

Effective use of land and water is fundamental to growth and sustainable development. In India, awareness and effect of conservation of land, water and plant resources date back to the dawn of civilization or even pre historic times as evidenced by the hymns to the Earth, Water and Trees in Vedas. Rig-Veda elaborates about the rational use of water from ponds, tanks, wells and canals for agriculture, domestic and other purpose. In Arthasastra, Kautilya made the king responsible for constructing ponds, tanks, lakes, reservoirs and wells. Chanakya (3rd to 4th Century B.C) developed non-monetary water pricing system of sharing different proportions of the produce. Expressions of ancient sentiments about land resources can be visualized from the Aryan writings (Atharveda) translated below.

“Tranquil, fragrant, pleasant with sweet drinks in her udder, rich in milk, let earth bless me, earth together with milk”. (Book xii Hymn I, verse 59).¹

The development of watershed programmes in India can be studied in two stages- Pre-Independence and Post-Independence.

Pre-Independence Development

Watershed development is as old as agriculture itself. Different rulers in different regions realized and executed works based on the availability of funds, needs of the people, available natural resources in the area, etc. to meet population demands and requirements of food needs. Sir Arthur Cotton submitted two reports during 1844 and 1845 to the then British Government after surveying entire area from Papi Hills to Sagaram in Godavari river area. This resulted in the construction of a storage type barrage at Dhavaleshwaram in Godavari district, utilizing river water for agricultural development in the area and also planned for utilization of run-off water to construct dams on Kalirune River in Tanjavur district of Tamilnadu and on Tungabhadra river near Bellary, in addition to planning Kurnool - Kadapa (KC) Canal with a distance of 306km for effective utilization of runoff water for increasing agricultural productivity.² The history of watershed development in India can be traced to the Famine Commission of 1880 which stressed the importance of water conservation .

The earliest example of soil conservation measures is the Bombay plan.³ As early as 1920s severe soil erosion in hilly regions and frequent droughts in the region of rainfed farming drew attention of the Government. Research programmes were taken primarily in the old Bombay State to prevent erosion and to provide a viable technology for the region practicing dry land farming. The government carried out pioneering work in controlling and stabilizing torrents which was a serious problem in the foot hills of Punjab and disrupted communication system. Legislation had also been enacted in some of the States to enforce closure of areas to grazing and regulating indiscriminate grazing, exploitation of forest etc. Some of the Princely States also took up programmes for afforesting denuded areas, controlling gullies and ravines, particularly in the State of Uttar Pradesh, Madhya Pradesh, Rajasthan and Gujarat.⁴

Watershed approach for development of agricultural rural areas as a strategy was in operation since 1939. The strategy enabled establishment of Dry Farming Research Stations and Demonstration Centres in the country.⁵

In Pre-Independence period, The Royal Commission on Agriculture (1928) first of all felt the needs of soil and water conservation through afforestation and soil erosion measures in the ravine tract of Bombay Presidency. Further in 1945 Famine Commission took some major steps in this direction (Shah, Amita 2000).⁶

Post Independence Development

The modern history of watershed management in India begins in 1956. Soil conservation programs received attention during the First Five year plan itself. During the period, a Central Soil Conservation Board was set up and a chain of 9 Research Demonstration and Training Centres, with multidisciplinary expertise were established in representative areas under the control of the Ministry of Agriculture (MoA). For tackling the problems of desert and their control, Desert Afforestation Station was established at Jodhpur.⁷

At the state level initial steps were taken by the old Bombay State by adopting intensive programme of contour bunding to combat erosion and moisture stress conditions and also resultant famine in the Deccan Plateau. Similar programmes for conservation of soil and moisture, particularly to support rainfed agriculture and that of afforestation on the foothills and hill slopes to control erosion, got extended in small way in other states as well.

During the Second Five Year Plan, All India Soil and Land Use Survey (AISLUS) Organisation with its 4 Regional Centres was established particularly to meet the soil survey requirements of the programs in the catchments of river valley projects. Under the centrally sponsored scheme, 43 Dry Farming Demonstration were launched in eleven states, Union Territory of Delhi and Damodar

valley. In 1959 a Model Soil Conservation Bill was circulated to the states for enacting suitable legislation for effective implementation of the soil and water conservation programmes.⁸

In the Third Five Year Plan, a working group reviewed the problems and facilities vis-a-vis new programmes to be taken up in the field of soil and water conservation. Besides, strengthening existing programmes and organisation, a national scheme for treating the catchment of selected multipurpose river valley projects were launched in 13 catchments. Another programme for survey and categorization of waste lands was taken up in 17 States in order to ascertain areas which could be reclaimed and through a third scheme landless agricultural labourers were resettled. Similarly a centrally sponsored scheme was launched for identification and categorization of ravenous areas in the four states. The programme content, both for agricultural and non-agricultural lands, got diversified to include practices like nalla bunding, reclamation of ravines and alkaline land, stabilization of shifting sand dunes by afforestation. Treatment of coastal areas subject to a limited extent, the problem of salinity, was taken up. State Soil Conservation Boards were also established in a number of States.⁹

To stabilize the catchment of reservoirs and to control situation, a centrally sponsored scheme of "Soil Conservation work in the Catchment of River Valley Projects (RVP)" was launched in 1962-63.

During the period from 1966 to 1969, the centrally sponsored scheme of Soil Conservation was launched in five intensive Agricultural Development programme Districts whereas the scheme for survey and categorization of Waste Lands for resettlement of the landless labourers as well as the scheme for identification and categorization of ravines areas were transferred to the State sector. During this period a separate inter-ministerial working group was set up to go into the problems of ravines in the state of Uttar Pradesh, Rajasthan and Madhya Pradesh. With the transfer of agricultural research to the Indian Council of Agricultural Research (ICAR) all the

Central Research Demonstration and Training Centres (Except the Centres located at Chatara, Nepal and Hazaribagh) were placed under the control of ICAR and reorganised into Central Soil and Water Conservation Research and Training Institute. While All India Soil and Land Use Survey continued to function under the Ministry of Agriculture, a part of it was taken out and strengthened to form the National Bureau of Land Use Planning under ICAR an attached office namely Resource Inventory Centre was set up in the Soil and Water Conservation Division of the Ministry of Agriculture.¹⁰

During the Fourth Five Year Plan, the concept of taking integrated programme planning on the basis of watershed with a multi-disciplinary approach was strongly advocated while serious attempts were made to initiate collection of hydrologic and sediment data from small watersheds and tributaries. Manuals for collecting hydrologic and sedimentation data and handbooks for estimation of runoff and sediment production were brought out.¹¹

By 1974, the Model Bill was re-circulated among the 14 States and 2 Union Territories enacted suitable legislations to facilitate implementation of Soil and Water Conservation programmes with greater involvement of the people.¹² Between 1975 and 1983, three pilot projects financed by World Bank and International Development Association (IDA) were initiated to develop agriculture in a area where assured irrigation was not available.¹³

Watershed approach got wide acceptance during Fifth Five Year Plan period. Three new central programmes of diverse objectives namely, (i) pilot project of Amendment of Alkali and Acid Soil in Compact Areas and (ii) Strengthening/Creation of State Soil and Land use Survey Organisation and (iii) Pilot Project for Control of Shifting Cultivation were launched. Recognizing the seriousness of the problem of Jhuming cultivation on the economy of North-Eastern States and the production potential of the alkaline soils in the Indo-Gangetic Basin, two National Boards have been set up to deal with these problems more effectively.¹⁴

Rainfed agriculture in semi-arid tropics faces two major constraints for sustainable growth. These are (i) Water and Nutrient Stress and (ii) degradation of natural resources. International Crops Research Institute for Semi-Arid tropics (ICRISAT) has also taken initiative in this direction. A multi-disciplinary team of agricultural scientists adopted a package approach back in 1974. Between 1975 and 1988, 14 cropping systems were evaluated along with a range of management practices. The multi-disciplinary team developed a technology package, which was later known as “Vertisol Technology”. This package specifically targeted vertisol areas in regions with a relatively dependable rainfall where the land was fallow during the rainy season (Flower, 1994).¹⁵

A strong support was extended by Government of India by taking up Integrated Watershed Development Programme as a movement for the overall development of agriculture during Seventh Five Year Plan.¹⁶ In 1986 Government of India selected 99 districts in 16 States under Watershed Management Programme.¹⁷ Recognizing the importance of the watershed programme in dry land regions, the GOI initiated intensive programme to demonstrate the potential benefits of the concept to a large group of farmers. In mid eighty’s World Bank funded dry land watershed projects were initiated by four states, Andhra Pradesh, Karnataka, Madhya Pradesh and Maharashtra.

