Climate Resilience Information System and Planning Tool for Mahatma Gandhi National Rural Employment Guarantee Scheme

The CRISP-M tool

Ritu Bharadwaj, Simon Addison and Mohan Reddy

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About the authors

Ritu Bharadwaj, senior researcher, Climate Change Group, International Institute for Environment and Development (IIED)

Simon Addison, principal researcher, Climate Change Group, International Institute for Environment and Development (IIED)

Mohan Reddy, national consultant, Climate Change Group, International Institute for Environment and Development (IIED)

Corresponding author: Ritu Bharadwaj ritu.bharadwaj@iied.org

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The Climate Change Group works with partners to help secure fair and equitable solutions to climate change by combining appropriate support for adaptation by the poor in low- and middle-income countries, with ambitious and practical mitigation targets. The work of the Climate Change Group focuses on achieving the following objectives:

- Supporting public planning processes in delivering climate-resilient development outcomes for the poorest
- Supporting climate change negotiators from poor and vulnerable countries for equitable, balanced and multilateral solutions to climate change, and
- Building capacity to act on the implications of changing ecology and economics for equitable and climate-resilient development in the drylands.

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International Institute for Environment and Development
Third Floor, 235 High Holborn, London WC1V 7DN, UK
Tel: +44 (0)20 3463 7399
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CRISP-M tool enables a top-down and bottom-up approach to climate risk management where climate risk-informed GIS planning is combined with community-level processes to ensure effective location-specific and needs-based planning, decision making and monitoring.

Contents

Summary

Climate change is manifesting itself in many ways — often with the most severe consequences for the poor and vulnerable in India — the risks associated with climate change are exacerbating and acting as threat multipliers to the risks that already exist, such as food insecurity, disease, migration and poverty. There is a need to build and promote integrated climate risk management approaches that can tackle the underlying causes of climate vulnerability, while also addressing drivers of poverty and food insecurity. Equally, development efforts need to build resilience against climate-related shocks and stressors.

India's Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) is one such programme that has the potential to support rural communities to prepare, cope and recover from climate impact risks. MGNREGS is the world's largest public works-based social protection programme that provides a rights-based social safety net to India's rural poor by assuring 100 days of guaranteed wage employment to every rural household. Through wage employment, the scheme also seeks to create durable assets to augment land and water resources, improve rural connectivity and strengthen the livelihood resource base of the rural poor. The MGNREGS scheme also has an additional risk management instrument to provide another 50 days employment in times of severe drought. Although the provisions and benefits of the MGNREGS programme have the potential to deliver climate resilience, and it has indeed helped poor households and communities cope with poverty and marginalisation, its impact on climate resilience outcomes has been limited to date.

Integrating climate information services (CIS) can help to enhance the climate resilience impacts of MGNREGS. The Ministry of Rural Development (MoRD) acknowledges this potential and the master circular for the programme specifically mentions the use of CIS in planning and design of works under MGNREGS. However, the practical implementation of this guidance is marred by several issues and challenges. Specific issues exist with the access, communication and use of CIS in MGNREGS planning and decision making. The Climate Resilience Information System and Planning Tool for MGNREGS (CRISP-M) has been designed to address these challenges.

CRISP-M is a web- and mobile phone-based GIS-aided tool to support planning, implementation and monitoring of MGNREGS. The functions of CRISP-M include:

1. A drought monitoring and reporting system to support early action on provision of additional wage employment.
2. Climate risk-informed planning of the integrated natural resource management assets of MGNREGS to strengthen climate resilience outcomes.
3. Creating transparency and accountability by remote sensing-based monitoring, and crowdsourcing data on MGNREGS assets and beneficiaries.

The CRISP-M tool was piloted in 18 village *Panchayats* of Niwali Block in Badwani, Madhya Pradesh, where the purpose of the whole process was to understand ways in which a climate risk-informed GIS plan could be combined with community-level processes to ensure effective location-specific and needs-based planning, decision making and monitoring.

The planning process utilised the democratic spaces within the village to forge collective discussion, decision making and action, and worked through them to develop village MGNREGS plans. This exercise was used to provide constant feedback and create a learning loop to improve upon the tool before finalising it for scale up in two phases. In the first phase the tool will be deployed in two districts and the evidence will be used to compare the results with the existing efforts of GIS-based planning of MoRD. In the subsequent phase the tool will be scaled up across seven states.

Some of the results that were seen emerging from the pilot process were:

- The tool supported the creation of more aware and sensitive social groups in the pilot villages, who were more responsive to the problems; it equipped them with the asset planning information for more equitable distribution of benefits and usufructs among various sections of the community.
- The tool helped to demystify the GIS technology and restore the self-confidence of the village community by effectively involving them in the planning process.
- Better consideration of integrated watershed treatment in the selection, choice and location of NRM assets. For example, an increased number of sub-surface water structures was proposed for the proper treatment of ridges and higher reaches (recharging zone) of watersheds that will help in ensuring more soil moisture for a prolonged period; and pasture development activities were identified for the first time in some villages to ensure sufficient fodder availability.
- The planning took care of the interests of the landless, small and marginal farmers by identifying activities for uplifting their socioeconomic status and skill enhancement, as well as water-harvesting structures near the farmlands of small and marginal farmers.
- Activities for convergence with various development schemes of other departments were also identified in the planning process.

More impacts are expected to emerge as the tool is operationalised, but it already shows the value of combining modern, scientific and climate risk information, methods, practices and technology with the traditional knowledge practices, skills and experience of the community for their better assimilation and for deriving optimum impact.

1 Context

Climate change is a silent threat to the Indian rural economy. The year 2020 will remain etched in India's memory. Apart from the COVID-19 pandemic, climate change brought the worst locust attack in decades, a warmer Indian Ocean led to three cyclones, a heat wave gripped the entire nation, and flooding killed hundreds and evacuated thousands more. The list goes on, but these are now not one-off events: India's first ever climate change assessment report[1] predicts that India is slated to face more such events in coming years. By the century's end, India's average temperature is projected to rise by 4.4°C, heatwaves are expected to increase three to four times in frequency, tropical cyclones are set to increase in intensity, and sea levels to rise by 30cm.

As climate impacts are getting worsened, the poor and marginalised are becoming more vulnerable. The risks associated with climate change are exacerbating and acting as threat multipliers to the risks that already exist, such as food insecurity, disease, migration and poverty. For example, climate change has increased the frequency and expanded the coverage of drought in recent years, with almost one third of the country now either drought-prone or arid. Almost 50% of the total rural work force and more than 60% of livestock in India are concentrated in the dry districts. Recurring drought leads to year-on-year fluctuations in agricultural production and creates extensive unemployment amongst casual farm and non-farm labourers. This results in a relatively high incidence of poverty — characterised by landlessness, low wages, and low purchasing power — that pushes many households into a vicious cycle of debt and drives households into adverse coping strategies like the sale of productive assets and eroding past development gains.

Thus, these climate disasters are pushing vast numbers of India's already extreme poor deeper into poverty. And there is a need to build and promote integrated climate risk management approaches that can tackle the underlying causes of climate vulnerability, while also addressing drivers of poverty and food insecurity. Equally, development efforts need to build resilience against climate-related shocks and stressors.

Social protection programmes can play an important role in building resilience to climate risks, addressing the underlying factors that cause poverty and increase vulnerability to deal with climate-related shocks and disasters. India's Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) is one such programme that has the potential to support rural communities to prepare, cope and recover from climate impact risks. MGNREGS is the world's largest public works-based social protection programme that provides a rights-based social safety net to India's rural poor by assuring 100 days of guaranteed wage employment to every rural household. Through wage employment, the scheme also seeks to create durable assets to augment land and water resources, improve rural connectivity and strengthen the livelihood resource base of the rural poor. With an annual budget of US$13 billion and coverage of over 270 million rural workers, the scheme has enormous potential to contribute towards climate resilience.

Although the provisions and benefits of the MGNREGS programme has the potential to deliver climate resilience (see Box 1) and it has indeed helped poor households and communities cope with poverty and marginalisation, its impact on climate resilience outcomes have been limited to date. With some adjustments, the scheme can help communities to absorb the effects of climate risks, adapt to climate impacts, and transform their capacities and strategies to address growing climate stresses.[2]

BOX 1: MGNREGS INTERVENTIONS WITH POTENTIAL TO ENHANCE CLIMATE RESILIENCE

1. **Guaranteed wages:** MGNREGS guarantees up to 100 days' wage employment to every household in rural areas, which can contribute to climate resilience by supporting households as a supplement to other sources of income, and smoothing consumption gaps during climate hazards when other livelihood sources may be undermined. The scheme also has a provision for an additional 50 days' employment in times of severe drought.
2. **Creating private and public assets:** MGNREGS interventions build natural resource management assets including water and soil conservation infrastructure — such as check dams, ponds and trenches, afforestation, fodder development and land development works — to support long-term livelihood strategies in rural areas.
3. **Strengthening institutions:** MGNREGS mandates that all planning and decision making on wage employment and infrastructure selection go through the village assembly *(Gram Sabhas)* and decentralised elected village bodies *(Gram Panchayat)*, where funds are transferred directly to the village level and into the bank account of beneficiaries.

2

Climate-smart planning and decision making under MGNREGS

Integrating climate information services (CIS) can help to enhance climate resilience impacts of MGNREGS. Global evidence on social protection suggests that the climate resilience contributions of social protection programmes can be enhanced by integrating CIS into planning and decision making to support more climate-smart decisions, and subsequently contribute to delivering timely and shock-responsive wages, developing climate-resilient infrastructure, and strengthening the delivery and monitoring process — enabling the communities to better prepare, cope and recover from climate stress.

BOX 2: WHAT ARE CLIMATE INFORMATION SERVICES?

Understanding the weather (the state of the atmosphere at any point in time) and the climate (the long-term statistics of weather) is crucial for many livelihood decisions, particularly those that rely directly on the weather, such as agriculture. People have always dealt with weather variability, often using historical records or their own traditional knowledge. However, with existing and projected climate change, historical and traditional knowledge are no longer solely sufficient as changes to natural weather variability and shifts in the frequency and severity of extreme weather events become the norm.

Weather and climate information is crucial for effective climate risk management, providing data to make more informed and robust decisions on hazard types, their probability of occurrence and their scale. Effective use can increase adaptive capacity; supporting people's ability to adjust to potential damage, to take advantage of new opportunities and to respond to consequences. Both short-term (weather) and long-term (climate) information are necessary to help people to address their existing adaptation deficit to short-term variability or longer-term climate change.

