

IMPACT AND EFFECTIVENESS OF “WATERSHED DEVELOPMENT PROGRAMMES” IN INDIA

(Review and Analysis Based on the Studies Conducted by
Various Government Agencies and Other Organisations)

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PREFACE

The Watershed Development Programme (WDP) initially envisaged as a measure for poverty alleviation and improved livelihoods has gained even greater importance in light of the worldwide recognition of its effectiveness in combating climatic change. In India several Ministries namely, Ministry of Agriculture, Ministry of Rural Development and Ministry of Environment and Forests have been involved in Watershed Development Programs with substantial variation in their approaches. The Ministry of Rural Development had been coordinating sector-wise flagship schemes such as IWDP, DPAP and DDP under Watershed Development Programmes. The main objective of the WDP was to improve water conservation, irrigation facility, and land use pattern leading to increased agricultural productivity in drought prone and desert prone areas. Poverty reduction, better livelihoods and improved bio-physical and socio-economic environment would bring about sustainable development.

An interdisciplinary approach has been followed for this study, given the complex and diverse factors underlying WDPs, such as the bio-physical, social, ecological, institutional and economic factors, besides the regional variations. The programme is operational across the country that involves multiple stakeholders. The Ministry of Rural Development, Government of India encourages debates and discussions and has formed various Committees to solicit feedback for improving the programme implementation in the country. The schemes such as IWDP, DPAP and DDP were merged under the Integrated Watershed Management Programme (IWMP) in 2008, to bring about a comprehensive approach to sustainable development. The 'Common Guidelines-2008' was developed for effective implementation of the project.

The Ministry of Rural Development (MoRD) had earlier taken up country wide evaluation of watershed development projects sanctioned during 1995-1998. Subsequently, another country wide evaluation of the projects sanctioned during the year 1998-2002 was undertaken. National Institute of Rural Development (NIRD) was selected as a nodal agency by the MoRD. The NIRD had successfully coordinated the study across different states. Further SIRDs and ATIs are also involved in the study in some states. The involvement of many organisations across the country with vast experience in the field of watershed has made the study comprehensive and well researched. The Centre for Rural Studies (CRS) at Lal Bahadur Shastri National Academy of Administration was entrusted with the analysis and evaluation of the reports submitted by various agencies.

This study contains an analysis of the reports from the 12 states encompassing various dimensions such as physical, social and institutional

among others. The analysis reveals that although the NIRD had developed common tools for data collection such as Rapid Reconnaissance Survey, Present Profile of the study areas and household survey approaches, the rigour of the individual reports varies with the capacities and understanding of the organisations involved.

In the present study, the effort has been to assess the impact of WDPs – the effectiveness of the programmes, identification of issues and lacunae in project implementation across the states - based on the reports submitted by various agencies.

The study noticed changes in ground water level, surface water, irrigation facility, water regeneration capacity, land use pattern, cropping pattern, livestock production, employment generation, income generation and debt reduction, etc. These changes are observed in all watershed development programmes with certain variations. But the changes like land use pattern, cropping pattern, crop diversification, etc. are more prominent in the watershed regions. Some areas need further attention such as greater involvement of the communities during implementation & post implementation phases, training & capacity building, social audit, women participation, and sustainable income generation. The programmes have been examined from the structural and functional dimensions and their effectiveness has been measured from the benefits accrued to various stakeholders.

We are grateful to the Department of Land Resources for their assistance in bringing out this report. We also express our gratitude to the NIRD and other evaluating agencies whose primary reports are basis for this analysis.

We gratefully acknowledge the contributions of Mr. Padamvir Singh, IAS, Director, LBSNAA, Mr. Prem Kumar Gera and Mr. Sanjeev Chopra, the Joint Directors of the Academy and Mr. Ashish Vachhani, Deputy Director of the Academy for their guidance and valuable inputs.

Thanks are due to all, especially the CRS faculty members and staff, who have contributed directly and indirectly for bringing out this analytical study on Watershed Development Programs.

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LIST OF ABBREVIATIONS

- CBO: Community Based Organisation
- CCB: Continuous Contour Bund
- CGIAR-Consultative Group on International Agricultural Research
- CPR: Common Property Resources
- COWDEP: Comprehensive Watershed Development Programme
- CSS: Centrally Sponsored Scheme
- CRS: Centre for Rural Studies
- CVB: Contour Vegetative Bund
- CVH: Contour Vegetative Hedge
- DDP: Desert Development Programme
- DLT: Drainage Line Treatment
- DoLR : Department of Land Resources
- DPAP: Drought Prone Area Development Programme
- DPR: Detailed Project Report
- DRDA: District Rural Development Agency
- EAP: Externally Aided Projects
- EAS: Externally Aided Scheme
- EPA: Entry Point Activity
- FAO: Food and Agricultural Organisation
- GDP: Gross Domestic Product
- GEMS: Geo Environmental Management Society
- GIDR: Gujarat Institute of Development Research
- GOI: Government of India
- GVK: Gramin Vikas Sanshthan
- Ha: Hectare

- HYV: High Yielding Varieties
- ICRISAT: International Crops Research Institute for the Semi- Arid Tropics
- IWDP: Integrated Wasteland Development Programme
- IWMP: Integrated Watershed Management Programme
- LMF: Large and Medium Farmers
- LBS: Loose Boulder Structures
- LNRMI: Livelihoods and Natural Resource Management Institute
- LSCD: Loose Stone Check Dam
- MOA: Ministry of Agriculture
- MoEF: Ministry of Environment and Forests
- MoRD: Ministry of Rural Development
- MNREGA: Mahatma Gandhi National Rural Employment Guarantee Act
- NGO: Non Government Organisation
- NIRD: National Institute of Rural Development
- NRAA: National Rain-fed Area Authority
- NREGS: National Rural Employment Guarantee Scheme
- NWDB: National Wasteland Development Board
- NWDPRA: National Watershed Development Programme for Rain-fed Areas
- PCR: Project completion report
- PIA: Project Implementing Agency
- PRA: Participatory Rural Appraisal
- PRI: Panchayati Raj Institutions
- PSI: People Science Institute
- RRS: Rapid Reconnaissance Survey
- SC: Scheduled Caste

- SIRD: State Institute of Rural Development
- TERI: The Energy Research Institute
- UNCED: United Nations Conference on Environment and Development
- WASSAN: Watershed Support Services and Activities Network
- WCED: World Commission on Environment and Development
- WDF: Watershed Development Fund
- WDP: Watershed Development Programme
- WDT: Watershed Development Team
- WHS: Water Harvesting Structure
- WSD: Watershed Development
- YASHADA: Yashwantrao Chavan Academy of Development Administration

EXECUTIVE SUMMARY

The Department of Land Resources, Government of India had entrusted a study to the Centre for Rural Studies, LBSNAA in 2010 to conduct analysis and documentation of the evaluation reports of watershed development programmes implemented during the year 1998-2002. The evaluation studies were conducted by various agencies across different parts of the country in coordination with NIRD, SIRD, etc.

The study involves secondary review and analysis of reports submitted by the agencies. It also includes review of secondary literature that includes both books and research reports. The study is based on cross comparison of indicators to provide a general overview of the impact and effectiveness of WDPs. We have compiled data and tried to systematically analyse the major findings based on common attributable indicators. However, we have taken into consideration the data that are feasible for a comparative study across states.

One hundred and five districts from twelve states namely, Uttar Pradesh, Madhya Pradesh, Maharashtra, Andhra Pradesh, Rajasthan, Gujarat, Himachal Pradesh, Karnataka, Jammu & Kashmir, Tamil Nadu, Assam and Nagaland were covered under the study. Sixty districts under IWDP, thirty districts under DPAP and six districts under DDP were part of the study. Another 9 districts in Karnataka were undertaken that includes DDP, DPAP and IWDP projects. NIRD study covered 312 micro watersheds under IWDP, 160 micro watersheds in DPAP and 45 micro watersheds in DDP projects in 8 districts. Another 59 districts under IWDP, DPAP and DDP were covered in Karnataka by NIRD. The studies by SIRDs and some ATIs covered 184 micro watersheds under IWDP, 219 micro watersheds under DPAP and 19 under DDP projects.

