

# AGRO-MET

*Weather-based, Crop and Locale-specific Agro-Advisories serving farmers of rural rain-fed regions*

The AGRO-MET, a component of the Climate Change Adaptation (CCA) project implemented in India by Watershed Organisation Trust (WOTR), is supporting communities and local self-governments to use locale-specific climate forecasts and agri-information for decision-making. Agro-Met is a key component, providing a multi-stakeholder learning and implementation platform that is integrated into agriculture planning and adaptation responses. Agro-Met processes facilitate flexible, weather-based agriculture planning and immediate response using forecasts and crop-calendars, and thus enable local communities to adapt to seasonal variability. At the same time it builds evidence and capacities of communities, technical and developmental agencies to undertake planning and implementation of adaptive responses in the face of climate change, for the long term.



## The Context

### **Climate Change & Vulnerable Ecosystems:**

Indian agriculture is monsoon dependent, with over 60 per cent of the crop area under rainfed agriculture that is highly vulnerable to climate variability and change. Climate variability directly impacts agricultural production, water availability, biodiversity etc. threatening livelihood, food and nutrition, and water security within the communities. Agriculture in these regions will be highly vulnerable due to damaged crops, stressed livestock and new parasites, diseases, fungi and other pests. Communities in rural areas region are particularly vulnerable to climate change not only because of their dependence on climate sensitive sectors such as agriculture, forestry etc. but also due to limited capacities to anticipate and effectively respond to it.

### **Need for robust knowledge & technology access:**

Reliability of rainfall is compounded by variations from place to place. Forecasting and making predictions are highly complex affairs fraught with uncertainty. Modern techniques do have means to calculate agriculture-specific forecasts in relation to rains or drought spells during the season. But such forecasts are general and do not reflect local variability. What farmers need is information about local conditions and advice that can help them make strategic and tactical decisions for their farms.

### **Inability of resource-poor farmers to take risks:**

The essence of farming is trying to improve the odds in the gamble against weather, pest, and disease. However, resource-poor farmers have no risk capital and their whole strategy is geared towards safety. Dryland farmers' entire income is often dependent on the vagaries of the weather. This is especially so in India's monsoon-driven weather system where local meteorological conditions, especially rainfall, vary even within a kilometer. An important reason why resource-poor farmers do not adopt new techniques is their inability to take risks. What is then required are advisories that will take into account the weather, the crops being grown, locally available and inexpensive solutions.

### **WOTR's Response**

In order to reduce risks and improve agriculture productivity despite local climatic variations, WOTR has launched a knowledge-embedded service to farmers that provides crop and locale-specific agro-advisories based on weather forecasts and the particular crop growth stage. The advisories focus on environment-friendly integrated solutions that are within the farmers' capabilities.

## An erratic weather creates havoc for the farmers

An erratic weather has been creating havoc for the locals. People in areas which had never before experienced such phenomena did not know how to respond. Their own knowledge systems did not have response-solutions which they could draw upon, leaving them reeling under uncertainty and financial loss.

### Weather vagaries in Andhra Pradesh



Sudden snow and heavy hailstorm in Ranga Reddy district of Andhra Pradesh on January 30<sup>th</sup> 2013, was a rare incident<sup>1</sup>.

### Weather vagaries in Maharashtra<sup>2</sup>



2010 saw monsoons continuing far beyond their usual time in early-October for the Akole cluster in Ahmednagar district, Maharashtra. Data from 9 local-met stations revealed that November saw over 150mm of rain. This unprecedented and intense rainfall destroyed the standing, ready-for-harvest crops. Added to this, 2011 saw an unexpectedly early and unusually heavy onset of the monsoons, with over 100mm of rain in 3 days, leading to disastrous effects on the summer crop. See the video:

<http://youtu.be/oix3rXQyHO4>



Villages in Akole cluster experienced frost in early February, 2012. It was a first-time-ever experience for the people of this region. Standing crops of Pearl Millet, Maize, Beans and Groundnut along with flowering mangoes and bananas dried up and shriveled overnight. See the video:

<http://youtu.be/ZnoRdrXMhJM>



In January 2013 Maharashtra declared 15 districts and over 11,000 villages as drought affected, a carry-over from the inadequate rains in 2011 and 2012. The Marathwada region reeled under a punishingly dry summer and suffered severe water scarcity.

