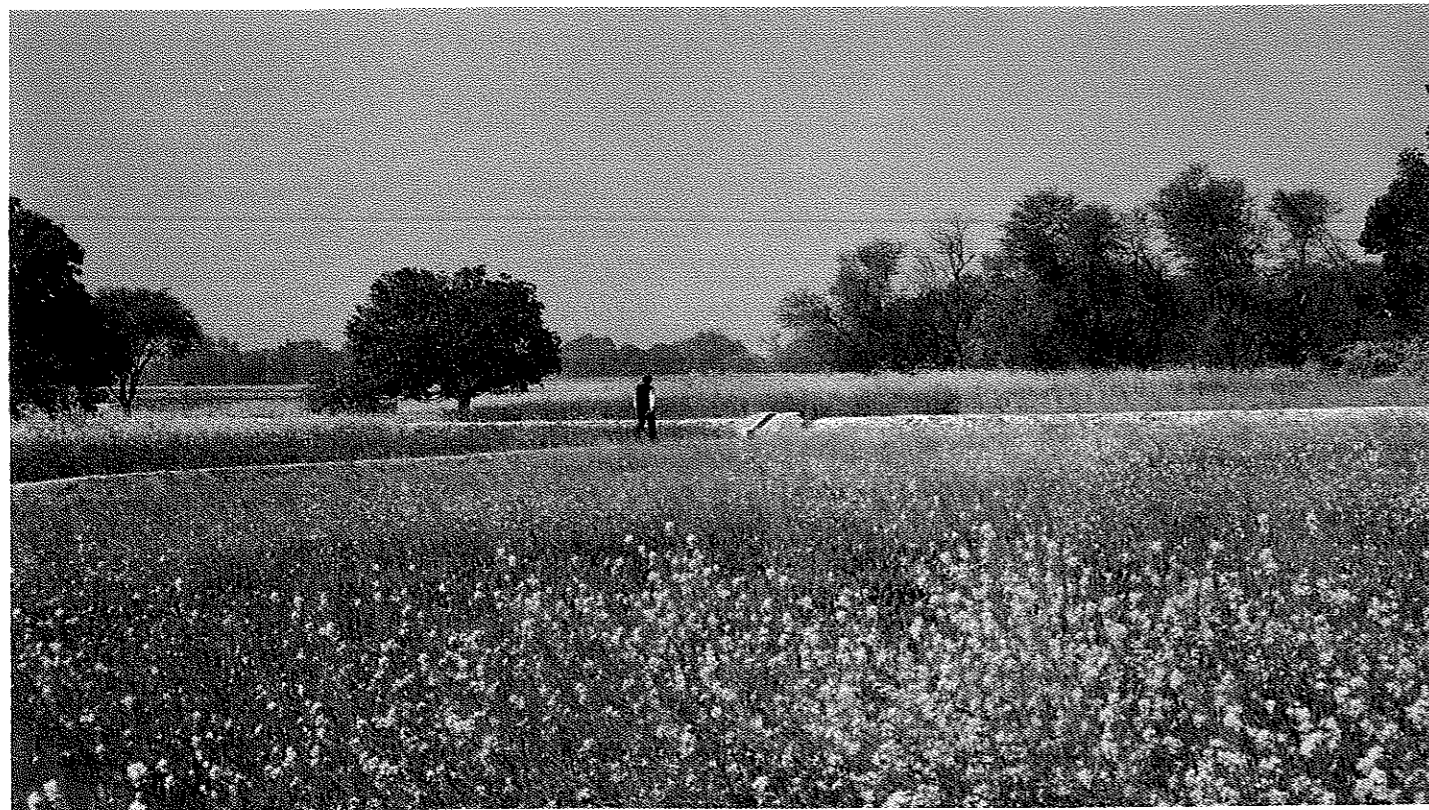




The need of the hour is to implement field tested techniques and lessons learned from pilot projects on a regional basis.



Rationale for watershed management.

At the prevailing growth rate, experts estimate that India's population would be nearly doubled in the next 50 years. This would mean that even at the present rate of consumption, the country would require about double the quantity of everything it consumes today.

Other than air and water, everything we physically consume is derived from three basic sources namely - plant life, animal life and mining. The management of these natural resources therefore assumes immense importance and holds the key to the very survival of the future generation.

An appraisal of the available literatures indicates that in India, the extent of wasteland could range anywhere between 25-60 percent of the total geographical area.

It has been estimated that in India on an average, 16.75 to/ha/year (or approximately 1 cm/10 years) of soil are lost through erosion.





Project implementation can only be successful if the people participate and contribute adequately to the development programme.

With a view to check erosion, soil and water conservation programmes were launched by both central and state governments during the various Five Year Plans since early fifties. Programmes like Flood Prone Rivers (FPR), River Valley Projects (RVP), the Drought Prone Area Programme (DPAP), Desert Development Programme (DDP), National Watershed Development Programme for Rainfed Agriculture (NWDPA), Soil, Water and Tree Conservation (Operation Soil Watch), Operational Research Projects on Integrated Watershed Management, Jawahar Rozgar Yojana (JRY) were started with the definite objectives: improvement of productivity of catchment areas, optimum use of soil, land and water and their conservation, employment generation etc. Altogether, approximately Rs. 6 billion is spent each year by governmental and non-governmental organisations for soil and water conservation programmes.

The Ministry of Agriculture, Soil & Water Conservation Division has identified 39 areas in which it sponsors erosion control activities under the following schemes:-

- River Valley Project (RVP)
- Flood Prone Rivers (FPR)

These schemes are implemented by various nodal State Departments on a grant/loan basis with a total annual budget of approximately Rs. 1400 million.

The soil and water conservation measures under these programmes are implemented mostly on government lands. As per their guidelines, these are to be maintained departmentally for a period of two years after which the beneficiary communities are expected to take over the responsibility of maintenance. This does not always happen in reality since the structures constructed in government lands are considered as government property. Moreover, the communities are interested only in direct benefits.

They generally fail to appreciate the indirect and long-term benefits these activities accrue to their lands, due to the lack of awareness. Failure to protect and maintain these structures eventually neutralizes whatever benefits the programme had generated earlier. The main reason for watershed management programmes under the RVP and FPR schemes not generating the desired results is lack of involvement of the local communities.

