

Making Smallholder Farming Climate-smart

Integrated Agrometeorological Services

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Climate change is accompanied by increasing weather uncertainty. Farmers, especially smallholder farmers, need advance warning of emergent weather conditions at a local level. Mobile telecommunication systems are increasingly cost-effective and an efficient way of delivering weather-based agro-advisories to farmers at a large scale. Agrometeorological services facilitate flexible, weather-based agriculture planning and help build evidence and capacities of communities, technical and developmental agencies to plan and implement climate-adaptive responses. The relevance and innovativeness of multi-institutional collaboration lies in the institutional, technical and pedagogical strategy adopted which offers important lessons on how agrometeorological services can be organised to make smallholder farming climate-resilient on a larger scale.

Agriculture in India today contributes only 14% of India's gross domestic product (GDP). Nevertheless, agriculture provides a source of livelihood for at least 57% of its people, most of whom live in rural areas. Nearly 31% of Indians living in rural areas are classified as living below the poverty line (Planning Commission 2014: para x, p 5) and most of these depend upon agriculture, which is highly dependent upon local weather conditions and rainfall. With over 60% of Indian agriculture dependent on rainfall (received from June to September) farming in India is a high-risk gamble dependent upon the vagaries of the monsoons and local meteorological conditions. With increasing climate variability, the need for advance warning to farmers of the likely occurrence of irregular or extreme weather events and advice on how to cope and adapt in the long run, is becoming urgent.

Confronted with climate variability, rising costs of agricultural inputs, declining productivity, low returns and market volatility, Watershed Organisation Trust (WOTR) decided to offer an integrated suite of services to farmers that included local weather forecasts and advisories (with market information), and reoriented its agricultural extension service to help farmers consider these inputs while making farm-related decisions. The key technology and knowledge partners are the India Meteorological Department (IMD), the Central Research Institute for Dryland Agriculture (CRIDA), and the Mahatma Phule Krishi Vidyapeeth (MPKV). The project was largely piloted in the Akole and Sangamner blocks of Ahmednagar district, Maharashtra. This area has been experiencing anomalous weather conditions.

Advisories crafted by WOTR are crop and farmer specific, using block-level weather forecasts provided daily by the IMD and crop weather calendars developed in collaboration with CRIDA and MPKV. Besides the normal objectives that crop-advisories have, such as reducing weather-induced risks and improving farm productivity, these advisories also seek to build adaptive capacities to climate variability and strengthen the sustainability of farming systems.

A multimodal delivery system (mobile handsets, advisory posters or "Krushi Shala," wall boards, and village public address systems) facilitates widespread outreach. Adoption of appropriate technologies and adaptation practices is promoted by providing on-farm specialist support, establishing "demonstration plots," conducting of Farmer Field Schools (FFS) and engagement with farmer groups, local governance institutions, and local government departments. Particular attention

The authors are grateful to an anonymous reviewer whose comments helped improve the article.

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is paid to delivering advisories through sms via mobile phones because of increasing rural penetration.

The participation of related social, technical and financial institutions across the civil, private and public spaces, working towards a common goal not only facilitates knowledge creation, pooling, and transfer of technology and expertise across levels, but more importantly, from the perspective of scale, efficiency and impact, opens up pathways to feed experiences and insights from the ground into policy- and decision-making processes and programmatic interventions.