Pic: Pune Mirror, Feb 2013

<sup>1</sup> <http://www.deccanchronicle.com/130131/news-current-affairs/article/chevella-andhra-pradesh-hails-snow>

<sup>2</sup> <http://www.wotr.org/2013/05/does-it-ever-rain-this-time/>  
<http://www.wotr.org/2013/05/summer-freeze/>

## What is being Done and How it works

3 products and processes that are inter-linked have been grounded in the clusters of Akole and Sangamner Talukas of Maharashtra.

### Acquiring local weather data and short range Weather Forecasts

WOTR has installed 69 Automated Weather Stations (AWS) in project villages. These form a dense network grid ranging from 3-5 kms. Of these 69 AWSs, 54 have direct telemetry links to WOTR's servers which send processed data directly to the Indian Meteorological Department (IMD). WOTR has a tie-up with IMD, providing round-the-clock weather information on an hourly basis. The Indian Meteorological Department (IMD), based on this weather information provides WOTR with 3-day weather forecasts for the project area, received online, on a daily basis. Unusual likely weather events such as unseasonal rain, frost or temperature spikes are conveyed directly to the villages either through word-of-mouth, SMSs or a phone call to key informants in the project villages. Besides this, the weather information obtained from the village based AWSs is displayed daily on black boards at accessible places in the village, by village youth who have been trained to read the weather data. This helps inform farmers to actual local weather conditions and alerts them to likely problems that may arise for their farms and livestock.



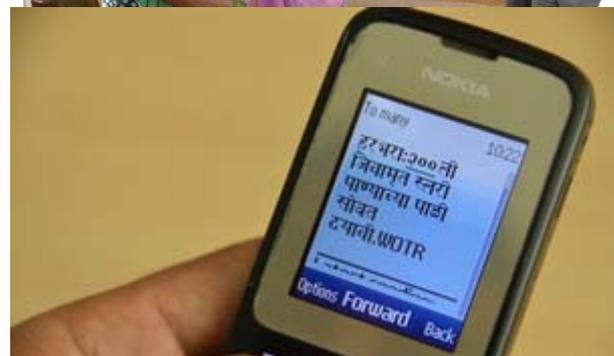
Weather station at Borban village

### Crafting of Agro-Advisories based on Weather Forecasts and their Dissemination

Based on these short-term (3-day) local weather forecasts, agricultural experts from WOTR prepare agro-advisories with inputs from CRIDA and the state agricultural university, the MPKV, with whom WOTR has a knowledge-sharing collaboration. These advisories that are crop and locale-specific include integrated nutrient-water-pest-and diseases management recommendations that stress organic and environmentally sustainable interventions. These advisories are issued in the local language at least twice a week in the summer months and more frequently during the agricultural season, as required, thus alerting farmers and giving them enough time to implement suggested measures. These advisories are disseminated through SMSs to mobile phones, Wallpapers that are put up at prominent places in the project villages and by word-of-mouth. Newer technologies such as IVR (interactive Voice Recording) are being explored to enable farmers who cannot read, especially women farmers, to still access the SMS advisories sent through mobile phone. At regular intervals, meetings are organized with farmers to discuss these advisories and get their feedback. In addition to developing and disseminating "regular" crop advisories, crop-weather-related Contingency Plans for specific crops



Weekly wallpapers displayed at prominent places in the village



Agro-advisories disseminated through bi-weekly SMSes

and agro-ecological zones (in this case the project area), are prepared which will be operationalised before and during the Kharif and Rabi seasons. This would help farmers better respond to unexpected weather event (like delayed onset of rains, dry spells, pest attack, etc), mitigate risks and reduce losses.

