UNIT 10 WATERSHED MANAGEMENT PROGRAMMES

Structure

10.0 Aim and Objectives

10.1 Introduction

10.2 The Concept of Watershed

10.3 Watershed Management

- 10.3.1 Characteristics
- 10.3.2 Importance

10.4 Objectives of Watershed Development Programmes (WDPs)

10.5 History of Watershed Development Programme in India

10.6 Watershed Management and India

10.7 Integrated Watershed Management Programme (IWMP)

10.8 Issues Before Watershed Management

10.9 Important Watershed Management Programmes in India

10.10 Watershed Development Approach Under Different Schemes

10.11 Worth Mentioning Government Initiatives

10.12 Externally Aided Watershed Development Projects

10.13 Let Us Sum Up

10.14 Check Your Progress

10.15 Suggested Reading and References

10.0 AIMS AND OBJECTIVES

After reading this Unit, you will be able to:

- define watershed;
- identify the principles of watershed management;
- know about some case studies from India; and
- talk/write knowledgeably about watershed conservation programmes.

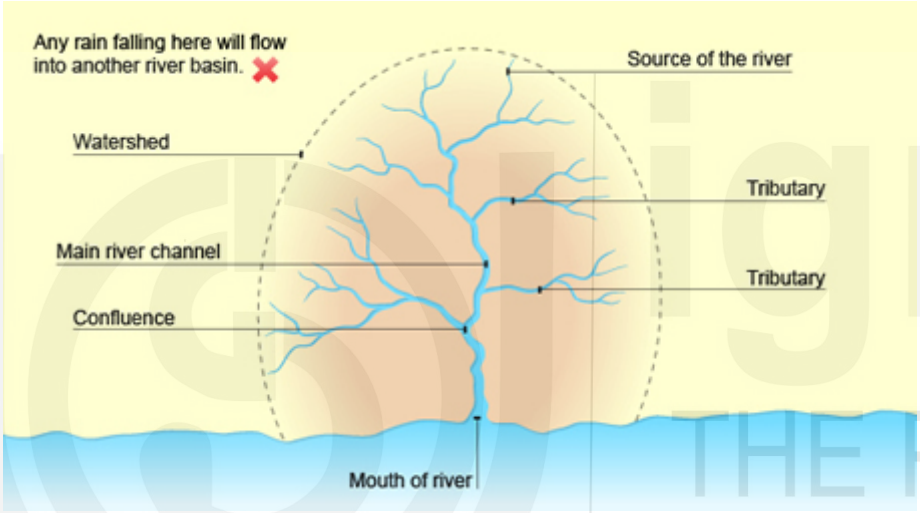
10.1 INTRODUCTION

Rapid urbanization and population growth have led to water shortages and rising water prices in many cities around the world. Scientists predict that due to the combined effects of climate change and population growth, water demand will exceed 40% of the water supply by 2030. In one of the Sustainable Development Goals (SDG), to achieve universally improved water supply and sanitation systems by 2030.

Watershed Management is an adaptive, comprehensive, integrated multi-resource management planning process that seeks to balance healthy, ecological, economic, and cultural/social conditions, within a watershed. It serves to integrate the planning of land and water.

10.2 THE CONCEPT OF WATERSHED

A Watershed is a geo-hydrological unit of an area draining to a common outlet point. It is recognized as an ideal unit for planning & developing of land water and vegetation resources. It is an area of land that feeds all the water running under it and draining off it into a body of water. Example: The place we live is a watershed which drains all the water to nearby lakes/rivers. And in turn, combining all such rivers and lakes which ultimately drain into the sea forms a watershed.



The development of catchment areas is a medium for the growth of agricultural production in rain-fed and semi-arid areas. Nearly 85 million hectares of land in the country are rain-fed. These areas were bypassed by the Green Revolution, and agricultural production has barely increased for decades. By documenting water management and improving soil and vegetation management, watershed development aims to create conditions conducive to increasing agricultural productivity while protecting natural resources.

