

The Arid & Semi arid Eco-regions

**Understanding Vulnerability
across the Arid regions of India
through Community
Experiences of Water:
A Rapid Appraisal**

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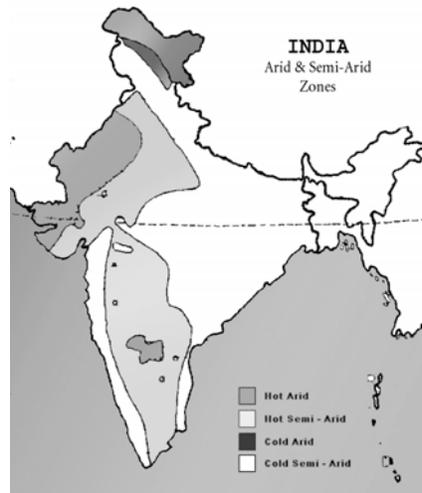
Seventy percent of the crop land of the country falls in the arid and semi-arid regions. These regions face the serious challenge of food security and livelihood for its inhabitants. Water is scarce in these regions. The groundwater table is low, rainfall is scarce and the water run-off is high. Annual rainfall is between 100 and 400 mm or 400 and 800 mm.

The northern arid regions, comprising largely of the desert of Rajasthan, the Rann of Kutch and the semi-arid regions of Punjab and Gujarat, are entirely dependent on groundwater and above-the-ground tanks, ponds, other traditional stores of water. No rivers flow through these regions. The semi-arid regions in the southern peninsula are dotted by rivers mainly fed through groundwater discharges and supplemented by monsoon rains. For the communities, the main source of water is small and medium scale stored water. Tanks and lakes, beels, oxbow lakes, ponds etc. irrigate, albeit unevenly, over 7 million hectares of land in five states of Orissa, Andhra Pradesh, Gujarat, Karnataka and West Bengal. In many areas, the tank is the only water source¹. There are around 120,000 small-scale tanks, irrigating about 4.12 million hectares mostly in the semi-arid southern states of Andhra Pradesh, Karnataka and Tamil Nadu.

¹ "Towards improved performance of irrigation tanks in semi-arid regions of India: modernization opportunities and challenges"; Anbumozhi V., Matsumoto K., Yamaji E.

Communities who are dependent on natural resources and environmental services have been adapting to changes in climate. However dramatic changes projected due to global warming are expected to increasingly adverse impact livelihood and livelihood resources in the arid and semi-arid eco-regions.

We carried out a rapid participatory



assessment of vulnerability to climate change in Chennekothapalli mandal of Anantapur district, Andhra Pradesh and visited Ramgarh region of Sam block in Jaisalmer, Rajasthan and Komna block in Nuapada district of Odisha,. These are representative of dry, hyper arid and semi-humid regions respectively. The assessment was conducted in collaboration with local civil society organizations. The assessment considered community perception and experience relating to changing climate and vulnerability in discussion groups

at the community level as well as collectively. These were supplemented by field transect with community representatives and triangulation between community representatives, field personnel of the CSOs, and review of secondary source materials. The focus of the study was to understand vulnerabilities of the livelihood related resource base and showcase community practices. This report focuses on 'water' and its implications for climate change policy and practice.

Anantapur

Anantapur district in Andhra Pradesh receives around 500 mm rainfall annually. The rainfall varies considerably from year to year and season to season. Prior to the 1960s, rainfed farming in this region was

primarily for meeting domestic consumption of the farmer and the demands of the local market for food and fodder. Minor millets were grown as the main crop in most areas in the district. Pigeon-pea, castor, sorghum and groundnut were grown in small patches. Groundnut was primarily a condiment and for oil, which was extracted using traditional bullock powered mills. The variety of groundnut cultivated in the 1960s and early 1970s was a traditional runner variety, which required about 150 days for maturity. About four decades back repeated crop failure due to erratic rainfall was one of the factors forcing farmers in Chennekothapalli mandal and other parts of the district to shift from a millet-pulse and oilseeds mix of cropping system to groundnut cultivation in their rain-fed uplands. The variety TMV-2



Leasing out his farmland, Mutthialu now herds sheep Mustikovila village, Chennekothapalli Mandal, Anantapur



Chinnapa and the bare ground-nut fields where all trees and vegetation are cleared

was introduced in the region in the early seventies and by the end of the decade, the bunch type groundnut replaced the runner type completely. At present the TMV-2 variety dominates the landscape.

