Integrating Climate Resilience in MGNREGS

Summary Report

ACKNOWLEDGEMENTS

This report is an outcome of GGGI's work in collaboration with Ministry of Rural Development, Government of India. Based on discussions with the Joint Secretary, MGNREGS, GGGI undertook an extensive field study for the States of West Bengal and Rajasthan in collaboration with IIEC. The findings of the study were reviewed by Mr. R.P Singh, Director, MGNREGS and the team would like to thank him for being instrumental in this collaboration between MoRD and GGGI. Water Sector Lead, Peter Vos and Climate Diplomacy Specialist, Anna Schulz provided useful insights to strengthen the findings of the report. Finally, this exercise would not have been possible without the support of Government Officials across administrative units in the States of West Bengal and Haryana. Mr. Dibyendu Sarkar, Commissioner MGNREGS West Bengal deserves a special mention for his involvement in the entire exercise. Besides ensuring administrative ease, he provided valuable insights that have enriched the analysis reflecting in this report.

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The summary report should be referenced as follows: GGGI (2019), Mainstreaming Climate Resilience in MGNREGS: Summary Report based on the field studies in West Bengal and Haryana.

The full report should be referenced as follows: GGGI (2019), Mainstreaming Climate Resilience in Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS)

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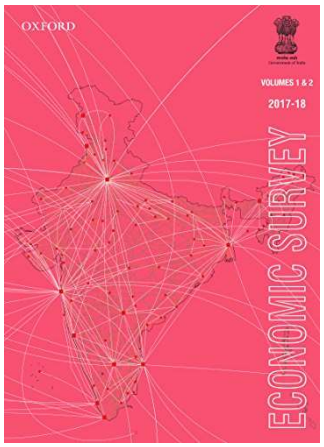
01 Context

1.1 Climate Change and Agriculture

Climate change characterized by higher temperatures, variable precipitation and extreme weather events impacts the lives and livelihoods of millions of people. Developing countries like India with a large population dependent upon natural resource base and high poverty ratio is among the most vulnerable to climate change. As per a World Bank report, *by 2020, pressure on India's water, air, soil, and forests is expected to become the highest in the world.*

Changes in temperature and precipitation triggered mainly by anthropogenic activities worldwide have a potential to wipe off a substantial income of the agriculture-dependent rural households.



The *Indian Economic Survey 2017-18,* using the temperature and projected trends of precipitation of the Intergovernmental Panel on Climate Change (IPCC), estimates that income from agriculture will decline by as much as 25% in the unirrigated areas of India. At the current level of farm income, climate change will bring down the income of a median farm household by ₹[1] 3600 per year.

1.2 MGNREGS & NRM Works

Mahatma Gandhi National Rural Employment Guarantee Act, 2005 (MGNREGA) aims to provide at least 100 days of guaranteed wage employment to every rural household whose adult members are willing to do unskilled manual labor. Last Financial Year FY 2018-19, 5.27 crore (53 million) households worked for an average of 51 days for a daily wage rate of ₹ 180 (average). That is roughly ₹ 9180 per household from MGNREGA works of which 20 days of wage or ₹ 3600 will be used to compensate for climate change loss.

Climate change can bring down the income of a median farm household by ₹3600 i.e. equivalent to 20 days of MGNREGS wor

Loss of 20 days of income for a poor household can be devastating. However, beyond wage employment, MGNREGA is also creating private and public assets for sustainable livelihood generation in rural areas. The Scheme with mandatory 60% expenditure in each district on agriculture and allied works, (Sub Para (1) of Paragraph 4 of Schedule I) along with focus on the recently introduced Mission Water Conservation (MWC) and Natural Resource Management (NRM) works is already helping the village communities cope with climate vulnerabilities albeit inadvertently.

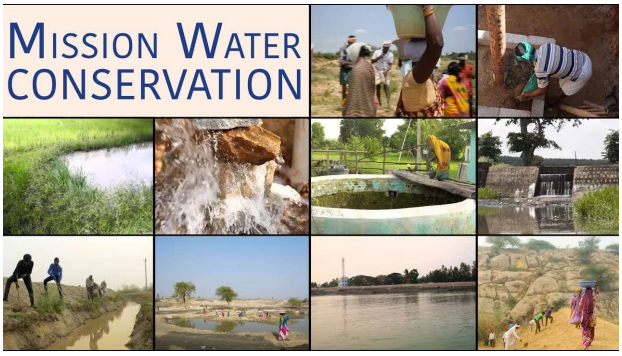


Figure 1: Glimpses of NRM Works under MGNREGS

But, if MGNREGA aims to transform the rural economy beyond ephemeral benefits, climate resilient planning, monitoring and reporting must take a center stage. The Schedule of the Act should adopt integration of climate resilience as a fundamental into MGNREGS.

1.3 Study

While several attempts have been made to quantify and qualify MGNREGA benefits to the environment, there has been no study which has systematically looked at MGNREGS existing contribution and potential to build a climate resilient rural community. Mapping the vulnerability context to MGNREGS interventions forms the foundation of this study. The study further highlights strategies to strengthen MGNREGS impact on specific vulnerabilities and is based on sample studies in two States of West Bengal and Haryana. CRIDA's climate vulnerability atlas provides the context for this study.

1.4 Vulnerability and its components

NICRA vulnerability assessment is a country-specific and government-approved vulnerability methodology prepared by IPCC experts. The vulnerability assessment is carried out based on an "indicator method", and three components of vulnerability–sensitivity, exposure, and adaptive capacity–are represented through several indicators. A schematic representation of the vulnerability components and the relationship is shown in the figure below.

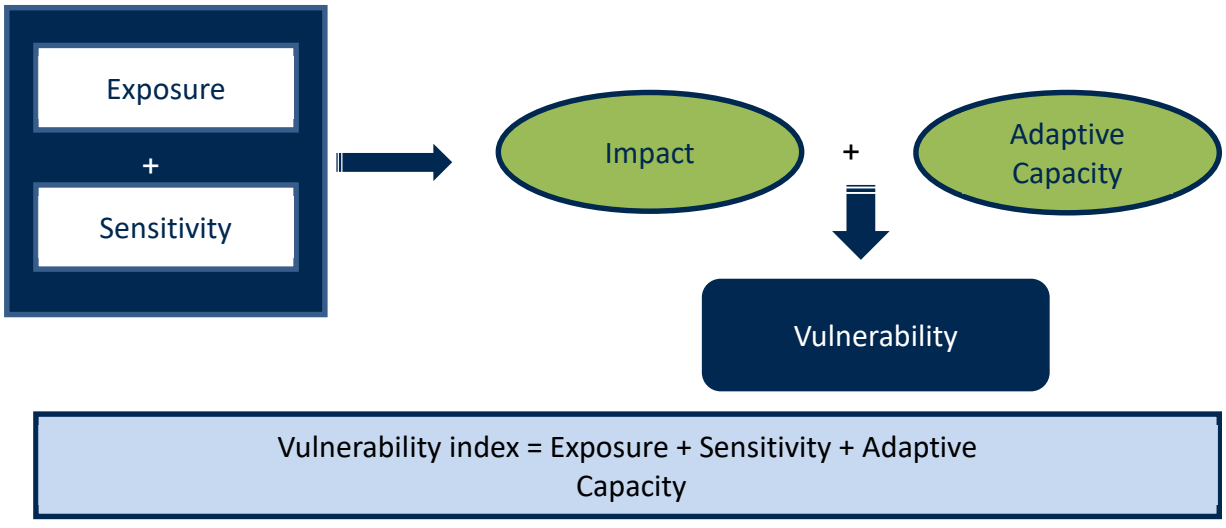


Figure 2: Schematic Representation of Vulnerability Components

02 Methodology & Sampling

2.1 Methodology

The study assesses the vulnerability in the sample districts based on critical parameters including last 25 years rainfall data of the Indian Meteorological Department (IMD), data from National Bank for Agriculture and Rural Development (NABARD), KVKs, groundwater department, census, and disaster management department.