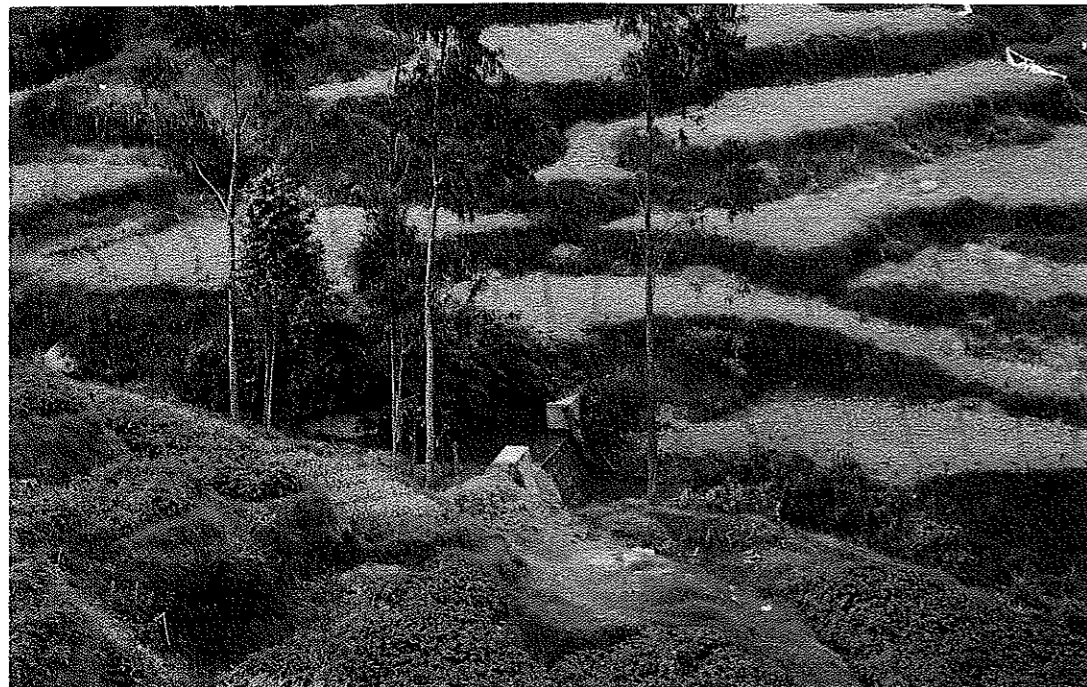
The scope of watershed management is, however, not limited to the implementation of soil and water conservation measures alone. Though this

a silent process

The degradation of the world's soils has been likened to the eating of a lollipop. It is a silent process. With each lick there is less for the future. The soil slips away in such small increments that its loss is hardly recognized except at times of major flooding or dust storms.

Ecological degradation is to a great extent the result of economic, social and political inadequacies. It is also, and with growing force, a principal cause of poverty. If the environmental balance is disturbed and the ecosystem's capacity to meet human needs is crippled, the plight of those living directly off the land worsens, and recovery and development efforts become all the more difficult.

*Elizabeth Dowdeswell,
Executive Director, UNEP*



is the first and most important step, a series of other multisectoral interrelated activities are also essential to bring about sustainable development in the watershed. The local farmers should come to a stage where they can manage their own land and water resources for greater agricultural production even after the withdrawal of the implementing agency.

There are many recorded cases which prove that project implementation can only be successful if the farmers are actively involved and contribute adequately to the programme. "Give away" aid from national or international sources does not generate feelings of identity and responsibility for the farmers, - on the contrary it may even slow down acceptance.

It should be realized that the present situation in India is not always what it should be. Most of the planning is done by the state authorities and the works are carried out by paying the farmers or labor from elsewhere without much involvement or contribution of the beneficiaries during the planning and implementation stages.

A good illustration of the consequences of this approach is the very clearly visible difference in the quality of private agricultural land, where people do care and neighboring government land - be it for afforestation or land for grazing - where people care far less.



Concept of watershed management.

Watershed management has been defined as an integration of technologies within the natural boundaries of a drainage area for optimum development of land, water and plant resources to meet the basic minimum needs of the people in a sustainable manner.

