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NITI Aayog

DEVELOPMENT MONITORING AND EVALUATION OFFICE

CLIMATE CHANGE IN GOVERNANCE

September 2022

Analysis by DMEO, NITI Aayog

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CLIMATE CHANGE AND SUSTAINABILITY

A Thematic Assessment of the Centrally Sponsored Schemes

September 2022

PREFACE

The Government of India (GoI) spends close to Rs. 14 lakh crores annually on development activities, through nearly 750 schemes implemented by Union Ministries. In 2019, the Development Monitoring and Evaluation Office (DMEO), NITI Aayog was assigned the task of evaluating 28 Umbrella Centrally Sponsored Schemes, which are schemes/programmes funded jointly by the Centre and the States and implemented by the States. This historic exercise, undertaken between April 2019 and February 2021, evaluated 125 Centrally Sponsored Schemes, under 10 Sectors, together covering close to 30% of the GoI's development expenditure, amounting to approximately Rs. 3 lakh crores per annum.

As a part of the evaluation studies, the Centrally Sponsored Schemes were also assessed based on various cross-sectional themes such as accountability and transparency mechanisms, use of technology, convergence, gender, social inclusion, regulatory framework, climate change, behaviour change, Research and Development and private sector participation. These evaluation studies adopted a mixed method approach and underwent a review process involving consultations with NITI Aayog subject matter divisions, concerned Ministries and Departments, and external sector experts. For the cross-sectional analysis across sectors, additional secondary research was undertaken by DMEO, and the findings were reviewed by experts in the respective domain in order to optimize the robustness of the evidence generated across the sectors.

The present report is an outcome of the thematic assessment of Climate Change and Sustainability across all the Centrally Sponsored Schemes. In this report, we seek to review aspects of sustainably and mitigation and adaptation to climate change that are present in schemes across the sectors. As the world faces a future where some effects of climate change are irreversible, it is of utmost importance to review schemes in order to assess where the government stands in its efforts to mitigate climate change and ensure its citizenry adapts to it.

We hope that this Report will help in strengthening elements of Climate Change and Sustainability in the design and implementation of central and state government programs. Building and adopting systems for ensuring a transition in a world where climate change is a reality, will contribute to the well being of citizens and future generations.

ACKNOWLEDGEMENT

We would like to express our gratitude to Shri Suman Bery, Vice-Chairman NITI Aayog and Shri Parameswaran Iyer, Chief Executive Officer, who have been the driving force, first in entrusting this important responsibility to the Development Monitoring and Evaluation Office (DMEO) and subsequently as mentors throughout the study, in providing all necessary support and guidance for the completion of the project. We would also like to extend our heartfelt gratitude to Dr. Rajiv Kumar, Former Vice Chairman NITI Aayog and Shri Amitabh Kant, former CEO NITI Aayog for their continuous support and invaluable inputs during the UCSS studies.

Our invaluable partners in this exercise have been officials across the Government of India and the State Governments without whose cooperation and insights this report would not have been possible. Next, we must thank our external expert, Dr. Anjal Prakash, for his critical inputs and feedback which helped us refine and bring coherence to the report. Special thanks are accorded to the implementation teams at M/s Deloitte Touche Tohmatsu India LLP, IPE Global Limited, Ernst and Young LLP and M/s KPMG Advisory Services Private Ltd who worked against significant challenges to deliver the evaluation studies, which is the base of the analysis in this report.

The DMEO team has been at the core of the cross-sectional analysis, and this report would not have been possible without the contributions of Ms. Nicole Almeida, Ms. Ruhani, and Mr. Kuldeep Pal, who worked tirelessly on every last detail of this herculean endeavour, under the guidance of Mr. Vikash Kumar Dubey, Director, Dr. Urvashi Prasad, Director and Mr. Paresh Dhokad, ex-M&E Specialist. Special thanks are extended to Mr. Alok Mishra, ex-Deputy Director General who played an important role in completing the study. The team would also like to thank former DMEO colleagues Ms. Sumitra K., Mr Asad Fatmi and Ms. Aishwarya Meena (intern at DMEO). The team would also like to thank Ms. Kanchan Puri, Ms. Disha Bhattacharjee, Ms. Bhawna Anand and Ms. Bijeta Mohanty for their support at various stages of the study. The team was also assisted by Mr. Shashikant Lakra, Office Assistant, DMEO. Across the cross-sectional reports, Dr Shweta Sharma, Director also oversaw coordination, standardization and monitoring of the processes.

In accordance with the massive scope and scale of the exercise, this report owes its successful completion to the dedicated efforts of a wide variety of stakeholders.

Director General
Development Monitoring and Evaluation Office
NITI Aayog

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LIST OF ABBREVIATIONS

AIBP	Accelerated Irrigation Benefit Programme
AECs	Adult Education Centres
APO	Annual Plan of Operations
AMRUT	Atal Mission on Rejuvenation and Urban Transformation
ASU&H	Ayurveda Siddha Unani & Homoeopathy
BMCs	Biodiversity Management Committees
BADP	Border Area Development Programme
CSP	Carbon Sequestration Potential
CWC	Central Water Commission
CSSTE	Centrally Sponsored Scheme on Teacher Education
CSS	Centrally Sponsored Schemes
C-DAC	Centre for Development of Advance Computing
CWBPs	City Water Balance Plans
CAA	Climate Change Adaptability
CCS	Climate Change and Sustainability
CC&S	Climate Change and/or Sustainability
CCAFS	Climate Change, Agriculture and Food Security
CIF	Climate Investment Fund
CAP	Climate-Altering Pollutants
CCRF	Code of Conduct for Responsible Fisheries
CAD	Command Area Development
CADWM	Command Area Development & Water Management
CBMWTF	Common Biomedical Waste Treatment Facilities
CCD	Conservation Cum Development
CNRE	Conservation of Natural Resources and Ecosystems
DEDS	Dairy Entrepreneurship Development Scheme
DIDF	Dairy Processing & Infrastructure Development Fund
DESA	Department of Economic & Social Affairs
DPRs	Detailed Project Reports
DRR	Disaster Risk Reduction
DMF	District Mineral Fund
DWS	Drinking Water and Sanitation

EST&P	Employment Through Skills Training and Placement
ERM	Extension/Renovation/Modernisation
FIDF	Fisheries and Aquaculture Infrastructure Development Fund
FGDs	Focussed Group Discussions
FPM	Forest Fire Prevention and Management
GI	Gastrointestinal
GEF	Global Environment Facility
GHP	Good Hygiene Practices
GLP	Good Laboratory Practices
GMP	Good Manufacturing Practices
GIM	Green India Mission
GHGs	Greenhouse Gases
GWI	Groundwater Irrigation
HKH	Hindu Kush Himalayas
HFCs	Hydrofluorocarbons
ICAR	Indian Council of Agricultural Research
ASEs	Institute of Advanced Studies in Education
ICPS	Integrated Child Protection Scheme
IPCC	Intergovernmental Panel on Climate Change
I&D	Irrigation and Drainage
KGBVs	Kasturba Gandhi Balika Vidyalayas
KRP	Key Resource Persons
LULUCF	Land use, Land-use change, and forestry
LPG	Liquefied petroleum gas
LHDC	Livestock Health & Disease Control
LEED	Local Economic and Employment Development
LECZs	Low Elevation Coastal Zones
MGNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
MPV	Mahila Police Volunteers
MHM	Menstrual Hygiene Management
MDM	Mid Day Meal
MoEFCC	Ministry of Environment, Forest and Climate Change
MHA	Ministry of Home Affairs
MoL&J	Ministry of law and Justice
MoSJE	Ministry of Social Justice and Empowerment
MoTA	Ministry of Tribal Affairs
MFP	Minor Forest Produce
MOVCDNER	Mission Organic Value Chain Development for North Easter Region
NAPCCHH	National Action Plan for Climate Change & Human Health

NAPCC	National Action Plan on Climate Change
NAPCCH	National Action Plan on Climate Change and Health
NAP	National Afforestation Programme
NBC	National Building Code
NCS	National Career Service
NCS-DA	National Career Service for DA
NCS-SC/ST	National Career Service for SC/STs
NCS	National Creche Scheme
NDMA	National Disaster Management Authority
NFDB	National Fisheries Development Board
NLM	National Livestock Mission
NMGI	National Mission for Green India
NMSA	National Mission on Sustainable Agriculture
NMSA	National Mission on Sustainable Agriculture
NPCA	National Plan for Conservation of Aquatic Ecosystems
NPDD	National Programme for Dairy Development
NP-MDMS	National Programme of Mid-Day Meal in Schools
NPMSH&F	National Project on Management of Soil Health & Fertility
NRCP	National River Conservation Plan
NWAP	National Wildlife Action Plan
NDCs	Nationally Determined Contributions
NTFP	Non-Timber Forest Produce
ORF	Observer Research Foundation
OSC	One Stop Centre
O&M	Operations and Maintenance
OOMF	Output Outcome Monitoring Framework
PTA	Parent Teacher Association
PIM	Participatory Irrigation Management
PVTG	Particularly Vulnerable Tribal Groups
PCCBP	Plastic Cell-Filled Concrete block Pavement
PMKVY	Pradhan Mantri Kaushal Vikas Yojana
PMKSY	Pradhan Mantri Krishi Sinchayee Yojana
PMRPY	Pradhan Mantri Rojgar Protsahan Yojana
RAD	Rainfed Area Development
RGM	Rashtriya Gokul Mission
RKVY	Rashtriya Krishi Vikas Yojana
RMSA	Rashtriya Madhyamik Shiksha Abhiyan
RUSA	Rashtriya Uchchatar Shiksha Abhiyan
RPL	Recognition of Prior Learning

RRR	Repair, Renovation and Restoration
RHKN	Rural Housing Knowledge Network
SSA	Sarva Shiksha Abhiyan
SAG	Scheme for Adolescent Girls
SPEMM	Scheme for Providing Education to Madrasas/Minorities
SDP	School Development Plans
SMC	School Management Committees
SDMC	School Management Development Committees
SNG	School Nutrition Gardens
SCM	Smart Cities Mission
SLWM	Solid and Liquid Waste Management
SOPs	Standard Operating Procedures
SAPCC	State Action Plans on Climate Change
SRC	State Resource Centres
SMAM	Sub Mission on Agriculture Mechanization
SMI	Surface Minor Irrigation
SMI	Surface Minor Irrigation
SDGs	Sustainable Development Goals
SAP	Swachhta Action Plan
DIET	The District Institute of Education and Training's
SLACC	The Sustainable Livelihoods and Adaptation to Climate Change
TSM	The Technology Sub-Mission
TAAS	Trust for Advancement of Agricultural Sciences
USCL	Udaipur Smart City Limited
UCSS	Umbrella Centrally Sponsored Schemes
UNDP	United Nations Development Programme
UHI	Urban Heat Island
WSP	Water and Sanitation Program
WDC	Watershed Development Component
WCD	Women and Child Development
WHO	World Health Organization

EXECUTIVE SUMMARY

This report is the summary of findings from evaluations reports across 10 sectors namely Agriculture Animal Husbandary and Fisheries, Women and Child Development, Human Resourse Development, Urban Transformation, Rural Development, Drinking Water and Saniation, Health, Jobs and Skills, Environment and Forest, Water Resources and the Social Inclusion. Schematic evaluations in these sectors covered questions regarding climate change and sustainaibility (CC&S) which have been briefly condensed here.

Main findings: Of the 104 Centrally Sponsored Schemes (CSS) spanning across ten sectors, 26 per cent have a Climate Change and/or Sustainability (CC&S) component or aspect in the design of the schemes itself. The Urban Sector stands out as all the CSS schemes have CC&S components. While some schemes might not have a CC&S component in the scheme design, the activities and outputs by nature might have CC&S aspects. For example, schemes like Ujjwala Scheme also contribute to mitigation efforts by the inherent nature of its activities, as LPG helps reduce carbon dioxide and black carbon emissions, which are the second largest contributors to global warming.

In the agriculture, animal husbandry, and fisheries sectors, of the 29 schemes analysed, 40% of the schemes have a CC&S component in the scheme design. Some of the effects of climate change, in general, include increased risks due to new patterns of pests and diseases, increased risk of crop failure due to extreme weather such as high temperatures, excess rainfall, droughts, floods, etc. This sector is the second largest contributor to GHG emissions in India, wherein enteric fermentation is the largest contributor. Schemes such as the Rashtriya Gokul Mission that focus on conservation and development of indigenous breeds (who tend to be more climate resilient) can be expanded.

In the Women and Child Development sector, special attention on the importance and inclusion of women in improving adaptation is required. Weather forecasts and other climate information needs to be provided to women farmers in a timely manner so that they are able to adequately practise crop diversification. POSHAN Abhiyan needs to address the threats to nutritional security due to climate change. Schemes like Pradhan Mantri Matru Vandana Yojana can help expecting mothers to adapt to dangerous heat waves and can thus, lower maternal as well as infant mortality rates.

The Drinking Water and Sanitation sector needs to adapt to climate change on a priority basis. Water scarcity due to climate change can deprive households of access to clean drinking water for proper handwashing and hygiene, hampering children's ability to grow healthy and strong. Swachh Bharat Mission 2.0 aims at strengthening of greywater treatment. Greywater use in agriculture can reduce demand for freshwater, thus making more freshwater available for drinking purposes. This can help in adapting to water scarcity due to climate change.

The environment and forests sector can play a crucial role in the mitigation of climate change. Forests act as carbon sinks, and thus, schemes like National Mission for a Green India must focus on increasing forest cover. This can help in the conservation of biodiversity as well as improve carbon geo-sequestration. Due emphasis needs to be given to the prevention and management of climate

change-induced forest fires. Significant investments need to be made into researching the impacts of climate change on wildlife habitats and marine ecosystems.

The water resources sector is witnessing a change due to climate change-induced changes in the water cycle. The melting of the Himalayan glaciers can destabilize the flow of Indian rivers and frequent floods and droughts can hamper agriculture which accounts for a large share of water usage. Sustainable water management practices and cropping patterns need to be adopted to enhance water security. Adoption of micro-irrigation techniques, rainwater harvesting, and restoration of water bodies can go a long way in building resilience against extreme climate events like floods and droughts.

In the urban sector, the agenda of 'housing for all' needs to be pursued vigorously and climate change-sensitive land-use planning needs to be incorporated in the city's Master Plan. Urban Local Bodies should create a Blue-green Master Plan that includes planning for water infrastructure (re-use, conservation, etc.), sustainable drainage systems that can withstand floods, integration of Non-motorised transport, etc. Through participatory and evidence-based methods, ULBs can create a mission, vision and plan to face the implications of climate change.

Cities are also a major contributor to GHGs due to the concentration of people and subsequent concentration of energy use, lack of green cover, use of transportation systems that rely on fossil fuels, etc. Buildings and transportation are the biggest contributors to CO2 emissions in the urban sector. Manufacturing of building material, construction of buildings, lighting and powering the building contribute to the carbon footprint. Stricter enforcement of green building codes and incentives to have green roofs and ensuring low concentration of Urban Heat Islands are needed.

In the health sector, there is a need to strengthen the management of heat-related illnesses as well as water-borne diseases arising due to extreme weather events like floods and cyclones. Climate change concerns need to be integrated into the National Health Mission and the capacities and resilience of the healthcare system to climate change induced events need to be built.

Climate hazards have a particularly harmful impact on socially and geographically disadvantaged people, according to the IPCC's 5th Assessment Report (AR5), Working Group II, including persons who face discrimination based on gender, age, caste, ethnicity, class, and disability. Tribal communities, for example, who live on marginal lands and rely heavily on natural resources for their livelihoods, are among the most exposed to climate change. Participatory approaches that involve women, children, tribal and rural populations, and other marginalized groups in taking climate action and being a part of the discourse around mitigation, adaptation and resilience is needed. Traditional knowledge of indigenous communities should be leveraged for conservation as well as adaptation.

BACKGROUND AND OBJECTIVES

1. Evaluation ensures the effective use of funds by assessing if the outputs and outcomes meet the targets as set in the objective of a scheme. The Development Monitoring and Evaluation Office (DMEO) took up the evaluation of 28 umbrella centrally sponsored schemes which compromises around 125 CSS schemes between years 2019-2021. women and child development, human resource development, urban transformation, rural development, drinking water and sanitation, health, jobs and skills, water resources, environment and forest; and social inclusion law & order and justice delivery. Schemes were evaluated on the Relevance, Efficiency, Effectiveness, Sustainability, Impact and Equity (REESI+E) framework. Apart from the REESI+E framework, schemes were analysed on 10 cross-sectional themes that span over sectors. These cross-sectional themes include gender, social inclusion, use of IT, climate change and sustainability, regulatory framework, etc. Cross-sectional themes were included in the evaluations to examine how schemes stand with regards to questions such as the mention of gender/gender equality in the scheme design, the existence of online scheme MIS, the existence of sustainability and climate change components in the implementation of schemes, etc.

2. This paper aims to summarise the findings across the 10 sectors under the cross-sectional theme of "Climate Change and Sustainability (CC&S)". Schemes and sectors that need to consider the effects of climate change on scheme implementation and beneficiaries are highlighted. A secondary literature review was conducted to supplement understanding of climate change at the sector level, and gaps have been identified where the sector/ schemes need climate change and sustainability components. This exercise aims to initiate thinking about challenges that are of planetary nature at the scheme level and sector level. The government of India has budgeted around 3 lakh crore of the Budget 2021-22 to Centrally Sponsored Schemes. A thorough understanding of the effect of Climate Change on these schemes and the contribution of these schemes (if any) to climate change is urgently needed.

3. This paper will focus on schemes as a mechanism of building resilience, adaptation to and mitigation of climate change. This paper aims to aid the discourse on domestic efforts to build an India that can withstand the challenges that climate change will bring and simultaneously create systems that reduce the amount of GHGs emitted.

INTRODUCTION

Stating the facts - Understanding Climate Change

1. According to the UN Framework Convention on Climate Change (1992), Climate Change is defined as 'a change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to the natural climate variability observed over comparable time periods'. According to the IPCC Sixth Assessment report (2021), human activities since the 1750s have led to an increased concentration of Greenhouse Gases (GHGs). This has led to widespread changes in the ocean, atmosphere, biosphere, and cryosphere.
2. The phenomena of climate change is already being experienced by all regions over the world (IPCC, 2021). For example, global surface temperatures (both global mean surface and air temperature) were 1.09 degree Celsius higher in 2011-2020 as compared to 1850-1900 (IPCC, 2021). Observed changes include rise in global surface temperatures, precipitation, retreat of glaciers and arctic sea ice, warming of the ocean, acidification and drop in oxygen levels in the ocean, global sea level rise and changes in the land biosphere. Specifically looking at the South Asia region, there is an observed increase in hot extremes and heavy precipitation (IPCC, 2021).
3. The extent of changes in the whole climatic system are unparalleled. For example, in 2019 CO2 concentrations reached the highest it has even been in 2 million years. Similarly, concentrations of methane and nitrous oxide have been higher now than any other time at least in the last 800,000 years (IPCC, 2021).
4. In the IPCC's 6th Assessment Report Working Group 1 Report (AR6 WG1), global surface temperatures under different future emissions scenarios are projected. Based on these projects, global warming of 1.5 degrees celsius and 2 degree celsius will be exceeded unless there are tremendous reductions in GHGs in the coming decade (IPCC, 2021). With additional increase in temperatures, there is a high likelihood of increase in the intensity of heatwaves, heavy precipitation, and agricultural and ecological droughts. Similarly, the number of intense tropical cyclones is projected to increase. Rainfall variability is likely to increase. Increased temperatures will intensify very wet and very dry weathers (IPCC, 2021). The monsoon is projected to intensify in the medium to long term in geographies including South Asia.
5. India is one of the most vulnerable countries concerning climate change - it has a very high population of poor people who rely on natural resources for their livelihood, with a high dependence on rainfall, and one of the highest densities of economic activity in the world. An increase in temperatures and changes in rainfall patterns could cost India 2.8 percent of

GDP and depress the living standards of nearly half the country's population by 2050 (Mani et al., 2018). India's significantly diverse climate zones, topographies and ecosystems also mean that climate exposures and risks are distributed unevenly through the country. Even the ambitious 2°C rise the world is aiming to fall below would increase the unpredictability of summer monsoons in India significantly. In the scenario where 4°C warming occurs, an extreme monsoon season which currently has the odds of occurring once in a hundred years is projected to occur every ten years by the end of the century (World Bank. 2013).

India's Contribution to Green House Gases

6. In 2019, India was the fourth largest cumulative emitter of GHG emissions and had the seventh largest per capita emissions (UN Emissions Gap Report, 2020). In 2016, India emitted 2,838, 889 Gg CO2 equivalent from the energy, industrial processes and product use, agriculture, and waste sectors (Third Biennial Update Report, 2021). Fig.1 shows the sector wise break up of contribution to GHGs. Energy includes fuel combustion activities, fugitive emissions by fuel. Industrial Processes and products include minerals, chemicals, metal production, etc. Agriculture includes enteric fermentation, manure management, rice cultivation, field burning of agricultural residue, etc. Waste includes solid waste disposal on land and wastewater handling. As per the Third Biennial Update Report 2021, land use, land-use change, and forestry (LULUCF) sector was a net sink.

Figure 1: *Sector-wise National GHG emission in Gg for 2016*

Source: *Third Biennial Update Report to The United Nations Framework Convention on Climate Change, 2021*

7. The emissions in the energy were driven mainly by electricity production (40%), followed by manufacturing industries and production (19%), transport (13%) and other sectors (10%).

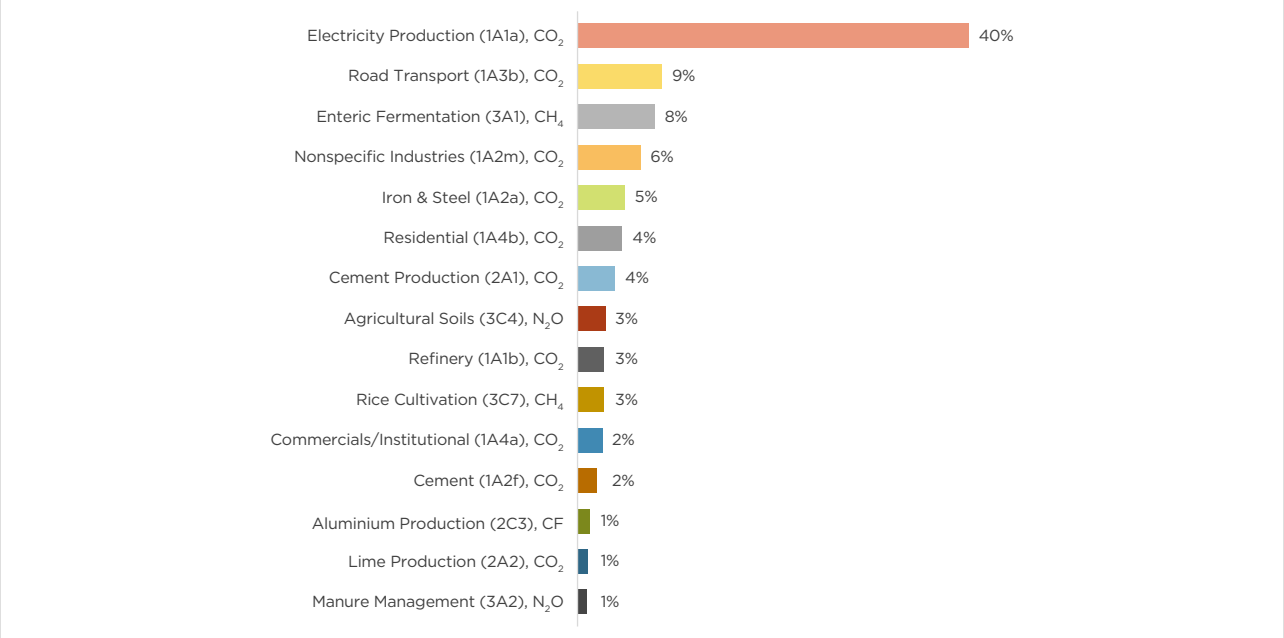

Figure 2: *Top 15 emission categories in terms of CO_2 equivalent*

Source: *Third Biennial Update Report to The United Nations Framework Convention on Climate Change, 2021*

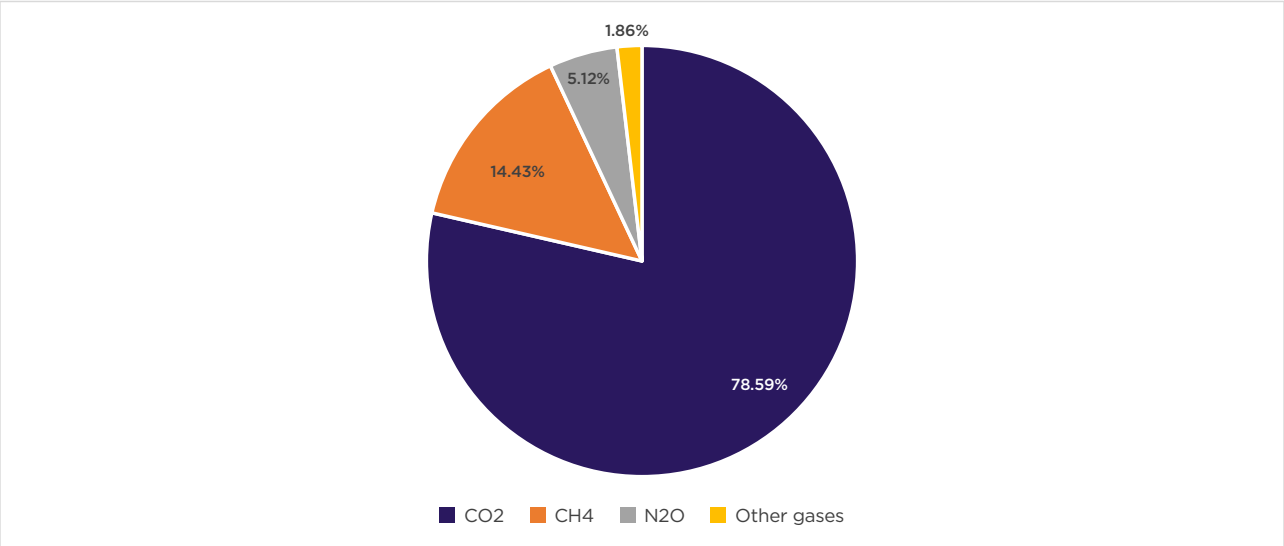

Figure 3: *Emissions of different gases*

Source: *Third Biennial Update Report to The United Nations Framework Convention on Climate Change, 2021*

Goals and Policy that Guides Response to Climate Change

8. At the global level the government has committed to achieving the Sustainable Development Goals. These goals directly or indirectly contribute to adaptation and/or mitigation of climate change. Following the Paris Agreement, India has also prepared the Intended Nationally Determined Contribution, a blueprint to achieve self- decided targets. This blue-print includes domestic policy, namely the National Action Plan on Climate Change. Further, the Central government also instructed States to create State Action Plans so as to decentralize and localize action.