During the Eighth Five Plan (1992-97) extensive changes were introduced in the programme for the development of rainfed agriculture. It was decided that central assistance for the implementation of the programme was liberalized where 75 per cent of the amount is to be given as grants and 25 per cent as loans to the States. The programme envisaged that a micro watershed would be taken up for development in every block having assured irrigation of less than 30 per cent (GOI, 1992, p.5).¹⁸ In order to achieve a holistic and sustainable development of vast rainfed areas, a National Watershed Development Project for Rain-fed areas (NWDPA) was

implemented in this plan by the Ministry of Agriculture. But very slow progress was achieved in watershed programmes during the Eighth Five Year Plan.

In the Ninth Five year plan (1997-02) different Ministries of Government of India, the State governments, NGOs, Multilateral Financial Institutions and International Funding Agencies have been associated for the implementation of Watershed Development programmes in India.¹⁹ NWDPRP programme of the Ministry of Agriculture has been restructured to include community oriented and participatory approach. The 10th Plan (2002-07) puts emphasis on watershed management; rain water harvesting and ground water recharge which can help augment water availability in rain-fed areas. Thus the National Rain-fed Areas Authority (NRAA) will be set-up to provide a vehicle for developing concerted action plan for rain-fed areas under National Watershed Development programme. The 11th Plan (2007-2012) is also giving much importance to watershed development which will accelerate agriculture development.²⁰

Planning of Soil Conservation in the States started with the implementation of Five Year Plans. Targeted programmes of bunding, afforestation of deteriorated areas, gully plugging, etc. were taken up. In addition to training, facilities were created under the Central Government for training of officers and assistants. Training courses were started under State sector also for sub-assistants and in some cases assistants also. Separate divisions and wings for soil conservation have been established in most of the States under the State Departments of Agriculture. Separate Directorates of Soil Conservation have also been established in some of the states namely, Punjab, Bihar, Assam, Nagaland, Meghalaya, Kerala and Orissa. In Tamilnadu, the Department of Agriculture Engineering look after soil conservation, while in Arunachal Pradesh the Department of Rural Works is responsible for such works. Soil conservation programmes are also undertaken by the State Forest Departments, which in few cases have established separate Project Directorate/Division. In

Gujarat, Maharashtra and West Bengal, Public Works Departments and Irrigation Departments undertake Special Soil Conservation activities like reclamation of coastal saline, stream bank erosion control, landslide treatment etc. Land Development Corporations have also been established in a few states such as Gujarat, Haryana, and Uttar Pradesh etc. to draw funds from the Banks.²¹

As a follow up to the establishment of the Central Soil Conservation Board, number of States has set up similar Boards at State level to achieve better coordination amongst the concerned Departments. Over a period of time the States have diversified the soil and moisture conservation programmes from bunding and terracing alone to an integrated multi-treatment approach consisting of nalla bunding, check dams, gully plugging, land shaping, percolation tanks, ponds, development of irrigated lands. The soil conservation programmes have been progressively oriented on watershed basis for an integrated development of whole watershed. The progressively trained soil conservation organization in the States have been able to take up special development programmes under the area development approaches, like Drought Prone Area Programme (DPAP), Small Farmers Development Agency (SFDA), Integrated Tribal Development (ITD) and Command Area Development (CAD) etc, by the State Soil Conservation Wings/Departments.²²

The watershed programme became the centrepiece of rural development in India. The concept was widely implemented at various locations in India. It is reported that though a total area of nearly 50 million hectares has been treated through Soil and Water Conservation, afforestation and related activities, an area of about 9 million hectares could be identified as having been treated clearly on the basis of watershed (Das, 1994).²³

Milestones in the Institutional Development of the Watershed Programme in India (summarized)

- 1880 Famine Commission stressed the importance of water conservation

- 1885 National Wastelands Development Board established under the Ministry of Environment & Forests
- 1928 The Royal Commission on Agriculture for soil and water conservation through afforestation and soil erosion measures in the ravine tract of Bombay Presidency
- 1939 Establishment of Dry Farming Research Stations and Demonstration Centres in the country
- 1942 Bombay Land Improvement Scheme Act, to enable contour bunding by all cultivators in watershed, which enabled sharing of costs between government and the people.
- 1956 Central Soil Conservation Board was set up under the Ministry of Agriculture
- 1962 Soil Conservation Works in the Catchments of River Valley Projects, following the integrated approach for the holistic development of a whole river valley adopted by the Damodar Valley Corporation (first modern multi – disciplinary inputs from various disciplines like soil science, agronomy, engineering, forestry, social science, fisheries, grass land development etc.
- 1963-Several institutions, such as the Soil Conservation Society of India, the Central Soil etc were established.
- 1967 Conservation Board, Soil Conservation Research Demonstration and Training Centre set up. International technical cooperation with United States of America (USA), United Nations Educational, Scientific and Cultural Organization (UNESCO), Food and Agriculture Organization (FAO) etc let do the setting up institution like the Central Arid Zone Research Institute (CAZRI), International Crop Research Institute for Semi Arid Tropics (ICRISAT) etc., mandated to conduct research on soil, water and agricultural potential in different eco-zones of the country.

- 1967 Central Ravine Reclamation Board (CRRB) set up, and a national policy on ravenous watersheds declared and ravine reclamation projects started in Uttar Pradesh, Madhya Pradesh, Rajasthan and Gujarat.
- 1974 Soil Conservation Division of the Ministry of Agriculture, GOI started model watersheds all over the country (e.g. Sukhomajiri in Harayana, Chinnatekur in Karnataka)
- 1985 National Wastelands Development Board (NWDB) set up under the Ministry of Environment & Forests.
- 1992 NWDB was transferred to the Department of Wasteland Development (DoWD) under Ministry of Rural Development. DoWD is renamed as the Department of Land resources (DoLR) to act as the nodal agency for Land Resource management. 1995 New Guidelines framed for Watershed Development in the country by Ministry of Rural Development.
- 2000 New Guidelines framed for National Watershed Development Project for Rainfed Areas (NWDPA).
- 2001 Common Guidelines of 1995 were revised by MoRD
- 2003 Guidelines for Hariyali were formulated.
- 2006 Parthasarathy Committee, National Rainfed Area Authority (NRAA) was set up
- 2008 National Rainfed Area Authority (NRAA), framed Common Guidelines, 2008, for watershed programs for all Ministries/Departments of GOI concerned with watershed development projects. The new guidelines are called as Integrated Watershed Management Programme (IWMP).

The three Ministries of the Government of India involved in the implementation of watershed programmes are listed below.

