6 | SDG 11 | SDG 13
Strategy alignment with NDCs: NDC 06

The cross-sectoral nature of disasters implies an inherent need towards a strong research- policy collaboration in order to address the research-policy-implementation gap and for timely and effective dissemination of latest disaster

related research. This is pertinent in the light of increasing frequency and intensity of climate-induced disasters in Uttar Pradesh.

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹. in Cr)
1. Enhancing capacities for building institutional resilience towards climate change induced extreme and slow onset disasters.			
1.1	Develop a dynamic climate hazard mapping system for dissemination and for informed decision making for risk management across sectors. To account for hazards such as - Hydromet hazards (Flood, Drought, Thunderstorm, coldwave , heatwave) - Slow onset disasters (desertification, epidemic diseases) -Track on a real-time basis all hydro meteorological hazards using IMD info with locations and extent specified, and thereby develop hazard specific dynamic maps. Hazards, are to also be tracked using the existing a citizen reporting mechanism. Merge all the layers for visualizing hazard location and extent of loss and damages. Information on loss profile, DALYs, livestock lost, crop loss, infrastructure damaged such as buildings, roads bridges etc., to be added. The tracking is to continue in the 2nd phase (till 2030).	UPSDMA, Office of Relief Commissioner	10.00
1.2	Increase the density of hydro meteorological observation platforms such as Doppler Radars {also suggested in (NIDM & GIZ, 2021) } to capture the changes in frequency and intensity of various climatic disasters at micro-watershed level. Install 3 additional S-band Doppler radars across the state.	IMD, UP SDMA, Office of Relief Commissioner	50.00
1.3	Access transboundary and trans-state advance warning and real-time tracking of rainfall and river flow data, through MoUs with upstream states, river management agencies, CWC, NRSC and other stakeholders. This will allow access to real-time data on rainfall and river flow, thus enabling integration of this information within the existing early warning system for floods set up by UP. For this purpose; - Establish a committee to develop protocol for data access from upstream states within 2022. Start generating real-time warnings for the State for each river/stream flowing into UP, by 2023.	UPSDMA , Irrigation and Water Resources Department, UP Flood Management Information Centre	10.00
1.4	Assess economic and non-economic loss and damages (income losses and physical damages), including irreversible loss and damages, due to changing climate risk hazards and slow onset events across sectors; -Economic loss: Business operations, Agriculture production, Tourism; Physical damages: property, infrastructure, business value chains etc. -Non economic loss to individuals, society and environment (health, human mobility, cultural heritage, indigenous knowledge, societal/cultural identity, biodiversity, ecosystem services) Develop methodologies to assess annual L&D by 2023 in line with the guidance provided by the UNFCCC on the same and set up timelines for update. First annual publication of economic and non-economic L&D to be completed by 2023.	Office of Relief Commissioner, All departments of the Govt. of UP	14.00
1.5	Assess department-wise the extent of economic and non-economic risks and vulnerabilities due to changing trends and future projections of hydrometeorological hazards and slow onset events originating within and outside the state boundaries..	Office of Relief Commissioner,	100.00

Table 60: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹. in Cr)
1.6	Assess sector-wise the extent of climate-induced economic and non-economic L&D (within and outside the state boundaries). First risk assessment to be completed by 2023, and it may include high resolution climate projections for UP at short, medium and long-term time scales. This action will further entails: Preparation of handbook for assessing sector-wise L&D in the state, including formulation of guidelines stating the required data sources, across sectors, that need to be mapped organise training workshops	Office of Relief Commissioner, All departments of the Government of UP, UP State Disaster Management Authority (UPSDMA)	100.00
1.7	Develop and implement a five-year rolling work plan to manage climate risks and alleviate large-scale climate induced L&D. Thorough stakeholder consultations at various levels of jurisdiction including at community level and scientific/ technical inputs, will be a part of the process. This will entail; -Developing a framework for building long term risk resilience across sectors -Developing Institutional frameworks and M&E frameworks -Assessing budgets and assign financing stream -Developing capacity building plans for each sector and departments therein	Office of Relief Commissioner, Gram Panchayats, ULBs, UPSDMA, DDMAs	100.00
1.8	Develop Heat- action plan for Uttar Pradesh, to manage and reduce the impacts of extreme heat events	UPSDMA	1.20
2. Build Climate resilience through creation of related knowledge products, policies and guidelines			
2.1	Develop a knowledge network to collate and disseminate information on; (1) applicability and scalability of Hydrometeriological hazard risk mitigation technologies and techniques, (2) Different types of risk transfer mechanisms. Financial instruments and tools , (3) Ways to mitigate disaster-induced migration, displacement and human mobility from the state , (4) Exploring social protection programmes and safety nets., (5) Any other relevant topic - Publish sector-specific research outputs for informed decision making by the depts. Workshops to be conducted on different thematic areas with concerned stakeholders such as government depts., and their agencies, the private sector and the local communities.	Directorate of Environment, UPSDMA, UPCCA	10.00
2.2	Mainstreaming climate risk and information into policy making by conducting annual trainings on mainstreaming Climate risks concerns into developmental Plans/Project All departments and their agencies at state, district, block, panchayat , city ULB level with the District Planning Committees of each district.	Directorate of Environment, Office of Relief Commissioner, UP SDMA,	0.50

Table 60: Summary of Proposed Actions and Estimated Budget Required

Chapter 12

Strategic Knowledge Mission

The National Mission on Strategic Knowledge for Climate Change (hereafter refer as NMSKCC) is one of the eight missions set up by the Government of India forming the base for National Action Plan for Climate Change (NAPCC). At national level, the mission seeks to build a dynamic knowledge system that would support and inform national actions for responding effectively to achieve the Updated Nationally Determined Contributions (U-NDC) and the Sustainable Development Goals (SDG). The mission focuses on recognizing the importance of measuring and quantifying climate change elements, the dynamic nature of knowledge and technology as well as importance of the ability to capture opportunities based on this knowledge and technology (DST, 2010).

Keeping this in mind, it is essential to establish a strong knowledge base for identifying, formulating, planning and implementing climate policies. Having a robust and strategic knowledge system is crucial not only at the national level but also at the state-level. The Uttar Pradesh Strategic Knowledge Mission for Climate Change (SKMCC) is one of the seven missions as outlined in the initial UP SAPCC (2014).

Therefore, following the NMSKCC and continuing the efforts of the Strategic Knowledge Mission (SKMCC) under initial SAPCC. The core vision for the mission will be "to guide climate policy in the state for implementation of climate actions to build sustainable, climate smart, resilient and green UP". In order to achieve the vision of the mission by 2030, the core components addressed are illustrated in the Figure 77.

Figure 77: Components of Strategic Knowledge Mission

The core components that the mission will address are:

• To strengthening of capacities of existing climate change related agencies such as UP Climate Change Authority (herein after referred as CCA or UPCCA)

• To create state of art knowledge hubs and network for building climate adaptation and mitigation knowledge products

• To generate awareness, outreach material and build capacity of public and private institutions and citizens of UP

•To make climate sensitive assessments, and promote ecosystem to build disruptive research and technologies

• To create frameworks for assessment of data points, action outcomes, climate performance of the state

12.1 STRATEGIC KNOWLEDGE MISSION STOCKTAKING

The government of Uttar Pradesh in the past five years has taken key steps that are towards development of knowledge products and dissemination. Some of the key actions are listed below:

• Remote Sensing application Centre set up the Surface Water Resources Division in November 2012 and is conducting a number of projects. These include flood inundation mapping, assessment of waterlogged areas, projects on LIDAR mapping, utility mapping, etc. In 2015, the division got equipped with Mobile Lidar, terrestrial Lidar and Bathymetric instruments for road widening, bridge site, siltation, dredging of rivers, etc. (RSAC, Surface Water Resources Division, 2021)

• Flood Mapping Information System Centre (FMISC) has been set-up as technical secretariat for flood management in the state during 2014, including all flood related information, develop databases, analytical tools, information products, dissemination among government agencies. FMISC coordinate activities such as Embankment Asset Management System, inundation mapping and flood forecast, river/embankment and topographic surveys, community participation in flood risk management, capacity building, etc. (IWRD, 2021)

• A study has been conducted on Ecosystem services-based adaptation to climate change in Bundelkhand region. It includes baseline study to assess vulnerability, improve forest ecosystem through community-based restoration, agroforestry, arrest run-off rain water, from 2017-2020. The study was conducted in 16 villages of Banda, Hamirpur, Orai (Jalaun) & Chitrakoot forest divisions benefitting farmers/ members of 16 Joint Forest Committees in 4 Forest divisions of Bundelkhand region (NABARD, Ecosystem services-based adaptation to climate change in Bundelkhand region of Uttar Pradesh, 2020)

• Council of Science and Technology (CST) has set up Technology Transfer and Development project for the state wherein R&D, pilot studies, etc are considered with an aim to develop indigenous technology and transfer. They are accepted in institutions, laboratories and technical universities.

• The CST is mapping science and technology needs to inventorize problems in sectoral areas that need such an intervention. The council is also looking at framing and inviting proposals to enable this process. Some of the activities done include: in process of mitigation of potable water problems in selected areas, national seminar on "Role of Science and Technology in Development of State" has been organized.

• Under Directorate of Environment, Uttar Pradesh, a plan was made to prepare environmental status reports of various districts of the state. For FY 2013-14, preparation of environmental status report for Lucknow and Gautam Buddha Nagar was initiated. A budget arrangement of 5 lakhs was made, out of which 2.40 lakhs was approved for the environmental research and implementation programme.

12.2 PROPOSED STRATEGIES, ACTIONS AND IMPLEMENTATION SCHEDULE

To achieve the vision by following thematic components of the SKMCC, total Four Strategies are proposed that will build and enhance holistic implementation of UP SAPCC 2.0 along with accomplishing the SDGs and NDC commitments. Across the four strategies under strategic knowledge, a total of ten action/sub-actions are proposed to be implemented till 2030 with an estimated budget of ₹12.75 Cr details depicted in the following Table 61. Across the mission, all proposed actions are further categorized into three classes based on their type of climate actions i.e., adaptation centric, mitigation centric or both; and based on the nature of actions i.e., implementation, policy, research, and Capacity building. All the actions are adaptation centric while co-benefit on the mitigation will be an additional outcome of the strategic knowledge actions. While, 50 percent of actions are policy oriented, rest are research and capacity building.

Strategy	No. of Actions	Estimated Budget (₹. in Cr)	Key Implementing and Nodal Agencies
Strategy 1: Strengthen and capacitate Climate Change Authority	2	2.00	Directorate of Environment
Strategy 2: Establish knowledge networks	2	5.00	Uttar Pradesh Climate Change Authority (UPCCA) Participating Agencies: Universities, IITs, NGOs, technical Institutes (ICAR/CSIR/ IISCs etc.), Individual Experts
Strategy 3: Capacity building for integrating climate change in development planning	3	5.00	Uttar Pradesh Climate Change Authority, MSME, Higher Education Department, Technical Education Department, Department of Medical Education
Strategy 4: Monitoring and Evaluation	3	0.75	Directorate of Environment, Uttar Pradesh Climate Change Authority
Overall Estimated Budget for Strategic Knowledge Mission (₹ In Cr)		12.75	

Table 61 Summary of Strategy-wise Number of Actions, Estimated Budget and Key Agencies of Strategic Knowledge Mission

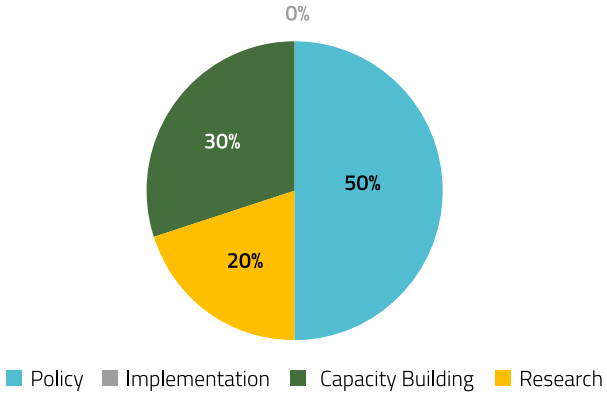


Figure 78: Distribution of Type and Nature of Actions Proposed Under Strategic Knowledge Mission

A summary of proposed strategies, actions, targets and other relevant information is outlined below. For a detailed list of strategies, refer to Table 88 in Annexure

Strategy 1: Building Institutional Capacity of Climate Change Authority (CCA)

Strategy alignment with SDGs: SDG 13
Strategy alignment with NDCs: NDC 06 | 07 | 08

Uttar Pradesh is the first state to have constituted a Climate Change Authority, for the purpose of helming the implementation and operation of adaptation and mitigation-centric work in the state. The scope of work of the Uttar Pradesh Climate Change Authority will involve but not restrict to activities such as commission, generation and dissemination of climate information, organising national and international trainings, establishing Centres of Excellence in relation to climate change in educational institutions, amongst others. While the objectives of the UPCCA have been elaborated in Box 1 (Chapter 14), it is pertinent that the institutional capacity of the authority is built through constitution of expert committees on areas such as; climate science, adaptation & mitigation research & policy planning for varied sectors, climate law, finance, capacity building for human resource strengthening. Box 1 below elaborates the responsibilities of the UP CCA.

Strategy 2: Establish Knowledge hubs and networks

Strategy alignment with SDGs: SDG 13
Strategy alignment with NDCs: NDC 06 | 08

While the recent years have seen an increase in climate action research, there has been a growing demand for a de-siloed approach towards climate action policy reforms situated firmly in cross-sectoral collaborations, knowledge exchange and sharing of practical experiences. Strategy two proposes setting up of knowledge networks, which through a multi-stakeholder and collaborative knowledge production framework will strengthen science-policy-practice connect and further consolidate the work, something that has been undertaken by the UP CCA. The knowledge hubs will have scientific and academic institutions, private sector representatives and corporate entities, NGOs, media, and community-based organisations, along with state and central government organisations. It is also proposed that district knowledge hubs are created in order to aid a decentralised bottom-up innovation and local knowledge. Thus identifying critical barriers and enablers to climate action at all levels leading to informed and timely decision making.

Box 1: Responsibilities of Climate Change Authority

1. Define scope of work and functions of thematic tracks
2. Commission and Generate information and disseminate: climate science, impacts, VRA, GHG inventories
3. Commission, collate and synthesise information generated by thematic tracks and associated knowledge networks for dissemination: SAPCC updates, policy-makers, district admin, Local bodies, general public, Any other
4. Knowledge Portal
5. Organising innovation challenges and investors meet to upscale successful pilots
6. Organise dialogues and roundtable on various climate issues
7. Organise training workshops for integrating CC in development planning of ULBs, Gram Panchayats, and District's
8. Develop DPRs to access large scale climate finance such as GCF, and other multilateral funds
9. Identify opportunities for legislations and regulations related to CC

Strategy 3: Capacity Building for mainstreaming Climate Change into Policy Development and Planning

Strategy alignment with SDGs: SDG 13
Strategy alignment with NDCs: NDC 06 | 07 | 08

Understanding that climate risk can never be made zero, it is pertinent that measures be put into place to make the country, economy, and people, resilient to climate induced changes. Thus, reiterating the requirement of factoring in adaptation and mitigating-centric changes into policy making at all levels, to ensure that economic development is not decoupled from climate resilience. This necessitates addressing behavioural biases, augmenting departmental capacities (technical and financial), and encouraging innovation in aspects such as governance, policy, regulation, finance and technology, in order to build adaptive capacity from bottom-up.

Strategy 4: Monitoring and Evaluation

Strategy alignment with SDGs: SDG 13
Strategy alignment with NDCs: NDC 06 | 07 | 08

Monitoring and Evaluation (M&E) of climate action is critical to understand 'what changed', 'how has it changed' and 'how much it changed over a given period' (IISD, 2019), thus leading to more effective prioritising and quicker decision-making. Despite certain technical limitations to what can and cannot be quantitatively measured through an M&E process, periodic M&E can help increase the climate resilience of systems, communities, businesses, and governments (at all levels).

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹. in Cr)
1. Building Institutional Capacity of Climate Change Authority (CCA)			
1.1	Build the institutional capacity of the UPCCA through constitution of expert committees on areas such as; • Climate science • Adaptation & Mitigation research & policy planning o Sustainable Agriculture o Water Resources o Forest, ToF and Biodiversity o Sustainable Urban Habitats o Sustainable Rural habitats o Human Health o Energy efficiency o Green Energy o Disaster management • Climate law • Finance o Public financing (Climate Budget Tagging) o International Public finance o Private sector finance • Capacity building The expert committees[16] are to be set up by 2025	Directorate of Environment	2.00

Table 62: Summary of Proposed Actions and Estimated Budget Required

[16]Other relevant stakeholders to be considered would be Universities, IITs, NGOs, technical Instt. (IITs, BHU, IIMs ICAR, CSIR, NLU, IISC etc.), National and international experts

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹. in Cr)
1.2	Undertake capacity building of human resources of UP Climate Change Authority		
2. Establish Knowledge Hubs and Networks			
2.1	Establish State and District-level Climate knowledge hubs and build preliminary datasets and mechanisms for climate relevant data collection	Uttar Pradesh Climate Change Authority	5.00
2.2	Establish thematic knowledge networks, focussing on the following areas; • Climate science • Adaptation & Mitigation research & policy planning • Sustainable Agriculture • Water Resources • Forest, Trees outside Forest (ToF) and Biodiversity • Sustainable Urban Habitats • Sustainable Rural habitats • Human Health • Energy efficiency • Green Energy • Disaster management The said thematic knowledge networks will aid in preparing preliminary datasets and mechanisms for high resolution climate risk and vulnerability assessments, by 2025. It is targeted that by 2030, the thematic networks will; **Climate science:** Update GHG inventories and climate trends and projections for UP at various resolutions (till 2030). **Adaptation and mitigation networks:** Prepare and Update, where required, vulnerability assessments, Impact assessments, Risk assessments, adaptation strategies, low carbon planning, Financing models, M&E frameworks		

Table 62: Summary of Proposed Actions and Estimated Budget Required

S.No.	Strategies/Actions	Nodal & Implementing Agencies	Estimated Budget Required (₹. in Cr)
3. Capacity Building for mainstreaming Climate Change into Policy Development and Planning			
3.1	Conduct regular trainings for integrating climate change in development planning & Finance. Such trainings will involve participants such as; • policy makers • departments & their agencies, • district officials, • local bodies • Financial institutions Training of master trainers as well as development of training plans and modules, to be finalized by 2025. By 2030, all regular trainings may be arranged through ENVIS centres	Uttar Pradesh Climate Change Authority, MSME, Higher Education dept , Technical Education Department , Department of Medical Education	5.00
3.2	Set up a Centre of Excellence for greening of MSMEs The target till 2025 involves development of roaster of experts and of IEC material on best practices and technologies		
3.3	Mainstream climate change into higher education curriculum in all streams (+2 and undergrad level). All relevant education curriculum modules is to prepared and teachers to be trained by 2025		
4. Monitoring and Evaluation			
4.1	M&E to be undertaken of the following sub-actions ; 4.1) SAPCC Actions 4.2) Other CC projects 4.3) Climate Budget Tagging It is targeted that by 2025; o A separate M&E cell is to be set up by UPCCA o M&E frameworks are to be developed o Data Collection to be concluded for yearly indicators o Budget Tagging of climate actions and schemes to be concluded Post 2025 and till 2030, the following targets are to be met; o M&E to be concluded and results produced o Climate Performance Index to be created o Performance audit reports to be published o Awards for best performing districts, ULBs, PRIs to be given o Results from M&E should feedback into policy, programmes	Directorate of Environment, Uttar Pradesh Climate Change Authority (UPCCA)	0.75

Table 62: Summary of Proposed Actions and Estimated Budget Required

Chapter 13

Financing UP SAPCC 2.0

Since the inception of multilateral negotiations on climate change, finance has played an important role as an enabling factor in addressing the global problem of climate change. During the discussions at the UNFCCC, developing countries continue to stress on public grants and grant-equivalent public financing flows from developed countries as one of the important sources (DoEA, 2020). As discussed in the previous chapters, India's NDC pledge includes commitments to approximately triple its renewable energy capacity by 2022 along with raising the share of non-fossil-based power generation capacity to 40 % of installed capacity by 2030. India has also committed to increase its carbon sink to 2.5–3 gigatonnes of equivalent carbon dioxide through additional tree cover by 2030.

With these commitments, it has been estimated that there is an investment potential of $2.1 trillion across India's climate-smart business. Of this, the investment in renewable energy accounts for more than $320 billion, across solar PV projects ($201 billion), wind power ($104 billion) and biomass projects ($15 billion). Further, climate-resilient investments in the transportation sector provides opportunity of $250 billion by 2030, along with an opportunity of more than $1.4 trillion by 2030 for green buildings market (IFC, 2017). It has also been estimated that the investment flows in India have averaged to approximately US$10.3 billion over five years between 2013-2018. Further, India needs funding of US$ 2.5 trillion by 2030 to meet its NDC targets (CEEW, 2019).

It has not only become important to set targets with an aim to achieve the goals but also to mobilise enormous funds to meet those targets. Therefore, identifying funding sources to implement state-specific priorities becomes crucial. Uttar Pradesh is already making attempts to identify priority areas that require intervention, but this should be systematically done for all the priority actions in each sector. This gives scope to realign Central and State Government's existing projects/ schemes, funds and incentives with an objective to rationalize the cost of implementation of the SAPCC. Even though some incentives come directly from the Centre, there should be a concerted Centre-State effort, especially in areas where the priorities are aligned (Mandal, Rathi, & Venketaramani, 2013).

The current chapter outlines methodology that has been followed to prepare the finance plan for UPSACC, a snapshot of current expenditure and investment, probable windows and sources of finance, followed by proposing a financing roadmap for the current UP SAPCC.

13.1 METHODOLOGY FOR PREPARING FINANCE PLAN FOR UP SAPCC

In order to prepare the finance plan for the current UP SAPCC, a four-step methodology has been adopted as outlined below:

STEP ONE

As a first step, strategies and actions have been shortlised across all the missions in a consultative manner and prioritised based upon their U-NDC & SDG linkages, availability of finance and ease of implementation

STEP TWO

Action wise targets till 2030 have been set for each of the prioritised actions based upon existing national and state development priorities, policy guidelines as well as inputs from consultations with sectoral exports.

STEP THREE

Budgets have been estimated for each of the prioritized actions based upon cost norms from national and State-level policy guidelines and literature review.

STEP FOUR

Potential sources of finance have been identified for each of the prioritised actions from which finance can be mobilised. This has been followed by preparing a comprehensive finance plan to understand current finance landscape of the state, mobilise finance along with mainstreaming climate actions into existing state priorities.

Figure 79: Methodology Followed to Prepare Finance Plan for UP SAPCC 2.0

13.2 CLIMATE FINANCE LANDSCAPE IN UTTAR PRADESH

Within the existing climate finance landscape in Uttar Pradesh, there is a need to mobilize funds in a way that aligns with the state as well as nation's development priorities. The state has a heterogeneous structure with public, private, national and international sources Figure 80). With this, it is important to understand the institutional architecture of climate finance in the state. This includes, national government, state government, international donor agencies, bilateral agencies, private investors, as well as international and domestic NGOs. Majorly, the sources of climate finance can be segregated into four categories, namely:

1. Budgetary sources: This includes allocations made to the departments under Centrally Sponsored Schemes (CSS), Central Sector Schemes (CS) and State Sponsored Schemes (SSS). Finance can be mobilized by leveraging existing departmental budgets.

2. **Private Climate Finance:** This includes grants provided by Domestic Donor NGOs such as C40, projects implemented through CSR as well as business investments which include private equity such as Green Bonds, loans and PPP Models.

3. **National Funds and National Financial Institutions:** In this category, finance can be mobilized through national specialized funds such as NAFCC, NCEEF as well as funds provided by NABARD, SIDBI, etc.

4. **International Funds:** This includes funds provided by multilateral and bilateral donor agencies such as The World Bank, UNDP, JICA, GEF, GIZ as well as funds like Green Climate Fund and Adaptation Fund. The international agencies provide funds in the form of grants, concessional loans and other loans.

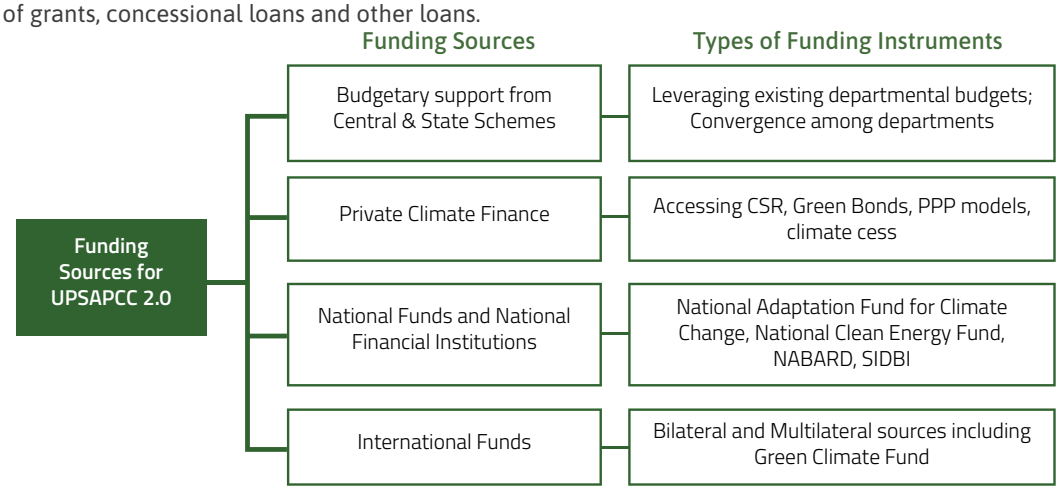


Figure 80: Climate Finance Landscape in Uttar Pradesh

Given that there are limitations in availability of funding, therefore, it calls for a need to identify and prioritize intervention areas that can be mainstreamed with the state's ongoing activities. One approach includes mobilizing funds through Central and State Budgets allocated across Central Schemes (CS), Centrally Sponsored Schemes (CSS) and State Schemes (SS). The other approach includes mobilizing private sector investments towards state's sustainable development priorities along with adopting public private partnerships. To implement the prioritized actions, there is also a need to access additional international climate finance such as GEF, AF, from multilateral/bilateral organizations such as GIZ, JICA, The World Bank.

13.2.1 Public expenditure and investments

The state can access a range of finance sources to support its SAPCC processes and thereby contribute to the achievement of the outlined goals. However, a light has been thrown on the current expenditure and investment trends in Uttar Pradesh. The expenditure analysis of Uttar Pradesh for the year 2021-22 suggests that there has been a 61 % reduction in the capital outlay of the state. This includes reduction of ₹ 3,008 crores and ₹ 2,675 crores in capital outlay for transport and energy, respectively. Capital expenditure on water supply, sanitation, housing, and urban development sector was reduced by ₹ 2,264 crores. An analysis of sectoral expenditure (in ₹ Cr) done in Uttar Pradesh has been presented in the table below (PRS, Uttar Pradesh Budget Analysis 2021-22, 2021). Details of revised budget estimates of various departments relevant for SAPCC sectors/ missions have been presented in Table 63.

Sector	Agriculture & Allied	Forest	Energy	Health (incl. Family Welfare)	Disaster Management	Habitat (incl. Urban, Rural, Housing &Transport)	Water
Revised Budget Estimates (2020-21) (in ₹. Lakh)	920458	110637	2199347	1091273	362006.07	3285958.31	1489974

Source: Department-wise Detailed Demand for Grants (2021-22)

Table 63: Sector-wise Revised Budget Estimates of State Departments

The sector-wise stocktaking of expenditure has also been done to outline the highlights of expenditure made across various programmes which are in line with the identified actions in UP SAPCC1.0. Uttar Pradesh has spent ₹ 2002.16 lakhs and ₹ 739.34 during the year 2015-2016 and 2016-2017 under Paramparagat Krishi Vikas Yojana, forming a total of 620 organic covering 31,000 farmers and 12400 ha of area (MoAFW, DEMANDS FOR GRANTS (2020-2021), 2020). On the other hand, a total of ₹ 28496.73 (In lakhs) has been spent on up-scaling of laser land levelling technology at village level between 2015 -2018 (ICAR-ATARI, 2018). Under Mission for Integrated Development of Horticulture (MIDH), an expenditure of ₹ 4365.50 lakhs were made till March 2014 (MoAFW, 2021).

As per the data collected from Irrigation and Water Department, Government of Uttar Pradesh for the period 2014-18, a total of ₹18.38 lakhs and ₹ 894 lakhs have been spent on improving water use efficiency through lining of canal and on-farm water management respectively. In addition, approximately ₹ 2.9 lakhs have been spent on water sector restructuring projects. On the other hand, a total of ₹ 10804.33 lakhs have been spent under other ongoing programmes such as Saryu Nahar Pariyojna, Kanhar Sinchai Pariyojna, Arjun Sahayak Pariyojna, Babina Block Irrigation, amongst others Given that the department is undertaking research and development works, therefore, a total of ₹ 26 lakhs have been reported as an expenditure on the same by the department.

Data collected from Minor Irrigation Department, Government of Uttar Pradesh suggests that a total of ₹ 144812.16 lakhs have been spent during 2013-2020 minor irrigation works including shallow, medium & deep tub wells, whereas ₹ 43947.60 lakhs have been spent on check dams, during the same time. On the other hand, ₹ 52560.82 has been spent by the Groundwater Department during 2020-21 on water conservation and Rain water harvesting structures. As per the data shared by the Department of Environment, Forest and Climate Change , the following programmes have been implemented in the state with an objective to increase area under forest: Social Forestry, Social Forestry in Urban areas, Nursery Management Plan, Sub-Mission on Agroforestry, National Bamboo Mission, Namami Gange, NAFCC Project, Campa, Vanavaran Sanvardhan Pariyojna, Total Forest Cover Plan, Intensification of Forest management, UP Participatory Forest Management & Poverty alleviation Project (JICA), Green Belt development Plan, National Afforestation Plan, Forest Fire Prevention and Management Scheme, etc. SDG Vision 2030 report of Uttar Pradesh outlines that Over 10 lakh saplings were planted at ten locations in the state in 'Clean UP, Green UP' campaign launched during November, 2015. In addition, during July 2016, the state entered the Guinness World Recording for planting 50 million trees on a single day, including 80 species (Sustainable Development Goals- Vision 2030).

Further, ₹ 95.23 Crores have been spent on projects sanctioned under Urban Drinking Water District Scheme in the state. Similarly, funds have been released under AMRUT for State Annual Action Plan (SAAP), including components such as urban water supply, sewerage, amongst others (MoHUA, 2015; UPJN, 2015-19). Initiatives by Directorate of Environment include expenses under Environment Research and Implementation Programme which has been approximately ₹ 10 lakhs per year since 2017-18 (DoE, 2018; DoE, 2019; DoE, 2020). Other initiatives include National Green Corps Yojana and Environmental Education, Training and Public Awareness Programme, where approximately ₹ 90 lakhs have been spent on district plans during 2019-20 (DoE, 2020).

13.2.2 National Funds

With an objective to prioritise the need to build climate resilience in the areas identified under relevant missions of NAPCC and SAPCCs, the National Adaptation Fund for Climate Change (NAFCC) was established in August, 2015. Government had set up a budget provision of ₹ 350 crores for the year 2015-16 and 2016-17. The projects sanctioned to the state under NAFCC are outlined in the Table 64 below.

Name of Project	Executing Entity	Project outlay (in ₹ Crores)
Ecosystem services-based adaptation to climate change in Bundelkhand region of Uttar Pradesh	Forest and Wildlife Department, Government of Uttar Pradesh	20.02
Climate resilience building in rural areas through crop residue management	Department of Agriculture of the Respective State Government	100.00

Source: NABARD (2015)

Table 64: Projects Sanctioned Under NAFCC in Uttar Pradesh

The National Clean Energy Fund (NCEF) had been created out of cess on coal produced / imported, through Finance Bill 2010-11. However, the guidelines were revised in 2017 to expand the scope of the fund to include clean environment initiatives (MNRE, 2018). In its 12th Inter Ministerial group (IMG) of National Clean Energy and Environment Fund (NCEEF) recommended a funding of ₹ 299.25 crores, under the project titled, "Installation of 17,500 SPV water Pumping System in Rajasthan, Tamil Nadu, Andhra Pradesh, Uttar Pradesh, Bihar and other selected states to meet the irrigation requirements" in the FY 2013-14 (DoE, 2017-18).

The State Disaster Response Fund (SDRF) is the primary fund available with State Governments for responses to notified disasters: wind hazards, drought, earthquake, fire, flood, tsunami, hailstorm, landslide, avalanche, cloudburst, pest attack, frost and cold waves. In case of disaster of severe nature, the National Disaster Response Fund (NDRF) supplements SDRF due to inadequate availability of funds. The allocation under SDRF to Uttar Pradesh for the FY 2020-21 was ₹ 2578 crores, of which the Centre's share of SDRF released was ₹ 1933 crores (MoHA, 2021).

13.2.3 International Funds

JICA has supported a number of projects across various sectors in Uttar Pradesh. One such project is Participatory Forest Management and Poverty Alleviation Project. In this project, afforestation activities were planned with a target of 80,500 hectares along formation of 800 Joint Forest Management Committees (JFMCs) will be formed. In addition, financial support was provided to the targeted JFMCs construction of small infrastructure facilities such as link roads and for livelihood improvement through small-scale income-generation activities. Under the project, a total of JPY 13,345 million of loan was provided with the Department of Environment, Forest and Climate Change as the executing agency (JICA, JICA Assissted Forestry Projects in India, n.d.). One of the unique features of the project includes the "Children Forest Programme", wherein schools (both government and private) in 6 districts of the state are to be covered over a period of 5 years with an aim to develop a sense of voluntary tree planting among children (JICA, n.d.).

In line with SDG-14, the Ganga Action Plan project (with an implementation period between 2005-2020) was designed for the abatement of severe pollution of the Ganga. With an objective to improve water quality of the river, the project aims to augment sewage treatment system capacity with construction and rehabilitation of the sewerage system in Uttar Pradesh. The project was commissioned with a commitment amount of ₹ 746 crores (JICA, 2019). Other projects include Small and Medium Enterprises Energy Saving Project, Agra Water Supply Project, amongst others (JICA, 2018).

In addition, The World Bank funded Uttar Pradesh Sodic Lands Reclamation III Project was approved in 2009 and closed in 2018 with a focus on on-farm development and land treatment, improvement of drainage systems and agriculture support services. The total commitment amount was US$ 197 million, where the implementing agency was Uttar Pradesh Bhumi Sudhar Nigam (The World Bank, 2022). Other projects funded by the Bank includes Uttar Pradesh Water Sector Restructuring Project (The World Bank, 2022), Uttar Pradesh Health Systems Strengthening Project (The World Bank , 2022), with a commitment amount of US$ 360 million and US$ 152 million respectively.

The Asian Development Bank has facilitated a project to provide recommendations for areas of investment across the agricultural value chain of selected commodities in Uttar Pradesh (ADB, Improving agricultural value chains in Uttar Pradesh, 2021). Similarly, ADB has funded Uttar Pradesh Power Distribution Network Rehabilitation Project. The Tranche-1 of the project was provided a total of ₹ 2218.5 crores of financing (ADB, 2021).

At the same time, Climate Adaptation and Finance in Rural India (CAFRI) has been designed and supported by GIZ as an integral part of the BMZ programme. The project is guided by the NDC and supports partners in reducing climate change risks of vulnerable groups and sectors The project also aims to build capacities of actors (at different levels) in the planning, implementation and financing of climate adaptation initiatives at state-level (GIZ, 2020). The project also supported a two-day 'Uttar Pradesh Climate Change Conclave 2021 (UPCCC 2021)' in collaboration with GIZ India (Technical Partner).

13.2.4 Private sector finance

In addition, private finance is one of the key sources of climate finance in the Indian landscape. Green bond is one emerging mechanism to finance green initiatives. In simple terms, green bonds are debt instruments that can be used by governments, international organisations as well as private sectors to raise money for the projects that contribute to climate mitigation/adaptation. Even though green bonds are at a nascent stage in the country, it not just broadens the investor's base but also expands the quantum of climate finance. India has become the second-largest issuer of green bonds (after China) among emerging markets with cumulative issues worth more than $10 billion by private companies and public sector entities such as the State Bank of India (SBI) (Financial Express, 2021).

Government green bond issues are backed by those public assets that are either contributing to low-carbon development or building capacity to cope with and be

resilient to climate change. A few examples of such assets include early warning systems for disaster risk management, investment in watersheds, clean transportation, large renewable energy (RE) projects, etc. (Financial Express, 2021). The sectors across which the projects can be financed under green bonds include waste management, storm water management, energy, green infrastructure, clean water and utilities, transportation and industrial efficiency (GIZ, Green Municipal Bonds in India: Potential, Barriers and Advantages, 2017). Recently, Ghaziabad Municipal Corporation has raised ₹ 150 crores through the issuance of green bonds and the proceeds will be utilised for the tertiary water treatment plant to benefit industries in Ghaziabad. The corporation also received ₹ 19.5 crore incentive from the Union government for raising funds through municipal bonds (The Economics Times, 2021).

Given that with enactment of Companies Act, 2013 by the Ministry of Corporate Affairs, Government of India, CSR has been made a mandatory provision by imposing statutory obligation on Companies to take up CSR projects towards social welfare activities. As per the National CSR Portal, a total of 124 companies had spent on CSR in Uttar Pradesh. During the same time, the total CSR expenditure by companies was reported to be ₹ 362 crores. The CSR initiatives were taken across 40 districts in the state. The portal has provided a snapshot of total amount spent on CSR in the state between 2014-15 to 2020-21 (Figure 81). Of the total amount, ₹ 2,216 lakhs have been on environment and conservation of resources (MoCA, 2021). District Kanpur Nagar has received the highest CSR funding of ₹ 424 lakhs by 7 companies, where ₹ 284.50 lakhs, ₹127.30 lakhs and ₹ 11.90 lakhs have been spent on education, health and environment sector, respectively (MoCA, 2021).

Figure 81: Total Amount Spent on CSR in Uttar Pradesh Between FY 2014-15 to FY 2020-21

Source: MoCA (2021)

13.3 PROPOSED FINANCE PLAN FOR UP SAPCC 2.0

13.3.1 Mission-wise Proposed Budget for implementation of UP SAPCC 2.0

The consultative process followed for the revision of UP SAPCC has helped in prioritizing a total of 179 actions across nine missions with an implementation period 2021–2030. The actions have been prioritized based upon their linkages with U-NDCs and SDGs, availability of funds and ease of implementation. Of the total strategies, 106 are adaptation actions, 51 are mitigation actions and 22 are both adaptation & mitigation actions, having a share of 59 percent, 29 percent and 12 percent respectively (Figure 82).

The total budget required to implement UP SAPCC 2.0 has been estimated to be ₹ 1,12,204.79 crores. A mission-wise break-up of actions and financial requirement for implementation of the same has been provided in Table 65. In order to implement the proposed activities, the proposed budget for Jal Mission is estimated to be ₹ 64,170.13 crores, which is the highest across all the missions. This is followed by the proposed budget for Sustainable Agriculture Mission (₹ 29,798 crores), Sustainable Habitat Mission (₹ 8,327 crores), Green UP Mission (₹ 6,293 crores), Energy Efficiency and Green Energy Mission (₹ 3,127 crore), Disaster Management Mission (₹ 306 crore), Health Mission (₹ 171 crore), and Strategic Knowledge Mission (₹ 13 crore).

