Participatory Watershed Management in South Asia: A Comparative Evaluation with Special References to India

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ABSTRACT— The paper discusses different approaches of watershed management programs implemented in South Asia, with special reference to India, based on existing literature and field experiences. Watershed degradation, particularly in hilly areas as well as water deficiency in draught prone areas due to lack of proper watershed development programmes, is critical Problem in India. A participatory approach has been adopted in watershed management during the last decade in many developing countries. Participatory Watershed management is meant for growing biomass, the pipeline for prosperity of the people for bridging the gap between poverty line and per capita income. In achieving this objective, the people's part is awareness, participation and response. The state should revise the methods and methodologies as frequently as possible as long as they are appropriate and economical. Whatever may be the value of a plan, the impact of participatory watershed management depends on effectiveness of the technology in the background of needs, priorities, cultural practices and community participation.

Key words— Empow erment, watershed management, participatory approach, social mapping, prosperity.

INTRODUCTION

Watershed management is an emerging concept for the efficient use of rain run-off in the rural areas of India. The approach to watershed management is participatory in nature; people friendly, location specific, process based and geared to cater to the problems and needs of the rural communities. The principle of watershed management is the proper management of all the precipitation by way of collection, storage and efficient utilization of run-off water and use of groundwater. The re-harvesting of run-off in the study area of watershed management is achieved by managing 25% of the total rainfall and 25% of the run-off to generate crop-growing area, through four re-harvesting mechanisms such as tanks, farm ponds, contour bunds and structures such as gully plugs and surface detention in depression. (Rao Jagannatha R. et. al., 2005).

Collective action among all watershed resource users is needed to manage hydrological processes for maximum productivity of the whole watershed system. In many areas it is about flood control. In hilly, semi-arid areas of India, the focus is on water harvesting, or trapping runoff during the rainy season for later use when water is scarce. In flatter areas with less opportunity for water harvesting, it is more about concentrating soil moisture to raise rain fed agricultural productivity. Watershed projects in developing countries that focus on water harvesting and soil conservation typically state three objectives: 1) conserve and strengthen the natural resource base, 2) make agriculture and other natural resource-based activities more productive, and 3) support rural livelihoods to alleviate poverty. The first objective builds the foundation for the second, which in turn supports the third.Besides the short term effects of watershed development on rural employment, there is a widespread belief that if watershed management (WSD) programmes succeed then they will reduce the flow of migration.(2004) Migration reduction impacts seem to be more marked in intensively treated, (Jetske Bouma pers comm.)

Throughout the world and particularly in India now Watershed Development Programme has also evolved as a comprehensive development concept for sustainable and efficient utilization of natural resources for the benefit of the local community with special attention to the rural poor. The basic objective under the watershed programme ought to be that the conservation and development measures be conceived as means and the production systems compatible with the concept of ecological security as ends. "Watershed development is, thus, holistic development seeking sustainable livelihood security system for all life forms in the area. (2001)

PARTICIPATORY WATERSHED MANAGEMENT

The key to the success of any watershed project and its sustainability depends on people's participation. For achieving the desired participation of people, the roles of community organizations, groups and other stakeholders are crucial. Local people must play an active role starting from project design, moving to implementation and the project maintenance. In this context, a participatory watershed management approach is considered as the ideal for achieving food security and sustainability. (Budumuru Yoganand et. al., 2006)

People's KNOWLEDGE and SKILLS must be seen as a potentially positive contribution to the project. A participatory project should seek every possibility to base its activities upon local resources, both to avoid situations of dependence on external ones and also to help develop local capabilities, which will be important if the development is to be sustained. People's Participation must empower WOMEN: participatory development should seek

to improve gender inequalities through providing a means by which women can take part in decision making. To succeed, watershed management has to be participatory. This is one of the lessons coming out of decades of failures of centrally-planned watershed development projects through which local people have been either coerced or paid to undertake terracing, bunding, destocking and other technical measures that external experts believed would cure watershed degradation (IDB, 1995; Kerr, Sanghi and Sriramappa, 1996; Pretty and Shah, 1999; Rhoades, 1998). Thus, participation is expected to achieve what coercion and subsidies could not, namely to make watershed development more successful and sustainable.

