

Disaster Preparedness using IT Tools: Case Studies on the use of ICT and GIS Derived tools for Micro-Level Drought Preparedness

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I. INTRODUCTION

Drought affects the lives of millions in the semi-arid tropics. The science and technology panel of UN convention to Combat Desertification and Drought (UNCCD) has recommended the adoption of a communication of system that combines top-down approaches with bottom-up approaches and community mobilization, to enhance preparedness that is considered better than relief when a drought occurs.

The Virtual Academy for the Semi-Arid Tropics (VASAT) was born out of this need to enhance drought preparedness among rural families, as they are the first and the worst to be affected by this natural disaster.

VASAT uses a blend of innovative methodologies embedded with Information and Communication Technology (ICT) based approaches to foster drought preparedness through rural knowledge centres. We have been conducting a series of studies for the past 3 years, where we have used GIS-based techniques to forecast micro-level drought vulnerability of villages in Adakkal *Mandal*, Andhra Pradesh State, India. It is situated within the latitudes 16° 28' 28.3" to 16° 41' 1.98" N and longitudes from 77° 2' 47.34" and 78° 2' 46E". There is evidence that this has helped rural families in that area to make informed decision in relation to crop cultivation as well as in the cleaning up of local water bodies to facilitate greater water retention.

II. PARTNERSHIP AT THE CORE: COMMUNITY-BASED WOMEN'S ORGANISATION AND ICRISAT

Adakkal is a block of 37 villages in the Mahabubnagar district of Andhra Pradesh State in India. Adakkal's economy revolves around semi-arid agriculture and livestock. Out of 14616.40 ha of cultivated land, around 11440 ha are cultivated under rainfed conditions. More than 70% of the farmers are small and marginal farmers. Adakkal is in a low rainfall region and its average rainfall was 550 mm, more than 90 percent of it occurring during the period June to October. Similar to other SAT regions Adakkal also depends on livestock. Nearly 70000 sheep, 9000 cattle and 8000 goats are helping the people of Adakkal to survive the vagaries of the local climate. However, there has been noticeable lack of drought coping and support systems in the locality, and, large scale out-migration has become the principal drought-coping mechanism of the people in this area while suicides among the farm families have started to occur since 2004 (Gaharwar, 2005).

The Adarsha Mahila Samaikhya (AMS- the Adarsha Women's Welfare Organization in English) is a federation of all-women micro-credit groups that functions in the Adakkal Block. It has a membership of 5200 women, covering all the 37 villages in the locality. The AMS has been operating in this area since 1994 to address various development issues of rural families resident in the area. The AMS, with the support of the

State Government, sought the partnership of ICRISAT to establish an information-based program to combat drought and to mitigate its impact. The activities in this regard take place under the umbrella of the VASAT project.

III. ROLE OF ICT - BASED TECHNIQUES TO ENHANCE DROUGHT PREPAREDNESS:

ICRISAT, with support from the State Government, set up an internet-connected hub in the AMS premises using a low cost connectivity arrangement and further supplied a small number of PC's to support the local operations. ICRISAT has set up Village Knowledge Centres in eight villages each with its own set of PC's and Internet facilities, and plans to extend this facility to all the 21 villages in the region shortly. The ICT-based hub in their premises as well as the village knowledge centres are operated by AMS rural women volunteers. ICRISAT and VASAT partners provide capacity strengthening support and technical advice. The AMS volunteers maintain hard copy registers of all user queries and the responses on a daily basis.

ICRISAT was engaged in an extended communication appraisal using a participatory learning framework for over a year in 2003-04, to find out the types and strengths of information linkages between various sources and people operating in the area of agriculture in Adakkal block. This study yielded interesting results, which showed, from the points of view of rural families resident in the area, that macro and meso-level knowledge-based development organizations had limited reach with the village community. Mass media, rural development offices of the local government, agricultural input companies etc. appeared to have strong linkages while natural resource management based education and research institutions and local banks had weaker linkages. The strongest linkages were found to occur within the community, which implied that the primary pattern of knowledge transfer was horizontal and between sources with relatively limited contemporary knowledge of agricultural production practices. Input suppliers and other agricultural traders were about the most important source of information. The linkages with the agricultural extension processes were assessed by the rural residents to be generally weak. Market, climate, employment and wages emerged as some the important information needs of the community.