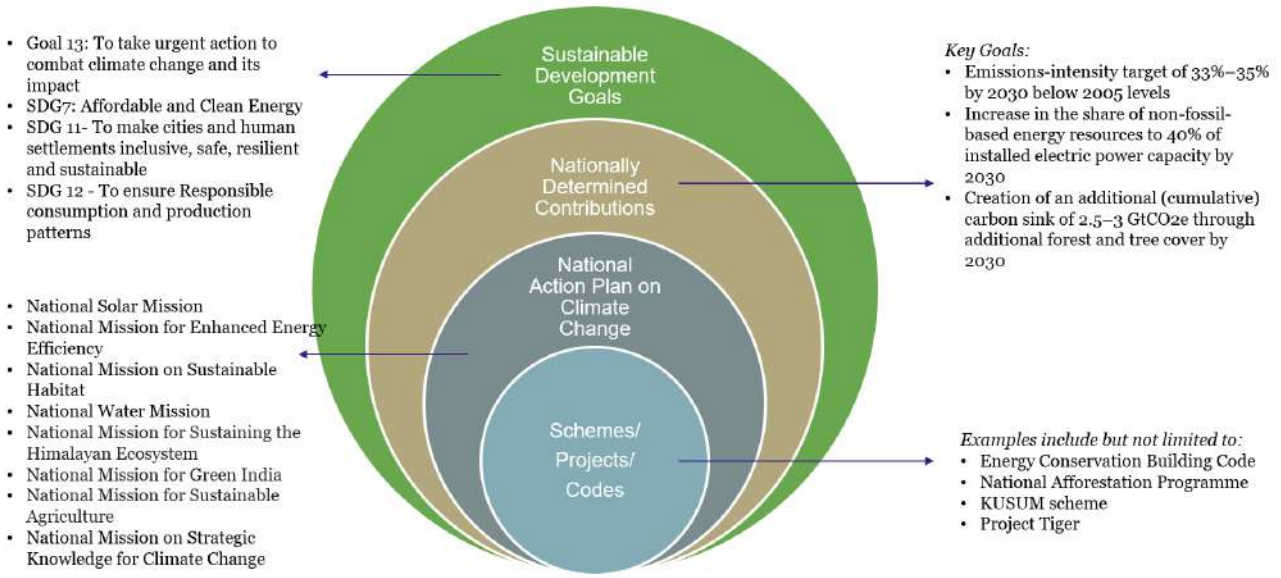

Figure 4: *SDGs, Nationally determined contributions, action plan on climate change and projects*

Sustainable Development Goals

9. The SDGs are a comprehensive list of goals that span social, economic and environmental dimensions. India is deeply committed to achieving the SDGs. Even though they are not legally binding, the SDGs have shaped the course of domestic priorities for many countries all over the world. In India, various schemes contribute to achieving the SDGs. Progress made is monitored by the National Indicator Framework and the SDG index. Since the scale of climate change is planetary, all sectors have a stake in the way the discourse unfolds around climate change. There are 17 SDGs, and all can be indirectly or directly affected by climate change. Fig. 3 lists some of the SDGs that directly or indirectly address sustainability and climate change.

Nationally Determined Contributions and International Commitments

10. India is a party to the Paris Agreement and is required to prepare "Nationally Determined Contributions" (NDCs) which are national climate action plans with set targets to reduce Green House Gases. Figure 3. highlights 3 key elements of India's first Intended NDC (INDC, 2015).

National Action Plan on Climate Change

11. Government response to climate change has been driven through the National Action Plan on Climate Change (NAPCC) and various State Action Plans on Climate Change (SAPCC). In 2008, the government prepared the National Action Plan on Climate Change which included eight missions as a multi-pronged, long-term and integrated approach to address climate change (information regarding the eight missions can be found in the Annexure). Subsequently, states have also prepared their respective State Action Plans on Climate Change (SAPCCs) that focused on adaptation interventions.

METHODOLOGY

1. The analysis in this report is created using data from the Umbrella Centrally Sponsored Schemes (UCSS) evaluation reports. Apart from the UCSS reports, secondary literature was referred to for definitions, mechanisms of the effect of climate change the sectors and broad recommendations. The UCSS evaluation reports span 10 sectors (culminating into 10 reports) and 115 schemes. For this report, a total of 103 schemes were looked at.

Table 1: Sectors and Schemes covered in the report

Sector	Schemes Covered
Agriculture, Animal Husbandry, Fisheries	30
HRD	7
WCD	15
Rural	6
Urban	5
Health	5
DWS	2
Jobs & Skills	5
Environment and Forests	8
Water Resources	13
Social Inclusion	8
Total	**104**

2. The Methodology adopted here has 3 stages: All relevant information concerning climate change was extracted from the 10 reports. The information in from these reports can be divided into two parts. Yes or No answers to questions related to climate resilience and income diversification across schemes to which climate change is relevant. The questions are listed below. The questions do not consider the relevance of climate change to a scheme. An overview of schemes with regards to question i. has been provided. Data from questions ii. to viii. are used to answer question ix.

   i. Are appropriate climate resilient policies, for mitigation and/or adaptation, included in the scheme design and objectives?

   ii. Are the planned design factors being successfully implemented?

   iii. "Is there an appropriate disaster risk reduction plan in place?"

   iv. Are there possibilities for circular economy development in the sector?

v. "Is there an appropriate/sufficient focus on diversification (eg. Agro biodiversity, agro-ecology) to reduce risk?"

vi. Is there an effective waste management/end-of-life system in place for resources used in the sector/scheme?

vii. Are there any training sessions held regularly for adopting green practices, using local materials etc.?

viii. Are the end beneficiaries aware of climate risk and possible individual mitigation/ adaptation measures?

ix. If no design component, any other practices (summary of questions ii. to viii.)?

3. Information/analysis of climate change components in schemes and suggestions on how to make the scheme a part of the circular economy or reduce the schemes carbon footprint.

4. Analysis of information from these packages: A meta-analysis of the information to give an overview was conducted using the information from the ten sector reports. A subjective judgement on the relevance of each scheme to climate change was undertaken. Following this, schemes were categorized into 'adaptation', 'mitigation' or 'both' depending whether the components of scheme design and activities, implementation contributed to adaptation and/or mitigation to climate change. Secondary research was taken up at the sector level to understand the broad impact of climate change on the sector and the contribution of the sector to climate change (if any) to understand the mechanism of impact.

SECTOR LEVEL OVERVIEW

1. This section gives a summary of all 103 schemes analysed in this report. Looking at the sectors in general, almost all Urban Centrally Sponsored Schemes include some aspect of climate resilience in the design and objective aspect of the schemes. For example, the Atal Mission on Rejuvenation and Urban Transformation (AMRUT) targets that at least 20 percent of the wastewater generated in ULBs should be recycled and reused. It also aims to minimise loss of water to less than 20 per cent. The Jobs and Skill Sector and the Women and Child Development Sector have no CSS that take climate change and sustainability into account at the design stage.

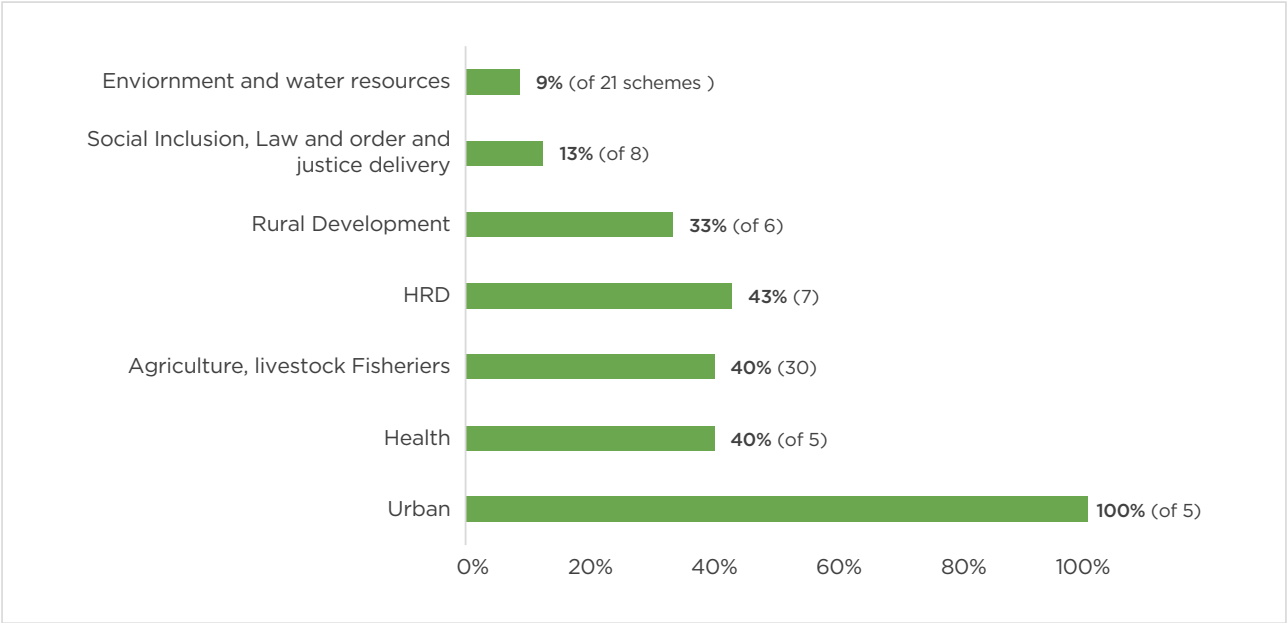

Figure 5: *Percent of Centrally Sponsored Schemes in a Sector that have a Climate Resilient/Sustainability Component in the Design and Objectives of the Scheme*

Source: *All 10 Sector UCSS Evaluations, 2020/21*

2. Even though schemes have not accounted for climate change and sustainability (CCS) at the design stages, some schemes by nature of their activities include components of CCS. For example, under the MGNREGS, activities include drought proofing, micro-irrigation, renovation of traditional water bodies, land development and water harvesting and conservation. Some schemes undertake certain activities and processes which may fortuitously contribute to climate resilience (For instance - the Anganwadi Services Scheme enhances mitigation efforts through the consequence of activities like mandating the use of smokeless chulhas to the extent possible while avoiding the use of firewood.)

3. A holistic view of all of climate change aspoects across the sectors can be taken. Fig. 6 looks at the nature of the scheme, activities, implementation, etc that have CC&S components. All the CSSs analysed here in the Drinking Water and Sanitation (DWS) and Urban have climate change and sustainability components. The Jobs and Skills and Social Inclusion sector are lagging behind in accounting for climate change and sustainability.

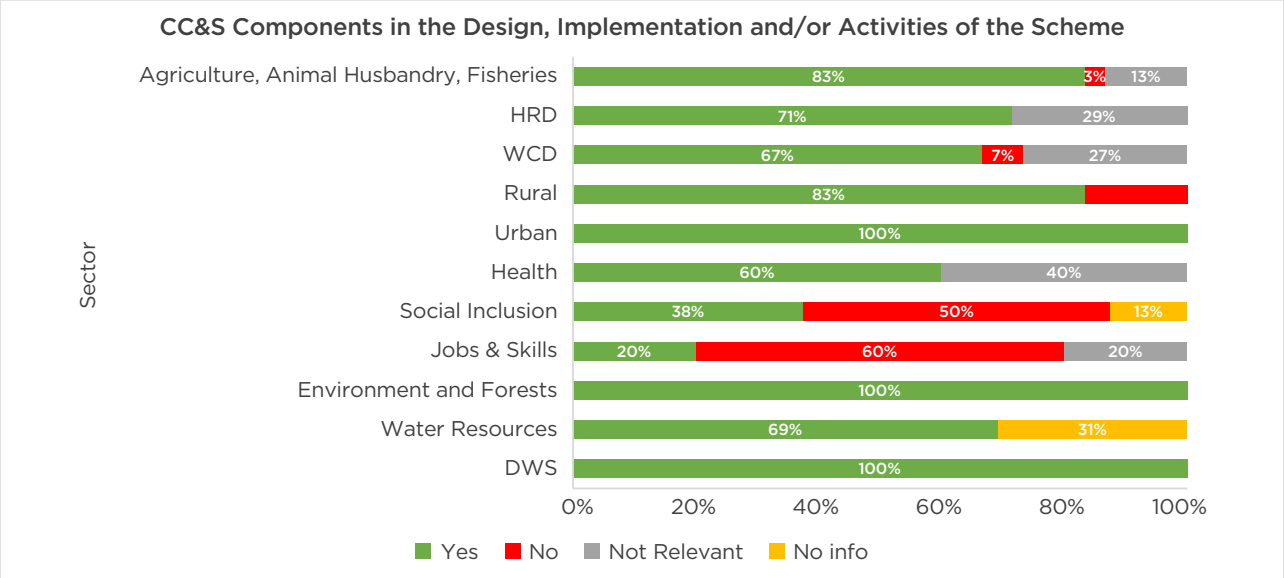

Figure 6: *Climate Change and Sustainability aspects in the Design, Implementation and/or Activities of the Schemes by Sector*

Source: *All UCSS Evaluations 2020/21. Not relevant includes scheme such as the Integrated Scheme on Agriculture Census and Statistics. No information indicates no information available for this particular exercise in the UCSS evaluations.*

Out of the various Centrally Sponsored Schemes evaluated across ten sectors, 68 schemes address climate change and sustainability either directly or indirectly. Details for the same can be found in the Annexure.

Mitigation

4. Climate change mitigation refers to strategies or policies that decrease the concentration of greenhouse gases in the atmosphere by cutting emissions or improving its capture (Terminologies Used in Climate Change, 2011). The Smart Cities Mission (SCM) contributes to mitigation by incorporating projects which enhance climate change resilience or are environment friendly, based on certain identified impacts like reduced dependence on energy from conventional sources and reduced pollution, which are directly linked to mitigation. Environmentally sustainable projects being implemented across cities include the use of LED street lighting, installation of rooftop solar, renewable energy generation, encouraging NMT, etc. (AMRUT OR SCM) By utilizing alternate sources of energy like solar, the scheme reduces the dependence on conventional sources of energy which heavily contribute to GHG emissions. For instance, the Smart cities of Jaipur, Visakhapatnam, Pune and Surat have implemented solar projects producing about 5 MW of solar energy and have consequently achieved carbon emissions reduction of about 13,500 tons per annum. Schemes like Ujjawala Scheme also contribute to mitigation efforts by the inherent nature of its activities, as LPG helps reduce carbon dioxide and black carbon emissions, which are the second largest contributors of global warming.

Adaptation

5. Adaptation is the process of natural or human systems adjusting to a new or changing environment. Individuals, communities, and countries endeavour to cope with the effects of climate change through adaptation (Terminologies Used in Climate Change, 2011). The Rainfed Area Development (RAD) Scheme is one of the schemes evaluated that has enormous adaptation potential. It is a sub-component of National Mission on Sustainable Agriculture (NMSA) which aims to transform Indian agriculture into a climate resilient production system through various components. RAD promotes integrated farming systems and diversified farming to increase climate resilience through diversification. Diversification is an effective adaptation strategy as it protects and preserves natural biodiversity, strengthens the agroecosystem's ability to respond to various stresses including those induced by climate change, and ensures food security as well as alternative income sources for farmers and producers (Lakhrran et al., 2017). To this end, diversified pulse, oilseed, millet based cropping systems, horticulture based cropping systems, livestock based farming systems and tree/silvi-pastoral agro forestry-based systems can be promoted through RAD.

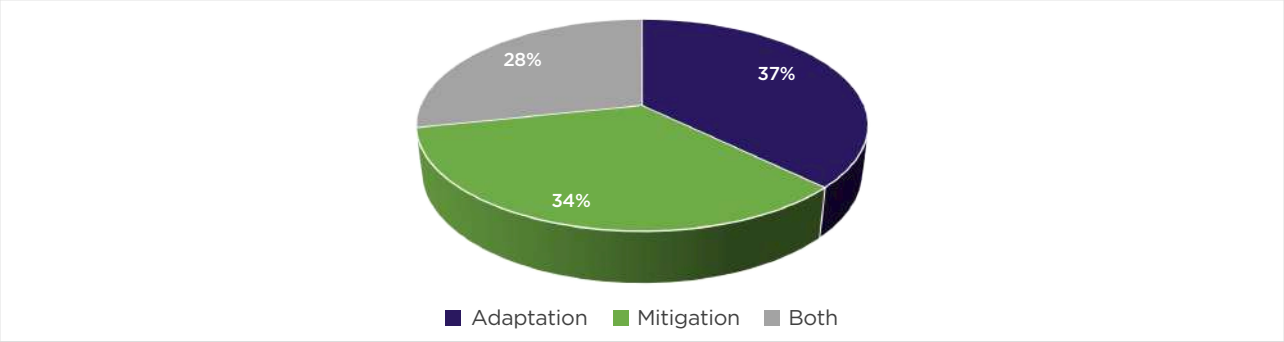

Figure 7: *Classification of Schemes as Adaptation, Mitigation or Both*

6. Of the Schemes that have CC&S aspects, 36 percent have a component that addresses adaptation, 33 percent have a component that addresses mitigation and 30 percent have a component that address both in varying extents. Source: All UCSS Evaluations 2020/21.

Schemes that Address Both Mitigation and Adaptation

7. Certain schemes also address both climate change adaptation and mitigation. For example, the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) is estimated to have achieved carbon sequestration of 102 million tonnes of carbon dioxide, which was captured through plantations and soil quality improvement in 2017-18 alone, thus contributing to mitigation. Drought proofing activities, including tree planting also enhance mitigation efforts. The scheme also addresses climate change adaptation by undertaking activities like micro-irrigation, renovation of traditional water bodies, land development and water harvesting and conservation.

8. Per Drop More Crop is another scheme that contributes to both mitigation and adaptation activities. Micro Irrigation, being one of the most efficient mechanisms, enables sustainable agriculture practices through drip irrigation, sprinklers, pivot, rain-guns etc. By promoting precision farming by making water available in a targeted manner to the root zone of crops, it allows adaptation to water availability issues caused by climate change. Further,

through the usage of fertigation, the nutrient availability in the soil is enhanced and a rise of 80-90 per cent in the efficiency of fertiliser use has been observed. By reducing the use of nitrogen rich fertilizer, which is prevalent in many Indian states, it contributes towards mitigation efforts by reducing the resultant GHG emissions.

9. This includes schemes that have climate resilient policies for mitigation and/or adaptation in their scheme design or objectives itself. It also includes schemes which do not have such design components but may by their very nature contribute to climate change mitigation and/or adaptation (For instance, the Mission for Integrated Development of Horticulture - The practice of Horticulture inherently helps to mitigate the effects of climate change through microclimate moderation, conservation of natural resources, carbon sequestration and creation of additional sources of livelihood and diverse income opportunities for farmers).

SUMMARY OF FINDINGS IN EACH SECTOR[1]

1. **Agriculture, Animal Husbandary and Fisheries:** Some of the effects of climate change on the agricultural sector in general include increased risks due to new patterns of pests and diseases, increased risk of crop failure, extreme weather such as high temperatures, excess rainfall, droughts, floods, etc can harm crops and reduce yields. Similarly, there is an increased risk of moisture stress and soil erosion (Kim). In the Animal Husbandary sector, heat stress and diseases due to warming temperatures pose the greatest threats. Coastal habitats and resources are likely to be impacted through sea level rise, warming sea temperatures, extremes of nutrient enrichment (eutrophication) and invasive species. Of the 30 schemes in the Agriculture, Animal Husbandary and Fisheries sectors, 83 percent have a climate change or sustainability component in design or implementation although the CC&S aspects are of varying intensity and nature. Schemes such as the Rainfed Area Development (RAD) which is a sub-component of the National Mission on Sustainable Agriculture (NMSA). RAD focuses on building climate-resilience through diversification by promoting integrated farming systems and diversified farming. Through RAD, diversified pulse, oilseed, millet based cropping systems, horticulture based cropping systems, livestock based farming systems, tree/Silvi-pastoral agro forestry-based systems and fishery based farming systems can be promoted. Details of other schemes can be found in Annexure 3.
2. **Women and Child Development:** Women are more vulnerable to the impacts of climate change due to inequitable social norms, lack of access to formal education, limited access to resources due to skewed power structurers and general economic poverty. Climate change has direct as well as indirect effects on health and poses economic, social, psychological and biological risks. Direct effects include increased subjection of the body to heat waves, poor air quality, frequent extreme climatic events like floods, droughts, and storms. Indirect effects include food insecurity and undernutrition due to crop failure and vector-borne disease transmission. Displacement of children due to flooding, natural hazards and climate change induced migration has detrimental effects the health and psychological well being of children. At the scheme level, only 67 percent of the 15 schemes have CC&S components. For example, the ICDS scheme guidelines mention that efforts are to be made to ensure either foster care or sponsorship for children affected by disaster and natural calamities.
3. **Human Resource Development:** Natural disasters can cause children to miss school due to sickness, injury, malnutrition or displacement, resulting in increased rates of absenteeism, reduced educational attainment and lower academic performance. Extreme weather events can destroy or damage school buildings; alternatively, they may be utilised to shelter people who have been displaced from their homes as a result of disasters, leaving students

1 Climate Change and Sustainability (CC&S) components of each Centrally Sponsored Scheme, effects of climate change on a particular sector and the sectors' contribution to climate change are detailed in Annexure 3.

temporarily unable to attend school. Of the 7 schemes, 71 percent of the schemes have aspects of CC&S, such as the Sarva Shiksha Abhiyan has evolved to include provisions for implementing eco-friendly policies undertaking of civil works with hazard resistant materials, usage of local construction materials, low cost, and environmentally friendly technologies, using environmentally sustainable designs, incorporating green architecture, environmentally safe incinerators, etc.

4. **The Urban Sector:** There is a concentration of people in urban areas, which leads to a "concentration hazard" (Satterthwaite et al.,). Such concentration has risks, for example, in the case of an emergency evacuation, there might be a lack of space for people, vehicles to evacuate. The concentration of people also has the potential for the spread of communicable disease. Migrants often build housing on difficult or undesirable land that is more likely to be in low-lying areas, on steep slopes, in ravines, and in other risk-prone areas exposed to extreme conditions such as floods and landslides (International Housing Coalition). They might lack the knowledge or means to reduce their vulnerability. As cities become larger and denser, they will experience urban heat island (UHI) effects. Pavements, buildings, and other surfaces absorb and trap heat. This will be exacerbated with rising temperatures and can lead to heat-related illnesses and mortality, increased air pollution levels and higher energy costs (ex. For air conditioning) (USEPA). All centrally sponsored schemes have components of CC&S in their design or implementation. For example, in the Smart Cities Mission, capacity building activities are being carried out to develop climate change awareness, mitigation approaches, and coach city officials with the assessment framework. More than 140 Cities (>5Mn population) in partnership with close to 40 International agencies are working together on critical aspects of climate adaptation and mitigation that were non-existent before the mission.

5. **Rural Development:** Livelihood options are determined by assets (natural, physical, human assets - education, skills, social, financial, access to forest produce, etc.) and climate change can affect this. The loss of jobs due to lost days due to extreme weather events, heat waves, forced migration, etc. could pressurize already highly stretched programs as more people are pushed into poverty. Schemes in this sector may not have CC&S components in design, but have such components in the implementation. PMGSY's clear focus on environmental sustainability is evident from its impetus to green technology (which is associated with economic and environmental benefits), and the clear frameworks instituted by development partners (ADB and World Bank) which lay down guidelines to construct roads in an ecologically compatible manner.

6. **Drinking Water and Sanitation:** Globally, average water stress[2] is 11%. India is among 31 countries experiencing water stress in the range of 25-70%. It is forecasted that India will be among the worst affected countries with respect to change in net precipitation by 2050 vis-à-vis 2010. In sanitation, Integrated water resources planning is needed for the creation of sustainable drinking water schemes. Measures like rainwater harvesting, recharging of water reservoirs, restoration of natural reservoirs need to be adopted so that longer dry periods do not lead to a decline in water supply.

2 Water stress for purpose of discussion in the above paragraph is defined as the ratio of total freshwater withdrawn annually by all major sectors, including environmental water requirements, to the total amount of renewable freshwater resources, expressed as a percentage. Source: UN (2018a, p. 72, based on data from AQUASTAT)

7. **Health:** Human health and wellbeing can be directly affected by climate change through floods, draughts, heat waves and fires. Ecological disruptions due to climate change such as crop failure, shifting patterns of diseases can have adverse effects on health for vulnerable populations. Responses to climate change or disasters such as migration and displacement can lead to overcrowding, negligence of health, stress, the spread of diseases, etc. Effects could be mediated through natural systems (pollution, vector, and waterborne diseases) or human systems (mental stress, occupation, undernutrition). Of the 5 CSS schemes, 60 percent have CC&S components. For example, under National Urban Health Mission, financial support has been provided to state and UTs for equipment, supplies and consumables required for biomedical waste management, Training, and capacity building (through PIP mode) under NHM till DH level. MoHFW has been encouraging the establishment of CBMWTF (Common Biomedical Waste Treatment Facilities) and all facilities are expected to develop linkage with CBWTF.

8. **Jobs and Skills:** Employment in sectors such as agriculture, animal husbandary, fisheries,etc which depend on natural conditions will be most affected by climate change. Similarly, warmer temperature and heat stress can lead to loss of working days especially for those working outside or involve heavy labor. None of the CCS schemes have CC&S components.

9. **Environment and Forests:** By nature of the schemes, most schemes have CC&S component in design and implementation but only 9 percent of the 21 schemes in environment and the water respurces sector specifically address climate change at the design level. The following impacts were observed at a country level that are aligned with the objectives of the three sub-schemes under the National Mission for Green India: 1) The total forest cover of India increased from 21.34% in 2015 (USAID, 2017) to 21.67% of the total geographic area of the country in 2019 (Forest Survey of India & MoEFCC, 2019). 2) Between 2017 and 2019, there have been an increase of 1212 sq. km in the area under tree cover in India (Forest Survey of India & MoEFCC, 2019). 3) The user base of the Forest Fire Alert system has grown significantly from around 2,000 in 2017 to more than 66,000 in 2019 (Forest Survey of India & MoEFCC, 2019)

10. **Social inclusion sectors:** Indigenous peoples, disadvantaged and vulnerable people, and local communities that are reliant on agricultural or coastal livelihoods are all at disproportionately higher risk of negative repercussions from global warming of 1.5°C and beyond. (IPCC, 2018). The evidence indicates that inequality worsens the disadvantaged groups' position in relation to climate change impacts in three main ways - increased exposure to climate hazards, increased vulnerability to harm caused by climate hazards, and decreased ability to cope with or recover from the damage (Islam & Winkel, 2017). Details of schemes can be found in Annexure 3.

WAY FORWARD AND RECOMMENDATIONS

1. **Agriculture, Animal Husbandry and Fisheries:** Crop diversification is an effective adaptation strategy (Annexure 3). Thus, integrated farming systems need to be promoted to enhance climate resilience. Incentives need to be provided to farmers for growing climate-resilient crops such as millets. This can promote crop diversification and do away with the monoculture of wheat and paddy. Micro-irrigation should be adopted rather than flood irrigation which results in the emission of methane. Fertigation techniques need to be promoted in cultivation so that fertilizer use efficiency can be enhanced. Reduction in the use of fertilisers will help to mitigate nitrous oxide emissions. One of the major challenges in realizing the full irrigation potential is the farm power availability which has to be met out with the grid connection or rely on diesel and other fossil fuels. There is a need to replace fossil fuel sources with renewable energy like solar pumping units.[3] In the Fisheries sector, it is integral to sensitize beneficiaries about the risks of climate change, especially to their occupation and to provide information regarding diversification of income. In order to mitigate climate change, there needs to be more focus on the diversification of species. This would ensure an adequate ecological balance by preventing overexploitation of a particular species. It will be favourable to make investments to support sustainable artisanal fisheries and minimise post-harvest losses. It would be prudent to introduce an economic incentive mechanism to ensure sustainable fishing practices are followed.
2. **Women and Child:** Gender integration in climate change policy is critical for ensuring effective local adaptation planning. Special focus is needed to provide weather forecasts and other climate information to women farmers so that they are able to adequately practise crop diversification. Women should be adequately represented in farmer organisations and must participate in decision-making processes. Access to clean cooking energy connections should be expanded via the Ujjwala scheme. Gender should be incorporated in climate change policies so that women can participate, benefit as well as feel empowered through a combination of approaches.
3. **Human Resources:** Environmental sustainability needs to be mainstreamed into the design and implementation of the Umbrella scheme of the National Education Mission in most states. In the Mid Day Meal programme, there are possibilities of a circular economy such as proper disposal of organic waste and, in turn, help in agricultural practices for ingredients for MDM. The environmental sustainability of the scheme should be improved by provisioning better access to low emission fuels or climate-resilient practices such as smokeless challahs for school kitchens in rural areas. With regards to SSA, while there have been concerted efforts to raise awareness generation/sensitization of students/stakeholders

3 States like Rajasthan and Gujarat have been using solar water pumping systems in drip and sprinkler irrigation in crops like rice, wheat, and seed cotton since 2011 (FAO, 2008)

across states on environmental issues and challenges, environmental sustainability is yet to be mainstreamed into the scheme's design and implementation in most states, especially from a climate change and waste management perspective. More articulated focus in the form of mandatory norms, along with requisite outputs/outcomes for adequate M&E are necessary for the design of SSA and Samagra Shiksha to ensure that stakeholders across levels integrate environmental sustainability into their respective Action Plans. Only prescriptive guidelines would not suffice in ensuring long term environmental sustainability. The states should ensure that environmentally sustainable practices such as the provision of eco clubs, mandatory rainwater harvesting facilities, kitchen gardens (under MDM), incinerators in KGBVs for disposal of organic waste etc., are undertaken in all schools. The system of developing government schools into 'Green Schools' in Gujarat is a best practice that could be emulated across states. The states should ensure that environmentally sustainable practices such as the provision of eco clubs, mandatory rainwater harvesting facilities, kitchen gardens (under MDM) etc., are undertaken in all schools. The progress of implementation of the climate change resilient practices prescribed in the guidelines (such as rainwater harvesting, solar panel, etc.) should be captured in the AWP&B of states. Best practices in ensuring environmental sustainability in schools could be promoted by the state and central governments on the SEShagun portal The scheme guidelines should have mandatory provisions to ensure environmental sustainability within the school facilities. Although the scheme has prescriptive guidelines for the provision of eco clubs, mandatory rainwater harvesting facilities, kitchen gardens (under MDM), incinerators in KGBVs for disposal of organic waste etc., in all schools, there is a need for ensuring implementation across these interventions across all schools. Beyond tracking the social performance, there is also a need to track the environmental performance of the scheme. The scheme AWP&B and the OOMF should have clearly defined outputs and outcomes for the same. There is also a need to publish the details of outputs and the funds utilized towards the environment conservation activities (such as the Swachhta Action Plan) in the public domain to improve the accountability and transparency of implementation.