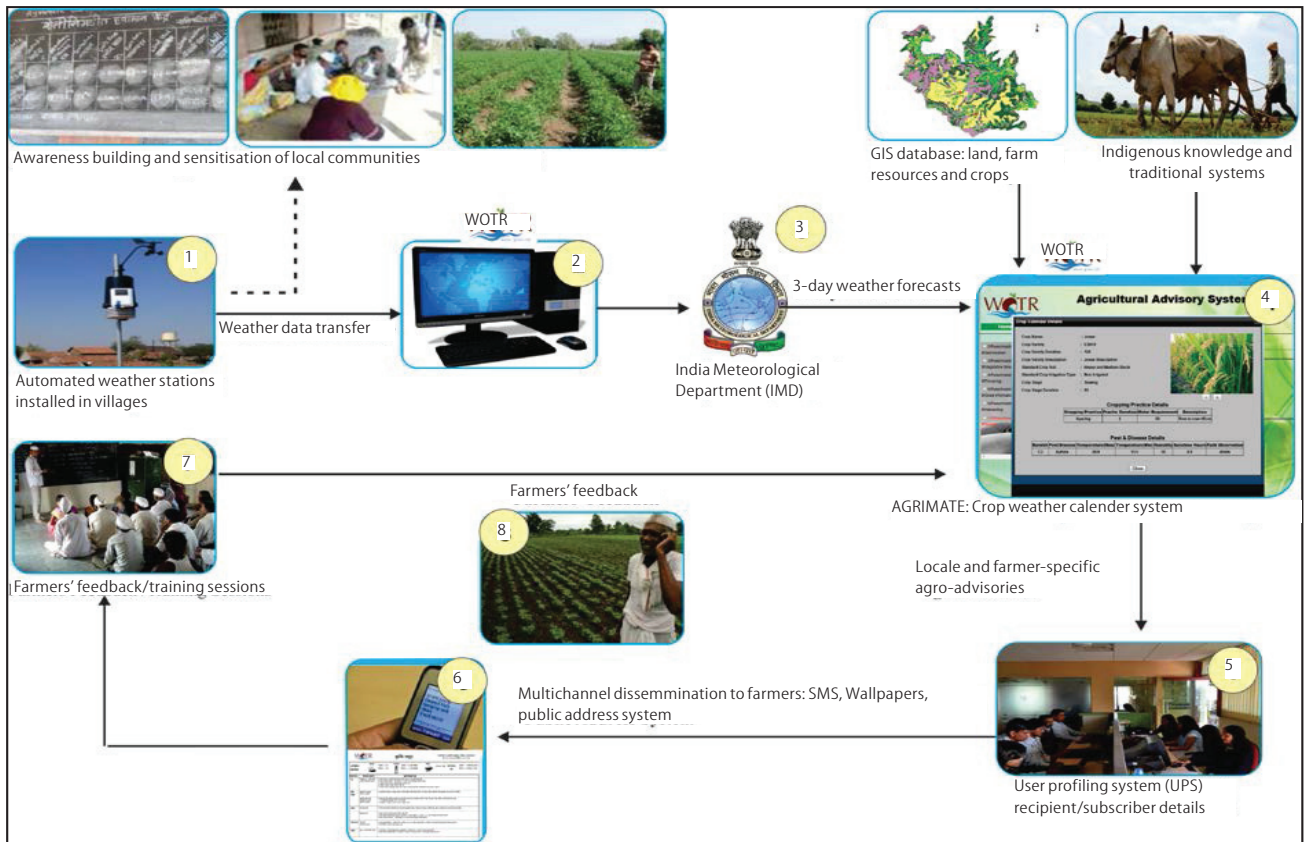
This article shares the experience of this collaborative effort as the strategy and institutional architecture adopted offers important lessons on how agrometeorological services can be organised to make smallholder farming climate resilient at scale.¹

Climate Variability, Agriculture and Agrarian Economy

Climate variability, irregular rainfall behaviour, and unexpected meteorological events directly impact ecosystems, water availability and biodiversity thus threatening agricultural production systems, livelihoods, food, nutrition and water security.

It is estimated that unseasonal rains, wind and hailstorms that lashed Maharashtra and Madhya Pradesh in March 2014 affected about three million hectares of rabi crops (wheat, pulses, oilseeds) with horticultural and cash crops (grapes, pomegranates and oranges) having suffered the most (*Economic Times* 2014). In Maharashtra alone, the damage was estimated to exceed \$8.33 billion or ₹5,000 crore (*Indian Express* 2014) whereas in Madhya Pradesh it was expected to cross over \$5.5 billion or ₹3,300 crore (Government of Madhya Pradesh 2014).