TABLE: PARTICIPATION MEANS DIFFERENT THINGS DIFFERENT PEOPLE. (K. SURESH)

S.No	Type of participation	Peoples role
1	Passive Participation	People participate by being told what is going to happen or has already happened. It is an announcement by an administration or project management without listening to peoples response.
2	Participation in information giving	People participate by answering questions posed by researchers using questionnaires, surveys or similar approaches. People do not have the opportunity to influence the proceedings.
3	Participation by consultation	People participate by being consulted, and external agents listen to views. This does not concede any share in decision making, and professionals are under no obligation to take on board peoples views
4	Participation for material incentives	People participate by providing resources, for example labour, in turn of food, cash or other material incentives. Though this is called participation, people have no stake in prolonging activities when the incentives end.
5	Functional Participation	People participate by forming groups to meet pre determined objectives related to the project. These institutions tend to be dependent on external initiatives and facilitators, but many become self reliant.
6	Interactive Participation	People participate in joint analysis, which leads to action plans and the formation of new local institutions or the strengthening of existing ones. These groups take control over local decisions, and so people have a stake in maintaining structures and practices.
7	Self-Mobilization	People participate by taking initiatives independent of external institutions to change systems. They develop contact with external institutions for resources and technical advice they need, but retain control over how resources are used.

HISTORY

In 1994, the Ministry of Rural Development (MoRD) of the Government of India produced a set of guidelines for implementing its watershed programmes, which aimed to tackle the concerns related to the realisation of the full benefits of watershed work. This progressive policy was essentially people-centered and it incorporated good practice from NGO and government policy, such as awareness raising, bottom-up planning, partnerships with NGOs, and community participation. Since 1994-95 Ministry of rural areas and employment, government of India has spent over US $3.5 billion and implemented nearly 10000 watersheds. Currently about US $200 million is allocating annually for watershed development in India. (Budumuru Yoganand et.al, 2006)

The traditional system of natural resource use in rural communities has significantly evolved over the years. In the past, priority of watershed management was given to the Biophysical frame work of watershed which is often based on top-down approach (Rhoades et.al, 2000). However in the traditional system, local people were not often consulted in the design of top-down approach, which resulted in failure of projects in achieving the project goals. Watershed projects are more efficient and effective when users are given a role in managing their own watershed resources (Johnson et. al, 2001).

Many success stories, for example, are found in hilly, bowl-shaped micro watersheds with very favorable conditions for water harvesting. In more typical cases, benefits are incremental and gradual. With a less visible connection between investments made and benefits realized, organizational challenges become more apparent (Kerr 2002).

SOCIAL MAPPING FOR PARTICIPATORY WATERSHED MANAGEMENT

Social map is an important part of participatory mapping on different aspects of rural life such as social issues, resources, health, wealth, literacy, census, livestock, economic activity, social stratification, forms of livelihood etc. Villagers prepare the maps of their village with chalks, colours and other materials either on ground or on paper. Once the social map is prepared by the villagers, it becomes easy for them to describe locations within village in terms of roads and rivers, the characteristics and conditions of the households, the ownership of dwellings and buildings and land use patterns. In terms of poor and non-poor households in the village, social maps visually present the location of such households and their key factors. In addition, there is also scope for presenting other kinds of information regarding households such as heads of households whether a male or female, the dependency ratios ownership of assets, cattle, beneficiaries under state programmes and health characteristics, literacy of each household etc. In any village, social maps form the useful basis for identifying problems in different households, their strengths and characteristics. (Neela Mukharjee, 2003)

Mapping on the ground: This is simply done by drawing on the ground by hand with a stick, with chalk on concrete, or by using rangoli powder. Mapping on the ground is visible to several people; can generate a good deal of discussion; can contain a lot of information; it can be altered or corrected easily; can be sequentially developed if required; and can be expanded, as usually the space (ground) is unlimited. The ground map can either be a plain one or it can be coloured with rangoli or other coloured powders to indicate various subjects such as land use: dry land, irrigated land, forest land, wasteland, housing layout etc. Mapping on the ground has the disadvantage that it cannot be carried away unless it is copied on paper. (James Mascarenhas et.al.1991)

Locality mapping can be done to draw on the knowledge of local people to develop a map of the local area. This is a good way, for example, of identifying who is undertaking land conservation activities, where land degradation problems are and where improvements have been noticed. Using large sheets of butcher's paper draw the outline of the local area, for example, roads, towns, rivers and property boundaries. This can be done by projecting an overhead map onto butcher's paper and tracing the required information. Having prepared the map, which could be as large as a whole wall, people can then add their information either directly or by using sticky notes. (Wolf-Ruger Winnegge, 2006)