It then lists out the possible adaptation interventions for the climate vulnerabilities and constraints, especially those related to NRM. The proposed interventions are derived from various secondary sources like the NICRA Action Plan, NICRA Annual Reports, State Action Plan on Climate Change (SAPCC) and stakeholder consultations with KVK officials, District agriculture officer, State Agriculture University etc.

This is then followed by a comprehensive review of MGNREGS activities, including those works related to soil and water conservation, groundwater recharge, plantation, irrigation, drainage, and other activities of selected districts were carried out.

The climate relevance of MGNREGS activities are identified by mapping the activities against the climatic constraints, expected climate issues of the district, and possible adaptation interventions identified in the activity. Based on the analysis of secondary data and field visits, the study highlights the gap and the potential of MGNREGA to build resilience of the rural communities.

2.2 Sampling

West Bengal and Haryana were the two States selected for this study. The two States present a contrasting picture of vulnerability and MGNREGA implementation and therefore together can help create a broad scenario for our understanding. Climate vulnerability context and MGNREGA performance in these States is presented in Annexure-I.

2.3 Selection of Districts

The leading districts in five MGNREGS parameters were mapped against CRIDA listed very high and highly vulnerable districts to identify the sample districts. Based on the selection matrix presented in the table below, Purulia and South 24 Pargana in West Bengal were selected. Similarly, for Haryana, to represent diverse vulnerabilities Kaithal and Sirsa were selected.

S. N.		Vulnerable Districts	MGNREGS Expenditure	NRM Expenditure as % of Total Expenditure	Number of MWC Blocks	Works Completed per GP	Expenditure per Active Job Card	Total
West Bengal	1.	**Purulia**		√	√			**2**
	2.	**South 24 Parganas**	√			√		**2**
	3.	Murshidabad	√					1
	4.	Dinajpur (Uttar)		√				1
Haryana	1.	Jind	√	√		√	√	4
	2.	**Sirsa**	√	√	√			**3**
	3.	Bhiwani	√		√	√		3
	4.	Fatehabad	√				√	2
	5.	**Kaithal**			√	√		**2**

Figure 3: Sample district selection matrix.

03 Findings from West Bengal

District wise findings of West Bengal are presented summarizing the vulnerability context, MGNREGS priority interventions and possible resilient measures.

3.1 State's Climate Vulnerability

West Bengal is the fourth most populous state in India (Census 2011). The state has six agroclimatic zones with varied rainfall and climatic variability.

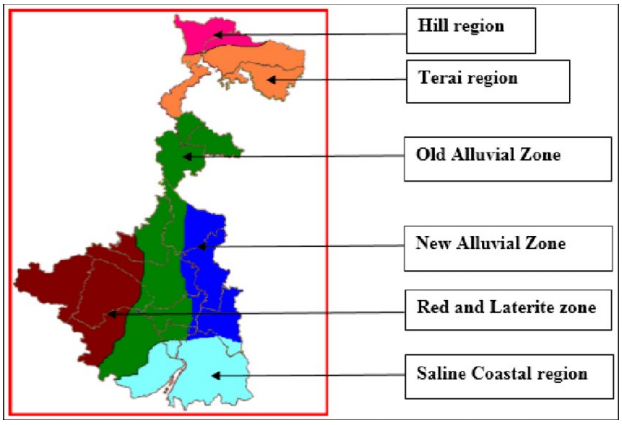


Figure 4: Agro-Climatic Zones in West Bengal

According to the West Bengal State Action Plan on Climate Change, the state has been facing inadequate and erratic rainfall, especially in the South Bengal districts. The erratic rainfall has caused drought-like situations in summer and floods during the monsoon season. Moreover, the onset of the monsoon has been delayed. Most farmers (96%) in the state are small and/or marginal; hence climate issues like inadequate and erratic rainfall not only significantly affect the crop production, but also their lives and livelihoods of millions.

Moreover, the frequency of cyclones has also been increasing in the state, causing damage to crop and livestock, and inundation of seawater. Considering the climate vulnerabilities of the state along with large population, adoption of climate resilience practices/technologies is very critical.

3.2 MGNREGS in West Bengal

State of West Bengal was the top MGNREGS spending state in FY 2017-18 accounting for 12.44% of the overall expenditure. The distribution of NRM works under the scheme shows that maximum NRM works are those related to plantation, followed by irrigation-related works and land-related works for livelihood support. Soil and water conservation work, drainage and other related works are also the other major works. However, groundwater recharge works are very little and insignificant in numbers. Out of the 81,953 irrigation-related completed works, quite a significant many i.e. 40,897 are farm ponds.

3.3 South 24 Parganas

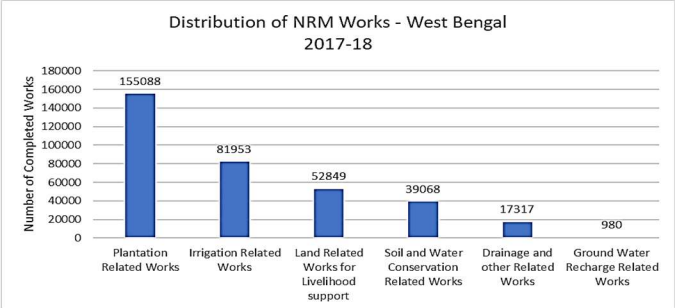


Figure 5: Distribution of NRM works in West Bengal (Source Ministry of Rural Development (2017-18)

3.3.1 Climate Vulnerability

South 24 Parganas District lies in the Saline Coastal region and has the largest area of degraded land (22.61%) of the total degraded land in West Bengal. Within the district, 17% of the total geographical area is classified as degraded or wasteland. Another 62% of the total area in the district is fallow/non-cultivable/forest. That leaves very less area for agricultural activities and increases the climate-sensitivity-related vulnerability of the district.

The net sow area in the district is 358,401 hectares, which is approximately 38% of the total geographical area. The district has large number of small and marginal farmers.

Being a coastal district, the lowlands and high tides make the area prone to inundation. The saline water ingress reduces water availability for irrigation and drinking. Coupled with exposure to extreme weather events like cyclones, there is a need for a strong and efficient irrigation system, surface water structures, and groundwater recharge to address the climate vulnerability issues of the district. Detailed vulnerability as per the sensitivity, exposure and adaptive capacity indicators is mentioned in the detailed report.

3.3.2 Status of Agri and Allied Sector

Around 30% of the net sown area of the district is irrigated, and 70% is rainfed. Because of poor irrigation facilities, there is mostly monocrop cultivation and paddy is the dominant crop. This indicates that the district has lower climate adaptive capacity. The major crops cultivated in the district are paddy, pulses, and oilseeds (mustard, sunflower).

3.3.3 MGNREGS & NRM Works

In 2017-18, South 24 Parganas was second highest in terms of wage labour and expenditure generated in the State. The district spent about 63% of its total expenditure on NRM works which are known to contribute majorly towards climate resilience. In terms of numbers, 22% of the total completed works were NRM works. Like in the entire State, a large number (5400) of farm ponds were constructed in the district during FY 2017-18. Some examples of NRM works addressing climate vulnerabilities in South 24 Pargnas is mentioned below:

In Nishapur, a farm pond is used by a group of farmers with adjoining land and is a classic example of community participation to combat vulnerabilities.

