CHAPTER I
CHAPTER I

INTRODUCTION

Water is one of our most valuable resources to humans. Every living organism requires water in some form. As such, water regulates population growth, influences health and living conditions, and determines biodiversity. The presence or absence of water is critical to determining the uses to which land can be put.

A “watershed” refers to an area that drains into the same body of water. Watersheds capture precipitation, filter and store water, and determine its release. It is an integrated system, with actions in one part of a watershed often impacting the whole watershed; as such, it is the most appropriate unit for water management and related ecological values.

1.1 Concept of Watershed

Watershed is defined as a geohydrological unit draining to a common point by a system of drains. All lands on earth are part of one watershed or other. Watershed is thus the land and water area, which contributes runoff to a common point. In other words watershed is a topographically delineated area draining into a single channel.

Watershed is considered as a biological, physical, economic and social system too. Viewed in another angle watershed is a natural unit of land, which collects water and drains through a common point by a system of drains. Hence it comprise of a Catchmerit area (Recharge Zone), a Command area (Transition Zone) and a Delta area (Discharge
Watershed management seeks to ensure the wise and effective use of water resources, and in particular the quantity and quality of water released. Over the years watershed advocates have developed and advocating for watershed management based upon “sustainable watershed management principles” and the underlying concept of...
“Integrated Watershed Management (IWM).” Sustainable watershed management principles include:

- Integrated resource management by linking water quality and quantity and the management of other resources, recognising hydrological, ecological, social and institutional systems, and recognising the importance of watershed and aquifer boundaries.

- Water conservation and the protection of water quality by recognising the value and limits of water resources, the cost of providing water, acknowledging both consumptive and non-consumptive values, and balancing education, market forces and regulatory systems.

- Resolve water management issues by multi-stakeholder collaborative planning, monitoring, researching, consulting, negotiating for consensus, and ensuring accountability through open communication, education and public access to information.

Watershed management is the process of creating and implementing plans, programs, and projects to sustain and enhance watershed functions that affect the plant, animal, and human communities within a watershed boundary. Features of a watershed that agencies seek to manage include water supply, water quality, drainage, stormwater runoff, water rights, and the overall planning and utilisation of watersheds. Landowners, land use agencies, stormwater management experts, environmental specialists, water use purveyors and communities all play an integral part in the management of a watershed.
1.2 Objectives of Watershed Management

The term watershed management is nearly synonymous with soil and water conservation with the difference that emphasis is on flood protection and sediment control besides maximising crop production. The basic objective of watershed management is thus meeting the problems of land and water use, not in terms of any one resource but on the basis that all the resources are interdependent and must, therefore, be considered together. The watershed aims, ultimately, at improving standards of living of common people in the basin by increasing their earning capacity, by offering facilities such as electricity, drinking water, irrigation water, and freedom from fears of floods, droughts etc.

The objectives of the watershed management include:

- Utilizing the available land to its maximum productivity by adopting various/suitable measures according to the land capability and without any environmental degradation.
- Maximizing productivity per unit area, per unit time and per unit of water to meet the food, fodder and fuel requirements of the people living in the watershed.
- Conserving as much rainwater as possible in the place where it falls and also increasing the ground water level to get water throughout the year and maintaining it for sustainability.
- Preventing soil erosion by means of suitable soil and water conservation measures.
- Draining the excess water safely and avoiding gully formation and flooding the areas.
- Maximising the water storage capacity in the watershed, both in the soil and storage structures.
- Improving the infrastructural facilities in the watershed.
- Increasing the level of income and status of the people living in the watershed.

1.3 Types of Watershed Management

Watersheds could be classified into a number of groups depending upon the mode of classification. The common modes of categorisation are the size, drainage, shape and land use pattern. The categorisation could also be based on the size of the stream or river, the point of interception of the stream or the river and the drainage density and its distribution. The All India Soil and Land Use Surveys (AIS&LUS) of the Ministry of Agriculture, Government of India, have developed a system for watershed delineation like water resource region, basin, catchment, sub-catchment, and watershed. The usually accepted five levels of watershed delineation based on geographical area of the watershed are the following:

1. Macro watershed (> 50,000 Hect)
2. Sub-watershed (10,000 to 50,000 Hect)
3. Milli-watershed (1000 to 10000 Hect)
4. Micro watershed (100 to 1000 Hect)
5. Mini watershed (1-100 Hect)
A watershed could be described as fan shaped (near circular) or fen shaped (elongated). Hydrologically the shape of the watershed is important because it controls the time taken for the runoff to concentrate at the outlet. Watersheds may also be categorised as hill or flat watersheds, humid or arid watersheds, red soil watershed or black soil watershed based on criteria like soil, slope, climate etc. Depending on the land use pattern watershed could again be classified as highland watersheds, tribal settlements and watersheds in areas of settled cultivation.

Watersheds can be as big as all the land that drains into the Pacific Ocean, or as small as an acre that drains into your schoolyard pond. Madison, Wisconsin is part of many different watersheds, one bigger than the next. The Yahara Watershed is part of the larger Rock River Watershed, which is in turn part of the Mississippi River Watershed.

Watersheds are made up of houses, neighborhoods, schools, farms, parks, big cities, and little towns. A watershed doesn’t always pay attention to human-made borders, either. Some cross city, county, state, and even international borders. One way of looking at a watershed is through a watershed wheel. This is a way to show how the interaction of space and time serves to organize the variety of life and activities in the watershed on an annual basis.

