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NEW RELEASES

Biodiversity and Adaptation to Climate Change

There are various drivers of degradation those are adversely impacting the ecosystems and in turn affecting ecosystem services. Ironically, the growth economy and unsustainable policies are leading to erosion of the very base - biodiversity and ecosystems. Ecosystem-Based Adaptation (EBA) is an emerging approach that works with nature to help vulnerable communities build the resilience of their ecosystems and livelihoods that are being threatened by climate change impacts. This approach expects to generate significant multiple benefits social, economic and cultural.

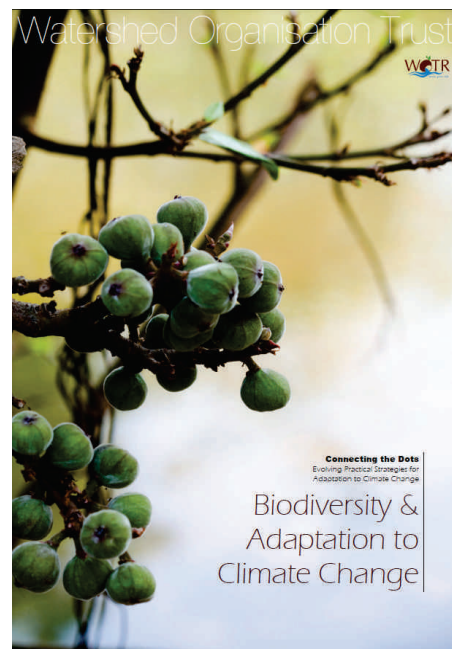
This position paper explains WOTR's proactive ecosystem based adaptation strategy crystallized from the ecosystem management and conservation work carried out in different states.

Participatory 3-D Modeling for Climate Change Adaptation in India: Experience, Guiding Principles, Future Opportunities

Although participatory mapping for development is not a new concept, the application of geographic information technologies (GIT) at the grassroots level, especially for indigenous peoples, has only emerged in the last two decades. Participatory Three-Dimensional Modeling (P3DM) a participatory Geographic Information System (PGIS) is a method that attempts to convey indigenous experience and spatial knowledge in a digital form that is communicable to researchers and policymakers, theoretically empowering indigenous communities with a voice in the legislative planning and management of natural resources. Through the construction and demarcation of a geo-referenced, scaled relief model, Indigenous communities can extract and display indigenous knowledge in a way that is meaningful not only for policymakers and academics but also to the communities themselves.

P3DM was conceived in the late 1980's in Thailand, and has been adapted and applied by WOTR in the last couple of years in its Climate Change Adaptation (CCA) project.

This manual provides important guidelines for the implementation of Participatory 3D Modeling (P3DM).



Participatory 3-D Modeling for Climate Change Adaptation in India: Experience, Guiding Principles, Future Opportunities



Prepared for the Watershed Organisation Trust (WOTR) by Virginia Batts,
in collaboration with Sushil Bajpai and Rajesh Rajak

June 2012



EDITORIAL



Rural communities face the daily reality of resource insecurity - a combination of scarcity (insufficiency inaccessibility and unavailability), vulnerability (weakness subject to damage and hazards) and stress (use exceeds availability). It is a very real condition of everyday life that relates to the communities' reduced ability to cope with, anticipate and recover from any further detrimental impact. This vulnerability is further stressed by dependency on an uncertain climate, volatile globalised markets, and unsupportive degenerated ecosystems.

This is especially so for agrarian communities as well as communities dependent on them for their livelihood, in the semi-arid regions that are particularly vulnerable to water scarcity compounded by climate vagaries. A vulnerable agriculture has far reaching, rippling impacts on global food-security as well. A sobering thought, indeed.

Since vulnerability is not an intrinsic characteristic of a particular human, group or system, it cannot be understood irrespective of specific temporal, spatial and cultural contexts. It also cannot be addressed with piecemeal, sectorial, governance, infrastructure, management, economic and development initiatives.