Mangrove Plantation

South 24 Pargnas was among the districts that faced the high-intensity cyclone 'AILA' in 2009.

Figure 6: Districts impacted by 'AILA'

The mangroves plantation works under MGNREGS were useful in reducing the damage of the cyclone and have prompted development of mangrove shelterbelts by Krishi Vigyan Kendra (KVK), Nimpith. MGNREGS interventions have also been used to establish/strengthen the mangrove shelterbelts. However, the scale is very limited. For example, in Gopalganj, only 5-10 km is being covered by MGNREGS from several kilometers of riverbank.

Figure 7: Mangrove Plantations in Gopalganj

Farm Ponds

Although Nishapur GP in Mandir Bazar Block has widespread irrigation canals fed by the river, it isn't very useful in supporting agriculture production. Firstly, the canal system does not have last-mile connectivity in the form of watercourse and field

channels. The flow in the canals is not enough to justify the cost of construction of watercourse/field channels and area lost for the same. In addition, the river, which feeds canals, is linked with the sea and in times of rise in sea level, it carries saline water for some months of the year.

As an alternate solution large farm ponds are being constructed in farmers' fields which are bigger than the standard farm pond designs. These ponds serve a dual purpose. They receive water from canals and provide water to the nearby fields through pumping and are also used for fisheries by the landowner.

Figure 8: Group farm pond in Nishapur

These farm ponds have significantly increased the area under irrigation, crop intensity, and production. Farmers are now going for double cropping. In the given context, the model appeared to be quite successful in reducing the climate vulnerability and can be replicated in other similar locations.

Desilting of canals

Another major issue for irrigation is silting in canals. Due to lack of silt trapping measures, a significant amount of silt flows and gets deposited in the canals reducing their capacity and leading to little or no water for tail-end farmers. Desilting to maintain the canal capacity is a frequent activity under MGNREGS. Though keeping the canals free from silting is essential and enhances the resilience by enhancing the adaptive capacities, incurring expenses for regular maintenance under the scheme might not be a sustainable solution.

Other Works

Works related to plantation of fruits, poultry shed, cattle sheds have also been taken up in the district. Such works help diversify the livelihood options for rural communities. Diversified livelihood options have diversified/different vulnerabilities and are suitable in building the climate resilience.

3.3.4 Examples beyond MGNREGS

Several successful case studies on climate adaptation/resilience projects (to address climate vulnerability issues) are being implemented by other State departments/agencies. Some useful adaptation interventions that fit very well in the MGNREGS framework is mentioned below. Detailed list of works to prioritize has been mentioned in the main report.

a) Solution for Water Inundation

Due to flat lowlands and very little slope, a slight increase in water level causes large areas to be inundated and damage to the crops in the district. In addition, seawater ingress (climate vulnerability issues) also reduces the availability of fresh water suitable for most of the crops. An innovative approach to address these issues have been adopted by KVK. About 20% of a low-lying field is dug up to make a pond up to 8-9 ft deep. Excavated earth is spread over to the remaining 80%, increasing the height of the field up to 1.5 ft. The increased height reduces water inundation issues, and the associated farm ponds also ensure water availability (increasing adaptive capacity) when required. Further, land embankment around the field is strengthened to 3 ft in height and 5 ft wide. With the rest of the soil, a 5-ft-wide and 4-ft-high pond embankment is created. The widened pond and land embankment is used for vegetable cultivation

throughout the year. At the same time, pisciculture with duck rearing is taken up in the pond thereby providing alternate livelihood options and increasing the adaptive capacity.

Figure 9: Mono to multi crop with fisheries in Bongheri

b) Horticulture and Land Embankment

In order to address climate vulnerabilities like water inundation in the fields during heavy rains, a peripheral canal is dug out, and the earth is added to the existing land embankment to raise it up to 3 ft height and 5 ft width. On an average, additional 5-10% of the total land is brought under cultivation. Vegetables like okra, cowpea, tomato, French bean, and bitter gourd are then cultivated over this strengthened bund (ail) during kharif season with almost no chance of submergence. The problem of salinity is also avoided in cultivation during Rabi summer season. The treated (encaptivated) low land now becomes suitable for paddy-cum-fish cultivation (providing livelihood options and increasing adaptive capacity) during kharif season as the fish cannot escape due to the embankments.

c) Ridge and Furrow Cultivation

Ridge-and-furrow cultivation provides a good scope for sustenance of marginal farmers by growing vegetables on the ridges throughout the year. The lowlands were converted into multi-cropping land having half of its entire land as ridge, where year-round vegetable cultivation is possible. This approach leads to multiple benefits and brings the area under useful production. Under MGNREGS, the basic infrastructure can be created, but it needs to be utilized in convergence of other line-departments like horticulture, fisheries, etc.

In small patches of lands, where excavation of ponds is not possible, the ridge-and-furrow system is a suitable alternative to harvest freshwater for irrigation (increasing adaptive capacity) during the dry spell.

Figure 10: Furrow and Ridge method in lowlands

d) Storm resistant two-tier shelter model for backyard poultry.

The district is exposed to frequent cyclones and increased rainfall intensity. To protect the livestock from cyclones, floods, heavy rains, a storm-resistant two-tier integrated shelter model (improving adaptive capacity) is implemented in the village. A double floor, durable housing with iron and net structure is developed under the NICRA project. The housing accommodates 20 poultry birds at the bottom floor and 20 pairs of ornamental birds on the top. The culling percentage of poultry birds has reduced, and the egg production per cycle has increased. The ornamental birds also provide additional income to the family.

3.4 Purulia

3.4.1 Climate Vulnerability

Purulia District is one of the most drought-prone districts of West Bengal. Degraded land or wasteland constitutes 38% of the total geographical area of the district, and more than 51% of the total area of the district is either fallow/non-cultivable/forest. Hence very less area is available for agricultural activities. Detailed vulnerability as per the sensitivity, exposure and adaptive capacity indicators is mentioned in the detailed report.

3.4.2 Status of Agri and Allied Sector

The net sown area of the district is around 49% of the total geographical area. The net irrigated area of the district is only 31% (which is very low), and around 69% of net sown area is rainfed. Due to lack of irrigation facilities, agriculture in the district is predominantly mono cropped (paddy). About 60% of the total cultivated land is upland, and only 17% of the net cropped area is under multi-crop cultivation. The details of different types of irrigation methods employed in the district are given in the below figure. During the site visit, it was observed that the crops are grown mostly under rainfed condition generally with low fertiliser consumption per unit area. Hence the crop productivity of Purulia district is low compared to other districts of West Bengal.

3.4.3 MGNREGS & NRM Works

During 2017-18, the total MGNREGS expenditure in Purulia was Rs. 17,458.14 lakh, which places the district at 17th of the total 23 districts in the state. The district spent about 74% of MGNREGS expenditure on NRM works Purulia is the only district in the state in the category of the most irrigation-deprived districts. All the blocks of the district are covered under Mission Water Conservation with madatory 65% of MGNREGS expenditure on NRM works.