The organizations involved in the study are NIRD, SIRD, YASHADA, GIDR, PSI, Dehradun; GEMS, Hyderabad; WASSAN, Secunderabad; Skill-Pro Foundation and MIDS.

Major Findings

Quality of Water Harvesting Structures (WHS)

The quality of Water Harvesting Structures (WHS) in majority of micro watersheds in Tamil Nadu and Gujarat seems to be either good or very good. In states like Uttar Pradesh, Madhya Pradesh, and Maharashtra, the quality is reported to be either average or good. However, in Jammu & Kashmir, the quality of WHS is reported not up to the mark.

Issues identified:

- Poor maintenance during post implementation phase. As a result, the siltation, damage, leakage, etc. were noticed in some watersheds.
- In some states like Jammu & Kashmir there was no people participation during construction.
- There was lack of adequate institutional mechanism.
- No equity and benefit sharing mechanisms among user groups, PIAs, etc.

Reduction in soil erosion

In majority of micro watershed areas in the states like Uttar Pradesh, Gujarat, Tamil Nadu, Madhya Pradesh, and Rajasthan there is reduction of soil erosion. In Gujarat both IWDP and DDP projects have achieved better than DPAP micro watersheds. But in Rajasthan, IWDP and DPAP are better than DDP projects. More than 2/3rd of micro watersheds have reduced soil erosion to an extent more than 50% in these states. Tamil Nadu, Madhya Pradesh and Uttar Pradesh have also achieved good result with more than 25% reduction in soil erosion. In Karnataka, Himachal Pradesh, and Jammu & Kashmir it has been noticed that there is reduction in soil erosion.

Issues identified:

- The general understanding is that in watersheds where area treatments were undertaken the community reported reduction in soil erosion. Soil and moisture conservation activities are significant in reducing soil erosion.
- Activities like afforestation, pasture development, horticulture, etc. can directly check soil erosion but these activities are scanty in many areas.
- Community and cooperative action will be useful in small and marginal farmers populated regions.

Increase in surface water and ground water

Increase in surface water is noticed in most of the micro watershed areas but the degree and the level of change varies. Tamil Nadu state performs better than many states in this regard. In states like Gujarat, Rajasthan, Madhya Pradesh, Maharashtra, Tamil Nadu, Karnataka and Nagaland there is

increase ground water level. Assam also exhibits substantial progress in improvement of ground water level after implementation of the project. 40% micro watersheds in Gujarat have resulted more than 2 meters increase in ground water level after implementation of WDP. This is highest amongst other states.

Change in land use pattern

There is positive change in land use pattern noticed in most watershed areas across all states. Net sown area is increased in majority areas. All programmes such as DDP, DPAP, and IWDP have shown positive trend with more irrigated lands have been covered under the watershed programmes. However, the main issue identified is that the people invest more in good class land in some states. Adequate importance to poor class land is lacking.

Cropping intensification

In Uttar Pradesh, Madhya Pradesh and Andhra Pradesh, the cropping intensity is higher. In contrast, Rajasthan, Karnataka and Tamil Nadu the cropping intensity is not in higher side and there is no substantial increase observed.

Reduced work burden

WDPs have resulted in reducing the work load of women by 1 to 2 hours in majority of states. Fetching drinking water, collecting fuel wood, fodder, etc. are relatively easier after WDPs introduced. Among a few states, where the data is available, Rajasthan and Tamil Nadu have reported better in reducing workload of women. It was found that in Jammu & Kashmir and Himachal Pradesh there is no significant reduction in workload.

Debt reduction position

Debt reduction position is found in majority of states with implementation of WDPs. States like Uttar Pradesh, Andhra Pradesh, Rajasthan, Madhya Pradesh and Nagaland perform well.

Involvement of CBOs

In the present study CBOs formed in all the study states were examined. The findings reveal that watershed committees had been actively involved in the implementation of watershed programme. User groups for all the major activity had been formed with exceptions of Jammu & Kashmir and Himachal Pradesh. It is found that in most cases the watershed committee exists in the villages to some extent, while User Groups (UGs) are not active after

completion of the project. Very few CBOs seem to have survived after the withdrawal of the project. States like Uttar Pradesh, Tamil Nadu and Andhra Pradesh have partially alive CBOs. It can be concluded that the success of watershed programme would not only rely on the watershed institutions, but depend more on how effective are the credit delivery system, input delivery system, output markets and technology transfer mechanisms. It is therefore imperative to ensure that watershed institutions should also have a strong linkage with various institutions like banks, market, etc. (ICRISAT).

People's participation, social audit, etc.

People's participation was moderate in majority places and in a few places it was conspicuous by absence of formal institutional mechanism. During the analysis it was revealed that out of the total 12 states, social audit was carried out only in two states namely, Uttar Pradesh and Tamil Nadu. Further, at both these places there was lack of awareness among the community about such an exercise that was ever carried out. In some states even there is no proper registers being maintained.

Various other benefits

Various other benefits such as reduced migration, women empowerment, etc. are noticed in many regions. But the benefits are not maximized without proper social mechanisms. Women participation in community institutions is still limited. Landless communities and weaker sections are still left out of the land focused programmes.

Employment opportunities for the community members are increased with better wage earnings in construction work during pre watershed and engagement in the agricultural field during post watershed programmes. But no specific formal mechanisms are developed to enhance the opportunities

Introduction

Effective use of land and water is fundamental to growth and sustainable development. The concept of watershed management has evolved to ensure effective use of both natural and social capitals. Thus, the watershed development programmes include land, water and human resources as essential components. The watershed programme is primarily a land based programme, which is increasingly being focused on water, with its main objective being to enhance agricultural productivity through increased in situ moisture conservation and protective irrigation for socio-economic development of rural people (Joshi, et al. 2004, 2006). It has been essential in a country like India where majority of the population depends on agriculture and about 60 percent of total arable land (142 million ha) in the country is rain-fed. A large portion of the rain-fed areas (65% of arable land) in India is characterized by low productivity, high risk and uncertainty, low level of technological change and vulnerability to degradation of natural resources (Joshi, et al, 2004). Over the years, the sustainable use of land and water has received wider attention among policy makers, administrators, scientists and researchers. Almost all major international developmental agencies like World Commission on Environment and Development (WCED), Food and Agricultural Organisation (FAO), and Consultative Group on International Agricultural Research (CGIAR) and its allied agencies amongst others have emphasized sustainable use of water and other natural resources.

It is realized that sustainable development is synonymous to maintenance of productivity of natural resources and maintenance of ecological equilibrium. Kushwaha and et al. (2010, p.1479) noted that the concept of sustainable development has received much needed impetus after the Rio Conference in June 1992, mainly through the 27 principles on sustainable development and the action plan called Agenda 21 (UNCED, United Nations Conference on Environment and Development, Rio de Janeiro, 3–14 June 1992). The approach was followed up in a big way during the World Summit on Sustainable Development in 2002 at Johannesburg. The Summit re-emphasized the need for strengthening the three pillars of sustainable development, viz. economy, society and the environment. The watershed forms an appropriate unit which links all these three components and has a direct bearing on human lives. The watershed approach is a system-based approach that facilitates the holistic development of agriculture, forestry and allied activities in the proposed watershed. It also forms an appropriate unit for

analyzing the development-linked resource problems, designing the appropriate solutions of identified problems and eventually testing the efficacy of the measures taken up.

Watershed Development Programmes (WDPs) have been accorded high priority in India's development plans (Singh, 1991). These programmes have been initiated in India to improve and sustain productivity and the production potential of the dry and semi arid regions of the country through the adoption of appropriate production and conservation techniques. The WDP approach seeks to improve and develop all types of lands-government, forest, community and private lands- that fall within a particular watershed. It is a holistic approach to improve and develop the economic and natural resource base of dry and semiarid regions (Ninan and Lakshmikanthamma, 2001). The programmes have stressed upon improvement of wasteland, runoff reduction, water conservation and protective irrigation mechanism in all areas including desert prone areas and drought prone areas. Development programs, envisaged under its purview include almost every activity which concerns land, water and biomass production. Experiences have shown that watershed as a base is very effective in use and management of land and water resources. With increasing awareness about the problems related to environment, use of watershed terminology is becoming popular and moreover in view of their potential for growth, improvement in income levels and augmenting the natural resource base of the disadvantaged regions of the country (Singh, 1991).