Shift away from Agriculture

Now the small scale farmers are once again reconsidering their livelihood options, while the trend is to opt for ground water based farming.

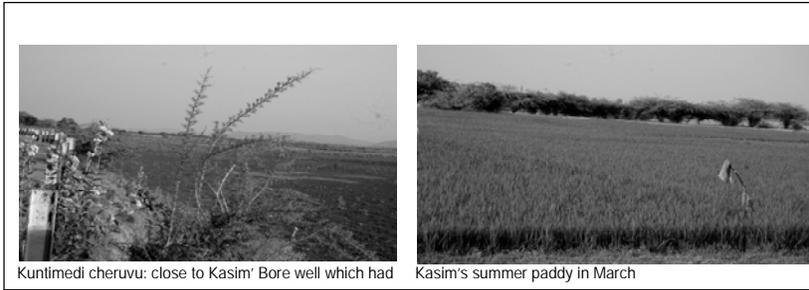
We met Mutthialu from the Boya community. 80% of his village, that is 372 households, are from his community of farmers. Mutthialu is frustrated with the repeated crop loss due to erratic rainfall and has given his five acres of land on lease. 'Rain-dependent farming is not dependable', he observed. He now prefers to herd sheep.

Sheep rearing has emerged as an alternative or additional source of income to help absorb the risk from crop failure. In nearby Koggira village for example, most of the 230 households of Goala community, who were farmers, have taken to sheep

rearing for additional income.

Community members estimated that currently there are about 4500 heads of sheep, an increase of nearly 25% over two years.

Chinnapa from Musthikovila village, who now works as a community forest guard shares his experience with ground- nut farming. He used to grow rain-fed groundnut in all his 5 acres of land. Last year (2011), his ground nut crop was a total failure due to deficit-rain. Chinnapa, who uses pesticides and fertilizer, had invested Rs. 10,000 but got back only 500. A good crop would have fetched him around Rs. 25000. He had also planted some millet, but that also failed. Chinnapa observed that for the previous 8 years except in 2007, the rains started a month late in mid-July and ended end August. Chinnapa, who lives with his 3 sons and their families, is now focused on collecting seeds of trees for dibbling before the next coming rainy season so that the forests can be regenerated



Nagaraju (34) of Kogirra village, a volunteer in a community forest protection committee also felt 'it has become tricky to depend on land based farming'. His wife works as daily wage labourer and earns between Rs. 100 & Rs. 150 per day depending on availability of work. He gets Rs. 3000 from the community forest protection committee. Their family of five including two children has 2.8 acres of up-slope

land. For the last two years, 2011 and 2012, they have kept their land fallow and feel that they have most probably saved what they would have had to invest in cropping. Like many others in the state, they have abandoned growing food as it is more profitable to rely on the one rupee rice scheme. Under the public distribution system they get 35 kg rice @ Rs. 1/kg, 1 litre palm oil @ Rs 45, 2 litres kerosene @



Venkata Narasiamma in her farm – no water in farm pond, nor in the bore well, orange intense heat and lack of water



Rs 15 a litre and 1 kg Sugar @ Rs.14. Nagaraju is now planning on sowing castor, as it fetches about Rs. 3800 a quintal and he expects a yield of 12 to 15 quintals from his land in a normal rainfall year. He feels that castor is not eaten by cattle or destroyed by the wild boar in the area, which the impact of variation in rainfall is much less than for groundnut.