Ministry of Agriculture (Department of Agriculture and Co-Operative)²⁴

This Ministry of Agriculture is responsible for implementing the programmes mentioned below:

1. **National Watershed Development Project for Rainfed Areas (NWDPR):** This project was launched in 1990. At present it covers all the 25 states and two Union Territories. The twin objectives of the programme is to improve production and to restore ecological balance
2. **Soil Conservation in the Catchments of River Valley Projects (RVP):** The scheme was launched in the year 1962-63. Subsequently another scheme of Integrated Watershed Management in the catchment of Flood Prone Rivers (FPR) was launched in 1980-81. The main aim of these schemes is to treat catchment areas, extending over more than one state, with appropriate soil and water conservation measures.
3. **Shifting Cultivation:** The Watershed Project in Shifting Cultivation Area (NDPSCA) was first launched during the Fifth Plan as a pilot project covering the whole of North Eastern region along with Andhra Pradesh and Orissa and later on was transferred to the State Plan Sector. The scheme was relaunched again in 1994-95 onwards in seven North-Eastern states.
4. **Reclamation of Alkali Soils:** The scheme was launched in 1974-75 in the states of Punjab, Haryana and Uttar Pradesh and extended to the states of Gujarat, Madhya Pradesh and Rajasthan in the Eight Plan Period. About 0.56 mha have been treated under this programme with an estimated expenditure of Rs. 82.54 crores till March 2005.²⁵ The main aim of the scheme is to reclaim land affected by alkalinity and improve land and crop productivity.

5. **External Aided Projects (EAPs):** Is in operation in 15 major states covering about 2.36mha area with an estimated cost of Rs.4756.26 crores.²⁶

Ministry of Rural Development (Department of Land Resources)

This Ministry implements the programmes mentioned below:

1. **Drought Prone Areas Programme (DPAP):** The program was launched in 1972-73 to tackle the special problems faced by areas constantly affected by severe drought conditions. The scheme covers 961 blocks of 180 districts in 16 states.²⁷ DPAP is targeted towards semi-arid and dry sub-humid areas.
2. **Desert Development Program (DDP):** The program was launched in 1977-78 and at present, this programme covers 232 blocks of 40 districts in hot desert areas of 7 states, Rajasthan, Gujarat, Andhra Pradesh, Karnataka & Haryana and cold desert areas of Jammu & Kashmir and Himachal Pradesh.²⁸ DDP is designed specifically for arid areas. There is virtually no difference between DPAP and DDP regarding operational guidelines, eligibility of soil erosion and Soil and Water conservation measures etc except that , under DDP the cost allocations are higher (4500-5000/Ha) than for DPAP projects(4000/Ha).
3. **Integrated Wasteland Development Programme (IWDP):** Was started in 1988-89 and since April 1st 1995, is being implemented through watershed approach under the new guidelines in 443 districts.
4. **Externally Aided Projects (EAP):** The Ministry of Rural Development is servicing externally aided watershed projects in the states of Orissa, Andhra Pradesh, Haryana, Kerala etc., for the development of degraded and wasteland areas.²⁹
5. **Technology Development, Extension and Training:** This scheme was launched during 1993-94 with the aim of promoting the development of suitable technology for the

reclamation of wastelands. Till March 2005, total area treated is 0.99mha and expenditure is Rs.80.16 crores.

6. **Investment Promotional Scheme:** The scheme is launched in 1994-95 to promote participation of the corporate sector and financial institutions to enhance the flow of funds for the development of non-forest wastelands.
7. **Support to NGOs:** The objective of the scheme is to create awareness, encourage the application of appropriate technologies for the development of wastelands and provide training for increasing capability and capacity building. Extension and publicity are other components of the scheme.
8. **The Wastelands Development Task Force:** The objective of the scheme was to develop wastelands through afforestation including soil and moisture conservation, plantation and protection.

Ministry of Environment and Forests

This Ministry implements the following schemes.

1. **Integrated Afforestation and Eco-Development Projects Scheme:** The scheme is being implemented since 1989-90 to promote afforestation and development of degraded forests on watershed basis.³⁰ Watershed based efforts of the Ministry of Environment and Forests are comparatively small.

Policy Evolution of Watershed Programmes

The watershed programmes were first reviewed in 1973 by a Task Force headed by Dr. B.S. Minhas, by another task force headed by Dr. M.S. Swaminathan in 1982 as well as by an Inter Departmental Group in 1984. In 1988 the National Committee on DPAP and DDP was set up under the Chairmanship of the member, Planning Commission to appraise and review the DPAP and DDP. The committee was initially headed by Dr. Y.K. Alagh and later by Shri L.C. Jain who took over as Member, Planning Commission in-charge of the subject. The committee submitted its report in August 1990.³¹

In 1994 a Technical Committee under the chairmanship of Prof. Ch. Hanumatha Rao was appointed to appraise the impact of the work done under DPAP/DDP, identification of the weaknesses of the programme and to suggest improvements. The committee felt that the programmes have been implemented in a fragmented manner by different departments though rigid guidelines without any well-designed plans prepared on watershed basis by involving the inhabitants. It recommended that sanctioning of works should be on the basis of the action plans prepared on watershed basis instead of fixed amount being allocated per block as was the practice at that time. It called for introduction of participatory modes of implementation through involvement of beneficiaries of the programme and Non-Government Organisations. The committee recommended suitable institutional mechanism for beginning about co-ordination between different departments at the central and state levels with a view to ensuring uniformity of approach in implementing similar programmes for the conservation of land and water resources.³²

On the basis of these recommendations, the Hanumantha Rao Committee formulated a set of “Common Guidelines”, bringing the three Area Development Programmes namely, DPAP, DDP and Integrated Wastelands Development program (IWDP) to be implemented on watershed basis by the Department of Land Resources (DoLR), Ministry of Rural Development. The “Common Guidelines” were made effective from 1st April 1995.³³

The common guidelines of 1994 were revised by MoRD in 2001 and then again modified and reissued as “Guidelines for Hariyali” in April 2003.³⁴ The Ministry of Rural Development set up another Technical Committee on DPAP, DDP and IWDP chaired by S. Parthasarathy in 2005 to address major issues in watershed programmes and recommend viable strategies and mechanisms for effective implementation of these programmes. The report concluded that the productivity of dry land agriculture needs to be developed if

food security demands of the year 2020 are to be met. The report recommended that a greater focus of watershed development programmes to increase productivity of lands in rain-fed areas might hold the key to meet the challenge of food security in years to come.³⁵

Under the aegis of the Planning Commission, National Rainfed Area Authority in consultation with the concerned Ministries framed Common Guidelines, 2008 for watershed programs for all Ministries/Departments based on the Parthasarathy Committee Report, other committee's observations and past experiences. The provisions in the Common Guidelines and the observations of the Parthasarathy committee have necessitated modification in the watershed schemes of the Department of Land Resources. Accordingly DPAP, DDP and IWDP of the Department of Land Resources have been integrated and consolidated into a single modified programme called Integrated Watershed Management Program (IWMP) and launched in 2009-10. This consolidation is for optimum use of resources, sustainable outcomes and integrated planning.³⁶ These guidelines are now applicable to all watershed development projects of all Departments/Ministries of Government of India concerned with watershed development projects.³⁷ Effective measures like fixing time lines for completion of the projects, regional review meetings, area visits by officers and close monitoring have been taken for the completion of on-going projects under DPAP, DDP and IWDP.

The Ongoing projects of DPAP, DDP and IWDP sanctioned up to 10th Five Year Plan continue to be implemented in accordance with earlier guidelines, Haryali guidelines 2003, which are still the existing macro-policy reference point.