Figure 1: An Overview of WOTR's Agro-advisory System



Legend

- (i) Met stations installed in project villages. Village youth trained to read the Met-data. Information displayed on boards in public places. Trainings on maintenance and security of weather stations conducted. Community sensitised to likely weather outcomes and impacts on agriculture and alerted to the need to undertake coping measures.
- (ii) Hourly local Met-data sent via SMS/GPRS to WOTR's servers. Data "cleaned", verified and forwarded to IMD servers.
- (iii) Three-day block level village-specific weather forecasts for project villages received daily by WOTR from IMD.
- (iv) Unusual/extreme weather event forecasts immediately disseminated to villages. Weather forecasts from IMD fed into AGRIMATE (An Automated Crop Weather Calendar Software). Indigenous knowledge and traditional agricultural practices of area referenced. GIS data base of farmers containing details of landholding, soil type, water availability, farm resources and crops grown. In-house experts prepare weather-based, crop growth stage and soil type specific crop advisories.
- (v) User profiling system (UPS) matches the advisory with the farmer/ subscriber and disseminates the same through mobile SMSs in local language at least twice weekly or whenever required.
- (vi) Multichannel Advisories Distribution: SMSs, info boards, weekly posters and public announcement system (loudspeakers), engagement with farmers' groups, local governance and public institutions.
- (vii) Onsite technical support, Farmers' Field Schools, farmers' feedback sessions and field investigations.
- (viii) Feedback looped into the Automated Content Management System (AGRIMATE and UPS) and to field extension personnel.

Figure 1 and the accompanying legend has been used by WOTR in its publications and presentations.

With India's climate expected to become warmer, intra-seasonal and inter-annual weather variability is expected to increase. Studies reveal a declining trend in the all-India summer monsoon rainfall over the last 60 years, which is expected to continue (Oza and Kishtawal 2014). This, together with the increasing frequency of erratic monsoon behaviour, irregular rainfall patterns, and intense unseasonal and extreme weather events will only result in more losses, damages and grief to farmers in India, especially smallholder farmers who have hardly any means to cope with these climate-induced disasters.

Traditional Knowledge and Adaptive Strategies

Over millennia, farmers have evolved methods of forecasting weather conditions, based on which they make farm-related decisions and adopt strategies to cope with weather-induced risks. For instance, the presence of flying termites in the evening and ants moving their eggs to higher ground indicate a strong likelihood of rain, and dark clouds in winter and continuous drizzling point to the outbreak of pests and diseases (Anandraja et al 2008). Similarly, when farmers in Dindigul district, Tamil Nadu notice westerly winds blowing in June–July, they conclude that good rains would only come in October–November and accordingly they minimise farm investments by growing only short-duration crops (cowpeas) and focus on small ruminants (Rengalakshmi nd).

Farmers' traditional knowledge and practices have been built by observing weather dynamics and behaviours of plants, animals and insects that have been fairly stable over hundreds of years. However, in recent times, the unpredictability of weather changes, frequency and intensity of unusual meteorological events, changes in the biophysical environment, and severity of losses resulting from these are increasingly undermining farmers' confidence in their traditional knowledge and their capacity to cope with and adapt to these changes. Traditional knowledge and coping practices now need to be augmented by scientific information of likely weather events on a timely basis as well as science-based adaptive and risk mitigation information in order to enable them to protect their crops and livestock and increase productivity.

With the explosive growth and spread of communication and information management technologies in recent times, it is now possible to make available meteorological, climatological, and hydrological information to farmers on a timely basis. Ready access to this kind of information is crucial if the world is to meet the growing food demand of a population globally expected to touch 7.5 billion by 2020 and 9.3 billion by 2050 (United States Census Bureau nd).

In the following sections we shall describe the perspective and rationale underlying the agrometeorological service, the various components that together comprise this service and the challenges faced during its implementation.

Farmer-centric Agrometeorology

The integrated agrometeorology service evolved by woTR consists of four components that are interlinked, as follows:

(i) Weather awareness, local weather data acquisition, and short range weather forecasts; (ii) Crafting of agro-advisories, dissemination, and feedback gathering; (iii) An automated content management system (ACMS) for agro-meteorological advisory generation and dissemination; and (iv) On-site capacity building, knowledge and technology transfer and engagement with local institutions.

These are discussed and cross-referenced in the overview of the overall system below (Figure 1, p 54).

Local weather data and short-range forecasts: Weather forecasting done by the IMD, at present, is targeted at the district level,² which, on average in Maharashtra, are about 7,000–8,800 sq km and which may include more than one agroclimatic zone. This level of forecasting is too broad-scale and is not able to satisfactorily anticipate weather variations or events in districts exhibiting extreme weather conditions or rainfall heterogeneity as in the case of drought-prone or hilly regions.³ Hence, it is necessary to downscale forecasts preferably to the village or cluster level (a group of about 10–20 villages) and obtain local meteorological information for purposes of weather forecasting and validation.