CIS seek to make this weather and climate information useable and helpful. Although some refer to CIS as weather or climate information, in this report it encompasses the useful dissemination of short-term (less than one day) weather information, all the way up to long-term climate projections for the second half of the century. CIS components include tools, products, websites and bulletins in formats that can be interpreted by different decision makers.

An effective CIS may also build people's and institutions' capacity to use this information effectively.

Adapted from Steinbach[4] et al. (Original sources: Hansen[5] et al. (2019), Barrett[6] et al. (2020))

The Ministry of Rural Development (MoRD) acknowledges this potential and the master circular for the programme specifically mentions the use of CIS in planning and design of works under MGNREGS.

"Planning and design of works under MGNREGS should take into account impacts of climate change in order to ensure resilience of vulnerable rural communities and make the benefits sustainable in the long run. Specifically, the following things should be ensured: historical and projected climate change data, especially incidence of droughts and floods, along with vulnerability assessment at the district, block or gram panchayat level should be used in the planning and design of MGNREGS works" (MoRD 2020).[3]

The practical implementation of this guidance is marred by several issues and challenges. Specific issues exist with the **access, communication and use of CIS in MGNREGS planning and decision making:**

Access, communication and use of CIS. Evidence from the ground shows that while more than half (58%) of households have access to CIS (via mobile, TV, radio, or newspaper), only 25% of them use it to plan or select MGNREGS assets or wage labour planning.[4] This is because (i) climate information is not communicated in a format households can understand; (ii) they are not able to interpret, analyse and use it for MGNREGS planning and decision making; and (iii) they do not understand the benefits of CIS in MGNREGS decisions.

Wage planning. The MGNREGS scheme has an additional risk management instrument to provide another 50 days employment in times of severe drought. This is based on the premise that wage employment provides cash that can help a household maintain a basic level of consumption and buy essential goods for the household and livestock feed, enabling the household to cope with climate shocks. However, findings from the field show that only 4% of households received any additional drought relief days. IIED's research found that there are delays of four to six months in governments officially declaring drought.[7] This leads to delays in sanctioning the 50 additional days of wage employment that would help families cope and recover during this critical period, when they are pushed towards distress migration. Migrants also usually return to their village near the financial year end and are therefore not able to take up the benefit of additional wage employment days.

Asset planning. MGNREGS assets generate environmental benefits such as ground water recharge, improving soils and water conservation, protecting biodiversity, and promoting sustainable food production. These benefits have the potential to build resilience to current climate risks such as moisture stress, delayed rainfall and droughts, as well as future climate change impacts. However, research shows that MGNREGS assets contributed only 18% and 29% respectively in building absorptive and adaptive resilience capacity in households.[8] This could be because: (i) the assets did not deliver benefits to agriculture and livelihood protection during the climate crisis, namely drought-proofing; (ii) the assets were not optimally designed as per the landscape and community needs, resulting in limited impact; (iii) the choice of assets was not as per local conditions, for example creating a percolation tank or recharge structure in a basaltic belt; (iv) assets were located in places where the vulnerable or marginalised communities were not able to seek benefits.

Community-based planning. MGNREGS decisions on labour allocation and asset selection are mandated to take place at village level, *Gram Sabhas*, which should allow for needs-based and demand-driven planning. Strong household participation can also help strengthen adaptive capacity. However, evidence from the field shows that household participation in MGNREGS decision making at the *Gram Sabhas* level is low, with only 15% of households reporting that their preferred MGNREGS asset had been selected. Female-headed households are significantly less able to have their choices heard.[9] A recent effort by MoRD to scale up top-down geographic information system (GIS)-based planning of MGNREGS assets may further limit community participation and their say in asset selection and choice.

3

Enhancing climate resilience impacts of MGNREGS through the CRISP-M tool

3.1 What is CRISP-M?

The Climate Resilience Information System and Planning Tool for MGNREGS (CRISP-M) is a web- and mobile phone-based GIS aided tool to support planning, implementation and monitoring of MGNREGS. This tool has been co-developed by International Institute for Environment and Development (IIED) with Madhya Pradesh Council of Science & Technology (MPCST), National Remote Sensing Centre (NRSC), Indian Meteorological Department (IMD), Indian Institute of Tropical Meteorology (IITM) and Ministry of Rural Development (MoRD), Government of India, under the Foreign Commonwealth and Development Office (FCDO)-funded Infrastructure for Climate Resilient Growth (ICRG) programme.

3.2 Functions of CRISP-M

1. **Drought monitoring and reporting system to support early action on provision of additional wage employment.** The CRISP-M tool integrates a drought-reporting mechanism that provides early warning to MGNREGS functionaries and communities about the onset of droughts in their initial stages. The tool has established thresholds at which it indicates decision makers should trigger drought declaration processes and initiate anticipatory response and planning measures for the additional 50 days' wage labour.
2. **Climate risk-informed planning of the integrated natural resource management assets of MGNREGS to strengthen climate resilience.** The tool integrates GIS layers of information (such as land use, topography, contours, geomorphology, geology, lineaments, ground water prospect, drainage polygons etc) with past and future climate data, so that planning for structures can be 'future fit' to deal with climate change impacts, such as reduced ground water, increased runoff and so on. The tool also integrates a mobile app that allows a community to carry out a participatory vulnerability assessment, and ground truthing of the information provided through the GIS tool, so as to modify or update the plan based on their local/traditional knowledge, needs and local field conditions. They are also able to identify and prioritise assets that can help in strengthening their existing livelihoods, and reduce their exposure to climate risks by diversifying their livelihoods base through agroforestry, horticulture, sericulture, fisheries, fodder development, and livestock-based farming systems.

3. **Creating transparency and accountability by remote sensing-based monitoring, and crowdsourcing data on MGNREGS assets and beneficiaries.** To bring in two-way accountability, and move beyond conventional top-down approaches to monitoring and impact assessment — which are often orientated solely to the needs of policymakers — the tool helps to build an information system crowd-sourced from the community, enabling them to verify claims on progress, report the actual status of their natural resource management (NRM) assets, highlight structures needing repair or maintenance, and ensure more equitable sharing of benefits. The app also includes a remote sensing-based monitoring dashboard feature that provides time series-based impact status of MGNREGS assets on different biophysical indicators — such as changes in cropped area, wastelands, forest area, area of water bodies and so on.

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The planning process utilised the democratic spaces within the villages to forge collective discussion, decision making and action, and worked through them to develop village MGNREGS plans. This exercise was used to provide constant feedback and create a learning loop to improve upon the tool before finalising it for scale up in two phases. In the first phase the tool will be deployed in two districts and the evidence will be used to compare the results with the existing efforts of the GIS-based planning of MoRD. In the subsequent phase the tool will be scaled up across seven states.

Some of the results that were seen emerging from the pilot process were:

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- It helped to demystify the GIS technology and restored the self-confidence of the village community by effectively involving them in the planning process.
- There was better consideration of integrated watershed treatment in the selection, choice and location of NRM assets. For example, an increased number of sub-surface water structures were proposed for the proper treatment of ridges and higher reaches (recharging zone) of watersheds that will help in ensuring more soil moisture for a prolonged period; and pasture development activities were identified for the first time in some villages to ensure sufficient fodder availability.
- The planning took care of the interests of the landless, small and marginal farmers by identifying activities for uplifting their socioeconomic status and skill enhancement, as well as building water-harvesting structures near the farmlands of small and marginal farmers.
- Activities for convergence with various development schemes of other departments were also identified in the planning process.

More impacts are expected to emerge as the tool is operationalised, but it already shows the value of combining modern, scientific and climate risk information, methods, practices and technology with the traditional knowledge practices, skills and experience of the community for their better assimilation and for deriving optimum advantage.

4

Components of CRISP-M

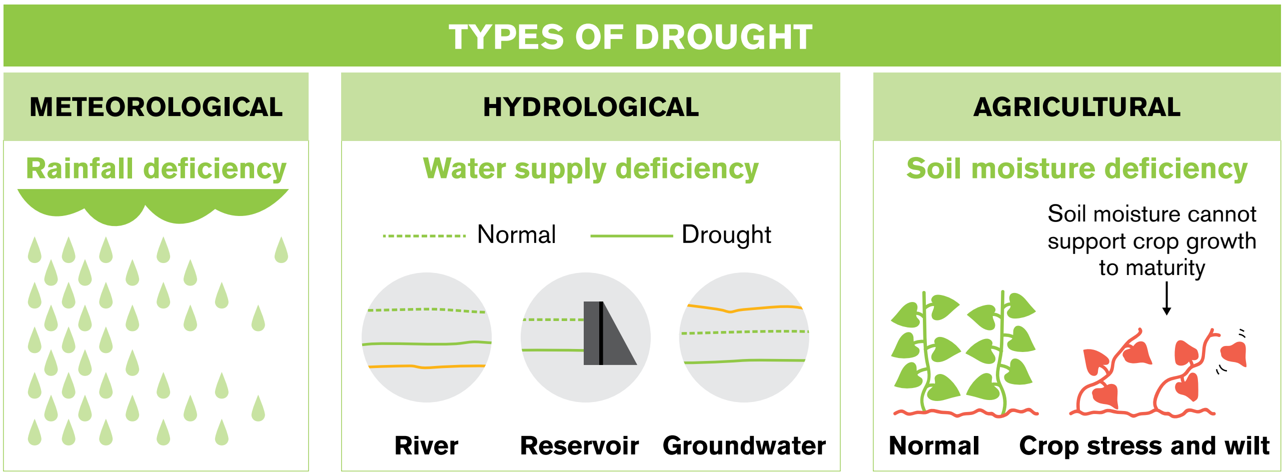
4.1 Drought early-warning system

Ever since the 2016 Manual for Drought Management was issued by the central Government of India many droughts have gone unreported, even though the manual prescribes "new scientific indices and parameters" for a "more accurate assessment of drought" in the country. As per the new guidelines, 'moderate' droughts are no longer eligible for relief funds from the central government and only droughts of 'severe nature' qualify. This means that the budget for the 50 additional days of employment under MGNREGS, provided in the event of drought, is eligible for a central grant only in cases of severe drought. Many states now delay the process of drought declaration even if its impacts are visible, only initiating the process of relief when it hits the severe category and they can seek a central grant. To this effect, non-transparency and ambiguity around drought data is being created. Apart from this, the stringent criteria for classifying drought-hit regions in the new manual makes the process of declaring drought long and difficult. The state governments have to prove severity in three out of the four impact indicators, and many of them do not have the systems in place to monitor these parameters and declare droughts in time.