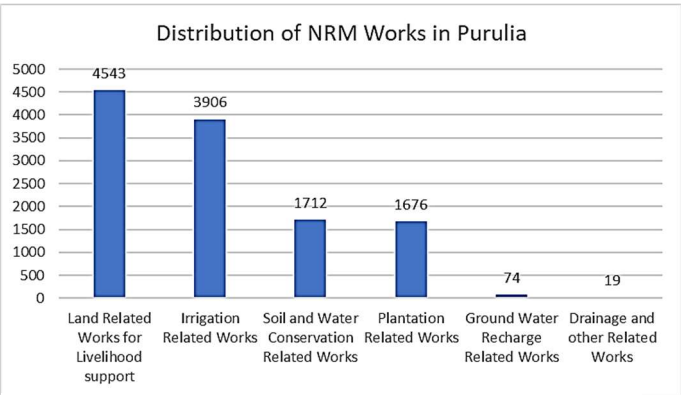


Figure 11: NRM Works distribution in Purulia

UsharMukti and 30×40 Model

UsharMukti is a newly introduced partnership between MGNREGA, Bharat Rural Livelihood Foundation (BRLF) and a group of Civil Society Organizations to improve the water situation in the rain-fed areas of Purulia, Bankura, Jhargram, Birbhum, Paschim Medinipur and Paschim Bardhaman. It is being implemented in all blocks of Purulia. One major intervention under UsharMukti is the 30×40 Model.

***UsharMukti* is a watershed-based programme under MGNREGS that follows the ridge-to-valley approach while implementing soil and water conservation works.**

The 30 × 40 model is an approach for conserving in situ. It divides the uplands (with 3-8% slope) into small plots of 40 ft across the slope and 40 ft along the slope), digging pits at the lowest point in each plot and bunding the plot using the soil dug out of the pits. For implementing this, the selected area is marked into 30 ft by 40 ft plots, starting from upper reaches, if possible, from ridge line. The length/width may be varied by up to 10%, if required. In each plot, the deepest point is identified, and a 7 ft × 7 ft × 3 ft pit is dug out. Side slopes are maintained based on the soil type, and bottom is maintained, if possible, at 5

ft × 5ft dimensions. A bund is formed around the plot with the excavated soil from the pit.

The pit and bund can capture all the water falling into the plot during rainfall. Tree plantations at suitable distance is carried out. The conserved moisture is mostly able to support trees. Experience reflects that the moisture also causes development of significantly higher biomass, as compared to untreated land.

*Figure 12: 30*40 Model in Purulia*

Plantation with mandatory soil-water conservation structures also forms a major part of UsharMukti works. Under the programme, DPRs are prepared for the entire year and works are taken up based on the priorities set by the community.

Figure 13: Other UsharMukti works in Purulia

3.4.4 Examples beyond MGNREGS

Purulia District faces climate vulnerability issues such as erratic rainfall, high rainfall intensity, delay in onset of monsoon, and increase in drought frequency. The Development Research Communication and Services Centre (DRCSC), a CSO, along with NABARD, has been implementing UNFCCC climate change adaptation project in the district to address climate vulnerability issues.

Based on the field visit and stakeholder consultations with DRCSC officials and villagers, the following adaptation project was identified which can be implemented through MGNREGS.

Integrated farming

Purulia District faces climate vulnerability issues like erratic rainfall, delay in onset of monsoon, and increase in drought frequency, so in order to address climate vulnerability issues and to improve adaptive capacity, an integrated farming project was implemented in Kashipur block.

In the project, various subsystems such as livestock, fish, poultry, and perennial/seasonal crop production are integrated. The subsystems are integrated in such a manner and proportion that each subsystem helps each other. For example, the waste of one subsystem is used as a resource for another subsystem to set up a network of nutrient flow, making the system more efficient. The integrated farming included different subsystems such as water harvesting, rice production, fodder production (Azolla), fishery, and duckery. Integrated farming approach enhances water availability for irrigation, provides alternative livelihood options, hence addressing climate vulnerabilities and improving adaptive capacity. This system has good potential for replication and can be implemented through

MGNREGS. Detailed list of works to prioritize has been mentioned in the main report.

Figure 14: Step pond with integrated farming

3.5 State Specific Suggestions

West Bengal is already addressing the contextual climatic issues by adopting appropriate approaches and incorporating the sustainability aspects to a certain extent. Although MGNREGS interventions are being planned from a broader perspective, and are addressing the climatic vulnerabilities, putting the climate lens at the time of planning and implementation will certainly make the interventions more impactful. Examples from outside where better outcomes and higher impacts on livelihood strengthening and enhancing the climate resilience of the socio-ecological systems have been achieved may be adopted under MGNREGS.

3.5.1 Institutional Support

Continuous engagement with the community in identifying and prioritizing NRM works can improve effectiveness of the interventions, as exemplified through the NICRA project. Some innovative models including the spreading of excavated soil in the rest of the field has made the field suitable for around-the-year cropping (in low-lying areas). Similarly, the ridge-and-furrow model has increased the returns from the fields significantly.

Similarly, deployment of group farm ponds within the MGNREGS is also an innovative approach, which requires the community to establish ownership and institutional mechanisms. This demonstrates that strong institutional systems can, in some cases, make a significant difference in the outcomes of the interventions.

3.5.2 Biodiversity Aspects

Soil and water/moisture conservation practices are important from a biodiversity perspective also. Due to continuous moisture near water bodies, not only green cover increases but also several species of vegetation and fauna flourishes. Multiple crop system replaces increases the livelihood profile of habitants and reduces their vulnerability. West Bengal MGNREGS has also experimented with introducing the exotic species of some vegetative products like dragon fruit, Arabian dates, etc. These options have the potential to fetch higher commercial value from the market and benefit the farmers. However, the exotic species may pose danger to native species by attracting new diseases/pests, for which the native species may not have resistance and may affect the biodiversity of native species.

3.5.3 Recommendations

The impact of MGNREGS interventions in West Bengal can be further increased by putting the climate lens, incorporating the experiences from other development agencies, including but not limited to CSOs and KVKs and focusing on institutionalizing the processes. In addition, environmental aspects, especially possible impact of introducing exotic species, also need to be considered. This strategy certainly enhances the impact of interventions by increasing the climate resilience of the most vulnerable rural sections of the community.

04 Findings from Haryana

District wise findings of Haryana are presented summarizing the vulnerability context, MGNREGS priority interventions and possible resilient measures.

4.1 State's Climate Vulnerability

Haryana has hot summers and mild winters. The average rainfall in the state is 544 mm. Net sown area in the State is 80% of the total geographical area. The state has extensive farming support either through canal or through groundwater irrigation. The state has considerable proportion of small and marginal farmers who are very sensitive to climate issues.

Haryana faces climate issues like rising temperature and erratic rainfall, which affects the mainstay of the economy, agriculture. Haryana produces about 6% of food grains in India despite comprising only 1.4% of the total geographical area. Increased demand for irrigation has resulted in the overexploitation of groundwater resources (55 out of 108 blocks are overexploited in Haryana). Groundwater depletion is therefore a major vulnerability in the state.

Some of the most vulnerable districts of Haryana are not equipped with water storage structures for agriculture, resulting in low crop productivity. In the recent past, Haryana has received funds from the National Adaptation Fund for Climate Change (NAFCC) for "Scaling-up Climate Resilient Agriculture Practices towards Climate Smart Villages (CSVs)" in 10 districts including Kaithal and Sirsa. It exemplifies the need to adopt climate resilient technologies in different sectors especially agriculture to address climate vulnerability issues.

While more than 55% of the blocks in Haryana face depleting groundwater issues, only 1.6% of the total NRM works under MGNREGS in the last four years were undertaken for groundwater recharging.

