Knowledge for Change

In Memory of Dr. N. K. Sanghi

In Memory of Dr. N. K. Sanghi

KNOWLEDGE for CHANGE

WASSAN FOUNDATION
Wassan Group of Institutions

PERMANENT GREEN
An Imprint of
Manchi Pustakam

In Memory of Dr. N. K. Sanghi
Knowledge for Change

Year: 2015

No of Copies: 1000

Editors : Suresh K., C. Udayashankar, M.V. Rama Chandrudu, M.V. Sastri

ISBN : 978-93-83936-28-1

Published by:
WASSAN FOUNDATION
12-13-452, Street No 1,
Tarnaka, Hyderabad - 500017.
Ph : 040-27015295 / 96
e-mail : wassanmail@gmail.com

&

PERMANENT GREEN
An Imprint of **Manchi Pustakam**
12-13-439, Street No 1,
Tarnaka, Hyderabad - 500017.
Ph : 9490746614
e-mail : info@manchipustakam.in

Suresh, K; Udayashankar, C; Rama Chandrudu, M. V. & Sastri M. V. (Eds.). (2015). In Memory of Dr. N. K. Sanghi: Knowledge for Change. Hyderabad, Telangana: WASSAN FOUNDATION and Permanent Green.

Printers:
Charita Impressions
Azamabad, Hyderabad.
Ph : 040-27678411

Contents

When the Message becomes the Man N.K. Sanghi

M.V. Sastri[1]

It is not often that an acquaintance becomes transformative to several,with amazing consistency, on a one-to-one basis. Gandhiji transforming thousands movementally in a political context is a different matter. I am talking more about instances of direct personal impact, where even if such impact is on a number of persons; it yet remains personal, on each individual.

The above thought comes to me as I write of Nand Kishore Sanghi, Dr. N. K. Sanghi for you and me, who left us very prematurely. His departure was not noticed by the press or television, reflective of his impact mostly on personal basis, even if they add up to a thousand or more. The bereavement was personal to each of the thousand, the grief causing a wound on each.

1. *Honorary Convener, Centre for World Solidarity (CWS), 12-13-439, Street No. 1, Tarnaka, Secunderabad - 500 017, Contact: +91 (040) 2701 8257, Email: sastrimv@gmail.com, Website: www. http://www.cwsy.org*

During the two years of his fatal affliction, N.K. Sanghi never complained of his pain, but only had words of praise for his healers and pain-reducers, whether they be doctors or friends. He meticulously completed things he ardently felt would be contributory to the further good of the larger society, from such resources as he had. Srinivas Goud, the financial specialist on whom he depended for all this detailed work, was equal to the several Sanghi demands, and, of course, Sanghi's family members were unflinching; they were wholeheartedly with him in doing all that he wished. That N.K. Sanghi chose me to facilitate these, marginally, is something I would ever cherish.

On Sanghi's seventieth birthday, his family asked me to speak about him to a small gathering, which I did, something again I would always cherish. There were two qualities of Sanghi I ventured to highlight:

One was his painstakingly interpreting someone else's viewpoint constructively. In the kind of work he was doing, Sanghi had to relate to various levels of understanding and articulation, and it would have been easy to be dismissive of some as being devoid of merit. But not once in my thirty or more years of being with Sanghi, did I hear him doing anything of that kind. He would weave sense in what he heard and ask the person for affirmation of his interpretation: "perhaps this is what you meant?" Of course the person would catch the straw and return from the meeting a more confident person to influence a whole community in his or her turn. That was N.K. Sanghi for you, and that was the way he influenced communities, through community leaders on whom he brought his transformative influence to bear.

The second point I highlighted in my talk was Sanghi's unwillingness to be on interview committees. "Please excuse me from this responsibility," he would urge disarmingly. Why did the ever-obliging Sanghi do this? That is because he never felt it was for him to place humans in a hierarchy of excellence - all were the same to him, each having something unique to offer which was no less excellent than what the others may contribute: if you and I had difficulty in locating that excellence, it is our problem. Sanghi was sure this approach would not help in running organizations - you cannot obviously select a dozen for a single post, which is why he would say "not for me membership of Selection Committees". Sanghi believed in the survival of what others may view as unfittest, because his God created them too.

This striving to identify a bit of God Almighty in each was Sanghi's singular trait and also becomes the message that was this unique man.

One can narrate several Sanghi vignettes: the luna that carried him for years from one end of the city to the other, breaking down often; his reluctance to use office facilities he was entitled to; his perennial readiness to do a field visit as he believed that he could learn through interaction with the struggling farmers; his unwillingness to accept anything until he checked the ground reality himself, to his satisfaction - the farm was his university and the farmers the professors. That is how he along with Vithal Rajan, M. S. Chari, M. A. Qayum and T. J. P. S. Vardhan gave the path-breaking concept and architecture of Non-Pesticidal Management (NPM): this christening we owe to Sanghi. That of course was one of his several contributions, which I am singling because it was perhaps the most telling in its impact.

For Sanghi, labour and pain were the essential pathways towards self-realization. So he laboured in good days as well as bad, and smiled when excruciating pain was God's grant to him. All his work and articulation were always imbued with spirituality. It is this quality which retained him, the eldest, as the ***numero uno*** of the families of his siblings - not that he wanted it - even when he moved into a different religion. Following this, he seems to have endeared himself to the families even more, and his advice, which was always sought, was binding on them till the end - a rare example of shared quest by a diversity in the families.

* * *

Remembering Dr. Sanghi

P. V. Satheesh[1]

When I recollect my earliest association with Dr. Sanghi, the first image that comes to my mind is of a long rectangular table at the CWS (Center for World Solidarity, an institutions that Mr. M.V. Sastri setup and help to grow into a world class institution). The occasion that brought me to this rectangular table was an exciting project called NPM (Non Pesticidal Management) where a dreaded pest on castor was to be eliminated through non pesticidal community action.

Dr. N.K. Sanghi, a handsome, wiry curly haired, ever smiling figure used to sit at the table along with dozens of activists, environmentalists and visionaries to dream together a pesticide free agriculture for India. This was

1. *Director, Deccan Development Society (DDS), 101, Kishan Residency, Street No, 5, Begumet, Hyderabad - 500 016, Contact: +91 (040) 27764577 / 27764744, Email: satheeshperiyapatna@gmail.com, Website: http://ddsindia.com*

one of the first experiences where in serious scientists would sit together with NGO activists and plan together for an ecological agriculture. What began on that rectangular table grew into a major movement in Andhra Pradesh that would shape agricultural policies of the government.Back to Dr. Sanghi, who unobtrusively sat through these meetings smilingly and quietly directing the group as to how to battle this nightmarish pest.

Many years later I would have opportunity to sit with Dr. Sanghi along with my other friends in DDS to discuss the details of a KrishiVignana Kendra we were about to start in Medak district. Dr. Sanghi would be at his persuasive best to convince hot heads like me who take what he perceived as an anti-science stand. His words still ring in my ears: "*Mr. Satheesh I am giving you an extra ten pairs of hands and legs to realise your own dreams of an Ecological Agriculture*".

Though our battle with the structure and philosophy of KVK is still on, we have by and large succeeded in moulding generations of young agricultural scientists in pursuing a non chemical agriculture. Dr. Sanghi, I think, is fully responsible for generating and consolidating this hope in my mind.

The third encounter I vividly remember with Dr. Sanghi is the days when I dreamt of a term called Dalit Watersheds. Since DDS works, by and large, with marginalized dalit women who hold small patches of rainfed lands on the upper reaches of their villages, the generally held theory that watersheds must follow a ridge to valley pattern used to put me off. I used to think that this model of watershed development would only succeed in making the dalit lands permanently work as a blotting paper to absorb all rainwater and carry to the valleys and benefit the lands of the rich who invariably owned the valley. Besides, whatever I had seen of watershed development was an evidence that it signalled the end of ecological agriculture - a hall mark of dryland farming. Troubled by these two thoughts I had started espousing the theory of dalit watersheds.

For me dalit watersheds meant ridge to ridge development where in the face of agriculture would not be so transformed as to make it chemical dependent; also a kind of watershed which would emphasize on least water intensive food crops such as millets and pulses that would bring food and ecological security to the poor and dalits.

Dr. Sanghi was probably the only scientist who would see some merits in this argument and back me all the way until we successfully developed over half a dozen watersheds on this model. Dr. Sanghi's conviction with this kind of development was not purely because of his kindness towards me. As an open

minded scientist he normally imposed a lot of faith in what he would coyly term as ITK - Indigenous Technical Knowledge. When I was making a film on indigenous practices in soil and water management he patiently explained to me a fascinating practice among the dry land ridge farmers who would instead of conserving soil "*in-situ*" would divert all the ridge soil to one location on their field. This would result in a rich deposit of fertile soil in one location and allow them to grow a favoured crop there. This was such a revelation to me and I could never thank Dr. Sanghi enough for giving me this insight.

I can go on and on reminiscing about Dr. Sanghi and about the hundreds of eyes he opened for me. Inspite of being a scientist Dr. Sanghi had a deep faith in the knowledge and practices of humble peasants and their capacity for group action. It is just faith which translated into a radical practice such as NPM and Indigenous Knowledge Systems.

From wherever he is in his secure place in heaven, I am sure he will continue to smile benignly on activists who in their owns small way continue to further his faith.

* * *

The Survival of Small Farmer Communities - Application of Non-chemical Practices For Pest Management

Dr. Vithal Rajan[1]

The writer is very grateful for being invited to contribute a paper for a memorial in honour of the late Dr. N. K. Sanghi, a pre-eminent agricultural scientist, a warm human being and friend, and a nationalist who served the poor farming communities of India with single-minded devotion. He was one of the few top scientist-officials of India who convinced civil society organizations to work for sustainable agriculture. He uniquely integrated modern science and indigenous knowledge in several practical ways to produce immediate support for thousands of poor farmers.

An Historical Introduction

The history of ecological farming in India is as old as agriculture itself. The great civilizations of India

1. *Chairman of the Confederation of Voluntary Associations, 1-2-16/11, Block 'B', 1st Street, Habsiguda, Hyderabad, Contact: +91 9704540608, Email: vithalrajan@hotmail.com, Website: www.vithalrajan.com*

developed on the basis of an agriculture that was rich, efficient and ecological. The very first mention of agricultural practices is found in the Buddhist Pali texts, *Kullavagga* and *Mahavagga* of the 5th Century BCE. Kautilya's *Arthasastra* of the 3rd Century BCE gives us a complete picture of the agricultural and forestry practices of his times. Later works, Varahamihira's, *Brhatsamhita* of the 6th Century CE, and Kashyapa's *Krishi-Sukti* of the 10th Century CE contain detailed treatises on agriculture, forestry, land and water management.

It is interesting to note today the injunctions of Kashyapa, after a process of environmental degradation, loss of forest cover, and the disasters brought about by mono-cropping, and massive use of pesticides. He enjoins kings to keep the top slopes of hills covered with mixed forests, which should contain fruit trees, such as the mango; trees which have bio-pesticidal properties, such as neem and pongamia; trees which are rich in Vitamin C, such as the amla; and leguminous trees for producing fodder, and nourishing the soil, as well as ornamental and timber trees. He insists that the forests should be guarded by brave soldiers. Turning to agriculture, Kashyapa extols the virtue of Indian farmers, who are vigilant and methodological, who have cordial relations among themselves, leading to community group action, which Dr. Sanghi used to say repeatedly was essential for successful farming.

In ancient days, farmers produced two crops a year by taking care of agricultural labour, livestock, seeds, water channels, tanks, and farm implements. That Indian farmers were famous for careful cultivation of several species of trees, crops, and vegetables is also known to us by reading the accounts of early Arab travellers, such as Ibn Batuta, and conquerors, such as Baber himself. The *Ain-i-Akbari* mentions that farmers in the Doab grew around 25 taxable crops during the kharif season, and another 15 taxable crops during the post-rainy rabi season. The great emperor Akbar was well aware that the magnificence of the Moghul Empire rested on their efforts. He not only passed laws to see that the peasants were not crushed under excessive taxation, but insisted that the tax-collectors should make individual assessments after meeting the cultivators in person, and not depend on the estimates of local landlords or chiefs. The emperor also instituted *taquavi* loans for helping cultivators in distress. The pleasure-loving Jahangir was no less a lover of Nature than his forebears, and one of the best accounts of the flora and fauna of his times is found in the *Tuzuk-i-Jahangiri*, penned by the emperor himself. In it, he writes: '*Whenever all the energies and purposes of justice-serving Kings are devoted to the comfort of the people and the contentment of their subjects, the manifestations of well-being and the*

productions of fields and gardens are not far off. God be praised that in this age-enduring State no tax has ever been levied on the fruit of trees, and is not levied now.'

The belief that justice will lead to plenty is an ancient one in this country, and is still adhered to by the people. That Indian farmers continued to sustain our populations through ecological farming methods right down to modern times is witnessed by Dr. R. A. Voelcker, Consulting Chemist to the Royal Agricultural Society of England, who said in the late 19th Century that he had never seen a more perfect picture of careful cultivation combined with hard labour, perseverance, and fertility of the soil. He said that Western experience could contribute little to the wisdom of the Indian farmer, and added that any advance may come from '*an enquiry into natural agriculture and from the extension of better indigenous methods....*'

Unfortunately, the early Sanskrit texts on agriculture ceased being referred to when our modern education system was established by Lord Macaulay. The impoverisation of the Indian peasantry brought about by colonial rule did further damage to oral traditions of knowledge which had come down from father to son, and mother to daughter for over a thousand years. Even great patriotic leaders, such as Pundit Jawaharlal Nehru, had to go through a process of 'discovering' India. Systems of agricultural and farm management based on European and American experience were introduced into India without much regard either to our local agricultural knowledge; or the historical and social processes of community joint responsibility for the maintenance of fields and water systems; or even the fragile nature of many of our soils, and the inter-relationships within a region of agriculture and forests. Though modern science through the Green Revolution has enabled us to stave-off the spectre of mass famine, or neo-colonial dependence on the import of food grains grown in America, by and large, our farmers have been left with a legacy of over-application of pesticides; the destruction of their soils and water-harvesting systems, following the great destruction of forests by government and industry; and commercial mono-cropping systems for profit, which has reduced the availability of several greens and non-economic plants, which once gave the poor free access to proteins and inputs of Vitamins A and C. Some studies into the nutritional deficiencies of the diet of the poor in present-day India have even gone to the extent of saying that in comparative terms the India of a hundred years ago was like a land flowing with milk and honey for the poor! Institutional attempts at correcting such deficiencies do not produce expected results. For

example, the supply of high density capsules of Vitamin A to rural children in the Deccan, in response to growing cases of blindness among children, has also resulted in producing childhood cirrhosis of the liver, a condition which can apparently develop if excessive Vitamin A dosage is imbibed along with a malnourished diet.

In any case, centralised Green Revolution strategies have not been able to meet the food production needs of the poor living in around a hundred districts declared as perennially drought-prone. The poor of such areas faced with declining food production have tried to survive by adopting non-ecological practices, and by cutting down trees, which have all added to environmental destruction. Lands around the City of Hyderabad, once thickly forested, which could boast of the existence of even leopards on the urban outskirts 30 years ago, have now lost all of their trees, resulting in massive loss of top soil, and the siltation of reservoirs. The drift of the rural poor to the City continues, and slums in Hyderabad are growing at the rate of over 15% per year. The City once among the best planned in the country is now unable to supply sufficient safe drinking water to its population.

All these problems interact with each other, further reducing the agricultural viability of vast acres of land, and the capacity for survival of the poor living in such areas. It is under these conditions that a few scientists, among whom Dr. Sanghi was the most notable, researched into the benefits of incorporating ecological systems of agricultural production and land management. The non-chemical management of pests is an important and integral part of the development of ecological science.

Community Survival

In this short paper, the focus will be on such processes as might help communities of the poor to survive in resource-poor, drought-prone and environmentally degraded areas, such as are found in the Telangana, Marathwada and North Karnataka region. The late Dr. Sanghi spent a great part of his working life tackling these problems.

No ecological agricultural practices can be promoted unless we also promote social processes of community coalition which will encourage people's participation in a very fundamental manner in all development strategies. What is required is much more than assent of the local poor to plans designed to promote environmental regeneration or agricultural production. We require

their full involvement in the articulation of priorities in the design of such plans and in bringing to the fore their local knowledge about their environment. Clearly what is needed is to go beyond PRA exercises towards planning by the poor of their own development strategies; the implementation of such strategies by organisations of the poor, such as *sangams*; and the participation in the governance of such organisations by the poor. A prior requisite for successful involvement of the people would be enabling strategies which give them access to land, the most important natural resource available, as well as to trees and water resources. Access to land and natural resources cannot be made effective without full involvement of all sections of the local community, followed by discussions, mediation and arbitration processes. If access even on an experimental scale to land and natural resources is provided to the poor, then we can build strategies which combine sustainable agricultural practices along with environmental regeneration through afforestation, and soil and water conservation, for gradually increasing the carrying capacity of the area.

A primary focus of such a combined strategy should be food security for the poor, and food conserving bio-diversity to produce a proper nutritional balance in their diets and variety. Such food security would increase the ability of the poor in environmentally degraded regions to move towards self-provisioning at the local level, and towards public health improvement through the reintroduction of preventive medicine and herbal medicine.

At the same time, such strategies would generate employment at the local level through focusing on labour-intensive environmental regeneration. Such extra employment would lead to income generation, the growth of savings in rural households, and ultimately the growth of purchasing power in the hands of the poor.

With the growth of food security and employment, the poor can move towards higher literacy levels, and local empowerment for local management. All these factors would lead rural communities towards the Gandhian ideal of *Gram Swaraj* and community survival.

Sustainable Agriculture

Sketching out such a context for the gradual improvement of a region and the capacities of the poor, Dr. Sanghi in discussion spelt out the institutional problems faced by agriculture. Till now resources that are costly, difficult to mobilise, and difficult to utilise by the poor, such as capital, technology, and

elite expertise, have been considered as essential for producing growth or improvement in living standards. Development experience has shown that such inputs lead to highly skewed development, and a widening gap between the rich and the poor. Even the best estimates produced decade-after-decade show that around half of our population lives below the poverty line. Malnourishment is endemic in the country. For vast populations there has been little improvement in literacy or educational levels, which are crucial indices of development and growth. On the other hand, we have had the destruction of soils, of water-harvesting capacities, and of invaluable genetic material, plant species once available in plenty in the environmentally degraded area. Resources which could have been quickly developed, such as employment potential in rural areas, traditional knowledge, local skills, and the aptitude of village communities to come together, to act together, to undertake group action, all these resources, social and material, have been neglected by experts, who have seen the elite as the prime movers in development processes rather than the masses themselves.

Sustainable agricultural strategies call for a reversal of such priorities. Dr. Sanghi argued that we must now concentrate not on costly inputs which put an additional burden on the poor, but on developing their own resources. Programmes such as the MGNREGS should be utilised to create sustained employment in rural areas in carefully organised environment regeneration programmes. Similarly, by encouraging the catalysis of local groups and utilising local knowledge to solve local problems, a move could be made towards community management systems for developing watersheds, afforesting wastelands and hill slopes, and for improving soils through organic manures, green manures, mulching, and other ecological practices.

Dr. Sanghi encouraged communities to optimize the use of water so that this precious resource is neither cornered by the rich, nor wasted in a unsuitable manner, such as by growing paddy on light friable soils leading, perhaps, to water-logging elsewhere in down-stream areas. It is only when the farming community can once again act as one that we will be able to secure the minimum maintenance of bio-diversity in an area. If all of this looks like a tall order, let us also reason out that the very depths of poverty to which the poor have sunk should encourage them towards ecological agriculture, since even small benefits or increases in yield will be jealously measured and protected by the poor. Provided government officials and community activists drawn from among NGOs can patiently support the poor through the next decade, the regions which are today degraded should see an increase in agricultural production, and

regional carrying capacity. This should happen hand-in-hand with environmental regeneration, perhaps through natural regeneration that may take place by the people providing 'social fencing' for community planted woodlots. Consequent to community stability, and people experiencing a certain measure of confidence in their own abilities, growth in living standards should lead not only towards prosperity, but also people's empowerment, and the development of democratic values, since much of this advance would be based on group action undertaken through democratic processes. It is with this perspective that Dr. Sanghi placed so much importance on community group action.

The Role of Bio-diversity

At the very heart of sustainable agricultural practices is the role of communities consciously maintaining the bio-diversity of the region. The practices that could lead to the strengthening of bio-diversity could be identified as follows:

a) Processes of natural regeneration

There is wide experience all over India that once communities of the poor have accepted the importance of afforestation, they are able to control effectively their cattle, goats and sheep from grazing over hillocks of wasteland which they have planted under useful saplings. A legal and social pre-requisite, of course, is a *Tree-Patta* scheme by which the poor know that the trees they are growing will be theirs, and will continue to supply them with fruits, fodder, fuel-wood, fibre, timber, and medicinal materials. The protection of such woodlots results in a process of natural regeneration, bringing the whole of the area back to life. With grasses, weeds, herbs, and plants growing in profusion, even under low rain-fall conditions, within a few seasons, the area will be covered once again with bird-life, snakes, rabbits and other small animals. It is not necessary to think that only very large contiguous areas have to be put under natural regeneration. Provided there is human care and 'social fencing,' even narrow lands, along field bunds, road-sides, and besides households, can produce the re-growth of plant variety, and the maintenance of bio-diversity.

b)Traditional Farming Systems

Under present-day conditions small farmers may be encouraged to utilize to the full un-broken traditions of complex cropping practices that have been

followed by their forefathers to get the best out of poor soils, and to hedge against pest attack, and varying weather and soil conditions. Indian farmers are famous for growing several crops on small pieces of land; for inter-cropping pulses and cereals; for mixed cropping so that they may get yields over a much longer period of time; for crop rotation to rebuild fertility of soil; for companion planting either to protect plants or to increase their nutritional efficiency. They are also famous for their silvi-pastoral systems stretching from Rajasthan to the dry Deccan area; and for specialized agro-forestry systems, such as the 'three-tier' cultivation of Kerala, with banana growing under arecanut cover and cardamom under the banana. While the *tangya* system of South East Asia has come to be known throughout the world, the Indian farmers' ability to integrate agriculture, livestock management, and non-farm activities into one integral unit is no less sophisticated. The recovery and extension of such farming systems will lead not only to crop protection, but to self-provisioning, even in resource-poor areas.

c) Soil improvement

While it is true that tropical soils are more fragile than temperate soils, and have a lower carbon content, the careful use of organic and green manures and the reintroduction of mulching, the use of leaf-litter, bio-fertilisers, earthworms and vermi-composting should enable our depleted soils to recover rapidly. The bulk of our farming community has been too poor to go in for excessive use of chemical fertilisers or petroleum based agro-industry. Their poverty itself has in this respect been helpful, since the bulk of the small and marginal farmers, that is, the bulk of the rural population, have continued organic farming practices. However, sustained support from governments and institutions is necessary so that the small farmer may receive support similar to that received by the richer farmer, to enable him to continue to expand on the use of organic soil-improvement techniques. Many of these techniques really require hard and long labour hours, and employment generation strategies should be reconsidered to see how they can be utilized for such careful on-farm work, which will not only increase plant vigour, drought-resistance and pest resistance, but also produce better yields from poorer soils.

d) Non-chemical pest management

The writer came in close contact with Dr. Sanghi mainly in the area of using non-chemical methods to manage pests. It will be seen that the processes and

methodologies identified in this paper are in no sense linear. Ecological processes are holistic and reinforce each other. For example, we have seen that the maintenance of bio-diversity is important for sustainable agriculture; at the same time for maintaining bio-diversity we have seen we require systems of sustainable agriculture. Similarly, we identified non-chemical pest management as important for maintaining bio-diversity; and that the maintenance of bio-diversity was simultaneously important for ecological pest management. This form of reasoning is not common in conventional scientific practice, but becomes understandable in terms of a holistic approach that integrates several categories and sub-categories of activities as an organic whole, and places human communities at the very centre of such activities, as part and parcel of un-broken nature cycles.

A Three-Dimensional Model

Based on the above mentioned principles, Dr. Sanghi worked out a three-dimensional model, involving main crops on one dimension, main pests on another, and non-chemical control methods on the third. While this system looks rather complex and formidable, in practice it is not really all that difficult to operate. It will be found that despite changes in region, soil, or climate, certain crops continue to remain important for the community: these would be the main cereals and pulse crops, such as rice or jowar in the southern Indian region, and red-gram and green gram. Oil-bearing crops such as sesamum, sunflower, safflower, groundnut, and mustard would figure in this matrix, as well as some vegetable crops; and some horticultural crops, such as banana, papaya, mango, guava, and the main cash crops - sugarcane, cotton, or tobacco, whichever is important in the region. While there are, of course, several pests that attack all our crops, among the salient dangerous ones are, of course, the *Amsacta albistriga*, *Helicoverpa armigera, Spodoptera litura*, semiloopers, borers, weevils, grasshoppers, fruit-sucking moths, gall midges, brown plant hoppers, and the rest.

On the third dimension the non-chemical management of pests can be grouped into several clear categories:

a) Processes involving natural regeneration;
b) Introduction of biological pest control agents, such as NPV, or innoculum of beneficial bacteria, fungi, parasites etc.;

c) Use of bio-pesticidal formulations extracted from neem, pongamia, garlic or other plant sources;
d) The reversion to traditional farming practices, involving complex cropping patterns, inter-cropping, multi-cropping, mixed cropping, and crop rotation, which create barriers to pest attack and movements;
e) The use of cultural practices and manual practices, involving the timely identification of a vulnerable phase in the pest's life-cycle, to destroy it through bonfires, light traps, by picking up of egg-masses, by manual collection of larvae, or similar means;
f) Last, but not the least, the use of traditional knowledge regarding the life-cycle of the pest; and its movements through the fields or across the seasons. Modern research can also be used in better understanding the ability of plants to withstand pest attack without diminishing yields. For example, it is now understood that a groundnut plant may suffer close to 50% defoliation from *spodoptera* attack at the podding stage without appreciable loss of yield. Further, a better understanding of the nutritional needs of the people would help the farming population diversify its crops, which in itself should produce a marked reduction in pest attack. Similarly, a better knowledge regarding development processes in the farming community would help them plan their agricultural priorities better, without falling prey to the temptation of growing mono-crops, such as sugarcane or cotton, which could invite a crippling pest attack.

Natural Regeneration

It may be found that natural regeneration processes figure across the widest spectrum of such ecological practices, and are recommended for the protection of almost all crops against the attack of all pests. The community could be induced to take up afforestation, or wasteland development in that area, with the help of 'social fencing' practices, by which the youth of the community prevent cattle from grazing over the newly planted woodlots. Such areas within a matter of a few years produce generous natural regeneration. This has been widely experienced throughout India, however degraded the region might be. With the coming back of plant life in profusion, we witness the return to the area of birds, spiders, lady-bird beetles, assassin bugs, potter wasps, which are all important predators of agricultural pests. For example, it is known that the potter wasp is one of the best predators of *helicoverpa* larvae, which otherwise destroy varied crops, from pulses to cotton. Similarly, lady-bird beetles and

assassin bugs, are among the best protectors of pulse crops, groundnut, vegetables and fruit trees. Cattle egrets and drongos clean out *spodoptera* larvae from groundnut fields. Owls prevent rodents attack and spiders are among the best guardians of rice fields.

Introduction of beneficial bacteria and micro-organisms

While the introduction of beneficial micro-organisms, such as bacteria, fungi, NPV, is part of natural control processes, this is a much more complex matter. NPV has been tried out successfully against *helicoverpa* larvae; and larval and pupal parasites are successful against borers and grasshoppers which attack fruit trees. The best protection against gall midge attack on rice again seems to be parasital infestation of the pest. Beneficial fungi control nematodes. It is well known that welsh onion when planted together with tomatoes is able to protect the vegetables since its root system is colonised by a bacteria, *Pseudomonas gladioli,* which prevents *fusarium* wilt. However, there are also pathogenic strains of the bacteria which would be harmful to the crop. Dr. Sanghi always stressed that we must be careful to use only non-pathogenic strains.

Cropping methods

Indian farmers even under the worst of agricultural conditions have designed intricate cropping systems. It is well known that one row of red-gram is usually inter-cropped with three rows of jowar, and the cereal creates a barrier to protect the pulse from pest attack. Similarly, crop rotation methods are used to clean out pests from the soil. For example, when cereals are infested with cyst nematodes, a brinjal crop is normally grown on the field to clean it out. Crops are also used to trap pests that would otherwise cause economic damage. For example, a castor crop can be protected by growing cucumber or *calotropis* along the edge which would attract the red-headed hairy caterpillar. The pest can then be manually killed, a practice mentioned even in ancient Indian texts on agriculture! Even a trap crop of mustard is used to protect cabbage from the diamond-backed moth.

Ecological strengthening of the region

Ecological farming methods through the use of mulching, introduction of earth-worms and vermicomposting, or the use of blue green algae or the water-fern azolla, all improve soil conditions, or nutrient supply to the plants. Such practices

also increase the number of beneficial micro-organisms in the soil; improve the physical and chemical quality of the soil; and enable the plants to grow vigorously without excessive use of chemical fertilizers, which could also attract a pest attack. Hence, such ecological practices should be thought of as having the same importance as preventive medical practices have for the maintenance of public health.

Cultural practices

Traditional cultural practices, such as timely lighting of bonfires to destroy a pest in its adult moth phase, or the collection of egg-masses before the larvae hatch, require community group action. Dr. Sanghi emphasized that modern science recognizes that the technologies which are most suitable in dry areas, and for the benefit of small farmers – that is the majority of the farming population – require close community group action. All our technological solutions must be inter-linked with social processes.

Bio-formulations

The use of neem and neem based extracts are widely known to farming populations. Well over a dozen million neem trees exist in the country, and agriculturists must take every opportunity to revitalize the use of neem, either in the form of a simple solution, produced by crushing fresh leaves; or by mixing neem oil or kernel extract with water as prophylactic sprays. Neem first finds mention in Kashyapa's famous *Krishi-Sukti* of the 10th Century. Such technologies whether utilizing neem or other plant formulations are non-phytotoxic. Such prophylactic technologies must be used before a pest attack sets in. Otherwise they may not be effective in repelling pests, and may lead farmers to the wrong conclusion that they are ineffective against the pest.

Ecological knowledge

Mention has been made earlier that perhaps the most important technology for the non-chemical control of pests is a knowledge system that is well understood by the farming population. After carrying out field-based studies on the relevance and efficacy of traditions, the agricultural extension worker must add to this body of knowledge by carrying out modern studies on pest cycles; and on the pest-tolerance property of crops. The farming communities should be involved in PRAs, **with an especially important role for women**,

so that the community may clearly articulate the real nutritional and security needs of the community. **During PRAs, appropriate designing of questions is crucial to success.** Such community articulation will help the farmers rethink their cropping priorities, and enable them to grow a wide variety of crops. Diversity in cropping in itself will create barriers to pest attack. Further, the growth of umbelliferous crops like coriander, will not only supply a spice with important nutritional priorities, and which will produce tasty food, but it also attracts predator wasps, which will help control the larval population of dreaded pests, such as the *helicoverpa*. As Dr. Sanghi demonstrated, these systems of non-chemical management of pests are rarely used in isolation. In fact, farmers recommend a complex of different methods to be used to control a pest.

Participatory governance

This paper, which owes so much to Dr. Sanghi's wisdom, tries to present a picture by which sustainable agriculture will strengthen the livelihoods of poor people. It points out that sustainability is linked to the maintenance of bio-diversity in nature. Further, neither community stability, nor agricultural sustainability, nor the maintenance of bio-diversity can be expected to take place in equilibrium over a period of time unless the poor of the country are involved in participatory governance of their own communities. If there is political will, all this can be facilitated by strengthening Panchayati Raj Institutions as laid out in the 73rd amendment to the Constitution. In essence, it is recommended that we recapture the best aspects of community integration and social responsibility of traditional Indian village communities, but within a modern context, which would move people towards incorporating in their communities the values of a modern scientific, democratic, casteless society. This was Mahatma Gandhi's ideal of *Gram Swaraj*. The objectives of such societies can be reformulated in terms of living in harmony with nature; and applicable to all of the 2800 and odd cultural communities that make up the rich tapestry of Indian democracy. Such a humane development has been at the spiritual focus of our religious life, whether Hindu, Jain, Buddhist, Christian, Islamic, or Sikh.

It need not be thought, as was believed by many Indian leaders at the dawn of Independence, that such a vision of rural India is somehow backward. The modernists at the time we achieved Independence were not only profoundly mistaken in their belief that the planning process and modern science would deliver us from poverty, but they were also unaware of the military colonial roots of the epistemology of western science, which has perceived the path of

scientific enquiry into the mysteries of nature as an acquisitive process of subjugating nature and conquered communities. The Gandhian vision was no less scientific than theirs. It was perhaps more profoundly Indian and ecological. We are beginning to see that such a vision would not only benefit the rural communities but by strengthening their purchasing power, their skills, and their markets, enable India to develop a strong and competitive industry which would once again bring her to the fore-front of powerful, rich manufacturing nations, a place which she held for several centuries, till colonial subjugation destroyed the very fibre of her industrial strength.

* * *

Empowering Women through Sangham Action

Dr. V. Rukmini Rao[1]

Dr. N K Sanghi was a special person. I first met Dr. Sanghi in 1992 at a Board Meeting at the Deccan Development Society (DDS) in Hyderabad. He had come to DDS to persuade the Board Members that we should adopt a Krishi Vigyan Kendra to implement agriculture programmes promoted by the Indian Council of Agricultural Research (ICAR). Many of us were reluctant. I, having returned recently from New Delhi, with my activist experience at Saheli Resource Centre for Women and with experience of working with the Norwegian Development Agency (NORAD), implementing women's development schemes through the government, was totally opposed to the idea. Most of us in the room felt that "Bharat Sarkaar" would impose its views on us and we as a voluntary organization

1. *Director, Gramya Resource Centre for Women, 12-13-440, Street No, 1, Tarnaka, Secunderabad - 500 017, Contact: +91 (040) 42601382, Email: vijayrukminirao@gmail.com, Website: www.gramya.org.in*

would not be able to move forward with our own innovations. Within two hours, Dr. Sanghi in his soft and gentle voice had changed our minds.

Over the next two decades, I had the good fortune to meet him again in other contexts and learn about watershed development from him. He took me to Ranga Reddy District and showed me how a watershed development programme **should not be implemented**. The Department of Agriculture had spent a fortune to make contour bunds but since people were not consulted, the farmers had leveled the land in the following season. My involvement with the Rayalaseema Watershed Development Programme, housed in Centre for World Solidarity and supported by Sri M V Sastri and several donor agencies was grounded in promoting people's participation and learning from the previous failures. My own interest in promoting women's rights, led to several interventions where women's groups were formed to undertake the watershed development activities. Participation and women's leadership became key cornerstones to implement this programme which was a pioneer to the Watershed Development Programmes implemented by the then government of Andhra Pradesh. Dr. Sanghi became a firm believer in SHG actions with women's leadership.

My interactions with Dr. Sanghi continued through learning about the "Red Hairy Caterpillar" project. Almost two decades later his ideas of introducing non-chemical approaches to pest management were up scaled by the Centre for Sustainable Agriculture (CSA), initially under the leadership of Dr. M S Chari and then Dr. G V Ramanjaneyulu. As Dr. Sanghi reminded us regularly, his first experience of Non Pesticidal Management (NPM) to control pests in castor, though successful, had not been up scaled due to lack of understanding about group action by farmers at the village level. While the technical solution was available the social engineering element was missing. Dissemination of the ideas did not take place since social action was weak. The up scaling of NPM activities throughout the erstwhile state of Andhra Pradesh as the Community Managed Sustainable Agriculture Project implemented by Society for Elimination of Rural Poverty (SERP) was proof that his ideas were 100% right. SHG groups through collective action demonstrated how to reduce pesticide use by half in the state.

Dr. Sanghi's interactions with Self Help Groups at the community level made him a staunch believer in the capacity of women not only to take up thrift and credit activities but also successful agriculture development. Watershed development activities, food security programmes undertaken with women's leadership highlighted his belief again and again. All of us who learnt from his life and experience are grateful for the opportunity we had to work with him.

Here I would like to share some of our experiences from DDS to promote women's empowerment through *sangham* action and collective farming.

Collective Farming to Promote Women's Empowerment

Today, many critical issues face agriculture in India. From 1995-2013, it is reported that 2,96,466 farmers have committed suicide[2].The number of suicide cases have increased by 26 percent to 1,109 in 2014, with majority of deaths reported from Maharashtra (986), Telangana (84) and Jharkhand(29)[3]. Farmer indebtedness, due to high cost of inputs and relatively low prices for agriculture, is a major cause of the crisis. The increasing overuse of groundwater, together with climate change and reduction in rainfall/ unseasonal rains has added to the crisis. The government's continuing emphasis on high input green revolution technologies combined with introduction of genetically modified crops such as cotton has brought farmers to the brink of destitution. While the Government of India and many state governments have taken steps to write off thousands of crores of Rupees of farmer debts, the problem remains. Most small and marginal farmers are running their households on a permanent giant wheel of debt. In this context, we can see a ray of light from the experiences of dalit women farmers who have set up their own alternative household food security programme by working collectively with support from DDS.

Promoting Household Food Security

The DDS in Medak District, Telangana, worked together with 3000 dalit women in 32 villages to create household food security by increasing *de facto* control on land and decision-making on what is to be grown and how (land was owned by men in the family). Jawahar Rojgar Yojana innovative scheme, Government of India, provided Rs 55 Lakhs to this programme . This was a onetime investment. The emphasis of the programme was collective thinking and individual farming to improve the fertility and food production on their lands. It also created work. The strategy revolved around: 1) Emphasis on food crops and bio-diversity, 2) Encouraging use of low cost internal inputs, 3) Use of traditional seed, 4) Bio-mass generation, and 5) no external dependency, resulting in people developing confidence in their own knowledge and moving from food insecurity to food security and food sovereignty.

2. *http://agrariancrisis.in/farmersuicides/index.html*
3. *http://indianexpress.com/article/india/india-others/farmers-suicide-cases-rise-26-percent-to-1109-in-2014/#sthash.SorfRij4.dpufEstablishing Women's Leadership*

While the land was mostly owned by men, the programme established women's leadership by selecting five women leaders in every village from the village *sangham* (community group) to manage the programme. In each village, 100 acres of fallow land was brought under cultivation to grow sorghum inter-cropped with a variety of other food crops. Each farmer contributed a fixed amount of grain to the Village Grain Bank. This in turn was distributed in the lean season annually, at the cost of Rs 2 to 3 a Kilo to the poorest households. The eligible households were identified by Participatory Wealth Ranking in an open process by the women themselves in village meetings. The Sangham women also decided that they would provide food support to the most-needy families free of cost. They changed their role from being beneficiaries to benefactors. The women had effectively set up an alternative Public Distribution System using their own locally produced food – Jowar (Sorghum).

This programme resisted globalization which emphasizes externalization of all inputs, institutionalizing dependence, industrialization of agriculture and other natural resources and subjecting people to market forces. The women in the DDS sanghams decided to use locally available farm yard manure, their own traditional seeds, used their own bullocks rather than tractors dependent on international oil supplies and maintained soil health by use of farm yard manure and inter-cropping. The programme resulted in enhanced productivity of poor people's poor resources (marginal poor quality lands).

Starting from 1995 till date, the programme was up scaled by NGO networks in Telangana and Andhra Pradesh in 8 districts. Currently, 115 villages are involved covering more than 6000 acres. Through the Millet Network of India (MINI), the women through DDS have reached out to 50 farmer organizations, scientists, nutritionists, civil society groups, media persons and women. These organizations represent over 15 rainfed states of India. The MINI sees millets not just as crops but as a concept and above all the ability to help the millet farmers make their agriculture autonomous[4]. The network has reached out to women farmer groups as far away as Nagaland. Dalit women organized in their sanghams in the Zaheerabad region have made this possible.

Developing Commons

With support from the government, the women sanghams used the social forestry programme in the early 90s to develop village commons. They were able to identify and develop 1400 acres in several villages by carrying out social fencing. They

4. *http://www.milletindia.org/aboutus.php*

planted trees and greens and were able to access fodder, fuel wood and nutritious food by harvesting leafy vegetables. They entered into agreement with the State forest department for benefit sharing which is yet to be realized.

Up Scaling Learning by the Government

Learning from the DDS sanghams has not only spread through Civil Society Groups and farmer organizations but used as models for government programmes to promote women's empowerment. The AP Mahila Samata Society is noted to have taken up similar programmes by supporting 175 women's groups in five districts, with support being provided to 4376 women farmers. The programme supported by United Nations Development Programme (UNDP) is faltering after ten years when support was withdrawn. The SERP which has organized more than 10 million women in erstwhile Andhra Pradesh also undertook purchase of land for landless women. After the state division, it is to be noted that 2,761 acres of fertile land in Andhra Pradesh[5] and 1772 acres of fertile land in Telangana[6] with assured sources of water was purchased and handed over to women in Self Help Groups. Other states such as Kerala have gone ahead with the Kudumbashree programme[7] supporting 2,01,650 women cultivators in 47611 groups for collective farming.

Conclusion

The vision of Dr. Sanghi that SHGs would be an engine for growth and change is demonstrated by women across the country. Not only are poor women leading innovation and change in the agriculture sector but are leaders, setting up cooperatives and producer companies to get a better share of income. They are raising their alternative voices through community radio and community media. Today at the KVK in Zaheerabad motivated by Dr. Sanghi at DDS, we can see young women scientists preparing healthy ready to cook foods and developing a variety of recipes for millets – locally produced, to be sold by the Sangham women through Sangham Organics. ***Women power is evident!***

* * *

5. *http://www.serp.ap.gov.in/SHGAP/FrontServlet?requestType=CommonRH&actionVal=loadaboutus*
6. *http://www.serp.telangana.gov.in/SHGTG/FrontServlet?requestType=CommonRH&actionVal=loadaboutus*
7. *https://en.wikipedia.org/wiki/Kudumbashree*

Challenges in Micro Finance for Women Self Help Groups in Andhra Pradesh and Telangana

C.S. Reddy[1]

When I learnt about the sudden demise of Dr. NK Sanghi, I was shocked, deeply saddened and pained by the fact that I had lost a very dear friend. The development sector lost a passionate development activist in the area of natural resource management and a strong advocate of people-centric approaches. He was always fascinated by the stupendous success of the women SHG movement achieving significant scale and gave due credit to APMAS for the work we have done in the sector.

My association with Sanghi saab is for more than two decades! When late Sanghi saab was at MANAGE, we worked together on the conceptualization, design and policy guidelines of the Rythu Mitra Groups (RMGs),

[1] *Chief Executive Officer & Managing Director of APMAS & President of Sadhikaratha Foundation, Plot 11 & 12, HIG, HUDA Colony, Tanesha Nagar, Near Dream Valley, Manikonda, Hyderabad - 500 089, Contact: +91 (8413) 403118 / 119 / 120 Email: info@apmas.org / creddy@apmas.org, Website: www.apmas.org*

which were later issued by the Govt. of Andhra Pradesh, based on the experience and lessons learnt from the women SHG movement. We organized a 2-day workshop with all the Joint Directors of Agriculture from all the districts of esrtwhile AP and spearheaded the process of promoting RMGs on a large scale and in facilitating the process of RMG – Bank linkage.

I have vivid memories of our close association almost 12 years ago. He was deeply committed to making RMG as a movement to cover all the small and marginal farmers and tenant farmers, passionate about it, very open to learn other experiences and above all a wonderful human being. We continued our working relationship on issues around sustainable institutions for natural resource management. I always felt that he had lots of affection for me and always respected my ideas. He always made me feel special and proactively sought my engagement in designing appropriate institutional models for NRM. I have always enjoyed many things that we did together: we organized workshops and were a part of a number of panel discussions. I have used some of his presentations and papers while preparing for various workshops and training programs.