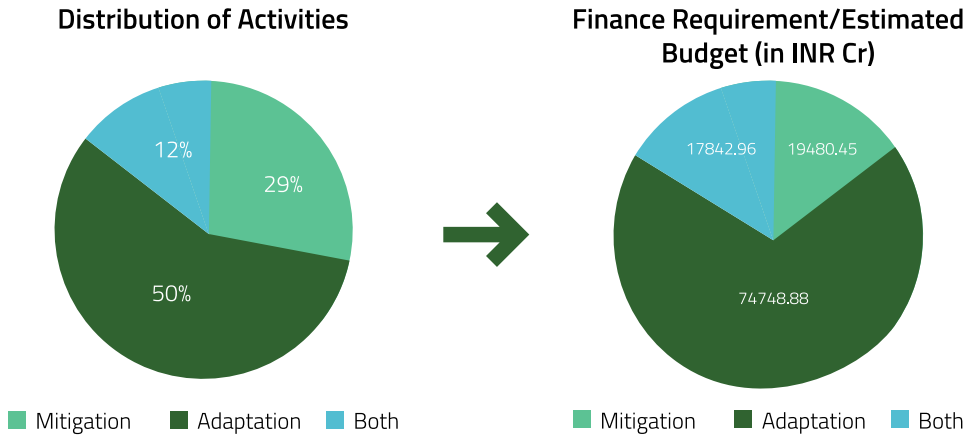


Figure 82: Distribution of Actions on the Basis of Type and Estimated Budget

13.3.2 Gap assessment of Proposed Budget for UP SAPCC 2.0

In order to assess the gap in the availability of finance to implement UP SAPCC 2.0, a gap assessment has been conducted. For this purpose, a methodology has been development to estimate the mobilisation of finance for the implementation of UP SAPCC 2.0. An analysis has been undertaken at action level to calculate the gap in funding available with the departments. Further, probable sources of funds have been identified for each of the action in order to estimate the share of financial requirement to be met by various sources. A strategy-wise estimated financial requirement, projected budget availability from relevant schemes, finance gap to be met through other sources and other probable funding sources have been outlined in the Table 66.

Missions	No. of Strategies	No. of Actions	Financial Requirement for 2021–2030 (₹. in Cr)
Jai Mission	5	25	64,170.13
Sustainable Agriculture Mission	5	19	29,797.73
Sustainable Habitat	9	35	8,326.75
Green UP Mission	5	20	6,292.68
Energy Efficiency and Green Energy Mission	6	37	3,127.55
Human Health Mission	5	31	171.50
Disaster Management Mission	2	10	305.70
Strategic Knowledge Mission	4	10	12.75
TOTAL (₹. in Cr)	39	179	1,12,204.79

Table 65: Sector-wise Break-up of Activities on the Basis of Type

Strategy	Estimated Financial Requirement (₹ in Cr) - A	Projected Budget Availability from Relevant Schemes (₹ in Cr) - B	Finance Gap to be met through other sources (₹ in Cr)- (A-B)	Other Probable Funding Sources
Sustainable Agriculture Mission				
Generate high resolution weather forecasts. Ensure access to weather forecasts and agro-met services by all farmers.	509.80	142.94 (28%)	366.86 (72%)	Bi-lateral funding, CSR and domestic donor agencies funding can be leveraged in building the agro-advisory systems. This can be done in a PPP mode.
Undertake wide spread training of FPO farmers on climate smart practices, techniques and tools to help them understand and address the impacts of climate change	118.80	95.04 (80%)	23.76 (20%)	NABARD has relevant programmes on 'Producers Organisation Development Fund' and 'Producers Organisation Development & Upliftment Corpus (PRODUCE)' which can be leveraged.

Table 66: A Snapshot of Finance Gap Assessment of UP SAPCC 2.0

Strategy	Estimated Financial Requirement (₹ in Cr) - A	Projected Budget Availability from Relevant Schemes (₹ in Cr) - B	Finance Gap to be met through other sources (₹ in Cr)- (A-B)	Other Probable Funding Sources
Mainstream climate smart adaptation practices and technologies through implementation of pilots covering all agro-climatic zones in UP	26040.93	19613.83 (75%)	6427.10 (25%)	Multi-lateral funding such as World Bank, Green Climate Fund and private sector finance such as CSR
Improve water use efficiency in agriculture with a focus on rice and sugar cane	2530	2530 (100%)	0	100% funding can be secured through government schemes
Enable enhanced access to risk sharing measures for farmers in a changing climate regime	598.20	598.20 (100%)	0.00	100% funding can be secured through government schemes
Jal Mission				
Enhanced monitoring and research to establish water budgets and manage water at micro-watersheds	174.81	174.81 (100%)	0.00	Multilateral funding such as World Bank (National Hydrology Project partly funded by state-central government and partly funded by the World Bank)
Strengthening water sector infrastructure to adapt to climate change	12765.5	7639.65 (60%)	5125.82 (40%)	Multilateral funding such as World Bank (Dam Rehabilitation and Improvement Project (DRIP) by MoJS - Proposed for 39 dams, funded by the World Bank)
Enhanced water use efficiency across sectors to reduce surface water and groundwater dependency	37772.37	35028.09 (93%)	2744.27 (7%)	Multilateral funding such as World Bank (National Hydrology Project partly funded by state-central government and partly funded by the World Bank), Private Sector finance such as CSR
Enhanced efforts towards groundwater recharge	13457.45	4458.61 (33%)	8998.84 (67%)	Private Sector CSR, Indian Donor Agencies
Readying for frequent and unprecedented floods at even non-traditional flooding regions and months	0	0	0	100% funding can be secured through government schemes

Table 66: A Snapshot of Finance Gap Assessment of UP SAPCC 2.0

Strategy	Estimated Financial Requirement (₹ in Cr) - A	Projected Budget Availability from Relevant Schemes (₹ in Cr) - B	Finance Gap to be met through other sources (₹ in Cr)- (A-B)	Other Probable Funding Sources
Green UP Mission				
Restore & improve quality of forest cover and increase area of Trees Outside Forest (ToF)	4128.97	2704.05 (66%)	1424.92 (35%)	Green bonds to raise large-scale finance for plantation related activities; CSR; International funds through GEF for enrichment of protected areas; For ravinous area reclamation related work fuding can be secured through The World Bank
Enhance tree cover in Urban and Peri-Urban areas (including institutional lands)	334.76	334.76 (100%)	0.00	100% funding can be secured through government schemes
Improve incomes of forest dependent population through agroforestry and food forests in private and community land	700.25	130.45 (19%)	569.8 (81%)	Voluntary Carbon Markets (or any other carbon market); CSR
Conservation of wetlands	753.20	97.92 (13%)	655.28 (87%)	National funds under programmes for wetlands rejuvination can be secured; Large-scale finacing can be secured through GIZ (Wetland management for biodiversity and climate protection), GEF, etc
Biodiversity Conservation	375.50	160.53 (43%)	214.97 (57%)	Grants, loans and other technical assistance by multilateral and bilateral organisations; CSR; development of eco-tourism in PPP mode.
Sustainable Habitat Mission				
Habitat- Urban				
Mainstreaming Climate Resilience and Pollution Mitigation actions into Urban Governance	26.00	13.00 (50%)	13.00 (50%)	External Funding Needed for preparation of the city climate action plans through C40, ICLEI, etc. Partly some of the sub-action under the 1.1 such as preparation of city water budget plans is now part of AMRUT 2.0. While Heat Action Plans, air action plans are partly funded by UPPCB

Table 66: A Snapshot of Finance Gap Assessment of UP SAPCC 2.0

Strategy	Estimated Financial Requirement (₹ in Cr) - A	Projected Budget Availability from Relevant Schemes (₹ in Cr) - B	Finance Gap to be met through other sources (₹ in Cr)- (A-B)	Other Probable Funding Sources
Building Climate resilient housing infrastructure	1.90	1.90 (100%)	0.00	100% funding can be secured through government schemes
Developing Climate Resilient Urban Water infrastructure and Storm water drainage	1377.75	1377.75 (100%)	0.00	Public Private Partnership, Multilateral Funding such as World Bank
Developing Climate resilient waste management infrastructure	2520.75	2510.55 (100%)	10.2 (0%)	Public Private Partnership, Multilateral Funding such as World Bank, ADB
Building Climate Resilient Road Infrastructure and low Carbon mobility options	992.00	322.25.00 (32%)	669.75 (68%)	Funding can be partly secured through Donor Agency such as C40 Cities Finance Facility to facilitate the structuring of a scalable business model; Multilateral such as The World Bank; Funding can be secured through CSR as well
Habitat - Rural				
Mainstreaming climate change in rural planning	110.75	110.75 (100%)	0.00	100% funding can be secured through government schemes
Building Climate resilient rural housing	6.50	6.50 (100%)	0.00	100% funding can be secured through government schemes
Developing climate adaptation integrated approach to rural skills development and diversification of livelihood Opportunities	41.10	41.10 (100%)	0.00	100% funding can be secured through government schemes
Building climate resilient road and climate smart waste infrastructure	3250.00	1625.00 (50%)	1625.00	Multilateral funding such as World Bank, Green Climate Fund, GIZ
Energy				
Minimise AT&C losses in transmission and distribution of electricity	414.68	287.26 (69%)	127.42	Funding for Prepaid Smart Metering & System Metering in Industries can come from the Revamped Distribution Sector Scheme.
Make SME clusters energy efficient	42.00	0.00	42.00	Funding can be secured through BEE SME Programme

Table 66: A Snapshot of Finance Gap Assessment of UP SAPCC 2.0

Strategy	Estimated Financial Requirement (₹ in Cr) - A	Projected Budget Availability from Relevant Schemes (₹ in Cr) - B	Finance Gap to be met through other sources (₹ in Cr)- (A-B)	Other Probable Funding Sources
Create enabling environment for market penetration of efficient cooling systems	360.75	323.00 (90%)	37.75	For action plan, funds can be secured from Domestic Donor Agencies like Shakti Foundation; for use of BLDC fans Funding can be secured through CSS: Production linked scheme which proposes a financial incentive to boost domestic manufacturing and attract large investments in the White Goods manufacturing value chain; National funds through NCEEF; private investments through PPP mode
Solarise conventional energy based private and public water pumping works	0.00	0.00	0.00	100% funding can be secured through government schemes
Set up off-grid solar power plants on waste land in rural UP thus increasing farmers income	665.00	443.00 (67%)	222.00	Funding will be partly secured from NCEEF in addition to PM-KUSUM
Enable significant transition to EVs in cities by 2030	1645.12	0.50 (0.03%)	1644.62 (99.97%)	Funding can be secured Donor Agency such as C40 Cities Finance Facility to facilitate the structuring of a scalable business model. In addition, private finance can be secured through PPP Mode
Disaster Management				
Enhancing capacities for building institutional resilience towards climate change induced extreme and slow onset disasters	295.20	28.20 (19%)	267.00 (81%)	Funding can be accounted for centrally using the Commissioning of Polarimetric Doppler Weather Radars (DWRS) Scheme (Part of the ACROSS Scheme of MoES); Funding through external sources such as UNDP/World Bank/ ADB/ + Other External funders to be considered; International Development Research Centre
Build climate resilience through creation of knowledge products, policies and guidelines to build climate resilience	10.50	10.50 (100%)	0.00	

Table 66: A Snapshot of Finance Gap Assessment of UP SAPCC 2.0

Strategy	Estimated Financial Requirement (₹ in Cr) - A	Projected Budget Availability from Relevant Schemes (₹ in Cr) - B	Finance Gap to be met through other sources (₹ in Cr)- (A-B)	Other Probable Funding Sources
Human Health				
Assess extent of spatial spread of health risks due to current and future climate change in the state at highest possible resolution to facilitate location specific adaptation actions.	18.00	18.00 (100%)	0.00	100% funding can be secured through government schemes
Enable access to data, real-time situational analysis of disease spread and establish reliable location specific short, medium and long term forecasting	56.00	560 (100%)	0.00	
Enable behavioural change in public to avoid climate linked disease epidemics	97.50	97.50 (100%)	0.00	
Strategic Knowledge Management				
Strengthen and Capacitate Climate Change Authority	2.00	0.00	2.00 (100%)	Funding to be secured through Bilateral organisations such as GIZ; National funds such as NAFCC
Establish Knowledge networks	5.00	0.00	5.00 (100%)	
Capacity Building for integrating climate Change in Development	5.00	0.00	5.00 (100%)	
Monitoring and Evaluation	0.75	0.00	0.75 (100%)	
Total (₹. In Cr)	**1,12,204.79**	**80983.62 (72.17%)**	**31221.16 (27.83%)**	

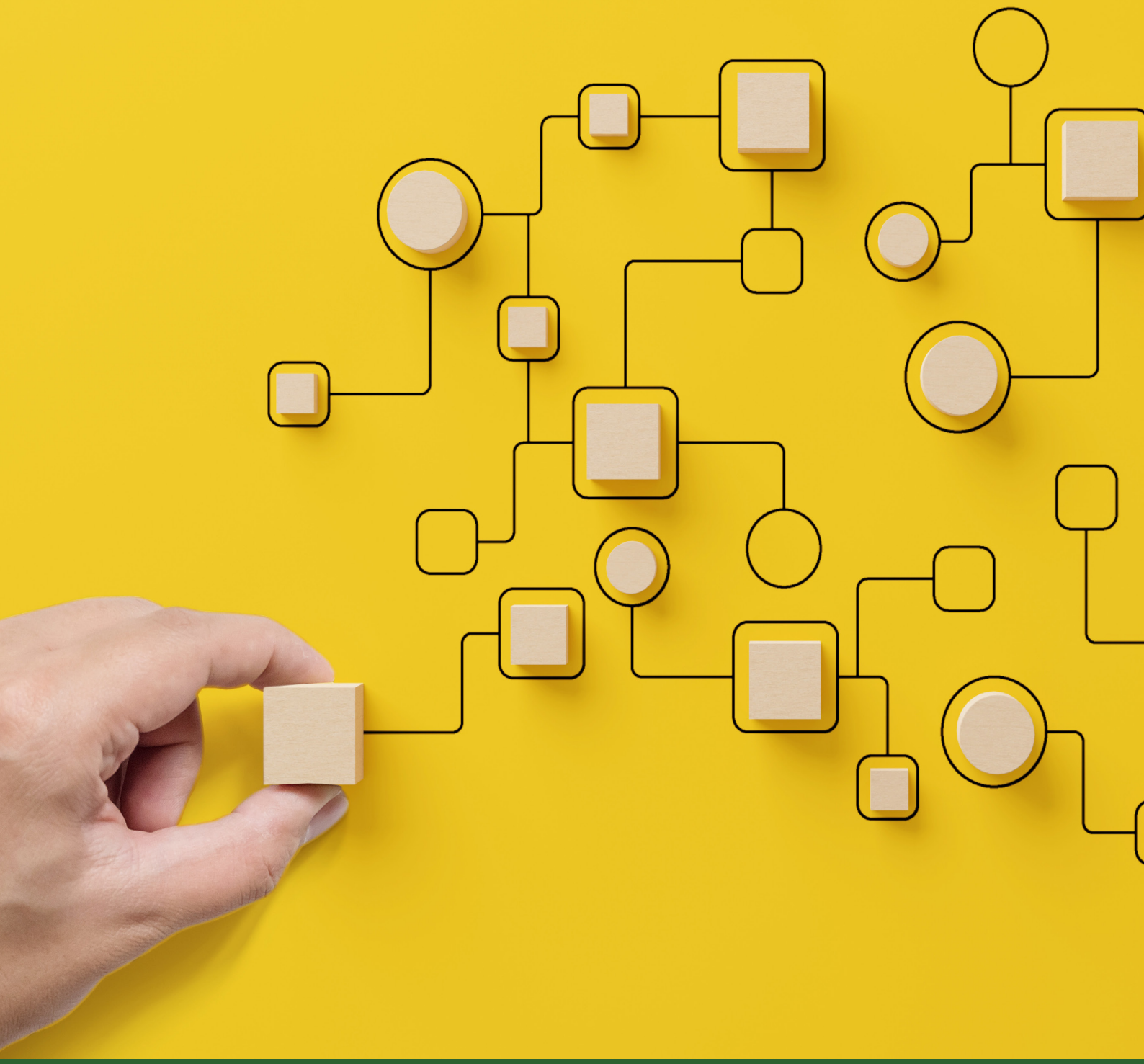
Table 66: A Snapshot of Finance Gap Assessment of UP SAPCC 2.0

The total finance requirement for implementation of UP SAPCC 2.0 is ₹1,12,204.79 Crores, of which 72.17 % of the finance can be mobilised through existing departmental schemes whereas 27.83 % can be mobilised through external sources of finance. An attempt has been made to provide a snapshot of the nodal department-wise estimated budget required to implement UP SAPCC 2.0

Name of Department	Estimated Budget (2021–2030) (₹. in Cr)
Agriculture Department	35727.40
Namami Gange and Gramin Jalapurti Vibhag	26555.70
Irrigation and Water Resources Department	12766.00
Department of Environment, Forest and Climate Change	12592.68
Urban Development Dept	10325.15

Name of Department	Estimated Budget (2021–2030) (₹. in Cr)
Groundwater Dept.	7484.25
Rural Development	3393.35
Invest UP	785.50
Directorate of Local Bodies	750.00
Relief Commissioner	224.00
PVVNL, MVVNL, KESCO	173.56
Dept. of Health and Family Welfare	161.50
Power Department	141.12
UPSDMA	71.20
UPNEDA	64.00
Infrastructure and Industrial Development	36.81
Panchayat Raj Department	15.00
DoE	13.25
Department of Animal Husbandry	13.20
UPPCB	10.50
Dept. of Basic education, Dept. of Higher Education	10.00
UP Climate Change Authority	10.00
Minor Irrigation Dept.	3.50
SWARA	2.50
Housing and Urban Planning Department	0.75

Table 67: Nodal Department-wise Estimated Budget Required Between 2021–2030 to Implement UP SAPCC 2.0



Chapter 14

Institutional Mechanism

A cohesive response to systemic risks, witnessed in the increasing intensity and frequency of climate induced and climate exacerbated risks in the state, warrants that regulatory response imbibe qualities of interconnectedness and constant evolution. Effective implementation and transformative action in the subnational climate space requires that horizontal and vertical coordination as well as collaborations and partnerships with non-government entities, be kept as the focus.

14.1 THE INSTITUTIONAL MECHANISM OF UP SAPCC

Department of Environment, Forest and Climate Change (DoEF&CC) Department, GoUP, is the apex authority that guides the formulation and implementation of climate policy and strategies for a climate resilient & green Uttar Pradesh. The Directorate of Environment, as part of the DoEF&CC, functions as the nodal agency for the purpose of coordinating the preparation and revision of State Action Plan on Climate Change (SAPCC) with other key departments of the state. It works in parallel with the Uttar Pradesh Climate Change Authority (UP CCA) to overlook the implementation of the eight missions (Sustainable Agriculture Mission, Sustainable Habitat Mission, Green UP Mission, Green Energy Mission and Energy Efficiency Mission, Health Mission, Disaster Management Mission, Strategic Knowledge Mission) as part of the SAPCC. The UPCCA was constituted in 2014 under the Societies Registration Act, 1860, with a corpus of ₹. 20Cr, for the implementation and operation of the work related to adaptation and mitigation of climate change in the state. The section below gives further details on the objectives of the UPCCA.

Objectives of the UP Climate Change Authority

To undertake various adaptation and mitigation centric climate change activities in the state, with need close coordination with other state depts..
To promote use of alternate energy, energy efficiency, activities such as tree plantation and water conservation
Establishment of Center of Excellence in relation to climate change in schools/universities/educational institutions and to provide assistance for research work and journals, newsletters related to climate change; Promotion of promotional materials.
Awareness generation in national parks, sanctuaries, zoological parks and other public places, on climate change through outdoor media such as hoardings on climate change; To make use of mediums such as TV and radio, for further dissemination and awareness building.
Organizing seminars, conferences and workshops on change climate
Establishment of e-library for resources on climate change; To build capacity for conducting research on climate change (by the directorate)
To coordinate and work with various departments for the preparation of State Action Plan on Climate Change and to conduct studies through consultancy.
Advising/cooperating with State/Central Government officials, Public Sector Undertakings and Private Institutions on the matter of Climate Change
To increase the efficiency of officers and employees by organizing national and international training, study tour programmes; To implement other necessary arrangements for human resource development like special salary/ allowance, insurance, health insurance etc.
Regular capacity building of officers and employees
Organize the rules/by-laws of the authority and to make new and additional rules or to amend/repeal the rules from time to time.
Acquiring and holding of immovable property for the purposes of the Authority
To transact in respect of any property of the authority for the fulfilment of the objects of the authority under the provisions contained in the Societies Registration Act, 1860.
To access financial assistance from the Government of Uttar Pradesh, the Central Government and other national and corporate institutions for the fulfilment of the objectives of the authority.
To maintain and use the money received for fulfilling the purposes of the authority.

Source: Government Order (No.-3659/55-PARY/14-30 (PARY)/14 Lucknow)

An **Apex Committee**, under the chairmanship of the Hon'ble Chief Minister, will be constituted for the operation of the UPCCA. The apex committee will have a 10 member composition, including the Hon'ble Chief Minister, GoUP, as the Chairman and the Hon'ble Environment Minister as the Vice-chairman. It will also have two member representation from an NGO and 4 experts nominated by the state. Table 68 gives the complete list of members of the apex committee. The Apex committee, which will convene once annually, is tasked with setting up guidelines for the management, operation and maintenance policy of Uttar Pradesh Climate Change Authority along with providing guidance for the planning and promotion of resources (both physical and financial) of the authority. It will review the submitted SAPCC and oversees the Monitoring and Evaluation of the proposed actions.

S.no.	Designation	Post
1	Honorable Chief Minister, Government of Uttar Pradesh	Chairman
2	Honorable Environment Minister, Government of Uttar Pradesh	Vice-chairman
3	Chief Secretary, Government of Uttar Pradesh	Member
4	Agriculture Production Commissioner, Government of Uttar Pradesh	Member
5	Principal Secretary Environment, Government of Uttar Pradesh	Member
6	Principal Secretary, Forest, Government of Uttar Pradesh	Member
7	Chairman, Uttar Pradesh Pollution Control Board	Member
8	NGO (Nominated by State Government)	02 Members
9	Experts (Nominated by State Government)	04 Members
10	Director, Environment Answer Sheet Country	Secretary

Table 68: Composition of the Apex Committee

Source: Government Order (No.-3659/55-PARY/14-30 (PARY)/14 Lucknow)

There is a **Governing Body** under the apex committee, with the Chief Secretary as the President, and 24 other members including the principal secretaries from all key departments (Environment, Forest, Energy, Housing, Irrigation, Agriculture, Medical and Health, Additional Energy, Transport, Finance, Industrial Development and Urban Development). Table 69 gives the list of governing body members. The Governing Body will meet at least four times in a year, and thereafter as and when necessary, to be decided by the Chairman.

An **Executive body** will be constituted to function under the Director, Environment Directorate, GoUP, to overlook the administrative and financial functions of the Climate Change Authority. This body, comprising of 16 members, will meet ordinarily six times a year.

S.no.	Designation	Post
1	Chief Secretary, Government of Uttar Pradesh	Chairman
2	Principal Secretary Environment, Government of Uttar Pradesh	Member
3	Principal Secretary Forest, Government of Uttar Pradesh	Member
4	Principal Secretary Energy, Government of Uttar Pradesh	Member
5	Principal Secretary Housing, Government of Uttar Pradesh	Member
6	Principal Secretary Irrigation, Government of Uttar Pradesh	Member
7	Principal Secretary Agriculture, Government of Uttar Pradesh:	Member
8	Principal Secretary Medical and Health, Government of Uttar Pradesh:	Member
9	Principal Secretary Additional Energy, Government of Uttar Pradesh:	Member
10	Principal Secretary Transport Department, Government of Uttar Pradesh	Member
11	Principal Secretary Finance, Government of Uttar Pradesh	Member
12	Principal Secretary Industrial Development Department, Government of Uttar Pradesh	Member

Table 69: Composition of the Governing Body Committee

Source: Government Order (No.-3659/55-PARY/14-30 (PARY)/14 Lucknow)

S.no.	Designation	Post
13	Principal Secretary, Urban Development, Government of Uttar Pradesh	Member
14	Chief Conservator of Forests, Uttar Pradesh	Member
15	Chief Engineer, Irrigation Department, Government of Uttar Pradesh:	Member
16	Director Agriculture Department, Government of Uttar Pradesh	Member
17	Chairman and Managing Director, Energy, Uttar Pradesh	Member
18	Director, NEDA, Uttar Pradesh	Member
19	Managing Director, Housing, Uttar Pradesh	Member
20	Director, Indian Meteorology, Lucknow	Member
21	Director, Remote Sensing Applications, Lucknow	Member
22	Director KGMU Lucknow	Member
23	Member Secretary, Uttar Pradesh Pollution Control Board Lucknow	Member
24	Experts- Four (Designated by the State Government)	Member
25	Director, Environment, Uttar Pradesh Lucknow	Member - Secretary

Table 69: Composition of the Governing Body Committee

Source: Government Order (No.-3659/55-PARY/14-30 (PARY)/14 Lucknow)

The **SAPCC Implementing Agencies** comprising of nine mission core committees will report to the UP CCA. These mission core groups comprise of Nodal officers nominated by departments that are key to the formulation of UP SAPCC and represent the sectors; Agriculture and Allied, Water Resources, Forestry and Biodiversity, Human Health, Habitats, Energy, Disaster Management and Strategic Knowledge. Each mission core group reviews and monitors the strategies and implementation plan proposed for their respective key departments, as part of the UP SAPCC. Figure 83 ahead schematically represents the implementation arrangement of all matters related to climate change in the state including implementation of the SAPCC comprising of the nodal agency and core group departments and decisions taken by the governing and apex committee as described above. The figure below further elaborates the SAPCC Core Group, elucidating on the departments within each mission.

The Implementing Agencies will be relevant government departments and agencies as well as technical experts with subject matter expertise on climate change science, impacts and mitigation vis-à-vis key sectors (Agriculture and Allied, Water Resources, Forestry and Biodiversity, Human Health, Habitats, Energy, Disaster Management). They are tasked with implementation of all the proposed activities approved by the Uttar Pradesh Climate Change Authority as part of the UP SAPCC.

Table 70 further elucidates the nodal and implementation agencies that form the part of each mission group as part of the UP SAPCC.

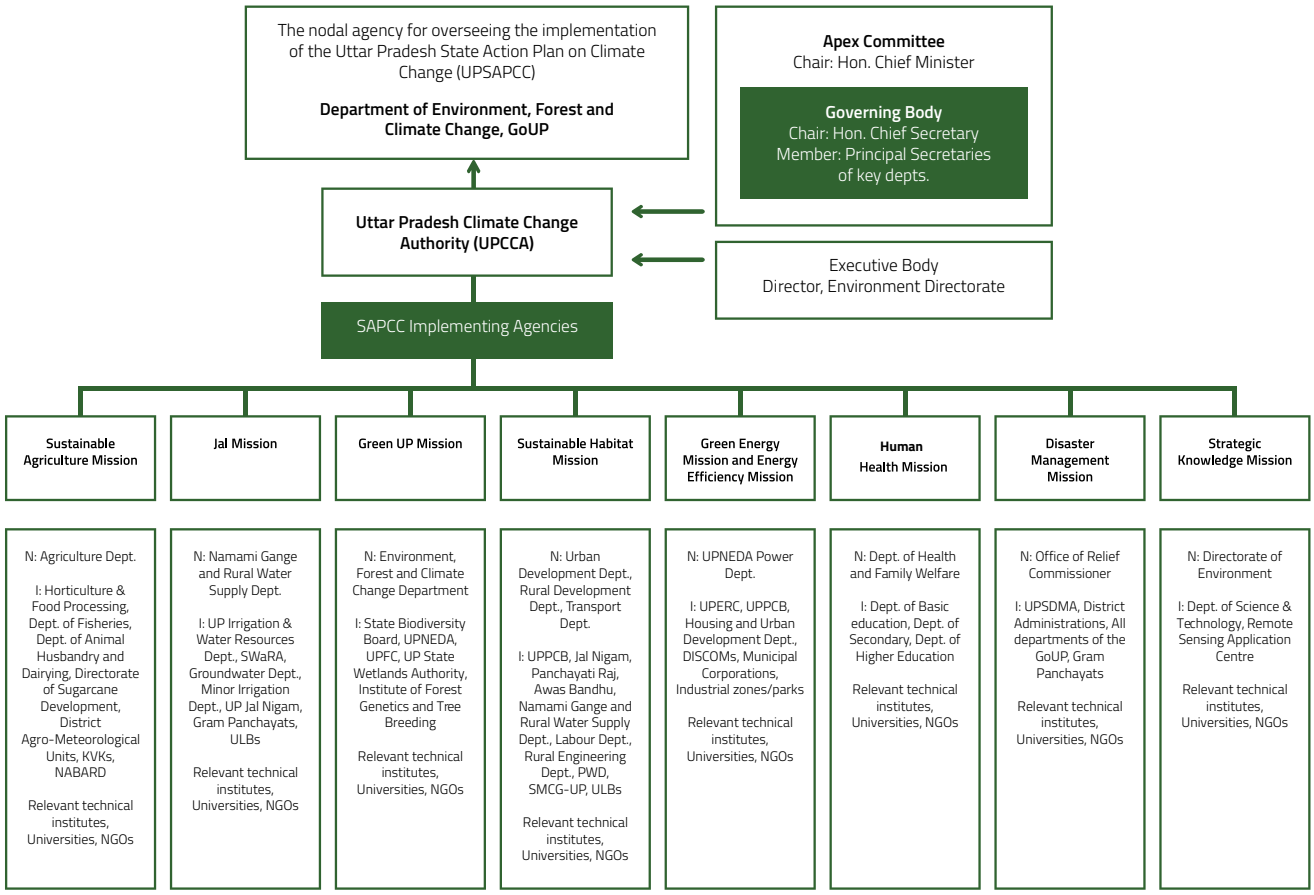


Figure 83: Institutional Mechanism of UP SAPCC

Missions	Nodal Agency	Implementing Agencies
Sustainable Agriculture Mission	Agriculture Department	4 Key Depts Animal Husbandry Deptt., Horticulture Deptt., Fisheries Deptt., Directorate of Sugarcane Development, District Agro-Meteorological Units, KVKs, NABARD
Jal Mission	Dept of Namami Gange and Rural Water Supply	5 Key Depts & Agencies Irrigation and Water Resources Department, Groundwater Department, Minor Irrigation, SWARA, UP Jal Nigam, Gram Panchayats, ULBs
Sustainable Habitat	Urban Development Department and Rural Development Department, TD	10 Key Depts & Agencies UPPCB, Awas Bandhu, Dept of Namami Gange and Rural Water Supply, Jal Nigam, SDMA, Panchayat Raj Department (PRD), Labour Department, Rural Engineering Department, PWD, SGMC-UP, ULBs

Table 70: Nodal and Implementing Agencies for the missions proposed under UP SAPCC 2.0

Missions	Nodal Agency	Implementing Agencies
Green UP Mission	Department of Environment, Forest and Climate Change	7 Key Depts & Agencies State Biodiversity Board, UPPCB, UPFC, Food and Civil Supplies Department, UPNEDA, UP State Wetlands Authority, Institute of Forest Genetics and Tree Breeding
Energy Efficiency and Green Energy Mission	Department of Power and UPNEDA	3 Key Depts & Agencies UPERC, UPPCB, Housing and Urban Development Department, DISCOMs, Municipal Corporations & or Industrial zones/parks
Health Mission	Department of Health and Family Welfare	Department of Basic education, Department of Higher Education
Disaster Management Mission	Rahat UP (Relief Commissioners office)	1 Key Agency & All Depts State Disaster Management Authority, District Administrations, Gram Panchayats and All departments of the Gov of UP
Strategic Knowledge Mission	Dept of Environment, Forest and Climate Change	2 Key Agencies Science & Technology, Remote Sensing, Universities & NGOs

Table 70: Nodal and Implementing Agencies for the missions proposed under UP SAPCC 2.0

For effective implementation of activities in the SAPCC, it is suggested that a climate change cell, be situated in all departments. The climate change cells in each department will aid planning of department specific initiatives to ensure synergy with the SAPCC. It is crucial that a third party review, monitoring and evaluation (M&E) be undertaken with periodicity suggested in the next chapter (Chapter 15: Monitoring and Evaluation). The third party reviewers/agencies will be approved by the state and drawn from an accredited panel of experts.

Chapter 15

Monitoring and Evaluation

India has set its Sustainable Development Goal Agenda 2030 with measurable targets for all the 17 SDGs. The goals are being realised through the various national and state developmental plans and programmes. Meanwhile, the 17 SDGs have been localised at state-level as well. Each state has set their own respective targets and monitoring frameworks. Changes in climate has the potential to jeopardise the attainment of these goals.

India's National Action Plan on Climate Change (NAPCC) , formed in 2008, had mission-mode strategies that aimed towards developing the climate resilience of agriculture sector, water resources, Himalayan ecosystems, forests and biodiversity, human habitats, energy (renewable as well as at the level of efficiency) and knowledge systems. Later a coastal mission and human health mission were also added to the document. This led to the formulation of the first set of State Action Plans between 2009-2014.

In 2015, India became a party to the Paris Agreement and declared its Nationally Determined Contributions (NDCs) demonstrating India's willingness to reduce the global GHG emissions at desired level. In 2021, at COP 26, the Hon'ble Prime Minister, ramped up the NDC targets, and declared that India would reduce the emission intensity of its GDP by 45% by 2030, increase the share of non-fossil energy capacity to 500 GW, enhance the share of non-fossil fuel energy to 50%, and create additional carbon sink of 2.5 -3 billion tonnes of CO_2 equivalent through additional forest and tree cover. While some sectors, such as the railways, is set to attain Carbon neutrality by 2030, however most of the other sectors will take time. Factoring in our developmental paradigm, its projected that India as whole will attain Carbon neutrality by 2070.

Substantial and continuous investments need to be made towards climate change adaptation as climate will continue to change even in the next 100 years and beyond, impacting adversely the natural resources and the dependent economy. In view of this, the updated UP-SAPCC maps out the mitigation strategies to be undertaken and the adaptation strategies to manage its climate risks for the next 10 years. Robust monitoring, and evaluation (M&E) of the updated UP SAPCC is crucial to ensure that the desired outcome of a climate resilient UP is achieved, without jeopardising the SDG goals that it has set out for itself, while ensuring implementation of National Climate policies at sub regional level and contributing to India's U-NDCs. The M&E of the UP SAPCC, will result in learnings, that if integrated within the state action plan on climate change will help build climate resilience and institutionalisation of SAPCC performance matrices.

The Uttar Pradesh Climate Change Authority, functioning under the aegis of Department of Environment, Forests and Climate Change, Government of Uttar Pradesh, is the nodal authority for climate change issues in the state. It will be responsible for overall monitoring and evaluation of the UP SAPCC; with multiple nodal and implementing departments and agencies implementing M&E of their strategies. They will do this with the help of technical partners.

The M&E process will be finalized and carried out in close collaboration with the Ministry of Environment and Forests and Climate Change. The collaboration with MoEFCC will ensure alignment with the priorities of the ministry to meet its national climate policies and goals encompassing NAPCC, Updated NDCs and the SDGs.

It is proposed to set up three-tier M&E framework. A brief description of the same is as follows.

- Tier 1: M&E of UP SAPCC strategies and actions

This M&E would set up indicators to measure the stated outputs and the outcomes of the actions. Example, extent of crop diversification, micro irrigation, number of people benefitted in terms of rise in income, number of houses saved from increase in intensity of extreme flooding events, access to knowledge for decision making by communities and policy makers etc. Also this tier of M&E would measure the amount of sequestration achieved through forestry activities, extent of increase in energy efficiency, penetration of renewable and new energy in the for each of the strategies and actions indicated if applicable etc.

- Tier 2: M&E of UP SAPCC Missions

This tier of M&E would assess the extent of reduction in vulnerability and extent or contribution towards missions of the NAPCC, e.g. National Mission for Sustainable Agriculture, National Water Mission, National Green Mission, Sustainable Habitat Mission, Human Health Mission, Energy Efficiency and Green Energy Mission, and Strategic Knowledge mission. This will also measure the extent of achievement of the sectoral state SDGs.

- Tier 3: M&E of overall UP SAPCC

This M&E will measure the extent of alignment with the goals of the U-NDCs, for e.g., it will measure the extent of reduction in emission intensity, share of renewable energy in the national total and share of energy efficiency achieved as part of the national total.

