WATERSHED MANAGEMENT

Extension Digest

In this issue

About the issue

There is an increase in concern about watershed problems and interest in methods of meeting them, around the world. Concern over repeated floods, excessive siltation, accelerated erosion with loss of soil and productive capacity have resulted in an interest in measures to correct these situations and prevent their occurrence.

Watershed management, is a holistic approach which aims at optimising the use of land, water and vegetation in an area to alleviate drought, moderate floods, prevent soil erosion, improve water availability and increase fuel, fodder and agricultural production on a sustained basis.

There is a urgent need to improve watershed management and to educate the general public on watershed problems and actions needed to meet these problems. This issue of the Digest focuses on the Common Approach/ Principles for Watershed Management, importance of indigenous technical knowledge, information technology applications in Watershed management and documents successes across the country.

Common Approach for Watershed Management

The thrust of Indian Agriculture in the post Green Revolution period was on enhancing agricultural productivity through sustainable practices. In order to achieve this, the Government of India implemented a national level programme for the development of rainfed areas through the watershed approach. The Watershed Approach aimed at augmentation and stabilization of production and productivity, minimizing ecological degradation, reducing regional disparity, and opening up opportunities for employment of rural poor in the rainfed areas. A similar approach was adopted for developing resource poor areas – drought prone, desert and wastelands. Watershed Development has been taken up under different programmes launched by the Government of India which include the watershed development projects of Ministry of Agriculture, Ministry of Rural Development, Ministry of Environment and Forests as well as several externally aided projects.

Need for a Common Approach

A need has been felt to bring about convergence and harmonization in the implementation of various watershed development projects. However, this has not been possible as the aims and objectives of these projects are different and the watershed approach has been adopted under these projects to achieve their varied objectives. While some of these projects had a specialized focus resulting in special norms and

delivery mechanisms geared to meet those needs, the six major projects / programmes, namely National Watershed Development Project for Rainfed Areas (NWDPRA), Watershed Development in Shifting Cultivation Areas (WDSCA), Drought Prone Areas Programme (DPAP), Desert Development Programme (DDP), Integrated Wasteland Development Project (IWDP), Employment Assurance Scheme (EAS) had elements of convergence and considerable common geographical area of operation. These programmes also account for about 70 percent of funds and area under watershed programmes in the country.

The need for unification of the multiplicity of watershed development programmes within the framework of a single national initiative was also emphasized by the Union Finance Minister in his Budget speech for 1999-2000. Consequently, the Planning Commission desired that the Ministry of Agriculture (MoA) hold consultations with the Ministry of Rural Development (MoRD) to arrive at a common set of guidelines for watershed development.

During an Inter-Ministerial Meeting various aspects of the watershed programmes were discussed. It was agreed that watershed projects with a specific focus and unique characteristics such as Reclamation of Problem Soils (MoA), and Integrated Afforestation and Eco-Development Projects (MoEF) would require a different approach. The major watershed development projects viz. NWDPRA and WDSCA of MoA, DPAP, DDP, EAS and IWDP of MoRD would be considered for arriving at a Common Approach / Principles. While the mandate of the Ministry of Agriculture is to enhance production and productivity of rainfed areas through sustainable agricultural practices, the mandate of the Ministry of Rural development is development and maintenance of the natural resource base in rural areas for increased employment generation and improvement of socio-economic conditions of rural poor on a micro-watershed basis.

A Sub-Committee has been constituted to formulate a Common approach / Principles for implementation of the selected watershed development programmes of the two Central Ministries viz. Agriculture and Rural Development. The mandate of the Sub-Committee is to examine existing guidelines of Watershed development projects of the two Ministries in order to identify the convergence and commonalties in approach in respect of specific criteria for selection of rainfed areas for treatment, programme components / interventions, institutional frame-work and modalities of implementation.

This Report is currently under preparation.

Watershed Management through I ndigenous knowledge

Sustainability in agricultural production depends considerably upon proper development, conservation and use of watershed resources at micro-level. It is now widely recognized that many of the available 'exogenous' technologies (emerging from formal research system) for management of watershed resources are not suitable for the small holding situation in India. Critical evaluation of watershed development programme implemented during last 2-3 decades in India has shown that in majority of cases (where such technologies have been used the farmers have reverted to their earlier practices after the withdrawal of project support. Realizing the above, a number of researchers have started examining indigenous innovations to see the role these could play in improving natural resource management.

A case study in Manchal Watershed of Ranga Reddy district reveals key principles , relevance of indigenous knowledge and their implications.

Underlying Principles behind Indigenous Technologies

Indigenous Technologies are based upon different principles and perceptions in order to meet additional requirements which are specific to small holding situations.

- **Enhancement of productivity besides conservation of land resource** focus is on short term as well as long term increase in productivity due to which the motivation among farmers and the cost effectiveness of these technologies are relatively higher.

- **Smaller size of group action for conservation of land resource** makes it easier not only to implement the measures but also to carry out subsequent maintenance

- **Creation of microenvironments in gully courses**. Indigenous technologies are based upon the concept of concentration of land resource (at appropriate place) rather than conservation of this resource at the original place. These technologies are also evolved to make the best use of micro level variability.

Relevance of Indigenous Technologies

Traditional technologies for development and conservation of land resource are found to be highly relevant particularly for small holding farmers as these measures are being implemented and maintained by farmers at their own cost. The percentage of their adoption is however limited; and the reason varies from farmer to farmer. Lack of technological knowledge is not the main reason for non-adoption. Limitation of finance, shortage of labour availability, lack of proper demarcation of field boundary, lack of proper mechanism for their maintenance, difficulty in facilitating group action among neighbouring farmers, low motivation etc. are some of the reasons which are adversely affecting the adoption of these technologies.

Implications of Indigenous Technologies on future Watershed Programme

New role for Outsiders. The role is likely to vary from providing financial and technical support to social support for facilitating group action, conflict resolution and equity, depending upon the type of measures to be adopted.

Thrust on Replication of Successful Experiences. Replication of successful examples and community led success stories, are likely to lead to most sustainable results.

Investment of Public Funds on Indigenous Technology. In view of emerging evidence in favour of indigenous technologies, barrier to invest public funds on such technologies needs to be removed through appropriate policy and administrative decision.