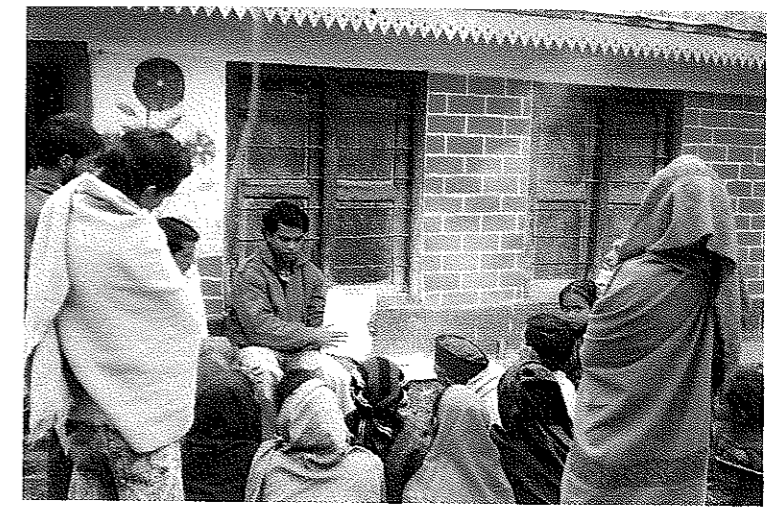
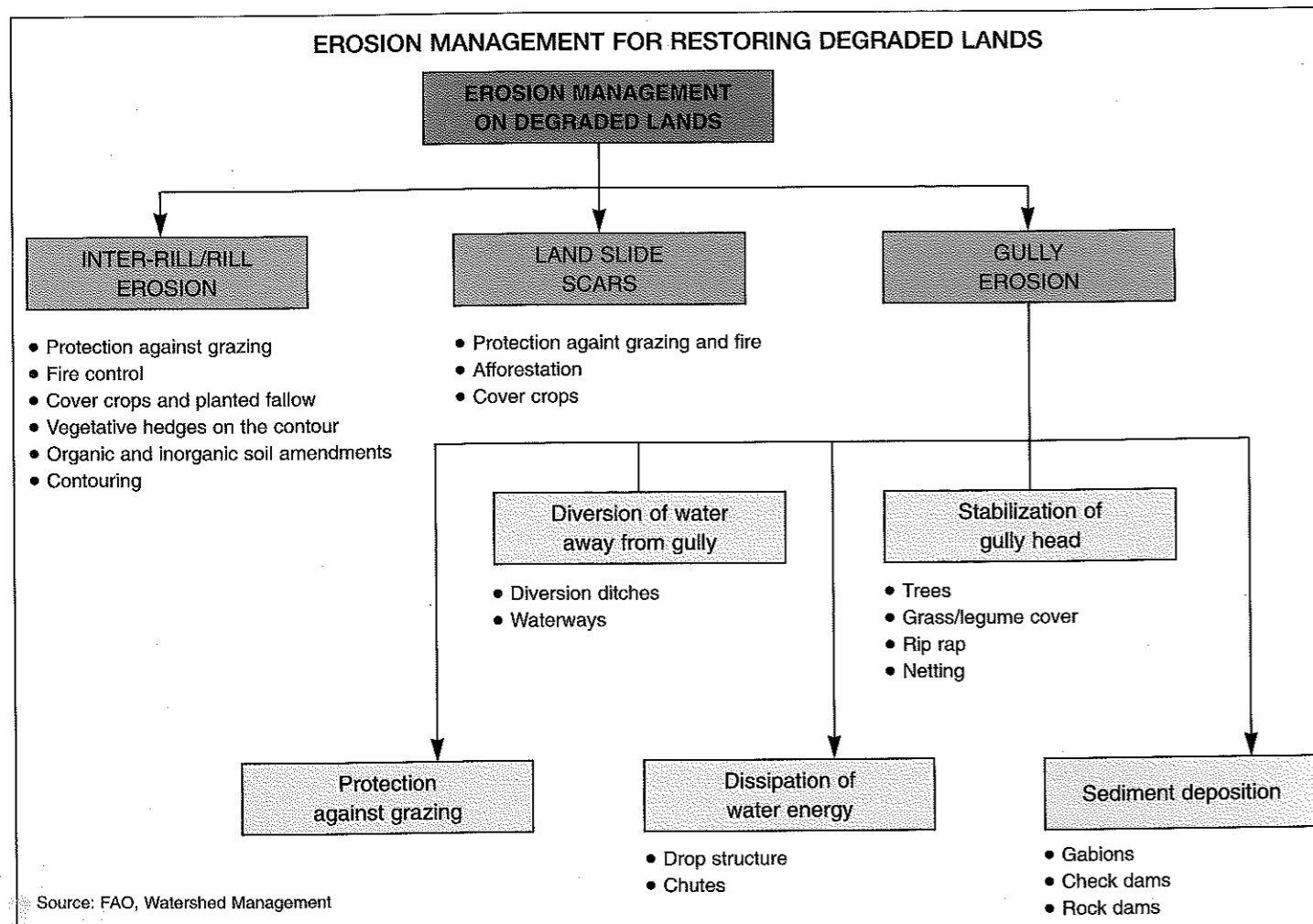
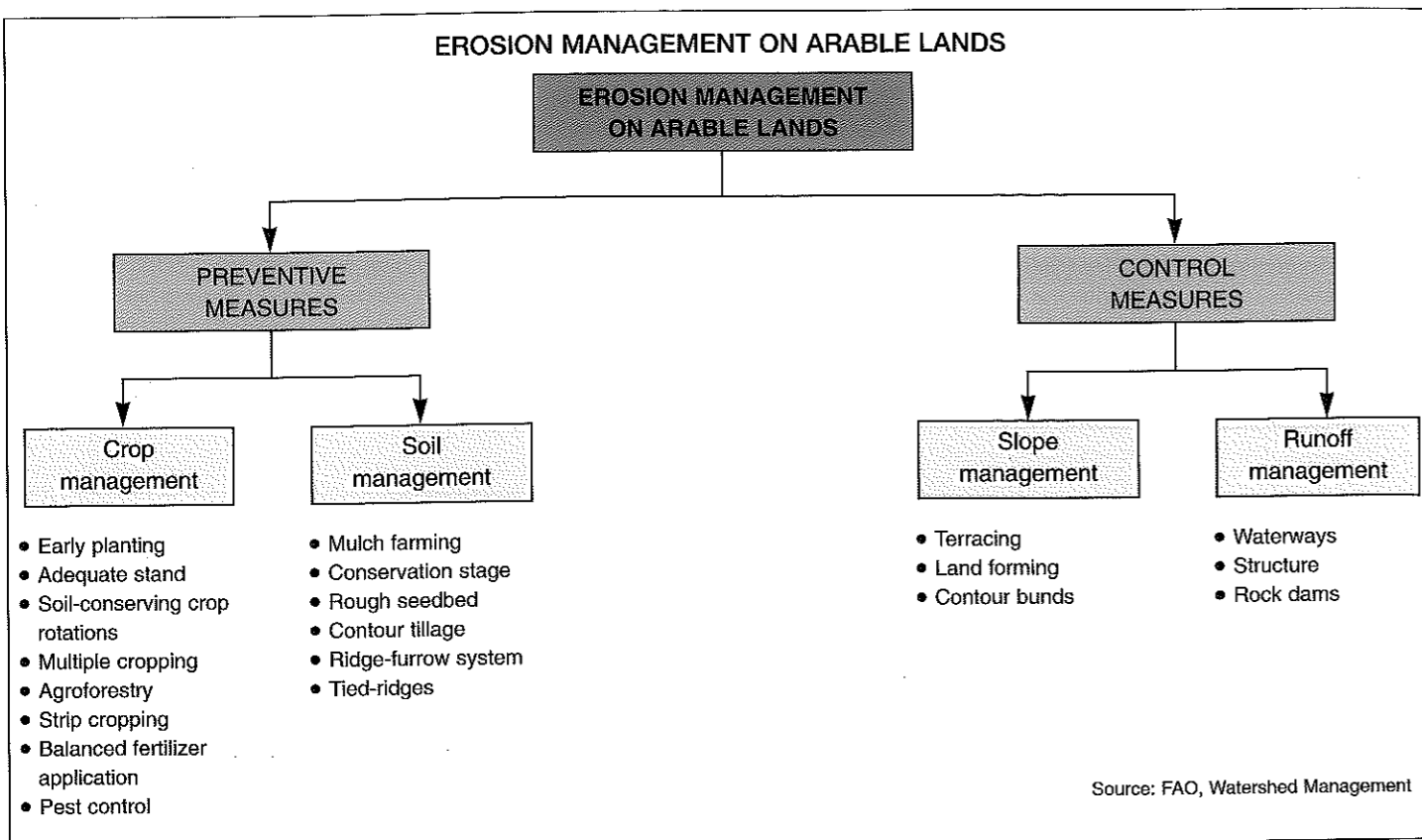
The concept of integrated treatment of all lands on a watershed basis was adopted and implemented by the Damodar Valley Corporation in the states of Bihar and West Bengal as early as 1949. It was only in the 1970s, however, that a series of such projects was started, developing comprehensive programmes for the integrated development and optimum use of land, water, animals, energy and forest resources, with government departments commandeering the show. The funding came from the government, which explains its major role.