The watershed provides a powerful study and management unit which integrates ecological, geographical, geological, and cultural aspects of the land. The watershed is also a useful concept for integrating science with historical, cultural, economic, and political issues. Water (movement, cycling, use, quality, etc.) provides a focus for
integrating various aspects of watershed use and for making regional and global connections.

Using the watershed concept, one can start with study of any number of small sub systems (e.g., a particular marsh or sub-watershed; or a particular pollutant, such as salt), and continually relate these small-scale issues to questions of larger-scale watershed system health.

People and their environment are interdependent any change in the surrounding environment directly affects the people living therein. A degraded environment results in a degraded quality of life of the people. Thus efforts to reduce poverty and improve the standard of living of the people must aim at improving the environment they live in. The environment does not recognise people determined administrative boundaries. A watershed provides a natural environmental unit for planning a developmental initiative.

A watershed protection approach is a strategy for effectively protecting and restoring aquatic ecosystems and protecting human health. This strategy has as its premise that many water quality and ecosystem problems are best solved at the watershed level rather than at the individual water body or discharge level. Major features of a watershed protection approach are targeting priority problems, promoting a high level of stakeholder involvement, integrated solutions that make use of the expertise and authority of multiple agencies, and measuring success through monitoring and other data gathering.
1.4 Components of Watershed Management

The three main components in watershed management are land management, water management and biomass management.

1.4.1 Land Management

Land characteristics like terrain, slope, formation, depth, texture, moisture, infiltration rate and soil capability are the major determinants of land management activities in a watersheds areas. The broad category of land management interventions can be as follows:

1. Mechanical measures
2. Structural measures
3. Vegetative measures
4. Production measures
5. Protection measures

Mechanical conservation measures may become necessary in watershed management in the initial stage. Structural measure include interventions like contour bunds, stone bunds, earthen bunds, graded bunds, compartmental bunds, contour terrace walls, contour trenches, bench terracing, broad based terraces, centripetal terraces, field bunds, channel walls, stream bank stabilisation, check dams etc.

Watersheds may contain natural ecosystems like grasslands, wetlands, mangroves, marshes, water bodies. All these ecosystems have a specific role in nature. Vegetative
measures include vegetative cover, plant cover, mulching, vegetative hedges, grass land management, vettiver fencing, agro-forestry, etc. The production measures include interventions aimed at increasing the productivity of land like mixed cropping, strip cropping, cover cropping, crop rotations, cultivation of shrubs and herbs, contour cultivation conservation tillage, land leveling, use of improved verity of seeds, horticulture, etc.

Protective measures like landslide control, gully plugging, runoff collection, etc can also be adopted. Adoption of all the interventions mentioned above should be done strictly in accordance with the characteristics of the land taken for management.

1.4.2. Water Management

Water characteristics like inflows (precipitation, surface water inflow, ground water inflow) water use (evaporation, evapotranspiration, irrigation, drinking water) outflows (surface water outflow, ground water out flow) storage (surface storage, ground water storage, root zone storage) are the principal factors to be taken care of in sustainable water management. The broad interventions for water management are listed below:

✓ Rainwater harvesting
✓ Ground water recharge
✓ Maintenance of water balance
✓ Preventing water pollution
✓ Econorric use of water
Rainwater harvesting forms the major component of water management. The rainwater collected can be recharged into the ground. Roof top water harvesting, diversion of perennial springs and streams into storage structures, farm ponds etc are the methods widely used for rainwater harvesting. Some simple and cost effective rainwater harvesting structures are the following:

- Percolation pits/tanks
- Recharge trenches/rain pits
- Recharge wells
- Ferrocement tanks
- Farm ponds
- V ditch
- Bench terracing

Economic use of water and avoidance of affluence in use of water at individual and community levels may be the major concern for water management in the years to come.

1.4.3 Biomass Management

Major intervention areas for biomass management are indicated below:

- Eco-preservation
- Biomass regeneration
- Forest management and conservation
- Plant protection and social forestry
Increased productivity of animals

Income and employment generation activities

Coordination of health and sanitation programmes

Better Living Standards for People

Eco-friendly life style of people

Formation of a learning Community

1.5 Principles of Watershed Management

The main principles of watershed management based on resource conservation, resource generation and resource utilisation are:

1. Utilising the land based on its capability

2. Protecting fertile top soil

3. Minimising silting up of tanks, reservoirs and lower fertile lands

4. Protecting vegetative cover throughout the year

5. In situ conservation of rain water

6. Safe diversion of gullies and construction of check dams for increasing ground water recharge

7. Increasing cropping intensity through inter and sequence cropping.

8. Alternate land use systems for efficient use of marginal lands.

10. Maximising farm income through agricultural related activities such as dairy, poultry, sheep, and goat forming.

11. Improving infrastructural facilities for storage, transport and agricultural marketing,

12. Improving socio-economic status of farmers

1.6 Historical Development of Watershed Management

The origins of modern watershed management can be traced to two parallel and independent efforts: the restoration of the Alps that started in the last quarter of the nineteenth century; and the conservation movement in the United States in the 1930s. The European effort led to the development of most of today’s land-restoration and torrent-control techniques, while the Americans forged ahead with vegetation manipulation and soil and water conservation.

Although the two approaches were very different in many respects, they shared one important factor: the techniques employed were designed primarily for use in watersheds that were only slightly if at all affected by human action. They were, therefore, designed to have an impact on naturally occurring physical relationships.