In fact, there are nine guidelines over a span of 30 years reflecting the importance accorded to watershed programme at the policy level. At the same time, it creates an impression that guidelines are treated as panacea for all ills of watershed programme, including implementation. One positive feature of these changing guidelines is the flexibility at which policies are adopted and corrected in a dynamic

and evolutionary process where the basic approach set out in the guidelines has been adopted and adapted and extended in response to gained experience and emerging needs. Unfortunately, the pace at which the changes took place does not allow any time or space for stabilising the implementation process.³⁸

Table 2.1 depicts the salient features of IWMP in comparison with Hariyali Guidelines are as below:

Table 2.1

SALIENT FEATURES OF IWMP IN COMPARISON WITH HARIYALI GUIDELINES

Sl. No.	Contents	Existing Provisions (Hariyali 2003)	Provisions under IWMP
1.	Programmes	Three programmes IWDP, DPAP, DDP	Single Programme IWMP
2.	Project Area	One micro-watershed (500 ha average size)	A cluster of micro-watersheds (1000 ha to 5000 ha)
3.	Selection of watershed	Project area did not exclude assured irrigation	Assured irrigation area excluded from project area
4.	Cost per ha.	Rs. 6,000	Rs, 12,000 for plains and Rs. 15,000 for difficult and hilly areas
5.	Central Share and State Share	75 : 25 for DPAP and DDP, 92: 8 for IWDP	90 : 10 for IWMP
6.	Project Period	5 Years	4 to 7 Years
7.	Number of Instalments	5 (15% , 30%, 30%, 15%, 10%)	3 (20%, 50%, 30%)
8.	Fund Allocation	Training & Community Mobilization 5% Administration 10% Works 85%	Institution & Capacity building 5% Monitoring & Evaluation 2% Administration 10% Works & Entry Point Activities 78% Consolidation 5%
9.	Institutional Support	Weak Institutional arrangement	Dedicated Institutional Structures at Central, State, District, Project and Village level

Sl. No.	Contents	Existing Provisions (Hariyali 2003)	Provisions under IWMP
10.	Planning	No separate component	1% for DPR(District Perspective Plan) Preparation with scientific inputs
11.	Monitoring & Evaluation	No separate budget provision for mid term & final evaluation	2% of project cost earmarked for Monitoring & Evaluation, provision for evaluation after every phase of the project`
12.	Sustainability	Weak mechanism with WDF as a tool	Consolidation Phase with WDF and livelihood component as a tool
13.	Livelihood	Not included	Included as a component

Source: Department of Land Resources, Ministry of Rural Development.

The programmes implemented by Ministry of Rural Development, IWMP, IWDP, DPAP and DPP are discussed below.

Integrated Watershed Management Programme (IWMP)³⁹

IWMP was launched in 2009-10. The main objective was to bring all watershed implementing Ministries, Departments and Agencies under one umbrella there by bringing in uniformity. This consolidation is for optimum use of resources, sustainable outcomes and integrated planning.

Objectives of Integrated Watershed Management Programme

- Restoring the ecological balance
- Harnessing, conserving and developing degraded natural resources such as soil, vegetative cover and water
- Prevention of soil run-off
- Regeneration of natural vegetation
- Rain water harvesting and recharging of the ground water table
- Introduction of multi cropping and diverse agro based activities and
- Promoting sustainable livelihood

Criteria for Allocation of Target area to States under IWMP

Keeping in view the mandate of the Department of Land Resources and its watershed schemes, the following criteria are adopted for the allocation of target area among the States.

- (i) Identified DPAP/DDP areas in the State as percentage of total DPAP and DDP area in the country.
- (ii) Total treatable wastelands in the State as percentage of total treatable wastelands in the country.
- (iii) Total SC/ST population of the State as percentage of total SC/ST population of the country.
- (iv) Percentage of rainfed area in the State to total cultivated area in the country.
- (v) 10 per cent mandatory allocation of North-Eastern States.

Achievements under IWMP

Under IWMP, a target for covering 22.65 million ha was set for 11th Five Year Plan. Against this, a total area of 24.213 million ha (5087 projects) has been sanctioned by State Level Nodal Agencies (SLNAs) of 27 States. The target for sanction of new projects under IWMP for the year 2012-13 is 5.0 million ha. A total of 743 projects covering an area of 3.60 million ha have been appraised/ sanctioned by SLNAs and a total amount of Rs. 2228.04 crore has been released during 2012-13 (as on 31.12.2012). So far, a total amount of Rs. 6092.27 crores has been released towards the central share for the projects sanctioned under IWMP. A total assistance of Rs. 97.65 crores has been released under Professional Support to 27 States for establishment/engagement of personnel at State and District level institutions from 2009-10 to 2012-13 (as on 31.12.2012).⁴⁰

Integrated Wastelands Development Programme (IWDP)

Wastelands are “degraded lands which can be brought under vegetative cover with reasonable efforts and which are currently under utilized. It is also the land which is deteriorating for lack of appropriate water and soil management or on account of natural causes.”⁴¹

To accelerate the pace of development of wastelands/degraded lands, the GOI had set up the National Wastelands Development Board in 1985 under the Ministry of Environment and Forests. Later a separate Department of Wastelands Development in the Ministry of Rural Development and Poverty Alleviation was created in 1992 and the National Wastelands Development Board was transferred to it. In April 1999, Department of Wastelands Development was renamed as the Department of Land Resources to act as the nodal agency for Land Resource Management. Consequently all land-based development programmes and the land reforms division were brought under this Department.⁴²

The Technical Committee constituted under the Chairmanship of Prof. C.H. Hanumanth Rao in 1994, to appraise the impact of DPAP/DDP recommended a common set of operational guidelines and expenditure norms for the three programmes of Ministry of Rural Development (MoRD). Accordingly, the Guidelines for Watershed Development were framed and brought into force from 1st April 1995. Since then, DPAP, DDP and IWDP are being implemented on watershed basis. Hariyali Guidelines launched w.e.f 1.04.2003 aimed at empowering Panchayat Raj Institutions (PRIs), both administratively and financially, in implementation of watershed programmes. From 2007-08 onwards, no new projects are sanctioned under this scheme.

Objectives of the Above Programme

- Developing wastelands/degraded lands on watershed basis, keeping in view the capability of land, site conditions and local needs.
- Improving the socio-economic condition of the poor and disadvantaged sections inhabiting the programme areas
- Restoring ecological balance of harnessing, conserving and developing natural resources land, water and vegetable cover.

- Encouraging the village community for sustained community action for operation and maintenance of assets created.⁴³

Physical Performance

The schemes for wastelands development is implemented by three Ministries viz, Ministry of Agriculture (MoA), Ministry of Rural Development (MoRD), Ministry of Environment and Forest.⁴⁴ Wastelands Development programme was started in early sixties and progressively strengthened during 9th and 10th Five Year Plans. The progress was slow till 8th plan. It acquired momentum during 9th and 10th plans as the areas treated as well as investment increased sharply from 17.672 million hectare and Rs. 46,388.0 million till 8th plan to 50.899 (188 per cent) million hectare and Rs. 192,512.2 (315 per cent) million at the end of 10th plan. The MoRD accounted for 32 million hectare (63 per cent) of the treated area investing Rs. 95,232 million (49.7 per cent) as compared to 18.77 million hectare (37 per cent) at the cost of Rs. 96,804. 9 million (50.3 per cent) by the Ministry of Agriculture.⁴⁵ Under IWDP, 1877 watershed projects covering an area of 10,722 million hectares with a total cost of about Rs.6067.58 crores were sanctioned upto 31.12.2010. Out of these, the final instalment of centre share for 607 projects has been released.⁴⁶ The Central fund released under the programme for 2010-2011 is 206.88 crores and the Andhra Pradesh State has released an amount of 5.76 crores for the programme for 2010-2011.