4. **Urban Transformation:** India's urban population is expected to rise to 40 per cent by 2030 (ICLEI). This will pressure city systems that have limited resources and capabilities to deliver services. This will be further aggravated by climate change. Urban local bodies should immediately develop City-level Climate Actions Plans in a participatory method, accounting for the trends in population growth and the disproportionate effects of climate change on the marginalised and poor. The AMRUT scheme should include the creation of a Blue-Green master plan for the city by the ULGs. The plan should include planning for all the network infrastructure (water, wastewater, sewage), water rejuvenation and conservation plan, wastewater recycling and re-use, development of green and blue cover in the city, by creating multi-functional spaces such as urban forestry, sustainable drainage system components to manage run-off, rejuvenation of water bodies and the integration of non-motorised transport components. The proposed Blue-Green Master plan should be overlaid with the land-use master plan to ensure that various planning aspects such as are captured. This includes protection of drainage/natural drains catchment and alignment paths to discourage encroachment during the dry season, provisioning of land for restoration of water bodies, and ground-water re-charging and reserving land for the facilities proposed, such as WTPs and STPs. With regards to the SCM, there is an urgent need for cities to look at aligning existing vulnerability and risk assessments and resilience efforts. New and

improved infrastructure and services need to ultimately hold up to future climate impacts. Implementing agencies need to apply a climate lens on key urban projects, whether they focus on Area Based Development programs or pan-city initiatives. Even though the core infrastructure elements include a sustainable environment, there is a need to link elements to possible manifestations of climate change such as rising temperatures, drought or heavy rainfall. For example, in affordable housing, it is integral to assess how the output infrastructure would sustain in the face of climate change. This would thereby affect the outcomes of the beneficiaries.

5. **Rural Development:** For populations whose livelihoods are closely tied to the environment, variation in climatic factors will greatly affect their lives. It is important to diversify livelihoods so as to ensure work is stable, durable, resilient and robust in the face of shocks. It is critical that alternate employment does not undermine the livelihoods options of others or have negative adaptation, for example, policies aimed to diversify income sources should not lead to the generation of incomes from natural resource extraction or carbon-intensive occupations. The National Social Assistance Program should cover those with low levels of adaptive capacity. Adaptation can be promoted through social protection: protection of those most vulnerable to climate risks, with low levels of adaptive capacity through social safety nets, food, pensions, fee waivers, etc. Co-benefits should be identified and incorporated in the scheme. There should be contingency plans for scaling up safety nets at short notice. There is a need to build state capacity to initiate public works programs in the aftermath of extreme weather events. In need for relevant and futuristic local programmatic interventions, it is recommended that the identification of resource endowment potential of regions to define clusters and models and mandated increased use of green processes and technology through the establishment of Technology sub-mission of PMAY (U) under the Ministry is undertaken.

6. **Health:** Certain co-benefits that reduce emissions and improve health over time are listed under the IPCC report on the impact of climate change on human health. For example, shifting to clean sources of energy reduces air pollution, which improves health. Spreading awareness about family planning and making available reproductive health care services to improve maternal and child health can lead to birth spacing, reduction of population growth, energy use, and eventually reduce climate-altering pollutants. Similarly, creating transport and mobility options that shifts from the use of motorized vehicles to physical activity (walking, cycling) will reduce emissions and promote physical activity. According to the proposed "National Action Plan on Climate Change and Human Health", to address the challenges of climate change, development of an integrated early health warning system, state-specific emergency response plan, along with the increased capacity to provide health care to the most vulnerable and the marginalized populations would be needed. Thus, a key area of intervention would be to strengthen the local monitoring of appropriate climate and disease variables and build temporally and spatially disease-specific databases. A surveillance system would help develop effective prevention strategies, aid epidemiological understanding and predictive computations[4]. According to the WHO toolkit for health and climate change[5], the way forward should include the following:

4 Ministry of Health & Family Welfare Government of India. (2016). National Action Plan for Climate Change & Human Health (NAPCCHH)

5 https://www.who.int/globalchange/resources/toolkit/en/

- Vulnerability & Adaptability assessment: to assess which populations and geographical areas are most vulnerable to different kinds of health effects as well as the capacity of health systems to manage those
- Strengthening early surveillance and response systems (EWSR) for climate-sensitive health hazards such as diseases
- Building resilience of the health system in primary functions and developing the ability to react to shocks
- Based on V&A, national plans and strategies need to be devised, followed by M&E of health adoption, engagement with other sectors and co-benefits of actions.

7. **Jobs and Skills:** Since employment in mining and fossil fuel-related industries is likely to decline, a reallocation of labour across sectors will be needed. (International Labour Organization, 2018). Reallocation of labour to the higher labour demand sector of renewable energy sources, as well as of the entire value chain associated with growing green sectors like electric vehicles and other related infrastructure projects, is a possibility. Reallocation might be difficult due to differing skill sets needed across sectors. Training programmes through vocational institutions or for employees in the informal sector may be useful because adaptation programmes typically involve employment in medium-skilled and low-skilled industries (International Labour Organization, 2018). Capacity building to adapt: Using vocational guidance, training, and skilling components of existing schemes to impart advanced knowledge of construction materials and climate-smart technologies (International Labour Organization, 2018). Generation of green jobs through investment- Between 2021 and 2030, India's move towards a green economy may add an estimated 1.4 million jobs in the renewable energy sector alone (International Labour Organisation, 2019). As of 2016-17, this sector employs 432,000 people (International Renewable Energy Agency, 2018). Further, a study by the Centre for Sustainable Employment found that the total employment created by the green energy programme is nearly 2.5 times the number of jobs created through the same investment in a fossil fuel programme, i.e., for an investment of USD 1 million, an estimated 197 jobs will be generated in the green energy programme compared to just 82 jobs in the fossil fuel industry (Azad & Chakraborty, 2018). Encouraging Green output through schemes or business sustainability reporting. This will create demand for green processes at multiple levels of the value chain. Jobs from creating climate-resilient infrastructure, like employment in the construction industry, in industries that supply inputs such as engineering services, will also be generated. Upgrading Skilling programmes to address green skill gaps (International Labour Organisation, 2019) like -
   - **Solar –** Skills required for installation of building-integrated PVs, module assembly, solar PV system integration, installation and commissioning of large-scale on-grid solar power projects
   - **Wind –** Skills for manufacturing high-capacity turbine gearboxes, complex-design wind-turbine blade fabrication, and gearbox failure analysis
   - **Bio-energy –** Knowledge of pest & disease control, skills in biomass gasifier design and fabrication, construction and commissioning of on-grid large scale bio-mass power projects, biomass-based combustion system handling, and logistics, repair and maintenance in biomass.

8. **Drinking Water and Sanitation:** Integrated water resources planning is needed for the creation of sustainable drinking water schemes. Measures like rainwater harvesting, recharging of water reservoirs, restoration of natural reservoirs need to be adopted so that longer dry periods do not lead to a decline in water supply. The issue of methane emissions needs to be addressed. Increased adoption of pour flushing toilets could lead to anaerobic conditions in the pits. For such issues to be mitigated, there is a need for investing in more innovative and scientific toilet technologies, such as source separation toilets. Integrated watershed development and renovation of traditional water bodies should be prioritised.

9. **Water Resources:** An increase in awareness and community participation in irrigation management through specialist organisations would lead to the adoption of sustainable water management practices and cropping patterns. The construction of additional storage through repair, renovation and restoration of water bodies will help in building resilience against extreme climate events like droughts and floods. Farmers can greatly reduce the effects of a drought by engaging in drought-proofing techniques including trench cum bunding and building farm ponds to collect field runoff. It is necessary to limit or eliminate power subsidies that encourage indiscriminate water resource extraction. Direct benefit transfer, as started by Telangana and Odisha, may take their place.

10. **Forest and Environment:** Forest and wildlife conservation plans need to incorporate mitigation, and adaptation actions for the near future (5-10 yrs) and long term (20-30 yrs) risks due to climate change. Climate change needs to be incorporated into a disaster management plan. Significant investments need to be made into researching the impacts of climate change on wildlife, their habitats and coastal/marine ecosystems. Investment in climate modelling activities is the need of the hour. Climate change vulnerabilities must be integrated into the management plans for tiger reserves and protected areas, with sufficient research data available.

11. **Social Inclusion:** The types, quantity, availability, and methods of processing, storage and marketing of the primary NTFPs in their region must all be thoroughly understood before any livelihood development measures for these communities can be implemented (Indo-Global Social Service Society, n.d.). This must be done not just at the state/regional level, but also at the micro-level, with a comprehensive grasp of the value chain, challenges, commercialization and revenue enhancement potential. The various afforestation programmes should prioritise the regeneration and planting of trees that generate significant NTFPs, like tamarind, mahua, and medicinal trees (Indo-Global Social Service Society, n.d.). Traditional knowledge of indigenous communities should be leveraged for conservation as well as adaptation. Mechanisms that involve women, children, tribal populations and other marginalized groups in taking climate action and being a part of the discourse around mitigation, adaptation and resilience is needed.

CONCLUSION

1. This report summarized the status of Centrally Sponsored Schemes from the findings of the UCSS evaluations with regards to Climate Change and Sustainability. Future research should use a system thinking approach, critical to planning to face the implications of climate change. Critical questions here include: How would a climate hazard in one sector effect another? What are the interlinkages between sectors?
2. At the same time, analyses of issues such as climate-induced migration which is a key concern for cities in the near future is needed. The role of Monitoring and Evaluation of these interventions is more critical than ever. Are the policies in place having the impact as desired? Do impacts vary across groups in the population? What are needs of Ministries/ Departments/and management to adapt and ensure resilience in the various scenarios?
3. While there is a need to focus on the concepts of climate justice and drive the international discourse on climate finance, it is equally important to look internally and safeguard our population from the current and future impacts of climate change. Going ahead there is a need for continued improvement in international governance around carbon emissions and trade, regulations (including in financial markets), and the involvement of the private sector in decarbonization.
4. CC&S components in schemes must be strengthened and budget allocate to such aspects increased. The transition to climate resilient agriculture, efficient systems of livestock management, investments in green buildings and enforcement of green building codes, moving towards Green-blue master plan for cities, strengthening health systems for all, creating value infrastructure that accounts for environmental factors and adaptation needs through MGNREGS, ensuring that sanitation systems, waste management and distaster management systems can sustain in times of crises are some of the key areas to focus on to ensure adaptation to climate change. The announcemnts made by the Prime Minister during the Cop 26 Conference including reaching zero emissions by 2070, along with the key areas to focus as highlighted in this report can form the basis for a holistic approach to achieve our international comments and fight the climate crisis.
5. Capacity at all levels of government as well as non-profits needs to be built to ensure adaptation policies over the coming years are effectively implemented. Adaptation, discussion, dialogue and learning around climate changes at the community level would help ensure transition over time. It is critical to identiy communities at that are affecting/ affected by climate change, for whom adaptation to climate change is urgent. Those involved in facilitation such transition should be trained to ensure community participation and empowerment. As we progress though the 21st Century, we are already seeing the effects of climate change and all 'hands on deck' are required to sail through the turbulent tides going ahead. Along with the policies in place and the remarkable commitments made during COP 26 at Glasgow, the key to making it through is holistic effort (encompassing all sectors) combined with science and evidence involving all groups of the population.

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ANNEXURES

ANNEXURE 1: NATIONAL ACTION PLAN ON CLIMATE CHANGE

National Solar Mission	Development and deployment of solar energy technology in the country to achieve grid power tariff parity and establish India as the global leader in solar energy through the creation of policy conditions for its deployment across the country
National Mission for Enhanced Energy Efficiency	Promote the market for energy efficiency through fostering innovative policies and market instruments
National Mission on Sustainable Habitat	Ensure that cities are made sustainable through improvements in energy efficiency in buildings, management of solid waste and shifting to modes of public transportation
National Water Mission	Conservation of water, minimizing wastage and ensuring its more equitable distribution both across and within States through integrated water resources development and management
National Mission for Sustaining the Himalayan Ecosystem	Addressing issues regarding Himalayan glaciers and their hydrological importance; protection and conservation of biodiversity; protection and conservation of wildlife; traditional knowledge societies and their livelihood; and planning for sustaining the Himalayan Ecosystem
National Mission for Green India	Protecting, restoring, and enhancing India's (diminishing) forest cover and responding to the issue of climate change through a combination of adaptation and mitigation activities
National Mission for Sustainable Agriculture	Promoting sustainable agriculture through adaptation measures which focus on ten key areas which are essential to Indian agriculture
National Mission on Strategic Knowledge for Climate Change	Build a dynamic and vibrant knowledge system that informs and supports national policy and action for responding effectively to climate change challenges, while not compromising on the nation's growth goals

ANNEXURE 2: SDG MAPPING TO SCHEMES

SDG Goal	SDG Target	Sector	Centrally Sponsored Schemes (UCSS/CSS)	Concerned Ministries/ Departments
Goal 1: End poverty in all its forms everywhere	1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters	Agriculture	PMKSY-PDMC, NFSM, RAD, SHM, SMAF	
		Animal Husbandry	NDP-I	
		Fisheries	IDMF	
Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture	2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality	Agriculture	PMKSY-PDMC, NFSM, ISAM, RAD, PKVY, MOVCD-NER, SMAF, NBM	
		Animal Husbandry	RGM, NDP-I, LHDC	
Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development	Urban Transformation	Smart Cities Mission-SCM	
		Skills	Pradhan Mantri Kaushal Vikas Yojana	
Goal 6: Ensure availability and sustainable management of water and sanitation for all	6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all	Urban Transformation	AMRUT	
		Rural	MGNREGS	
			Shyama Prasad Mukherjee Rurban Mission - SPMRM	
		Water Resources	Repair, Renovation and Restoration (RRR)	
		Social Inclusion, Law and Order and Justice Delivery	Pradhan Mantri Adarsh Gram Yojana (PMAGY)	Ministry of Social Justice and Empowerment (MoSJE)
			Pradhan Mantri Jan Vikas Karyakram	Ministry of Minority Affairs (MoMA)
			Development of Particularly Vulnerable Tribal Groups (PVTGs)	MoTA
			Border Area Development Programme	MHA

SDG Goal	SDG Target	Sector	Centrally Sponsored Schemes (UCSS/CSS)	Concerned Ministries/ Departments
Goal 6: Ensure availability and sustainable management of water and sanitation for all	6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations	WCD	Working Women Hostels Ujjawala Swadhar Greh One-Stop Centre	Women and Child Development
		Rural	Swachh Bharat Mission (Rural)	Drinking-Water and Sanitation
			SPMRM	
		Urban Transformation	Swachh Bharat Mission (Urban)	Housing and Urban Affairs
			SCM	
		Social Inclusion, Law and Order and Justice Delivery	PMAGY	MoSJE
			Pradhan Mantri Jan Vikas Karyakram	MoMA
			Development of Particularly Vulnerable Tribal Groups (PVTGs)	MoTA
			Border Area Development Programme	MHA
	6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	Agriculture	MOVCD-NER, RAD, PKVY	
		Urban Transformation	AMRUT	
			SCM	
	6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	Agriculture	PMKSY-PDMC	
	6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate	Agriculture	PMKSY-PDMC	
		Water Resources	RRR	
	6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	Water Resources	RRR	
		Environment & Forest	Integrated Development of Wildlife Habitats-IDWH	
			Biosphere Reserve (BR)	
			National Plan for Conservation of Aquatic Eco-systems-NPCA	

SDG Goal	SDG Target	Sector	Centrally Sponsored Schemes (UCSS/CSS)	Concerned Ministries/ Departments
Goal 6: Ensure availability and sustainable management of water and sanitation for all	6.a By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitationrelated activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies			
	6.b Support and strengthen the participation of local communities in improving water and sanitation management	Agriculture	PMKSY-PDMC	
		Social Inclusion, Law and Order and Justice Delivery	PMAGY	MoSJE
			Pradhan Mantri Jan Vikas Karyakram	MoMA
			Development of Particularly Vulnerable Tribal Groups (PVTGs)	MoTA
			Border Area Development Programme	MHA
Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all	7.1 By 2030, ensure universal access to affordable, reliable and modern energy services	Urban	AMRUT	
		Social Inclusion, Law and Order and Justice Delivery	PVTGs	MoTA
	7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	Urban	SCM	
	7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology			
Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	8.4 Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production, with developed countries taking the lead	Urban	SBM (U)	

SDG Goal	SDG Target	Sector	Centrally Sponsored Schemes (UCSS/CSS)	Concerned Ministries/ Departments
Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities	Animal Husbandry	NPDD, DIDF, SSCDF	
		Rural	PMGSY	
Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable	11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	Urban	SCM	
			AMRUT	
			SBM(U)	
		Social Inclusion, Law and Order and Justice Delivery	Strengthening of Machinery for Enforcement of Protection of Civil Right Act 1955 and Prevention of Atrocities Act 1989	Ministry of Social Justice and Empowerment (MoSJE), Ministry of Home Affairs (MHA)
			Special Central Assistance to SC Sub-Scheme	MoSJE
			PMAGY	
			Support to Tribal Research Institutes	Ministry of Tribal Affairs (MoTA)
			Modernization of Police Force	MHA
			Border Area Development Programme	
			Infrastructure Facilities for Judiciary	Ministry of Law and Justice (MoL&J)
			Gram Nyayalayas	

SDG Goal	SDG Target	Sector	Centrally Sponsored Schemes (UCSS/CSS)	Concerned Ministries/ Departments
Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable	11.a Support positive economic, social and environmental links between urban, per-urban and rural areas by strengthening national and regional development planning	Social Inclusion, Law and Order and Justice Delivery	Strengthening of Machinery for Enforcement of Protection of Civil Right Act 1955 and Prevention of Atrocities Act 1989	Ministry of Social Justice and Empowerment (MoSJE), Ministry of Home Affairs (MHA)
			Special Central Assistance to SC Sub-Scheme	MoSJE
			PMAGY	
			Support to Tribal Research Institutes	MoTA
			Modernization of Police Force	MHA
			Border Area Development Programme	
			Infrastructure Facilities for Judiciary	Ministry of Law and Justice (MoL&J)
			Gram Nyayalayas	
	11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels			
Goal 12: Ensure sustainable consumption and production patterns	12.2 By 2030, achieve the sustainable management and efficient use of natural resources	Agriculture	PMKSY-PDMC, NFSM, SHM, SMSP, SMPPQ	
		Animal Husbandry	RGM	
		Urban	SCM	
		Environment & Forest	Conservation of Natural Resources and Ecosystems (CNRE)	
	12.3 By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses			

SDG Goal	SDG Target	Sector	Centrally Sponsored Schemes (UCSS/CSS)	Concerned Ministries/ Departments
Goal 12: Ensure sustainable consumption and production patterns	12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment	Agriculture	NFSM, SHM	
	12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse	Urban	AMRUT	
			SCM	
			SBM(U)	
		Urban	SPMRM	
	12.8 By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature			
	12.c Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities			
Goal 13: Take urgent action to combat climate change and its impacts	13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries			
	13.2 Integrate climate change measures into national policies, strategies and planning	Agriculture	PMKSY-PDMC, NFSM, RAD, SMAF, NBM, PKVY, SHM, SMSP, SMPPQ	
		Animal Husbandry	DEDS	
		Urban	MGNREGS	
		Environment & Forest	CNRE	
			NPCA	

SDG Goal	SDG Target	Sector	Centrally Sponsored Schemes (UCSS/CSS)	Concerned Ministries/ Departments
Goal 13: Take urgent action to combat climate change and its impacts	13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning			
	13.a Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible	Agriculture	NFSM	
	13.b Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries, and small islands developing States, including focusing on women, youth and local and marginalized communities			
Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development	14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution			
	14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans	Fisheries	IDMF, FIDF	
	14.3 Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels			

SDG Goal	SDG Target	Sector	Centrally Sponsored Schemes (UCSS/CSS)	Concerned Ministries/ Departments
	14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics			
	14.5 By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information			
Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development	14.a Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries			
	14.c Enhance the conservation and sustainable use of oceans and their resources by implementing international law, as reflected in the United Nations Convention on the Law of the Sea, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of "The future we want"			
Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and dry lands, in line with obligations under international agreements	Environment & Forests	NPCA National Afforestation Programme Green India Mission	

SDG Goal	SDG Target	Sector	Centrally Sponsored Schemes (UCSS/CSS)	Concerned Ministries/ Departments
Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally	Environment & Forests	National Afforestation Programme Green India Mission	
	15.3 By 2020, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world	Water Resources	WDC-PMKSY	
	15.4 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development			
	15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species			
	15.7 Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products	Environment & Forests	Project Tiger Project Elephant	
	15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species	Environment & Forests	National Bio-Diversity Targets	
	15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts			
	15.a Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems			

SDG Goal	SDG Target	Sector	Centrally Sponsored Schemes (UCSS/CSS)	Concerned Ministries/ Departments
Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	15.b Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation			
	15.c Enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities			

ANNEXURE 3: SECTOR AND SCHEME-WISE ASSESSMENT

Agriculture, Animal Husbandry and Fisheries

The impacts of Climate Change on the Sector and Scheme Beneficiaries

1. Agriculture is a source of livelihood for nearly two thirds of India's population (Intended NDC). Uncertainty in weather conditions can affect the planning of agricultural activities and can lead to a loss of income for those wholly dependent on agriculture. Those involved in subsistence farming may become food insecure.
2. Keeping in mind India's growing population which is projected to surpass China to become the most populous country in the world (Bloom, 2011), food security in the face of climate change is of utmost importance.
3. A study on the top grains grown in the country reflects that the national food supply (which is closely associated with grain production) is sensitive to the effect of climate variability on monsoon grain production. The researchers analysed data on yields of five major grain crops of India (finger millet, maize, pearl millet, sorghum, and rice) over 46 years (1966-2011) and covered 593 of India's 707 district (Davis et al., 2019). The findings revealed yields from rice, India's main crop experienced larger declines during extreme weather conditions and reliance on a single crop like rice for food security can make India's food supply potentially more vulnerable to the effects of varying climates. This study found that yields of other crops (maize, millet, sorghum, etc) were more resilient to extreme weather (Davis et al., 2019). Depending on different climatic variables (such as temperature, precipitation, etc.), there are different impacts for various crop yields (Mishra, 2020).
4. Some of the effects of climate change on the agricultural sector in general include increased risks due to new patterns of pests and diseases, increased risk of crop failure, extreme weather such as high temperatures, excess rainfall, droughts, floods, etc can harm crops and reduce yields. Similarly, there is an increased risk of moisture stress and soil erosion (Kim).
5. The agriculture sector in India faces a diverse range of challenges which include increasing production cost, depleting ground water resources, reducing the availability of water, declining soil quality, scarcity of quality agriculture inputs, low productivity, reducing crop diversity, climate change, increasing land degradation and most importantly low-price realisation to farmers (USCC package 1).
6. There can be potential positive effects on this sector. Some positive effects include increased productivity due to increased concentration of CO2; a low-level temperature rise can lead to increased productivity in some regions, there is a possibility of cultivating new crop varieties and for protected cultivation there could be a reduction in heating cost (Kim.)

Contribution of the Agriculture sector to Climate Change

7. Going ahead, it is as important to invest in adaptation as well as mitigation. The main contribution of this sector to GHG's are as follows (Dickie et al., 2014):
    - The use of synthetic fertilizers leads to No2 emissions,
    - Emissions from electricity used in pumps for irrigation,

- Most rice production systems where there are flooded fields result in methane emissions from anaerobic decomposition,
- Black carbon emissions from agricultural fires,
- Emissions associated with the agricultural supply chain (transport, cold chain,etc but usually captured in transport emissions),
- Fertilizer production,
- Agriculture is a key driver of deforestation and conversion of peatlands, forests, etc to agricultural lands. Similarly this sector contributes to emissions through agricultural waste burning and grassland burning.

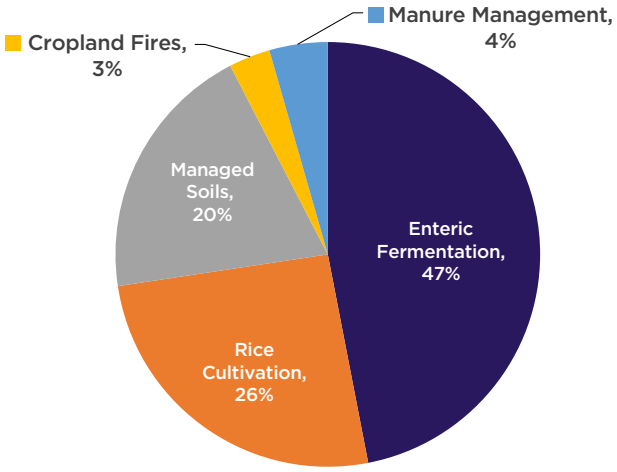

Figure 8: *Emissions from Agriculture in India (2015-2020)*

Source: *Climate Change Inventory (https://www.climatetrace.org/)*

Scheme level analysis[6]

Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)

8. The PMKSY- per drop more crop scheme component directs the use of a fertigation device. There is a subsidy available on these devices such as venturi injector or fertilizer tank. Fertigation avoides overuse of fertilizers and water. When fertilizers are applied to crops, a set of chemical reactions in the soil lead to the generation of Nitrous Oxide. Fertigation thus helps to manage the use of fertilizers and thus reduce emissions while maintaining the level of crop production (Skiba and Rees, 2014).
9. Micro-irrigation is a sustainable measure by enabling water savings upto 40 per cent as compared to conventional flood irrigation. It also enhances crop yield by 47 percent and incomed 48 percent respectively (Ministry of Agriculture and Farmers Welfare, 2017). This mechanism also helps in soil health management and enhances nutrient efficiency. Further to improve the productivity of crops, fertigation is practised in the areas irrigated through micro-irrigation techniques which maximises the benefit of micro-irrigation.

6 Information for the scheme level analysis is sourced from the Agriculture Sector, UCSS Evaluation (2020/21), DMEO, NITI Aayog, Volume 2.

Rashtriya Krishi Vikas Yojana - RAFTAAR

10. Given that RKVY has convergence with other schemes and can have a more far-reaching impact than a single scheme, provisioning for climate-friendly practices through the scheme may be beneficial. While the scheme promotes climate-resilient practices, there is no mandate for complying with them.

11. The following was observed from primary and secondary analysis concerning this scheme (USCC, 2020) :

    - The scheme encourages the adoption of green practices but does not mandate any specific activities for climate sustainability.
    - RKVY funds are permitted to be used for implementing solar energy in agriculture i.e Solar pump sets, Solar dryers, solar energy in the greenhouse etc., under agriculture mechanization.
    - The funds may also be used for the creation of greenhouse infrastructure (under horticulture), and setting up of new soil testing and fertiliser quality control laboratories.
    - Apart from these, sustainable agricultural practices specified under various schemes of DAC&FW are eligible for financial assistance under RKVY.

The mission for Integrated Development of Horticulture

12. Horticulture helps to mitigate the effects of climate change through several ways. The key mechanisms include microclimate moderation, carbon sequestration, natural resources conservation and increasing adaptive capacity through the creation of additional sources of livelihood and income opportunities.

13. The interventions are targeted to increase the area under horticulture crops, the orchards help in carbon sequestration and mitigation. Horticulture crops also diversify the source of income for farmers and help in reducing risks. More than 4 lakh hectares of area has been bought under horticulture. The focus is there on rejuvenation of old orchards, increasing input use efficiency through mechanisation and drip irrigation, protective cultivation, organic farming and integrated pest management and nutrient management. Good agriculture practices and packages of practices are also being encouraged. These activities help in building climate resilience and better input use efficiency.