Since the Second World War, watershed management efforts have also been undertaken in many developing countries, primarily as a corollary to the construction of important
water-resources development infrastructures, and in recognition of the need to protect these as well as valuable agricultural lands and human settlements. Initially, the technologies and methodologies applied were the same as those that had been used with success in the developed world.

However, many of the initial efforts did not achieve the desired results, primarily because an essential difference in the situation of the watersheds of the developing countries had not been sufficiently taken into consideration. In the developing countries, watersheds (and particularly those located relatively near to important downstream resources) are often inhabited by large and increasing human and animal populations. Most of the people living in these watershed areas are struggling to survive owing to limited resources. As they are forced to cultivate steep, fragile slopes using inappropriate technology, not only do they continue to get minimal returns but in the process they destroy the existing resource base, thereby compromising future prospects for continued production and accelerating downstream soil and water disturbances.

The heritage of technology from Europe and the United States - torrent and gully control, slope treatment measures, landslide prevention, vegetation and soil treatment, etc. - although a necessary component, was patently insufficient to resolve the challenge of watershed management in the developing countries. The key to success is to involve local people and enable them to use their land, livestock and other natural resources in a way that improves productivity, while at the same time reducing to a minimum the
negative impacts on soil and water resources, both in the watershed itself and in
downstream areas.

To produce the desired results, therefore, watershed management efforts must
incorporate “forest hydrology”, “soil and water conservation” and “land use planning”
into a broader, logical framework that takes into consideration not only physical
interrelationships but economic, social and institutional factors as well.

1.7 Watershed Development

A watershed, ecologically speaking, consists of a hierarchy of nested niches
constantly influencing and interacting with each other. Similarly, those living within the
watershed do not institute a homogeneous human community but an agglomeration of
distinct groups or alliances in continual interchange with each other. Thus, both the
watershed and the watershed community living therein are distinct networks of dynamic
relationships constantly in flux and in ever changing configurations and permutations
both in relation to themselves and each other.

Watershed development is the development of watershed area based on type of
soil, depth of soil, vegetative cover, harvestable rain water in that area and watering that
area and water budgeting and treatment given to soils from the ridge to the village. It is
not a simple word. The term watershed development encompasses additional dimensions
like equity, sustainability, gender and peoples participation. It has become a trusted tool
for the overall development of the village and people living within a watershed area.
Watershed development refers to the conservation regeneration and the judicious use of all the resources — natural (like land, water plants, and animals) and human — within the watershed area. Watershed Management tries to bring about the best possible balance in the environment” between natural resources on the one side and man and animals on the other. Since it is the man which is primarily responsible for degradation of environment, regeneration and conservation can only be possible by promoting awakening aried participation among the people who inhabit the watersheds.

The process of watershed development consists in harvesting rainwater wherever it falls, regenerating the environment, increasing green cover and adopting sustainable land husbandry practices in the watershed. It implies making bunds, digging trenches, building gullies etc in a way that will arrest the rapid flow of water from hill slopes to the ground. This is necessary because during the few days of rainfall, the tendency of water is to gush down the slopes and also take the top soil cover along with it. This means that there is no water conservation and precious fertile soil is lost too. When this flow is reduced or made to go through steps, water percolates into the ground at various spots and increases the underground water. At the bottom of the hills, it collects to form water reservoirs and while flowing down slowly it helps turn patches of land green.

Man and his environment are interdependent the changes in the environment directly affect the lives of the people depending on it. A degraded environment means a degraded quality of life of the people. Environmental degradation can be tackled
effectively through the holistic development of the watershed. A watershed provides a natural geo-hydrological unit for planning any developmental initiative.

In order therefore to have effective mobilisation along watershed lines, it is necessary to have the full participation of the watershed community as well as the local milieu in which the watershed community dwells. This means the evolving and establishment of enabling and positive relationships resulting in enduring partnerships. For reality experienced is after all, nothing but relationships.

1.8 Genesis of Watershed Development Programme (WDPs)

In the 80s several of the International Agencies (World Bank, Indo-British programme, later indo-German programme), several voluntary agencies (Aga Khan, MYRADA, BAIF), entrepreneurial individuals (Salunke and Anna Hazare) and some governmental institutions (NARS) started integrating crop, soil and water components and working on an area basis or on community basis. The area approach was primarily on a watershed basis as suggested earlier by Sivaraman and later by Prof. Swaminathan. The community effort largely taken by Civil Societies (NGOs) and individuals was on a habited basis. The results of such efforts had been encouraging particularly under the the agencies other than NARS. The difference between these two sectors had been the importance given to the participatory approaches by the rest of the agencies, while the NARS developed an action plan all by themselves and only got the approval of the action plan by the people who had been the primary stakeholders. Another important difference between these two sectors had been the continuity and longer association of the other
agencies with the community as compared to the NARS programmes. During these exercises / experiences, it was observed that the benefits had been accruing to only those who owned some lands. There were only few instances where the landless were also benefited such examples come from Salunke’s programme of Panipanchayat and that of the CSWCR&TI of Chandigarh at Sukhomajri. Here the water generated through the programme was treated as a common pool resource and even the landless had a share in the water so created. In the later case even the usufructs from the catchment area of the reservoir constructed in the programme were accessible to the entire community. In other words, all the landless and have-fewer communities were also the beneficiaries in such programmes. It is here that programmes like Karnataka Watershed Development Project (KAWAD), Andhra Pradesh Rural Livelihood Project (APRLP) and West Orissa Rural Livelihood Project (WORLP) funded by DFID, UK provided the path to fund such communities as well and make them partners in the WDP. That livelihood support systems are a requirement to make area development on a sustainable basis is now realized and being pursued by all the voluntary agencies as well as the goals through their revised programmes.