Attention towards repair and maintenance of Indigenous Water Harvesting structures. The current emphasis is only on construction of new water harvesting structures. Attention towards repair and maintenance of indigenous water harvesting structures may be considered as a pre-requisite before investment on any new structure is made for water resource development. This would require both financial assistance from outside and also a high level of social action among the concerned persons. Formation of a proper institutional base at the village level and working out a modality for regular contribution by users towards future maintenance of structures may be considered as a pre requisite for any external financial investment on these structures

Flexibility in sequence of implementation. Appropriate flexibility may be introduced in implementation of the programme. This would not only help in better participation of people but also in introducing better financial management in the watershed area.

Improving Financial Management under the Watershed Programme

Considering that indigenous technologies lead to short term as well as long term gains in productivity and can be implemented on individual farmer basis or small group basis, this opens up a possibility of improving financial management in the watershed programme. Aspects which could be considered on experimental basis include : Higher rate of contribution from farmers; Fixing ceiling on allocation of funds for each family; introduce the concept of Incremental rate of contribution from resource rich families; Linkage with credit institutions for implementing bankable technologies; Modification in the methodology for preparation and approval of technical plan.

(Sustainable development of land and water resources through Indigenous ideas, initiatives and

innovations: a case study of Manchal watershed in Andhra Pradesh. Paper presented at the National Symposium on Sustainable Agriculture Production; Lessons from Traditional Technologies on 30-31 January, 1999 at Vigyan Bhawan, New Delhi; by N.K.Sanghi, S.K.Moinuddin, B.Renuka Rani, K.Maheswari and P.Sailaja MANAGE,Hyderabad, India)

Pre-requisites for Participatory Approach under Watershed Programme

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Active participation of people is undoubtedly crucial for sustainable development of natural resources under watershed programme.

Most of the earlier programmes have focussed attention on achieving pople's participation in our plans. Besides, their concentration has been on development of physical resources (land, water and prennial vegetation) with very little time and energy left for development of social resources.

These efforts have resulted in passive participation of people in the programme, that too for the period upto which the project continued.

Based upon past experiences the strategy has now been reversed, in which focus is on our participation into their plan and development of social resources besides development of natural resources.

Formal research on participatory approach is presently in infancy particularly under Indian situation. A number of organizations dealing with technological, social and management aspects have however been studying 'peoples' participation from their own perspectives. Each of these organizations have identified specific prerequisites which determine peoples' participation. An attempt has been made here to integrate them in such a way that they could provide complementary effects at the field level. An integrated list of the pre-requisites is given here.

1. Organization of community into a new institutional set up at the village level.
2. Use of Participatory Rural Appraisal Tools in project management.
3. Preparation of action plan through written proposal from the users.
4. Flexibility in modification of action plan during implementation phase
5. Contributory approach for each developmental work
6. Group action and conflict resolution for community oriented activities.
7. Equity for poor and women for each component under the project.
8. Redesigning of steps and procedures for preparation of action plan.
9. Replication of community led success stories.
10. Building upon Indigenous innovations, initiatives and ideas.
11. Direct funding for the community against the approved action plan.
12. Small size of unit watershed
13. Social auditing and transparency at the village level

Further details about each of the above prerequisites are proposed to be discussed in subsequent publications.

Watershed Management in India : Initiatives across the country

This section attempts to give a glimpse of what is happening across the country in watershed management.

Some of the successes in watershed management and new initiatives across different states of India are documented here. While some of them are initiatives by Government and Non Governmental Organizations for better management of water resources, others are attempts made by the community/ rural population to improve their natural resource base and get more from their land. There are many such successes in different parts of the country. As it is not possible to give a comprehensive coverage, an attempt is made here to highlight key issues of a few of the cases documented in current literature.

Will people take loans for treatment measures on Private lands in a micro-Watershed? The MYRADA experience

Investments in soil and water conservation measures in micro-watersheds are being made under several Government sponsored programmes. In all cases investments are either 100% grants or some contribution mainly in terms of labour from the beneficiaries. To test the real value placed by people on treatment measures MYRADA decided to pilot initiatives in several micro watersheds in 1994-95, where people would be persuaded to take 100 % loans for treatment measures on their own lands. MYRADA gradually progressed towards a 100% loan model on private land. Three micro-watersheds were selected for this pilot. In all the three pilot micro watersheds there were farmers who had lands in these but who were members of SHGs in adjacent villages where they resided.

Given here is an analysis of progress in three micro-watersheds documented by MYRADA in their report.

Jadetadihalla Micro Watershed (MYRADA Huthur Project)

In this watershed farmers have flow irrigation which is adequate for one irrigated paddy crop and with good rainfall also to support a second crop of cotton flowers or maize. There are 16 farmers in this micro watershed (MW) who belong to several self-help groups (SHGs). These 16 members came together to form another Self Help Group (SHG) which also functions as the Watershed Development Association (WDA).

MYRADA proposed that the farmers rely on loans for watershed treatment on their private lands rather than on grants. After several rounds of discussions the SHG agreed. MYRADA agreed to support all treatment on common lands through grants. It was agreed that MYRADA would provide a grant to the SHG/WDA which would convert the grant into loans for treatment on private lands, and fixed the repayment schedule over 5 years. The SHG/WDA decided not to charge interest on these loans.

The SGH/WDA decided to begin by treating private lands, which had the highest potential for returns. Due to the availability of flow irrigation, farmers invested all the loans on terracing lands, which had the highest access to water. The crops have changed from ragi to paddy (main crop) which has assured irrigation. Maize, flowers and cotton have been introduced for the second crop, which depends on the availability of water. Discussions with the farmers indicate that between 95% to 98% of repayments have come from the increase in income from agriculture.

G.M. Doddi Micro watershed

In this watershed lands are all unirrigated except for 3 farmers who have terraced their lands; 2 have sunk borewells and 1 lifts water from the weir; lands of most of the other farmers are undulating. There are 54 farmers with lands in this micro watershed (MW) all members of the Watershed Development Association. Of these, 29 belong to 6 different self-help groups (SHGs).