Drought is normally triggered by the deficiency or erratic distribution of rainfall, but its spread and intensity is dependent on many factors, such as agroclimatic conditions, soil type, status of surface and ground water resources, cropping choices and patterns, and socioeconomic vulnerabilities. In India there are other systemic factors that underline the perpetual nature of drought:

- Despite high average annual rainfall of around 1150mm there is considerable annual, seasonal and regional variations in rainfall patterns.
- Two thirds of the rainfall takes place in a relatively short time period of less than 90 days. Most of the excess water, which could have been harvested or conserved for enhancing natural resilience towards drought, gets lost as run-off.
- High dependence on rain-fed cropping makes almost 70% of India susceptible to agricultural drought.
- Over-exploitation of ground water, lack of conservation efforts and low storage capacity of surface water lead to inadequate water availability for irrigation, increasing vulnerability to hydrological drought.
- Migration of cattle and other animals from drought-hit areas to surrounding areas increases the pressure on already-scarce resources.
- Successive years of sub-optimal rainfall compound the effect of drought. Low and erratic rainfall reduce the surface and ground water recharge and replenishment of soil moisture, resulting in vulnerability of agriculture based livelihoods.

Figure 1. Types of drought



Source: DPR on Integrated Drought Management Information System

While the CRISP-M tool tries to address the systemic issues causing and intensifying the impacts of drought in a holistic manner, the component on the drought early warning system specifically addresses the following:

1. Provides a system for the acquisition of updated data on all the parameters related to the assessment of a drought situation on a real-time basis, with different indicators updated every 24–48 hours.
2. Provides a mechanism to monitor and identify the onset of drought-like situations through:

a. **Drought indicators**

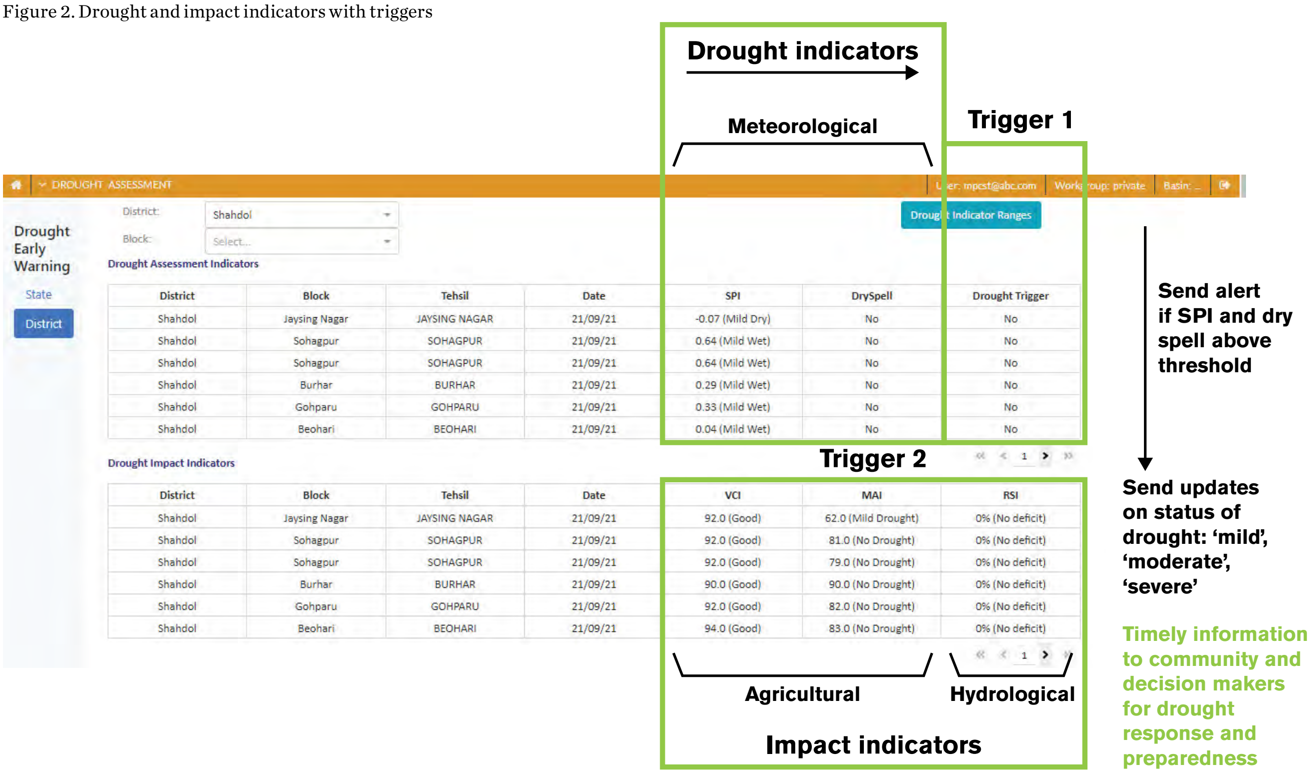
- The Standardised Precipitation Index (SPI) is used to characterise a meteorological drought on a range of timescales of 1–3–6 months
- Dry spell — defined as no rainfall or low rainfall (less than 50%) for a short period, usually of two consecutive weeks, which is considered along with rainfall deviation.

b. **Impact Indicators**

- The Normalised Differential Vegetative Index (NDVI) is used to quantify the status of vegetation health by measuring the difference between red light (which vegetation absorbs) and near-infrared light (which vegetation strongly reflects). Higher NDVI values are associated with greater biomass and health of vegetation.
- The Vegetative Cover Index (VCI) is a composite index for observed Normalised Differential Vegetative Index (NDVI) and Normalised Difference Wetness Index (NDWI) — a remote sensing derived index to provide a fraction of the leaf water content at canopy level. This index helps determine the health of vegetation condition.
- The Reservoir Storage Index (RSI) shows the percentage change in live storage water level/ volume of reservoir, w.r.t average storage volume of last ten years.
- The Moisture Adequacy Index (MAI). Soil moisture levels provide the amount of moisture available to crops depending upon the 'crop water requirement', 'climate evaporative demand' and 'soil water holding capacity'.

3. Diagnosis of emerging droughts based not only on rainfall patterns but on impact parameters predicting hydrological, meteorological and agricultural drought, and establishing a threshold at which to trigger alerts to MGNREGS functionaries and community (see Figure 2). These **indicators, reference values and thresholds comply with the range prescribed in the Indian Manual of Drought Management**,[10] enabling state governments to use the report and data generated through CRISP-M to initiate a drought declaration process.

Figure 2. Drought and impact indicators with triggers



Drought assessment process[i]

Step 1: Mandatory indicators, namely rainfall, deviation, the Standard Precipitation Index (SPI) or dry spell are considered to assess if the drought trigger at the first level is set off.

Table 1: Reference levels for Trigger 1

Rf Dev/SPI	Dry spell	Drought trigger
Deficit or scanty rf/SPI <-1	Yes	Yes
Deficit or scanty rf/SPI <-1	No	Yes if rainfall is scanty or SP <-1.5, else No
Normal rf/SPI >-1	Yes	Yes
Normal rf/SPI >-1	No	No

Dry spell: A dry spell is a short period, usually 4 weeks (up to 3 weeks in case of light soils), of low rainfall or no rainfall. Thus, 3–4 consecutive weeks after the due date for the onset of monsoon season with rainfall less than 50% of the normal in each of the weeks is defined as a dry spell. This indicator is important in that it quantifies the extent of the intra-season rainfall variations which is so critical for the health of crops and maintenance of soil and hydrological regime. In regions normally associated with high rainfall (south west monsoon rainfall >1400mm), the dry spell criteria may need to be recalibrated in sync with the agro-climatic conditions.

SPI VALUE	CATEGORY
<- 2	Extremely dry
-1.99 to -1.5	Severely dry
-1.49 to -1.0	Moderately dry
-0.99 to 0	Mildly dry
0 to 0.99	Mildly wet
1.0 to 1.49	Moderately wet
1.5 to 1.99	Severely wet
>2.0	Extremely wet

Source: Indian Manual for Drought Management, 2016

i Based on the process, indicators and reference values used in the Indian Manual for Drought Management (2016), so that the report from the tool can be used for drought declaration

Step 2: In the event that the first drought trigger is set off in Step 1, the impact indicators under drought Trigger 2 are assessed

Table 2: Impact Indicators for Trigger 2

Impact indicators		
Remote sensing	Soil moisture	Hydrology
VCI or NDVI deviations	PASM / MAI	SFI / RSI / SGWI

Impact indicators

The Reservoir Storage Index (RSI) is used to monitor the water storage in the selected major reservoirs of India. The availability of water in reservoirs can act as an effective foil against drought.
The reservoir storage status derived from percentage of storage deficit vis-à-vis long term averages can provide an indication of drought.

Category of deficit based on % age deficit in live storage volume of reservoir

PERCENTAGE DEFICIT IN LIVE STORAGE VOLUME OF RESERVOIR W.R.T. AVG. STORAGE OF LAST 10 YEARS	CATEGORY OF DEFICIT
Less than 20%	Normal deficit
20–30%	Mild deficit
30–40%	Moderate deficit
40–60%	Severe deficit
>60%	Extreme deficit

The Vegetation Condition Index (VCI) compares the observed Normalized Difference Vegetation Index (NDVI) and Normalized Difference Wetness Index (NDWI) to the range of values observed for the same period in previous years. The VCI is expressed in percentage and gives to a scale an idea where the current value is placed within the extreme values (minimum and maximum) in the historical datasets normalized of 0 – 100%. Lower and higher values indicate bad and good vegetation state conditions, respectively. For using VCI in drought assessment following threshold values are used.

Classification of vegetation condition based on VCI value

VCI VALUE (%)	VEGETATION CONDITION
60–100	Good
40–60	Fair
0–40	Poor

The Moisture Adequacy Index (MAI) is obtained from weekly water balance and is equal to the ratio (expressed as a percentage) of actual evapo-transpiration (AET) to the potential/ reference evapo-transpiration (PET or RET) following a soil–water balancing approach during different phenological stages of a crop. Drought impact is related to moisture availability at certain crop growth stages. Hence, categories of MAI (severity) at different growth stages are integrated into a single index value to identify drought impact on a particular crop.