10.3 WATERSHED MANAGEMENT

Watershed management is the process of controlling and organizing the use of land and other resources in a watershed to provide needed goods and services without adversely affecting soil and water resources. Each project under the plan achieves this goal from a micro perspective. The method is to solve under-production or under-production land and participate in related activities to benefit the landless. These plans adopt a joint multi-resource management strategy, involving all stakeholders in the basin. They work

together to determine the resource problems and concerns of the basin and formulate and implement a basin plan with environmentally friendly solutions. It is socially and economically sustainable.

Watershed management or development refers to the management and conservation of surface and groundwater resources which includes conservation, regeneration, and judicious use of all resources. Example: Even afforestation and reforestation is a measure to protect watersheds building check dams, percolation dams etc.

10.3.1 Characteristics

Activities Undertaken: The activities carried out in these plans include measures to protect soil and water, such as building dams, water structures, clearing village ponds, treating drainage pipes/canyons, leveling the land, binding farms, dealing with problematic soil, agricultural forestry, agricultural gardening, Silvi-pasture, organic farming, the use of organic fertilizers, the value-added and product sales of the farmer groups, the training and capacity building of interest groups.

Land Treatment: (a) Soil and moisture protection: land leveling, layered binding, contour binding, nutrient binding, contour planting, drainage pipe treatment, gully stabilization, gully blockage, infiltration ponds, and agricultural ponds. (b) Afforestation: Plant trees in degraded forests, Panchayat land, public land, private land, etc. (c) Pasture development: In community areas, there are suitable grass and fodder on pastures.

Production Activities

Cropping Pattern

- Introduction of suitable crops, improved crop varieties, inter-cropping, contour cultivation, and crop management practices;
- Sericulture;
- Horticulture;
- Livestock development fodder cultivation, milch cattle distribution, the establishment of milk co-operatives;
- Integration of other activities such as sheep rearing, fisheries, piggery, poultry, bee-keeping, etc.

Employment Generation Activities

- Creating more employment through land-based and productive activities;
- Raising backyard nurseries;
- Wage earning through community assets creation such as community buildings, village roads etc.
- Cottage industries based on bamboo, wood craft, cane craft etc.

10.3.2 Importance

- ✓ It recharges the groundwater table.
- ✓ Restores water for drinking and other human proposes
- ✓ Protects bio-diversity of a region, it managed properly can restore bio-diversity
- ✓ Restores soil Fertility and helps in soil conservation
- ✓ Helps fight climate change, and promotes sustainable agriculture.

10.4 OBJECTIVES OF WATERSHED DEVELOPMENT PROGRAMMES (WDPs)

The development of catchment areas aims to balance the protection, regeneration, and utilization of land and water resources in human basins. The common benefits of successful watershed development projects include increased agricultural production and improved drinking water supply. The general attributes of the watershed development method are roughly threefold. Promote rural economic development, create employment opportunities and restore ecological balance (Department of Land Resources, 2006). However, different goals include:

Environmental: For protecting vegetative cover throughout the year, to create ecological balance in the watershed area, protecting fertile topsoil, utilizing the land-based on its capabilities, in situ conservation of rainwater, increasing groundwater recharge, etc.

Economic: It draws attention for an 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 the formation of watershed committees and self-help groups, establishing sustainable community organizations, etc.

Equity: To develops 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.

10.5 HISTORY OF WATERSHED DEVELOPMENT PROGRAMME IN INDIA

About 60% of India's arable land (142 million hectares) is fed by rainwater, which is characterized by low productivity, low income, low employment rate, high poverty rate, and many fragile and marginal lands. Regardless of