For this purpose, woTR has, in collaboration with the IMD, installed 69 automated weather stations (AWS), mostly one in each project village.⁴ Altogether, they make for a high density grid, with a 3–5 km distance between most of the weather stations. A sufficiently dense network of high quality data points, will enable the IMD to better calibrate their weather models, given the diversity of topographies and agroclimatic ecologies in the project districts. Fifty four of these AWS⁵ are telemetrically linked to woTR's servers and send on an hourly basis, weather information⁶ round-the-clock, which, after quality checks, is then forwarded to the IMD. IMD sends woTR daily, three-day weather forecasts for the 61 project villages. Weather forecasts are highly localised as the rainfall data of four villages in the same agroclimate zone (scarcity zone) in the project area, which are within 3–8 km from each other, shows (Table 1). The data also underlines the high variability of weather outcomes in semi-arid regions and the need to validate forecasts.

Table 1: Forecast and Actual Rainfall Received in One Cluster (Sangamner taluka)

Date of Forecast	Jawale Baleshwar		Sarole Pathar		Gunjalwadi		Karjule Pathar	
	Forecast Rainfall (mm)	Actual Rainfall (mm)	Forecast Rainfall (mm)	Actual Rainfall (mm)	Forecast Rainfall (mm)	Actual Rainfall (mm)	Forecast Rainfall (mm)	Actual Rainfall (mm)
4 June 2013	13.6	9.6	13.6	12.2	12.6	23.4	11.5	9.60
6 June 2013	6.5	6.4	7	10.8	6.8	2.2	7.1	6.4
20 July 2013	7.6	0.19	4	5.8	4.0	3.2	2.2	3.6
21 July 2013	11.4	0.07	8.1	1.8	7.4	2.0	5.3	1.2
24 July 2013	10.6	0.21	6.5	8.4	6.7	7.86	4.9	6.0
12 October 2013	13	11.6	13.4	16.4	13.7	7.20	13.8	23.0

In order to sensitise farmers to local weather variability and how it affects crop and livestock, key weather information⁷ obtained from the AWS is displayed on blackboards at accessible places in the village. This is done by village youth who have been trained to understand and read the weather data. This helps farmers make appropriate farm-related decisions

and enables them to anticipate and prepare for likely problems that can arise due to changing weather conditions.

Mahadu Kondhar, a farmer from Purushwadi, Akole taluka, Ahmednagar district, had this to say,

I received an sms forecasting cloudy weather and rain on the 3 and 4 of March 2014 and advising that crops should be harvested, covered or safely stored. I immediately covered my wheat harvest in the field. It rained that evening at 6.00 pm and I am very happy to have saved my wheat crops which otherwise would have got destroyed.

Running and maintaining the AWSS in these remote areas, however, has not been without its challenges. These include identifying sensor drift and recalibrating them; designing solar battery powered systems to ensure continuous power backup; designing a monitoring system to identify malfunctioning equipment; ensuring safety of the AWSS (once the community recognised their value, they protected these delicate instruments); keeping the equipment free of birds, insect and debris; network connectivity issues, data losses in transmission or storage due to equipment malfunction; and putting in place standard operating procedures for maintenance and system operations.

Agro-advisories, dissemination, and feedback: Once WOTR receives the three-day localised weather forecasts sent by the IMD, agricultural experts from WOTR prepare agro-advisories based on crop weather calendars prepared with inputs provided by CRIDA and the State Agricultural University (the MPKV). Crop weather calendars have been developed for 12 principal crops grown in the area. These crops are pearl millet, finger millet, sorghum, maize, field pea, groundnut, paddy, onion, gram, wheat, soya bean, and tomato.

These advisories that are crop, growth stage, and locale-specific are holistic in nature and include nutrient–water–pest–disease–soil health management recommendations that stress local solutions and resources, organic and environmentally sustainable interventions. These may also include information on market prices and developmental schemes. The focus of the agrometeorological advisories is not only to improve crop yields and farm incomes, but also to make small-holder farming sustainable, productive, and climate smart. These advisories are issued in the local language at least twice a week during the agricultural season or more frequently, if required, to alert farmers and give them time to implement suggested measures.