When MYRADA indicated that all treatment on private lands would be on the basis of loans. There was objection from the people. The SHG members persuaded the others to go in for loans and pointed out that these loans would be repaid to the WDA and not to MYRADA which would build up a common fund in the WDA which could later be used for agricultural inputs, marketing support and for other investments.

MYRADA provided the funds for treatment on private lands as a grant to the WDA, which converted it into loans to individual farmers. Thirty-five have taken loans in the first round for treatment of private lands.

Income from agriculture is the major source of repayment of the WDA loan. The farmers have shifted from cultivating ragi and pursuing sericulture to maize in the non-irrigated areas and vegetables in the irrigated plots as sericulture was perceived to be a risky proposition.

Kere Doddi Watershed Association (MYRADA Hunthur Project)

There is no irrigation system in this watershed. There are 71 farmers in this Micro Watershed (MW) who are all members of the Watershed Development Association.. The initiative to treat the micro watershed and form a WDA was taken by 19 farmers who are members of Self-Help Groups. Since this programme started after the other two, it was not difficult for the farmers to accept and to persuade others of the visible and positive impact of treatment in a neighboring micro watershed. MYRADA provided grants to the WDA, which converted these into 100% loans for treatment on private lands.

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Community generated environmental regeneration in Rajasthan

The regeneration of the Arvari and other small rivers with johads (check-dams), in *Alwar* district in Rajasthan has brought about a change to the lives of the people. Johads are small earthen check dams that capture and conserve rainwater improving percolation and groundwater discharge.

In the 80s, 700 villages in Alwar district were reeling from drought. Only 6 per cent of the area was under forest cover; the topsoil had eroded, only 3 per cent land was cultivable and there was widespread degradation. 80 per cent of the men had migrated to nearby cities.

Realizing the importance of johads the *Bhaonta village* decided to dig out the ancient johad, Once the johad had water in it, it recharged the groundwater and made the Arvari river, which originates from there, come back to life. Similar activities were conducted downstream and the river started flowing through the year by 1995. This initiative has been inspired by the Tarun Bharat Sangh (TBS) which set up its ashram at Bheekampura and started promoting johads through their paani yatras. Till date, they have built 3,000 water-harvesting structures in 650 villages. F or every Rs 100 invested to making johads, the productivity of the village has gone up to Rs 400 per capita per annum. More than 6,500 square kilometers of land was re-claimed in 65 villages, wells had water, *milk* production increased 10 times and those who had migrated came back to build johads. What makes the TBS initiative different is involvement of the local people. No decision was taken to build anything unless there was consensus among the villagers. The villagers have elected a "water parliament' to ensure that the rivers, and the wells they regenerate, do not dry up again. During sessions of the water parliament In-depth study and discussions are held highlighting the villages' individual problems and finding ways to tackle them. There are strict rules regarding the use of the river water. The choice of crops is also monitored by the members of the Parliament. Since the water resources are limited, sugar rice (paddy) are forbidden. The model has been replicated in other areas of the district. The result is that 700 villages have water throughout the year.

TBS only contributes 25 per cent of the cost of construction, the rest come from the villagers themselves. This is termed as the largest ever mobilisation of people in the cause of environmental regeneration made possible by an effective village level institution. *(Grassroots Vol 1(1) 1999).*

Indigenous rainwater harvesting system in Rajasthan

The people of Lapodia village in Dudu block of Jaipur district, of Rajasthan have regenerated their degraded pasturelands through an ingenious system called "chauka" which relies on storing rainwater in dyked pastures. Trenches advocated by the Soil Conservation Department were found inadequate and ineffective as they do not spread water on pasturelands. The chauka is divided into two equal rectangles. Dykes 1.5 metres high are built along three sides on the periphery of the rectangle that lies towards the lower part of the land along the gradient. Trees are planted on dykes for additional support to withstand rain. Rain that falls in the chauka is collected towards the lower half that is dyked. As water level rises it flows into the neighboring chauka and so on. It spreads water evenly over a large area. The system also promotes recharge of groundwater. The credit for this initiative goes to Gram Vikas NavYuvak Mandal, an

recharge of groundwater. The credit for this initiative goes to Gram Vikas Navyuvak Mandal, an organisation which has emerged from within the village community. *(ASIAN WATMANET March-April 1999)*

Women's empowerment in managing land and water resources in Bundelkhand, Madhya Pradesh

Three years back, not even a blade of grass grew on the barrens -now there are lush green fields and hillocks and, the well and ponds are full of water. Each of the 110 households in Gauraiya village 25 km from Sagar district headquarters in Madhya Pradesh gets assured water supply through pipes. Within two years of the project launched by the Rajiv Gandhi Watershed Management Mission the area under cultivation has almost doubled and the average farm produce has trebled.

Community leaders like Sitabai, Rajkumari, Malati and Siyarani now head all-women watershed management committees. They now protect the 5.5 lakh trees planted in the community and government land. Social fencing by women volunteers has ensured that 90 per cent of the planted trees survive. The improvement in soil quality and underground water levels has also led to regeneration *of* teak and bamboo trees planted by the Madhya Pradesh Forest Department. The women have also organised self help groups and are now exploring new avenues to augment their incomes. Today every woman member of the committee operates her own bank accounts and keeps a record of the income and expenditure of the group she leads.

This is a story of the change in gender relations brought about by women's empowerment in managing land and water resources. *Grassroots Vol. 1(1) May 1999*

People's participation in Madhya Pradesh

In villages in Jhabua district of Madhya Pradesh, community participation in watershed management programmes has transformed rural ecosystems and is bringing in economic prosperity due to the efforts of the Rajiv Gandhi Watershed Development Mission.

Water level has increased, trees have come up on once barren land, wasteland has decreased and the livestock population and the irrigated area have increased. New crops have been introduced. The work is being carried out with the help of the panchayats. A combination of fencing, cattle protection trenches and stone bunds are being used to prevent grazing in wasteland. Soil and water conservation measures such as gully plugs and staggered contour trenches have increased soil accumulation and soil moisture.