the total amount or distribution, the precipitation patterns in these areas are very different. This leads to water stress during the critical stages of crop production and makes agricultural production vulnerable to pre-and post-production risks. The Indian government has sponsored and implemented watershed development projects in the country since the early 1970s. Various water catchment development plans have been formulated, such as the Dry Area Plan (DPAP), Desert Development Plan (DDP), Watershed Project (RVP), National Rainwater Basin Development Project (NWDPRA), and Integrated Wasteland Development Plan (IWDP). Then the water launched in each aquatic ecological area is affected by water stress and similar drought conditions. The entire watershed development plan mainly focused on the structural methods of soil protection and rainwater harvesting in the 1980s and earlier. Despite doing all we can to protect the soil Maintenance habits (such as contour binding, excavation of foundation pits, etc.) are what farmers are accustomed to farming in the field. It has been suggested that the top-down approach to the Strait Jacket in the catchment area may not achieve the desired results, and therefore, the chaos of individual and community-based interventions is essential.

The integrated watershed development programme with a participatory approach was emphasized during the mid-1980s and in the early 1990s. This approach had focused on raising crop productivity and livelihood improvement in watersheds along with soil and water conservation measures. The Government of India appointed a committee in 1994 under the chairmanship of Prof. C.H. Hanumantha Rao. The committee thoroughly reviewed existing strategies of the watershed programme and strongly felt a need for moving away from the conventional approach of the government department to bureaucratic planning without involving local communities. The new guideline was recommended in the year 1995, which emphasized on collective action and community participation, including the participation of primary stakeholders through community-based organizations, non-governmental organizations, and Panchayati Raj Institutions (PRI). Watershed development guidelines were again revised in the year 2001 (called Hariyali guidelines) to make further simpli1cation and involvement of PRIs more meaningful in planning, implementation, and evaluation, and community empowerment and guidelines were issued in the year 2003. Subsequently, Neeranchal Committee (in the year 2005) evaluated the entire government-sponsored, NGO and donor implemented watershed development programs in India and suggested a shift in focus “away from a purely engineering and structural focus to a deeper concern with livelihood issues”. Major objectives of the watershed management programme are 1) conservation, up-gradation, and utilization of natural endowments such as land, water, plant, animal, and human resources in a harmonious and integrated manner with low-cost, simple, effective and replicable technology; 2) generation of massive employment; 3) reduction of inequalities between irrigated and rain-fed areas and poverty alleviation.

10.6 WATERSHED MANAGEMENT AND INDIA

The concept of watershed management is as old as the concept of crops under irrigated conditions, and this concept has led to the development of water tanks/reservoirs to increase production to meet the needs of a growing population. Different rulers in different regions realize and carry out their work according to the availability of funds, the needs of the people, the natural resources available in the region, etc. to meet the population and food needs. Tax beneficiaries and collect income from them. Sir Arthur Cotton submitted two reports to the British government in 1844 and 1845 after investigating the Papi Mountain to Sagaram area in the Godavari River Basin. In Dhawaleswaram in the Godavari region, a dam was built to use river water for agricultural development in the area. Early rulers have recognized the need to maintain better environment and natural resources, such as soil, water, and vegetation, and implemented them in different types of rural institutions (e.g. village officials, Gram Panchayat, rural rulers/administrators). Attempts to destroy natural resources are punished.

During the colonial period, due to the centralization of power and the absence of the democratic structure, the importance of Indian village-level administrative agencies gradually declined. This leads to greater destruction of vegetation in rural areas and environmental degradation due to soil degradation. Therefore, the Indian government and provincial governments have taken improvement measures, such as greening measures, soil protection measures, drainage water plans, etc. However, the expected results have not been consistently achieved. Therefore, in 1983-84, the Indian government launched the Watershed Development (WDP) programme to protect and use natural resources to increase productivity and improve socio-economic status. Although the plan has been in operation since 1983/84, its purpose is to assess the impact of the watershed plan in order to develop better strategies for protecting natural resources, improving and using natural resources to improve the growing population.