SOCIO-ECONOMIC CHALLENGES TO PARTICIPATORY WATERSHED MANAGEMENT

Watershed management is simultaneously a technical and social undertaking. From a socioeconomic perspective, it involves coordinating the actions of numerous land users in a watershed who may have multiple, conflicting objectives. In the 1980s watershed management was treated largely as a technical problem, but lack of attention to socioeconomic complications undermined numerous projects because people refused to go along with technical plans that conflicted with their diverse interests. Today, watershed professionals pay more attention to the socioeconomic aspects of watershed management. It is now recognized that local people need to be involved in decision-making so that they can use their land, animals and other natural resources in a productive way without causing harm to water and soil resources in the upland watershed...or downstream. Adoption of watershed provided effective re-harvesting of rain run-off in order to maximise agricultural production. It provided for effective water management plan with approved practices and design. In this regard, quantity and costs of soil and water conservation measures with specific location were estimated. It contributed to a significant change in land use by covering more area under cultivation. The adoption of dry farming technology has shifted cropping patterns to hybrid and commercial varieties. Promotion of animal husbandry activities resulted in providing subsidiary occupation for communities. The participatory approach in watershed management has some limitations, with the majority of the farming community not thinking beyond the limits of village jurisdiction. This, to some extent, hinders the cooperative and collaborative process across the villages. The financial resources are limited in order to bring in more allied activities. However, investments in water resource development can be justified only when they contribute to greater efficiency in production. In conclusion watershed is a concept of integrated approach for rural development. It also provides for efficient use of scarce water resources, in order to act as life security for rural communities so that an overall development of an area is achieved. (R. Jagannatha Rao)

One of the biggest challenges to watershed management is that its costs and benefits are distributed unevenly, yet cooperation is required to make it work. Uneven impacts result from spatial variation and multiple, conflicting uses of natural resources. The conflict between using upper watersheds for grazing and protecting them for regeneration to support downstream irrigation is a good example. If the benefits are large and quickly maturing, those who lose in the short term may be willing to wait for gains, and devising mechanisms to diffuse costs may be manageable. But this is more difficult in the majority of cases where benefits are gradual and incremental. Even in

higher rainfall areas of India vegetative regeneration takes about three years – too long to ask poor people to refrain from using resources they need. (John Kerr)

TECHNICAL CHALLENGES TO SUCCESSFUL PARTICIPATORY WATERSHED MANAGEMENT

From a technical perspective, PWM involves reducing soil erosion, promoting vegetative cover, and harnessing rainwater resources. Watershed development prevents both surface runoff and groundwater from moving naturally downstream. It suggests two perverse project outcomes: first, what is good for one micro watershed can be bad for others downstream, and second, what is good for a watershed in the short term can be bad in the long term. Recent literature presents additional cases detailing inaccurate understanding of technical relationships in watersheds. One example is faulty assumptions regarding the role of trees in watershed hydrology. All over India and elsewhere, trees are planted in watershed projects with the stated objective of promoting groundwater recharge. A motto of the Tamil Nadu Forest Department is 'Save Trees to Save Water.' However, most trees have precisely the opposite function because they are net consumers of water (Calder 2002). More recent evidence shows that due to filters in the landscape, most eroding soil simply moves from one part of a watershed to another (e.g. Swallow et al. 2001). Some farmers actually benefit from soil erosion through silt deposition on their land and even actively encourage erosion to move soil to where it can be most productive (Chambers 1990).

To ensure optimum and sustained productivity through scientific planning, the watershed needs a decision-making information system that involves an appraisal of agro-ecological characteristics, resource limitations and potential of the watershed for resource development. This complete information helps in generating an information system for watershed management, a 'Watershed Management Information Systems (WATMIS)'. The development of a WATMIS in the context of local needs and problems, population and infrastructure leads to computation of resource surpluses and shortfalls at the present level of food/fuel demand and supply. Future demands for sustainable development of the watershed can then be formulated based on which thrust areas in each sector (or sub watershed?), can be identified. One of the objectives of the watershed programme is ensure drinking water security in the watershed villages. One of the major findings suggests that in the watershed villages drinking water security has not been given adequate priority in the watershed planning and implementation. The founding and recommendations of the study led to modifications of the watershed guidelines of Ministry of rural development. A methodology has been developed to monitor runoff and soil erosion from watersheds under different land use. A computer program enables comparative evaluation of hydrologic phenomenon for different storm events, and for different watersheds. The preliminary results obtained indicate that soil erosion and runoff are influenced by hydrologic characteristics of the soil. For example, high vertical drainage of soils in watershed C is the reason for low surface runoff. Consequently, the soil erosion from watershed C is also low. On the contrary slowly permeable subsoil characteristics of watersheds A and B is responsible for 60 to 70 per cent runoff coefficient for intense rainstorms and for high erosion of about 1 t ha-' yr-' . Small soil erosion under forest cover is attributed to the protective effects of vegetation cover, and to the binding effects of roots and leaf litter. (Roche et.al 1981)