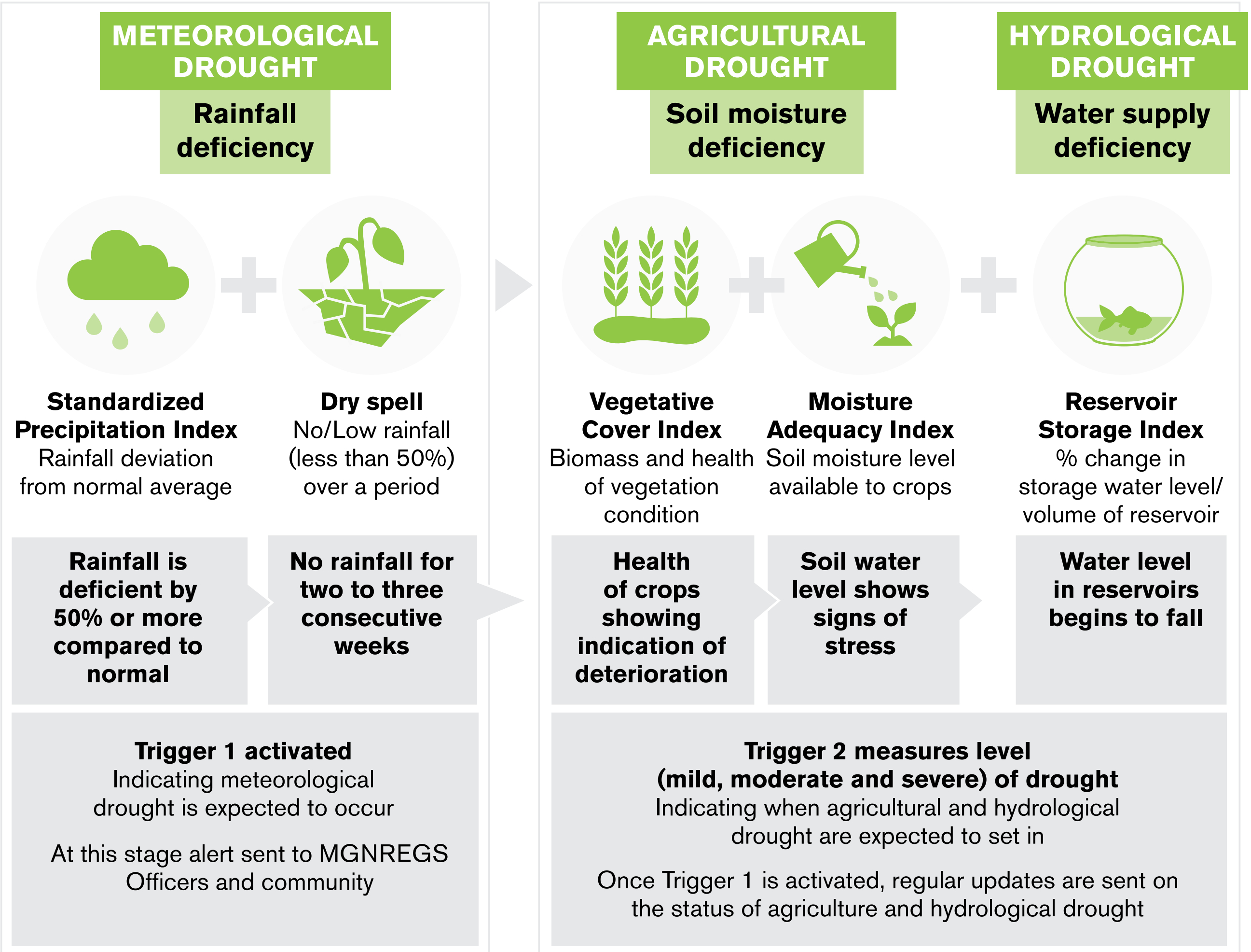
Classification of agricultural drought based on MAI (%)

MAI (%)	AGRICULTURAL DROUGHT CLASS
76–100	No drought
51–75	Mild drought
26–50	Moderate drought
0–25	Severe drought

Source: Indian Manual for Drought Management, 2016

Step 3: The climate information system provides support to the MGNREGS officials and their beneficiaries to receive early warning of droughts in their initial stages — through email, SMS and WhatsApp, based on the triggers of the indicators. This facilitates anticipatory planning for additional wage employment days, leading to the delivery of timely additional wage employment days to prevent distress migration.

Figure 3: Flow of information through drought early warning system

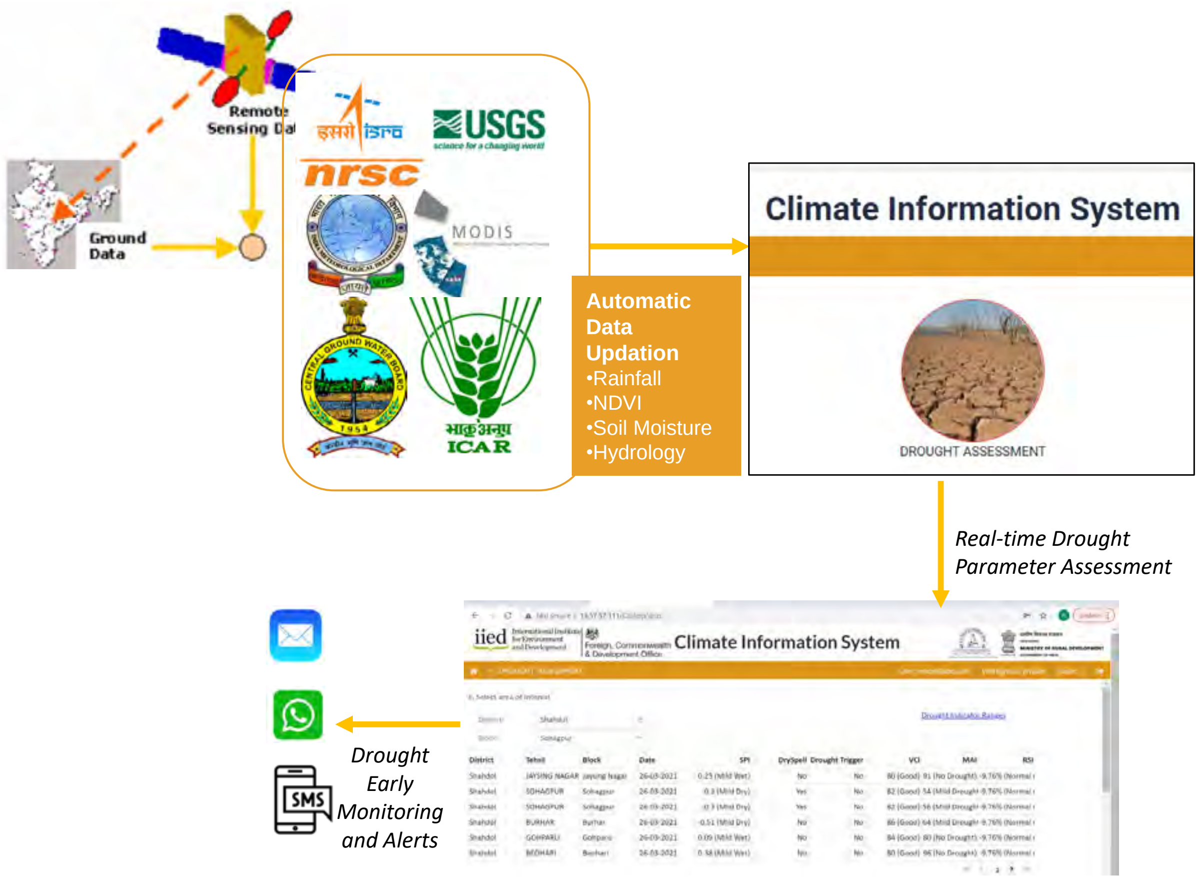


I am Prakash Karte, Gram Rozgar Sahayak, village Panchayat — Kunjri MGNREGA, from Niwali Block, Barwani District. I have to support the local village Panchayat in labour budgeting for providing employment to rural households in case of a drought, when crops are destroyed and the community does not have other sources of livelihoods. But I can only plan for an additional 50 days after drought is declared, and currently it takes a very long time because of the complex requirements of data to carry out drought impact assessments, and by the time it is declared most of the households have to undertake distress migration. The drought early warning system now helps me to assess the risk of a drought in advance and start planning for providing additional 50 days, wage employment to rural households in my Gram Panchayat.

The drought early warning system utilises near real-time rainfall data, weather forecasts and remote sensing data on impact parameters to make drought information accessible and useful for key decision makers, namely (i) the MGNREGS functionaries at state, district and block level responsible for the declaration of drought and relief operations; and (ii) community members who can utilise the app recommendations to prioritise asset planning to minimise the imminent losses or damage of crops or other livelihood sources. This tool has been tested over a limited set of areas in Madhya Pradesh, India to influence the local planning process.

Easy access and interpretation of information improves the capacity of stakeholders to monitor, forecast, plan for, and cope with the impacts of drought. The system is capable of providing drought status updates and predicting drought occurrence from the rainfall forecasts with almost 15 days' lead time, well before the actual drought declaration process and allowing a quick start to processes like ground truth surveys and so on. Further, the module is also capable of sending automatic updates to the relevant officials to maintain smooth information flows among the different stakeholders.