10.7 INTEGRATED WATERSHED MANAGEMENT PROGRAMME (IWMP)

The Ministry of Land Resources and the Ministry of Rural Development of the Government of India run centrally sponsored Integrated Watershed Development Programme (IWDP), Drought Prone Area Programme (DPAP), and Desert Development Programme (DDP) programmes to develop waste/degraded land through watershed methods. These three plans are implemented on the basis of separate standards, funding methods, and technical components in accordance with their respective goals. DDP focuses on reforestation to prevent the growth of indifferent deserts, while DPAP focuses on non-agricultural land and drainage pipelines for in-situ soil and moisture protection, agriculture and forestry, pasture development, gardening, and alternative land use. On the other hand, IWDP has taken over

pasture development, soil and moisture protection as an outstanding activity in wastelands under state, community or private control. The common theme is the sustainable management of land and water resources. In order to achieve the integration of all regional development programmers, a new programme called the "Integrated Waterway Management Plan" (IWMP) has been launched for the integrated planning of communities, sustainable results, and rural livelihoods. The Integrated Watershed Management Plan (IWMP) covers all three regional development plans, which will be implemented by specialized agencies operating at the national, state, and regional levels.

The main features of the integrated management plan for the catchment area are 1. Decentralization of power to the states: Countries will now have the right to sanction and supervise the implementation of catchment area projects within their scope of responsibility and within the parameters specified in this Code. 2. Specialized agency: There will be a specialized executive agency, with multidisciplinary professional teams at the national, state, and regional levels to manage the watershed plan. 3. Financial assistance for special facilities: Additional financial support will be provided to strengthen district, state, and national facilities to ensure the professionalism of river basin project management 4. Duration of the program: With the expansion of the scope and expectations of this method, the duration of the project has been extended by 4 to 7 years according to the type of activity, divided into three different phases of the activity, namely the preparation phase, the work phase, and the merger phase.

Major Activities of the Watershed Project are:

- Soil & moisture conservation measures like terracing, trenching, vegetative barriers, etc.

- Planting & sowing of multi-purpose trees, shrubs, grasses, legumes, and land development
- Encouraging natural regeneration
- Promotion of agro-forestry and horticulture
- Wood substitution and fuel-wood conservation measures
- Measures needed to disseminate technology
- Training, extension, and creation of a greater degree of awareness among the participants
- Encouraging peoples' participation

10.8 ISSUES BEFORE WATERSHED MANAGEMENT

The watershed project failed to achieve sustainability because the implementing agency had no personnel involved. To make water catchment projects sustainable, a community management system is needed, which can only succeed with the contributions of farmers and their commitment to time and resources.

In many cases, it is found that stakeholders neither participate in the selection of project components nor encourage them to participate in various project activities. The entire development process of the basin involves the participation of government departments and local contractors, using a clear top-down approach, while the participation of the basin communities is very small. As a result, there is a mismatch between supply and demand, resulting in an insufficient description of local demand and watershed expectations, resulting in inefficient implementation and insufficient sustainability.

Since watershed is a land-based activity, the benefits of watershed management mainly affect farmers because the project intervention failed to provide livelihoods for landless families. The portfolio of alternate livelihood opportunities created for the beneficiaries due to intervention through watershed management could not cope with stress and shock and the primary stakeholders could not maintain those activities after the completion of the project period.

In the majority of the cases, sustainability had been causality mainly due to the absence of primary stakeholders in project planning and implementation stages.

The withdrawal mechanism has not been properly spelled out by the project implementing agencies for which local community level institutions did not come up to own the project. Due to lack of capacity and involvement of the community at the project completion stage, the assets created under the project could not be maintained with the involvement of local community which ultimately affected long run sustainability of the project.

10.9 IMPORTANT WATERSHED MANAGEMENT PROGRAMMES IN INDIA

In order to accelerate the development of wasteland/degraded land, the government established the National Wasteland Development Committee in 1985 under the leadership of the Ministry of Environment and Forestry. Later, in 1992, a separate wasteland development department was established in the Ministry of Rural Development and Poverty Reduction, and the National Wasteland Development Committee was entrusted to establish this department.