Sr no.	Strategy	Target	Indicator for M&E	Responsible department	Frequency of M&E
1. Agriculture Mission					
1.1	Generate high resolution weather forecasts. Ensure access to weather forecasts and agro-met services by all farmers.	2,81,75,093 farmers	% of farmers accessing the agri-weather advisories	Agriculture Department	Annual
		200 weather stations at 10kmx10 km resolution	No. of weather stations added		
		Involve in state technical institutions in doing the weather and climate analysis	No. of institutions within the state involved in developing and disseminating advisory		
1.2	Undertake wide spread training of FPO farmers on climate smart practices, techniques and tools to help them understand and address the impacts of climate change	All FPOs covering agriculture crops, horticulture crops, milk, meat and fisheries	No. of Master trainers trained	Agriculture Department	
			% of farmers trained on CC climate smart practices		
1.3	Mainstream climate smart adaptation practices and technologies through implementation of pilots covering all agro-climatic zones in UP		Ha of farm land adopting Flood and drought resilient varieties of rice	Agriculture Department	Annual
			Ha of land adopting Integrated nutrient management		
			Ha of land adopting Integrated Pest and Disease management		
			Ha of land embracing soil and water conservation techniques		
			No. of SHGs registered for beneficiation		
			No. of fruit beneficiation units added to prevent wastage	Horticulture Department	
			Area under drought and flood resilient vegetable varieties		
			Area under flood and drought resilient fruit varieties	Horticulture Department	
			No. of livestock with Heat resilient housing	Animal Husbandry and Dairy	
			Amount of green fodder produced using intercropping, on seasonally dry wetlands etc.	Development Department	
			Number of trainings on silo preparation		

Table 71: Indicative indicators for Tier 1 M&E

Sr no.	Strategy	Target	Indicator for M&E	Responsible department	Frequency of M&E
			Amount of fodder produced through hydroponics		Annual
			No. of new businesses started for producing milk products		
			No. of restored fish ponds	Fisheries Department	
			No. of hatcheries producing climate resilient fish seeds		
			No. of new businesses on tank fisheries		
			Overall increase in farmers income	Agriculture	
1.4	Improve water use efficiency in agriculture with a focus on rice and sugar cane	23.12 lakh ha	-Ha of sugarcane switched to water conserving irrigation technique.	Agriculture department	Annual
		23.12 lakh ha	-Ha of sugarcane farmers switched to lower water consuming cultivar		
		75 Seed marts	No. of seed marts developed for water conserving sugar cane varieties		
		Cover 50 districts that show groundwater depth from 0-6 below ground	No. of districts (with water depth from 0-6 below ground) covered where rice area has been switched to drought resilient rice cultivars		
		75 Seed marts	No. of seed marts developed for flood resilient rice varieties.		
		Cover 50 districts that show groundwater depth from 0-6 below ground	No. of districts (with water depth from 0-6 below ground) covered where rice area switched to water conserving technologies (micro irrigation techniques, direct seeded, land levelling, mulching,SRI etc.)		
		Cover 50 districts that show groundwater depth from 0-6 below ground	No. of districts (with water depth from 0-6 below ground) covered where rice area switched to drought resilient food crops millets.		
1.5	Enable enhanced access to risk sharing measures for farmers in a changing climate regime	Cover all farmers in UP under restructured weather based crop insurance scheme	Cover 2,81,75,093 farmers registered under PM kisaan Yojana	Agriculture Department	Annual
		Genetic up gradation of indigenous female cattle (64.5 lakh female cattle to receive AI in the state)	No. Of female cattle's inseminated with superior indigenous breeds.	Animal husbandry	
		Insure all exotic breeds of cattle.	No. of exotic breeds of cattle insured	Animal husbandry	

Table 71: Indicative indicators for Tier 1 M&E

Sr no.	Strategy	Target	Indicator for M&E	Responsible department	Frequency of M&E
		Study and implement pilots to explore the feasibility of weather index livestock and fishery insurance, 1 in each of the 9 agroclimatic zones	No. of pilots carried out.	Animal husbandry department and fishery department	Annual
		Compile strategies for risk management with case studies on good practices for agriculture, horticulture, ,livestock management and fisheries	No. of pilots carried out.		
			Compilation published.		
			IEC material developed on the same for dissemination to farmers.		
2. Jal Mission					
2.1	Enhanced monitoring and research to establish water budgets and manage water at micro-watersheds	A study report on impacts of climate change on water resources in UP	A report	UPIWRD	Annual
		Cover all 551 blocks with hydro met monitoring stations.	No. of AWS's, digital rain gauges, no. of SCADA on barrages and dams, no. of automatic water level recorders, no. of acoustic Doppler current profilers, soil moisture sensors water quality sensor and analyzers		
		4062 piezometers in 4062 wells across UP	No. of piezometers.		
		8 basin authorities for all the 8 rivers flowing through the state.	No. of basin authorities established		
		Basin level hydro analysis information centres.	No. of hydro analysis information centre established.		
		Water budgets for 59,163 gram panchayats and 3894 urban centres	No. of gram panchayat water budgets developed		
			No. of gram panchayat water budgets developed No. of urban centres water budget developed		

Table 71: Indicative indicators for Tier 1 M&E

Sr no.	Strategy	Target	Indicator for M&E	Responsible department	Frequency of M&E
2.2	Strengthening water sector infrastructure to adapt to climate change	Development of guidelines for retrofitting/ building climate resilient water infrastructure (dams, barrages, canals and check dams)	Publication of the guidelines	UPIWRD	Annual
		Development of course that teaches guidelines for retrofitting/ building climate resilient water infrastructures	No. of water recourse management related engineers passing the course	UPIWRD, SWARA	
		A study on retrofit requirements for making existing water infrastructure in the state climate resilient.	Study completed.		
			Result disseminated to the relevant departments for actions.		
2.3	Enhanced water use efficiency across sectors to reduce surface water and groundwater dependency	Develop baseline water consumption for water intensive industries(thermal power plants, textile, leather, paper and pulp, sugar and ethanol industries, hotels, beverages industries, dairy and steel miles)	Water baseline published	Namami Gange, UP Jal Nigam Board, Urban development Department	Annual
		A compendium of best practices on water use efficiency across sectors	Separate compendium for thermal power plants, textile, leather, paper and pulp, sugar and ethanol industries, hotels, beverages industry, dairy and steel miles.		
		Fixing of water use limits for different industries types and water metering.	No. of Smart water meters installed.		
		Notification issued to all water intensive industries to re use waste water.	Annual reduction in tariff paid by consumers.		
		11,79,871.5 Ha of area under crop cultivation.	Area under drip irrigation and area under sprinkler irrigation		
		Improved water use efficiency in households with direct to home water access.	Net annual saving in tariff paid by household with direct access to water in rural and urban areas	Agriculture and horticulture department	

Table 71: Indicative indicators for Tier 1 M&E

Sr no.	Strategy	Target	Indicator for M&E	Responsible department	Frequency of M&E
		100% coverage of households with water (2,64,27,705) household	Notification issued on the same for all urban centres in UP	Namami gange, Jal Nigam and GP's	
		All residential societies in urban areas generating waste water greater than 0.5 MLD	Notification	Urban Development Dept	
		Insure roof top rain water harvesting for existing and planned institutional and commercial buildings in rural and urban areas with plot size greater than 300 km^2	No. of planned institutional and commercial buildings in rural and urban areas (plot size greater than 300 km^2) with roof top rain water harvesting system	Urban Development Dept and Namami Gange Dept	
2.4	Enhanced efforts towards groundwater recharge	GW Recharge plans for industrial clusters in over exploited and critical blocks.	No. of recharge plans developed and no. of recharge plans implemented	Groundwater dept.	Annual
	Readying for frequent and unprecedented floods at even non-traditional flooding regions and months	Assist potential sites for groundwater recharge by flood water in over exploited areas in UP.	No. of sites identified, no. of plans made and no. of plans implemented.		
		Build climate resilience of groundwater based water supply systems.	No. of groundwater recharge plans developed for dependent water distribution systems and no. of GW recharge plans implemented.		
		Implement wetland recharge (95876.33 Ha) across UP.	Wetland area recharged No. of community based wetland associations established.	Namami Gange	
3. Green Mission					
3.1	Restore & improve quality of forest cover and increase area of Trees Outside Forest (ToF)	4081 km^2 of open forest 4029 km^2 of moderately dense forest	Drivers of deforestation and degradation identified. No. of restoration plans develop. Area restored.	Forest Dept.	Annual
		Enrichment of protected areas (3221 km^2)	Drivers of deforestation and degradation identified		
			No. of restoration plans develop.		
			Area restored.		
		Conservation of tree species with economic and social values.	Drivers effecting canopy density and soil cover in protected area		
			No. of enrichment plans develop.		

Table 71: Indicative indicators for Tier 1 M&E

Sr no.	Strategy	Target	Indicator for M&E	Responsible department	Frequency of M&E
			No. of enrichment plans implemented.		
		1065 km^2 of ravine areas in Bundelkhand areas of UP	Ha of Area managed for preventing soil erosion in Bundelkhand region in UP.	Department of Environment, Forest and Climate Change and UPNEDA	
		All rural households using firewood in UP	No. of households supply with LPGs.		
			No. of Biogas plants (household level and community level)		
			No. of crop residue based bio gasifiers created		
			No. of households with improved chulhas		
			No. of household with electric convection stoves.		
3.2	Enhance tree cover in Urban and Peri-Urban areas (including institutional lands)	150 thousand plants by 2030	No. of plants along avenues.	Department of Environment, Forest and Climate Change	Annual
			No. of trees across institutional land (school, colleges, offices, railway land)		
			No. of mini forest in urban areas.		
		75 central high tech nurseries of 1 Ha each (one in each district)	No. of central high tech nurseries created		
		32647 satellite nurseries each for a cluster of 3 villages	No. of satellite nurseries created.		
		Ensure innovative scheme for survival of trees	No. of trees survived.		
3.3	Improve incomes of forest dependent population through agroforestry and food forests in private and community land	Plantation of 8 crore saplings (UP SDG vision	No. sampling planted	Department of Environment, Forest and Climate Change , Agriculture Department, Horticulture Department, Animal Husbandry Department, UPFC	Annual
			Ha of agro forestry created.		
		2 crore samplings for food forest	No. sampling planted		
			Ha of food forest created		
		NSP pricing set for 10-15 remunerative afro forestry species	No. of NTFPs and wood species for which NSP is set.		
		Buy back arrangement in place	No. of species for which value change has been establish for buy back.		
		Forest certification of 450408 Ha of land under terrestrial and social forestry.	Area certified.		

Table 71: Indicative indicators for Tier 1 M&E

Sr no.	Strategy	Target	Indicator for M&E	Responsible department	Frequency of M&E
3.4	Conservation of wetlands	Natural wetlands covering all lakes and pond in UP.	Wetland maps (no. of wetland and area under different wetland classification)	Department of Environment, Forest and Climate Change , State Forest Research Institute, State Biodiversity Board and U.P State Wetlands Authority	Annual
			Assessment of biodiversity status and water quality.		
			No. of site specific restoration and conservation plans		
			No. of wetlands restored		
			No. of wetland association formed		
3.5	Biodiversity Conservation	Endangered species recovery plans	No. of plans developed	Department of Environment, Forest and Climate Change and State Biodiversity Board	Annual
			No. of endangered species conserved.		
		Biodiversity conservation in 59407 BMCs	Conservation training modules developed		
			No. of trainings conducted		
		Ex- situ conservation of rare, endangered and endemic tree species	No. of nurseries developed		
			No. of propagation plots established		
			No. of species conserved		
		Remove invasive species spread across 1,24,800 Ha	Area cleared		
			No. of products developed		
			No. of businesses established		
		Scientific survey in PBRs 59407 PBR's	No. of PBRs covered		
		Conserve biodiversity heritage site	No. of BHS prioritised		
			No. of BHS conserved through ecotourism		
		3 community seed banks in each of the 9 agro climatic zones.	No. of training conducted.		
			No. of community seed bank established.		
4. Energy Mission					
4.1	Minimise AT&C losses in transmission and distribution of electricity	Separation of agriculture feeder in 2000 mixed feeders	No. of feeders segregated.	Power Department, DISCOMs, UPERC, Namami Gange,	Annual

Table 71: Indicative indicators for Tier 1 M&E

Sr no.	Strategy	Target	Indicator for M&E	Responsible department	Frequency of M&E
		Smart metering of 27,551,094 domestic consumers (LMV 1)	No. of domestic smart meters installed	Agriculture Department, UPNEDA, PVVNL, MVVNL, KESCO	
		Smart metering of state tube wells and pumps(34970 consumers- LMV 7)	No. of tube wells and pumps connected to smart metre		
		Smart metering 23,897 no. of public water works	No. of public water works connected to smart meters		
		Smart metering of private tube wells used by large farming areas formed by big corporations	No. of smart meters installed by large farming areas.		
		Smart metering of all government offices (91,874 consumers LMV 3)	No. of smart meters installed by all government offices.		
		Smart metering of heavy industries consuming 100 Bhp/ 75 kw(13,125 consumers	No. of smart meters installed by heavy industries.		
		Smart metering of M&Es (176,389 consumers LMV 6)	No. of smart meters installed by M&Es.		
		Differential tariff rates by time of date use of electricity	Tariff rates declared		
			Tariff rates implemented		
		AMI meters in all feeders	No. of AMI meters installed by PVVNL, DVVNL, MVVNL, PUVVNL and KESCO		
		AMI meters for all distribution transformers	No. of AMI meters installed by PVVNL, DVVNL, MVVNL, PUVVNL and KESCO		
		SCADA/DMS in all towns having population greater than 1 lakh	No. of SCADA/DMS installed		

Table 71: Indicative indicators for Tier 1 M&E

Sr no.	Strategy	Target	Indicator for M&E	Responsible department	Frequency of M&E
4.2	Make SME clusters energy efficient	Clay brick units to convert from FCBTK to zick-zack technology and manufacture perforated brick across all 10 clusters.	No. of units converted to zick- zack	UPNEDA, Directorate of MSME (GoUP) , Leather manufacturing units, Foundry Association, Power loom Associations, Ceramics research institutes, Glass manufacturer's associations, Horticulture and Food Processing Departments, UP Rice Mills Association, UP Paper & Packaging Association	Annual
			No. of units manufacturing perforated bricks.		
		Integration of energy efficient waste practices in leather, foundry, power loom and textiles, ceramics, glass products, rice mills, packaging material, mint oil, perfumery, carpets, sugar and ethanol manufacturing units.	No. of units bench marked.		
			No. of training conducted on energy efficiency units		Biannual
			Amount of GHG reduction		Annual
4.3	Create enabling environment for market penetration of efficient cooling systems	Cooling action plan for UP	Cooling action plan published	UPNEDA, Agri Dept, Horti Dept, Animal Husbandry Dept, Health Dept, Skill Development Mission, DST	Annual
		Ensure thermal comfort in all residential, commercial and institutional buildings	Notification on Eco Niwas Samhita notified		
			Thermal comfort norms of UP- ECBC 2018 notified		
			No. of buildings with completion certificate.		
			No. of workshops conducted for mistries on passive cooling material and building designs.		
		Architects and builders in the state made aware about HVAC systems	No. of IEC material designed and disseminated.		
		Make mandatory BLDC fans in government buildings and social housing programmes	No. of BLDC manufacturing units commissioned		
			No. of BLDC fans installed in government buildings		
			No. of BLDC fans installed in buildings constructed through PM Awas Yojana		
		District cooling in commercial and industrial townships.	No. of tenders advertised for district cooling.		
			No. of commercial and industrial townships with district cooling.		

Table 71: Indicative indicators for Tier 1 M&E

Sr no.	Strategy	Target	Indicator for M&E	Responsible department	Frequency of M&E
	Create enabling environment for market penetration of efficient cooling systems	Procure energy efficient star rated cooling appliances with low/ 0 GWP including air conditioners	Techno economic evaluation of low/0 GWP refrigerants	UPNEDA, Agri Dept, Horti Dept, Animal Husbandry Dept, Health Dept, Skill Development Mission, DST	Annual
			No. of equipments sold.		
		Introduce low/0 GWP refrigerants for cold chain infrastructure and refrigerators	No. of pack houses installed with low/ 0 GWP refrigerants		
			No. of reefer transport installed with low/ 0 GWP refrigerants		
			No. of cold storage installed with low/ 0 GWP refrigerants		
			No. of ripening chambers installed with low/ 0 GWP refrigerants		
			No. of vaccine storage installed with low/ 0 GWP refrigerants		
			No. of milk chillers installed with low/ 0 GWP refrigerants		
			No. of commercial refrigerators installed with low/ 0 GWP refrigerants		
			No. of household refrigerators installed with low/ 0 GWP refrigerants		
		Popularize small medium large cold chain infrastructure with low/0 GWP technologies.	No. of small, medium, large cold chains with low/0 GWP refrigerants		
		Trained cold chain operators and service technician for efficient O&M	No. of professionals trained.		
		Development of cooling solutions across sectors.	No. of challenges undertaken.		
4.4	Solarize conventional energy based private and public water pumping works	Solarize all conventional energy based private and public water pumping works	No. of solarize all conventional energy based private and public water pumping works.	Power dept., Jal Nigam	Annual
4.5	Set up off-grid solar power plants on waste land in rural UP thus increasing farmers income	Cover all waste land	No. of off grid solar power generation installed.	Power dept., Agri Dept,	Annual

Table 71: Indicative indicators for Tier 1 M&E

Sr no.	Strategy	Target	Indicator for M&E	Responsible department	Frequency of M&E
4.6	Enable significant transition to EVs in cities by 2030	EV charging networks in 10 top cities with highest population.	No. of EV charging networks in the cities.	Urban Development Dept., Invest-UP	Annual
			No. of EV charging stations installed in along highways connecting these cities.		
		Procurement of E buses and retrofitting of old buses (12400 units)	No. of E buses		
5.A	**Sustainable Habitat Mission – Urban)**				
5.1	Mainstreaming Climate Resilience and Pollution Mitigation actions into Urban Governance	Preparation of Comprehensive Climate Action Plan	Number of Smart and AMRUT Cities with Climate Action Plan	Urban Development Department, Pollution Control Board	Yearly
			Number of ULBs above 1 lakh population with inclusion of climate resilience measures into Urban Master/Development Plan		
			Number of million plus cities with GHG inventory		
			Number of AMRUT cities with City Water Budget Plans		
			Number of Non-attainment cities achieved NCAP target		
5.2	Building Climate Resilient Housing Infrastructure	Resilient Housing Norms and research for resilient infrastructure	Percent of total ULBs with mapped flood prone areas/housing societies	Housing Department	
			Number of ULBs with at least one residential/institutional/commercial building achieving Highest green building rating as a pilot		
5.3	Developing Climate Resilient Urban Water infrastructure and Storm water drainage	Mapping of critical water supply facilities and retrofitting	Number of critical water supply facilities mapped that are potentially disrupted by extreme weather events (Floods)	Urban Development Department State Disaster Management Authority (SDMA) Jal Nigam PWD	Yearly
			Number of water treatment plants with protocol to tackle floods and drought events (contingency plans)		
		Retrofit and build new separate storm water drainages	Percent of total new storm water lines laid separately (not mixing sewage drains and storm water)		
			Percent of ULBs met the Service Level Benchmarking of water supply and storm water indicators		

Table 71: Indicative indicators for Tier 1 M&E

Sr no.	Strategy	Target	Indicator for M&E	Responsible department	Frequency of M&E
5.4	Developing Climate resilient waste management infrastructure	Efficient Solid waste management of all ULBs	Percentage of ULBs achieved above Gold Ranking in Prerak DAUUR Samman Criteria as per Swachh Survekshan 22 toolkit (refer https://ss-cf.sbmurban.org/assets/pdf/SS2022%20Toolkit_1st%20February%202022_Final.pdf)	Dept. of Namami Gange and Rural Water Supply, SMCG-UP, Urban Development Department, and Uttar Pradesh Pollution Control Board (UPPCB)	Yearly
		Decentralised Liquid Waste Management			
		Preparation of Faecal Sludge and Septage Management (FSSM) Plans	Percent of total ULBs below 5 lakh population with FSSM Plans in place		
5.5	Building Climate Resilient Road Infrastructure and Low Carbon mobility options	Resilient Road Infrastructure	Number of ULBs with identified critical water logging areas during floods	Urban Development Department PWD ULBs UPPCB, Transport Dept. Urban Transport Directorate, Department of Environment, Forest and Climate Change	Yearly
		Preparation of Comprehensive Mobility Plans	Percentage of ULBs above 5 lakh population with a comprehensive mobility plan in place (including GHG mitigation actions)		
		Urban E-Mobility	Number million plus ULBs procured E-Buses		
		Avenue Plantation	Percentage of total ULBs with at least 50% of arterial road with both side plantation.		
5.B	**Sustainable Habitat Mission- Rural**				
5.6	Mainstreaming climate change in rural governance and planning	Awareness and Trainings of PRIs and Citizens/Trainees	Number of large awareness and training of PRI representatives conducted Number of large awareness and trainings of citizens and trainees conducted	SWSM (Namami Gange Dept.) PWD RDD Rural	Yearly
		Climate Vulnerability into GPDPs	Percentage of GPDPs addressing Climate Risks/Impacts (floods, droughts, other events)		
5.7	Building Climate resilient rural housing	Training of trainers and specially mistries (i.e., construction masons)	Number of trainings/workshops on resilient and green building		
5.8	Developing climate adaptation integrated approach to rural skills development and diversification of livelihood Opportunities	Generate awareness among target groups about the benefit of skill development, employment and learning opportunities for alternate livelihoods	Number of Alternate Livelihood and Skill Development Trainings		
			Number of local skill development centres/kiosks set up at block level		

Table 71: Indicative indicators for Tier 1 M&E

Sr no.	Strategy	Target	Indicator for M&E	Responsible department	Frequency of M&E
5.9	Building climate resilient road and climate smart waste infrastructure	Mainstreaming Climate Resilience into road construction norms	Percentage of total length of road constructed which use sustainably sourced material (local & Green Roads)		
		All weather road access to all	Percentage of villages with all weather road access (which are flood proof)	Engineering Dept.,	
		Effective solid and liquid waste management in villages	Percentage of Districts scores above previous years state average score in Swachh Survekshan Grameen		
			Percentage of total villages with Functional Toilets		
			Percentage of total villages with source segregation of waste		
6. Health Mission					
6.1	Assess extent of spatial spread of health risks due to current and future climate change in the state at highest possible resolution to facilitate location specific adaptation actions	Study assessing current and projected extent of climate linked diseases	Study on vector borne diseases (dengue, malaria, Chikungunya, scrub typhus, japans encephalitis and kala azar	Dept. of Health, Dept. of Environment	Every 2 years
			Study on water borne diseases (typhoid, hepatitis, food poisoning		
			Study on respiratory diseases (seasonal influenza, COPD, Asthma, rhinitis, sinusitis)		
			Study on human displacement		
			Study on mental health		
			Study on malnutrition and anaemia		
			Heat stress		
			Any other		
6.2	Enable access to data, real-time situational analysis of disease spread and establish reliable location specific short, medium and long term forecasting	Short medium and long term location specific forecasting of climate linked diseases.	Forecasting capability developed through rounds of challenges on :-	Dept. of Health, Dept. of Environment	Annual
			vector borne diseases (dengue, malaria, Chikungunya, scrub typhus, japans encephalitis and kala azar		
			water borne diseases (typhoid, hepatitis, food poisoning		
			respiratory diseases (seasonal influenza, COPD, Asthma, rhinitis, sinusitis)		
			human displacement		
			mental health		
			malnutrition and anaemia		
			Heat stress		
			No. of people accessing the forecast		

Table 71: Indicative indicators for Tier 1 M&E

Sr no.	Strategy	Target	Indicator for M&E	Responsible department	Frequency of M&E
6.3	Enable behavioural change in public to avoid climate linked disease epidemics	All 11th and 12th students	No. of people accessing the forecast	Education department	Annual
		Internalization of good practices for building immunity for +2 students.	Curriculum developed for +2 students		
		Internalization of good practices for building immunity for nursery to class 5 students	Curriculum developed		
		Internalization of good practices for communities.	Training modules developed for MLAs, Women SFGs, ASHA/ ANM/ AWW workers, rural and urban water and sanitation utilities, Panchayat.		
7. Disaster Management					
7.1	Enhancing capacities for building institutional resilience towards climate change induced extreme and slow onset disasters	Develop hazard specific dynamic maps by tracking on a real-time basis all hydro meteorological hazards using IMD data, with locations and extent specified.	Portal for dynamic climate hazard mapping for the purpose of visualising hazard location and extent, developed	UPSDMA, Office of Relief Commissioner, Water Resources Department, UP Flood Management Information Centre, Insurance companies. Gram Panchayats, ULBs, DDM	Annual
			Hazard specific dynamic maps generated		
		Install 3 additional S-band Doppler radars across the state	Number of S-band Doppler radars installed		
		Set up MoUs with upstream states, river management agencies, CWC, NRSC and other stakeholders to access real-time data (Trans-state and transboundary)	Number of transboundary and trans-state MoUs signed		
			Committee formed to manage transboundary and trans-state data access and sharing		Biannual/ quarterly
			Percentage of warning communication and dissemination		
			Proportion of at-risk exposed/ population covered by the early warning dissemination		Annual
		Annual publications of economic and non-economic loss and damages	No. of Studies conducted to assess annual L&D		
		Assessment of sector-wise climate induced loss and damage at all levels of jurisdictions including at community level	handbook for assessing sector-wise loss and damage, developed		
			No. of Dept.-wise L&D trainings conducted		Biannual

Table 71: Indicative indicators for Tier 1 M&E

Sr no.	Strategy	Target	Indicator for M&E	Responsible department	Frequency of M&E
		-Developing a framework for building long term risk resilience across sectors	Framework developed		Annual
		-Develop Institutional frameworks and M&E frameworks -Assess budgets and assign financing stream -Develop capacity building plans for each sector and departments therein			
		Heat action plan	Heat action plan developed		Annual
7.2	Build climate resilience through creation of knowledge products, policies and guidelines to build climate	Trainings on mainstreaming Climate risks concerns into developmental Plans/Project	No. of trainings conducted	UPSDMA, IIT Kanpur, BHU, and others, Office of Relief Commissioner, District Planning Committees, Network of Research Institutions (Including IIT Kanpur, BHU), Dept. of Environment	Biannual
		Establish the knowledge network	Number of knowledge networks established		
8. Strategic Knowledge Management					
8.1	Strengthen and Capacitate the UP Climate Change Authority	Establishment of expert committee on climate science	Scope of work, functions and thematic stats established.	UP Climate Change Authority Departments, Research Institutes (IITs, BHU, IIMs ICAR, CSIR, NLUs), NGOs, National and international experts	Annual
			No. of research studies commissioned		
			Members appointed.		
		Expert committee on adaptation and mitigation research and policy planning formed	Scope of work, functions and thematic stats established.		
			No. of research studies commissioned		
			Members appointed		
		Expert committee on climate law	Scope of work, functions and thematic stats established.		
			No. of research studies commissioned		
			Members appointed		

Table 71: Indicative indicators for Tier 1 M&E

Sr no.	Strategy	Target	Indicator for M&E	Responsible department	Frequency of M&E
		Expert committee on climate finance	Scope of work, functions and thematic stats established.		
			No. of research studies commissioned		
			Members appointed		
		Human resource strengthened	Director appointed	UP Climate Change Authority	Annual
			Thematic programme officers appointed		
			Research associates appointed	Universities, IITs, NGOs, technical Instt. (ICAR/ CSIR/ IISCs etc.), Individual Experts	
8.2	Establish Knowledge networks	Knowledge hubs created in all 75 districts	No. of knowledge hub created	UP Climate Change Authority	Annual
		Thematic knowledge network created	Climate science	Universities, IITs, NGOs, technical Instt. (ICAR/ CSIR/ IISCs etc.), Individual Experts	
			Adaptation and mitigation		
			Sustainable agriculture		
			Water resources		
			Forest, T forest and biodiversity		
			Sustainable urban habitats		
			Sustainable urban habitats		
			Human health		
			Energy efficiency		
			Green Energy		
			Disaster management		
			No. of trainings and workshops		

Table 71: Indicative indicators for Tier 1 M&E

Sr no.	Strategy	Target	Indicator for M&E	Responsible department	Frequency of M&E
8.3	Capacity Building for integrating climate Change in Development	Trainings conducted for policy maker, department and agencies, district officials, local bodies and financial institutions	Training module developed	UP Climate Change Authority Experts	Annual
			No. of master trainers trained		Biannual
			No. of training conducted		Biannual
			No. of people trained		Annual
		Centre of excellence for greening of MSNEs	Curriculum developed		Annual
			Centre established		Annual
		Mainstreaming climate change in +2 level	Workshop module developed		Biannual
			Training plans developed		Annual
			Experts indentified		Annual
			Master trainers trained		Annual
			No. of workshops conducted		Biannual
			No. of children trained		Annual
8.4	Monitoring and Evaluation of UP SAPCC	M&E of all projects and programmes of the government and that of strategies indicated UP SAPCC	Climate performance index developed	UP Climate Change Authority Third Party Auditors, Departments	Annual
			No. of M&Es conducted.		
			No. of audit reports published		

Table 71: Indicative Indicators for Tier 1 M&E

S.No	Mission	Relevant Monitoring Indicators at State-Level (Based on the Drivers of Vulnerability, State SDG Targets, S)	Periodicity
1.	Sustainable Agriculture Mission	Annual Crop Production per unit area (Kg/Ha)	Annual
		% Net Area Cultivated under Horticulture Trees	
		Percentage change in area under wastelands	
		Percentage of workforce primarily employed in Agriculture	
		Percentage of area under rainfed agriculture	
		Percentage change in small and marginal Landholdings	
		% of HH owning mechanized farming implements	
		Crop insurance coverage	
		Livestock per 1,000 rural population	
		Stray Cattle Density (per km^2)	

Table 72: Indicative Indicators for Tier 2 M&E for Each Mission Of The Sapcc

S.No	Mission	Relevant Monitoring Indicators at State-Level (Based on the Drivers of Vulnerability, State SDG Targets, S)	Periodicity
2.	Jal Mission	Irrigation Potential created (lakh Ha)	Annual
		Proportion of households with access to safe drinking water (%)	
		Groundwater withdrawal against availability (%)	
		Number of Blocks/mandals/taluka over-exploited (%)	
3.	Green UP Mission	% Change in Forest Area	Annual
		Forest area (in ha)/1,000 (SC/ST) rural population	
		Percentage of HH using firewood as fuel for cooking	
		Training/exposure visits/awareness campaign for BMCs, PBRs, mechanism for benefit sharing	
		Percentage of area covered under afforestation schemes to the total geographical area	
		Total area protected (national parks and wildlife sanctuaries) (km^2)	
4.	Sustainable Habitat Mission	Access to basic amenities (safe drinking water, sanitation, and wastewater drainage)	Annual
		Number of pucca houses (Urban and Rural-PMAY)	
		Percentage of households with kitchens inside the house and use of clean fuels for cooking	
		Prioritization of natural resource management works under MGNREGS	
		Access to Transport and Road connectivity	
		Total length of surfaced roads (NH SH & PWD) per 100,000 population	
		Proportion of municipal solid waste treated to the total municipal solid waste generated in the state (%)	
		Number of Water treatment plants installed	
5.	Green Energy and Energy efficiency Mission	Access to clean cooking and heating fuels	Annual
		Access to and consumption of electricity	
		Percentage of villages with solar street lighting system	
		% of HHs electrified	
		Number of solar water pumps sets	
		Proportion of renewable energy to total annual energy	
		Production by installed capacity (%)	
		Proportion of AT&C losses to total energy produced (%)	

Table 72: Indicative indicators for Tier 2 M&E for each mission of the SAPCC

S.No	Mission	Relevant Monitoring Indicators at State-Level (Based on the Drivers of Vulnerability, State SDG Targets, S)	Periodicity
6.	Health Mission	Access to functional healthcare facility	Annual
		Number of health care facilities (Sub-centres, CHCs and PHCs)	
		Infant Mortality rate	
		% of Hhs covered under health scheme/ health insurance	
		Disease incidence (Vector-borne)	
		Disease incidence (Water-borne)	
		Disease incidence (Respiratory)	
7.	Disaster Management Mission	Disaster preparedness score as per Disaster Resilience Index	Annual
		Lives lost due to extreme weather events (per 1 crore population)	
		Percentage of households (rural and urban) at risk to damage by wind, flood and earthquakes	
8.	Strategic Knowledge Mission	Number of knowledge products created for Climate Awareness Trainings	Annual
		Percentage of climate change inclusion into sectoral policies	

Table 72: Indicative indicators for Tier 2 M&E for each mission of the SAPCC

Key indicators at the SAPCC level	Periodicity
Percentage of actions initiated	Quarterly
Percentage of actions implemented	Yearly

Table 73: Indicative indicators for Tier 3 M&E for the overall SAPCC targets

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ANNEXURES

A Climate Profile

	Mean Temperature (oC)					
District	Maximum	Annual Trend	Minimum	Annual Trend	DTR	Annual Trend
Amroha	31.29	0.003	18.28	0.022	13.01	-0.019
Agra	32.60	0.005	18.74	0.025	13.86	-0.020
Aligarh	31.88	0.002	18.57	0.024	13.30	-0.019
Ambedkar Nagar	31.94	0.008	19.08	0.021	12.86	-0.013
Amethi	31.88	0.005	19.24	0.018	12.64	-0.010
Auraiya	32.32	0.004	19.02	0.021	13.30	-0.017
Azamgarh	31.84	0.008	19.10	0.023	12.74	-0.015
Baghpat	30.41	0.006	17.69	0.025	12.72	-0.019
Bahraich	31.56	0.002	18.99	0.016	12.57	-0.014
Ballia	31.65	0.009	19.13	0.025	12.52	-0.016
Balrampur	31.56	0.006	19.06	0.018	12.50	-0.013
Banda	32.40	0.014	19.07	0.021	13.33	-0.006
Bara Banki	31.72	0.004	19.12	0.017	12.60	-0.014
Bareilly	29.74	0.003	17.38	0.019	12.36	-0.017
Basti	31.94	0.008	19.08	0.021	12.86	-0.013
Bhadohi	32.01	0.006	19.07	0.023	12.94	-0.018
Bijnor	26.75	0.012	15.16	0.030	11.59	-0.018
Budaun	31.28	0.003	18.39	0.022	12.89	-0.019
Bulandshahr	31.29	0.004	17.38	0.019	13.91	-0.016
Chandauli	31.90	0.010	19.01	0.022	12.89	-0.012
Chitrakoot	32.36	0.011	19.10	0.022	13.25	-0.011
Deoria	31.55	0.008	19.15	0.023	12.40	-0.015

Table 74: District-wise average maximum and minimum temperature and average diurnal temperature range (DTR) and their trends in Uttar Pradesh between 1980-2019

Etah	32.04	0.002	18.95	0.023	13.09	-0.020
Etawah	32.54	0.004	18.98	0.021	13.56	-0.017
Faizabad	31.91	0.006	19.16	0.020	12.75	-0.013
Farrukhabad	31.68	0.002	18.99	0.020	12.69	-0.018
Fatehpur	32.19	0.010	19.12	0.021	13.08	-0.011
Firozabad	32.41	0.002	18.91	0.025	13.50	-0.023
Gautam Buddha Nagar	31.61	0.002	18.37	0.022	13.24	-0.021
Ghaziabad	31.61	0.002	18.37	0.022	13.24	-0.021
Ghazipur	31.86	0.011	19.11	0.026	12.75	-0.015
Gonda	31.73	0.005	19.09	0.019	12.64	-0.013
Gorakhpur	31.55	0.008	19.15	0.023	12.40	-0.015
Hamirpur	32.51	0.014	18.94	0.020	13.56	-0.006
Hapur	31.45	0.003	18.32	0.022	13.12	-0.020
Hardoi	31.61	0.003	19.01	0.019	12.60	-0.016
Hathras	32.32	0.002	18.81	0.025	13.51	-0.023
Jalaun	32.47	0.009	18.92	0.020	13.55	-0.011
Jaunpur	31.95	0.005	19.16	0.021	12.79	-0.016
Jhansi	32.70	0.013	18.68	0.021	14.02	-0.008
Kannauj	32.00	0.003	19.00	0.021	12.99	-0.017
Kanpur Dehat	32.32	0.004	19.02	0.021	13.30	-0.017
Kanpur Nagar	31.86	0.008	19.14	0.019	12.72	-0.011
Kasganj	32.41	0.002	18.91	0.025	13.43	-0.017
Kaushambi	32.32	0.007	19.14	0.023	13.18	-0.016
Kheri	30.77	0.003	18.33	0.017	12.39	-0.020
Kushinagar	31.29	0.008	19.10	0.024	12.19	-0.015
Lalitpur	32.74	0.015	18.52	0.022	14.22	-0.007
Lucknow	31.87	0.006	19.19	0.019	12.68	-0.012
Mahoba	32.51	0.014	18.94	0.020	13.56	-0.006
Mahrajganj	31.39	0.006	19.02	0.021	12.37	-0.014
Mainpuri	32.04	0.002	18.95	0.023	13.09	-0.020
Mathura	32.23	0.002	18.72	0.025	13.52	-0.022
Mau	31.90	0.009	19.09	0.023	12.81	-0.014
Meerut	30.37	0.007	17.69	0.025	12.72	-0.019

Table 74: District-wise Average Maximum And Minimum Temperature and Average Diurnal Temperature Range (DTR) and T their Trends in Uttar Pradesh Between 1980-2019

Mirzapur	32.08	0.009	18.93	0.020	13.15	-0.011
Moradabad	29.02	0.008	16.72	0.026	12.30	-0.018
Muzaffarnagar	29.21	0.011	17.00	0.028	12.21	-0.017
Pilibhit	29.83	0.003	17.50	0.018	12.33	-0.016
Pratapgarh	32.32	0.007	19.14	0.023	13.18	-0.016
Prayagraj	32.17	0.006	19.11	0.023	13.06	-0.017
Rae Bareli	31.87	0.006	19.19	0.019	12.68	-0.012
Rampur	29.72	0.000	17.38	0.019	12.36	-0.017
Saharanpur	28.14	0.014	16.06	0.026	12.07	-0.012
Sambhal	31.29	0.003	18.27	0.022	13.01	-0.019
Sant Kabir Nagar	31.75	0.008	19.10	0.021	12.63	-0.014
Shahjahanpur	30.96	0.003	18.29	0.019	12.67	-0.017
Shamli	29.21	0.011	16.99	0.027	12.21	-0.017
Shrawasti	31.56	0.004	19.01	0.016	12.53	-0.013
Siddharthnagar	31.47	0.006	19.03	0.018	12.44	-0.014
Sitapur	31.55	0.003	18.99	0.016	12.54	-0.014
Sonbhadra	32.04	0.011	18.85	0.017	13.19	-0.007
Sultanpur	31.94	0.008	19.06	0.020	12.86	-0.013
Unnao	32.32	0.004	19.01	0.020	13.30	-0.017
Varanasi	31.94	0.008	19.08	0.023	12.87	-0.020

Table 74: District-wise Average Maximum And Minimum Temperature and Average Diurnal Temperature Range (DTR) and T their Trends in Uttar Pradesh Between 1980-2019

District	Number of Extreme Heat Days (Temp. >=45°C) between 1980-2019	Number of Severe Heat Days (Temp. >=47°C) 1980-2019
Amroha	15	0
Agra	159	4
Aligarh	62	0
Ambedkar Nagar	2	0
Amethi	7	0
Auraiya	85	1
Azamgarh	2	0
Baghpat	1	0
Bahraich	0	0

Table 75: District-wise Number of Extreme Heat Days and Severe Heat Days in Uttar Pradesh Between 1980-2019

Ballia	0	0
Balrampur	0	0
Banda	110	1
Bara Banki	2	0
Bareilly	0	0
Basti	2	0
Bhadohi	6	0
Bijnor	0	0
Budaun	9	0
Bulandshahr	15	0
Chandauli	2	0
Chitrakoot	74	1
Deoria	0	0
Etah	58	0
Etawah	129	2
Faizabad	3	0
Farrukhabad	20	0
Fatehpur	41	0
Firozabad	138	8
Gautam Buddha Nagar	53	1
Ghaziabad	53	1
Ghazipur	2	0
Gonda	0	0
Gorakhpur	0	0
Hamirpur	126	1
Hapur	32	0
Hardoi	12	0
Hathras	115	2
Jalaun	103	1
Jaunpur	5	0
Jhansi	163	4
Kannauj	46	0
Kanpur Dehat	85	1
Kanpur Nagar	12	0

Table 75: District-wise Number of Extreme Heat Days and Severe Heat Days in Uttar Pradesh between 1980-2019

Kasganj	137	8
Kaushambi	48	0
Kheri	0	0
Kushinagar	0	0
Lalitpur	143	2
Lucknow	9	0
Mahoba	126	1
Mahrajganj	0	0
Mainpuri	58	0
Mathura	106	2
Mau	2	0
Meerut	1	0
Mirzapur	8	0
Moradabad	0	0
Muzaffarnagar	0	0
Pilibhit	0	0
Pratapgarh	48	0
Prayagraj	13	0
Rae Bareli	9	0
Rampur	0	0
Saharanpur	0	0
Sambhal	15	0
Sant Kabir Nagar	0	0
Shahjahanpur	2	0
Shamli	0	0
Shrawasti	0	0
Siddharthnagar	0	0
Sitapur	1	0
Sonbhadra	7	0
Sultanpur	2	0
Unnao	85	1
Varanasi	2	0

Table 75: District-wise Number of Extreme Heat Days and Severe Heat Days in Uttar Pradesh Between 1980-2019