Advisories are disseminated through mobile telecommunication networks (via SMSs) directly to individual farmers across 61 project villages; by announcements over the village public address system (loudspeakers); weekly posters that are put up at prominent places in some villages and on wall/blackboards. These are supported by agricultural professionals who provide extension, technology and training support at the farm and village level, establish “demonstration plots,” undertake FFS and engage with farmers’ groups, local governance institutions and government departments. This multichannel dissemination and support system has been deployed to address issues of mobile connectivity (quality and

coverage), low literacy levels and because farmers generally adopt new technologies and practices when these build on their knowledge and skill sets and demonstrate their usefulness.

A total of around 6,300 farming households (approximately 12,600 farmers counting the couple as a farming household) in Maharashtra have been exposed to these integrated agrometeorological services. Agrometeorological crop advisories through SMSs have been delivered to 8,309 unique recipient farmers and 3,11,388 advisories have been disseminated.⁸ Crop demonstrations have been undertaken on over 1,071 farm plots which serve as technology demonstrators and occasions for training and capacity building.

In order to validate, fine-tune, and improve the crop advisories, crop-wise meetings are organised at regular intervals with farmer groups to discuss these advisories and get their feedback. Data is also collected once at the end of the month from “recipient” farmers (five per crop) and a few “control” farmers (three per crop) who do not receive the advisories. This information is then taken into consideration when preparing new advisories.

In addition to developing and disseminating “regular” crop advisories, contingency cropping and management plans for extreme meteorological events are also prepared as required, and disseminated to mitigate risks and reduce losses.

Automated content management system: The ACMS is a dynamic system which consists of two parts: (i) “AGRIMATE” that aligns forecast weather conditions with required crop management practices; and (ii) a user profiling system (UPS) that matches and disseminates to the recipient farmer the advisory particular to her crop. The UPS is used for advisories delivered through SMS.

The ACMS is supported by a database embedded in a geographic information systems (GIS) platform which includes relevant details of the participating farmers such as farm holding, access to irrigation, land capability, soil type, and crops grown. Traditional agricultural practices are also considered when formulating advisories. These geo-referenced databases help tailor advisories to the farmer’s specific situation and needs, and allow building on traditional practices which facilitate adoption of new practices and recommendations. At present, however, due to technical limitations, advisories disseminated do not take into consideration individual farm specificities like soil moisture, water balance, irrigation facilities, energy sources, or whether there is a pest/disease attack on her farm, etc. Specific advice in this regard, however, is given over phone to farmers who contact WOTR. Feedback received from the field is also fed into the system which enables learning, customisation, fine-tuning of advisories, and better knowledge management.

On-site capacity building: Weather-based crop advisories, periodically given, help farmers cope with ongoing and emergent risks. The human interface builds trust and confidence which is crucial for widespread adoption of technology and knowledge.

This requires establishing relationships, providing farmers regular on-farm extension support, knowledge, technology transfer, and linkage building so as to increase productivity, reduce costs and build capacities of farmers to cope with climate and market risks while conserving the environmental resources on which agriculture itself depends.

To ensure this, woTR has appointed agricultural experts and trained para-agronomists (who reside in the project areas) to provide need-based and on-demand services to the farmers. Farm-level soil analysis to establish fertility status is undertaken and emphasis is laid on building up soil health through addition of compost, recycling of agricultural residues, vermicomposting, green manuring and application of locally prepared organic products. Plant growth and protection is promoted through application (in soil and through foliar spraying) of bio-fertilisers and bio-pesticides (some of these prepared locally) together with judicious application of chemical fertilisers and pesticides, as required.

Equally importantly, since water for irrigation is a constraint in these regions, farmers are introduced to appropriate cropping patterns, crop intensification techniques as well as conservation irrigation technologies (primarily drip and sprinkler systems together with proper irrigation scheduling) that increase distribution and water-use efficiency: the idea being to optimise output per drop of water. In some of the villages, this effort is supported by engaging the community in a water-budgeting exercise. This helps raise awareness on the need to use scarce water resources more efficiently and in adopting cropping patterns that can be sustained by water available for agricultural operations.