Objectives of Watershed Development Programmes (WDPs)

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

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

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

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

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

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

Components of Watershed Development Programme

The components of watershed development programme would include; (i) soil and land management (ii) water management (iii) crop management (iv) afforestation (v) pasture or fodder development (vi) livestock management (vii) rural energy management (viii) other farm and non-farm activities (ix) and development of community skills and resources. All these components are interdependent and interactive.

Watershed Development Programmes (WDPs)

Watershed Development Programmes (WDPs) are among the very important programmes placed under the purview of Department of Land Resources (DoLR), Ministry of Rural Development (MoRD). Three important schemes namely, IWDP, DPAP, and DDP are widely implemented by the State Governments with due priority. The DoLR has been committed in updating guidelines for these schemes with periodic inputs from Research Organizations, Voluntary Organizations, Technical Committees, Workshops and Seminars amongst others. Especially, the inputs from the C.H. Hanumantha Rao Committee and Parthasarathy Committee are quite popular.

Evolution of watershed development approach

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

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

It is reported that up to the 10th Five Year Plan (2002–07), nearly 51 mha has been developed on watershed basis. The MoRD accounted for 63% of the 'treated' area and the MoA 'developed' the remaining 37% of the area. The MoEF and Planning Commission had only limited involvement. During the Eleventh Plan, the three area development programmes, namely, Integrated Wasteland Development Programme, Drought Prone Area Programme and Desert Development Programme have been integrated and consolidated into a single programme called Integrated Watershed Management Programme

(IWMP). This consolidation is for optimum use of resources, sustainable outcomes and integrated planning. The modified IWMP would adopt a three tier approach in which the upper reaches which are mainly forested and hilly would be treated with the support of Forest Department. For land situated intermediate slopes above the agriculture lands, the IWMP would address all the necessary issues of land treatment by adopting best possible options including cropping pattern, horticulture and agro-forestry etc. In the lower tier, which are plains and mainly agricultural lands, the IWMP would be dovetailed with the employment generating programme such as National Rural Employment Guarantee Scheme (NREGS) and would fill the critical gaps of NREGS and vice-versa. Under the new programme, a cluster approach would be followed with a broader vision of natural hydro-geographical unit of average size of 4,000 to 10,000 ha comprising of clusters of micro-watershed which will be selected as project area. The programme is implemented by dedicated institutional agencies at state and central level. The project period is proposed in the range of 5 to 7 years in three distinct phases, i.e. Preparatory, Watershed works and Consolidation phase. The consolidation phase will include livelihood activities, marketing, processing and value addition activities (Planning Commission, Government of India).

Review of literature

There is plethora of literature available on watershed management programme covering wide range of issues. However, in this piece of work we have only attempted to review selected literature from the vast sources literature available in the context of understanding major issues, impact and effectiveness of the programme. Studies by Farrington, et al (1999), Deshpande and Narayanamoorthy (1999), Kerr et al (2000), Vaidyanathan (1999, 2006), Reddy and Dev (2006), Biswas, et al (2005), Pascual, et al (2009) and others have discussed several issues in watershed development programmes. They have covered policy related issues, institutional drawbacks, implementation issues, community and participation issues, etc. Despite the fact that there are large numbers of issues already covered, the research scope in the issue of watershed management is tremendous. Over the years, with the attention shifted from more centralized to decentralized system of governance, watershed development programmes have equally emphasized on decentralized approaches such as more community and people's participation and involvement of PRIs in planning, executing and monitoring of the projects, etc. To ensure good governance, mechanisms like social auditing, periodic review and better documentation processes are taken into account as best practices in some of the WDP regions. There is a good number of studies available on participatory aspects of watershed management. Wani, et al (2001) study in Kothapally in Andhra Pradesh is one

of such studies that highlight the effective community participation in watershed management. In fact, their study has developed the model for effective participation in watershed management.

Deshpande and Reddy (1991), Shah (2001), Joshi (2004) and others have reviewed different dimensions of watershed management. These studies while addressing several issues have also focused the positive impact of watershed management on cropping, agricultural productivity, employment generation and increase in income amongst others. The Kothapally study by Wani et al (2001) has shown significant impact of watershed management on crop production, increase in ground water level, reduction in runoff water, increase in income, etc. Similarly, ICRISAT has reported various benefits of the watershed development programmes in the country.

Studies by Deshpande & Narayanamoorthy (1999), Kshirsagar, K.G., M.P. Madhusoodhanan, S. Chavan and R. Rathod (2003) and many others have acknowledged that the watershed development programmes are potential to augment income and reduce poverty among the watershed communities. These studies have focused that there is positive change in crop yielding and productivity, cropping intensity and optimum use of farm implements despite some odds. Deshpande and Narayanamoorthy (1999) have observed several positive impact of National Watershed Development Programme for Rainfed Areas (NWDPR, implemented in 1990) across the four states in the Western and Central Rainfed zones of India viz. Gujarat, Rajasthan, Madhya Pradesh and Maharashtra. However, they have noticed that the changes are varying across states. Some of the issues identified by them are:

- The guidelines are well prepared but not effectively implemented.
- Absence of any external monitoring and evaluation has relaxed the programme and the implementing officers also do not realize these constraints due to absence of feedback.
- The extension machinery was not properly equipped to meet the requirements.

Further, their studies of NWDPR in the southern plateau for the states of Andhra Pradesh, Tamil Nadu and Karnataka show that there was lack of effective beneficiary participation in the meetings and training programmes. Moreover, there was lack of proper local planning in the hilly areas. They have emphasized the need for local planning, peoples' participation, training, capacity building, etc.

Bio-physical aspects of watershed development are studied by large number of researchers from both science and social sciences. Kerr et al (2002) noticed that many studies have revealed that watershed development interventions were successful in controlling soil erosion, runoff reduction, etc. Most of the studies on watershed management in India have reported significant changes in bio-physical aspects than in social and institutional aspects. Farrington et al. (1999) also noted that the successful watersheds have in fact reduced runoff water and recharged ground and surface water aquifers, improved drinking water supply, increased agricultural intensification and crop productivity. Studies by MYRADA, TERI, ICRISAT and other reputed organizations have focused on bio-physical, social, economic and institutional dimension of watershed development programmes. Kalpataru Foundation (2001) has observed similar changes after implementation of the WDPs under various schemes.

Participatory approaches of watershed management, emphasis on decentralized approach or bottom up approach, etc. are widely discussed by Farrington (1999), Yugandhar, et al (1999) Kerr (2000) D'silva Emmanuel and Sudha Pai (2003) and Vaidyanathan (2006) amongst others. All these studies have stressed importance of proper institutional mechanism both at the ground level and at the top level. Some of the authors have also talked about the issues of equity in distribution and lack of inclusiveness. ICRISAT has reported the lessons learnt from the previous watershed management programme studies in different regions of the country. Some of them are as follows:

1. Lack of equity in the benefits to small holders and landless.
2. Lack of Sustainability in the management of projects after cessation of the project.
3. Lack of Community participation in watersheds.
4. Lack of Scaling up methods and models.
5. Lack of holistic approaches in the technical support to most development projects by NGOs.

Sen (2008) has given significant comment on Indian policies with regard to watershed development programmes and rural development. In a book, *Water First: Issues and Challenges for Nations and Communities in South Asia* edited by Lahiri-Dutt and Wasson (2008), she has extensively discussed some of the significant issues on mainstreaming participatory principles,

reorienting the concept of sustainability' in WDPs, reemphasizing equity aspects of watershed programmes, reconsidering scales of operationalisation of watershed programmes, cost-sharing, evaluation and mid-term correction of watershed development programmes amongst others.

Despite the fact that the studies are aplenty in the area of watershed management, the documentation and analysis of the evaluation studies and impact assessment studies is essential to set up a benchmark for the future studies. This can help in further improvement of the programme in the wake of Integrated Watershed Management programme (IWMP) already implemented in the country.