District	Annual Rainfall (in mm) (Temp. >=45°C) between 1980-2019	Annual Change (+/-) Days (Temp. >=47°C) 1980-2019	Winter Season Rainfall (JF) (in mm)	Annual Change (+/-)	Pre Monsoon Season Rainfall (MAM) (in mm)	Annual Change (+/-)	Monsoon Season Rainfall (JJAS) (in mm)	Annual Change (+/-)	Post Monsoon Season Rainfall (O,N,D) (in mm)	Annual Change (+/-)
Amroha	884	-4.69	46	-0.21	40	-0.09	764	-3.73	33	-0.7
Hapur	707	-4.56	36	0.18	37	-0.20	614	-4.14	21	-0.4
Bareilly	954	-0.14	37	0.09	41	-0.17	842	0.52	33	-0.6
Pilibhit	1149	-4.75	38	0.12	48	-0.23	1017	-3.91	46	-0.7
Bulandshahr	701	-4.15	30	0.17	32	-0.17	615	-3.76	23	-0.4
Gautam Buddha Nagar	519	-5.86	27	-0.02	30	-0.44	447	-5.08	15	-0.3
Kheri	1125	-6.54	39	0.23	55	-0.29	981	-5.58	50	-0.9
Budaun	765	-2.50	30	0.22	32	0.18	676	-2.35	27	-0.6
Bahraich	1165	-9.06	35	0.30	60	-0.12	1016	-8.13	54	-1.1
Shahjahanpur	861	-4.71	31	0.22	38	0.05	756	-4.14	36	-0.8
Aligarh	616	-3.37	25	0.14	31	-0.23	539	-2.83	20	-0.5
Kasganj	731	-5.97	28	0.19	31	-0.21	646	-5.36	26	-0.6
Mathura	552	-2.00	20	0.13	28	0.07	484	-1.77	19	-0.4
Shrawasti	1188	-9.29	34	0.15	65	-0.50	1037	-7.58	53	-1.4
Sitapur	981	-7.11	32	0.44	41	0.13	864	-6.53	44	-1.2
Hathras	624	-2.05	22	0.29	29	-0.25	551	-1.60	22	-0.5
Etah	678	-5.91	25	0.20	26	-0.26	600	-5.17	27	-0.7
Hardoi	836	-4.05	30	0.30	32	0.12	736	-3.18	38	-1.3
Farrukhabad	758	-9.00	27	0.00	29	-0.16	670	-7.77	31	-1.1
Firozabad	641	-3.68	22	0.34	25	-0.13	567	-3.24	27	-0.6
Siddharthnagar	1130	-15.84	23	-0.33	57	-0.92	997	-13.64	52	-0.9
Mainpuri	664	-8.33	23	0.03	22	-0.21	589	-7.17	29	-1.0
Mahrajganj	1307	-19.69	25	-0.42	86	-1.34	1133	-16.71	64	-1.2
Agra	757	-2.83	24	0.16	21	0.04	678	-2.76	34	-0.3

Table 76: District Level Analysis of Mean Annual And Seasonal Rainfall in Uttar Pradesh During the Period 1980-2019

Gonda	1026	-13.62	26	0.11	41	-0.36	910	-12.01	50	-1.4
Bara Banki	966	-10.66	28	0.30	38	-0.09	853	-9.36	48	-1.5
Kushinagar	1131	-19.84	20	-0.33	73	-0.90	985	-17.65	53	-1.0
Kannauj	689	-8.90	26	0.05	23	-0.24	606	-7.30	35	-1.4
Lucknow	862	-7.35	29	0.24	29	0.03	760	-6.20	44	-1.4
Basti	1126	-11.98	25	-0.15	46	-0.27	1002	-10.93	53	-0.6
Gorakhpur	1102	-15.17	24	-0.26	50	-0.13	979	-14.42	50	-0.4
Sant Kabir Nagar	1230	-15.03	26	-0.24	53	-0.29	1095	-13.91	55	-0.6
Unnao	745	-9.67	27	0.06	22	-0.11	657	-8.04	38	-1.6
Etawah	592	-6.84	21	-0.14	18	-0.15	524	-5.42	30	-1.1
Kanpur Nagar	717	-8.26	27	0.18	22	0.08	630	-7.24	38	-1.3
Auraiya	645	-12.65	23	-0.20	19	-0.34	570	-10.88	33	-1.2
Faizabad	955	-13.13	25	-0.08	37	-0.31	847	-11.83	45	-0.9
Kanpur Dehat	680	-11.94	24	0.13	19	0.02	599	-11.06	37	-1.0
Deoria	977	-12.46	20	-0.28	51	-0.14	857	-11.98	50	-0.1
Sultanpur	908	-12.23	26	-0.08	32	-0.14	813	-11.45	37	-0.6
Ambedkar Nagar	1018	-13.05	25	-0.14	40	-0.14	909	-12.09	44	-0.6
Rae Bareli	738	-10.32	23	-0.14	19	-0.23	658	-8.37	38	-1.6
Jalaun	683	-10.12	22	0.03	18	-0.07	607	-9.35	36	-0.7
Azamgarh	952	-10.52	20	-0.17	34	-0.04	858	-9.96	40	-0.3
Mau	869	-5.66	19	-0.14	32	0.13	779	-5.65	39	0.0
Fatehpur	723	-9.70	24	-0.06	19	-0.25	643	-8.04	37	-1.4
Ballia	946	-6.15	19	-0.06	46	0.02	834	-6.31	47	0.2
Jaunpur	892	-10.27	25	-0.16	30	0.13	803	-9.89	34	-0.3
Jhansi	783	-5.28	21	0.19	19	-0.08	705	-4.98	38	-0.4
Banda	822	-3.10	25	0.09	21	0.06	739	-2.58	37	-0.7

Table 76: District Level Analysis of Mean Annual And Seasonal Rainfall in Uttar Pradesh During the Period 1980-2019

Ghazipur	858	-3.47	20	-0.05	31	0.19	773	-3.50	35	-0.1
Kaushambi	837	0.08	29	0.15	22	-0.13	746	-0.08	40	0.1
Prayagraj	869	-3.11	27	0.09	21	-0.09	782	-3.11	39	0.0
Varanasi	910	-4.80	27	-0.10	29	0.18	820	-4.77	35	-0.1
Chitrakoot	875	-2.66	28	0.12	21	-0.08	788	-2.63	38	-0.1
Chandauli	909	-3.57	27	-0.41	29	-0.18	816	-2.61	38	-0.4
Bhadohi	875	-4.82	28	-0.03	25	0.11	785	-4.71	37	-0.2
Mirzapur	954	-2.96	28	-0.10	25	-0.20	861	-2.37	39	-0.3
Lalitpur	940	-2.64	21	0.14	14	0.24	870	-2.40	35	-0.6
Sonbhadra	946	-4.27	29	-0.33	29	-0.20	848	-3.58	40	-0.2
Amethi	829	-11.59	25	-0.01	25	-0.22	739	-10.11	40	-1.2
Ghaziabad	654	-5.01	36	0.22	43	-0.47	560	-4.26	16	-0.5
Sambhal	815	-3.72	35	0.01	35	-0.08	715	-3.19	30	-0.5
Mahoba	885	-4.83	27	-0.01	21	0.23	797	-4.66	40	-0.4
Saharanpur	1144	3.10	71	0.25	79	-0.53	960	4.16	34	-0.8
Bijnor	1031	-6.60	61	-0.30	58	-0.84	879	-4.46	33	-1.0
Muzaffar-nagar	907	-2.16	59	0.20	59	-0.29	764	-1.55	26	-0.5
Baghpat	657	-4.97	38	0.21	46	-0.52	555	-4.26	18	-0.4
Meerut	807	-6.14	48	0.21	48	-0.34	689	-5.42	22	-0.6
Moradabad	948	-6.47	47	-0.44	44	-0.55	821	-4.52	37	-1.0
Rampur	1065	-5.96	36	-0.05	51	-0.81	935	-3.99	43	-1.1
Shamli	716	1.09	48	0.42	47	-0.04	599	0.95	22	-0.2
Balrampur	1039	-12.75	25	-0.09	49	-1.15	919	-10.23	46	-1.3
Hamirpur	751	-6.55	24	0.03	21	0.19	669	-6.14	38	-0.6
Pratapgarh	843	-7.59	28	-0.01	24	-0.09	753	-7.04	38	-0.4

Table 76: District Level Analysis of Mean Annual And Seasonal Rainfall in Uttar Pradesh During the Period 1980-2019

District	Heavy Rainfall Days1980-2019				Very Heavy Rainfall Days			
	1980-1989	1990-1999	2000-2009	2010-2019	1980-1989	1990-1999	2000-2009	2010-2019
Amroha	13	14	10	6	0	1	1	0
Hapur	4	7	13	3	0	1	0	0
Bareilly	9	5	10	11	3	1	1	1
Pilibhit	9	11	12	12	3	4	2	0
Buland-shahr	6	8	8	3	0	1	0	0
Gautam Buddha Nagar	4	0	3	1	0	1	0	0
Kheri	10	9	14	13	4	0	2	0
Budaun	10	8	3	3	1	0	0	0
Bahraich	21	10	14	16	7	0	1	1
Shahja-hanpur	8	3	16	6	0	0	0	0
Aligarh	3	2	0	5	1	1	0	0
Kasganj	7	4	5	4	2	0	1	0
Mathura	3	3	0	2	1	0	0	0
Shrawasti	21	18	22	22	5	1	2	4
Sitapur	15	3	8	3	3	0	2	1
Hathras	4	4	1	6	1	0	0	0
Etah	4	3	4	3	2	0	1	0
Hardoi	11	4	9	3	0	0	1	0
Far-rukhabad	11	4	9	4	0	0	1	0
Firozabad	3	3	2	6	2	0	0	0
Siddharth-nagar	27	9	9	10	1	1	1	1
Mainpuri	6	2	7	4	2	0	0	0
Mahrajganj	42	13	21	11	3	1	3	2
Agra	2	0	1	0	0	0	0	0
Gonda	25	4	4	8	3	0	1	0
Bara Banki	20	3	9	9	5	0	0	1
Kushinagar	29	10	7	5	4	2	0	0
Kannauj	8	0	5	2	1	0	0	0

Table 77: District-wise Number of Heavy Rainfall Days and Very Heavy Rainfall Days (1980-2019)

Lucknow	15	5	9	8	4	0	2	0
Basti	35	13	12	10	0	1	1	3
Gorakhpur	18	11	10	10	5	0	0	2
Sant Kabir Nagar	37	21	19	17	7	1	1	2
Unnao	12	1	4	4	1	0	1	0
Etawah	5	1	4	4	0	0	0	0
Kanpur Nagar	9	0	4	5	0	0	0	0
Auraiya	9	1	2	1	0	0	0	0
Faizabad	24	4	2	10	0	1	2	0
Kanpur Dehat	11	2	2	3	0	0	0	0
Deoria	19	7	1	1	0	1	0	2
Sultanpur	19	14	3	5	1	1	0	0
Ambedkar Nagar	19	15	8	9	0	1	0	1
Rae Bareli	12	4	2	9	0	0	0	0
Jalaun	4	3	3	3	0	0	0	0
Azamgarh	14	6	5	7	0	1	0	0
Mau	10	2	2	2	0	0	0	0
Fatehpur	11	2	0	7	0	0	0	0
Ballia	8	6	1	5	0	0	0	1
Jaunpur	16	13	6	3	2	1	0	1
Jhansi	4	4	6	3	0	0	1	0
Banda	7	8	5	8	0	0	0	0
Ghazipur	3	7	1	4	0	0	0	0
Kaushambi	13	7	3	20	2	0	0	0
Prayagraj	11	8	1	12	1	0	1	0
Varanasi	11	7	5	8	1	1	0	1
Chitrakoot	6	5	2	9	0	0	0	1
Chandauli	5	5	3	5	1	0	0	0
Bhadohi	10	7	6	10	3	2	1	1
Mirzapur	6	7	6	8	0	1	0	1
Lalitpur	10	8	6	15	1	0	2	1
Sonbhadra	5	5	2	8	1	0	0	0

Table 77: District-wise Number of Heavy Rainfall Days and Very Heavy Rainfall Days (1980-2019)

Amethi	14	6	1	10	2	0	0	0
Ghaziabad	7	12	16	4	0	2	2	0
Sambhal	9	10	6	3	0	2	1	0
Mahoba	10	11	3	5	0	0	0	0
Saharanpur	8	11	14	9	1	0	0	2
Bijnor	11	12	10	11	0	2	0	1
Muzaffar-nagar	10	8	8	12	3	1	2	0
Baghpat	8	10	11	2	0	1	0	0
Meerut	6	11	12	6	3	2	0	0
Moradabad	9	11	7	10	0	2	1	1
Rampur	7	3	4	7	0	0	0	0
Shamli	10	4	9	4	2	2	0	1
Balrampur	23	4	7	12	2	0	0	0
Hamirpur	11	7	5	5	0	0	0	0
Pratapgarh	17	6	2	8	2	0	0	0

Table 77: District-wise Number of Heavy Rainfall Days and Very Heavy Rainfall Days (1980-2019)

District Name	Baseline (1981-2010)	Near-Term RCP 4.5 (2011-2040)	Near-Term RCP 8.5 (2011-2040)	Mid-Term RCP 4.5 (2041-2070)	Mid-Term RCP 8.5 (2041-2070)	End Century RCP 4.5 (2071-2100)	End Century RCP 8.5 (2071-2100)
Agra	32.5	33.6	33.9	34.3	35.2	34.7	37
Aligarh	31.8	32.9	33.1	33.6	34.5	33.9	36.4
Prayagraj	32.6	33.7	33.9	34.4	35.3	34.7	37
Ambedkar Nagar	32.4	33.3	33.5	34	34.8	34.3	36.4
Auraiya	32.6	33.7	34	34.5	35.3	34.8	37.1
Azamgarh	32.4	33.3	33.5	34.1	34.9	34.4	36.5
Budaun	31.7	32.9	33	33.5	34.3	33.8	36.2
Bagpat	31	32	32.1	32.7	33.6	33	35.5
Bahraich	31.1	32.1	32.2	32.8	33.6	33.1	35.5
Ballia	32.1	33	33.2	33.8	34.5	34.1	36.1
Balrampur	31	32	32.1	32.7	33.5	33	35.2
Banda	32.6	33.7	34	34.5	35.3	34.8	37

Table 78: Districts Recording Higher Annual Average Maximum Temperature in Near-term, Mid-term and End-Century

Bara Banki	32.1	33.1	33.3	33.8	34.7	34.1	36.4
Bareilly	31.4	32.6	32.7	33.3	34	33.5	35.9
Basti	32	33	33.1	33.6	34.5	34	36
Bijnor	29.4	30.5	30.6	31.3	32.1	31.5	34
Bulandshahr	31.4	32.5	32.7	33.2	34.1	33.5	36
Chandauli	32.4	33.4	33.6	34.2	35	34.5	36.8
Chitrakoot	32.6	33.7	34	34.5	35.3	34.7	37
Deoria	32	32.9	33	33.6	34.3	33.9	35.9
Etah	32.2	33.3	33.5	34	34.9	34.3	36.7
Etawah	32.7	33.8	34.1	34.5	35.4	34.9	37.2
Faizabad	32.4	33.4	33.6	34.1	35	34.4	36.6
Farrukhabad	32.1	33.3	33.4	33.9	34.8	34.2	36.6
Fatehpur	32.7	33.7	34	34.5	35.3	34.8	37
Firozabad	32.6	33.7	33.9	34.4	35.3	34.7	37
Gautam Buddha Nagar	31.5	32.5	32.7	33.2	34.1	33.5	36.1
Ghaziabad	31.2	32.3	32.5	33	33.9	33.3	35.8
Ghazipur	32.6	33.5	33.8	34.3	35.1	34.6	36.9
Gonda	32	33	33.1	33.6	34.5	34	36.1
Gorakhpur	32	32.9	33	33.6	34.4	33.9	35.9
Hardoi	32.1	33.2	33.4	33.9	34.7	34.2	36.5
Hathras	32.2	33.3	33.5	34	34.9	34.4	36.8
Jalaun	32.7	33.8	34.1	34.5	35.4	34.8	37.2
Jaunpur	32.6	33.6	33.9	34.4	35.2	34.7	36.9
Jhansi	32.6	33.6	34	34.4	35.3	34.7	37.1
Amroha	30.9	32	32.2	32.7	33.6	33	35.5
Kannauj	32.4	33.5	33.7	34.1	35	34.5	36.8
Kanpur Dehat	32.6	33.6	33.9	34.4	35.2	34.7	37
Kanpur Nagar	32.4	33.5	33.7	34.2	35	34.5	36.8
Kaushambi	32.9	34	34.2	34.7	35.6	35	37.3
Lakhimpur Kheri	31.1	32.2	32.3	32.9	33.7	33.2	35.6
Kushinagar	31.5	32.3	32.4	33	33.8	33.4	35.4
Lalitpur	32.4	33.4	33.7	34.2	35	34.5	36.9

Table 78: Districts Recording Higher Annual Average Maximum Temperature in Near-term, Mid-term and End-Century

Lucknow	32	33.1	33.3	33.8	34.7	34.1	36.5
Mahrajganj	31.8	32.6	32.7	33.3	34.1	33.6	35.7
Mahoba	32.7	33.8	34.1	34.5	35.4	34.8	37.1
Mainpuri	32.5	33.6	33.9	34.3	35.2	34.7	37
Mathura	32.1	33.2	33.5	33.9	34.8	34.3	36.7
Mau	32.4	33.3	33.5	34	34.8	34.3	36.4
Meerut	31	32	32.2	32.7	33.6	33	35.5
Mirzapur	32.4	33.4	33.7	34.2	35.1	34.5	36.9
Moradabad	31.1	32.3	32.4	32.9	33.8	33.2	35.7
Muzaffar-nagar	30.4	31.4	31.5	32.1	32.9	32.4	34.9
Pilibhit	31.1	32.2	32.4	32.9	33.7	33.2	35.6
Pratapgarh	32.7	33.7	34	34.4	35.3	34.8	37
Rae Bareli	32.4	33.5	33.7	34.2	35.1	34.5	36.8
Rampur	30.7	31.8	32	32.5	33.3	32.8	35.3
Saharanpur	29.7	30.7	30.8	31.5	32.3	31.8	34.2
Sant Kabir Nagar	32.1	33	33.1	33.6	34.5	34	36
Sant Ravi-das Nagar (Bhadohi)	32.8	33.8	34	34.6	35.4	34.9	37.2
Shahjah-anpur	31.8	32.9	33.1	33.6	34.4	33.9	36.3
Shravasti	31.5	32.5	32.5	33.1	34	33.4	35.7
Siddharth-nagar	31.8	32.7	32.8	33.4	34.2	33.7	35.8
Sitapur	31.9	32.9	33.1	33.5	34.5	33.9	36.3
Sonbhadra	31.7	32.8	33	33.6	34.4	33.9	36.4
Sultanpur	32.6	33.6	33.8	34.3	35.2	34.6	36.8
Unnao	32.2	33.3	33.6	34	34.9	34.4	36.6
Varanasi	32.6	33.6	33.9	34.4	35.3	34.7	37
Hamirpur	32.7	33.7	34.1	34.5	35.4	34.8	37.1
Kasganj	31.9	33	33.2	33.7	34.6	34	36.5

Table 78: Districts Recording Higher Annual Average Maximum Temperature in Near-term, Mid-term and End-Century

District Name	Baseline (1981-2010)	Near-Term RCP 4.5 (2011-2040)	Near-Term RCP 8.5 (2011-2040)	Mid-Term RCP 4.5 (2041-2070)	Mid-Term RCP 8.5 (2041-2070)	End Century RCP 4.5 (2071-2100)	End Century RCP 8.5 (2071-2100)
Agra	19.3	20.4	20.7	21.4	22.6	21.9	24.7
Aligarh	19	20	20.3	20.9	22	21.5	24
Prayagraj	19.6	20.7	20.9	21.6	22.8	22.1	25
Ambedkar Nagar	19.7	20.6	20.8	21.4	22.5	21.9	24.4
Auraiya	19.2	20.3	20.5	21.2	22.4	21.7	24.5
Azamgarh	19.7	20.6	20.8	21.5	22.6	22	24.5
Budaun	18.8	19.8	20	20.7	21.8	21.2	23.8
Bagpat	18.3	19.3	19.5	20.3	21.3	20.8	23.3
Bahraich	18.7	19.7	19.9	20.5	21.6	21	23.3
Ballia	19.9	20.7	20.9	21.6	22.6	22.1	24.6
Balrampur	18.7	19.6	19.8	20.5	21.5	21	23.2
Banda	19.5	20.5	20.8	21.5	22.6	22	24.8
Bara Banki	19.4	20.4	20.6	21.3	22.3	21.8	24.4
Bareilly	18.7	19.7	19.9	20.6	21.6	21.1	23.6
Basti	19.5	20.4	20.5	21.2	22.2	21.7	24.1
Bijnor	17	18	18.2	18.9	20	19.4	21.9
Bulandshahr	18.8	19.8	20	20.7	21.7	21.2	23.7
Chandauli	19.6	20.6	20.8	21.5	22.7	22	24.8
Chitrakoot	19.6	20.6	20.9	21.6	22.8	22.1	25
Deoria	19.6	20.4	20.6	21.3	22.3	21.8	24.1
Etah	19	20	20.3	20.9	22	21.4	24.1
Etawah	19.2	20.3	20.5	21.2	22.3	21.7	24.4
Faizabad	19.7	20.6	20.8	21.5	22.6	22	24.6
Farrukhabad	18.9	19.9	20.2	20.8	21.9	21.4	24.1
Fatehpur	19.6	20.7	20.9	21.6	22.8	22.1	25.1
Firozabad	19.2	20.3	20.6	21.2	22.4	21.8	24.4
Gautam Buddha Nagar	18.9	19.9	20.2	20.9	22	21.4	24
Ghaziabad	18.7	19.6	19.9	20.6	21.6	21.1	23.6
Ghazipur	19.9	20.8	21	21.7	22.8	22.2	24.9

Table 79: Districts Recording Higher Annual Average Minimum Temperature in Near-Term, Mid-Term and End-Century Under RCP 4.5 and RCP 8.5 Scenario as Compared to Baseline

Gonda	19.5	20.4	20.6	21.2	22.2	21.7	24.1
Gorakhpur	19.5	20.4	20.5	21.2	22.2	21.7	24
Hardoi	19.2	20.2	20.4	21.1	22.2	21.6	24.3
Hathras	19.2	20.3	20.5	21.2	22.3	21.7	24.4
Jalaun	19.2	20.2	20.5	21.2	22.3	21.7	24.4
Jaunpur	19.8	20.8	20.9	21.7	22.8	22.2	24.9
Jhansi	19.1	20.1	20.4	21.1	22.2	21.6	24.3
Amroha	18.3	19.3	19.5	20.2	21.2	20.7	23.1
Kannauj	19.1	20.1	20.4	21.1	22.2	21.6	24.4
Kanpur Dehat	19.4	20.4	20.7	21.4	22.5	21.9	24.7
Kanpur Nagar	19.4	20.4	20.7	21.4	22.6	21.9	24.8
Kaushambi	19.8	20.9	21.1	21.9	23	22.4	25.3
Lakhimpur Kheri	18.7	19.7	19.9	20.6	21.6	21.1	23.4
Kushinagar	19.2	20	20.2	20.8	21.7	21.3	23.4
Lalitpur	19.3	20.3	20.5	21.2	22.3	21.7	24.3
Lucknow	19.3	20.3	20.5	21.2	22.3	21.7	24.4
Mahrajganj	19.4	20.2	20.4	21	22	21.5	23.7
Mahoba	19.2	20.2	20.5	21.2	22.3	21.7	24.5
Mainpuri	19	20.1	20.3	21	22.1	21.5	24.2
Mathura	19.3	20.4	20.6	21.4	22.5	21.9	24.6
Mau	19.8	20.6	20.8	21.5	22.6	22	24.5
Meerut	18.3	19.3	19.5	20.2	21.3	20.8	23.2
Mirzapur	19.5	20.5	20.7	21.4	22.6	22	24.8
Moradabad	18.5	19.4	19.7	20.4	21.4	20.9	23.3
Muzaffar-nagar	17.6	18.5	18.7	19.5	20.5	20	22.4
Pilibhit	18.6	19.6	19.8	20.5	21.5	21	23.4
Pratapgarh	19.8	20.8	21	21.7	22.9	22.2	25
Rae Bareli	19.6	20.6	20.8	21.5	22.7	22.1	24.9
Rampur	18.2	19.2	19.4	20.1	21.1	20.6	23
Saharanpur	16.9	17.9	18.1	18.9	20	19.4	21.9
Sant Kabir Nagar	19.5	20.4	20.5	21.2	22.2	21.7	24.1

Table 79: Districts Recording Higher Annual Average Minimum Temperature in Near-Term, Mid-Term and End-Century Under RCP 4.5 and RCP 8.5 Scenario as Compared to Baseline

Sant Ravi-das Nagar (Bhadohi)	19.8	20.8	21	21.8	22.9	22.3	25.2
Shahjah-anpur	18.9	19.9	20.1	20.8	21.9	21.3	23.9
Shravasti	19.1	20	20.2	20.8	21.9	21.3	23.6
Siddharth-nagar	19.4	20.2	20.4	21.1	22.1	21.6	23.9
Sitapur	19.2	20.2	20.4	21.1	22.1	21.6	24.1
Sonbhadra	18.9	19.9	20.1	20.9	22.1	21.4	24.4
Sultanpur	19.7	20.7	20.9	21.6	22.7	22.1	24.8
Unnao	19.3	20.4	20.6	21.3	22.4	21.8	24.7
Varanasi	19.8	20.8	21	21.7	22.8	22.2	25
Hamirpur	19.2	20.3	20.5	21.2	22.4	21.7	24.5
Kasganj	18.9	19.9	20.1	20.8	21.9	21.3	23.9

Table 79: Districts Recording Higher Annual Average Minimum Temperature in Near-Term, Mid-Term and End-Century Under RCP 4.5 and RCP 8.5 Scenario as Compared to Baseline

District Name	Baseline (1981-2010)	Near-Term RCP 4.5 (2011-2040)	Near-Term RCP 8.5 (2011-2040)	Mid-Term RCP 4.5 (2041-2070)	Mid-Term RCP 8.5 (2041-2070)	End Century RCP 4.5 (2071-2100)	End Century RCP 8.5 (2071-2100)
Agra	634.9	603.3	594.7	640.1	659	684.5	752.6
Aligarh	676.5	623.9	630.1	669.2	698	731	776.6
Prayagraj	966.7	911.5	911.1	921.2	964.4	978.7	1026.2
Ambedkar Nagar	1027.4	1001.7	1015.3	1053.6	1075.3	1111.8	1182.1
Auraiya	727.1	692.9	678.9	717.6	747.7	770.5	839.5
Azamgarh	1068.5	1049.3	1058.2	1082.5	1112.7	1158.8	1227.4
Budaun	818.1	722.3	745.2	780.2	824.8	843.3	902.1
Bagpat	618.7	568.4	580.8	568.6	605.9	631.8	691.9
Bahraich	1284.2	1201.7	1247.2	1295.5	1258	1329.5	1261
Ballia	1099.5	1064.8	1060.8	1087.7	1158.3	1163.6	1270.6
Balrampur	1411.3	1368.4	1417.6	1456.3	1411.4	1467.9	1468.3
Banda	889.4	851.6	817.4	834.1	884.7	913.6	961
Bara Banki	988.9	920.6	927.2	980.5	984.1	1005.3	1059.8
Bareilly	1043.8	932.6	952.7	979.3	1061.6	1065.4	1115.2

Table 80: Districts Recording Higher Annual Rainfall in Near-Term, Mid-Term and End-Century Under RCP 4.5 and RCP 8.5 Scenario as Compared to Baseline

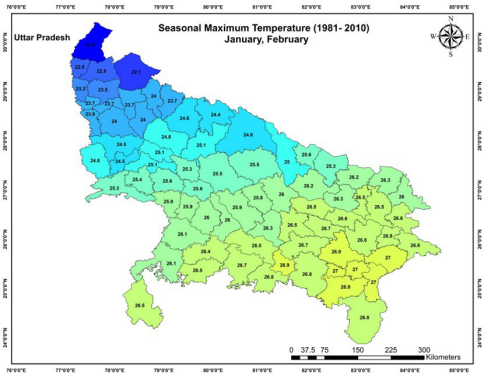
Basti	1134.2	1109.5	1141.2	1191.1	1190.1	1225.7	1332.3
Bijnor	1039.3	930.6	973.4	991.2	1006.6	1101.1	1062.7
Bulandshahr	745.6	675.4	688.5	707	734.3	782.1	816.1
Chandauli	1120.7	1115.4	1095.3	1100	1158.2	1181.1	1249.3
Chitrakoot	941.1	880.9	865.4	871.6	922.8	948.1	989.1
Deoria	1115.4	1082.1	1117.5	1145	1171.5	1183.4	1291.5
Etah	722.5	660.9	668.8	716.1	739.2	764.3	837.4
Etawah	720.8	685.6	673.7	714	742.5	767.6	839.1
Faizabad	1041	995	1012.8	1069.4	1074.5	1111.3	1183.9
Farrukhabad	801.2	722.5	730.6	774.5	802.8	809.4	889.5
Fatehpur	849.9	821.9	789.6	816.4	867.6	882	940.1
Firozabad	692	651.7	649.1	701.9	718.1	749.9	829.1
Gautam Buddha Nagar	663.8	604.6	615.5	617.7	656.3	692.3	732.5
Ghaziabad	757.4	679.8	700.1	700.1	729	785.1	819.8
Ghazipur	1122.7	1101	1086.4	1108.8	1157.9	1207.3	1278.3
Gonda	1151.1	1093.3	1133.3	1190.3	1174.2	1213.1	1260.8
Gorakhpur	1180.3	1154.8	1202.3	1236.4	1244.7	1268.6	1383.1
Hardoi	865.9	798.1	801.1	840.7	852.4	873.4	928.7
Hathras	662.3	617.2	620.4	670.3	692.1	725.5	780.7
Jalaun	756.2	737.2	712.2	731.1	773.6	814.9	875.9
Jaunpur	1019.3	980.6	986.2	1009.9	1036.9	1081.5	1139.7
Jhansi	818.8	777.2	775.4	799.4	817.8	868.3	925.4
Amroha	878.6	786.2	809	829.4	847.9	921.4	944.1
Kannauj	754.4	704	698.7	741.7	763	776	851.9
Kanpur Dehat	751.8	724.8	701	735.6	771.7	793.1	855.9
Kanpur Nagar	767.8	747.7	716.2	748	791.7	807.6	871.4
Kaushambi	915.5	862.5	848.1	864.9	909.7	927.5	976.5
Lakhimpur Kheri	1231.8	1151.2	1173.1	1214.7	1234.1	1275	1249.5
Kushinagar	1299.2	1255.7	1337.7	1348.3	1356.1	1361	1477.5
Lalitpur	985.7	960.8	927.8	978.9	1020.8	1016.7	1026.8
Lucknow	866.4	811.7	794.4	841.4	860.4	879.1	937.3
Mahrajganj	1515.3	1455.1	1580.5	1585.6	1569.2	1598.9	1706.5

Table 80: Districts Recording Higher Annual Rainfall in Near-Term, Mid-Term and End-Century Under RCP 4.5 and RCP 8.5 Scenario as Compared to Baseline

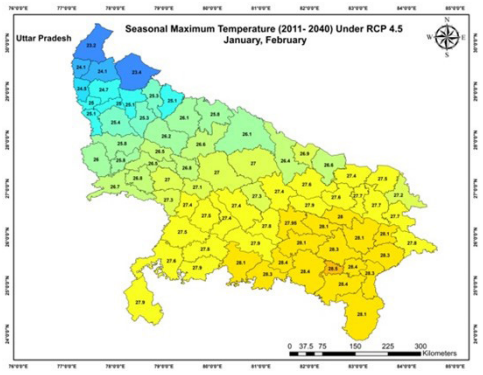
Mahoba	909.7	855.5	848.4	866	900	934.2	1001
Mainpuri	745.9	689.1	690.4	739.6	763	781.6	865
Mathura	597.2	565.5	557.7	601.6	635.2	656.5	703.6
Mau	1101.8	1078.5	1084.2	1111.5	1150	1190.3	1269.9
Meerut	806.4	727	755.6	756.1	784.4	850.7	883
Mirzapur	1040.5	1014.7	1014.7	1012.6	1068.3	1070.2	1121.4
Moradabad	944.9	841.9	874.1	895.8	924.8	988.9	997.3
Muzaffar-nagar	763.9	704.4	731.1	728.2	757.6	811.4	851.9
Pilibhit	1313.4	1206.3	1201.3	1241.7	1318.1	1310	1336.2
Pratapgarh	953.4	896	896.1	929.3	961.1	987.8	1045.7
Rae Bareli	882.1	839.4	813.6	864.4	901.6	909.2	973.6
Rampur	1099.8	986.8	1019.7	1033	1098.8	1138	1140.3
Saharanpur	1026.4	987.1	1023	1038	1065.2	1117	1114
Sant Kabir Nagar	1186.6	1163.4	1209	1249.4	1251.4	1278.5	1398.1
Sant Ravi-das Nagar (Bhadohi)	1009	960.7	963.5	971.9	1006.1	1025.5	1078.1
Shahjah-anpur	1005.8	904.2	922.7	956.2	1017.8	1015.8	1080.8
Shravasti	1325.5	1255.3	1300.7	1345.5	1295.1	1353.6	1295.9
Siddharth-nagar	1448.8	1398.2	1479.4	1523.5	1485.2	1540.5	1630.9
Sitapur	1024.8	958.8	978.3	1023.7	1018.9	1067.7	1068.3
Sonbhadra	1098.6	1102.5	1094.7	1077.2	1167.5	1144.8	1172.1
Sultanpur	986.8	943	940.8	994.7	1019.8	1050.1	1108.2
Unnao	792.9	756.6	730.3	770.3	805	816.3	880.3
Varanasi	1061.7	1033.4	1023.2	1032.9	1066.8	1098.3	1158.6
Hamirpur	813.2	800.1	768.1	785	834.5	872.2	932.3
Kasganj	736.5	660	676.3	716.3	744.5	766.8	834

Table 80: Districts Recording Higher Annual Rainfall in Near-Term, Mid-Term and End-Century Under RCP 4.5 and RCP 8.5 Scenario as Compared to Baseline

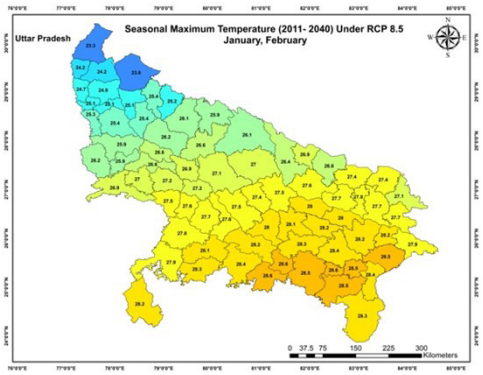
Baseline (1981-2010)



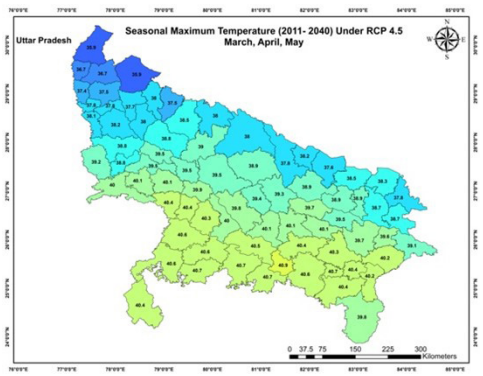
Near-term (2011-2040) under RCP 4.5



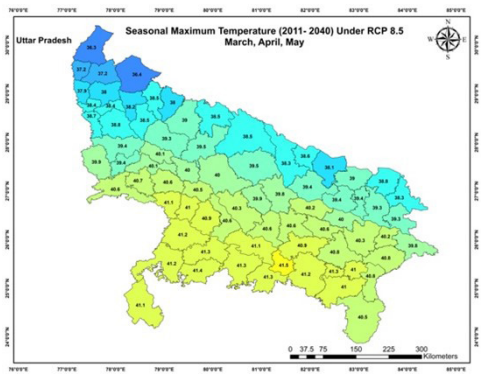
Near-term (2011-2040) under RCP 8.5



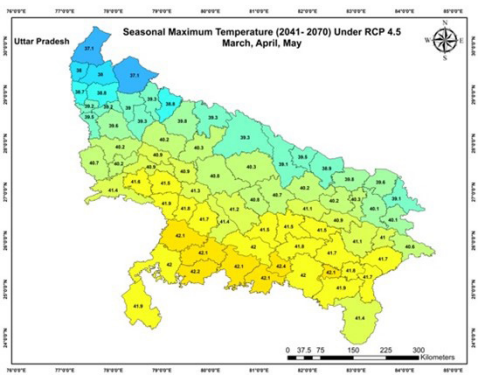
Near-term (2011-2040) under RCP 4.5



Near-term (2011-2040) under RCP 8.5



Mid-term (2041-2070) under RCP 4.5



Mid-term (2041-2070) under RCP 8.5

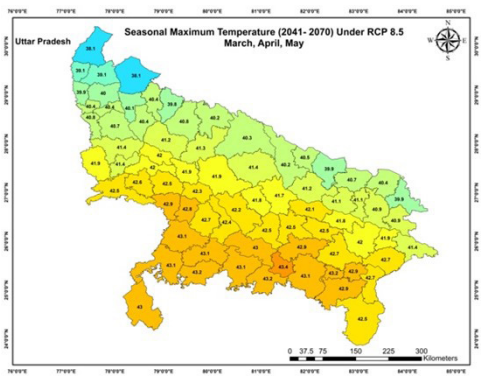


Figure 85: Seasonal Maximum Temperature (MAM) for Baseline (1981-2010) and its Projection in Near-Term (2011-2040), Mid-Term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.5

End-Century (2071-2100) under RCP 4.5

End-Century (2071-2100) under RCP 8.5

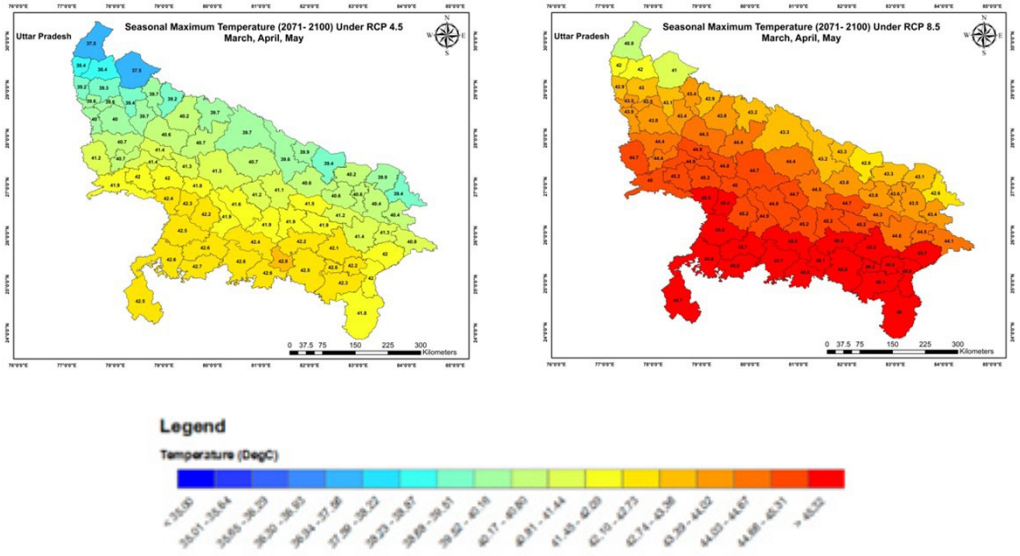
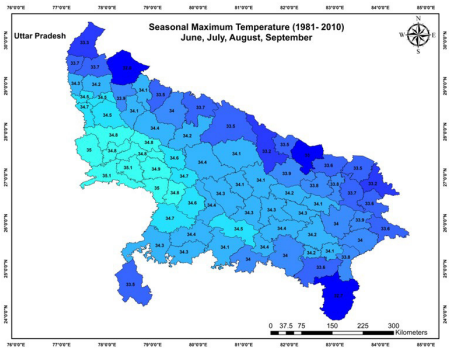