Coverage

The projects under the programme are sanctioned in the blocks not covered by DDP and DPAP. The projects under the programme are being implemented in 470 districts in all 28 states of the country.⁴⁷

Funding Pattern

IWDP is a 100 Percent central sector scheme. The cost norm is Rs 4000 per hectare. The cost norm has since been revised to Rs. 6000 per hectare for the projects sanctioned after 1.4.2000. The funding of the projects is shared between the centre and states in the ratios of Rs 5500 per hectare and 500 per hectare respectively. However the old projects sanctioned upto 31.3.2010 continue to be funded entirely by the central government.⁴⁸

Wastelands in India

Out of total geographical area of 329 million hectare in India 175m.ha has become wastelands. An area of 150m.ha has been degraded due to wind and water erosion which constitutes 85.7 per cent of total watersheds. The remaining 25m.ha (14.3 per cent) has been degraded due to water logging, salinization, alkalinity, shifting cultivation etc. The degradation of top-soil in India has been estimated as 141m.ha constitutes 11 per cent of the total loss of top-soil of the world. The treatment of wastelands and protection of farm lands from constant degradation through land management procedures is the need of the hour.

Table 2.2 shows the State-wise area of total wastelands in the country as per 'Wastelands Atlas of India, 2000, 2005 and 2010'. The table 2.3 points that the area of the wastelands has been decreasing since 2000-2010 with 63.85 m.ha. in 2002, 55.27 m.ha. in 2005 and 47.23 m.ha in 2010. The decrease can be attributed to various watershed programmes implemented in the country.

Drought Prone Areas Program (DPAP)

India predominantly characterized by a tropical monsoon climate, has a large variability in rainfall both in space and time. Consequently, India has been experiencing frequent droughts or floods in the country. Droughts in India are mainly the result of failure of rains from south-west monsoon. The drought prone areas of the country are characterized by large human and cattle populations living in rural areas, heavy pressure on the already degraded natural

resources for food, fodder and fuel. The major problems are continuous depletion of vegetative cover, increase in soil erosion and fall in ground water levels due to continuous exploitation without any effort to recharge the underground aquifers.

Table 2.2

STATE-WISE AREA OF TOTAL WASTELANDS IN THE COUNTRY AS PER 'WASTELANDS ATLAS OF INDIA, 2000, 2005 AND 2010'

Sl. No.	State	Total wasteland area (million ha)		
		Wastelands Atlas, 2000	Wastelands Atlas, 2005	Wastelands Atlas, 2010
1	Andhra Pradesh	5.17	4.53	3.88
2	Bihar	0.59	0.54	0.68
3	Chhattisgarh	1.02	0.76	1.18
4	Goa	0.06	0.05	0.05
5	Gujarat	4.30	2.04	2.14
6	Haryana	0.37	0.32	0.24
7	Himachal Pradesh	3.16	2.83	2.25
8	Jammu & Kashmir	6.54	7.02	7.38
9	Jharkhand	1.59	1.12	1.17
10	Karnataka	2.08	1.35	1.44
11	Kerala	0.14	0.18	0.25
12	Madhya Pradesh	5.95	5.71	4.00
13	Maharashtra	5.34	4.93	3.83
14	Odisha	2.13	1.90	1.66
15	Punjab	0.22	0.12	0.10
16	Rajasthan	10.56	10.15	9.37
17	Tamil Nadu	2.30	1.73	0.91
18	Uttar Pradesh	2.27	1.70	1.10
19	Uttarakhand	1.61	1.61	1.28
20	West Bengal	0.57	0.44	0.20
21	Arunachal Pradesh	1.83	1.82	0.57
22	Assam	2.00	1.40	0.88
23	Manipur	1.29	1.32	0.70
24	Meghalaya	0.99	0.34	0.39
25	Mizoram	0.40	0.45	0.60
26	Nagaland	0.84	0.37	0.48
27	Sikkim	0.35	0.38	0.33
28	Tripura	0.12	0.13	0.13
29	Union Territories	0.06	0.03	0.04
	Grand Total	63.85	55.27	47.23

Source: Outcome Budget 2013-2014, Department of Land Resources, India

In order to address specific problems of drought prone areas, DPAP is being implemented on watershed basis from 1995 onwards. No new projects have been sanctioned under this programme w.e.f 2007-08. The origin of the DPAP can be traced to the rural works programme launched in 1970-71 with the object of creating assets designed to reduce the severity of drought in the affected areas. The programme spelt out a long term strategy in the context of the conditions and potentials of identified drought prone districts. In all 54 districts as well as parts of 18 other districts contiguous to them were identified in the country as drought prone for purposes of the programme. The programme grew to cover 12 per cent of the country's population and nearly one fifth of the area. Labour intensive activities such as medium and minor irrigation projects, road construction, soil conservation and afforestation projects were taken up under the program. The success of this activity prompted the government to take up a mega sized project named the Drought Prone Area Development program in 1972-73, with the principle objective of mitigating the impact of droughts in vulnerable areas.⁴⁹

Objectives of the Programme

- The objective of the programme is to minimize the adverse impact of drought on the production of crops, productivity of land, availability of water, livestock and human resources thereby ultimately leading to drought proofing of the affected areas.
- To implement development works through the watershed approach, for land development, water resources development and afforestation/pasture development.

Coverage

At present DPAP is under implementation in 972 blocks of 195 districts in 16 states. The program in Andhra Pradesh is being implemented in 11 districts, 94 blocks; 2.121 m.ha is under the project out of 9.9218 m.ha of identified areas.

At present DPAP is under implementation in 972 blocks of 195 districts in 16 States, as detailed below (Table 2.3)

Table 2.3
COVERAGE OF DPAP IN 16 STATES OF INDIA

Sl. No	States	No. of District	No. of Blocks	Identified Area in m. ha	Project area in m.ha.
1	Andhra Pradesh	11	94	9.9218	2.121
2	Bihar	6	30	0.9533	0.2715
3	Chhattisgarh	9	29	2.1801	0.580
4	Gujarat	14	67	4.3938	1.222
5	Himachal Pradesh	3	10	0.3319	0.206
6	Jammu & Kashmir	6	22	1.4705	0.280
7	Jharkhand	15	100	3.4843	0.7975
8	Karnataka	17	81	8.4332	1.185
9	Madhya Pradesh	26	105	8.9101	1.6335
10	Maharashtra	25	149	19.4473	1.808
11	Orissa	8	47	2.6178	0.6595
12	Rajasthan	11	32	3.1968	0.5535
13	Tamilnadu	18	80	2.9416	0.811
14	Uttar Pradesh	15	60	3.5698	0.8885
15	Uttaranchal	7	30	1.5796	0.423
16	West Bengal	4	36	1.1594	0.2795
	Total	195	972	74.5913	13.7195

Source: Department of Land Resources, Ministry of Rural Development.

Funding Pattern

Till March 1999, the funds were shared on 50:50 between the Central Government and State Governments. However with effect from 15th April 1999, funding is shared on 75:25 basis between the Centre and State Governments. In respect of on-going projects that were sanctioned prior to April 1999, the old funding pattern is continuing.

With effect from 1.4.2000, uniform cost norms @ Rs. 6000/- per ha have been introduced.

Physical and Financial Performance

Under DPAP, 27,439 watershed projects covering an area of 13.72 m.ha., with a total cost of about 7,364 crores were sanctioned upto 2006-07. Out of these, 14,498 have been completed by 31.12.2010. From 2007 onwards, no new projects have been sanctioned under DPAP.

The central funds released under the programme from 1995-96 to 2010-11 is amounting to Rs. 3912.42 crores. An amount of Rs. 221.84 crores was released in 2010-11 for this programme.

Desert Development Programme (DDP)⁵⁰

Due to increase in human and livestock population in desert areas, the natural resources of the region are under great stress. The major problems of desert areas are continuous depletion of vegetative cover, increase in soil erosion and fall in ground water table. All these factors account for diminishing productivity of land and loss of natural resources.