National Food Security Mission

14. Initiatives are being undertaken to include components of adaptation and resilience in agriculture and also reduce carbon emission in the process. Such initiatives under NFSM include crop diversification programme, crop rotation programme, inter-cropping programme, etc. The mission funds special projects such as reclamation of problematic soils, development of water-logged areas and mitigation of adverse effects of climate change are funded under the Mission.

15. The following was observed from primary and secondary analysis with respect to this scheme: The Ministry has collaborated with ICRISAT, ICAR, and IIMR for developing stress tolerant/climate-resilient varieties of crops. Many sustainable practices have been promoted under NFSM, including micro irrigation, bio-fertilizers, bio-pesticides, integrated nutrient

management, soil reclamation, etc. Inter-cropping of pulses with sugarcane in autumn and spring in 12 states, along with training and demonstrations have been undertaken.

Sub Mission on Agriculture Mechanization

16. SMAM is promoting the mechanisation of agriculture/horticulture by strengthening farm power and post-harvest technologies. Under the PHT component support is provided for the purchase of machinery for crop residue management. However, during implementation there is limited focus on crop residue management and more stress is there on increasing farm power. Increasing farm power by promoting machinery that consumes energy makes agriculture more resource intensive.
17. Demonstration on crop residue management is also being taken up that can help in reducing pollution from burning of crop waste and straw. Apart from this, there is no training related to disaster risk or climate change.
18. The evaluation report by WAPCOS on SMAM highlights the overall positive impact of mechanisation as it helped in reducing inputs with an 11% reduction in seed rate, 26.6% reduction in weed instances, 22.4% reduction in diesel consumption and 12.7% reduction in fertiliser requirements (Ministry of Agriculture and Farmers Welfare, 2018).
19. Within the scheme there is a need to encourage precision mechanization that can help in better utilisation of resources i.e soil and water.

Rainfield Area Development

20. Rainfed Area Development (RAD) is a sub-component of the National Mission on Sustainable Agriculture (NMSA). RAD focuses on building climate-resilience through diversification by promoting integrated farming systems and diversified farming. Through RAD, diversified pulse, oilseed, millet based cropping systems, horticulture based cropping systems, Livestock based farming systems, tree/Silvi-pastoral agro forestry-based systems and fishery based farming systems can be promoted.
21. In addition, for value addition and farm development activities silage, apiculture, Water harvest conservation and resource conservation activities can be taken up. Reclamation of problem soils and vermi-composting are few other components that can contribute towards climate change adaptation.
22. Training and capacity interventions involve training on the concept of integrated farming, climate change adaptation, Good Agriculture Practices on soil water and crop management of natural resources for food and livelihood security. A cluster-based approach is being followed and efforts are being made to promote integrated nutrient management practices and on-farm water management interventions in identified clusters through other schemes of NMSA and PMKSY-PDMC.
23. However, among the scheme components, more than 40% of funds are utilised on livestock-based farming and 90% on integrated farming. There is a need to promote peripheral plantation, agro-horti-silvi systems and there is a need for more focus on soil reclamation and value addition and farm development activities to promote protective irrigation and input efficiency (UCSS, 2020).

Paramparagat Krishi Vikas Yojana

24. One of the prime objectives of the scheme has been to ensure the adoption of climate resilient organic farming practices that will help in developing the health of the soil by mitigating the damage done due to the extensive use of fertilizers and pesticides.

25. Organic agriculture helps to mitigate climate change by storing carbon in the soil. Zero tillage and mixing crop stubble with the soil results in more carbon being stored into the soil,which means less carbon in the atmosphere.

26. Besides,organic farming avoids the use of fertilizers,whose production requires the burning of fossil fuels. Also,after the application of fertilizers like ammonium nitrate to crops,chemical reactions in the soil produce nitrous oxide (N2O) which is a greenhouse gas. By focusing on reduction of fertilizer usage, Paramparagat Krishi Vikas Yojana helps to mitigate greenhouse gas emissions.

27. Organic farming also helps the farmers to adapt to climate change because organic content covering the topsoil helps to prevent water loss which makes the soil more resilient to droughts and land degradation.

Plant Protection and Quarantine

28. Both IPM and MPRNL seek to minimize the use of pesticides and promote organic farming and the use of bio-fertilisers. The schemes hence promote climate-friendly practices. Under the umbrella SMPPQ scheme, financial assistance is provided to the States for establishing/ strengthening of Pesticide testing, bio-pesticides testing and Bio-control laboratory. The Umbrella scheme includes a component for the creation of an environmental impact study cell, to examine the impact of pesticides on the environment, and mitigation measures wherever possible.

Agro Forestry

29. Agroforestry is known to have the potential to mitigate the effects of climate change through microclimate moderation, conservation of natural resources and creation of additional sources of livelihood and income opportunities. The guidelines stipulate that specific demonstration projects be taken up in the field of climate-resilient agroforestry systems. A study published in the International Journal of Current Microbiology and Applied Sciences concluded that total carbon sequestration potential (CSP) varied from 0.032 to 1.849 million tonnes of carbon and the total CSP of all 15 analysed states came out to be 7.230 million tonnes of carbon.

30. It is noteworthy that higher area under agroforestry does not automatically translate into higher CSP. However, it is one of the factors at play for higher CSP. As the scheme's progress has been quite limited, its contribution to climate mitigation may not have been in line with the potential.

National Bamboo Mission

31. Bamboo is known to have the potential to mitigate climate change effects through carbon sequestration, restoring soil fertility at degraded lands, and its ability to grow without any fertilisers. However, the scheme does not specifically mandate any climate-resilient activities

towards capacity building of farmers for sustainable farming or employing climate-friendly practices for Processing.

Soil Health Management

32. The soil health-driven initiatives take its root from successful programs in the states of Karnataka and Gujarat. Initially, the National Project on Management of Soil Health & Fertility' (NPMSH&F) was initiated as part of NAPCC. Under this scheme, soil health cards were introduced and interventions for strengthening soil testing labs and expanding their testing capacity were taken up.

33. This evolved into the current Soil Health Management component wherein multiple other initiatives i.e., PKVY, MOVCDNER etc. were also introduced. Soil health card and strengthening of soil testing labs have evolved and remains an integral component of National Mission on Sustainable Agriculture. Given there is limited scope for increasing agricultural area, maintaining food security in highly populous nations such as India requires interventions to improve productivity.

34. The current agricultural practices are severely stressing the natural resource base and contributing to a decline in soil health, water availability and quality, biodiversity, and air quality. Large areas under the green revolution belt have also seen a decline in productivity and water levels in many districts have also dropped to critical levels. Given the quantum of challenges, the promotion of improved agricultural practices can help in adapting to climate change and ensure food security (Paroda et al., 2018).

35. Imbalanced use of chemical fertilizers have affected soil health and productivity, and excess use of nitrogen rich fertilizer which is prevalent in many Indian states have affected soil health and are contributing towards GHG emissions. Deterioration in soil quality affects its capacity to retain water and store carbon. For example, soils in the Indo-Gangetic plains are severely degraded with soil organic carbon content dropping below critical threshold. Soil health cards can promote management of soil nutrient through scientific methods which helps in maintaining soil health and improved productivity through judicial use of fertilizers.

36. The soil health card recommendations also focus on increased use of vermi-compost, FYM. Bio-fertilizers are also being promoted to reduce dependence on chemical fertilizers. The soil health cards also measure soil organic carbon and pH value of soil to understand the nature of soil. The health card and analysis can help in developing activities for improving fertility and reclamation of problem soils. The site and crop-specific recommendations help in contributing towards sustainable and more climate-resilient agriculture.

National Project On Organic Farming

37. Some objectives of this scheme have relevance to climate change. For example, there is a focus on statutory quality control of biofertilizers and organic fertilizers under the Fertilizer(Control) Order (FCO), 1985, including revision of standards and testing protocols, keeping in view the advances in research and technology and bringing remaining organic inputs under quality control regime.

38. The objectives of these schemes also include capacity building for soil health assessment, organic input resource management, technology development through support to research and market development. After synthetic fertilizers are applied to the soil, a set of chemical reactions generates Nitrous oxide. Nitrous oxide has a greater global warming potential than some of the other GHGs, such as carbon dioxide (Tullis, 2020).

39. Similarly, Mission Organic Value Chain Development for North Easter Region (MOVCDNER) also takes into its ambit the creation of awareness among the farmers and the consumers of the positive aspects linked with organic farming and the associated environmental benefits which come along.

Integrated Scheme on Agricultural Cooperation

40. To manage efficiently and effectively the risks arising out of such global events of rising temperature, depleting natural resources, and deteriorating agricultural productivity; farmers' organizations and agricultural cooperatives can act as pivotal agents who can curb the negative impacts arising from such extreme weather conditions and natural hazards (FAO, 2018). The large size of their membership places cooperatives in a unique position to raise member awareness about the importance of reducing their carbon footprints and to lobby Governments to significantly reduce their greenhouse gas emissions.

41. Under ISAC, though there is no documentary evidence of addressing the climate change impacts, some of the funding activities undertaken by the NCDC, are listed below, to address the adverse effects of climate change:

- Water conservation works/services
- Generation and distribution of power by new, non-conventional and renewable sources of energy
- Creation of water harvesting/irrigation infrastructural facilities
- Trainings conducted by NCUI targeted climate change and environment protection

Animal Husbandry

The impacts of Climate Change on the Sector

42. The potential impact of climate change on animal husbandry can be through high precipitation, increased temperatures, increased carbon dioxide or a combination of these factors (Rojas-Downing et al., 2016).

- An increase in CO2 decreases the quality of forage (more on C3 species) but can have positive effects on plants, such as reduced transpiration. Variation in precipitation and prolonged dry spells affects forage growth, quality, and biodiversity.
- Higher temperatures will lead to increased water consumption by animals, low-quality feed and reduced feed conversion rate will lead to smaller animals and thus affect production.
- High yielding cows are more susceptible to heat stress. Heat stress increases body temperatures which in turn lead to reduced milk production and quality (Prathap Pragna. 2016).

- Increased temperatures lead to lower reproduction of cows, pigs, poultry and egg production.
- Increased temperatures may result in higher mortality in grazing animals. New diseases can affect the health and immunity of animals. Prolonged heat can affect the liver functionality and metabolism of animals.
- Increased heat and precipitation can lead to increased pathogens, parasites, disease transmission, outbreaks of severe diseases and the spreading of vector-borne diseases.

Contribution of the Livestock Sector to Climate Change

43. It is important to clearly list out the direct and indirect contribution of livestock to climate change. The livestock sector contributes 14.5% of global anthropogenic greenhouse gas (GHG) emissions (Rojas-Downing et al., 2016). Livestock is a source of emissions in the following ways (Dickie et al., 2015).
    - Enteric fermentation: As a by-product of the natural digestive process, ruminants such as cattle, goats and sheep emit methane.
    - Manure that falls on grazing lands or that is applied as a fertilizer on croplands causes Nitrous Oxide emissions
    - Decompositions by storing of manure and urine cause methane emissions.
44. Apart from the above-mentioned direct sources of GHG emissions, animal husbandry also contributes to emission indirectly through deforestation for grazing, use of non-renewable sources of energy in livestock feed production, transport and processing of livestock products, etc.

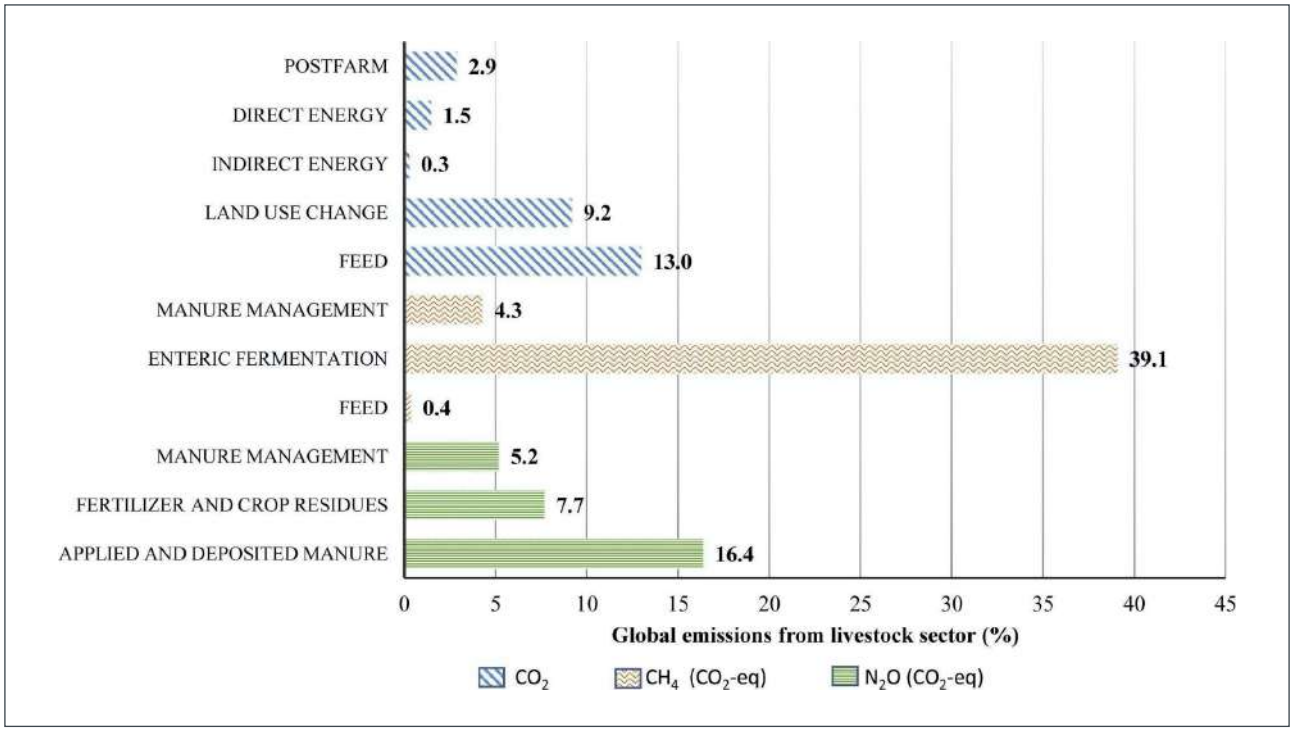

Figure 9: *Global Emissions from the Livestock Sector*

Source: *Gerber et al. 2013*

Scheme level analysis[7]

National Dairy Plan

45. Diversification of the livelihood of agricultural communities by making dairy activities more productive and profitable is the underlying objective of the project which also contributes toward Climate change adoption. The project guidelines also have incorporated environmental and social awareness activities. There is an Environment and Social framework in place for the project which has indicated climate change mitigation measures to minimize the associated risk of the project activities (NDP Guidelines, 2013)

46. Promotion of renewable energy 1000 Flexi biogas plants of 2 cubic meter capacity with 50% subsidy has been supported through the scheme. Facilitation was provided to promote the sale of slurry as manure. 21 biogas plants have been established in semen stations for lighting, pumping, water and electricity needs. Pilot rooftop solar panels have also been established in 55 DCS.

Dairy Entrepreneurship Development Scheme (DEDS)

47. There is a possibility of creating a circular economy in this scheme. For example, livestock manure for vermi-composting acts as an important fertiliser. Livestock rearing and dairy development can thus help in maintaining soil productivity for agriculture. Agriculture residue on the other hand acts as fodder for animals. The cultivation of fodder crops can help in meeting the demand for green fodder. Thereby creating a mutually beneficial complementary and circular economic cycle.

48. The scheme can promote diversification of agri-allied activities by promoting dairy development and vermi-composting. The scheme can also support climate-friendly biomass-based BMC. Apart from this there are no specific components under the scheme for promotion of climate change mitigation/adaptation or sustainability. There are no provisions for training programmes in the scheme on climate awareness/mitigation or adaptation measures for beneficiaries. Also, there is no specific provision for promotion of climate-friendly technology/renewable for refrigeration in cold storage and BMC.

National Programme for Dairy Development (NPDD)

49. NPDD is promoting diversification of agricultural activities by strengthening dairy infrastructure. This encourages integrated farming practices including animal husbandry and dairying. Animal waste acts as an important fertilizer for crops, whereas crop residue is an important feed source for animals in increasing their productivity. Together they produce milk which is an important source of nutrition for the large Indian population.

50. Male calves borne from milch cows are an important source of draught animal power as nearly 50% of total cultivable area is managed by draught animals (Phaniraja and Pachasara, 2001). These animals can be used for multiple purposes such as water lifting, etc. These in turn help in reducing dependence on machinery, fuel and tractors and contribute towards a circular and energy-efficient economy.

7 Information for the scheme level analysis is sourced from the Animal Husbandry Sector, UCSS Evaluation (2020/21), DMEO, NITI Aayog, Volume 3.

51. It is important to note that NPDD does not have any component on creating awareness on climate change and sustainability or disaster risk reduction. Under the project, the states can get support for effluent treatment plants. However, there is no specific provision in the scheme for promotion of clean/renewable energy or energy efficient technology. Despite the availability of equipment and chillers that can use climate-friendly energy-efficient technology, budget constraints put limitations on choice of milk unions/cooperatives and infrastructure and equipment proposed under NPDD are often limited by budget constraints.

National Livestock Mission (NLM)

52. NLM does not have any component which directly builds awareness on climate change and sustainability and only one of the targeted activities under the mission is targeted at climate change i.e Germplasm conservation, collection and evaluation with special reference to climate change'. However, promoting activities to control and prevent animal diseases and environmental pollution is one of the mission objectives. Apart from the activities mentioned above, none of the mission activities or awareness generation is designed with an objective of climate change adaptation or mitigation.

53. No specific disaster risk reduction plan is in place but only activities/infrastructure that comply with state disaster management and environmental norms are to be approved under the mission. Within the guidelines it is highlighted that all infrastructure should have a disaster management component.

54. In this sector, few components within the National Livestock Mission that can support climate change mitigation and adaptation are mentioned below.

- Fodder cultivation, if carried out on cultivable wasteland/designated grazing land/ agriculture land, by use of minimal fertilisers and pesticides, can help in reducing emissions and help in ensuring availability of green fodder. This can help in reducing pressure on forests and prevent forest degradation.
- Interventions like distribution of chaff cutters, fodder block manufacturing units can help in crop residue management and better utilisation of residue that otherwise might be burned by the farmers.
- Carcass utilisation units- fallen carcasses are a source of pollution and may also spread diseases, carcass utilisation plants or slaughterhouses with carcass utilisation plants but better utilisation of carcass for important resources like leather. This indirectly contributes to the circular economy. This is the only scheme that has components on carcass utilisation.
- Insurance and health- Climate change can have potential impact on health and wellbeing of livestock, livestock insurance helps mitigate associated risk and health cover that is being provided under NLM for vaccination helps in control of disease. It has been observed in the HH Survey that 92% of the NLM scheme beneficiaries have availed insurance. The graph below depicts the findings from the analysis.

Livestock Health & Disease Control (LHDC)

55. While the main objective of the scheme relates to maintaining livestock health and controlling diseases, several components of the scheme directly/indirectly relate to climate change. For

instance, cold chains depend on hydrofluorocarbons (HFCs), which have a major impact on our climate – HFCs contribute 4% of the total global warming impact of moving all freight, refrigerated or not. For each move that is refrigerated, HFCs contribute a significant portion to the climate footprint. Similarly, the needles, syringes, and medical equipment used for immunizing livestock can have a major adverse impact on the environment, if not disposed of prudently. The disease diagnostic laboratories established as part of the scheme can also contribute to climate change if not using climate-friendly equipment/technology. The scheme thus has a lot of potential to address climate sustainability.

56. The following was observed from primary and secondary analysis with respect to this scheme:

- The scheme promotes the state biological production units to comply with Good Manufacturing Practices (GMP), and disease diagnostic laboratories to comply with Good Laboratory Practices (GLP).
- The state governments have been advised to employ an effective waste management/ end-of-life system for resources used in the schemes (needles, syringes, medical equipment). It does not currently promote the use of renewable energy at newly established labs, hospitals, or dispensaries. However, use of solar power is being considered for these establishments.
- The technology used for biological production units, state vaccine production units, are not mandated to be environment friendly.
- The scheme does not have any specifications for using refrigeration units that run environmentally friendly refrigerants.
- There are specific training sessions for stakeholders on adopting green practices, disposing medical waste, installing sustainable medical equipment, etc.

Rashtriya Gokul Mission (RGM)

57. Diversification is an extremely important aspect of climate sustainability. This ensures that an ecological balance is maintained and no particular species are over-exploited. The greater the diversity in genes, the more likely it is that individuals in a population will possess the differentiated genes which are needed to adapt to an environment.

58. As per the 20th Livestock Census, the total bovine population in India stands at 303.76 million in 2019. The total number of cattle in the country is 193.46 million. Of this, 73.5% (142.1 million) is indigenous/nondescript cattle. There is a 6% decline in the total indigenous population. This is a cause for concern as the main aim of RGM is to increase the population of indigenous cattle. At the same time, the population of exotic/crossbred cattle rose by 29.3% in 2019. While the increase in diversity in crossbred cattle is appreciated, the simultaneous decline in indigenous cattle is worrisome, and defeats the purpose of the Mission.

59. The following was observed from primary and secondary analysis with respect to this scheme:

- An important objective of the Mission is conservation and development of indigenous breeds. These breeds are climate resilient (high heat tolerance levels), disease-resistant, and can survive under extreme weather conditions.

- Making these cattle genetically superior through AI would increase farmers' income and enhance cattle diversity, which is an important aspect of climate resilience.
- Ruminant livestock generate a significant proportion of anthropogenic GHG emissions, and thereby contribute to climate change. Ruminants such as cattle. sheep, goats and buffalo produce meat and milk through enteric fermentation (a digestive process by which carbohydrates are broken down by microorganisms into simple molecules for absorption into the bloodstream of an animal). This process produces methane which is emitted via belching, and the amount of methane produced is directly related to the type of food consumed and the level of intake (Porsavatdy et. al., 2016)
- Hence, the scheme promotes balanced diet for animals (through LRPs) to reduce emissions. Biogas plants are installed at the farm and biogas is used to run efficient generators to produce electricity within the Gokul Gram. It also imparts training to stakeholders for sustainable practices.

Dairy Processing & Infrastructure Development Fund (DIDF)

60. The scheme only focuses on modernization and creation of infrastructure, setting up testing equipment to determine milk quality, project management and learning, and other related activities. It does not lay any emphasis on inculcating any climate-resilient practices, adoption of energy-efficient machinery, or usage of renewable sources of energy. There are no planned design factors for promoting sustainability.

61. The following was observed from primary and secondary analysis with respect to this scheme:

- The potential for incorporating climate change and sustainability practices in the scheme is immense. These practices may be in the form of promoting the use of cold chain refrigeration units that run on alternate (less-harmful) gases as most cold chain systems depend on hydrofluorocarbons (HFCs), which have a major impact on our climate.
- The scheme could promote the use of renewable energy at newly established milk processing units, manufacturing facilities, and milk testing labs.
- The scheme promotes the use of R22 gas in refrigeration units, which is less harmful than HFC.
- It also encourages the use of energy-efficient technologies in the infrastructure created. The scheme propagates the adoption of Good Manufacturing Practices (GMP) and Good Hygiene Practices (GHP).
- The KII discussions revealed that sensitization on climate change is part of beneficiary sensitization during a project and post-project. The scheme does not have any disaster risk reduction plan in place. There are no effective waste management/end-of-life systems in place for resources used in the scheme (obsolete equipment)
- There is no specific training for stakeholders on adopting green practices, using climate-friendly refrigeration units, installing sustainable dairy equipment, etc.

Fisheries

62. In 2016, the government merged all ongoing schemes for fisheries under Blue Revolution: Integrated Development and Management of Fisheries, covering inland fisheries, aquaculture, marine fisheries including deep sea fishing, Mariculture and all activities undertaken by the National Fisheries Development Board (NFDB). Presently, two schemes are ongoing under the Blue Revolution:

    i. Integrated Development and Management of Fisheries

    ii. Fisheries and Aquaculture Infrastructure Development Fund (FIDF)

The impacts of Climate Change on the Sector and Scheme Beneficiaries

63. Warming of water may impact fish diversity, distribution, abundance and phenology. Acidification of water will affect calciferous animals. Storms, floods and drought will severely impair fisheries. Sea level rise will lower fish production and damage the livelihoods of communities. Some tropical fish stocks may face regional extinction. Some others may move towards higher latitudes. Coastal habitats and resources are likely to be impacted through sea level rise, warming sea temperatures, extremes of nutrient enrichment (eutrophication) and invasive species. Most fish species have a narrow range of optimum temperatures related to their basic metabolism and availability of food organisms. Even a difference of 1 degree C in seawater may affect their distribution and life processes.

Scheme level analysis

Integrated Development and Management of Fisheries

64. With limited resources in the coastal waters and the exacerbating impact of pollution, climate change is bound to have far-reaching consequences on the fisheries industry. Climate change will also impact the composition and location of production. One major advantage that India has is that it has higher fish production from inland fisheries. Inland fisheries are a low carbon footprint food source compared to terrestrial agriculture, marine fisheries and fed aquaculture (FAO, 2018). Inland fisheries require neither feed nor fertilizer (the main contributors to greenhouse gas emissions and often use non-mechanized gear that does not require fuel (consumed by boats using active fishing gear in major marine fisheries). This places India in a position where its overall capability towards climate resilience is better than other countries where marine fisheries production is higher. The Integrated Development and Management of Fisheries scheme focuses on this aspect. One of the main objectives of the scheme is to achieve economic prosperity of the country and the fishers and fish farmers in a sustainable manner, keeping in view the biosecurity and environmental concerns (Department of Animal Husbandry, Dairying & Fisheries, 2019). It also involves implementing the Code of Conduct for Responsible Fisheries (CCRF). Under the management of marine fisheries, the scheme promotes allocation of funds towards studies on the impact of climate change, natural calamities, pollution, etc. on fishery resources. The following was observed from primary and secondary analysis with respect to this scheme:

    - Reducing fishing mortality in fisheries which are currently over-exploited leads to environmentally sustainable practice. This is done in the scheme by adopting the

Code of Conduct for Responsible Fisheries. This has also been done through levying an annual fishing ban period of 61 days.

- The scheme lays special emphasis on climate-smart agriculture through strengthening of aquaculture, which ensures rise in fish production while still maintaining sustainability.
- However, no specific training is being imparted as part of the scheme to sensitize beneficiaries on climate change.

Fisheries and Aquaculture Infrastructure Development Fund

65. The scheme through its components contributes towards improving asset ownership and economic security. It fills the credit and resource gap in the fisheries sector for modernization, creates aquaculture infrastructure, reduces post-harvest losses which eventually contribute to better price realization and supports the fishing sector to generate sustained income. The infrastructure thus created will help reduce spoilage losses. A robust infrastructure will not only increase farmer income, but also enable an increase in exports (if spoilage is lower).
66. The scheme contributes to UN SDGs by contributing towards SDG 14: Life Below Water as the scheme provides financial support for infrastructure development and augment fish production with sustainable growth.

Women and Child Development

Gender integration in climate change policy is critical for ensuring effective local adaptation planning. Women are more vulnerable to the impacts of climate change due to inequitable social norms, lack of access to formal education, limited access to resources due to skewed power structurers and general economic poverty. The vulnerability to impacts of climate change is high in case of rural women due to five main reasons. First, women participation in agriculture is high in rural India, women constitute 42% of the agricultural labour force in India (NCAER,2018). Second, women have limited access to productive assets like land. Women in India own only 14% of operational agricultural land (Agriculture Census 2015-16). Since most women farmers lack ownership over the land they cultivate, women cannot use the land as collateral to get credit from banks.

Third, rural women find it difficult to adapt to climate change since they are deprived of basic educational and health facilities. Fourth, due to poor availability of weather forecasts and other climate information,women are not able to adequately practise crop diversification (Paudyal, Aggarwal et al,2019). Fifth, women are poorly represented in farmer organisations and thus, have limited participation in decision-making processes. All these factors make it extremely difficult for women to cope up with climate change vis-à-vis men.

The need of the hour is to incorporate gender in climate change policies so that women can participate,benefit as well as feel empowered through a combination of approaches. (Aggarwal et al,2019).