Most watershed villages have become self sufficient in fodder and forage. Agricultural productivity has increased with many farmers cultivating cash crops like soybean and cotton. Ground water table has increased .The cropped area and area under rabi (dry season crop) has increased. The project has also led to the empowerment of women with formation of women's thrift and credit groups. The changes have produced employment opportunities and brought down migration from these villages. *Green file Vol.No.135 March, 1999.*

Watershed management in Kurnool District, Andhra Pradesh

The watershed schemes being implemented by the central and state governments in Kurnool district have resulted in greenery everywhere, increase in the number of wells and the water-level in them. The watershed schemes were aimed at developing the ayacut areas by preventing soil erosion, preserving fertility and groundwater and developing the forest area. Under the scheme, checkdams, rock-fill dams, stone bunds, percolation tanks were constructed throughout the district. In the S.Rangapur watershed in Kurnool district, the water table substantially increased enabling cultivation of double crop through irrigation wells. Despite drought in the area the crop yield in this village had gone up during the current season.

Before the implementation of the scheme, all the 65 families in the hamlet were economically poor. Today the number of wells have increased and water is in abundance even in summer due to the construction of

check-dams. Groundnut yield has doubled. Growth in income per head is 36 per cent according to official estimates. The villagers have started a forest development programme under the banner 'Ashokavanam' and have decided to avoid using wood for cooking and were planning to generate biogas. The women in the village have formed four thrift societies. Women in Lakshmipalle of Done mandal are also representing a watershed committee, which has become an example for others to follow. *(Newstime 15.1.99)*

Village-level planning in watershed management in Kakannur, Andhra Pradesh

Kakannur village, in Mahabubnagar district of Andhra Pradesh, is an example of what successful village-level planning in watershed management with the help of the local community can achieve in a short span of time. Assisted by a non-governmental organisation called VASORD, it has successfully stopped migration of people even during the non-harvesting season.

The village has doubled the yield of its principal crop castor seeds and has also added 300 acres of land under cultivation, besides adding to income generation in terms of higher wages and higher crop productivity. The watershed development programme has ensured that water is now available at 70 ft below the ground, where three years ago the groundwater was not available even at 150 ft.

The process began with the formation of "Kakannur watershed association" which worked towards contouring, bund making, creating check dams and 'gully' controls. The National Remote Sensing Agency also helped in providing data with the help of satellite imageries. *(Newstime 11.11.98).*

Water Harvesting

Lack of emphasis on water conservation has led to acute shortage say experts on water management, who advocate harvesting of rainwater to tide over the crisis. It is estimated that just one per cent of annual precipitation all over India is sufficient to take care of its domestic water requirements. Mizoram in India has been traditionally harvesting rainwater. Chennai has also enforced this practice and it is mandatory for all building plans to incorporate rainwater-harvesting structures.

Farmers in very dry areas have developed – and are developing – a number of systems for conserving soil and water which enable them to make the most of limited and unpredictable rainfall. These systems are often highly effective, well adapted to local ecological and social conditions, and often outperform methods based on modern agronomic knowledge. Indians, over centuries, have developed a range of techniques to harvest water. Some of the indigenous practices and recent initiatives are documented here. These have been discussed exhaustively in "Dying Wisdom", published by the Centre for Science and Environment, New Delhi.

- In the western and central Himalayas, diversion channels called *kuhls* or *guhls* were built to draw water from hill streams or springs. The length of these channels varied from 1-15 km, and carried a discharge of 15-100 liters per second.

- In Meghalaya, a 200-year-old system of tapping stream and spring water for irrigating plants by using bamboo pipes is prevalent. About 18-20 litres of water enters the bamboo pipe system, gets transported over hundreds of metres, and finally reduces to 20-80 drops per minute at the site of the plant, like a modern drip irrigation system.

- The *zabo* system of cultivation practiced in Kikruma village of Nagaland is a combination of forestry, agriculture and animal care with soil erosion control.

- The *ahar-pyne* system of irrigation is found in south Bihar. *Ahars* are rectangular catchment basins, and pynes are channels constructed to utilise the water flowing through hilly rivers.

- *Kunds*, found in the Thar Desert, are covered underground tanks with an artificially prepared

- *Kunds,* found in the Thar Desert, are covered underground tanks with an artificially prepared catchment area to increase runoff. It was developed to supply drinking water.

- Karnataka has been a forerunner in managing traditional water harvesting structures, like *arakere, volakere, devikere, katte, kunte* and *Kola.* The maximum number were tanks – 40,000 tanks still exist today.

- Khatri is a unique way of water storage in various parts of Himachal Pradesh. These are hand-hewn caves located on both sides of the road beneath huge rocks. Once these khatris are carved out they are provided with an iron gate and locked. The water seeps into these reservoirs from the rocks and is collected inside and is sufficient for daily use. Two types of khatris are found: in one rainwater is collected from house roofs in tins and stored in reservoirs. In the second type, only seeping water is collected and is used as drinking water.

- A special water harvesting structure in Kasaragod district of northern Malabar is called *surangam,* a tunnel dug through a laterite hillock from the periphery of which water or moisture seeps out.

- One-third of the irrigated area of Tamil Nadu is watered by ancient tanks called *eris,* which have played an important role in maintaining ecological harmony – flood-control, preventing soil erosion, reducing wastage of runoff and recharging groundwater.

- Some tribals of Nicobar Island make extensive use of split bamboos in their water harvesting systems. The split bamboos are placed along a slope with the lower end leading into a shallow pit. These serve as conduits for rainwater which is collected, drop by drop, in pits called jackwells. *(Agarwal , Anil and Narain, Sunita. Dying Wisdom. Centre for Science and Environment, New Delhi.)*

Himachal Pradesh makes Rain water harvesting mandatory

Himachal Pradesh (HP) has taken an important decision for spreading the message of resource conservation by introducing an important amendment in its building bye-laws. In order to meet the chronic water scarcity, the installation of a rainwater harvesting technique structure in all buildings in the urban areas of HP has been made compulsory by the state government. Building designs would not be approved if they do not include rainwater harvesting as part of essential service. Under the new scheme, all commercial and institutional buildings, tourist and industrial complexes, etc, existing or coming up and having a plinth are of more than 1000 square metres must have rain water storage facilities commensurate with the size of roof area.

The Himachal Pradesh Government has organised a number of training camps for the people of various parts of the state to orient them to rainwater harvesting schemes in towns.*(Tribune 17/4/99)*

National water harvesters' network

A national water harvesters' network has been set up by Centre for Science and Environment (CSE's) water harvesters' advisory committee in New Delhi.