Before long, however, non-governmental and voluntary organizations started taking an interest and stressed the social aspects of these projects. It was soon recognized that development could not be thrust upon people. No developmental programme worth its salt can function without the agreement, involvement and participation of the people whom it is supposed to benefit. Government organizations however, are overly skeptical about the ability of villagers to grasp technical complexities or to handle large sums of money and would rather manage the whole show themselves. As Elizabeth Dowdeswell, Executive Director UNEP, puts it, "sometimes, when reading the reports of economists, foresters, engineers, ecologists and agronomists, it is hard to believe they are describing the same country."

definition of watershed management

A watershed is a topographically delineated area that is drained by a stream system.

A watershed is made up of its physical and hydrological natural resources as well as human resources. Management of a watershed thus entails the rational utilization of land and water resources for optimum production but with minimum hazard to natural and human resources. Therefore, watershed management is the process of guiding and organizing land use and use of other resources in a watershed to provide desired goods and services without adversely affecting soil and water resources. Embedded in this concept is the recognition of the interrelationships among land use, soil and water, and the linkages between uplands and downstream areas.



Over the years, the persistence of NGOs in securing community involvement inspite of governmental skepticism, merely proves that it is only by an integrated, gender sensitive, people-oriented effort of state, local and non-governmental agencies that development can take place and spread throughout the country.

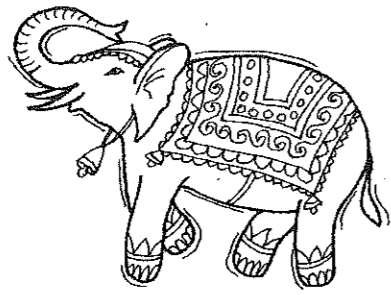
The role of community participation in development cannot be denied and what is now termed the "participatory approach" is a cornerstone of modern developmental theory. As one of the aims of any watershed management project is to create viable, local, community-based organizations, or Watershed Management Committees that will manage and maintain the watersheds which they inhabit, the participatory approach is considered essential.

Working towards change.

Our natural resources: soil, water and forests are being over-used to sustain a growing population.

Erosion and the rapid depletion of reserves of groundwater are causing increasing poverty. The catastrophic consequence of this is visible in the mass migration to urban areas, malnutrition, a massive increase in the workload of women in rural areas and a rise in the number of landless laborers.

To counter this downward spiral of mutual destruction between man and nature, developmental goals in India have to be tailored to meet indigenous needs. For relatively rapid development what is needed in varying proportions is education, readily available health services, redistribution of land, the channelising of investment to small subsistence farmers, self-help promotion, and the participation of all in working towards change.



Solutions must be found that represent an integrated response of national and local governments, communities, and individuals and that address the multiple resource needs of local people without adversely affecting the environment. Neither a “bottom up” nor a “top down” approach alone can achieve the objectives of watershed management.

A watershed management approach considers the productive areas of natural resources development, but also realizes that the actions of upstream farmers affect those living downstream. With only a local farmer perspective, downstream effects of land use are often overlooked.

Furthermore watershed management should not deal only with farmers. Landless people play a crucial role in the management of natural resources and must be included in any programme.

Similarly, watersheds that are critical habitats for certain plant and animal species require a regional or national response; otherwise, the food and resource needs of subsistence farmers will naturally take precedence.