Impact of Climate Change on the WCD Sector

Impact on health

Climate change has direct as well as indirect effects on health. Direct effects include increased subjection of the body to heat waves, poor air quality, frequent extreme climatic events like floods,

droughts, and storms. Indirect effects include food insecurity and undernutrition due to crop failure and vector-borne disease transmission. The UNFCCC notes that women are highly vulnerable to adverse impacts of climate change due to biological, political, and cultural factors. (Sorensen et al,2018)

Air pollution gets amplified due to warmer climate. Various diseases like dengue and malaria spread easily in a warmer climate and affect children the most. Food scarcity and extreme heat harm young and poor children the most.

Table 2 shows the impacts of different climate change indicators on the health of women and children and how these impacts are exacerbated by various socio-economic, cultural and biological vulnerabilities associated with women. The table also suggests gender-based solutions which can be undertaken to mitigate the impact of climate change on women and children.

Table 2: Impacts in the WCD Sector

Climate Change indicator	Climate Change Impact on health	Social, cultural, economic and Biological Risks	Women-centric solutions
Heat waves, **heat island effects**	◆ Reproductive risks ◆ Neonatal mortality ◆ Infant mortality	Inadequate cooling amenities	Provide air conditioners to expecting mothers
Rising temperatures and **increased precipitation**	Diseases transmitted through vectors: ◆ Malaria, ◆ Dengue ◆ Chikungunya ◆ Japanese encephalitis	Most women are not a part of the labour force and thus are home-bound due to which they are exposed to standing water sites	◆ Vector-borne surveillance systems ◆ Provision of bed nets, insecticides ◆ Provision of child care facilities so that women can join the labour force
Increased rate of evaporation, water scarcity and drought	◆ Water scarcity forces people to consume water from contaminated sources ◆ Women have to travel long distances to procure fresh water which means: ★ Greater risk of neck and spine damage, ★ Increased exposure to heat and heat strokes,	◆ Due to poverty, poor people do not have sufficient means to buy tap connections and purify water ◆ Excess time devoted to fetching water means reduced time for earning a livelihood and also a greater risk of sexual harassment of women	◆ Increase pipe water connections to urban areas which are far away from the water sources
High temperatures lead to **worsening of air quality** due to an increase in: ◆ Allergens, ◆ Ground-level ozone ◆ Forest fires	◆ Allergic reactions become severe for women ◆ Diminished lung function ◆ Rise in asthma cases ◆ Rise in premature deaths	Women at home use traditional indoor cooking stoves and open biomass chulhas which further amplify air pollution and harm women's respiratory systems	Increase access to clean cooking energy, LPG connections through Ujjwala scheme

Climate Change indicator	Climate Change Impact on health	Social, cultural, economic and Biological Risks	Women-centric solutions
Reduction in yields of crops like maize, wheat; Reduction in fish stocks due to warming of oceans	◆ **Food insecurity** ◆ Undernutrition ◆ Anaemia ◆ Loss of income to women farmers due to reduced crop and marine yields	Food scarcity adversely affects women particularly and exacerbate their diseases like anaemia and nutritional deficiency	◆ Crop diversification ◆ Use Genetic engineering to produce climate-resilient crops ◆ Food fortification for nutritional security
Increased frequency of **disasters like cyclones, cloudbursts** and floods	◆ Women are more prone to die in extreme weather events like floods,cyclones ◆ Flooding compounds the issues of diseases transmitted by vectors	◆ Separation from family during disasters may amplify the woes of women and children	◆ Provide "lost and found" facilities so that missing women and children can be tracked and integrated with their families in safe shelters

Table 1: Impact of different climate change indicators on women, associated vulnerabilities and gender-based solutions(Sorensen et al,2018)

Impact on worker productivity

Severe weather, including high temperatures, has been shown to hurt various drivers of growth such as human survival, human capital, and worker productivity (Garg et al,2020). While cooling technology (such as air conditioning (AC)) can mitigate some of these negative impacts, it is difficult to reduce losses in worker productivity on account of heat, when the tasks are conducted outdoors. India has a tropical climate which exposes workers to heat and humidity, thereby reducing their productivity, and the lack of resources makes it harder to compensate for the loss in productivity.

Impact on migration

The process of environmental degradation can lead to migration. Coastal flooding, erosion of shorelines, extreme weather events can lead to displacement and internal migration. Due to poverty and inadequate climate information,women are highly vulnerable to displacement and are forced to take refuge in temporary shelters where they face the threat of sexual abuse.

Scheme level Analysis[8]

Anganwadi Service scheme (U-ICDS)

Though there is an absence of climate-resilient policies and disaster risk reduction plans in the core scheme design and implementation framework, some key practices have been highlighted in the operational guidelines in ICDS regarding climate change. These are:

- Mandating the use of smokeless chulhas to the extent possible.
- Requiring fuel to be stored safely, to eliminate fire hazards.
- Not using firewood to the extent possible in the interest of environmental protection.

8 Information for the scheme level analysis is sourced from the Women and Child Development Sector, UCSS Evaluation (2020/21), DMEO, NITI Aayog, Volume 2.

- Waste storage should be done in such a way that waste should be covered and discharged at regular intervals.
- Disposal of waste according to Plastic Waste Management Amendment Rules 2021 and Bio-Medical Waste Management Rules,2016;
- Disposal of sewage according to standards set by Central and State Pollution Control Boards; and
- Proper garbage management so that contamination of food and water can be eradicated.

Further, the efforts made towards digitalisation of AWCs underscores the stakeholders' interest towards greater accountability with climate-resilient administrative processes. Approximately, 8.2-kilogram paper registers have been substituted with a 173 grams smartphone with the roll out of the ICDS-CAS software[9]

The state of Odisha has a Climate Change Action Plan according to which children will bear the brunt of disasters. For instance, during cyclones and floods, schools and AWCs remain closed, and children are forced to stay in cyclone and flood shelters. Basic health and Anganwadi services get affected due to disruption in connectivity and the inundation or damage of the facilities. This highlights the need for provisions under the scheme to address the risks that women and children face and thus,the construction of climate-resilient Anganwadi centres needs to be expedited. (Review of Odisha SPACC, 2017).

On the whole, the Anganwadi Scheme does not consider climate change as an integral part of scheme design. Monitoring Mechanism is also missing for climate change. However, construction-based projects must have climate change components embedded into it.

Poshan Abhiyan (U-ICDS)

The scheme does not have any component/strategy that addresses climate change or contributes to sustainable practices since climate change is not relevant to the scheme's objectives. However, climate change and sustainable practices should be made an integral part of policy design. Schemes where physical infrastructure is being created, rain water harvesting, renewal energy usage should be made an integral part of it.

PMMVY (U-ICDS)

The scheme does not have any component/strategy that addresses climate change or contributes to sustainable practices since climate change is not relevant to the scheme's objectives. However, climate change and sustainable practices should be made an integral part of policy design. Schemes where physical infrastructure is being created, rain water harvesting, renewal energy usage should be made an integral part of it.

Scheme For Adolescent girls (SAG, U-ICDS)

The scheme does not have any component/strategy that addresses climate change or contributes to sustainable practices since climate change is not relevant to the scheme's objectives. However, adolescent girls can be educated on how to dispose of their sanitary napkins and prevent environmental degradation. Adolescent girls should also be made aware about the use of biodegradable sanitary napkins. Thus,sustainable practices should be made an integral part of policy design.

9 https://pib.gov.in/PressReleseDetail.aspx?PRID=1594226

National Creche Scheme (NCS, U-ICDS)

The scheme does not have any component/strategy that addresses climate change or contributes to sustainable practices since climate change is not relevant to the scheme's objectives. However, climate change and sustainable practices should be made an integral part of policy design. When physical infrastructure for creches is being created, rain water harvesting, renewal energy usage should be made an integral part of it.

Integrated Child Protection Scheme (ICPS, U-ICDS)

Overall, there is an absence of resilient climate policies and disaster risk reduction plans in the scheme design and implementation framework. However, the scheme guidelines mention a few areas wherein climate and disaster specific interventions are highlighted, which are:

- The scheme guidelines mention that efforts are to be made to ensure either foster care or sponsorship for children affected by disaster and natural calamities.
- Under the General Grant-In-Aid for Need-Based/Innovative Interventions (ICPS Guidelines): While an attempt has been made to incorporate all major interventions/services for all children in difficult circumstance into the ICPS, the Ministry recognises the specific needs of a district/city and maybe initiated as pilot projects. This component can be used for post-disaster rehabilitation work. The guidelines further state that the scheme shall provide flexibility to the State Governments to initiate innovative projects on issues/risks/vulnerabilities, which are not covered by the existing programs of this scheme. The SCPS has a general grant-in-aid fund under which such projects can be supported.

Beti Bachao Beti Padhao

The scheme does not have any component/strategy that addresses climate change or contributes to sustainable practices since climate change is not relevant to the scheme's objectives. However, climate change and sustainable practices should be made an integral part of policy design. Schemes where physical infrastructure is being created, rain water harvesting, renewal energy usage should be made an integral part of it.

Swadhar Greh Scheme

The aim of the scheme is to provide temporary accommodation, maintenance and rehabilitative services to women and girls rendered homeless due to a range of difficult circumstances. The scheme does not have any component/strategy that addresses climate change or contributes to sustainable practices since climate change is not relevant to the scheme's objectives. However, climate change and sustainable practices should be made an integral part of policy design. When shelter or physical infrastructure for women is being created, rain water harvesting, renewal energy usage should be made an integral part of it.

Ujjwala Scheme

The Ujjwala Scheme plays a pivotal role in tackling climate change. This scheme intends to provide cooking (LPG) connections to below-poverty-line families. LPG helps reduce carbon dioxide and black carbon emissions which are the second largest contributors of global warming.

Working Women hostel

The scheme does not have any component/strategy that addresses climate change or contributes to sustainable practices since climate change is not relevant to the scheme's objectives. However, climate change and sustainable practices should be made an integral part of policy design. When hostels or physical infrastructure for women is being created, rain water harvesting, renewal energy usage should be made an integral part of it.

Mahila Shakti Kendra

The scheme does not have any component/strategy that addresses climate change or contributes to sustainable practices since climate change is not relevant to the scheme's objectives. However, climate change and sustainable practices should be made an integral part of policy design. When kendras or physical infrastructure for women is being created, rain water harvesting, renewal energy usage should be made an integral part of it.

Gender Budgeting, Research, Publication and Monitoring

The scheme does not have any component/strategy that addresses climate change or contributes to sustainable practices since climate change is not relevant to the scheme's objectives. However, climate change and sustainable practices should be made an integral part of policy design.

One-Stop Centre (OSC) Scheme

The scheme does not have any component/strategy that addresses climate change or contributes to sustainable practices since climate change is not relevant to the scheme's objectives. However, climate change and sustainable practices should be made an integral part of policy design. When physical infrastructure for women is being created, rain water harvesting, renewal energy usage should be made an integral part of it.

Mahila Police Volunteers (MPV) Scheme

The scheme does not have any component/strategy that addresses climate change or contributes to sustainable practices since climate change is not relevant to the scheme's objectives. However, climate change and sustainable practices should be made an integral part of policy design.

Universalisation of Women Helpline

The scheme does not have any component/strategy that addresses climate change or contributes to sustainable practices since climate change is not relevant to the scheme's objectives. However, climate change and sustainable practices should be made an integral part of policy design.

Human Resources Development

Impacts of Climate Change on the Sector and Scheme Beneficiaries

Direct impacts of climate change on human resources development include the following (Randell, H., 2019):

- Extreme weather events can destroy or damage school buildings; alternatively, they may be utilised to shelter people who have been displaced from their homes as a result of disasters, leaving students temporarily unable to attend school.

- Droughts or heat waves may cause agricultural households to lose income and food security. As a result, they may be unable to pay school fees, or may withdraw their children from school to help earn additional income.
- Severe droughts may cause girls to miss school, as they need to travel long distances to collect water or they may be married off at an early age, which often coincides with dropping out of school.
- Families may migrate in search of necessities and employment, consequently pulling their children out of school.

Natural disasters can cause children to miss school due to sickness, injury, malnutrition or displacement, resulting in increased rates of absenteeism, reduced educational attainment and lower academic performance. Disaster exposure is shown to increase the likelihood (by 9-18%) of acute illnesses (like diarrhoea, fever, and acute respiratory illnesses) in children under 5 years of age, and is also associated with stunting and underweight in children under the age of 5 (7% increase in likelihood), and lowers the likelihood of timely immunizations among children (likelihood reduces by almost 18%) (Datar et al., 2013).

The elements connected to human capital creation and utilisation, such as school performance, cognitive development, and later income and productivity are impacted by the direct effects of natural disasters (like loss of lives or destruction of property) which further has indirect effects - macro impacts (general disequilibrium effects on prices and wages, or fiscal restrictions) and micro impacts (such as household-level impacts like inability to invest in human capital, high probability of disability and mortality) (Onigbinde, 2018). The long-term effects of rainfall shocks in India show that higher rainfall during school years reduces the total years of schooling (especially for ages 11–13). For this age group (which transitions from primary to secondary school), positive rainfall shocks significantly increase the likelihood of dropping out. The death effects of disasters on educational attainment is an important concern in the disaster-human-capital literature. The death of a parent or guardian is one of the most traumatic experiences a child can have, with multiple studies indicating that if the loss of a parent reduces investments in children, it can have other long-lasting consequences (Onigbinde, 2018).

Scheme Level Analysis[10]

National Education Mission

- The National Education Mission does not have any specific provisions/guidelines/ interventions for climate change, disaster risk reduction, waste management, circular economy and any associate practices under its constituent schemes for teacher education, higher education and adult education.
- Across all the constituent Centrally Sponsored Schemes of National Education Mission, minimal inclusion of climate change resilient policies and practices are found to be present. There is minimal planning of design factors for climate resilience or disaster mitigation in the National Education Mission and its constituent schemes. Overall, the National Disaster Management Agency guidelines serve as prescriptive guidelines for all educational institutions (school education and tertiary education). As a part of this, fire extinguishers and safety kits are mandated in all educational institutions.

10 Information for the scheme level analysis is sourced from the HRDSector, UCSS Evaluation (2020/21), DMEO, NITI Aayog, Volume 2.

- While the present scheme of Samagra Shiksha (and erstwhile SSA, RMSA) prescribes usage of solar energy/wind energy/clean energy, rainwater harvesting, recycling and reuse of textbooks, the actual implementation is minimal and not entirely evident. An Environmental Management Framework was prepared for erstwhile SSA in December 2013, as a part of World Bank's SSA III (World Bank, 2018). The erstwhile scheme of RMSA also included an Environmental Management Framework developed by the World Bank. But the actual implementation of the policies is not monitored.
- While the National Disaster Management Agency guidelines accommodate disaster risk reduction practices in schools, no specific disaster risk reduction policies/practices are observed to be evident in higher education, teacher education or adult education.
- The Samagra Shiksha guidelines prescribe recycling, re-use of textbooks, environmentally friendly incinerators in girls' toilets, e-waste disposal systems. However, the presence of these facilities is not sufficiently tracked through any existing systems. While the respective constituent CSS beneficiaries and scheme implementers admitted to having undergone training sessions or programmes, the majority of these were not undertaken as part of the scheme under the National Education Mission. Under the Saakshar Bharat mission, few Master Trainers and KRPs underwent training on environmental health awareness and reducing pollution under the scheme.
- While end beneficiaries such as students (for school education and higher education) and teachers (for teacher education) are aware of climate risks and mitigation, this is due to the inclusion of such topics in the curriculum. Awareness of climate risks and mitigation strategies is not included to some extent in the scheme guidelines of Samagra Shiksha under the National Education Mission. Under the Saakshar Bharat Scheme, over 62.5 per cent of beneficiaries indicated that Adult Education Centres (AECs) emphasized climate change and relevant mitigation/adoption strategies to raise awareness about climate issues. Similarly, under RUSA, 68 per cent of principals indicated allocation of funds towards training on environmental conservation.

National Programme of Mid-Day Meal in Schools (NP-MDMS)

- The scheme impacts environmental sustainability by using LPG as fuel, kitchen gardens for vegetables, renewable sources of energy for electricity and provision for zero chambers for perishable products. MDM focuses on climate conservation and mitigation. There is a significant emphasis of MDM on environment conservation and water conservation. The scheme organizes tree plantation drives, kitchen garden, reuse of materials towards its efforts for climate conservation. The scheme aims to reduce the use of firewood in school kitchens which would help in resolving air pollution. Instead, there are recommendations at the district level to use other modes of cooking like gas, solar, etc.
- The scheme has propelled the following positive impacts:
  - Electricity across the kitchen through the renewable energy source
  - Compliance to use Zero energy cooling chamber for perishable product
  - Increase in usage of LPG Kitchen Garden as practice adopted across states and Union Territories.

- The central Ministry is encouraging states and Union Territories to become self-reliant and implement climate-resilient practices like developing kitchen gardens in order to grow fresh vegetables for the mid-day meal scheme. Centralized Kitchen ensures better compliance to provision for environmental sustainability such as renewable energy as a source of electricity and zero energy cooling chambers for perishable food products, as compared to school kitchens. The facility survey indicates that 35 per cent of the school kitchens use renewable sources of electricity as compared to the centralized kitchen (50 per cent). A centralized kitchen ensures better compliance to the provision of Zero-energy cooling chambers for perishable materials as compared to School Kitchens. The facility survey indicates that 89 per cent of school kitchens as compared to 50 per cent of Centralized Kitchens have not installed Zero-Energy cooling chambers for perishable materials, despite the mandatory provision in scheme guidelines. NP-MDMS provision all kitchens to use LPG as cooking fuel. It is observed that only 68 per cent of school kitchens use LPG as compared to 75 per cent centralized kitchens
- The Central Government has advised all the States and UTs for the development of School Nutrition Gardens (SNG) in schools. Funds @ Rs 5000 per SNG are also made available under the flexi component. The scheme guidelines do not include much on diversification for risk reduction or end of life waste management systems. There is no effective waste management/end-of-life system in place for resources used in NP-MDMS. All the districts have been advised to prepare a contingency plan to encounter any eventuality.

Scheme for Providing Education to Madrasas/Minorities (SPEMM)

The scheme guidelines do not have any interventions towards climate change, disaster risk reduction, waste management etc. There are also no provisions for building awareness towards the environment in the education sector.

Sarva Shiksha Abhiyan (SSA)

The scheme guidelines of both SSA, as well as the Samagra Shiksha, promote environmental sustainability through the adoption of environmentally sustainable practices in the School Development Plans (SDP). Over the last few years, the scheme has increased its stated focus on climate and environment conservation through various policy measures. The World Bank Implementation Completion Report (World Bank, 2018) for the Elementary Education 3 Project for India observes the scheme's emphasis on ensuring a clean and hygienic environment at schools with awareness activities towards the environment and climate conservation over the last few years to be noteworthy.

The initial guidelines of SSA didn't lay much emphasis on the issues around climate change. However, over time, it has evolved to include provisions for implementing eco-friendly policies. Few scheme provisions of environment and sustainability are shared below:

- The undertaking of civil works with hazard resistant materials, usage of local construction materials, low cost, and environmentally friendly technologies, using environmentally sustainable designs, incorporating green architecture, environmentally safe incinerators, etc.
- As part of the Learning Enhance Programmes, interventions for Environmental Studies and Social Sciences can be designed apart from subjects such as Mathematics, English, and Science

- Curriculum for environmental studies with suitable pedagogy for environmental studies
- Promotion of cleanliness, sanitation, and environmental preservation through convergent activities with other Central Sector Schemes such as Swachh Vidyalaya under Swachh Bharat. The National Disaster Management Guidelines with School Safety Policy have been designed by the National Disaster Management Authority which provides for detailed plans for disaster management, highlighting roles and responsibilities of key stakeholders as well as Disaster Resistance norms for infrastructure in the schools. This is applicable under erstwhile SSA as well as the present scheme of Samagra Shiksha since February 2017 (MOE, 2017).
- The surveyed states in the UCSS evaluation indicated undertaking schemes prescribed (as prescribed in NDMA guidelines) disaster management initiatives such as mock drills, ensuring disaster-resistant infrastructure, promotion of climate-resilient practices such as rainwater harvesting, solid waste management facilities, kitchen gardens, usage of solar energy, formation of youth clubs in schools, etc.
- In Bihar, the 'Safe Saturday' program under the Chief Minister's school safety initiative is undertaken for all eco-friendly/disaster management interventions under the scheme. States indicated that ~10 per cent of school grant is mandatorily allocated for Swachh Bharat initiatives, and other initiatives are undertaken in collaboration with NGOs, the Department of Science and Technology etc. The present scheme of Samagra Shiksha mentions setting up incinerators in Kasturba Gandhi Balika Vidyalayas (KGBVs) for safe disposal of organic waste, sensitization of stakeholders on safe disposal of e-waste and recycling of paper waste. But there are no specific provisions/guidelines for the circular economy, diversification, or effective end-of-life waste management system in the scheme' design of erstwhile SSA or present Samagra Shiksha.
- All states indicated the presence of an Eco Club, undertaking solid waste management initiatives. Gujarat has undertaken specific initiatives for the promotion of Green Schools. Uttar Pradesh indicated a defined waste management process in place wherein the assets maintained under the scheme are written off through auctioning at the Zila Panchayat level and the funds generated through the same are used for school development initiatives. The reusable materials received from the waste are used again by the school. The states indicated organizing sensitization activities towards pollution, environment conservation and climate change. However, the details of the training sessions undertaken, and the funds spent were not furnished by them.
- Though all the states indicated undertaking training programs on environment and climate change, only 32 per cent of surveyed teachers indicated having attended such training.
- Around 70 per cent School Management Committees (SMC)/School Management Development Committees (SDMC) indicated that schools were sufficiently covering learning around climate change and mitigation, reducing pollution, adopting green practices, etc. Over 84 per cent of the students indicated being taught topics on environment and climate conservation by their teachers in classrooms. 61 per cent indicated having received assignments on climate change.

Key provisions or guidelines for environmental sustainability under SSA included: utilization of hazard resistant and eco-friendly material for infrastructure development; built-in safety features in the structural design of any new school buildings against natural hazards like earthquakes, floods,

cyclones etc, as per National Building Code standards (NBC); retrofitting existing school buildings to comply with the same standards, and ensuring best practices in environmentally sustainable designs in the SDP to showcase and implement them. The policies and guidelines for environmental sustainability were further strengthened under the Samagra Shiksha scheme. Some of the new notable initiatives include

i. emphasis on compliance with disaster resistance specifications for school infrastructure under the 'Guidelines on School Safety Policy, February 2016', developed by National Disaster Management Authority (NDMA)

ii. provisions for rainwater harvesting systems and rooftop solar panels (on-grid and off-grid) for all newly constructed schools

iii. financial provisions for the electrification of existing infrastructure using renewable sources of energy like wind, hydro-electric energy and solar power

iv. minimum 10 per cent of Composite School grant to be used for the Swachhta Action Plan (SAP) or the 'Swachh Vidyalaya Campaign' to promote WASH interventions of Swachh Bharat Mission, such as proper Operations and Maintenance(O&M) of school toilets, safe drinking water facilities, and improvements in WASH infrastructure

v. reuse and recycling of school textbooks to generate less paper waste. The scheme's guidelines prescribe that the textbooks be collected for reuse at the school level by the school authorities/parent–teacher association (PTA) and provide special incentives to States who encourage practices such as creating book banks in their schools to promote the reuse/recycling of textbooks amongst students.

vi. incinerators to be established in KGBVs for disposal of organic waste. However, there are no other articulated guidelines/provisions in either SSA and Samagra Shiksha's framework for waste management and development of a 'circular economy'

vii. Eco Clubs in standalone schools under Samagra Shiksha for promotion of environmental conservation/sustainability at the school level through awareness building/sensitization[11].

While there are several prescriptive guidelines under SSA and Samagra Shiksha for environmental sustainability, however, no clearly defined outputs/outcomes have been developed for ensuring accountability and monitoring. There is a lack of clearly defined mandatory programmatic norms for integrating substantial environmental sustainability practices into the scheme's implementation. While the states undertake environment conservation activities, the same is state-specific and ad-hoc. Most states did not indicate the adoption of any substantial climate change resilient practices/action plans.

Rashtriya Madhyamik Shiksha Abhiyan (RMSA)

RMSA adopted an Environment Management Framework prepared by the World Bank[12] which detailed environment conservation activities in the school curriculum, campus and among the community. Post subsuming of the schemes, the Environment Management framework was adopted in Samagra Shiksha[13]. Some of the notable initiatives include:

11 http://samagra.MHRD.gov.in/youth.html

12 https://rajsmsa.nic.in/public/Documents/21-04-2015-130205-Environmentalpercent20Managementpercent20Framework.pdf

13 Samagra Shiksha Manual

- Emphasis on compliance with disaster resistance specifications for school infrastructure
- Provisions for rainwater harvesting systems and rooftop solar panels
- Financial provisions for electrification of existing infrastructure using renewable energy sources
- Development of Swachhta Action Plan (SAP) or the 'Swachh Vidyalaya Campaign' to promote WASH interventions
- Reuse and recycling of school textbooks to generate less paper waste
- Incinerators to be set up in KGBVs for disposal of organic waste
- Eco Clubs in standalone primary, elementary and secondary schools under Samagra Shiksha for promotion of environmental conservation/sustainability at the school level through awareness building/sensitization campaigns amongst students[14]

In terms of circular economy, water harvesting as a measure is being implemented. In addition, as part of Samagra Shiksha, the reuse of textbooks is also promoted. No action plans/provision for climate change in scheme guidelines and limited understanding of state-level stakeholders on its impact.

End-of-life, waste management systems have been promoted as part of the Samagra Shiksha, in terms of incinerators in girls' toilets, sensitization of stakeholders for disposal of e-waste, and rainwater harvesting. Also, some states have a well-defined waste management process in place. The assets are written off through auctioning at the Zilla Panchayat level and the funds generated through the same are used for school development initiatives. The reusable materials received from the waste are used again by the school. Further such end-of-life systems can be expanded upon at a later stage. 89 per cent of the beneficiaries have reported training on the environment. SDMC members and principals have reported receiving training on Swachh Bharat. Shaala Swachhta programmes are conducted awarding schools with good hygiene practices. States indicated that ~10 per cent of school grant is mandatorily allocated for Swachh Bharat initiatives, and other initiatives are undertaken in collaboration with NGOs, Department of Science and Technology

Centrally Sponsored Scheme on Teacher Education (CSSTE)

Appropriate climate-resilient policies have not been included in the mandate of the scheme. In lieu, environmental and climate change is suggested as part of the scheme documentation that teachers undergoing B.Ed. training or any other equivalent must study Environmental Science to understand the consequences of climate change. Focus on risk reduction related to climate change has not been considered vividly as part of scheme design. However, with the convergence of schemes under Samagra Shiksha, MoE has given due significance for use of renewable sources of energy within the infrastructure (energy sources) etc.

Disaster management has been included as a measure to be taught to teachers under Institute of Advanced Studies in Education (IASEs). The District Institute of Education and Training's (DIET) vision for educating Anganwadis also talks about teaching them about disaster management. Most of the teachers reported receiving climate risk-related education in their teacher education programmes. Teachers have received training on the environmental and climate change-related issues.

14 http://samagra.MHRD.gov.in/youth.html

There are no direct policies that impact climate change, except from ensuring awareness among beneficiaries. The scheme is not *sustainable* in its current form as

- scheme's design/guidelines do not include diversification of funds
- low level of community awareness and involvement regarding the scheme and its benefits amongst targeted beneficiaries,
- lack of specific provisions towards ensuring climate change resilient practices or disaster mitigation practices.

Rashtriya Uchchatar Shiksha Abhiyan (RUSA)

The scheme guideline does not have a specific mention of ensuring climate change resilient practices or disaster mitigation practices. Most states undertake disaster management classes, rainwater harvesting and Swachh Bharat initiatives, these are not undertaken as part of RUSA.

Saakshar Bharat

State Resource Centres (SRC) have claimed that awareness building sessions and training programs to sensitize literacy trainers/functionaries and beneficiaries on climate change, disaster management, adoption of green practices and environmental health/sustainability were organized from time to time at the state level as well as in the AECs. There is also some inclusion of these issues in the adult education curriculum designed by SRCs. As per primary surveys, 62.5 per cent of beneficiaries indicated that AEC teaching-learning interventions emphasized climate change, its mitigation/adaptation measures, and awareness building. Training programs on reducing pollution, green practices, climate change, and environmental health were provided to Master Trainers, Key Resource Persons (KRP) and beneficiaries under the scheme in some states.

Best Practices

The government of Gujarat initiated the Green and Sustainable Program in 2013 for sustainable development and maintaining the flora, fauna and ecological balances in government schools through active participation of stakeholders such as students, teachers and the community. The programme, undertaken under the Sarva Shiksha Abhiyan scheme includes initiatives like RWH, usage of solar energy and cooking using solar cooker, plantations of flora, Waste Management Plan with recycling and reuse and School safety Plan and overall School Augmentation Plan.