Members suggested that a regional network be initiated in Tamil Nadu to promote rainwater harvesting in Chennai. The state government is also willing to promote water harvesting to counter the problem of acute water shortage. Professor M S Swaminathan, provided office space for the network unit in Chennai and Prof. A Vaidyanathan agreed to chair the group.

The Tamil Nadu unit of the national water-harvesting network was launched in April 1999. The network is meant to: (i) provide an opportunity for individuals and institutions actively engaged in water harvesting, in Chennai, to share their knowledge and experience and promote free and open interaction among them; and (ii) to reach out to a wider public in the city and outside to propagate the role of urban rainwater harvesting in terms of technology, experience and its potential contribution in meeting urban water needs. The network plans to expand to rural water harvesting in future.

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Catching rainwater in Centre for Science and Environment (CSE)

CSE has made sure that every raindrop that fell on its roof and in its compound would be captured. Before the monsoons could arrive in Delhi, CSE constructed various water harvesting structures in its office complex. The rooftop water on the northern side of the building is used to recharge ground aquifer through an abandoned borewell and also in 11 shallow (about 30 feet deep) borewells dug in the campus.

The runoff water from the ground (paved and unpaved areas) are utilised for recharging the ground aquifers. At the gate, a trough has been made and three borewells dug so that all the water that flows from the paved scooter parking area is used for recharging. In the unpaved areas, three checkbunds have been made, to allow for groundwater recharge.

In order to reduce the volume of stormwater, the height of seven stormwater drains have been raised. The water that would fall on the car shed has been directed through a split bamboo into a small storage tank for immediate use.

Greening Insitutional Land - through Watershed Strategy at MANAGE

A.K. Goel, Director General MANAGE

MANAGE is a premier institute for Agricultural Extension Management in India under the Ministry of Agriculture and Cooperation. The institute has a 42 acre campus in Hyderabad. Topography is undulating with light red soils and the area is dotted with mini-hillocks coupled with deep gullies indicating heavy runoff during uncertain season with a few rainy days. Annual rainfall is 750 mm. Building blocks have come up along with a few garden patches here and there during last 4 years. But for these green spots, the remaining landscape presents a barren picture for major part of the year.

One of the areas of interest in MANAGE is ‘watershed management’. In fact, guidelines to operationalize the Hanumantha Rao Committee report on Watershed Development were formulated in MANAGE. An idea struck us sometime in January, 1999 as to why the same watershed concept should not be applied to our own campus itself? Why could each and every drop of water not be conserved whenever it fell in our campus premises? An area of 42 acres of land with 750 mm rainfall amounts to 12.6 hectare meter volume of water or 1.26 lakh cubic meter of water being received perennially. If every drop is conserved, perhaps MANAGE campus could be converted into a lush green garden with trees, creepers, flowers and water bodies with microfauna over a period of 5 years.

The idea was infectious and very soon, everyone was talking about it. That was the time when Mr. Hanumantha Rao – the author of ‘Four waters concept’ took a brainstorming session in February, 1999, with faculty members. He perambulated the length and breadth of the campus. The visit was a reeducation to us when we discovered the hitherto unknown features in our campus – like an ancient aqueduct, an old archbridge, an old well and the like. We sat around the contour map once again and shared the dream of conserving every drop of water.

During March, 1999, all the water harvesting structures were put on the map and located on land as well. A contour trench around mini hillocks, a series of sunken ponds along rills interspersed with mini-percolation tanks around ridge, a series of stone dams along gully to harvest soil, water trapping structures along road ribbon and redirecting it to avenue trees through graded trenches were some of the things to be done before arrival of rains. The civil engineering wing was responsible for executing the works, and the watershed faculty was made responsible for covering the entire developmental process. Both the wings have risen to the occasion.

Works have already commenced in right earnest. Monsoon arrives in Hyderabad in June and lasts four

months. We expect that the entire rainfall in the campus during the monsoon to be conserved within its boundaries without letting even a drop of water escape. There are three major exit points for runoff water. We have decided to monitor them immediately during and after a heavy downpour. Even if a drop escapes, we have failed but we fervently hope to succeed.

This line of thinking in MANAGE gives rise to the concept of 'Water Budget'. An institute with X Acres of land with Y millimeters of annual rainfall receives a quantity of X-Y units of water perennially. A major portion of it goes waste as on today. But with proper planning, it can be conserved within the campus with minimal expenditure on appropriate soil water harvesting structures. Once water stops, wealth sprouts and over a period of time, it multiplies not in a linear manner but exponentially like compound interest —year after year. That wealth rightly belongs to the institution eternally.

In our country, the total number of such institutes number a few thousands. There are 29 State Agricultural Universities – each with a few thousand acres of land. Then we have regular universities, Institutes of Technologies, Engineering and Management, Post-Graduate Centers and Degree Colleges, Central Public Sector undertakings with huge extents of land around them, Agricultural Research, Extension and training outfits, Animal Husbandry, Horticulture, Sericulture and Agriculture Institutes, Secretariat Buildings, Commissionerate, Collectorate and subordinate office outfits, residential bungalows, state public sector outfits, etc. All this adds upto 2000 to 3000 units with around 2 lakh acre of land. Responsibility to account for this 'water receipt' on an annual basis would rest with the CEO of the institute/office. They have adequate funds, authority and manpower. What is perhaps needed is just a spark to set their imagination on fire. They, after all are professionals. With the click of a button, they can communicate with any part of the globe through satellites. They would love to communicate now with mother earth – through the five forces of nature – also called "Panchabhutalu".

Information Technology and Watershed Management

Cyber Management of Natural Resources

MANAGE has initiated a Project which proposes to connect the Manchal watershed with MANAGE and DPAP office through a computer and communication network, using dial-up connectivity. This network is expected to empower farmers who are part of watershed management and facilitate them to do their own data analysis and generate reports to be submitted to the DPAP office. Farmers can contact the officials or send queries to the DPAP or PIA officials to solve their problems in the village itself.