Objectives of the study

- To examine various performance indicators that contribute towards effective implementation of the programme
- To assess overall impact of the programme on;
 - Ground water level condition, reduction in soil erosion, increase in surface water and other physical conditions in watershed management
 - Land use pattern, cropping pattern and agricultural productivity in the region
 - Socio-economic and livelihood conditions of the communities
 - To identifying existing issues and deficiencies (if any) in implementation of the programmes

Methodology

The Department of Land Resources, MoRD had entrusted a study to the Centre for Rural Studies (CRS) for analysis and documentation of the reports submitted by various agencies to assess an overall impact of the WDPs in the country. Complying with the offer to analyse and document the study reports, the CRS had undertaken the study in the second half of 2010. The authors have read the reports thoroughly before commenting upon any issues with regard to watershed development programmes. In order to have better understanding about the issues, the authors have visited several research institutes and collected literature for review.

Thus, the study is primarily a cross-comparison of indicators to provide a general overview of the impact and effectiveness of WDPs in the country. We have compiled and systematically analyzed the major findings based on common measurable and attributable indicators highlighted in the reports.

The detailed list of the districts, states and schemes studied by various Institutes/Agencies involved in the study is as follows:

Sl. No.	State	Number of districts covered	Programmes and districts covered	Agencies involved in the study
1.	Rajasthan	14	IWDP: Jaipur, Bundi, Tonk, Jhalawar, Sirohi, Sawai Madhopur, Ajmer, Baran, Dausa, Dholpur, Jaipur, Rajasamand, Udaipur	Indira Gandhi Panchayat raj and Gramin Vikas Sansthan (IGPRS) (State Institute of Rural Development) Jaipur, Rajasthan
		08	DPAP: Dungarpur, Baran, Banswara, Kota, Tonk, Jhalawar, Udaipur, Sawai Madhopur	
		05	DDP: Barmer, Bikaner, Jaisalmer, Jalore, Rajasamand	
2.	Assam	01	IWDP: Hailakandi	North Eastern Regional Institute of Water and Land Management, Tezpur Assam
3.	Maharashtra	01	IWDP: Amravati	Watershed Development and Management Centre, SIRD, YASHADA
		02	DPAP: Yavatmal, Satara	
4.	Madhya Pradesh	05	IWDP: Shahdol, Sihore, Seoni, Narsinghpur, Guna	MGIRD, Madhya Pradesh and Council for Training and Research in Ecology and Environment, New Delhi

		06	DPAP: Chindwara, Damoh, Seoni, Shahdol, Umariya, Jabalpur	Council for Training and Research in Ecology and Environment, New Delhi
5.	Nagaland	06	IWDP: Wokha, Zunheboto, Mon, Dimapur, Mokokchung, Kohima	National Institute of Rural Development, North Eastern Regional Centre Jawaharnagar, Khanapara, Guwahati
6.	Gujarat	04	IWDP: Panchmahal, Sabarkantha, Patan, Junagadh	SIRD, Ahmedabad Watershed Development Research Unit, Society for Promoting Participative Ecosystem Management (SOPPECOM), Pune and Gujarat Institute of Development Research (GIDR), Ahmedabad
		05	DPAP: Amreli, Panchmahal, Bhavnagar, Bharuch, Junagadh	
		01	DDP: Patan	
7.	Andhra Pradesh	06	IWDP: Nalgonda, Medak, Warangal, Khammam, East Godavari, Nellore	Geo Environmental Management Society (GEMS), Hyderabad
8.	Himachal Pradesh	06	IWDP: Hamirpur III, Hamirpur IV, Kangra, Kinnaur, Shimla, Sirmour	People's Science Institute (PSI), Dehradun
		01	DPAP: Bilaspur	
9.	Jammu & Kashmir	01	IWDP: Rajouri	People's Science Institute (PSI), Dehradun
10.	Karnataka	09	Bangalore (rural), Belgaum, Bellary, Gulbarga, Kolar, Raichur, Tumkur, Chitradurga, Hassan	Poverty Learning Foundation, Secunderabad

11.	Uttar Pradesh	08	IWDP: Varanasi, Agra, Ambedkarnagar, Chandauli, Lakhimpur, Lucknow, Pratapgarh, Sitapur	Watershed Support Services and Activities Network (WASSAN), Secunderabad
		08	DPAP: Balrampur, Behraich, Hamirpur, Jalaun, Jhansi, Lalitpur, Mahoba, Sonbhadra	
12.	Tamil Nadu	09	IWDP: Coimbatore, Dharmapuri, Karur, Namakkal, Salem, Thirunelveli, Tiruchirapalli, Vellore, Virudhunagar	SKILLPRO Foundation and Madras Institute of Development Studies (MIDS)

Sample micro-watersheds studied

NIRD study covered 312 micro watersheds under IWDP, 160 micro watersheds under DPAP and 45 micro watersheds under DDP projects in 8 districts. Another 59 districts under IWDP, DPAP and DDP were covered in Karnataka by NIRD.

The studies by SIRDs and a few ATIs had covered 184 micro watersheds under IWDP, 219 micro watersheds under DPAP and 19 under DDP projects.

Limitations of the study

As already cited, this secondary study is primarily based on the reports submitted by the evaluating agencies. The reports can be appreciated for the relatively wide coverage of the data but the depth was limited. Approaches followed by the agencies differed in sample size, measurements regarding land use, water conservation, etc. Inquiry related to some social issues like women's empowerment, community building were lacking. Majority of the agencies clubbed the data on the three schemes inhibiting a clear and specific picture on impact by individual schemes. We have sincere efforts in analyzing and bringing forth the present report. However, the analysis would have been much better if reports provided could have followed a more uniform and intensive approach.

Review and Analysis

This chapter is a gross but precise analysis to examine effectiveness and assess impact of the watershed development programmes (WDPs) under IWDP, DPAP and DDP schemes covering wide range of areas from north to south, west, and north-east in the country. The evaluated reports of watershed development programmes produced by various agencies helped us examining several issues pertaining to water harvesting structure, conservation mechanism, land use pattern, and livelihood issues amongst others under watershed management. We have compiled and systematically analyzed the major findings based on common measurable and attributable indicators highlighted in the reports.

1. Quality & Status of water harvesting structures

Harvesting the rain and runoff water is the prime objective of the watershed development programme. To do this, many structures of various types like check dam, nala bund, farm ponds, etc. needs to be constructed across the gullies of various orders. Quality and current status of water harvesting structures play a crucial role in generating impacts in a post project scenario. It helps us assessing the nature of project implementation. Further, unless the qualities of the structures are good, the desired results cannot be produced. Also these structures are expected to withstand the rough conditions. Thus the quality is essential to maintain status quo. Maintenance of water harvesting structures is significant to enhance storage capacity and also in certain cases the infiltration capacity. The structures also require periodical maintenance like plastering, pointing, and repairing to prevent cracks and leakages. Maintenance of storage capacity and infiltration capacity is essential in order to avoid water flow as a runoff.

The better performing states to maintain quality of harvesting structure are Gujarat and Tamil Nadu. States like Uttar Pradesh, Maharashtra, and Himachal Pradesh, Rajasthan, Karnataka, Andhra Pradesh, and Madhya Pradesh have mostly good and average performance in this regard. In Jammu & Kashmir, the quality of WHS is not up to the mark.

It was found that in Gujarat more than 84% of watersheds had structures that can be placed in either good or very good category and hardly any watershed

was found to be under 'poor' category. This reflects good quality of construction in terms of selecting technically appropriate site, technical specificity of construction (wing wall, apron, pitching and core wall in case of earthen structures, spill way, inlet and outlet etc), good quality of material used, and effective community consultation amongst others. In Gujarat, the northern districts fared well in case of quality of implementation and it is DDP followed by IWDP that do better in case of schemes. The scheme wise analysis can be referred at figure-1. The evaluation also assessed the status of the structures. It was found that more than 50% of the structures are in good working condition. However around 38% of WHS are partially damaged with structural problems like cracks, scoring from sidewall, leakage, problems for apron, spillway, stone pitching etc. Siltation was very less as people had removed silt. Partially damaged structures were found in more or less equal numbers in most of the watersheds.