Figure 4. Process of information flow for drought early warning under CRISP-M tool



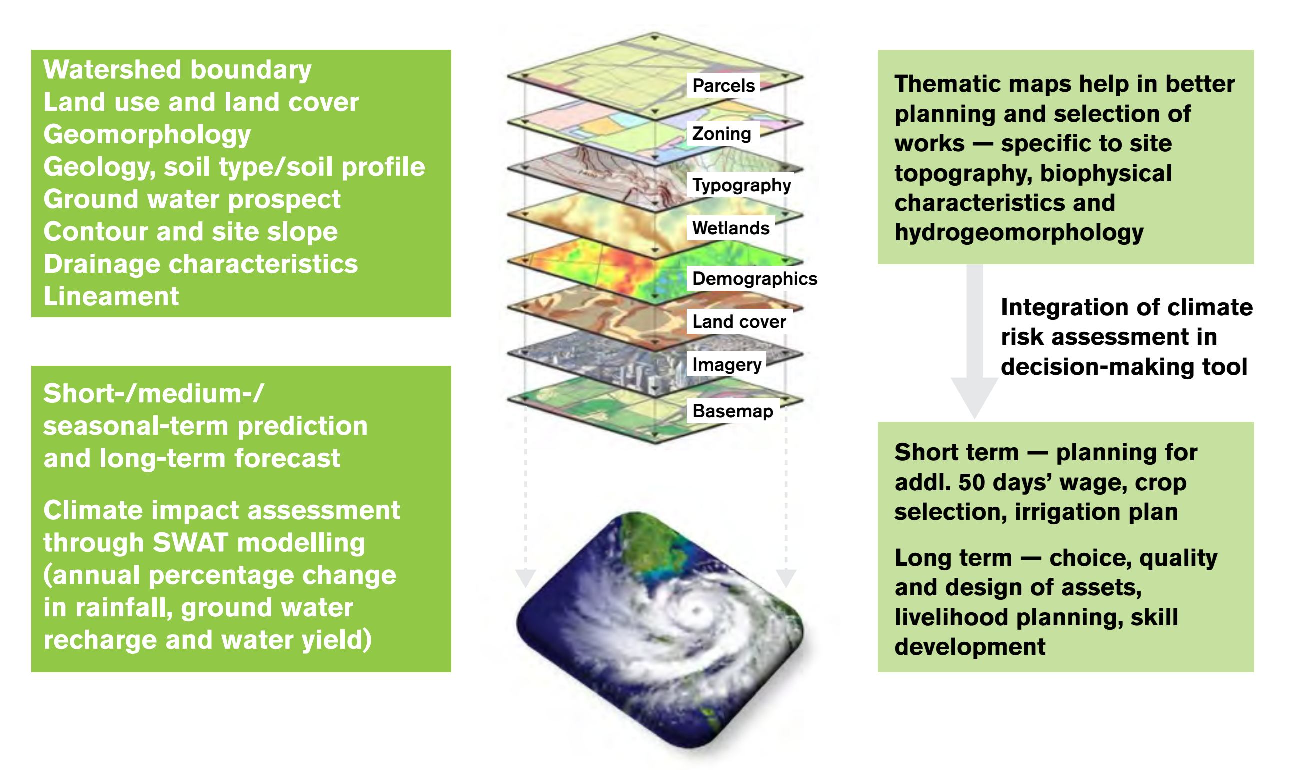
The manner in which different interventions and actions under the drought early warning system support resilience outcomes of MGNREGS are indicated in the table below.

CRISP-M INTERVENTION	RESILIENCE OUTCOME		
	Prepare	Cope	Recover
DROUGHT EARLY WARNING			
1. Provides a system for acquisition of real-time data for all the parameters related to the assessment of drought	✓		
2. Diagnoses emerging droughts not just on rainfall pattern but on impact parameters predicting hydrological, meteorological and agriculture drought, and establishing threshold at which to trigger alerts to MGNREGS functionaries and community	✓		
3. Strengthens climate information systems for MGNREGS and their beneficiaries to receive early warning through email, SMS and Whatsapp	✓		
4. Provides prototype to design anticipatory planning for additional wage employment days based on drought early warning alerts	✓	✓	
5. Deliver timely additional wage employment days to prevent distress migration	✓	✓	
6. Link agro-advisories with drought early warning alerts	✓	✓	✓

4.2 GIS-assisted asset planning tool

The operational guidelines of the MGNREGS programme place emphasis on climate compatible and scientific structures; however, it was operationalised with a lack of technical capacity and tools. The location-specific identification of appropriate NRM structures for water conservation, soil conservation, water harvesting and land development and so on. requires information on existing land use, soil type, drainage characteristics, geomorphology, slope, ground water conditions etc. But such information is often not available either among the community entrusted with the planning of these structures or with the village-level *rozgar sahayaks*/employment guarantee assistants, or even among the block- or district-level engineers who are supposed to support the village-level institutions (*Gram Panchayat* and *Gram Sabha*) in the design and selection of the assets under MGNREGS.

Figure 5. CRISP-M framework to support MGNREGS planning



The CRISP-M tool integrates ten GIS layers of the latest information, namely: administrative boundary (block and village), watershed boundary, land use, geomorphology, geology, ground water prospect, lineament, drainage polygon and contour. Each of these layers are separately digitised and offer a resolution on 2.5 metres, offering a fairly accurate estimation of ground conditions, which the community and MGNREGS functionaries can relate to.

This information is layered with a climate impact assessment output through Soil & Water Assessment Tool (SWAT) modelling based on climate forecasts. SWAT runs multiple scenarios and provides information on expected annual percentage change in rainfall, ground water recharge and water yield. Based on these inputs, the tool generates an advisory of possible climate-resilient strategies, types and design of assets, to suit the local climatic, topographical and geomorphological factors. These include:

- Land development — including in situ soil and moisture conservation measures, ie contour trenches, gully plugs, contour bunds, broad base furrows
- Drainage line treatment — with a combination of vegetative and engineering structures, ie *nala bandh*/ check dams, gabion structures, underground dykes, soak pits, collector wells, jacket wells, infiltration trenches, percolation tanks, ponds, vegetative measures, diversion drains
- Development of small water-harvesting structures such as low-cost farm ponds (*kundi/kunyan*)
- Nursery raising for fodder, timber, fuel wood and horticultural species
- Afforestation including block plantations, shelterbelts, bund stabilisation, etc
- Agroforestry and horticultural development
- Pasture development either by itself or in conjunction with plantations, and
- Repair, restoration and upgrading of existing common property assets and structures to obtain sustained benefits from previous public investments.

While MoRD is planning to scale up GIS-based planning though information available on the Bhuvan portal,[ii] which to some extent resonates with the features of this component of CRISP-M, there are certain issues around it, namely: (i) while the existing planning process uses GIS-based information on several aspects, these layers are not individually digitised which does not allow the user the ability to envision how different parameters like land use, geology and so on pan out in different areas; (ii) many data sets used in the planning process are old, some dating back almost a decade, and do not represent the true picture on the ground; (iii) the resolution of the information is not on a fine scale and the location of many existing geotagged structures and those planned are not accurate — this makes it difficult for MGNREGS functionaries and village-level *rozgar sahayaks* to use the plan for actual implementation because it does not conform to the on-ground situation; and (v) the community does not get a say in planning (selection and location) of the assets.

The purpose behind creating this component of the tool is to support outcome-based long-term perspective planning, rather than the short-term ad hoc year-on-year shelf of projects, ie it will take MGNREGS interventions from point-to-point recharge and conservation activities to landscape-based area treatments, or a watershed approach, with defined outcomes of drought-proofing or flood resilience. The idea is to create sufficient water impounding and storage capacity in every village as a measure towards drought-proofing. This is proposed to be achieved through:

- Augmentation, conservation and optimum utilisation of soil and water resources in rain-fed areas
- Restoring ecological balance and improving the environmental resource base
- Developing an easily available repository of scientific and technological inputs for detailed and area specific planning, for community and field functionaries
- Harnessing all available techno-scientific resources to support the decision-making process at the community level, and
- Location-specific and needs-based action plans.

I am Radheshaym Kochk, village Panchayat — Gawadi secretary, from Niwali Block, Barwani District. We faced a lot of problems in identifying suitable sites for the planning of water conservation and harvesting structures. It was very difficult to understand the complex hydrology, geomorphology concepts to identify suitable locations and types of structures. Also many of the earthen structures created were either not suitable (did not hold water) or got destroyed in one or two incidences of heavy rainfall. Many times communities rejected the water-harvesting sites suggested by the experts as they were not designed or located as per their needs and requirements. This tool helps us understand the water yield at a particular point, current run-off, and future run-off in climate change scenarios, and also suggests which type of water conservation structures will be suitable in any location. The tool also allows me the choice to change any structure in case I feel that the structure suggested by the tool does not meet my requirements or suit the local conditions.

ii Bhuvan (https://bhuvan.nrsc.gov.in/home/index.php) is an Indian web-based utility which allows users to explore a set of map-based content prepared by Indian Space Research Organisation (ISRO). The content includes thematic maps related to disasters, agriculture, water resources, land cover and also processed satellite data of ISRO.

Figure 6. Community-level planning at Kunjri, Niwali, Barwani, Madhya Pradesh

Figure 7. CRISP asset planning recommendations for the Kunjri GP, Niwali, Barwani, Madhya Pradesh

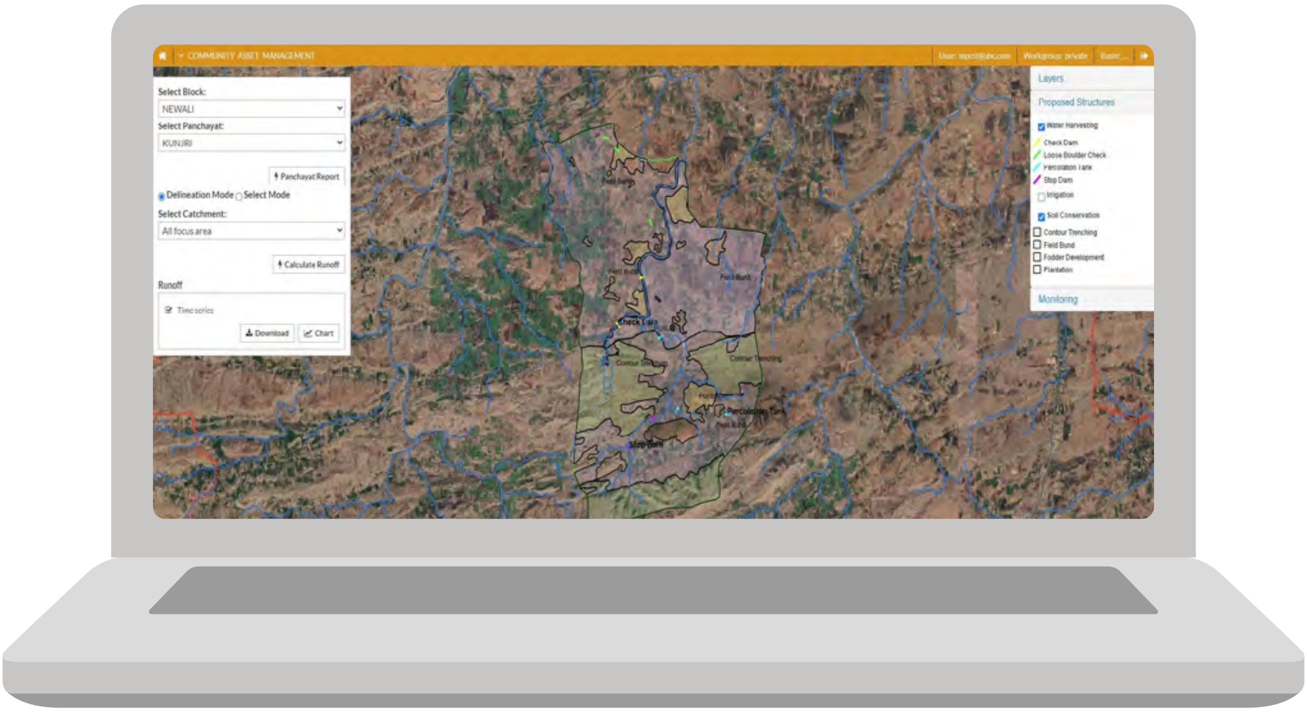


Figure 8. Validation of the community-level planning, Kunjri

The pathway through which this component of the CRISP-M tool supports resilience outcomes of MGNREGS is indicated in the table below.