In April 1999, the Wasteland Development Department has renamed the Ministry of Land and Resources and served as the node agency for land resources management. As a result, all land development plans and land reform departments are included in this department. The Watershed Area Plan (DPAP), Desert Development Plan (DDP) and Integrated Wasteland Development Plan (IWDP) implemented by the department are watershed management plans implemented by the department.

Later, Prime Minister Krishi Sinchayee Yojana (WDC-PMKSY) merged DPAP, DDP, and IWDP into the best components of watershed development to ensure the best use of resources, sustainable results, and comprehensive planning.

Prime Minister Krishi Sinchayee Yojana (Watershed Development Component) (WDC-PMKSY)

The main objectives of the WDC-PMKSY are to restore the ecological balance by harnessing, conserving, and developing degraded natural resources such as soil, vegetative cover, and water. The outcomes are prevention of soil erosion, regeneration of natural vegetation, rainwater harvesting, and recharging of the groundwater table. This enables multi-cropping and the introduction of diverse agro-based activities, which help to provide sustainable livelihoods to the people residing in the watershed area.

The salient features of WDC-PMKSY are as below:

- Setting up of Dedicated Institutions with multi-disciplinary experts at State level - State Level Nodal Agency (SLNA), District level - Watershed Cell cum Data Centre (WCDC), Project level - Project Implementing Agency (PIA), and Village level - Watershed Committee (WC).
- Cluster Approach in selection and preparation of projects: Average size of project - about 5,000 ha.
- Enhanced Cost Norms from Rs. 6000 per ha. to Rs.12,000/ha. in plains; Rs.15,000/ ha in difficult/hilly areas
- Uniform Funding pattern of 90:10 between Centre & States.

- Release of central assistance in three instalments (20%, 50% & 30%) instead of five instalments.
- Flexibility in the project period i.e. 4 to 7 years.
- Scientific planning of the projects by using IT, remote sensing techniques, GIS facilities for planning and monitoring & evaluation
- Earmarking of project funds for DPR preparation (1%), Entry point activities (4%), Capacity building (5%), Monitoring (1%), and Evaluation (1%).
- Introduction of new livelihood component with earmarking of project fund under Watershed Projects i.e. 9% of project fund for livelihoods for people having no asset and 10% for production system & micro-enterprises.
- Delegation of power of sanction of projects to States.

Neeranchal Watershed Programme

Neeranchal is a national watershed management project supported by the World Bank. Neeranchal aims to further strengthen the watershed part of PMKSY, especially all parts of PMKSY in general, and provide technical support to improve delivery capabilities. The programme is being implemented in nine participating countries-Andhra Pradesh, Chhattisgarh, Gujarat, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, Rajasthan and Telan-gana.

The main purpose of Neeranchal is to achieve the main goal of the watershed part of Pradhan Mantri Krishi Sinchayi Yojana (PMKSY), and to ensure that every farm (Har Khet Ko Pani) can get irrigation, and the effective use of water (Per Drop More Crop) solves the following problems:

- bring about institutional changes in watershed and rainfed agricultural management practices in India.
- build systems that ensure watershed programmes and rainfed irrigation management practices are better focussed, and more coordinated, and have quantifiable results.
- Device strategies for the sustainability of improved watershed. management practices in programme areas, even after the withdrawal of project support.
- Through the watershed plus approach, support improved equity, livelihoods, and incomes through forwarding linkages, on a platform of inclusiveness and local participation.

10.10 WATERSHED DEVELOPMENT APPROACH UNDER DIFFERENT SCHEMES

The watershed development works in India have been undertaken by a variety of schemes that ultimately achieve the common objectives of the watershed development programme. They are as follows.

Drought Prone Areas Programme (DPAP)

The Drought Prone Areas Programme (DPAP) was launched by the Government in 1973-74 to tackle the special problems faced by those fragile areas which are constantly affected. The programme is being implemented on Watershed basis since 1995. The responsibility of planning, executing and maintaining the Watershed Projects is entrusted to local people's organization specially instituted for the purpose. In view of the large problem area to be treated and the present level of financial allocation, the programme has to be taken up on a continuing basis for several years. The Watershed Projects taken up for these purposes have a project period of 5 years. The states covered are Andhra Pradesh, Bihar, Gujarat, Himachal Pradesh, Jammu and Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu, Rajasthan, Utter Pradesh and West Bengal. The expenditure on DPAP was being shared equally by the central and State Governments on 50:50 bases till 31.3.99. This funding pattern had been revised to 75:25 w.e.f. 1.4.99.