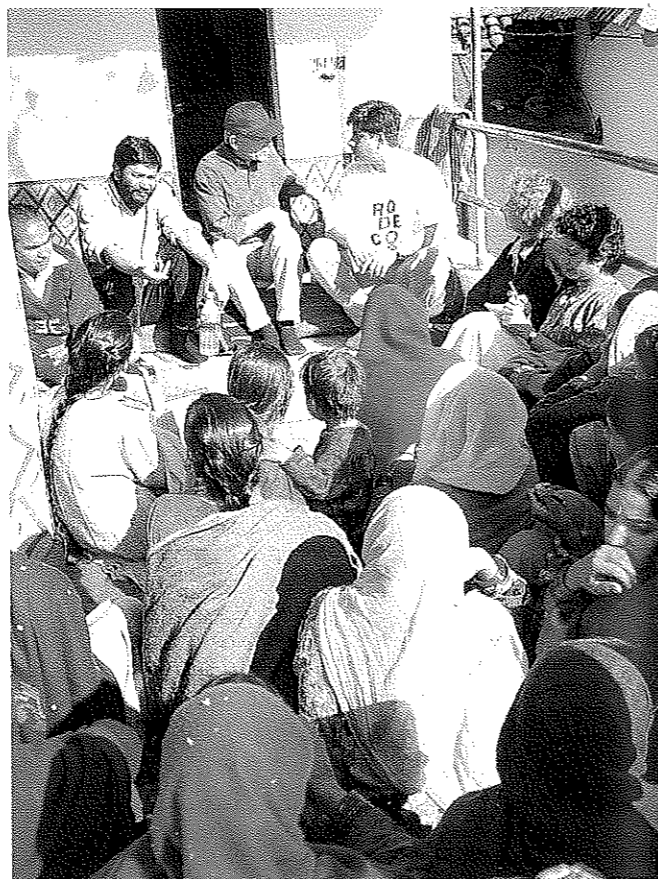
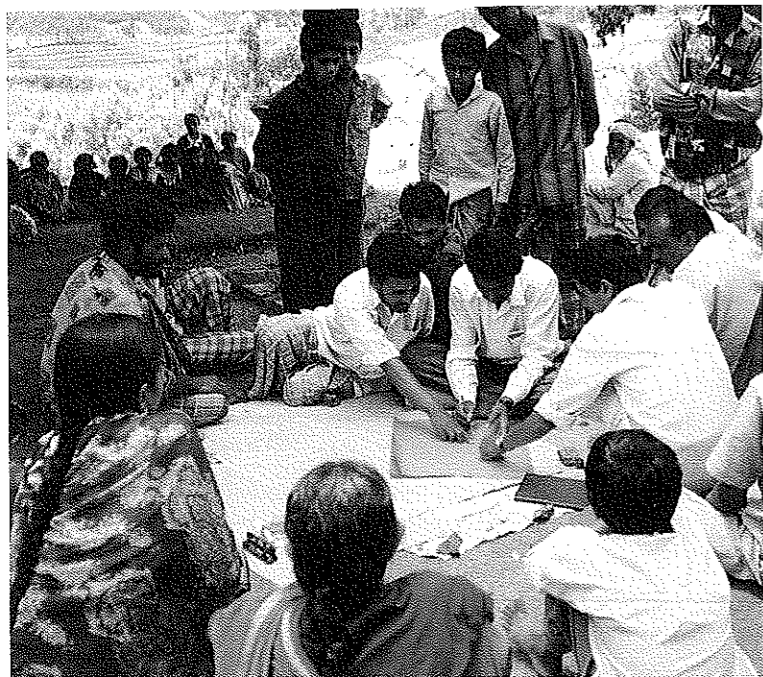


A watershed management approach incorporates “Soil and Water Conservation” and “Land Use Planning” into a broader, logical framework by focusing on the following concepts:

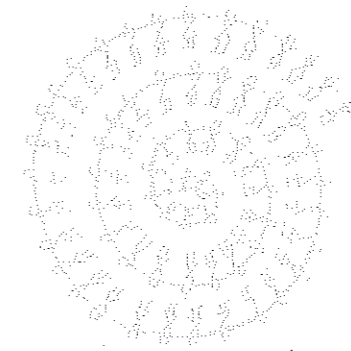
- People are affected both positively and negatively by the interaction of water and other resources, and in turn, people have an impact on the nature and severity of such interactions by the ways in which they use resources and the quantities in which they use them.
- The impacts of these interactions follow watershed boundaries, not political boundaries; water flows downhill regardless of how people define their administrative boundaries. Thus, what is done in the highlands of one administrative unit (country, community, or landowner) can significantly affect another political unit occupying a downstream position within the watershed.

watershed management solutions must:

- deal with rural poverty.
- develop programmes that protect and rehabilitate degraded areas, particularly those that pose hazards to human life and welfare.
- develop awareness for soil and water conservation.
- develop community based organisations that assist the rural poor to implement soil and water conservation measures and to improve their livelihood.



Watershed management should be a joint venture between all stakeholders.



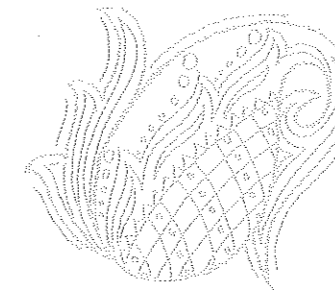
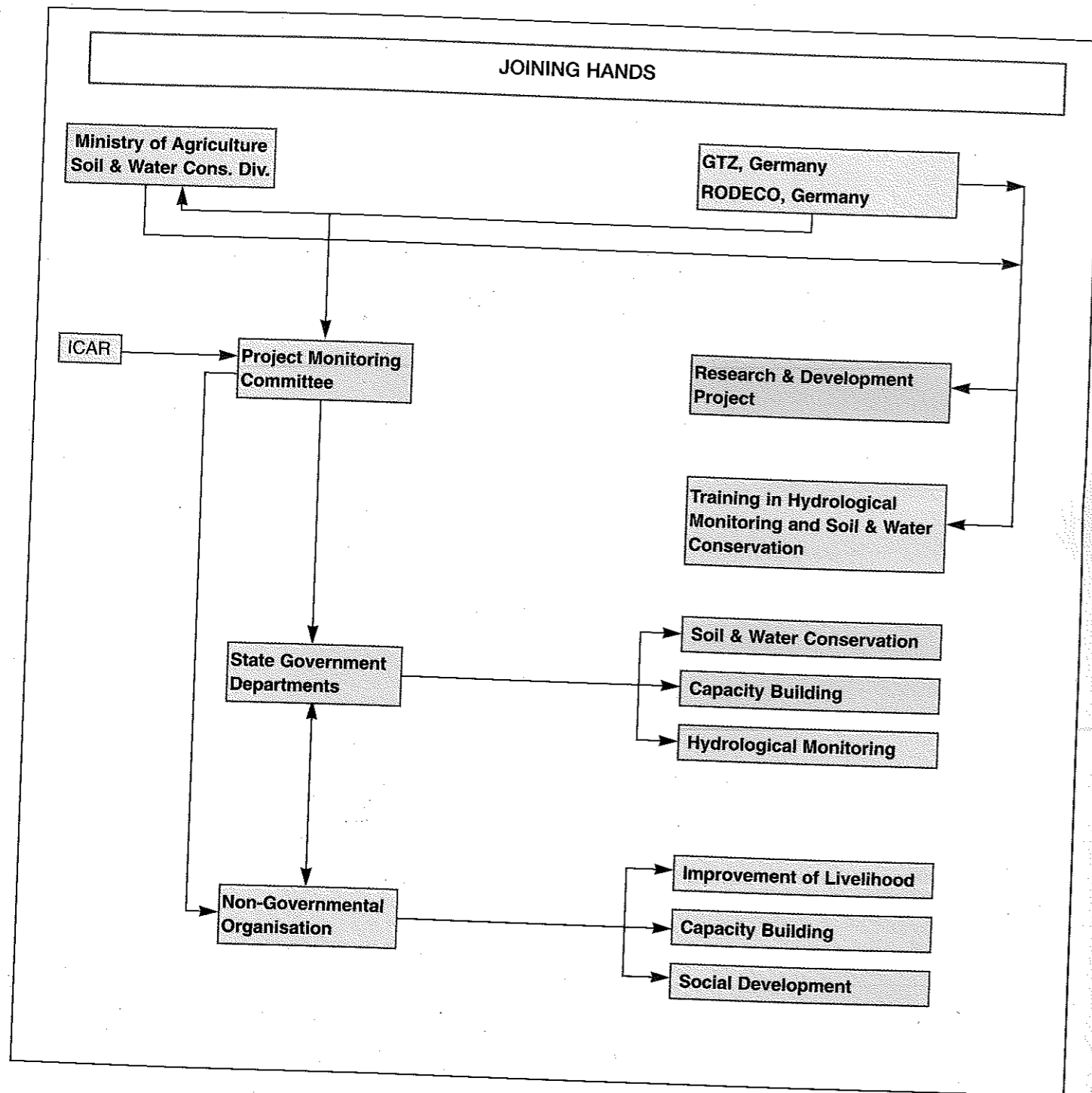
Developing a framework for nationwide replication.