CRISP-M INTERVENTION	RESILIENCE OUTCOME		
	Prepare	Cope	Recover
GIS-ASSISTED ASSET PLANNING TOOL			
Improve the selection and design of MGNREGS assets by combining GIS and climate modelling forecasts with a climate vulnerability assessment	✓		
Use landscape and integrated natural resource management approaches as the basis for design and selection of MGNREGS assets	✓		
Prioritise community works that reduce exposure to climate change risks and build resilience including plantation and fodder development	✓	✓	✓
Prioritise individual works that help households reduce exposure to climate risks	✓	✓	✓

4.3 CRISP-M mobile application for community-based planning and monitoring

Although the MGNREGS design stipulates that all planning has to be carried out at the village level through the *Gram Sabhas*, the existing plan of MoRD to scale up Bhuvan GIS-based planning only considers a top-down planning approach without any strategy or a process to involve the community. This will take away the right of the community to have a say on which assets are created, their location, who the beneficiaries will be and which activities are prioritised.

MGNREGS can create meaningful climate resilience only if it evolves as a people-centred environment rehabilitation programme. Further, whilst it can be viewed as soil and water conservation or engineering interventions, it should also provide opportunities for marginalised and weaker sections of the rural community to have a better say not just in planning and implementation, but also in monitoring and ensuring equitable access to the assets, resources and benefits created through the programme.

To ensure this, the most important element of the strategy envisaged under the CRISP-M tool is to ensure that rural people see the impact of the activities carried out under MGNREGS. This task sounds simpler than it actually is because of heterogeneous nature of rural communities, which are stratified by caste, ethnicity, gender, religion, class, asset level, occupation, literacy, and so on. Therefore, to bring these diverse groups together and encourage them to come forward with their aspirations and needs, and to convert community demand into community action, a bottom-up participatory strategy is being facilitated through the use of a mobile application under the CRISP-M tool, which is based on:

- Establishing coordinating structures at block and district level to act as the facilitators for awareness generation, capacity building, planning, implementation, monitoring and community action processes
- Making rural people the key actors in the programme in planning, implementation, monitoring, management and maintenance — the necessary mechanism and process through which they can provide input into the GIS based planning has been built into the tool
- Harnessing all available techno-scientific resources and using indigenous/local knowledge to support the decision-making process at the village level through a function which captures the change in structure suggestions from the communities
- Involving people's representatives and members of village-level Panchayati Raj Institutions (PRIs) in the planning and monitoring process
- Organising awareness and training programmes for effective and inclusive bottom-up planning, implementation and monitoring
- Creating transparency for equitable sharing of gains and benefits.

The key elements of the mobile application that helps in ensuring the participatory strategy is achieved are discussed below.

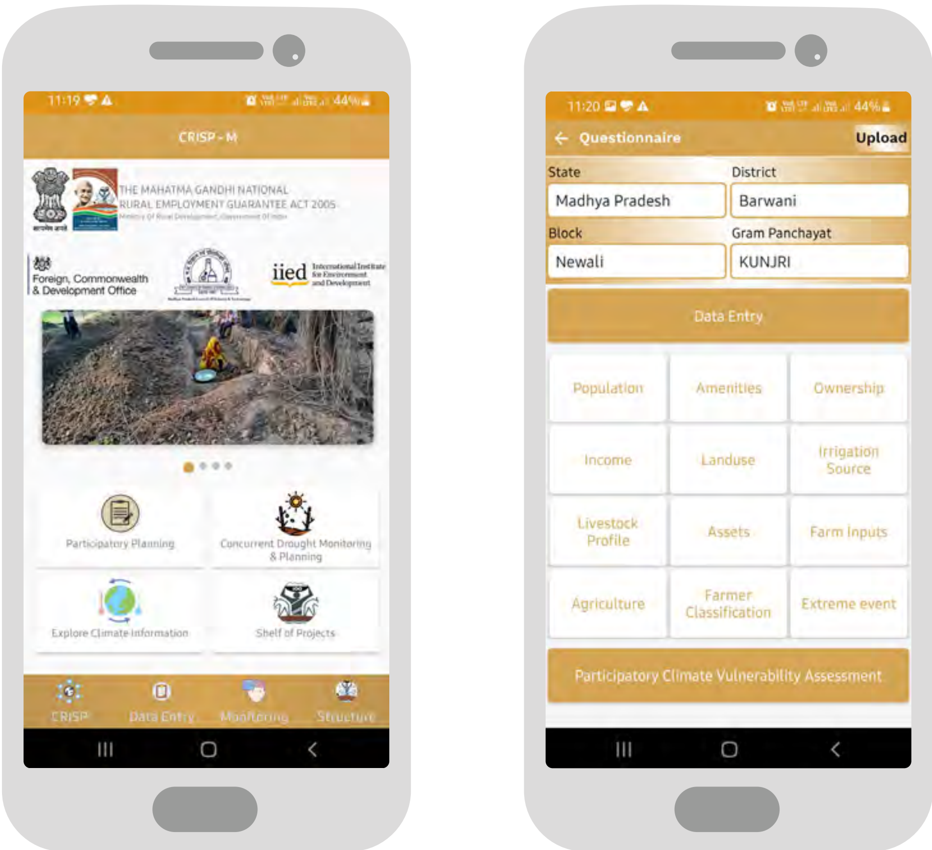
Figure 9. Community-based planning

Digitally aided participatory vulnerability assessment

The mobile application provides the community with information about geo- and bio-physical characteristics and potential climate risks, and sets out a process which helps the community to use it as an input for carrying out a participatory vulnerability assessment as follows:

- High-resolution GIS maps help the community visualise the village landscape on the map — identifying locations of farmlands, forest areas, residential space and so on. The community facilitator explains the topography, hydrogeomorphology and other characteristics based on the GIS maps and explains the possible climate risks such as change in rainfall, droughts, floods, ground water recharge, water yield etc.
- The mobile app has a series of questions which are used as prompts to facilitate the community carrying out a participatory vulnerability assessment, whereby different parameters around the five types of livelihoods capital, namely natural, social, human, physical and financial, are discussed and assessed by the community. This assessment helps in identifying areas that need attention and prioritisation in the planning process, for example a forest area identified as being degraded might prompt the need for a plantation to meet the timber or fuelwood requirements; or lack of fodder for livestock might prompt the need for pasture development; and a high number of landless migrants might prompt the need for skill enhancement and so on. The facilitator/ village *rozgar sahayak* captures the key discussion points in the app. This process is also used to prioritise the most vulnerable households who are tagged and digitised.

Figure 10. Mobile app dashboard

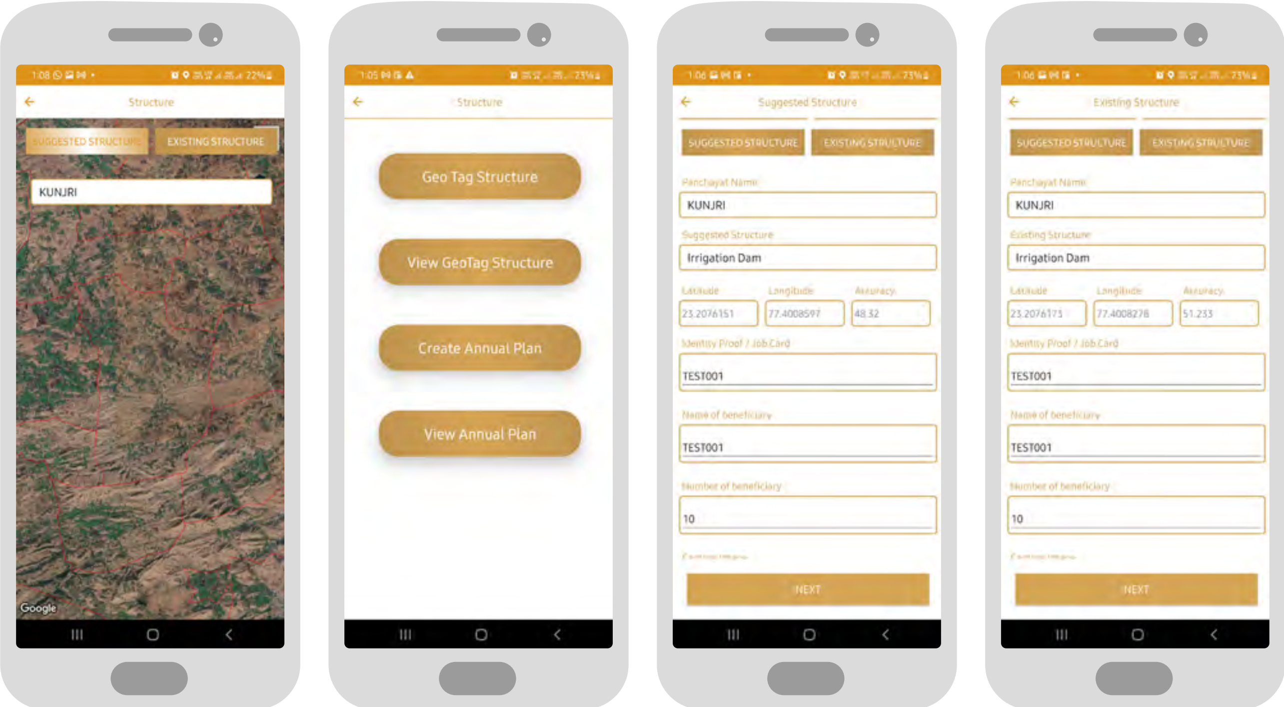


Updating/modifying GIS plans based on local needs and priorities

In this process the community is provided with an explanation of the type and location of the structures proposed though the GIS maps, based on geomorphological, biophysical and climate risk factors. The individual households can then raise their concerns regarding the proposed plans/structures. The community is encouraged to organise themselves into groups to understand problems related to soil, water and biomass degradation and their causes, and are simultaneously encouraged to articulate the needs and requirements of vulnerable households to deal with them. Community members are facilitated to reflect on the rationality of their demands and aspirations.