The quality of water harvesting structures in Tamil Nadu under IWDP scheme revealed that out of the 45 watersheds taken for evaluation, the quality was found to be good in 67%, very good in 18%, satisfactory in 11% and poor in 4% of watersheds (Figure-1). The status further reveals that while 51% of the structures have remained intact without having any damage, 40% structure have silted up and in 9% watershed structures were found to be damaged. The major issues observed by the evaluating agencies are: quality and maintenance of water harvesting structures, location of watershed, improper design, lack of good quality, and problem of delaying in desilting activity amongst others.

Study in Uttar Pradesh that covers both IWDP and DPAP schemes revealed that out of the 87 sample watersheds the quality of water harvesting structures was found to be good in 23 (26.44%), satisfactory in 41 (47.13%) and poor in 23 (26.44%) watersheds. Thus, 73.56% watershed structures were found to be either good or satisfactory. Further, scheme wise analysis shows that DPAP is comparatively better than IWDP as far as WHS is concerned. But poor quality of water harvesting structure leading to damage or partial damage is a major concern. This is followed by silting up of soil in the watershed, which is also a major concern in most of the watersheds.

In Madhya Pradesh, the quality of water harvesting structures in majority of watersheds (92%) was found to be either satisfactory or good. 5.3% of watersheds are found to be very good. However, maintenance is poor during post implementation. The management of activities after implementation is found to be weak in many watersheds.

In all the 15 sample districts of Rajasthan, except Jaisalmer, majority of the households had reported either partly functional or fully functional water harvesting structure. In Jaisalmer majority of the households (>50 percent) had viewed about broken or dysfunctional structures. On the other hand, medium rainfall receiving districts like Bundi, Dausa and Tonk majority of the households viewed that the structures are fully functional. This could be due to the greater benefits from the WHS in the medium and higher rainfall regions or districts. Majority of the households from the arid districts of Jaisalmer, Bikaner, Barmer and Jalore responded that maintenance of retention walls with the watershed development fund (WDF). With regard to water bodies called 'Khadins' majority of the households reported that de-silting of these water bodies has not been done in eleven of the fourteen sample districts and more so in the case of arid districts. Whatever a little de-silting was done it was done by small and landless households.

The quality of construction in Jammu & Kashmir is found not up to the mark. All the structures erected during the implementation were found to be defunct. Check dams were silted and some were broken. As reported, the possible reason could be that these structures were constructed without people's participation.

For the construction of check dam in Assam, timber shuttering technology was used. It is a simple and cost effective technique. The gully control measures were also made with locally available materials and earthwork was also found to be appreciable. However, some of the assets had been damaged owing to flood in 2004.

Karnataka exhibits poor performance with its district Hassan as the front runner while Raichur ends up lowest. As per the evaluating agency the maintenance of the structures was hardly visible in the study area. In Andhra Pradesh indigenous materials were used by the project implementing agency and specified norms were applied for the construction of water harvesting structures.

In Maharashtra despite of its good quality water harvesting structure, siltation was found to be a serious concern.

Similarly, in Himachal Pradesh, about 35% to 72% of the structures were observed to be in working condition but silt was being cleared occasionally. Here also user groups reported that there is no mechanism in place for the

management of the created assets and there is no equity in benefit sharing either.

Major issues identified

A major issue identified was lack of clarity in mechanism with regards to maintenance of structures during and post implementation phase. As a result, the siltation was found to be common in most of the watersheds. Damage without proper maintenance, lack of adequate institutional mechanism and local community involvement are some of the issues identified by the studies. No proper management of WDF is another issue. Lack of awareness among various stakeholders about usages of WDF is noticed in some states.

2. Community contribution to Watershed Development Fund (WDF)

For effective management of a watershed, WDF is established out of the contributions from the stake holders. The contribution should be a minimum of 10% of the cost of the work executed on private lands (5% for SC/ST) and 5% in case of common property. This fund should be utilized for maintenance of assets created on community land or for common use after completion of the project. Contribution is collected from the beneficiaries as it allows a sense of ownership over the assets created. It is also a reflection on their involvement in planning and execution of the watershed program.

Findings reveal that the contribution is made by deducting the wages of labor engaged in watershed work. This deduction from the wages was seen in majority of the cases. Sometimes the beneficiary also contributed to WDF in terms of cash or kind. In a few cases the fund was deposited in the banks of the nearby towns as FDR and was mostly seen lying unutilized.

- In Uttar Pradesh, it was reported that out of the 87 sample watersheds, contribution was totally paid by the beneficiaries as per the norms in just two DPAP and one IWDP watersheds. On the other hand, contribution was paid partly by beneficiaries and partly taken out from labor wages in 10 DPAP and 12 IWDP watersheds. In another 62 watersheds (29 DPAP and 33 IWDP), contribution was totally taken out from the labor component.
- In Tamil Nadu, out of the 45 watersheds, in 42% watersheds the beneficiaries paid as per norms, in 33% cash was partly paid by the

beneficiary, in 9% cash was partly taken from labour wages and in 16% it was completely taken from the labour wages.

- In Jammu & Kashmir, the contribution of watershed development fund is nil.
- In Himachal Pradesh, complete Watershed Development Fund was utilized in construction of various assets. Community made negligible contribution. Highest contributions were made by Sirmour and Hamirpur districts and lowest by Kinnaur. This could be attributed to the fact that there was lack of interest and active participation amongst the villagers during the implementation of the Integrated Watershed Development Programme.
- In Maharashtra the public contribution was less than 5%.
- In Assam, it was found that the Watershed Committee deducted the amount from their total estimate cost and until now, no user charge was collected from those who are applicable. Thus, community participation was there during planning and execution stage but not during the post project implementation.
- Andhra Pradesh and Nagaland reported that all the beneficiaries have contributed for watershed development programme as per norms.
- In Rajasthan, funds were collected from the beneficiaries as a community contribution. This was collected in both cash and labor form, which varies from 5% to 10% of the project cost. This fund was deposited in the banks of the nearby towns as FDR and still lying unutilized. This fund has not been utilized so far in absence of clear cut guidelines. This community contribution was deducted from the wages of the labor proportionately.
- In Madhya Pradesh, Watershed Committees opened Project Fund Account and Development Fund Account in each watershed but there was very limited knowledge about operation of watershed development fund account to watershed committee functionaries. The average people had almost no idea about purpose and process of use of this fund.
- In Gujarat, WDF was created out of the wages of labor. Only in case of 36% of watersheds the WDF component was taken as per the norms. This was observed mainly from the NGO supported projects. Eighty percent of projects in Banaskantha and sixty percent of the projects in Patan followed the norms while very few projects from the tribal areas of south Gujarat adhered to the norms. Overall DDP projects seemed to perform better on this aspect. With regards to status of fund, it was either exhausted or was lying unutilized.

Overall findings reveal that the contribution to WDF is not same in all the states. Not in all the watershed areas the contribution is made as per norms. When it comes to the contribution, it is not that always the beneficiary contributes. In certain cases the beneficiary pays partly and the balance is paid by the labors. It was seen to be completely deducted from the wages of the labour or in extreme cases it was deducted from the total estimate cost of the project. Even where the fund was created the community lacked awareness about the mechanism for its usage. This reflects that the community doesn't seem interested in the project and has not been mobilized properly by the project implementing agency. It also reflects that Gram sabha was not engaged properly by PIA for dissemination of information to the local community during project implementation phase .All this has resulted in poor maintenance of the watershed works after withdrawal.

3. PIA wise performance in different states

One of the objectives of the study is to assess performance of the project implementing agencies (PIA) with regard to implementation of the programme. In this regard some reports have shown impact of watershed development programmes in both government and non-government PIAs. It was found that in some states like Uttar Pradesh and Gujarat GO run PIAs are doing better. Further, in some states like Madhya Pradesh and Andhra Pradesh, NGO run PIAs perform better (Figure-6). Therefore, there is no proper correlation found between PIA and WDP impact on physical, biological or social factors.

Impact Assessment

1. Increase in ground water level

Increase in ground water table in watershed areas is one of the important measurable indicators of successful watershed programme. Various factors are accountable for increase in ground water. The water harvesting structures play a key role by storing water and allow sufficient time for water to percolate into the ground. Land development activities such as contour bunding, land levelling and cultivation practices also contribute towards accumulation of ground water. The increased water levels also render some respite in the drinking water situation in the project villages.