As I worked more closely with Sanghi saab it became very clear to me that he has no personal agenda, he does not belong to any organization (though he was associated with WASSAN), nor he has any ego. He always wanted to do whatever that is in the best interest of the farming community and promote natural farming. His respect for others, particularly the younger generation, was very inspirational. In any forum that we both were present, I have always seen all the government officials and stalwarts in the development sector respecting him and listening to his ideas and suggestions carefully. He was most suited to be a policy advocate as he was always persuasive, persistent and would never give up. He was always humble and never wanted to be in the limelight. When we both shared a room in Delhi attending a workshop on watersheds, I discovered that all his virtues and qualities come from his disciplined practice of spirituality. Late Sanghi saab was a wonderful human being and at APMAS we are committed to celebrate his life by following his ideals in our work.

Introduction

India's Self Help Group (SHG) movement has emerged as the world's largest and most successful network of Community Based Organizations (CBOs). It is predominantly a women's movement. As some experts have pointed out, it is a

development innovation in its own right and a home grown model. The SHG Bank Linkage Program (SBLP), which is India's own innovation, has proved to be one of the most effective poverty alleviation and women's empowerment programs. The SBLP had a modest beginning with 255 credit linked groups and a loan amount of Rs. 29 lakh in 1992-93. Since then, the program has grown exponentially. In the process, SHGs emerged as a mass movement across the country and largest community based microfinance model in the world. As per NABARD's microfinance report, as on March 2014, about 7.4 million SHGs have savings accounts in banks, with an aggregate bank balance of Rs. 9,897 crores. Only a third of their savings is in the bank account and the remaining two-thirds with SHG members in the form of loans. This implies that SHGs' own fund could be nearly Rs. 30,000 crores. Over 4.2 million SHGs have active bank loans, having a total loan outstanding of Rs. 42,928 crores. However, there remain regional disparities in the growth of the SHG movement, with limited progress in eastern and western regions of the country.

A number of Microfinance Institutions (MFIs) operated in the erstwhile state of Andhra Pradesh and experienced phenomenal growth during the period 2001-2010. While a number of women and their households benefited from the easy access to microfinance loans from MFIs, there were some clients who fell into a debt trap as they borrowed from a number of MFIs and also from the SHGs. During this period, several not-so-good practices of MFIs such as multiple lending, reorganizing existing SHGs to form Joint Liability Groups (JLGs)[2], high rates of interest on loans (MFIs always showed their interest rates as "flat rate" and not on declining basis), coercive recovery practices etc. cropped up. And many of these MFIs did not follow code of conduct prescribed for MFIs. Without formal regulatory framework and MFIs not being responsible and accountable my MFI association resulted in the State Government promulgating the MFI Regulation Ordinance in the year 2010. Following this, almost all the MFIs stopped their operations resulting in a loss of nearly Rs.7,000 crores which mostly affected the Indian Banks that provided bulk loans to the MFIs for on-lending. Currently, no commercial MFIs are operating in the States of Andhra Pradesh & Telangana.

---

2. *SHG has 10-20 women, all members saving regularly and engage in internal lending and access bank loan to leverage their savings. However, the Joint Liability Groups (JLGs) have 5-10 women members and are formed by the MFIs primarily for the purposes of loan recovery. As soon as a JLG is formed, the MFI would make an assessment and within 15 days provide loans to all the individual members of the JLG. These JLGs do not have any savings as MFIs are not allowed to mobilize savings.*

SHG Movement in Rural Andhra Pradesh and Telangana

SHGs and SHG Federations

In AP, there are 6.71 lakh SHGs covering 71.31 lakh members, in which 20.24 lakh are SC & STs, and 91,154 are persons with disability (PWDs). All the SHGs formed into 27,611 Village Organizations (VOs), 676 Mandal Samakhyas (MSs), and 13 Zilla Samakhyas (ZSs) and 5 Girijana Samakhyas.

In Telangana, there are 4.2 lakh SHGs covering 47.74 lakh members, in which 16.3 lakh are SC & STs, and 57,983 are persons with disability (PWDs). All the SHGs formed into 18,119 VOs, 437 MSs, 9 ZSs and 3 Girijana Samakhyas. It is evident that there are good number of SHGs and their federations covering large number of women and other vulnerable sections in both the states.

Promotion of Savings

There are two types of savings: i) compulsory and ii) voluntary. Most of the groups have only compulsory savings, where all the members save an equal amount. On the other hand, some groups have both voluntary and compulsory savings and the members are free to save any amount as voluntary savings, after depositing the compulsory savings amount, which is equal for all members. Voluntary savings are again for different purposes – health, education, Sthree Nidhi, gender and social events like marriage, birth ceremonies. The SHGs have savings of Rs. 5,363 crores with an average of Rs. 49,972 per SHG[3]. There is not much difference between AP (Rs. 50,454) and Telangana (Rs. 49,208) in the

Table 1: State-wise Details of SHG Saving Products

S. No.	Type of Savings	AP		TS	
		No. of SHGs	Savings (Rs. in crores)	No. of SHGs	Savings (Rs. in crores)
1	Mandatory	6,58,137	3291.50	4,15,021	1969.46
2	Health	20,317	5.22	15,107	4.73
3	Educational	4,115	0.41	1,163	0.42
4	Other savings	80,028	2.34	1,45,087	6.76
	Total		3320.61		2042.24

3. *The average savings per SHG as per the data of SERP/ MEPMA is significantly higher than the data reported by NABARD. SERP/ MEPMA report total corpus of the SHGs (funds in bank account + cash on hand + funds given as loans to members) whereas NABARD collects the SHG bank balances as on 31st March 2014 and reports the same.*

average savings per SHG. Small number of SHGs, both in AP (3.7%) and Telangana (3.9%), have voluntary savings for health of Rs. 9.95 crores and for education of Rs. 83 lakh. About 2.25 lakh of SHGs have promoted savings with Sthree Nidhi of Rs. 9.1 crores with an average of Rs. 404 per SHG. Interestingly, the percentage of SHGs promoted savings with Sthree Nidhi in Telangana is nearly thrice (35%) as compared to AP (12%).

SHG bank linkage programme

The data in Table 2 shows that during the last one decade the number of SHG credit linkages and the loan disbursed has been increased each year. This has been possible due to the proactive role played by the State Government, NGOs and banks and long-term funding support from the World Bank to the SERP. Since 2004-05 to 2008-09, year to year there is an increase in number of credit linkages and the amount of loan disbursed. However, from 2009-10 to 2011-12 the number of credit linkages decreased though there is a net increase in the amount of loan disbursed. It is because of large volume of loan with long repayment period to a lesser number of groups and fewer fresh linkages. Similar trend is found in both the states.

Table 2: Year-wise Disbursement of Loan to SHGs in AP and Telangana

Year	Andhra Pradesh		Telangana	
	No of Groups (In lakhs)	Amount (Rs. In lakhs)	No of Groups (In lakhs)	Amount (Rs. In lakhs)
2004-05	1.81	82,294	1.08	41,548
2005-06	1.81	1,34,821	1.08	65,321
2006-07	2.34	2,09,602	1.32	96,785
2007-08	2.79	4,01,427	1.52	1,86,851
2008-09	3.01	4,46,576	1.75	2,17,089
2009-10	2.63	4,42,364	1.51	2,07,771
2010-11	2.45	4,72,870	1.45	2,36,401
2011-12	2.21	5,37,478	1.31	2,70,204
2012-13	2.58	6,74,772	1.89	4,17,919
2013-14	2.74	8,53,207	1.77	4,57,878

Insurance Services

In light of bank linkage program with *Pavala Vaddi*[4] and *Vaddi Leni Runalu*, a huge amount of money is transacted by the SHG members in the name of total financial inclusion covering even the swapping of old debts. The core objective of the scheme is to protect the family members of an SHG member from financial risks, in the event of her death, to safeguard the institution of SHG from repayment burden, when a borrowing members dies, to ensure the perpetuality of the SHG, providing loan insurance to all the borrowing members, to ensure 100% repayment at all levels even in the time of turbulence and to increase the size of loans to SHG members, by creating confidence among the Bankers. Table 3 shows the number of SHG members covered under loan insurance programme and the amount paid in AP and Telangana States.

Table 3: Coverage of Loan Insurance Services in AP and Telangana

Financial Year	AP			TS		
	No. of SHGs	No. of members	Total Amount	No. of SHGs	No. of members	Total Amount
2012-13	5,135	53,144	1,45,77,299	3,296	36,391	87,56,859
2013-14	10,356	1,07,823	2,58,39,359	9,758	103,932	2,39,87,582
2014-15	206	2,127	4,44,005	95	1,055	2,65,030

Data source :www. Serp.ap.gov.in; www.serptelangana.gov.in

As part of social security measures, the government of Andhra Pradesh is implementing various insurance programs through the Indira Kranthi Patham (IKP). At present three types of insurance products are in progress – ABH, AABY, Swavalambana. Following are the details of claims under community managed micro insurance.

Table 4: Details of Community Managed Micro Insurance

S. No.	Claims	AP		TS	
		ABH*	AABY**	ABH*	AABY**
1	Initiated	48,269	22,254	28,954	13,687
2	Rejected	1,151	1,041	782	654
3	Pending	8,073	108	4,482	59
4	Settled	38,097	21,082	22,955	12,788

**Data as on June 2015; ** Data for the year 2013-14;*
Data source :www. Serp.ap.gov.in; www.serptelangana.gov.in

4. *Government of Andhra Pradesh provided loans to SHGs at 3% per annum interest rate during 2008 to 2012 to incentivize timely repayment of bank loans and interest-free loans were provided to SHGs by the State Government from 2012 onwards. This implies that the entire interest rate for bank loans is paid to the banks by the State Government on behalf of the SHGs.*

Urban SHG Movement in AP and Telangana

There are 1.85 lakh SHGs covering 19.43 lakh women in Andhra Pradesh and 1.19 lakh SHGs covering 12.55 lakh women members in Telangana. The data in Table 5 shows that in both the states, majority of the SHGs are BCs (44%) followed by OCs (35%), SCs (11%), Minorities (9%) and STs (2%). All the SHGs formed into 5647 SLFs in AP and 3,457 SLFs in Telangana. The data shows that majority of the SHGs have availed bank linkage in both the states. However, the percentage of SHGs availed bank linkage is high in AP with 83% as compared to Telangana (73%). Of the SHGs credit linked to banks since inception, many SHGs are credit linked twice (35%), followed by once (26%), thrice (25%) and 4 & above linkages (14%). However, the percentage of SHGs credit linked more than twice is low in Telangana state with 27% and high in AP with 47%. Of the SHGs availed credit linkage, about 27% and 25% of SHGs availed *Vaddileni Runalu* in AP and Telangana respectively.

Table 5: Region-wise Urban SHG Programme in Andhra Pradesh

S. No.	Particulars	AP	Telangana
1	SHGs -Total SHGs	1,85,036	1,19,575
2	Slum Level Federations (SLFs)	5,647	3,457
3	No. of SHGs availed BL	1,54,333	86,750
4	Total SHGs availed VLR	42,013	22,183
5	Total amount (Rs. in Lakhs)	7,004	2,970.48

Data source: www.mepma.org

Commercial microfinance institutions in India

In India, there are 155 MFIs covering 3.3 crores of clients in 561 districts with a loan outstanding of Rs. 33,517 crores. According to Microfinance Map of India published by Sa-Dhan, 23 and 29 organizations have been operating in AP and Telangana respectively. Of the total MFIs, 5 have been operating in both AP and Telangana states.

Issues in microfinance

Sub-optimal Utilization of Savings by the SHGs

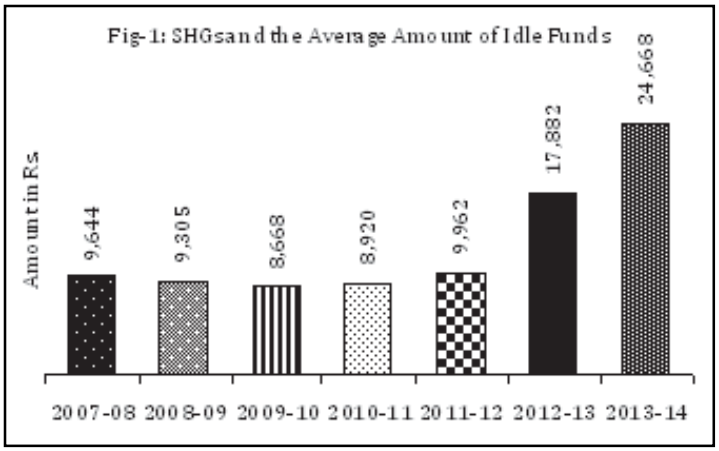
Promotion of savings is one of the five core elements (***panch sutras***) of SHGs (regular savings, regular meetings, regular lending & prompt repayment, regular book keeping and regular leadership rotation). There are two types of savings among the SHGs – compulsory and voluntary. The literature on SHG savings

clearly points to the fact that compulsory savings are common, and the voluntary savings is exceptional and a recent phenomenon.

According to a study conducted by APMAS in 2009, some factors helped SHG members in achieving some of the goals of savings such as mobilization of credit, self reliance and saving promotion. However, other factors resulted in failure of SHG members and their SHGs in addressing the objective like old age security (APMAS, 2009).

Impounding of SHG funds in Savings Bank Account (SB A/c):

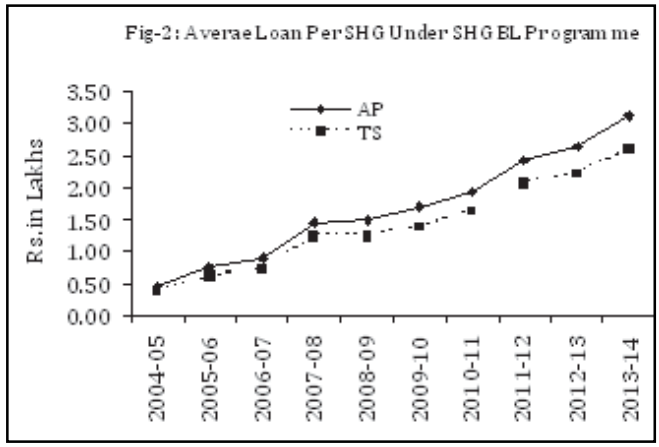
According to NABARD, the average amount of funds in SHG SB accounts as on 31st March 2014 was Rs. 9,897 crores with an average of Rs. 13,322 per SHG. Average bank balance of SHGs was much higher in AP & Telangana with Rs. 24,668 when compared to the national average. The data in Fig 1 shows that between 2007-08 and 2010-11, the average amount of funds decreased over the year; however, the decrease is not so significant. But it has significantly increased from Rs. 9,962 to Rs. 24,668 during the last three years i.e. 2011-12, 2012-13 and 2013-14. The reasons are multiple and vary. If we analyze it, the banks, SHGs and the promoting agencies are responsible for it: i) banks not allowing SHGs to withdraw savings during the loan period; ii) for the past three to four years there is very less lending from own funds to members as bank loans have subsidized interest rate or provided interest-free loans; iii) promoting savings until the group gets credit linkage; once the group got credit linkage, withdraw their savings and distribute the same along with the loan obtained from bank; iv) to get large loan by maintaining large amount of funds in SB account; v) to build reputation of the group at bank by maintaining large amount of funds in SB account; vi) members loan defaulting and low repayment in the past forced SHGs to keep funds in SB account, which in turn helps the group to get large volume of bank loan, indirectly the SHG funds in the bank account serve as a collateral for loans.



Impounding SHG funds in SB account has mixed results on groups. The favourable aspects include: i) avoidance of defaulting, ii) building faith among bankers about SHGs, iii) eligibility to interest free loan/ subsidy owing to regular loan repayment. The adverse aspects include: i) no credit services to member from internal or group funds. Consequentially, group loses interest on loans; as there is no internal lending, naturally members' dependency on money lenders increases; ii) the rate of interest paid by banks on SHG funds in SB account is low when compared to the interest rate collected from members by the SHGs. As a result, the group earning would be lessened.

Large volume of loan under SHG bank linkage programme

The data in Fig-2 shows that during the last one decade the average loan per SHG has increased nearly 7 times in both the states. It is because of large volume of loan in repeat/ loan cycles to large number of SHGs in AP and Telangana. This is because a majority of the SHGs in AP and Telangana are credit linked more than once, and the loan size is high in subsequent linkages. Also, larger loans sizes are promoted through proactive policy intervention by the State Government during the State Level Bankers Committee (SLBC) meetings and the supportive role played by the SERP field staff in completing the formalities.



Large loans to leaders

Each group selects two or three members, who are called the 1st and 2nd leaders; or 'President, 'Secretary' and 'Treasurer' to lead the group. A study conducted by APMAS in 2005 has examined the loans accessed by members and leaders, to ascertain whether leaders used their position to access more loans. Of the total loan amount, 25.71% was borrowed by SHG leaders, of which 14.15% and 11.56% were the amounts borrowed by the 1st and 2nd leaders, respectively. Nearly 3/4th of the loan amount was borrowed by the members – and this included the

share of former leaders, which was 2.93%. During interactions with SHGs, some group leaders and members reported that at the time of loan disbursement, members who do not need a loan and who feel that interest is an additional burden refuse the loan. In such instances, leaders take those members' share of loan amount too. The common perception was that leaders took pains to access external loans, and, therefore, they had the right to take larger loans.

Multiple credit sources and over indebtedness

The SHG members in AP and Telangana have multiple credit sources – i) SHGs funds, ii) loan from bank under SHG-bank linkage programme (SBLP), iii) loan from village organization and iv) loan from Sthree Nidhi. In addition, some SHG members enrolled with commercial microfinance institutions to avail credit. The loans from internal funds vary from Rs. 1000 to Rs. 30,000, mostly between Rs. 5,000 to Rs.10,000. Most of the SHG members accessed loans at least once, and there are no 'Pure Savers' in SHGs. All the eligible SHGs got credit linkage 1-6 times and the loan size varies from Rs. 50,000 to Rs. 5,00,000 with an average of 2.35 lakh under SBLP. The loan size and the number of linkages are positively correlated i.e. the loan size is high in repeat linkage as compared to the previous loan. The SHG-bank linkage loans are equally distributed among the members; need based lending is a rare phenomenon in the study states.

Normally VO sanctions loan of Rs. 10,000 each to 4 to 5 members in a group. About one half of the SHGs got credit linkage from Sthree Nidhi Credit Cooperative Federation, and the loan size ranges from one lakh rupees to 1.5 lakh rupees per SHG. Irrespective of loan absorption and repaying capacities, many SHGs and their members have been availing large amount of loans to meet household credit needs especially for social needs, household economic activities, asset creation and became indebted. Owing to low returns on investments and major chunk of loan on social needs and non-productive assets many SHG members have been depending on other than household earning sources to repay loan installments.

Absence of Credit Utilization Monitoring Mechanism

The SHG members have been borrowing large loans from SHGs for various purposes. There is a community based recovery mechanism (CBRM) to ensure good loan recovery and to manage default at various levels - i) SBLP sub-committee at VO and MS levels, ii) Joint Mandal Level Bankers Committee

(JMLBC) at Cluster level, iii) District Consultative Committee at District level, iv) SHG BL monitoring unit of a bank at district level, v) SHG Bank Linkage Unit at project level, and vi) State Level Bankers Committee at state level. But the promoters and the credit agencies have not been paying any attention in ensuring effective use of the loan for the intended purpose especially in cases of loans intended for income generation. Thus, there is a loan diversion for social and other household credit needs that leads to low repayment and/ or defaulting.

No Margin[5] for SHGs – Group Fund does not grow!

SHGs mobilize funds internally and externally. The internal sources include savings from members, interest on group funds in SHG bank account, interest on loans disbursed to members, fines & penalties, visiting fees etc. The external sources include loans mobilized from banks, NGO-MFIs, Federations, and the grants from SHPIs and the Government. Interest on loans is a major income source to SHGs, which contributes to the growth of the group fund over a period of time and reduces dependency on external agencies for meeting the growing credit needs of the SHG members.

Generally SHGs charge 12% to 24% interest per annum on the loans disbursed. Across the country the SHGs promoted by the NGOs practice charging a higher rate of interest than the interest paid by the SHGs for the funds that they access from various sources such as bank, NGO or SHG owned MFI. As a result, NGO supported SHGs have built a healthy group corpus over a period of 15-20 years reducing their dependence on bank loans as they are able to meet the member credit needs from own funds. However, there is a practice of differential rates of interest based on the source of SHG funds for on-lending to their members in most Government supported programs including SERP & MEPMA. Often times, SHGs charge a higher rate of interest on loans given from the members' savings as compared to loans accessed from external sources. Over the past 15 years, it has been observed that various Central and State Government supported SHG promotional schemes and programmes introduced interest subvention as an incentive for prompt repayment by SHGs.

Under the Government of India's flagship programme, National Rural Livelihoods Mission (NRLM), the banks have been mandated by the

5. *Margin is the interest spread that a women SHG has to meet its operational costs and to build a group corpus that grows over time to meet the growing credit needs of members. For example, if SHG borrows from a bank at 7% interest per annum, if lends to the SHG members at 12% per annum there will be a interest margin (spread) of 5% which makes SHGs profitable and sustainable in the long-run.*

Government of India from the year 2013 to lend to SHGs at 7% per annum in the entire country for NRLM-compliant SHGs and give a further incentive of 3% for prompt repayment in the selected 150 districts which are left-wing extremism districts. Such incentives from Government of India for bank lending to SHGs existed from the year 1990. For instance, in the erstwhile State of Andhra Pradesh, the State Government introduced ***"Paavala Vaddi"*** (4% interest per annum) in the year 2004 and decided to subsidize the entire interest on the bank loans to SHGs in 2011 through an interest subvention scheme called ***"Vaddi Leni Runaalu"***. As a result SHGs get the loan from the banks without any interest and the same is passed on to the members, resulting in SHG having no margin/ profit from the on-lending. Instead of SHGs performing the role of a financial intermediary by having an interest margin, they merely act as a pass through vehicle for the interest free loans from banks.

Increased dependency on traditional credit sources – Back to square one!

The Govt. of Andhra Pradesh has enacted AP Microfinance Bill in 2010 to address the issue of irresponsible lending of microfinance institutions to the women. The ordinance prohibits MFIs from lending to the self help groups that are already covered by the formal banking system without seeking prior approval of the banks. As a result, most of the MFIs registered under NBFC have closed their operations in the State. Though the State Government has promoted Sthree Nidhi Credit Cooperative Federation Ltd with SHGs as share holders, its operations and extent of credit is minimal when compared to the operations of MFIs. As a result, those SHG member households that were dependent on MFIs and not accessed adequate credit from SHGs have been slowly moving towards traditional sources for credit.

Loan waiver and financial discipline

Prior to 6-12 months of General Elections of AP & Telangana in the years 2004, 2009, and 2014, the major political parties in the states have made promises about the waiver of SHG loans during election campaigns to gain mileage from SHG women. In the year 2004, the Telugu Desam Party (TDP) has propagated that if Congress Party came into power, it will close the SHG programme in the state. As a result, most of the SHGs stopped repayment of bank loan installments about 3 months before the elections and another 3 months after the elections. Therefore, the repayment has decreased drastically by 25 to 30 percent.

In the year 2009, the TDP has announced SHG loan waiver in its election manifesto. But Congress Party has announced large loans to SHG women, and that they want to see SHG woman as '*Lakshadikarulu*'. Thus, majority of the SHGs stopped repayment of loan installments about 4-6 months before and after elections. In the year 2014, the TDP has announced the waiver of all SHG and agriculture loans not only in its election manifesto but also during the electioneering for about one year before the general elections of 2014. Thus, most of the SHGs including farmers have stopped repaying loan installments to banks, and most of the groups became default. As promised, immediately after forming the government, the Chief Minister of AP, has affixed his 1st signature on the file for Waiver of SHG and Agriculture loans in AP.

The loan waiver has mixed effects – i) financial discipline created over the years by the SHPIs has been distorted, ii) low repayment rate, iii) high willful default, iv) more financial burden on government, v) more interest burden, vi) impediments in getting repeat linkage, vi) promoters need more energies to reinstate good repayment, and vii) to avail interest subvention scheme some of the SHGs/ households borrowed large loans without any investment & repayment plans and thus pushed into debt trap.

Conclusion

In the states of Telangana and Andhra Pradesh, the women SHG movement achieved significant scale and financial inclusion is near universal. Women SHGs and their federations gained considerable visibility and are managing a large amount of funds in the rural and urban areas. To address poverty and deprivation, a number of initiatives were supported by SERP & MEPMA thru the women SHGs and SHG federation for human development and livelihoods promotion. Though the movement has grown to cover almost all the women of the two states, the movement faced a number of challenges resulting in the jeopardy of the SHG system sustainability. There is a sense of fatigue in the system and interference of the SERP/ MEPMA staff undermined the autonomy and independence of these institutions. All the SHG federations are registered under the MACS Act and can function as autonomous organizations. The same has not been possible due to their dependence on the government funding and also staff. While financial inclusion has been very good, impact of SHGs in the areas of asset creation, improvement in the areas of human development indicators and women empowerment are still not fully achieved.

References

1. APMAS (2005) *SHG-Bank Linkage Programme A Study in Andhra Pradesh,* Research and Advocacy Unit, APMAS, Hyderabad.
2. ———————— (2007) *SHG-Bank Linkage Programme - A Recurrent Study in Andhra Pradesh,* Research and Advocacy Unit, APMAS, Hyderabad.
3. ———————— (2011-12) *A Study on Utilization of Sthree Nidhi Loans by the Self Help Group Members in Andhra Pradesh,* study conducted by APMAS to Sthree Nidhi Cooperative Federation Private Ltd., Hyderabad
4. ————————- (2012-13) *Credit Requirements of Tribal Households in Tribal Project Management Units and Delivery Mechanisms in Andhra Pradesh*' study sponsored by Sthree Nidhi Cooperative Federation Pvt. Ltd., Hyderabad.
5. NABARD (2014) *Status of Microfinance in India 2013-14,* C-24, G-Block, Bandra Kurla Complex, Bandra, Mumbai.
6. Raja Reddy, K and CS Reddy (2013) *Self Help Groups in India – A Study on Quality and Sustainability,* ENABLE Publication, APMAS, Hyderabad.
7. Sarangi, T.P. (2011) *Rural Indebtedness and Practices of Microfinance Institutions in Andhra Pradesh*, study conducted by Centre for Microfinance Research, Bankers Institute of Rural Development, Lucknow.
8. www.serp.ap.gov.in
9. www.serp.telangana.gov.in
10. www.sthreenidhi.org

* * *

Creating Knowledge Spaces through Knowledge Dialogues

Dr. Shambu Prasad C.[1]

The contribution to knowledge of researchers is increasingly assessed by the number of papers or patents that he/ she has produced. This could often be erroneous in cases of many mature researchers who choose to deprofessionalize themselves in the latter part of their careers with a view to connect better with society and facilitate others in building newer knowledge at the interfaces between formal and informal research. Nand Kishore Sanghi was one such "deprofessionalized intellectual", to use Ivan Illich's phrase, who let go of the most dominant and status-rich discipline or tag in agriculture, that of a "plant breeder" and whole-heartedly embracing participatory methods of research. It is not often that one see an officer or a coordinator of "Transfer of Technology" of a regional centre (that Dr. Sanghi was

1. *Professor (General Management), Institute of Rural Management, Anand - 388 001, Contact: +91 (2692) 221616, Email: shambu@irma.ac.in, Website: www.irma.ac.in*

the head of from 1985-95) actively seeking and involving in farmer participatory research and extension.

I first came across Dr. Sanghi and his work while documenting the institutional history of ICRISAT's (International Crop Research Institute for Semi-Arid Tropics) watershed (Shambu Prasad, Hall and Wani, 2005). Despite encouraging agronomic results in the first year and good rates of return predicted by the economists we were wondering why many farmers rejected the integrated vertisol technology package in the early 1980s. The insights came from an article that Sanghi authored with John Kerr that had a full section devoted to "Why Farmers in the Indian Semi-Arid Tropics Reject Recommended Soil and Water Conservation Practices" (Kerr and Sanghi, 1992). This was perhaps one of the earliest recognition from the Indian agricultural establishment that farmers' knowledge, traditional or indigenous, needs to be understood and respected. I met and got to know Dr. Sanghi only following his retirement and in his capacity as Advisor, WASSAN. We had started a small group to carry forward dialogues between Civil Society Organisations (CSOs) and academics involved in understanding science-society relations, which was then known as the Science and Technology Group (later renamed as the Knowledge In Civil Society or KICS) with the Centre of World Solidarity and M V Sastri playing generous hosts of dissimilar groups of academics and practitioners.

Dr. Sanghi while familiar with NGOs in agriculture was new to the world of activism that some of the members of KICS represented. His presence, knowledge and willingness to collaborate and listen to people from diverse backgrounds (social scientists and CSOs), and sectors – health, energy, textiles – beyond his own areas of expertise was a tremendous source of strength and support for the fledgling KICS Forum. I had soon realized that Dr. Sanghi was one of those few scientists of his generation (like Dr. T M Thiyagarajan, Dr. O P Rupela and Dr. B C Barah) who despite being part of the rigid and hierarchical agricultural establishment, had in their own work pushed the boundaries by constantly seeking to engage with knowledge, irrespective of whether it emerged from within or outside the establishment. Sanghi would often refer to 'paradigm change' in his conversations and talks. His gentle demeanour and humility was one that one would rarely associate with active dissent that CSOs and academics in science studies are used to. It is through the work of people like Dr. Sanghi that I have realised the role of creative dissent in fostering institutional innovation in agriculture (Shambu Prasad et al. 2009). Creative dissenters like Dr. Sanghi would at times occupy positions of importance that base themselves

on a linear or pipeline model of innovation, but would make innovation processes more inclusive by being sensitive to non-formal sources of knowledge.

In this paper I hope to try and look at the role of knowledge in agriculture beyond the conventional bi-polar discussions of indigenous being exclusively associated with 'traditional' and farmers' and in opposition to modern scientific knowledge. I suggest that the role played by creative dissenters, like Dr. Sanghi, in enabling the transition in agriculture from its hierarchical modes of organising knowledge to one that is more sustainable and inclusive needs to be better appreciated. Dr. Sanghi played an important role in opening up the agricultural research establishment to knowledge and ideas from outside: first, as an intellectual who deprofessionalized himself[2] and secondly, in creating processes that allowed for knowledge dialogues between the formal and the informal. I will illustrate this through some of the work that Dr. Sanghi did more directly and later through his contributions to the institutional architecture on the System of Rice Intensification (SRI).

Creating Knowledge Spaces: Conversations on Indigenous Knowledge and Paradigm Change

The dominant role of Western science as value-free and universally applicable knowledge has been challenged by several scholars both in the West and from the "Third world". The recognition of the diversity of knowledge traditions, following the monumental work of Joseph Needham on China or the lesser known work of Dharampal in India, has led to the celebration of and research on, indigenous knowledge since the late 1980s. Scientific knowledge, including modern-scientific, is today seen by many scholars as 'value-laden', 'local' and 'situated'. This insight has led to two approaches. The first, a celebratory, often revivalist one, has (over) stressed the unique virtue of their particular system of science – Islamic, Indian, Chinese or Tribal. The second, consisting of those who recognized that differences between knowledge systems exist but are, like Dr. Sanghi, concerned about finding ways by which they can co-exist, that Shiv Visvanathan eloquently refers to as 'cognitive justice'.

The sociologist of scientific knowledge David Turnbull had referred to the need to decentre science and posited the idea of knowledge spaces for reframing science and other local knowledge traditions (Turnbull, 1997). We can see much of Sanghi's later work in seeking to constantly create knowledge spaces. To move

2. *For Gustavo Esteva's expansion of Ivan Illich's ideas of deprofessionalizing and disabling profession see O' Donovan (2015).*

knowledge from the local site and moment of its production and application to other places and times, knowledge producers deploy a variety of social strategies and technical devices for creating the equivalences and connections between otherwise heterogeneous and isolated knowledge. An essential component is the social organisation of trust (Turnbull 1997:553).

As the zonal coordinator of the Transfer of Technology division (1985-95) Sanghi promoted famer participatory methods of managing pests without the use of pesticides. He later sought to expand this space with organisations such as CWS (Centre for World Solidarity) and CSA (Centre for Sustainable Agriculture) to up-scale a local innovation. The story of NPM has been much written about (Quartz 2010, Ramanjaneyulu 2011) and does not need repetition here. Of interest though is the process of getting indigenous knowledge up-scaled, and as Dr. Sanghi would later point out, 'mainstreamed' too. This up-scaling was fraught with serious difficulties due to stiff opposition from the agricultural establishment and a debate on the very nature of the innovation.

Scientists from within the establishment were keen to call it IPM (Integrated Pest Management), whereas dissenting scientists like Dr. M S Chari, Dr. O P Rupela, Dr. G V Ramanjaneyulu and others including Dr. Sanghi were making the case for it being referred to as NPM or Non-Pesticidal Management. In recent times the active involvement of CSOs in both generating and disseminating knowledge on agriculture and Natural Resource Management (NRM) has challenged the monopoly over agricultural knowledge that many Indian agricultural research centres have been used to. The absence of interface between research centres and CSOs has been characterised by mutual distrust. Scientists like Sanghi would often play the role of knowledge broker by bridging the knowledge divides in meetings. Critical to his method was winning and building trust and creating conditions for dialogue and alignment if not consensus first in participatory NRM, later on NPM, rainfed agriculture and SRI.

In addition to social strategies of building trust across actors Turnbull suggests the use of technical devices which may include maps, templates, diagrams and drawings, broadly the techniques for spatial visualisation to enable the linking of heterogeneous components of a knowledge tradition. Dr. Sanghi used simple tables and maps to build consensus and mediate knowledge. I provide two examples to illustrate this. The first is a letter written to Dr. Rupela on 13 July 2006, which was copied to many, including me. This process of multiple sharing

of ideas among people who might not have met but could think together is one of the ways of building trust. In the letter Dr. Sanghi expresses his excitement at the work by Rupela on the "Learning Workshop on Biological Approaches for Crop Production and Protection" and recalls Prof. Anil Gupta (of IIM Ahmedabad and founder of the Honey Bee network on indigenous knowledge) for encouraging him to work closely with Rupela. Sanghi indicates the need for work to bridge formal and informal research. He also highlights the need for a paradigm to go beyond technical innovations to look at institutional aspects of innovations:

> "We have of course reasonable evidence on the merit of above themes from our informal research in limited number of villages but it has always been difficult to convince the senior persons associated with mainstream research and development about these aspects. Data from formal research as well as informal research will indeed go a long way to steer the rainfed development in a new direction...
>
> There is, however, a continued concern regarding modalities for upscaling the alternative technologies. It is now well recognized that the new paradigm for development in rainfed areas will consist of not only alternative technologies but also new ways of providing support services (which may largely include greater space to CBOs, refinement in financial management system, legal provision regarding user's right over CPR (including common land, groundwater, etc.)."

In the letter Sanghi shares his ideas on this "new paradigm" focusing on alternative support services that he and his team had worked on regarding upscaling of NPM programme. The letter ends with a mention of the ongoing policy context and discussions on rainfed agriculture and a gentle request: "Is it possible to integrate the learning (from formal and informal research) on five different themes indicated by you in your email?... Is it possible to discuss about these aspects so that a common view could be formulated for identifying policy issues to upscale these approaches?"

It was not uncommon for Dr. Sanghi to follow up his meetings with government officials and policy makers with a letter indicating not prescriptions on what needs to be done but the expression of ideas and often a gentle encouragement to include people in shaping a different vision as well as indicative processes by which this could be done. Not all these efforts would be successful but there

was no harm in trying. For some like me it would open up avenues for interaction with officials in Odisha. Social scientists, and activists, fed on Thomas Kuhn's ideas on paradigms and scientific revolutions, tend to pose paradigms as an intellectual challenge for hapless policymakers to navigate. Sanghi, to me, was the gentlest user of the word paradigm that enabled conversations including people without putting them off and giving them space to participate rather than make them feel guilty for the condition of the world.

"Beyond...": The search for newer vocabulary

Existing paradigms tend to fit newer ideas, anomalies too, within internal terms. Thus, for instance, a new method like NPM is sought to be fit within IPM, SRI[3] is seen by the rice establishment as nothing but Best Management Practices. Those involved in paradigm change need to also work on creating a new vocabulary. The second instance of Sanghi creating knowledge spaces relates to this need to create a contemporary language based on fast-emerging field realities. By 2007, the work on NPM had not only spread, but pesticide-free villages were being discussed in the media with increasing regularity. NPM, like SRI, was an innovation that was clearly different from the Green Revolution, but yet was not 'organic'. In the West, organic meant a process certification that was clearly outside the reach of small farmers in India due to the prohibitive costs involved. Organic in India often invoked an almost puritanical and rich combination of associations involving indigenous or native seeds, promoting biodiversity, opposing GM crops and highlighting self-sufficiency for farmers. Agroecology, while popular as a concept in many parts of the world both as a movement and a discipline (Silici, 2014) was still an alien category in Indian agricultural knowledge systems.

Dr. Sanghi was struggling with this need for a name and shared some of this in a talk with students of rural management at XIMB in December 2006. The talk was titled "Beyond organic farming: An emerging paradigm for rainfed agriculture". In his talk Dr. Sanghi acknowledges the dual paradigms of chemical and organic farming that exist but seeks to understand a third that seems to emerge from the field but is not clearly labelled. The slides in the talk are interesting not just for creating knowledge spaces but also suggesting ways by which maps and templates can be worked to build bridges. Sanghi begins with 'what we are not talking about' and then seeks to highlight the features of this

3. *SRI is a climate-smart methodology for increasing the productivity of rice, and increasingly other crops, by changing the management of plants, soil, water and nutrients, while significantly reducing external inputs.*

new 'ecological farming'. He then suggests steps of evolution of this newer kind of farming that indicates a social process that could lead a village to being pesticide free in 3-4 years (step 1), selling of pesticide free produce in local market (step 2), establishment of community managed seed banks (step 3), and the sequence of adopting non-chemical methods of nutrient management that could lead to this ecological farming becoming organic if the communities so desired. He then goes on to outline key policy and support structures required to make this happen. Dr. Sanghi used the opportunity to engage with students to test his ideas that actually had a high policy import and that got refined in his later work. The use of a language that is amenable to a student and policy maker alike enables a movement towards newer knowledge.

I had several opportunities to visit Hyderabad and interact with Dr. Sanghi between 2009-2012. Dr. Sanghi agreed to become a core committee member once KICS was registered in 2010. Dr. Sanghi would join us for the sharing sessions and workshops whenever he could and he invariably brought a sense of calm and dignity to the meetings he attended that at times tended to be overcritical of the government or its policies. He was a careful listener and had this knack of taking in the best of what people would say. He would bring to these meetings the excitement of newer possibilities in agriculture that often would go with headings like "Beyond... (organic farming, pesticide free villages)".

Knowledge Dialogues for Upscaling SRI in India

The opportunity to work and think together on newer paradigms and vocabulary on agriculture with Dr. Sanghi was waiting to happen. An idea that crystallized later into a pilot was a Learning Laboratory on "Knowledge Intensive Agriculture" (KIA). This pilot project was supported by the Institutional Learning And Change (ILAC) initiative of the CGIAR (www.cgiar-ilac.org) and was to explore newer emerging forms of agriculture, captured by the phrase KIA, seeking to learn from the way both NPM and SRI worked.

The silent, yet solid, support of Dr. Sanghi helped us push thinking more confidently that we would have otherwise done. In an encouraging letter in January 11, 2008 to me he shared on the concept note for the KIA pilot on "learning alliances for poverty reduction", He said:

> "The impetus (for NPM) has indeed come from a successful experience generated under informal research set-up which needed to be upscaled under the mainstream. This experience highlights

> that institutional reform is crucial if learning alliance is to be facilitated. Most of the partnerships need to be among autonomous organizations with common interest around a new paradigm... we may look forward to facilitate such alliances around emerging successful examples including SRI in different states so that it gets upscaled at a faster rate. May be each experience will require different types of partners in the learning alliance."

We were using 'learning alliance' liberally much beyond its earlier Latin American settings (Lundy *et al,* 2005) and Sanghi found the phrase useful to create new knowledge spaces that furthered collaboration. KICS was later involved in an ambitious project of formulating an Indian manifesto on science and technology (KICS 2009). We followed the manifesto with pilots exploring cases on democratizing knowledge that led to a revised manifesto (KICS 2011). In our discussions he urged us to look at the example of NPM where the para-statal organization, SERP, had actually helped NPM upscaled even though it was not mainstreamed. Dr. Sanghi was involved in the case on NPM, with CSA, titled "Whose Knowledge Counts". He was later to elaborate on this in a knowledge dialogue that occurred at the National Institute of Plant Health Management in January 2010, the invitation letter of which had three ideas about the emerging institutional architecture and was seeking to give shape to a non-violent science mentioned in the manifesto:

> "This innovative approach is deeply rooted on the following three principles namely
>
> i. A new paradigm that combines indigenous and modern science through a knowledge dialogue. This knowledge based development is in contrast to the input based development that has been prevalent from Green Revolution days,
> ii. Technological interventions that seek to explicate non-violent science through adoption of preventive measures at un-harmful stages of pest (e.g. pupae, moth and egg) as compared to control measures at harmful stage of the pest (e.g. larvae), and
> iii. Enabling institutions that have rejected the top down extension system and put in place a decentralized participatory extension system on the platform of sustainable community based organizations (e.g. women SHGs and their federations)."

The years 2010-2013 were interesting times for policy making in India. The Twelfth Five Year Plan was being formulated and the (erstwhile) Planning Commission undertook consultative processes that involved many CSOs sharing their perspectives. Expectations, and demands, form the Government were high and many felt that there was a possibility to change policies, especially in agriculture, by drawing upon the innovative experiments from the grassroots. Dr. Sanghi was an active member and guide to the Revitalizing Rainfed Areas (RRA) Network and played the role of the master communicator of knowledge between the agricultural establishment on the one hand and the CSOs on the other.

For those of us involved in the SRI movement, as historians of innovation or as promoters, a big challenge lay in influencing the agricultural extension. Repeated meetings with policy makers would tend to veer around ideological biases from the earlier paradigm. Posers would often be like "If SRI is indeed so good, why does it not work in Punjab and Haryana?" or "why not include herbicides for weeding operations instead of the mechanical weeder which would involve a lot of work (read drudgery)?" A more enlightened poser would be "would you not be better off working with the rural development ministry that might understand your language rather than the agriculture ministry?" Repeated pleas to get the agricultural establishment to work out their posers based on actual field experiments and allocating research budgets and programmes would often be met with silence, if not denial. Changing agriculture policy from outside the establishment and the corridors of Delhi seemed to us a herculean task. It was not the merit of the idea but your position in the knowledge hierarchy that would count.

In late May 2011 a sub-group of the Planning Commission on "Upscaling Innovative Technologies" was announced to suggest how informal R&D could indeed find ways to be taken more seriously. The official ToR had indicated a focus on food security and innovative techniques (specific reference to SRI was made) with mechanisms for scaling up to be suggested by the Sub Group (SG). The time frame to come out with recommendations was short, less than two months. The unofficial expectation of the establishment was that the SG would choose few technologies that ICAR had already identified as innovative and suggest ways of scaling. The members though were largely from outside the establishment and had no reason to do so.