1.9 Objectives of Watershed Development Programmes (WDPs)

Watershed development aims to balance the conservation, regeneration and use by humans of land and water resources within a watershed. Common benefits from successful watershed development projects include improved agricultural yields and increased access to drinking water. The overall attributes of the watershed development
approach, by and large, are three fold, viz. promoting economic development of the rural area, employment generation, and restoring ecological balance (DoLR, 2006). However, the multiple objectives include:

**Environmental**- For protecting vegetative cover throughout the year, to create ecological balance in the watershed area, protecting fertile top soil, utilizing the land based on its capabilities, in situ conservation of rain water, increasing ground water recharge, etc.

**Economic**- It draws attention for increase in cropping intensity through inter and sequence cropping, maximizing farm income through agricultural related activities such as dairy, poultry, sheep and goat farming, improved and sustained livelihood status of the watershed community with special emphasis on the poor and women, etc.

**Institutional**-It includes formation of watershed committees and self-help- groups (SHGs) establishing sustainable community organization, etc.

**Social**-It includes alleviation of poverty, awareness generation, improving skills of the local community, capacity building activities, women’s participation in decision-making process, empowerment of the community, etc.

**Equity**-To develop equitable distribution of the benefits of land and water resources development and the consequent biomass production, involvement of village communities in participatory planning, implementation, social and environmental arrangement, maintenance of assets and to operate in a more socially inclusive manner.
1.10 Evolution of watershed development approach

Though the watershed development approach was adopted as early as 1949 yet status wise as today it stands fragmented in terms of activities, programs and funding sources (Vaidyanathan, 1991). There had been a tendency for proliferation of activities with special area, rural development and employment programs. Departments namely agriculture, forests, rural development, National Waste Land Development Board and voluntary organizations are working on different programs like soil conservation, land shaping and development, minor irrigation, social or farm forestry and afforestation.

Three ministries at the Centre namely, the Ministry of Agriculture (MoA), Ministry of Rural Development (MoRD) and Ministry of Environment and Forest (MoEF) along with some respective departments in the States are involved in policy formulation and implementation of watershed development programmes. Ministry of Agriculture started this programme way back in 1960s and mainly dealt with the issues such as to check soil erosion, optimizing production in rainfed areas and reclaiming degraded lands. Subsequently, the MoA approaches were broader and the attention was also in other areas such as soil and water conservation in the catchments of RVPs and Flood Prone Rivers (FPRs), WDPs in shifting cultivation areas, reclamation of alkali soil, Watershed Development Funds and Externally Aided Projects (EAPs). MoRD has been implementing watershed development projects only since the late 1980s. It deals with non-forest wastelands and poverty alleviation programmes having components of soil and water conservation. Watershed programmes implemented by MoRD include
the Drought Prone Areas Programme (DPAP), Desert Development Programme (DDP), Integrated Wastelands Development Programme (IWDP), and Externally Aided Projects (EAPs). Since 1989, the MOEF has been implementing the National Afforestation and Eco-Development Project, with the intention of promoting afforestation and development of degraded forests within an integrated watershed approach.

It is reported that up to the 10th Five Year Plan (2002-07), nearly 51 mha has been developed on watershed basis. The MoRD accounted for 63% of the treated area and the MoA, developed the remaining 37% of the area. The MoEF and Planning Commission had only limited involvement. During the Eleventh Plan, the three area development programmes, namely, Integrated Wasteland Development Programme, Drought Prone Area Programme and Desert Development Programme have been integrated and consolidated into a single programme called Integrated Watershed Management Programme (IWMP). This consolidation is for optimum use of resources, sustainable outcomes and integrated planning. The modified IWMP would adopt a three tier approach in which the upper reaches which are mainly forested and hilly would be treated with the support of Forest Department. For land situated intermediate slopes above the agriculture lands, the IWMP would address all the necessary issues of land treatment by adopting best possible options including cropping pattern, horticulture and agro-forestry etc. In the lower tire, which are plains and mainly agricultural lands, the IWMP would be dovetailed with the employment generating programme such as National Rural Employment Guarantee Scheme (NREGS) an would fill the critical gaps of NREGS and vice-versa. Under the new
programme, a cluster approach would be followed with a broader vision of natural hydro-geographical unit of average size of 4,000 to 10,000 ha comprising of clusters of micro-watershed which will be selected as project area. The programme is implemented by dedicated institutional agencies at state and central level. The project period is proposed in the range of 5 to 7 years in three distinct phases, i.e. Preparatory, Watershed works and Consolidation phase. The consolidation phase will include livelihood activities, marketing, processing and value addition activities (Planning Commission, Government of India).

1.11 Watershed Development Programmes in India

Conservation of water and checking soil erosion is central to the attainment of economic as well as financial sustainability of dry land and agriculture. Integrated watershed development programme is the major policy instrument for achieving this goal. The importance of watershed development as a strategy of agricultural and overall rural development in rainfed areas has been recognized in India for the past several decades. It dates back to the establishment of four dry farming research stations at Rohtak, Sholapur, Hyderabad and Bellary in early 30's.