An early realisation was that a spectrum of information services, rather than those covering only the rural production aspects, would be useful to obtain local buy-in into the management of new information services. Secondly, a process of facilitation would be a valuable input in enabling information access by the rural families, whose familiarity with PC-based information systems was extremely limited. Since the start in 2004, ICRISAT has helped the AMS, whose members manage the information hub, in designing a simple and daily information service covering local weather, wages and market information besides providing occasional other

services such as rapid delivery of school examination results. Production-related information was always presented as an auxiliary service rather than primary. The regularity of this wider range of information was essential in rendering the ICT-based information service to be perceived as a reliable source for any information including agricultural production-related information. A structured experiment on varying values of prominence of technology and the intermediary revealed that equal prominence of intermediary and technology has a greater impact on farmer-participants.

SUPPORT THROUGH VIDEO CONFERENCING:

Since March 2007, VASAT has been using a two-way video-conferencing facility provided by the Indian Space Research Organization via the National Remote Sensing Centre to assess changes in the effectiveness of query-responses when a new digital medium is used. Initially the video conferencing was conducted for two hours per week, and from November 2008 we have increased the frequency. During these VC sessions the AMS volunteers are provided with package of practices of different crops grown in their area. The training is provided in Telugu, the local language, with the help of MSPPT presentations and videos. The complex queries that arise in the videoconferencing are noted down and are uploaded on to an online forum (www.aaqua.org), which has features to enable any registered expert to view the queries and answers. In addition to this, experts from ICRISAT give special sessions on new technologies in agriculture.

IV. THE DROUGHT VULNERABILITY ASSESSMENT FRAMEWORK

A method developed at Indian Institute of Technology, Bombay, was adopted as the base for developing the micro-level drought vulnerability maps. This framework uses GIS derived tools to predict the effect of a varying rainfall on the water availability of that region.

This methodology has been refined over the past two years since it was first used successfully during the 2007 *khari*f season in Adakkal *Mandal*, Mahabubnagar District (Dileepkumar *et al*, 2007). Initially, the status of degradation of surface water bodies or tanks assessed in terms of surface area, silt accumulation and encroachment on the reservoir bed. Thematic maps showing the village boundaries were digitized from the geo-referenced cadastral maps that were obtained from central survey office, Hyderabad. GIS was used to develop colour coded drought vulnerability prediction maps from the water deficiency and surplus data that is calculated and put into the GIS database. It is observed that the rural people could easily understand these color code maps.

The micro-level drought vulnerability maps were developed using the water budget method which involves the calculation of water demand for human, livestock and agricultural uses for each village and the water available in the surface water

bodies that is collected from the runoff from the catchments for a range of rainfall. From the above data the water deficit and water available for each village is estimated; this information is further used to develop drought vulnerability assessment for each village. The water deficit and available information is used as input into the database of village map, which is then used in developing colour-coded maps indicating drought vulnerability of villages at different rainfall scenarios from 200 to 900 mm. These maps were developed in such away that the rural person with proper training could easily understand the colours in the map. Red colour indicates the villages that are highly prone to drought, orange and yellow colours also indicate vulnerability of villages to drought but less intensity than the red colour. Green colour indicates that the villages can just sustain in drought situation. These maps could help in decision making at two levels for avoiding the impact of drought. At administrative level the planners can take proper decisions in adopting proper strategies to reduce the impact of drought. Whereas at the village level farmers these maps can help in knowing the drought condition and thus can reduce the impact of drought by choosing alternative cropping patterns or by taking up other employment opportunities.

A: VALIDATION OF DROUGHT VULNERABILITY MAPS

Preliminary studies undertaken on micro-level drought vulnerability have shown that drought vulnerability maps developed have been useful in drought preparedness and even the rural families were good enough to understand the vulnerability with little training. The field surveys and comparison of predicted and observed rainfall have also shown consistent results (Dileepkumar *et al*, 2007, Sreedhar *et al*, 2008). For the validation of the drought vulnerability maps that were developed and the rainfall predictions provided for the season four raingauge stations were established in the Adakkal *Mandal* at Rachal, Timmapur, Janampet and Kandur villages. The rural women were trained in measuring the rainfall and also uploading the rainfall data onto the Wiki-based website (http://vasatwiki.icrisat.org/index.php/Rainfall_2009_kharif) every day in the morning. The predicted rainfall is compared with the actual rainfall of the villages to assess the usability of micro-level drought vulnerability maps in the rural context.

B: DISSEMINATING THE VULNERABILITY MAPS AND FOSTERING DROUGHT PREPAREDNESS:

With the partnership of Adarsha Mahila Samaikha, VASAT actors distributed the vulnerability maps and through face-to-face interactions; they were able to bring across the severity of the drought situation to the knowledge of farm communities in that *Mandal*. These maps were also made available in the village knowledge centres for further reference. This

videoconferencing facility has also been used to foster drought preparedness and to give advisory on cropping patterns and on water and soil management.

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