Based on the identified problems and the requirements of the community, location-specific watershed management activities are identified in the zone of recharge, transition and discharge of the watershed. Skill enhancement activities are identified on the basis of the status local resources and socio-economic conditions. While selecting the activities, the ideas, experiences and indigenous technical knowledge available within community is also used. The planning process identifies five years shelf of projects,[iii] keeping in view the concept of the ridge-to-valley approach for watershed management and the prioritisation of benefits for the most vulnerable households.

Figure 11. Community asset validation and monitoring through mobile app



During this process the structures or the activities proposed in the top-down GIS maps may differ from what gets proposed through the community-led process. To ensure that the decisions of the community are captured, digitised and updated in the GIS maps, the mobile app has the function to:

- Go to the location of each structure and, based on the decision of the community in the *Gram Sabha*, validate the structure proposed if the decision is not to change it or suggest a different structure if they decide that another structure better meets the needs/requirements of the HH or community
- Take a photograph for ground truthing and capturing the conditions of the surroundings of the proposed site, and ensure its georeference is on the map, and
- Tag the household/s benefiting from the asset/structure/activity based on their unique job card number.

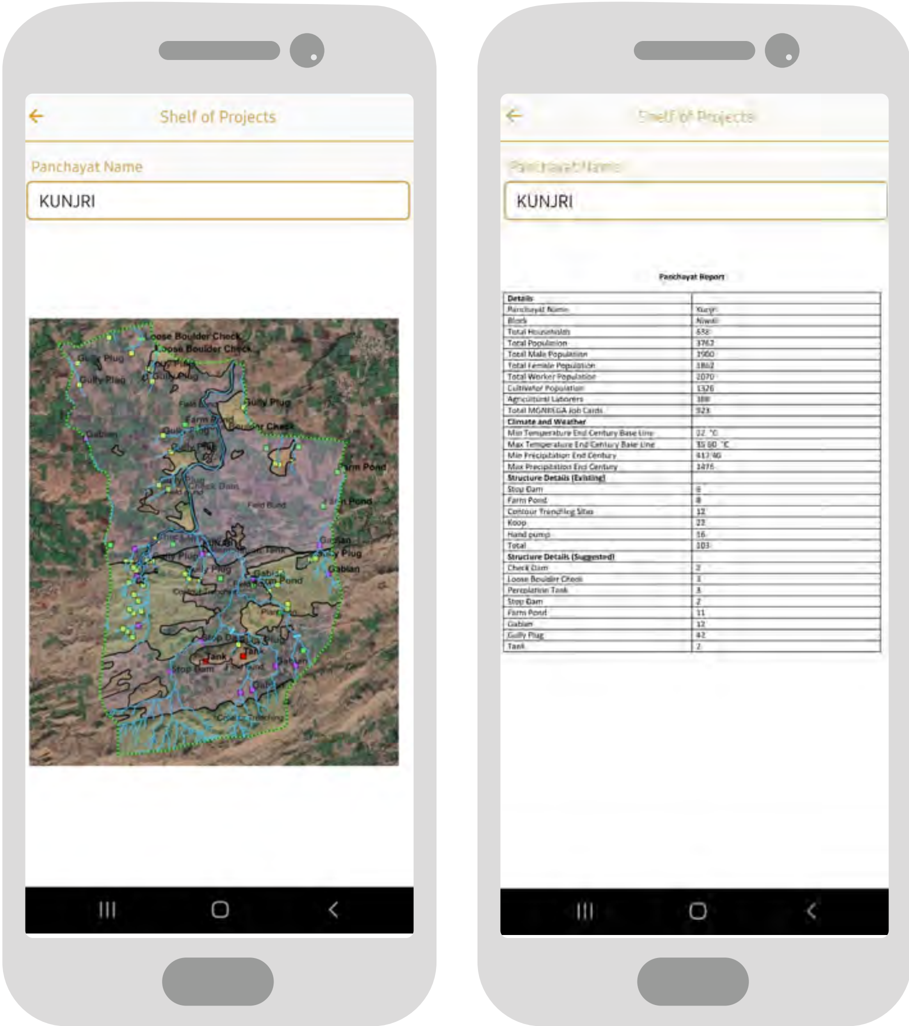
iii Shelf of project is the list of approved works to be carried out under MGNREGS at village Panchayat level

Once the information for all structures has been validated or updated, the community can view the five-year plan on the GIS map.

To assist in approval of the plan created through this process, the village *Panchayat* can print a shelf of project and a map, which can be used by them for approval.

This process leads to the preparation of a technically sound action plan with people's participation, through a top-down and bottom-up approach where techno-scientific and climate impact information is combined with local/traditional knowledge for climate risk management.

Figure 12. Final village map after community-level planning



Details	
Panchayat Name	Kunjri
Block	Niwali
Total Households	[illegible]
Total Population	3762
Total Male Population	1900
Total Female Population	1862
Total Worker Population	2070
Cultivator Population	1326
Agricultural Laborers	[illegible]
Total MGNREGA Job Cards	[illegible]
Climate and Weather	
Min Temperature End Century Base Line	[illegible] °C
Max Temperature End Century Base Line	[illegible] °C
Min Precipitation End Century	[illegible]
Max Precipitation End Century	[illegible]
Structure Details (Existing)	
Stop Dam	[illegible]
Farm Pond	[illegible]
Contour Trenching Sites	12
Koop	22
Hand pump	16
Total	103
Structure Details (Suggested)	
Check Dam	[illegible]
Loose Boulder Check	[illegible]
Percolation Tank	[illegible]
Stop Dam	[illegible]
Farm Pond	11
Gabian	12
Gully Plug	42
Tank	2

Water balance tool to facilitate planning for long-term drought proofing

Long-term drought proofing requires a reduction in run-off, an increase in ground water recharge, surface water harvesting, and soil and moisture conservation, with a view to harness maximum rainfall during the short monsoon season within the micro-watershed boundary. This can help ensure water availability throughout the year and support the community to increase their cropped area, harvest a double instead of a single crop, increase their crop productivity and diversify their livelihoods. To plan structures with an optimum design and location to meet this objective, the community typically has to rely on watershed experts or civil engineers to plan water conservation structures and catchment treatment plans suitable for different locations.

The mobile app integrates a do-it-yourself water balance tool based on digital elevation modelling technology and climate information, through which the community can go to a location and use the tool to assess the water yield at that particular point based on its distance from the drainage line, slope, run-off and other parameters. The tool also allows the community to assess insights on past and future hydrological changes due to climate change impacts in terms of historical run-off, and current and projected future run-off. Based on these inputs the tool suggests structures most suitable for that location, which the community, if they want to, can change based on their local knowledge, and can modify and update the plan. The tool helps the villagers develop a complete shelf of NRM activities map which can be used in preparing a long-term perspective plan for the treatment of the entire area, following the strategy of zero leak; thereby creating sufficient water recharge, water impounding and storage capacity in every village as a measure towards drought proofing.

I am Yogesh Kumar, Technical Expert, MPCST from Niwali Block, Barwani District. MGNREGS officials are using only basic rainfall data to design structures. However, the scientific planning of assets requires hydrology, biophysical, geomorphology and climate projections so that climate-resilient infrastructure can be built. This tool allows them to layer different information such as lineament, ground water prospect, geomorphology, soil type, contours and so on. with future climate change impact projections, so that context-specific and future-fit climate-resilient assets are created. The tool also has a e-learning module which makes it easy for the MGNREGS functionaries to understand how to use it for planning and implementation purposes.

Creating transparency and accountability by crowdsourcing data on MGNREGS asset status and beneficiaries

In order to bring in two-way accountability, move beyond conventional top-down approaches for monitoring and impact assessment that are orientated solely to the needs of policymakers, and supplement the existing MGNREGS monitoring information system, the CRISP-M tool helps build an information system crowd sourced from the community by enabling them to: (i) verify the claims on the progress of work by the authorities; (ii) report the actual status of the NRM assets; (iii) highlight structures needing repair or maintenance; (iv) create resource awareness among the community; and iv) ensure more equitable sharing of benefits.

The mobile app allows community members, village institutions and beneficiary households to add in information about existing structures, beneficiary job card details, and include photos uploaded with location codes and time/date stamps to show the status of assets created.

Such a system will allow MGNREGS functionaries to look beyond the data or information collected through the *Gram Panchayats* and *Rozgar Sahayaks* and provide a transparent mechanism for information generation and sharing; creating accountability at both ends to verify claims on what has been accomplished and who has benefited from it.

In the long run this system will improve the quality of monitoring, create a step change from the existing approach, and improve the measurability of climate resilience impacts. The driving force behind this approach is not the accountability of MGNREGS functionaries, but climate-resilient development and poverty reduction at the local level. It will create a process for enabling the community to join the planning and monitoring process, create a space for shared learning between those who monitor and those who implement, and ensure democratisation of the complete implementation process of MGNREGS through joint decision making and co-ownership. This will empower village institutions and lead to more effective resilience plans and actions for vulnerable communities. Once scaled up, this could go a long way towards establishing a system of mutual accountability and building trust to create resilience in the places where it is most needed.