WOTR has been attempting to address these agricultural issues through an innovative strategy that combines agro-meteorology, promotion of agricultural practices that conserve water while improving soil health, and judicious water budgeting and crop planning that makes every drop count. The results have begun to come in now.

Read on to know more... and yes, we will happy to hear from you of your own experiences as well as any feedback you may have...

- Radha Kunke
Editor

AGROMET

Dry land farmers live dangerously. Their entire income is often dependent on a single season - the unpredictable Indian monsoon. A failed crop affects not just these farmers but also has dire implications for the landless poor. Being dependent on farmers and their ability to provide earning opportunities, an uncooperative climate means migration and disrupted families for them.

But in India's monsoon-driven weather system, local agro-meteorological conditions, especially rainfall, vary even within a kilometre; and distantly located weather stations at taluka places are not able to provide accurate data that can generate locale-specific knowledge. Also, most indigenous knowledge about weather predictions based on observing surrounding flora and fauna, is now lost.

The aim of the Agro-meteorology component of WOTR's Climate Change Adaptation (CCA) project is to improve agriculture productivity despite variations in local weather conditions.

Automated Weather Stations (AWS) have been installed in the project villages and simultaneously, interested youth in the villages have been trained to read the met-data and display them on daily weather information boards installed at prominent places in the villages. This helps people be informed about local weather conditions like rainfall, temperature, humidity, wind speed etc.

There is also an automated online platform that uniquely combines locale-specific Met-advisories and Agro-advisories that provide timely information to farmers so that they can plan their agricultural activities accordingly.

WOTR has also tied up with the Indian Meteorological Department (IMD) for regular 3 day weather updates, received online, which are relayed to the field through SMS and word of mouth too. This is indeed an instance of application of advanced technology to solve issues in remote villages.

Thus armed with local weather data, the local community understands and uses weather information for agriculture planning and management. WOTR's Agro met stations empower through knowledge generation at the local level to regenerate rural capacities and build resilience to climate change.

'Will it be a good monsoon or not?' is the burning question of climate- dependent, rural communities. In the given scenario of an often errant climate, this question becomes cause for much tension and agony and in case of the wrong weather, much financial loss too.

The eternal adage, forewarned is forearmed, is very much applicable in this situation. If only farmers would know when and what to expect...



The image of Indian Agriculture has become rather stereotypical - the poor, thin, debt ridden farmer begging the skies for rain, the suicidal Vidarbha farmer or the rich sugar baron / zamindar. Older people in the village complain that the younger generation is now least interested in tilling the land. They all would rather go in for a city / government job. The future of India as a predominantly agrarian society is no longer such a surety, given the uncertainty of the 'field'. GM foods, subsidised chemical fertilisers, water logging and salination of soils, madly fluctuating market prices of agricultural produce, grain rotting in godowns, a poor public distribution system are the other side of a now strongly critiqued Green Revolution. While all this and its variants exist, there is more.

So, here is bringing you some good news from the Agricultural Sector, for a change:

TRADITIONAL RICE VARIETY: **DHOBAL**

In Sattechiwadi village, Sangamner, some farmers practice paddy in the Kharif (Monsoon) season. These farmers have very small fields (less than 4 acres) in the main drainage line of village, which get flooded for a few days in monsoon season. Due to this they cannot take any crop other than paddy. Usually they sow a traditional variety of rice called “Dhobal”. This variety has two cultivars one is white and the other is red.

2 cultivars: White & Red

Resilience Special Power: Survival in high / scanty rain

Production: 600- 1000 kg / acre

Maturing time: 130-140 days

Used in: Daily meal of farmers, Kheer (porridge), SarBhat (Curry Rice) or Masala Bhat (Spicy Rice)

Sustainability quotient: High

Farmers use organic manure to grow this variety. They use traditional seeds every year.