Objectives of DPAP

- To minimize the adverse effects of drought on the production of crops, livestock, the productivity of land, water, and human resources.
- To promote the overall economic development and improve the socio-economic conditions of the poor and disadvantage sections inhabiting the programme areas.
- To take up development works by watershed approach for land development, water resource development, and afforestation or pasture development.

Desert Development Programmes (DDPs)

Over the years, the increase in human and livestock population in drought-prone and desert areas has placed the natural resources of the regions under great stress. The major problems are continuous depletion of vegetative cover, increase in soil erosion, and fall in the groundwater table. All these factors account for diminishing productivity of land and loss of natural resources. The problems would have been worse but for the introduction of some highly focused specific area development programmes in such regions. As per the recommendations of the National Commission on Agriculture, mentioned in the Interim Report (1974) and the Final Report (1976) the Desert Development Programme (DDP) was started in the year 1977-78. The

programme was started both in the hot desert areas of Rajasthan, Gujarat, and Haryana, and the cold desert areas of Jammu & Kashmir and Himachal Pradesh. Since 1995-96 the coverage has been extended to few more districts in Andhra Pradesh and Karnataka. From inception till 1994-95, an area of over 5.5 lakh hectares of area was treated under the core sectors of land development, water resource development, and afforestation/pasture development. Till 31.3.99, in cold and sandy desert areas, Desert Development Programme was 100 percent centrally sponsored whereas in non-sandy areas, the expenditure was being shared by the Central and State Government in the ratio of 75:25. This funding pattern has been revised to 75:25 from 1.4.99 uniformly in all areas of the country.

National Watershed Development Project for Rainfed Areas (NWDPRA)

During the Sixth Five-year Plan the department of Agriculture and cooperation launched a pilot project for propagation of water conservation and harvesting in rain fed areas (in 19 watersheds) located in 15 states. The main objectives were water harvesting and water conservation. Besides, the Ministry of Rural Development selected 23 watersheds in drought-prone areas for soil and water conservation. In 1983-84 two World Bank aided projects were started in Andhra Pradesh, Karnataka, Madhya Pradesh, Maharashtra, and Garhwal region of Uttar Pradesh. These projects showed the potentials of vegetative conservation measures to support biomass production. Based on these experiences, the National Watershed Development Project for Rainfed Areas (NWDPRA) was launched during the Seventh Five-year Plan in 99 selected districts of the country. It was intended to develop a sustainable biomass production system and restore ecological balance in rain-fed areas. However, the main emphasis was on increasing crop production on arable lands. The project did not provide funds for non-arable land, as it was expected to be met from other sources. But non-availability of funds in time acted as a constraint. Therefore, during the Eighth Five-year Plan, the scheme was modified to provide single-window financing for both arable and nonarable lands. The modified scheme provides 100 Percent finance (75 Percent grant and 25 Per cent loan) to states for watershed development.

National Watershed Development Project for Rainfed Areas is being implemented in 2479 watersheds covering 350 districts spread over 25 states and 2 Union Territories. The community development blocks having less than 30 Percent of the available land under assured irrigation qualify for inclusion in the project. The area of a watershed is 500 to 1000 hectares. The project is being implemented with greater emphasis on people's participation at both planning and implementation stages. The main objectives of the modified National Watershed Development Project for Rain fed Areas are to conserve, upgrade and utilize land, water, plant, animal, and human resources in a harmonious and integrated manner, to generate massive employment during the project period and regular employment after completion of the