Dr. Barah, the agricultural economist, who was serving as the NABARD Chair professor at IARI, ensured the survival of the group as the Member Convenor

and handled much of the external interface with great finesse. He too, like Dr. Sanghi, believed in sourcing knowledge widely and valued interactions with actors typically outside the agricultural establishment. There were several discussions and internal confusions too. The temptation to scout and choose technical innovations rather than focus on institutions and inclusive mechanisms for scaling up innovations from outside the establishment was high. Experiences from across India were being pooled and given the diversity of SRI practices it led to heated discussions. What worked in AP would not in Jharkhand or Uttarakhand and every state had a story that was unique in its own way.

The SG consulted the SRI community through an e-survey and was in touch with the RRA network as many of its members were in other working or sub-groups. Another SG was making a recommendation on SRI with targets and areas. As we went along it was felt that it would be useful to co-opt Dr. Sanghi for his inputs. Reviewing the e-mail correspondence of those months (May – Aug 2011) one sees the craft of Dr. Sanghi in policy making. He kept pushing us to work with as many actors as possible, urging us to request state governments to provide information and build rapid and resourceful tables to capture the diversity, but also the commonality among various ways of taking SRI further.

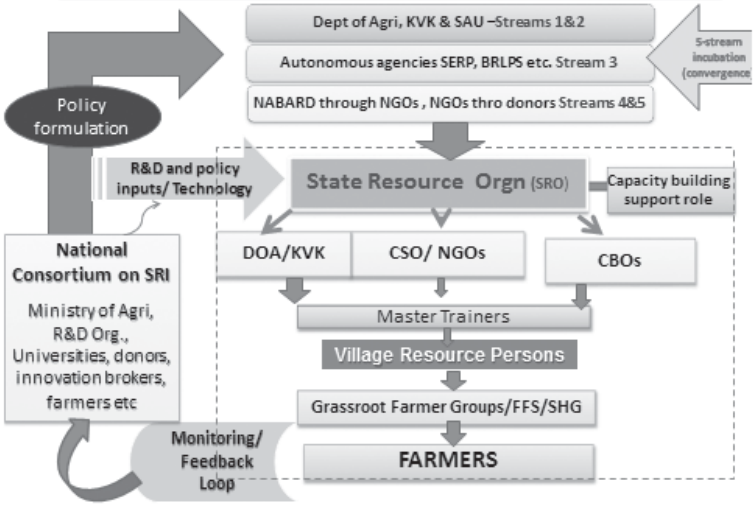
In an insightful note (dated May 24, 2011) titled "Emerging successful experiences and their implications" shared to the RRA network before the sub-groups were in place Sanghi gently reminded members to think over a few questions. He observed that "the major investment on generation and upscaling of above experiences have come through one or other informal R&D organizations" and hence wanted more thoughts on eight broad ideas that he felt that the Sub-groups or working groups could reflect on:

1. What had been the source of knowledge in the above experiences? In future whose knowledge should count?
2. Who have been instrumental in generation and upscaling of above experiences?
3. What role has been played by NGOs, CBO and innovative farmers in the whole process?
4. Whether it is possible to integrate the formal and informal research as well as developmental set-up through a consortium approach as being currently attempted under NAIP?
5. Whether sufficient fund can be allocated during XII plan for such initiatives through the consortium approach (both for generation and upscaling of experiences)?

6. Whether adequate reform can be made in the delivery mechanism in which greater control for carrying out adaptive research as well as upscaling of successful experiences are in the hands of sustainable CBO?
7. Whether the existing CBOs can be restructured and investment can be made to organize them in a sustainable manner?
8. Whether the financial management system (particularly for developmental work at CBO level) may be improved in such a way that subsidy oriented approach is replaced with revolving fund oriented approach?

We were keen that some of these insights were used in our own SG. Sanghi kept pushing us to work through tables comparing irrigated and rainfed SRI, identifying those states that were capable of quick expansion and finding commonalities in the processes of SRI upscaling – government or non-governmental. Sanghi showed tremendous strategic and nimble thinking encouraging us to go beyond our limitations of operating in an information-scarce environment. The data on acreage was not codified and National Consortium on SRI (NCS) had to use quick surveys and collate information from its network and secondary sources. A few of us were sceptical as we felt we should not spend too much time digging incorrect numbers and project accordingly. However we watched, sometimes in disbelief, as Dr. Sanghi soon

Fig-2 : SRI needs different Institutional Framework



Source: 12th Plan Sub Group on Upscaling Innovative Technologies

came up with the requisite numbers that would enable conversations in policy circles. In this he was bringing to the discussions both his experience of working in complex systems like watersheds, and an intimate understanding of the way agricultural policy makers think.

While one could go into great detail about the tables, suffice it is to suggest that the tables were synthesised with typologies being worked out and five streams of SRI identified. The main contribution to the Sub Group was to provide a map of the institutional architecture to upscale knowledge intensive innovations like SRI irrespective of the organisation involved in its promotion (Shambu Prasad and Barah, 2013). See Fig-2.

Agricultural Science and Creative dissenters

Despite our efforts in the SG, almost none of its recommendations went past the working group and into the policy. We were all quite disappointed and the NCS started working on getting the document greater visibility in policy circles within its limited means. A few round tables were organised and IARI began to take greater interest in SRI work and experiments were initiated. Sanghi continued to participate whenever he could. He contributed to the document about integrating SRI with MGNREGA and we benefitted from his participation in the round table in Feb 2013 where he shared his presentation on "Reforms in delivery mechanism for promoting SRI - some considerations". Despite his ill-health he shared his thoughts in the following months. In a letter to Ramanjaneyulu, Ravindra and me in May 2013 (one of the last few that I would get from Dr. Sanghi) he reiterated the criticality of reforms in delivery mechanisms and was seeking to integrate different forms of producer collectives:

> "Mainstreaming of learning from above experiences continues to be a challenge. Is it worthwhile to further debate about alternate channels of upscaling through new partnerships based upon their areas of strengths...? There are mixed experiences with producers' organisations in the present forms. What are the alternative forms of producers' organisations or any other type of CBO?"

Sanghi continued to be active for some time in the e-groups of JAI-SRI-AP and RRA commending colleagues in the field for their work and initiatives on millets. Nemani Chandrasekhar, his ever faithful and resourceful secretary, would keep us informed about his health. I always hoped that I would get to see him again. While many of us would indeed be missing Sanghi, to me the greater loss is to

India's agricultural establishment. There are few people in the establishment who could be better ambassadors than Dr. Sanghi for including people from outside to participate pro-actively with scientists in creating newer agricultural futures. At a time when the credibility of Indian agriculture science is low[4] the establishment clearly needs scientists who can talk and engage with society much more than another new seed. Innovation needs creative dissent of the kind that Sanghi practiced. Sanghi will be remembered by many as a scientist who shaped a new paradigm in agriculture, collectively and collaboratively, through conversations with CSOs, farmers and fellow agricultural scientists. One sincerely hopes that this festschrift is not just read by the staff of CSOs that he worked with but is widely shared and read by future agricultural researchers in the many state agricultural universities. Sanghi for social scientists like me would be remembered for being a deprofessionalized intellectual but to those pursuing agriculture his life could be a model for making the profession of an agricultural scientist respectful, rewarding, recognized and loved by many.

References

KICS (2009) 'Knowledge Swaraj: An Indian Manifesto on Science and Technology', Secunderabad: Knowledge in Civil Society, http://kicsforum.net/kics/kicsmatters/Knowledge-swaraj-an-Indian-S&T-manifesto-2009.pdf.

KICS (2011) 'Knowledge Swaraj: An Indian Manifesto on Science and Technology', Secunderabad: Knowledge in Civil Society, http://kicsforum.net/kics/kicsmatters/Knowledge-swaraj-an-Indian-S&T-manifesto.pdf .

Lundy, M., Gottret, M. V., & Ashby, J. (2005). *Learning alliances: an approach for building multi-stakeholder innovation systems*. Institutional learning and change (ILAC).

Kerr, J. M., & Sanghi, N. K. (1992). *Indigenous soil and water conservation in India's semi-arid tropics*. Gatekeeper series no 34. London: International Institute for Environment and Development.

O'Donovan, Ó. (2015). Conversing on the commons: an interview with Gustavo Esteva—part 1. *Community Development Journal*, *50*(3), 529–534. http://doi.org/10.1093/cdj/bsv013

Quartz, J. (2010). Creative dissent with technoscience in India: The case of Non-Pesticidal Management (NPM) in Andhra Pradesh. *International Journal of Technology and Development Studies*, *1*(1), 55-92.

4. *Down to Earth's cover story "Science under Siege" of Oct 15-31, 2013 captures this credibility crisis well.*

Ramanjaneyulu, G. V. (2011). Innovating on pest management: practices and processes. *Innovation and Development*, *1*(1), 155–157.

Shambu Prasad C, A.J. Hall and S.P. Wani, 2005. Institutional history of watershed research: The evolution of ICRISAT's work on natural resources in India.Global Theme on Agroecosystems Report no. 12. Patancheru, India: International Crops Research Institute for the Semi-Arid Tropics. 40 pp.

Shambu Prasad, C. (2006): System of Rice Intensification in India: Innovation History and Institutional Challenges. Hyderabad: WWF-Dialogue Project at the International Crop Research Institute for Semi-Arid Tropics and XIMB.

Shambu Prasad, C., Beumer, K., & Mohanty, D. (2007). Towards a learning alliance: SRI in Orissa. XIMB and WWF-Dialogue project, ICRISAT, Patancheru, India.

Shambu Prasad, C. and Barah, B. C. (2013): Upscaling SRI: Unpacking innovation, investments and institutions, LEISA India. 15(1): 16-19.

Shambu Prasad, C. 2014. Creative dissent: Linking vulnerability and knowledge in India. In Hommels, A., W. Bijker, and J. Messman, eds. *Vulnerability in Technological Cultures: New Directions in Research and Governance*. MIT Press, Boston, USA.

Shambu Prasad, C.,T. M. Thiyagarajan, O. P. Rupela, A. Thakur, and G. V. Ramanjaneyulu. 2012.Contesting agronomy through creative dissent: Experiences from India. In Sumberg, J. and J. Thompson. Eds. 2012. *Contesting Agronomy: Agricultural Research in a Changing World*. Routledge and Earthscan series on sustainability, London.

Silici, L. 2014. Agroecology-what it is and what it has to offer. *Issue Paper 14629. IIED. London: International Institute for Environment and Development*.

Turnbull, D. (1997). Reframing science and other local knowledge traditions. *Futures*, *29*(6), 551-562.

* * *

A Reflection on Policy Formulation Processes - A Case Study of Watershed Management Projects in Andhra Pradesh[1]

M.V. Rama Chandrudu[2] and Dr. C. Suvarna[3]

Dr NK Sanghi is a strong believer of state specific guidelines and always thought that Andhra Pradesh was a pioneer in this matter. He contributed to the conceptualization of Process Guidelines of APRLP, particularly on productivity enhancement and livelihoods components. He defined how these components could be integrated into existing guidelines. The first author had the fortune of working with him closely for almost 15 years and benefited from his "incorrigibly positive spirit" and "innocent thought process".

---

1. *Though these experiences are from erstwhile Andhra Pradesh state, the processes/ experiences mentioned belong to the two new states.*
2. *Executive Director and Secretary, WASSAN, H.No. 12-13-452, Street No. 1, Tarnaka, Secunderabad - 500 017, Contact: +91 (040) 27015295 / 96, Email: duram123@gmail.com, Website: www.wassan.org*
3. *Member-Secretary, Telangana State Bio-diversity Board, Government of Telangana, Telangana State Biodiversity Board, 6th Floor, Chandravihar Complex, M.J. Road, Nampally, Hyderabad - 500 01, Contact: +91 (040) 24602345 Email: telanganabiodiversity@gmail.com, Website: http://www.tsbiodiversity.org*

Though Government of India supported watershed development projects (financial support and program design) for a long period, the real paradigm shift in these projects took place with the advent of Guidelines for Watershed Development Programme in 1994. Through these path breaking guidelines Ministry of Rural Development, Government of India rationalized the on-going schemes related to drought relief and employment generation. These guidelines have introduced several innovative protocols with a strong belief on community participation. For the first time in India, development funds were directly transferred to the bank accounts of local committees. Otherwise, works were generally executed either through department or contractors. Similarly, there is a significant focus on participatory and comprehensive action plans; partnerships between voluntary organizations and state governments; special budgetary provisions for training and community organization and so on. It took some time for state governments, district level agencies, voluntary organizations, communities, local politicians and others to completely appreciate the implications of these changes on the discourse of policy and practice of watershed management in the country.

However, there are many questions and challenges in transferring these guidelines into reality. Are the provisions of guidelines adequate for promoting participatory watershed management? Are the District Project Management Team and Project Implementing Agencies ready for this initiative? Are the budget provisions (unit costs) sufficient? What is the meaning of training and community organization? How to select voluntary organizations and appoint them as Project Implementing Agencies? How to monitor the project at district level? What is the role of state government in this project? Did the agencies understand the spirit of guidelines? Such questions kept increasing with time. Very soon it became clear that these fears were not completely unfounded and some of them are "real" problems. Given this background, where a new policy with an egalitarian framework and passion for participatory development, is introduced by Central Government, to unprepared state and district level administrative machinery, the probability of failure seemed to be much higher.

In a federal system like India, the role of central government is largely limited to setting the vision and objectives; defining the strategy; provision of financial resources and guidance, while the state governments are expected to follow these guidelines, place effective implementation mechanisms and ensure that the expected end results are achieved. This is applicable to watershed development projects also. However, given the "newness" of the guidelines and

demands of participatory watershed management projects, there are several issues and concerns which need to be addressed. It is important to "contextualize" these national guidelines locally and "interpret" them in the interest of local communities. "Initiatives" have to be taken at the state level to ensure that the policies of national interest are truly relevant to the local conditions. However, there may be questions of role clarity between state and central governments. The dilemma of "who should do what?" may be a hurdle in taking any initiative. The key question is also, whether there is any "space and opportunity" for such initiatives. These questions may be little out of space now (2014-15) as the new phrase "cooperative federalism" is in currency. But, these are daunting questions for the state governments. It is not rare that even senior officers are desperate and make complaints that several "irrelevant" decisions (guidelines) are made at the top and there is not enough space to alter them to local conditions. The watershed development projects in Andhra Pradesh offer an experience (and a host of lessons from this experience), where dynamic senior government officers collaborated with like-minded partners, particularly with committed civil society organizations, politicians, peoples' institutions, to see that national policy of watershed management was relevant to local conditions and aspirations of local communities.

This paper presents the reflections of two individuals, who have gone through the process of "contextualizing national policies for a local condition" and witnessed the "ups and downs" of this process, with a specific focus on watershed development projects in Andhra Pradesh. Section 1 of the paper explains "what" changes took place in the policy content (national provisions and local adaptions). Section 2 explains "why" these changes took place (reasons behind the change). In Section 2, the authors took the liberty[4] of mentioning names of some key senior government officers and important civil society organizations, who made significant contribution in this process. Section 3 is largely on lessons learned followed by a concluding section.

Section 1 - What changes took place in the policy content?

Experiences of Andhra Pradesh indicate that content of policy is dynamic. Part of the policy changes, while certain part gets entrenched without any change. It is also observed that certain policy provisions are never/ rarely operationalized. In this section, changes in the contents of the policy and other arrangements

4. *These are the perceptions of the authors and others could have different opinions/ points of view on this matter.*

are chronicled. This section also presents the variations between the policy provisions at national level and local level.

First Phase (1994 to 2000) - Early Glory

In this phase, watershed development projects enjoyed high priority and glory. In Andhra Pradesh these were considered as an important agenda of the state government during 1994 - 2000. With the objective of addressing the major concerns of the drought prone areas, the state government was able to mobilize large number of watershed development projects from the Centre. During the same period, Andhra Pradesh also promoted other important community based development initiatives such as – self-help groups of women (micro finance and institutionalising women's collectives); joint forest management; participatory irrigation management and so on. As state government was keen on addressing the critical concerns of rural areas/ communities, these initiatives were considered to be necessary conditions for "accelerated growth". Given the massive scale of these initiatives, the state government had to "prepare" itself to support them and deliver the promise. This triggered a new way of functioning and policy framework for these initiatives. Implementing participatory development projects on a large scale was a challenging exercise for the senior officers of the Government. The following interesting policies were promoted during this phase, for watershed development projects in the state.

- As watershed development projects have high potential (for changing the rural economy and ecology), Government of Andhra Pradesh developed a State Perspective Plan for Watershed Development projects. This document[5] provided a clear direction to the state – indicating the commitments of the state government; expected funding support from different sources; phasing of the projects, area/ targets to be covered, institutional arrangements and so on. Within the broad framework of this document, the state government shaped its implementation strategies.
- The national policy suggested DRDA as the nodal agency at district level for watershed development projects. As GoAP realized that DRDA would be over loaded with a massive project like this, it established separate Drought Prone Areas Project Offices in the 13 DPAP/ DDP districts. This

5. *This process of preparing State Level Strategic Plan was subsequently integrated into the Guidelines of Integrated Watershed Management Project (2008) of Government of India.*

dedicated[6] institutional arrangement helped to provide focus on the watershed projects. These DPAP Offices had a Project Director with requisite Multi-Disciplinary Teams.

- As watershed development projects demand high level of efforts towards community mobilization, GoAP decided to appoint local NGOs as Project Implementing Agencies. NGOs were expected to provide necessary inputs and support the peoples' institutions on watershed related issues. During this period, in some districts of the state (e.g. Nalgonda District) majority of the projects were implemented by local NGOs. Though this provision is part of national guidelines, several state governments have neglected this provision, while GoAP tried to make maximum use it.

Second Phase (2001–2005) – Harmonising Innovations with Mainstream

This period witnessed series of changes in policies of watershed development project in the country and state. This was strongly linked to the changes in leadership at government and administrative set up of watershed development projects. During this period, Government of India changed watershed guidelines twice (Revised Guidelines in 2001 and Hariyali Guidelines in 2003) and GoAP issued Process Guidelines twice (2002 and 2005). Government of India also constituted a committee for reorienting watershed development policy and programs (Parthasarathy Committee, 2005-06). The policy formulation processes and the content of the same have significant impact on the quality of the program at grass root level.

The state administration realized the gaps in watershed development project during the initial phase (1994-2000). There was an excessive focus on "physical and engineering works" in the project, while the participation, equity and gender issues got neglected. GoAP wanted to improve the quality of watershed development projects and bring in livelihoods focus. With the support of Department for International Development, India (DFID I), Government of Andhra Pradesh executed AP Rural Livelihoods Projects (APRLP) in five districts of the state from 2000-2007. The last two years (2005-2007) of APRLP were used for consolidating the initial experiences.

During this phase, GoAP attempted to mainstream some of the good practices and innovations into watershed development projects as part of APRLP. For

6. *Later, this arrangement was also up-scaled to the entire country in the Guidelines of Integrated Watershed Management Projects (2008).*

enabling this, GoAP issued "Process Guidelines for Watershed Development Projects" in Dec 2002. These Process Guidelines gave significant emphasis on participatory processes; institution development; capacity building support; productivity enhancement and livelihoods; focus on equity, gender considerations. Experiences from Civil Society Organizations contributed significantly towards policy improvements of watershed development project in the state. However, these Guidelines could not be implemented properly as they were inconsistent with the new Hariyali Guidelines, issued by MoRD in Apr 2003. Hariyali Guidelines did not give space for several newer provisions and innovations that GoAP wanted to promote as part of Process Guidelines (2002). This stalemate was resolved during 2005, when the government changed in 2004. GoAP issued second version of Process Guidelines in 2005, which could harmonise the proposed innovations within Hariyali Guidelines. The main features of the Process Guidelines of Watershed Development Projects in Andhra Pradesh, during this phase are as follows:

- District level dedicated offices (District Water Management Agency) were established in all districts of the state to provide leadership to watershed development projects
- Policy was highly forward looking and sensitive to the concerns such as gender, equity and participation
- Dedicated budgets for capacity building; livelihoods and productivity enhancement
- Livelihoods Resource Centres were established for strengthening delivery of capacity building services at community level
- Consortium of Resource Organizations was established to forge partnerships between GoAP and resource organizations for strengthening the project
- Partnerships were forged between Grama Panchayati and Village Organization; responsibility of project implementation was divided between these two institutions
- NGOs were given the role of resource organization and anchored few livelihoods resource centres

However, in harmonising the national level Hariyali guidelines and the state process guidelines, there were few "compromises" that had serious implications on the quality of watershed projects:

- Constant re-organization of the watershed teams (state/ district/ project level administrative arrangements) destabilized the project management.

- NGOs were no longer selected as Project Implementing Agencies. As a result, the facilitation support for institutional development was weakened.
- Grama Panchayati received very little direct support. Orientation to them as responsible institutions for implementing watershed development project was fairly weak. There was very limited supervision and monitoring of the performance of Grama Panchayati.
- There were several partnership related issues between NGOs and DWMA in anchoring Livelihoods Resource Centres.

Third Phase (2006 – 2009) – State of Confusion and Low Priority

During this period, watershed development projects faced considerable neglect from the policy makers at central and state governments. The APRLP project was formally closed by Dec 2007. The Parthasarathy Committee submitted its report to MoRD, GoI. It was strongly recommended that community based institutions such as watershed committees should be part of watershed development project and Grama Panchayati should be engaged with governance of projects, rather than implementation of projects. Based on this report, MoRD initiated another process of revising Guidelines for Watershed Development under the guidance of Planning Commission, GoI. As a result of this, Common Guidelines for Watershed Development Projects (2008) were issued by MoRD. These Common Guidelines are applicable to all watershed development projects funded by MoRD and MoAgri in the country. Some elements of Process Guidelines of GoAP (2002 and 2005) were integrated[7] into Common Guidelines for Watershed Development Projects (2008). Some of the key elements are:

- Establishing dedicated institutional arrangements at national/ state/ district/ project level for watershed projects.
- Each state to develop a State Strategic Plan and State Specific Process Guidelines to contextualize watershed projects in their local setting.
- Budgetary support for livelihoods and productivity enhancement was included in the financial allocations of watershed projects.

Unit cost was increased from 6000 to 12000 Rs/ hect and the provision for NGOs as Project Implementing Agencies was re-introduced. The contribution from Civil Society Organizations in the process of drafting the Common Guidelines was well recognized by Planning Commission, GoI and MoRD.

---

7. *This could be considered as one of the important achievements of Government of Andhra Pradesh, where key elements of a locally defined policy of the state government were integrated into national policy*

GoAP revisited State Perspective Plan for watershed development projects as per the directions of Common Guidelines. Commissionerate of Rural Development adopted Human Resource Policy which helped in attracting and retaining the staff.

During this period, there were some other path breaking policies/ schemes that emerged in the country. National Rural Employment Guarantee Scheme is one such important initiative by Government of India. As this initiative was also steered by MoRD, GoI, majority of the staff and efforts were engaged with this new initiative. The watershed projects were neglected in all aspects - deployment of staff; monitoring; fund flows; capacity building support and supervision. This step motherly treatment to watershed development projects was questioned by several Civil Society Organizations and their networks. However, the situation on the ground did not change much. Both central government and state governments were busy in streamlining the administrative set up of watershed development projects. During this phase very few projects were sanctioned by MoRD, GoI.

Fourth Phase (2010 onwards) - Learning Lessons from Deliberate Deviations

GoAP should have been in a comfortable position as most of its policies (contents of Process Guidelines) were incorporated into the framework of Common Guidelines for Watershed Development Projects (2008). However, the priority at the state level was largely on Mahatma Gandhi National Rural Employment Guarantee Scheme and the watershed projects got low priority. Initially, Commissionerate of Rural Development, GoAP started to follow certain practices, which seemed to be in line with watershed guidelines/ policy, but they had potential for damaging the core principles of watershed management. The Commissionerate, quickly realized the gaps and started taking steps for improvement. Subsequently, State Level Nodal Agency embarked on a path that opened up several new opportunities and strategies for improving the watershed management projects (mainly implementation systems). Some of these instruments/ strategies were like double edge swords with both positive and negative aspects.

- Initially, GoAP decided to implement IWMP through Mandal Praja Parishad Development Officers (MPDOs) as they are already part of MGNREGS. As these functionaries could not perform many tasks of the PIA (with desired quality), GoAP took a decision to appoint its own staff and NGOs as PIAs.

- Software[8] was developed for IWMP to help in planning, implementing and monitoring watershed projects. This on-line package also helped in stabilizing the project protocols, including fund flows/ payments/ records.
- A clear policy and protocol for forging convergence between IWMP and MGNREGS is a break-through in the country. This policy facilitates convergence between two major schemes at village level, through comprehensive planning, clear division of activities between two projects, uniform wage rates, etc.
- IWMP played a major role of convergence with other line departments like Department of Agriculture; Horticulture; Rural Water Supply and Sanitation; Animal Husbandry; Forests. Several innovative schemes/ approaches were demonstrated in a collaborative manner with these departments.
- SLNA, AP partnered with Society for Social Audit, Accountability and Transparency (SSAAT) for improving transparency and accountability. Protocols for social audit of IWMP were also developed by SSAAT.
- Intensive review meetings (on monthly basis) are conducted for better planning, coordination and implementation of the watershed projects at the state/ district level.

Fifth Phase - Need for Reinventing Watershed Approaches

Since 2014, there is a huge change in the country. New governments at central and state level and bifurcation of Andhra Pradesh into Andhra Pradesh and Telangana have defined a new context. There are several new initiatives as the newly formed governments at state and central levels have a new vision for the states and the country. They want to re-define the policy, program and directions of development. Planning Commission is abolished and NITI Ayog is established. 14th Finance Commission has recommended a new set of relationships between state and central governments. Several centrally sponsored schemes and flagship programs are being pushed out, as the central support is reduced from 90% to 50%. Watershed development projects (IWMP) fall in this category. Central government is willing to share higher share of tax revenue, and reduced its share from 90% to 50%. This financial condition is slowly settling down on the states and senior government officers of several states are unsure about the willingness of their political bosses (Chief Ministers/ Ministers for Rural

8. *The software and other systems (E.g.: Social Audits) developed for MGNREGS were found to be very relevant to IWMP also. Similar software was developed for IWMP also. This convergence between the two schemes brought a significant change in the course of direction of these programs.*

Development and Agriculture) to allocate remaining 50% for watershed projects, from state budgets.There are debates on the prudence of such financial policy. There are new schemes such as Pradhan Mantri Krishi Sinchayi Yojana (from GoI); Mission Kakatiya; Harita Haaram; Grama Jyothi (Government of Telangana); Neeru - Chettu; Smart Villages; (Government of Andhra Pradesh). Watershed projects and approaches are finding little support from Central/ State governments. There are new and more glamorous programs, for them. It appears that there is slow death of watershed approaches. It is the time for civil society organizations, concerned senior officers, committed donors, sensitive politicians to network and put together some good ideas and re-invent watershed projects and its approaches. This agenda is setting new challenges to all.

Section 2 - Why these changes took place

There are series of changes in the contents of the policy of watershed projects since 1994. Obviously these policies have significant impact on the quality of practices on the ground. This dynamic process of policy formulation and practice is nurtured and shaped by several individuals, organizations and other strategic partnerships. In this section four "reasons" behind the changes are presented. There may be several other contributing factors/ reasons.

Vision of Individuals

Bureaucracy in Andhra Pradesh is always regarded as very proactive and committed. They are known for taking risks and interpreting the policy for the benefit of the community. Several members have shown out of the box thinking for achieving the intended results of the government policies. In the context of watershed management projects in Andhra Pradesh, some of the senior government officers who played significant role in changing the direction of policy discourse are Shri BN Yugandhar; Shri Smarjit Ray; Shri SP Tucker; Shri K Raju; Shri Reddy Subramanyam; Shri K Tirupataiah; Shri Sanjay Gupta; Smt C Suvarna. Though each one is a unique personality, with distinct approach and priorities, all of them have a strong commitment and vision for a community centric watershed management. This vision and commitment pushed them to take several new initiatives and go beyond defined roles. All of them collaborated with civil society organizations, extensively interacted with them and understood their experiences and suggestions. These members also devised administrative instruments such as forming a working group, establishing a committee, commissioning a study and so on, where new ideas were generated

and integrated into new policies/ programs systematically. They were able to steer the agenda from higher level to project level, by motivating their team. They closely observed similar projects supported by NABARD. The results of such efforts have accumulated over a period of time and created a new culture in the state. This character of bureaucracy in Andhra Pradesh is a unique contributing factor for this policy change process and a continued effort on this agenda.

Civil Society Organizations and Networks

Added to the visionary bureaucracy, active and committed civil society organizations in the state benefited this process. A partnership between these two ensured "necessary and sufficient" conditions for creating an enabling policy across the time lines. A vibrant civil society group in the state was instrumental in conceptualizing the new ideas/ agenda for policy change. These agencies promoted several innovative programmes on a variety of issues and crystalized/ synthesised the lessons. These experiences were readily available for "up-scaling and mainstreaming" into the watershed projects. These agencies were willing to collaborate with the state to improve the government policy (in content) and make it relevant to the local conditions. Centre for World Solidarity; Deccan Development Society; AccionFreterna; WASSAN; APMAS; Centre for Peoples Forestry; Centre for Environmental Concerns; MARI; Dhan Foundation – are some of the voluntary organizations which contributed to the changes in "thought and action" of watershed programme in the state. Some of them promoted networks of organizations and demonstrated innovative and challenging agenda on the ground. Rayalaseema Watershed Development Program was one such initiative, which was promoted by Centre for World Solidarity. Dalit Watersheds was another experiment by Deccan Development Society. WASSAN offered a platform for all actors associated with watershed mandate to come together and exchange thoughts, good practices, issues & concerns. Since 1998 WASSAN is organizing Annual Network Meetings in which latest developments; issues and problems are discussed by a range of stakeholders. Representatives of NGOs, Government, Communities and others participate in these deliberations to improve the quality of watershed management in the state. These meetings offer an immense scope for reflection, correction and appreciation. Over a period of time, several new thoughts were integrated into watershed program (policy and practice) from these deliberations. Such effort is a unique feature in the country. As this process is

carefully nurtured by state bureaucracy and NGOs, one can easily perceive the relationship between the dynamic nature of policy formulations in the state and vibrant civil society action.

WASSAN and its partners were invited to be on the committees/ working groups/ pilots that focused on policy formulation agenda. In this process, WASSAN and its partners could significantly contribute to policy formulation processes in the state – Process Guidelines of Watershed Development Projects; Capacity Building Strategies; Establishing Livelihoods Resource Centres in the state; Creating roles for Village Organizations in Watershed Development Projects; Comprehensive Land Development Project; MGNREGS and CPRs; Integrating Forest Lands into IWMP; Integrating Groundwater Concerns within IWMP; evolving policy for groundwater regulation; partnership policy between NGO and GOs - are some of the unique contributions of WASSAN and its partners in the state.

Strategic Partnerships

Government of Andhra Pradesh developed strategic partnership with reputed agencies such as ICRISAT, MANAGE and other academic institutions. These partnerships also extended to bilateral projects such as AP Rural Livelihoods Projects, AP Drought Adaptation Initiatives, so on. These partnerships triggered a new thought process and action within the mainstream projects. Such co-existence offered invaluable confidence to the mainstream systems to uptake any new idea, without much doubt. As a result of such partnerships the entire administration is open to adaptation to new processes, protocols and policies. These partnerships offered a unique position to the state government and was far ahead of other states, in several issues. The initiatives under these partnerships could offer considerable flexibility and boldness in the project norms and protocols. There is an opportunity to experiment and learn from the same and these experiments were of different scales. There was a space to forge partnerships. Given this culture of partnerships, GoAP was in a position to propel itself into new frontiers.

Political Will

"Political will" is an important pre-condition for change. The governments in the state/ country changed several times in the last 20 years which had implications on the policy and practice of watershed management. For e.g., watershed development projects received high attention during the initial phase

(mid 90s to early 2000), as the state government considered them as an important intervention for rural development. This priority changed over a period (mid 2000) to MGNREGS and watershed projects received (relatively) low priority. While the broad 'setting' was defined by political processes/ mandates of the elected government of that particular period, the contents of these policies are largely defined by the senior government officers, in collaboration with civil society organizations.

However, issues like partnerships with NGOs in watershed projects remained contentious. This issue witnessed ups and downs over the period. There were glorious and dark periods. The application of IT in MGNREGS and IWMP could demonstrate high level of transparency in the financial aspects of the projects. These issues required considerable political will and support from the ministers and concerned political parties/ cadre, including people's representatives. One could see that senior bureaucrats were able to garner support these path breaking initiatives in the state. They were able to "educate and motivate" the senior members of the political parties on the implications of these changes and boldly encouraged them to be supportive to these matters. They could also "shape" the new thought/ initiative in such a way that this idea provides a fillip to the image of the government. These efforts helped to create enabling support systems and political will for change in the state.

Section 3 - Lessons Learned on Policy Formulation Processes

Some key statements from State Strategic Plan of Andhra Pradesh clearly indicate that the agenda of watershed management projects is long term and is not over: *"Out of 9301 watershed projects taken up so far under various schemes of DoLR, 4741 were completed and 4560 projects are under implementation. A total area of 46.50 lakh ha area is taken up for treatment and an amount of Rs.1722 crores was spent so far"*... The State Strategic Plan also indicates that 22141 micro watershed projects are yet to be completed and an area of 110 Lakh hects is yet to be covered under watershed projects in the state. This is about 40% of geographical area of the state. During IWMP period (since 2009), about 27 Lakh hect area was covered. This is about 5 Lakh hect/ year. If this pace is continued, it might take about 22 years to complete the above area. There are districts in which not even 30% of watershed area is treated so far. Apart from this, several villages where watershed projects are already completed may require another round of investments.

However, future watershed development projects in Andhra Pradesh and Telangana have to find themselves in the midst of changing global equations; changing technology; climate change related issues; deteriorating soil fertility; diminishing forest covers; depleting groundwater; increasing urbanization; decreasing productivity of several crops (irrigated/ rainfed crops); newer aspirations of younger generations in rural areas; increasing disparity between rich and poor in the society; conflicting agriculture and land use policies (corporatization of agriculture; special economic zones; increasing mono-cropping; others); breaking institutional arrangements for rural/ agriculture finances; increasing landlessness and further fragmentation of land; low level of political support for agriculture/ rainfed crops. Some of these issues are age-old, while several other issues are increasingly becoming important and more visible in recent past.

Apart from the above issues, in the advent of recommendations of 14th Finance Commission, where IWMP is integrated into Prime Minister Krishi Sinchayi Yojana, there is a need for the states and the Centre to look at the emerging situation where funding support from Central Government for IWMP is being reduced from 90% to 50%.

A strong vision and policy framework has to be articulated at this juncture, where the relationships between central government and state governments are changing. Based on the achievements so far, the future course of action needs to be defined. In this context, the lessons learned from past on "policy formulation processes" itself is not out of place.

Lesson No 1 - Cultivating Partnerships

It is obvious that previous achievements are a result of effective partnerships between several actors in the agenda – senior government officers; strong networks of civil society organizations; representatives of political parties/ people; academic institutions; community based organizations and other actors. It is important that the elected governments in democracy cultivate and nurture such partnerships effectively and learn from each other. The essence of democracy is visible when plurality of institutions exists and multiplicity of thoughts is encouraged. Such vibrant society would throw up relevant policy solutions for a given situation. There should be harmonious relationships between people's representatives, bureaucracy, civil society groups and communities. This partnerships, networking and associations would help to

create an ambience in the society that eventually addresses the critical issues of development. This "space" needs to be consciously identified and nurtured by governments and should not suffocate it.

Lesson No 2 - Strong Support for Innovations, Experimentation and Action Research

Change is not possible without knowledge. It is important to create new knowledge and existing knowledge should always be upgraded. This requires considerable efforts by the governments and policy makers. These efforts should broadly focus on ways and means of promoting innovation, experimentation and learning. Governments should have clear funding support to autonomous institutions that are engaged in creating innovative knowledge products; action research and experimentation. There should be partnership between these knowledge stream and action stream. The combination of these two streams should be generating new policy framework. This would lead to an informed process of change, rather than an ad-hoc way of creating policies and pushing them down. These efforts could create an opportunity to integrate innovations/ lessons from experiments into mainstream programs and minimize learning time/ efforts.

Lesson No 3 - Independent and External Feedback

It is important to realize that any policy and program are not written on stone. There could always be change and improvement on any aspect of the policy/ program. For this dynamism, there is a need for effective and independent feedback to the system. Though several programs have feedback loops, these are generally marred with vested interests. It is important to cultivate "openness and open mind" for improving the existing systems – policy, practice and protocol. Project management teams should have support for independent and external feedback systems so that they could engage in midcourse corrections also.

Lesson No 4 - Orientation to Cadres

Policy formulation processes could be driven and shaped by internal teams themselves, while external inputs provide necessary guidance and direction. For this to happen, capacities of project cadres have to be improved. A reflecting and capable team could define its course of action, if there is "space and

opportunity" for them. For this purpose, there is a need for improving sensitivity, competency and commitment of project cadres, particularly project leadership at state/ district level. Developing sense of direction and common vision could be an important input in this process. Significant capacity building inputs have to be organized to the project cadres to understand the purpose, expected end results and necessary protocols. Organizational processes/ protocols should have adequate space and flexibility to innovate at local level, without compromising on the vision/ values of the initiative. Improving and cultivating belief on partnerships is an important aspect of this process.

Conclusions

The policy formulation processes in Andhra Pradesh in the context of watershed development projects are largely guided by principles of partnership and collaboration among several like-minded partners including government officers, civil society organizations, people's representatives/ governments and other agencies/ individuals. The processes that contributed to this are "owned and nurtured" by several actors and these efforts need to be continued, in the interest of "greater good" of the society. Though all these initiatives are not systematically institutionalized, there is a loose cohesion in this process. These efforts could produce meaningful results – "new and relevant policy and practices" in the context of watershed management projects. This paper tried to re-construct the processes and to decipher the hidden lessons from this long standing experience in the state. It is important to facilitate such processes in other parts of the country also.

* * *

In the Shadows of Green Revolution! A time-transect walk with Dr. NK Sanghi in the Rainfed India Policies

Ravindra A.[1]

When the larger agriculture science establishment was swayed by the potential of the Green Revolution and was busy framing it, a small group of researchers in ICAR initiated the AICRIPDA – 'All India Coordinated Research Project on Dryland Agriculture' based in Hyderabad. The program was started in the early 1970s with support from the government of Canada. The group's primary mandate was to "reduce the growing socio-economic gap between the drylands and water endowed regions and to establish efficient patterns of land utilization and moisture conservation"[2]. The economic dichotomy between the regions having and not having access to large-scale irrigation was well seeded into the birth of Green Revolution. Dr. N. K. Sanghi (NKS) used to share many

1. *Director, WASSAN, H.No. 12-13-452, Street No. 1, Tarnaka, Secunderabad - 500 017, Contact: +91 (040) 27015295 / 96, Email: raviwn@gmail.com, Website: www.wassan.org*
2. *http://www.crida.in/Dryland/AICRPDA.htm*

anecdotes about this phase of his work in still-to-be-born CRIDA where he and Dr. J. Venkateswarlu initiated their career in ICAR under the leadership of Dr. Krishnamurthy who provided scientific leadership on the subject.

While Ministry of Agriculture was setting up 'extension system' to take the new miracle seeds developed in the research stations to 'ignorant' farmers in irrigated areas along with a package of subsidised fertilisers and pesticides; the small research group in AICRPDA started understanding the nuances of the complex dryland agriculture from farmers' fields. NKS used to narrate his explorations into farmers' fields to understand the weeds and about his discovery on how much farm labour used these very weeds as greens for consumption. This dichotomy in the 'scientific method' between dryland agriculture and green revolution is stark; one part of Indian Agriculture is built around the logic of 'transferring' technology developed while the other part is focused on participatory methods in its exploration and innovation.

The contrast is visible even today. Crop Based programs of the Department of Agriculture, when one looks at closely, essentially package subsidies into seed, fertilisers, pesticides and now, weedicides purchased and delivered by the Department. Watershed development program on the other hand is based on a participatory approach where the targeted community is given the resources to plan and execute the program. NKS has been deeply involved in the formulation of the policies around watershed development programs after he joined MANAGE headed by Dr. Arora, who brought several interesting people together under the guidance of Sri. B. N. Yugandhar to give shape to the guidelines on Participatory Watershed Development program.

One of the anecdotes that NKS shared was about his promotion! After completing his Ph.D in Plant Breeding from IARI, NKS started his career with a brief stint at the Ford Foundation as a part of the team promoting Green Revolution. Soon after joining ICAR, he started his career with dryland agriculture but none of his work was around plant breeding. When his promotion to next scientific cadre was due, the then DG, ICAR who was also a classmate of NKS was in a dilemma on how to promote NKS! How to incentivise a Plant Breeder by appointment who had done nothing about plant breeding but done extremely good work in dryland agriculture along with farmers? NKS was then promoted and posted at the Zonal Directorate that supports Krishi Vignan Kendras!

The issue still remains. Complex and integrated nature of the dryland agriculture, the risk of rainfall failure, single agriculture season available in a

year for experimentation, etc. complicate the research and publications cannot be produced in short time. The incentive system in agriculture research does not consider this reality. Treating dryland agriculture scientists in the same way as those working on rice dissuades scientists opting for dryland agriculture research. This is besides the enormous gap in research investments between dryland or rainfed agriculture and irrigated agriculture. Only 12 per cent of ICAR's budget is spent on rainfed agriculture research that caters to 55% of the Indian agriculture even today!

Any dryland farmer typically faces a series of risks every year as the season unfolds! First is the sowing risk related to onset of monsoons, later the 'dry spells'. Once the crop survives pest attacks and market/ price risks add on to the monsoon risks. A key aspect of managing risks in dryland agriculture is to keep the costs or investments low. During the nineties the earlier generation of pesticides were at their zenith as pest complexes developed resistance to those pesticides. This gave a good window of opportunity for NKS to collaborate with Centre for World Solidarity (CWS) to evolve solutions for managing pests without using chemical pesticides.

NKS being the Zonal Coordinator of KVKs at that time, found his way to collaborate with others in CWS – Dr. Abdul Qayyum (retired from the Dept of Agriculture), Dr. M.S. Chari (a retired entomologist with ICAR) and Sri. M.V. Sastri (who founded CWS), in particular, to develop a program to manage 'Red Hairy Caterpillar' that has become a menace in castor and other crops in Nalgonda district. The group could elicit collaboration from the Department of Agriculture. During those early days, NKS used to spend nights in the villages along with Dr. Qayyum to observe the pests and the effectiveness of various measures including light traps. This might be the first intensive exposure for NKS to the NGOs. As their efforts continued over years, the concept of NPM (non-pesticide management of pests) was born. The program has made a deep impression on NKS and NPM has become a life-long agenda for him. He extended immense support for us at WASSAN when we decided to mainstream NPM into the major government programs. After his retirement, as Advisor to WASSAN, NKS had spent several nights along with us in the field exploring NPM and various aspects of rainfed agriculture.

NPM is now a large national program integrated into the Community Managed Sustainable Agriculture taken up by NRLM. While we celebrate NPM's scaling

up, the fact remains that the mainstream Department of Agriculture is still to accept and invest on it, at least, in the rainfed areas of the country!

Much of the later part of NKS 's engagement was with watershed development program. For the first time substantial public investments were placed with the community allowing them to plan and implement the watershed development program with support from a facilitating agency. While the Guidelines on Participatory Watershed Development Program was a major breakthrough making room for participatory processes, their implementation with the spirit of participation was a major challenge. Till this program came up in 1994, entire focus was on soil conservation and drought relief focused work or at best, river valley projects to reduce siltation of the 'temples of modern India', the large irrigation dams!