In some parts of the North Bengal Terai river floods have deposited large quantities of coarse sand and distorted drainage patterns in the process. Such sand-laden areas are regenerated with a series of measures that retain sheet flows and allow cultivation. Because of this soil profiles will slowly built-up and over a period of 5-8 years soil fertility will restore. (N.Mahapatra)

EVOLUTION OF INDIAN WATERSHED PROJECTS

Indian watershed projects began in the 1970s and 1980s with a highly technocratic approach that failed to recognize the need to address the challenges of watershed governance. Since about 1990 projects have taken a more participatory approach that focuses more on social organization, but success remains elusive. Early large-scale projects in the 1980s included the World Bank-supported Pilot Project on Watershed Development and the Model Watershed Program of the Indian Council of Agricultural Research. In the late 1980s various Indian NGOs including MYRADA in southern India, Social Centre in Maharashtra, and the Aga Khan Rural Support Programme in Gujarat embarked on watershed development focusing much more on social organization (Hinchcliffe et al. 1999; Farrington and Lobo 1997).

To date, soil and water conservation works have been completed by International Development Association (IDA) on over 200,000 ha, improving average crop yields by about 24 percent and broadening crop diversity in five districts of Karnataka. Groundwater availability has improved to four to six months. Groundwater yields have increased by nearly 1,000 liters per hour, giving farmers greater choice of crops and in many cases, double cropping on arable lands. For communities where implementation has been completed, crop yields have increased by 24 percent over the baseline, cropping patterns have shifted to higher

valued crops, and milk yields have been enhanced by 15 to 20 percent.

Average annual household income has increased by about 66% .The increase in average income has contributed to a reduction in migration by about 70 percent. The project has already achieved its target of establishing 4,300 farmer groups and 6,600 new self-help groups to sustain participatory watershed management across 7,000 communities in 742 micro-watersheds. The project has resulted in a new government policy for co-management of common lands in watersheds that will have long-term impacts on improved natural resource conservation and rural livelihoods. It has also helped strengthen decentralization. (IDA 2001-2008)

Meanwhile, Social Centre would begin by identifying villages where topography was favorable for water harvesting and where people could show evidence of collective action around natural resources. Villagers also had to promise not to plant water intensive crops like sugarcane, which would allow a small minority of well-off farmers to capture benefits. Many other NGOs operated similar programs. Integrated Watershed Development Project: The IWDP was initiated in 1990 with support from the World Bank. In the mid-1990s, two new programs aimed to combine the technical expertise of government agencies and social organization skills of NGOs. The Indo-German Watershed Development Programme (IGWDP) followed the model of Social Centre described above, and the Adarsh Gaon Yojana (AGY) followed the approach taken by Mr.Anna Hazare of Ralegaon Siddhi, site of the most successful watershed project in Maharashtra (Kerr et al. 2002). Accordingly, to be eligible for the AGY, a village had to ban open grazing and tree-cutting in upper watershed pastures, engage in group labor (shram dan) for the benefit of the village as a whole, forego alcohol consumption, and practice family planning. To be eligible for the IGWDP, villages had to demonstrate the capacity for collective action and agree not to grow water intensive crops like sugarcane. The status brought out the need for a regime to be established for the maintenance of physical assets at the village level and how the contribution collected for watershed development can be better utilized for post project maintenance and enhancement of the livelihoods of the rural communities. (Chaturvedi et al. 2005)

The report presents infiltration studies of the year 1996-97 for the Bargi Left Bank Canal Command area of Narsinghpur district of Madhya Pradesh. The design of methods for estimation of flood mitigation and erosion control is often based on estimates of peak discharge derived from prediction of infiltration rate. Water conservation procedures require computation of cumulative infiltration to produce estimates of runoff yield. It was found that --The soils present in the Sher-Umar doab are mainly black clayey soil (black cotton soils) with very low infiltration capacity ranging from 0.1 cm/ hr to 4.8 cm/hr.The soils are not suitable for flooding method of irrigation. If this practice of irrigation is used (after the completion of the Bargi Left Bank Canal), then proper drainage should be provided. Excess irrigation with canal water may lead to water logging and Salinization (1996-97).