The objectives are to:

- Establish a three way connectivity between Manchal Watershed, MANAGE and DPAP office.
- Enable efficient communication of reports viz. Watershed committee reports and PIA reports, required by DPAP from MANAGE and Manchal Watershed, using dial-up telephone line facility.
- Empower farmers working in watershed management (Watershed Committee members) in collecting farmers data, preparing action plan and generating monthly/quarterly reports.
- Implement an electronic mail system from Manchal to MANAGE/DPAP in regional language (Telugu) for solving problems at the field level or any advice required by the farmers.
- Implement/enable on-line conferencing between farmers of Manchal with MANAGE NRM experts to discuss issues and problems.
- Add value-added services to the village computer service, such as prices of agricultural commodities at Market Yards in Andhra Pradesh, and vegetable prices in the Ryuthu Bazaar, on a daily basis.

The project is targeted to be completed by December end, 1999.

Planning and Management of watersheds in rural areas

The People's Research Organisation for Grassroot Environmental Scientific Services (PROGRESS), Hyderabad, has initiated a project on design and development of software for Planning and Management of different types of watersheds in rural areas. The objectives are to design and develop a software that could assist in Resource assessment, Planning and Monitoring in Watershed Management Programmes.

A Database covering socio-economic data; natural resources data and monitoring data on water levels, land use, soil moisture, stream flow, physical activities, financial progress, thrift and credit has been established for these watersheds. A monitoring network has been set up to assess the impact of the watershed treatment.

The software has been developed in three modules viz. Database module, designing module and mapping module, that could work independently as well as a single system when integrated together.

Current status

- Implementation of activities in watersheds is at different stages from 2 to 3 years
- Resource information and climatic data has been collected and there is regular inflow of data from the monitoring network
- Collected data has been taken into the database.
- Structural designs are ready for use
- Mapping is under progress
- Base maps and resource maps of all watersheds are completed.

In the following months PROGRESS proposes to finalize the design models and mapping module; and test run the modules with PROGRESS watersheds and with watersheds of other partners.

For further details please contact the Project Coordinator at PROGRESS, 12-13-626, Nagarjunanagar, Tarnaka, Hyderabad- 17. Phone:91-040-7172408, Fax- 7172471. E-mail: progress @hd2.vsnl.net.in.

Watershed Management over the Web

Watershed analysis and management are developing as tools of integrated ecological and economic study and decision making at the regional scale. The new technology offered by the advent of the Internet and the World Wide Web (WWW) is complimentary to some of the paradigms of watershed analysis. The Internet offers a unique opportunity to deliver information to stakeholders and provide for most of the needs of the watershed management concept say Alexey Voinov and Robert Costanza . The authors explore how some of the methods and tools provided by the Internet can be used for regional studies at the watershed scale and how this presents additional challenges for the specific types of web tools to be developed.

Regional management implies close interaction and linkage between different agents in the region. Efficiency of this interaction depends on the information that is shared among all stakeholders. According to the authors, the web offers a number of features and tools to improve watershed management that make it an important tool for watershed analysis

an important tool for watershed analysis.

The WWW is:

- **Open**: provides information across geographical, administrative, social and economic boundaries; is relatively cheap and can be accessed by all the stakeholders in a watershed
- **Interactive**. The user can interact with the provider of information and with other stakeholders.
- **Fast**. Once the information is updated on the server it becomes immediately available for further use and processing. The feedback can often be handled automatically.
- **Spatially distributed**. The nodes on the Internet can represent the spatially distributed data of different stakeholders on the watershed and outside.
- **Hierarchical**. The hierarchical structure supported by the Web design allows organization of the data in logical ways.
- **Flexible**. Data can be processed by the user himself according to his own goals and interests.

A watershed management web page can be considered as a problem oriented web page that contains data and methods for decision making in a particular geographic region of a watershed.

Conceptual structure of a watershed management web page

- A watershed landscape model brings together the geographic, ecological and socioeconomic data about the watershed and its subsystems and helps identify the gaps in information available.
- The stakeholders and interest groups on a watershed can represent themselves in separate web pages giving a brief summary of their activities and concerns that will be placed on the root page. The immediate benefits of this are: all discussions are documented and filed; they are open to the public; participants do not need to travel to meetings. The results are immediately posted on the web and made available for discussion and decision making. The web serves to integrate the knowledge and data available at different institutions and sites, and to offer it to the user.

The three major components of watershed analysis linked by the Web

-The framework developed can be replicated for a variety of watersheds.

-It provides data and insight for educational purposes at all levels and serves as a tool for building consensus and public involvement.

-By sharing the data and concepts over the Web potential users are invited to collaborative research and analysis of the future trends of watershed development. The interactive and flexible system that the Web tools offer may serve for analysis and decision support.

(Voinov, Alexey and Costanza, Robert. Watershed Management over the web)

Selected Abstracts

Ahluwalia, M. Presenting communities: the case of a community-based watershed management project in Rajasthan, India. In *Community-based sustainable development consensus or conflict? IDS Bulletin* (1997) 28 (4) 23-34

This paper focuses on a community-based watershed project in Rajasthan implemented by Seva Mandir. The tools of environmental entitlements analysis are applied in a project evaluation mode to explore the effects of social difference on project experience and impact.

Seva Mandir has successfully facilitated 'community' identity and action, across caste, class and gender differences, in the context of local political struggles. Yet natural resource management remains an area of conflict: while certain stakeholders have benefited from soil and moisture conservation activities and the enclosure of commons, others especially pastoralists and women have faced high costs to their livelihoods.

Rajasekaran, N. Farmers, sustainability and watershed programmes. *Economic and Political Weekly* (1997) 32(26) A55-A61

This paper analyses the need for and significance of sustainable development programmes of India's dry regions and the role of participation in sustaining the development process. The data show how increases in yield per hectare, reduction in farm income inequalities and improved environments have resulted in such areas. Discussions emphasize the point that socially acceptable living can only be attained by resorting to watershed development programmes.

The empirical results indicate that training contact farmers from both genders can lead to the formation of groups, possibly headed by charismatic leaders, to achieve wholesome participation. Local resource users should be involved in the formulation, implementation, maintenance and evaluation stages. As the benefits of the programme are not tangible in the short run, participation can only be ensured through decentralization of decision-making and raising levels of consciousness says the author.