That the drylands constitute a major agriculture production system supporting livelihoods of more than half of Indian population, and that public-investments are needed for strengthening these production systems were not much recognised. Watershed Development Program is a landmark in putting forth this point of view.

NKS's days at MANAGE were focused on developing the planning tools for participatory watershed development. His interaction with WASSAN during this time and the collaboration with the AP Rural Livelihoods Program (APRLP) led to some policy changes. An instrument we all proposed and pushed was to carve out a production systems and livelihoods window into the 'works' budget of the watershed program. This has brought out the focus on production systems within the largely mechanical structures oriented watershed programs.

We all realised that the participatory methods and taking decision-making into the hands of community would not be realised without their institutions. NKS's association with MYRADA made a deep imprint on him; Self Help Groups (SHGs) had become his passion; it was like a second religion for him! Would SHG movement and government embracing it make a major dent on rural poor in rainfed India by itself? Probably not - was our argument against the initial conviction of NKS. From the context of rainfed production systems, SHGs can at best be an efficient outreach mechanism. But the fundamental corrections in the macro policies, investment structures, decentralisation etc. are a must.

This was more and more visible during our collective explorations into tribal areas during the 'Odisha Tribal Empowerment and Livelihoods Program'. We spent days together in some of the villages designing the planning methods for

integrating land rights, watershed and livelihoods development. These tribal areas have everything – very recently reclaimed soils with high organic carbon, water in the perennial streams and labour in plenty to name a fewo. Yet, one finds these people working as casual migrant labour in all the cities! These are the villages where people still depend on mango kernels for their food, at times during summer! With poor infrastructure and pathetic level of production support systems, these are the ghostly shadows of 'GR - neglect'! And, GR casts a much larger shadow on Indian planning! Seeing the bounty of nature in the tribal areas and the strength of the adivasi farmers, we always wondered why the Indian Planners did not believe in the strength of these areas and people to produce enough surplus for themselves and for those areas! Why food has to be produced somewhere and transported?

The perspective of agriculture development as a vehicle to the misconstrued notion of 'National Food Security' left out these rich and potentially higher productive regions as areas of poverty, food insecurity etc., which needs development and food supplied through Public Distribution System. The fact that these regions are rich in natural resources, have high production potential (though complex) and that these regions can produce surplus food for themselves and for the country were largely ignored by mainstream agriculture planners obsessed with seeds-fertilisers-pesticides and 'extension' of on-farm research results on using these inputs.

'Rainfed agriculture', a broader term that includes high rainfall and yet drought prone regions and the semi-arid/ arid zones need a different policy and development dispensation. Integrated, complex and prone to risks, rainfed agriculture needs a special treatment to harness its potential. Several of us realised that watershed development is one major step in the direction but is not sufficient in itself. This discourse led to 'Re-thinking Rainfed Agriculture' - a workshop along with ICAR organised by us at NAAS in 2007, Delhi. The Workshop, which brought forth the need for a larger engagement on the subject. NKS contributed substantially to get this workshop in place. The workshop brought forth the need for a new 'paradigm' for strengthening rainfed agriculture by bringing together multiple perspectives of researchers, practitioners and planners on the subject[3].

3. *http://www.rainfedfarming.org/documents/Rainfedworkshopproceedings.pdf*

Above all, this workshop has seeded the idea of 'Revitalising Rainfed Agriculture Network' to further this engagement with policy, practice and science to strengthen rainfed agriculture. This is a necessary complement to watershed development. In an agriculture policy environment dominated by 'subsidised inputs-syndrome' an integrated perspective of watershed development, even if successfully implemented, will not usher in any larger impact on the livelihoods of poor by itself. And, that the massive investment discrepancies between GR areas and rainfed areas need to be corrected. The argument caught the imagination of several – researchers, development practitioners, bankers, officials and various individuals resulting in the formation of the National RRA Network.

NKS actively contributed to the evolution of the RRA Network (Revitalising Rainfed Agriculture Network). The agenda is complex and involves evolving an integrated perspective on the development of agriculture, livestock, fisheries and commons; developing institutional mechanisms, planning methods and tools, and framework of budgets that are amenable for making public investments. The challenge is to institutionalise such perspectives into enhanced public investment in rainfed areas!

Working along with NKS intensely as members in the drafting committee for the Working Group (on NRM and rainfed farming) report on rainfed agriculture for the 11th Five Year Plan gave us an opportunity to synthesize and weave together a policy framework for investing on rainfed agriculture. Further deliberations in grounding and testing the framework on field and deliberations during the 12th Five Year Plan Working Group led to further insights and development of the framework for a larger Rainfed Agriculture policy.

The journey is on... but now, without the support and wealth of experience, credibility and deeper insights that NKS gave us!

* * *

Save our Soils for Sustainable Rainfed Agriculture

Dr. J. Venkateswarlu[1]

Dr. NK Sanghi and I started working together from 1971 in the Dryland Research Programme. He was recruited as a Plant Breeder. He showed great acumen and interest in laying down experiments in field research.

But his interest was in the overall development of the rainfed farmer. Thus we started working more for the welfare of the farmers. His main concern was to enthuse the farmers to adopt new techniques but with less dependence on external inputs, particularly fertilisers. His concern equally was on the health of the soil. We used to have extensive discussions on these subjects. I am writing this paper to commemorate my association with my esteemed colleague, Dr. Sanghi.

1. *Consultant and Ex-Director, CAZRI (Jodhpur), 26, SBI Colony, Gandhinagar, Hyderabad - 500 080, Contact: +91 (040) 27532928 / 27530330*
Email: jagarlapudi34@yahoo.co.in

Importance of Soils

Our earlier philosophers expressed their views on the importance of soils and the need to protect them as cited below:

- *Man, despite his artistic pretentions, his sophistication and many accomplishments, owes his existence to the first six inches layer of top soil (Copernicus, 543 B.C.)*
- *Aristotle (384 B.C.) said that Soil is the stomach of the plant*
- *Franklin D. Roosevelt (1933) pointed out that while Soil organic matter is the building block for all life on- and in- the earth, a Nation that destroys its soil, destroys itself*
- *The eminent soil scientist Charles E. Kellog (1983) said: "Essentially all life depends on soils. There can be no life without soil and no soil without life. They have mutually evolved."*
- *In her speech at the inaugural address of FAO, Indira Gandhi (1981) felt "The Earth is ravaged, desecrated, made sterile, perhaps through ignorance in the initial stages but lately driven by greed and arrogance. Today it is not the ignorant but the knowing who pose the main danger to human survival."*
- *More recently, Jones (2006) asked us to*

  "Listen for a while
  Earth is lying naked and barren
  Crying for help without words
  Calling so softly for carbon
  There is no time to bargain."

Land degradation

Globally and now nationally the smallholders have been recognized to have a role in sustainable development and inclusive growth. In a rapid changing society where 2000 farmers are lost every day from agriculture (Ghosh, 2013), unless attention is paid to the Small and Marginal Farmers (SMF), there would be a serious problem of ecological refugees from rural to urban areas. We are losing about 4.9 hectares per minute through various degradation processes (Bai *et al* 2008). It is the smallholder that is the most affected. Thus smallholder farming in less-favoured areas (LFAs) need be considered on priority if sustainable development is the aim. In the presentation, we focus on saving our soils.

Soil degradation poses risk to earth's future. It is a more serious threat to human health than climate change (Mercer 2012). But it is rarely discussed in the media

and by governments. There is a need to realize that soil carbon itself is a lynchpin in securing soil for the world. So basically by increasing the carbon content in the soils we can find solution to several of the global problems like food security, energy security, climate change mitigation and biodiversity protection, said Mercer. Causative factors include intense farming and now the climate change, besides others. Once the soil loses its carbon, producing more abundant yields becomes difficult because of the lack of nutrients in the production base (UNESCAP, 2009). In fact $1/4^{th}$ of the world population is affected with the global degradation. Such affected area is estimated to be about 20% of cultivated area, 30% of forest area and 10% of grasslands (FAO, 2008). Globally, 78% of the degraded lands are in humid areas.

The next stages in agricultural development should focus more on conserving the natural resources, recycling carbon and ensuring that soils retain vital nutrients. Also there is the need to protect the biodiversity, the lifeline of the smallholders and regenerate the natural resources of soil and water (UNESCAP, 2009). Amundson *et al* (2015), most recently, point out that the strategies in relation to soil and human security in the 21^{st} century, should focus on regaining a balance in (i) organic C inputs and losses, (ii) soil erosion and production, and (iii) release and loss of nutrients. Soil sustainability - based on quantitative principles and measurements of soil erosion and production, soil nutrient loss and release, and soil carbon loss and return - must be the ultimate goal for managing the global soil resource and should serve as the driving principle for soil research that will support this management.

Further, they said that these are challenging goals that will be difficult to achieve. The solutions will require an effort commensurate with the magnitude of the problems. First, effective solutions to soil sustainability, much like the approaches required to contend with climate change, must involve highly multidisciplinary research in novel intellectual settings or institutions. Second, the ultimate success of any innovation requires a dialog and interface with policy makers and public institutions, the ultimate "deciders" in broad-scale social change. These linked efforts will depend on continued, and arguably much greater, investments in knowledge and innovative knowledge transfer and simply different ways of conceptualizing and approaching problems. From our vantage point, the future of Earth's soil resources is tenuously in our control or within our ability to sustain it into the future. Only those on Earth in 2100 will know how well we succeeded.

Paradigm Shift in Soil Conservation

Retrieving degraded lands effected largely by soil erosion, calls for a paradigm shift from the traditional soil conservation through mechanical structures to land husbandry. Here, I would like to quote the doyen in soil conservation, Hudson (1992): "Current changes indicate that even the term soil conservation will probably fade away to be replaced by land husbandry because that better describes the fundamentals of the new approach. The idea of the care of crops and their management and improvement has for years been called crop husbandry. Animal husbandry has described the care and management of livestock. Soil conservation was appropriate when we were mainly concerned with increasing knowledge and awareness of soil degradation and learning how to decrease the process. But that was mainly a defensive strategy and what we now seek is a positive approach where care and improvement of the land resource comes first and control of erosion as a result of good land husbandry."

Soil Health

Soil health is defined as the capacity of soil to function as a living system. Healthy soil maintains diverse community of soil organisms that help control plant diseases, insects and weed pests, from beneficial symbiotic association with plant roots, recycle essential plant nutrients, improve soil structures with positive repercussions for soil and nutrient holding capacity and ultimately improve production (Collette *et al*, 2011).

From an ecosystem perspective a healthy soil does not pollute the environment, rather it contributes to mitigate climate change by maintaining or increasing its carbon content.

Functional interactions of soil biota with organic and inorganic components, air and water determine a soil's potential to store and release nutrients to plants to sustain their growth.

Thus "soil health is the capacity of a soil to function". Soil health is reflected through how well is the soil functioning to infiltrate water and recycle nutrients to water and feed growing plants. Soil is controlled by macroscopic and microscopic flora and fauna. They need food (being heterotrophic) to survive and help in making the soil functional (USDA, 2010). Soil life adds life. A living soil enriches soil. In order to make the soil live effectively, the needs are water, food (organic matter), air and favourable pH and temperature. The below ground biodiversity provides ecosystem goods and services to crop plants (Johri, 2006).

The SOM generally, contains some fresh residues (<10%), decomposing organic matter (33-50%) and stabilized organic matter (33-50%) and living organisms (~5%). It is the stabilized organic matter that forms the humus component in the soil. It holds water 4-6 times its weight and its cation exchange capacity (nutrient holding capacity) is 250-400 me percent. It decomposes slowly, @ 2.5% per annum. A 15 cm soil with 1.0% SOM contains 1000 kg N, 100 kg P and 5 kg S/ ha (Krishnamoorthy and Venktaeswarlu, 1976).

A teaspoon of living soil contains more of these organisms than the population on the earth. Some details of the flora and fauna are provided below.

Table: Flora and Fauna in soils

Examples	Functions
Macrofauna	
Earthworms	• Major decomposer of dead and decomposing organic matter and derive nutrition from bacteria and fungi leading to recycling of nutrients • Generate tonnes of casts each year, drastically improving structures • Stimulate microbial activity • Mix and aggregate soil • Increase infiltration • Improve water holding capacity • Provide channels for root growth • Improve water quality
Nematodes	• Many help in controlling diseases and recycle nutrients • Help in dispersal of microbes • Omnivores feeding on roots of plants (plant parasites)
Arthropods (e.g. insects, springtails, beetles)	• Shred organic matter • Stimulate microbial activity • Enhance soil aggregation • Mineralize plant nutrients in bacteria and fungi • Improve water infiltration by burrows • Control pests
Macroflora	
Fungi	• Nutrient cycling through their hyphae (VAM) • Water dynamics • Disease suppression • Decompose organic matter
Bacteria	(i) <u>Decomposer</u> • Convert energy in SOM into forms useful to the rest of the organisms • Decompose and breakdown pesticides and pollutants • Retain nutrients in their bodies (ii) <u>Mutualists</u> • N-fixing, nitrifying, denitrifying (iii) Obtain energy from components of N, S, Fe or H instead of carbon compounds
Actinomycetes	Degrade recalcitrant compounds
Protozoa	Mineralize nutrients making them available for use by plants and other soil organisms and thus help in nutrient recycling

Thus soil biodiversity underpins a multitude of ecosystem functions and processes that are essential both to sustainable food production and manage the agroecosystems beyond farming. It arrests the current alarming state and trend in degradation of agricultural soils.

Soil biodiversity is a key determinant of land productivity and farming which is presently facing significant sustainability challenges. Improved management of soil biodiversity in agro-ecosystems offers solutions for sustainable farming and food security, whilst simultaneously increasing carbon storage (C-sequestration), improving water cycling and reducing off-farm pollution (Dias and Coates, 2012).

The soil biodiversity regulates three major bio-geochemical cycles on earth, namely nutrient, carbon and water cycling which are essential in food, energy and water security. Additional important functions of soil biodiversity include:

- Regulating pests and diseases,
- Supporting pollinators, and
- Reducing chemical pollution.

Thus soil biodiversity can be used as a direct intervention in the production systems. For example, inoculation with soil beneficial organisms, such as nitrogen fixing bacteria, mycorrhiza, and earthworm.

Such interventions enhance/ improve:

- Plant nutrient uptake
- Heavy metal tolerance and
- Soil structure and porosity

As most of these soil biota are heterotrophic, they need external energy through organic matter. To reiterate the need and importance of agriculture soil biodiversity, the following may be kept in view:

- Soil biodiversity received much less attention than desired
- Soil biodiversity is worth trillions of dollars (Gnacadja, 2010)
- Of about 100 crop species that provide 90% of food for 146 countries, 71 are bee-pollinated. If we lose these "keystone" species, whole edifice will collapse (FAO, 2005)
- Over 80% of plant species can act as host to VAM fungi
- VAM is the corner stone of a second green revolution (Roy – Bollue and Hijri, 2011)
- Ants, termites and earthworms are ecosystem engineers
- Preservation of biodiversity protects drylands (Zanu, 2010).

In the process, the synergy between soil-water-crop-livestock can be revitalized which is very much important in reducing production costs and provide sustained income (Seragaldin, 1999 and Kurien, 2001).

In summary, the biota in the living soil help in nutrient cycling, soil carbon sequestration, improving soil physical conditions, assisting nutrient and water acquisition by plant, fixation and mobilization of nutrients, enhancing plant health and enabling biotic and abiotic stress tolerance.

A living soil provides nutritious food of high quality. It enables drought tolerance and provides resilience. It also helps in lowering pollution.

Since most of the beneficial biota are heterotrophic, they need to be provided with energy through organic matter. Presently the SOM stock in the arable area is quite poor. This is all the more so where farmers moved to chemical agriculture discarding the traditional systems. We need to revisit these earlier practices for revival with suitable/ possible adaptations. Let us also realize that available potential of organic nutrients is 10.75 Mts. But we are tapping only 3.75 Mts (Singh, 2012). These are estimates based on bulky organics only. If we take traditional systems also into account there is plenty of scope to go non-chemical in crop production.

Soil is a living system. A teaspoonful of soil would contain a billion of the micro-flora and fauna. There are several types habitating in the soil. Some are autotrophic which draw upon atmosphere for their carbon supplies. There are quite a large number of useful organisms that are heterotrophic deriving their energy from organic sources. And it is these useful heterotrophic organisms that need organic matter in the soil as their source of energy (Broadbent, 1957).

Further, organic matter also drives several other chemical processes and physical properties (Fan *et al,* 2005). Thus SOM contributes considerably to increasing soil stability and resilience that are so important in food supply stability (Niggli *et al,* 2007). Pimentle *et al* (2005) argue that enhanced SOM leads to better aggregate stability and biologically more active soils, increasing water retention. In fact, they reported 28- 34 percent high maize yields in the Rodale experiments in the organically managed plots in years of drought. This is what the author used to see in Anantapur district during 1955-56 in the farm fields where mixed cropping had been the practice contributing large quantities of leaf litter on to the soil. SOM and leaf litter provide "SPONGE WATER" for withstanding intermittent dry spells in the monsoon period. Even runoff and nutrient losses would be reduced (Niggli *et al* 2007; Thorup – Kristensen, 2007). However, the

level of SOM that can be maintained in soil depends on its texture, the way it is managed and the climate. Thus, SOM is always in equilibrium with the environment (Broadbent, 1957).

Emerging Issues

Soils back on the agenda

World is losing soil 10 to 20 times faster than it is being replenished. In the past 4 decades 30% arable land of the planet became unproductive. Our system is clearly dysfunctional and in destroying the soil we are putting enormous burden on future generations. As soil thins the crop yields decline exponentially. Among soil scientists, concern over the global fast depleting soil is universal (Montgomery, 2010 and Hartenninh, 2008). I would like to place the following for consideration:

- Soil is a non-renewable resource
- Soil is the basis for more than 90% of the world food production
- Soil loss outpaces soil formation at least by ten fold
- Soil loss by erosion works out to 3 tonnes/ person/ year
- About 30% of global land area is degraded affecting 1.5 billion people
- Costs of inaction are much higher than the costs of action
- Aim at zero net land and soil degradation

It is heartening to learn that FAO (Anonymous, 2011) called for Global Soil Partnership for food security and climate change mitigation and adaptation. They point at the need to build capacities and enlarge knowledge and technologies for sustainable management of soil resources at all levels to enhance food security in the era of climate change. Further they call for evolving means from national and international agencies for soil quality – soil health best practices, standards, guidelines and monitoring systems. Their vision is for healthy productive soils for food secure world.

Global Soil Week as a support to the global soil partnership was held (Anonymous, 2012), which is a contribution to Global Soil Partnership. It was emphasizing the role of soil as a finite and vital resource for sustainable development and human well being. Key objectives of the meet were:

- To foster the exchange of knowledge and experiences on sustainable soil management between scientists, decision makers and practitioners on an equal footing

- To set 'agenda for action' to improve the sustainable management of soil and its restoration for sustainable development
- To outline ways in which global soil week can contribute to implement the agenda

The full expression of the potential of improved crop genotypes (hybrids, GMOs) would not be possible unless the base (soil) is made productive by improving the soil organic matter.

Organic agriculture possibly is one route that may partly mitigate the problem. Presently (Willer 2011) 37.2 Mha are under organic agriculture in 160 countries of which only 1.18 Mha is in our country, the maximum being in Australia (12.0 Mha). For the health of the nation, this route needs to be further pursued.

Way Forward

'**Business As Usual**' is not an option anymore. We must look for alternative paths. Several of the technological leap froggings aiming at non-chemical agriculture are discussed above. Both food and environment should win. Increased production must be achieved with a decreased impact on the natural resources, more so at a time when the cost of energy continues to rise. This is the wake up call to all of us. Perhaps a lot of research is needed to **kill** prejudices. In any case, resilience in production systems has to be achieved, particularly in view of the climate change. This can be achieved by building up the impoverished soil organic matter (SOM). Enhanced SOM improves nutrient and water holding capacity of the soil. It acts as a glue and improves soil structure, reduces erosion as well as waterlogging, improves macroporosity, enhances biodiversity (in soils), creates ideal tilth and prevents soil surface crusting. All these lead to increased yields, reduced input costs and increased nutrient use efficiency. It also chelates metallic micronutrients for their slow release, reduces use of herbicides and pesticides; prevents pollution and improves crop quality. The SOM provides resilience in production systems even against climate change and can wean out crops from **addiction** to fertilizers. In fact, in course of time, the onslaught of the chemical fertilizers would eventually be overcome by shifting to non-chemical farming.

In order to reduce cost and also to enable the farmer to come out from dependence to independence in production systems non-chemical sources of feeding the soil and the crops have been in use in traditional systems. They can be incentivized, adapted and improved with the advances in our knowledge.

Policy Options

Agency	Intervention	Some details
FAO	World Soil Chapter (1981)	• Inventorize land resources • Assess land degradation hazards • Evaluate production capacity • Improve soil fertility • Combat desertification • Integrated land use planning • Training & institution building
GoI	Land use Policy & Land use Boards (1986)	• Set with 21 objectives including the above • Ensure proper land use through community involvement • Provide workable technologies • Provide legal support
European Commission	Thematic Strategy on protection of soils (2006)	• Give importance to soil as with air and water • Address soil erosion, organic matter decline, landslides, contamination and loss in soil biodiversity
USA	Soil legislation (2008)	• Improve knowledge • Exchange information • Develop and implement best protection practices for soil management • Soil restoration • Carbon sequestration • Long-term sustainable use of National Soil resources
UN	Global soils partnership (2012)	• Promote sustainable management of soil resources • Encourage investment, technical cooperation, policy education awareness and extension in soils • Promote targeted soil research and development on gaps and priorities • Enhance quality and quantity of soil data and information • Support harmonization of methods, measurements and indicators for sustainable soil management

That organic manure means composts or FYM and animal manure is a MUST needs a correction. Biomass, in any form (trees, dung and crop residues) should be in focus. All the needed nutrients for the present and future production can be met from such sources. For instance Partap (2006) and Chillat (2007) extensively using the data from Michigan State University (USA) found that greater use of N-fixing crops and trees globally could result in the production of 140 Mts of N which would be more by 82 Mts than the presently produced chemical nitrogen (i.e. 58 Mts). MPTs are a boon of not only providing fodder and fuel but also supply much needed plant nutrients and biomass for pest management. In one estimate, the working group on animal husbandry for the XIth FYP indicated as much as 800 Mt/ year animal dung would be available of which even if 1/3rd is used as manure, it provides 7.5 Mts of nutrients (2.90 Mts N, 2.75 Mts P_2O_5, and 1.89 Mts of K_2O). Such simple technological innovations were upscaled through community managed development with SHGs as the platform by Vijayakwar (2007). Such sustainable, regenerative and eco-friendly systems (Johl 2006) as an alternative to chemical agriculture needs all the support of the government through incentivization using MGNREGS for works and by providing subsidies as done for chemicals (fertilizers and pesticides).

On a modest estimate, about 10 to 12.5 t/ ha of farm based fresh biomass can be generated with little or no effect on the main crops grown in the fields. Even that small loss, if any, will be amply compensated with the subsequent years through recycling processes. This is besides carbon sequestration.

Based on several of our own studies and the policy interventions suggested by other national and international agencies I suggest the following policy interventions to save our soils for sustainable development of rainfed agriculture.

- Move from soil conservation to land husbandry with ITK as the front runner
- Soil health testing services must include physical and biological indicators
- Renewable energy and inputs must gradually supplant non-renewable resources
- Payment for Ecological services should be part of our NRM activities in several of the programmes like IWMP and MGNREGS
- Investments on sustainable land management must only be in the Blue Box of the WTO so that the government can invest in saving the soils as indicated above.

References

Abrol, Y.P. (2005) Policy options for efficient N-use, Policy paper 33, NAAS, New Delhi

Amundson, R., Berhe, A. A., Hopmans, J.W., *et al* (2015) Soil and human security in the 21st century. Science Mag, Vol. 348, Issue 6235, May 8, 2015

Anonymous (2011) Global soil partnership for food security: FAO

Anonymous (2012) Global Soil Week

Bai, Z.G., D.L. Dent, L. Olrson *et al* (2008), Proxy global assessment of land degradation, Soil Use Management, 24, 223-234

Batchelor, C.H., M.S. Ram Mohan Rao and A.J. James (2000) KAWAD: Water resources audit, KAWAD Report 17, pp 90

Battacharya, A (2008) Sustainable Livelihood based Watershed Management - Watershed Plus Approach. *In* First working group meeting of FRIA, Manila

Broadbent, F.E. (1957) Organic matter. *In* Soil. Year book of Agriculture USDA, Washington D.C. p 151-157

Chaillat, K. (2007) Global Organic Shift? Down to Earth, August 31, p 31

Collette, L., A. Kassam, P. Kenmore *et al* (2011) Save and grow: A policymaker's guide to the sustainable intensification of smallholder crop production, FAO, pp 106

Dias, B.F. and D. Coats (2012) Soil biodiversity, functions, ecosystem services and International sustainable development agenda. Secretariat of the conservation on Biological Diversity, Montreal, Canada, pp 18

Fan, T., B.A. Steward, W.A. Payne *et al* (2005) Long-term fertilizer and water availability effects on cereal yield and soil chemical properties in northwest China, Soil Sci Soc. Am J. 69, 842-855

FAO (2005) *On* Honeybees and Women in Agriculture

FAO (2008) Land degradation is on the rise

Ghosh, P. (2013) India losing 2,000 farmers every single day. A tale of rapidly changing society. Intl. Business times

Gnacadja, L. (2010) The trillion worth soil biodiversity. Development watch: An alliance for monitoring international cooperation

Harteminh, A.F. (2008) Soil are back on global agenda. Soil use and management, 24, 237-330

Hudson, N. (1992) Land husbandry Betsford London, U.K. pp 190

Johl, S.S. (2006) Environmental degradation and its corrections in agriculture sector, Indian J Agric. Econ. 61, 601-609

Johri, B.N. (2006) Below ground biodiversity: the provision of ecosystem goods and services. Policy paper 36, NAAS, New Delhi

Krishnamoorthy, Ch. And J. Venkateswarlu (1976) Nutrient availability – concepts and relationships. *In* Soil Fertility theory and practice. Ed J.S. Kanwar, ICAR, New Delhi, p65-92

Kurien, V. (2001) Value-based crop-livestock production systems for the future in the semiarid tropics. *In* Future agriculture in semiarid tropics, Eds. M.C.S. Bantilan, Parthasarathy Rao and P. Padmaja, ICRISAT, Patanacheru, p 73-82

Mercer, P. (2012) Soil degradation poses risk to earth's future. VOA (17.07.2012)

Montgomery, J.R. (2010) Soil-opinion – 2020 Vision, Nature 463/7, 31

Niggli, U., J. Earley and K. Ogorzalek (2007) Organic agriculture and environmental stability of the food supply. Intl. Organic Agri & Food Security, 3-5 May 2007, Rome, FAO (mimeo)

Partap, T. (2006) The Indian Organic Pathway: Making way for itself. Occasional paper 1. ICCOA, Bangalore

Pimentel, D.P. Hepperly, J. Hanson *et al* (2005) Environmental, energetic and economic comparisons of organic and conventional farming systems. BioScience. 55, 573-582

Roy-Boldue, A. and M. Hijri (2010) The use of Mycorrhizae to enhance P uptake. A way out the P crisis J. Biofertilizer and Biopesticides. 2, (1) 1-5

Sergaldin, K. (1999) Science in the service of humanity: The challenge for agricultural research in India and the world: Commencement address at the convocation of ANGRAU, Hyderabad, pp 11 (mimeo)

Singh, A.K. (2012) ppt presentation on crop production, New Delhi

Thorup - Kristensen, K. (2007) Effect of crop management practices on the sustainability and environmental impact of organic and low input food production systems. III Intl. Cong European Integrated Project: Quality, Low Input Food (QLIF). Univ. Hohenheim, Germany, 20-23 March 2007, 432-438

UNESCAP (2009) Sustainable agriculture and food security in Asia and the Pacific. UNESCAP, Bangkok pp 102

USDA (2010) Soil biology; Technical Note, Ed. A.G. Tugul, A.M. Lewardowski and D.H. Vonarb, NRCS

Vijayakumar, T. (2007) Sustainable development of agriculture through SHGs and their federations - a case study in Andhra Pradesh. *In* National workshop on National Paradigm for rainfed farming - redesigning support system and incentives, 27-29 September, 2007

Willer, H. (2011) The world of organic agriculture: Survey. *In* The World of Organic Agriculture. Statistics and emerging trends 2011, IFOAM, Bonn & FiBL, FRICK

Zanu, G (201) Preservation of biodiversity protects drylands. Sc. Dev. Net. Agric & Environment: Biodiversity

* * *

Managing Pests without using Pesticides

Dr. M.S. Chari[1], Dr. Ramanjaneyulu[2], G. V., Zakir Hussain[3], Chandra Sekhar G.[4], and Rajashekar G.[5]

Indian Agriculture is as old as human civilisation and constantly evolving with contemporary innovations by the practitioners. Under the garb of modernising agriculture, the 'traditional cyclic approaches' were replaced by the 'linear industrial approaches' which led to ecological and economic crisis in farming. The institutional innovations which largely involved usage of external industrial inputs replaced the contemporary innovations by practitioners which involved multiple approaches to solve a problem and pluralistic ways of understanding an issue or a phenomenon. The

1. *Retd. Director of Central Tobacco Research Institute (CTRI) and Managing Trustee*
2. *Executive Director, 3. Joint Director, 4. Program Manager, 5. Program Manager, Centre for Sustainable Agriculture (CSA)*
12-13-445, Street No. 1, Tarnaka, Secunderabad - 500 017
Contact: +91 (040) 27017735 / 27014302, Website: www.csa-india.org

framework of their understanding always saw the indigenous knowledge as 'traditional'-'subsistence' and backward. The mainstream agriculture institutions not only failed to understand the Indian socio-economic-political-ecological context but also the science behind the production practices or the cropping systems. The experiments with Non Pesticidal Management in the erstwhile Andhra Pradesh clearly shows that the contemporary innovations based on Indigenous knowledge could have spread effectively if proper support is provided.

Pest management is seen as killing insects with toxins externally sprayed (Pesticides) over crops or genetically modified (GM) to produce internally in the plants. The ecological problems both with pesticides and GM crops are ignored.

The learnings from Integrated Pest Management (IPM) projects and Farmer Field Schools (FFS) experiences worldwide should have led to research on the complex interaction between crop ecology, agronomic practices, insect biology, and climate change to develop effective methods to manage disease and insect control strategies. Similarly the farmers' knowledge on using the local resources could have been captured and the principles could have been standardized. But FFS mostly remained as a paradigm shift in agricultural extension: the training program that utilizes participatory methods "to help farmers develop their analytical skills, critical thinking, and creativity, and help them learn to make better decisions". The agriculture research and extension system worldwide still continue to believe in chemical pesticide based pest management.

While the inevitability of pesticides in agriculture is promoted by the industry as well as the public research and extension bodies, successful experiences emerging from farmers' innovations call for a complete paradigm shift in pest management.

Shifting Paradigms: Non Pesticidal Management

The ecological and economical problems of pests and pesticides in agriculture gave rise to several eco-friendly innovative approaches which do not rely on the use of chemical pesticides. These initiatives involved rediscovering traditional practices and contemporary grass root innovations supplemented by strong scientific analysis mainly supported by non-formal institutions like NGOs. Such innovations have begun to play an important role in development sector. This also shows how collaborative work of diverse players like public institutions, civil society organizations and farmers can generate new knowledge and practice and can evolve more sustainable models of development.

Pest is not a problem but a symptom. Disturbance in the ecological balance among different components of crop ecosystem makes certain insects reach pest status. In fact experience shows that most of the pest problems are pesticide induced (Ramanjaneyulu, 2009). Non Pesticidal Management evolved from this perspective , which is an 'ecological approach to pest management using knowledge and skill based practices to prevent insects from reaching damaging stages and damaging proportions by making best use of local resources, natural processes and community action'.

Non Pesticidal Management is mainly based on

- Understanding crop ecosystem and adopting suitable cropping systems and crop production practices. The type of pests and their behavior differs with crop ecosystem. Similarly the natural enemies' composition also varies with the cropping systems.
- Understanding insect biology and behavior and adopting suitable preventive measures to reduce the pest numbers. Curative measures if needed, are based on using various products made out of locally available resources. The measures coupled with natural processes effectively manage the pests.
- Building farmers knowledge and skills in preventive and curative measures. This is done through a Farmer Field School approach.

Backyard Biotechnology

Most of the curative practices are based on making and using products from the locally available plant and animal material by various processes like making solutions, concoctions, decoctions and fermented products. These products are locally prepared and locally used. Hence, the processes are standardised and not the products.

Farmers find them very useful and easy to make. As they do not use any external inputs they are cheaper. Even if some of them have highly toxic material (like *Holarrhena antidysenterica* (*Pala Kodise*) people never faced a problem as they know how to handle them safely. The recipes of these products are more or less based on the regular food preparations. Hence women find it easy to make.

Basic set of practices followed

1. Growing healthy plants

This is the first step in Non Pesticidal Management. This involves

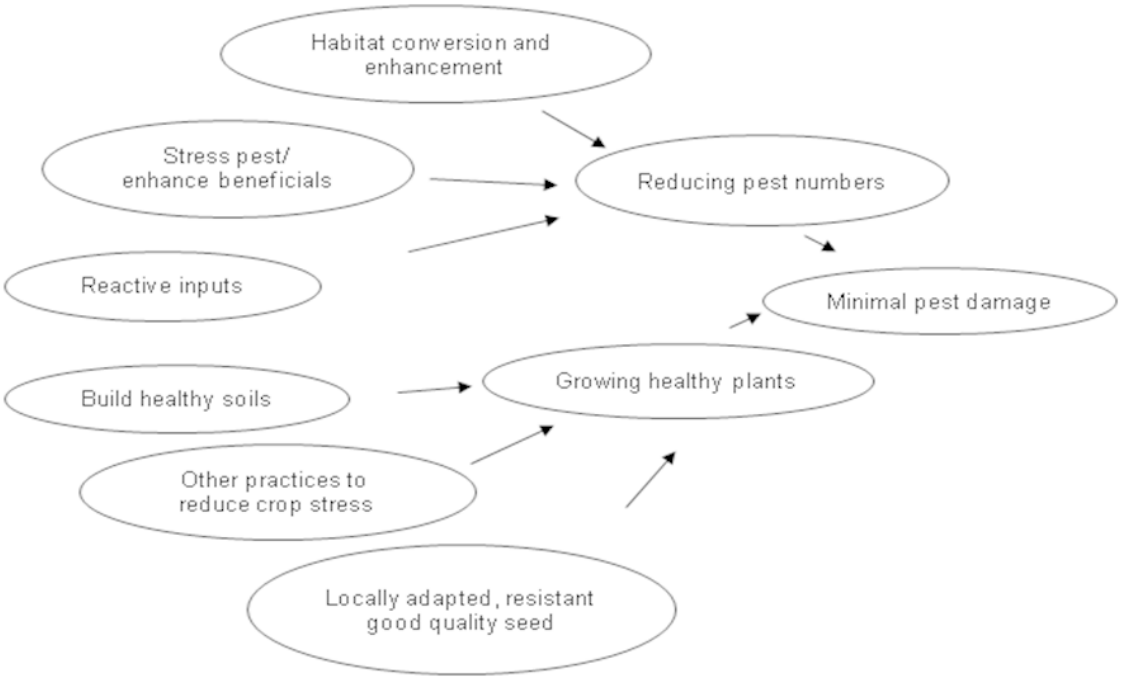


Fig 1 Schematic Representation of Non Pesticidal Management

1.a. Good Quality Seed: Selection and use of good quality seed which is locally adopted either from traditional farmers' varieties or improved varieties released by the public sector institutions is important. Farmers are suggested to make their decision based on a seed matrix regarding suitability of the different varieties into their cropping patterns, based on the soil types, reaction to pest and diseases and their consumption preference. They maintain the seed in their seed banks. This ensures farmers to go for timely sowing with the seeds of their choice. In rainfed areas timely sowing is one critical factor which affects the health and productivity of the crop. The seed is treated with concoctions depending on the problem; for example, cow urine, ash and asafetida concoction provides protection against several seed borne diseases like rice blast, or

beejaraksha, *beejamrut* to induce microbial activity in the soil and kill any seed borne pathogens. In crops like brinjal dipping of seedlings in milk and dipping fingers in milk before transplanting each seedling was observed to prevent viral infections. Several such practices are documented and tested by the farmers.

1.b. Reduce stress: The pest and disease susceptibility increases with abiotic stress. Practices like mulching will improve the soil moisture availability.

2. Build healthy soils

Healthy soils give healthy crop. Chemical fertilizers, especially nitrogenous fertilizer makes the plants succulent and increases the sucking pests like Brown Plant Hopper in rice. Production practices, such as using crop residues or other biomass as surface mulch; using compost and green manures; intercropping of legumes in cropping systems and biocontrol of insect pests and diseases, all help to enhance yields and sustain soil fertility and health (Rupela *et al* 2007).

3 Enhancing the habitat

3.a. Crop diversity: Crop diversity is another critical factor which reduces the pest problems. Traditionally farmers have evolved mixed cropping systems, intercropping and crop rotation systems. These systems create a better environment for nutrient recycling and healthy ecosystems. On the contrary, monoculture of crops and varieties lead to nutrient mining and pest and disease buildup. Under NPM, farmers adopt mixed and intercropping systems with proper crop rotations.

3.b. Trap and Border crops: Many sucking pests fly from neighboring farmers' fields. In crops like chillies, groundnut, cotton, sunflower where thrips are a major problem, sowing thick border rows of tall growing plants like sorghum or maize will prevent insects from reaching the crop. Farmers adopt marigold as a trap crop for the gram pod borer, which reduces the pest load on pigeon pea. The flowers that have been oviposited by the female moths of Helicoverpa can be picked out and destroyed (KVK, DDS, 2003).

Table 1: Trap crops used for pest management

Crops	Pests	Trap crops
Cotton, groundnut	Spodoptera	Castor, sunflower
Cotton, Chick pea, pigeon pea	Helicoverpa	Marigold
Cotton	Spotted bollworm	Okra

3.c. Other agronomic practices: Several crop specific agronomic practices like alley ways in rice to allow enough light to reach the bottom of the plant are documented by the farmers and suggested by the scientists (*Vyavasaya Panchangam*, 2007).

4. Understanding insect biology and behavior

4.a. Life cycle: Most of the insects undergo complete metamorphosis in the four stages of the life cycle. Such insects damage the crop only in larval stage and at least two of the stages [egg and pupa] are immobile. Every insect has different behavior and different weaknesses in these stages. They can be easily managed if one can understand the life cycle and their biology. The different stages in the insect life cycle are morphologically different and relating between one stage and other is difficult unless one studies/ observes the life cycle.

Adult stage: Adults of Red Hairy Caterpillar (RHC) are attracted to light – thus, community bonfires or light traps (electric bulbs or solar light) can be used to attract and kill them. Similarly adult insects of Spodoptera and helicoverpa can be attracted by using pheromone traps. Normally pheromone traps are used to monitor the insect population based on which pest management practices are taken up. Natural Resources Institute, UK in collaboration with Tamil Nadu Agriculture University, Gujarat Agriculture University, Centre for World Solidarity, Asian Vegetable Research and Development Centre has evolved mass trapping method to control Brinjal Fruit and Shoot borer and demonstrated on a large scale (http://www.nri.org, GAU, 2003). The adults of sucking pests can be attracted using yellow and white sticky boards.

Egg stage: Some insects like Spodoptera lay eggs in masses which can be identified and removed before hatching. Insects also have preference for ovi-position. Spodoptera prefers to lay eggs on castor leaves if available. Hence growing castor plants as trap crop is practiced. By observing the castor leaves farmers can easily estimate the Spodoptera incidence. Helicoverpa lays eggs singly, but has a preference towards Okra, Marigold (mostly towards plants with yellow flowers). Hence marigold is used as a trap crop where ever helicoverpa is a major problem. Rice Stem borer lays eggs on the tip of the leaves in nurseries; farmers remove these tips before transplanting (*Vyavasaya Panchangam, 2007*).

Larval Stage: The larval stage is the one that causes damage like borers. In this stage they would be voracious feeders and if identified in the initial stages, they can be managed; otherwise we have to resort to control measures.

Pupal Stage: The larvae of Red Hairy Caterpillar burrow and pupate in the soil. Deep summer ploughing, which is a traditional practice in rainfed areas expose these larvae to hot sun which kills them. The larvae of stem borers in crops like paddy, sorghum pupate in the stubbles. So farmers are advised to cut the crop to ground level and clear the stubbles.

4.b. Biology: The larva of Red Hairy Caterpillar (*Amsacta albistriga*) has a dense body hair, which wards off the sprayed pesticide. Therefore it needs to be controlled in other stages of its life cycle. For any safe and economic method of pest management one must understand how the pests live and die, where does it come from and when, where and how does it damage the crop. Knowledge of these biological attributes of pest will help farmers to use NPM methods successfully on a sustainable basis (GAU, 2003).

5 Understanding crop ecosystem

The pest complex and the natural enemy complex are based on the crop ecosystem. The pest complex of cotton is completely different from that of Sorghum. The pest complex in wet rice ecosystem differs from the pest complex in dry rice. Decision about any pest management intervention should take into account the crop ecosystem which includes cropping pattern, pest-predator population, stage of the crop etc. Similarly the management practices followed in one crop cannot be practiced in another crop. For example, to manage helicoverpa in pigeon pea, the farmers in Andhra Pradesh and Gulbarga shake the plants; as a result the insects fall down over a sheet spread between the rows. The insects are collected and killed. Similarly, in paddy there is a practice of pulling a rope over the crop to control leaf roller.

6. Reactive sprays for control

Insect population may reach pest status if the preventive steps are not taken in time, changes in weather conditions and insects coming from neighboring farmers fields. In these situations based on the field observations farmers can take up spraying botanical extracts and natural preparations (Green sprays)

instead of chemical pesticides. There is a wide range of these preparations which are evolved by the farmers (CSA, 2007). These preparations can be classified into four categories based on how they are prepared.

6.a Aqueous or solvent extracts: Neem Seed Kernel Extract is prepared in several ways. Kerosene is used as a solvent for extracting 'Allenin' from garlic. After extraction, this solution is mixed with chilli extract and used against sucking pests (Prakash and Rao 1997, Vijayalakshmi *et.al* 1999, Prasad and Rao 2007).

6.b. Decoctions: Plants like tobacco, *Nux Vomica* etc contain volatile compounds which can be extracted by boiling them in water to form a decoction. Several decoctions are used in pest management (Prakash and Rao, 1997, Vijayalakshmi *et.al*, 1999, Prasad and Rao, 2007).

6.c. Concoctions: Concoctions are mixtures. For example, 'five leaves mixture' is an aqueous extract of any five latex producing leaves. This is popularly used to control pests in Tamil Nadu and other parts of south India (Prakash and Rao, 1997, Vijayalakshmi *et.al*, 1999, Prasad and Rao, 2007).

6.d. Fermented products: These are products made by fermenting different botanicals with animal dung and urine. These products have rich microbial cultures which help in providing plant nutrients in addition to acting as pest repellents and pest control sprays. For example cow dung, urine-asafetida solution is used to manage Rice blast (Prakash and Rao, 1997, Vijayalakshmi *et.al*, 1999, Prasad and Rao, 2007).

The Evolution of Non Pesticidal Management

In 1988, ASW and EZE organized People's Science Conference at Bangalore to promote concept of substituting synthetic chemical pesticides by a non-pesticide approach based on locally available resources. This led to a collaborative programme for non-pesticidal approach for controlling RHC in 1989 with Zonal Coordinator, Transfer of Technology (ToT) Unit, ICAR, Hyderabad; Department of Agriculture, ASW/ CWS (Centre for World Solidarity); OXFAM; and village based voluntary organizations as partners.