The study reveals that water scarcity and land degradation were the major constraints to agricultural productivity in the village Rajasamadhiyala before implementation of watershed development activities.. Over a period of time water storage capacity increased significantly, covering more area under irrigation and enhancing the cropping pattern, intensity and productivity of several crops. Crop productivity in upstream watershed Rajasamadhiyala is higher than the two downstream villages. For example, in case of groundnut it is 29% higher than in Aniyala and 68% higher than in K B Dham. Similarly cotton productivity is 21% higher in Rajasamadhiyala than in Aniyala and 57% higher than in KB Dham. In Rajasamadhiyala watershed higher production is seen in some of the crops, such as vegetables, higher by 67% and 59%, pigeonpea 53% and fodder by 40 and 26% compared to Aniyala and KB Dham villages respectively.

In conclusion huge investment of 16.25 million rupees in rainwater harvesting structures which is nine folds more than the normal watershed investments have currently benefited farmers in the watershed as well as the farmers from the downstream villages also. Agricultural crop productivity was increased by 119% in case of groundnut, 53% in cotton, 95% in wheat and by 50% in case of cumin. The internal rate of return was 9.4% with the cost benefit ratio of 1: 1.24 on such a large investment. However, over-exploitation of groundwater such as doubling the number of bore wells as well as pumping hours in Rajasamadhiyala will jeopardize the development unless suitable legal or social mechanisms for sustainable use of groundwater use are put in place by the community. (Sreedevi T.K.August 2006)

A field study was conducted to determine the effect of various bioengineering measures like vegetative barriers of citronella, lemon, vetiver and Geranium grass and mechanical soil conservation measures like contour bund, graded bund and graded bund with vegetative single row live hedge of 0.40 m2 cross section were evaluated to assess their effectiveness in reducing soil erosion and supplementing residual moisture. Popular hill millet i.e. ragi (Elucine coracana) grown in this area was selected as representative crop to assess erosion. A vertical interval of

1.5 m was maintained in case of different soil conservation measures while an area of 0.1 ha was maintained under each treatment. Average run off and soil loss during the year 2002 to 2004 on weekly as well as on annual basis revealed that run off (mm) was maximum in control plot (206.20) followed by plots with geranium grass (121.58), citronella grass (102.65), lemon grass (91.80), contour bund (85.80), graded bund (73.89) and graded bund with vegetative hedge (71.26), while the soil loss (t ha−1) showed a different trend in all these treatments. Maximum soil loss was observed in control plot (8.63), followed by plots with graded bund (3.20), citronella grass (3.75), geranium grass (3.54), lemon grass (2.69), contour bund (1.74) and graded bund with vegetative hedge (1.56). Plots with graded bund with vegetative hedge (T7) were the most effective in reducing run off as well as preventing soil erosion, hence, it is recommended as the best soil conservation practice for this region.(Mane et al, 2009)

In recent times also, the Maharashtra state is pioneer in Participatory Irrigation Management (PIM). There are successful examples of Water User Associations (WUA) in various parts of the state. With this background, Maharashtra Government has made it mandatory to the irrigation beneficiaries to form WUA. To empower the users and provide justice to tail-enders and weaker section of society, MFMIS bill is brought in, in which following are the provisions:

1) Water will be supplied only to WUAs' (Water User Associations).
2) Water supply to WUA will be only on volumetric basis
3) WUAs' will have freedom for cropping pattern
4) WUA has to contribute 15% in rehabilitation work of minor
5) Tail-enders is assured about supply of water.
6) Women's representation is made obligatory in WUA.