Access to water reduces vulnerability but...

Despite the scarcity of rainfall, the brown of landscape Anantapur in summer, is dotted by small islands of lush green summer paddy, thanks to irrigation bore wells. .Kasim of Kuntimedi village grows paddy twice in a year in 4 acres of land. He had sunk a bore well upto a depth of 150' in 2000. Kasim admitted that the 'bore' is on auto mode, which means that it runs whenever there is current about 7 hours a day. Thus he is able to get a yield of 33 quintals per acre in the Kharif season and 28 quintals per acre during Rabi. Recently, despite being situated just behind the Kuntimedi cheruvu , which is a huge water harvesting structure, he has had to

deepen the bore-well to 200' as the well ran dry post monsoon.

Drying-up of irrigation bore-wells has emerged as a major vulnerability for the marginal famers who have at great expense have opted to dig bore wells in order to improve output. Often they have to watch their crops dry up before their eyes. Venkata Narasiamma of Venkatapalli village, is one such victim. She belongs to a dalit community and is secretary of Kalpataru Sangham. She owns 3.30 acre land, little away from habitation. In 2008 she planted 60 Sapota, 48 mango and 220 orange trees, using organic methods. Two years later, she sank a bore-well upto a depth of 150' and installed a drip irrigation system at the cost of Rs. 65,000/- because of support from the horticulture mission. She has been also been inter-cropping varieties of crop and vegetable during the rainy season. .Last year (2011), for the first time she got a harvest of mango and sapota. She earned Rs.17000/- from fruits, Rs.500 from vegetables along with a yield of 2 quintals of groundnut and half quintals of wheat and ragi. This year, she had pinned her hope on Orange



but unfortunately, all the 220 fruiting orange trees started dying towards the end of February as there was no water in the bore well. The reason: there are seven other irrigation bore wells belonging to big farmers within a half kilometer radius. The depth of these bore-well are between 200 and 350 feet, Narasiamma says that she cannot afford to deepen her borewell.

Takua neelu ekua boru

During the discussions, community members estimated that the number of bore well in the area had gone up from about 40 bore wells at depth between 80 and 100ft, to about 300 where the minimum depth is about 300 ft, in 6 to 10 years. They said that there was a clear trend of absentee owners setting up huge commercial orchards in the dry lands of Chennekothapalli. mandal of Anantapur. The 100 odd acres of orchard on the way to Koggira has 13 bore wells at depth of 80- 150'. All the bore wells operate for 7 hours a day that is during the entire daily electric supply.

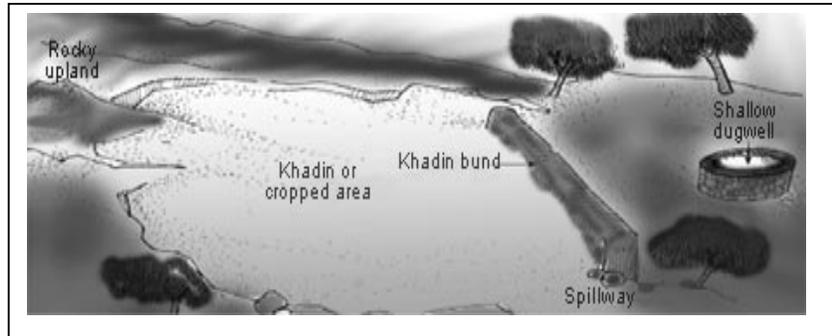
Aspiration for double cropping despite of deficit rainfall

Encouraged by subsidized electricity at the flat rate of Rs. 20 per month, and the promise of good returns, farmers aspire to sink irrigation bore wells, even when they can scarcely afford it. For instance, Odi Chinnapa who has five acres of land in one patch along the tar road to Ventakatapally village, recently invested about Rs. 1,00,000/- on one irrigation bore well at 250' by raising a loan from relatives. His plan is to grow

groundnut in 4 acres and summer paddy in one acre.