Red cultivars

White cultivars

ANDHRA PRADESH

System of Crop Intensification (SCI)

Following the successful implementation of System of Rice Intensification (SRI) - a method of cultivating rice using scientific but sustainable methods – WOTR has gone on to introduce this modified method for other crops too. Crops like maize, vegetables, groundnut, sunflower etc. are productively grown by this method, called System of Crop Intensification (SCI). This is a move to promote low external inputs, increase land productivity, use of indigenous seeds, and reduce cost of cultivation. It involves promotion of agricultural demonstration plots, vermi-compost pits, training farmers on better practices of transplantation, crop geometry (spaced planting), soil and manure preparation, correct tillage operations, seed treatment, better sowing methods etc.

JALNA, MAHARASHTRA

Farmer Field Schools (FFS)

Under its PPCP (Public Private Community Participation) initiative, in May 2011, with the help of the Agriculture Department, WOTR started Farmer Field Schools to guide farmers mainly for their cotton crop, from the very first stage onward, right from preparing the land for sowing to harvesting the crop, sometimes even the marketing of their produce.

Farmers also responded whole heartedly with genuine participation. They not only followed all the instructions diligently but also developed an insatiable appetite for more information. Like children learning the alphabet, they assembled every week to learn the basics of agriculture and have doubts resolved. They even brought insects and pests from their fields to the 'classroom' to discuss whether it was beneficial or harmful to the crop and how to deal with it.

“Every Tuesday at 9 in the morning, we had our FFS classes. There, we were taught all the basics, just like we are taught the alphabet in school! We had no idea what was a bed, what was drip... We are working on setting up a processing plant for our turmeric crop. I would like to tell the young generation even with only 2 acres of land one can earn more than from a job. But they have to use this new technology in organic farming and try to set up an ancillary agro- business. Then their progress is in their own hands.”

- Samadhan Bhika Raut, Farmer-
Malkheda, Bokardan

“Without soil testing... our situation was like... as if, one is suffering from TB but taking medicine for some other illness. The illness never got cured. In spite of being a farmer for so long, I didn't know what to do to increase the productivity of my land, which fertilizer and how much to use. The trainings about farm bunding, drip irrigation etc. were also really useful.”

- Narayan Namdev Ghodke,
ex-Sarpanch- Malkheda,
Bokardan

"... Government officials had never come to our village before. The banks which never even allowed us inside their offices are now ready to give us loans for drip irrigation. FFS has shown us the way ahead.”

- Kadoba Narayan Lahane,
Lead Farmer- Mhasrul,
Jafrabad

“This year, the rainfall was much less than expected. We thought we will have a really bad crop. But to our surprise, it was as much as last year's, when we had actually had a good rain. We are not sure, but we think it is because of organic fertilizers and farming methods. Something gets retained in the soil and the yield is good.”

-Ramesh Dabke, Farmer-
Malkheda, Bokardan

FFS is an effort toward bringing new technological advances in organic and sustainable agricultural practices to the grassroots. It aims at achieving maximum yield at the least cost to farmers, while also keeping in mind the long term sustainability of their lands. Through FFS, the community has been able to increase the productivity of their agricultural land, significantly reduce their expenditure on chemical fertilizers and increase income from agriculture. A key aspect of FFS is a move towards informed sustainability- stressing on organic fertilisers and soil health after soil testing with use of appropriate soil nutrients.

The uniqueness of FFS is its integrated nature, combining private funds, technical expertise from government and universities and NGO facilitation. The technical support is given by the Government Agriculture Departments at District and Taluka levels. The programme is facilitated by WOTR. Activities like Capacity building, community awareness and mobilisation and management are funded by ITC Ltd. Resource persons and experts from places like Krishi Vigyan Kendra, Kharpudi, Jalna (KVK) and Badnapur University Agriculture Research Centre, also lend their valuable inputs.

Also, this is now an effective platform which farmers can use to avail information about relevant schemes and also for the overall development of their villages. FFS also has a very strong social impact by being open to all levels of farmers and bringing them together as a group with common concerns. The farmers have now realised the potential of coming together as a group.