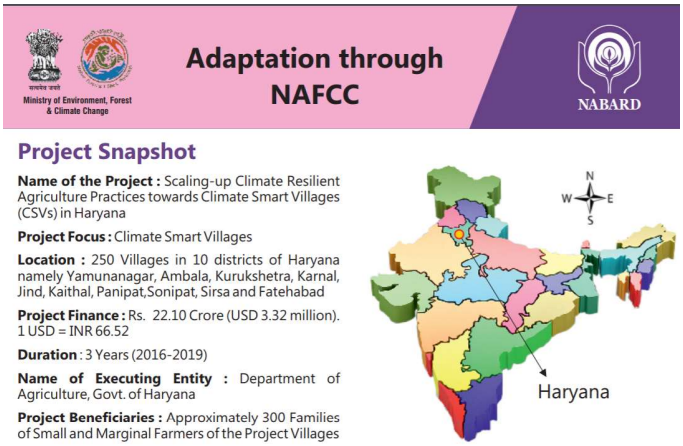


Figure 15: Snapshot of NAFCC CSV in Haryana

4.2 MGNREGS in Haryana

The state accounted for 0.61% of the total MGNREGS expenditure for 2017-18. There are 64 overexploited blocks and 14 critical blocks spread over 20 districts in Haryana. Although MWC requires 65% of MGNREGS expenditures on NRM works in MWC blocks, the state has spent only 61.88%. Among completed works, public NRM works and individual works are the highest, constituting about 79% of total works. The third category is rural infrastructure (21%). Rural connectivity, micro-irrigation and land development accounted for about 70% of the MGNREGS resources in Haryana in FY 2017-18 as shown in the chart below.

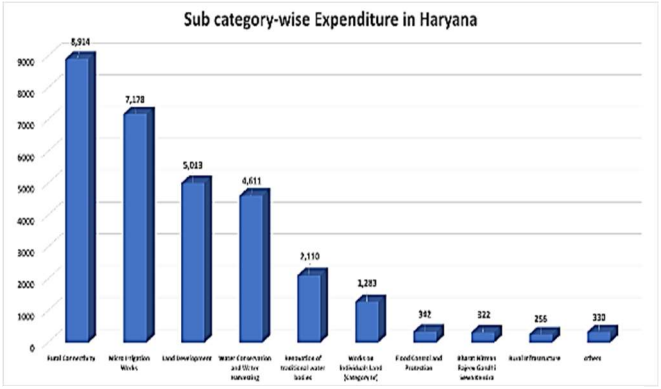


Figure 16: Subcategory wise MGNREGS expenditure

4.3 Kaithal

4.3.1 Climate Vulnerability

The normal annual rainfall in Kaithal is 511 mm, which is unevenly distributed. The south-west monsoon sets in from the last week of June and withdraws in the end of September, contributing about 85% of the annual rainfall.

Kaithal is also among the overexploited districts with respect to groundwater depletion. Six out of the seven blocks in the district are overexploited. The net irrigated area is around 96% of the total net sown area. Out of the total irrigated area, tube-well-based irrigation comprises 84% and the rest is canal-based. The land holding of small and marginal farmers (who are highly sensitive to climate issues) is around 63% of the total land holding of the district. The major crops cultivated in the districts are wheat and rice.

Summary of the vulnerability issues in Kaithal is listed in the table below:

Sensitivity	Exposure	Adaptive Capacity
High net sown area Low rainfall SMF community GW exploitation	High rainfall variation High July rainfall variety High-intensity rainfall Change in maximum temperature	High irrigated area Large aquifer systems High fertiliser usage High per capita income (6th rank) High agriculture workforce Low literacy rate

Figure 17: Summary of the vulnerability in Kaithal

4.3.2 MGNREGS & NRM Work

Total NRM works completed in FY 2017-18 are only 245 in Kaithal district. Maximum works (about 84%) are related to irrigation with only four farm ponds have been completed during the period.

Discussions with villagers revealed that major MGNREGS-NRM works taken up are related to cleaning/desilting of canals. Though the overall productivity of agriculture is increasing due to the introduction of new or crop varieties, land productivity has been decreasing. Excessive use of fertilizer and

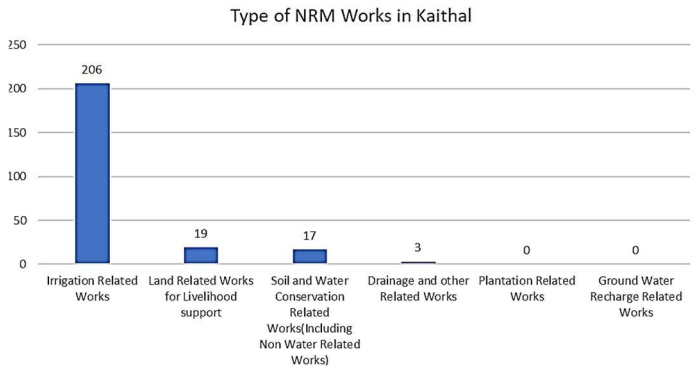


Figure 18: NRM Works in Kaithal in FY 2017-18

declining organic carbon in the soil has also been reported. These can be addressed through MGNREGS which allows for constructing of bio-composting structures.

Although factors like high area under irrigation, availability of large aquifers, and higher per capita income coupled with usage of hybrid/high-yielding varieties and fertiliser have increased the adaptive capacity of the communities, rapid depletion of groundwater, reduction in rainfall and land productivity are likely to make them very vulnerable in the near future.

4.3.3 Examples beyond MGNREGS

Successful case studies on climate adaptation/resilience projects (to address climate vulnerability issues) implemented by other departments/agencies in the district were explored.

Three/ Five-Pond System

In villages, dirty water (mainly liquid waste from houses) flows into the ponds and contaminates them. The three/five-pond system is a very simple and effective system for treatment of wastewater. Grey water passes through three/five ponds, excavated at a suitable land site. The ponds are placed serially to act as a stabilization system for wastewater.

The three-pond system consists of an anaerobic pond (10 ft deep), facultative pond (5 ft deep), and maturation pond (5 ft deep). The five-pond system is

like a three-pond system and adds two ponds, an alternate anaerobic pond and a second maturation pond for better treatment of wastewater.

The treated wastewater can be used for irrigation, drinking water for livestock, fisheries, or groundwater recharge, hence reducing groundwater extraction and helps in reduction of groundwater depletion. Detailed list of works to prioritize in Kaithal has been mentioned in the main report.

4.4 Sirsa

4.4.1 Climate Vulnerability

Sirsa has three distinct features: spland plain, alluvial bed (flood plain) of river Ghaggar, and sand dune clusters. Sirsa has two types of soils: sierozem and desert soils. Sierozem soils are found in major regions of the district. The climate of Sirsa is tropical desert type.

The net sown area of the district is around 94% of the total geographical area. The land holding of small and marginal farmers is around 95% of the total land holding of the district. The district has a large section of small and marginal farmers who are highly sensitive to climate issues. The normal annual rainfall of Sirsa is 318 mm. The major crops in the district are wheat, cotton, rice, and rapeseed mustard Summary of the vulnerability issues in Sirsa is listed in the table below.

Sensitivity	Exposure	Adaptive Capacity
• High net sown area • Low rainfall • SMF community • Groundwater exploitation	• High rainfall variation • High July rainfall variety • High-intensity rainfall • Change in maximum temperature	• High irrigated area • Large aquifer systems across the state • High fertiliser usage • High per capita income (6th rank of Haryana) • High agriculture workforce • Low literacy rate

Figure 19: Summary of the vulnerability in Sirsa

4.4.2 MGNREGS & NRM Work

All seven blocks of Sirsa District are overexploited with respect to groundwater. The distribution of completed NRM works in Sirsa across the main categories is shown in the figure below.