As observed from the data furnished by the evaluating agencies, the ground water level experienced marginal increase in Andhra Pradesh, Jammu & Kashmir and Uttar Pradesh. This could be attributed to undulating topography of the area, low or irregular rainfall, impermeable layers below surface of the water harvesting structures, and over exploitation of ground water. In Andhra Pradesh, majority of watersheds have reported marginal increase in ground water level even after WDPs (Figure-2). Uttar Pradesh faced severe drought conditions after completion of watershed program which could be one of the major reasons for this marginal increase or to some extent reduction in ground water level. WDPs resulted moderate increase in ground water level in Gujarat, Himachal Pradesh, Rajasthan, Madhya Pradesh, Maharashtra, Tamil Nadu, Karnataka and Nagaland. The study in Assam revealed that WDP areas had substantial progress in the improvement of ground water level after the implementation of the project.

2. Increase in surface water and stream flow

Increase in surface water or stream flow is another indicator that can help establishing positive impact of watershed development programmes on physical factors. Both surface water and stream flow has increased during the post watershed development programmes in many states. In Madhya Pradesh, in all the watersheds the surface water has projected growth of <20% and stream flow <5%. In Rajasthan, 49% watersheds had <20% increase in surface water and 46% between 20-40% and 5% shows no increase. Similarly, 44% watershed regions had <5% stream water flow, 53% had 5-10% stream water flow and no increase in flow in 4% noticed. Tamil Nadu has also shown a better impact with 73% watersheds the surface water has increased between 20-40% and 27% the increase is below 20%. Stream flow period has increased by less than 5% in 56% watersheds. In 40% watersheds it has increased between 5-10% and in few cases (4%) the surface water has increase beyond 10%. In Andhra Pradesh, surface water increased by up to 40% and increase in stream water flow between 5 to 10% in all watersheds. 44.7% watersheds in Uttar Pradesh had registered increase in surface water. Of 44.7%, 17.2% and 19.5% watersheds had increase in surface water by 20-40% and <20% respectively. Only 8% watersheds had registered increase surface water more than 40%.

3. Soil erosion reduction

The best performing watersheds are those where soil erosion was reduced by more than 50 percent and the worst performing are the ones where there is

an increase in soil erosion or the implementation failed in arresting soil erosion. Uttar Pradesh and Tamil Nadu feature in best performing states. This could be attributed to the fact that there is a linkage in quality and status of water harvesting structures. In other states as well there is reduction in soil erosion but with certain degree of variations.

The state of Uttar Pradesh was successful in reducing soil erosion in 75 watersheds out of the 87 sample watersheds. In remaining 12 watersheds there was no change seen in soil erosion or soil erosion was not there. On further looking at 75 watersheds, soil erosion reduced the maximum extent (more than 50%) in 11 DPAP and 7 IWDP watersheds. In remaining 57 watersheds the soil erosion got controlled up to 50% after watershed. Among these 57 watersheds 25 watersheds were implemented with DPAP funds and 32 watersheds with IWDP funds (see Table-1).

In MP where area treatments were undertaken the community/beneficiaries report reduction in soil erosion as compared to pre watershed situation. Over all impact on soil erosion is positive with reduction in soil erosion in all areas irrespective of both DPAP and IWDP.

Gujarat has reported that in 98.3% of micro watersheds there is reduction in soil erosion (Figure-3). In DDP it is 80% micro-watersheds where there is reduction of soil erosion more than 50% and among 20% micro watersheds the reduction is up to 50%. Further among IWDP watersheds, it is 70% micro watersheds where there is reduction of soil erosion above 50% and in 30% watersheds there is reduction of soil erosion up to 50%. The IWDP projects have 30% micro watersheds which exhibit more than 50% soil reduction and 65% micro watersheds exhibit up to 50% reduction in soil erosion (Table-1). 70 to 90% of the total micro watersheds have been treated through the programme. Area was treated with activity like Contour Bund, Gully Plug, Nalla Plug, Check Dam, Village Pond, Bori Bund, Afforestation. These have contributed in checking soil erosion in varying degrees. All projects in Patan report more than 50% reduction. These findings corroborate the observation that DDP projects gave more stress on the area based treatments and thus astounding results.

Findings in Tamilnadu revealed that in around 73% of the watershed the soil erosion has reduced between 25 and 50 percent, where as in 27% it is beyond 50% (Table-1). The ones in which reduction is more than 50% are 12 watersheds , 1 from Coimbatore, 4 from Thirunelveli , 1 from Tiruchirapalli, 2 from Vellore and 4 from Virudhunagar. As per farmers response soil erosion

has reduced except for very few in Virudhunagar and Tiruchirapalli. Soil erosion has reduced to greater extent in Dharmapuri, Salem, Thirunelveli, Tiruchirapalli, Vellore and Virudhunagar. As far as the soil erosion in cultivable land is concerned it has reduced in 62% watersheds and in 38% it is moderate. In none of the watersheds the soil erosion was observed to be severe now. In case of non arable land in 91% it was found to be moderate and in 4% it was very less. Only in 4% one each in Namakkal and Virudhunagar it was found to be severe.

More than 50 percent of the farmers in 14 of the fifteen districts of Rajasthan have reported reduction in soil erosion to the extent of more than 25 percent. In the case of Jaisalmer, Bikaner and Barmer districts in the arid zone, substantial number of farmers have reported that there is no reduction in soil erosion. Highest reduction is noticed in the humid south eastern plains districts of Bundi, Baran and semi-arid eastern plains districts of Tonk and Dausa along with Dholpur from the flood prone zone. On the whole, impact of WSD on soil erosion is prominent in the districts with rainfall ranging between 500 and 900 mm. Overall impact was found to be positive in all the districts except Jaisalmer. The study by NIRD in Rajasthan reveals that 87% respondents have viewed positive change in soil erosion reduction under IWDP, 73% respondents have viewed positive change in soil erosion reduction under DPAP and only 59% respondents viewed positively in DDP projects (Figure-4).

Jammu & Kashmir reveals that 60% reduction of soil erosion except for Patrara watershed where soil erosion reduced by only 20% as a result of IWDP.

The soil of Assam is of highly clayey texture hence high erosion occurs due to rainfall in the barren land. The vegetative barrier with "Murta" (a local species of cane bamboo) was used to check soil erosion. This has resulted reduction in soil erosion.

Andhra reported no reduction in soil erosion as no measures were taken to contain it. In Pamukta village in Nalgonda district and Pathur village in Medak district the gullies were plugged with loose boulders instead of filling it by earthen work followed by stone pitching.

In Maharashtra there is reduction in soil erosion but execution of the project was not done properly. The instructions in the detailed project report were

ignored. As a result, it appears that erosion-sedimentation control is a distinct possibility. In Amravati district of Maharashtra loose Boulder Structures were constructed from ridge to valley in series. These were found to be very important structures in controlling soil erosion. Most of the LBS were found silted and needed to be raised. The gully plugs and LBS in Khatkali and Bhilkheda villages were observed in good condition. In Satara district, in village Asavali, CCT was proposed in the DPR but not executed. In all the 17 villages in Mann, Koregaon and Khandala blocks, the activities have not been implemented according to proposed plans, except for the 6 projects in Khatav block. The DRDA took over implementation from NGO and conveniently carried out watershed activities like earthen nalla bunding and cement nalla bunding. Therefore, the general impact is devoid of soil erosion control that seems to have been ignored all through the projects.

The general understanding is that in watersheds where area treatments were undertaken the community reported reduction in soil erosion as compared to pre watershed situation. Soil erosion is prominent in the districts with low rainfall. However, the variation in the percentage of reduction depended on soil and moisture conservation activities in the respective districts. Activities like afforestation, pasture development, horticulture can directly check soil erosion but these activities are scanty and executed works are also not satisfactory. It is expected that soil losses would be substantially reduced if community or cooperative action is taken as in developing countries the size of a farm does not allow a small farmer to have an impact on land improvement hence concerted effort is required.