DHULE, MAHARASHTRA

The Village Development Committee has been given the reins of running an unusual bank – **Agricultural Equipment banks.**

The Agri-Equipment bank has all farm implements – weeders, howers, sprinklers, sprayers, threshers etc. These can be rented by the farmers at pre decided rates on first come, first serve basis. This ensures that even small, poor farmers get access to equipment which otherwise they would never afford to buy. This money from this goes back into a common maintenance fund to repair and replenish the stock.

We at WOTR look toward dynamising the field of Agriculture and making it truly viable and sustainable in today's day for farmers in all our project areas. This might seem an impossible dream but well, to quote John Lennon, "You may say we are dreamers, but we are not the only ones..."

“The situation today is such- too much competition in other fields and less yield in agriculture. So the youth today is drawn more and more to the cities or turns to addiction in frustration. It is the dream of our group of 10-12 farmers to set an example and guide other farmers in our area. Guided by FFS, we now harvest 3 crops from our lands. Experts from WOTR gave us excellent guidance for our ginger crop and our yield has increased from 60-70 quintals per acre to 100-150 quintals! In the ginger market, the traders used to give us very less. We toiled and they earned the profits. Now, our training is oriented toward getting maximum profit for farmers. We also have a dream to set up a processing unit, possibly with the help of NABARD and export our products.”

- Madhukar Mirje, Farmer and Wasundhara Sevak- Malkheda, Bokardan

KRUSHISALLA: AGRO ADVISORIES FOR FARMERS

A few months ago, the people of WOTR's project villages saw a large paper with advice on farming adorning walls in prominent places in the village. This paper was not largely ignored or casually torn/ spat on like the usual advertisement, political and cinema posters. Farmers in all the villages actually started reading it, not immediately trusting it, but observing the truth in its weather forecasts.

This was WOTR's KrushiSalla (Agro Advisory) and it passed the farmers' examination. Mostly the weather forecasts, related to rainfall and temperature were proving to be correct. KrushiSalla contains: weather forecasts at the Tehsil level, some remedial measures to minimize any impending harmful impacts of the weather on crops, and Agro advisories based on local weather conditions, prepared by in-house agricultural experts from WOTR. The advisory is given a week in advance, thus giving enough time to implement suggested measures. It stresses on organic and sustainable methods and also contains some marketing advice. The final aim is to help farmers take informed decisions.

So the next step was to actually take those decisions; act on the given agricultural advice. In a country where agriculture has been practiced for more than 10,000 years, it is not easy to change farming methods. There is immense peer pressure, self-doubt and a potential risk of crop failure. But many farmers, especially the young lot have come forward and decided to follow the KrushiSalla.

Annasaheb Dongr, Bhojdari made up his mind to plant maize following the advice given in the KrushiSalla.

Accordingly, he increased the distance between two sari (furrows) from 2 ft. to 2.5 ft. and the distance between two plantlets to be 1.5 ft. instead of 1 ft. He then used urea and super phosphate. He feels his yield has certainly improved this year, compared to the last.

Umesh Walunj, Bhojdari religiously reads the KrushiSalla every week and then explains it to those who are unable to read it as well. "I used to cultivate maize in the traditional method and needed 7 kg seeds per acre. The cost of fertilisers was high and my yield was 30 sacks of maize per acre. Following KrushiSalla, now only 5 kg of seeds is required and the yield has gone up to 35 sacks per acre."

Umesh is also a proponent of organic fertilisers.

"The maize stems become strong with Amritpani (organic fertiliser made from manure, neem leaves etc.). Even in today's era of rampant



"I could plan my agricultural activities due to the weather forecast given in the Krushi Salla. I have learnt how to prepare Jivamrut (organic fertiliser) from the WOTR's para-agronomist and started using it according to the Krushi Salla. By spraying Jivamrut, leaves are greener and the crop is less prone to pest attacks. There is no mawa to be seen on the crop."



Area: Sangamner and Akole, Maharashtra

Crops: Maize | Tomato | Bajra (Pearl Millet)



inflation, expenses can go down if one follows the KrushiSalla.”He has also started using vermin-wash, vermin compost and Limboni pend (neem).