The state of Nagaland shared the working details of its pilot, which is setting up school kitchen gardens with the Department of Horticulture. The kitchen garden may provide most of the non-staple food products like vegetables, legumes, roots, tubers, fruits etc. The establishment of Kitchen Garden is also helping other convergent schemes such as MGNREGA in terms of employing locals and the Department of Horticulture in terms of mainstreaming the needs of their mandate and agenda, that is promotion of climate-resilient green practices.

Urban Transformation

Effect of Climate Change on the Urban Sector

India's urban system consists of 7,933 cities and towns (statutory towns and census towns) of varying population sizes, with an urban population of 37.7 crore (GoI Census, 2011). India's urban population

is estimated at 48.3 crores in the year 2020, making it the second largest country contributing towards global urban population (United Nations, 2018).

India's urban population accounted for 31.15 per cent (37.71 crores) of its total population (GoI Census, 2011), and is estimated to be 34.90 per cent (48.3 crores) in the year 2020. Urbanisation is expected to reach 52.80 per cent (87.66 crores) by 2050 (United Nations, 2018), which is more than double the urban population in 2011.

This growth in cities is accompanied by an increase in vulnerable populations living in slums and unsafe housing. This makes them more vulnerable to extreme weather events. The vulnerability of urban populations to floods and storms whose frequency and intensity of climate change is likely to increase in most places. There is a concentration of people in urban areas, which leads to a "concentration hazard" (Satterthwaite et al.,). Such concentration has risks, for example, in the case of an emergency evacuation, there might be a lack of space for people, vehicles to evacuate. The concentration of people also has the potential for the spread of communicable disease.

Due to financial constraints, lack of space, etc, lower-income people might build houses that might be hazardous or at risk of landslides, flooding, etc. Migrants often build housing on difficult or undesirable land that is more likely to be in low-lying areas, on steep slopes, in ravines, and in other risk-prone areas exposed to extreme conditions such as floods and landslides (International Housing Coalition). They might lack the knowledge or means to reduce their vulnerability. Low elevation coastal zones (LECZs) are more susceptible to environmental changes such as flooding, storms (includes areas in major cities such as Kolkata, Mumbai, Chennai).

Rising temperatures will require heat-proofing. Mean temperatures in India have increased by 0.5°C and projections show a significant increase in frequency and intensity of heat-related events (Mahadevia et al., 2020). As cities become larger and denser, they will experience urban heat island (UHI) effects. Pavements, buildings, and other surfaces absorb and trap heat. A high concentration of these surfaces can lead to urban heat island effects. This will be exacerbated with rising temperatures and can lead to heat-related illnesses and mortality, increased air pollution levels and higher energy costs (ex. For air conditioning) (USEPA).

High precipitation for a prolonged period can disrupt a city's infrastructure such as its sewage collection and sewage system. Sewage runoff can further cause health problems. City infrastructure - hospitals, waste disposal and sewage system, water supper, etc will need to be resilient.

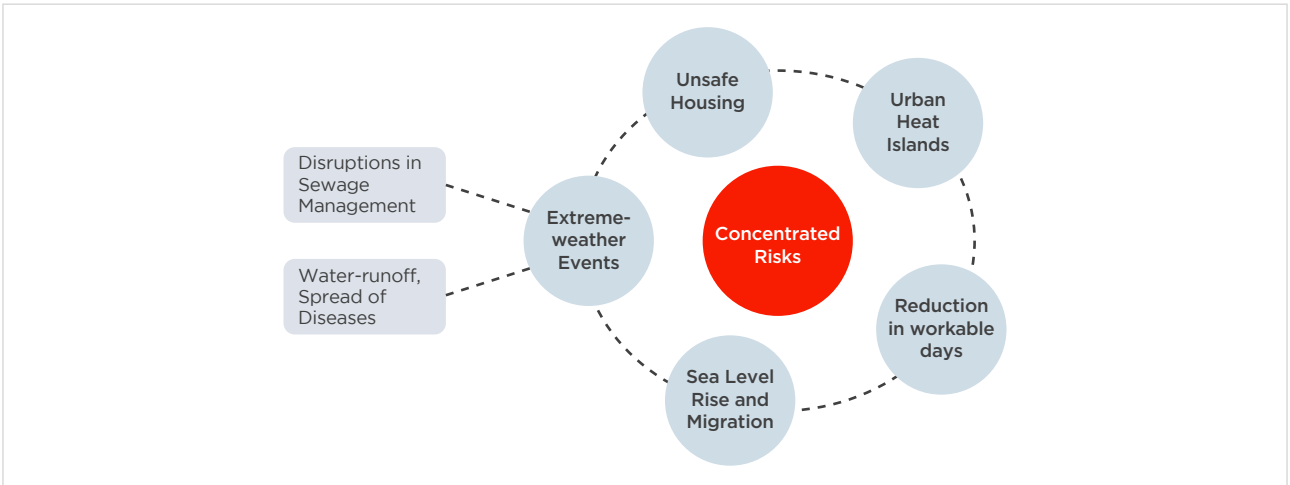

Figure 10: *Various interacting impacts of Climate Change in the Urban sector*

Fig. 10 shows the various interacting impacts of Climate Change in the Urban sector which are aggravated by 'concentrated risks'. Inter-relation between the Jobs sector (reduction in workable days due to heat stress and diseases) and the health sectors can further intensify vulnerabilities.

Contribution of the Urban Sector to Climate Change

Cities are a major contributor to GHGs due to the concentration of people and subsequent concentration of energy use, lack of green cover, use of transportation systems that rely on fossil fuels, etc. Buildings and transportation are the biggest contributors to CO2 emissions in the urban sector. Manufacturing of building material, construction of buildings, lighting and powering the building contribute to the carbon footprint.

Globally, even though cities account for less than 2 percent of the Earth's surface, consume 78 percent of the world's energy and produce more than 60 percent of greenhouse gas emissions (UN Climate Action). Urban sprawl and expansion of cities erode wetlands, marshes, etc that might increase the risk of flooding during prolonged periods of precipitation. According to the IPCC report on Urban Areas, cities are sufficiently dense and have a spatial scale such that they can affect their microclimate.

Scheme level Analysis[15]

Smart Cities Mission

- **At the design stage:** Guidelines, policy frameworks, design toolkits, benchmarks, best practices provided in multiple areas that have a direct and indirect impact on climate change and environmental sustainability has been advocated by the Mission. A clear framework has now been established through the Climate Smart Cities Assessment Framework, and tools provided to cities to set their baseline (the year 2019).
- Budget allocation: projects which enhance climate change resilience or are environment friendly, as per the impact identified:
  - Conservation and reuse of critical resources
  - Preservation of ecosystems and open spaces
  - Reduced dependence on energy from conventional sources
  - Reduced pollution
- SCM comprises around 283 projects totalling an investment of around Rs. 19,130 crores under these categories. About 17 percent of these projects are completed, while another 37 per cent of projects have been grounded (by project value).
- Implementation: Capacity building activities are being carried out to develop climate change awareness, mitigation approaches, and coach city officials with the assessment framework. More than 140 Cities (>5Mn population) in partnership with close to 40 International agencies are working together on critical aspects of climate adaptation and mitigation that were non-existent before the mission.
- Some common examples of environmentally sustainable projects being implemented across cities are LED street lighting, rooftop solar, smart metering, renewable energy

15 Information for the scheme level analysis is sourced from the Urban Transformation Sector, UCSS Evaluation (2021), DMEO, NITI Aayog.

generation, encouraging NMT, etc. Smart cities of Jaipur, Visakhapatnam, Pune and Surat have implemented solar projects producing about 5 MW of solar energy and resulting in a reduction of carbon emissions by about 13,500 tons per annum. Ahmedabad has set up wind power projects with a capacity 8.4 MW resulting in a reduction of about 8,300 tons CO2 per annum

- It is worthwhile to also note that SCM has garnered international collaboration for expanding resources and capabilities of mission cities in planning, designing and implementing various sustainable environment projects. While GIZ's Climate-Smart Cities initiative is supporting three cities (Kochi, Coimbatore, and Bhubaneswar) in thematic areas of green buildings, urban green spaces and storm water drains have been initiated through an urban design thinking project in cooperation with TU Berlin (GIZ, 2018). The AFD's CITIES program has been supporting 12 smart cities, through a challenging process, on themes of sustainable mobility, public open spaces among others (AFD, 2018).
- Guidelines, policy frameworks, design toolkits, benchmarks, best practices provided in multiple areas that have a direct and indirect impact on climate change and environmental sustainability have been advocated by the Mission. A clear framework has now been established through the Climate Smart Cities Assessment Framework, and tools provided to cities to set their baseline (the year 2019).

AMRUT

The Mission target is that at least 20 percent of the wastewater generated in ULBs should be recycled and reused. It also aims to minimise loss of water to less than 20 per cent. The Mission has prescribed guidelines for adopting sustainable practices across its projects. MoHUA has prepared and circulated detailed Standard Operating Procedures (SOPs) on Urban Flooding which captures not only mitigation strategy for such events, but also roles and responsibilities of different city-level agencies and their engagement in the case of urban flooding. The Mission has recently launched the JSA that focuses on rejuvenation of water bodies and fresh-water conservation in cities. Guidelines also advise on the following aspects:

- Low cost options shall be given preference and smart solutions shall be applied in order to reduce costs and improve services at the time of preparation of design and technical estimates,
- A list of smart solutions developed by the Centre for Development of Advance Computing (C-DAC) are also suggested in the guidelines,
- During the preparation of SLIPs, resilience and securing projects against disasters particularly for vulnerable and the poor shall be incorporated,
- Disaster secure engineering and structural norms would be included in the design during project development stage, and
- SLIPs mandate the required approvals from ULBs and competent authority and built in resilience factor to ensure environmentally sustainable implementation of the scheme. While the above are listed in guidelines, their implementation is not closely tracked or linked to the overall theme of climate change and sustainability.
- AMRUT 2.0 guidelines expect cities to prepare and submit City Water Balance Plans (CWBPs). This will give the status of water, quantum of water available, water demand-supply and the gaps. Using this data, action can be taken to fill up these gaps.

Storm water drain projects costing about Rs. 2,970 crore (4 per cent of the total by value) are directly aimed at reducing inundation in urban areas. Some examples of wastewater treatment projects include:

- Reverse Osmosis was established at Kodungaiyur & Koyambedu, Tamil Nadu to fulfil the needs of water-intensive industries in Chennai and reduce the burden on the ground-water resources.
- Udaipur sewerage project: Convergence with SCM and PPP model for implementation. In July 2017, Hindustan Zinc Ltd HZL signed an agreement with Udaipur Smart City Limited (USCL) for design, construction, supply, installation, testing, commissioning and operation of an STP of 40 MLD (25+10+5) capacity. This project has resulted in improving the ecosystem of the lakes and freshwater consumption has correspondingly reduced in the city. Water quality of the Ahar River, Pichola and Udai Sagar lakes will be improved due to the reduced volume of wastewater discharges from the city. The results and overall impact of this initiative have been appreciated by the State Government. With the completion of the project, ULB will be able to treat 100% of Udaipur City's sewage and significant reduction of freshwater consumption at the operational site. At present, the sewerage plant covers 20.3% of Udaipur city.

Some challenges include:

- Capacity constraints at implementation agencies (ULB and SLNA) for planning as well as the implementation of projects needed for scaling-up/expanding coverage of Mission/ projects.
- There is a need for a holistic approach to planning the entire water cycle in a city – this is currently not adequately addressed in SLIPs. (Page 323).
- There are gaps in tracking project outcomes, progress against SLIPs and status of reforms implementation.

PMAY (U)

- The technology sub-mission (TSM) of PMAY (U) coordinates with various regulatory and administrative bodies, private agencies for upscaling the deployment of modern construction technologies and materials aligned with the concept of green building and energy-efficient technologies and climate change. This sub-mission works on the following aspects:
  - Design & planning, Innovative technologies and materials, Green buildings using natural resources, and Earthquake and disaster-resilient technologies.
- As per the India Cooling Action Plan (2019) prepared by the Ozone Cell, Ministry of Environment, Forest & Climatic Change (MoEFCC), PMAY(U) mission provides benefits to the houses of EWS and LIG segment by use of climatic appropriate and energy-efficient building designs for the construction of houses. This design provides thermal comfort, reduces the cooling loads and provides gains in terms of thermal efficiency.
- The Mission has also undertaken initiatives for BLC components, which are self-built and stand-alone houses by providing suitable design layouts, which are modified by the State/city authorities based on the local requirements. 'Angikaar' Campaign emphasised

convergence with other national-level schemes that focus on energy-efficient solutions and reduction in O&M costs such as LED lights, rooftop solar; and other environmentally sustainable practices such as water conservation through rainwater harvesting, LPG gas usage, tree plantation etc.

- With regards to use of Sustainable construction material: DHPs and LHPs - focuses on fast construction and sustainable practices. All projects need to follow NBC requirements. BMTPC has recognised 54 alternative technologies and CPWD to ease out the rollout released SORs against 29 alternative technologies. ~ 15 lakh houses have been constructed using alternate technologies.
- With regards to Disaster Resilience, all housing projects under this scheme need to abide by the norms and standards of NBC and local bye-laws to develop disaster resilient housing.
- E-Courses in relation to vulnerability and alternative technologies, workshops on climate-resilient and sustainable development have been initiated by BMTPC in collaboration with academic institutes. ASHA-India - incubates pre-prototype/post-prototype initiatives.

SBM (U)

- The Mission encourages the adoption of environment-friendly technologies and has set up a Technology Evaluation Committee for Solid & Liquid Waste and Water Supply to test emerging innovative solutions as suggested by ULBs and extend financial support for the same. The mission document also makes various suggestions for using environment-friendly technologies such as bio-digester toilets (developed by DRDO). This technology is expected to be environment-friendly, maintenance-free and efficient without depending on conventional energy sources.
- Challenges include:
  - With regard to mission design : Main gaps remain in improving toilet emptying and illegal dumping, and enhancing functional treatment capacity. Wastewater remains untreated. Modern and scientific management of other waste streams – plastic, C&D waste, sanitary waste, remediation of legacy waste continues to be a challenge.
  - With regard to implementation: Maintenance of community toilets, and improving access to IHHLs, is important to maintain the increased levels of toilet use. Survey data suggest that cleanliness, water availability and maintenance of community toilets remains an issue
  - Ensuring segregation of waste from the source till final disposal remains a challenge
  - There appears to be the insufficient capacity (Public Health Engineering and technical) at the Mission level to support its ambitious mandate on sanitation and SWM
  - The capacity of existing ULB officials is insufficient to address technical and financial gaps
  - Current M&E systems do not track equity outcomes and adherence to SBM guidelines on improving inclusion

- SBM's monitoring tools could be leveraged to (1) help cities improve service levels (2) learn more about intra-city variations in service delivery gaps

DAY-NULM

- The Mission guideline refers to climate change/climate-resilient infrastructure development. The guidelines state that "Permanent shelters may be built of concrete or durable and weatherproof alternate structures, with environmentally friendly designs, rainwater harvesting, solar heating/lighting facilities etc." (MoHUA, Scheme for Shelters for Urban Homeless (Revised Operational Guidelines), 2018). Consultations at the state level also indicate that guidelines are issued by the states concerning infrastructure development and climate resilience (EY & Athena Research: KIIs, 2020).
- Under the Employment Through Skills Training and Placement (**EST&P**) component, the Mission is also extending skills training in green jobs and renewable energy sectors. Between 2016-17 to 2019-20, 1048 candidates have been trained in skills programmes under green jobs, and 1244 candidates have received training in sources relevant to renewable energy (NULM MIS Data). The placement rates for candidates under green jobs and renewable energy have been lower than the national average of 53 percent.

Rural Development

Rural Development in India with respect to Climate Change

Livelihood options are determined by assets (natural, physical, human assets - education, skills, social, financial, access to forest produce, etc.) and climate change can affect this. The loss of jobs due to lost days due to extreme weather events, heat waves, forced migration, etc. could pressurize already highly stretched programs as more people are pushed into poverty. Public employment schemes are important to drive recovery after disasters, for reconstruction and for the creation of resilient infrastructure. Public assets can then be built in such a way that they reduce the impact of future shocks.

In the context of climate change and the depletion of natural resources, the implementation of infrastructure programmes in rural development spaces necessitates increasing the use of green technology. Adoption of green technology requires re-orientation of skills and procurement of relevant green material. In the majority of the projects, the implementation machinery is not geared towards searching for and instituting green processes and material in construction of infrastructure under rural development programmes.

Scheme level Analysis[16]

MGNREGS

- Scheme's design does not actively touch upon issues like climate resilience while aligned with SDG 6 (clean water and sanitation for all) and SDG 13 (climate action). Sustainability of Gains: The scheme mandates 60 percent expenditure on creation of productive assets which are directly linked to agriculture and allied activities through development of land, water and trees. In the last 4 years, the average expenditure in this regard has been more than 65 percent.

16 Information for the scheme level analysis is sourced from the Rural Development Sector, UCSS Evaluation (2020), DMEO, NITI Aayog, Volume 2.

- However, while secondary literature notes that asset creation under MGNREGS has led to dynamic changes in the resource sustainability, the primary findings do not observe sustainable gains in terms of improvement of irrigation potential and soil fertility
- Dhara Vikas is an initiative under MGNREGS in Sikkim, which seeks to increase the dry season spring discharge by enhancing the recharge of the springs during the monsoons. It is a climate change adaptation initiative that helps in enhancing rural water security. Vulnerability assessments at district, block and GP level, historical and projected climate data along with frequency of droughts and floods are not being used in planning and designing of MGNREGS works.
- Drought proofing, flood control and MRM measures are closely linked to climatic factors. The designs of these measures are not based on locally identified climatic adaptation needs. For example, the design of ponds under MGNREGS is not based on the changing rainfall patterns in the district nor are the designs of field bunding and contour trench. The scheme under its design or any provision does not specifically mention issues like climate change and its resilience. It is by the nature of the activities and the assets created that climate resilient works are undertaken.
- Social protection schemes such as Mahatma Gandhi National Rural Employment Guarantee Scheme offers relief in times of distress such as during the COVID19 pandemic and can also be key in India's fight against climate change.
- In a study that estimated carbon sequestration achieved through activities under MGNREGS, in 2017-18 alone, 102 million tonnes of carbon dioxide was captured through plantations and soil quality improvement. Drought proofing is one of the activities conducted that also includes tree planting. Similarly activities include micro-irrigation, Renovation of traditional water bodies, land development and water harvesting and conservation (Ravindranath and Murthy, 2021).
- MGNREGS can be made a climate-adaptive programme over a period of time by replicating existing examples like construction of cascading tanks in Vizinagram that has led to reliable availability of groundwater all through the year. Additionally the following measures be undertaken:
    - A base paper on Climate resilience and adaptation to be prepared that will inform MGNREGS on the differences in climatic factors in general and the local climatic factors in particular.
    - Conduct vulnerability assessments for each district to identify climatic factors that directly impact MGNREGS works.
    - Building adaptive designs and practices in NRM works and based on local climatic changes and consequent adaptive measures.
    - Training the technical staff in climate change and climate adaptive practices within MGNREGS.

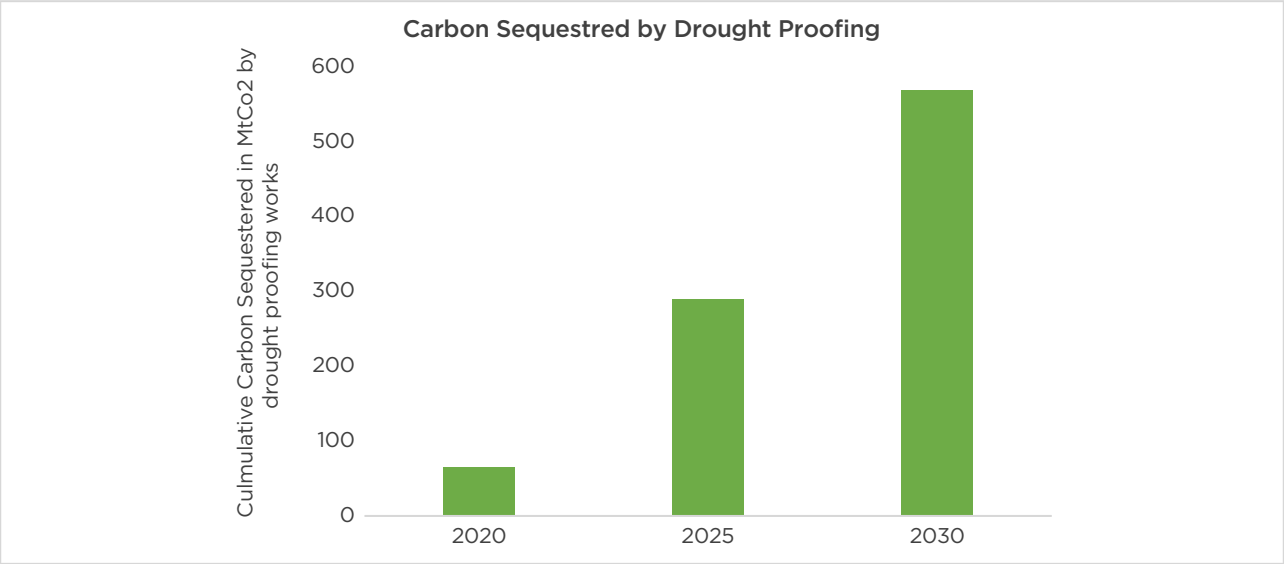

Figure 11: *Projected Carbon Sequestration under Natural Resource Management under MGNREGS*

Source: *(Ravindranath and Murthy, 2021).*

PM Awas Yojana - Gramin

Sustainable practices are defined as activities which are undertaken to ensure that present consumption of natural resources do not compromise with their future availability. It involves judicious and efficient use of resources. At the moment, there are five major efforts that were taken or have been taken by DoRD to introduce sustainable practices in PMAY-G. They include:

- A study was undertaken with the support of the United Nations Development Programme (UNDP), CSIR-CBRI, and IIT-Delhi. The study included the development of house design typologies which are specific to the conditions of different regions, geo-climates and culture. Aspects of the use of locally available construction materials are also taken into consideration for the adoption of green practices in the construction of houses;
- States/UTs have been asked to construct demonstration houses based on region-specific house designs so that beneficiaries can visit, experience, and opt for such technologies/ house designs;
- Guidelines based on the outcomes of a consultation workshop held on 16 January 2018 with leading academic institutes of Architecture and Engineering, experts in the field of affordable rural housing, relevant government and non-government organisations and the State governments to carry out the collaboration among the academic technical institutes and State governments for different aspects of PMAY-G implementation, including the use of region-specific house designs in the construction of houses (GoI, 2019);
- IT-based portal Rural Housing Knowledge Network (RHKN) for comprehensive knowledge on construction technologies (including the green/local construction technologies), costing and resources is being revamped, with collaboration of NIRD-PR and NIC;
- Despite these efforts, PMAY-G has an unexplored potential for ensuring sustainable practices in the scheme. To start with, in order to furnish the demand of land for landless beneficiaries, it is important to ensure that forest land, green patches of land are not

provided to landless beneficiaries. Scheme guidelines mention providing community or government land to landless beneficiaries, but it doesn't exclude green land from this. The housing need of the present should not compromise with natural resources and hence scheme guidelines should exclude land with valuable natural resources from this process.

- Apart from the above, mandating solar roofs and integrated cook stove systems can make the houses self-sufficient for electricity needs and reduce biomass use significantly. Inspirations can be drawn here from Chief Minister Solar Powered Green Housing Scheme of Tamil Naduthe, where the Government had ordered for construction of 60,000 Solar Powered Green Houses of 300 square feet each, every year for the next five years commencing from 2011-12 at a unit cost of Rs.1.80 lakhs per house.
- It is recommended to allocate 2 percent of funds under Special Projects for the development of green technologies for housing. Similarly, it is recommended to make 10 percent of District Mineral Fund (DMF) at the district level available as an additional subsidy for households opting for green technologies.

PM Gram Sadal Yojana (PMGSY)

- DoRD's mandate to use green technologies and environmentally optimized road designs are noted to have generated cost savings and environmental benefits. PMGSY's clear focus on environmental sustainability is evident from its impetus to green technology (which is associated with economic and environmental benefits), and the clear frameworks instituted by development partners (ADB and World Bank) which lay down guidelines to construct roads in an ecologically compatible manner.
- Gaps in compliance with maintenance requirements and unclear convergence targets significantly lower the scheme's sustainability.
- Presently, only compensatory tree plantation is viewed as an attempt at environmental restoration.
- Environment audits of roads have not been undertaken.
- Recommendations: It is recommended that DoRD continue to increase the proportion of PMGSY roads constructed and upgraded under green technologies. Recommend NRIDA to develop a compendium of different technologies and rank them in their "green" component for SRRDAs. Recommend involving the community in the assessment of the Environment and Social impact assessment of road and undertaking pilots of the Environment Audit. Also, upscale the PMGSY innovation using plastic waste is the plastic cell-filled concrete block pavement (PCCBP) which has been piloted in Odisha in 2019

Deendayal Antyodaya Yojana-National Urban Livelihoods Mission (DAY-NRLM)

- The Sustainable Livelihoods and Adaptation to Climate Change Project (SLACC) brings a climate perspective to the National Livelihoods Mission. It is aligned with SDG 13 Climate Action. SLACC is a World Bank-supported pilot project embedded within DAY-NRLM to improve the adaptive capacities of rural poor farmers to cope with climate variability and change.

- The project ran from 2015 to 2019 and was funded by the Government of India and the Special Climate Change Fund administered by the Global Environmental Facility. Sustainable Livelihoods and Adaptation in Climate Change (SLACC) and MKSP provides direct interventions for climate change within DAY-NRLM.
- The conceptualization of these interventions are appreciated. SLACC is noted to have ensured greater awareness and utilization of climate resilient agricultural practices. Going forward, there is greater potential for intensifying similar interventions.

Shyama Prasad Mukherji Rurban Mission (SPMRM)

- Under SPMRM, there are no specific guidelines related to the circular economy or sustainable practices. However, there is some alignment with SDG 11 – Sustainable Cities and Communities, and SDG 12- Ensure Sustainable Consumption and Production.
- Climate change practices and disaster risk resilience-related activities under SPMRM rely more on the convergence of other programmes. : Green jobs are being actively promoted under the scheme through solar energy and solid waste management, agro-processing and eco-tourism initiatives, and there is scope for further benefits to be harnessed through such activities.

National Social Assistance Program (NSAP)

- The guidelines of NSAP do not establish any mechanisms to mitigate direct or indirect effects of climate change or generate awareness on climate risks among beneficiaries of the scheme. As no targets have been presented nor is this a mandate under the scheme, therefore this theme cannot be evaluated.

Drinking Water and Sanitation

Impact of Climate Change on the Drinking Water Sector

Water resource is an important national asset and is of foundational importance for sustenance of life, food security, and maintaining ecological balance. Over the past two decades, the demand for freshwater in India has increased significantly on account of growing population, rapid urbanization, industrial development and inefficient agricultural practices.

The country has a high dependence on the annual monsoon for its water supply, making it very vulnerable to the erratic rainfall patterns and heat waves brought about by climate change. Frequent floods and droughts caused by climate change can have a huge impact on water availability. After two consecutive years of weak monsoons (2017 & 2018), 330 million people — a quarter of the country's population — are affected by a severe drought. According to the Composite Water Management Index (CWMI) report released by the Niti Aayog, by 2030, the country's water demand is projected to be twice the available supply, implying severe water scarcity for hundreds of millions of people and an eventual six per cent loss in the country's GDP (NITI Aayog, 2019). The total water demand by 2050 is estimated to be 1180 BCM out of which 68% is irrigation, 9% is domestic, 7% for industries, 6% for energy consumption, 2% for environment and 8% for other sources (NITI Aayog, 2019). Assuming that the demand and supply gap remains constant (in absolute BCM terms), by 2050 it would represent a 47% gap from projected demand.

Globally, average water stress[17] is 11%. India is among 31 countries experiencing water stress in the range of 25-70%. It is forecasted that India will be among the worst affected countries with respect to change in net precipitation by 2050 vis-à-vis 2010. Net precipitation in significant parts of north, central and west India is expected to decrease by at least 0.5 mm per day while in the rest of the country it will decrease between 0.1 to 0.5 mm per day (PBL Netherlands Environmental Assessment Agency, 2018). As per the World Bank, in 2017, only 56% of the rural population in India had access to safely managed drinking water services (World Bank, n.d.).