Active collaborations between government agencies, NGOs and civil society organizations will have to be forged in order to achieve improved institutional integration leading to better management of water resources in the district. (Bhagwat, 2006)

Therefore, the focus on the development activities must be balanced by management mechanisms, enabling policy and institutional mechanisms to achieve a sustainable utilization of groundwater resources. The groundwater management rather than development is the major challenge facing the organizations/institutions dealing with water resources. In the various watersheds of India like Lalatora in Madhya Pradesh, the treated area registered a groundwater level rise by 7.3 m. At Bundi in Rajasthan, the average rise was 5.7 m, and the irrigated area increased from 207 ha to 343 ha. In the Kothapally watershed, the groundwater level in open wells rose by 4.2 m. In the Rajasamadhiyala watershed, the number of open wells increased from 255 in 1995, with very poor yield with an average water column of 5.9 m to 308 wells with mean water column of 10.4 m. Overall, there has been an increase of 4.4 m of water column in 2004, as compared to that of 1995. The average pumping duration of 5.25 h per day in 1995 2 increased to 10.4 h per day in 2004, resulting in increased irrigated area by 58 per cent. Similarly, the number of bore wells also increased from 102 to 200 during the period. Doubling of the number of the bore wells in the watershed is a cause of concern as in spite of farmers' experience of defunct bore wells in 1995 and earlier they have again drilled more bore wells than open wells. The marginal positive groundwater balance in lean and average rainfall years could tilt to negative side very soon if the farmers continued drilling bore wells and pumping at the rate they have done from 1995 to 1999. Although the villagers acted collectively for water harvesting, there is no concern or awareness amongst the villagers for a sustainable use of groundwater (Suhas P. Wani et al, 2010)

EVALUATION OF INDIAN WATERSHED PROJECTS

There is a decline in interest in watershed structures during the post-implementation phase and this can be attributed to (i) failure or collapse of the new institutions set up to manage watersheds; and (ii) lack of clear norms on how to operate Watershed Development Funds. The Watershed Association, which is supposed to lead, instead becomes inactive in the post implementation phase of watershed programs. Unlike in the case of the forest or water user groups, the user groups in watershed development projects, whose members both benefit and bear the costs of collective action, are not vested with power to make decisions or control finances. If the User Groups are given these powers, then there is a possibility that the devolutionary process could become more successful. (D.Suresh Kumar et al., 2007)

It has been noted that participatory watershed management projects have been raising income, agricultural productivity, generating employment and conserving soil and water resources. Evidence from the three case studies:

Case 1: Farmer-participatory integrated watershed management – Consortium Model. - This case describes a novel approach that International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) has developed to address the issue of efficient use of natural resources in rain fed areas.

Case 2: Impact of watershed program and people's participation using Meta analysis Approach: This study was based on the meta-analysis and the authors made an attempt to evaluate the watershed programs and people's participation,

Case3: Sustainable Rural Livelihoods Frame work for assessing the impact of participatory watershed development: This was an interesting study in which sustainable rural livelihoods frame work was adopted for assessing the impact of watershed program on the five capital assets.

These case studies and other general impact studies suggest that watershed development brought several positive trends including diversification of the rural economy, development of new institutions, increasing cropping intensity, improved fodder production, increased availability of drinking water with rising ground water table, capacity development of the community etc. Based on the evidence found, it has been suggested that participatory watershed management could be a viable strategy of rural development for achieving sustainable rural livelihoods in India. (Budumuru Yoganand et al., 2006)

The case study of Ralegan Siddhi shows the success of Gandhian approach to people's participation in watershed management. Since 1975, this has resulted into participation of all the 325 village families, renovation of a temple, stopping illicit liquor distillation, water harvesting in 4 small watersheds, construction of many check dams, plantation of five hundred thousand forest trees, controlled grazing, raising of ground water level from 20 m depth to 6.5 m, sale of onions worth Rs. 80 million in 1995 alone (exchange rate in June 1995 1 US$ = Rs. 31.3), solar street lights, village toilets, biogas, organic farming, introduction of livestock, a full high school, institutionalization of decision making at village assembly level, local voluntary organizational capacity building, acceptance and application of voluntary code of conduct, formation of different action committees, etc. The success has made the Government of India to request the leader (Mr. Anna Hazare) to take up the program in 300 counties (talukas) of Maharashtra state. The major elements responsible for the successful people's participation in watershed management at the Ralegan Siddhi village are: emergence of local leadership, underpinning of moral sanctions for all, voluntary moral codes e.g. ban on uncontrolled grazing and tree cutting etc., GO/NGO partnership, involvement of all sections of society, holistic and sustained development over long time (10-20 years), use of simple, appropriate but efficient technology for watershed management, primacy of village assembly in decision making. The only weakness sighted with this model of people's participation in watershed management has been that it is driven by a strong and highly motivated local leader which is the case of most Gandhian models of development. It is still to be seen if it is replicable when it is tested on the 300 proposed counties.(B.Mishra et al.,1993)