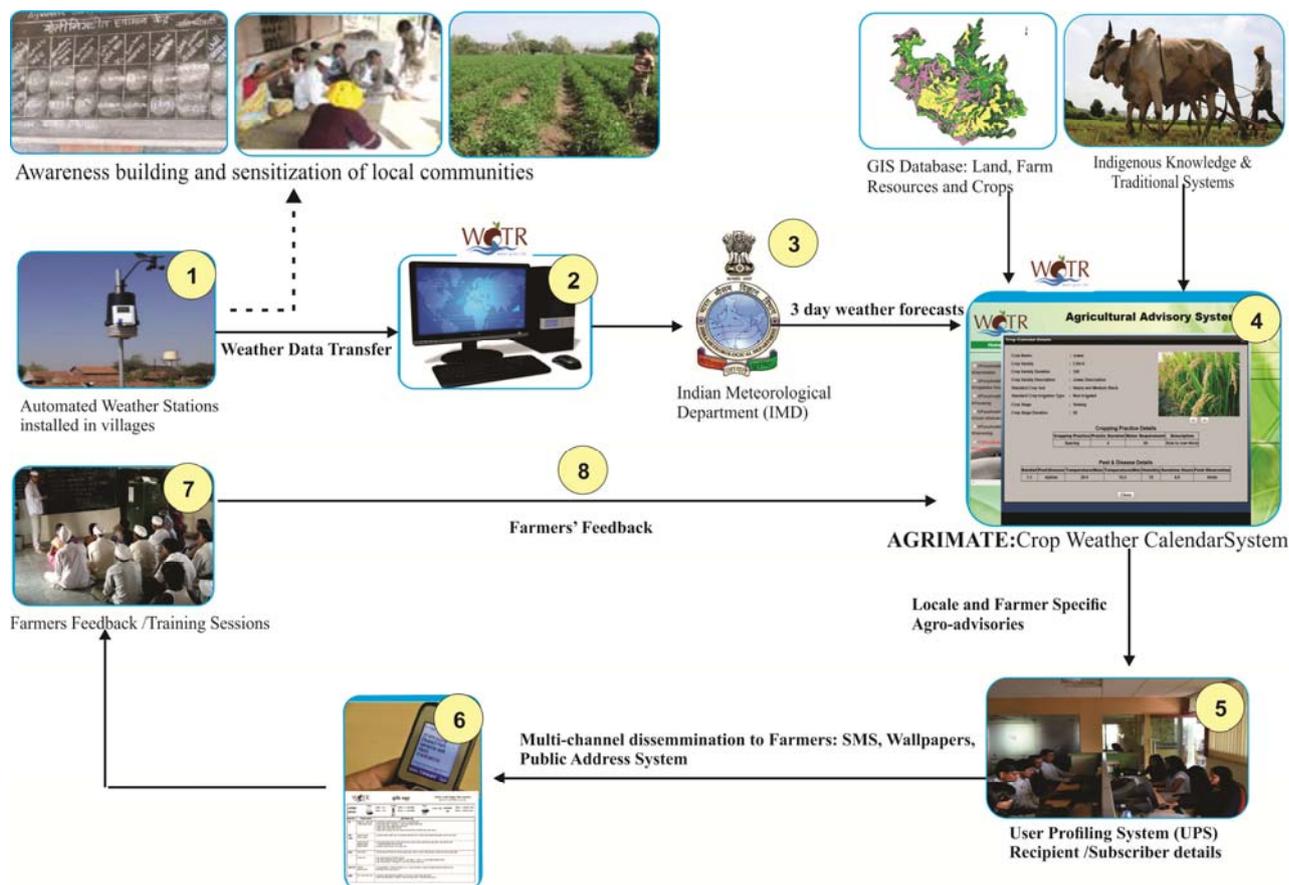
### **AGRIMATE - Automated Content Management System for Agro-Advisory Generation**

WOTR is has developed an IT-enabled, query-driven Automated Content Management System (ACMS) called AGRIMATE that can generate crop advisories for specific crops tailored to local weather and edaphic conditions. This system would also be able to generate contingency plans in response to different meteorological scenarios. In order to generate farmer, location and crop specific advisories, the AGRIMATE is integrated into a GIS-enabled platform which has a detailed geo-referenced data base of each of the participating farmers'. It includes details like crops grown, the land capability, soil quality and fertility status of his/her farm as well as access to irrigation, if any. Besides this, information on traditional knowledge and indigenous practices is also collected and inputted into the system. The idea behind AGRIMATE is to reduce dependencies on high end human expertise, make knowledge management menu, process and indicator driven and obtain a holistic and nuanced understanding of the actual conditions a farmer has to deal with. The system also helps capture feedback from the field, enables learning, knowledge management and better customization and fine-tuning of advisories.

At present such agro-advisories are being generated and disseminated regularly (through weekly wall-papers and bi-weekly SMSes) in the Sangamner and Akole Talukas of the Ahmednagar District, Maharashtra. Efforts are in process to extend it to the Marathwada region of the state as well as to other states, notably, Andhra Pradesh and Madhya Pradesh.