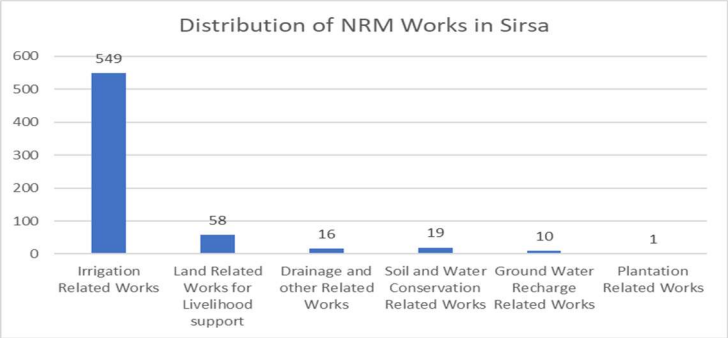


Figure 20: NRM Works in Sirsa in FY 2017-18

It reflects that a maximum number of works are irrigation works with little or no priority to other NRM works. Considering the groundwater stress and low green cover and water logging in some patches, plantation works, drainage-related works, and groundwater recharge works need to be taken up in more numbers.

Though the district has a strong network of irrigation canals, they are susceptible to silting. This silt not only decreases the canal capacity but also acts as a limiting factor in providing adequate irrigation to tail-end farmers. To address this issue, the canal cleaning/desilting works are being taken up regularly.

Figure 21: Desilting of canal in Nathushree-Chopta

For places where drinking water requirements ar met by canal water, Public Health Engineering Department (PHED) and MGNREGS have joined hands to clean and maintain the water storage tanks. Construction for storing drinking water, have also been taken up under MGNREGS for the period when there is no water flow in the canal. Tanks are lined and are being maintained by the Public Health Engineering Department (PHED). However, silting of these tanks reduces capacities and affects the water quality. Cleaning of these tanks has also been taken up under MGNREGS.

It has also been observed that the use of heavy machinery, overuse of irrigation water, and reduced permeability have caused an increase in salinity.

Similar to Kaithal, land productivity has decreased with time in Sirsa. In some places, land patches have become uncultivable due to salinity and water logging. Like Kaithal, Sirsa too has a greater adaptive capacity to deal with climate issues now but reducing rainfall, reduced canal water and land productivity would make the communities more vulnerable in the future.

4.4.3 Suggested Works under MGNREGS

It has been observed that even though considerable resources are being invested in NRM works to address the different issues related to climate change, there is much more potential to align the MGNREGS works with climate resilience of the socio-ecological system. As mentioned in the previous sections, following works/combination of works may be taken up to enhance the climate resilience of the socio-ecological system.

Approach to Achieve Climate Resilience	Potential Works/Combination
Enrich the water resource status	• Surface water storage structures (ponds), etc. • Groundwater recharge structures **In Shivaliks and Aravali regions:** • Check dams, stop dams, etc., as per applicability
Livelihood options, creation or strengthening	• Wage employment • Orchard plantation • Livestock shelters • Fisheries promotion in the waterbodies created/renovated • Fodder crop cultivation
For enhanced climate resilience	• Ensuring a combination of irrigation with proper drainage work • Combination of water storage works with fisheries • Combination of desilting of water bodies with plantation on boundaries • Safe disposal of drainage water and use of bio-drainage works • Silt trap structures instead of regular desilting works • Leveraging technical expertise of other stakeholders through convergence (especially the horticulture and forestry expertise may be leveraged)

Figure 22: Potential Works under MGNREGS

Detailed list of works to prioritize in Sirsa has been mentioned in the main report.

4.5 State Specific Suggestions

4.5.1 Area-based Planning

Despite the adoption of GIS for MGNREGS planning, no area-based approach is being applied in Haryana. The study identified a perception in the field that GIS-based planning is only for undulating topography. However, GIS is a tool, which provides the opportunity to understand the spatial distribution of parameters, which is useful in any context and can support MGNREGS works and increase the impact of efforts to integrate actions to address climate vulnerability.

Figure 23: e-SAKSHAM for MGNREGS planning

4.5.2 Priority to Natural Resources

Haryana has one of the lowest percentages of forest cover in India, with only 3.53% of the geographical area covered by forests. Including tree cover, the green cover is only 6.79% of the total geographical area. In addition, more than 50% of the blocks in the state are water stressed from the groundwater development stage perspective. Large-scale and rapid deforestation has resulted in unsustainable development and may exacerbate the impacts of climate change in the state. Investment of MGNREGS resources in both groundwater recharge and afforestation will not only improve the provision of natural environmental services and increase sustainable growth, but it also has the potential to support livelihoods.

4.5.3 Capacities of MGNREGS Team

Lack of technical and administrative capacities of the MGNREGS staff may be a limitation in effective and diversified implementation of MGNREGS projects. Though beyond the scope of this study, lack of adequate staff seems to negatively affect the selection and implementation of the appropriate works, which can have a higher impact in supporting the livelihoods and natural resources even in extreme climatic events.

4.5.4 Recommendations

The impact of MGNREGS interventions in Haryana can be further increased by putting the climate vulnerability lens and planning MGNREGS interventions accordingly. Efforts to replenish the natural resources including groundwater recharge must be prioritized. Further, planning process needs to be improved by adopting already initiated area/project-based approach. And lastly, technical staff strength and their capacities need to be enhanced to ensure that MGNREGS can contribute in reducing the climate vulnerability in Haryana.

05 Integrating Climate Resilience in MGNREGS

Out of the 260 permissible works, 206 (approximately 80%) are either NRM or Agri& Agri-allied. To understand the climate resilience potential of these works, efforts have been made to identify the approaches through which these works can enhance climate resilience of the rural socio-ecological systems in the given vulnerability context. Climate resilience of the works can be further enhanced by incorporating the future climatic data based on climate modelling. For example, hydrological principles of design, past climatic data (especially precipitation) and possible future extreme events can be used to estimate the flow and therefore the stability of a MGNREGS structures.

Even the 54 non-NRM/agriculture/agri-allied works like road works, buildings, toilets, cyclone shelters, toilets, etc.), wastewater management works (like drains, soak pits, stabilization tanks, etc.), can be made climate resilient, by incorporating the future climate data simulated through climate models.

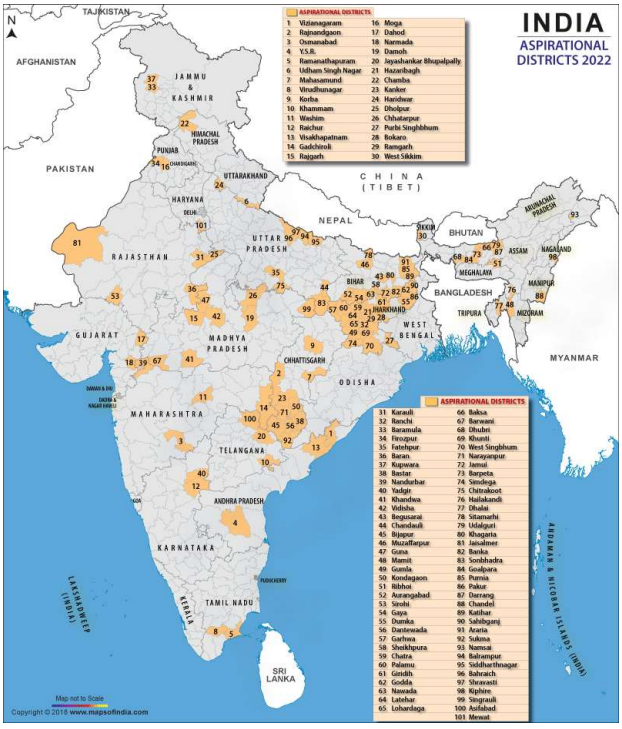
Resilience can be enhanced by taking up works in certain combinations, like the contour trenches with plantation on the bund. Likewise, Farm ponds will be more resilient (sustain for a longer period), if constructed with inlet and outlet, and embankments are strengthened with vegetation/trees. The following list relates those identified factors contributing to vulnerability and MGNREGS work categories, which can address these factors directly and should be considered before finalising the works.