4. Runoff reduction

With regards to runoff reduction it was observed that the programme is successful in achieving this goal. Runoff is indicating a positive impact in most of the project areas. According to the beneficiaries this has been possible because of the contour bunding or field bunding which has also helped in checking the runoff of rainwater resulting in soil moisture retention.

5. Land use pattern, cropping pattern and agricultural productivity

There is an attempt here to understand how the WDPs have helped improving land use pattern and agricultural productivity across different watershed regions. In order to give a general picture of the scenario, the central government schemes of IWDP, DPAP and DDP evaluated by the established organizations are taken into consideration for review and analysis.

(a) Change in land use pattern

Better land use pattern is one of the important objectives of watershed management. With increase in surface water conservation and increase in availability of water in the watershed regions, it is expected that there will be more positive change in land use pattern.

In Himachal Pradesh, the change in land use is in a positive direction due to watershed development programme. The report indicates about 35% to 70% changes in land use in all the districts of the state. This is especially due to initiation of vegetable cultivation especially in fields close to development of irrigation structures. There is also decrease in cultivable wastelands due to WDP in the state. On an average about 60% of the cultivable wastelands especially that are nearby the newly developed irrigation structures are put into use i.e. cultivation started in these wastelands due to WDPs.

Rajasthan has shown a very positive change in land use pattern after implementation of the watershed management programme. For example, in Baran positive change is observed in all watershed areas (Figure-5). The average net sown area increased from 274.8 Ha to 309.65 Ha after watershed programme. In Jaipur, the average net sown area has increased from 333.29 Ha to 346.71 Ha. However, the distribution is much skewed. In Dungarpur, almost all watershed areas have an increase in area under both kharif and rabi crops. Jhalwar district has undergone a phase of transformation with more areas from an average 426 Ha during pre watershed period to 490.22 Ha in post watershed period in are being covered under cultivation with better irrigation facilities, an increase of 41.67 Ha in the average area irrigated during post watershed period (Table-2). Similarly, the other districts too have positive impact on land use pattern in the post watershed period.

Madhya Pradesh has obtained noticeable changes in the land use pattern with most villages in the watershed areas in Guna, Narsinghpur, Seoni and Sehore undertaken for the study reported to have positive trend. This positive trend is found in both DPAP and IWDP areas. In Seoni district DPAP Phase (I & V), and IWDP-V, in Shahdol DPAP Phase (I & VII) and IWDP (I) have all received positive trend in land use during post project period. The study by NIRD further reported that there was increase in the net cultivated area as well as the twice sown area under the DPAP, the average increase noticed minimum 5 Ha and maximum 25 Ha respectively, however the completion report indicates minimum 10 Ha and maximum 80 Ha in Chhindwara, min 10 Ha and maximum 104 Ha in Damoh, Min 7 Ha and Max 20 Ha in Jabalpur, minimum 7 Ha and maximum 65 Ha in Seoni, minimum 18 Ha and maximum 178 Ha in

Shahdol, and minimum 40 Ha and maximum 109 Ha in Umaria. The average area sown more than once has shown a positive increase in Umaria and Shahdol. More or less, in all the districts, increase in the net cultivated area and sown more than once noticed (Table-3). Kodo crop has been replaced by the main Rabi crops in the districts. Similarly, Gram sowed in the cultivated areas as a second crop in a year.

In Maharashtra, the study in Satara district has reported positive change in land use pattern in the DPAP areas. For example, the total land treated under the DPAP programme in the project was 11763 Ha in the 15 watersheds visited by the study team. In the pre-condition of the project the 5460 Ha of land is under net sown area, which is increased up to 6073 Ha in the post conditions. About 613 Ha more land is brought under cultivation due to increased water level. In Yavatmal there is some change in land use pattern. 10% increase in net sown area observed after the watershed programme implemented in the studied regions.

In Gujarat, the impact assessment study helps us understand that the watershed development programmes have induced land use pattern in a positive direction with more area covered under cultivation.

From the state in Uttar Pradesh it is found that 41% watershed is reported to have positive change. In Andhra Pradesh the farmers are investing more resources in good class lands due to socio-economic conditions. This was observed during the study in Nalgonda (IWDP-II), Medak (IWDP-II) and East Godavari (IWDP-I) districts. They never tried to improve waste land (cultivable), unfertile land and permanent cultivable fallow lands due to more cost on improvement and risk factors. The awareness should be spread among the farmers that they should use the land as per their capability, so the land can be used properly and production can be enhanced without further deterioration of land. In Tamil Nadu, the observation is same which is in line of the state of Andhra Pradesh, where the farmers in most of the watershed areas (91%) are investing more in good class lands and the proper land use pattern is noticed only in a few watershed areas (9%) under integrated wasteland development programme (IWDP). In the north eastern region, the study in Assam has not reported much about the land use pattern, except the fact that there is change in cropping pattern from mono-cropping to double and multiple cropping. This shows that the watershed programmes have enabled for better and maximum use of land. However, the study in Nagaland has reported a substantial change in land use pattern with increase in terraced cultivation and horticultural practices and declining in *jhum* cultivation in the region. For example, in Zunheboto-I-IWDP the size of *jhum* land has reduced from 1606 Ha to 720 Ha

in the studied villages. TRC land has increased from nil to 960 Ha and Horticultural land has increased to 27 from nil. Further, the size of forest land has increased from 894 to 1220 Ha.

By and large the studies reported that there is improvement of land use pattern and improvement in agricultural productivity in the watershed regions. While DPAP programmes are doing well in some states than IWDP in other states, it goes just reverse.

(b) Cropping pattern and agricultural productivity

Since water is essential for agricultural production, the provision of adequate water by means of increasing ground water level and conservation of surface water are instrumental. With available water harvesting structure farmers are inclined to new cropping pattern and agricultural diversification. Both agricultural diversification and intensification lead to increase in agricultural productivity in the regions where watershed programmes are effective.

Crop diversification

Crop diversification is also an important outcome of the watershed programme. In Andhra Pradesh, the districts covered under study such as Nalgonda, Medak, Khammam, and East Godavari have resulted better adoption to commercial crops especially among the small and medium farmers. In most places, the farmers tend to move towards growing cotton and in some places, the farmers are slowly moving towards growing fruits and vegetables. Vegetable cultivation is popular where there is adequate water or irrigation facility available. However, very less people are interested so far to take up micro enterprises initiatives. Crop diversification in Madhya Pradesh and Gujarat has not received any substantial attention by the farmers even after implementation of the watershed programmes. The studies by NIRD in MP and Gujarat have reported that in the absence of investments and facilitation no such diversification happens. It is reported that there is hardly any component or budget provision for production enhancement on agricultural diversification and it was visualized that once natural resources are conserved farmers on their own invest for such development. In Rajasthan, the studies have reported that in majority of the watershed areas there is change in crop diversification but the quantum of diversification is not properly reported by the evaluating agencies. In Karnataka too, the watershed has a very little impact on crop diversification, multipurpose trees, new ventures and livestock. The impact on micro-enterprises is not very positive

either. The Jammu & Kashmir study has reported that there are marked changes in crop diversification despite the fact that there is no proper investment in this regard. The study reveals that SMF and LMF have derived maximum benefits through cultivation of water consuming crops after implementation of IWDP. There has been 50% and 60% increase in multipurpose trees or farm lands among SMF and LMF respectively. In Uttar Pradesh, It has been reported that the respondents' opinion about the positive impact of watershed programmes on crop diversification is higher in IWDP areas than in DPAP areas. Vegetable cultivation is being adopted in IWDP areas. The performance of small-medium farmers (SMF) is better than large and medium farmers (LMF). In case of Maharashtra, Assam, Nagaland, this indicator is ignored under the study.

By and large crop diversification is possible due to WDPs. In some states there is more preference to commercial crops with better water harvesting structures and in irrigated areas. In some other states, vegetables crops are well adopted. This not necessarily means that the area under cereal crops is declining.

(c) Cropping intensity

The change in cropping intensity is one of the major indicators to assess impact of the watershed development programmes.