On the recommendation of the National Commission on Agriculture, the DDP was started in the year 1977-78 both in the hot desert areas of Rajasthan, Gujarat and Haryana and the cold desert areas of Jammu and Kashmir and Himachal Pradesh. From 1995-96 onwards DDP has been implemented on watershed basis and the coverage of programme extended to another six districts of Karnataka and one district in Andhra Pradesh.

Objectives

- The objectives of the programme are to mitigate the adverse effects of desertification and adverse climatic condition on crops, human and livestock population and combating desertification.
- To restore ecological balance by harnessing, conserving and developing natural resources i.e. land water, vegetative cover and raising land productivity.

- To implement development works through the watershed approach, for land development, water resources development and afforestation.
- Improving socio-economic conditions of the resource poor and disadvantaged section of village community viz. asset less and women.

Coverage

DDP is under implementation in 235 blocks of 40 Districts in 7 states covering an area of 45.794 m.ha. In Andhra Pradesh, the DDP programme is implemented in 16 blocks of the state, covering an area of 1.9136m.ha. The states where DDP is under implementation are Andhra Pradesh, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka and Rajasthan. The details of the programme are given in the table 2.4

Table 2.4
COVERAGE OF DDP IN SEVEN STATES OF INDIA

Sl. No.	Name of the State	District	Blocks	Identified Area in m. ha.	Project area in m.ha.
1	Andhra Pradesh	1	16	1.9136	0.527
2	Gujarat	6	52	5.5424	1.531
3	Haryana	7	45	2.0542	0.5945
4	Himachal Pradesh	2	3	3.5107	0.276
5	Jammu & Kashmir	2	12	9.6701	0.3645
6	Karnataka	6	22	3.2295	0.791
7	Rajasthan	16	85	19.8744	3.789
	Total	40	235	45.7949	7.873

Source: Outcome Budget 2013-2014, Department of land Resources

Funding Pattern

The DDP is a centrally sponsored programme and funds are directly released to DRDAs/ZPs for implementation of the programme both by the Central and State Governments. With effect from 1.4.1999, the total cost of watershed projects sanctioned to the state is shared between the central and state governments in the ratio of

75:25. The projects sanctioned before 1.4.1999 continued to be funded on the old pattern. With effect from 1.4.2000, uniform cost norms @ 6000/- pattern have been introduced.

Programme Performance

Under DDP, 15,746 watershed projects covering an area of 7.873 million hectares with a total cost of Rs 4487.12 crores were sanctioned up to 2010-11. Out of these, 8977 projects have been completed. During 2010-11, no new projects have been sanctioned under DDP. The centre has spent a total amount of Rs.3004.18 crores on this program from 1995-96 to 2010-11.

Evolution of Water Policies in India

The British rulers in India did not evolve a clear cut and definite policy on the utilization of India's water resources before 1947. During the Second World War, India had to suffer serious food shortage, ultimately resulting in the Bengal Famine. The partition of the country worsened the food situation and the self sufficiency in food became the most important short-term objectives of the government at that time. At the same time rapid industrial development launched soon after 1951 necessitated two things: the increased production of agricultural raw materials on the one side and the generation of electricity on the other. To these were added a third dimension, viz flood control. For centuries, Damodar, Kosi and other rivers were the scourge of the people living in the eastern states and accordingly, flood control was added as an important objective of management of water resources. Thus, India's water policy since Independence or more specifically, since 1950-51, consisted of the construction of huge dams and reservoirs, distribution canals, etc., all of which were designated as major and medium irrigation works.⁵¹

For the past two decades much interest is shown on water policies which can be attributed to rising water demands due to increasing population, increasing water scarcity, low consciousness about the scarcity of water, uneven distribution of water over time and space frequent floods and droughts, increasing water pollution,

changing economic policies at the national and international levels, competition among different water users. The objective of the National Water Policies is to take notice of the existing situation of water scarcity and related problems and to propose a framework for creation of a system of laws and institutions and for a plan of action with a unified national perspective.⁵²

By 1980s it became evident, that while water is a State subject, the lack of a national policy was a impediment to the development of coherent water policies.⁵³ This led to the development of national water policy in 1987 by the Ministry of Water Resources GOI to govern the planning and development of water resources and their optimum utilization. It was reviewed and updated in 2002 and later in 2012.

The two policies, 1987 and 2002 are similar on focusing on developing a data bank, estimating the available water, prioritizing available water with drinking water given highest priority, developing ground water levels, encouraging stakeholders participation in water management, monitoring water quality, promoting conservation consciousness, developing a flood control mechanism, using cost effective measures to control mechanism, modernization and maintenance of water works, ensuring the safety of the structures built on water bodies, developing relevant science and technology and training of personnel.⁵⁴

The key differences are focuses on the development of an improved institutional framework with a focus on enhancing the performance of the institutions, promoting the rehabilitation of the displaced, enhancing private participation in water management, developing an effective monitoring system, and ensuring that states share waters of joint rivers in amicable manner without conflicts.⁵⁵

The 2002 water policy is again reviewed and updated in 2012. The main emphasis of National Water Policy 2012 is to treat water as economic good which the ministry claims to promote its

conservation and efficient use. This provision intended for the privatization of water-delivery services is being criticized from various quarters. The policy also does away with the priorities for water allocation mentioned in 1987 and 2002 versions of the policy.⁵⁶ In a major departure from the past, the policy also suggests that people displaced by large water projects should be made partners in progress and given a share in the benefits comparable to the project-benefited families. In fact, the policy suggests that the cost of rehabilitation and compensation to the project affected families be “partly” borne by the project-benefited families through “adequate pricing of water”. The policy was adopted with disapproval from many states. Himanshu Thakkar, an expert at the South Asia Network on Dams, Rivers and People, said the policy showed the government had been unable to “learn from the past.” “The entire focus should have been on how to sustain groundwater, which is the country's lifeline”.⁵⁷

The basic principles of the policy are ensuring equity and social justice in allocation of water, treating river basin as basic hydrological unit for planning. The policy is for incentivizing states to increase water storage capacity, which inter-alia should include revival of traditional water harvesting structures and water bodies, pricing of water, recycle and reuse of water and subsidies and incentives to be provided to private industry for recycling and reusing treated effluents, for the abolition of all forms of water subsidies to the agricultural and domestic sectors, removing the large disparity between stipulations for water supply in urban areas and in rural areas, all hydrological data, other than those classified on national security consideration, should be in public domain, establishing National Water Informatics Centre to collect, collate and process hydrologic data regularly from all over the country, conduct the preliminary processing, and maintain in transparent manner on a GIS platform. Finally National Water Board is to oversee the implementation of the National Water policy.⁵⁸

The policy is for “Integrated Watershed development” activities with groundwater perspectives need to be taken in a comprehensive manner to increase soil moisture reduce sediment yield and increase overall land and water productivity. To the extent possible, existing programs like Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGA) may be used by farmers to harvest rain water using farm ponds and other soil and water conservation measures.⁵⁹

NECESSITY OF WATERSHED PROGRAMME

The following situations experienced by India make watershed programme inevitable and indispensable,

Increased water demand

Water demand is increasing due to fast-growing population and expanding scale of economic activities. Since 1950, the population has more than doubled. With about 1.2 billion people, India is the world’s second most populous country. India is on track to become the world’s most populous country in the not-so-distant future, however. Both Census and UNPD projections anticipate that India’s population will exceed China’s (1.3 billions) by 2025.⁶⁰

Urbanization, the major consequence of population growth and economic expansion, put serious pressures on both quantitative and qualitative dimensions of water resources.⁶¹ Water demand is also growing due to the broadening perspective of water and its ecological, ethical, and cultural roles. Water is needed to meet not only human needs which include water supply for domestic use, drinking water, municipal and industrial uses, agriculture, irrigation, livestock management, hydro-electric power, navigation improvement, drainage and flood control, outdoor recreation, fish and wildlife conservation but also the needs of the water-based ecosystems that form part of the global life-supporting system.