Nothing spreads like success. The success of his maize has got other farmers also huddling around the KrushiSalla.

Things did not stop at maize. Umesh went on to follow the advisory for his tomato crop too with very happy results. His quality of tomatoes has inspired Five more farmers from his village have to start using vermin-wash. Vermi-wash prevents the falling of young tomato buds which increased number of tomato fruits and in turn also income from the final produce.

ShantaramRaghu Dhokre, Khandgedara

“KrushiSalla also gives minimum and maximum wind speed expected for the next week and this is very important especially for tomato cultivators. Wind speed can hamper effective spraying to a great extent by not being able to reach the whole field uniformly. I used chemical fertilisers on tomato for years now. This has resulted in decreased soil quality and eventually decreased yield. Last year I have made two tomato plots: first one was given manure treatment and the other one was given the usual dose of chemical fertilisers. The tomato plants grown on manure continued giving fruit even after the chemical one was done for.”

Bajra is the traditional Kharif crop in this part of Maharashtra. Tilling, sowing, weeding and then directly harvesting: this is the traditional system.

After reading KrushiSallaput up at one of the gathering places in his village, Shantaram realized that bajra should be sown only after seed treatment. Following the Salla, he dissolved urea in water and sprayed it instead of using it directly for his bajra crop. He had also sprayed Amrutpani and saw yellow leaves turn green. He believes he will get a better harvest due to this healthy and sound growth.

From the KrushiSalla, he used the prior intimation of possible natural events, changes in humidity, temperature, wind speed etc. intaking practical decisions like fertiliser treatment to his crop if rain was forecasted for the next week. This leads to optimum utilisation of rainwater and fertiliser.

But he does admit that in case of very heavy rainfall, he would be helpless to save his crop even by being forewarned. But adaptation is all about being prepared for the very worst.



Bhausaheb Devram Mande, Pimpaldari

“I grew tomato as a summer crop last season. I made my own Jivamrut and used it thrice. I saved an average of Rs.400 per spraying. This is all because of Krushi Salla.”



Baban Sakharam Dhokre, Khandgedara

“The change in weather has brought in new levels of pest challenges. After reading Krushi Salla many of us are using Amrutpani. Farmers who have opted for seed treatment before sowing, and sprayed urea and Amrutpani are reaping rich rewards.”

WOTR's VULNERABILITY ASSESSMENT TOOL (VAT)

Mapping Climate Vulnerabilities

India with her 700 million of rural population is highly dependent on climate-sensitive sectors (agriculture, livestock, forests and fisheries) and natural resources (such as water, biodiversity, mangroves, coastal zones, grasslands) for survival and livelihoods. Climate Change is directly or indirectly responsible for adversely affecting these sectors by creating negative socio-economic pressures. Tackling climate change is already proving to be one of our biggest national challenges. The first step towards this is to know the problem: Vulnerability.

The Vulnerability Assessment Tool (VAT) is a unique tool developed by WOTR to assess vulnerabilities of communities in a particular area. It gives 'indications' of the vulnerability of communities to the hazard which they are most likely to face. The tool is open-ended and allows constant improvisations. We at WOTR believe that there needs to be a shift in policy and implementation approaches from 'Development Planning' to 'Planning taking into account Uncertainty due to Climate Change'. So, WOTR has started conducting VAT trainings for implementation teams and development professionals.

Training program topics:

Concept of Adaptation to climate change and Vulnerability:

Terms like Vulnerability (The extent to which a natural or social system is susceptible to sustaining damage from climate change), Sensitivity, Resilience, Adaptation, Adaptive capacity, Risk, Hazard (An event with potential to cause harm) and Sustainable development are defined in the workshop.