Watershed Development Programmes which has been increasingly emphasized for dryland plain region in India is a manifestation of the shifting priorities in agricultural sector which till recently had concentrated mainly on crops and regions with assured irrigation. Some of the points of development to be kept in mind are:
• Growth of yield among irrigated crops and regions attained during the initial phase of the green revolution has come to some kind of a halt. Hence the future growth of agricultural production will have to increasingly come from dryland region at least till another flux of large-scale investment in irrigation takes place.

• Frequent failure of rainfall especially since 1980's has resulted into highly fluctuating productivity in dry land region making at difficult to sustain the population on farming system alone.

• The immediate solution of tapping groundwater has also reached alarming levels of depletion in many parts of the dry land region.

• With increasing human and livestock population with the uncertain crop yield has reduced availability of the Common Property Resources (CPRs) and the biomass.

Importance has been given to dry farming in India, esp. since the mid 1980 in order to combat the limited natural sources of water and to protect the land from degradation, conserve rainwater and improve the general economic condition of dry land farmers.

In India, watershed development programme is taken up under various programmes launched by the Government of India. The Drought Prone Area Programme (DPAP) and Desert Development Programme (DDP), adopted watershed approach in 1987. The Integrated Watershed Development Board, National Watershed Programme in Rainfed Areas (NWPRA) under Ministry of Agriculture and Integrated Wastelands Development Programme in 1996 under Ministry of Rural Development and Employment. At present, on-going 4 Central schemes IWDP, DPAP, DDP and NWDPR have been merged into a
new scheme called *Bhoomi Vikas Yojana* under a common guideline (Guideline for Watershed Development, 1995 and revised in 2001) which envisages bottom-up approach. The main aim is to manage the land and water resources for sustained production. The watershed Development Programmes like DDP, Drought-Prone-Area-Programme (DPAP) and Integrated Wasteland Development Programme (IWDP) are implemented by the Zilla Panchayats through Watershed Associations. A Project Implementing Agency can be a Government Department or NGO.

Both the Centre and State Governments have been making continuous and constant efforts to improve the living standards of rainfed farmers through planned programmes. These programmes were implemented by both Government Organisations (GOs) and Non-Government Organisations (NGOs). The focus is on giving technical support in watershed projects, mapping of project areas design and implementation guidelines for soil and water conservation structure like bunding, check dams, gully plugs, desiltation of tanks etc. The detailed planning and design for all soil and water conservation measures is done with the consultation of each subject matter specialist such as engineer, forester, agronomist, social scientist, etc, in the watershed development team. The Government of India has fixed the cost norm of watershed development, which is about Rs 6000/ha.
Figure 1.2 Watershed Development: BAIF's Holistic Approach

1.12 Watershed Development in Andhra Pradesh

Andhra Pradesh (AP) is the fifth largest state in India, both in area and population. Bounded by Madhya Pradesh, Chattisgarh, and Orissa in the north, the Bay of Bengal in the east, Tamil Nadu and Karnataka in the south and Maharashtra in the west, AP forms the major link between the north and the south of India. The northern area of AP is mountainous. The highest peak Mahendragiri rises 1,500 m above the sea level. The climate is generally hot and humid. Average rainfall in the state is 925 mm. The Krishna and the Godavari are the major rivers in the state. With a 970-km coastline, AP is the
largest maritime state in India. It consists of three distinct regions: (a) Coastal region, made up of nine districts, (b) Rayalaseema region, consisting of four districts, and (c) Telangana region, consisting of the capital Hyderabad and nine adjoining districts. In AP there are extensive areas of rainfed agriculture, which could potentially benefit from the sort of approaches seen elsewhere. Watershed development programmes in AP have been implemented for many years. In order to combat the frequent recurrence of drought in the state, Drought-Prone Area Programme (DPAP) was introduced in the year 1976, as a centrally sponsored scheme with matching state share of 50:50. Integrated Wasteland Development Programme (IWDP) was introduced in 1991 with 100 percent central assistance. The wasteland development programmes taken up before April 1995 have not performed well, mainly because they had been planned and implemented on departmental basis by government officials and in isolated patches, without any regard for the complete micro-watershed principle or for people’s participation (GoAP, 2001).

The renewed watershed programmes envisages a great opportunity for improving the productivity, profitability and sustainability of dry farming areas through social mobilisation. Rainfed agriculture should be based on watershed as the unit of development to become productive. Watershed is not a technology but a concept, which integrates conservation, management and budgeting of rainwater through simple but discrete hydrological units. Simultaneously, watershed supports a holistic framework, which means the combined application of technologies on soil and water conservation with improved crop varieties, farming systems and agronomic management, taking into account both arable and non-arable land. Water resource development, management,
harvesting and equity in sharing form the nucleus of watershed development (GoAP, 2001).

With assured availability of water, farmers get motivated to accept more profitable, sustainable and innovative farming systems. Water availability has also catalysed the adoption and spread of value-added activities in the entire area of the watershed, such as horticulture. Cropping systems need to be tailored to suit different rainfall-cum-soil zones. Watershed development is the only solution to ensure drought-proofing and to mitigate the distress caused by frequent droughts. In view of these benefits, a massive’ programme for development of all the degraded lands in Ancihra Pradesh in 10 years was launched during 1997(GoAP, 2001). The action plan for development includes wetlands, degraded lands (i.e., dry lands which are being cultivated under ainfed conditions) and degraded reserve forests. It is envisaged to develop 10 million hectares of degraded and wastelands, with an outlay of about Rs. 4,000 crore (US$ 888.89 million) from 1997 to 2007 at the rate of 1 million hectares every year. However, only an little over 50 percent of the target has been achieved till Maich 2007, at a cost of about Rs. 2,000 crore.