India’s demand for water is growing at an alarming rate. Industry accounted for about 20 per cent of water withdrawals and four percent of water consumption worldwide. According to the

Ministry of Water Resources (MoWR), industrial water use in India stands at about 50 billion cubic meters or nearly 6 per cent of total freshwater abstraction.⁶² According to Government of India report, 1999, it was pointed out that the requirement of water for irrigation in India will grow more than 50 per cent in the next 50 years.⁶³

India's aggregate water demand is expected to rise to 1498 billion cubic meters by 2030 with agriculture accounting for 81 per cent of the consumption, industry 13 per cent and municipal and domestic sectors accounting for seven per cent. This is an increase from the present 800 billion cubic meters.⁶⁴

Water Wars

It is not an exaggeration to say that future wars will be fought for water as distribution of water in time and space is uneven and hence the judicious utilization and management of water resource is of utmost importance.⁶⁵ The per capita water has reduced from about 5277m in the year 1955 to the level of 1970m in the year 1998. Water disputes have already started between world nations and interstates. Some of the important interstate water disputes in the country are Kaveri Water dispute between Karnataka, Kerala and Tamil Nadu; the Krishna water dispute between Maharashtra, Karnataka and Andhra Pradesh; the Tungbhadra river water dispute between Andhra Pradesh and Karnataka; the Parambikulam, Aliyar and Bhavani river water dispute between Tamil Nadu and Kerala; the Godavari river water dispute between Maharashtra, Andhra Pradesh, Madhya Pradesh, Karnataka and Orissa; the Narmada river water dispute between Gujarat, Madhya Pradesh, Maharashtra and Rajasthan; the Mahi river water dispute between Gujarat, Rajasthan and Madhya Pradesh; the Ravi and Beas river water dispute between Punjab, Haryana, Rajasthan, Delhi, Jammu and Kashmir; the Yamuna river water dispute between Uttar Pradesh, Haryana, Himachal Pradesh, Punjab, Rajasthan, Madhya Pradesh and Delhi; the Karmanasa river water dispute between Uttar Pradesh and Bihar; and the Barak river water dispute between Assam and Manipur.

Decrease in per capita Arable Land Area

The arable land area (% of land area) in India in 1950s is 54.8 per cent and in 2010 is 49.1 per cent. A noticeable decrease is seen in the total arable land area. In addition to soil degradation, prime agricultural land is also being converted to industrial, urban, recreational, and other non-agricultural uses. Urbanization is a principal threat to prime agricultural land, especially in densely populated countries (e.g., China, India).⁶⁶

In view of the ever-shrinking arable land resources, it is important to identify and implement strategies for restoration of degraded soils and intensification of existing prime agricultural land. Watershed Management is an appropriate option to implement these strategies.

Mitigating Droughts

Drought is a creeping disaster, which brings large scale starvation, malnutrition, migration, unemployment and poverty. Overtime soil erosion has increased, ground water levels have gone down and consequently the severity of drought has increased leading to ecological degeneration. Droughts are becoming increasingly severe in the recent period.

Drought connotes a situation of water shortage for human, cattle and agriculture consumption resulting in economic losses, primarily in agriculture sector. Drought leads to a situation of decreased food production, decreased availability of dairy and livestock products, loss to industries directly dependent on agricultural production, increased cost of water and other commodities, reduction of economic development and growth etc.

Drought is a common phenomenon in one or other part of India. Arid and semi-arid regions, practicing largely rainfed agriculture are more prone to drought than the other climatic zones; Fifty four districts in the country together with parts of another 18 districts contiguous to them are identified as drought prone.

About 144.43 M ha of the total land in India is under water and wind erosion. About 260 M ha of the land area is drought prone. Thus the total problem area is about 173.65 m. ha.⁶⁷

Out of 329mha of total area of the country, 173.65mha is degraded. In fact, according to the Ninth Five Year Plan Document, soil erosion is contributing to degradation in about 45 per cent of the cultivable area of the country. The estimates of wastelands range from 76 million hectares to 175 million hectares. In a densely populated country like India, one cannot afford to let so much land remain idle.⁶⁸

Evidently, the existing interventions for drought proofing have failed to counteract the overall processes of degradation of natural resources. This calls for evolving an overall policy frame-work that provides adequate incentive and opportunities for soil and moisture conservation, through watershed development.

Over Exploitation of Ground Water

The importance of groundwater in Indian economy can be hardly overemphasized. Estimates state that groundwater sources account for as much as 70 per cent to 80 per cent of the value of farm produce attributable to irrigation. India's agriculture is closely tied to the availability of groundwater as we can see it from the increase in groundwater irrigation than canal irrigation. During drought years, groundwater happens to be the predominant source of irrigation. Groundwater provides the greatest measure of security on all the three fronts sought by farmers: timeliness, adequacy, and reliability.⁶⁹ Besides, groundwater is the source of four-fifths of the domestic water supply in rural areas and around half that of urban industrial uses. Hence, groundwater's role as a catalyst of rural development as well as poverty alleviation cannot be denied.

While groundwater development has had important implications for the economy, the overuse of groundwater has also been emerging as a major concern.⁷⁰ Ground water is being used at a faster rate than the rate at which it is being recharged. Overexploitation of

groundwater is a major and serious problem in states of Punjab, Haryana, Delhi, Tamilnadu, Rajasthan etc.

At the country level, there is phenomenal increase in groundwater structures thus putting pressure on groundwater resources. The extent of extraction has increased significantly over the years as the number of wells and tube wells has gone up substantially.⁷¹

Watershed management happens to be a useful technology for effectively recharging the groundwater by water and soil conservation methods.

Desertification

Desertification refers to a special type of land/soil degradation, where desert like conditions spread to the areas on the fringe of the desert in semiarid and arid regions. Desertification implies decline in soil quality leading to reduced biological productivity and environmental moderating capacity of land in arid regions. Desertification may happen as a result of natural and anthropogenic or human-induced factors. Desertification is an especially severe problem in dry regions in India. An appropriate strategy for desertification control may involve natural resource planning at the watershed level.

Deforestation

Forests are important ecosystems because of their impact on global hydrological cycles, biodiversity, and numerous social, economic, and political issues, however, forests are rapidly dwindling. The global annual rate of deforestation is estimated at 12.37 m.ha. out of a total remaining area of 1505 m.ha. or 0.82 per cent/yr.⁷²

India has 76.52 million hectares of recorded forest area (Forest Survey of India, The State of Forest Report, 1997) as against 33 percent of National Forest Policy of 1988.⁷³ Per capita availability of forest in India is 0.07 m.ha which is much lower than the world average of 0.8 m.ha. A large part of these forests is degraded and productivity is very poor.

The rate of deforestation in country is very high and between 1970 to 1990 it was up to 1.5 million ha per year. The total forest degraded lands estimated by Government of India, Ministry of Environment and Forests is 35.89 Mha.

Watershed Management can play a crucial role in planning for a judicious management of forest ecosystems, and in restoration of degraded soils.

Water Crisis

Water crisis is usually viewed in terms of an increasing imbalance between water supply and demand. The increase in population at geometrical rate and over use of water for various purposes are considered to be the major reasons for decreasing the water resources in the world.⁷⁴

When the annual per capita availability of renewable fresh water in a country or a region falls below 1700 cubic meters, it is held to be a situation of water stress. If the availability is below 1000 cubic meters, the situation is labeled as that of water scarcity. And when the per capita availability falls below 500 cubic meters, it is said to be a situation of absolute scarcity (Engleman and Roy 1993).