The Story of Red Hairy Caterpillar *(Amsacta albistriga)* Management: During late eighties, Red Hairy Caterpillar (RHC) was a major pest in the dryland areas of Telangana. This pest attacks crops like castor, groundnut, sesame, sorghum and pigeon pea in the early stages and causes extensive damage. This

forces farmers to go for 2-3 resowings or late sowing which affect the yield. The problem of crop failure due to delayed and uncertain rainfall was compounded by this pest damage. Resowings were needed in more than 30 % area.

Discussions with several voluntary agencies, farmers from different regions and few concerned scientists established that

1. this pest infests crops only on light red soils.
2. there is only one generation of moths that lay the eggs producing the caterpillars which later hibernate in the soils and the adult moths appear in waves at the onset of the monsoon. The early emerging moths should be destroyed to control the pest.
3. the foraging caterpillars are also attracted to some wild non-economical plants such as calatropis, wild castor, yellow cucumber.
4. the later instars of larvae have dense red hair all over the body, which prevents pesticides from reaching the body of the insects.

Package of practices were evolved based on the insect behavior, to manage the RHC before it reaches damaging stages and proportions: deep summer ploughing to expose and kill the resting pupae; lighting community bonfires to attract the moths and kill them, alternatively light traps (electric bulbs or solar light) were also used; digging trenches around the field to trap migrating larvae; using calatropis and jatropha cuttings to trap the larvae; neem sprays to control the early instar larvae.

During 1989 to 93 the program covered 18,260 ha in 95 villages across 12 districts of the erstwhile AP in two phases involving 21 Voluntary Organizations.

With these measures RHC could be effectively managed. Farmers could avoid late sowing and only 4% of farmers went for re-sowing in areas where RHC management was followed. After the initial success of these methods, it evolved into a Red Hairy Caterpillar Management program with coordinated action of Centre for World Solidarity (CWS), ICAR Zonal Coordinating Unit, Directorate of Oilseeds Research and Department of Agriculture (Qayyum and Sanghi, 1993).

In 1994, CWS organized a workshop in collaboration with National Academy of Agriculture Research Management (NAARM), Hyderabad to bring together initiatives working in NPM across country. This workshop evolved a joint strategy paper on NPM.

In 1998, CWS organized the second National Workshop on Non Pesticidal Management in collaboration with MANAGE in Hyderabad. The workshop which was attended by eminent scientists and civil society organizations called for expansion and popularizing the concept and practices.

From 1998 to 2004 focus was on experimenting with other crops and pests in the states of erstwhile Andhra Pradesh and Maharashtra.

In 2004, the Sustainable Agriculture desk at Centre for World Solidarity was registered as a separate organization Centre for Sustainable Agriculture (CSA) to focus on expanding the work on NPM and sustainable agriculture.

Punukula, a small village in Khammam district of Telangana used to spend about Rs. 40 lakh annually on chemical pesticides to grow crops like cotton, chillies. In 2004, it declared itself as a pesticide free village after five years of NPM work.

In 2004, a pilot project was organized by WASSAN (Watershed Support Services and Activities Network) and CSA (Centre for Sustainable Agriculture) to understand the scope for scaling up of NPM.

During 2004-05 the farmers in the then Andhra Pradesh were experiencing a period of serious livelihoods crisis. The Society for Elimination of Rural Poverty (SERP), working with federations of Women Self Help Groups, identified increasing costs of cultivation due to heavy dependency on external inputs as one of the main reasons for the growing indebtedness. Learning from the experiences of villages like Punukula and Enabavi in Telangana, SERP initiated pilot scaling up of Non Pesticidal Management in collaboration with a consortium of Civil Society Organisations led by Centre for Sustainable Agriculture in 2005-06 (Ramanjaneyulu *et al* 2009, Vijay Kumar *et al* 2009).

- Farmer Field School approach originally designed and promoted by FAO was suitably modified and established to train farmers (both women and men) regularly on the NPM and other ecological farming practices.
- The program is implemented using experienced farmers as 'Community Resource Persons' (both women and men) and the federations of Women Self Groups at the Mandal level managed the entire program. The program was supported by experienced local NGOs and Centre for Sustainable Agriculture as the nodal agency for technical support and project management till 2007-08.

- With the initial success with NPM, SERP has cast its net wide across the country to identify best practices from the successful ecological farming models. Ecological/ Natural Farming Master farmers like Sri. Bhaskar Save, Sri. Subash Palekar, Sri. Nammalwar have provided inspiration and necessary support to promote 'polycrop' models, organic soil management practices, soil and water conservation, and *in situ* water harvesting practices.
- By 2007-08 the program spread to more than 7.0 lakh acres across the erstwhile state of AP, largely through the support of NGOs. It became evident during this period that resource conserving, regenerative, sustainable agriculture practices which are largely based on local resources based solutions, farmers knowledge and skill in packaging them to suit their situations, bring in wide set of benefits that accrue to the practitioners and their farm ecology. In 2007-08 a state level Project Management Unit was setup to take over the roles of providing overall technical support and project management.
- As the scope of the intervention expanded it was named as 'Community Managed Sustainable Agriculture' (CMSA). CMSA represents a model of agriculture which is largely based on farmers' resources, knowledge and skills and the institutional systems are managed by the Community.

Impacts

The Community Managed Sustainable Agriculture is a comprehensive package bringing together several ecological farming practices. The enabling strength of the women Self Help Group institutional platform has facilitated rapid spread of these practices. There have been a range of important impacts to farmers and poor rural households:

- Reduction in cost of cultivation due to NPM is reported by all the farmers. The savings in costs range from Rs. 3000/ acre in paddy, redgram to Rs. 15,000/ acre in chillies.
- A quick survey by SERP in three districts has shown that the number of cases of hospitalisation due to pesticide poisoning has reduced from 242 cases/ year to 146 cases/ year; a 40 percent drop. Where entire villages have adopted NPM the drop is 100 per cent.
- Unlike the popular argument that pest outbreaks could happen, villages adopting NPM have not seen pest outbreaks caused due to ecological disturbance or pest resistance. Farmers could effectively manage rice blast using fermented solution of asafoetida, cow dung and urine (http://

www.oryza.com/forums/showthread.php?t=535), and sucking pests in cotton and chillies using similar methods.

- Where organic soil management practices are adopted, the increased soil moisture conservation has helped to tide over drought spells for about additional 10 days. Encouraged by this, integrated effort to conserve water within the field by adopting conservation furrows, trenches and farm ponds was initiated.
- Efforts to internalise the seed production at community level, particularly in crops like paddy, groundnut, have shown positive results.
- AP produces and exports most of the chillies in the country. High pesticide residues often have led to the rejection of the export chillies and products using chillies. The chillies produced in Guntur district adopting NPM practices were tested for pesticide residues and were found to be in accordance with EUROGAP standards.
- During 2009-10, more than 7638 farmers (in addition to the 251 who come under PoP strategy) were supported to establish Intensive Farming System model in 36 x 36 m which produce food round the year with a combination of seasonal and perennial crops. The net incomes from these models ranged from Rs. 4000 to 12,000 in addition to meeting the family food needs.
- The CMSA approach enables bundling of various relevant services to farmer families, including credit access on the doorstep. Ultimately, the approach involves facilitating development of micro-credit plans for sustainable agriculture and linking farmers to commercial banks, especially where this is related to marketing needs. Access to banks for farming reduced as the focus shifted to the poorest of the poor, who depended more on the group credit system. CMSA approach also facilitates the farmer's access to high quality inputs through a network of community seed banks and agricultural implements from Custom Hiring Centers run by the federations of Women Self Help Groups.

Observations on benefits and strengths of the program

Getting out of pesticide poisoning is seen as a major benefit for the farmers. They clearly recognise and acknowledge that their health has significantly improved and the health costs have come down after adoption of NPM. While there is considerable scope to increase wider awareness on the benefits of appropriate use and correct application of pesticides and fertilizers, the NPM interventions have demonstrated the effectiveness of using local resources and preventive measures.

The ecological farming practices like NPM, organic soil management, multiple cropping models, SRI etc., have been adopted by the farmers to a considerable extent. The Farmer Field School approach to build the capacity and the confidence being part of the group has proven to be very useful in promoting such practices. The risk of failure of such practices is also very low which make them easy to try. Even partial adoptions give benefit to the farmers. Community management with FFS, CRPs, VOs and Mandal federations, has built in more ownership on the program.

Pesticide use across states 2005-06 to 2009-10

Erstwhile AP is the only state which showed the reduction in pesticide use in the country in the five year period of 2005-06 to 2009-10, even when compared with the states growing Bt cotton or using low volume insecticides.

S.No.	States/UTs	2005-06	2006-07	2007-08	2008-09	2009-10
1	Andhra Pradesh	1997	1394	1541	1381	1015
2	Gujarat	2700	2670	2660	2650	2750
3	Haryana	4560	4600	4390	4288	4070
4	Jammu & Kashmir	1433	829	1248	2679.27	1640
5	Karnataka	1638	1362	1588	1675	1647
6	Kerala	571	545	780	272.69	631
7	Madhya Pradesh	787	957	696	663	645
8	Maharashtra	3198	3193	3050	2400	4639
9	Orissa	963	778	N/A	1155.75	1588
10	Punjab	5610	5975	6080	5760	5810
11	Rajasthan	1008	3567	3804	3333	3527
12	Tamil Nadu	2211	3940	2048	2317	2335
13	Uttar Pradesh	6671	7414	7332	8968	9563
14	West Bengal	4250	3830	3945	4100	NA
	Total in India (in round fig.)	**39773**	**41515**	**43630**	**43860**	**41822**

Source: http://ppqs.gov.in/IpmPesticides.htm MT of active ingredient

Practices involving heavy earthen works like farm ponds, conservative furrows and trenches need more capacity building for the staff and labour involved. As the risk of failure of such models is high, adaptation to local situations is needed with a good capacity building plan for the people involved.

Convergence of various interventions of IKP such as marketing, dairy along with CMSA will provide additional benefits. Convergence with line departments (Agriculture, Animal Husbandry) still seems to be a distant possibility due to rigid compartmentalisation of their working. Discussions with agencies were undertaken to increase integration and linkages.

The Community Resource Person based extension is working well for horizontal expansion of the program. Involving some more experienced resource organisations at state and district level will be important to strengthen the program. Till now the program is implemented through the women's Self Help Groups and their federations. These institutions which are formed for thrift and credit, have shown that they can form an important platform for farming families. They can also then potentially form the springboard where by farming families can be organised into cooperatives for more focussed work along the value chain.

There has been a range of impacts of considerable importance to poor rural households in the erstwhile AP, summarised as follows:

Economic Benefits	Ecological Benefits
• Lower cost of production & substantial statewide savings • Yield maintained or increased • Higher household income • Lower Debt • Higher cropping intensity • Lower risk perception and higher investment in agriculture • Business innovation and new livelihood opportunities	• Better soil health, water conservation • Conservation of agro-biodiversity • Fewer pesticide related health problems • Smaller carbon footprint as a result of reduced use and production of inorganic fertilisers

References

ANGRAU 2001, 2006, 2007. *Vyavasaya Panchangam* (Annual Calender of crop production practices in Telugu), published by Acharya NG Ranga Agricultural University, Hyderabad.

CSA, 2006. *Annual Report NPM, 2005-06*, unpublished report by Centre for Sustainable Agriculture, Hyderabad.

CSA, 2007. *Annual Report NPM, 2006-07*, unpublished report by Centre for Sustainable Agriculture, Hyderabad.

CSA, 2007. Susthira Vyavasayam lo vividha padarthala Tayari (Telugu), (Various preparations in sustainable agriculture) published by Society for Elimination of Rural Poverty, Government of Andhra Pradesh

CWS, 1994. *Non Pesticidal Management in Crops*, Proceedings of the Workshop organized by CWS and NAARM.

CWS, 1998. *Non Pesticidal Management*, Proceedings of the Workshop organized by CWS and MANAGE.

GAU, 2003. *Non Pesticidal Management of Brinjal Fruit and Shoot Borer*, technical bulletin, Department of Entomology, Gujarat Agriculture University.

GEAC, 2005. *Proceedings of 53rd Meeting of GEAC*, Ministry of Environment and Forests, Government of India http://moef.gov.in/enfor/geac.html

KVK DDS *Annual Report* 2003 unpublished report by Krishi Vigyan Kendra, Pasthapur.

Qayum. M. A. and Sanghi. N. K. (1993) Red Hairy Caterpillar Management through Group Action and NPM Methods published by ASW and Oxfam (India) Trust.

Prakash, A.; Rao, J. 1997: *Botanical pesticides in agriculture.* CRC Press. USA.

Ramanjaneyulu, G.V, Kavitha Kuruganti and Zakir Hussain, 2004. *No Pesticides No Pests*, published by Centre for Sustainable Agriculture http://www.csa-india.org.

Ramanjaneyulu, GV, Chari MS, Raghunath TAVS, Zakir Hussain and Kavitha Kuruganti 2009. *Non Pesticidal Management: Learning from Experiences* in Integrated Pest Management: Innovation-Development Process Volume-1, edited by Rajinder Peshin and Ashok K. Dhawan, Springer.

Rupela, O.P., Gowda, C.L.L., Wani, S.P., and Hameeda Bee, 2007. *Evaluation of Crop Production Systems Based on Locally Available Biological Inputs* in Biological Approaches to Sustainable Soil Systems edited by Norman Uphoff, 2007.

Vijayalakshmi, K.; Subhashini, B.; Koul, S. 1999. *Plants in Pest Control: Pongam, tulasi and aloe.* Centre for Indian Knowledge Systems, Chennai, India.

Groundwater: Reimagining Its Role In India's Agriculture

Himanshu Kulkarni[1] and SiddharthPatil[2]

This paper, has been prepared as a compilation of thoughts and logic from ongoing work by ACWADAM and many of its partners including WASSAN, touches upon many aspects on 'water', especially 'groundwater' that were close to Dr.Sanghi's heart. The inferences and conclusions in various sections of this paper are not necessarily complete and are 'work in progress'. However, the ideas and concepts are based on long-term understanding, research and analysis by ACWADAM on groundwater, aquifers and participatory groundwater management. Many of our colleagues, friends, partners, collaborators, mentors, teachers and students have contributed to this understanding. Dr. Sanghi was clearly

1. *Executive Director, 2. Researcher, Advanced Center for Water Resources Development and Management (ACWADAM), 4, Lenyadri Society, Sus Road, Pune - 411 021, Contact: +91 (020) 25871539,*
Email: acwadam@gmail.com, Website: http://www.acwadam.org/

a person who understood our work quite deeply. This is just a small 'remembrance' in his memory and a token of the respect that we have for him.

Introduction

By the turn of the century, South Asia alone had more area under 'groundwater irrigation' than the rest of the world combined; at the beginning of the last decade 30% of the global area under irrigation was in South Asia (Shah, 2009). India is now the largest user of groundwater resources in the world, as indicated by many different statistics (Shah, 2009), even though global data sets[3] indicate at least eight other nations to have a higher per capita annual groundwater consumption. In fact, by the mid-80s, India had become the largest groundwater user in the world, which may have prompted the process of periodic groundwater assessments by the Central Ground Water Board, Government of India. Given India's great dependency on groundwater in agriculture, rural domestic water supply and urban water supply, many regions have witnessed groundwater extraction in excess of the potential annual recharge to aquifers, leading to a situation of overexploitation. In many regions of the country, groundwater contamination has also emerged co-terminus to acute groundwater scarcity. There is need for a special discussion on India's aquifers, which must not be looked at only from a classical 'development' lens, but must form the basis for aquifer based participatory groundwater management in the context of extreme events like floods and droughts and more specifically in the context of reviving rainfed agriculture across the country.

Rainfed agriculture is becoming increasingly sensitive to changes in weather patterns, as is reported from many of the field sites where ACWADAM is working on groundwater management with its partner organisations. So is the stock of drinking water towards the end of a typical Indian summer. In between, there is the larger question of groundwater and the complex nature of its use. Whether weather changes are part of changing climate may be a point of debate. The results, however, are not so debatable. Impacts include huge losses to crops and economies even over short time frames. Crop losses in the usually predictable rainfed, kharif crop were far more severe in parts of India in the good rainfall years of 2005 and 2006 (when rains played havoc, causing flooding, and disrupting not only agriculture but all walks of life). In many ways, such changes have endangered agricultural livelihoods and have also led to further stress on

3. *www.earthtrends.wri.org*

groundwater resources, despite groundwater being less sensitive to natural vagaries than surface water. This paper discusses the importance of aquifers, particularly in revitalizing rainfed agriculture, and the need to manage them.

Groundwater dependency and vulnerability

Variability in both incomes and risks in agriculture is often a function of the dynamics of water resources systems. Reliability of water supply implies assured yields and incomes, although other factors also play a role. In developing countries such as India, increased access to groundwater has served as the primary mechanism for poverty alleviation, whereby small farmers even in deep interiors have gained access to irrigation through private investments (Shah, 2009). At the same time, the water-level declines caused by intensive development now threaten the livelihoods of millions of such small farmers. Similarly, while increased use of groundwater for domestic water supplies has ensured some degree of domestic water security and reduced exposure to pathogens, emerging quality problems such as arsenic and fluoride represent a major threat to the health of the same millions.

The Central Ground Water Board (CGWB), India's lead organization dealing with groundwater resources, makes 'national-level' assessment of groundwater resources from time to time. Four such national groundwater assessments have been conducted, first in the year 1996 and then in 2004 (CGWB, 2006), 2009 (CGWB, 2011) and 2011 (CGWB, 2014). The primary basis for classification of assessment units (largely administrative, mostly 'blocks') into safe, semi-critical, critical and overexploited categories is the relationship between pumping and annual replenishment. Within the span of less than 10 years – 1996 to 2004 - the proportion of districts in the semi-critical, critical and overexploited categories has grown from 9% to 31%, area from 5% to 33% and population affected from 5% to 35%. This jump shows that the groundwater crisis had deepened considerably and we need to now urgently address the task of sustainable management of groundwater resources in this country. A district-level comparison of the data on the level of groundwater development between 1995 and 2004 shows that many districts which were in the "safe" category in 1995 (Level of Groundwater Development ≤ 70%) have now moved over to "unsafe" category (Level of Groundwater Development ≥ 70%). Dramatic as this change would appear, we must be cautious to remember that such a change could partly be on account of a reformed methodology and probably newer, improved data-sets (Kulkarni and Shankar, 2010).

However, these figures present only a part of the picture, in that they point to the problem of 'scarcity' and the degree of exploitation, giving the assessment a 'quantitative' dimension. In a recent analysis, which was published in Kulkarni *et al* (2009ii) and Kulkarni and Shankar (2010), an attempt was made to arrive at a more complete and dynamic picture of India's groundwater crisis by comparing the level of groundwater dependence at the district level with the level of groundwater development.

A lumped picture of groundwater development and quality is useful to understand groundwater "vulnerability" in India. Vulnerability here implies potential danger to drinking water sources, either in terms of the quantity of water available or the quality of available water or as a compounded effect. When one brings aggregated district-level data on groundwater use and quality patterns together, an interesting broad picture emerges indicating that serious issues of scarcity and water quality imply that groundwater vulnerability is now visible in about 60% of the districts of the country (Kulkarni et al, 2009ii).While on the one hand such statistics are useful to draw some broad policy recommendations, they offer limited succour with regard to developing comprehensive strategies in groundwater management. This is especially crucial to the India-context, given the fact that the groundwater story has unfolded on millions of farms, at the village level and also at larger scales such as in watersheds and river basins, almost as an integrated puzzle with many pieces. It is these pieces that hold the key to good strategies of groundwater management.

Each piece of the groundwater puzzle is what is meant by the 'micro' picture. The relationship between these two important parameters is complex and depends upon the "aquifers" from which groundwater is tapped by wells, tubewells and borewells. The fundamental basis for good groundwater management is a clear understanding of *aquifers*[4]. *Understanding aquifers is primarily based on good understanding of geology – rock types and rock structure.* The geological diversity in India makes aquifer understanding challenging, but all the more important because *the local situation*, which dictates the approaches to understanding and managing groundwater resources, is crucial (Kulkarni, 2005). Moreover, these local situations also determine the implications of groundwater overuse, droughts, floods etc., especially on how drinking water security is endangered under a particular situation.

4 *An aquifer is described as a rock or rock material that has the capacity of storing and transmitting water such that it becomes available in sufficient quantities through mechanisms like wells and springs.*

Therefore, disaggregation holds the key to accurate understanding of groundwater problems in India. Current sets of data are far too 'gross' to constitute good decision-support systems for strategy formulation on groundwater management. Whether in the case of groundwater overexploitation or groundwater contamination, it is important to 'typologise' the groundwater situation in an area. Such typology emerges as a consequence of mapping aquifers, understanding their behaviour through space and time, understanding patterns of use and exploring opportunities for people to come together and manage groundwater resources collectively (Kulkarni et al, 2009ii). It is only the micro-picture that can truly capture the dynamics around a resource from which usage is highly decentralized.

As much as 70-90% of all water consumed on an annual basis globally is used in irrigated agriculture (Lopez-Gunn et.al. 2011). Some 82% of India's water is used for agriculture as against 14% in rich industrialised countries, (Anon (2009) cited in Narain (2012)), with this picture unlikely to change, at least in the near future. Clearly, the problem of unsustainable levels of groundwater extraction is going to be more acute in those districts where the groundwater is the life support for large sections of the population. Rising demand for groundwater irrigation is clearly a significant cause for rising groundwater resource vulnerability. Using the share of groundwater in total irrigated area (Kulkarni *et al*, 2015, *in* press), districts[5] are classified as those with high groundwater dependence and those with low dependence. Groundwater dependence is high if groundwater accounts for over 50% of the irrigated area of the district (Figure 1). Comparable data for 540 districts is used from CGWB (2011) based on the 2009 national level groundwater assessment and the ratio of groundwater irrigation (GWI) to net irrigated area (NIA), for the latest year for which data is available from Ministry of Agriculture land-use statistics (MoA, 2014). Of the total of 540 districts, 280 (52%) are in the high dependence category while 260 (48%) are in the low dependence category (Table 1). We also classify districts on the basis of their Stage of Groundwater Development as "Safe" (SGD less than or equal to 70%) and "Unsafe" (SGD greater than 70%) (Figure 1). This 'quick analysis' based on secondary data allows us to make some broad-sweep observations:

1. The Himalayan and the Sub-Himalayan region, including the North-eastern States of India show significant data-gap in terms of 'groundwater assessment' (Figure 1a), making it difficult to hazard any guesses regarding

5 *Here, we use data at the district level since source-wise irrigation data is not available at the block level for all blocks of the country.*

groundwater resources development for this region. It is perhaps this very reason why groundwater irrigated area shows up as 'zero' or less than 50% in Figure 1b, giving a somewhat biased impression that the region is largely rainfed. It is not, given that spring water, and even well-water provides some percentage of irrigation in the region.

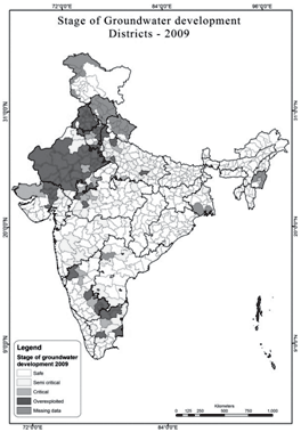
2. There are two major pockets of overexploitation (Figure 1a) that have emerged in India – one in the northwest portion of the country and the other in the southeast, perhaps two diverse settings in terms of geology, socio-economics and ecosystem characteristics.
3. Hence, except large regions in Odisha and West Bengal, much of India has irrigation from groundwater, surface water irrigation notwithstanding. Hence, against popular notions of large regions of India being rainfed, it is really difficult to fathom the precise distribution of rainfed areas in India, at the scales of districts.

A more interesting feature is brought out by an overlay of the two maps (after Kulkarni *et al*, 2015, *in press*). This overlay reveals that, out of a total of 540 districts, 163 (30%) are in the unsafe category in terms of groundwater development, of which 143 are districts with high groundwater dependence. Some 137 districts (25%) currently have safe levels of groundwater development but because they are highly dependent on groundwater for irrigation, we can clearly predict that these districts are likely to move to the danger zone soon, deepening an already serious problem. While developing a sustainable strategy for managing groundwater, we must take into account the dynamic situation in which, with uncontrolled exploitation of groundwater resources, more and more districts and blocks will enter the danger zone in the near future even as pockets of rainfed farming morph into irrigated areas through access to groundwater. The rapid change between 1995 and 2009 in the deepening and widening of the groundwater over-exploitation crisis should be taken as a warning sign of serious groundwater stress (Kulkarni et al, 2015, *in press*). While considering the groundwater stressed areas with high groundwater dependence for better management practices and regulation, the overlay of the groundwater development and groundwater dependence also provides pointers for areas with lower groundwater development and dependence. Nearly 44% of the districts analysed fall under the safe SGD and low groundwater dependence category and this can be seen as potential for increasing groundwater based irrigation to improve livelihoods, albeit with reformed models of access, distribution and management of groundwater. Strategies for promoting groundwater should be formulated in a sustainable management framework taking into account the

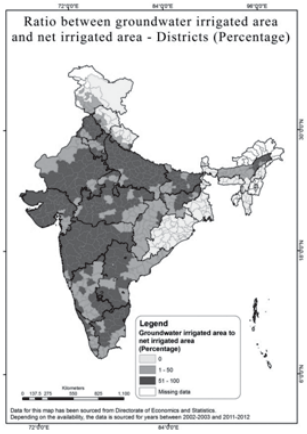
specific aspects of each groundwater typology. This involves the detailed work of assessing the aquifer characteristics, studying socio-economic factors driving the groundwater economy, developing protocols for sustainable use of the resource and evolving appropriate regulatory regimes.

Figure 1 District wise Groundwater Dependence and Stage of Development in India, 2009

(a)



(b)



Source: (a) CGWB, 2011 and (b) Land Use Statistics Reports, Directorate of Economics and Statistics, Department of Agriculture and Cooperation, various years

TABLE 1
Cross-Classification of districts on the Basis of degrees of groundwater development and groundwater dependence

	Low Groundwater Dependence **GWI/NIA < 50%**	**High Groundwater Dependence** **GWI/NIA >50%**
SGD Less than or Equal to 70% ("Safe")	Category 1: 240 (44%)	Category 3: 137 (25%)
SGD More than 70% ("Unsafe")	Category 2: 20 (4%)	Category 4: 143 (27%)

Variability in groundwater conditions – the temporal dimension

An assessment of the groundwater in a specific hydrogeologic setting requires an understanding of the physical framework within which groundwater occurs, i.e., *aquifers*. Accumulation and movement of groundwater in an aquifer depends on its physical properties, thickness, spread, extent of weathering, structural

features (such as fractures, folds and faults) and their *transmissivity (coefficient representing the flow-component of an aquifer) and storativity (coefficient representing the storage-component of an aquifer).* The variability in aquifers is particularly high in the crystalline and volcanic rocks (often referred to as "hard rock" formations) on account of their low primary porosity (Kulkarni, 2005; COMMAN, 2005). Groundwater resources in hard rocks are characterised by limited productivity of individual wells, unpredictable variations in productivity of wells over relatively short distances and poor water quality in some areas.

The initial thrust of irrigation by tubewells, following the Green Revolution, was restricted to India's 30% alluvial areas, which are generally characterized by relatively more pervious geological strata and large volumes in storage. But from the late 1980s, tubewell drilling was extended to hard rock regions (where they came to be labelled as 'borewells'), where the groundwater flow regimes are extremely complex. Deeper aquifers often have good initial yields, but a tubewell/ borewell drilled here may be tapping groundwater accumulated over several hundreds of years. Once groundwater has been extracted from a deeper aquifer, its replenishment depends upon the inflow from the shallow system or from the surface, several hundred metres above it. The path this water has to traverse is characterized by relatively unfavorable media, which greatly slows down the rate of groundwater recharge (Shah, etal, 1998). This poses a severe limit to expansion of tubewell technology in areas underlain by such strata. Similarly in the mountain systems, which comprise 17% of India's land area, effects of groundwater overuse may not take very long to appear (Kulkarni *et al*, 2009ii).

Clearly, there is also a 'time-dimension' involved in the understanding of groundwater resources, a dimension that cannot be ignored if one adds the 'typology' of socio-economic conditions surrounding groundwater resources in South Asia. Aquifers seldom exist in pristine isolation. The complex layering of rock strata with varying aquifer properties gives rise to specific *groundwater typologies* (Kulkarni et al, 2009i). We must remember that while the physical structure is often useful in identification of properties of rock strata, the typologies are not just entities in physical space. They go with a historically governed pattern of access to groundwater and the social processes that regulate its use. Identification of typologies becomes more complex when we bring the topic of water quality into the discussion. While the physical structure broadly sets out the range of options available, the trajectory of development of groundwater resources is governed by a specific historical context and the choices

made therein. Hence, groundwater typologies need to be seen as a *socio-physical category* with a clearly defined *time-dimension*.

The large-scale exploitation of groundwater resources is a consequence of three factors (Planning Commission, 2007; Kulkarni and Shankar, 2010):

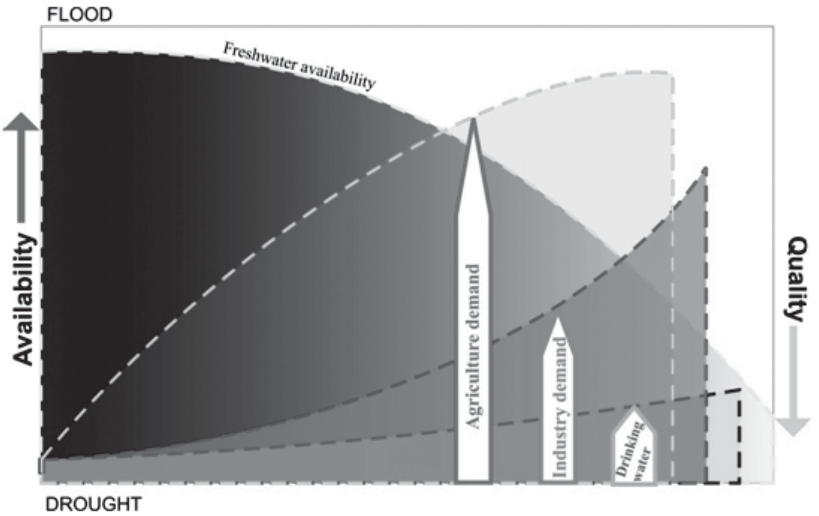
a) an ever-growing demand for groundwater mainly from within agriculture, but increasingly now from growth in industrialization and urbanization;
b) the economics of crop-choice and intensification have not always matched the availability of groundwater resources; and
c) existing power-subsidy regime that promotes competitive and uncontrolled pumping of groundwater.

In most *demand-supply* discussions, the *availability* is usually ignored. Figure 1 provides a schematic view of the relationship between availability, demand and supply of groundwater in any region (Kulkarni and Shah, 2013). The availability (within a hydrologic/ hydrogeologic unit) defines the upper limit for demand and supply, an aquifer in the case of groundwater resources. In many rural areas of India, a single village usually has different episodes of water supply – in other words, water supply schemes that simply try to keep pace with the ever-increasing demand. Most supplies are engineering-based, techno-fixes that cater to a specific 'demand range'. Hence, they work for a certain period in time, after which demand outstrips the supply range and a deficit is created, for which another scheme (supply-step) is created. All of this builds into a scenario where an unregulated demand not only creates a scarcity of freshwater but the quality of water also progressively deteriorates.

When continuously on the rise, demand would eventually outstrip supply when all available (local) supply options are exhausted. This would necessitate getting water from "external" sources, needing transfer of water across long distances either through piped systems or through tankers. We have seen this situation in many urban areas of the country, especially with respect to drinking water and now see the same situation gradually unfolding in many rural areas as well. Such water transfers increase almost exponentially, when a region faces drought, such as what large parts of Maharashtra are facing currently. Active social regulation, through community-based, participatory forms of management of groundwater, can ensure that water availability remains within the boundary of available supply clearly according some sustainability of the supply-side interventions like managed aquifer recharge. In other words, with demand

management, a water supply scheme in a village or a town will tend to be operational over a longer period of time. This conceptualization sets the theme for a strong articulation of demand management of groundwater in the current Indian context.

Figure 2
Rising Demand and Freshwater Depletion (Kulkarni and Shah, 2013)

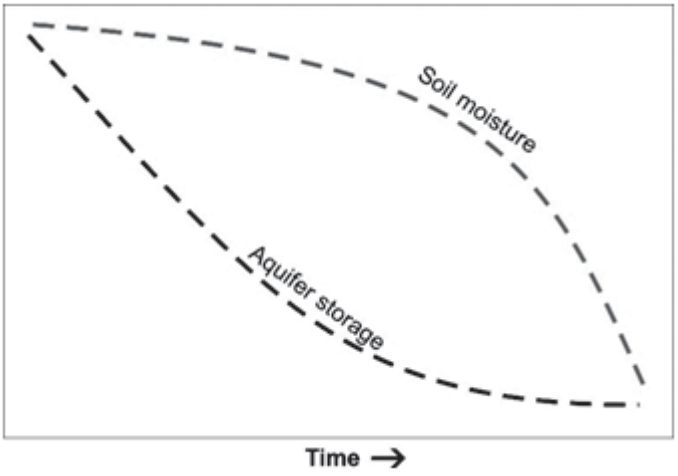


Re-prioritising water use in agriculture

Water level decline, aquifer depletion and groundwater contamination all have a significant bearing on soil-moisture and soil-health. It is increasingly becoming clear that climate change alone is not responsible for soil health, especially depletion in soil moisture. There is reason to believe that as the storage within a shallow, unconfined aquifer depletes, soil-moisture also depletes. It would be interesting to study the precise nature of such depletion, particularly as to how the vadose zone responds to the depletion (and also to the contamination) of a shallow unconfined aquifer. This relationship has great bearing in the context of revitalizing rainfed agriculture in an otherwise significantly groundwater dependent country like India.

The fundamental rationale in prioritising water and soil management in rainfed agriculture is straightforward, given the complex nature of the water crises in India. The uncertainty of productivities in rainfed farming, resulting from a

Figure 3
Aquifer storage depletion and soil moisture deficits could be related in the manner shown below



plethora of problems including a changing climate and aquifer depletion has a significant bearing on productivity of water resources in rainfed farming. Research along these lines, especially in the form of 'action research' will be able to push public investment and farmer-focus on structuring water management practices such as timely management of protective irrigation and the spinoffs in water-use efficiency by way of improved soil fertility (through environmental-friendly mechanisms), appropriate variety of seeds and practices of mixed cropping/ inter-cropping. Moreover, such work on the ground will enable comparisons between productivity criteria such as water extracted per unit energy used or water extracted per unit of rainfed crops versus that for irrigated crops eventually leading to a far more disaggregated debate on prioritizing water within agriculture.

While the substance of work on water management in rainfed agriculture will need to include various dimensions such as hydrology, hydrogeology, socio-economic aspects, engineering and economics, the question today does not remain on whether a region is rainfed or irrigated. Rather, given the hydrological and hydrogeological diversity in India, one must carefully look into three broad scenarios under which the Indian rainfed farmer is located today:

1. Areas or regions where large-scale groundwater overexploitation has occurred, prompting farmers to forego protective irrigation and

maximise returns from the rabi crop, leaving the Kharif virtually to 'fate'

2. Areas or regions where groundwater development is quite limited, but farmers have created some access through private investments on wells – in other words, farmers involved in large-scale protective irrigation as priority and where the larger stake is still in Kharif farming
3. Areas or regions that have no access to irrigation – neither in Kharif nor for Rabi.

These three categories may exist even in a single area, say a watershed or a slightly larger unit of a small river basin. Prioritising water – especially groundwater usage – for providing the necessary buffers during the *kharif cropping season* becomes important in our policy and practice domains, whether under agricultural programmes or under rural development initiatives.

Groundwater and climate change: understanding scenarios

Concepts and experience are the foundations for strategic decision making (Moench and Stapleton, 2007). Adaptations occur, often as much in response to changes in the groundwater conditions as to those happening in the purely social and economic contexts; such adaptations are beginning to emerge into a formal regime, both within the larger "risk" arena of extreme events and climate change but also within a rapidly globalizing context (Moench and Dixit, 2004). Changes in climate conditions are bound to have major, but difficult-to-predict implications for weather and climate at more local levels. Arguably, groundwater systems themselves are more stable than climate and weather systems, but patterns of groundwater use are extremely sensitive to climate and weather as they are to human stressors, mainly changes in demand. Recharge and other flows will be influenced by climate changes (at least in the long term) as a direct consequence of water available for recharge and use but probably more on account of the way groundwater is used under various scenarios that emerge as a consequence of the impacts from climate change.

The availability of groundwater in an aquifer, at any given time, is a function of the natural state of the aquifer, its properties and the impacts of use (pumping, contamination and a complex set of socio-economic conditions that determine how supply and demand match each other). Hence, adopting management strategies for sustainability and equity around groundwater resources requires an understanding of how each groundwater system behaves under various *scenarios*. Each scenario is defined by components of diversity, variability and

the overall impact created by the climate at a certain point in time. In other words, groundwater system behavior with regard to rainfall, infiltration-recharge, aquifer conditions and characteristics along with patterns of use, will define the framework for such scenarios. Strategies of groundwater management can then be modeled out from each such scenario. A unique attempt to understand such scenarios has been made through the example presented below.

Behaviour of two typical aquifer systems (both from hard-rock aquifer settings in central India) were compared under 5 different scenarios:

1. An aquifer with partially developed wells under normal rainfall conditions
2. A fully developed but desaturated groundwater system under normal rainfall conditions
3. A fully developed and nearly desaturated groundwater system under drought conditions (following a normal rainfall year)
4. A fully developed and completely desaturated groundwater system under a normal rainfall year (following a drought)
5. A fully developed and completely desaturated groundwater system under a sub-normal rainfall year (following a drought) or under two consecutive droughts

Table 2 is a conceptual model showing a comparison between the two systems under the five scenarios mentioned above.

Table 2 : Comparison of Water Availability in Two Aquifer Systems under Different Rainfall Scenarios

	AQUIFER SYSTEM "A"			AQUIFER SYSTEM "B"		
SCENARIOS	Rainfall in mm	Water availability in mm	Recharge required to restore aquifer to 'normal post-monsoon' level (as % of rainfall)	Rainfall in mm	Water availability in mm	Recharge required to restore aquifer to 'normal post-monsoon' level (as % of rainfall)
Scenario 1	802	36	4.5	500	64	13
Scenario 2	802	56	7	500	90	18
Scenario 3	400	38	9.5	250	59	23
Scenario 4	802 after a drought year	56	7	500 after a drought year	90	18
Scenario 5	400 after a drought year	28	14	250 after a drought year	45	36

The table shows how, under each of the five scenarios compared for illustrative purposes, water availability and required recharge vary. Similarly, the table also shows the difference in values under a single scenario for the two aquifer systems. Interestingly, Aquifer System B, despite falling under a low rainfall regime, has the capacity to store larger volumes of water than Aquifer System A. This illustration is just a crude manner of explaining the concept of scenarios, a process that holds great potential in groundwater management strategy development.More such examples need to be undertaken by adding dimensions such as actual groundwater use, cropping patterns, soil conditions etc.

Recommendations

India's groundwater situation is complex, being a function of aquifers, groundwater flow patterns, chemical profiles, patterns of use and more lately, the impact of Climate Change. The complex nature and diverse contextual regime of groundwater problems in India compel the development of a strategic approach to groundwater management. The fugitive nature of the (groundwater) resource and the open-access domain in which it is commonly used, pose major challenges in implementation of the principles of Common Pool Resource Management in the practice of groundwater management. In this light, the development of strategies to respond to groundwater over-use and deteriorating groundwater quality require a process-based approach that incorporates the potential impacts of a changing climate on one side and the impacts stemming from a growing demand on a depleting-deteriorating resource on the other. In this light, therefore, a few clear recommendations emerge in evolving a fresh paradigm for managing groundwater resources in India, particularly with regard to groundwater and agriculture. While this list can be made more comprehensive, the following elements are quite important and require discussions, debate and a deep understanding of various issues, aquifers and groundwater characteristics of a region being the most significant.

1. Push for "disaggregation"
   - *Developing 'micro-scale' understanding of aquifers and groundwater usage patterns*
   - *Databases that are more 'local' than 'regional'*
2. Diversity – spatial typology of impacts
   - *Identifying the precise nature of the problem (e.g. type of scarcity, type of salinity etc.) and the seasons in which problems are most severe*

- *Scale of the problem itself – in space and time*
- *Resource characteristics – such as the aquifer properties and groundwater quality*
- *Use and use*r characteristics

3. Variability – temporal changes
   - *Changes in resource*
   - *Supply interventions*
   - *Trends in demand for water*
4. Scenarios: resultant of diversities and variabilities
   - *Geohydrological, land-cover, socio-ecological settings*
   - *Rainfall-recharge-abstraction scenarios*
5. Re-prioritize groundwater use in the following order
   - *Low, but perennial volumes of secure and safe drinking water must be ensured first*
   - *Domestic water*
   - *Water for livestock*
   - *Water for 'protective' irrigation in securing rainfed crop*
   - *Winter crops*
   - *Summer crops*
6. Groundwater governance – through a highly decentralized structure empowering communities to integrate science and participation in their decisions.
7. A robust framework of legislation that moves away from 'command and control' and encourages the management of groundwater as a common pool resource.

References

COMMAN. 2005. Managing groundwater resources in rural India: the community and beyond. *British Geological Survey Commissioned Report CR/05/354.*

Central Ground Water Board (2006): Dynamic Ground Water Resources of India (as on March, 2004), CGWB, Ministry of Water Resources Publ.

Central Ground Water Board (2011): Dynamic Ground Water Resources of India (as on March, 2009).CGWB, Ministry of Water Resources Publ.

Central Ground Water Board (2014): Dynamic Ground Water Resources of India (as on March, 2011).CGWB, Ministry of Water Resources Publ.

Kulkarni, H. (2005) Groundwater overdraft: a physical perspective. *In: COMMAN 2005. Community Management of Groundwater Resources in Rural India – Research Report, R. Calow and D. Macdonald (eds), British geological Survey Commissioned Report CR/05/36N., pp. 1-13.*

Kulkarni, H., Badarayani, U., Dhawan, H., Upasani, D. and Gupta, R. (2009i) Groundwater management in India: from typology to protocols and community-driven pilots.*In: Kulkarni, H., Badarayani, U. and Upasani, D. (eds) "Groundwater management – typology of challenges, opportunities and approaches." Arghyam-ACWADAM publ. ACWA H-09-2, pp. 18-34.*

Kulkarni, H., P.S. Vijay Shankar and S. Krishnan (2009ii): *Synopsis of Groundwater Resources in India: Status, Challenges and a New Framework for Responses*, Report submitted to the Planning Commission, Government of India, for the Mid-Term Appraisal of the 11th Plan (ACWA Report ACWA/PC/Rep-1).

Kulkarni, H. and Vijay Shankar, P. S. 2010. Sustainable Groundwater Management: Challenges for the 21st Century. *International Conference on Dynamics of Rural Transformation in Emerging Economies, New Delhi, April 2010.*

Kulkarni, H. and Shah M. 2013. Punjab water syndrome: diagnostics and prescriptions. Review of Rural Affairs, Economic and Political Weekly, XLVIII (52), December 28, 2013, 64-73.