Prior to the implementation of new watershed guidelines, an area of 4.19 lakh hectares. was treated under DPAP in the state. However, after the new watershed guidelines have come into force from 1995—96 onwards, a total of 2,090 watersheds involving an area of 10.45 lakh hectares have been introduced. After the launch of the 10-year perspective plan, another 5,887 watersheds in wastelands and forestlands covering
an area of 18.22 lakh hectares have been added. As a result, as on 1st April 2005, an area of 4.2 million hectares with an expenditure of Rs. 1692 million, have been brought under the programme. It is also proposed to take up the development of forestlands in flinging villages falling within the boundary of watersheds. The Watershed Development Committees (Vana Samrakshana Samithis) have taken up the works as per the revised guidelines. The programmes under DPAP/DDP/EAS/IWMP/AP Hazard Mitigation/VSS are integrated with watershed programmes.

In the last decade, AP has remained in the forefront with regard to implementation of watershed development programmes. The programmes of dry land development in the state have undergone a major change since 1995—96 with the introduction of new watershed guidelines, based on the recommendations of Hanumantha Rao Committee Report. The main principle adopted in the guidelines lays special emphasis on the active mobilisation and participation of the stakeholders in the programme, including planning, implementation and subsequent management. The guidelines specify how watersheds are to be developed, using the micro-watershed (500 ha) as the basic unit for treatment. Of the 23 districts in AP the DPAP is under implementation in 17 districts. Over the late 1990s the approach has been continuously modified in the light of experience. The districtwise break-up of watersheds is presented in Table2.3.

Andhra Pradesh has taken up the watershed development programmes by strictly adhering to the new watershed guidelines since 1995—96. As per the guidelines implementation of the watershed has to be completed in four years covering 500 hectares
of area with an outlay of Rs. 20 lakh per watershed (Rs. 4,000 per ha). Desert-prone
districts like Anantapur receive Rs. 22.5 lakh per watershed (Rs. 4,500 per hectare) due to
their unfavourable agro-climatic conditions. The average area under watershed is limited
to about 500 hectares in line with the guidelines.
Table 1.1 Watershed Development Programmes in Andhra Pradesh across Districts

<table>
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<th>District</th>
<th>No. of watersheds</th>
<th>Area (in lakh ha)*</th>
<th>Area per watershed (in ha)*</th>
<th>Amount allocated (Rs. In lakh)</th>
<th>Amount spent (Rs. In lakh)</th>
<th>Percent of utilisation</th>
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Source: Status Report on Watersheds, Commissioner of Rural Development
1.12 Participatory Approach to Watershed Management

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

User participation has a lot of implications for watershed management and research. There was hardly any scope for learning in the traditional approach and there would be tendency towards giving priority to the biophysical framework of watersheds justified a top-down planning approach. Planning in the traditional system was often based on the capacity of land rather than needs and capacities of local people. This produced a mismatch between local population and outside watershed project managers and no flow of information between land users and other key actors such as researchers, planners and policy makers etc.

A major challenge in the traditional watershed management approach was the assumption of technology transfer instead of development of technology on peoples land and their surroundings. Another important weakness was regarding the training and research where the major responsibility for training has been given to agricultural research institutions and agricultural universities, which are sound in technical aspect of
watershed but are weak in social science aspects of the institution building as well as forging links with non-farm sector to generate value added products from watersheds.

Another key weakness is ignoring local knowledge on local soil types and conditions for suitability of technology to the specific soil while designing and implementation of the projects. It would be better to adopt on-farm research trails for water thed projects designed and implemented jointly by users, scientists and other stakeholders. Farmer participation in the on-farm research will provide an interactive mode so that both scientists and farmers can decide on the conduct of trials and technology to be tested, and active participation of stakeholders in the research that is important for successful adoption of technology. In the conventional approach people’s participation often limited to project implementation stage and no focus on institutional building for long term collective management of resources.

Earlier resources were allocated by the central and state goverments for watershed development and which are supply driven. This top-down approach was not conductive for inducing the stakeholder’s participation in designing the programmes that are targeted to their improvement. There was lot of mismatch between the needs of the stakeholders and the activities for implementation of watershed development. Such watershed projects often failed to achieve the intended targets in the absence of peoples’ participation. Realising this, participatory watershed management has emerged as a new paradigm for watershed development in India. This paradigm shift was expected to contribute towards more decentralised govenance and increased participatory approaches to natural resource
management that will rise to face the new challenges by strengthening the capacity of local people.

1.12.1 Emergence of Participatory Approach

Participatory watershed management has emerged as a new paradigm for sustainable rural livelihoods and it occupied the central-stage of rural development in the fragile and semi-arid environments of the developing nations. The concept of participatory watershed management emphasises an interdisciplinary, inter-sectoral and multi-institutional mechanism. Participatory watershed management has been defined as a process “which aims to create a self-supporting system, which is essential for sustainability”. Participatory watershed management provides opportunities to the stakeholders to jointly negotiate their interests, set priorities, evaluate opportunities, implement and monitor the outcomes. This concept came widely into practice in late 1980s and over the time peoples’ institutions, like zilla parishads (district revenue administrative units), self help groups, and watershed implementing committees were gradually involved in the project management system. With allocation of more funds for watershed development, several non-governmental organisations came forward to aggressively participate in implementing the watershed programs.