Difference between Adaptation (actions undertaken as a response to stress) and Adaptive capacity (ability of a system to adjust to climate change and to take advantage of opportunities, and cope with the consequences)

Types of Adaptation: Anticipatory/ Reactive (as a private, public response as well as for specific sectors like Agriculture) and Policy-driven adaptation

Approaches to Adaptation: Building adaptive capacity, Taking adaptive action, Autonomous or unassisted adaptation

Vulnerabilities of a community can change over time in many different and subtle ways. The speciality of VAT is its flexibility. Coping with

TOOLS:

VAT WORK SHEET:

a participatory methodology for Vulnerability Assessment

- Documentation of drivers and pressures in Climate Sensitive Livelihood sectors (Agriculture, Livestock, Forests, Fisheries), Data collection from the field – past history, current scenario, responses to problems till date
- Identifying Risks and Resources (5 Capitals* needed for identified climate risks / vulnerable groups)
- Sensitivity Analysis based on 5 Capitals- Systems approach to map all interdependencies and interactions
- Rating of 5 Capitals of the village in village on scale of 1-5 (1 denoting low or nil status of the capital in the village and 5 denoting good status of)
- Generation of VULNERABILITY CODE - Grading of highly sensitive and essential resources on a scale of 1 – 5 according to the 5 capitals

This code could change over time and indicate which capital needs to be boosted by external interventions.

uncertainty and change is interwoven into its approach and so the assessment is never static. It is an effective tool to gauge the efficacy of current interventions and plan new immediate interventions if needed. VAT could help implementation team and development practitioners in planning and modifying their approach and actions- Adapting to a changing climate in a real sense.

* 5 Capitals are Natural, Physical, Social, Human and Financial Capital the capital in the village

UNDERSTANDING CLIMATE CHANGE



The training on Adaptation to Climate Change, held between Aug 21-24, 2012 and sponsored by the Swiss Agency for Development Co-operation, was an exciting input to one's understanding of the issue. It was attended by participants from a variety of backgrounds and organisations. It brought in various nuances of Adaptation to Climate Change, Vulnerability and its connect Economics and paradigm of Growth.

It covered a variety of topics that ranged from the basic question 'What is Climate Change', the science behind it, and its national and international impacts. The discussion created a deeper understanding of adaptive capacity and resilience in local communities. It discussed the various policy interventions in India with respect to the National Policy on Climate Change and the various Missions. The role of Knowledge Management was highlighted, especially of Traditional Knowledge Systems that could immensely help in not only building resilience but also mitigation.

At the end, it discussed the various frameworks being used in WOTR to understand the issue and the various tools being developed within WOTR to help in implementing Climate Change projects.

The training used a variety of games and films, field visits, and interaction to understand difficult to understand concepts.



आलं, गेलं, राहलि - WHAT COMES IN, WHAT GOES AWAY AND WHAT REMAINS

WOTR's Water budgeting Tool

"Ever thought about how much there is to learn from a glass of water?" This is how the session starts. The adjoining graphic is explained, leaving the audience a bit shocked. Then the facilitator makes 2 columns: Credit & Debit - Income & Expenditure. This Accounts 101 is not for money, but for another kind of liquidity- Water, the mother resource.

This is WOTR's Water Budgeting Tool.

Water Budgeting trainings are regularly conducted, where the community is familiarised with the tool to assess their water usage, based on which they make decisions for their own villages. Here, Water flows instead of money and Rain instead of daily wages or market sales. Expenditure of water on home, farm and cattle is something people are all familiar with. Things we hardly ever think about i.e. evaporation of water from open water bodies and transpiration from leaves are also debited.

In water sources, external sources like tankers or canals or moving sources of water like rivers are excluded. Only water directly received by the village as rain and that got stored as groundwater is included. Next, the total water received by the village is calculated (in hectare metre) by multiplying its area with the amount of rainfall in metres.

1 hectare metre = 1 crore litre. So the amount of water available is calculated in crore litre, then in the number of water tankers which would make up that many crore litre and then in the cost of all these tankers put together. Most villages in project areas have had to have water brought to them in tankers in the summer. So calculating something in number of tankers really drives the point home. After further calculations of water lost through various sources, a much smaller, but still substantial figure is obtained. Then the consumption of water for people, animals and agriculture is calculated.