It was the rapid depletion of natural resources that led the Indian and German Governments to setup the Indo-German Bilateral Project “Watershed Management”, that would be instrumental in bringing about the fundamental and desired changes in the implementation as well as monitoring of soil and water conservation measures.

The project has the major responsibility to evolve approaches, mechanisms and models for watershed management that are adaptable, and can be replicated in the entire country which is characterized by great diversity in terms of its topography, environment and socio-economic conditions. The important issue was to evolve ways and means to make watershed management a people’s movement with every inhabitant in a watershed making his/her contribution towards it. Some of the areas for exploration for the project and its partners viz: the Central and State Government Departments and the Non-Governmental Organizations are:

- How can participation of the local population in watershed management activities be achieved?
- What kind of activities may constitute a part of watershed management? Could there be scope for innovation and flexibility in order to meet the livelihood and other needs of the inhabitants of the watershed?
- How can the NGOs and State Government Departments work together in achieving the watershed management objectives?
- What could be the strategies for building the capabilities of various actors within a watershed and what kind of training design and facilities are required to meet the needs at state and national levels?
- What could be indicators for effectively monitoring the impact within a watershed? What could be the systems, tools and technologies best suited to local conditions for monitoring and evaluation?

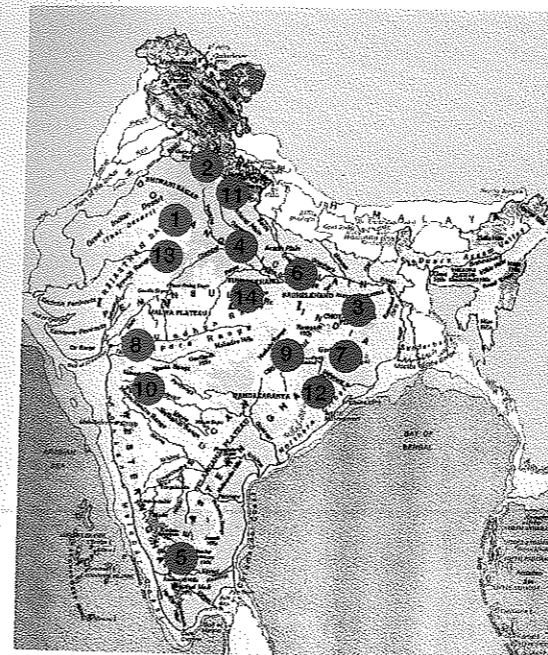
In addressing these and other related issues, the project is focusing on developing a set of protocols for Integrated and Participatory Watershed Management. These protocols can then be used by planners and policy makers as a framework for replicating Watershed Management activities throughout the country on a sustainable basis.



The Representative Watershed Programme.

In order that nationwide applicable protocols emerge, it was decided that a sample from amongst the watersheds across the country be chosen.

Presently nine watersheds have been chosen. These watersheds are expected to be representative in nature:



- They represent the wide variety of agro climatic regions i.e. the Gangetic plains; western lower Himalayan range; semi-arid regions; Eastern and Western Ghats; and the southern Indian hills. Incidentally, these regions also provide an opportunity to work with people of diverse socio-economic backgrounds within the country.
- On the other hand, care was taken to select those watersheds that are similar to the surrounding watersheds within that region so that the learning could be replicated practically.
- Finally, high to very high priority watersheds (based on the severity of erosion) were selected, once again to ensure that the lessons of these watersheds can be applied in other watersheds even if the extent of erosion is high.

It is pertinent to add here that only untreated watersheds were selected, not only from the point of view of replication, but also to compare the rate of soil loss, before, during and after the treatment of the watersheds. It is thus imperative to set up Silt Monitoring Stations (SMS) in each Representative Watershed (RWS) and in other reference watersheds.

No.	Project Regions	SMS	RWS
1.	Rajasthan(Sahibi)	2	1
2.	Himachal Pradesh	1	1
3.	Bihar (DVC)	3	1
4.	Uttar Pradesh (Gomti)	2	1
5.	Tamil Nadu	3	1
6.	Bihar	2	
7.	Orissa	2	
8.	Gujarat	2	
9.	Madhya Pradesh	2	
10.	Maharashtra	3	
11.	Uttar Pradesh (Upper Yamuna)	2	1
12.	Andhra Pradesh	2	1
13.	Rajasthan (Banaras)	2	1
14.	Uttar Pradesh (Sone)	1	1
	Total	29	9



Soil and water conservation activities are the central

element of any watershed management project.





Prioritization of watersheds.

The All India Soil & Land Use Survey (AISLUS) is an office of the Ministry of Agriculture. Since 1958 it has been engaged in conducting soil and land resource surveys in the catchment areas of River Valley Projects (RVP) and Flood Prone River (FPR) to prioritize Soil Conservation Programmes.

Soil Conservation activities aim at controlling siltation of the reservoirs retarding flood hazards as well as reducing erosion and are planned in 39 catchments involving an area of about 130 million hectares.