Kulkarni, H., Vijay Shankar, P. S. and Patil, S. 2015 (*in press*). The relevance of groundwater typology in India's rural development.*India Rural Development Report, IDFC, in press.*

Lopez-Gunn, E., Zorrilla, P. and Llamas, M.R. (2011) "The impossible dream? The Upper Guadiana system: aligning changes in ecological systems with changes in social systems" On the Water Front, vol. 2, pp. 115-126.

Moench, M. & Dixit, A., (eds.) 2004.*Adaptive capacity and livelihood resilience: adaptive strategies for responding to floods and droughts in South Asia*. Kathmandu, and Boulder, USA, ISET.214 pp.

Moench, M. and Stapleton, S. 2007.Water, climate, risk and adaptation.*Working Paper 2007-01.Co-operative Programme on Water and Climate.*80p.

Narain, S. (2012): Excreta matters – volume 1: State of India's Environment – A Citizen's Report 7. Centre for Science and Environment, New Delhi, 286p.

Planning Commission, Government of India. 2007. Report of the Expert Group on Groundwater Management and Ownership. *Planning Commission, New Delhi. 61p.*

Shah, M., Banerjee, D., Vijay Shankar, P. S. and Ambasta, P. 1998. India's drylands: tribal societies and development through environmental regeneration. *Oxford University Press, New Delhi, 322 p.*

Shah, T. 2009.Taming the Anarchy: Groundwater Governance in South Asia.*Resources for the Future, Washington DC and International Water Management Institute, Colombo, 310p.*

* * *

Silt Utilization In Restoration of Traditional Tanks

R. V. Rama Mohan[1]

Dr. Sanghi, a person with deep interest in participatory water management and water institutions, was all ears whenever I approached him for professional help. He used to probe me with a valley of simple questions that finally took the conversation to philosophical heights. A thorough approach in interpreting data, blended with a very friendly nature always left us elated at the end of discussions that we had. He was a great source of inspiration and had positive thoughts for me in times of difficulties in taking forward water initiatives at CWS.

Introduction

Telangana and Andhra Pradesh, in particular, and Southern India in general, are dotted with thousands of Minor Irrigation (MI) tanks, which are locally called

1. *Director and Team Leader, (SuGWMP), CWS, 12-13-451, Street No. 1, Tarnaka, Secunderabad - 500 017, Contact: +91 (040) 27007906, Email: projectsugwm@gmail.com, Website: http://www.cwsy.org/html/sugwm.html*

Cheruvulu. Most of these tanks were constructed by local rulers several centuries ago and occupy a central role in the life and livelihoods of rural areas. These tanks not only provided water for irrigation, but also met other water needs of people and animals. Even today, every village in these two Telugu states has one or more tanks and/ or ponds serving people in multiple ways.

Traditional tanks were built by creating an earthen bund across water flow paths resulting in the capture and storage of rain water. These structures had a primitive type of sluice and surplus flow mechanisms, to which improvements were done in later years by constructing concrete/ *pucca* structures. Tanks having less than 40 ha command area are classified as smaller ones (known as *Panchayat Raj* tanks) and those having more than 40 ha are treated as bigger ones (managed by the Minor Irrigation Department).

Altogether, there are about 80,000 tanks (around 10,000 being tanks with more than 40 ha of command area) in the two states of Telangana and Andhra Pradesh, roughly in equal number in each. Over the years, most of these tanks faced gross neglect, nature's fury and silted up in absence of regular maintenance. Thus, the last few decades saw a declining trend in the area irrigated by tanks and, instead, in significant increase in irrigation from private wells in both the States. Further, traditional form of community-based management of these structures has become a matter of past, barring a few traditional structures such as *Gonchi* systems (Rama Mohan, 2013). The reasons for this have been several: neglect in regular maintenance, emergence of permanent structures on tank bed and peripheral lands, illegal encroachments and pollution due to domestic waste and industrial sewage. All these rendered many tanks dysfunctional not only in these two states but all over India. On the other hand, many irrigation tanks get damaged or breached during every rainy season, particularly due to intense rainfall events and higher peak discharges at tank weirs. Restoration works are done routinely on such tanks, but not much effort was made so far to examine the discharge capacities of tanks and to take corrective steps. As per the data quoted by Pingle (2011), the decline of the irrigated area in the erstwhile Andhra Pradesh under tanks was 5,58,330 ha (from 11,79,987 ha to 6,21,657 ha) between 1956 and 2009, a whopping 47 %. Telangana alone lost about 3,12,441 ha of irrigation potential during this period.

In the light of the importance of these tanks in securing drinking water as well as irrigation for the people, SuGWM project[2] worked on restoration of selected

2 *Sustainable Ground Water Management (SuGWM) Project is an innovative initiative of Centre for World Solidarity, that focused on recharging, augmenting and efficient use of ground water with active participation of local population and Gram Panchayats. The project is supported by EU and BfdW. More details of the project are available at www.cwsy.org/ sugwm*

tanks in its operational villages in Warangal and Anantapur districts in Telangana and Andhra Pradesh respectively. With relatively small financial support and careful facilitation, the project could successfully organize tank de-siltation and restoration works leading to increased tank capacities and soil fertility in the farmers' agricultural lands. Wholesome participation of farmers and the catalytic role of Gram Panchayats (GPs) are the hallmarks of this process. Voluntary transport of silt by farmers using local means of transport resulted in bringing in cash contribution by farmers equal to that of the project.

Some initiatives of tank restoration in India

In India, tanks, ponds and lakes have traditionally played an important role in irrigation, drinking water supply, ecology, fish culture and domestic use. The importance of some of these water bodies has waned due to a number of reasons such as shifting away from the community based tank system to an individual beneficiary oriented groundwater dependent system, encroachments, silting, population pressure, multiplicity of agencies responsible for their upkeep etc.

Tank repair and maintenance was an integral part of collective community management systems that existed in India for centuries. Rulers before the independence encouraged voluntary and collective participation in tank de-siltation and maintenance works. They offered land in the command area if any one constructs new tanks or maintains existing ones. After the beginning of British rule in India, enumeration and restoration of many minor irrigation sources (including tanks) were done but with an eye on augmenting tax revenues. Post-independence, India's Five Year Plans gave deserving importance to restoration of these ingenious tanks and invested in their maintenance. In 1950-51, tanks in India were irrigating 3.46 million ha against the total irrigated area of 20.3 million ha. First to Sixth Five Year Plans had an emphasis on smaller surface water irrigation sources. But, a significant shift towards encouraging the use of groundwater for expanding the area under minor irrigation started from VIIth Five Year Plan (1985-90).

Recognizing the need for restoring the traditional minor irrigation sources, a pilot scheme for Repair, Renovation and Restoration of water bodies was initiated by Government of India during 2005 (middle of Xth Five Year Plan), limited to 26 districts in 15 States. Later years saw the expansion of the scheme to the entire country with provision of State and Central share of funds. States like Odisha, Karnataka, Tamil Nadu and erstwhile Andhra Pradesh, were encouraged

to access external assistance under this program. NABARD played a catalyst role by extending loan assistance to States in various forms and schemes towards construction and revival of water bodies for many years.

There are some notable experiences of irrigation tank restoration with participatory approach, particularly from south India. Many local Non-Governmental Organizations (NGOs), bilateral funding and international donor agencies invested in them and enriched the practice of Participatory Irrigation Management (PIM)[3]. Each of them was unique in their approach and offered many lessons to mainstream Government schemes. Palmyra[4], with assistance from Indo-Canadian Environmental Facility (ICEF), rehabilitated around 200 linked-tank system in a watershed in Villupuram District of Tamil Nadu. Dhan Foundation organized tank users as associations and federated them at the level of chain-of-tanks in south Indian states for resolving inter-village conflicts and sustaining the tank systems in future. Council for Advancement of People's Action and Rural Technology (CAPART), a society under the Ministry of Rural Development in India, facilitated the revival of small water bodies in remote corners of the country through grass-roots voluntary agencies. Water storage tanks built during the period of Chandela Kings and Kalchuri dynasty in Madhya Pradesh about 1000 years ago are still in use for irrigation. Efforts to revive and improve them by Government and many NGOs reported to be yielding results, particularly helping ground water dependent irrigation in the State. *Indiramma cheruvulu*, a program for restoring and de-silting tanks in erstwhile Andhra Pradesh, was implemented during 2007-2010. The scheme was launched during Jan 2007 by the Govt. in Andhra Pradesh using the NREGS funds, which was then a new opportunity for States to revive rural infrastructure, for tank repair and stabilization of existing *ayacut*. Most of de-siltation in MGNREGS was used to strengthen the bunds, but silt was not transported. Initially, transport using tractors was supported by the scheme but this did not take off. While demand for silt from farmers was always there, major obstacle could be collectivizing hundreds of farmers to come forward at one time, without which the silt removal would not continue.

With major focus on silt removal and utilization to improve soil fertility, Balavikasa's work stands out. Balavikasa, an NGO based in Warangal, Telangana,

3. *PIM refers to the concept of enhancing the farmers' participation in irrigation management. Several states in India adopted the concept by enacting Acts from late 1990s.*
4. *Palmyra is a centre of Auroville with focus on ecological land use and rural development. More information is available at http://www.auroville.org/conten ts/799*

has so far helped farmers to restore 675 tanks in Telangana as well as Rayalaseema regions of undivided Andhra Pradesh (The Hindu, 2015). *Jala Vikasa Padhakam* of Balavikasa encourages farmers to come together and carry silt on their own for application in the agricultural lands. The organization provides partial support to such work, such as for removing silt using appropriate machines from tank bed. Over the last 20 years, many a village in Telangana and Andhra Pradesh states witnessed farmers' collective action in reviving age old tanks. Lodi Multipurpose Social Service Society (LMSSS) is another reputed NGO in Warangal that did commendable work on tank desiltation and utilization.

Mission Kakatiya, with a tag line '*Mana Ooru – Mana Cheruvu*', is a recently launched program of the Government of Telangana. This program aims to renovate around 46,000 irrigation tanks in Telangana state over a period of 5 years from 2014-15. With around Rs. 22,000 crores estimated budget, the Government is pooling resources from own funds, Central Government, NABARD and other financing agencies. While restoring tanks to their functional capacity, emphasis is also placed on de-silting and utilizing the silt for improving soil fertility in agricultural lands. Farmers are being motivated to come forward and voluntarily participate in transporting the silt to their lands. Though the program was formally launched on 12th March 2015, a series of media stories and press coverages for few months point to shifting focus of the program away from silt transport and utilization by farmers. By end of May 2015, work on around 6000 tanks was launched.

Thus, a lot of experience on tank revival exists in India, but most of it removed silt to the extent required for strengthening the tank bund and invested more on physical structures (sluice, surplus weirs etc.) and distribution channels. Also, considerable focus was on involving Water Users' Associations (WUAs) in the planning and implementation of these works. The present author's search for initiatives that emphasized on substantial silt utilization did not yield much result. Projects that had considered silt as a source of plant nutrients and as a valuable resource are probably very few, unless a comprehensive search reveals more.

Tank restoration in SuGWM Project

Sustainable Ground Water Management (SuGWM) project[5] is one of the flagship initiatives of the Centre for World Solidarity (CWS), an NGO based in Hyderabad,

5. *SuGWM project website at www.cwsy.org/sugwm provides work done by the project and results achieved. Apart from its focus on strengthening Panchayat Raj institutions at grass-roots on water governance, the project demonstrated innovative techniques of water recharge and efficient use*

Telangana. CWS has been testing the relevance of participatory groundwater management and social regulations in the allocation and use of water for about a decade. SuGWM project is one such recent intervention wherein integrated management of groundwater for water supply, sanitation as well as irrigation is demonstrated with the participation of institutions of local governance in six GPs in Telangana and Andhra Pradesh. The project started in July 2011 with a time-frame of five years. The project is being supported by the European Union (EU) and Bread for the World (BfdW) and implemented by CWS, along with its local partners RIDS and Jana Jaagriti in Andhra Pradesh and CROPS in Telangana states.

During the baseline surveys and studies done on the status of drinking water supply systems in project GPs, it was found that most of these villages have fairly good water supply infrastructure (such as over-head storage tanks, pipe distribution network, public stand posts, household connections) but much of it in poor functional condition. Also, the borewells which are sources of water for these systems are not yielding well and many of them dry up during non-rainy periods. Realizing the need for 'water source protection and sustainability', SuGWM project focused on augmenting these water sources through methods such as tank restoration and innovative borewell recharge[6]. Particularly, existing tanks and ponds were selected by studying their potential to recharge drinking water sources and restoration works were taken up.

While carrying out tank restoration, the emphasis was on creating demand among farmers for silt application in agricultural lands and de-silting the tanks as much as possible to meet the generated demand for silt. Part of the soil was used to strengthen bunds of these tanks but sluice and surplus weirs were not tampered with. Table 1 below compiles the details of tanks and the work done. Soil quality as well as the amount of silt accumulated was taken into consideration in selecting the tank for de-silting. Availability of tractors locally and distance from the tank to agricultural lands are also important parameters. But, the most important one is whether around 100 to 150 farmers are willing to carry silt to their farm lands by paying the transportation costs themselves.

By May 2015, the project restored 12 tanks (7 tanks with substantial silt utilization component) and facilitated utilization of 49,970 cu.m of silt by farmers. This

6. *This technique involves using dry borewells for recharging rain water. Information hand-outs and construction methodology is available at http://cwsy.org/html/publications.html*

experience generated during 2011-2015 taught that for any silt removal and utilization program to succeed, organizing farmers into a group and working out the processes of cash contributions, transportation and application are essential. Unless these processes are taken care, the program cannot be implemented within the limited summer months. The collective work of farmers is the hallmark of success and GP representatives as well as village elders play crucial role in bringing farmers together.

Table 1 : Details of Tanks and Work done

District & State	Mandal	GP & Village	Tank	Silt removed (cub. m)	Farmers / Area benefited (no. / acres)
Anantapur, Andhra Pradesh	Nallamada	Masakavankapalli	Kothachennapalli Kunta	4,750	38 (76)
			Eguvabai Kunta	6,750	54 (108)
	Gandlapenta	Maddivarigondi	Kotha Kunta	5,700	38 (76)
			Lingalavari Kunta	2,250	15 (30)
			Ayyavari Kunta	1950	13 (26)
Warangal, Telangana	Lingala Ghanpur	Vanaparthy	Pedda Cheruvu	23,440	313 (378)
		Waddicharla	Thalla Cheruvu	5,130	108 (151)
Total				**49,970**	**579 (845)**

No. of tanks	Silt removed (cub. m)	Costs of silt application (INR)		Total cost per cub. m of silt (INR)	Farmers' contribution in transport of silt (INR)
		Cost of silt removal*	Cost of transport**		
7	49,970	1404280	33,07,805	94.30	26,48,805

* *Cost of silt removal using earth moving machines was supported by the project and in Vanaparthy, by Balavikasa and Lodi Multipurpose Social Service Society (LMSSS)*

** *Cost of transport was entirely borne by farmers in Anantapur district, whereas small support of Rs. 65 per tractor load (average) was provided by the project in Warangal district.*

During April 2012, in Vanaparthy village of Warangal district, farmers negotiated with tractor owners to pay the transportation charges in two slabs, viz., Rs. 100 for a distance within 1 km and Rs.150 for distance more than 1 km from the tank location. On average 20 tractor loads were transported to apply in one acre of land by each farmer. Farmers were identified and grouped by their distance from the tank and accordingly contribution of about 60% of the cost was met by farmers and SuGWM project contributed remaining 40% of the transport of silt.

In March 2015, farmers in Vanaparthy again initiated silt removal and transport from Pedda Cheruvu. This time, Lodi Multipurpose Social Service Society (LMSSS) in Warangal, came forward to support silt removal from the tank bed. Farmers removed 10,940 cu. m (5470 tractor loads) of silt and met most of the transport cost. A total of 113 farmers applied silt in 219 acres of agriculture land. Farmers decided to have three different rates for transport of silt - Rs. 100, Rs. 150 and Rs. 180 - per tractor load, depending on the distance of the tank to the agriculture lands. SuGWM project encouraged farmers by giving a small support of Rs. 30 per each tractor load of silt transported.

Silt removal and transport in Vanaparthy during March 2015

In Masakavankapalli village of Anantapur district, farmers discussed with tractor owners from their own and neighbouring villages to agree on Rs. 125 as the average rate per tractor load for any agricultural land in the village. Enrolled farmers paid this amount in full for 50 loads (for two acres of land) each after the delivery of silt by tractors. SuGWM project met entire cost of removing the silt from tank bed.

Silt removal in Eguvabai Kunta during April 2013

Thus, silt removal from tanks and application in agricultural lands needs to be done in an organized fashion by synchronizing different sub-processes by different stakeholders. For example, uninterrupted removal of silt by a machine from tank bed is only possible when there are sufficient tractors available to carry the silt and also there are farmers already enrolled for applying the silt to their lands. Based on the ground experience in SuGWM project, these processes may be organized into the following four major steps:

a) Preparatory phase - demand enumeration from farmers
b) Finalizing the demand for silt from farmers
c) Engaging stakeholders for uninterrupted transport and silt application
d) Aggregating silt transported and organizing payments

A brief account of each of these process steps are explained in Rama Mohan (2015) with insights into specific details and micro-level processes.

Tank breaches and need for caution

Tank breach incidents are reported every year during floods and heavy rains. They are reported in the local newspapers as isolated incidents and dwell mostly on the loss that occurrs due to the breach, but not on what caused such a breach. Going by the history, there is no evidence of engineers/ departments/ research institutions making an effort to aggregate these damages temporally and to see the emerging patterns.

Breaches in the bund, feeder channels, surplus weirs occur rather repeatedly in many tanks. Data available for the period 1998-2009 speaks volumes about repeated breach of tanks and the need for corrective measures in terms of

ensuring proper side slopes of tank bund, increasing Maximum Flood Discharge (MFD) of surplus weirs, etc. Climate change, which is perceived in longer dry periods with increased intensities of rainfall, is resulting in higher peak discharges. Tank breaches, particularly repeated breach of the same tank, could be due to discharges higher than the design capacity at the site of the tank. Attempts to renovate and restore tanks without taking steps to address this problem are not sustainable. A brief study on tank breaches and causes initiated by the author in 2009 made two important observations:

(1) Occurrence of tank breaches is geographically extensive and repeated investments on tank repairs over years is huge
(2) Reasons for tank breaches are beyond the normally inferred cause of poor quality of construction and maintenance

The causative factors for tank breaches are varied in nature, such as, hydrological, technical, administrative and institutional aspects. In the absence of a well-defined and pro-active strategy for avoiding tank breaches, so far the departments are only responding to the post-breach situation. The hydrological significance of damages and breaches, particularly of the same tank several times within a few years, can have new insights to be explored. Pursuing this problem primarily from the hydrological perspective, the author collected data (using the RTI Act) related to all tank breach incidents in most of the districts in undivided Andhra Pradesh for the period 1998-2009[7].

After segregating the data for the present Telangana and Andhra Pradesh States, Table 2 presents the over-all tank damage/ breach events and total amount of funds spent by each of 27 irrigation divisions/ circles in 15 districts on renovating them during 1998-2008:

Table 2: Tank damages and funds spent on repairs

Sl.	District	Irrigation Division / Circle	Total breach events	Total funds spent (INR Lakhs)
1	Ranga reddy	IB Div., Hyderabad	109	108.69
2	Mahabubnagar	IB Div., Mahabubnagar	329	682.58
		IB Div., Nagarkurnool	123	64.45
3	Nalgonda	IB Div., Nalgonda	283	830.00
4	Nizamabad	IB Div., Nizamabad	174	477.00
5	Karimnagar	Irrigation Div., Jagtial	213	421.60

7. *RTI request dated 19.06.2009 to PIO, O/o CE (MI), I & CAD Dept., Andhra Pradesh. The data is for the period 1998-2009, for many of the Irrigation Divisions in 15 Districts in undivided Andhra Pradesh.*

... contd

6	Adilabad	IB div., Nirmal	166	339.55
		Irrigation Div., Peddapally	24	198.57
7	Warangal	Irrigation Div., Mulugu	548	283.42
8	Khammam	Irrigation Div., Palvancha	74	194.62
		Irrigation Div., Bhadrachalam	160	422.14
		Irrigation Div., Khammam	93	308.06
Sub-total : Telangana			**2,296**	**4,330.68**
9	E.Godavari	YI Div., Peddapuram	187	222.84
		Special MI Div., RC Varam	32	94.50
		Godavari Central Div., Dowlaiswaram	91	303.19
10	Krishna	Special Irrigation Div., Vijayawada	475	791.40
11	W.Godavari	Irrigation Div., Eluru	106	218.41
		Special MI div., KR Puram	59	266.87
12	Prakasam	Irrigation Div., Ongole	294	158.84
		Special Div., Markapur	317	780.73
13	Kadapa	Irrigation Circle, Kadapa	315	960.83
14	Chittoor	Irrigation Div., Chittoor	18	85.29
		Irrigation Div., Madanapalli	184	748.88
		Irrigation Div., Palamaner	141	186.68
		Irrigation Div., Srikalahasti	486	1801.29
		Irrigation Div., Tirupati	148	474.42
15	Anantapur	Irrigation Circle, Anantapur	172	761.30
Sub-total AP			**3,025**	**7,855.45**
	TOTAL		**5,321**	**12,186.13**

Data from one irrigation Division/ Circle of Mahabubnagar and Nalgonda in Telangana State and Chittoor and Kadapa from Andhra Pradesh are analyzed for deeper insights. Classifying the flood damages of tanks under three broad heads, viz., damage of tank bund or its structures, breach of bund and seepage/ piping formation on the bund, number of such damages/ breaches are tabulated in Table 3. Also, from hundreds of tank damage and repair incidents every year, tanks that got repeatedly damaged/ breached across these 11 years were separated and presented.

It was found that, number of tanks got damaged and the number of such repair events were generally more during years of normal or surplus rainfall. But, there

were also years with rainfall less-than-normal, when many tank damages had occurred nevertheless. *It seems that, it is the intensity of individual rainfall events, but not the total rainfall in a year that really matters.* Since the rainfall data is at the district level, there could be local variations which render such comparison less accurate. Further analysis of rainfall intensity data from automatic rain gauges in the vicinity of selected tanks may offer more insights into this aspect.

Most of the repairs cost relatively less (from Rs. 30,000 to Rs. 100,000) but cumulative costs were significant due to several breach incidents in a year. Even

Total no. of			Tanks with repeated breach history during 1998-2009
Damages	Breaches	Seepage	
Mahabubnagar Div.			
53	113	12	• Peddacheruvu, Khanapur (V), Makthal (M) • Ooracheruvu, Pothireddypalli (V), Thimmajipet (M) • Bheemreddycheruvu, Kollur (V), Utkur (M) • Indrasagar, Ujjali (V), Manganoor (M) • Peddacheruvu, Chowdhur (V), Nawabpet (M) • Thylam cheruvu, Bawajipally (V), Thiimmajipet (M)
Nalgonda Div.			
175	69	39	• Gachigiri tank, Dugnelly (V), Kattangur (M) • Pedda cheruvu, Pasnoor (V), Nampally (M) • Pedda cheruvu, Veliminedu (V), Chityal (M) • Pedda cheruvu, T.Yellemla (V), Chityal (M) • Mysamma cheruvu, T.Penpahad (V), Athmakur-S (M)
Madanapalli Div.			
102	45	36	• Venkatamma Cheruvu, Cheekalabayalu (V), Madanapalli (M) • Kadiraya Cheruvu, Kadiraya Cheruvu (V), Kalakada (M) • Vyasasamudram, Kandukur (V), PTM (M) • Pedda Cheruvu, Kannemadugu (V), Thamballapalli (M) • Ramaswamy Cheruvu, Vittalam (V), Valmikipuram (M)
Kadapa Circle			
248	67	0	• Pedda Orampadu tank, Pedda Orampadu (V), Obulavaripalli (M) • Korlakunta tank, Korlakunta (V), Obulavaripalli (M) • Bommavaram tank, Bommavaram (V), Obulavaripalli (M) • Bethayapalli tank, Bethayapalli (V), Gopavaram (M) • Chennavaram tank, Chennavaram (V), Gopavaram (M) • Brahmanapalli tank, Brahmanapalli (V), Gopavaram (M) • Madapur big tank, Madapur (V), Atloor (M)

V – Village, M - Mandal

after permanent restoration works were done, there were instances of breach and damages to the same tank during subsequent years. On many occasions, damage to surplus weirs and occasional washing away of the weir were reported. Also, a considerable amount of money was spent on repairing repeated breaches on the tanks listed in Table 3.

In some cases, minor works as temporary repairs in a year, were followed by long delays in carrying out permanent repairs. There appears to be further damages during this gap period. On an average, Rs. 5-10 crores of expenditure was incurred on repairs and restoration of damages to tanks during the 11 year period in each irrigation division in the study districts. Maintaining proper side slopes of earthen bund and providing sufficient discharge capacity at surplus weir are two important measures that could avoid most of the tank breaches. But, there is no evidence from the data available for any investments made for the same.

Any investment in improving the tank system including feeder channels and de-silting the tank bed should be made, after examining changes in hydrological conditions of catchments and comparing discharge capacity of surplus weirs. Therefore, it is important to examine the tanks taken up for restoration and de-silting for their 'hydrological fitness' by simulation studies and, if required, increasing the discharge capacity of sluices needs to be included as an important component in the package of tank restoration.

Observations and Recommendations

A large number of smaller tanks in Telangana and Andhra Pradesh got silted up in the absence of regular maintenance. The removal of a substantial part of the silt accumulated must be made an essential part of tank restoration program, without which the benefits are going to be superficial. There are a number of experiences in tank restoration in India and several agencies, Government Departments and NGOs involved in such programs could organize and collectivize tank-dependent communities for operation, maintenance and future sustainability. But, there were very few that emphasized on silt removal and utilization by the collective strength of farmers.

Silt removal and utilization on a significant scale needs organizing farmers and installing few processes and systems beforehand. At least 100 farmers coming together for carrying around 2000 to 3000 tractor loads of silt are optimal for deriving best results. It is important to motivate and collectivize farmers to

'spearhead' the silt removal and utilization program on a contributory basis. Farmers, in general, are willing to carry silt to their farms as it helps them through increased soil fertility and net higher incomes from crops. Tank silt utilization on wider scale requires institutionalizing such 'participatory processes' as well, for enthusiastic participation by farmers, transparency and sustainable benefits.

Information about a tank's bed area, boundaries and the discharge capacity of its surplus weirs, etc., are not easily available to the general public. Publication of a directory of tanks with information about survey numbers, bed area, full-tank level (FTL), peak discharge capacities, breach history and tank bed *patta* holdings, if any, may be made for each district. This will be useful for rural people, GPs and urban colony associations to be more vigilant about the encroachment of tanks in their respective areas. Assessment of quality of silt for primary and micro nutrients and any problems of salinity/ alkalinity must be done before organizing a silt utilization program. This information could be made part of the tank directories suggested above.

The temporary *pattas* given on tank bed and ridge areas, permitting farmers to cultivate land when there is no water may be stopped, and such farmers may be provided land elsewhere permanently. This will smoothen tank restoration, particularly in restoring the design storage and discharge capacity of tanks.

Since most of the ground water sources, including drinking water source borewells get rejuvenated due to tank restoration and de-siltation programs, it is essential to consciously choose tanks that are on the upstream-side of such sources and where there is more direct recharge potential.

Tank breaches and damages are very common and widespread in every rainy season. Though investment on each repair is small, they aggregate to significant amounts at an irrigation division or a circle level. History of tank damages and breaches may be studied before selecting a tank for restoration. Tanks having repeated breach history shall be carefully subjected to hydrological simulation tests and necessary steps of increasing the discharge capacities or bund strengthening (with design side-slopes) are to be taken up.

SuGWM project experimented and introduced certain simple but effective practices for ensuring farmers' participation in silt utilization from tanks. In fact, it is SuGWM project which participated by contributing in a small way, but farmers initiated and led the process. Some of these processes might not be done with the best possible accuracy on the ground, as it should have been. There is further scope to refine these methods and processes to suit local

conditions and for more efficiency in using resources. Silt that accumulates is a resource that may be categorized as a common property resource. Gram Panchayats, as custodians of natural resources in their areas, may derive a small income by collecting 'silt charges' from the transporters of silt. This is an idea yet to be tried in SuGWM project.

References

Pingle, Gautam (2011): "Irrigation in Telangana: The Rise and Fall of Tanks", Economic and Political Weekly Supplement, Vol. XLVI, No. 26 & 27, pp. 123-130.

Rama Mohan R.V. (2013), *Re-using irrigation Drainage: Gonchi Irrigation System in Penna River Basin* (Hyderabad: Centre for World Solidarity) (available at http://cwsy.org/html/small_gonchi_irrigation_system.pdf)

Rama Mohan R.V. (2015), *Silt utilization in Restoration of Traditional Tanks* (Hyderabad: Centre for World Solidarity) (available at http://www.cwsy.org/html/images/silt-utilization-in-tank-renovation-process-brief-compressed.pdf)

The Hindu (2015): "Villagers do their bit for reviving tanks", News article accessed from http://www.thehindu.com/todays-paper/tp-national/tp-telangana/villagers-do-their-bit-for-reviving-tanks/article6935343.ece

A Journey in Developing Rainfed Areas

K. S. Gopal[1]

Many of us work on ecology, livelihoods and development of the poor and farming systems in low rainfall drought prone areas. Dr. Sanghi was unique to inspire, assist and to relate with everyone. He guided me to my potential and to succeed. He endeared everyone and in the organizations he worked for and for all his fellow travellers has left a big void. Dr. Sanghi was 'one amongst us' – a person providing feeling, thought and impression.

1980

I first met Dr. Sanghi on a hot summer afternoon in 1981 on a farm land in a village in the dry, impoverished and "where no development or extension worker would venture to step in" - Narayankhed Taluk in Medak district

1. *Director, Center for Environment Concerns (CEC), 3-4-526/40, Narayanaguda, Hyderabad - 500 027, Email: cecgopal@yahoo.com, Website: cechyd.org*

of Telangana. He was discussing and persuading farmers on implementing soil and moisture conservation activities under an Indo-Australian project. It was my first learning on "empathy, participatory learning and development of knowhow". Our institutional mandate was to tap and provide groundwater based irrigation to small farmers to grow sugarcane crop and sell to nearby factory, a smart, simple, quick and linear route to alleviate poverty: tap groundwater (natural resource), tap bank credit and government subsidies (economic resources) and modern farm inputs (technological resources) and use human resources to serve assured high value markets.

The groundwater survey showed only select lands as having groundwater potential. Upon the survey a few more were dropped. Exclusion had found its way: benefit a few farmers even while our aim was to show pathways to banish poverty but this was seen as a price to pay, benefit a small segment by growing, by producing a commodity in short supply for good income to some farmers for cascading impact on the local economy to offer new livelihood opportunities to more poor people. After completing a laborious paper work we began digging wells and borewells. This was relatively easy with mobilized project money, government subsidy and bank loan.

The next task was to energize the wells. One had to pay huge bribes and I had to personally follow up each case with the electricity department as their engineers would not entertain poor farmers who mostly belonged to scheduled caste and scheduled tribe communities. So we bribed and gave up on another principle but found it inevitable, as electricity was crucial and there was no other way. Next a dilemma followed: maximum distance for electric connection was less than 300 meters from existing electric pole. But to maintain groundwater levels, hydrology requires longer distance between two wells. So some farms had to use diesel engines. While electricity was highly subsidized, in comparison diesel was prohibitively expensive.

By the time irrigation became operational, the water table went down, because in the meanwhile other farmers had dug wells, got electricity connection and were pumping out the water. Our open wells needed deepening. Everyone threw their hands up, project money for the beneficiary was fully expended, banks had given the sanctioned loan and government subsidy is no longer available to an existing beneficiary. The farmer and project somehow managed to deepen the open wells albeit to a little extent.

Ground reality unfolded. Water was insufficient and sugarcane required large quantities of water. Sowing was delayed as the farmers had no bullocks and first had to raise money from private sources and then find rented bullocks to plough the field. Soils were poor but farmer had no farmyard manure. Crop loans mobilized from the banks were used to weed and harvest the cane crop.The crop yield was half of what we predicted and when compared to other farmers. Compared to our income projections, sugarcane sale proceeds did not cover even the running costs. In fact there was an opportunity cost loss, as the farmer family had to spend their time in the farm and lost on wage employment. The farmers defaulted on bank loans. Banks stopped giving crop loans. This meant further misery. Banks demanded repayment of the capital, crop loan and the mounting interest costs. With the farmers having worked hard to develop the land, it could be sold easily to urban buyers to repay the debt.

1984

Following withdrawal of tax concessions to companies for rural development by the Indian government, a group of reputed and well intended people got together to continue the work. We formed a non-government organization. It had an ambition to demonstrate new models of development, farming practices and poverty alleviation for wider adoption in the Deccan region, as the area had many common features and heritage. We began to work in few villages implementing government schemes of Integrated Rural Development and Housing. By this time we could gain the trust of the poor people.

A group of women from one village sought our assistance to collectivize to harness their small save monies for us to keep, not disclose to their men and give it when they needed. Being administrative support, we agreed. Within weeks more villages sought our services. We expanded the facility to forty villages and refused the others. The formation, discipline and what some people saw as "vibrancy" in the women groups caught donor attention seeking the empowerment of women and they began to liberally provide financial support.

Interactions with the women led to our knowing of *aada panta* (women preferred crops) and they were rainfed food crops. We liked the idea of improving their crop yields as these crops were grown extensively in the area under rainfed conditions and most households had land following the Telangana peasant armed struggle against feudal oppression leading to the government implementing land reforms and distributing surplus lands to the landless. This

took me back to Dr. Sanghi for his ideas. He advised soil health, moisture retention, cropping pattern synergy and crop rotation, use of indigenous inputs and improved crop cultivation practices. Conceptually it sounded a "must do" but not a "can do" as it was complex, required long drawn measures and considerable resources. We sought quick, fit into logical framework and hopefully demonstrate impressive results.

We chose to develop fallow lands to bring more land under crop cultivation, using small and specific investments for land leveling, seed purchase and weeding. For timely plough and seed sowing, the traditional practice was of sharecropping while harvests involved workers getting a share of the produce. Alongside we helped some women groups to lease good quality double crop potential lands with the first crop for food and the next for cash.

The above "'push" strategy for production was accompanied with "pull" strategy of purchase and sale of grain at subsidized prices and with credit facility. Despite all efforts procurement was low while the stored grains had few takers. While to us storing sorghum for long periods was very difficult, to the women they said that they had to walk long distances and had to wait for hours to grind the grain, and this must be done every week as the shelf life of the grain was very short. We then had global experts including Bill Mollison of permaculture fame and Masanobu Fukuoka of "One Straw Revolution" to stay and help us with holistic and organic agriculture. Rather than "look back" we "looked ahead". But thanks to my more energetic new enthusiasts in the organization, I got an exit route.

Fast Forward

A decade later and under aegis of a collaborative cotton pest plant protection technology project involving a central government research institute, a multi-national insecticide agri-business, the non-pesticide activists of WASSAN with Centre for Environment Concerns as facilitating agency. Dr. Sanghi represented WASSAN. Here again he assisted every member to pursue in the shared goal. He tried convincing us on the need for a whole area being chemical free and practicing organic methods to manage pests. While scientists and business wanted products that worked and could be sold to individual farmers, his focus was now on working with communities in pest control rather than provide solutions to individual farmers.

Discussions in the collaboration were intensive. Dr. Sanghi would politely persuade everyone on learning from farmers and their holistic understanding and approach to crop cultivation. But each member was an expert in agriculture sciences or in field work on non-insecticide based pathways for sustainable production of cotton. The collaboration worked for five years but lost momentum: activists gave therapies and practices for pest control, scientists wanted data to be validated and more research and the multi-national firm representative wanted to explore the working of their new insecticide molecules. But using the learning, CEC later developed a handbook on non-pesticide management for forest trees following its need because the forest department had introduced alien, non-local and cloned species while their partner, The World Bank required an end to pesticide usage.

Diversification

I shifted to work on the effective and worker friendly implementation of the National Rural Employment Guarantee Scheme. It seemed as the only pathway of providing incomes to the poor in drought prone low rainfall areas. Soil works were a major investment in the Scheme. Dr. Sanghi told me that soil organic matter is crucial and hence this investment must be supplemented for soil nutrient improvement. As farmyard manure was scarce and leaf litter collection was a laborious job, I decided to try a factory approach to produce large scale leaf litter based enriched manure. I leased irrigated land to produce, add value and sell to nearby farmers. I failed as our business plan had a simple flaw, revenue calculations were based on wet weight of harvested leaf, whereas what is ultimately sold is based on dry weight, which I found was drastically lower. I abandoned this experiment but Dr. Sanghi wanted me to continue on finding other methods to improve soil organic content.

I was Member of Central Employment Guarantee Council and Chair of the "Committee of Individual works for small farmers" in MGNREGS. I found that while water conservation is its number one priority, it had little to offer to poor farmers. The focus was on groundwater improvement that benefitted and was private property of few people. It seemed a zero sum game as the thirst for water went up among farmers and even these few fortunate farmers faced plunging water table.

2010 – Challenging the framework

I realized a key fault line in the trajectory and ideas of developing rainfed farming systems. To suit to monsoon vagaries we promoted changes in cropping pattern (so desperate is the Indian Council of Agriculture Sciences to improve rainfed farming that they are developing new varieties of edible cacti to make India food secure), sought short duration and drought resistant seed varieties etc. The same is with forestry wherein growing a narrow spectrum of alien mono crop of plant species whose leaves are green in colour but cannot be browsed nor can birds perch or provide any fruit and requires no water except from the monsoons.

I came to one conclusion that for plant life and diversity, water is the trigger. It is a prerequisite and in large quantities for modern farm production. So how can soil organisms grow in hot climates when water is basic for them to survive, let alone thrive! I felt to improve rainfed farming is basically flawed, as it ignores the water imperative. Differentiating farming as irrigated and rainfed was an engineered ploy to keep the semi-arid tropics impoverished. We avoided democratization of the key and most valuable natural resource of water and kept us busy and preoccupied with romantic notions of developing rainfed farms and dryland farming systems.

More of Crop per Drop

In 2010 the ICAR new slogan was more of crop per drop. This is reinforced by our Prime Minister Modi. This translates to more investments on dams and canals that make politicians happy while more subsidies for drip systems, plastics, agri-textiles and green houses to be pocketed by industry while the ICAR will provide the sciences of industrial production of new plant traits, nutrients and pest control products. This nexus of government-agriculture-scientists-industry will allow no competition from new ideas and innovations and will destroy peasant autonomy and holistic ecological principles based understanding and practice for sustainable agriculture growth and development.

Take "drop" for instance – we have three systems – groundwater is private property and the winner takes it all, surface irrigation is canal based that is based on government supplies and its frequency and the "state of the art" is the drip irrigation systems whose value to farmers is, not because it reduces water usage but because it drastically reduces the need to deploy labour and also comes with high government subsidies. In short, the architectural edifice of our agriculture strategy and development pathway cannot deliver on the

ambition of the nation and its citizens, especially the residents of drought prone, low rainfall areas.

What about the "crop". This is perfectly understandable and in our scientific capacity. The predisposition, scientist strengths and cultivated domain expertise of the ICAR and the global agriculture research is to create the "wonder" seed. They want to emulate Norman Borlaug which led India to move from begging bowl to bread basket. The perils of green revolution are well known and new ecological threats loom large and all over. Dr. Sanghi never talked of seed to me but of soil improvement and growth of organisms for healthy plant growth, wherein our farmers will be provided with soil health cards by extension staff. Deficiencies will be corrected with industrially produced inorganic material.

Industry will be very happy and contribute to safe securing Indian agriculture production. The drip companies no longer offer irrigation systems that run on free electricity but provide everything from tissue culture plants to multiple soluble plant nutrients to insecticides and to marketing linkage. A "one stop" shop in agriculture. All this has heavy subsidies but as the fiscal situation permits only limited resource it will be rationed to serve a few farmers and with highly inflated procurement prices. This in turn will destroy the market and other producers of agriculture inputs and technologies. This is happening in drip irrigation systems – simple extrusion based plastics costs five to six times more than the cost of production while no company provides after sales service making the farmer helpless. Those outside government largesse system (producers and buyers) will find it uneconomical to use them as their market prices are based on 'incentives' involved in government patronage.

New Approach

My resolve was to provide irrigation within the low rain limits of semi-arid areas. My activities so far revolved on building the mezzanine floor such as soil conservation, watershed, organic matter and organisms of algae, bacteria and fungi etc. They were hosted in a hostile ecosystem wherein the essential foundation, elixir of life, water, is denied, dependent on monsoon and missing. It is for this primary reason that farmers were not enthusiastic and one could not harness their potential – entrepreneurial, labour or capital. I was convinced that water is the game changer for agriculture to succeed and bring farmers back to their farms and this resolve got reinforced upon seeing Dr. Sanghi take to "critical" irrigation in rainfed crops.

The challenge was to develop a simple irrigation technology that requires one fourth to one fifth of the water used in the state of the art drip irrigation systems and suiting lower rainfall of the semi-arid areas of India. From Dr. Sanghi, I had already learnt on the value of listening to the ideas of farmers. I made a decision – do not talk on water efficiency from those who work on reducing water usage compelled by falling groundwater table and intensification of agriculture. Instead talk to rainfed farmers how they construct an efficient irrigation system. I sought ancient Indian rainfed area farmer knowledge and on the practices adopted to grow sacred groves. We studied each aspect, improved all components and co-opted an adapted system of water distribution efficiency from modern agriculture sciences and materials.

Co-Creation

We wanted to start with trees and if successful then move on to vegetables and flowers. The first is to bring unused lands under productive trees and the later suits small farmer comparative advantage. Our aim was to drastically reduce water requirement and without adversely impacting plant growth and yield. The answer was simple – take the water down to plant roots. We looked at and tested subsurface cellulose materials. Each had their problems. The traditional way to grow trees in low rainfall areas with less water was by using buried clay pots. We looked at and studied sweating properties of clay pots. We observed huge variations and short period of active sweating. The cotton wick used to send water get hardened with salt in the water etc. So we defined our task as:

1. Take to and provide water at the plant root zone
2. Shift from watering plants to providing assured moisture at the plant root zone
3. Improve and standardize sweating properties and life of clay pots
4. Provide drippers to avoid clogging through salt accumulation or soil particles
5. Ensure longest duration and widest spread of moisture at the plant root zone
6. Find low cost water containers to store water
7. Piping system for smooth, no wastage and gravity based flow of water
8. Design layout to reach measured water quantum to all plants from one service point.

We reduced variations in clay pots and maximized its sweating properties, when buried one foot in the soil. Special mould made UV resistant five litre plastic

water containers were used to connect with rat and UV resistant HDPE pipes for efficient and automated supply of water to all plants. We combined sweating with initial oozing of water as wet and sweat keeps the moisture adequate and for the longest period. Salt accumulation in cotton wicks was overcome with drippers that slowly release measured water. A sand cap in the water oozing outlet point avoided clogging. Water filters are used where water source quality was not reliable. To fetch water we developed wheel based trolleys and to store harvested rainwater on farm lands, we used insulating materials. To avoid sending heated water to plant roots as the overhead tanks were of plastic, we provided a canopy to deflect heat.

It worked

Our trials on twenty different species of grafted fruit trees and in five different soils using one fifth of water compared to the recommended irrigation under drip system showed good leaf growth and plant health. We noticed that while in conventional drip irrigation the soil moisture content alternates between field capacity and wilting point, our system provides optimum air and moisture ratio mix in soil particles. While farmers with drip systems but having less water had to leave many trees un-irrigated and to die, we rationed water supply to fully grown trees to withstand extreme plant moisture stress and be alive to recoup to good health in the monsoon period. The technology was christened System of Water for Agriculture Rejuvenation (SWAR).