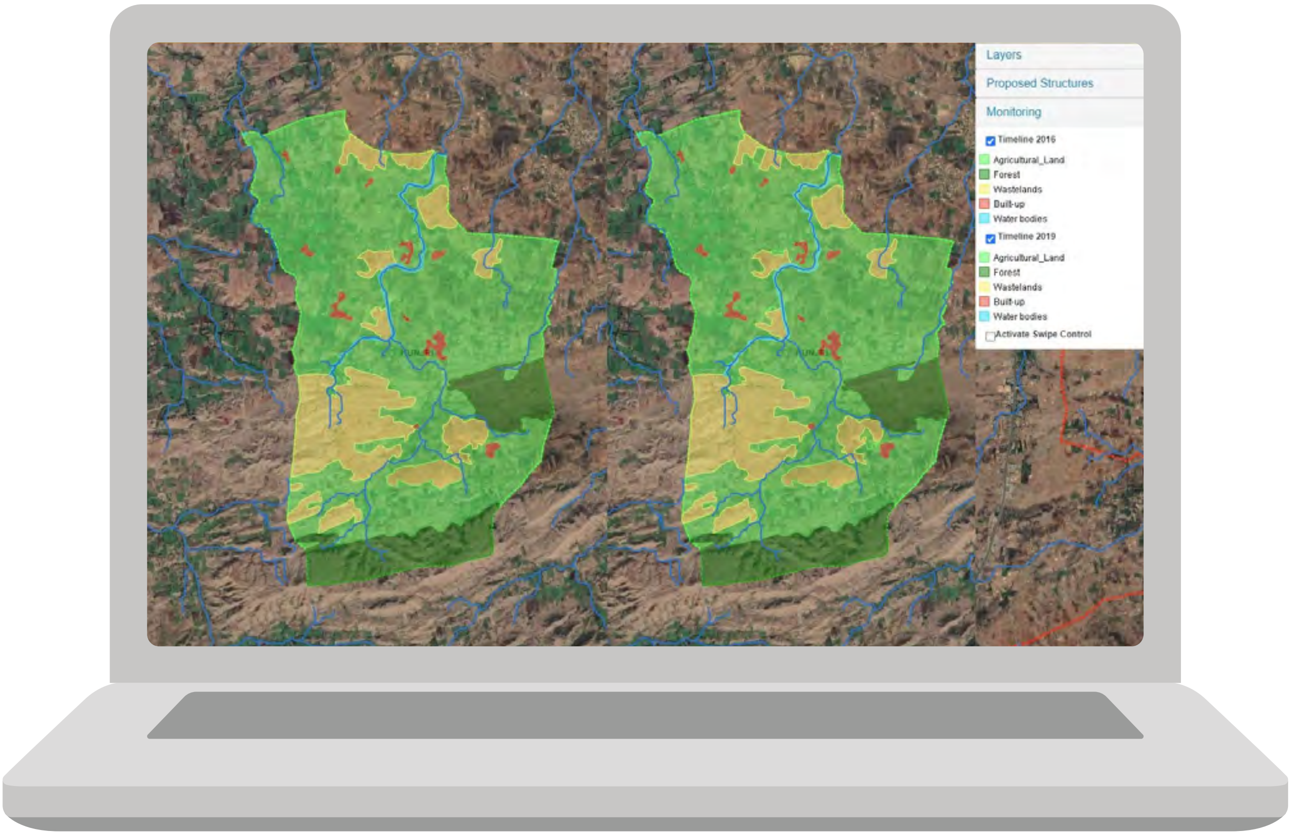
Figure 13. Remote sensing-based monitoring dashboard

Remote sensing-based monitoring of biophysical impacts of MGNREGS initiatives

The app also includes a remote sensing-based monitoring dashboard feature providing time series-based impact monitoring of MGNREGS assets on different biophysical indicators such as changes in cropped area, wastelands, forest area, area of waterbodies and so on, to bring about transparency and accountability for achieving equitable, sustainable and climate-resilient natural resources management, and to ensure better targeting of MGNREGS initiatives.

This will help to: (i) create interest among a wider range of stakeholders to engage more systematically with MGNREGS planning and performance monitoring, so that a more pro-poor and equitable approach emerges over time; (ii) develop and internalise lessons from a transparent monitoring mechanism, namely operational success or failure of adopted strategies and the impact on restoring ecological balance; and (iii) create support to move towards more participatory planning and monitoring systems to enhance the climate resilience impacts of MGNREGS investments.

Figure 14. Monitoring the land-use changes in the landscape(2016–2019) due to MGNREGS works



The pathways through which this component of CRISP-M supports resilience outcomes of MGNREGS are indicated in the table below.

MOBILE APPLICATION FOR COMMUNITY-BASED PLANNING AND MONITORING	RESILIENCE OUTCOME		
	Prepare	Cope	Recover
MOBILE APPLICATION FOR COMMUNITY-BASED PLANNING AND MONITORING			
Provide a mechanism to associate and correlate the field data with the scientifically available data for better insight into solutions	✓	✓	✓
Use landscape and integrated natural resource management approaches as the basis to design and select MGNREGS assets	✓	✓	✓
Empower community to carry out DIY planning of watershed assets	✓	✓	✓
Use innovative tools to strengthen climate-responsive decision making at all levels of MGNREGS	✓	✓	✓
Promote convergence with other initiatives to supplement risk management instruments		✓	✓
Improve the maintenance and monitoring of benefits of MGNREGS assets by combining remote sensing and digital social audits to understand their benefits for climate resilience and improve future selection and design.	✓	✓	✓

5

Conclusions

The process of development of the CRISP-M tool led to the development of five principles for climate information good governance.

1. Understand the current landscape of climate information, how and by whom it is collected and shared, and at what frequency.

In India there is a strong history of climate data collection and monitoring, providing robust data for climate forecasting and analysis. There are pockets of great expertise, including individuals and institutions like the India Meteorological Department, Indian Institute of Tropical Meteorology, National Institute of Hydrology, Indian Institute of Forest Management, and Madhya Pradesh Council of Science and Technology. There have also been great advancements in GIS and remote sensing. But there is still a need for coordination and co-exploration of climate information between experts and decision makers. To ensure this, we invested effort in bringing together the institutions generating and managing climate data, those undertaking climate data analysis, and government organisations and communities responsible for decision making.

2. Adopt an approach for the co-development of drought early warning and climate risk management approaches, tools and guidance with concerned government agencies and community.

We brought on board 12 government institutions — ranging from those involved in data generation, to those working on data analysis, to the final users of the data. We facilitated their interaction, providing them with support to enable them to produce these tools themselves. This helped to embed co-development, building capacity within their systems and supporting systematic approaches to help information and knowledge emerge and flow to the right people at the right time. This also process-built understanding among the agencies that these modules are not a perfect model — they need to be revisited and revised and will evolve with a feedback loop from data users that allows for their constant improvement.

3. Focus on proper communication of climate information.

The limited usability of climate information emanates from its poor communication — the format in which it is made available, how it is made available and the capacity of the end users (both government agencies and community) to interpret and use it for decision making. Our efforts are directed towards bringing all key end users on board and trying to understand their needs around climate information. Then we can design the climate information systems according to these needs and requirements, and, through a relevant communication strategy, enable users to undertake their own exploration and take decisions at the local level.

4. Create a drought early monitoring, reporting and preparedness system.

We are developing a concurrent monitoring and reporting mechanism that can provide MGNREGS functionaries and communities with real-time information. This will help them to understand when they are at risk of facing 'drought' and 'drought-like situations' based on the parameters outlined in the Indian Manual for Drought Management. In this way they can plan for contingency measures, ie labour budgeting under MGNREGS to provide wage employment to households in the event of loss of other sources of livelihoods or crop failure; or for example, providing government officials with relevant information in case a severe-category drought has to be announced and relief measures have to be set in motion.

5. Create a climate information and decision support module.

Climate change is defined as a wicked problem because of its uncertainty and complexity. But uncertainty does not mean inaction — our response to it has to be different; supporting existing tools to make decisions differently. Beyond drought early warning systems, we are integrating climate information in the existing GIS-based planning framework of MGNREGS, so that the assets created under the scheme (such as water-harvesting structures, soil and moisture conservation, plantations and so on) are fit for purpose under climate change conditions. This is being done by integrating both 'top-down' as well as 'bottom up' approaches. A top-down approach includes assessing the cause-effect relationship between climate change projections and their impacts and risks. But as this kind of assessment does not provide enough information on who is vulnerable to these climate risks, and how they can be addressed, we are covering this gap by complementing it with bottom-up approaches. We are integrating this information through participatory processes, allowing communities to use their local knowledge in decision making.

The CRISP-M tool has been co-developed by IIED with Madhya Pradesh Council of Science and Technology (MPCOST) under the NAFCC readiness project with:

Ministry of Rural Development (MoRD)

Rural Development & Panchayati Raj Departments, Government of Madhya Pradesh, Rajasthan and Uttar Pradesh

Madhya Pradesh Council of Science & Technology (MPCST)

National Remote Sensing Centre (NRSC)

Indian Meteorological Department (IMD)

Indian Institute of Tropical Meteorology (IITM)

National Institute of Hydrology (NIH)

Indian Institute of Forest Management (IIFM)

Water and Land Management Institute (WALMI)

Core Team

International Institute for Environment and Development (IIED)

Ms Ritu Bharadwaj, senior researcher, Climate Change Group

Mr Mohan Reddy, national consultant, Enhancing Climate Resilience under MGNREGS Project

Ms Raashee Abhilashi, national consultant, Enhancing Climate Resilience under MGNREGS Project

Ms Amit Garg, climate information system architecture expert

Madhya Pradesh Council of Science and Technology (MPCOST)

Dr. Alok Chaudhary, senior principal scientist, Head GIS and Image Processing Division

Mr Abhishek Kumar, project manager and GIS developer

Mr Enshaw Ali Raza, android developer

Mr Yogesh Yadav, junior research fellow

Mr Ankit Singare, junior research fellow

Strategic Advisor

Clare Shakya, director, Climate Change Group, IIED

Simon Addison, principal researcher, team leader, Climate Governance and Finance Team, Climate Change Group, IIED

Dr. T. Thomas, scientist, Central India Hydrology Regional Centre, Bhopal, National Institute of Hydrology

Mr Lokendra Thakkar, senior scientific officer and coordinator, Madhya Pradesh State Knowledge Management Center on Climate Change, Environment Planning and Coordination Organization (EPCO)

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Acronyms

CIS	Climate information services
CRISP-M	Climate Resilience Information System and Planning Tool for MGNREGS
FCDO	Foreign Commonwealth and Development Office
GIS	Geographic information system
ICRG	Infrastructure for Climate Resilient Growth
IIED	International Institute for Environment and Development
IITM	Indian Institute of Tropical Meteorology
IMD	Indian Meteorological Department
MAI	Moisture Adequacy Index
MGNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
MoRD	Ministry of Rural Development
MPCST	Madhya Pradesh Council of Science and Technology
NDVI	Normalised Differential Vegetative Index
NDWI	Normalised Difference Wetness Index
NIH	National Institute of Hydrology
NRM	Natural resource management
NRSC	National Remote Sensing Centre
PRI	Panchayati Raj Institution
RSI	Reservoir Storage Index
SPI	Standardised Precipitation Index
SWAT	Soil & Water Assessment Tool
VCI	Vegetative Cover Index

The CRISP-M tool enables a top-down and bottom-up approach to climate risk management where climate risk-informed GIS planning is combined with community-level processes to ensure effective location-specific and needs-based planning, decision making and monitoring.

International Institute for Environment and Development
Third Floor, 235 High Holborn, London WC1V 7DN, UK
Tel: +44 (0)20 3463 7399
Fax: +44 (0)20 3514 9055
www.iied.org

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