Figure 85: Seasonal Maximum Temperature (MAM) for Baseline (1981-2010) and its Projection in Near-Term (2011-2040), Mid-Term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.5

Baseline (1981-2010)



Near-term (2011-2040) under RCP 4.5

Near-term (2011-2040) under RCP 8.5

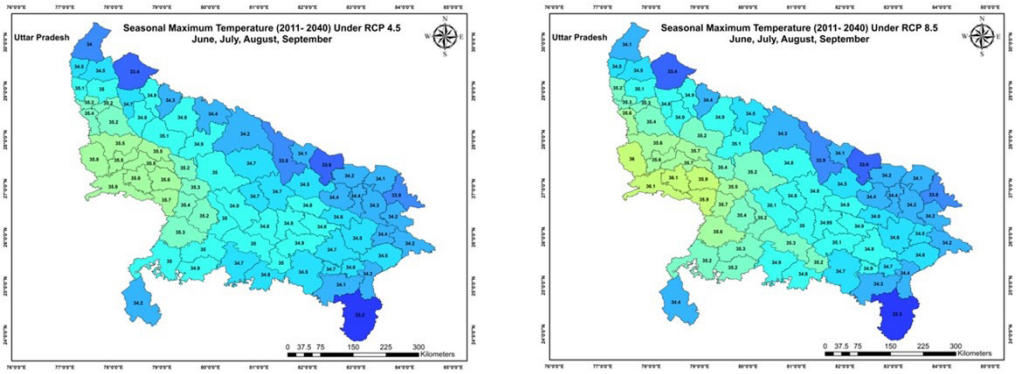
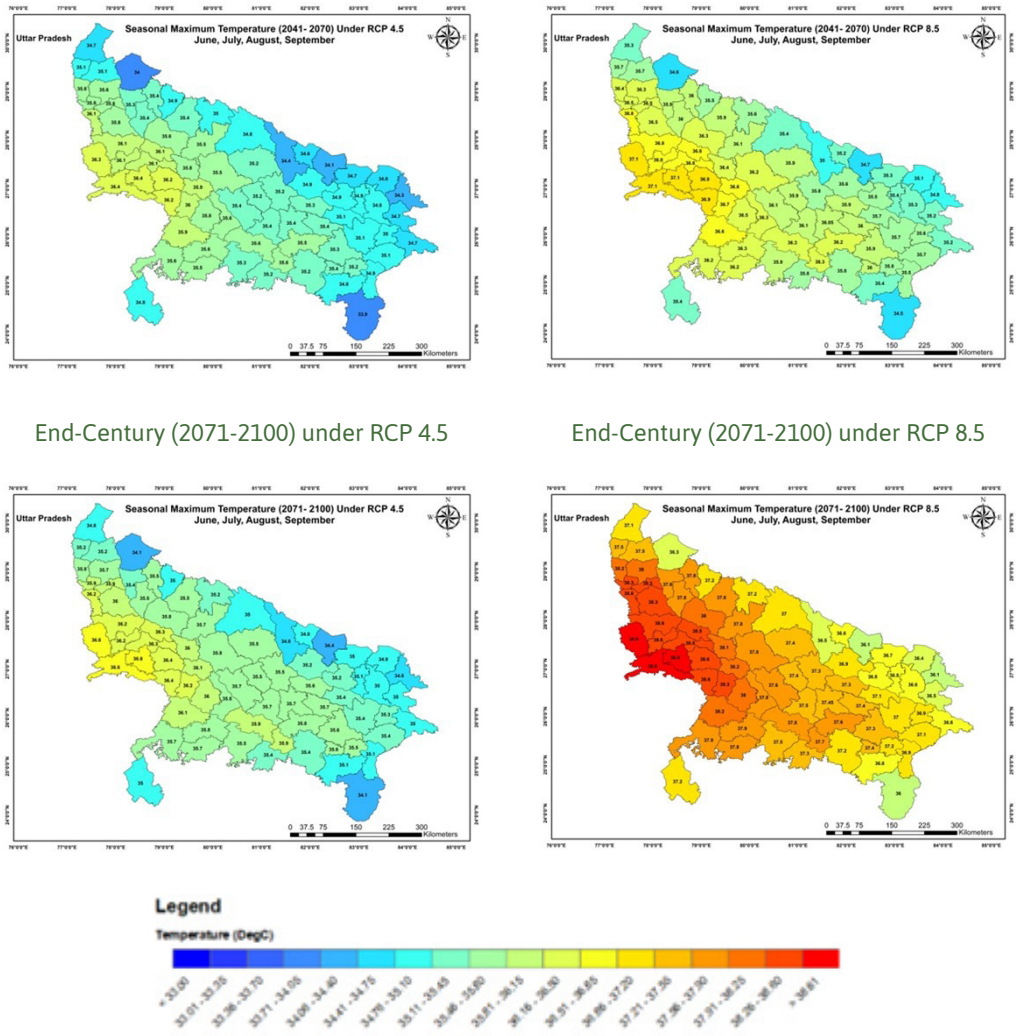


Figure 86: Seasonal Maximum Temperature (JJAS) for Baseline (1981-2010) and its Projection in Near-Term (2011-2040), Mid-Term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.5

Mid-term (2041-2070) under RCP 4.5

Mid-term (2041-2070) under RCP 8.5



End-Century (2071-2100) under RCP 4.5

End-Century (2071-2100) under RCP 8.5

Figure 86: Seasonal Maximum Temperature (JJAS) for Baseline (1981-2010) and its Projection in Near-Term (2011-2040), Mid-Term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.5

Baseline (1981-2010)

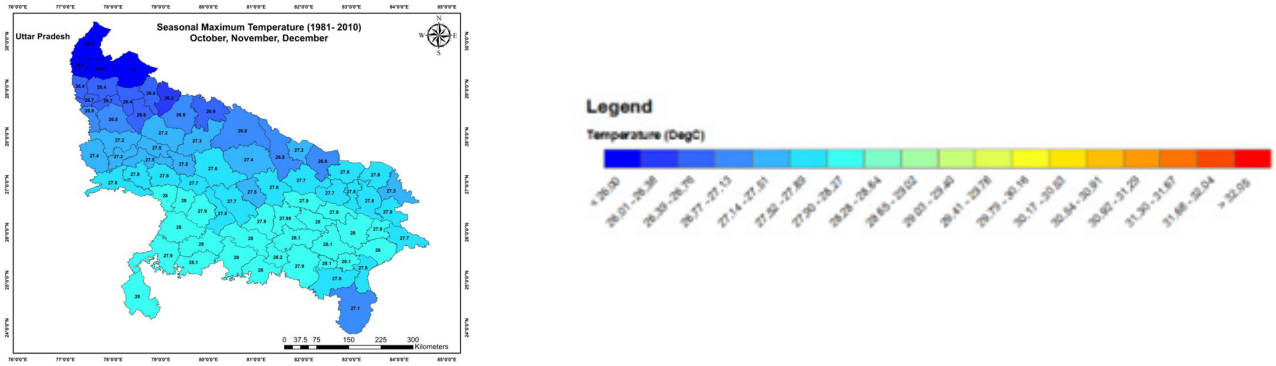
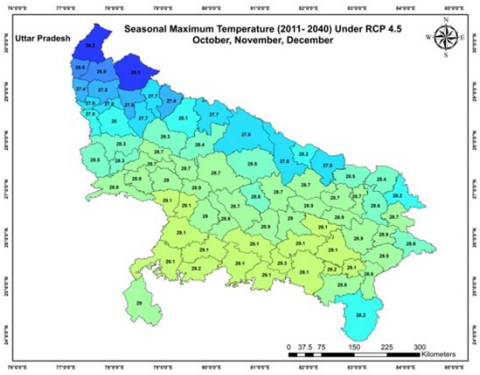
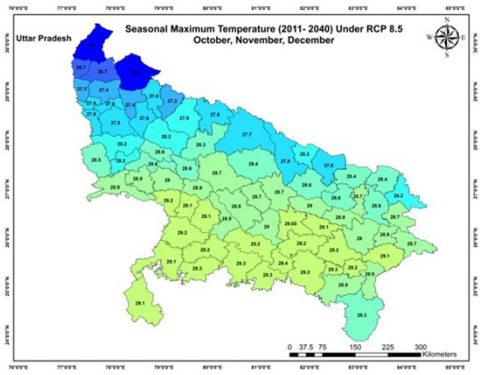


Figure 87: Seasonal Maximum Temperature (OND) for Baseline (1981-2010) and its Projection in Near-Term (2011-2040), Mid-Term (2041-2070) and End-Century (2071-2100) under RCP 4.5 and RCP 8.5

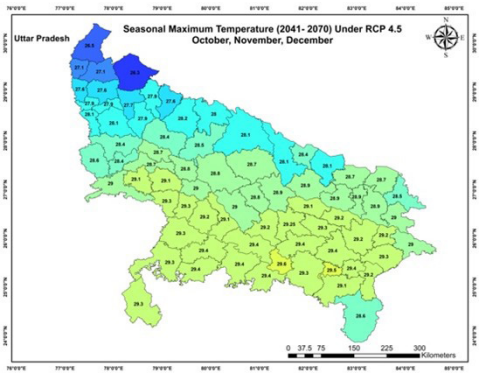
Near-term (2011-2040) under RCP 4.5



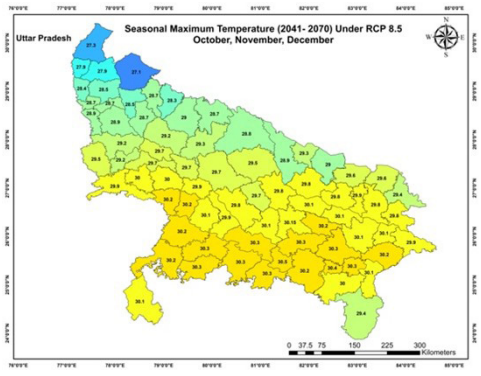
Near-term (2011-2040) under RCP 8.5



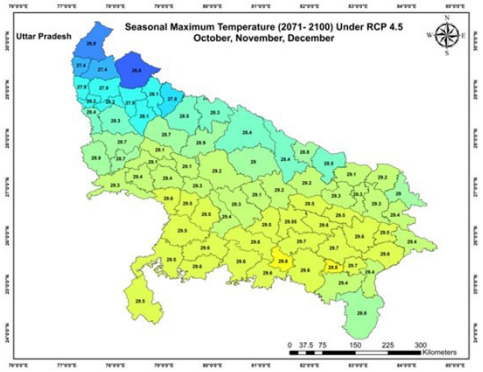
Mid-term (2041-2070) under RCP 4.5



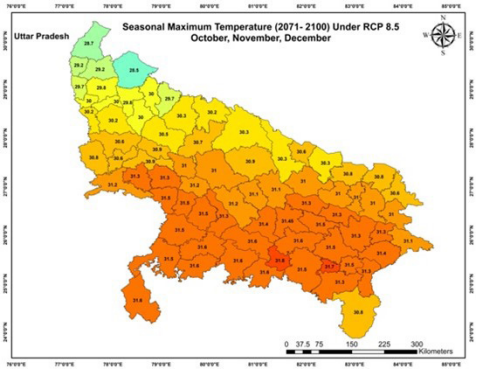
Mid-term (2041-2070) under RCP 8.5



End-Century (2071-2100) under RCP 4.5



End-Century (2071-2100) under RCP 8.5



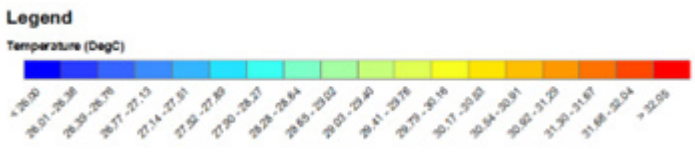
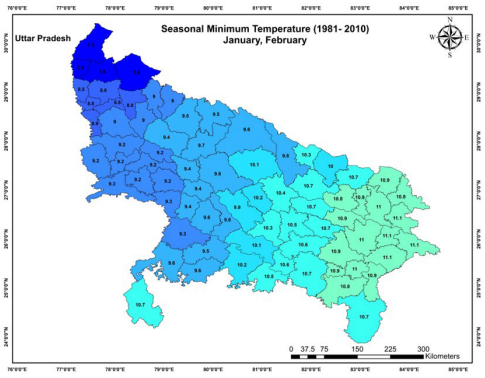
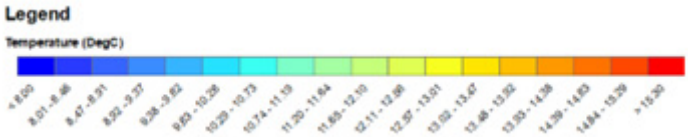


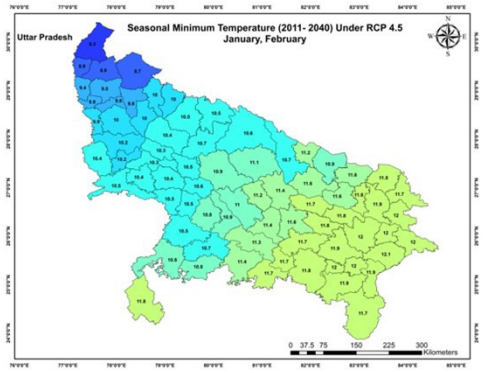
Figure 87: Seasonal Maximum Temperature (OND) for Baseline (1981-2010) and its Projection in Near-Term (2011-2040), Mid-Term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.5

Baseline (1981-2010)

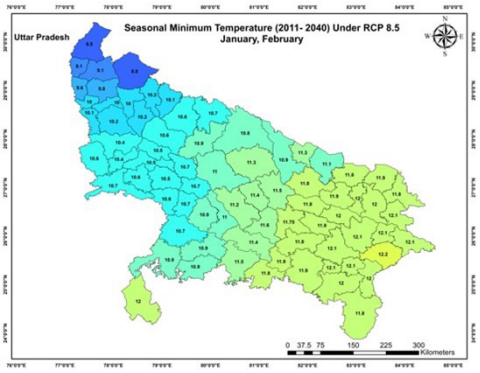




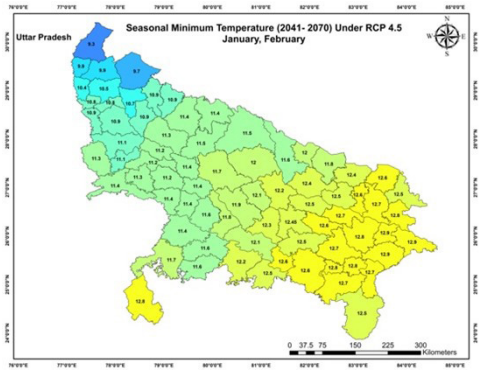
Near-term (2011-2040) under RCP 4.5



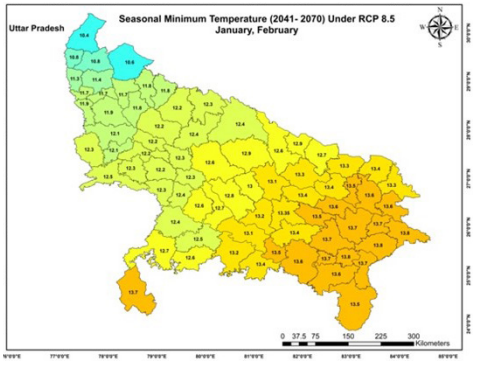
Near-term (2011-2040) under RCP 8.5



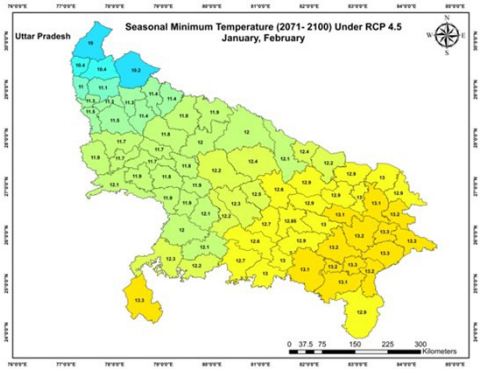
Mid-term (2041-2070) under RCP 4.5



Mid-term (2041-2070) under RCP 8.5



End-Century (2071-2100) under RCP 4.5



End-Century (2071-2100) under RCP 8.5

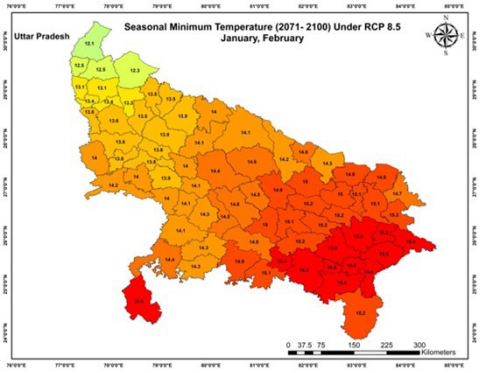
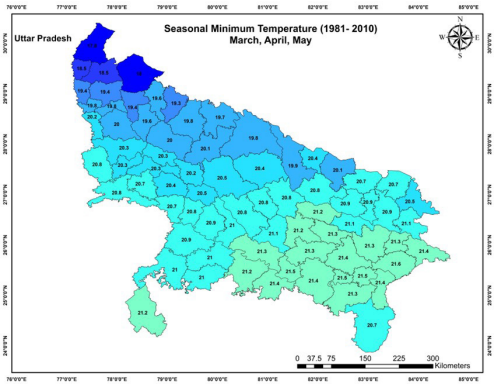
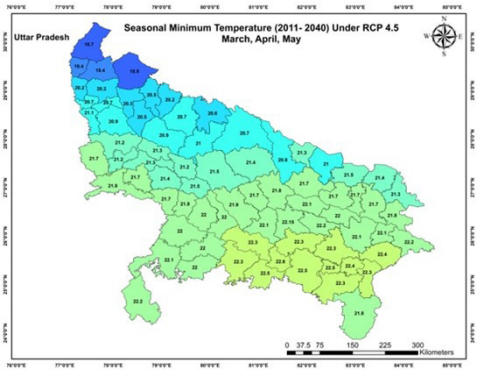


Figure 88: Seasonal Minimum Temperature (JF) for Baseline (1981-2010) and its Projection in Near-Term (2011-2040), Mid-Term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.5

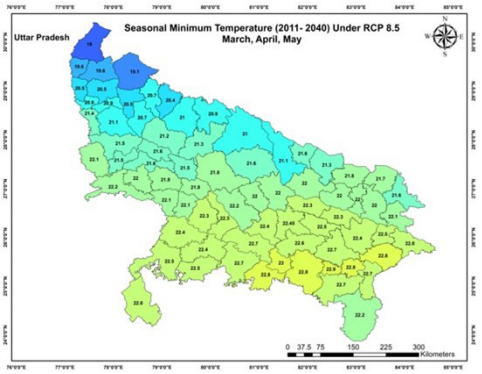
Baseline (1981-2010)



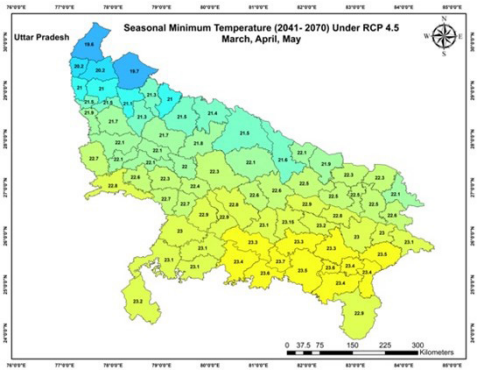
Near-term (2011-2040) under RCP 4.5



Near-term (2011-2040) under RCP 8.5



Mid-term (2041-2070) under RCP 4.5



Mid-term (2041-2070) under RCP 8.5

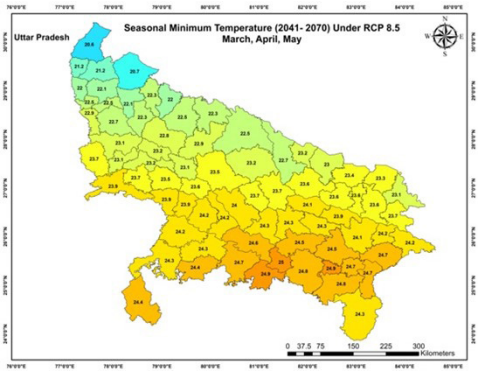


Figure 89: Seasonal Minimum Temperature (MAM) for Baseline (1981-2010) and its Projection in Near-Term (2011-2040), Mid-Term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.5

End-Century (2071-2100) under RCP 4.5

End-Century (2071-2100) under RCP 8.5

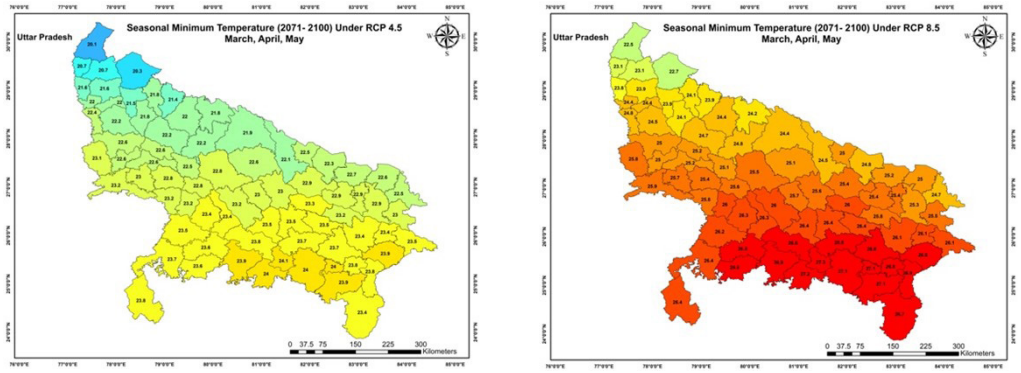
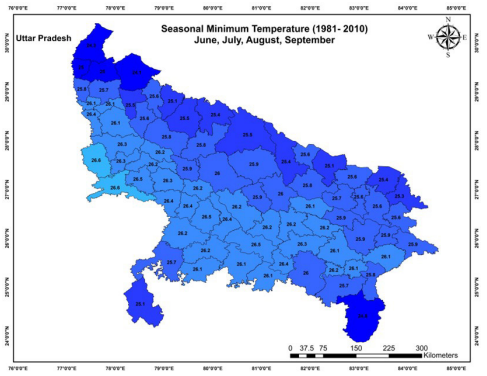


Figure 89: Seasonal Minimum Temperature (MAM) for Baseline (1981-2010) and its Projection in Near-Term (2011-2040), Mid-Term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.5

Baseline (1981-2010)



Near-term (2011-2040) under RCP 4.5

Near-term (2011-2040) under RCP 8.5

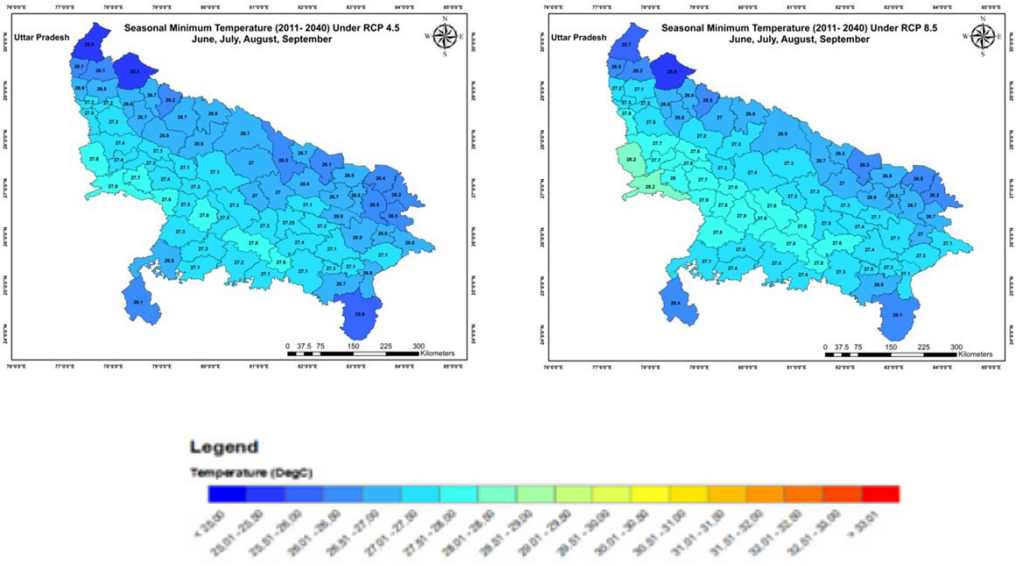
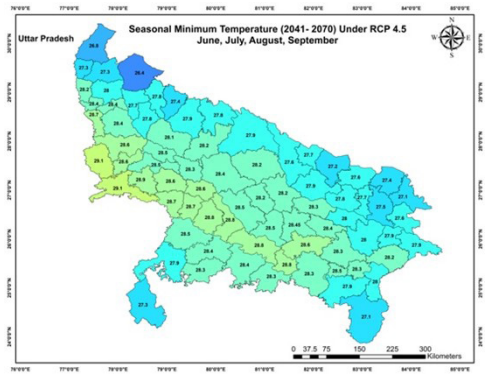
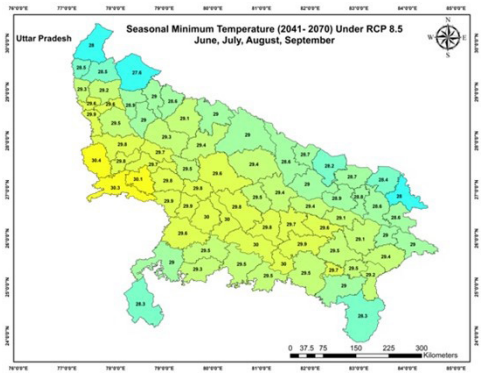


Figure 90: Seasonal Minimum Temperature (JJAS) for Baseline (1981-2010) and its projection in Near-Term (2011-2040), Mid-Term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.5

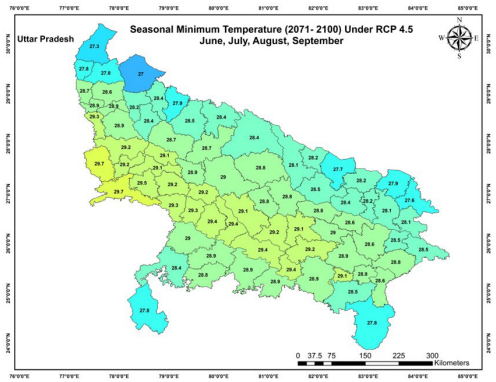
Mid-term (2041-2070) under RCP 4.5



Mid-term (2041-2070) under RCP 8.5



End-Century (2071-2100) under RCP 4.5



End-Century (2071-2100) under RCP 8.5

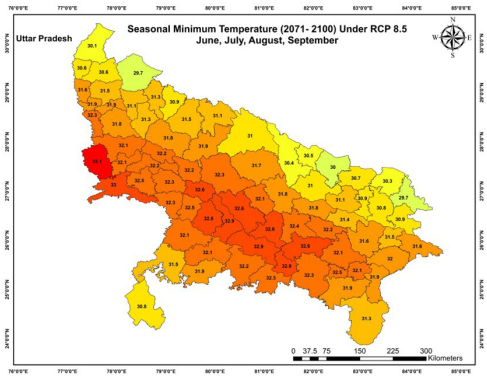


Figure 90: Seasonal Minimum Temperature (JJAS) for Baseline (1981-2010) and its Projection in Near-Term (2011-2040), Mid-Term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.5

Baseline (1981-2010)

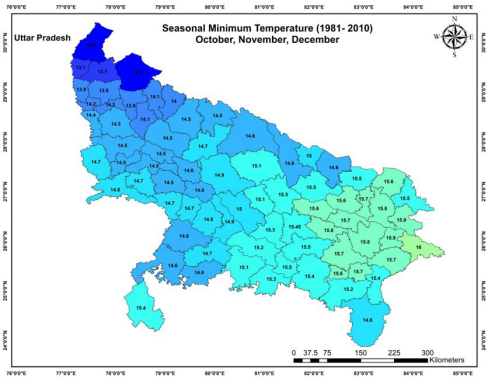
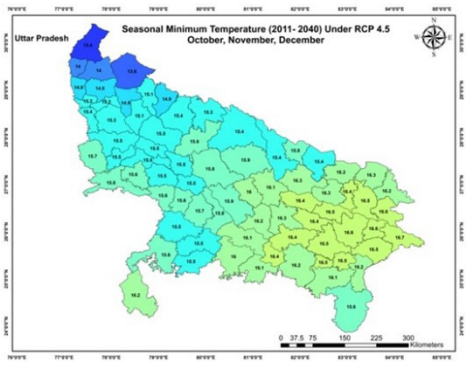
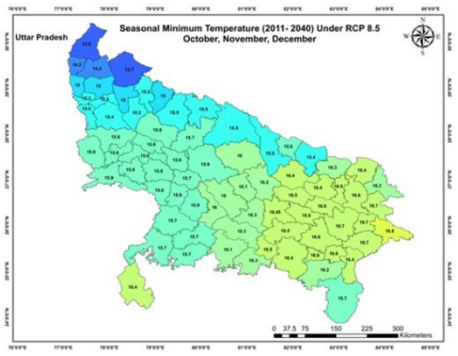


Figure 91: Seasonal Minimum Temperature (OND) for Baseline (1981-2010) and its Projection in Near-Term (2011-2040), Mid-Term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.5

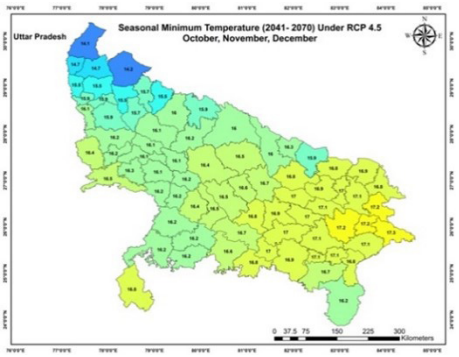
Near-term (2011-2040) under RCP 4.5



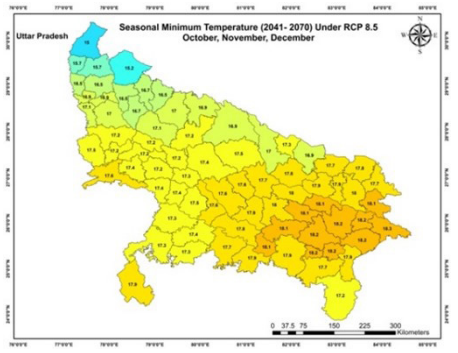
Near-term (2011-2040) under RCP 8.5



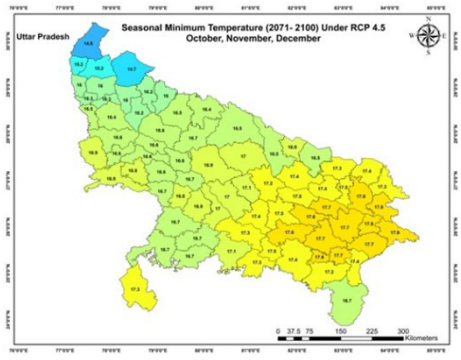
Mid-term (2041-2070) under RCP 4.5



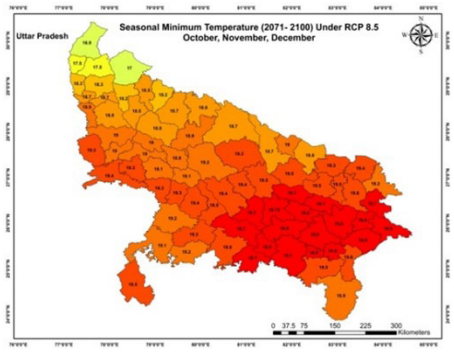
Mid-term (2041-2070) under RCP 8.5



End-Century (2071-2100) under RCP 4.5



End-Century (2071-2100) under RCP 8.5



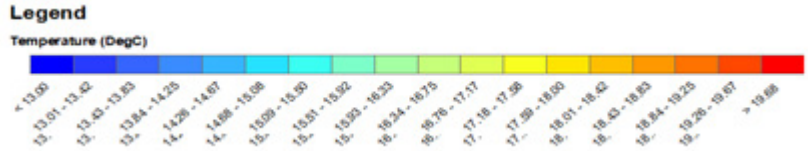
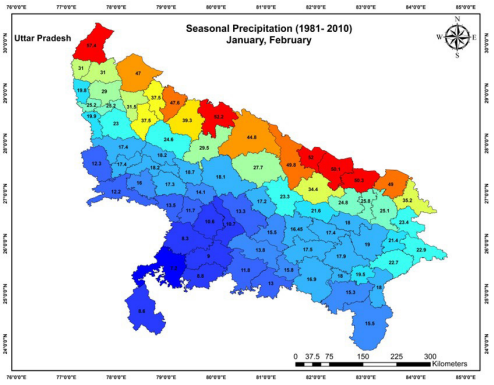
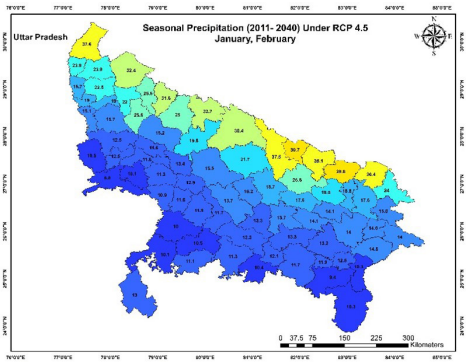


Figure 91: Seasonal Minimum Temperature (OND) for Baseline (1981-2010) and its Projection in Near-Term (2011-2040), Mid-Term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.5

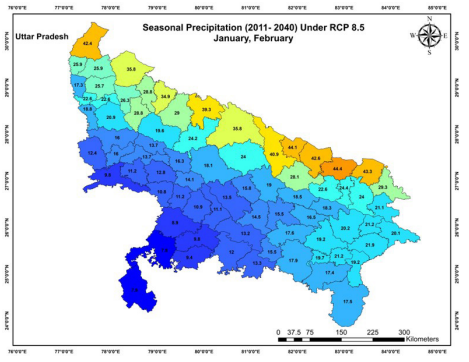
Baseline (1981-2010)



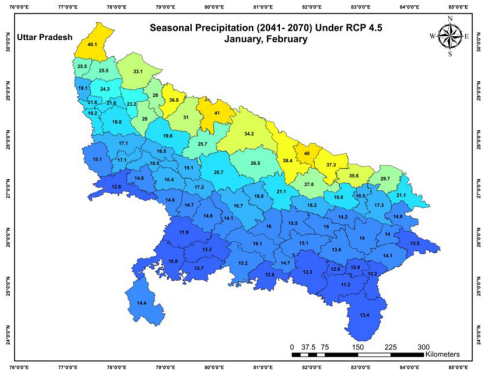
Near-term (2011-2040) under RCP 4.5



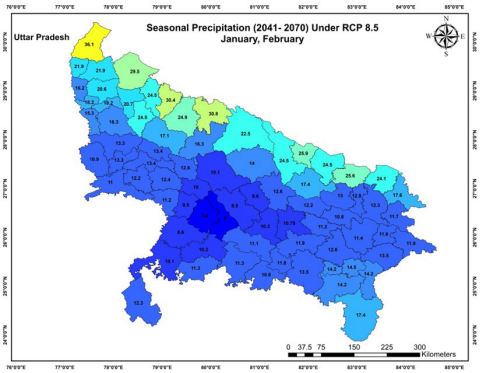
Near-term (2011-2040) under RCP 8.5



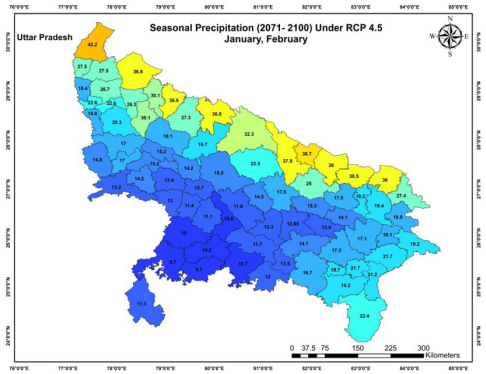
Mid-term (2041-2070) under RCP 4.5



Mid-term (2041-2070) under RCP 8.5



End-Century (2071-2100) under RCP 4.5



End-Century (2071-2100) under RCP 8.5

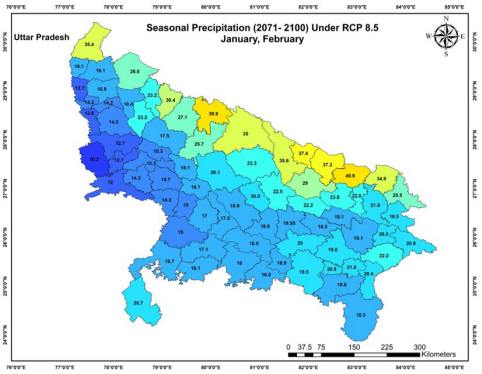
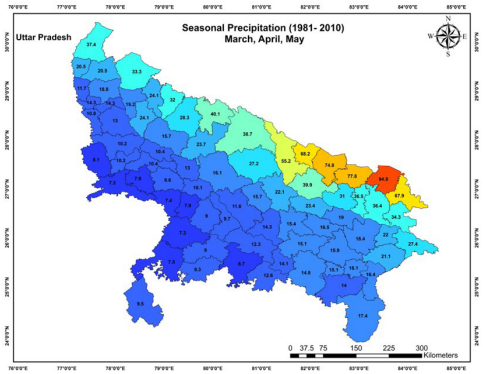


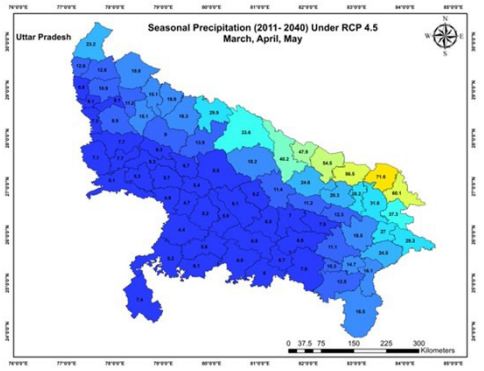
Figure 92: Seasonal Precipitation (JF) for Baseline (1981-2010) and its Projection in Near-Term (2011-2040), Mid-Term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.5

Figure 92: Seasonal Precipitation (JF) for Baseline (1981-2010) and its Projection in Near-Term (2011-2040), Mid-Term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.5