'Takua neelu ekua boru' (little water, bore wells aplenty) is the expression used by the community in Koggira to describe the situation. Paddy is cultivated only in low land with irrigation. It is no longer cultivated in medium uplands, due to water scarcity. It has been replaced by ground nut. Due to scarcity of water, farmers are installing sprinkler system which irrigates two and a half times the land than tradition flow irrigation. The Koggira community also shared the experience of Teepamma, to demonstrate farmers desperation to have a dependable source of irrigation. Teepamma of Koggira village had been sharing water from a bore well, which she sank in 1998 with two others to grow mulberry. She wants to have her own bore well. She has tried at seven locations in her land without any success, and has run into debt to the tune of Rs. 30000/-.

Excessive extraction of water, by those can afford to have borewell and then deepen them, is a major contributor to groundwater depletion, a condition which is likely to get worse under global warming. Nonetheless, having own source of irrigation through borewell is a necessity to keep the farm based livelihood alive particularly in climate changing era. However in absence of any regulation at the community level or by the state, local farmers feel that this practice is already



threatening to cause irreversible damage to the ground water reserves.

Wisdom and community management matters

Anantapur could perhaps learn from those in Rajasthan, where there is a rich tradition among communities for developing and conserving water resources. Traditional wisdom in water harvesting and optimum utilization is best showcased in some of the indigenous systems witnessed in

Ramgarh region of Jaisalmer, Rajasthan, where communities are able to grow multiple crops of wheat, mustard, pulses, oil seed or guar with just 50 to 100mm rainfall.

The *khadin*, for example is an ingenious construction designed to harvest surface runoff water for agriculture. It is a sort of temporary lake. A long (100-300 m) earthen embankment is built across the lower hill slopes below gravelly uplands. On two sides, a ridge (*pa*) is raised.



A bumper crop in a desert! On a Khadin



Gupteswar standing near a tree which yield NTFP & Flat Beans: Little water & land; sizeable income

Suices and spillways allow excess water to drain off. The pal of the *khadin* is called *dhora*. The length of the *dhora* depends on the influx of water. Many *khadins* are about 5 to 7 kilometres long.

The *khadin* system is based on the principle of harvesting rainwater on farmland and the subsequent use of this water-saturated land for crop production. The water flow during the rainy season are held in the *khadin*, the water slowly dries up but it humidifies the soil within the *khadin*. The humidity of the soil allows for wheat and other crops to grow.

Similarly, *kuin* or small well is a system of water harvesting for drinking .Unlike

the common well, which is dug to tap the water table, *kuin* collects rain water soaked in the sand. In the desert, from place to place, beneath the surface of the sand, at a depth ranging from 10 to 60 feet, there are layers of gypsum, which stops the water from percolating to the salty water table below. The rainwater is trapped between the sandy surface and the gypsum layer. It then spreads as a humid patch which does not evaporate completely due to unique nature of sand. Thus every single drop which falls in this region penetrates the sand and is transformed into humidity. When a *kuin* is dug, a little clean water filters into the cavity from the surrounding sand. By tradition, the community observed discipline in



Kuin (berian): water harvested from humidity trapped in sand above the gypsum layer (Hema village, Ramagarh, Jaisalmer)

extraction of water, and collects on what they need for drinking.

Pragmatic use of rain water: small is enough

"It is possible to get good income from few showers of rainfall if farmer understands and uses it rationally", says Gupteswar Majhi of Danjhola village. Komna block in Odisha. Kankada (spike gourd) and shimba (flat bean) does not require much water. Farmers like Gupteswar Majhi gets about Rs. 20,000 from 200 clusters selling at around Rs. 30 per kg from half an acre of land. The creeper dies after September and again sprouts back from the rhizome in July following the initial rains and the spike gourd is harvested over 10 weeks in August and September. No irrigation is required and intermittent rain in July is sufficient for the crop. Similarly, flat bean does not require irrigation and can generate income of upto Rs. 6000 for 50 plants. These plants are sown in the uplands and planted on ridges and tended with support sticks.