In India, participatory watershed management has roots in the non-government sector that go back nearly as far as the government programs. The seeds of the participatory watershed management can be traced to a small village called Ralegan sddhi in Maharashtra state of India. Anna Hazare, a local leader was responsible for bringing
many social changes in the village particularly soil and water conservation measures besides family planning, a ban on alcohol, protection of non-arable lands against open grazing and felling of trees and voluntary labor for community welfare and other measures which helped in restoring natural resources base of the village. This ultimately led to people participation in watershed management and the evolution of participatory watershed management looking beyond just the biophysical aspects to also focus on social and institutional aspects following a bottom up approach. It is now widely accepted that the communities must participate to enhance the productivity of natural resources in a sustainable fashion.

Over the past decade, watershed management has evolved from a government concern with mainly public land management to a situation where the watershed population is seen increasingly as the active partner with government agencies being placed in an advisory and supporting role. There are several reasons for this: forest protection through policing by forest guards and nationalisation of forests in order to protect them have largely failed; watershed populations and pressure on upland resources have increased as populations during the twentieth century have doubled every 25 to 30 years; resettlement programmes have proved to be very costly and generally socially unacceptable; pilot projects based on government funds, dails’ paid labour, etc. have generally turned out to be costly and short lived.

Watershed management staffs are now increasingly aware that elements traditionally considered beyond the scope and the area of interest of a project—for
example land husbandry—may play a decisive role in the watershed. Food price policies and subsidies may favour certain crops or make them unprofitable to grow; emphasis on export crops may force subsistence farmers on to increasingly marginal land; insecure land tenure may make farmers more interested in occupying land than in sustaining its long-term production capacity; management of communal land is becoming a world wide concern.

However, local populations and their representatives are still only rarely involved in the design and planning stages of watershed management projects. Most watershed planners still work in top-down centralised government departments and therefore find it difficult to respond simultaneously to demands for better, faster planning and project formulation for the nation’s priority watersheds, and to the need to involve local leaders in project design. Further more, most financing and technical assistance agencies, national as well as international, still insist on a detailed project document before authorising funds for project activities, including those that would involve local people. There is therefore a clear need for the decentralisation of government agencies, the creation or strengthening of rural organisations and institutions, local resource control and management, and rural-based training programmes.

1.12.2 Institutional Arrangements

The management structure and the institutional setup appears to be complex and it is better to look at the institutional arrangements in implementing participatory watershed
development program for understanding the impact of participatory watershed management better.

Management of watershed development in India evolved significantly over the past three decades. During the 1970s to early 1980s, the main concentration was largely on biophysical criteria. In late 1980s there were some significant changes looking beyond soil and water conservation to include improving the productivity of natural resources. In 1994-95 Ministry of Rural Areas and Employment, Government of India came up with strict guidelines to achieve multiple objectives including productive, social, ecological / environmental and equity issues to achieve optimum utilisation of the watershed’s natural resources; employment generation and development of other economic resources in the village; easy and affordable solutions and social condition of the resource poor, respectively. The present guidelines outline the various implementation stages of the watershed development projects, the operational procedures and provide sufficient operational flexibility at State, District and Project levels to enable them to respond to differing situations and aspirations of the village community.

The 1994 Guidelines assumed new arrangements for allocating funds and managing projects. The District Rural Development Agency (DRDA) or Zilla Parishad (ZP—district level council) was made responsible for the overall responsibility for program implementation in the concerned district. They appoint watershed Development Advisory Committee to advice on issues like selection of villages, training and monitoring. PIAs (Project Implementation Agencies) are selected by the DRDA and the
programs requires formation of Watershed Development Teams (WDT) of technical experts like civil or agriculture engineers, agronomists, soil scientists etc. to assist watershed committees. The WDT works closely with the rural communities in planning and implementing the watershed program. Each WDT is expected to handle 10 micro watersheds. The Watershed Association (WA) represents all members of the community who are directly or indirectly associated with the watershed. The WA appoints a Watershed Committee (WC) consisting of representatives of user groups, self help groups, the gram panchayat (elected village assembly) and the WDT. Secretary from each committee is responsible for maintaining accounts and records. Funds flow directly from central Government and state government to the DRDA/ZP.

Partnership based community participation is central to the watershed program and the guidelines lay down a detailed planning process. The guidelines also encourage the involvement of users groups (UGs) and self help groups (SHGs). Each team is expected to conduct a participatory rural appraisal to identify potential programs and concerned user groups. This leads to the development of a watershed development plan, containing details of various activities, lists of user groups, funding requirements and users’ contributions. The plan is approved by the WA and then submitted to the DRDA, through the PRA. These new guidelines also aim to promote up-gradation and adoption of low cost local technologies and materials and emphasise the importance of people’s participation in the programs and the need to improve technical as well as management skills of project staff and the village community.
1.12.3 Participatory Planning

Participatory watershed planning must go beyond initial consultations with the “target population” after which the project designers go back to the office to write up a detailed project proposal. Participation in planning requires a mechanism for priority rating and decision-making at the local level. People need to be informed about available alternatives and to feel that their concerns are being addressed. Initial planning must be followed by a system of monitoring and evaluation so that the rural people themselves will be able to follow and measure progress made on joint decisions, and make changes if necessary to ensure satisfactory results.