Impact of Climate Change on the Sanitation Sector

Sanitation is an essential aspect of human life, and has implications on public health, economy, social conditions and the environment. Increased risk of disease/illness either due to increased exposure to pathogens or hazardous substances as a result of increased environmental contamination, or due to a lack of access to proper sanitation when sanitation systems are destroyed or damaged, are the climate change-related health implications from sanitation systems (Kohlitz et al., 2019).

The possible impacts of climate change on this sector are as follows (Kohlitz et al., 2019) –

- Longer dry periods can lead to a decline in water supply that impedes the functioning of water-reliant sanitation systems, for instance concerning flushing toilets or blockages due to low sewer flows
- High variation in rainfall can cause ground movement in soils with high clay content, resulting in pipe damage for sewer conveyance.
- Storms and cyclones can destroy sanitation infrastructure (like toilets, pipes, power supply), leading to open defecations, disruptions to water treatment facilities, etc
- Higher water temperatures can be conducive to the proliferation of algal blooms and compound the effects on sanitation

Scheme level analysis[18]

Jal Jeevan Mission National Rural Drinking Water Programme (NRDWP)

Before 2019, the Jal Jeevan Mission was called National Rural Drinking Water Programme (NRDWP). NRDWP is targeted to address the water needs of approximately a population of 91 crore. NRDWP has undergone many reforms and initiatives to accelerate performance and achieve national goals. These included efforts to devolve and decentralized governance through principles of participative planning, convergence to attain energy efficiency, operational sustainability, conjunctive use of water, and initiatives on Water quality like water labs and a focus sub-mission on Water Quality to tackle the issue in arsenic and fluoride affected habitations.

Groundwater dependence: There is still a high dependence on groundwater for NRDWP schemes, which raises questions on source sustainability and indicates environmental degradation through groundwater depletion. Performance Audits reveals that sustainability plans were either not developed or not approved by Source finding committees, and other technical approving authorities

17 Water stress for purpose of discussion in the above paragraph is defined as the ratio of total freshwater withdrawn annually by all major sectors, including environmental water requirements, to the total amount of renewable freshwater resources, expressed as a percentage. Source: UN (2018a, p. 72, based on data from AQUASTAT)

18 Information for the scheme level analysis is sourced from DWS Sector, UCSS Evaluation (2019), DMEO, NITI Aayog

in States. Also, convergence efforts for source replenishment under MGNREGS/IWMP were not executed effectively. There have been considerable proportion of slipbacks[19], and as pointed out by performance audit, the reasons for habitation slip backs are excessive extraction of groundwater, inadequacy of efforts to address quality related aspects, lack of sustainability of water sources, and inadequate/non maintenance of water supply schemes (CAG, 2018).

As there is over dependence on groundwater, dependence on a single source for water may build up sustainability issues. Conjunctive use of water to include groundwater, surface water and rainwater harvesting has been one of the focus areas under NRDWP. Convergence with MGNREGA/IWMP program to build harvesting structures has been one of the few initiatives taken in this direction. However, from time-to-time states have come up with different water conservation campaigns, rejuvenation of water bodies, Information,Education and Communication(IEC) strategies, and conservation technologies to promote water conservation initiatives. Resurrecting traditional and locally popular practices of conservation may also help in achieving demand for water. Some such practices have been documented (Water and Sanitation Program (WSP), 2011), and others need to be identified for efforts to scale up.

Wastewater/Reuse: Practices for wastewater treatment, proportion of wastewater treated, and infrastructure for treatment and good practices need to be further investigated. Rural India is devoid of sewerage networks, and thus there is little evidence of contamination of water due to mixing with wastewater. On the contrary, there is not enough information on treatment of wastewater/reuse in rural areas. 1.5 % of water sources have been tested positive with faecal coliform and bacteria due to contamination by faecal matter. This was largely due to people defecating in the open near the water sources. In Maharashtra, in many Gram Panchayats, it was observed that distribution lines and water connections were laid in unsafe manner, leading to contamination and leakages. Risk of contamination of water increases due to open defecation in open drains or for discharging wastewater from septic tanks was highlighted.

Overall, there is inadequate focus on planning and implementation of sustainability activities. Sustainability of outcomes, financial, and environmental sustainability have not been well addressed under the program leading to slip backs. There is also a lack of Integrated water resources planning as an input towards creation of sustainable drinking water schemes. Currently there is a lack of integrated planning and accurate data of the existing water resources (like long term source sustainability, environmental flow, industrial and agricultural requirements). This leads to ineffective and incomplete planning of rural water supply schemes.

Swachh Bharat Mission - Gramin

Due to the focus on ensuring universal sanitation coverage and making rural India Open Defecation Free (ODF) status, interventions for Solid and Liquid Waste Management (SLWM) were initially on the lower side and picked up in the last two years of the program. A study in CEPT UNI Journal of Water, Sanitation and Hygiene for Development suggested that while the household sanitation coverage had already reached 67 per cent by August 2017, halfway through the program period, SLWM component has been performing poorly. For example, of the 250,000 GPs targeted initially, SLWM work had started in only 3,000 GPs (Mehta, 2018)

A study observed that a major proportion of waste collected from on-site containment systems ('faecal sludge') is disposed of without any proper treatment or is applied to agriculture and fisheries

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in ways that have adverse impacts on health and environment, not to mention widespread bacterial contamination of water sources (Singh & Mukherjee, 2018). Even though SBM-G advocates making informed choices in selecting toilet models from options like twin leach-pit, septic tank, bio-toilet, a study done by WaterAid saw a blanket use of twin leach-pit technology, even in places where it wasn't deemed appropriate in terms of cost or disposal mechanism. It also found the prevalence of misconceptions with respect to the usage of twin leach-pit technology which ultimately discouraged villagers to use it (Praxis et al., 2017).

Adaptation of technologies, keeping in mind the terrain or geographical area, was also not prevalent. For instance, only 20 percent of toilets constructed by river banks, and 29 per cent by ponds, use septic tanks, which is deemed the safest technology for such settings.

Another crucial aspect of hygiene is menstrual hygiene management (MHM) by women and girls. This was a stated focus under SBM-G and guidelines on gender addressing this aspect were issued by the Ministry of Drinking Water and Sanitation, which were then incorporated into the main guidelines. The National Family Health Survey 2015-16 reported that 48 per cent of rural women use a hygienic method of menstrual protection, and women with 12 or more years of schooling are more than four times as likely to be using a hygienic method as women with no schooling (81 per versus 20 per cent). Another study reported that 76 percent of surveyed girls were not using sanitary napkins (O'Reilly et al., 2018). Disposal of sanitary waste also contributes to adverse impacts on the environment. There is a need for targeted communication with girls and women on hygiene behaviour and practices.

Sustainability of gains made under SBM-G falls under the category of first, usage and second, maintenance of toilets. There has been little quantifiable research on the usage aspect. However, a study by WaterAid showed that only 33 percent of the constructed toilets were deemed sustainably safe, 35 per cent were safe, but would need major upgrades to remain safe in the long term; and 31 per cent were unsafe, creating immediate health hazards. Moreover, only 30 per cent of the superstructures had basic features of user-friendliness. In discussions with the users, it was found that less than a quarter reported toilets were constructed at their own initiative, and less than half recalled having received technical information (Raman et al., 2017). According to a study, the issue of methane emissions may have to be addressed, due to increased adoption of pour flushing toilets, which could lead to anaerobic conditions in the pits. For such issues to be mitigated, there is a need for investing in more innovative and scientific toilet technologies, such as source separation toilets (Kulak et al., 2017).

There have been limited studies on the environmental impact of the scheme. However, in 2017, a study predicted that covering the sanitation gap through pit latrines would be expected to cause large increases of India's annual greenhouse gas (GHG) emissions, equivalent to 7 percent of current levels (Kulak et al., 2017). However, there have been no follow up studies on the actual impact of pit latrines on the emission levels.

Health

Effect of Climate Change on the health sector

Human health and wellbeing can be directly affected by climate change through floods, draughts, heat waves and fires. Ecological disruptions due to climate change such as crop failure, shifting patterns of diseases can have adverse effects on health for vulnerable populations. Responses to climate change or disasters such as migration and displacement can lead to overcrowding,

negligence of health, stress, the spread of diseases, etc. Effects could be mediated through natural systems (pollution, vector, and waterborne diseases) or human systems (mental stress, occupation, undernutrition).

According to the IPCC report on impacts on human health due to climate change, until mid-century, the effects will mainly exacerbate already existing health problems. For example, that health losses because of undernutrition (induced due to climate change) will occur mainly in areas that are already food-insecure (Woodworth et al., 2014).

Potential effects of climate change include:

- Greater risk of death, illness, damage due to heat waves
- Increased risk of food insecurity due to disruptions in food production
- Consequences for health due to reduced income incase of lost work due to extreme weather events, heat waves, etc.
- Greater risk of diseases
    - Vector-borne diseases associated with climate drivers are malaria, dengue, tick-borne diseases, HFRS and Plague
    - Food and water-borne diseases: rise in vibrios/Cholera outbreaks linked to variations in temperature and rainfall, insecure disposal of faecal waste during high rainfall can increase transmission
    - Common zoonotic food- and water-borne bacterial pathogen have shown higher disease rates at warmer temperatures.
    - the rise in temperatures and heavy rainfall are associated with a rise in enteric diseases and infections, diarrhoea, and harmful algae blooms.
- Warmer conditions in general aid the production and release of airborne allergens which may have an effect on asthma and other allergic respiratory diseases such as allergic rhinitis. Similarly, there may be effects on conjunctivitis and dermatitis (here children are more susceptible)
- Even minor increases in atmospheric concentrations of ground-level ozone may affect health and mortality levels, tropospheric ozone is formed through photochemical reactions in the presence of sunlight and elevated temperatures
- There are non-climatic health effects of climate-altering pollutants (CAP) such as black carbon and tropospheric ozone which have substantial, direct, negative effects on human health. Similarly, acute air pollution due to wildfires can have adverse effects if the fires last for days.

High precipitation associated water and sewage runoffs can cause dire problems. In a study that looked at the association between extreme precipitation and gastrointestinal (GI) illness-related hospital admissions in Chennai, India from 2004 to 2007, hospital admissions related to GI illness were positively associated with extreme precipitation in Chennai, India. Projected changes in precipitation and extreme weather events suggest that climate change will have important implications for human health in India, especially where health disparities already exist (Bush et. al, 2013).

There are certain positive effects of climate change. For example, modest reductions in cold-related morbidity and mortality in some areas and reduced capacity of disease-carrying vectors due to exceedance of thermal thresholds. These positive effects will be outweighed by the severity of the negative effects of climate change (Ministry of Health and Family Welfare, 2016).

Scheme level analysis[20]

NHM (Urban and Rural)

Basic health services and the resilience of health systems during a disaster are central to the fight against climate change. The long-term objectives of NHM include reduction of maternal and child mortality, population stabilisation, gender, and demographic balance. The National Health Policy, 2017 aims at reduction of U5MR to 23 by 2025, IMR to 28 by 2019, MMR from current levels to 100 by 2020 and TFR to 2.1 or less by 2025. The latest available data for India indicates the following progress: the TFR has been reduced from 2.9 in 2005 to 2.2 in 2018, IMR from 58 in 2005 to 32 in 2018 and the MMR was estimated at 113 in 2016-18 (SRS, 2006); (SRS, 2018-2020).

According to the IPCC report on impacts on human health due to climate change, in the short to medium term, effective measures to reduce vulnerability are to improve basic public health. This includes vaccination of children, increasing access to clean water and sanitation,health services, disaster preparedness and poverty alleviation. (Woodworth et al., 2014).

Under population stabilization, key indicators include total fertility rate, crude birth rate and spacing between births. According to the IPCC report on impacts on health due to climate change, "providing access to reproductive health services (including modern family planning) to improve child and maternal health through birth spacing and reduce population growth, energy use, and consequent CAP emissions over time" (Woodworth et al., 2014).

A National Action Plan on Climate Change and Health (NAPCCH) was drafted in 2016 and discussed with members of the expert group (NEGCCH). The NAPCCH aims to provide a policy framework to protect the health of citizens of India against climate-sensitive illness, especially among the vulnerable like children, women and marginalized populations(Ministry of Health and Family Welfare, 2016).

Under National Urban Health Mission, financial support has been provided to state and UTs for equipment, supplies and consumables required for biomedical waste management, Training, and capacity building (through PIP mode) under NHM till DH level. MoHFW has been encouraging the establishment of CBMWTF (Common Biomedical Waste Treatment Facilities) and all facilities are expected to develop linkage with CBWTF. The number of operational CBMWTF has increased to 211 (2017) from 178 (2008). Most of these are operating as an outsourced model. To improve the supply of equipment, consumables and bar-coding facilities, the responsibility has been assigned to CBMWTF.

National AYUSH Mission

The basic objective of NAM is to promote AYUSH medical systems through cost-effective AYUSH services, strengthening of AYUSH educational systems, facilitating the quality control of Ayurveda, Siddha, Unani & Homoeopathy (ASU&H) drugs, ensuring sustainable availability of ASU&H raw materials by promotion of the cultivation and post-harvest processing of medicinal plants.

20 Information for the scheme level analysis is sourced from the Health Sector, UCSS Evaluation (2020), DMEO, NITI Aayog, Volume 2.

95% of the AYUSH products are plant-based and the source is predominantly forests. This needs to move towards cultivated sources for long-term sustainability (Department of AYUSH). The National AYUSH Mission through the National Medicinal Plant Board is funding for encouraging cultivation of raw materials, which otherwise are sourced from forests.

Jobs and Skills

Impact of Climate Change on Jobs

Climate change can impact labour markets and working environments in multiple ways. While it directly affects sectors like agriculture, fisheries and animal husbandry, it also has indirect impacts on all sectors, including jobs upstream and downstream that rely on such ecosystems.

Sectors directly affected by Climate Change

- Agriculture – Erratic new patterns of rainfall, temperatures, pests, and diseases increase the risk of crop failure by harming crops and thus impacting the income of farmers.
- Fisheries - Fisheries sector will be severely impacted by storms, floods and droughts. Sea level rise will cause a fall in fish production and as a result harm the livelihoods of communities dependent on it.
- Animal Husbandry – Heat stress in cows reduces milk production and increased temperatures lead to new diseases and quicker transmission among animals. This can adversely affect those engaged in the animal husbandry sector.

Heat Stress and Working Environments

On average 1.5 working-life years were lost per person annually in India during the period 2008–2015 due to environment-related hazards (International Labour Organization, 2018). Heat stress will reduce the total number of work hours (by around 5% by 2030) (International Labour Organization, 2018), especially for those who work outdoors, further reducing productivity. Water scarcity will affect industries linked to water use and limited access to clean water will affect the workforce. Heat stress and water scarcity can thus affect the safety of the working environment in many sectors.

Impact of the move towards renewables

Efforts taken to mitigate climate change can also affect jobs and employment. The gradual move from fossil fuels to renewables is unavoidable and evident from the investment of USD 70 billion in renewable energy in the last 7 years in India (Singh, R. K., 2021). This shift can affect jobs across all sectors as the cost of production gets impacted (For instance–the coal cess has gone from Rs. 50 per tonne to currently Rs. 400 per tonne or opportunities for cost reductions in other areas due to the use of green material etc).

Also, as India's CSR landscape changes, more companies are choosing sustainable supply chains, and this in turn demands changes in the employees' skill sets (International Labour Organisation, 2019). This also demands a change in processes, inputs and outputs of jobs upstream and downstream in the supply chain– right from raw materials to transport. This is also aided by government interventions like the reduction in the GST levy on electric vehicles from 12% to 5% to promote electric vehicles, the National Electric Mobility Mission Plan 2020, the Green Urban Transportation Scheme etc.

This shift will also give rise to a whole host of "green jobs" which can either come from traditional sectors like manufacturing, construction, transport etc as they adapt, or from emerging green sectors like renewables, waste management, water conservation, etc. Green jobs are those that contribute to either protecting the environment and reducing the negative effects of human activity on it (i.e., mitigation), or contribute to better cope with the current conditions of climate change (i.e., adaptation) (Martinez-Fernandez et al., 2010).

Scheme Level Analysis[21]

JOBS

a. **Pradhan Mantri Rojgar Protsahan Yojana (PMRPY)** has the objective of incentivising the employers for the generation of new employment by paying the employers' full contribution of 12% towards EPF and EPS, for three years. The theme of Climate Change and Sustainability does not apply to this scheme.

b. **The National Career Service (NCS)** does not have any component/strategy that addresses climate change or contributes to sustainable practices. However, climate change and sustainable practices can be made an integral part of policy design by updating the vocational guidance training or skilling components by incorporating skills required for adaptation or green jobs.

c. **National Career Service for SC/STs (NCS-SC/ST)** does not have any component/strategy that addresses climate change or contributes to sustainable practices. However, climate change and sustainable practices can be made an integral part of policy design by updating the vocational guidance and coaching components by incorporating skills required for adaptation or green jobs.

d. **National Career Service for DA (NCS-DA)** does not have any component/strategy that addresses climate change or contributes to sustainable practices. However, climate change and sustainable practices can be made an integral part of policy design by updating the component of non-formal training of suitable trades by incorporating skills required for adaptation or green jobs. As work environments deteriorate due to climate change, differently-abled individuals may face further challenges in productively participating in the workforce.

SKILLS[22]

a. **Pradhan Mantri Kaushal Vikas Yojana (PMKVY)** aims to enable Indian youth to undergo industry-relevant skill training that will help them secure a better livelihood through Short Term Training. Also, individuals having prior learning experience will be evaluated and certified through the Recognition of Prior Learning (RPL). Climate change and sustainable practices can be made an integral part of policy design by updating the skill training components by incorporating skills required for adaptation or green jobs. The MoEFCC and MSDE are undertaking the upskilling of RAC service technicians on knowledge of alternative refrigerants and replacing ozone-depleting chemicals (PIB, 2018).

21 Information for the scheme level analysis is sourced from the Jobs Sector, UCSS Evaluation (2020), DMEO, NITI Aayog, Volume 2.

22 Information for the scheme level analysis is sourced from the Skills Sector, UCSS Evaluation (2020), DMEO, NITI Aayog, Volume 3.

Other Measurers

Under the Samagra Siksha programme of MHRD, there has been an increased focus on offering skill-based courses in schools and higher education institutions – especially employability skills courses, such as communication skills, ICT skills, self-management, entrepreneurship skills and green skills are mandatory.

The Skill Council for Green Jobs, promoted by the Ministry of New and Renewable Energy and the Confederation of Indian Industry, has the objective of assessing the skills needs of service users and manufacturers/service providers, within the green business sector and implementing industry-led, collaborative skills development and entrepreneur development programs across the nation.

Environment and Forests

Impacts of Climate Change on the Sector and Scheme Beneficiaries

The well-known and popularly understood impacts of climate change, such as temperature rise, sea-level rise, change in precipitation patterns, increased likelihood of extreme weather events, among many others, can all cause a series of changes on the biological diversity across the world through a disruption of the complex relationships that various elements within an ecosystem have with each other. Specifically, in India, with its significant ecological diversity, as well as a growing population with developmental needs, the need to account for these elements is essential. Climate change is also predicted to have a significant impact on aquatic ecosystems as changes to coastal, marine, and inland freshwater systems are imminent and will impact fish and other forms of aquatic life that form the ecosystem.

According to a World Bank report, rising temperatures and shifting monsoon rainfall patterns as a result of climate change may cost India 2.8 per cent of its GDP and lower the living standards of almost half of the country's population by 2050 (Mani et al., 2018). Adaptation measures in vulnerable sectors like agriculture, fisheries, forestries, water resources and ecosystems are estimated to cost India approximately USD 206 billion between 2015 and 2030 (MoEFCC, 2018). So far, 27 climate change adaptation projects are worth approx. USD 90 million are being taken up under the Central Sector Scheme on National Adaptation Fund for Climate Change and the Climate Change Action Programme has been approved for USD 39 million for five years (MoEFCC, 2018). The environment sector needs to respond to this diverse range of dynamic challenges.

Scheme Level Analysis[23]

National Mission for Green India (NMGI)

The following impacts were observed at a country level that are aligned with the objectives of the three sub-schemes:

- The total forest cover of India increased from 21.34% in 2015 (USAID, 2017) to 21.67% of the total geographic area of the country in 2019 (Forest Survey of India & MoEFCC, 2019)
- Between 2017 and 2019, there have been an increase of 1212 sq. km in the area under tree cover in India (Forest Survey of India & MoEFCC, 2019).

23 Information for the scheme level analysis is sourced from the Environment and Forest Sector, UCSS Evaluation (2020), DMEO, NITI Aayog, Volume 3.

- The user base of the Forest Fire Alert system has grown significantly from around 2,000 in 2017 to more than 66,000 in 2019 (Forest Survey of India & MoEFCC, 2019)

However, it is challenging to distinguish the degree to which each of the schemes has contributed to it.

The present forest cover is 21.67% of the geographic area of the country (Forest Survey of India & MoEFCC, 2019) which has increased over the years but is still below the target of 33% forest cover. Under the Green India Mission (MoEFCC, n.d.), the target for 10 years is -

- to increase forest/tree cover on 5 million ha of forest/non-forest lands and to improve the quality of forest cover on further 5 million ha,
- improve ecosystem services like hydrological services, biodiversity, and carbon sequestration, and
- increase forest-based livelihood income of around 3 million households living in and around the forests

There is a broad understanding of climate change impact on the scheme performance in terms of invasive plants population and changes in plant composition of the region. The awareness and capacity building workshops are an integral part of the scheme implementation, but awareness generation activities pertaining to climate change were not being undertaken.

According to the state-level stakeholders interviewed, the activities under Green India Mission (GIM) and National Afforestation Programme (NAP) subschemas, by design, are meant to address climate change by carbon sequestration from the increased forest/green cover. However, monitoring of the level of carbon sequestered was not being done by most states. Moreover, climate change was not considered as an explicit factor while planning activities under the sub-schemes. The incorporation of activities pertaining to climate change impacts in the Annual Plan of Operations (APO) did not take place, under the Forest Fire Prevention and Management (FPM) sub-scheme.

The theme of climate change is not well covered in the scheme design at present. More efforts are needed to incorporate the effects of climate change into the planning of scheme activities and awareness generation on the subject amongst state forest departments and communities is required.

Integrated Development of Wildlife Habitats

The population of tigers was estimated to be 2,967 in 2018 (Jhala et al., 2018) as compared to 2,226 in 2014. Based on official Project Elephant documents, the number of elephants across the country has increased from 25,569 in 2007 to 29,964 in 2017.

There is no evidence of climate change being accounted for as a part of the scheme guidelines in the form of design guidelines, climate-resilient policies, an understanding of how climate change will impact the target groups, or disaster risk reduction. Further, sustainable practices such as waste management, capacity building with respect to pollution, green practices, locally and sustainable sourcing materials etc. are not accounted for in the scheme guidelines. While some of the state-level stakeholders interviewed agreed that climate change should be considered under the planning of wildlife schemes, there was little understanding of how it is to be incorporated at the state level in drafting APOs.

The theme of climate change is not well covered in the scheme design at present and is not being covered in planning the APOs at the state level. More efforts are required to incorporate the impacts

of climate change into the planning of scheme activities and awareness generation on the subject amongst state forest departments and communities is required.

Integrating climate change and disaster management into conservation planning

While the element of climate change has been considered as a major risk in national planning documents such as the National Wildlife Action Plan (NWAP) (2017-31) and the National Action Plan on Climate Change (NAPCC), it has not been integrated into the scheme guidelines. One of the actions mandated by NWAP is the inclusion of disaster risk reduction measures and measures for climate change adaptation in management plans for protected areas as one of the actions required. Sector experts have also highlighted the importance of incorporating climate change as well as disaster management into planning at the reserve level. The uncertainty of climate change and its effects need to be accounted for and adapted to minimize these impacts, without which the communities and biodiversity in the landscape would suffer significantly. Similarly, while significant efforts have been made to develop disaster management plans for human habitations, efforts also need to be made for understanding how to manage wildlife in case of disaster situations

Conservation of Natural Resources and Ecosystems (CNRE)

The CNRE scheme has two sub-schemes: the National Plan for Conservation of Aquatic Ecosystems (NPCA) and the Biosphere Reserves sub-schemes.

- **National Plan for Conservation of Aquatic Ecosystems (NPCA)**

  Under the NPCA, India has made substantial progress towards the Ramsar convention. There is an addition of 10 new Ramsar sites which makes India the country having the highest number of Wetlands of International Importance in the region of South Asia and is next only to Japan and China in Asia (Verma & Nawab, 2020). India at present has two sites (Keoladeo National Park and Loktak Lake) in Montreux Record which tracks the Ramsar wetland accounting to change in ecological character. Efforts for the conservation of wetlands has resulted in the removal of Chilka lake from the Montreux Record in 2002.

- **The Biosphere Reserve Scheme**

  The Biosphere Reserve Scheme does not account for climate change factors and does not have climate-resilient policies under its objectives. The NPCA guidelines highlight the need for developing a plan to analyse the effect of climate change on wetlands and mentions how wetlands are important for mitigating climate change. The details for waste management of resources used in the scheme or sector are not defined. The NPCA scheme guidelines have only been put in place in 2019 and implementation is ongoing. The implementation of mitigation plans for climate change risk, awareness & capacity building, sustainable practices is yet to be assessed from primary data on availability. Further, two Externally Aided Projects (EAPs) under progress have major components on Climate Resilience: 'Wetlands management for biodiversity and climate protection' (GIZ) with funding support from the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety under the International Climate Initiative (IKI) and the UNEP/GEF funded project on 'Integrated management of wetland biodiversity and ecosystem services' (through WISA). As per the KIIs, disaster risk reduction does not come under the purview of these schemes and the plans are put into place by other departments.

Hence, the BR scheme does not adequately consider factors that are focused on climate change and under NPCA, since the guidelines for the scheme have only been released in 2019, it is too early to describe the status of implementation of climate change mitigation strategies under the scheme. Overall, the performance of this parameter needs improvement.

Sea level rises by around 2.2 mm every year in the Sundarbans due to continuous natural subsidence. According to the Man and Biosphere Programme of UNESCO, climate-related hazards affect at least 40% of all Biosphere Reserves, with landslides, floods, and wildfires being the most common, as well as snow and ice-related hazards (UNESCO, n.d.). Sample states highlighted the need to have a climate-proofing plan for the biosphere reserves. Tamil Nadu, West Bengal, Uttarakhand state nodal minister states that extreme weather event has resulted in additional renovation work. Tamil Nadu state highlighted the need of having baseline data concerning the climate change impact on the native species and developing monitoring plans. West Bengal highlighted the issue of salinity rise, additional funding to mitigate the impacts. Assam stakeholders highlighted that biodiversity has been facing challenges due to frequent extreme weather events and indicated the requirement of having a mitigation plan in place. Discussion at National KII and Expert KIIs also indicated the need of having a climate-proofing plan for the Biosphere reserves.