Fernandez, A.P. Self-help groups in watershed management. *ILEIA Newsletter* (1998) 14 (1) 12-13

Examines MYRADA's involvement with watershed management in Gulbarga, India, and the associated PIDOW-MYRADA project, which was a partnership between Government, the Swiss Development Cooperation and MYRADA. Its objective was to enable the users involved to emerge as a fourth partner and progressively control watershed resources. MYRADA's role was to ensure that process of planning and implementation would help people acquire the skills, confidence and organizational expertise to manage the resources within their watershed. Initiative in Gulbarga spread rapidly to other MYRADA watered projects. The paper discusses what has been learned about the role of Self-Help Credit Management Groups

Shah, Amita. Moisture-yield interaction and farmers' perceptions: lessons from watershed projects in Gujarat. *Artha Vijana* (1997) 39 (4) 457-472

Recent watershed projects in India have promoted vegetative barriers, which though technologically more sound and environmentally conducive, might bring only limited economic gains. The paper examines the yield impact of vegetative bundings and farmers' perceptions about moisture yield interactions in Gujarat. The analysis is based on responses from a sample of 197 farmers from two watersheds, Vatrak and Narmada, comprising both those who had, and those who had not adopted the vegetative barrier. The analysis suggests that; (1) traditional bundings are not only widely prevalent but also considered very important for higher yields under 'normal' rainfall conditions: compared to this, yield impact of vegetative barriers is low and uncertain; (2) given the indigenous practice of soil-moisture conservation, fertilizer is the most important factor for obtaining higher yields; and (3) a strategy to provide stability in yield would require large scale investments in the form of water harvesting structures and irrigation. What is needed is to improve net returns, hence farmers' paying capacity rather than large-scale subsidies spread over a large number of watershed projects in the dryland regions.

Pande, V. C et al. Farm resource development — a case study of watershed management in Semi-Arid Tropics of Gujarat. *Indian Journal of Soil Conservation* (1998) 26 (1) 52-56

Integrated Watershed Management programme not only strengthens the resource base but also brings equity in distribution, sustaining the growth process. The vicious circle of underdevelopment, which revolves around poor resource base, in the Semi-Arid Tropics (SAT) can be broken through an integrated watershed development approach, say the authors.

The present study was taken up in two SAT model watersheds of Gujarat, India, to examine sustainability and equity issues. The results revealed that net returns not only increased but also had fair distribution across the community. Watershed Management also resulted in higher investment on farm assets, with better distribution in the post project period as compared to pre project period.

Datta SK.; Virgo, K. J. Towards sustainable watershed development through people's participation: Lessons from the lesser Himalaya, Uttar Pradesh, India. *Mountain Research and Development* (1998) 18 (3) 213-233

The paper reviews experiences of the Doon Valley Integrated Watershed Management Project in Uttar Pradesh, India, with emphasis on the evolution of a participatory 'process orientated' approach aimed at developing community capabilities to sustain the increased natural resource production systems introduced by Project activities. The focus is on promoting convergent planning and strengthening the skills and institutional capacities of the rural communities, as well as of the government agency responsible for implementation. Conclusions are that human resource development should precede external technical watershed management activities and under the participatory approach, external implementers need to be encouraged to merge their technical skills with the indigenous skills of villagers in order to achieve a convergent approach.

The initial focus of watershed management project should be on communities and the adjacent areas under their influence, rather than on the physical aspects of watersheds. Women proved to be most receptive and capable of forming cohesive groups to manage natural resources. The project produced initial improvements in living conditions and in local involvement by people in managing natural resources. This was supplemented by physical soil and water conservation measures and community – managed grass and fodder tree plantations. Reduction in pressure on intervening forest areas is expected to favour natural eco-regeneration. Increased environmental awareness and involvement of the villagers in expected to facilitate protection of afforestation programme beyond the village limits.

Agarwal Anil and Narain, Sunita. Dying Wisdom: rise, fall and potential of India's traditional water harvesting systems. New Delhi, Centre for Science and Environment, 1997. State of India's Environment; a Citizen's Report 4.

Looks at India's traditional water harvesting systems and the millennial tradition that expertly met people's drinking water and irrigation needs. Looks into India's 15 ecological zones and their localised water harvesting systems and argues for revival of local water harvesting systems.

Rhodes, Robert. Participatory Watershed Research and Management: Where the shadow falls. IIED Gatekeeper series no. SA81.

A popular investment by development agencies and international donors has been the funding and establishment of participatory watershed research and management projects says Robert Rhodes.

A number of people-oriented research and development projects have been implemented throughout the world which aim to look at multi-objective, diverse stakeholder issues within the contexts of multiple scale settings (e.g. watersheds, catchments, landscapes, river basins). Concerns of conventional watershed projects are addressed with a participatory component which assigns equal weight to people's perceptions and needs along with hydrological and other biophysical processes.

However, despite the logic behind such an approach, there is concern about practical accomplishments. There are few published impact studies on whether the participatory watershed approach actually works. A few early evaluations of watershed projects indicate they are not yet living up to expectations. Some innovative projects have reverted back into the top-down, sectoral, component which do not address local people's needs.

Robert Rhodes in this paper critically examines some of the central conceptual and operational issues and

recommends positive, practical steps for the future. Four questions are explored in the search for lessons learned and new directions gleaned. These pertain to the comparative advantage of combining participation and watersheds? Evidence that the participatory watershed approach is viable; reasons for 'landmines' along the road of participatory watershed management? And how the participatory watershed initiative can succeed?

The paper makes an argument that it is time to address potential pitfalls in the comceptualisation and operationalisation of such projects. Eight 'landmines' are discussed which include; Scale confusion and scale wars; The participatory methodology fetish; Social underdesign of projects; Re-invent the wheel syndrome; Great expectations; Tragedy of the participatory commons; Duplicating management structures; Stakeholder complexity and competition

Abernethy, C. L; *Wijayaratna* C. M. Evaluation of the impacts of projects to reduce human-induced soil losses in watersheds. In *Modeling soil erosion, sediment transport and closely reigned hydrological processes. Proceedings of an international symposium, Vienna, Austria, 13 to 17 July 1998 edited by Summer; et al.* UK;

Watershed management projects, especially in developing countries under pressure of rising populations, present challenges in design and evaluation. Efforts to reduce human-induced soil losses, without displacing the relevant communities require time and persistence, because such efforts must involve persuasion, rather than direction, of the communities towards both different styles of socio-economic behaviour and new land-use practices. Several successes have been reported in tropical and sub-tropical environments in community based projects. Such projects address multiple goals: reducing soil loss; increasing dry-season flows; reducing floods; and improving the economic value of land and livelihood of people. Therefore, such projects must be multidimensional and multidisciplinary, and these considerations have time and cost implications. Developing better insights into the benefit-cost effects of the various characteristic components is valuable, and the identification and quantification of intermediate benefit targets desirable. This paper discusses the methodologies of monitoring and evaluation programmes that focus primarily on measuring the physical results that are due to promoting socio-economic action and adjustments of land-use behaviour within the community.