Sensitivity/Adaptive Capacity Issues	Category of Works that can Contribute to Addressing the Issue
Vulnerability Issue Type: Adaptive capacity	
Low groundwater availability	• Groundwater recharge related works • Water conservation and harvesting works
Low net irrigation area	• Irrigation-related works
High poverty	• Land-related works for supporting livelihoods • Water conservation and harvesting works • Plantation (orchard) works
Low density of livestock	• Livestock support works
Vulnerability Issue Type: Sensitivity	
Low rainfall	• Water conservation and harvesting works • Groundwater recharge works
High net sown area	• Water conservation and harvesting works • Irrigation-related works
Flood proneness	• Drainage and other related works
High drought prone	• Water conservation and harvesting works • Plantation works
High area with small/marginal farmers	• Works on individuals' land
Low available water content of soil	• Soil health-related works

Figure 24: Mapping of MGNREGS work Category against specific vulnerabilities.

5.1 Prioritization of Vulnerable Districts

The unit of vulnerability context in India is so far limited to district and so it is important to identify the most vulnerable districts and plan specific MGNREGS interventions in them. To prioritize, a



combination of NICRA Vulnerability Atlas, NITI Aayog's identified Aspirational Districts and MoRD's Priority Districts for NRM works have been used to

identify 70 districts across 18 states that needs the immediate of MGNREGS. The Ministry can closely

monitor the performance of the scheme in these vulnerable districts mentioned in Annexure-II

5.2 Climate Vulnerability Orientation

MGNREGS promotes bottom-up planning expecting the Gram Sabha to identify works related to context and critical issues. However, it is learnt during the study that sometimes it is difficult to capture actual issues that need to be addressed by the community, and in most of the cases, short-term benefits start guiding the identification and prioritization of the works. In such situations, the potential of MGNREGS works for strengthening the livelihoods, natural resource base, and sustainable development is significantly reduced.

Field functionaries should equip the Gram Panchayat with broader perspectives and propose possible solutions under MGNREGS based on the vulnerability context of the GP. Several documents like the Mission Water Conservation Guidelines, NICRA Vulnerability Atlas and State Action Plan on Climate Change can be used to make an informed planning and implementation decision. Other more specific documents like NABARD's PLP which identifies the priority area of development in each of the districts every year can also be considered.

Secondly, awareness and capacity building of the MGNREGS team on climate change/climate resilience and the important contextual reports/documents is needed to bring the climate vulnerability orientation. Given the outlays and outreach of MGRNEGS, the Ministry can carry out a more detailed vulnerability identification exercise and engage experts to align MGNREGS works with the vulnerabilities.

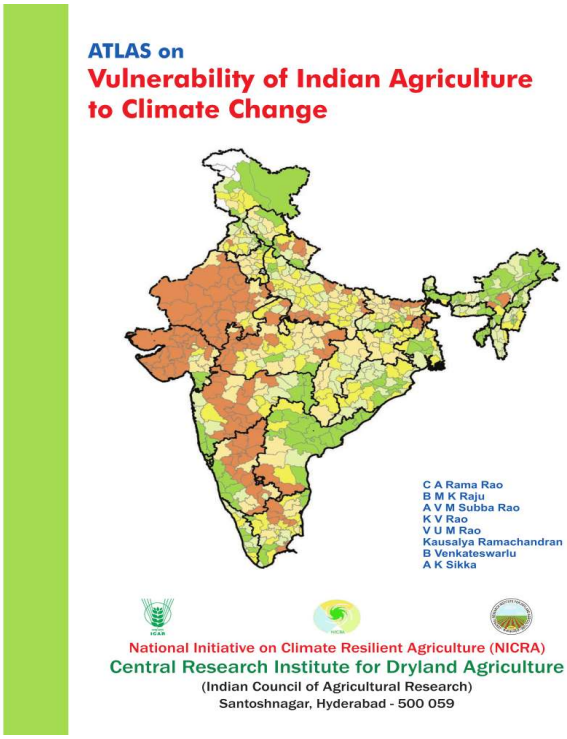


Figure 26: NICRA Atlas

5.3 Project Vs. Works Approach

MGNREGS implementation framework emphasizes on individual works, from planning through the implementation and monitoring. Recently, an area-based approach using GIS and remote sensing has been adopted to implement the watershed approach and to achieve better outcomes.

The Greening of Hillocks project in Andhra Pradesh involves the integration of trenches and bunds, tree plantations on bunds, drainage line treatment works, percolation tanks, injection wells, and other water and moisture conservation of works targeting increased green cover, while addressing local livelihood concerns.

The UsharMukti programme, Greening of Hillocks, pastureland development, integrated farming models, 30 × 40 models are all examples within the MGNREGS that demonstrate that integration of different works taken up as a project is more effective in comparison to individual works.

To facilitate the implementation of project-based approach, the technical staff needs to consider multiple works for achieving higher-level outcomes. Simultaneously, provisions in MGNREGS MIS should facilitate tracking and reporting on collective outcomes of a project including several works.

5.4 Sequence of implementation

GIS is now being used for planning under the MGNREGS. Once the planned works are approved, they become part of the Shelf of Works and based on the demand, these works are selected for implementation. However, for NRM works, the sequencing of work is very crucial for effectiveness and sustainability. For example, construction of a check dam in lower catchment areas without treating the upper reaches of the watershed may render the check dam ineffective due to siltation. In addition, it will handle less flow of water, if the upper catchment is already treated. That is, if the check dam is constructed first, it must be designed for a higher flow of water, which will make it costlier and over-designed. Similarly, the water conservation works need to be prioritized compared to promoting more water requiring practices, to ensure sustainability.

5.5 Convergence of Technical Resources

Many a times MGNREGS team might not have the required expertise for preparing estimates or implementing certain works. However, given the scope of convergence in the scheme, technical competencies can be leveraged from the competent department/programme/other agencies in the state, Technical expertise is required not only during planning but also during implementation. Poor design and poor-quality implementation cannot result in the resilient infrastructure. In West Bengal, close supervision by a team and convergence of departments resulted into the development of large-size orchards, which can support livelihoods of several self-help group members. On the other hand, the MGNREGS team of Haryana finds it difficult to prepare an estimate of tree plantation works.

5.6 Sustainability of Proposed Interventions

There is a possibility that some of the interventions recommended, if not implemented properly, may further aggravate the vulnerability. Interventions that may have a potential sustainability issue if not implemented properly are given below:

5.6.1 Land Development

The intervention intends to convert lowlands into medium lands nearby river/seashore. Though it has been found very impactful from the farmers' perspective, it can pause greater threat, if adopted at scale without considering the natural damage. While taking this activity, provisions need to be considered to maintain the natural drainage of the area, so that excess water can be drained out without damaging the fields.

5.6.2 Vermicomposting

Some of the worms being used for vermicomposting collect the heavy metals in their body while composting the biodegradable material. This results in a high concentration of heavy metals in the worms. These works are also used for feeding the poultry birds as a nutritious feed. This risk the induction of the heavy material into the human food chain. This risk can be avoided by carefully choosing the worms and avoiding the use of worms as poultry feed.

5.6.3 Tree Plantation

Tree plantation is more dependent on groundwater. Some of the trees may have a very deep root zone and may affect the groundwater table further. These species of plants may be avoided especially in water-

scarce areas. Drip irrigation may be adopted to further reduce the water requirement of fruit plantation.