Since ecosystems provide valuable environmental services that support agricultural production and improve productivity, communities are encouraged to regenerate and protect the watersheds they live in and undertake in-situ soil and water conservation (and harvesting) measures,⁹ both on-farm and in the catchments they live in.

Impact, Uptake and Feedback of Agro-advisories

Studies have revealed that timely provisioning of appropriate advisories benefit and are welcomed by the farming community. It helps them reduce losses and also increase productivity and incomes. Advisories that promote sustainability, eco-friendly approaches and use of biological and organic inputs also serve the added purpose of validating traditional knowledge and practices, reducing costs of cultivation, improving overall farm resilience, reducing environmental damage and building farmers' capacities to adapt to climate change and climate-induced shocks. The benefit of such an integrated approach is the maintenance and enhancement of environmental services on which rain-fed agriculture crucially depends.

The National Council of Applied Economic Research (NCAER 2015: xxii, 29) conducted a survey based on baseline data which included input costs per hectare and average per hectare production of different crops. It was found that 93% of farmers surveyed across different states and districts who received agrometeorological advisory bulletins (disseminated under the Agromet Advisory Services of the IMD/Government of India)

agreed that numerical weather prediction were reliable and used this information in making decisions during different farming stages from sowing to harvesting. Around 57% felt that timeliness of the weather forecasts had improved. It is estimated that four principal crops—wheat, paddy, sugar cane and cotton—alone have the potential to use crop weather information to generate an annual economic profit of ₹42,000 crore. The incremental profit due to the Agromet Advisory Services is assessed to be 25% of farmers' net income (MOES 2016).

The impact studies undertaken by National Centre for Medium Range Weather Forecasting (NCMRWF) (Rathore and Maini 2008) and Indian Agriculture Research Institute (IARI) (Vashishth et al 2013) noted that agro-advisories along with various awareness and demonstration programmes in the villages resulted in increased crop productivity, reduced costs of cultivation and increased confidence, skills and knowledge of farmers.

Results from other service providers indicate that farmers have been able to secure between 5% and 25% higher incomes, 10% higher price realisation (Innowin 2014) and improved crop productivity to the tune of 21% on an annual basis.¹⁰

Studies conducted by woTR of farmers who received its agrometeorological advisories together with crop extension services ("demonstration plots" of 0.2 ha each) in the project region showed yield increases of 26% on average for cereals (pearl millet, paddy, wheat); 28% for oilseeds (groundnut); 18% for onions; 23% for brinjal; 21% for kharif tomato; 21% for cabbage and 31% for chickpea. Overall, cost reductions achieved have ranged from 10% to 20% with vegetables registering the highest gains.¹¹

Umesh Walunj, a farmer from village Bhojdari in Sangamner taluka, affirms,

We planted maize based on the agromet advisories given to us. The maize stems have become thick and the crop grows well due to the judicious use of fertilisers. Earlier we used fertilisers arbitrarily which was not beneficial. But now, because of the agro advisories we get more yields with less fertiliser. Two years ago, our fertiliser cost per application for the maize crop was ₹3,000 to ₹4,000. But today, in spite of inflation, by following agro advisories, our cost has come down to only ₹1,500 to ₹1,600. Even the quantity of seed required has reduced from 7 kg to 5 kg per acre. Last year I got 30 quintals of maize per acre but by following agro advisories it increased to 35 this year. That is, my yield has increased by five quintals per acre!

Yield increases and cost reductions were realised most when agrometeorological advisories were supported by on-site extension support and undertaking of appropriate and timely management measures.

Observations, Key Learnings and Recommendations

- (i) Farmers recognise the need for and are demanding weather forewarnings and advice on how to cope with and adapt to weather variability while increasing their incomes and well-being.
- (ii) Weather-based agro-advisories must be locale-, crop- and farmer-specific;¹² Given monsoon variability, advisories, especially targeted at rain-fed regions, need to also recommend soil, water, and biodiversity conservation practices.
- (iii) Mobile telecommunication systems (SMSs, interactive voice response systems or "phone-in" helpline services) are a

cost-effective and efficient way of delivering agrometeorological advisories to farmers at scale. Given connectivity, literacy and contextual issues, multimodal distribution channels such as radio (especially community radio), television, newspapers, folk media, and village level public address systems will also need to be used to bridge this “communication divide.”