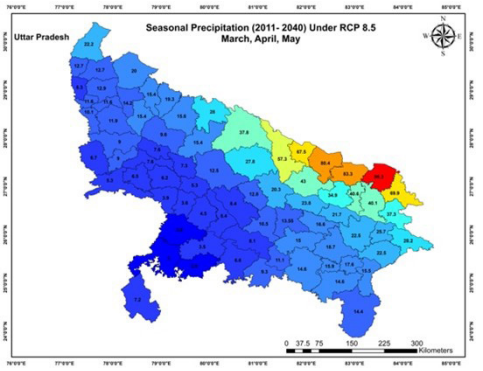
Baseline (1981-2010)



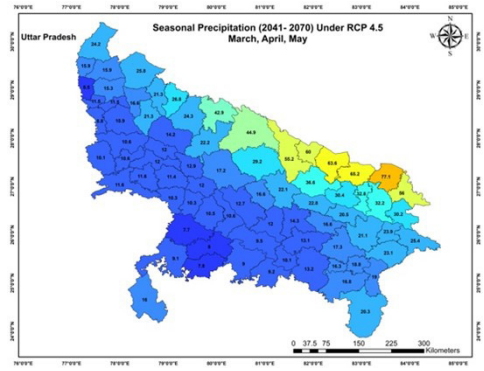
Near-term (2011-2040) under RCP 4.5



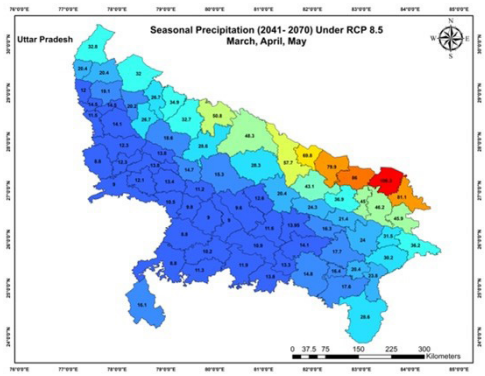
Near-term (2011-2040) under RCP 8.5



Mid-term (2041-2070) under RCP 4.5



Mid-term (2041-2070) under RCP 8.5



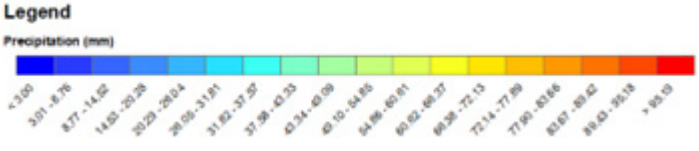


Figure 93: Seasonal Precipitation (MAM) for Baseline (1981-2010) and its Projection in Near-term (2011-2040), Mid-term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.5

End-Century (2071-2100) under RCP 4.5

End-Century (2071-2100) under RCP 8.5

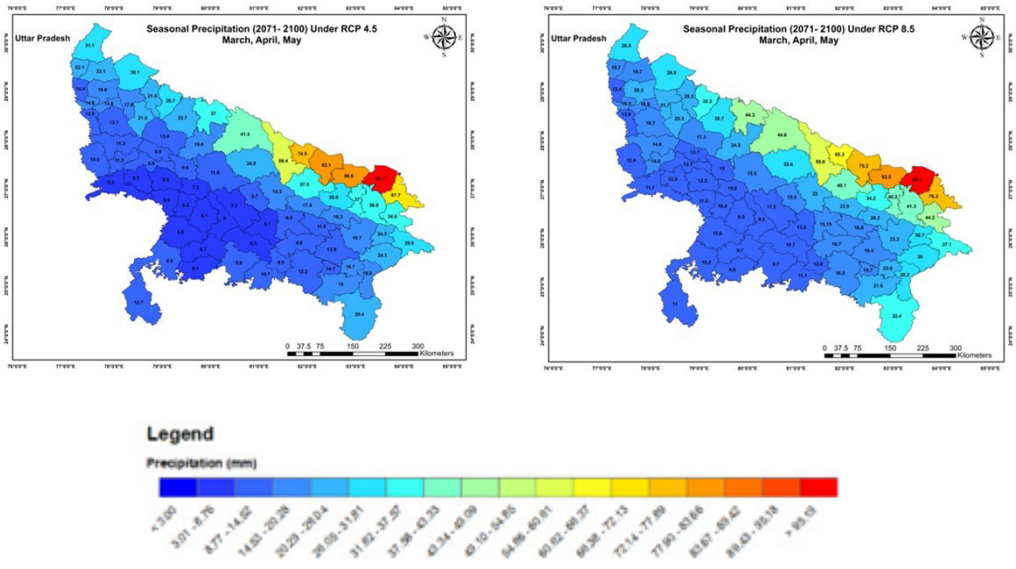
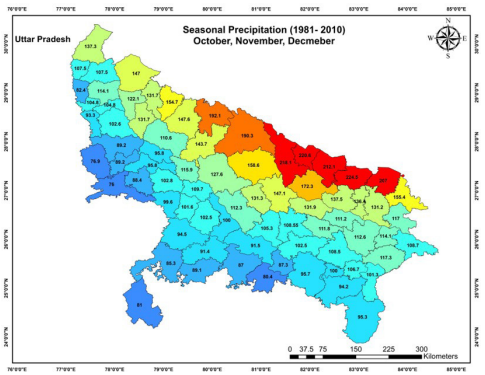


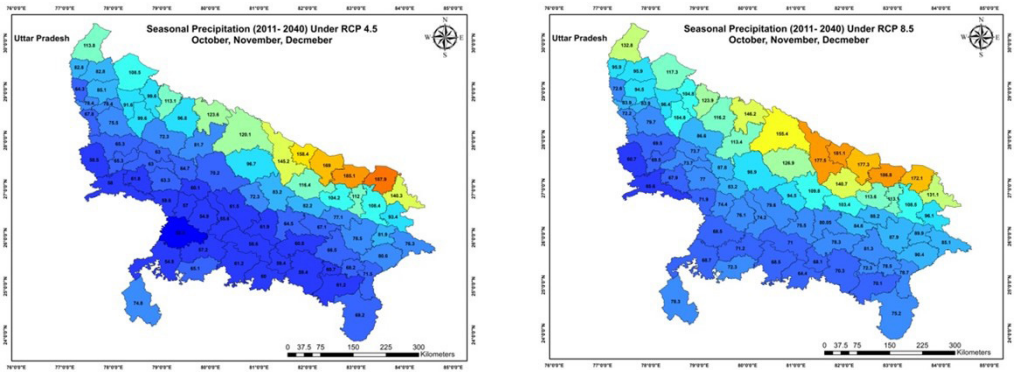
Figure 93: Seasonal Precipitation (MAM) for Baseline (1981-2010) and its Projection in Near-Term (2011-2040), Mid-Term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.5

Baseline (1981-2010)

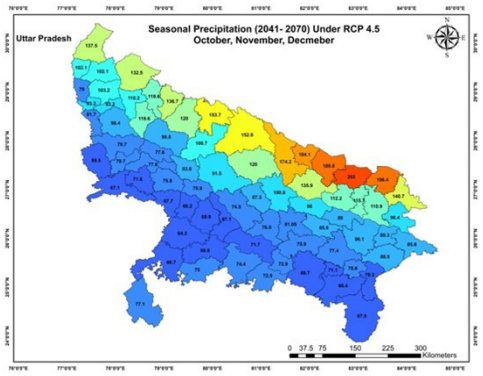


Near-term (2011-2040) under RCP 4.5

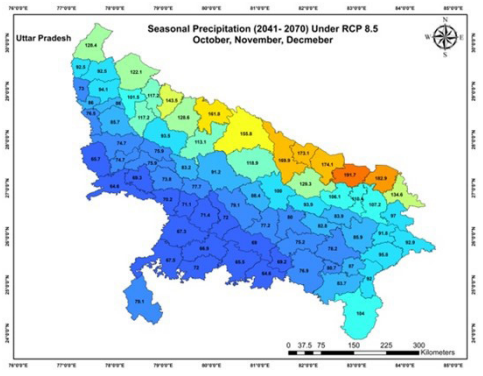
Near-term (2011-2040) under RCP 8.5



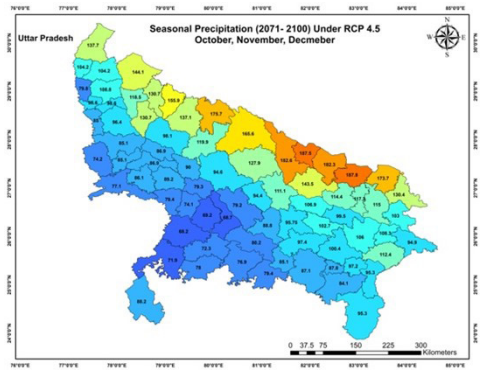
Mid-term (2041-2070) under RCP 4.5



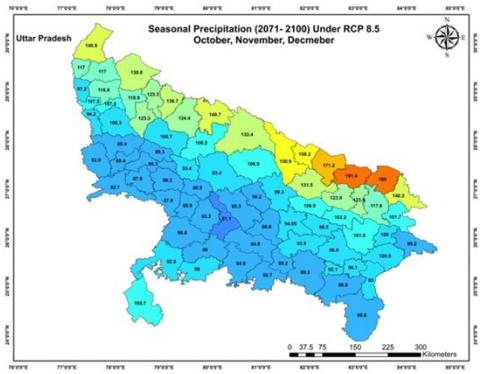
Mid-term (2041-2070) under RCP 8.5



End-Century (2071-2100) under RCP 4.5



End-Century (2071-2100) under RCP 8.5



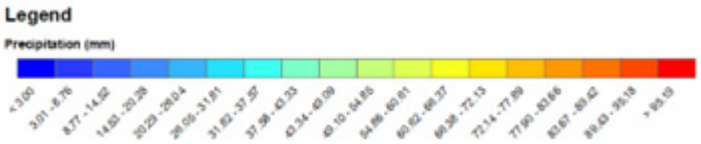


Figure 94: Seasonal Precipitation (OND) for Baseline (1981-2010) and its Projection in Near-Term (2011-2040), Mid-Term (2041-2070) and End-Century (2071-2100) Under RCP 4.5 and RCP 8.5

B Detailed List of Proposed Strategies for Sustainable Agriculture Mission

Table 81: Proposed Strategies for Sustainable Agriculture Mission

S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and Implementing Agency	SDG and NDC linkages
	Strategy 1 Generate high resolution weather forecasts. Ensure access to weather forecasts and agro-met services by all farmers.									
1.1	Establish a network of Agro-Automatic Weather Stations (AWSs) at a finer resolution of 10kmx-10km grid. Integrate the ones installed by IMD under its Gramin Krishi Mausam Sewa (about 200 to be installed across India)	Implementation	Adaptation	2433 AWSs across UP	Tender, procure and Install all AWS	Continue maintenance	50.00 (Installation & maintenance)	Gramin Krishi Mausam Seva	NA: Agriculture Department IA: IMD, Agriculture Universities,	NDC 06; SDG 2,8,13
1.2	Analyze and disseminate weather information based on high resolution and agro-advisory. Info package for dissemination to include: 3 to 7 days weather forecasts to farmers via SMS Extreme weather forecasts Pest and Disease forecasts for crops and animals, Other Agriculture	Research	Adaptation	Farmers registered under PM KISAN in UP. As of 2021 around 2,81,75,093 farmers are registered.	2022-23: Reliable weather data product development & strong interface for dissemination via SMS 2024 onwards start Dissemination	Continue dissemination	459.80 (includes data product develop–a one-time cost and recurrent SMS costs through 2024-2030)	Gramin Krishi Mausam Seva National Mission on Agriculture Extension and Technology	NA: Agriculture Department IA: DAMU's (District Agro-Meteorological Units), KVKs & AU, IMD	NDC 06 SDG 2,8,13

B Detailed List of Proposed Strategies for Sustainable Agriculture Mission

Table 81: Proposed Strategies for Sustainable Agriculture Mission

S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and Implementing Agency	SDG and NDC linkages
		Strategy 2	**Undertake wide spread training of FPO farmers on climate smart practices, techniques and tools to help them understand and address the impacts of climate change**							
2.1	Develop FPO specific training packages for farmers on all aspects of climate smart agriculture approaches and technologies Relevant for various food crops, pulses, oil seeds, horticulture crops, livestock and livestock produce, and Fisheries in UP.	Capacity building	Adaptation	Training packages to be developed within 2022	Complete development of training packages for Master trainers and farmers by 2023	-	5.00	UP Atmanirbhar Krishak Samanvit Vikas Yojana Promotion of Farmer Producer Organization and Business Activities scheme	NA: Agriculture Department IA: Banker's Institute of Rural Development (NABARD)	NDC 06 SDG 2,8,13

B Detailed List of Proposed Strategies for Sustainable Agriculture Mission

Table 81: Proposed Strategies for Sustainable Agriculture Mission

S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and Implementing Agency	SDG and NDC linkages
2.2	Create a pool of Master Trainers on Climate Smart Agriculture approaches and technologies	Capacity building	Adaptation	Two trainings in each of the 69 KVKs	Undertake training through 2024-2025 in batches of 75 master trainers (one for each district)	Continue update trainings through 2026-2030	13.80 (@1.38 Cr. per annum for 10 years @ Rs 1,00,000 per training with 75 participants representing every district in UP.	UP Atmanirbhar Krishak Samanvit Vikas Yojana Promotion of Farmer Producer Organization and Business Activities scheme	NA: Agriculture Department IA: Banker's Institute of Rural Development (NABARD)	NDC 06 SDG 2,8,13
2.3	Organize FPO wise training for farmers registered in the FPO's in the State. The trainings will be organised for the areas	Capacity building	Adaptation	At least 4 trainings annually, 7 day each, for all the FPOs	Undertake annual trainings through 2021-2025	Undertake annual trainings through 2026-2030	100.00 (@1 lakh per training)	UP Atmanirbhar Krishak Samanvit Vikas Yojana Promotion of Farmer Producer Organization and Business Activities scheme	NA: Agriculture Department IA: Banker's Institute of Rural Development (NABARD)	NDC 06 SDG 2,8,13

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Table 81: Proposed Strategies for Sustainable Agriculture Mission

S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and Implement-ing Agency	SDG and NDC linkages
	Strategy 3 Mainstream climate smart adaptation practices and technologies through implementation of pilots covering all agro-climatic zones in UP									
3.1	Undertake a baseline survey in UP across 9 Agro-Climatic Zone (ACZs) to take stock of current agriculture practices and iden-tify barriers towards uptake of climate smart practices and technol-ogies propagated by various government schemes including adoption of micro and drip irrigation systems	Research	Adaptation	27 Rapid assess-ments (3 across each 9 ACZs)	Cover all 27 surveys	-	2.70 (@10 lakhs/ assessment)	-	NA: Agricul-ture De-partment IA: Agriculture Universities	NDC 06 SDG 2,8,13

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3.2	Pilot climate smart adaptation technologies and practices appropriate for all 75 districts to tackle issues of real-time rainfall contingencies (delayed rainfall, mid-crop rainfall, drought, floods etc.), post-harvest management and value chains, and Institutional, knowledge and policy requirements for making agriculture in UP climate resilient. To encompass climate smart strategies for crops, livestock, horticulture, agroforestry and fisheries	Implementation	Adaptation/ Mitigation	75 districts	Complete 37 pilots (one in each district) within 2021-2025	Complete 38 pilots (one in each district) within 2022-26	23100.00 (Based on budget estimates done for the World Bank Maharashtra POCRA project)	All programmes and schemes of Agriculture Dept, Horticulture Dept, Animal Husbandry Dept, Dairy Development Dept, Fisheries Dept and Sugar Industry & Cane Development Dept can contribute to this action by mainstreaming climate smart technologies & practices	NA: Agriculture Department IA: Agriculture Universities	NDC 06 SDG 2,8,13

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3.3	Develop Village level agriculture contingency plans incorporating analysis of historical climate data and future climate projections to define the climate contingencies of the villages Current and future impact analysis on natural resources within each village (water availability, soil health etc.) Development of impact outlooks on agriculture crops, horticulture crops, livestock and fisheries prevalent within the villages Enumeration of management alternatives considering weather contingencies for crops, livestock and fisheries	Policy	Adaptation	97941 populated villages	Cover 50% villages within 2021-2025	Cover 50% villages within 2026-2030	2938.23 (@ 3 lakhs per village plan on an average)	Rashtriya Krishi Vikas Yojana Krishi Vikas Yojanay (Agriculture Development Plans) Formulation and Monitoring of district/ state agriculture plans	NA: Agriculture department IA: Agriculture Dept. , Fisheries Dept., Animal husbandry department, horticulture department and agroforestry unit, agriculture universities and technical institutes	NDC 06 SDG 2,8,13

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Table 81: Proposed Strategies for Sustainable Agriculture Mission

S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and Implementing Agency	SDG and NDC linkages
	Strategy 4 Improve water use efficiency in agriculture with a focus on rice and sugar cane									
4.1	Provide technical and market support to enable transition of rice growing areas to coarse grain and pulse growing areas in districts where groundwater levels have gone down from zero to 6 m below ground in the last 10 years. Establish FPOs, agriculture marts and other support including training to farmers enabling shift to cultivation of coarse grains, horticulture crops and other crops of lesser duration.	Implementation	Adaptation	Cover 50 districts that show ground water depth from 0-6 below ground. Districts. The rice yields in these districts range from 800 kg/ha (Jhansi) to 2792 kg/ha (Bijnor).	Cover 7 high productivity districts 18 middle productive districts between 2021-2025	Cover rest of the districts within 2026-2030	220.00	National Mission on Sustainable Agriculture UP Atmanirbhar Krishak Samanvit Vikas Yojana Promotion of Farmer Producer Organization and Business Activities scheme	NA: Agriculture department IA: Agriculture department, NABARD	NDC 06 SDG 2,8,13

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Table 81: Proposed Strategies for Sustainable Agriculture Mission

S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and Implementing Agency	SDG and NDC linkages
4.2	Enable capacity of farmers to shift to flood resilient rice varieties in flood prone districts of UP. Undertake wide scale awareness programs on flood resilient varieties of rice available and their productivity and farming practice, establish relevant seed marts and provide training to farmers on the best practices for cultivation of flood resilient varieties of rice.	Capacity building	Adaptation	Eastern UP districts prone to floods covering an area of 7.34 million ha (flood prone area in UP) 20 FPOs	Cover 4.34 million ha in 2021-2025	Cover 3.00 million ha in 2026-2030	1000.00	National Food Security Mission UP Atmanirbhar Krishak Samanvit Vikas Yojana Promotion of Farmer Producer Organization and Business Activities scheme	NA: Agriculture department IA: Agriculture department, KVKs, NABARD	NDC 06 SDG 2,8,13

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S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and Implementing Agency	SDG and NDC linkages
4.3	Train farmers on artificial tank fishery technologies to conserve water and develop FPOs for enabling market access	Capacity building	Adaptation	8800 ha 75 FPOs (20 FPOs by 2023 and rest by 2030)	4400 ha till 2025	rest till 2030	290.00 Tank fisheries: 247.00 FPO's : 43.00	Pradhan Mantri Matsya Sampada Yojana Blue Revolution Integrated Development and Management of Fisheries Agriculture Dept's Fisheries Scheme UP Atmanirbhar Krishak Samanvit Vikas Yojana Promotion of Farmer Producer Organization and Business Activities scheme	NA: Agriculture department IA: Fisheries department	NDC 06 SDG 2,8,13

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Table 81: Proposed Strategies for Sustainable Agriculture Mission

S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and Implementing Agency	SDG and NDC linkages
4.4	Train sugarcane farmers to: Adopt water conservation techniques (skip, furrow and drip irrigation) Cultivate water stressed tolerant varieties Transplant young seedlings (25-35 days old) Maintaining spacing(5X2 feet) Retaining sufficient moisture and avoiding inundation of water Encouraging organic method of nutrient and plant protection measures. Practicing intercropping for effective utilization of land Undertake wide scale awareness programs to motivate farmers to shift to water stress tolerant varieties and adopt water conservation techniques Establish nurseries for growing saplings of the stated variety Establish seed marts for water stress tolerant varieties of sugar cane such as CoLk94184 and other short duration sugarcane varieties	Capacity building	Adaptation	Cover entire sugarcane area in UP (23.12 lakh ha)	Cover 11 lakh ha within 2021-25 Conduct 30 trainings in 2021-25 Open 40 seed marts	Cover 12.3 lakh ha in 2026-30 Conduct 30 trainings in 2025-30	800.00	Agriculture Dept's Cane Development Scheme Development and Consolidation of Sugarcane Cultivation (by Sugar Industry & Cane Development Department)	NA: Agriculture department IA: Indian Institute of Sugarcane Research, Agriculture Universities, Directorate of Sugarcane Development, NABARD	NDC 06 SDG 2,8,13

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S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and Implementing Agency	SDG and NDC linkages
4.5	Bring more area under drought resilient food crops (Rice to Millets in GW stressed areas)	Implementation	Adaptation	Cover 50 districts that show ground water depth from 0-6 below ground	Cover 7 high productivity districts 18 middle productive districts	Cover rest of the districts	220.00	National Mission on Sustainable Agriculture	NA: Agriculture department IA: Agriculture department, Agriculture Universities, KVKs, NABARD	NDC 06 SDG 2,8,13
	Strategy 5: Enable enhanced access to risk sharing measures for farmers in a changing climate regime									
5.1	Extend Restructured Weather Based Crop Insurance Scheme to all farmers registered under PMKSY. (Coverage so far: 46.947 lakhs as of FY 2019 2020; 61.270 lakhs as of FY 2018 2019)	Policy	Adaptation	To farmers registered under PMKSY in UP (As of 2021: 2,81,75,093 farmers registered under PM KISAN)	2021-2025	2026-2030	530.00	Pradhan Mantri Fasal Bima Yojana National Crop Insurance Program Restructured Weather Based Crop Insurance Scheme	NA: Agriculture department IA: Agriculture Department, Banks	NDC 06 SDG 2,8,13

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S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and Implementing Agency	SDG and NDC linkages
5.2	Extend genetic up-gradation of all indigenous female domestic cattle by superior Indian breeds through artificial insemination to increase milk productivity of the indigenous cattle stock	Implementation	Adaptation	To 64.5 lakh indigenous female cattle in the state (2019 livestock census) To be covered by 2021-30	Cover 50% in 2021-25	Cover rest in 2026-30	11.00 (@ 17 lakhs per district as per Annual Report 2019 2020 of DAHD, MFAHD)	Rashtriya Gokul Mission (Scheme to improve and expand the facilities of animal breeding in cows / cattle through artificial and natural insemination and to provide facilities for breeding through banks (district level scheme) Scheme for Artificial Insemination (State Scheme) Scheme for use of sexed semen in cows Scheme to improve and expand the facilities of animal breeding in cows / cattle through artificial and natural insemination and to provide facilities for breeding through banks (district level scheme) Scheme for operation of mobile veterinary and artificial insemination clinics (State scheme) Bovine Breeding Sexed Semen Production	NA: Dept. of Animal Husbandry IA: Dept. of Animal Husbandry, Veterinary institutes and hospitals, NGOs	NDC 06 SDG 2,8,13

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S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and Implementing Agency	SDG and NDC linkages
5.3	Sensitize livestock owners to take up livestock insurance cover for their superior breed indigenous cattle -Extensive IEC on benefits of insurance Implementation of livestock insurance scheme	Capacity building	Adaptation	All high yielding indigenous exotic breeds of cattle by 2021-30	Cover ½ of the indigenous cattle population by 2025	Cover rest by 2030	25% state, 25% centre, and 50% owner	Risk Management and Livestock Insurance Scheme	NA: DoAH IA: Banks	NDC 06 SDG 2,8,13
5.4	Undertake a study and implement pilots to explore the feasibility of weather indexed livestock and fisheries insurance for insuring farmers against sharp loss in milk yields, morbidity and mortality due to extreme weather conditions and due to pest and disease attacks	Implementation	Adaptation	One pilot each in the 22 agro climatic zones to be covered by 2021-2025	Cover 50% in 2021-25 Cover ½ of the indigenous cattle population by 2025		2.20 (@ 10 lakhs per ACZ)	Sub Mission on livestock development under National Livestock Mission	NA: DoAH IA: Banks	NDC 06 SDG 2,8,13

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5.5	To generate sustainable farmer's income, undertake a feasibility study to explore the possibility of aggregation of marginal landholdings to be taken on rent/lease applicable for only 5 years. The farmer gets the lease rent every month, share of profit from sales of his produce and nominal daily wages for the days he/she works on the land. The institution (government or private company) that leases the land will take care of all farming inputs and climate smart agriculture practices.	Research	Adaptation	Marginal landholdings (80%) with clear ownerships	Complete study and recommendation by 2025	Develop implementation plan	5.00	Krishi Vikas Yojanay (Agriculture Development Plans)	NA: Agriculture Department IA: Agriculture Universities and technical Institutes,	NDC 06 SDG 2,8,13

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5.6	Set up partnership mode for research, capacity building and popularizing risk management solutions in agriculture.	Policy	Adaptation	Set up an institution	Complete setting up an institution by 2025		50.00	Krishi Vikas Yojanay (Agriculture Development Plans)	NA: Agriculture Department IA: Agriculture Universities and technical Institutes,	NDC 06 SDG 2,8,13

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Table 82: Proposed Strategies for Jal Mission

S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and Implementing Agency	SDG and NDC linkages
1	**Enhanced monitoring and research to establish water budgets and manage water at micro-watersheds**									
1.1	Study impacts of climate change on water resources in UP	Research	Adaptation	Study at 10km X 10km resolution	Assessment to be completed	--	2.50	"Medium and Minor Irrigation Schemes Uttar Pradesh Water Sector Restructuring Project Phase 2 (Under Major Irrigation Scheme)"	NA: SWaRa IA: Irrigation and Water Resources Department, Minor Irrigation Dept, Research/ technical Institutes (e.g. IITs, BHU)	NDC 06 SDG 6, 13
1.2	Setup hydro-met monitoring stations to capture the high spatial variability in rainfall observed across UP	Implementation	Adaptation	200 Soil Moisture Sensor[18] 15 Automatic Water Quality Sensor(AWQS) 20 Water Quality Analyzer	50 % of installation of all instruments	50 % of installation of all instruments	1.50[19]	"Major, Medium and Minor Irrigation Schemes National Hydrology Project - Phase III"	"NA: UPIWRD IA: Irrigation and Water Resources Dept., Minor Irrigation Dept.	

[18] Targets taken from https://idup.gov.in/post/en/national-hydrology-project-nhp (presentation available to download)

[19] 0.3 Cr for 200 Soil moisture sensors (@15k/sensor); 0.045 Cr for 15 Automatic water quality sensors (@30K/sensor); 0.6 Cr for 20 Water quality analyzer (@3.5lakh/unit)

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S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and Implementing Agency	SDG and NDC linkages
1.3	Increase the density of piezometer and observation wells to measure ground water levels in each micro-watershed (21278). The state has 9500 piezometers and observation wells in both rural and urban areas	Implementation	Adaptation	4062	4062		42.31	"Minor Irrigation - Groundwater Survey, Assessment & Development State Ground Water Conservation Mission Atal Bhujal Yojna"	"NA: State GWB IA: Minor Irrigation, Ground Water Dept.	NDC 06 SDG 6, 13

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1.4	Estimate water budget for baseline and future climate projections & development needs	Policy	Adaptation	Entire state	Assessement to be completed		2.50	Jal Jeevan Mission Pradhan Mantri Krishi Sinchayee Yojana Uttar Pradesh Water Sector Restructuring Project Phase 2	NA: Irrigation and Water Resources Department IA: Implementation Support Agency (ISA) under Jal Jeevan Mission	NDC 06 SDG 6, 13
1.5	Involve gram panchayats and urban communities and stakeholders to develop their own local water budgets for judicious use across sectors	Policy	Adaptation	All gram panchayats and Urban centers	3,894 urban centres as per 2011 census; Gram panchayat level water budgets (29,582 GPs out of 59,163)	Rest of the GPs	126.00 (@20,000 per unit equaling to 63057."	Major, Medium and Minor Irrigation Schemes Ground water public awareness and publicity scheme Nabard supported Integrated Rainwater Management (watershed development) project Atal Bhujal Yojna	NA: Namami Gange and Gramin Jalapurti Vibhag IA: Groundwater Dept., Dept. of Panchayati Raj, Urban Development Dept. and ULBs, Urban Development Dept. (JJM-U)	

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2	**Strengthening water sector infrastructure to adapt to climate change**									
2.1	Develop guidelines for building climate resilient large dams, barrages, canals and check dams and for retrofitting exiting ones in the State to accommodate extreme rainfall as per the future projections. Develop a course on the guidelines.	Policy	Adaptation	All engineers in the public and private sectors involved in these works will be encourage to take the courses and will get certified	Course Design to be completed within 2021-22 & courses to start thereafter	Continue course	1.00	Ram Ganga and Sharda Sahayak Command Area Development projects Saryu Canal Project Phase III - subsidy Arjun Sahayak Irrigation Project - subsidy Per Drop More Crop - Micro Irrigation Scheme	NA: Irrigation and Water Resources Department IA: SWaRa, WALMI, UP	NDC 06 SDG 6, 13

[20] Basins plans developed by SwaRa (calculations till 2030). In the basin plans, the estimated budget for this action point for all basins is 19141Cr for 15yrs, hence budget for 10yrs came to 12761 Cr.

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2.2	Correction of system deficiencies for equity of canal water by restoring the canal/drain section for present availability of rainwater, surface water, ground water, existing cropped area, cropping intensity and its future possible trends	Implementation	Adaptation	All canal and drainage network in State	50% of Work	50% of Work	12761[20]	Ram Ganga and Sharda Sahayak Command Area Development projects Saryu Canal Project Phase III - subsidy Arjun Sahayak Irrigation Project - subsidy Major Irrigation - Maintenance & Repairs	NA: Irrigation and Water Resources Department IA: Irrigation Water Resources Department	NDC 06 SDG 6, 9, 13
2.3	Map the retrofit requirement of check dams constructed as per the future projections of rainfall. +Undertake retrofitting	Implementation	Adaptation	3,567 check dams in the State	All check dams	-	3.50 (study @ INR 5 lakh per district) + 15 Cr (Retrofit cost which is assumed ½ of annual release for check dams)	Minor Irrigation - Capital outlay for construction Major & Medium Irrigation - Maintenance & Repairs Pradhan Mantri Krishi Sinchayee Yojana	NA: Minor Irrigation Dept. IA: Minor Irrigation Dept.	NDC 06 SDG 6, 9, 13

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3	**Enhanced water use efficiency across sectors to reduce surface water and ground water dependency**									
3.1	Study water use in water intensive industries in UP (the top water intensive industries)	Research	Adaptation	All Water intensive industries	Thermal power plants, textile, leather industries, Paper and pulp, Sugar and ethanol industries, Hotels, beverage, dairy, and steel mills	--	5.00 (@50 lacs per study)	Atal Bhujal Yojna Uttar Pradesh Water Sector Restructuring Project Phase 2	NA: Groundwater Dept. IA: Groundwater Dept., Industries, Universities and technical institutes	NDC 06 SDG 6, 9, 13

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3.2	Catalogue best practices in improving water use efficiency to optimize productivity by industry type Undertake wide dissemination through dialogues with industries to set roadmaps to improve water use efficiency in the industries to the best possible level	Capacity Building	Adaptation	All Water intensive industries	Thermal power plants, textile, leather industries, Paper and pulp, Sugar and ethanol industries, Hotels, beverage, dairy, and steel mills	--	1.80 (@20 lacs per study)	Atal Bhujal Yojna Uttar Pradesh Water Sector Restructuring Project Phase 2 National Ganga River Basin Authority projects	NA: Groundwater Dept. IA: Groundwater Dept., Industries' associations or infrastructure & industries department, Universities and technical institutes. Infrastructure and Industrial Development Dept., MSME and Export Promotion Dept.	NDC 06 SDG 6, 9, 13

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3.3	Based on benchmarking the best practices in water intensive industries fix their limit of groundwater abstraction. Monitor water use through smart water meters to enforce regulation as and when necessary.	Implementation	Adaptation	All Basins	Development of policy	Implementation of Policy	--	--	NA: Groundwater Dept. IA: Groundwater Dept.	NDC 06 SDG 6, 9, 13
3.4	Develop and implement policy for waste water re-use in water intensive industries.	Policy	Adaptation	All Basins	Development of policy	Implementation of Policy	--	--	NA: Namami Gange and Rural Water Supply Department IA: UP Jal nigam Urban Development Dept., Industries Dept	NDC 06 SDG 6, 9, 13

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AGRICULTURE										
3.5	Promoting micro irrigation like sprinkler or Drip Promote micro irrigation practices (such as sprinkler, drip irrigation) in Agriculture	Implementation	Adaptation	1179871.5 ha in all basins	Drought prone districts	Rest of the districts	5177.8713[21]	Per Drop More Crop - Micro Irrigation Scheme Pradhan Mantri Krishi Sinchayee Yojana, Nabard supported Integrated Rainwater Management (watershed development) project Atal Bhujan Yojna Uttar Pradesh Water Sector Restructuring Project Phase 2	NA: Agriculture Department IA: Agriculture Department, Horticulture Department , Irrigation and Water Resources Departmen	NDC 06 SDG 2, 6, 13

[21] Basins plans developed by SwaRa (calculations till 2030)

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DOMESTIC										
3.6	Design and Undertake Information, Education and Communication for efficient water use for domestic use (- school education/women self-help groups).	Capacity Building	Adaptation	HH with direct to home water access in rural and urban areas	Design and implement IECs	Continue the IECs	2.00 (@20 lakh per yr)	State Drinking Water and Sanitation Mission (National Rural Drinking Water Programme)	NA: Namami Gange and Rural Water Supply Department IA: NGOs, GPs, Urban Local bodies, WUA, Urban Development Department (JJM-U)	NDC 06 SDG 6,13
3.7	Universalize water meters at HH level – both rural and urban with differentiated pricing mechanisms fixed by a regulator	Implementation	Adaptation	100 % of total households (2,64,27,705)[22] in UP	Urban areas	Rural areas	26427.7 (@ Rs. 5000 / water meter + Rs. 5000 installation & material)"	"State Drinking Water and Sanitation Mission (National Rural Drinking Water Programme), Jal Jeevan Mission - Rural Water Supply, Jal Jeevan Mission - Urban"	NA: Namami Gange and Gramin Jalapurti Vibhag IA: Namami Gange and Gramin Jalapurti Vibhag (JJM-R), Urban Development Department (JJM-U)	NDC 06 SDG 6, 11, 13

[22] https://ejalshakti.gov.in/jjmreport/JJMState.aspx

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3.8	Promote reuse and recycle of wastewater in residential societies	Capacity Building	Adaptation	All residential societies generating wastewater greater than 0.5 MLD	Integrate it within permission for building plans and completion certificates	--	--	--	NA: Urban Development Dept IA: Jal Nigam, ULBs	NDC 06 SDG 6, 11, 13
3.9	Ensure rooftop rainwater harvesting in existing and planned institutional (gov/semi gov) and commercial buildings in rural and urban areas with plot sizes greater than 300 sq m (integrate it within permission for building plans and completion certificates)	Policy	Adaptation	Rural + Urban in all basins	Urban area	Rural area	615,8.001[23]	Jal Jeevan Mission - Rural Water Supply Nabard supported Integrated Rainwater Management (watershed development) project Rooftop Rainwater Harvesting Systems on Govt Buildings Jal Jeevan Mission - Urban	NA: Urban Development Dept IA: Jal Nigam, ULBs, Namami Gange and Rural Water Supply Department	

[23] Basins plans developed by SwaRa (calculations till 2030)

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S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and Implementing Agency	SDG and NDC linkages
4	**Enhanced efforts towards ground water recharge**									
4.1	Develop and implement groundwater recharge plans[24] in industrial clusters	Policy	Adaptation	All industrial clusters located in Over exploited and critical blocks	All water intensive industrial clusters	Focus on remaining industries	21.5.00[25]	"State Ground Water Conservation Mission, For Groundwater Development including recharge and other activities (C.O), Capital Outlay on Minor Irrigation - Groundwater Recharge Checkdam Development Ground Water Survey - Development, Assessment and Strengthening, Water harvesting promotion works from Ground Water Fund"	NA: Groundwater Dept. IA: Groundwater Dept.	NDC 06 SDG 6, 9, 13

[24] http://cgwb.gov.in/Master%20Plan%20to%20GW%20Recharge%202020.pdf

[25] https://www.ibef.org/download/uttarpradesh.pdf

(38000 acre land under industries – considering 5 times peripheral area for GW recharge i.e. 190000 acres which is 0.3 % total area of UP. Budget for groundwater recharge for whole UP is 7156.45 cr, hence budget to recharge industrial clusters = 0.3% * 7156.45 = 21.5 cr)

C Detailed List of Proposed Strategies for Jal Mission

Table 82: Proposed Strategies for Jal Mission

S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and Implementing Agency	SDG and NDC linkages
4.2	Develop action plans for limiting groundwater extraction for irrigation and domestic use in 35 districts reporting salinity, nitrate pollution, heavy metals, and bacterial development.	Policy	Adaptation/ Mitigation	35 districts	Development of action plans	Implementation of Action plans	--	--	NA: Groundwater Dept IA: Agriculture Dept., Urban Development Dept	NDC 06 SDG 6, 13
4.3	Undertake flood water transfer to recharge GW in over-exploited and critical GW areas of UP (inter river and canal transfers)	Implementation	Adaptation	Eastern districts of UP like Deoria, Mau, Ballia, Ghazipur, Jaunpur, Varanasi etc.	Conduct feasibility study	Scaling up the pilot study in other sub basins with surplus flood water	1	Atal Bhujal Yojna	NA: Groundwater dept. IA: Irrigation Water Resources Department, research institutes, Local body associations	NDC 06 SDG 6, 13

C Detailed List of Proposed Strategies for Jal Mission

Table 82: Proposed Strategies for Jal Mission

S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and Implementing Agency	SDG and NDC linkages
4.4	Design and implement GW recharge mechanism appropriate for each and every existing and upcoming GW based water supply systems in UP	Implementation	Adaptation/ Mitigation	Rural + urban GW supply existing and under pipeline	Overexploited and critical blocks of UP	Critical and Safe blocks of UP	7134.95[26]	State Ground Water Conservation Mission Capital Outlay on Minor Irrigation - For Groundwater Development including recharge and other activities Capital Outlay on Minor Irrigation - Groundwater Recharge Checkdam Development Water harvesting promotion works from Ground Water Fund	NA: Groundwater Dept. IA: Groundwater Dept.	NDC 06 SDG 6, 13
4.5	Develop and implement holistic Wetland recharge measures across UP also covering channels feeding into it.	Implementation	Adaptation/ Mitigation	95876.33 ha in all 8 basins	Major Basins like Ganga, Yamuna, Rapti	Other remaining basins	6300[27]	National Ganga River Basin Authority projects,	NA: Forest Department. IA: Wetland board, Forest Dept. Groundwater Dept	NDC 06 SDG 6, 15

[26] http://cgwb.gov.in/Master%20Plan%20to%20GW%20Recharge%202020.pdf

[27] Basins plans developed by SwaRa (calculations till 2030)

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Table 82: Proposed Strategies for Jal Mission