Using data collected by Wasundhara Sevaks (WOTR trained youth from the community) using GIS and GPS systems, the water consumption of individual crops is calculated. This forms the basis for crop planning. If more water gets spent on the kharif crop, then the crop pattern for the rabi crop needed to be changed accordingly so that water can be conserved.



2200 ml =
all water on Earth

12 SPOONS = FRESHWATER



1 DROP = RIVERS

TOTAL FRESH WATER
ON EARTH

Distribution of water on earth in %	
Oceans	97.2
Ice-caps	02.0
Groundwater	00.62
Fresh water lakes	00.009
Inland seas and Salt lakes	00.008
Atmosphere	00.001
Rivers	00.0001
Total	99.8381

SAMPLE WATER BUDGETING INFORMATION PUT UP IN THE VILLAGE

Total available water	Run-off and evaporation	Gross available water	Water required for drinking	Water required for Crops	Total Water Requirement	Water Available Balance/ Deficit
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The water budgeting table is put up in prominent places in the village, so the whole community can see the accounting of their water. Accordingly, a 4-year plan can be formulated, at the end of which, the Water Budgeting tool will ensure that the village never lacks water, or is at least prepared for an imminent drought situation.

The aim of WOTR's Waterbudgeting tool is:

Let us for once, treat water as a limited resource fund and not as a free, unlimited grant from nature. This will ensure:

- a) Optimum utilisation of available water resources without strain on the eco system
- b) Tanker-free villages

Most traditional farming systems had an inbuilt basic harmony with the water cycle and common community sense. There were crops which were grown in particular seasons and particular soil and climate types. Kharif and rabi were not merely time of harvests but the cycle of seasons, in the agricultural year, in the life of a farmer, in the nutrition of a nation. They brought with them a particular cuisine, culture and economy, which regulated everything from festivals and food to soil nutrients and the water table.

Now there are no rules. Today, we pride ourselves that we can grow water guzzling crops in deserts. But only when one starts valuing 'freely' available natural resources like water, does the real cost become clear. Using this simple budgeting tool on resources other than money, one can calculate the real profitability of home, agriculture, industry. The balance sheet might shock us.

TRAINING ANNOUNCEMENTS

Technical Training in Watershed Management | Nov 20-23, 2012

Meant for technical staff from NGOs and other agencies that are directly involved in implementation of watershed development projects. Various issues related to technical aspects such as planning, designing of structures, Participatory Net Planning (PNP), different measures for area and drainage line treatments with a focus on low-cost structures. Hands on training using software for PNP.

THE AGRICULTURE-LIVESTOCK LINK

In earlier times of rain-fed, single-crop agriculture, there was a strong link between agriculture and livestock as it supported communities in farm operations, enhancing soil fertility (manure), and transportation. All households, depending on their landholdings, kept cattle, bullocks, goats and back-yard poultry. Even though the milk production from indigenous cattle was low, sale of farm animals was a critical source of income. Small ruminants especially goats played a vital role for poor households as a buffer in times of need and. Apart from this, livestock provided nutritional security; the diet of communities was rich in milk, milk products, eggs and meat from local poultry. The livestock was raised entirely on the extensive system of production depending on the village common property resources (CPR), agriculture fallows and grazing lands. There was no system of fodder production and crop-residues were stored as additional feed for livestock.

But today, growing needs of the ever increasing population and growing market demand for livestock products specifically meat and milk, has led to animal husbandry policies that promote adoption of high input-out production systems and animal breeding programmes focused on increasing breed productivity, concentrating on a single productive trait). Another key driver of change is the increased



emphasis on agriculture production. This has resulted in vast areas of CPRs being converted to agriculture lands. Preserving grazing lands is considered unproductive. Even at the individual household level, the need for food and financial security, better education and quality of life are the key drivers of inducing this change.