(iv) Advisories will need to be complemented by “extension services,” on-site training and awareness campaigns, technology demonstrations, farmer-specialist interactions, and engagement with local governance bodies.

(v) Caution is in order: soil health and need-based irrigation management, both of which hold the key to sustained productivity, are largely ignored but need to be addressed adequately.

(vi) For greater outreach and impact at the farm level, there is need for closer collaboration between public, civil society, and private technology and financial service providers so that farmers get access to accurate information, and affordable technologies. This will facilitate “last mile connectivity,” especially in underserved regions in the country.

Going Forward

The need to make agriculture more resilient to climate risks is more urgent than ever. It is heartening to note that this need has been recognised and weather forecasts as well as advisories

to farmers on how to cope with the attendant risks are being increasingly made available through various information and technology channels.

In the years ahead, as mobile telephony and broadband coverage expands in rural areas, the already ubiquitous “handy” is poised to play an important role in shaping rural destinies. It is therefore imperative that already now, as we stand on the verge of an explosion in rural connectivity, we get both the “medium” and the “message” right if agriculture is to help lift millions of Indians out of poverty in a globalised world with a changing climate.

The message must be holistic in nature, build on customary practices and focus not only on current needs—reducing risks, increasing productivity and higher incomes—but also with an eye on the future—addressing issues of sustainability, improving resilience and building adaptive capacities. The medium must embrace a variety of dissemination channels that also include mass media, agencies and networks in the social, commercial, developmental and governance sectors.

In order to make Indian agriculture sustainable, climate-smart, and resilient rapidly and at scale, stakeholders at all levels must come together in synergistic and complementary partnerships, each contributing their strengths and resources to a shared purpose, in a spirit of mutual respect, support and learning.

NOTES

- 1 The project was funded by the Swiss Development Cooperation and National Bank for Agriculture and Rural Development (NABARD). Other contributing donors were the Swiss Re, Bread for the World and The Modi Hormus House Trust Fund and the Hindustan Unilever Foundation (HUF). Periodic technical support to WOTR was provided by two Swiss private companies, namely, Schwank-Earthpartner AG and Meteodat.
- 2 The IMD has now started giving block level forecasts in some regions of the country and plans to cover all blocks eventually.
- 3 As in the case of Ahmednagar district which has two blocks adjacent to each other—Sangammer and Akole—which are project sites. The Sangammer block is a plateau having very dry conditions (annual rainfall varies from 150–500 mm) and is drought-prone. Akole block, on the other hand, is hilly and has rainfall that ranges from 700–1,200 mm in a “normal year.”
- 4 Most of these are in the project villages in Maharashtra. At the time of writing, the number of AWSs had risen to 87.
- 5 Due to unavailability of mobile connectivity, the remaining stations are offline but provide weather data to the local farming community. Once a week data from these stations is downloaded and uploaded on the WOTR server. At the time of writing, the number of such telemetrically linked AWSs had risen to 77.
- 6 These are temperature, humidity, rainfall, wind speed, wind direction, barometric pressure, and in some cases, solar radiation.
- 7 Rainfall, relative humidity, temperature, and wind speed.
- 8 “Unique” is defined as one recipient per crop.
- 9 Such as farm bunds, contour trenches, check dams, farm ponds, grass and tree plantations, and protection of existing vegetation.
- 10 “LifeLines Agriculture—Success Stories,” viewed on 6 August 2014, <http://lifelines-india.net/agriculture/successstories>.
- 11 The figures for yield increase are obtained by actually measuring the farm output of

“demonstration plot” farmers to whom SMS-based agrometeorological advisories were also given, and “control” group farmers who followed customary practices and did not receive SMS agrometeorological advisories. Each demonstration plot is of approximately 0.20 ha. Cost figures were obtained from records and by interviewing participating farmers.

- 12 By “farmer specific” is meant, at least that the farmer receives advisories according to the crop she grows, the phenological stage it is in, the broad soil type of the farm and the forecast local weather conditions. While ideally, the specificities of the farm condition like soil moisture, water balance, irrigation facilities, energy sources or whether there is a pest/disease attacks on her farm, etc, should be taken into consideration at the time of formulation of the advisory, at present such a degree of customisation and sensitivity is not technically feasible.

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