These random examples of peoples experience with water in the arid eco-regions indicate that development and policy and programme planning lacks the creativity and determination to tap into such resources.

Rural people in drylands have evolved, over centuries, suitable land use and management systems of farming, pastoralism and animal husbandry and often rely on a combination of rain-fed agriculture, livestock rearing and other income generating activities to sustain

themselves. Families also create buffer stock of crops or liquid assets, and the use credit as means for survival during the lean times.

Adaptation to Climate Change

Meanwhile Climate Change is upon on. What is the strategy for small and marginal farmers, 90% of whom are dependent on rain for their crops. Modernity has looked at this dependence as backward, and has promoted subsidized irrigation, green revolution, GM crops etc. Despite the thousands of crores spent on fertilizer and other subsidies, farmers are increasingly in debt and despair. Now we learn that the method of cultivation produced has increased carbon emissions which has led to climate change – one of whose impacts is the further reduction in availability of water, and more erratic rainfall.

Sooryanarayan of Mallenipalli in Anantapur summarized the situation. He says "My father used to cultivate paddy on this land, as we are in the tank shed area. We then shifted to groundnut, as that was the commercial crop in the district. For the last two years, due to uncertainty of rains and whether we have shifted to multi-cropping and crop rotation – one year Jowar and the other year Castor. And with the Castor crop we grow alasandra or red gram. We are cultivating anumulu, alasandra, kandi, amudam, jonna, saja. Each one of us four brothers select one crop. And every year we change.



Venkat & his wife, at the edge of their Palekar model Plot

Sooryanarayan's father told us that this was exactly how they used to do farming in his days. The inputs were local, and the crop of a range of coarse grains consumed locally.

In the same village a poor family, Venkat and his wife has adopted the Palekar model on a small 36 by 36 feet plot. He practices complex intensive vegetation thereby increasing productivity and efficiency of resources. It is a mix of short term and long term crops. Some are horticultural plants, others vegetables and different varieties. The plot is lined and interspersed with mango, drumstick and custard apple trees. The planting is done in such a way that the farmers gets a continuous seasonal flow of produce, both for consumption and for the market. The fertility of the soil also increases.

A version of this model is being practiced by the Mottam family in Kudurpi. It has worked well for them as they have a regular market in the village and they are able to send out small amounts of different vegetables,

every week, thereby ensure a regular income stream. In addition the Mottam family has now started adopting NPM (Non-Pesticidal Management) practices. Such intensive practices are possible when self-labour is highly valued and used instead of machines. The Mottam model promotes low external inputs, uses the available water efficiently, and maintains the soil and environmental resources.

In the neighbouring mandals of Chennekothapalli, Roddam and Ramgiri, Dharani is an effort promoted by Timbaktu, which seeks to revive traditionally hardy and suitable crops, and develops the forward linkages right upto the market. Says Srinath, an organic farmer "we are not properly 'feeding' the earth. We should have our own seed so that we can take up sowing in time". H Obulesu explains that under Dharani, they use native seeds and the native breeds of animals. Soil health is restored with organic manures. The government on the other hand actually discourages us by subsidising chemical fertilizers and pesticides.

While these solutions have been taken forward by NGOs like the Centre for Sustainable Agriculture, the government in its sustainable agriculture mission, would still promote at the larger level modern agriculture and pin their faith on bio-technology, particularly GM crops. There are good economic reasons for this, one of them is the mainstream monetary system on which modern economics rests, will not

work if more and more of us, managed a low carbon lifestyle of subsistence and localization.

Dr. Sheshagiri Rao, an agricultural Scientist, who is also a practicing farmer, in Pavaguda in Karnataka, another semi –arid region, says “people in the semiarid region are used to climate variability and we have always lived with climate variability, variability in rainfall and variability of temperature. You don’t need a special adaptation to climate change itself. What the small farmer cannot take, is a hit in production. He therefore hedges his income, from other sources. For the farmer, adaption at the farm level itself, means that he must go in for diversification.