5.6.4 Fisheries/Poultry

Poultry and fisheries are highly susceptible to diseases, which can be easily transmitted to humans. Proper care and precautions need to be followed while dealing with fisheries/poultry.

5.6.5 Village Drains

Village drains are a good tool to promote the sanitation in the village. However, it needs to be considered that village drains are meant for grey water disposal and mixing of sewage water must be avoided. This is important as there are no provisions for treating the sewage water and its increased concentration to harmful levels can spread several diseases.

5.6.6 Groundwater Recharging

Groundwater recharging enriches the water resource and improves the groundwater table by raising the water table. Through this intervention, harvested water is diverted to groundwater aquifer to offset the impact of groundwater extraction. However, special care must be taken to avoid polluted water to get recharged. Once the aquifer is polluted, it is impossible through any of the current technologies to treat that without extracting. From the sustainability perspective, it is very important to take care that polluted water is not mixed with the water being recharged to the aquifers.

5.6.7 Three/Five-Pond System

Three-pond system or five-pond system is very effective to stabilize the grey water of the village. However, as all the grey water gets collected in the first pond, this pond with grey water becomes the breeding place for mosquitoes, and care must be taken to avoid vector-borne diseases in nearby areas.

5.7 Conclusion

Climate change can be simplified as an increase in the frequency of extreme climatic events and their extremities. Most of the population of the country is still dependent on agriculture and related livelihoods. This makes the country more vulnerable to climatic events as agriculture is heavily impacted even by moderate variations in the climate. It has been found in this study that even though the MGNREGS by its fundamental characteristic should enhance the climate resilience through its socio-ecological impacts, there is still a large scope to align the scheme with climate resilience principles and have higher impact and reduce risks to rural communities.

Through this study, several opportunities were identified to strengthen the programme including adopting a project-based approach, addressing broader issues through programme interventions, understanding institutional capacities and leveraging those of other stakeholders while planning and implementing the programme within the necessary timelines and in identified priorities/sequences. Some modifications in the tracking system through MIS have also been suggested to ensure that the above recommendations are adopted, and expected outcomes are achieved

ANNEXURE-I

Variables (as on 27.05.2019)	State : WEST BENGAL	State : HARYANA
Total No. of Districts	23	22
Total No. of Blocks	342	140
No. of "Very High/High" vulnerable districts[1]	1	9
No. of '**Medium**" vulnerable districts	8	6
Total No. of GPs	3,344	6,234
Critical exposure factor	Projected decrease in July rainfall	Projected increase in number of drought years/ Projected rise in Min T
Critical Sensitivity factor	High Net Sown Area	Low Rainfall
Critical Adaptive Capacity factor	Low Net Irrigated Area	Low Groundwater

I Job Card		
Total No. of JobCards issued[In Lakhs]	120.73	9.3
Total No. of Workers[In Lakhs]	273.66	16.86
Total No. of Active Job Cards[In Lakhs]	80.03	4.22
Total No. of Active Workers[In Lakhs]	134.1	6.4
(i)SC worker against active workers[%]	27.2	49.82
(ii)ST worker against active workers[%]	7.28	0.01

II Progress	**FY 2018-2019**	**FY 2017-2018**	**FY 2018-2019**	**FY 2017-2018**
Approved Labour Budget[In Lakhs]	2800	2600	100	100
Persondays Generated so far[In Lakhs]	3384.91	3125.55	77.9	90.37
SC persondays % as of total persondays	31.45	31.12	45.59	47.66
ST persondays % as of total persondays	8.44	8.46	0.01	0.01
Women Persondays out of Total (%)	48.1	47.59	50.05	48.64
Average days of employment provided per Household	77.06	59.63	33.73	33.12
Average Wage rate per day per person(Rs.)	174.46	170.66	281.27	277.85
Total Households Worked[In Lakhs]	43.93	52.41	2.31	2.73
III Works				
Total No. of Works Takenup (New+Spill Over)[In Lakhs]	29.84	30.28	0.26	0.31
Number of Ongoing Works[In Lakhs]	17.4	21.72	0.14	0.19
Number of Completed Works	12,44,620	8,56,526	12,887	12,167
% of NRM Expenditure(Public + Individual)	61.88	63.22	57.81	59.84
% of Category B Works	70.98	68.8	45.3	48.99
% of Expenditure on Agriculture & Agriculture Allied Works	56.88	75.99	59.58	63.32
IV Financial Progress				
Total Exp(Rs. in Lakhs.)	7,72,769.66	7,91,049.5	36,546.17	31,905.31
Wages(Rs. In Lakhs)	5,79,598.6	5,89,629.72	22,369.33	24,827.87

ANNEXURE-II

S. N.	District	State	S. N.	Districts	State
1.	Cuddapah	Andhra Pradesh	36.	Lohardaga	Jharkhand
2.	Darrang	Assam	37.	Raichur	Karnataka
3.	Dhubri	Assam	38.	Rajgarh	Madhya Pradesh
4.	Barpeta	Assam	39.	Vidisha	Madhya Pradesh
5.	Hailakandi	Assam	40.	Barwani	Madhya Pradesh
6.	Araria	Bihar	41.	Guna	Madhya Pradesh
7.	Purnea	Bihar	42.	Damoh	Madhya Pradesh
8.	Katihar	Bihar	43.	Chhatarpur	Madhya Pradesh
9.	Sitamarhi	Bihar	44.	Singrauli	Madhya Pradesh
10.	Muzaffarpur	Bihar	45.	Osmanabad	Maharashtra
11.	Khagaria	Bihar	46.	Nandurbar	Maharashtra
12.	Korba	Chhattisgarh	47.	Washim	Maharashtra
13.	Bastar	Chhattisgarh	48.	Kandhamal	Odisha
14.	Dantewada	Chhattisgarh	49.	Malkangiri	Odisha
15.	Kanker	Chhattisgarh	50.	Dhenkanal	Odisha
16.	Rajnandgaon	Chhattisgarh	51.	Balangir	Odisha
17.	Dantewara	Chhattisgarh	52.	Firozpur	Punjab
18.	Dahod	Gujarat	53.	Moga	Punjab
19.	Narmada	Gujarat	54.	Jaisalmer	Rajasthan
20.	Chamba	Himachal Pradesh	55.	Dholpur	Rajasthan
21.	Mewat	Haryana	56.	Sirohi	Rajasthan
22.	Sahebganj	Jharkhand	57.	Karauli	Rajasthan
23.	Pakur	Jharkhand	58.	Baran	Rajasthan
24.	Godda	Jharkhand	59.	Ramanathapura	Tamil Nadu
25.	Palamu	Jharkhand	60.	Virudhunagar	Tamil Nadu
26.	Purbi Singhbhum	Jharkhand	61.	Khammam	Telengana
27.	Ranchi	Jharkhand	62.	Asifabad	Telengana
28.	West Singhbhum	Jharkhand	63.	Chitrakut	Uttar Pradesh
29.	Bokaro	Jharkhand	64.	Bahraich	Uttar Pradesh
30.	Chatra	Jharkhand	65.	Shravasti	Uttar Pradesh
31.	Dumka	Jharkhand	66.	Siddharth Nagar	Uttar Pradesh
32.	Garhwa	Jharkhand	67.	Balrampur	Uttar Pradesh
33.	Girdih	Jharkhand	68.	Sonbhadra	Uttar Pradesh
34.	Gumla	Jharkhand	69.	Fatehpur	Uttar Pradesh
35.	Hazaribagh	Jharkhand	70.	Malda	West Bengal

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