Iyer R.R. Water resource planning: changing perspectives. *Economic and Political Weekly* (1998) 33 (50) 3198-3205

Examines the changing perspectives in India on water resources planning. It is noted that in the recent past this has meant large-scale irrigation development through big dam projects. There have been several movements against such projects. The paper considers the negative consequences of large-scale dams, and discusses some of the successful local initiatives in watershed development and social transformation which suggest that there are alternatives to dams. Some recommendations are also, presented to reorient the approach to water resources policy.

Samra, J.S.; Mishra, *A* S. eds. Participatory rural appraisal for watershed management (case studies). Dehradun, India; Central Soil and Water Conservation Research and Training Institute (1998) v I- 178 pp.

This book documents participatory rural appraisal (PRA) watershed management exercises carried out by different teams of multidisciplinary facilitators in different agro-ecological settings in India. The PRA cases documented were carried out in the some villages of Uttar Pradesh, Punjab), Western Ghats, Gujarat, Rajasthan, Madhya Pradesh.

The cases present the results of the PRA exercises, covering rapport building, social, resource, soil and hydrology mapping. Seasonal analysis, transect walk, preference ranking for crops and/or animals, matrix ranking, triangulation, indigenous technical knowledge, and problem identification.

Hinchcliffe, Fiona et al, eds. Fertile Ground; the impacts of Participatory Watershed Management. London, I.T. Publications, 1999.

Presents the findings of in-depth research into the impacts of participatory watershed management in a range of agroecological and socio-economic settings in Africa, Asia, Australia and Latin America. The twenty-three case studies in this publication present a picture of the problems, achievements and challenges faced by conservation professionals and farmers around the world. They provide evidence of the importance of local people's involvement in natural resource planning and management. The collection provides an analysis of the biophysical, socio-economic and institutional impacts of development and management practices and points to practical and realistic ways forward for both governments and external support agencies.

Pangare, Vasudha Lokur. Gender issues in Watershed Development and Management in India (AGREN Paper 88a, London, ODI.)

This paper reviews a number of government and non-government projects in the states of Andhra Pradesh and Maharashtra. Argues that unless we progress from a view of women as a 'disadvantaged group' to a point where they are treated as integral members of the community, development efforts will continue to sideline women's concerns. Increasing women's participation in watershed projects is critical to the long-term sustainability of development efforts. There is a need to sensitize policy makers and staff of project implementing agencies to the core issues affecting women's participation in decision-making processes and the distribution of benefits between men and women. Unless women are involved in the decision-making process, watershed development projects will remain welfare oriented as far as women are concerned.

The paper gives suggestions on how to strengthen women's involvement in watershed activities. An assessment of the interface between livelihoods and resource base can help to identify the key issues related to the economic survival of women resource users and ensure that their interests do not become sidelined. Stronger guidance on the number of women to be appointed to the watershed committees is needed as current recommendations (of one or two women) have resulted in tokenism. Project implementing agencies must take responsibility for facilitating women's participation by setting up support systems and providing training. Training in gender issues and technical training especially for women will strengthen women's roles in the decision-making hierarchy. Emphasises the need to ensure that watershed development activities are compatible with women's livelihood strategies.

D'Souza, Marcella. Watershed Development - Creating Space for Women (AGREN Paper 88 b, London, ODI)

Looks at a German-funded project in Maharashtra and advocates the need for a sectoral approach to meeting women's needs. While watershed development does initially lead to an increase in women's workloads, it can also offer them unique opportunities to improve their economic situation as well as enhance their status in society. Watershed development has a notable impact on employment and income opportunities, food security, fodder, fuel and water availability and access to credit. Socially, impacts relate to migration rates and the status and self-confidence of women. The degree to which impacts are positive varies in time and the extent to which development plans allow for women's empowerment.

This paper focuses on some options for mitigating the negative impacts of watershed development and to enable women to become more self-reliant and more self-confident. It addresses two key issues: viz How to capitalise on the opportunities offered and mitigate some of the key problems arising from watershed development activities; and the approach, the organisational framework and mechanisms adopted by the Indo-German Watershed Project to create space for women in watershed development.

Watershed Manuals

Venkateswarlu, J. Technical Manual on Watershed Technologies. MANAGE, Hyderabad.

The technical manual enlists technologies relevant to different agro climatic regions in India. Focus is on people friendly, low cost technologies, which are simple and easy to operate and maintain and are based on local materials and indigenous knowledge.

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The Manual is divided into five parts dealing with Resource Inventorization, Resource conservation, Arable Cropping Systems. Non-Arable Farming Systems and Non-farming Systems and Watershed in retrospect which are important and necessary for the overall development and management of any watershed.

Rs. 120.00 (set price)

Sanghi, N.K. Operational Manual. MANAGE, Hyderabad

This manual describes the operations that Project Implementation Agencies (PIKs) and Watershed Development Teams (WDTs) and facilitating agents will need to carry out step by step for initiating participatory planning and implementation in different phases of the watershed programme. It specifies formats for process documentation, action plans and accounting procedures for PIK and WDT members as well as watershed development committees and user groups.

(in press)

Desai, G.R. and S.K. Arora. Trainers Training Manual for Participatory Management of Watershed Projects. MANAGE, Hyderabad.

This manual is based on four modules dealing with the

(i) Common guidelines and technical issues;
(ii) Participatory rural appraisal and community organizations,
(iii) General management and project management skills and
(iv) Administration and accounts matters.

Rs. 100.00

Orders may kindly be sent to Director General, MANAGE.