S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and Implementing Agency	SDG and NDC linkages
4.6	Form Wetland user association bodies at local level for management and governance (community ponds and lakes)	Policy	Adaptation	All Basins	Major Basins like Ganga, Yamuna, Rapti	Other remaining basins	--	--	NA: Forest Department IA: Forest Department , Wetland board	NDC 06 SDG 6,15
5	**Readying for frequent and unprecedented floods at even non-traditional flooding regions and months**									
5.1	Initiate coordination between Indian neighboring states to access rainfall and flash flood data on a real time basis for all the rivers and their tributaries that flow into Uttar Pradesh.	Policy	Adaptation	To finalize MoU between all neighboring states and all relevant river basin agencies	MoU between all neighboring states and all relevant river basin agencies	Implementation of plan and dissemination of data to downstream local bodies and public	--	--	NA: Irrigation and Water Resources Department IA: Flood Management Information System Centre	NDC 06 SDG 6,13

C Detailed List of Proposed Strategies for Jal Mission

Table 82: Proposed Strategies for Jal Mission

S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and Implementing Agency	SDG and NDC linkages
5.2	Developing a system of hydro-meteorological observations and transmission of real time data through automatic sensors and satellite based transmission between the transboundary river basins between India and Nepal in order to take appropriate decisions for downstream regions for unprecedented floods	Policy	Adaptation/ Mitigation	Transboundary river basins like Gandak, Ghagra, Gomti and Rapti	Development of mechanism for transboundary data sharing	Implementation of plan and dissemination of data to downstream local bodies	--	--	NA: Irrigation and Water Resources Department IA: SDMA, , IMD	NDC 06 SDG 6, 13, 17

D Detailed List of Proposed Strategies for Green UP Mission

Table 83: Proposed Strategies for Green UP Mission

S No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Budget (In INR Cr)	Probable Sources of Funding	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
	Strategy 1: Restore & improve quality of forest cover and increase area of Trees Outside Forest (ToF)									
1.1	Enhance quality of Open Forest cover and ecosystem services in Uttar Pradesh.	Implementation	Mitigation	4081 sq. km The total open forest area in the state as per ISFR 2021 is 8162 sq. km. As per expert consultations, about 50% of this area will be available for restoration.	1. Demarcate area to be restored around villages subjected to intense biotic pressure and unsustainable extraction of forest produce. 2.Assess extent of drivers of degradation and deforestation + root stock density situtaion 3. Design appropriate restoration plans 4. Undertake restoration of at least 25% of the demarcated area (1020 sq. km)	Undertake restoration in remaining 75% of the demarcated area (3061 sq. km	1306.00 Cost per ha is Rs 32,000	CAMPA Forest Conservation Development and sustainment Social Forestry CSR funds Green Bonds	NA:Environment, Forest and Climate Change Department IA: Environment, Forest and Climate Change Department	NDC 5 SDG 13, 15

D Detailed List of Proposed Strategies for Green UP Mission

Table 83: Proposed Strategies for Green UP Mission

S No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Budget (In INR Cr)	Probable Sources of Funding	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
1.2	Undertake conservation and sustainable management of moderately dense forest areas showing degradation	Implementation	Mitigation	4029 sq. km	Undertake 2029 sq. km plantation	Undertake 2029 sq. km plantation	604.00 Cost per ha = Rs 15000	CAMPA Forest Conservation Development and sustainment Social Forestry	NA: Environment, Forest and Climate Change Department IA: Environment, Forest and Climate Change Department- Department	NDC Goal 5 SDG Goal 13, 15
1.3	Enrich protected areas	Implementation	Mitigation	50% of the protected area i.e., 3221 sq. km	1610 sq. km	1610 sq. km	1030.00 Cost per ha= Rs 32,000			
1.4	Enable assisted migration of tree species having conservation, economic, and social values to conducive locations	Research	Mitigation	To identify at least 5 species in each of the 9 agro-climatic zone (total 45 species) for plantation/ propagation. In consultation with in house research and other research organisations	Research based nurseries for 45 climate resilient varieties and propagation plots of at least 10 ha/ species = 450 ha + research component	Maintenance of the research nurseries and propagation plots	535.50 Lakhs for 450 ha for first 5 years 229.50 Lakhs for 450 ha for the remaining 5 years	Forest related research work and dissemination Review and formulation of work plan	NA: Environment, Forest and Climate Change Department IA: State Forest Research Institute	

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Table 83: Proposed Strategies for Green UP Mission

S No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Budget (In INR Cr)	Probable Sources of Funding	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
1.5	Continue gullied and ravinous area reclamation to stop further ingress of ravines into the non-ravine farmland	Implementation	Mitigation	Target ravines in Chitrakoot, Banda, Mahoba, Hamirpur, Jalaun, Jhansi and Lalitpur. Wasteland area= 1065 sq. km	355 sq.km	710 sq. km	Total Cost= Rs 745.5 crore Cost/ha= Rs 70,000		NA and IA: Environment, Forest and Climate Change Department	NDC Goal 5 SDG Goal 13, 15
1.6	Ensure access to clean cooking fuels such as LPG/ biogas/ solar cooker /electric convection stoves to fuel wood dependent HHs	Implementation	Adaptation/Mitigation	Cover all HHs in forest fringe villages (A per ISFR 2019, the population in forest fringe villages in UP is 2,27,20,296 (ISFR 2019) living in the Forest Fringe Villages. If we consider 6 persons per HH (Census 2011), then the number of HHs is estimated to be 37,86,716).	18,93,358 households	18,93,358 households	Total Cost= Rs 435.47 crore Cost/connection= Rs 1150	Pradhan Mantri Ujjawala Yojana New National Biogas and Organic Manure Programme (NNBOMP)	NA: Environment, Forest and Climate Change Department IA: Environment, Forest and Climate Change Department, UPNEDA, Food and .Civil Supplies, Khadi Gram Udyog/ UP Bioenergy Development Board	NDC Goal 5 SDG Goal 13, 15

D Detailed List of Proposed Strategies for Green UP Mission

Table 83: Proposed Strategies for Green UP Mission

S No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Budget (In INR Cr)	Probable Sources of Funding	Nodal and implement-ing Agency (NA/IA)	SDG and NDC Linkages
	Strategy 2: Enhance tree cover in Urban and Peri-Urban areas (including institutional lands)									
2.1	Undertake tree plan-tation in on avenues, households, and in Institutional lands,	Implemen-tation	Adapta-tion/ Mit-igation	150000 plants (15000 plants/ year; based on UP SDG Vision 2030)	75000 plants	75000 plants	0.795 Cost per plant= Rs 53.00	National Bam-boo Mission Social Forestry in Urban Areas Development and Strength-ening of Forest Parks Environmental forestry and wildlife- Public Park Scheme	NA: Envi-ronment, Forest and Climate Change Department, Nagar Vikas Nigam IA: Environ-ment, Forest and Climate Change Department	NDC Goal 5 SDG Goal 13, 15

D Detailed List of Proposed Strategies for Green UP Mission

Table 83: Proposed Strategies for Green UP Mission

S No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Budget (In INR Cr)	Probable Sources of Funding	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
2.2	Develop high-tech and satellite nurseries for generating quality plant material for tree plantations outside forests	Implementation	Mitigation	75 central high-tech nurseries for each district & 32647 satellite nurseries	Setup 75 central high-tech nurseries of 1 ha each (1 in each district) and 32647 satellite nurseries each for a cluster of 3 villages Initiate innovative schemes ensure survival	Maintain nurseries and continue to plant trees	333.97 (@ 10lakh for high quality nurseries and 1 lakh for satellite nurseries)	Nursery Management Plan 5% of CSR funds from the top GHG emitting large industries in the State (like C finance)	NA: Environment, Forest and Climate Change Department IA: All departments	NDC Goal 5 SDG Goal 13, 15
	Strategy 3: Improve incomes of forest dependent population through agroforestry and food forests in private and community land									
3.1	Support agro-forestry plantations on farmer and community land and link it to established Carbon markets to supplement farmers incomes	Implementation	Adaptation/ Mitigation	8 Cr saplings (UP SDG Vision 2030)	4 Cr Saplings	4 Cr saplings	560.00 Cost per plant= Rs 70	Sub-mission on agro-forestry Voluntary Carbon Markets and any other carbon market that evolves in the future	NA: Environment, Forest and Climate Change Department IA: Agriculture Dept., Horticulture Dept.	NDC Goal 5 SDG Goal 1,2, 13, 15

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Table 83: Proposed Strategies for Green UP Mission

S No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Budget (In INR Cr)	Probable Sources of Funding	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
3.2	Encourage food forests in marginal farmers land to ensure harmonious integration of landscape and people — providing their food, energy, shelter, and other material and income needs in a sustainable way.	Implementation	Adaptation/ Mitigation	2 Cr saplings	1 Cr saplings	1 Cr saplings	140.00 Cost per plant= Rs 70	National Bamboo Mission Sub-Mission on Agro-forestry	NA: Environment, Forest and Climate Change Department IA: Agriculture Dept., Horticulture Dept.	NDC Goal 5 SDG Goal 1,2, 13, 15
3.3	Fix minimum support price (MSP) for different agro-forestry species produce (NTFP, wood)	Policy	Mitigation		Set the MSP pricing policy for 10-15 remunerative agroforestry species, including teak, eucalyptus and poplar, along with buy-back arrangement with UPFC		0.25	Sub-Mission on Agro-forestry	NA: Environment, Forest and Climate Change Department IA: Uttar Pradesh Forest Corporation	

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Table 83: Proposed Strategies for Green UP Mission

S No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Budget (In INR Cr)	Probable Sources of Funding	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
3.4	Ensure compliance with NCCF-STD-01 Forest Management Certification Standard of all forest divisions in UP. Currently, the scope of certification has been identified across 41 forest divisions covering terrestrial and social forestry areas extending over 450408 ha	Policy	Mitigation	Rest of the 13 forest land under forest divisions	-	-	-		NA: Environment, Forest and Climate Change Department IA: Uttar Pradesh Forest Corporation	NDC Goal 5 SDG Goal 2, 8, 12,15

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Table 83: Proposed Strategies for Green UP Mission

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	Strategy 4: Conservation of wetlands									
4.1	Map, restore, con-serve and monitor all natural wetlands	Implemen-tation	Mitiga-tion	Natural wetlands covering all lakes and ponds	Complete mapping, Study & document water and biodiversity status, Develop site specific restoration and conservation plans for all lakes and ponds	Implementing site specific restoration	735.20	National Plan for Conserva-tion of Aquatic Eco-systems (NPCA)	NA: Environ-ment, Forest and Climate Change Department IA: : U.P State Wet-lands Au-thority and State Forest Research Institute	NDC Goals 1, 5 SDG Goals 1,7,15

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Table 83: Proposed Strategies for Green UP Mission

S No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Budget (In INR Cr)	Probable Sources of Funding	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
	Strategy 5: Biodiversity Conservation									
5.1	Conserve endangered species in UP as per the IUCN Red List.	Policy	Adaptation	Endangered Species Recovery Plans for prioritised species	Prepare the priority list of endangered species (2022), Develop Endangered Species Recovery Plans (2022-2024) ,Implement plans (2026 onwards)	Continue restoration as per plans	10.00	Integrated Development of Wildlife Habitat, Conservation Breeding Programme. Conservation of Aquatic Ecosystems	NA: Environment, Forest and Climate Change Department IA: State Biodiversity Board	NDC Goals 1, 5 SDG Goals 1,7,15
5.2	Promote conservation of biodiversity on common lands in rural areas	Capacity Building	Adaptation	Train all 59407 BMCs	Develop training modules for BMCs in 2022. Continue training 2023 onwards	Continue training	59.00	Managment of Wildlife outside protected areas	NA: Environment, Forest and Climate Change Department IA: State Biodiversity Board, Urban Development Department	

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Table 83: Proposed Strategies for Green UP Mission

S No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Budget (In INR Cr)	Probable Sources of Funding	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
5.3	Ensure ex-situ conservation via multiplication of rare, endangered and endemic tree species	Research	Adaptation	To identify at least 5 species in each of the 9 agro-climatic zone (total 45 species) for plantation/ propagation. In consultation with in house research and other research organisations	Research based nurseries for 45 climate resilient varieties and propagation plots of at least 10 ha/ species = 450 ha + research component	Maintenance of the research nurseries and propagation plots	The budget will be subsumed from the activity designed and mentioned above for assisted migration of tree species	Development of Babbar Lion Breeding centre and lion safari park in distict Etawah Project Tiger Project Elephants	NA: Environment, Forest and Climate Change Department IA: Institute of Forest Genetics and Tree Breeding	NDC Goals 1, 5 SDG Goals 1,7,15
5.4	Develop Restoration Plan for area infested by invasive alien species. Build capacity of locals to harvest and recycle invasive in UP forests to useful products such as briquttes	Policy	Adaptation	Total recorded area for invasive species (ISFR 2019): 1,24,800 ha	62400 ha	62400 ha	17.00	CAMPA	NA: Environment, Forest and Climate Change Department IA: Environment, Forest and Climate Change Department, NABARD	NDC Goals 1, 5 SDG Goals 1,7,15

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Table 83: Proposed Strategies for Green UP Mission

S No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Budget (In INR Cr)	Probable Sources of Funding	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
5.5	Periodic scientific surveys to supplement PBRs	Research	Adaptation	59407 PBRs	Random Survey design to be completed by 2022. Surveys to be undertaken 2023 onwards (preferably mobile based data storage and transmission to central server storing UP data base)	Surveys to continue	118.00	Uttar Pradesh State Biodiversity Board Fund	NA: Environment, Forest and Climate Change Department IA: State Biodiversity board	NDC Goals 1, 5 SDG Goals 1,7,15
5.6	Conservation of Biodiversity Heritage Sites (BHS). Conservation funding through eco-tourism in these sites	Implementation	Adaptation		Priority BHSs identification (2021). Development of BHSs (2022-2026) .Ecotourism model development for BHSs conservation (2022-2026)	Generate revenue and undertake BHSs conservation	50.00	Development of ecotourism Uttar Pradesh State Biodiversity Board Fund	NA: Environment, Forest and Climate Change Department IA: State Biodiversity Board	NDC Goals 1, 5 SDG Goals 1,7,15

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5.7	Conserve climate resilient seeds grown in community owned open field seed banks	Implementation	Mitigation	3 field seed banks in each of the 9 agro-climatic zones	Train communities on scientific methods on open field community seed bank conservation techniques and establish open field tree banks	Continue training and establishing open field seed banks in at least 3 fields in each of the 9 agro-climatic zones of the State	Total cost= Rs 121.5 crore Cost per unit=Rs 45 lakhs	Experimental Field Demonstration and Seed Growing Field	NA: Environment, Forest and Climate Change Department IA:Agriculture Department	NDC Goals 1, 5 SDG Goals 1,7,15

E Detailed List of Proposed Strategies for Enhanced Energy Efficiency and Green Energy Mission

Table 84: Proposed Strategies for Enhanced Energy Efficiency and Green Energy Mission

S. No.	Actions	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
Strategy 1: Minimise AT&C losses in transmission and distribution of electricity									
1.1	Separation of agriculture feeders	Mitigation	All mixed feeders in the State (2000)	50% mixed feeders	Rest in 2026-30	100.00	PM Kusum (Component C) Assistance from ADB to UPPCL for Uttar Pradesh Power Sector Improvement Project Deendayal Upadhyay Gram Jyoti Yojana	NA: Agriculture Department IA: Power Department, DISCOMs	NDC 3,4 SDG 1,2,7,9,11,12
1.2	Setting up of Prepaid Smart Metering & System Metering								

E Detailed List of Proposed Strategies for Enhanced Energy Efficiency and Green Energy Mission

Table 84: Proposed Strategies for Enhanced Energy Efficiency and Green Energy Mission

S. No.	Actions	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
1.2.1	For all domestic consumers in the State	Mitigation	Out of 27,551,094 number of domestic consumers (LMV1), smart metring of 6,083,877 consumers will be completed till March 2022 in AMRUT cities.	Cover 21,467,217 domestic connection remaining to be connected in the state			PM KUSUM	NA: Power Department IA: DISCOMs	NDC 3,4 SDG 1,2,7,9,11,12
1.2.2	For state tube wells and pumps	Mitigation	All State tube wells and pumps. 34,970 consumers (LMV7) as per UP State Tariff Order for DISCOMs 2021-225	Cover 17970 in the 1st phase	Rest 17000 consumers to be target	2.12	Integrated Power Development Scheme (IPDS), PM KUSUM	NA: Power Department IA: DISCOMs, Namami Gange and Gramin Jalapurti Vibhag	NDC 3,4 SDG 1,2,7,9,11,12

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Table 84: Proposed Strategies for Enhanced Energy Efficiency and Green Energy Mission

S. No.	Actions	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
1.2.3	For public water works	Mitigation	Public water works. 23, 897 consumers (LMV7) in this category As per UP State Tariff Order for DISCOMs 2021-225	13,897 consumers	10,000 consumers	1.45	Integrated Power Development Scheme (IPDS)	NA: Power Department IA: DISCOMs	NDC 3,4 SDG 1,2,7,9,11,12
1.2.4	For private tube wells	Mitigation	Target metering of tubewells used by Large contract farming areas formed by big corporations	Cover all contract farming areas	---	0.877	Integrated Power Development Scheme (IPDS)	NA: Power Department IA: DISCOMs	NDC 3,4 SDG 1,2,7,9,11,12

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S. No.	Actions	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
1.2.5	For all government offices from block levels onwards	Mitigation	Block level and above government institutions. 91,874 consumers (LMV3) as per UP state Tariff order 2021-22 for DISCOMs	All 91,874 consumers	----	5.597	Integrated Power Development Scheme (IPDS)	NA: Power Department IA: DISCOMs	NDC 3,4 SDG 1,2,7,9,11,12
1.2.6	For Industries:	Mitigation	Large and heavy power consumers consuming above 100 bHP /75kW.. 13,125 consumers as per UP State Tariff Order for DISCOMs 2021-22	All 13,125 to be covered	---	8.8030	Industry Funds	NA: Power Department IA: DISCOMs	NDC 3,4 SDG 1,2,7,9,11,12
		Mitigation	Small and medium power up to 100 HP/75kw. 176,389 consumers (LMV6)	100,389	76,000	118.628		NA: Power Department IA: DISCOMs	NDC 3,4 SDG 1,2,7,9,11,12

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Table 84: Proposed Strategies for Enhanced Energy Efficiency and Green Energy Mission

S. No.	Actions	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
1.3	UPERC in consultation with DISCOMs to set up differential tariff rates by time of day use for each DISCOM circle for different consumers	Mitigation	Declare tariff rates by 2023	---	---	-	-UDAY	NA: Power Department IA: DISCOMs	NDC 3,4 SDG 1,2,7,9,11,12
1.4	Install Communicable AMI meters to all Feeders to enable energy accounting	Mitigation	All feeders in the State	All feeders covered by the PVVNL	All feeders in the areas covered by DVVNL, MVVNL, PUVVNL and KESCO	3.67 (only for PVVNL)	Deendayal Upadhyay Gram Jyoti Yojana	NA: Power Department IA: DISCOMs	NDC 3,4 SDG 1,2,7,9,11,12
1.5	Install communicable AMI metres on all Distribution Transformers for facilitating energy accounting	Mitigation	All DTs in the state	All DTs in the areas covered by PVVNL & MVVNL	All DTs in the areas covered by PUVVNL, MVVNL, DVVNL & KESCO	63.40 (only for PVVNL +MVVNL)	Deendayal Upadhyay Gram Jyoti Yojana	NA: PVVNL, MVVNL IA: PVVNL, MVVNL	NDC 3,4 SDG 1,2,7,9,11,12

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Table 84: Proposed Strategies for Enhanced Energy Efficiency and Green Energy Mission

S. No.	Actions	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
1.6	SCADA/DMS in towns having population > =1 Lakh	Mitigation	All DISCOM areas to be covered	PVVNL and KESCO	DVVNL+ MVVNL+ PUVVNL	110.16 (only for PVVNL+ KESCO	Share Capital for Transmission Works to Uttar Pradesh Power Transmission Corporation Limited	NA: PVVNL, KESCO IA: PVVNL, KESCO	NDC 3,4 SDG 1,2,7,9,11,12
				Strategy 2: Make SME clusters energy efficient					
2.1	All Clay brick making units to be converted to zig-zag technology & perforated brick making technology	Mitigation	Map clay brick units still operating on FCBTK technoloy across all 10 clusters	Access finance for converting to Zig-zag and implement	----	10.00*	MSME Programmes of UPNEDA and private funds	NA: UPPCB IA: IA: UPPCB	NDC 3,4 SDG 1,2,7,9,11,12

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Table 84: Proposed Strategies for Enhanced Energy Efficiency and Green Energy Mission

S. No.	Actions	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
2.2	Training on the best practices of environmentally friendly and energy efficient technologies across supply-chain for all type of Industries including but not limited to: (1) Leather manufacturing & goods (2) Foundry (3) Poweloom and textiles (4) Ceramics (5) Glass products (6) Rice Mills (7) Packaging material (8) Mint Oil (9) Perfumery and essential oils (10) Service Industries (11) Carpet Industries (12) Sugar and Ethanol Production	Mitigation	Benchmarking and adoption of Best Available Energy Efficient Technologies by units.	Benchmarking and Training on best practices and facilitate financial support for changing to the efficient technology. Bring in notification to enforce clean technology.	Implement	32.00 (Only for training and benchmarking)		NA: UPNEDA IA: Directorate of MSME (GoUP)	NDC 3,4 SDG 1,2,7,9,11,12

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	Strategy 3: Create enabling environment for market penetration of efficient cooling systems								
3.1	Ensure thermal comfort in new and existing buildings in UP								
3.1.1	Develop a cooling action plan for UP in line with India Cooling Action Plan	Mitigation	Cover all cooling sectors (space cooling in buildings, cold chains and refrigeration, passenger transport air conditioning, and refrigerants) including an operational roadmap for sustainable cooling	Development of plan within 1 year.	-	2.00	UPNEDA Capacity Building Funds	NA: UPNEDA IA: UPNEDA	NDC 3,4 SDG 1,2,7,9,11,12
3.1.2	Implement residential building codes for energy efficiency (Eco Niwas Samhita)	Mitigation	Entire State	Social and government housing schemes, particularly covering EWS and LIG residences	Continue for other residential buildings	-	UPNEDA Capacity Building Funds	NA: UPNEDA - IA: -UPNEDA	NDC 3,4 SDG 1,2,7,9,11,12

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3.1.3	Retrofit existing government buildings in accordance with UP-ECBC 2018 to ensure energy efficiency and thermal comfort	Mitigation	All existing government buildings with a connected load	50% of the government buildings stock in cities	Rest 50%	---	Respective Departmental funds	NA: UPNEDA IA: Housing and Urban development Department, Municipal Corporations & or Industrial zones/parks	NDC 3,4 SDG 1,2,7,9,11,12
3.1.4	Build awareness for adoption of appropriate Heating, Ventilation, Air Conditioning (HVAC) systems having right-size and ensuring thermal comfort with emphasis on energy efficient performance and least lifecycle costs.	Adaptation/ Mitigation	All architects & builders	IEC material prepared and run on print, TV and digital platform	Continue	3.00	UPNEDA Capacity Building Funds	NA: UPNEDA IA: Urban Development Department, Municipal Corporations & or Industrial zones/parks	NDC 3,4 SDG 1,2,7,9,11,12

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3.1.5	Enabling the use of BLDC fans in the state: (1) Mandate use of BLDC fans in government buildings and social housing programs. (2) Undertake IEC for awareness amongst public (3) Manufacture BLDC fans in UP	Mitigation	All government buildings and social housing throughout the state	-	-	1.00 (IEC)	UPNEDA Capacity Building Funds	NA: UPNEDA IA: UPNEDA, MSME	NDC 3,4 SDG 1,2,7,9,11,12
3.2	**Explore and pilot other new and innovative space cooling options for enabling thermal comfort of Uttar Pradesh's population**								
3.2.1	Assess the feasibility and pilot district cooling technologies; Explore potential for trigeneration based DCS	Mitigation	Assess feasibility of DCS and trigeneration in the State and initiate 3 pilots accordingly	Complete State wide feasibility Assessment within 2021-23.	Pilot 3 DCS in the State	1.00 (For state wide feasibility assessment)	UPNEDA research funds (Capital outlay on other scientific and environmental research)	NA: UPNEDA IA: Companies dealing in District Cooling technologies	NDC 3,4 SDG 1,2,7,9,11,12

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3.2.2	Assess, shortlist & pilot feasible thermal storage technologies available globally that prepare ice for cooling at off-peak hours.	Mitigation	Residential & commercial buildings	Residential & commercial buildings	Residential & commercial buildings	25.00	UPNEDA Demonstration Project Funds	NA: UPNEDA IA: UPNEDA	NDC 3,4 SDG 1,2,7,9,11,12
3.2.3	Enable public procurement of highest star rated energy efficient cooling appliances having low/ zero GWP refrigerants	Adaptation/ Mitigation	In line with Ministry of Finance's Financial Rules (GFR)- Office Memorandum No. 26/6/12-PPD43 regarding mandatory procurement of energy efficient electrical appliances and equipment's, issue public procurement guidelines for highest star rated energy efficient with low-GWP options for the State	Notify guidelines by end of 2021-25	Start public procurement	.....	.....	NA: UPNEDA IA: UPNEDA, Finance Dept	NDC 3,4 SDG 1,2,7,9,11,12

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3.2.4	Develop and implement Demand Side Management programmes with DISCOMS to replace inefficient and HFC cooling systems with new star rated EE appliances based on new and innovative technologies	Mitigation	DSM programs with DISCOMs, namely, PVVNL PUVVNL DVVNL MVVNL KESCO	Feasibility studies to be carried out	Implementation of DSM programs	1.00 (IEC)	UPNEDA research funds (Capital outlay on other scientific and environmental research)	NA: UPNEDA IA: DISCOMS, Companies manufacturing cooling systems	NDC 3,4 SDG 1,2,7,9,11,12
3.3	**Build capacity to adopt new generation energy efficient and new coolant based technologies for cold chains**								
3.3.1	Undertake techno-economic evaluation of energy efficient, low GWP refrigerant based new & evolving technologies that can be adopted for retrofitting and in new cold chain infrastructure and refrigerators within UP. Map suppliers.	Mitigation	Cover assessment for Pack-houses Reefer transport Cold storage Ripening chambers Cold chain vaccine management Milk chillers Commercial refrigerators HH refrigerators	Complete assessment within 2022-24	-	0.75	UPNEDA research funds (Capital outlay on other scientific and environmental research)	NA: UPNEDA IA: UPNEDA, Technical Institutes	NDC 3,4 SDG 1,2,7,9,11,12

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3.3.2	Standardize design, construction and associated specifications for small, medium and large cold-chain infrastructure components. Commission demonstration projects for cold chain elements.	Mitigation	Notify standardization: Implement pilots and showcase success	Implement pilot project to demonstrate clean and low GWP technologies for cold chain infrastructure and refrigeration	-	100.00	BEE, NHM (National Horticulture Mission), Bilateral/multilateral funding	NA: UPNEDA IA: Technical Institutes, Horticulture Dept	NDC 3,4 SDG 1,2,7,9,11,12
3.3.3	Trainings & Capacity Building: (1) cold chain operators and service technicians to ensure efficient O&M (2) farmers on better management of produce both pre-harvest and post-harvest using cold chain infrastructure	Adaptation	FPO trainings-cover all FPOs. Conduct annual trainings for each agriculture produce that is stored and supplied through cold chain infra	Cover ½ of the FPOs for each product that goes into a cold chain	Cover other ½ product that go into cold chain	14.00	BEE, NHM	NA: UPNEDA IA: Uttar Pradesh Skill Development Mission, Agriculture Dept, Horticulture Dept, Skill Development Mission	NDC 3,4 SDG 1,2,7,9,11,12

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3.3.4	Undertake extensive IEC for enabling adoption of energy-efficient, renewable energy/ alternate energy and low/zero GWP refrigerant designs in cold chains.	Adaptation/ Mitigation	Develop and disseminate IEC material	Entire State	Entire State	2.00	IEC Funds of UPNEDA, NHM	NA: UPNEDA IA: Agriculture Department, Horticulture Department	NDC 3,4 SDG 1,2,7,9,11,12
3.4	**HH & Commercial refrigeration**								
3.4.1	Facilitate market penetration of star rated energy efficient and low GWP refrigeration systems through IEC	Mitigation	Develop and disseminate IEC material	Entire State	Entire State	2.00	BEE,Star Rating Programme	NA: UPNEDA IA: UPNEDA , Civil Society Organizations	NDC 3,4 SDG 1,2,7,9,11,12

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3.4.2	Train service technicians on installation and maintenance of low GWP based refrigeration systems including effective recovery, recycling and reclamation of refrigerants	Adaptation/ Mitigation	Develop training modules covering aspects such as installation and maintenance of refrigeration plant, energy efficient operation, safe installation, management, disposal and recycling norms	Train 20 for each district	Impart updated training	4.00 (Partly sponsored and partly paid by the trainee)	UPNEDA Capacity Building Funds	NA: UPNEDA IA: UPNEDA , Skill Development Mission	NDC 3,4 SDG 1,2,7,9,11,12
3.5	**Enable adoption of energy efficient alternate coolant based (alternate to HFCs) cooling systems in transport sector in UP**								
3.5.1	Explore and shortlist feasible low GWP refrigerant based technologies and replace existing air conditioning units in public buses.	Mitigation	Replace 100% air conditioning units in state bus fleet with energy efficient units having low GWP/no GWP	Replace refrigeration units in pubic bus fleets of 10 smart cities	Cover other cities with population greater than a million	200.00	AMRUT	NA: UPNEDA IA: State bus transport Department	NDC 3,4 SDG 1,2,7,9,11,12

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3.5.2	Develop State R&D funds for hosting challenges to develop sustainable cooling solutions across sectors in line with Global Cooling Prize	Mitigation	IITs, incubate companies of IITs, Engineering colleges, Universities and private companies	Develop the fund. Create challenge 1 each year	Continue challenge	5.00 (for hosting the challenge every year)	UPNEDA research funds (Capital outlay on other scientific and environmental research)	NA: UPNEDA IA: UPNEDA, DST of Uttar Pradesh	NDC 3,4 SDG 1,2,7,9,11,12
	Strategy 4: Solarise conventional energy based private and public water pumping works								
4.1	Continue solarizing new standalone and grid connected agriculture Pumps sets	Mitigation	Target LMV5 consumers. Total number of consumers as per Tariff Order 2021-22 for UP State DISCOMs is 12,50,368.	Cover 50% of the pumps connected to all DISCOMs in UP	Rest 50% of the pumps connected to all DISCOMs in UP	-	PM KUSUM (Component B & C)	NA: UPNEDA, Power Department IA: Agriculture Department	NDC 3,4 SDG 1,2,7,9,11,12
4.2	Solarising water pumps of rural and urban water distribution systems	Mitigation	LMV 7: 20,730 consumers LMV8: 33,651 consumers and HV-4: 98 consumers; (9 municipalities have started putting in place solarised water pumping systems for their water distribution)	Target 50% of LM7, LMV8 and HV4 consumers	Target rest	-	PM KUSUM (Component B & C)	NA: Power Department IA: Jal Nigam	NDC 3,4 SDG 1,2,7,9,11,12

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Strategy 5: Set up off-grid solar power plants on waste land in rural UP thus increasing farmers income									
5.1	Setting up of 500 kW to 2 MW Renewable energy based power plants (REPP)39 and feeding into grid connection on degraded farm land	Mitigation	UP has around 3716 sq km of wasteland covering scrub land, land affected by salinity, and degraded plantation land which can be utilised for this purpose.	Create enabling environment. Identify land parcel as per farmers choice. Set up disaggregated power generation in 35 districts	In rest 40 districts	665.00	PM KUSUM	NA: Agriculture Department IA: UPNEDA	NDC 3,4 SDG 1,2,7,9,11,12

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6	**Strategy 6: Enable significant transition to EVs in cities by 2030**								
6.1	a. Assess annual growth rates that should occur (2W, 3W, 4W, buses) to register 100% presence of EVs on city roads by 2030 b. Assess average trip length per day c. Assess electricity demand d. Map EV charging locations at Commercial spaces, Institutional areas, Along colony roads , Along state roads within petrol pumps or next to bus stops , Along highways within the State , 100% presence of EVs on city roads by 2030	Mitigation	All AMRUT cities (including SMART cities)			0.50	UPNEDA Funds	NA: UPNEDA IA: Invest-UP, DISCOMS	NDC 3,4 SDG 1,2,7,9,11,12

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	e. Assess charging capacity requirements and the number and location of Fast and Slow charging stations to match requirement across battery capacity of different vehicle types f. Assess number of charging stations that will be directly connected to grid or to stand alone solar power generation units on highways g. Assess fund requirement and develop PDD for the same should occur (2W, 3W, 4W, buses) to register								
6.2	Set up solar based EV charging network	Mitigation	10 top cities with highest population in UP	5 top most populous cities	Rest of the 10 most populous cities of UP	Large stations: 73.52; Small neighbourhood station: 50.00	FAME in PPP mode	NA: Infrastructure and Industrial Development,Invest UP IA: Invest-UP	NDC 3,4 SDG 1,2,7,9,11,12

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6.3	Replace all city buses with E-Buses	Mitigation	All 12400 of its fleet	1000 buses	1000 buses	1571.0045	FAME in PPP mode	NA: Urban Development Department IA: Transport department	NDC 3,4 SDG 1,2,7,9,11,12

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	Strategy 1: Mainstreaming Climate Resilience and Pollution Mitigation actions into Urban Governance								
1.1	Preparation of a comprehensive city climate action plans for the urban areas in U.P. • Undertake urban climate risk assessment and identify extent of vulnerability for each urban centre above 50,000 pop. (Medium, Large, Metropolitan, and Megapolis cities) • GHG Emission Inventory • Ensure preparation Heat Response Action Plan for all cities/ towns [similar to Gorakhpur] • Conservation of existing city forests and devise a policy to create zone wise city forests • Ensure preparation of city water budget plans, including water scarcity and drought contingency plans, flood management plans, Conserve and rejuvenate urban wetlands and other waterbodies (incl. traditional) of all sizes. • Prepare and ensure implementation of Air and Noise Pollution Action plans (micro plans) for all cities	Adaptation/ Mitigation	All cities in UP with more than a 100,000 population; there are 50 cities in total[28]	Comprehensive action plan for 20 cities	Rest of the 30 cities	22.00 – 30.00	AMRUT2.0/ Donor Agencies/ UPPCB Funds	NA: Urban Development Department IA: Urban Development, UPPCB,	NDC 06 SDG 11,13

[28] Lucknow, Kanpur, Ghaziabad, Agra, Varanasi, Meerut, Faridabad, Prayagraj, Bareilly, Moradabad, Aligarh, Saharanpur, Gorakhpur, Noida, Firozabad, Loni, Jhansi, Muzzafarnagar, Mathura, Shahajahnpur, Maunath Bhanjan, Farrukhabad & Fatehpur, Hapur, Etawah, Mirzapur, Buladshahar, Sambhal, Amroha, Fatehpura, Khora, Orai, Bahariach, Jaunpur, Unnao, Badaun, Banda, Lakhimpur, Haathras, Laalitpur, Modinagar, Pilibhit, Manipuri, Etah, Basti, Chandausi, Gonda, Khurja, Azamgarh, Ghazipur, Mugalsarai, Kanpur cantonment, Sultanpur, Shamli, Ballia, Baraut, Greater Noida, Kasganj

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	• Scale up Installation of Continuous Ambient Air Quality Monitoring stations (CAAQMS), particularly across smaller cities and towns in the state • Upgrade manual units for air quality monitoring to automatic monitoring units • Assess area under crop residue burning in peri-urban areas in U.P., develop a scheme to spray bio-decomposer to avoid air pollution and conduct wide-scale awareness for farmers to apply the spray post harvesting. • Develop and implement action plan for mitigating noise pollution in cities (tackle honking, create vegetation buffers/barriers along roads etc.)								
	Strategy 2: Building Climate resilient housing infrastructure								
2.1	Mapping and identify low lying housing societies in all floods (urban and river) prone cities such as Moradabad, Prayagraj, Varanasi, Kanour, Agra, Gorakhpur, Ayodhya, Ghazipur	Adaptation	Urban Level Spatial Maps to be prepared by 2025	Mapping of detailed city wise flood prone housing risks by 2025	---	0.8 - 1.5 Cr (@10-20 lakhs per city)	AMRUT 2.0 / UIDSSMT/ Progressive Development of Ayodhya/ CSS Untied funds	NA: Urban Development Dept. IA: Awas Bandhu	NDC 06 SDG 11,13

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	Research, Policy and Departmental Convergence Actions								
2.2	Develop a policy to ensure retrofitting of existing building which are flood resilient (into urban housing schemes)	Adaptation	All Cities and Towns of Uttar Pradesh	Class 1, and Class 2 urban settlements	Class 3 to 6 urban settlements	0.50 – 1.00 (monitoring and evaluation fund)	RAY/ PMAY-U/ Asra Awas Yojana/ Departmental Budgets for policy formulation and monitoring	NA: Housing Department IA: Urban Development Department	NDC 06 SDG 9,11,13
2.3	Ensure adherence to green building norms by Institutional and commercial buildings	Mitigation							
2.4	Ensure implementation of IEC 62305 BIS norms for lightning proof skyscrapers/tall buildings	Adaptation/ Mitigation							
2.5	Ensure implementation of rain water harvesting construction norms at housing societies, and institutional building (are more than 300 sq.m).	Adaptation							
	Strategy 3: Developing Climate Resilient Urban Water infrastructure and Storm water drainage								
	Research, Policy and Departmental Convergence Actions								
3.1	Identify critical water supply facilities (treatment plants, supply lines) whose services can be potentially interrupted during extreme weather events (floods)	Adaptation	Flood Prone Cities above 5lakhs Policy	50 %	Rest 50%	2.50 -3.00 (@30 lakhs per city/M. Corp)	AMRUT 2.0/ Smart City Mission/ UIDSSMT	NA: Urban Development Dept. IA: SDMA, Jal Nigam	NDC 2,6 SDG 6,9,11,13

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3.2	Ensure consideration of climate change and rainfall variability in design of new water supply facilities in flood prone areas	Adaptation		-	-	-	-	NA: Urban Development Dept. IA: Urban Development Dept., Public Works Dept., SDMA, Jal Nigam, ULBs	NDC 2,6 SDG 6,9,11,13
	Implementation Action								
3.3	Retrofit the vulnerable water supply facilities	Adaptation/ Mitigation	All cities and towns of all classes	50%	Rest 50%	500.00 – 750.00 (@0.5-1 Cr per ULB for critical locations only)	AMRUT 2.0/ Smart City Mission/ UIDSSMT/ Urban Drinking water scheme	NA: Urban Development Dept. IA: Public Works Dept.,, Jal Nigam	NDC 2,6 SDG 6,9,11,13
3.4	Retrofit old and build new separate storm water drainages to accommodate draining of the enhanced volume of water in projected extreme rainfall events scenarios	Adaptation/ Mitigation	All cities and towns of all classes	50%	Rest 50%	500.00 – 1000.00 (@0.5-1 Cr per ULB for critical locations only)	AMRUT 2.0 | Smart City Mission | UIDSSMT| Adarsh Nagar Vikas/panchayat Yojana |	NA: Urban Development Dept. IA: Public Works Dept., Jal Nigam	NDC 2,6 SDG 6,9,11,13