## The Agro-Met System & Process



## An Overview of the Agro-Advisory System at WOTR

<b>1</b>	<ul style="list-style-type: none"> <li>• Met stations installed in project villages.</li> <li>• Village youth trained to read the met-data. Information displayed on boards in public places.</li> <li>• Trainings on maintenance and security of weather stations conducted.</li> <li>• Community sensitized to likely weather impacts and learns to factor in weather in farming decisions.</li> </ul>
<b>2</b>	<ul style="list-style-type: none"> <li>• Hourly local Met-data sent via SMS/ GPRS to WOTR's servers.</li> <li>• Data "cleaned", verified and forwarded to IMD servers.</li> </ul>
<b>3</b>	<ul style="list-style-type: none"> <li>• 3-day village level weather forecasts received daily by WOTR from IMD.</li> <li>• Unusual / extreme weather events forecasts immediately disseminated to villages.</li> </ul>
<b>4</b>	<ul style="list-style-type: none"> <li>• Weather forecasts from IMD fed into AGRIMATE (An Automated Crop Weather Calendar Software).</li> <li>• Indigenous knowledge and traditional agricultural practices of area referenced.</li> <li>• GIS data base of area containing details of farmer-wise land, soil, water, farm resources and crops grown together with socio-economic data</li> <li>• In-house experts prepare weather- based locale, crop and farmer specific agro advisories.</li> </ul>
<b>5</b>	<ul style="list-style-type: none"> <li>• User Profiling System (UPS) matches the advisory with the farmer/ subscriber and disseminates the same through mobile SMSs in local language twice weekly or whenever required.</li> </ul>
<b>6</b>	<ul style="list-style-type: none"> <li>• Multi-channel Advisories Distribution: SMSs, weekly wall-papers in local language and public announcement system (loudspeakers).</li> </ul>
<b>7</b>	<ul style="list-style-type: none"> <li>• On-site technical support, Farmers' Field Schools, farmers' feedback sessions and field investigations carried out.</li> </ul>
<b>8</b>	<ul style="list-style-type: none"> <li>• Feedback looped into the AGRIMATE system, the crop advisories generation process as well as to field extension personnel and specialists</li> </ul>

## Interim Results/ Observations

- Weekly Wallpapers disseminated to 41 villages in Maharashtra reaching an average of 5800 farmers.
- Weather based locale-specific agro-advisories through SMSes have been provided to over 6,500 farmers for *summer/ kharif/rabi* crops in the Sangamner and Akole Blocks of the Ahmednagar District and Bhokardan Block of Jalna District of Maharashtra.
- SMS services have been provided for 10 crops - Sorghum, Wheat, Chick Pea, Onion, Tomato, Groundnut, Paddy, Pearl Millet, Maize and Soybean
- Approximately 8000 plots, covering about 3,500 acres of area, have been geo-referenced and mapped to include details like crops grown, the land capability, soil quality and fertility status of his/her farm as well as access to irrigation, if any
- There have been significant agricultural productivity gains ranging from 30-80% on average
- Costs reductions of between 40-50% which can be attributed to advisories provided on-site as well as through the Wallpaper and SMSs.
- Following agro-met interventions communities have been able to make more informed decisions on their agricultural activities.
- Meteorological forecasts provided generally are for the district as a whole, often, with little local connect. Similarly, agro-advisories provided by agricultural universities are too generalized to be much of much use for farmers. Advisories that consider local weather and farm conditions become relevant to them.
- Since the advisories cover the crops mainly grown in the area and particular to their soil conditions, disease and pests, and are related to the particular growth stage of their crops, they find these useful and the number of those following them is increasing.
- The met-information and the agro-advisories are disseminated in a variety of ways – verbally, through village display boards, through wallpapers, and through local-language SMSes. This ensures that information is available to all. Farmers who have found the information useful and have applied it and got good results share it with other farmers.
- Women farmers who otherwise find it difficult to access extension services or other means of knowledge and information find the intervention particularly useful.

## From the Ground

### Farmer Feedbacks

**Balasaheb Mendhe, Mahalwadi village** grows brinjals this season. Based on the SMS-advisory he applied jeevamrit slurry @ 200 litres/acre and sprayed 30 ml silicon and 45 gms micronutrients for growth and development of fruits. “There is 15% increase in the yields even though it has been an intensely hot summer”, say he.

**Sachin Vitthal, Pimpaldari village** grows tomatoes and was advised to intercrop his tomatoes with marigold flowers to avoid root-knot nematodes. “The attack of root-knot nematodes has been very less this time”, says Sachin.

Such farmer feedbacks are regularly collected every month by the field-extension agronomists and the agricultural experts working with WOTR. A detailed register is maintained of their feedbacks along with their phone numbers. This way farmers are also directly contactable, besides regular feedback sessions on the field, for updates and clarifications, so as to understand ground-realities and improve our own responses.