The last two decades AISLUS has been carrying out rapid reconnaissance surveys aimed at prioritizing severely eroding/high runoff generating sub-watersheds within the RVP/FPR catchments.

There are two methods of prioritizing the watersheds:

- Sediment Yield Index Model for RVP areas and
- Potential Run-off Index for FPR areas

THE SEDIMENT INDEX MODEL (SYI)

The AISLUS in 1972 developed a Sediment Yield Index methodology for demarcating the priority watersheds in each of the RVP catchments. It comprises systematic delineation and codification of sub-catchments, watersheds and sub-watersheds on 1:50,000 scale drainage base maps prepared from Survey of India toposheets. The erosion intensity units are then mapped in the field using toposheets, aerial photographs and other base material.

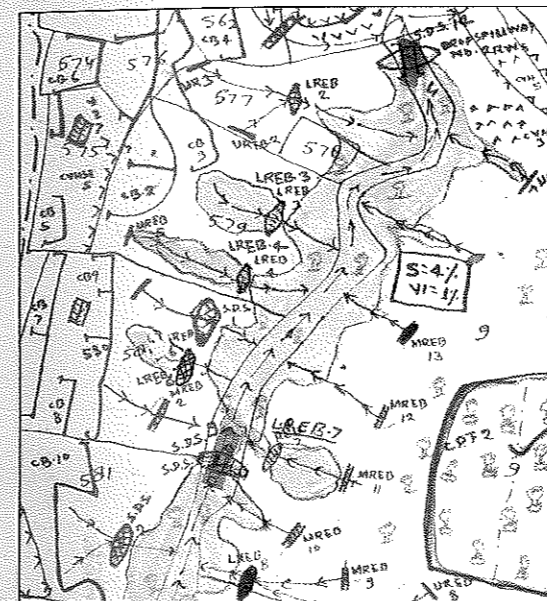
The following mapping units are assigned numerical values implying their comparative but not proportional silt potential.

- Physiography and slope
- Surface cover conditions and present land use
- Soil class, depth, texture, colour etc.
- Impressions of erosion

The likely delivery of the eroded material into the reservoir is judged by delivery ratio. (It refers to the per cent of the soil material detached from the source area reaching the

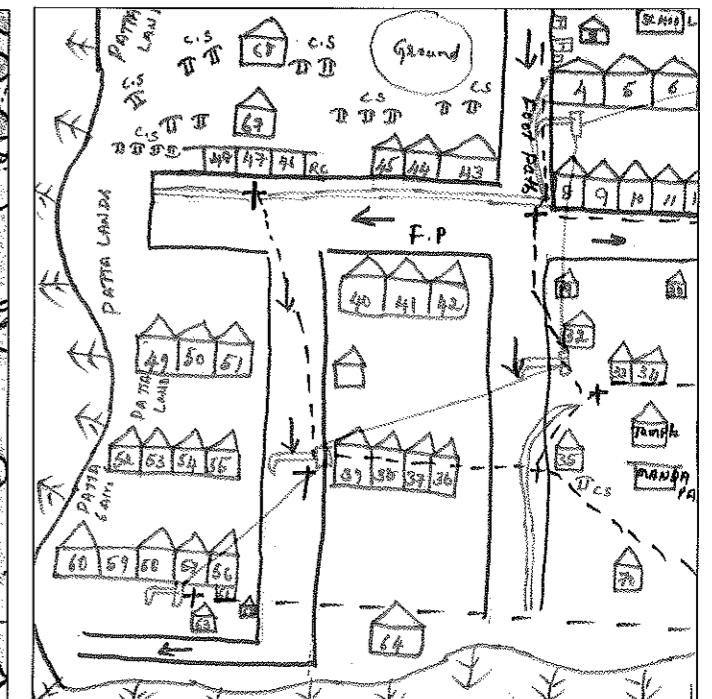
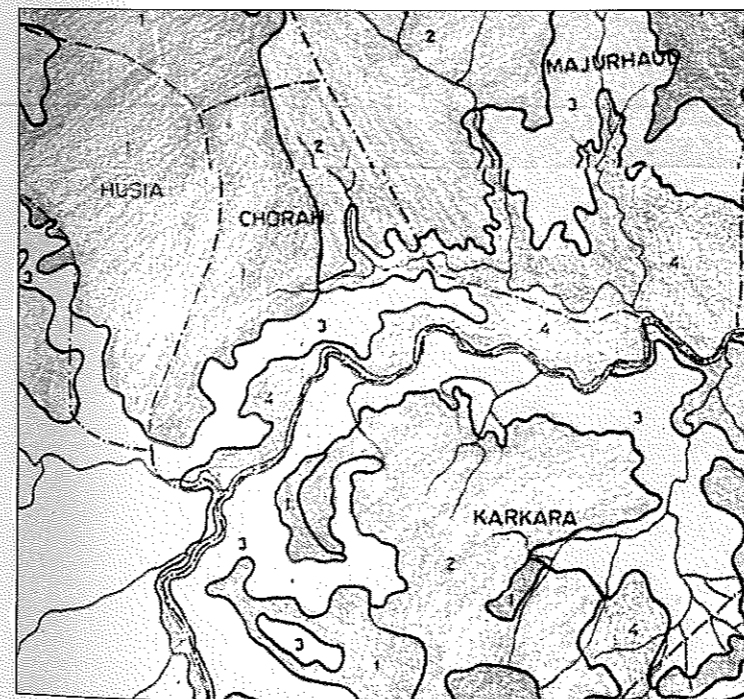
sink area of a reservoir through surface flow or travelling through drainage courses). The following factors are collectively considered to determine the delivery ratio:

- Nature of soil
- Distance from reservoir
- Relief/length ratio and drainage density
- Proximity of active stream
- Slope gradient and surface cover conditions
- Existing lakes, ponds, silt traps etc.



The application of the SYI model for prioritization of sub watersheds in the catchment areas involves the evaluation of:

- Climatic factors comprising total precipitation, its frequency and intensity.
- Geomorphological factors comprising land forms, physiography, slope and drainage characteristics.
- Soil factors i.e. soil texture, structure, organic matter content.
- Surface cover factors governing the flow hydraulics and management factors
- Computing Silt Yield Index for individual watersheds/sub-watersheds. Grading of watersheds/sub-watersheds into very high, high, medium, and low priority categories.