So from surface irrigation we shifted to water provision at the root zone, from the idiom of water, we moved to the language of moisture. Next was spreading moisture wide in the root zone for larger food nutrient catchment area. Chemical fertilizers and fungicides used to grow plants come at significant economic and ecological costs. On the other hand live fungi and bacteria will improve the soil. This called for inoculants that rapidly multiply organisms in the soil. This would enhance plant growth, improve resource efficiency, will impart resilience to multiple stress types and they could be locally produced. We put an *in-situ* prepared 10-15 kg of enriched farm yard manure for multiplication of organisms in the soil. This led to wider and better capillary spread of moisture. The moisture provided the ecosystem for organisms to thrive and multiply fast. A combination of moisture and soil organisms create a rich plant root food environment for plant health, reduced dependence on external nutrient inputs and withstand plant diseases and enhance pest resistance.

Little is known to us about roots and their behavior. No one can answer how much moisture is required at plant root zone for different species in different soil types and of varying age and growth stage and under varying temperatures and humidity levels. We opted for a simple template on plant root moisture requirement, one fourth to one sixth of the water recommended by surface drip irrigation companies, as plant water requirement is claimed to have been scientifically validated and could serve as a proxy indicator. This summer (2015) we began growing vegetables and it is already showing promising results. Limited scaling up is underway.

Recognition

SWAR received the Global Champion Innovation Award for Climate Change and Forestry at the 2015 Paris International Agriculture. Mahatma Gandhi said "there is enough for every ones need, not some ones greed". Under this approach, it is possible for areas with scanty rainfall to compete and to deliver on sustainable farming, subject to minimal water, its efficient use as the trigger for effective soil organisms that can make India food secure. The annual precipitation in the drought areas in India is 350 mm while it is 1200-1400 mm in high rainfall areas and hence doable with a technology that uses a fourth of water compared to drip systems. And all this we could do using our own resources.

Ambition

SWAR will be a sustainable agriculture business entity for high value dryland horticulture fruit trees and cultivate vegetables and using minimal water that can be easily adopted by poor farmers in drought prone areas, using existing water source or stored rainwater or fetched from nearby water bodies. To augment water resources we want SWAR to develop our degraded public and forest lands to serve as rich ecological harvests and improve the productive natural resource endowments.

This dual approach will lead to massive increase in the quality and quantity of the vegetative cover, crucial to Dr. Sanghi for sustainable development and agricultural growth of low rainfall drought prone areas. SWAR hopes to unleash the creative capabilities of millions of poor farmers as sought by Dr. Sanghi to succeed in developing agriculture and promoting sustainable development in the semi-arid areas. SWAR will be marketed as do it yourself technology so that

farmers can get the most economic and good quality components from different sources and install them suiting their convenience.

Much of the ideas and chosen priorities of my journey to develop rainfed areas came from Dr. Sanghi. He encouraged me to chase my own pathway and always provided critical and constructive ideas and inputs that led me to reflection and rejection and thinking and action.

I can still see my sitting with Dr. N.K. Sanghi for breakfast – he would meditate and thank the Almighty for the bread. He would then march to the field to help others to succeed with their service to humanity and the planet.

* * *

Individual Forest Rights (IFR) Title[1] Holders - Status and Challenges

Dr. D. Suryakumari[2] and Gargi Das[3]

As per the 2011 census, 104.28 million persons belong to Scheduled Tribe (ST) constituting 8.6 percent of the total population. Indigenous communities in India until recently have not received adequate attention by the Government in respecting their customary rights, entitlements and livelihood needs despite their struggles for the right to habitation, collection of non timber forest produce and right to till the land, right to safe drinking water and water for irrigation of their fields. Because of their inaccessible locations and indifference of the officials they are not able to access their due share from the development funds and service delivery mechanisms. Lack of awareness about identifying and handling the

1. *IFR Title – Title recognized under FRA*
2. *Director, 3. Programme Officer, Centre for People's Forestry (CPF), 12-13-483/39, Street No. 14, Tarnaka, Secunderabad - 500 018, Contact: +91 (040) 27154484 Email: skdasigi@rediffmail.com, sk@cpf.in, Website: www.cpf.in*

issues, lack of skills to have productive engagement with other stakeholders and inadequate capacities to see things from a perspective and plan accordingly are the major setbacks, from the community side, responsible for the condition.

The Forest Rights Act, 2006

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 or the FRA as it is commonly known, is one of the important milestones in Indian history. The Act is being implemented since 2008 to correct the 'historic injustice done to forest-dwelling communities'. These forest-dwelling communities were cultivating/ occupying forest land and using forest produce since ages but had no tenurial security. Broadly speaking, this Act recognizes and vests individual forest-dwellers with forest rights to live in and cultivate forest land that was occupied before 13th December 2005 and grants community forest rights to manage, protect and regenerate the forest and to own and dispose minor forest products from forests where they had traditional access.

As per the report of the Ministry of Tribal Affairs, as on 31st January 2015, extent of forest land for which titles were distributed is 75,95,088 acres, across the country for 15,62,453 titles. Out of this approximately 30,82,105[4] acres is recognised as individual rights and the rest as community titles.

This paper looks into the measures proposed to develop the lands under IFR titles after the recognition of rights under FRA and looks into the state of affairs with the IFR title holders in the ground in the state of Andhra Pradesh, in the light of the measures taken up by the Government of India and the Ministry of Tribal Affairs (MOTA) to improve the overall status and living standards of the IFR title holders.

The 12th Plan - Consultation with civil society organisations

The 12th Plan preparation process involved NGOs in the working groups to identify the field level issues and come up with suggestions for the priorities in the 12th Plan. In a two-day consultation workshop[5], various issues covering the

4. *Some states have not given separate figures for individual and community rights and as such the above figure has been arrived at as an approximate value.*
5. *The workshop was organised by CPF in December 2010, on the Sub Theme – 'Forest Rights and Tribal Farming Systems' under the thematic area - 'Regenerating Natural Resources and Rural Livelihoods in Rainfed Areas of India: Priorities for the 12th Five Year Plan' anchored by WASSAN*

implementation of FRA Act, development of agriculture, concerns over livestock management, and development of irrigation sources etc. were discussed. ***Prominent concerns*** raised are as under:

1. Till now, farming in forest land was considered as illegal and hence communities cultivating land in forest fringe areas could not receive any institutional support. Of late some banks are extending credit to individual cultivators based on the titles received.
2. Ground water utilization for irrigation is very low[6] due to non/ under exploitation and lack of three phase power supply which is needed to lift groundwater using motors.
3. Land alienation by non tribals in informal ways and also acquisition by the Government for other projects/ industries without following due procedures (Grama sabha resolution).
4. People in the nearby plains do not have the concept of growing fodder and as such send their unproductive cattle to forest fringe villages under payment to tribal families leading to stress on existing fodder resources.
5. Funds made available in budgets are often not proportionate to the population of the tribal communities. Allocated funds too are not fully utilized due to various reasons and as a result, the inputs required for tribal land development and water resource development have not been provided for adequately.

Recommendations to address the concerns

1. Strategy to be in place ***for land development*** of FRA individual title holders in the following lines: a) Financing agriculture development in FRA title holders lands, b) incentivising organic farming practices, and c) focused allocations of MGNREGA and/ or formulation and implementation of special schemes consisting of a package aiming at integrated development of these lands and the families.
2. ***Water resources development***: Special allocations need to be earmarked for development of water sources for irrigation of tribal lands (may be @ one bore/ dug well for 10 households to have assured irrigation for at least one crop for one acre to each household).

---

6. In VR Puram mandal of Khammam district, of the 9797 ha.m of the groundwater available, only 1% is being used. In Chintur mandal it is 6% against the available groundwater of 2930 ha.m. In case of non tribal mandals of the district the use of groundwater is to the tune of 70-90% (source: Groundwater department of AP's data).

3. ***Water and soil conservation mechanisms*** need to be developed using MGNREGA funds.
4. ***Fodder development*** on revenue waste/ earmarked grazing land has to be included in the comprehensive land use planning at Gram Sabha (habitation) level.
5. District administration in all scheduled areas has to be directed to take up the issue of ***Land alienation*** and sort out the problems within a stipulated time frame.

The 12th Plan and Tribal land development

There is no special mention about the tribal areas and their land development in general and about the IFR lands in particular in the 12th Plan document. However, under the section "Key Policy initiatives needed", the Plan document stated the following:

> "1.156. Action is needed on several fronts including provision of basic support services such as technology and irrigation infrastructure, access to credit, good and reliable seeds and improved post-harvest technology. The latter is particularly important since the bulk of the acceleration in growth will come from diversification towards horticulture, animal husbandry and fisheries. The greatest potential for improving productivity is in the rainfed areas, which account for 55 per cent of net sown area and where most of the poor live. Land productivity is low in these areas, but effective water management combined with better seeds, promotion of soil health and critical on farm investments supported by public sector efforts to improve infrastructure can make a big difference. Rainfed farming requires a natural resource management perspective with a farming systems approach focusing on producing diverse products that mutually reinforce each other and stabilise the system. These areas are ecologically fragile and highly vulnerable to the vagaries of climate, so the resilience of the system has to be increased. They require knowledge and institutional investments to improve soil moisture management, enhance soil productivity, revitalise common pool resources, provide appropriate seed and low external input systems as also farm mechanisation, along with diverse livelihood options such as livestock and fisheries. Some of the government's key inclusiveness promoting programmes, such as MGNREGA, can make

a major contribution to improving land productivity, if the projects under it are structured to increase farm productivity. Properly designed and converged, MGNREGA can contribute to creating positive synergy with agricultural growth."

Ministry of Tribal Affairs (MOTA) and the FRA

As the nodal agency for the implementation of the Forest Rights Act, the MOTA issues guidelines to states regularly. As per the suggestions of the National Advisory Committee on FRA, the MOTA facilitated a discussion with representatives of all states in 2010, where it was decided to provide post implementation support to title holders and ensure that they are integrated into all government schemes.

Further, in the amended Rules of FRA notified in September 2012, one rule was inserted emphasising on the need to bring in convergence of schemes for the benefit of the title holders. This rule reads as:

> "***16. Post Claim support and handholding to holders of rights***: The State Government shall ensure through its departments especially tribal and social welfare, environment and forest, revenue, rural development, panchayat raj and other departments relevant to upliftment of forest dwelling scheduled tribes and other traditional forest dwellers, that all government schemes including those relating to land improvement, land productivity, basic amenities and other livelihood measures are provided to such claimants and communities whose rights have been recognized and vested under the Act".

IFR title lands in Andhra Pradesh

As per Government records, 81800 IFR titles were issued across the state of Andhra Pradesh for an extent of 170731acres. Of the 13 districts, Visakhapatnam and Srikakulam districts recorded maximum titles. CPF conducted a field study during November 2014 and February 2015 in Srikakulam and Visakhapatnam districts to understand the field situation with regard to convergence of different schemes for the development of IFR title lands. Out of 44631 title holders from these two districts, 1002 IFR title holders (2.2%) were surveyed (Table 1).

In Srikakulam the survey was done in 7 villages under two mandals and in Visakhapatnam 20 villages were surveyed in four mandals.

Table 1: Sample size of the study

Districts	Total IFR recognized in the district as per ITDA records	Extent of land recognized (in acres)	No of IFR title holders surveyed for the study	Extent of land in acres
Srikakulam	15823	32074	351	796.77
Vishakhapatnam	28808	54061	651	1196.32
Total	44631	86135	1002	1993.1

Key Findings

Land utilization pattern: In Srikakulam district, 79 percent of land is under cashew plantation and 20.7 percent under agriculture. Kottakota, Titukupaiguda, Ambalagandi and Kusumuru are the villages where all the title land is under cashew plantation. In Visakhapatnam district, 100 percent of IFR land is under agriculture.

Convergence of various schemes: Only 28.8 percent of IFR title holders surveyed are under convergence. The convergence is mostly under MGNREGA (13.3%), Cashew rejuvenation programme (9.5%) and irrigation facilities under Andhra Pradesh Micro Irrigation Project (APMIP) and Indira Jala Prabha (IJP). Convergence is more in Srikakulam district, i.e.39.8 % whereas it is only 22 % (of the sample households) in Visakhapatnam.

Irrigation: Most of the farmers cited lack of irrigation as the major hurdle in undertaking agriculture on Forest land. The survey revealed that **only 10 percent of the sample title holders land is under irrigation.**

In Srikakulam, IFR lands are in slopy region and fully dependent on rain. **Only 0.85 percent of total IFR lands under study is under irrigation from a natural flowing stream**. It is therefore important that irrigation related schemes such as IJP and APMIP converge with IFR lands. 8 locations under the study were surveyed again in 2014 Sep-Nov for IJP, but there was no progress. During the interactions, PO of ITDA, Seethampeta, informed that IFR title holders in the district are benefitted by plantation programme. Agriculture can be promoted but irrigation is major problem in the region. Government is providing support through MGNREGA and recently; they are planning to support IFR farmers under '*Neeru – chettu*' scheme.

In Visakhapatnam it is mostly rainfed agriculture. In the survey, 54 IFR title lands are irrigated from borewell and 43 IFR lands from other natural sources such as streams. IJP survey was done for 23 locations last year but as yet none of them are sanctioned. There is no financial support for maintenance of the borewells.

Land development activities: 22.9 percent of the IFR land benefitted from land development activities in both the districts. In Srikakulam, it is 37.3 percent and in Visakhapatnam 15.2 percent of land was developed. 15% of the persons who received support for land development activities expressed that the work assigned was not the one they asked for. The major land development activities were pruning, pits for horticulture plantation, stone removal, trenches, stone packing, stone bunding etc.

In the survey, in 7 villages in Visakhapatnam and 3 in Srikakulam no IFR title holder benefited from convergence. The Program Officer, Integrated Tribal Development Authority, Paderu asserted that the first priority of ITDA is to work on IFR land. Activities like land leveling, boundary trenches, boulder removal, stone bunding, stump removal and small water ponds are currently undertaken on IFR lands under MGNREGA program. Teak and coffee plantation is provided along with maintenance cost. But there is no awareness and motivation among farmers.

Land development activity in Srikakulam is provided mostly under cashew rejuvenation programme and is not available for land under normal agriculture. There is a need to expand the services and reach out to villages which are still not covered under MGNREGA scheme. In Visakhapatnam, the MGNREGA work for land development is available in places where the community demand and their voice is loud and hand holding support is available from NGO. In other parts the MGNREGA work is very insignificant.

Linkages with Financial institutions: When forest dwellers did not have any legitimate rights on their agricultural land, they faced severe credit problem. It was hoped that after getting land titles people could easily mobilize finances. But in reality, ***less than one percent of title holders*** of the sample respondents accessed bank loans. The financial inclusion process needs to be scaled up and reach out to more people. Mostly large farmers with revenue lands also secured the bank loans. Farmers, who did not get loan, claim that Bank does not consider forest patta for giving loans.

It is in the discretion of a Bank whether to give loans on IFR lands. One of the bank managers said that they provide loans only to the large farmers who have the potential to repay the loan as per the time schedule. He asserted that Bank has no problem in giving loans to forest land holders as long as borrowers keep repaying the loan.

Monitoring and support: Though there was land development support from the Government there is no handholding and capacity building of the farmers for effective plantation or agricultural activities. In Srikakulam farmers follow traditional practices in cashew plantation.

For the tribal community handholding support is the backbone of any project which can be withdrawn once it reaches the stage of self sustainability. Villages which received training programmes from KVK, arranged by local NGO, the yield of the plantation crops has increased. Institutional building that provides constant handholding support to the farmers is needed.

Training improves yields and returns

Ms. Arika Pagadalamma of Titukupaiguda village, Seethampeta Mandal, Srikakulam district is one among the 45 IFR farmers of the village who have cashew plantation in FRA land. The cashew trees were planted in 2000. In one acre of land she has 107 trees. In 2012, her land was brought under convergence with ITDA cashew rejuvenation programme. She was given training on preparation of pits, spacing (distance between two trees) and pruning techniques, methods of organic fertilizers, manure, and sustainable harvesting techniques by KVK, facilitated by a local NGO. In 2012-13 her trees yielded 223.55 kgs of cashew, which gave an income of Rs 13,413. In the year 2013-14 the yield increased to 323 kgs giving an income of Rs 22,610. The average yield per tree was 2.09 kgs in the year 2012-13 and 3 kgs in the year 2013-14. For the other farmers who didn't receive any technical and handholding support, the yields ranged from 1 to 1.3 kgs.

Action on the National Advisory Committee Recommendations

The action taken by the State Governments on the National Advisory Committee's recommendations which were reiterated in the amended rules of FRA of 2012 is reviewed here.

In Andhra Pradesh although land development (28 percent of the study sample) and irrigation facilities (12 percent of the study sample) are available under MNREGS, it needs to reach all the title holders. Regarding convergence of various

developmental schemes operating in the areas of education, training, health, employment no specific work was done. Till date, the state governments have not issued any circulars[7] to field officials for convergence or vocational training. No steps were taken to set up a monitoring system.

In Telangana[8] land development is effectively taken up under MGNREGS. 74 percent of the title holders (of the study sample) benefited from land development and 16 percent of the title holders (of the study sample) benefitted with irrigation facilities. However, there is no convergence with regard to vocational skills, linkage with banks and other financial institutions and monitoring & hand holding support.

In both Andhra Pradesh and Telangana states, with the support of the NGOs, the communities could better access the land development and irrigation facilities.

Odisha and Madhya Pradesh governments extended their support to IFR farmers under various agricultural and health schemes, i.e. farmer health cards and Kisan credit cards that were meant for the mainstream farmers. In Andhra Pradesh and Telangana, such facilities were available only to the farmers owning revenue land.

Status of Tribal agriculture in general

Majority of the tribal communities in India today are settled agriculturists. The level of irrigation is less than 2 percent in most of the regions.[9] In spite of favorable resource conditions, tribal regions perform poorly in terms of infrastructure, returns from agriculture and almost all human development indicators. A large part of this has to do with the lack of irrigation investments in tribal districts. Tribal regions receive comparatively higher rainfall. But, some non-tribal regions with similar rainfall benefited from more public investments, largely in groundwater provisioning, including electricity subsidies for pumping groundwater. Tribal areas, on the other hand, have remained deprived of such public investments. Their access to agricultural technology and inputs is poor. The dependence of tribal people on income from seasonal migration, often

7. *Though a GO (No 57 dt. 01-03-2014) issued by the General Administration department mentioned that the responsibility of FRA implementation is of the PO - ITDA, points specific to convergence, support and monitoring have not been included.*
8. *Information used from the policy brief – "IFR title holders in Telangana state: what they are looking for" by Gargi Das and Dr. D. Suryakumari*
9. *Sharma, B.D. (1984). Planning for Tribal Development. Prachi Prakashan, New Delhi.*

under distress, is twice as high as that for non-tribal people living in the same districts[10].

Comparison between Mandla, a tribal district and Hoshangabad, a non-tribal district in Madhya Pradesh (MP) would highlight this discrimination. In the year 1995 credit to agriculture (Rs./ Capita) for the State was Rs. 192. For the tribal Mandla district it was about 1/4th at Rs. 59/- and for the non-tribal Hoshangabad it was almost double at Rs. 376. The Gross Irrigated Area as % of Gross Cropped Area for the entire state was 22.53; for Mandla it was just 3.66% and for Hoshangabad it was 43.05%. The situation is not different in value of agriculture production (Rs./ ha) the figures for the state, Mandla and Hoshangabad being Rs. 2141, Rs. 1232, and Rs. 2899, respectively.

The above data indicates that there is significant difference between the tribal and non-tribal districts in agricultural development. It is also observed that the policy on tribal affairs has not given adequate emphasis to livelihood enhancement and improvement of economic status of tribals. There are no concerted effort at improving the access of the tribal people to improved agricultural practices and water control[11].

Conclusion

After looking into the FRA implementation, guidelines issued and the support being offered at the ground level and the situation of tribal agriculture in general, it may be concluded that the needs and priorities of tribal communities are not a priority to the policy makers or the field level implementing agencies. Mere issue of titles will not help the tile holders unless there is systematic and focused support to them. In order to improve their status, whole hearted efforts towards convergence with adequate financial allocations is essential. Importance has to be given to tribal agriculture and their overall well being needs.

Complete handholding and constant monitoring is required at every stage for achieving the desired results. The Government or locally based NGOs should take proactive role in facilitating the process of convergence.

---

10. *International Water Management Institute-Tata, Rethinking Tribal Development: Water Management Strategies for Revitalizing Tribal Agriculture in Central India, Water policy Briefing, Issue 27, May 2007, p.1.*
11. *International Water Management Institute – Tata, Rethinking Tribal Development: Water Management Strategies for Revitalizing Tribal Agriculture in Central India, Water policy Briefing, Issue 27, May 2007, p.1.*

Recommendations

- There should be awareness among the implementing agencies about the convergence needs of IFR lands.
- Convergence activities should be local specific instead of being generic.
- Constant handholding and monitoring support should be provided to IFR land holders.
- Institutional credit should be made accessible for IFR title holders.
- Awareness and capacity building programmes on the government schemes for the community.
- Monitoring mechanism should be in place to pursue post title follow up.

References

1. Civil Society Consultation held on 15th and 16th December 2010
2. Policy Brief by Centre for People's Forestry, titled "IFR title holders in Telangana State: What they are looking for - December 2014, by Gargi Das and Dr.D.Suryakumari
3. Phansalkar and Verma, 2005, Mainstreaming the Margins: Water-centric Livelihood Strategies for Revitalizing Tribal Agriculture in Central India, 2005,
4. International Water Management Institute-Tata, Rethinking Tribal Development: Water Management Strategies for Revitalizing Tribal Agriculture in Central India, Water policy Briefing, Issue 27, May 2007, p.1.
5. National Advisory Committee report on FRA
6. Amended Rules of FRA notified in September 2012
7. Relevant sections of 12th Plan Document
8. GO 57 Dt. 01-03-2014 issued by the General Administration Department of Government (United) of Andhra Pradesh

* * *

The Cow and Bull Story of Venkatramapuram

Uma Shankari[1]

Sometimes one feels all the stories have been told. What is the point in telling yet another one? Especially since our stories are usually addressed to a seemingly deaf and mute government; or to an uncaring society, pulling in different directions. When I wanted to write about the changes in the livestock situation in my village, I was going through the literature on livestock in India and I felt everything has been said by the wisest of men and women and what more there is to say? Then I was reminded of a meeting recently. In that meeting my good friend Shanta Sinha urged the audience not to lose faith in the system. She said, "We pray, don't' we? And not all our prayers are answered, but we don't stop praying." Shri Sanghi was one such person, who tirelessly and

1. *Swadeshi, Venkatramapuram Village, Chittoor, Contact: +91 9989798493 Email: umanarendranath@yahoo.co.in*

tenaciously advocated for a rational, sane and wise approach to water, drought prone regions, rainfed agriculture, ecologically sustainable agriculture. I am honoured to be included in this volume in his memory.

So here again goes the story of cows and bulls, sheep and goats, the buffaloe, pigs and birds. The paper traces the changes in the last few decades in the livestock situation in a village in Chittoor dt. of AP, a drought prone region of the country. This is not an academic study. The author has been a farmer with her extended family of relatives and workers in the village since 1985. It is a report of what she has seen and heard and experienced. The suggestions and opinions expressed are to be taken as representing those of the community as well.

Break down in marriage

It is well known that in dryland regions of India cattle and other livestock has played a critical symbiotic role in the economy of the region. "*The ox is the Indian peasant's tractor, thresher and family car combined; the cow is the factory that produces the ox." (Marvin Harris*: http://sociology101.net/readings/Indias-sacred-cow.pdf). If agriculture has been the hero in the economy, livestock can be said to be the heroine – married to each other through centuries of give and take. Typically the men tended the bullocks and women the cows. Now this marriage between agriculture and livestock has broken down. Well, almost.

Since in the drought prone regions only one monsoonal rainfed crop is possible (except in pockets where privately owned wells make it possible to have a second crop or a year round crop), the cropped fields double up as grazing lands for the livestock, especially cattle and sheep. Secondly, these regions typically have large tracts of lands unsuitable for any agriculture like hillocks, sheet rocks, thorny bush forests, which also served as grazing lands (till they were classified as wastelands by the colonial British government to be assigned to whatever purpose they deemed fit). In return the farmers get the valuable dung for manure for the next rainfed crop, milk for nutrition, work from bullocks, calves - free of cost - for replenishing the stock, meat when they die or when they are sold. Communities which specialized in livestock breeding and maintenance emerged in these regions. Sometimes there were more livestock than people in these regions! The symbiotic relation between agriculture and livestock was well recognized and the cow was considered a sacred animal throughout India.

Now all this is well known. But there have been significant changes in the last few decades ever since the Green and White Revolutions spread from wet areas

to dry areas, especially since the 1980s. What are the challenges today in livestock management?

The white revolution came to the village in 1983, without much fanfare, when the government initiated milk cooperative started a milk collection centre in the village, to be transported to the modern dairy processing plant at Chittoor. The APDDCF (Andhra Pradesh Dairy Development Cooperative Federation) was modeled on the successful Amul Dairy in Gujarat and within just a few years the APDDCF Chittoor became a proud component of the AP government for its high standards and levels of performance.

Within the village it ushered many changes. Electric pumpsets had already appeared in late seventies and bullocks were being retired from drawing water. At that time there was only one tractor in the entire village, a second hand Russian model, but it served several purposes - ploughing and transportation and was run on good profits to the owner, not withstanding that quite a portion of the earnings went into its repair and maintenance. Unlike the bullocks a tractor cannot be retired or junked easily. An old bullock can be retired, sold for meat, money quietly pocketed and forgotten. By the time the cow or the bullock dies, it would have already been replaced by half a dozen progeny. So no replacement costs. Does the tractor give milk, manure? Does it have progenies? No, it is not a joke. A tractor cannot be sold except at a vastly discounted rate. And when it is still working it eats and drinks more, falls sick oftener and the doctor takes a lot of money. In spite of all the above advantages of the bullocks, people took to tractors and pumpsets, because the work got done faster. Human beings seem to have a 'thing' for speed it seems.

The milk cooperatives drove the bullocks even further in favor of cows. In the eighties the joke used to be 'whether he bathes himself or not, the farmer bathes the cow every day.' In fact a common scene was the cow being bathed at the handpump in the village. The handpump disappeared in the next few years, giving way to deeper borewells and piped water supply to every household and the only open drinking water wells in the hamlets were filled with dirt. The irony is that as we progressed in the modern technologies, the situation today, after thirty years, is that out of 300 plus borewells drilled since 1980s, hardly three or four are functioning! Government and communities are frantically drilling borewells in many villages just for drinking/ domestic water, going down to 700 to 1000 ft., without striking any water. Let alone the cow, even the human beings have to skip their daily baths!

Number of cattle (and sheep) per household were also becoming less and less. The children started to go to school and family labor became scarce. Without free family labour, rainfed crops – a mixed crop of millets-groundnut-pulses (the groundnut is the main crop) were soon becoming unviable due to uncertain yields and prices. Places like the Chittoor region had no market or price support from the government for their crops as they did not grow rice. The groundnut crop does have an MSP but it is not enforced through procurement. But groundnut is a good crop for the farmers; it serves as food, gives edible oil and the oil cake and the crop residues are a very nutritious feed and fodder for the milch animals; last but not least the soil gets enriched by groundnut crop. So regardless of lack of government support people grew rainfed groundnut year after year to the last inch of their fields. But as labor costs kept increasing, and as family labor became scarcer, farmers hit upon the idea of mango gardens!

Chittoor district has a very good climate for mangoes and has over the centuries developed many varieties of mangoes, out of which three or four varieties command very good prices. Unlike field crops it is less labor-intensive, and can be managed even in absentia. This trend started in mid 1990s but got intensified under the MNREGA program.

The MNREGA program encouraged mango plantations in private lands and supported them for three years along with the cost for watering. Most farmers took to this program as a way of escaping unviable rainfed farming. But unfortunately rains have been failing since 2012. Paradoxically it led to more borewell drilling, as mango plants needed to be watered through the summer for the first seven years, and even later if you wanted good sized mangoes. And this led to more borewell drilling till 2013. From 2013 onwards most of the borewells simply dried up and the newly drilled borewells were not striking water at all or giving just a trickle. By 2013 even drinking water began to be supplied though tankers! Thousands of mango (and coconut) trees have dried up and died since 2013. The government which so enthusiastically promoted mango is nowhere to be seen now. When we appealed for compensation for mango trees, the Joint Collector laughed and said, "farmers should take care of their own trees; what can the government do?" He is probably innocent and unaware that farmers have looked after the trees like almost their children all these years as these have become the only source of lumpsum annual income for them, even as the cow brings money every 15 days!

Meanwhile since the last 15 years the women SHGs had come into being and most women bought cows, as milk had a market at the doorstep. Even the landless women grazed their cows along the roadsides and other commons and survived. So, in effect the economy of the village has become mango-milk economy. I have already briefly described the mango situation; I will examine the milk situation below.

Mango and milk do not in fact go together. As soon as mango plants were planted farmers fenced up those lands so that cows don't graze the young plants. Cows don't prefer mango leaves; but if there is no grass they may eat up the leaves. So grazing lands got reduced. Secondly the previous rainfed crop mix - groundnut/ millets/ pulses left a lot of crop residues - millet stalks and groundnut stalks - which provided valuable fodder through the summer. Mango trees do not serve that purpose; they cannot be cut and fed to cows - either green or dry. So farmers started buying paddy straw for fodder. This added to the cost of milk production, which is constantly increasing. Since, there is no other source of employment and income, and since they get cash income every fortnight, farmers are continuing with cows.

Who is milking whom?

To get back to the story of milk, the APDDCF was wound up, giving way to the private dairies, starting with the Heritage Company, owned by the then (and the present) Chief Minister Chandra Babu's family. Most farmers feel that instead of promoting the public sector cooperative dairy, the Chief Minister promoted his own company. The most important consequence has been that farmers have lost their voice in the milk sector as they cannot question the private dairies. Recently the NDDB was pressed into service to restart the cooperative sector by building Bulk Milk Chilling Units through the women SHGs. It has a limited reach as yet.

Meanwhile private dairies rule the day in our village. Since there are many private dairies (29 last year), competition as well as collusion between them keep the prices stable but low. Farmers have learnt to live with them by switching their loyalty from one dairy to another, and trying to get a better deal. Sometimes the same family offers milk to more than one dairy!

Studies by scholars show **that neither the farmers' labour nor the fixed cost of the cow is factored into the price paid by the company**[2]. It is shameful that this study does not see this as a problem and does not mention it in its discussion on policy recommendations. The same study notes that the top three earners in terms of value addition in the co-operative dairy plant were: milk *peda* (65.28%), *khoa* (47.50%) and skimmed milk powder (41.98%). All the dairy products had added more than 30 per cent of value after passing through the value chain. In money terms, it varied from Rs 5.26 in toned milk to Rs 85.50 in khoa. Full cream milk's contribution to the value addition was least among the co-operative dairy products. In the private dairy plant, ice cream (55.80%), Mysorepak (44.44%) and ghee (39.82%) secured the top three ranks in terms of value addition. Except full cream milk (27.49%), all other dairy products have added more than 30 per cent of the value to the product. In terms of money, the value addition ranged from Rs. 5.54 in toned milk to Rs. 81.63 in ghee. But it does not argue for how the profit from the value added products can be and should be passed on to the milk farmers who are the primary producers.

The study by NIRD[3] however does take a note of this issue. To quote*:*

> *"It is unfortunate, while, even the wage earners are guaranteed of the employment through national policy (NREGA), the self-employed rural dairy farmers are deprived their justified rate of milk imputed on the basis of family labor cost....*
>
> Time and again the models failed to provide remunerative prices to the dairy farmers for want of expression on the operating system and due representation in the policy making body. Hence there is a dire need for inclusion of farmers/ quota in the executive committee/ general council of the dairies/ feed mixing plant/ corporations/ federations at various levels be it private or government. Such a pro-farmer mode of development ensures remarkable gains to the community at large. It also ensures sustainable livelihoods providing food security, equity and livelihood security through effective participation of the farmer. Farmer's representation in the executive

2. ***Evaluating Value Chain & Retailing of Milk in Chittoor, Andhra Pradesh,*** MRK Murthy, KH Rao, GP Reddy, *International Journal of Engineering Research &Technology (IJERT) Vol. 1 Issue 9, November – 2012 link: http://www.ijert.org/view-pdf/1619/evaluation-of-value-chain-a-retailing-of-milk-in-chittoor.*
3. *"A Study on Improvement in Rural Livelihoods through Dairy farming" Dr. S.Venkatadri Dr. K.Swaroopa Rani, Dr. G.Raghunadha Reddy, Centre for Self Employment and Rural Enterprises, National Institute of rural Development, Hyderabad 2008. Link: http://www.nird.org.in/nird_docs/ven_con.pdf.*

committee would be of immense use in translating policy intention of the development programmes into field reality as they could act as watch dog on the operating system."

What I have noticed in the last five years is this: Because of acute feed/ fodder shortage, farmers do not even want to rear adult cows. They are in fact rearing calves, and selling them when they are about to calve. During the summers in the last five years, for want of fodder as well as water, and high cost of feed, farmers sold away their cows in large numbers throughout the district. And where do they land up? In the beef market certainly. That brings us to the question of beef eating and beef ban or ban on cow slaughter.

Beefing up the rural economy

Indian society has always had an ambivalent attitude/ stance about beef eating. Right from the Vedas the cow was seen as a sacred animal but were also sacrificed and eaten. In fact it was eaten because it was a sacred animal! And it was sacred because it was so useful![4] But in the course of history, perhaps due to spread of Buddhism and Jainism, meat eating was discouraged and beef eating was actively forbidden amongst the Hindus, although communities outside of the Hindu fold continued to eat beef. The thinking is: Of course cows are sacred, but they too have to face death, just like us, isn't it? As long as I don't kill it, it is ok.

Beef in fact formed an important source of nutrition for these communities. Recently I was researching for an article on food and nutrition[5] and the Dalits in my village told me that they got to eat much more beef in the olden days than now. There were many more cattle, and old and diseased cattle were allowed to be taken away by Dalits, beef was not sold in the neighbourhood, so it did not have a price tag, even now it is sold in a town 20 kms away, and it is slightly cheaper than chicken meat, but the time, effort and transport costs make up for it, so they end up eating chicken more often than beef. But even now beef is cheaper than chicken or mutton and poorer Dalit communities do enjoy the nutritional benefits from it.

Marvin Harris says that this seeming ambivalence about beef eating is not really so, as the cow had a critical role in Indian agriculture, was much loved and revered, just like the dog in the Western societies and the car in the modern

4. *http://www.countercurrents.org/ambedkar050315.htm.*
5. *Uma Shankari: Well Being by Eating Well: http://sch.sagepub.com/content/current*

Western society. Just as the Westerner does not mind junking the dog or the car when they become old, diseased and dysfunctional so did the Hindus deal with their cattle: quietly turned them away to fend for themselves or to be taken away (or sold to) by beef eating communities. Indian society has debated this issue time and again and had come to a reasonable stand of "promoting the cow" in the Directive principles in its Constitution. Banning beef would remove a source of income for the farmers however small and insignificant it may be. It would deprive the meat and leather industry as well.

White Revolution ~ on the skeletons of cows and the cowherds

India stands first in the world in milk production. But this in no way means that our farmers have first rate cows; nor does it mean we have well off cow farmers. In fact the best Indian cows are said to be in Brazil! In India they are just a wee bit better than skeletons: their performance in milk is much below their optimum. The farmers in our village have all switched to crossbred cows in the hope of getting higher yields, but they too have been turned into skeletons due to acute shortage of feed/ fodder.

Both the cow and the cow farmer in India are in a miserable condition, especially in the dryland regions which have always been their niche zones. There is acute fodder and feed shortage due to break down of rainfed field crops; acute shortage of grazing lands due to diversion of grazing lands to non-grazing purposes. The income from milk does not even cover the purchase cost of neither the cow nor the farmers' labour, so that even if he wants to purchase feed and fodder he cannot afford to do so. So during summer he sells away his cows for a pittance to the meat industry and now that too is being blocked! In fact the recent livestock census shows reduction in their numbers, for the first time since Livestock Census was started!

Whom does the White revolution benefit, I wonder.

What can be done?

It may be a good idea to declare an MSP for milk as well and more importantly enforce it.

Grazing areas should be recognized and left for livestock.

Small millet crops should be encouraged for fodder if not for grains. Most of them can withstand severe drought conditions.

Drinking water troughs for cattle are being installed in the villages of Chittoor district and the farmers appreciate the move.

Dry and drought prone regions should be preferred zones for cow based ecological farming. Cow based organic agriculture must be promoted actively by the government.

Fodder scarcity should be anticipated and dry fodder should be made available during the summer season.

Women SHGs can be encouraged to make feed and supply it locally with a small profit.

Indigenous cow breeds should be encouraged along with exotic cross breeds, as they are more resistant to drought conditions.

Government should ensure that milk prices offered by the milk companies are fair and just, and cover the cost of milk production adequately and ensure a reasonable profit to the milk producers.

There, another set of recommendations... let us be patient, and pray!

* * *

Combating Desertification and Mitigating Farmers Distress in Anantapur District

A 10 Point Programme

Dr. Y. V. Malla Reddy[1]

I know Dr. Sanghi for the past 18 years or so when he was in MANAGE. He was one of the few who had a focus on people rather than programmes; and a flair for traditional wisdom and indigenous knowledge systems. He emphasized on rebuilding environmental resources to be people centric and sustainable. He contributed substantially to reshape the watershed programmes a) from top-down to bottom-up approach; b) from mere conservation of natural resources to integrating livelihoods and sustainable environment; and c) from land owner centric to land less and off-farm & non-farm livelihoods. He has contributed significantly in WASSAN evolving (in the decade of 2000) into a voice of rainfed farmers and participatory action research policy

1. *Director (Ecology and HRD), Acction Fraterna, RDT - Ecology Centre, Upparapalle Road, Bangalore Highway, Anantapur - 515 002, Contact: +91 (08554) 244222 Email: yvmallareddy@yahoo.co.in, Website: http://www.af-ecologycentre.org/*

advocacy. This paper is a tribute to the down-to-earth scientist. I dedicate this article to Dr. Sanghi in view of his commitment to the rainfed farmers and rainfed farming.

This 10 point programme aims to combat drought and desertification and to mitigate agricultural crisis through protective irrigation and climate resilient sustainable agriculture and provide certain amount of income, food and nutritional security, particularly to rainfed farmers. Further it improves the endowment of environmental resources and fights the desertification process by adding tree cover, Bio-diversity, rain water harvesting and enhanced ground water.

The experience of farmers in the Anantapur district had been that they get a good crop once in every 2-3 years. But now for the past 15 years they get only one or two good crops in 10 years. The rainfall which is always low in this district is getting more and more dispersed and unpredictable. It is no more following the pattern which it used to. The climate change is happening much faster than visualized and negatively affecting the health of crops, animals and human beings. Further the process of desertification is hastened.

Consequently, the present situation has deepened the agricultural crisis and farmers' distress; and rainfed farmers see no hope of making a livelihood in agriculture. So, many are abandoning agriculture and migrating to cities desperately to work as casual labor in construction or any other industry. The sudden increase in outmigration from rainfed farming is alarming in last 2 or 3 years. If it continues, 50% of farmers may give up farming in next 5 years and might live in city slums under untold suffering. This may even be a biggest displacement of farmers and largest disgraceful downward occupation mobility from farmers to casual labor.

Salient features of Anantapur agro-climate

- Low and ill-distributed rainfall (521 mm) with 1850 mm Potential Evapo-transpiration. Winter temperatures 12-15° minimum and 25-33° maximum. Summer temperatures 40-43° maximum and 26-31° minimum.
- Cultivated Area of 11 lakh ha, 85% shallow red-gravelly soils, 15% Black soils.
- Almost 10 lakh (90%) ha. is rainfed, only 10% is under irrigation that too mostly under tubewells.

- 7 lakh farming families, 90% of them are small and marginal from SC, ST & BC Communities.
- Small holdings, mostly slopy, rolling, undulating and shallow.
- 2 lakh ha. of forest area almost without tree cover.
- 2 lakh ha. of Revenue hillocks, wastelands, streams, tank beds etc. without tree or grass cover.
- Accentuated frequency of droughts and desertification process.

Given this situation of Anantapur District of severe agriculture crisis and severe distress of farmers, a 10 point programme is proposed to address the problems of Droughts, Desertification and Poverty. If this 10 point programme is implemented systematically with a sense of urgency in next 10 years we can by and large overcome the frequent droughts and alleviate rural poverty on sustainable basis. And importantly combat desertification.

1. Provide Protective Irrigation to rainfed crops during dry spells through "Anantapur Water Grid" for Drought mitigation

In this district, under rainfed conditions, mainly groundnut and some other crops are grown in 10 lakh ha. Generally, droughts occur because of long dry spells in the months of July and August (Groundnut crop is sown in July, and peg penetration and pod formation takes place in August) resulting in huge crop failures. If we can provide 1 or 2 protective irrigations during these dry spells we can protect rainfed crops and prevent droughts to a great extent. This protective irrigation could be made possible through "Anantapur Water Grid". Anantapur district is endowed with thousands of traditional small and medium irrigation tanks spread across the district. We have to build "Anantapur Water Grid" by interlinking these water bodies with river waters from Tungabhadra and Handri-Neeva Projects and synergizing different water sources viz., rain water, groundwater, local surface water and river waters in a "conjunctive use of water". The water from the Water Grid could be used for protective irrigation for rainfed crops. To achieve this, the following needs to be done:

- Restore traditional irrigation tanks to their full capacity.
- Convert all traditional irrigation tanks into percolation tanks and storage reservoirs.
- Supplement the local surface water with River waters in order to fill all the traditional (percolation) tanks. This is called "Ananta Water Grid".
- Build a distribution network system to rainfed lands through piped or tanker system and mobile sprinkler/ drip systems.

- Use this distribution system (Ananta Water Grid) for giving protective irrigation to rainfed crops during long dry spells by using mobile sprinkler or drip systems.
- This will also improve the groundwater recharge across the district and stabilize the borewells. Use the augmented groundwater also for protective irrigation when necessary.

With this system of protective irrigation, droughts could be mitigated and relief provided to lakhs of rainfed poor farmers. The proposed Anantapur Water Grid will also create a more spatially equitable distribution of water across all regions of the district. And will achieve a greater social equity by benefitting large number of small and marginal rainfed farmers, belonging to SC, ST, BC and other poor communities.

2. Promotion of rainfed horticulture and agro forestry in 33% of cultivated area: Tree crops are more drought tolerant and improve environment.

The soil and climate in this district are favorable for certain crops of rainfed horticulture. There is an urgent need to develop rainfed fruit trees and other tree crops in 33% of cultivable land in the district, i.e. 4 lakh ha. It will also enhance tree cover in the district and compensate for lack of adequate forest cover. AF-Ecology Centre has successfully demonstrated since 20 years that fruit trees like Mango, Sapota, Amla, Custard Apple, Jamun, Ber etc. can be grown in rainfed lands with initial irrigation for establishment. The Government is now scaling up this successful programme under DWMA. There is plenty of scope for establishing rainfed trees for fodder, manure, biomass, medicinal use, timber etc. The tree crops not only improve green cover in the district but also add livelihood support to poor farmers. To ensure survival of tree crops, there is need to undertake *in-situ* soil and rainwater harvesting measures; and to "hand hold" farmers for 3-5 years from planting to yielding.

3. Increase fodder availability through afforestation and common lands development: Vegetation improves environmental endowment and combats desertification.