project, to improve production, environment, and restoration of ecological balance through scientific management of land and rainwater, using in-situ moisture conservation, a network of low cost, water harvesting structures, natural vegetative conservation measures for run-off management and for recharge of groundwater capability and to develop sustainable farming as well as livelihood systems based on the individual as well as common property resources. The Eighth Five-year plan fixed a target of only 28 lakh hectares of area to be covered under National Watershed Development Project for Rainfed Areas. But the actual area covered was as high as 42.97 lakh hectares. This is because per hectare requirement of funds under the approved projects is much less than the per hectare cost ceilings fixed. The Ninth plan further intensified the programme. Training of Implementing Agencies (TIA) at various levels is an important component of the National Watershed Development project for Rainfed Areas. But the progress has been slow in many states due to the non-availability of lands for the purpose.

10.11 WORTH MENTIONING GOVERNMENT INITIATIVES

Kuan Talab Jiao Abhiyan

The coordinated efforts of the local community and district administration have transformed the water-scarce village Jakhni of Banda district in Bundelkhand in Uttar Pradesh into a water-abundant village. Not only is water available round the year in the village, but the groundwater levels have also increased so much that hardly any deep excavation is required to get water. It is the resolve of the village residents to not let the water levels drop that makes the case study of Banda district a success story of sustainable water management. About three ago, village Jakhni was declared as a Jal Gram given abundant water availability, recharged wells and ponds, etc.

Participatory Well Recharge Programme

Mazhapolima is a community-based well recharge programme, initiated by the district administration in collaboration with the Panchayati Raj Institutions in the District. Networking NGOs/CBOs, households, departments and agencies, research institutions, private sector, and all other key stakeholders, either as water users or as water providers/planner is fundamental to the programme. It was initiated in 2009 by the Thrissur district administration in collaboration with Panchayati Raj institutions to ensure water security to households. In the first 3.5 years, around 8500 open wells were recharged across 53 Gram Panchayats, providing drinking water to approximately 40,000 people. The programme was run by a team of dedicated people headquartered at the Thrissur district office.

Pani Panchayats for Water Management

Backed by Pani Panchayats Act (2002), participatory irrigation management is flourishing in Odisha. In Sunei Medium Irrigation project of Mayurbhanj

district, the efficient coordination amongst Pani Panchayats under the supervision of the project committee coupled with adherence to rotational irrigation practice (beginning with the tail end of the command area) led to a whopping 36% increase even in a drought-like situation in 2015-16 Kharif season. The decision of the Project Committee and Pani Panchayats to restrict paddy cultivation during the Rabi season also proved to be effective in maximizing output. As of 31st May 2018, altogether 30,033 Pani Panchayats have been programmed out of which 28,105 have been formed by conducting elections. Not only does such participatory irrigation management bring equity in water distribution, improve crop productivity through collective effort and create a sense of ownership among the farmers for the irrigation infrastructure, it also integrates women into the mainstream through a provision in Pani Panchayat Act to reserve 33% women at block level. The formation of Water Users Associations in all categories of irrigation commands supplements this participatory approach.

Mission Kakatiya

Mission Kakatiya was launched by the Telangana Government in 2015 with an aim to restore all silt-filled tanks and ponds (minor irrigation sources) so that the rainwater could be harvested and used for agricultural and other purposes. The historical importance of tanks, which have been the lifeline of the region but became extinct due to pressures of urbanization and industrialization, was kept in mind while launching Mission Kakatiya. The topography and rainfall pattern in Telangana makes tank irrigation an ideal type of irrigation by storing and regulating water flow for agricultural use, particularly paddy cultivation. Before the launch of Mission Kakatiya, a census was conducted which found that there were 46531 water bodies with about 5000 chain link tanks in the State. The Mission envisaged to repair and rejuvenate 9,300 minor irrigation tanks every year through desilting, restoration of feeder channels, re-sectioning of irrigation channels, repairs to cross masonry and cross drainage structures, repairs of bunds, etc. By 2018, about 17859 water bodies were restored and around 12.47 lakh acres of command area stabilized. This resulted in increased agricultural production, showing record irrigation during the year 2016-17, irrigating an ayacut (the area served by an irrigation project) of around 16 lakhs acres through direct and indirect irrigation.