Recommendations

NGMI

MoEFCC should undertake a consultative process involving states, experts and civil society stakeholders, to prepare a strategic plan that will cover the contribution expected from all plantation schemes (GIM, NAP, MGNREGS, CAMPA and state schemes) to achieve the national and international targets of carbon sequestration for the country. This was also indicated as an action point in the fourth meeting of the National Executive Council for the Green India Mission. Through this plan, all schemes including GIM and NAP can also have scheme-specific outputs developed and incorporated in the guidelines along with clear targets, timelines and funding requirements to achieve their contribution to the national and international goals

IDHW

- Changes in fire frequency, insect and pathogen attacks and variations in species distribution caused by climate change are expected to have major impacts on global biodiversity. For this purpose, climate change-specific research needs to be encouraged and the management plans for Protected Areas and Tiger Reserves need to be revised to integrate climate change adaptation measures.
- **Integrating landscape approach into the scheme guidelines** - As climate change and increased habitat fragmentation have resulted in increasingly dynamic patterns of colonization and extinction, conservation measures have begun to evolve from a mainly reserve-based approach to include landscape-scale processes, since the 1990s (Donaldson et al., 2017).
- **Integrating climate change and disaster management into conservation plans** - To integrate climate change and disaster management into the planning process, firstly significant investments need to be made into researching impacts on wildlife, their

habitats and coastal/marine ecosystems. Investment in climate modelling activities will also be required to explore the nature of these impacts, their timescale and consequent wildlife habitat vulnerabilities. Collaboration with other institutions and Ministries such as the National Mission on Strategic Knowledge on Climate Change being implemented by the Department of Science and Technology, the Indian Space Research Organisation and the Ministry of Earth Sciences can be explored for this purpose. Second, climate change vulnerabilities must be integrated into the management plans for tiger reserves and protected areas, with sufficient research data available. Adaptation measures would need to be designed and implemented to address these climate vulnerabilities. The National Adaptation Fund on Climate Change provides funding for the implementation of such adaptation measures. International sources such as Green Climate Fund, Global Environment Facility (GEF) and Climate Investment Fund (CIF) also provide funds for climate change. Finally, while a Disaster Management Plan has been developed by the Department of Animal Husbandry, Dairy & Fisheries that integrates animals into the National Disaster Management Plan, there is a need to have a plan specifically for wildlife as well. These need to be further incorporated into management plans for protected areas by respective state forest departments

CNRE

Climate proofing of biosphere reserve management plans - Climate proofing is also required for vulnerable BRs. Due to the multidisciplinary nature of biodiversity, the execution and implementation of conservation measures is a challenge. Climate change has posed a serious threat to biodiversity and extreme weather events have been a major challenge to biodiversity management. Special funding for climate-proofing of these 18 biosphere reserves can help address and mitigate the challenges faced due to extreme weather events and climate change. Apart from having management plans, climate change action plans similar to State Action Plans on Climate Change could also be put in place for each biosphere reserve.

Sector Level Recommendations

Forest and wildlife conservation plans need to incorporate mitigation and adaptation actions for the near future (5-10 yrs) and long term (20-30 yrs) risks due to climate change. India needs about USD 206 billion between 2015 and 2030 to implement adaptation measures (MoEFCC, 2018), hence enhancing resources for undertaking adaptation interventions needs to be explored through domestic and international sources such as Green Climate Fund.

Sukumar et al. summarise certain broad adaptive strategies for terrestrial ecosystems and aquatic ecosystems (Sukumar et al., 2017) -

- Anticipatory planting of species taking into consideration latitudinal and altitudinal changes. A temperature change would most likely result in a universal change in species' migratory patterns from lower to higher latitudes, as well as towards higher altitudes from lower altitudes. However, on a more regional level, the changes would be contingent on the climate change impact on a smaller scale. Therefore, the use of models for specific regions could vastly improve the understanding of forest cover change and species movement to aid the predicted shifts through planting activities and can increase adaptation, the genetic variability of plant species would also need to be taken into account. The rationalization

of existing PA boundaries, and the redrawing of new boundaries while accounting for climate change induced impacts, such as the altered migratory patterns of species to higher altitudes, is an important activity in the ambit of adapting to climate change

- Restoration of degraded and altered ecosystems, to maximise the probability of a minimum number of species surviving, conservation management activities should promote the plantation of mixed species, which should account for their existing presence in different biomes and their resilience to the variability there. Additionally, the inundation of invasive alien species is a factor that needs to be closely monitored and actively controlled through the restoration of the ecosystem by planting native species.
- Implementing sustainable forest management practices: Scientific practices to encourage the growth of trees and forest cover to increase carbon sequestration, proper care of natural forests to lessen the risk of fires that cause large scale destruction, care with regards to diseases and pests and the sustainable use and collection of NTFP are some practices recommended by the authors.
- Redesigning the existing PA network: The rationalization of existing PA boundaries, and the redrawing of new boundaries while accounting for climate change induced impacts, such as the altered migratory patterns of species to higher altitudes, is an important activity in the ambit of adapting to climate change.
- Shifting to landscape approach to conservation planning: The shift towards landscape-level planning is an essential step towards the sustainable, long-term management of pressures from development needs and climate change disruptions. Corridor planning and management to ensure connectivity of habitats given the complexity of the differing land ownership patterns (government, private) across a landscape form an integral part of this.
- Creating institutional mechanisms for climate change adaptation: It is critical to adaptation to set up institutions at a more local scale, in addition to the governmental institutions at the Centre, and establish capacities to ensure the sustainable implementation of these strategies.

Water Resources

Impact of Climate Change on the Sector

Changes in temperature and precipitation caused by climate change has a significant impact on India's hydrological processes & regional water resources. It has an impact on water supply and demand, as well as water quality, particularly in semi-arid and arid areas. Rising temperatures contribute to melting glaciers, causing them to retreat and affect availability of water in Himalayan rivers, including the entire Gangetic belt, putting hundreds of millions of people's water supply at risk. In the last few decades, nearly 67% of the Himalayan glaciers have retreated because of global warming. After 1990, the annual precipitation has undergone a clear change in the Hindu Kush Himalayas (HKH) (Wester et al., 2019). The Precipitation Percentage Anomaly (PPA) in the region showed a significant increase in just over the last two decades (Zhan et al. 2017)

Another significant impact of climate change is the increasingly frequent heavy precipitation events. Over the previous decade, an increase in precipitation intensity over a short time period has resulted in an increase in the number of flood events per year. By 2100, extreme rainfall events are predicted in three major river basins: Godavari, Krishna, and Ganga with the dry season becoming drier and

the wet season becoming wetter (Asian Development Research Institute, n.d.). Over the last five decades, there has been increasing events of natural disasters in the country which is testimony to the fact that climate change is a reality, and it can have a profound impact on our country's economy.

Scheme Level Analysis[24]

Accelerated Irrigation Benefit Programme (AIBP)

The scheme guidelines don't have any explicit provisions for adoption of the climate-resilient practices. While in eligibility criteria for inclusion of Extension/Renovation/Modernisation (ERM) projects, criteria related to various water sector reforms like the adoption of MI practices, Participatory Irrigation Management (PIM), initiation of Command Area Development (CAD) works were mentioned; however, no specific guidelines related to climate-resilient practices were noted. It may be noted that MMI projects, which involve the creation of storage reservoirs, inherently support climate change resilient practices by acting as water absorbers during periods of excess rainfall and using the excess water during periods of drought. However, because of the drastic changes in climatic patterns in recent years and considering the long lifespan of MMI projects, it is imperative to incorporate additional climate-resilient practices (say use of advanced rainfall and flood forecasting models, provisions for small-scale water harvesting structures, provisions for adequate diversions and intakes in areas prone to flash floods, etc.) at the design stage to avoid incidences of water inundation or water shortages at later stages as already observed in some command areas during the primary study. In this respect, inter-departmental coordination may be explored at the design stage (like with the flood wing to incorporate aspects of recent developments in flood modelling).

During the primary survey, certain incidences of droughts and excess rainfall/floods affecting the projects were reported. In view of the drastic changes in climatic patterns in recent years, it is imperative to incorporate the aspects of recent climate changes at the time of design to mitigate instances of inundation or shortages.

Incidences of flood/excess rainfall were reported to have severely affected some projects; some of the notable examples are summarized here: Progress in Narmada canal (Rajasthan) was hampered by the floods in 2017 when motors and panels of the pumping stations were severely damaged, and some canal breaches were reported. Subsequently, the existing syphone of the Lunui and Sukri rivers were extended. Incidences of severe breaches of the canal during monsoons were reported during Focussed Group Discussions (FGDs) at villages in the command area of Champamati Major Irrigation Project in Assam, where extensive damages to agricultural lands and households were reported. In absence of any assistance from the government, the villagers reported having formed a flood committee themselves which is entrusted to collect fees, mobilize resources, and conduct canal repair works post-monsoon every year.

Lower storage capacities and erratic rainfall patterns are endemic concerns for the irrigation and drainage (I&D) sector in India. Low water storage levels in dams, during droughts, severely affect water access in the tail end villages. This issue gets further exacerbated in projects, which have provisions for inter-state water sharing, like the Bawanthadi project in Maharashtra (which has a water-sharing pact with Madhya Pradesh) and multi-purpose projects which need to cater to essential requirements like drinking water before catering to irrigation needs. To tackle the issues

24 Information for the scheme level analysis is sourced from the Water Resources Sector, UCSS Evaluation (2020), DMEO, NITI Aayog, Volume 2.

related to low dam storage capacities, convergence with other water resources sector schemes may be explored for enabling activities like desiltation, allocating O&M budget for dam maintenance, etc.

As pointed out by various research studies, to combat climate change-induced water resources challenges, it is important to strengthen existing data collection networks and promote interdisciplinary research centres.

Command Area Development & Water Management (CADWM)

The scheme has no specific guideline for adopting climate-resilient practices. However, it is understood that increase in participatory irrigation management and awareness generation through specialized agencies would lead to the adoption of sustainable water management practices and cropping patterns. Currently, the CADWM scheme has no specific provision for waste management. However, it may be noted in a similar recent CSS scheme viz. ISBIG, provisions for wastewater reuse and solar power based micro irrigation systems have been introduced. Topics of the training included mainly water management, crop management and maintenance of irrigation systems. Also, it is concerning to note that around 48% of the trainees reported receiving training more than 2 years ago and around 70% of the trainees confirmed attending less than 2 trainings in the last 3 years.

As reported by many states, the existing prescribed norms limit the extent to which lining of field channels may be done. It may become a serious issue in terms of climate change and unsustainability, as unlined or 'kutcha' portions of water courses are vulnerable to incidences of excess water run-off (as reported during monsoons in Bihar) and also deteriorate quickly after 2-3 seasons of drying and wetting of the fields.

Hence, there are no specific provisions in the scheme guidelines in relation to the adoption of climate-resilient practices. However, some of the scheme provisions in relation to participatory irrigation management, once properly implemented, would contribute to sustainable water management practices Provisions related to wastewater reuse may be incorporated in line with provisions in similar CSS schemes like ISBIG. Considering that the 'kutcha' portion of the water courses are more susceptible to climate change, revisiting the prescribed cost norms is warranted to ensure the maximum lining of the field channels.

Repair, Renovation and Restoration (RRR) of water bodies

Creation of additional storage through RRR aids in building resilience against extreme climate events like droughts and floods. However, erratic rainfall patterns (excess rainfall, less than normal rainfall, abrupt interval) poses a major risk to scheme sustainability, which is unaddressed under current scheme guidelines. It directly affects discharge which leads to temporary/permanent non-usage of water bodies. Repercussions of climate change have been observed across all states. For instance: In Madhya Pradesh, there has been an increase in periods of dry spells, which requires supplementary irrigation even during the monsoon period. Hence, though the climate change factor is critical to scheme sustainability, it is unaddressed under the current scheme guidelines. RRR also aids in building climate resilience to some extent by creating additional storage.

Erratic rainfall pattern poses a major risk to scheme sustainability, which is unaddressed under current scheme guidelines. The frequency and intensity of rainfall being predicted to further shift on account of climate change. Rainfall is regarded as critical to scheme sustainability across all 8 states: Andhra Pradesh, Bihar, Madhya Pradesh, Manipur, Meghalaya, Rajasthan, Tamil Nadu and Telangana. The 5th MI census further finds low discharge in water bodies due to deficit rainfall and droughts as a major reason behind the permanent non-usage of water bodies.

Surface Minor Irrigation (SMI)

Climate change is an important factor threatening scheme sustainability as SMI is directly dependent on rainfall. The last few years have witnessed spatial and temporal shifts in rainfall patterns. The change in discharge due to climate change threatens scheme sustainability. The scheme is completely dependent on rainfall but there is no mechanism under current guidelines to address the climate change factor.

The negative implications of climate change in recent years, often leading to 'no flow' conditions have been highlighted by Assam, Bihar, J&K, Uttarakhand and Himachal Pradesh

Groundwater Irrigation (GWI)

The climate resilience aspect has been considered indirectly in the scheme through the eligibility criteria. For example, one eligibility criterion is to have an average annual rainfall of 750 mm or more for having the availability of enough water for recharge. If rainfall in any area reduces in future due to climate change, that area will not qualify the eligibility criteria and not be considered under this scheme.

However, it is not clear from the guidelines what will happen (e.g. whether the CGWB/state dept. officials visit and prohibit the farmers to withdraw groundwater from the existing abstraction structures in those areas) for existing groundwater abstraction structures in any area if annual rainfall falls below the stipulated level in future

Watershed Development Component (WDC)

Change resilience, mitigation and adaptation have not been brought into the watershed design. Moreover, post-project management of natural resources like water and forest has not taken much focus in the ongoing generation of Watershed Programs. The climate change issue is especially important with respect to rainfed areas because rainfed agriculture is extremely vulnerable to climate change.

- The GoI included agriculture as a priority sector for climate change adaptation in its Nationally Determined Contribution (NDC) to the UNFCCC. under the Paris Agreement. The National Rainfed Area Authority (NRAA) prioritized 168 rainfed districts in India based on the climate vulnerability characteristics and risks.
- Increased investment in climate-smart agriculture measures to reduce vulnerability is essential to sustain productivity in rainfed areas.
- The scheme guidelines do not focus on the topic of climate change resilience in rainfed areas. Far and few efforts are being made on the ground from the states.
- As per NRAA, many extreme climatic events are being observed because of climate change, resilience has not been brought into the watershed design. There is a need to bring better resilience strategies to the production system with climate change mitigation as well as adaptation practices in rainfed areas.
- Post-project management of natural resources like water has not taken much focus in the ongoing generation of Watershed Programs. Besides, it is observed in states like Rajasthan, although rarely, that farmers over-extract groundwater owing to water-intensive crops.

- The climate change concept has not made way at the village level. There is a strong lack of awareness for climate change in the implementation of programs and there is a need to educate the people at the grass-roots level. The drought-proofing activities like Trench Cum Bunding and farm ponds to harvest the running water of the field have helped the farmer to mitigate the drought to a greater extent by providing protective irrigation under rainfed conditions during the critical growth period of the crop (DMEO, Niti Aayog, 2020).
- Crop diversification and movement of farmers towards allied activities empowered the farmer to economically sustain crop failure under drought conditions.
- The National Rainfed Area Authority has given ample consideration to understand the impact of climate change in the new guidelines.
- Post-project management of natural resources like water has not taken much focus in the ongoing generation of Watershed Programs.
- On the ground, some states like Rajasthan, Andhra Pradesh (Chittoor district) and Karnataka are giving exclusive training concerning water-saving technologies and climate-resilient crops. However, this is confined to only a few states.
- There is a strong lack of awareness for climate change in the implementation of programs and there is a need to educate the people at the grass-roots level.

Hence, the scheme lags in environmental sustainability as climate change resilience strategies have not been brought into the watershed design and new guidelines should focus on this.

National River Conservation Plan (NRCP)

There are currently no scheme components that targets this aspect. There is a need for the inclusion of measures for holistic river conservation due to climate change such as non-structural approaches for protection of river basins through the construction of alternatives to embankments for flood management such as floodplain zoning, catchment area treatment and other

Flood Management and Border Area Development Programmes

The impact assessments do not include the estimation of vulnerabilities in terms of climate change risks and their mitigation. As part of sustainable development, Disaster Risk Reduction (DRR) must involve all sections of society, including the government, non-governmental organisations, as well as the private sector. It necessitates a people-centered, multi-sector strategy, resulting in the development of resilience to various, cascading, and interacting hazards, as well as the establishment of a culture of prevention and resilience.

- The impact of climate change is getting reflected in frequent occurrences of floods in rivers with increased water levels. The design of various works proposed under the flood management scheme is dependent upon the hydrological aspects of the area. Hydrological aspects take care of past flood experiences, increased flood peaks to account for extreme flood conditions (due to climate change) in the design of various structures proposed under the flood management schemes.
- The master plans prepared by some of the States under the guidance of the monitoring agencies do have scope to address climate change issues like flood frequency analysis, studies on the typology of land, rainfall, temperature, waste management issues, etc

However, the Detailed Project Reports (DPRs) rarely address the climate change issues specific to a State or District. Hence, most of the States do not include environment management or climate change mitigation as part of the overall planning for flood management. Adequate capacity building of State officials for preparation of DRR and Master Plans including training on the inclusion of environment and climate change aspects into the scope of flood management is carried out. The Master Plans also do not include Climate Change Adaptability (CAA) although training is imparted to the state officials by institutes like NWA, Pune and Central Water Commission (CWC). Important issues like climate change are also not adequately addressed through training by institutions like National Water Academy, Pune.

Recommendations

Repair, Renovation and Restoration (RRR) of water bodies

- Power subsidies that favour indiscriminate abstraction of water resources need to be reduced/removed. These may be replaced by direct benefit transfer, as initiated by Telangana and Odisha.
- Towards achieving the objective of groundwater recharge and increased availability of drinking water along with building climate resilience; the scope of work under RRR may be enhanced further to include percolation tanks and water bodies used for drinking water/other community purposes.
- Water bodies may be connected to adjacent canal systems so that excess flood waters may be stored in these canals when water demand for irrigation is comparatively less. This would reduce the incidences of flooding while additional water stored may be gainfully utilized for irrigation and other allied purposes during the dry season.

Surface Minor Irrigation (SMI)

Create climate-resilient agriculture: ICT enabled decision making and research in irrigation technology

- Towards agriculture's adaptation to the increasing frequency in the number of extreme climate events such as droughts or floods; decision making with regards to crop type and irrigation scheduling may be done through ICT driven tools, like drones (details in SMI-R12).
- Considering the prevailing uncertainty regarding the resilience of crop, soil and associated microbes to climate change (Banga & Kang, 2014), funding towards research in irrigation technology is needed to develop climate-resilient agriculture. Include provision of wastewater reuse under SMI
- Given the vast amount of wastewater generated by the country, which is expected to grow further, the reuse of secondary treated wastewater for irrigation could be an efficient mechanism for water resource management. Public acceptance in this regard is highlighted by the HH survey: 74% of respondents are willing to use treated wastewater for irrigation if the government makes it mandatory.
- Investment in such infrastructure could aid in the creation of nutrient-rich and reliable water supply for irrigation. Furthermore, it could also help in coping up with seasonal water shortages and irregularities due to variability and climate change.

- Its inclusion as a part of scheme guidelines would encourage the states to invest in such infrastructure. Necessary studies in this regard may be undertaken to develop safety norms for use of treated wastewater in agriculture from the perspective of public health.

Watershed Development Component (WDC)

On account of frequent extreme weather events because of climate change, disaster resilience needs to be brought into the watershed design. There is a need to bring in better resilience strategies to the production system with mitigation and adaptation practices to address climate change in rainfed areas to the core of the watershed programme design. While framing new guidelines, the focus should be there on climate resilience (as it affects the rainfed areas the most). The following areas should accommodate components pertaining to climate change and its mitigation:

- Project planning and prioritization
- Preparation of DPR
- Long-term O&M
- Capacity Building of stakeholders

Sector level

Summing up it is quite evident that climate change considerations should be a part of mainstream water resources planning in this country. Few possible actions could involve:

- Existing models can be spatially developed for more precise climate change forecasts.
- A more flexible agricultural policy will be required, one that can predict crop selection for the planting season.
- In areas where high precipitation is predicted, forest policy should involve erosion mitigation techniques.
- Overflow and capacity challenges caused by heavy precipitation will need to be addressed in the process of wastewater treatment as well as sewerage planning.
- Water-intensive enterprises must consider siting challenges connected to precipitation changes as they grow.

Water management strategies that are climate-smart include securing important water resources and their sustainable use through adaptive strategies and practices for optimal water management, especially in drought-prone areas. To boost agricultural water-use efficiency, an integrated approach must be implemented through the deployment of novel techniques like micro-irrigation, rainwater harvesting, and resource conservation farming.

Social Inclusion

Impact of Climate Change on the Sector

Social inclusion is the action of improving the terms on which individuals and groups participate in society, improving the opportunity, ability, and dignity of those individuals or groups who are disadvantaged based on their identity. Access to resources, services and opportunities are still prejudiced by factors such as caste, religion, tribe, age & gender and acute deprivation is prevalent in nutrition, health, school education and sanitation for millions of Indians.

Indigenous peoples, disadvantaged and vulnerable people, and local communities that are reliant on agricultural or coastal livelihoods are all at disproportionately higher risk of negative repercussions from global warming of 1.5°C and beyond. (IPCC, 2018). The evidence indicates that inequality worsens the disadvantaged groups' position in relation to climate change impacts in three main ways - increased exposure to climate hazards, increased vulnerability to harm caused by climate hazards, and decreased ability to cope with or recover from the damage (Islam & Winkel, 2017).

Climate hazards have a particularly harmful impact on socially and geographically disadvantaged people, according to the AR5 WGII report, including persons who face discrimination based on gender, age, caste, ethnicity, class, and disability. Tribal communities, for example, who live on marginal lands and rely heavily on natural resources for their livelihoods, are among the most exposed to climate change.

Since Non-Timber Forest Produce (NTFP) has a ready and accessible local market, income from NTFPs forms a supplementary source of income especially in March - during the agricultural post-harvest time. However, many indigenous groups have noticed phenological changes, as well as a decrease in the quantity and quality of produce. According to a study conducted in Madhya Pradesh's Mandla district, tribal groups have noticed a substantial change in the phenology of mahua since 2005: a gradual shift in fruiting as well as flowering periods from mid-March to mid-February (Sushant, 2013). Due to the early onset of the flowering period during the harvest time, the community is left with lesser time to collect mahua. Honey collection has been estimated to have decreased by up to 90% in the Wayanad district of Kerala as a result of the changing climate (Anon, 2011). The rural poor seem to be losing a supplementary income source, food as well as healthcare, as the availability of forest produce like food, fuel, and medicinal herbs declines (Basu, 2009). Despite the fact that diminishing NTFP is a serious concern for forest communities and biodiversity, several afforestation programmes in India continue to focus primarily on timber plantation and charge the forest department with the responsibility of increasing forest cover. Thus, while large scale plantation of fast-growing timber has become the main focus, the slow-growing NTFPs do not get the required attention (Indo-Global Social Service Society, n.d.).

Apart from direct losses, indirect effects include the effect of climate change hazards on production and distribution leading to a rise in prices resulting in disadvantaged groups having to pay a higher percent out of their income on a bundle of essential goods and services. Exposure of disadvantaged groups to hazards due to occupation type is also a concern as is the exposure due to the nature of assets and resources they depend on – they tend to lack diversified assets, rely on commonly owned resources that are being threatened due to environmental degradation, extraction leading to resource depletion (Islam & Winkel, 2017).

Contribution of the Sector to Climate Change

Many indigenous societies cultivate and preserve multifaceted and intricate relationships between humans and nature. Indigenous communities are often leading the charge in innovative initiatives in climate and health adaptation, employing traditional knowledge and novel ways, because of their relationship to the land and the increased implications of climate change (Schramm et al., 2020).

Local communities in some regions have already envisaged the effects of climate change on their livelihoods and natural resources, according to a study. The study indicates that local communities had begun to adapt to climate change by modifying their livelihoods and cultural traditions (Halder et al., 2012).

Indigenous peoples who have adapted to numerous stresses over centuries, including climate change consequences recently, have the ability to aid themselves or adapt (Salick & Ross, 2009). Traditional knowledge, local insights, and experiences are valuable sources of information for climate science, according to indigenous people's perception studies on climate change in various regions of the world (Ingty & Bawa, 2012).

Scheme level analysis

Babu Jagjivan Ram Chhatrawas Yojana for SC Boys and Girls

The scheme guidelines target the construction of hostels in blocks having low literacy levels and at least 20 per cent SC population.

The risk factors in construction-related projects are very high. The project is exposed to risks pertaining to the quality of materials being used for construction, disaster-proof infrastructure, environmental hazards, and risks pertaining to the geography of the area in which the hostels have been sanctioned. It is difficult to comment on whether any risk assessment was undertaken before the sanction of projects for the construction of hostels under the scheme. Furthermore, no such provision has been mentioned in the guidelines either.

Pradhan Mantri Adarsh Gram Yojana

The scheme emphasizes the issues pertaining to sanitation and environmental sustainability by putting appropriate efforts into making villages open defecation free with adequate water disposal systems. Considering the triggering of global warming, a separate section of the scheme has been dedicated to planting trees, water harvesting, use of renewable sources of energy in form of biogas, solar and wind energy, which can be facilitated through a considerable number of public awareness and training sessions.

MSP for Minor Forest Produce

The evaluation team notes (UCSS, 2020) that the preamble of the Forest Rights Act emphasises sustainable resource use, biodiversity conservation, ecological balance management and ensuring livelihood and food security of STs and other traditional forest dwellers. Also, infrastructure development which includes facilities for storage, primary processing, warehouses, cold storage, construction of modern haats and multipurpose training centres such as Van Dhan Kendras, are integral components of the scheme. Therefore, a risk mitigation plan consisting of environmental planning and design benchmarks becomes imperative.

Owing to a decrease in forest cover across the country - numerically as well as deterioration in the quality of forests - the production of Minor Forest Produce (MFP) is bound to decline in future unless adequate research and planning to rejuvenate the eroding MFP base is in place and targeted interventions to sustain the limited resources of tribals is enforced with austerity.

There is a lack of backend support through infrastructure and procurement. Inadequate infrastructure in the forest villages to store MFPs, which have a short life, compels the tribals to sell their produce at cheaper rates. Many MFPs such as tamarind, chironjee kernel, honey, gum karaya, etc. require cold storage facilities as their quality could deteriorate if left in uncontrolled temperature. Therefore, storage and timely procurement by the state is integral to the success of the scheme. Unfortunately, both the components have been neglected, reducing the potential of the scheme. Infrastructure with a low carbon footprint, the use of local information to understand the change in forests and thus produce climate change, and community participation in building strategies to create diversified sources of income is needed.

Special Central Assistance to Tribal Sub-plan Schemes

The scheme focuses on infrastructure development activities. As such, a social and environmental plan consisting of diagnosis of potential social and environment-related concerns, followed by a plan to mitigate any adverse effect on the environment and community becomes crucial. Also, as informed during National KIIs, it is up to the State Government to utilize the funds under SCA for the purpose they find apt. The scheme guidelines do not bar the State from seeking funds to address the environmental issues. However, the evaluation team notes that sample states do not stipulate any environment and social management plan within the scheme framework or provide any information regarding risk mitigation planning, which is a crucial element for impact and sustainability.

Scheme for development of Particularly Vulnerable Tribal Groups

Lack of focus on environmental impact assessment, risk analysis and project sustainability. Co-benefits approaches that are suitable for the local context have not been taken under consideration. Effective waste management/end-of-life system is not in place for resources used in the projects under the scheme.

The Scheme for Development of Particularly Vulnerable Tribal Groups (PVTG) aims to accelerate the overall socio-economic development of PVTGs by using a "habitat development method" (MoTA, 2015) and assisting them in all aspects of their social and economic lives. This is a flexible scheme i.e. the state and local level stakeholders are involved in the planning for activities crucial for the survival, protection and development of PVTGs. The habitat development approach is implemented on-ground with the help of Conservation cum Development (CCD) plans which balances the socio-economic development of PVTGs with the need to preserve their cultural distinctiveness. The CCD plans are developed by the states/UTs through institutions such as Integrated Tribal Development Agencies, etc. over a period of 3-5 years and aim at addressing the development deficits as perceived by the states/UTs. Voluntary organizations are involved in the planning and implementation of the scheme as well, which is to be indicated in the CCD plan itself. PVTGs are prioritised for protection and enhancement in social indices such as health, nutrition, livelihood, and education to reduce their vulnerability.

Under the Scheme for Development of PVTGs, PAC plays a significant role as it is the apex committee of the Ministry of Tribal Affairs that reviews and approves the CCD plans submitted by the state governments/UT administration. These CCD plans are prepared in consultation with the gram sabha as well as with women at the hamlet or habitat level. Hence, the scheme follows a bottom-up approach in the planning and approval of CCD plans.

Although the responsibility for proper execution, implementation, supervision and coordination of the scheme lies with the state governments, the implementing agencies execute the CCD plan in the micro-project areas.

Border Area Development Programme (BADP)

There is a lack of focus on environmental impact assessment, risk analysis and project sustainability. Co-benefits approaches that are suitable for the local context have not been taken under consideration. Effective waste management/end-of-life system is not in place for resources used in the projects under the scheme. There are no training sessions held for evacuating in case of any natural calamity. End beneficiaries are not aware of climate risks and possible individual mitigation/ adaptation measures.

ABOUT DMEO, NITI AAYOG

The Development Monitoring and Evaluation Office (DMEO), attached to NITI Aayog, is the apex monitoring & evaluation (M&E) office in the country, with a mandate to drive evidence-based policy making through M&E of government policies and programmes. Since its inception in 2015, the Office aims to shift the discourse of public policy towards rigorous, data-driven, citizen-centric, and decentralized policymaking, to improve governance and facilitate the formation of a New India.

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