In terms of pressures, at the village level communities reported that ban on grazing in forest areas, and natural resource conservation and management programmes such as watershed development, Joint Forest Management, social forestry and waste land development programmes have been the main pressures on communities to reduce rearing indigenous cattle and other non-dairy livestock.

Farmers also revealed that fluctuations in agriculture markets prices, market demand and repeated crop losses due to climate vagaries and increasing water scarcity are also huge pressures and greatly influences the cropping patterns, the seeds they use and the type of livestock they rear.





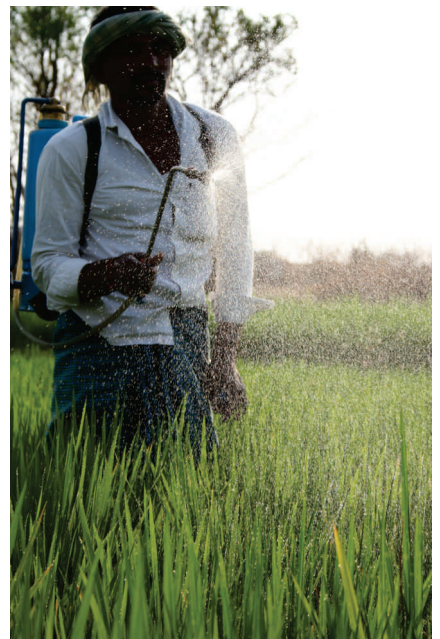
So in the dry regions of AP & Maharashtra, there is a clear shift from low-input crop-livestock farming to high input–output water intensive cash crop and dairy based farming. There is a clear reduction of small livestock specially goats and back yard poultry rearing at HH level and a prominent shift to rearing crossbreds cows and buffaloes. But only farmers with four acres and above land holdings are able to produce adequate quantities of green fodder as well as invest in higher amounts of concentrate feed and better health care for high yielding crossbred cows. The rest of the farmers with smaller landholdings still depend on fodder harvested from the CPRs or crop residue, which is stored and fed through the year. It was obvious that majority of farmers feed inadequate quantities of green fodder and feed concentrates to the animals and large component of fodder is from the CPR/ crop residue which is of low quality (more cellulose content).

A striking fact surfaced during interactions with communities is that high input–output crop-livestock production systems have made the lives of rural women more difficult - as these production systems are highly labour intensive. Reduction in small stock, especially goats and backyard poultry, has led to reduced nutritional and financial security for women and children. There is also a significant decrease in intake of animal products (curd, ghee, milk, eggs & chicken meat) by villagers as practically all villagers strongly claimed to prefer animal products from indigenous livestock than crossbred cows and broilers.

Other critical problems include unavailability of farm labour as well as increasing labour costs; failing bore wells and fast depleting ground water tables; increasing rabi crop failures and reduction in summer cropping; increasing input cost in agriculture and animal husbandry – the list is never ending. Even dairy farming that was once profitable also requires high investment costs over a period of time due to health problems in animals, fertility issues and water scarcity issues.

The vulnerability of dry land regions gets exacerbated with climate change. The enormous environmental stress created by the high resource footprint of crossbred dairy farming on an already fragile ecosystem often goes unnoticed due to the high temporary gains from productivity. This further deteriorates the state of the ecosystem which in return makes the crossbred farming more vulnerable towards extreme climate variability. This puts the system into a downward reinforcing spiral which continues till a collapse threshold is reached, either of the ecosystem or of the livestock – and rebuilding the ecosystem to support livelihoods would be challenge.

But communities are continuously finding better options to reduce their vulnerability to climate change (adaptation responses). However, majority of them are short-term fixes that reduce their vulnerability temporarily but decrease the resilience of the ecosystem towards changing climate patterns. This subsequently increases the community's vulnerability in the long term.



VIEWED THROUGH WOTR'S CLIMATE CHANGE ADAPTATION LENS,

“ Low to medium input–output livestock production systems are more sustainable for fragile ecosystems and reduce risk and vulnerability of communities to emerging climate hazards in dry land regions. ”



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