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	Strategy 4: Developing Climate resilient waste management infrastructure								
4.1	Management of solid waste Setting up of Waste processing facilities Creating value chains for waste recycling and reuse (Waste to energy and any other) Setting up of sanitary landfill Supporting entrepreneurs for city waste collection and reuse Bioremediation/capping of old landfills (legacy waste)	Mitigation	Total MSW facilities gap = 8750 TPD	100% of gap to be met by 2025	-	500.00 – 1000.00	SBM	NA: Urban Development Department, IA: Directorate of Local Bodies, UPPCB, ULBs	NDC 2,6,7 SDG 6,11,12,13
4.2	Ensure Management of construction and demolition waste [NOIDA, Ghaziabad, Lucknow, Agra, Varanasi, Kanpur, Prayagraj has C&D processing plants in place]	Mitigation	New Construction of C&D processing plants at Meerut, Bareilly, Aligarh, Moradabad, Saharanpur, Gorakhpur, Jhansi	Commissioning of existing under construction plants by 2022, new construction in Meerut, Bareilly and Aligarh	Moradabad, Saharanpur, Gorakhpur, Jhansi	10.50 -15.00 (approx. 1.5 crore per city estimate assumption)	SBM/ UPPCB Fund	NA: Urban Development Department IA: Urban Development Department, UPPCB, ULBs	NDC 2,6,7 SDG 6,11,12,13

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4.3	Ensure E-waste, Hazardous and Plastic Waste management and reuse protocols	Mitigation	All cities and Towns	50% towns	Rest of towns and cities	0.5	UPPCB	NA and IA: UPPCB and Urban Dept.	NDC 2,6,7 SDG 6,11,12,13
4.4	Policy formulation for in-situ waste water treatment, recycling, and re-use generated at neighborhood level including (cluster of housing societies, commercial complexes and institutional buildings) producing at least 0.5 MLD of wastewater for economic viability and ensure implementation in cities with pop. above 5 lakhs	Adaptation/ Mitigation	[As on 2021, Total wastewater treatment capacity gap is 659 MLD]60	25% of treatment gap reached at local level	25 % of treatment gap reached at level and rest at macro or city level	1500.00 – 2000.00	JJM-U/ Smart City Mission/ SBM	NA: Urban Development Dept, UPPCB IA: Urban Development Dept, UPPCB	NDC 2,6,7 SDG 6,11,12,13
4.5	Encourage preparation of Fecal Sludge and Septage Management Plans in towns which have population below 5 lakhs.	Mitigation	Towns below 5 lakh population	60% of towns	40% of towns	5.00 – 10.00	JJM-U/ Smart City Mission/ SBM	NA: Urban Dept. IA: SMCG-UP, Urban Dept., UPPCB	NDC 2,6,7 SDG 6,11,12,13
	Strategy 5: Building Climate Resilient Road Infrastructure and low Carbon mobility options								
5.1	Identify and map critical road infrastructure susceptible to extreme weather events (such as floods, extreme heating and cooling) • Design and implement norms for constructing heat, cold and flood resilient green roads in respective identified areas	Adaptation	All cities and towns above 1 lakh pop.	50% of cities above 1 lakh pop.	Rest 50% of cities	10.00 -15.00	AMRUT	NA: Urban Development Dept. IA: Public Works Dept., SDMA, ULBs	NDC 2,3,6 SDG 7,9,11,13

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5.2	Develop comprehensive mobility plans that integrates GHG mitigation actions in all Saharanpur, Moradabad, Bareilly, Lucknow, Kanpur, Prayagraj, Varanasi, Jhansi, Agra, Aligarh, Meerut, Ghaziabad, Ayodhya, Firozabad, Mathura, Vrindavan and Shahjahanpur • Enhanced coverage of pedestrian walkability and cycling tracks across the cities • Smart Traffic Management Systems to ease congestion, smoothen traffic flow • Enhance infrastructure to promote non-motorized transport modes such as bicycles and rickshaws • Study the current share of different transportation modes and design required modal shifts to enable reduction in traffic congestion	Adaptation/ Mitigation	All 17 smart cities	All 17 cities CMP by 2025	-	4.00 – 5.00 (@25 to 30 lakhs per city)	UDD Capital Outlay/ AMRUT	NA: Urban Development Dept. (urban Transport) IA: Public Works Dept., UPPCB, Urban Dept., ULBs, Transport Dept., Metro Rail Corporation	NDC 2,3,6 SDG 7,9,11,13

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Table 85: Proposed Strategies for Sustainable Habitat Mission

S, No.	Actions	Type of Actions	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
5.2	• Study Sustainable mass rapid transit and public transport to shift from private transport modes options o Promote Bus Rapid Transit (BRTS) based on feasible pphpd routes. o Increase routes, frequency and night services; Increase the number of bus stops; priority lanes; o Promote fuel-efficient bus driving and reduce idling; provide more bus shelters; bus priority at traffic lights o Plan metro rail development for Saharanpur, Moradabad, Bareilly, Aligarh, Ayodhya, Firozabad, Mathura, Vrindavan and Shahjahanpur as well based feasibility.								
5.3	Implement the policy of vehicle scrapping for phasing out of old vehicles as per national policy	Mitigation	All cities					NA: Transport Dept. IA: UPPCB, Urban Transport Directorate	NDC 2,3,6 SDG 7,9,11,13

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5.4	Implement EV policy roadmap in large and metropolitan cities and • Create setting up for adequate EV charging stations aligned with EV growth • Procurement of EV public buses under UPSRTC (700 buses) • Provide fiscal incentives to general public for buying EVs • Modification Building Bye Laws to incorporate EV charging infrastructure norms as per MoHUA Amendment to model bye laws 2019	Mitigation	All major cities above 5 lakh population	60% of public bus fleet to be EV by 2025	Rest by 2027	900.00 – 1000.00	FAME II / AMRUT 2.0 / Smart Cities Mission/ UIDSSMT	NA: Transport Dept. IA: UPPCB, Urban Transport Directorate	NDC 2,3,6 SDG 7,9,11,13
5.5	Ensure plantation and maintenance of tree line along city roads	Mitigation	All city roads	40% of urban arterial Roads across cities	Rest of 60%	20.00 -30.00	Social Forestry in Urban Areas/ Smart Cities/AMRUT	NA: Urban Dept IA: Public Works Dept., Environment, Forest and Climate Change Dept., ULBs	NDC 2,3,6 SDG 7,9,11,13

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	RURAL HABITAT SECTOR								
	Strategy 1: Mainstreaming climate change in rural planning								
	Awareness, Outreach and Capacity Building								
1.1	Large awareness and training of PRIs representatives and the targeted beneficiaries at block level on climate impacts on rural areas and resilience practices	Adaptation	5000 – 10000 trainees per year	40 % of the blocks (specifically focusing on Bundelkhand Districts)	100 % of all block in the state	10.00-20.00	Rashtrya Gram Swaraj Yojna	NA: Panchayati Raj Department (PRD) IA: Panchayati Raj Department (PRD)	NDC 06 SDG 6,11,13
	Research, Policy and Departmental Convergence Actions								
1.2	Policy to mandate the inclusion of climate change vulnerability assessment in GPDPs	Adaptation/ Mitigation	All GPs	--			Mission Antyodaya/ RGSA/Adarsh Gram Yojana	NA : PRD IA: Rural Development Dept. , PRD	NDC 06 SDG 6,11,13
1.3	Promote incentivization of gram panchayats for showcasing climate resilient best practices (e.g. provide 10% additional funds to annual budget)	Adaptation	All GPs					NA: PRD IA: PRD	NDC 06 SDG 6,11,13

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1.4	Scale-up Rurban Mission Activities across the state [15 -16 new clusters]	Adaptation/ Mitigation	As per state dept. targets	Identification by 2022, ICAP preparation 2023	Implementation of all new cluster by 2026	Approx.. 90 - 100 Cr CGF or as per Rurban ICAP estimates	Rurban Mission (as per central and state share)	NA: Rural Development Dept. IA: Rural Development Dept.	NDC 06 SDG 6,11,13
1.5	Ensure strict adherence to no development policy in ecologically sensitive areas (river flood plains, waterbodies, forests areas etc.) • Illegal construction demolitions • No development awareness drives	Adaptation/ Mitigation	All villages	100% of villages by 2023	--	0.50-1.00	Rashtrya Gram Swaraj Yojna Community Development funds	NA: Rural Development Dept.. IA: Rural Development Dept, PRD	NDC 06 SDG 6,11,13
	Strategy 2: Building Climate resilient rural housing								
	Awareness, Outreach and Capacity Building								
2.1	Promote awareness on climate resilient and green building designs under PMAY Training of trainers and specially mistries i.e., construction masons)	Adaptation/ Mitigation	Target groups (masons, construction builders etc.)	50 % of blocks	Rest 50 % of Blocks	5.00 - 8.00	PMAY/ RGSA	NA: PRD, Rural Development Dept., IA: Rural Development Dept., UPNEDA. PRD, Skill Development Mission	NDC 06 SDG 11,13

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	Research, Policy and Departmental Convergence Actions								
2.2	Flood Resilient housing policy • Identification, Demarcate and notify flood and/or landslide prone areas in each village panchayat and map the land use plan • Ensure no construction in the notified flood prone areas (including on dariya land) • Ensure flood resilient building norms/bye laws are enforced in existing and future buildings	Adaptation	Policy at All GPs	--				NA: : PRD IA: PRD, Rural Development Dept., Directorate of Environment., Housing Department.	NDC 06 SDG 11,13
	Strategy 3: Developing climate adaptation integrated approach to rural skills development and diversification of livelihood Opportunities								
	Awareness, Outreach and Capacity Building								
3.1	Generate awareness among target groups about the benefit of skill development, employment and learning opportunities for alternate livelihoods (Farming+MGNREGA) • Promote employment under MGNREGA to all unemployed person in villages • Strengthen alternate livelihoods to vulnerable sections such as SC/ST • Provide individual assets for livelihood generation • Promoting gender equality by providing more women off season wage employment • Formation of New SHGs	Adaptation	Target groups (such as SC/ST in all villages, unemployed youth and Women)	50 % of blocks	Rest 50 % of Blocks	0.5 - 1	MGNREGA/ NRLM/RESTI/ Rurban Mission/ SJGSY/ Women Empowerment	NA : Rural Development Department IA: Rural Development Department// Skill Development Mission	NDC 06 SDG 4,8,11

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	Research, Policy and Departmental Convergence Actions								
3.2	Livelihood and rural labor capacity needs assessment: • Identify inherent skills of local community to strengthen alternate skill development opportunities • Mapping of Skills of Migratory Labour	Adaptation	All districts (with rural population share above 50%)	Assessment by 2023		0.20 -0.50	MGNREGA NRLM	NA: Rural Development Dept. IA: Labour Department/Rural Development Dept/UPSDM	NDC 06 SDG 4,8,11
3.3	Strengthen coordination and collaboration with the private sector in skills development both to increase the relevance of training, an to improve and facilitate its delivery	Adaptation	Policy	-	-	-	-	NA: Rural Development Dept. IA: Labour Department, UP Skill Development Mission	NDC 06 SDG 4,8,11
3.4	Ensure promotion of micro credit facility for promoting alternate livelihood opportunities	Adaptation	-	-	-	-	-	NA: Rural Development Dept. IA: MSME, RDD, Institutional Finance	NDC 06 SDG 4,8,11

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	Implementation Actions								
3.5	Set up skill development centers at village and block level to provide skill development opportunities to local communities as well as to act as one-stop kiosks with information on the local labor market/ employment, vocational learning opportunities and support schemes	Adaptation	All blocks	50 % Blocks	Rest 50 % Blocks	30.00 – 50.00	SJGSY	NA Rural Development Dept. IA: Labour Department/ Rural Development Dept/UP Skill Development Mission	NDC 06 SDG 4,8,11
	Strategy 4: Building climate resilient road and climate smart waste infrastructure								
	Research, Policy and Departmental Convergence Actions								
4.1	Strengthening Climate Resilience into PMGSY • Technical assistance to understand climate change impacts at micro level for road construction and planning. • Special treatment for flood-affected areas through adequate waterways and submersible roads to allow easy passage of water, use of concrete block pavements, and improved drainage;	Adaptation/ Mitigation	Research reports/ study plans/policy/ guidelines/G.O	-	-	-	-	NA : Rural Development Department IA: PWD, Rural Development Department, Uttar Pradesh Rural Road Development Agency	NDC 06 SDG 6,9,11,13

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	• Use of environmentally optimized road designs and new technologies which uses local and marginal materials and industrial by-products such as sand, local soils, fly ash, brick kiln wastes, and other similar materials in place of crushed rocks; • Innovative bridges and culverts through use of pre-fabricated/ pre-cast units for roads and bridges having better ability to withstand earthquakes and water forces such as continuous beams, bearing free construction, and river training works;								
	Implementation Actions								
4.2	Develop all weather roads access to all remaining villagesS (if any habitation remain)	Adaptation	All villages	Based on habitations remained			PMGSY	NA: Rural Development Dept. IA: PWD, Rural Development Dept.	NDC 06 SDG 6,9,11,13

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4.3	Gram panchayat level waste management programmes • GP level Solid Waste Management (SWM) • GP level Liquid Waste Management (LWM) o Construction of Community Soak Pits o Construction of drainage Channels, institutional soak pits • Community Managed Sanitary Complex (CMSC) to be constructed • Construction of Functional Community Toilets/Alternate low cost toilets	Mitigation	All GPs	All GPs to be covered by 2026	3000 - 3500 (@SWM -6 Lakh per GP; LWM-2.8 Lakh per Village; 8 Lakh per Community Toilet)		JJM//SBM(G	NA: Rural Development Dept. IA: Rural Development Department, Swatchh Bharat Mission (Rural)	NDC 06 SDG 6,9,11,13

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S. No.	Actions	Nature of Actions	Type of Actions	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
	Strategy 1: Assess extent of spatial spread of health risks due to current and future climate change (temperature, precipitation, humidity, air quality amongst others) in the state at highest possible resolution to facilitate location specific adaptation action.								
1.1	Vector borne diseases Dengue Malaria Chikungunya Scrub Typhus Japanese Encephalitis Kala-azar	Research	Adaptation	Complete assessment within 2 years	Repeat every 5 years	6.00	Vector Borne Disease Control Programme Pradhan Mantri Atmanirbhar Swasth Bharat Yojana scheme 04- Divisional Health and Family Welfare Training Center 03- National Digital health Mission ; Pradhan Mantri Swasthya Suraksha Yojana (PMSSY) Implementation of schemes under National Rural Health Mission	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare	NDC 06 SDG 3,13

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1.2	Water borne disease Diarrhoea (Cholera), Typhoid Hepatitis A and Food poisoning	Research	Adaptation	Complete assessment within 2 years	Repeat every 5 years	4.00	Pradhan Mantri Atmanirbhar Swasth Bharat Yojana scheme Divisional Health and Family Welfare Training Center National Digital health Mission ; Pradhan Mantri Swasthya Suraksha Yojana (PMSSY) Implementation of schemes under National Rural Health Mission External Research Mobilisation and Development Partnership--> National Institute of Environmental Health Sciences, Center for Climate Change and Human Health Research	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare	NDC 06 SDG 3,13

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1.3	Respiratory diseases Seasonal Influenza, COPD, Asthma, Rhinitis Sinusitis	Research	Adaptation	Complete assessment within 2 years	Repeat every 5 years	5.00	Pradhan Mantri Atmanirbhar Swasth Bharat Yojana scheme Divisional Health and Family Welfare Training Center National Digital health Mission ; Pradhan Mantri Swasthya Suraksha Yojana (PMSSY) Implementation of schemes under National Rural Health Mission	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare	NDC 06 SDG 3,13

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1.4	Malnutrition and anaemia	Research	Adaptation	Complete assessment within 2 years	Repeat every 5 years	2.00	Pradhan Mantri Matru Vandana Yojana Pradhan Mantri Atmanirbhar Swasth Bharat Yojana scheme Divisional Health and Family Welfare Training Center National Digital health Mission ; Pradhan Mantri Swasthya Suraksha Yojana (PMSSY) Implementation of schemes under National Rural Health Mission	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare	NDC 06 SDG 3,13

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1.5	Heat stress	Research	Adaptation	Complete assessment within 2 years	Repeat every 5 years	1.00	Pradhan Mantri Atmanirbhar Swasth Bharat Yojana scheme Divisional Health and Family Welfare Training Center National Digital health Mission ; Pradhan Mantri Swasthya Suraksha Yojana (PMSSY) Implementation of schemes under National Rural Health Mission	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare	NDC 06 SDG 3,13

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	Strategy 2 : Develop Early Warning and Alert Response System (EWARS) for predicting disease outbreaks								
2.1	To enable easy access for researchers develop data retrieval system which allows real-time capture of disease incidence data and other required data from existing data collection platforms of the state	Policy	Adaptation	Map data sources, sign MoUs for data retrieval if necessary and develop retrieval system within one year	---	2.00	National Digital health Mission Implementation of schemes under National Rural Health Mission	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare, Technical Institutes and universities	NDC 06 SDG 3,13

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2.2	Undertake real-time analysis and spatial visualization to assess temporal progress of the causal agent and disease spread • All vector borne diseases • Water borne diseases • Respiratory diseases • Malnutrition and anaemia • Heat stress	Research	Aadaptation	Complete within 2 years	----	10.00	National Digital health Mission Vector Borne Disease Control Programme Pradhan Mantri Atmanirbhar Swasth Bharat Yojana scheme Divisional Health and Family Welfare Training Center Allocations to Institute of Virology and Infectious Diseases Pradhan Mantri Swasthya Suraksha Yojana (PMSSY) Implementation of schemes under National Rural	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare, Technical Institutes and universities	NDC 06 SDG 3,13

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2.3	Develop standardized short, medium and long term forecasting for all priority climate linked diseases through organization of challenges. The forecasts should realistically indicate location of occurrence, location specific timing of peak incidences, maximum weekly incidences, total number of cases in a transmission season, maximum hospitalization requirements							NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare	NDC 06 SDG 3,13

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2.3.1	Challenge name: Vector borne disease challenges	Research	Adaptation	5 challenges, one each annually for all 6 vectors separately. Repeat every year for next 4 years to achieve standardization..		12.00	0502- Institute of Virology and Infectious Diseases Pradhan Mantri Swasthya Suraksha Yojana (PMSSY)	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare	NDC 06 SDG 3,13
2.3.2	Challenge name: Water borne diseases	Research	Adaptation	4 separate challenges for each water borne disease indicated in strategy 1. Repeat every year for next 4 years to achieve standardization.		8.00	Pradhan Mantri Swasthya Suraksha Yojana (PMSSY)		

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2.3.3	Challenge name: Respiratory diseases	Research	Adaptation	5 separate challenges for each respiratory disease indicated in strategy 1. Repeat every year for 4 years to achie standardization..		10.00	Pradhan Mantri Swasthya Suraksha Yojana (PMSSY)	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare	NDC 06 SDG 3,13
2.3.4	Challenge name: Malnutrition and anaemia	Research	Adaptation	1 challenge. Repeat every year for next 4 years to achieve standardization.		2.00	Pradhan Mantri Swasthya Suraksha Yojana (PMSSY)		
2.3.5	Challenge name: Heat stress	Research	Adaptation	1 challenge. Repeat every year for next 4 years to achieve standardization		2.00	Pradhan Mantri Swasthya Suraksha Yojana (PMSSY)		

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2.4	Establish institutional mechanisms for enabling forecasts to reach to decision makers and all players involved in health service delivery at district/block/gram panchayat level in the state to enable preparedness	Policy	Adaptation	Map the institutional mechanism and pilot forecast delivery in the 3rd year onwards (web platform/mobile app/sms)	Continue forecasting	10.00	Implementation of schemes under National Rural Health Mission	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare	NDC 06 SDG 3,13
	Strategy 3: Enable behavioural change in public to avoid climate linked disease epidemics								
3.1	Regular exposure workshop for children from nursery to std 12, to ensure behavioral change towards adopting good practices to prevent climate linked diseases;	Capacity Building	Adaptation					NA: Dept. of Health and Family Welfare IA: Dept. of Basic education, Dept. of Secondary Education, NGOs working on nutrition and health	NDC 06 SDG 3,13

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3.2	Develop and implement school curriculum that children need to pass at +2 level compulsorily to enable internalization of benefits of balanced diet intake, exercising, personal hygiene, community hygiene, etc. to avoid Vector borne diseases Water borne diseases Respiratory diseases Malnutrition and anemia Heat stress	Policy	Adaptation	Create curriculum within 1st year Train teaching methods to teachers in the same year Start teaching curriculum in the 2nd year Take examination in the 2nd and 3rd year onwards	Update curriculum as necessary and continue teaching	5.00	Implementation of schemes under National Rural Health Mission Research and development in the colleges / universities of the state Samagra Shiksha Abhiyaan	NA: Dept. of Secondary Education IA: Dept. of Health and Family Welfare ,Dept. of Secondary Education,	NDC 06 SDG 3,13

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3.3	Develop and implement a curriculum on climate and health friendly behavior for children in school attending nursery to class 5.	Policy	Adaptation	Create curriculum within 1st year Train teaching methods to teachers in the same year Start teaching curriculum in the 2nd year Take examination in 2nd and 3rd year onwards	Update curriculum as necessary and continue teaching	5.00	Implementation of schemes under National Rural Health Mission Allocations to Government Primary School B. Special. aid to council schools Allocations to Primary and Upper Primary Schools in Vintingaya Villages Samagra Shiksha Abhiyaan	NA: Dept. of Basic Education, IA: Dept. of Basic education, Dept. of Health and Family Welfare	NDC 06 SDG 3,13
3.4	Design a communication plan and targeted training modules wherever necessary with clear objectives of enabling internalization of behaviors best suitable to combat climate change impacts	Capacity Building	Adaptation						

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3.4.1	MLAs: Communicate vulnerability assessment of their local area for them to influence policy on CC and health adaptation	Capacity Building	Adaptation	Annual communication	Annual communication	8.00	Total_Allocations under Urban Health Services- Hospitals and discpensaries	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare	NDC 06 SDG 3,13
3.4.2	ASHA/ANM/AWW: Training modules, imparted by master trainers	Capacity Building	Adaptation	Annual communication	Annual communication	10.00	Pradhan Mantri Matru Vandana Yojana Rural Family Welfare Centers located at Primary Health Center Rural Sub Centers (Opened under Family Welfare) Training of assistant health nurses, rural midwives and health nurses Implementation of schemes under National Rural Health Mission Total_Allocations for medical education- Training and Research (Allopathy) National Ayush Mission (Allocations for medical education- training and research (Ayurvedic))	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare , Gram Panchayats	NDC 06 SDG 3,13

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3.4.3	Women SHGs: Training modules to be imparted by master trainers	Capacity Building	Adaptation	Annual communication	Annual communication	10.00	Pradhan Mantri Matru Vandana Yojana Rural Family Welfare Centers located at Primary Health Center Rural Sub Centers (Opened under Family Welfare) Training of assistant health nurses, rural midwives and health nurses Implementation of schemes under National Rural Health Mission Total_Allocations for medical education- Training and Research (Allopathy) National Ayush Mission (Allocations for medical education- training and research (Ayurvedic))	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare, Gram Panchayats	NDC 06 SDG 3,13

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3.4.4	Rural and Urban water and sanitation Utilities: Annual Communication of reports on vulnerability assessments	Capacity Building	Adaptation	Annual communication at the start of their annual plan preparation	Annual communication at the start of their annual plan preparation	50.00	Total_Allocations under Urban Health Services- Hospitals and discpensaries Rural Family Welfare Centers located at Primary Health Center Rural Sub Centers (Opened under Family Welfare) Implementation of schemes under National Rural Health Mission	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare Facilitated by:, ULBs, Gram Panchayats	NDC 06 SDG 3,13
3.4.5	Panchayats: Communicate impacts of CC on human health for them to integrate adaptation action in their planning	Capacity Building	Adaptation	Start of GPDP cycles	Start of GPDP cycles	10.00	Rural Family Welfare Centers located at Primary Health Center Rural Sub Centers (Opened under Family Welfare) Training of assistant health nurses, rural midwives and health nurses Implementation of schemes under National Rural Health Mission	NA: Dept. of Health and Family Welfare IA: Dept. of Health and Family Welfare Dept. of Rural Development , Gram Panchayats	NDC 06 SDG 3,13

G Detailed List of Proposed Strategies for Human Health Mission

Table 87: Proposed Strategies for Human Health Mission

S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
	Strategy 4: Transform all health Infrastructure (buildings)into green infrastructure									
4.1	Ensure installation of energy efficient lighting systems	Implementation	Mitigation	Upgrade all Infrastructure	50 % of infrastructure in first phase	50 % of infrastructure in second phase	-	NHM Funds, PWD Funds, ULD, Panchayat and PWD Funds	NA: Department of Health IA: UPNEDA, PWD. Gram Panchayats, ULBs	NDC 06 SDG 13
4.2	Introduce solar roof top systems									
4.3	Procure only CFC free cooling systems									
4.4	Undertake rainwater harvesting									
4.5	Undertake regularly green building auditing All actions be undertaken as per Indian Public Health Standards (IPHS, 2022).									

G Detailed List of Proposed Strategies for Human Health Mission

Table 86: Proposed Strategies for Human Health Mission

S. No.	Actions	Nature of Actions	Type of Action	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
Strategy 5: Design and construct disaster resilient new health infrastructure and retrofit existing ones to withstand the extreme climate events such as floods, extreme heat and cold.									
5.1	Identify the climate hot spot districts and the vulnerable infrastructure	Implementation	Adaptation	Upgrading all infrastructure	50 % of infrastructure in first phase	50 % of infrastructure in next phase	NHM Funds, PWD Funds, ULD, Panchayat and PWD Funds	NA: Department of Health IA: UPNEDA, PWD. Gram Panchayats, ULBs	NDC 03 and 04 | SDG 3,13
5.2	Undertake retrofitting for protection from extreme heat, and extreme floods								
5.3	Ensure water availability during droughts by linking rainwater harvested systems and other sources								

H Detailed List of Proposed Strategies for Disaster Management Mission

Table 87: Proposed Strategies for Disaster Management Mission

S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
	Strategy 1: Enhancing capacities for building institutional resilience towards climate change induced extreme and slow onset disasters									
1.1	Develop a dynamic climate hazard mapping system for dissemination and for informed decision making for risk management across sectors. To account for hazards such as; - Hydromet hazards (Flood, Drought, Thunderstorm, coldwave , heatwave) - Slow onset disasters (dissertfication, epidemic diseases)	Research	Adaptation	Track on a real-time basis all hydro meteorological hazards using IMD info with locations and extent specified, and thereby develop hazard specific dynamic maps .Also, track hazards using the existing a citizen reporting mechanism. Merge all the layers for visualizing hazard location and extent of loss and damages. Also add information on loss profile , DALYs, livestock lost , crop loss, infrastructure damaged such as buildings , roads bridges etc.	Merge the two systems for visualizing hazard location and extent .Develop mechanisms to delete double counting	Continue tracking	10.00	State Disaster Response Fund	NA: UPSDMA IA: UPSDMA, Office of Relief Commissioner	NDC 06 SDG 13

H Detailed List of Proposed Strategies for Disaster Management Mission

Table 87: Proposed Strategies for Disaster Management Mission

S. No.	Actions	Nature of Action	Type of Actions	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
1.2	Increase the density of hydro meteorological observation platforms such as Doppler Radars as per the suggestion of NIDM(2021) to capture the changes in frequency and intensity of various climatic disasters at micro-watershed level.	Implementation	Adaptation	Install 3 additional S-band Doppler radars	Install all three S-band Doppler Radars		50.00		NA:IMD, Office of Relief Commissioner, UP SDMA IA: IMD, UP SDMA, Office of Relief Commissioner	NDC 06 SDG 13
1.3	Access transboundary and trans-state advance warning and real-time tracking of rainfall and river flow data	Policy	Adaptation	Set up MoUs with upstream states, river management agencies, CWC, NRSC and other stakeholders to access real-time data on rainfall and river flow Integrate warning within the exiting early warning system for floods set up by UP in place	Set up committee to develop protocol for data access from upstream states within 2022.By 2023, start generating real-time warnings for the State for each river/stream flowing into UP	Continue to generate warning	10.00	State Disaster Response Fund	NA: UP SDMA IA: Irrigation and Water Resources Department, UP Flood Management Information Centre	NDC 06 SDG 13

H Detailed List of Proposed Strategies for Disaster Management Mission

Table 87: Proposed Strategies for Disaster Management Mission

S. No.	Actions	Nature of Action	Type of Actions	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
1.4	Assess economic and non-economic loss and damages (income losses and physical damages), including irreversible loss and damages, due to changing climate risk hazards and slow onset events across sectors; - Economic loss: Business operations, Agriculture production, Tourism; Physical damages: property, infrastructure, business value chains etc. -Non economic loss to individuals, society and environment (health, human mobility, cultural heritage, indigenous knowledge, societal/cultural identity, biodiversity, ecosystem services)	Research	Adaptation	Establish methodologies for assessing annual loss and damages based on the hazards reported. Publish annually the loss and damages incurred due to hazards; - Economic Loss - Non economic Loss	Develop methodologies by 2023 in line with the guidance provided by the UNFCCC on the same and set up timelines for update. 2023: First annual publication of economic and non-economic loss and damages	Update periodically methodologies as per the evolving guidelines. Continue publication of economic and non-economic loss and damages	14.00	State Disaster Response Fund	NA: Office of Relief Commissioner IA: Office of Relief Commissioner	NDC 06 SDG 13

H Detailed List of Proposed Strategies for Disaster Management Mission

Table 87: Proposed Strategies for Disaster Management Mission

S. No.	Actions	Nature of Action	Type of Actions	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
1.5	Assess department-wise the extent of economic and non-economic risks and vulnerabilities due to changing trends and future projections of hydrometeorological hazards and slow onset events originating within and outside the state boundaries			Extent of risk to accessed across sectors at all levels of jurisdictions including at community level	Access high resolution trends of climate hazards and slow onset events.Map sector-wise the assets at risk, at a Block level .Access high resolution climate projections for UP at short, medium and long-term time scales. Undertake stakeholder consultations to access current climate risk .Undertake modelling to access future climate risk .Complete risk assessment by 2023	Update risk assessment	100.00		NA: Office of Relief Commissioner IA: Office of Relief Commissioner	NDC 06 SDG 13

H Detailed List of Proposed Strategies for Disaster Management Mission

Table 87: Proposed Strategies for Disaster Management Mission

S. No.	Actions	Nature of Action	Type of Actions	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
1.6	Assess sector-wise the extent of economic and non-economic loss and damage due to changing trends and future projections of hydrometeorological hazards and slow onset events originating within and outside the state boundaries	Research	Adaptation	Extent of climate induced loss and damage assesed across sectors at all levels of jurisdictions including at community level	(1) Prepare handbook for assessing sector-wise loss and damage in the state. This will include formulation of guidelines stating the required data sources, across sectors, that need to be mapped (2) organise training workshops (3) Ensure better Inter-departmental coordination (4) *Assess high resolution trends of climate hazards and slow onset events. (5) *Map sector-wise the assets at risk, at a Block level.	Update risk assessment	100.00		NA: Office of Relief Commissioner IA: UPSDMA, All departments of the Govt. of UP	NDC 06 SDG 13

H Detailed List of Proposed Strategies for Disaster Management Mission

Table 87: Proposed Strategies for Disaster Management Mission

S. No.	Actions	Nature of Action	Type of Actions	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
					(6) *Access high resolution climate projections for UP at short, medium and long-term time scales. (7) Undertake stakeholder consultations to access current climate risk .Undertake modelling to					
1.7	Develop and implement a five-year rolling work plan to manage risks and avoid large scale loss and damages due to changing trends of climate and future projections, through stakeholder consultation at various levels of jurisdiction including at community level and scientific/ technical inputs	Policy	Adaptation	A comprehensive framework for risk insurance. Explore all approaches.A framework for building long term risk resilience across sectors. Institutional frameworks in place. Assessment of Budgets and assigning of financing stream.Capacity building plans in place. M&E frameworks develop	Develop the frameworks	Implement	10.00		NA: Office of Relief Commissioner IA: Office of Relief Commissioner, UPSDMA, Gram Panchayats, ULBs, DDMAs	NDC 06 SDG 13

H Detailed List of Proposed Strategies for Disaster Management Mission

Table 87: Proposed Strategies for Disaster Management Mission

S. No.	Actions	Nature of Action	Type of Actions	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
1.8	Develop heat action plan for the Uttar Pradesh	Policy	Adaptation				1.20	State Disaster Response Fund Uttar Pradesh Disaster Management Authority	NA: UPSDMA IA: UPSDMA	NDC 06 SDG 13
	Strategy 2: Build climate resilience through creation of knowledge products, policies and guidelines to build climate resilience									
2.1	Develop a knowledge network to collate and disseminate information on ; -- (1) applicability and scalability of Hydrometeriological hazard risk mitigation technologies and techniques, (2) Different types of risk transfer mechanisms. Financial instruments and tools , (3) Ways to mitigate disaster-induced migration, displacement and human mobility from the state , (4) Exploring social protection programmes and safety nets., (5) Any other relevant topic	Policy	Adaptation	Establish the knowledge network	Publish sector-specific research outputs for informed decision making by the depts. Conduct workshops on different thematic areas with concerned stakeholders such as government depts., and their agencies, the private sector and the local communities.	Continue the activities	10.00	State Disaster Response Fund Uttar Pradesh Disaster Management Authority	NA: Directorate Of Environment IA: UPSDMA, UP CCA	NDC 06 SDG 3,13

H Detailed List of Proposed Strategies for Disaster Management Mission

Table 87: Proposed Strategies for Disaster Management Mission

S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Relevant Central & State Schemes	Nodal and implementing Agency (NA/IA)	SDG and NDC Linkages
2.2	Mainstreaming climate risk and information into policy making	Policy	Adaptation	Conduct annual trainings on mainstreaming Climate risks concerns into developmental Plans/ Project All departments and their agencies at state, district, block, panchayat , city ULB level with the District Planning Committees of each district	Annual Trainings with the District Planning Committees	Continue	0.50	State Disaster Response Fund Uttar Pradesh Disaster Management Authority District Disaster Management Authority Organizing mock exercise in districts	NA: Directorate of Environment IA: Relief Commissioner, SDMA, Directorate of Environment	NDC 06 SDG 3,13

I Detailed List of Proposed Strategies for Strategic Knowledge Mission

Table 88: Proposed Strategies for Strategic Knowledge Mission

S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Responsible Agency	SDG and NDC Linkages
				Strategy 1: Strengthen and Capacitate Climate Change Authority					

1.1	Build the institutional capacity of the UP CCA through constitution of expert committees on areas such as;
	• Climate science
	• Adaptation & Mitigation research & policy planning
	  • Sustainable Agriculture
	  • Water Resources
	  • Forest, ToF and Biodiversity
	  • Sustainable Urban Habitats
	  • Sustainable Rural habitats
	  • Human Health
	  • Energy efficiency
	  • Green energy
	  • Disaster management
	• Climate law
	• Finance
	  • Public financing (Climate Budget Tagging)
	  • International Public finance
	  • Private sector finance
	  • Capacity building
		Policy	Adptation	Ongoing			2.00	NA: Directorate of Environment
								
								Implementing agency:
								
								Directorate of Environment
									NDC 6,7,8
									SDG 13

I Detailed List of Proposed Strategies for Strategic Knowledge Mission

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S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Responsible Agency	SDG and NDC Linkages
1.2	Undertake capacity building of human resources of UP Climate Change Authority	Policy	Adptation	Ongoing			2.00	NA: Directorate of Environment Implementing agency: Directorate of Environment	NDC 6,7,8 SDG 13
				Strategy 2: Establish Knowledge networks					
2.1	Establish State and district-level climate knowledge hubs and build preliminary datasets and mechanism for climate relevant data collection	Research	Adaptation	The thematic knowledge networks will aid in preparing the preliminary datasets and mechanisms for high resolution climate risk and vulnerability assessments, by 2025. It is targeted that by 2030, the thematic networks will; Climate science: Update climate trends and projections for UP at various resolutions (till 2030).			5.00	NA: UP Climate Change Authority IA: UP Climate Change Authority Participating Agencies: Universities, IITs, NGOs, technical Instt. (ICAR/CSIR/IISCs etc.), Individual Experts	NDC 6,8 SDG 13

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S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Responsible Agency	SDG and NDC Linkages
				Adaptation and mitigation networks: Prepare and Update, where required, vulnerability assessments, Impact assessments, Risk assessments, adaptation strategies, low carbon planning, Financing models, M&E frameworks					
2.1.1	Establish thematic knowledge networks, focussing on the following areas; • Climate science • Adaptation & Mitigation research & policy planning • Sustainable Agriculture • Water Resources • Forest, Trees outside Forest (ToF) and Biodiversity • Sustainable Urban Habitats • Sustainable Rural habitats • Human Health • Energy efficiency • Green energy • Disaster management	Research	Adaptation						NDC 6,8 SDG 13

I Detailed List of Proposed Strategies for Strategic Knowledge Mission

Table 88: Proposed Strategies for Strategic Knowledge Mission

S. No.	Actions	Nature of Action	Type of Action	Target	Target (2021-2025)	Target (2026-2030)	Estimated Financial Requirement (in INR Cr)	Responsible Agency	SDG and NDC Linkages
	Strategy 3: Capacity Building for integrating climate Change in Development								
3.1	Conduct regular trainings for integrating climate change in development planning & Finance. Such trainings will involve participants such as; • policy makers, • departments & their agencies, • district officials, • local bodies • Financial institutions	Capacity building	Adaptation	For the Authority: Developing training plan & modules , Training of master trainers, Developing a roaster of experts, Organising trainings. For Centres of excellence: IEC material on best practices and technologies, Organising technology demonstration, Handholding with financing institutions	Training of master trainers as well as development of training plans and modules, to be finalized by 2025.	By 2030, all regular trainings may be arranged through ENVIS centres	5.00	NA: UP Climate Change Authority Implementing Agencies: UP Climate Change Authority	NDC 6,7,8 SDG 13
3.2	Set up a centre of excellence for greening of MSMEs	Capacity building	Adaptation		The target till 2025 involves development of roaster of experts and of IEC material on best practices and technologies			IA: MSME Nodal : UP Climate Change Authority	NDC 6,7,8 SDG 13

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3.3	Mainstream climate change into higher education curriculum in all streams (+2 and undergrad level).	Capacity building	Adaptation		All relevant education curriculum modules is to prepared and teachers to be trained by 2025.			NA: UP Climate Change Authority IA: UP Climate Change Authority, Higher education dept , Technical education dept , Medical Education dept.	NDC 6,7,8 SDG 13

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	Strategy 4: Strategy 4: Monitoring and Evaluation								
4.1	M&E to be undertaken of the following sub-actions ; • SAPCC Actions • Other CC projects • Climate Budget Tagging	Policy	Adaptation	Results from M&E should feedback into policy, programmes	It is targeted that by 2025; A separate M&E cell is to be set up by UP CCA M&E frameworks are to be developed Data Collection to be concluded for yearly indicators Budget Tagging of climate actions and schemes to be concluded	Post 2025 and till 2030, the following targets are to be met; M&E to be concluded and results produced Climate Performance Index to be created Performance audit reports to be published Awards for best performing districts, ULBs, PRIs to be given	0.75	NA: Directorate of Environment IA: UP Climate Change Authority	NDC 6,7,8 SDG 13

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