POTENTIAL RUN-OFF-INDEX MODEL (PRI)

This model is used for prioritization of watersheds/sub-watersheds in Flood Prone River (FPR) catchment areas. It is a modification and expansion of the SYI model wherein the erosivity values of an assemblage of soil and land parameters are replaced by the Run-off weightage values. The delivery ratio is not taken into account. The assessment of numerical run-off weightage value is based on the relative appraisal of the impact of soil and land attributes on the run-off generation. The run-off potential index is the total quantum of run-off generated per unit area.

CATEGORIZATION AND GRADATION OF SUB-WATERSHEDS

The gradation and assignment of priority ratings to the sub-watersheds are based on the descending values of Sediment Yield Index/Potential Run-Off Index values. For deciding upon the boundaries of various priority categories, i.e. very high, high, medium, low and very low categories, the data (SYI or PRI values) are tabulated and their spread studied. The frequency distribution of the data is worked out by grouping the data in narrow bands of SYI/RPI values against the number of sub-watersheds within each of the ranges.

looking ahead

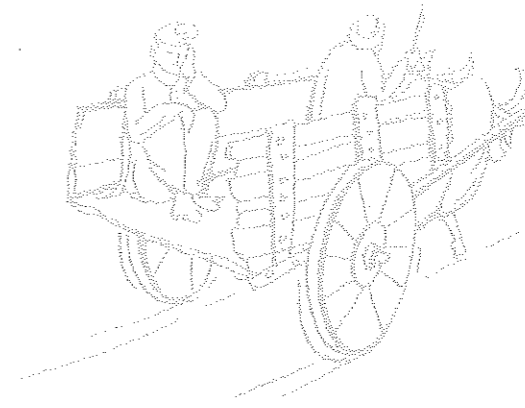
While there is a realization that soil and water conservation measures were the first and most important step, a series of other multisectoral interrelated activities are also considered essential for management of resources within the watershed. This thinking led to the creation of the Representative Watershed approach. This approach envisages to overcome the following inherent limitations of the RVP/FPR Schemes:

- Funds must allow other activities besides soil and water conservation.
- Monitoring and evaluation of the schemes must be improved.
- Participation of local people must be enhanced.

REPRESENTATIVE WATERSHEDS (RWS)

RWS	State	District	Area (ha)	Watershed Code	Catchment	Priority	RVP/FPR	State Department	NGO	Status
Burhanpura	Rajasthan	Sikar	1175	Mf4j	Sahibi	Very high	FPR	Forest Department, Jaipur, Rajasthan	Kumarappa Institute of Gram Swaraj (KIGS), Jaipur, Rajasthan	Ongoing since, Oct. 94
Karkara	Bihar	Chatra	1751	Tb2d	Tilaya Dam	Very high	RVP	Damodar Valley Corporation (DVC), Soil Conservation, Hazaribagh, Bihar	Professional Assistance for Development Action (PRADAN), Hazaribagh, Bihar	Ongoing since, Oct. 94
Arki	Himachal Pradesh	Solan	2460	Sd3d	Sutlej	Very high	FPR	Forest Department, Kunihar, Himachal Pradesh	Social Uplift Through Rural Action (SUTRA), Jagjit Nagar, Himachal Pradesh	Ongoing since, March 95
Nawazgarh	Uttar Pradesh	Sultanpur	1750	Gc8a	Gomti	High	RVP	Department of Agriculture, Soil Conservation, Sultanpur, Uttar Pradesh	Baba Sri Nath Shiksha Sansthan (BSNSS), Sultanpur, Uttar Pradesh	Ongoing since, May 96
Katterly	Tamil Nadu	Nilgiris	2976	Bc3e	Lower Bhavani	Very high	RVP	Department of Agric. Engineering, Ooty Tamil Nadu	MYRADA, Bangalore, Karnataka	Ongoing since, April 96

RWS	State	District	Area (ha)	Watershed Code	Catchment	Priority	RVP/ FPR	State Department	NGO	Status
Kinchumunda	Andhra Pradesh	Vishakapatnam	1015	Mh1b	Machkund	High	RVP	Forest Department, Vishakapatnam, Andhra Pradesh		Planning stage
Jhangeri	Uttar Pradesh (Hills)	Tehri Garhwal	2750	Yk2h	Upper Yamuna	High	FPR	Forest Department, Dehradun, Uttar Pradesh	Society of People for Development (SPD), Dehradun, Uttar Pradesh	Ongoing since Aug.'99
Rajwas	Rajasthan	Tonk	3275	2D2A6w	Banas	High	RVP	Forest Department, Jaipur, Rajasthan	Kumarappa Institute of Gram Swaraj (KIGS), Jaipur, Rajasthan	Ongoing since Aug.'99
Makkarat	Uttar Pradesh	Sonebhadra	2850	Sg3p	Sone	Very high	RVP	Department of Agriculture, Soil Cons. Renukoot, Uttar Pradesh	Banvashi Seva Ashram (BSA), Renukoot, Uttar Pradesh	Ongoing since Aug.'99



Participatory approach for sustainable development.

As discussed earlier, lack of involvement of the people in the past in the management of watersheds has been a major hindrance in sustaining whatever conservation measures have been adopted. The project strives to reverse this trend.

Maintenance of the development activities carried out in the watershed is a key issue for the project and it is mainly to ensure this that the need for people's participation has been emphasized in the RWS programme.

The project views participation as an evolutionary process and has begun with creating awareness and agreement amongst people regarding issues related to watershed management and getting them involved from the very early stages of implementation

in a manner that not only benefits the people but creates a sense of ownership and the confidence to exercise control over resources; the knowledge of their rights and entitlements about possible sources of external support. The project believes that such a process could enable the people to gradually be able to draw out the external resources as per their needs, and sustain the process of development. To achieve this, the project is striving to develop an attitude in the project to work as a community, and organizing themselves into groups and collectives that function on the basis of norms that are evolved by the people themselves. These norms may ensure, inter alia, representation of the various interest groups, a say in the decision making and equitable distribution of benefits.

The project visualizes that in each RWS, based on the efforts and experiments in forming groups and working together, people's own institutions in the form of Watershed Committees would emerge, which would be responsible for and capable of coordinating and sustaining the development of the watershed.