In Anantapur district there is 2 lakh ha. forest land without forest cover. In addition to this, there is another 2 lakh ha. Revenue land with hillocks, streams, uncultivable wastelands etc. which is also without tree or grass cover. It amounts to 20% of the geographical area of the district. These 4 lakh ha. are common

property resources which can support livelihoods of poor farmers and landless as well as combat desertification by improving environment. In Anantapur district the main livelihood after agriculture is sheep/ goat rearing and dairy. The shepherds in the district are migrating for months to distant places as enough fodder is not available for sheep. Also the farmers are selling away cattle for throw away prices due to fodder shortage. Grasses and trees that give fodder, fruit, biomass, timber etc. could be grown in this 2 lakh ha. of forest land plus 2 lakh ha. of Revenue common lands to augment fodder (and biomass) for sheep and cattle. Several traditional water bodies in forest land, revenue hillocks need to be renovated and appropriate soil conservation and rainwater harvesting measures have to be taken up. Seetaphal, Jamun, tamarind and other native forest fruit trees (with market value) along with fodder trees like neem, *narepi*, peepal, banyan etc. have to be grown in these lands. Once they are established, semi-intensive sheep and cattle grazing or cut and carry fodder systems could be promoted. This would also add substantially to the ground water recharge, biomass enhancement, increase in soil organic matter and in combating desertification.

4. Promote Integrated Farming System (IFS) at every rainfed household level: Each rainfed farmer to own at least 100 fruit trees plus 2 or 3 cows/ 10 sheep in order to supplement annual crops and stabilize incomes.

There is a need to promote IFS for every rainfed farmer. The IFS should integrate annual crops, tree crops and cattle/ sheep/ goats. This system would diversify income sources, spread risk and provide income stability in case of droughts as farmers will get income from multiple sources like annual crops, tree crops, cattle and sheep. Even if one source fails, other will come to his/ her rescue. Relevance of tree crops was already discussed in the previous point. Regarding cattle, we have to follow a two pronged approach:

a) Promote local/ native drought-tolerant breed cattle as they are best suited to this region. They will freely move and graze on hillocks, streams and can survive well even on dry fodder from annual crops like millets, pulses and groundnut. Different native breeds of cattle suitable to our area are Punganur, Tharparkar, Hallikar, Ongole, Sindhi etc. These will survive by grazing in common lands and crop residues. The farmers can own more no. of cattle as they are inexpensive. They may give less milk compared to exotic cattle, but compensate with other benefits. The local breeds are best

suited for rainfed farmers and they are important resource by way of dung and urine for Jeevamrutham for practicing Sustainable Agriculture.

b) Promote dairying with the exotic milch animals like Jersey, Heifer etc. for farmers with irrigation facilities, who have green fodder; and better equipped to manage the sensitive animals.

5. Promote mixed/ intercropping with millets and pulses and ensure food and nutritional security: Provide locally grown food in ICDS, Mid-day Meals and PDS and Reduce Food Miles.

In Anantapur district the crop area of millets has reduced drastically because of extensive cultivation of groundnut. Due to this the villagers are completely dependent on the rice distributed under PDS. Consequently the malnutrition is increasing and immunity of villagers is decreasing. So there is need to diversify the rainfed crops with millets and pulses and reduce groundnut cultivation. Suitable millets and pulses for Anantapur district are Jowar, Bajra, Fox-tail millet, Redgram, Cow-pea, Lab-Lab, Gingilly, Green Gram etc. In order to bring back millets and pulses, Government should provide adequate incentives. Government should provide crop insurance, credit facility, support price, and procurement facility for millets and pulses. The millets and pulses produced in the district should be consumed locally as much as possible by supplying in PDS programme and by providing millets and pulse based cooked food in mid-day meal scheme and Integrated Child Development Scheme (ICDS) in order to create food and nutritional security for children/ students and mothers. Such a localized food production and distribution system would reduce food miles, save distribution costs and enhance food and nutritional security.

6. Shift Green Revolution model (HEIDA) to LEISA.

The Green Revolution model which I called High External Input Destructive Agriculture (HEIDA), is not suitable for Anantapur agro-climate and particularly inimical to rainfed small and marginal farmers. High use of chemicals in agriculture is leading to increased cost of cultivation and polluting the environment. Farmers are caught in the debt trap and losing a lot due to HEIDA. The rainfed farmers and small farmers are being thrown out of agriculture as they cannot afford high crop investments and cannot take risks. This is also destroying the health of people, environment and ecology. The productivity of soils is decreasing because of high use of chemicals. So there is a need to replace HEIDA and campaign intensively for Low External Input Sustainable Agriculture

(LEISA) practices. Government under HEIDA is giving direct and indirect subsidy of about Rs 10,000/- per ha. on chemical fertilizers, mechanization, free electricity etc. So the Government should provide at least Rs 7500/- per ha. as incentive to all farmers who shift from HEIDA to LEISA, so that they grow diversified crops, prepare and use their own manures and practice bio-management of pests and diseases.

In order to mitigate climate change also we have to shift from HEIDA to LEISA. LEISA is eco-friendly and very beneficial to small and marginal rainfed farmers.

7. Processing and value addition of Agri-produce and Remunerative prices.

The agri-produce grown in this district is known for its high quality. Anantapur farmers are growing vegetables and high value fruits like sweet lime, pomegranate, sapota, guava, citrus, water melon, grapes, mango etc., and other crops like groundnut, bengal gram, jowar and lentils. Proper processing and marketing facilities are lacking for these crops. Cold storages and ware-houses should be built adequately for storage. At least first stage processing units have to be established in the district. Assured market or procurement facility and a price stabilization mechanism have to be provided for all agri products. The agri processing industries like fruit juice, pulp tomato ketchup can help in stabilizing prices and give remunerative price to farmers. A price stabilization fund should be setup to cushion the price fluctuations and avoid distress sale.

8. Industrialisation – An essential and urgent necessity for the district.

Anantapur is also the least industrialized and otherwise also most backward district in Andhra Pradesh. Given a population of over 40 lakhs, there are only about 20,000 industrial workers. It has good educational institutions and human resources. Bangalore International airport is just 75 Kms away from the borders of Anantapur district. The National Highway from Kanyakumari to Delhi runs through the length of Anantapur. And the district is strategically located between Bangalore and Hyderabad offering good scope for an industrial corridor. The crop land is least productive given chronically drought-prone and desert like agro-climate. Perhaps this is the only district in the country where farmers themselves are inviting industry and prepared to sell their land at a lower rate compared to any other district! The farmers are keen to see their children employed in industry as they cannot see future in agriculture.

However, one constraint for industrialization is the scarcity of water in the district. So, there is an urgent and high priority need to allocate 5 TMC of assured water exclusively for industry in the district. The water availability will trigger a rapid industrialization in the district given other congenial factors. With the climatic constraints for agriculture sector, it is fair, logical and essential to incentivise and encourage micro, small, medium and big industrialization.

9. Health security & Education Support.

One of the main causes (apart from droughts) for poverty and increasing rural indebtedness is ever increasing health expenditure. So all the villagers have to be provided with health security in order to help them come out of poverty. *Arogya Sri* scheme has to be extended to all, augmented to include all diseases and implemented effectively. The infrastructure and functioning of all Government health institutions from ICDS, ANM, PHCs to hospitals should be improved at all levels in order to effectively reach out to the rural people.

Another major cause for poverty and high rural indebtedness is increasing costs on their children's education. Unable to see any future in agriculture farmers desperately want to provide higher education to their children which is becoming costly day by day. So, all the rural children who want to go for higher education should be supported fully by the government. Also there is a strong need to improve quality of education in all the Government institutions in the rural areas and higher educational institutions.

10. A time bound 5 year action plan for comprehensive development of Anantapuram district.

Alleviating the crisis in agriculture which is caused by drought and desertification is basic and a necessary condition, but not sufficient for development of Anantapur district. A piece-meal approach to address the chronic problems of drought and poverty in Anantapur district will not solve the gigantic problem of being the most backward district in the state. Multi-sectoral interventions and convergence is necessary. A time bound, comprehensive 5 year action plan has to be worked out including the above measures as well as other sectoral interventions such as industrialization (micro, small, medium & large), non-farm skilled employment for under educated youth, additional and alternative income generation programmes for women, landless etc. And further, adequate financial, human and institutional resources

to implement such a plan should be made available at the disposal of the District Administration. The elected people's representatives, including Panchayat Raj Institutions, Political parties, the Government machinery and the civil society organizations have to work in cohesion and concerted manner in implementation and monitoring the comprehensive plan.

Conclusion

There is a need for immediate action for development of Anantapur district with a sense of urgency and seriousness. Lest we all may be late for ever! Farmers may disappear in desperation and disgrace to cities to work as casual labor! Farmers becoming casual labor will be disgraceful. In the absence of industrialization, the educated community also has to migrate in search of employment. The district will become a desert! Then who else will remain in Anantapur district!

A sense of urgency and political commitment is needed to address the problems of chronic drought, desertification, poverty and backwardness in Anantapuram district.

* * *

Successful Integration of labour and land – Implications of MGNREGS on Small and Marginal Holdings[1]

CH. Ravi Kumar[2]

Finding integration and balance between demand for agriculture labour and work and wage needs of the agriculture workers without much conflict was one of Dr. Sanghi's interests, in line with his approach of exploring middle path in every aspect. I always admired Dr. Sanghi's patience and persistence in hearing views of others and in his attempts towards moderation. My paper argues that MGNREGA achieved that integration between land and labour perfectly for those who have some land and who are also the workers and not so perfectly for the non-working landed class and working landless class.

Mahatma Gandhi National Rural Employment Guarantee Act was enacted in 2005 with the main

1. *This is the modified version of the paper submitted for a National Seminar on Agriculture Risk Management jointly organised by CGG and NIRD, Hyderabad in January, 2014.*
2. *Advocate, Flat No. 102, Shankar Nivas, 2-2-23/41, DD Colony, Bagh Amberpet, Hyderabad - 500 013, Email: raviuls@gmail.com*

objective of enhancement of livelihood security of the households in rural areas of the country by providing at least one hundred days of guaranteed wage employment in a financial year at the notified wage rates to every household whose adult members volunteer to do unskilled manual work. Creation of durable assets and strengthening the livelihood resource base of rural poor is also stated as an important objective of the scheme (MRD, 2006). The uniqueness of this Act is its self-targeting nature and providing work as a right, unlike earlier Food for Work or other Rural Employment programs. It does not exclude any household or person on the basis of caste or class.

Mahatma Gandhi Rural Employment Guarantee Scheme formulated by respective states under the Act basically provides a scope to fill the employment and income gap for vast majority of agriculture workers and small and marginal farmers in rural areas as agriculture and other sectors in rural areas are not able to absorb total rural work force adequately. The scheme, with its huge magnitude in terms of expenditure to the tune of around 400 billion rupees and coverage of around 80 million persons annually, has also generated a wide ranging debate on issues like corruption, utility of the assets created, implementation difficulties of a large scale demand based program, increase in wage rates etc. Perhaps the most controversial and important debate around the Scheme in recent times has been around altered conditions of demand and supply of labour in rural areas, particularly for agriculture.

This paper is based on compilation and analysis of information, data, observations, opinions and case examples from multiple sources. The experience of long years of continuous engagement with the scheme as well as stakeholders at multiple levels also contributed to the analysis and conclusions.

Primary data related to profiling of job card holders was used from four selected villages in four districts i.e. Tamarapally in Visakhapatnam, K.N. Palem in Anantapur, Chowderpally in Mahabubnagar, Devennapet in Warangal district. Perceptions and process of change were captured through focussed group discussions with landless workers, small and marginal farmers and other stakeholders from four selected villages, i.e. Thotavada of Srikakulam district, Tamarapally, K.N.Palem and Chowderpally villages. Household level impact documentation was made from interactions with several households from various places, of which a few selected case examples are presented.

In addition, secondary literature consisting of official data sources like progress reports of the scheme maintained by the Rural Development Department of

erstwhile Andhra Pradesh up to December 2013, Population census, 2001 and 2011, Agriculture census 2010-11, various research studies, articles and published case studies of the households were used.

Through the above sources, this paper presents the overview of the implementation of the scheme in erstwhile A.P, dominant discourse and criticism on the scheme, profile of small and marginal holdings and limitations in the categorisation. It also discusses the extent of participation of small and marginal land holding families in MGNREGS, its implications on their wage income and lands and how it contributed to transition in their livelihoods. Finally it argues for looking at the contribution of MGNREGS and the way forward to strengthen the farming from small and marginal land holders and landless agriculture workers perspective.

Overview of Mahatma Gandhi NREGS

Erstwhile Andhra Pradesh was perceived as one of the best performers in the country in MGNREGS with its unique implementation arrangements (Dreze, 2008 and Khera, 2011). The salient features of implementation systems were: **an extensive and innovative use of information technology, a Rural Standard Schedule of Rates (RSSR)** based on work-time motion studies, **Institutionalisation of an independent and regular social audit process**, **Specific payment process schedule and compensation system** for delayed wages, **Automatic payment of unemployment allowance** to the workers in cases of failure to provide wage employment within 15 days of work application, **Promotion of organisation of workers** in the form of **Shrama Sakthi Sanghas (SSS), Partnership with Civil Society Organisations** in organising and strengthening the Shrama Sakthi Sanghas as well as building independent review and feedback mechanisms. Several other innovative efforts were also made from time to time in terms of building convergence with various other departments and in introducing new technologies like e-musters, mobile technology etc.

The Scheme has been in implementation in 69071 habitations of 21862 panchayats in 1098 mandals of 22 districts in the undivided State. Out of around 25 million registered workers belonging to 13.5 million households, 18.9 million individuals (around 75 percent) of 9.4 million households accessed wage employment in MGNREGS, since the inception of the scheme in 2006. These figures indicate the coverage of most of the agriculture workers, whose number stands at around 17 million in the state as per 2011 census as well as significant number of cultivators or other categories of workers in the rural areas.

Dominant Discourse and Criticism on MGNREGS

There is a wide ranged criticism of MGNREGS from several quarters like 'farmers' organisations dominated by medium and large land holders, most of the elected public representatives etc. This criticism is magnified by the media shaping to a large extent the general public opinion as well.

The prominent among the accusations is that MGNEGS has led to an increase in wage rates in agriculture and shortage of farm workers which further resulted in increase in production costs and made farming difficult and unviable. They argue and complain that MGNREGS has emerged as an alternative to employment in agriculture and the assets created under the scheme are not much useful for agriculture or 'farmers' and are of low quality. The funds being spent under the scheme are wastage of resources. Further, they lament that MGNREGS has made agriculture workers lazy and un-productive.

Based on these arguments, there are demands to stop the scheme during agriculture seasons or link with regular agriculture operations like sowing, weeding and harvesting that provide labour subsidy to farmers and make the work force readily available to them. Political leadership of the then State government also agreed with the above contentions and recommended these changes in the scheme to the Central government.

The above criticism stems from the established power relations and popular perception of a 'farmer'. Certain socio-economic and gender criteria are fixed in popular perception or discourse about being a 'farmer', i.e. predominantly of dominant castes, owning above small holding, preferably irrigated, growing paddy or other high value crops and essentially a male person. In reality that 'farmer' may have nothing to do with actual cultivation, except holding the land on 'his' name with rentier and marketing interests. This is supported by the fact that *in some of the regions of the undivided state, tenants constitute about 75% of the farmers and it is the absentee land owners who are entitled to institutional credit and any other form of support that the state provides* (Vakulabharanam, 2011).

This paper through the established impacts of the scheme on small and marginal holding families and their agriculture, challenges the above criticism and popular perceptions.

Overview of Small And Marginal Holdings

As per the Agriculture Census, 2010-11, in the undivided A.P there were 8.5 million marginal holdings with an extent of around 3.7 million hectares. Marginal holdings constituted 65 percent in number and 26 percent in extent. Small holdings were around three million with an extent of around 4.1 million hectares, constituting 22 percent in number and 29 percent in area. Average sizes of the holdings in marginal and small categories are 0.43 Ha and 1.4 Ha respectively which indicates that many holdings are towards lower size within the two categories. Small and marginal holdings by women are three million with around 2 million hectares in the category of small and marginal holdings. Number of holdings by women is relatively higher in small and marginal category (23 and 27 percent respectively as against 15-20 percentages in other holdings).

There are two main limitations regarding the data of land holdings from Agriculture census. One is that the operational holding is not based on ownership but on the responsibility for the direct management of the land and can also include tenancy. The other limitation is regarding the extent of actual cultivation under a holding. Operated area includes both cultivated and uncultivated area of a holding, provided part of it is put to agricultural production during the reference period. Many of the small and marginal holders have left majority or total extent of their land fallow, owing to investment needs or distress migration, but in the records it is being shown as under cultivation to obtain bank loans and other purposes. In that case the actual cultivated area would be less than the operational area. It has implications for understanding dependence of the operational holder or cultivator on the reported operational area.

The high disparity between the total operational holdings (around 13 million) of Agricultural Census and number of cultivators from general Census (around 6.5 million) brings out the limitation of agriculture census. The high number of agriculture worker population, i.e. 17 million also indicates that for majority of small and marginal holders, agriculture wage work is the major occupation. This is true particularly of SC and ST communities, where 94% of their holdings fall under small and marginal categories.

From the above categories and the limitations in their counting, it can be understood that all agriculture workers are not completely landless, all land holders are not farmers or cultivators and all farmers or cultivators are not land holders. The focus of this paper is on those ever increasing small and marginal farmers cum land holders who are unable to secure all the family livelihood

needs from their land holding or agriculture and are compelled to do wage labour on other's lands or other places.

Particpation of Small and Marginal Land Holding Families in MGNREGS

The design of the scheme is most suited for agriculture workers with small and marginal holdings, particularly of rainfed areas. The integration of land and labour happens perfectly in their case. The scheme addresses their constraints of lack of adequate work within the village and lack of capital investment for development and short term cash needs for cultivation of lands. Small and marginal holding families are in a better position than completely landless families to take this risk of banking on an un-reliable employment opportunity provided by the scheme. As a result, the participation of small and marginal land holding families is generally higher than landless agriculture workers.

The analysis of profile of job card holders and the participation status in MGNREGS in two successive years of selected four sample villages (Table 1) illustrates this point. Less than 10 percent to a maximum of 40 percent of the job card holders in these villages are landless. However, the number of households reported as working for wage in agriculture range from 50 to 100 percent. This shows that majority of the job card holders are land holders and depend on agriculture wage labour as well, for their livelihood. The participation percentage in MGNREGS is higher in the villages where the number of landless households is less and the number of land holding job card holders is high, which shows the better access of wage employment by small and marginal land holding families.

Table 1: Profile and participation of households in MGNREGS in study villages

S.N	Village	Total job card holders	Absolute landless	HHs worked in 2011-12	Total HHs worked in 2012-13	Average Participation range	HHs working as AW
1	Devannapet, Warangal	735	321	324	412	45 – 55%	728
2	Tamarapalle, Visakhapatnam	83	3	75-80		90%	83
3	Chowderpally, Mahabubnagar	398	46	171	153	40 -45%	197
4	K.N. Palem, Anantapur	175	15	130	139	70-80%	155
	Total	**1391**	**385**				**1163**

All the above four villages are in rainfed areas, with Devannapet and Chowderpally having relatively higher proportion of borewell irrigation. The additional reasons for low participation in Devannapet are being in proximity to Warangal town and relatively limited scope for taking up works. For Chowderpally it is due to delayed payments and ineffective implementation of MGNREGS in those years. In case of K.N. Palem, the average days of work per household are more than 90 and around 60 percent of the households worked for more than 100 days which is much higher than state average. Alternative wage employment opportunities are limited in this village and significant extent of agriculture lands are left fallow owing to erratic and low rainfall, lack of irrigation facilities, groundnut cultivation becoming unremunerative etc. Tamarapalle is a total Scheduled Tribe hamlet with rainfed and seasonal agriculture and all most all the households having land and working as agriculture labour which provides an ideal scenario for the scheme to be most effective as it provides wage employment to all the households in the lean season.

The above findings are also supported by a comparison of agriculture worker population (Population Census, 2011) and number of people who accessed wage employment in the scheme (2012-13) presented in Table 2. In the districts where agriculture worker population is high combined with high landlessness and prevalence of irrigation intensive agriculture (Guntur, East Godavari, West Godavari and Krishna), the participation in MGNREGS is relatively low and in the areas with significant agriculture workers combined with large number of small and marginal holdings and rainfed agriculture (Mahabubnagar, Nalgonda, Prakasam and Anantapur), the participation in MGNREGS is relatively high.

Table 2: Comparison of agriculture worker population with participation in MGNREGS

S.N	District	Agriculture worker (AW) population, 2001 *	Individuals worked in NREGS 2012-13 **	Rank in AW population	Rank in MGNREGS participation	Difference in ranks
1	Guntur	1073447	340840	1	17	16
2	East Godavari	985980	482614	2	13	11
3	West Godavari	951723	317191	3	18	15
4	Krishna	877277	381950	4	16	12
5	Kurnool	802585	582777	5	6	1
6	Mahabubnagar	779467	633670	6	3	-3

...contd

7	Nalgonda	671241	783324	7	1	-6
8	Prakasam	673018	562519	8	7	-1
9	Anantapur	670960	528963	9	10	1
10	Chittoor	629527	304306	10	20	10

*Source: * Census, 2011, ** retrieved from www.nrega.ap.gov.in on 06.02.2014*

Impact of MGNREGS on Small and Marginal Land Holding Families and their Lands

The small and marginal land holders are able to secure benefit of more than one lakh rupees in the form of investment in addition to the maximum wage income of Rs. 15,000. Further, given their asset profile, this benefit triggers a wider chain reaction enabling the household to move to the next level in the livelihoods ladder. This can be captured from the experiences shared by a group of small and marginal farmers of SC community of Chowderpally village:

> '*The present means of our livelihood are agriculture in own lands, wage employment in MGNREGS and in others farms in that order of priority. The importance of MGNREGS is that it provides cash income in significant amounts periodically and at crucial times to use for farm investments for Kharif season. We get 2000-3000 rupees at once in contrast to small amounts of 100-150 rupees of daily agriculture wage income. On an average each family is earning 7000-8000 rupees in a year from MGNREGS. As a result, the dependence on local money lender for small consumption and investment needs has reduced significantly. Because of MGNREGS, we have cut down working as agriculture labour by 50 percent and are able to spend more time on our own agriculture. Through MGNREGS an average investment of rupees 10000 to 20000 was made in our lands which helped to bring them into cultivation and improve the quality. The works that were taken up mostly are farm bunding and silt application. In this process, mutual exchange of labour has increased among small and marginal farmers, balancing the increased labour costs.*'

This signifies the transformation of majority of the workers who have land, from agriculture worker to a farmer, both materially and psychologically, even in a village with below average level of implementation of the scheme. This is further highlighted by the observations shared by the Field Assistant cum small

farmer and others of K.N Palem village, Anantapur district, in which the performance of MGNREGS is good:

> '*Families with 1 to 2 acres of agriculture land and 2 to 3 working persons benefitted considerably from the scheme. Marginal farmers, mostly SCs and BCs are able to retain their land with the support of NREGS. Farm produce coupled with rice and other groceries from Public Distribution System provides for food security and the income from MGNREGS caters partly to the cash needs. Over the last 7-8 years, living standards of agriculture worker households has increased in terms of housing, household consumer goods, education to their children and assets like livestock etc.*'

According to the villagers of Tamarapally, a small tribal hamlet in Chintapally mandal of Visakhapatnam district:

> '*each family is able to earn on an average between Rs. 10,000 – 15,000 per year. The works implemented under MGNREGS are land levelling, stone bunding, farm bunds, trenches, check dams, mini percolation tanks etc. In some instances families benefitted from MGNREGS with investments up to Rs. 40,000. As more than 95 percent of the families have land and participate in MGNREGS as workers, almost all the families have benefitted both ways. After MGNREGS, some of the small and medium land holders have reduced working as wage labour in agriculture as their nominal cash needs are being met by MGNREGS income.*'

Apart from the above observations from the selected villages, various other studies also confirm that MGNREGS has contributed to improvement of land, water and agriculture as well as reducing indebtedness.

In a field based study, 90 percentage of respondents in Mahabubnagar district, who are also landholders, felt that MGNREGS is a complementary scheme that benefits the poor and helps in mitigating the risks that the farmers face during droughts (KPMG, 2011).

A recent study by the Indian Institute of Science, Bangalore in four States found that MGNREGS works have increased the area irrigated, soil fertility and contributed to an increase in crop yields in the range of 46 per cent to 100 per cent across the study districts. Further, due to land development under MGNREGS, previously uncultivable land has now been brought under

cultivation. In Medak district of Andhra Pradesh, the increase has been estimated to be by as much as 10-15 per cent. It also found reduction in vulnerability indices of water, agriculture and livelihood (Indian Institute of Science, 2013).

As per the study conducted in 6 States by Sambodhi, a research organisation, almost 85 per cent of the farmers have reported an improvement in land quality after the creation of MGNREGS assets. In the study sample, 11 per cent and 12 per cent of beneficiaries have also started horticulture and sowing of additional crops on their land (Ramesh. J, 2013). According to a study in Tribal areas of erstwhile AP, debt for consumption by households decreased 76 to 85 percent (Council for Social Development, 2010).

The expenditure details and works profile of MGNREGS establishes that small and marginal farmers have accessed a major share of investments, directly or indirectly, for their own land development and strengthening of agriculture. The government has taken up lands assigned to the poor and other SC and ST lands as a priority for development in addition to small and marginal holdings of other social groups. All the assigned lands come under small and marginal holding category, which constitute around five million acres in A.P. For individual land development projects alone, investments of around 42.8 billion rupees were made for around 2.9 million acres of fallow lands and around 22.45 billion rupees made for improving the productivity of around 2.1 million acres of land under cultivation. This is apart from the investments on horticulture, water resources development etc. The average investment for fallow lands is around Rs.15,000 per acre and for cultivable lands, it is around Rs. 10,000 per acre. In some cases expenditure of over one lakh rupees per acre has been incurred, particularly for raising horticulture plantations and bringing fallow lands into cultivation. Development of individual fallow land and land under cultivation together constitute around 25% of the total expenditure on works. Other major expenditure is related to development of water resources, common lands and other works which also contribute to increasing productivity of the farm lands, which together constitute around 75 percent in value and in number of the total works and expenditure.

Numerous case examples documented by the Department of Rural Development along with other studies show positive impacts of the scheme on lakhs of small and marginal holding households in the State, even as the dominant sections refuse to recognise them as farmers, their agriculture as farming and the positive impact of the scheme on their farming. The case example (See Box: NREGS

NREGS provides a choice and dignity

Kodi Bheemamma is a 50 year old woman belonging to BC community. She lives in Chowderpally village, Bomraspet mandal, Mahabubnagar district with her husband, two sons, two daughters-in-law and three grand children. Though the extended family contains three nuclear families with six workers, they have only two NREGS job cards. They have two acres of own land and have taken 1 ½ acres on lease on equal cost and profit sharing.

Bheemamma and her husband mostly work in MGNREGS and do not go much for outside work as they are not in a situation to work hard now and not much in need. Her sons and daughters-in-law go for agriculture wage labour besides participating in MGNREGS. Through MGNREGS they are getting an annual wage income of Rs. 15,000 to 30,000 in regular intervals and they are able to spend more on health and education. She also bought one buffalo and now they have a calf. Through NREGS they developed their lands by taking up bunding and silt application for which they have also received wages and are registered for teak plantations and have dug pits.

She felt that their social status enhanced after MGNREGS and the nature of relations with other dominant castes and land owners changed: '*Earlier we were forced to work for big farmers. Now we have the power to choose. If MGNREGS is stopped we have to again migrate out and these gains will be lost for the majority in the village.*'

To build on the gains from MGNREGS, she suggests that uncultivated lands need to be further brought into cultivation and productivity of the cultivated lands to be increased with further investments on manure, soil and moisture conservation etc. They need irrigation facility and support for raising horticultural crops. In addition, availability of non-exploitative credit through institutional sources is necessary according to her, for agriculture as well as taking up other livelihood activities.

provides a choice and dignity) provides an illustration of the profile of wage work and agriculture of a marginal land holding family and a women farmer's perception of the scheme and its impact on their agriculture as well as socio-economic status.

Agriculture and MGNREGS Work – Complementary than Competing

A major criticism against the scheme is that works are being taken up during agriculture season, creating a situation of competition and multiple choices for farm workers. Program related progress data and various research studies show

that MGNREGS works are barely taken up during peak agriculture work periods, as 80-90 percentage of total work days are generated in lean agriculture seasons.

According to a study, 67 percent reported that it provided employment security when no other work was available while 12 percent felt that it increased their household income as additional members got employment (Ravi and Engler, 2009). Another field based study reveals that 87 percent of land holding respondents in Kurnool district felt that MGNREGS is a complementary scheme that benefits the poor by having a regularity of employment during non agriculture seasons (KPMG, 2012). MGNREGS does not provide a real alternative to wage labour in agriculture for landless workers to completely withdraw from the labour market, particularly when the number of days of employment under MGNREGS is restricted to 100. It provides an alternative and acts as complementary source of income and work for small and marginal farmer cum workers, as observed from the focus group discussion with a mixed group of landless labourers and farmers of various categories in Thotavada village of Srikakulam district.

The SC landless workers said they need both agriculture work and MGNREGS. But at times, particularly during October-November and December-January they do not get either. Most of the small and marginal farmers, particularly of BC community are engaged on their own farms during those periods. When MGNREGS works are opened, they also report to work in a big way along with the landless workers. As a result, work gets completed quickly and the landless workers are again left without any work until a new work is started under the Scheme.

Another major critique against MGNREGS is that it has led to increase in wage rates thus leading to escalation in input costs. Evidence from the field indicates that this is not true. Often, the critics account the increased wages totally to MGNREGS, ignoring the aspects of inflation and proportionate increase in wages or income in other sectors. It is true that MGNREGS has increased the bargaining capacity of the agriculture workers and it has helped them to enhance their wages to the extent of statutory wages which were not paid for several decades. However, it is only one factor among several factors that have contributed to increase in wages (Binswanger-Mkhize, 2013) as well as increase in production costs in agriculture (Murthy and Mishra, 2011).

Another study underscores this by pointing out that "*resting the responsibility of increasing agricultural wages solely on shortage of hired agricultural labour caused by MGNREGA may be an overstatement since agricultural productivity conditions too have not remained static over time,"* (Mahajan, 2012). Similarly, another study by Gulati *et al*, indicates that '*from 1995 to 2005, growth rate of wage rates is negligible; some of the states in some work types registered even negative growth. But from 2005 to 2012 the growth rates are positive and for many types of works it is higher than five percent,"* (Gulati, Jain and Satija, 2013). In this study, while attributing labour scarcity to MGNREGS, authors attribute the rise in wages more to the pull factors like increase in construction activity etc., than MGNREGS, which seems contradictory. In the absence of MGNREGS, the prolonged stagnation and negative growth rate in rural wages would have caused large scale distress and starvation, forcing majority of small and marginal land holders to abandon their farm lands, becoming foot loose and surplus labourers. This would have caused further drop in wages, below statutory minimum wages leading to forced labour and inequalities in the society.

Conclusion and Recommendations

The central arguments presented in this paper are that the participation of small and marginal farmers, particularly in rainfed agriculture areas is high in MGNREGS than the landless agriculture workers, given the perfect match between the design of the scheme and their needs and aspirations. The paper also argues that a major part of investments from the scheme have also been made directly or indirectly for the benefit of small and marginal farm holdings. The combined impact of wages and investments on this category is quite high as compared to other sections, and this has led to an upward shift towards own-account cultivation and enhancement of their income and asset base. This near perfect integration of land and labour has also contributed to sustainability and profitability of small and marginal holdings. The paper therefore counters the contention that MGNREGS is harming the interests of the 'farmers' and the farming sector and calls for a critical re-examination of the stereotyped notions of 'farmer' and 'labourer'.

While the shortage of labour supply in agriculture cannot be denied altogether, it varies across various categories of land holdings and regions depending on factors such as availability of family labour for agriculture and alternative non-farm employment, cropping pattern, productivity of the lands, agro climatic

and other structural factors. The solutions to this problem majorly lie outside the realm of MGNREGS, if the principles of equity and non-discrimination are to be followed. To address the labour shortage issue for small to medium land holding farmers appropriate mechanisation that improves the productivity and reduces the drudgery of workers, various collective approaches to crop planning and farm work within a village are to be explored.

The wage rates in agriculture appear 'high' though they are around statutory minimum wage rate, given the stagnation in overall scale of economics of many crops and high disparities in terms of productivity and overall profitability among various crops. This disparity is because of variations among different crops in research, infrastructure and procurement support, availability and kind of irrigation, cost of various other inputs including credit etc. There is a need to minimise the above disparities to address the crisis in agriculture comprehensively, rather than finding both problem and solution within MGNREGS.

Providing labour subsidy to agriculture through MGNREGS may additionally benefit small and marginal farmers to an extent, but will be detrimental to the landless agriculture workers and will hinder any further progressive transformation of these classes. Further, much of the MGNREGS funds will be diverted and spent on the lands of well to do and non-farm dependant and even absentee land owners, similar to what is happening now in the horticulture program, even though it is restricted technically to small and marginal holdings category.

Agriculture if perceived as a sustainable livelihood option that provides self-employment, dignity and food security to a majority and as a holistic process involving livestock, fisheries, poultry, value addition at village level etc. Governments should adopt a different set of strategies and policy interventions. Implementation of land reform measures; reducing the number of absentee or non-farm income secure land owners and their extent and improving the conditions of tenancy in favour of the tenants are one set of strategies to bring in more rural families under the impact range of MGNREGS. Increasing investments in agriculture, particularly in rainfed areas, promoting low external input and sustainable agriculture practices, ensuring institutional credit, timely and appropriate extension services, adequate cover for crop failure, encouraging processing for value addition at village level, promoting collective initiatives, encouraging diversification of livelihoods etc., with a focus on small and

marginal land holdings are another set of strategies that strengthen the farming and livelihoods of the majority.

References

Ashok Gulati, S. J. (2013). *Rising Farm Wages in India - The 'Pull' and 'Push' Factors*. Ministry of Agriculture, Government of India, Department of Agriculture and Cooperation. New Delhi: Commission for Agricultural Costs and Prices.

Binswanger-Mkhize, H. P. (2013, June). The Stunted Structural Transformation of the Indian Economy - Agriculture, Manufacturing and the Rural Non-Farm Sector. *Economic and Political Weekly, xlviII*(26 & 27), 5-13.

Council for Social Development. (2010). *Socio-Economic Impacts of Implementation of Mahatma Gandhi NREGA in Tribal regions of Chattisgarh, Orissa, Jharkhand and Andhra Pradesh*. Commissioned study, Ministry of Rural Development, Government of India, New Delhi.

Department of Rural Development, Government of Andhra Pradesh. (n.d.). *State Level Consolidated Reports*. Retrieved December, January, February 2013, 2014, from The Mahatma Gandhi Rural Employment Gurantee Scheme - AP: http://www.nrega.ap.gov.in/reports

Department of Rural Developm ent, Government of Andhra Pradesh. (n.d.). *Gender Wise Work and Wage Earning Analysis*. Retrieved on February 7, 2014, from http://www.nrega.ap.gov.in/Nregs/FrontServlet?requestType=Gender_engRH&actionVal=view&page=state&year=2012

Dreze, Jean, Reetika Khera, and Siddhartha (2008): Corruption in NREGA: Myths and Reality, The Hindu, January 22, 2008

Indian Institute of Science. (2013). *Environmental Benefits and Vulnerability Reduction through MGNREGS*. Bengaluru: Indian Institute of Science.

INDIA: Basic Income Pilot Project releases an impressive list of findings. (2013, August 19). Retrieved from Basic income news: http://binews.org/2013/08/india-basic-income-pilot-project-releases-an-impressive-list-of-findings

Khera. R. (Ed.) (2011). *The Battle for Employment Guarantee*, New Delhi: Oxford University Press, India.

KPMG. (2012). *Impact of MGNREGS wage employment programme on the agricultural farmers in Andhra Pradesh*. Hyderabad: Department of Rural Development, Government of Andhra Pradesh.

Mahajan, K. (2012, November 5) *Agriculture wages and NREGA: Exploring the Myth.* Retrieved December 1, 2013, from http://www.livemint.com/Opinion/tv3TkQeVfEpOia7eeVENfJ/ Agricult...

MRD, Ministry of Rural Development (2006): The National Rural Employment Guarantee Act

2005 (NREGA): Operational Guidelines 2006, 2nd Edition, Delhi: MRD.

MRD, Ministry of Rural Development (2014 b): *Mahatma Gandhi NREGA at a Glance,* retrieved February 7, 2014, from http://www.nrega.nic.in/netnrega/home.aspx

R. V Ramana Murthy, R. M. (2012). *Pricing of Paddy: A Case study of Andhra Pradesh.* DRG Studies Series, Reserve Bank of India, Department of Economic and Policy Research, Mumbai.

Ramesh, J. (2013, May 14) *Rising farm wages will lift all boats.* Retrieved May 17, 2013, from http://www.thehindu.com/opinion/op-ed/rising-farm-wages-will-lift-all-boats/article4712302.ece

Shamika. R, Monika. E. (2009) *Workfare in Low Income Countries: An Effective Way to Fight*

Poverty? The Case of India's NREGS

Vamsi Vakulabharanam, N. P. et.al., (2011). Understanding the Andhra Crop Holiday Movement. *Economic and Political Weekly , xlvi* (50), 13-16.

100 DAYS 100 HOPES. (2013). Hyderabad: Commissioner, Department of Rural Development, Government of Andhra Pradesh.

* * *

NAND KISHORE SANGHI
15/01/1944 - 02/03/2015

Studies

B.Sc. (Ag.) from Agra, 1962
M.Sc. (Ag.) in Botany and Genetics from Agra, 1964
Ph.D (Plant Breeding and Genetics) from IARI, Delhi, 1970

Areas of Contribution

Watershed Support Services and Activities Network (WASSAN), Secunderabad, Advisor, since February 2004

Roles and Responsibilities:

- Improving the quality of involvement of the NGOs associated with watershed programme in Andhra Pradesh
- Facilitation of action research on the following aspects under watershed programme in Andhra Pradesh
  - *Capacity building of women SHGs federation (at mandal level) to work as a PIA*
  - *Institutionalization of participatory processes particularly at field level*
  - *Application of project management principles for all components under watershed programme*
  - *Application of information technology (IT) at Watershed Committee / PIA levels*
- Facilitation of policy reform through refinement of guidelines of watershed programme and development of step by step approach for NRM and watershed programme
- Steering the field study (sponsored by India-Canada Environment Facility) for understanding the processes under the ongoing watershed programmes in 7 states of the country

National Institute of Agricultural Extension Management (MANAGE), Hyderabad, Director (Renewable Natural Resources)- From June 1995 to January 2004

Roles and Responsibilities:

- Member of the working groups responsible for preparation of operational manuals for watershed programme funded by Ministry of Rural Development, Government of India and for formulation of revised guidelines for watershed programme funded by Ministry of Agriculture (NWDPRA), Government of India.
    - *Carried out action research on participatory watershed management by being a PIA in Ranga Reddy district, Andhra Pradesh*
    - *Facilitated participatory approach under various foreign funded watershed projects. These included KAWAD (DFID), APRLP (DFID), KANDI area development project (World Bank), KWDP (DANIDA), SDC Supported Watershed Project in Karnataka, etc.*
    - *Coordinated the field study on Institutionalization of participation in NRM funded by IIED, United Kingdom and Development Alliance, New Delhi*
    - *Carried out a consultancy assignment on Participatory monitoring and evaluation (PME) for APRLP*
    - *Organized a series of training courses for senior to middle level officers associated with NWDPRA in different states of the country*

Zonal Coordination Unit for ToT projects, Hyderabad, Zonal Coordinator - From April 1985 to May 1995

Roles and Responsibilities:

Coordinated the activity of farm sciences centers (KVKs) associated with State Agricultural University, Indian Council of Agricultural Research and voluntary organizations with special emphasis on linking them with main system of research and extension in Andhra Pradesh and Maharashtra.

- Promoted farmer participatory research and extension on the followings:
    - *Management of pests through non-pesticidal methods*
    - *Management of watershed programme through participatory approach*
- Facilitated linkage between NGO and GOs in Andhra Pradesh with particular reference to management of those technologies where group action is a pre-requisite.

All India Coordinated Research Project for Dryland Agriculture, Hyderabad, Scientist S-3 (Plant Breeding) - From July 1977 to March 1985

Roles and Responsibilities:

Carried out on-farm-research on crop management and natural resource management in red soil of Telangana region, Andhra Pradesh

- Studied indigenous technologies for management of crops and natural resources
- Facilitated participatory approach in model watershed programme implemented by ICAR / CRIDA

All India Coordinated Research Project for Dryland Agriculture, Hyderabad, Scientist S-2 - From June 1971 to June 1977

Roles and Responsibilities:
Conducted field trials on new varieties / hybrids of rainfed crops at research station as well as in farmers fields

Ford Foundation, Delhi, Program Associate - From June 1969 to June 1971

Roles and Responsibilities:
Carried out field trials on wheat at HAU, Hissar (as a part of the programme)

Rockfeller Foundation, Delhi, Research Associate - From July 1964 to September 1964

Roles and Responsibilities:
Assisted in the ongoing programme on sorghum improvement

Published work

a)	No. of books (chapters in books)	:	4
b)	No. of Reports / Reviews	:	20
c)	Research papers presented in Conferences / Symposium / Seminar	:	46
d)	Technical articles (list enclosed)	:	6

* * *

In Memory of Dr. N. K. Sanghi

Knowledge for Change

One quality of Dr. Sanghi was his painstakingly interpreting someone else's viewpoint constructively. In the kind of work he was doing, Sanghi had to relate to various levels of understanding and articulation, and it would have been easy to be dismissive of some as being devoid of merit. He would weave sense in what he heard and ask the person for affirmation of his interpretation: "perhaps this is what you meant?"

- M. V. Sastri

Inspite of being a scientist Dr. Sanghi had a deep faith in the knowledge and practices of humble peasants and their capacity for group action.

- P. V. Satheesh

The late Dr. Sanghi spent a great part of his working life tackling the processes as might help communities of the poor to survive in resource-poor, drought-prone and environmentally degraded areas.

- Vithal Rajan

Dr. Sanghi's interactions with Self Help Groups at the community level made him a staunch believer in the capacity of women not only to take up thrift and credit activities but also successful agriculture development.

- V. Rukmini Rao

Dr. Sanghi was deeply committed to making RMG as a movement to cover all the small & marginal farmers and tenant farmers, passionate about it, very open to learn other experiences and above all a wonderful human being.

- C. S. Reddy

Dr. Sanghi was one of those few scientists of his generation who despite being part of the rigid and hierarchical agricultural establishment, had in their own work pushed the boundaries by constantly seeking to engage with knowledge, irrespective of whether it emerged from within or outside the establishment.

- C. Shambu Prasad

Dr. Sanghi's interest was in the overall development of the rainfed farmer. His main concern was to enthuse the farmers to adopt new techniques but with less dependence on external inputs, particularly fertilisers. His concern equally was on the health of the soil.

- J. Venkateswarlu

Dr. Sanghi was one of the few who had a focus on people rather than programmes; and a flair for traditional wisdom and indigenous knowledge systems. He emphasized on rebuilding environmental resources to be people centric and sustainable.

- Y. V. Malla Reddy

WASSAN FOUNDATION
Wassan Group of Institutions

PERMANENT GREEN
An Imprint of
Manchi Pustakam

ISBN 978-93-83936-28-1