The per capita availability of water in the country is 1545 cubic meters as per the 2011 census. The average annual per capita availability of water in the country, taking into consideration the population of the country as per the 2001 census, was 1816 cubic meters which reduced to 1545 cubic meters as per the 2011 census, denoting that the per capita water availability in the country is reducing progressively due to increase in population. Also there are reports that demand for water in India would rise dramatically to about 833 cubic kilometers in 2025 and 899 cubic kilometers in 2050 due to increase in population, rapid urbanization and a growing GDP with significant lifestyle changes.⁷⁵

It is estimated that by the year 2025, as much as two-thirds of the world's population-estimated to have expanded by an additional

2.6 billion people will be living in conditions of serious water shortage and one-third will be living in conditions of absolute water scarcity.⁷⁶

Crisis can be averted by improving water use and management.

Food Security and the Greenhouse Effect

India's principal issue of the 21st century is food security and environment quality. Despite the phenomenal advances made in agricultural technology, India's food production has not kept pace with the increase in population. India is ranked at number 67, way below neighbouring countries like China and Pakistan, in 2010 Global Hunger Index by the International Food Policy Research Institute.⁷⁷ Degradation of soil and water resources and lack of appropriate technology to address the basic issue of resource management are the primary factors responsible for low agricultural productivity. Important among environmental issues are poor water quality and the accelerated greenhouse effect.

The problem of food security needs to be addressed at immediately. As one of the world's largest emitters of greenhouse gases India contributes significantly to global warming. Watershed Management programme decreases greenhouse effect and increases food security.

Mitigating Migration

Migration of labourers, especially rural to urban is on the increase. A typical case is the drought-prone Mahaboobnagar district in Andhra Pradesh, which has had high migration rates for several decades. It is now well known for the legendary Palamur labourers who work in construction all over India. The neighbouring district of Ananthapuram is also highly drought prone and is one of the poorest districts in India. There, too, seasonal migration has become routine (Rao, 2001).

There is an interesting relationship between agriculture, natural resources and migration. A common understanding is that deteriorating agriculture leads to out migration and improving the

natural resource base and generating employment in rural areas can mitigate migration.

Watershed projects has the strong potential of employment generation that varies across regions depending on cropping intensity and labour intensive crops grown in that region and hence can check migration.

Problem of Poverty

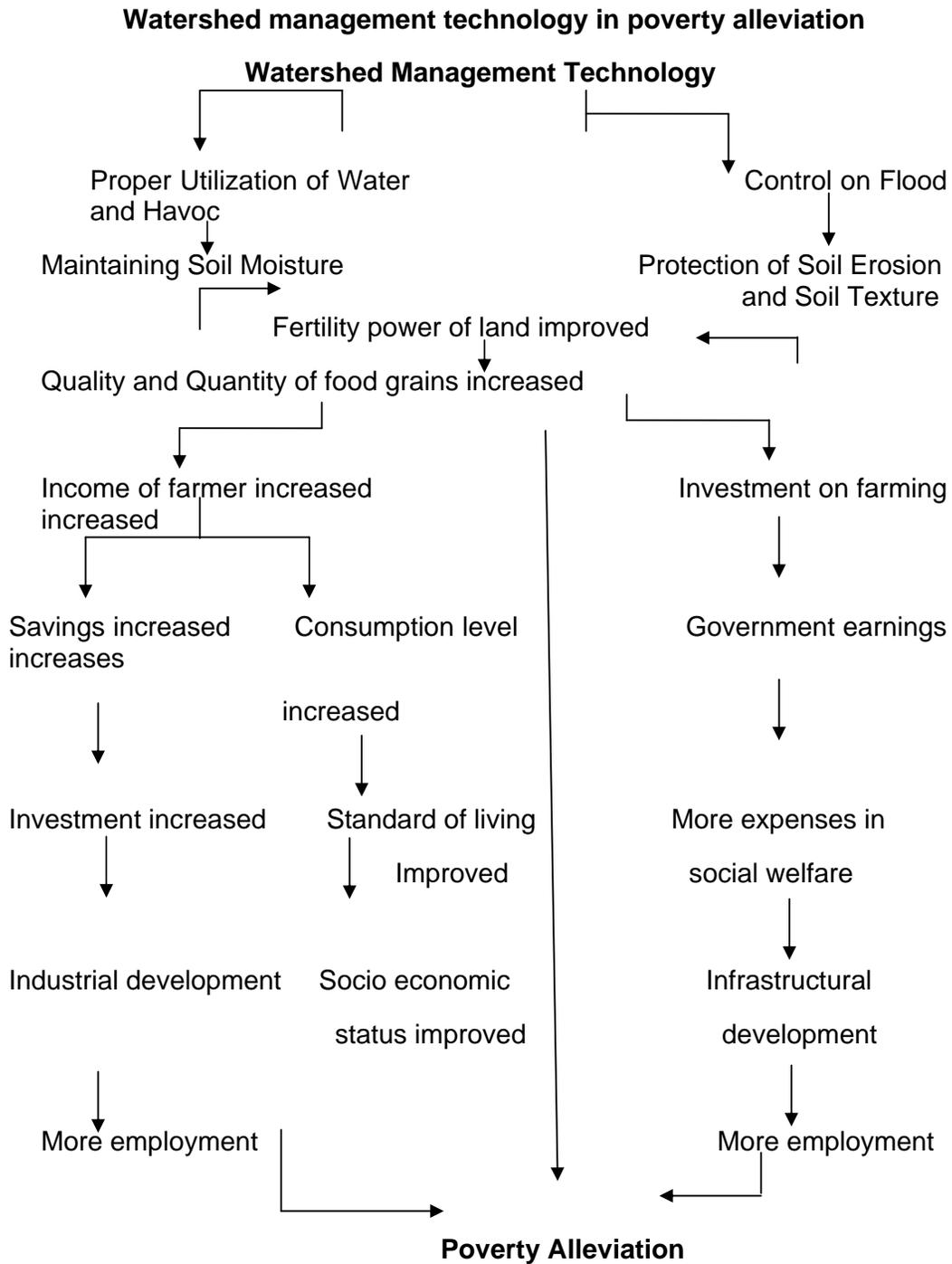
The watershed programmes has increasingly become more poverty focused. There has been a shift from assessing the impact of watershed management on regeneration of natural resource base, health of the environment and agriculture productivity to enhance to overall impacts on poverty and livelihood security in a sustainable manner.⁷⁸

The Figure 2.1 clearly explains how watershed technology works in addressing the problem of poverty.

Over the decades, watershed management programme in India has been transformed from a purely soil and water conservation technology to a comprehensive programme for promoting sustainable rural livelihoods. The programme is one of the most popular development programmes implemented across the country. It is among the flagship programmes for Rural Development in India. It is widely admitted that Watershed management Programme is seen as the panacea for all problems of rainfed areas.⁷⁹ More than US \$4 billion Rupees were spent on this programme by the central government alone since the beginning of the 8th Plan (1992-1997). These allocations are being doubled during the 11th Plan Period (2007-2012) with enhanced per hectare investments.⁸⁰ An allocation of Rs 2458 crore has been made for the programme for 2010-11. In recognition of the socio-economic and environmental benefits, India has one of the largest Micro-Watershed Development programmes in the world. An amount above Rs 2,300 crores (US \$600 million) is being spent annually through various projects supported by the government, NGOS and bilateral funds for watershed programme.

These allocations are expected to be doubled (crossing Rs1000 crore or US\$ 1 billion) during the 11th Five Year Plan Period with enhanced per hectare investments.⁸¹

Figure2.1



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