Participatory planning also means tentative or preliminary project designs in order to “get started” on the ground. As noted above, most national and international funding agencies require a fully prepared project document before allocating funds. However, if participatory planning is to be taken seriously, implementation phases will need to be preceded by formulation projects which will provide the necessary funding to permit the involvement of local people or their representatives. What is required is a new approach where by more funds will be earmarked for project formulation and a fairly long start-up period, in which the details are worked out in consultation with the watershed population.

Use of advanced planning techniques and tools such as rapid rural appraisal, computer-assisted land-use planning, watershed hydrologic modelling and Geographic Information Systems (GIS) should be encouraged in order to speed up planning and make it more reliable and flexible. However, the time saved through the use of these tools
should be spent on cooperation with the land users, rather than on more detailed top-down land-use planning for them.

1.12.4 Participatory Monitoring and Evaluation

Participatory monitoring and evaluation must be an integral part of participatory watershed management. People who participate, investing time and effort in an activity from which they hope to benefit, will need to be part of a continuing process of investigating how things are going, whether changes are needed, whether expected results are still realistic, whether new alternatives have become available, etc. Poor people, who may have invested a rather large share of their available time and resources, and thereby exposed themselves to greater risks in case of project failure, will be especially anxious to follow progress. In such cases it is necessary to design a rather sensitive set of indicators that will be able to answer questions raised by the participants, and give early warning when, or hopefully before, things start going wrong.

1.12.5 Participatory Approach in Extension

It is evident that traditional extension methods, where the role of the extension agent was to bring the “message” of the research station or the ministry to the farmer, must be broadened in order to be effective in the context of participatory watershed management, where the community itself is often the “research station” or the “outdoor laboratory” and where the ministry and its personal can learn from as well as teach the local people.
The watershed extension worker will have to explore possible solutions with the rural people, help form and support user groups, associations and the like, and initially act as the link with government agencies, research stations, universities, non-governmental organisations, etc. in carrying a “message” in the opposite direction, namely from the community to the support services. Eventually, however, he/she should work him/herself out of the job by showing community representatives how to obtain government services directly.

1.13 Role of Rural Organisations Participatory Planning

Rural organisations are a key element both for participatory planning and for the sustainability and continuity of the project once implementation begins. Without them, no dialogue can take place between government agencies and the watershed population, and bottom-up planning therefore cannot exist.

Government agencies need to identify appropriate rural institutions and formal as well as informal leaders. They should not, however, seek to control or employ such leaders, as this would reduce the latter’s authority and their mandate to speak on behalf of the group or community.

There are no established rules or models for rural organisations, and none which will be implicitly best for involvement in watershed management planning and implementation. A group may be formed on the basis of a variety of interests common to its members: religion, trade unions; growers associations (coffee for example); grazing or
livestock associations; extended family; common boundaries; women’s groups, cooperatives; etc. The important question is not what it is but how well it functions, how well it represents the interests of its members and to what degree its leaders really speak on behalf of all members.

Non-governmental organisations (NGOs) may play a decisive role in providing support to rural organisations in their formation, in the training of community leaders, in the generation of political awareness, and soon. Because they are independent of the government structure, they can be more flexible and directly responsive to the needs of the community, and they may have easier access to minority groups and peoples, areas of national or international conflict, etc. Some care is needed, however, when NGOs speak or act on behalf of rural people. NGOs have their own objectives for which they are created and supported, and these may or may not coincide with the needs of the upland people. Large national and international NGOs often have an urban view on issues such as nature conservation, deforestation, and water and air pollution, with a quite different priority rating than that of the upland subsistence farmer who is trying to feed his/her family.

The effective involvement of local people in the planning and implementation of watershed management implies that the traditional top-down system must be changed to one with increased decentralisation. This does not mean, however, that national-level organisation of watershed management should be disbanded. On the contrary, a convincing argument can be made for the further strengthening and coordination of
national agencies and mechanisms. Centralised planning is needed for watersheds of national importance. The decision to protect areas upstream of major hydroelectric dams, city water intakes, major irrigation schemes and flood-prone development areas will have to be made at national level. And for all major efforts, national-level commitment of resources will be essential.

Even in these watersheds of national importance, however, it is unrealistic to plan land use and land-use changes without consulting the land users, be they government agencies, local communities, commercial or subsistence farmers, livestock owners or herders, or fuelwood collectors. It is also unrealistic to expect that land-use changes will happen unless the land user sees a benefit for him/her self and the immediate community/family.

The findings of the Latin American Technical Cooperation Network in Watershed Management confirm that strong national organisation of watershed management efforts is essential, and identify a number of elements as basic for effective and sustainable efforts. These elements are the entire mote relevant for projects and programmes aimed at involving and providing benefits to local people in all regions:

✔ An interministerial committee. The challenges of upland conservation cut across the responsibilities of many ministries and can be most effectively overseen by a committee designed to promote harmonisation of policy issues such as environmental protection, agricultural production, forestry, water supply
infrastructure, employment, and human settlement and migration, thereby ensuring that the needs of local people are adequately considered.

✓ A mechanism for inter-agency coordination of ground-level action. The coordination of implementing institutions is essential for appropriate rural development as well as for the optimum sustainable use of natural resources. For example, the construction of rural roads must advance cautiously in watersheds with hydroelectric facilities. Soil conservation programmes, networks of protected areas, rural schools construction, etc. must be coordinated and, if necessary, modified to ensure effective integrated watershed management.

✓ A lead agency for effective planning and implementation of a given watershed management effort, it is necessary to identify and strengthen the responsibility of one of the coordinating agencies.