Meri Chhat Mera Pani Campaign in Chitrakoot

The district administration of Chitrakoot district resolved the water problems of the region by launching a unique campaign titled – ‘Meri Chhat Mera Pani’ – through which rainwater was harvested at the terraces of buildings. Chitrakoot district is one of the aspirational districts identified by Niti Aayog due to the acute scarcity of water resources in the region. Under the campaign, check dams were created to ensure that the rainwater met the river and groundwater were recharged using soak pits. As per an estimate, about 4,56,91,597 liters of water were saved in an area of 71393.12 square meters

by constructing rainwater harvesting structures in all administrative buildings and gram panchayats of the district.

10.12 EXTERNALLY AIDED WATERSHED DEVELOPMENT PROJECTS

Several international agencies like the World Bank, European Economic Community (EEC), German Bank for Reconstruction and Development (GBRD), Danish International Development Agency (DANIDA), Swiss Development Corporation (SDC), and Official Development Assistance (ODA) have been involved in implementing watershed development projects in India with the help of both government and non-government organizations.

10.13 LET US SUM UP

A balance between economic and environmental objectives and consideration of all interactions of the watershed system are important criteria in watershed management. This balance is necessary for countries at various stages of development. Conflicts are increasing over shared water resources between agriculture, industry, and urban domestic use as well as between State governments. Sustainable water management is thus crucial for economic development and livelihood of the people. In a country like India, where a lot of running water goes waste, it becomes very important to apply the technology of watershed management to solve its annual problems of droughts and floods.

10.14 SUGGESTED READINGS AND REFERENCES

Abbast S.A. (2001): Water resource Projects and their environment impact".Himalaya publishing house, New Delhi. Pp 89-92

Biswas Asit K. (1993): *"Water for sustainable development in 21st century – A Global perspective",* Oxford Publisher, Delhi. Pp 73-75

Banil P.C. (1993). *"Water Management in India",* Anmol Publishing, New Delhi. Pp 32-37.

Chaturvedi M.C. (1987). *"Water resources systems planning and management",* Tata McGraw Publishing Co. Ltd., New Delhi. Pp 43-48

Grigg Nell's (1985): *"Water Resources Planning",* McGraw Hill Book Company, Washington.

Sen & Das P.K. (1986): *"Water utilization of Form level",* National Institute of Rural development, Hyderabad. Pp 168-173.

Sharma V.K. (1989): *"Water Resources & Water Management",* Himalaya Publishing Bombay.

World Bank (1993): Water resources management, a World Bank policy paper, Washington. Pp 105-112.

A. Rangareddy (2003): *"Water resources: Need for a holistic approach. Indian Journal of Public Administration* 49(3) Pp 253-264.

Govindan K. and Thirumurugan, V. (2003), *Principles and Practices of dryland agriculture*. Kalyani publishers, Ludhiana, Punjab, India.

Radder, G. D., Belgaumi, M. I. and Itnal, C.J. (1995), Water harvesting proceedings for dryland area. In: Singh, R.P. (ed) sustainable development of dryland agriculture in India, Scientific Publisher, Jodhpur.

Dewan (2003): "Water Resources management: Issues and strategies for agriculture sector. *Indian Journal of Public Administration* 49(3) Pp -332-341.

Dhar T. N. (2003): "Water resources management: Challenge of the 21st Century, *Indian Journal of Public Administration*, 49(3). Pp 502-513.

Tiwari Amitab and Tiwari Suuchi. (2003): Water Resources Management in Indian: Issues and options. *Indian Journal of Public Administration*. Vol. 49(3)

Todkar S.A. (2003): Management and development of water resources Maharashtra Bhugolshastra Parishad, Vol.XVII, July-December, Chandrapur, (M.S.) • *UN Report.* (2007): "Enough water for all. Yojana, 51(9)