Kothapally was predominantly a cotton growing area prior to project implementation. The area under cotton was 200 ha in 1998, and maize, chickpea, sorghum, pigeon pea, vegetables and rice were also grown. After 4 years of activities in Adarsha watershed, the area under cotton cultivation decreased from 200 ha to 80 ha (60% decline), with simultaneous increase in maize and pigeon pea areas (ICRISAT 2002). The area under maize and pigeon pea increased more than three-fold from 60 ha to 200 ha and 50 ha to 180 ha respectively, within four years, and the area under chickpea also increased two-fold during same period.(Wani, S.P.et al 2003.)

The results of the participatory research carried out in the Amachal watershed show that incorporating farmers in an innovation process helps them to address their own problems as well as seek appropriate information when necessary. Also the participatory approach enables the community to visualize and evaluate the impact of innovative technologies. (Shubha Vishnudas, 2006)

If done properly, the impact of wet watershed improvements can be very significant. An evaluation was done of six sites in North Bengal. In all these sites a number of wet water management improvements were undertaken (Despande and Dey 1999). The results of this study show an extremely high return to investment. Against an average investment of INR 3960/ha (US $ 90/ha):

- Average cropping intensity increased from 90% to 201%
- On average the gross value of production increased almost ten-fold. It was INR 17600/ha (US $ 370/ha) on average after completion
- Assured soil moisture availability during the rain fed cropping season increased from 2 days to 10.9 days on average; besides the interventions reduced soil erosion and gradually increase water retention capacity, a.o. by increasing the organic content of the soils

- Land value increased from INR 30750/ha to INR 84300/ha.

Participatory watershed management adopted in the study area from Karnataka, Southern India promoted agriculture and allied operation and socio-economic development by achieving overall development of the villages. (Rao, Jagannatha R, 2005)

ISSUES OF PWM IN PRESENT CONTEXT

People's part: Watershed management is meant for growing biomass, the pipeline for prosperity of the people for bridging the gap between poverty line and per capita income. In achieving this objective, the people's part is awareness, participation and response. The points of interest in awareness are thorough understanding of all aspects of the subject, modification of the same suiting to the region and locality, tastes and background and simple communication with patience, interest and sincerity to achieve the purpose of making them understand. Community participation becomes possible through group discussions, working together and united efforts. Response to the watershed development activity depends upon the modus operandi in establishing rapport, convincing elders and rural leaders, appropriateness of the technology and reaching the farmer in his own language, physical demonstration, exhibiting results, showing economical benefits and making arrangements for finances, implementation and marketing. Motivation is also important aspect in getting response.

State and Integrated approach : Systems management, team work, appreciation of new ideas though small, respect for good old economical methods though elementary, application of basic scientific methods though simple and understanding the value of hard work and integrated approach should be inculcated in the State's officials. The state should revise the methods and methodologies as frequently as possible as long as they are appropriate and economical. The state's obligations in watershed management include appreciation of the concept, training, transfer of technology and research and development and extension of infrastructural facilities.

Sustainable society: Along with wareshed management, due considerations must be given for livestock development, pisciculture, sericulture, health and hygiene, education, transport etc. for having sustainable development.

Economics: Several billions of rupees are spent every year for carrying out activities related to watershed management. But government's policy lacks the will in detail; people are prey to fate, lethargy, selfishness, frictions and squabbles. Hence the watershed management is faltering the pace. It is high time to get out of the horrible situation to increase the pace of progress for prosperity. The common man should get rid of rut with a will to cooperate and participate for a better future. A simple measure like privatization of public sector and collection of a portion of funds from the profits should take care of the finances for watershed management. (J.V.S.Murthy)

CONCLUSION

A lasting victory over land degradation by watershed management is possible only through appropriate technological inputs to restore the fertility of lands, social and economic reforms to involve people, political and governmental attitudinal changes for better rural upliftment and motivation of the peoples' will for better cover management. Whatever may be the value of a plan, the impact of watershed management depends on effectiveness of the technology in the background of needs, priorities, cultural practices and community participation. (J.V.S.Murthy)

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