Diversification

While talking about a livelihood approach, development planners and NGOs tend to think of farmer remuneration or sustainable agriculture within the same economic paradigm as that of a factory or other unitary systems. They look for that one project which will give their clients a big income. However local rural people have plural strategies to cope with drought and climate variability. The farmer in semi-arid regions spread their survival bets by taking to other activities like sheep and goat rearing. It is largely a form of gathering requiring little external investment. From the farmer’s point of view, he invests only his labour. Because of the low cost involved it is highly profitable, and most of the

surplus generated is directly consumed.

Other similar activities are cattle rearing and poultry. Fishing in local lakes, tanks etc is also an option. However many are losing their livelihood due to non-filling of the tanks and the loss of babul (*Acacia*) trees in the tank bed areas, which are source of nutrition for the fish in the tanks.

Another contributor to income in semi-arid regions, wage-labour and remittances from migrant labour, are trees. Despite their shortage, there are still trees (tamarind, mango etc) in revenue as well as *gaathan* lands in semi-arid regions like Rayalseema. The tree owners are not very efficient in handling the produce. So many of the small farmers take these on annual lease and they get a big margin out of it. Others process non-timber forest produce, like brooms, boda grass, limestone etc. A fifth income earner is craft. Others are involved in weaving, mat making and like.

Thus when we talk about a livelihood approach to adaptation, it must certainly mean how the diverse organic linkages can be nurtured and maintained – rather than find one fixed project for each group, which end up making them victims of a larger uncertain market. However as the mainstream cash economy penetrates the countryside, the traditional adaptation strategies are less able to insure the people against prolonged dry spells and erratic rains.

Bio-diversity & food security

Inter-cropped and traditional varieties have much more chances of surviving a bad and erratic monsoon and allow the farmer to be secure in his basic food needs. Crop diversification and intercropping systems are a means to reduce the risk of crop failure due to adverse weather events, crop pest or insect attacks. But these systems are most suitable to small farm, labour-intensive subsistence farm economies. Studies have shown that households whose consumption levels are close to subsistence (and are therefore vulnerable to income shocks) devote a larger share of land to safer, traditional varieties of rice and castor than to riskier, high-yielding varieties and spatially diversify their plots to reduce the impact of weather shocks that vary by location. However such an economy which has been dis-incentivised by absurdly subsidized rice (two rupees rice scheme) from irrigated large farm economies as opposed to say minor millets and other coarse grains.

The concern is that, despite the mandatory noises favouring sustainable and rainfed agriculture by the powers that be, traditional seed banks of hardy crops, traditional manures and pest management tools are slowly disappearing. They are giving way to one-stop shops of agricultural inputs and finance promoting mono-cropping of cash crops like groundnut, sunflower, etc. Further, the low carbon footprint practices are disincentivised as the rules

of seed subsidy and seed certification favour externally produced seeds and absurd subsidies for food, with no compensation to farmers who are growing local hardy varieties.

What is evident is that people have different strategies to cope with idiosyncratic shocks. However, they are less able to insure themselves against aggregate shocks. Adverse weather, in the form of prolonged dry-spells or delayed have considerable negative effects on the harvest yield. These are shocks that affect everyone in the local environment and are therefore harder to diversify locally ('Weather Insurance in Semi-Arid India'; Helene Bie Lilleor et al;) and thus impact the lives of the people much harder.

To conclude, local wisdom and dynamics are seldom factored into policy and programme formulation. With advancement of technology particularly small, micro and nano technology, it is possible to design for varied micro-environments even at the panchayat level. But it is can only happen when different agencies working in a particular eco system work in synergy. You cannot have some people bore deeper wells and grow paddy, over the same aquifer when someone else is struggling to grow minor millers. Nor can you continue supplying subsidized power, when it is being indiscriminately used to empty out aquifers.