### Case-Story

#### **Manjula Lohate, woman farmer, Bhojdari village:**

Manjula, a 45-year old farmer, cultivates 3 acres of her land single-handedly as her husband works in the city. She grows bajra, gram, wheat, onions and tomato on her field. She also has a small plot of 30 *guntas* (‘R’s) in which she grows pomegranate. She has constructed a small farm-pond of 10x10 m<sup>2</sup> which she uses to drip-irrigate the pomegranate plot.

She came across the Krishi Salla (the weekly wall-paper) and found it very useful. Based on the advisory given through Krishi Salla, she used mulch on her pomegranate plot. This reduced the evaporation rate considerably and brought down her water use by 50 %. “Earlier I used the drip for 2 hours every day. Now I use it only for 1 hour”, she says.

She also began to use amritpani – the organic fertilizer/pesticide preparation using cattle dung - which has brought down the pest and disease incidences a lot. “I have stopped using chemical sprays on my tomato crop entirely.”

She is also the *first* farmer in her village to see the merits of composting and is preparing 4 tons of compost on her farm for the next season.

Manjula is also part of the group of 15 women farmers in her village that WOTR is now working with intensively. WOTR has taken the Krishi Sallas and SMS advisories further and fortified them by providing farmer-specific extension and handholding services, a need expressed by farmers themselves. Since each farmer has his/her own specific issues related to crops grown, soil conditions, social and economic constraints, they require the last-mile handholding to become completely resilient. Such small groups are being piloted in 2 villages of Maharashtra.

## Key Learnings

1. For the system to work, farmers must be mobilized, motivated and provided with hands-on experiential learning through on-farm crop demonstrations and Farmers' Field Schools.
2. Meteorological expertise and computing power to make forecasts is also required as also expertise in agriculture. Since no single agency is likely to have all these competencies in-house, generating a meaningful farmer-and-results oriented agricultural knowledge management and extension system (that includes on and off-site advisory generation and dissemination) requires multi-stakeholder partnerships involving the private, public, civil and community sectors.
3. Meteorological equipment must be calibrated to acceptable standards and maintained regularly to prevent failure. The challenge is particularly severe in remote rural areas where connectivity is a problem and local conditions can disrupt reliable transmission of data.
4. Appropriate communication using means, medium of language which is locally relevant is crucial for raising awareness, eliciting and incentivizing effective adaptation responses.
5. Since adaptation is local it needs local level climate information, current and future, to enable effective decision-making at the individual and community level. Local adaptive capacities are enhanced when local weather information is analyzed and appropriately communicated.
6. Since field and extension oriented agro-meteorology requires the coming together of high-end technology, local knowledge and on-farm implementation, it is necessary to have professional and field based personnel to facilitate, support and provide on-field guidance, at least in the beginning stages. Platforms must be created where related actors and systems can come together. NGOs can play an effective interface role to enable such platforms.
7. It is important to combine local and scientific knowledge systems not only for empowering communities but also for bringing relevance to scientific knowledge systems.

## ACKNOWLEDGEMENTS

1. This project is part of a large-scale Climate Change Adaptation project (CCA) implemented by WOTR which is jointly financed by the Swiss Development Cooperation ([http://www.sdc.admin.ch/en/Home/About\\_SDC](http://www.sdc.admin.ch/en/Home/About_SDC)) and the National Bank for Agriculture and Rural Development ([www.nabard.org](http://www.nabard.org)). The Swiss Re (<http://www.swissre.com/>) has also contributed towards the agro-meteorology component and the development of the AGRIMATE.
2. Specific to agro-meteorology, WOTR has knowledge and technology partnerships with the Indian Meteorological Department (IMD), the Central Research Institute for Dryland Agriculture (CRIDA) and the State Agriculture University, the Mahatma Phule Krishi Vidyapeeth (MPKV).

## Notes and References:

3. Several video films have been made which are available on U-Tube as well as on the WOTR web site. Specific to this topic, is the video, "Weathering Climate Change"  
([http://www.youtube.com/watch?v=peVD\\_p8pPGo&feature=youtu.be](http://www.youtube.com/watch?v=peVD_p8pPGo&feature=youtu.be))
4. Agro-advisories by way of Wall Papers (pasted at public and frequented places in the village) have been issued since November 2011. Since December 2012 SMS advisories are being provided to 1,800 kharif/rabi farmers and 343 summer crop farmers through. The coverage will be progressively increased.