Out of the states covered under the study, in Uttar Pradesh it was reported that out of 87 sample watersheds almost 84 (>95%) watersheds have noticed increase in cropping intensity. Out of the 84 watersheds, 32 DPAP and 31 IWDP watersheds have noticed less than 100% in cropping intensity. Five DPAP and 8 IWDP watersheds noticed 100% in cropping intensity. Whereas five DPAP and eight IWDP watersheds noticed more than 100% increase in cropping intensity. It is more than 100% in three DPAP and six IWDP watersheds. Majority of watersheds have noticed increase in yield of cereals, pulses, cash crops, etc. However, this is not uniform across watersheds. Pulses production is better in DPAP projects. In Andhra Pradesh, the average cropping intensity in all districts undertaken for the study reported to have a change on 100-120%. This has been possible due to increase in moisture availability in soil and extending irrigation from surface as well as ground water. These districts include, Nalgonda, Medak, Warangal, Khammam and East Godavari. In rain fed areas, the cropping intensity has been increased by 20% or less than 20%. Farmers are showing interest towards mango and cashew orchards and commercial plantations (cotton and tobacco). In this

state with the increase in moisture availability in soil and extending in irrigation from surface as well as from ground water the average cropping intensity increased by 100% through inter-cropping, double cropping and relay cropping. These are mostly seen in the lower reaches of water harvesting structures. Due to improvement in irrigation below the existing water harvesting structures the yield of common crops such as cereals, pulses, oilseeds, fruits, vegetable and cash crop(cotton)has been increased by 50-100%, 25-50%, and <25%, respectively. It is observed that by WDP the milk production has increased by 50-100% of the average output. In Tamil Nadu it is reported that WDPs have not reported any substantial change in the cropping intensity. In some watershed areas, the cropping intensity has decreased mainly due to insufficient rain, easy access to NREGA work, etc. In some watershed areas, the cropping intensity is reported to be same and in a few cases there is increase in cropping intensity noticed. In Tamil Nadu, WDPs lead to increase in yields due to various reasons. These reasons include

- Increase in residual moisture content due to contour bunding helping in crop growth and yield
- Loosening the hard strata, thus increase in infiltration of water and easy penetration of roots due to land development activities like levelling and tillage
- Decrease in soil erosion and hence protection of fertile top soil due to contour bunding
- Increase of ground water and supplemental irrigation due to water harvesting structures

Rajasthan has noticed no substantial change in cropping intensity with most of the households (>70%) from the arid districts have reported no increase in cropping intensity. Of the 15 sample districts 8 districts have majority of the households (more than 50 percent) reporting increase in crop intensity up to 20 percent. The increase is more than 20 percent in Dausa as a substantial proportion (35 percent) of households reporting the increase. On the whole, the impact of WSD on crop intensity is up to 20 percent in the districts with medium rainfall (LNRMI study). Similarly, Karnataka did not show any perceivable improvement in cropping intensity. The Madhya Pradesh study by NIRD has reported that around 80% of watershed reports cropping intensity improvements above 100% which is consistent with the changes reported in biophysical aspects like ground water improvements, soil erosion reduction, etc. In Himachal Pradesh, people introduced vegetable cultivation in the nearby irrigation areas. In Jammu & Kashmir, watershed programmes (IWDP)

have helped SMF and LMF to better focus on water consuming crops. There is also increase in multipurpose trees or farm lands amongst SMF and LMF respectively. The major findings of NIRD study in Gujarat have revealed that 50% of watersheds report an increase in cropping intensity above 100%. In consistent with impact on bio-physical aspects, the cropping intensity impact is observed in the watersheds in northern districts. IWDP projects have a comparatively better performance than the DPAP and to an extent DDP projects.

(d) Increase in agricultural productivity

Assam, there was increase in cash crop production (increase from 185 Ha to 232 Ha), milk production and paddy production. In Gujarat in almost all watershed projects there is increase in production of cereal crops. Cash crops are not pre-dominant in many watershed except for watersheds in North Gujarat region. However, the increase reported is higher in case of IWDP and DDP as compared to DPAP projects. More than 2/3rd of the IWDP and DDP projects which are mainly implemented in the north Gujarat region report an increase in cash crop production. In Maharashtra the productivity of all crops is increased in the post watershed scenario. The study in Yavatmal, Amaravati and Satara districts has reported that there is increase in productivity of crops, cereals and cash crops. In Rajasthan increased moisture retention and water availability for irrigation resulted into increase in cash crop production. In Baran district it was reported that there is increase in cash crop from 20-25% in kharif as well as rabi seasons. There is increase in productivity of all major crops after watershed. In Bundi it was noticed increase in cropping area for double crops, change in single to double crop/mixed cropping, increase in crop production due to improvement in land geometry and higher water inputs, increase in fodder availability, milk production, etc. increased cropped area, productivity and farm income noticed in the watershed areas of Dungarpur, Jaipur, Jhalawar, Kota, Sawai-Madhopur districts amongst others. Most of the respondents in Madhya Pradesh had positive opinion about increase in cereal production. Nearly 86% respondents viewed that there is increase in yield of cash crop production. Cotton is an important cash crop being grown in most of the watersheds, predominantly, tribal inhabited watersheds in Betul and Rajgarh districts reports no change in cash crop production as there are no cash crops cultivated in these watersheds. In Himachal Pradesh, the yield from cash crops has exceeded the yielding from other varieties among the Small-Medium farmers and large and medium farmers. The cereals production has also been better among both these categories after the watershed programmes. In Jammu & Kashmir, the yield from maize production is better.

But with the watershed programmes operational the production of wheat is gradually increasing. Andhra Pradesh study has reported that due to increase in irrigation below the existing water harvesting structures the yield of common cultivated crops such as cereals 50-100%, pulses <25%, oilseeds <25%, fruits 25-50%, vegetables <50% and cash crop (Cotton and Tobacco) 25-50% has been increased. Efforts should be made to increase the yield of common cultivated crops by adopting the following measures:

- High yielding / Hybrid variety of seeds
- Judicious use of irrigation water
- Short duration and with low requirement of moisture level crops
- Proper use of manures and fertilizers

There is also increase in production of milk due to watershed development programmes in the region. Only concentration is given for the production of Milk. Due to increase in biomass in grazing lands and availability of fodder helped the farmer in production of milk and as such there is an improvement in economic status also. It is observed that by watershed development programme the milk production has increased by 50-100% of the average output.

The impact of watershed development programmes (WDPs) on crop yield is reported to be positive in Tamil Nadu. It is noticed that the yield of cereals has increased between 50 and 100% in 53% of watersheds, in 44% watershed it is between 10 and 20%. The yield of pulses has not been so good as cereals but certainly there is improvement in yield after watershed programme. The less increase in yield is reported with oil seeds, an increase between 25 and 50% in 27% watersheds and less than 25% in 49% watersheds.

In Nagaland after the IWDP project implementation PIA and WDT members had to change the mindset of the community towards settled cultivation from jhum cultivation. With increase in area of irrigation and bench terracing has resulted into a change in cropping sequence there by increase in cash crop cultivation, horticulture and afforestation. The cropping frequency, cash crop, horticulture, crop area, etc has increased significantly.

6. Reduction in workload

After the intervention of the land development and bunding activities under watershed programme, the land which was earlier tough and lacked moisture becomes bit loose. Rainwater also gets harvested which helps in the retention of moisture in the soil. Further, the increase in ground water and surface water also helps for providing drinking as well as irrigation water and reduces the time to fetch drinking water. As soil and water quality and quantity improve the availability of fodder and fuel wood also increases. Further, for women who are primarily assigned to fetch drinking water and water for all other household activities, watershed development programmes have been very instrumental in reducing work load.

Some studies who have highlighted this issue have reported that watershed programme resulted positively in reducing the workload of women in terms of fetching drinking water, collecting fuel wood and fodder for livestock in the study states by about 1-2 hrs per day. Jammu & Kashmir and Himachal Pradesh observed no significant reduction in the workload as the community did not get any respite from the water crisis. People still had to travel far distances to fetch drinking water. In Tamil Nadu of the 45 watersheds taken into consideration for study no change was observed in 9%, work load reduced by 2 hrs in 38% and by 1 hr in 53% of watersheds. The ones which report no change are 2 watersheds each in Virudhunagar and Dharmapuri. 2 hrs reduction in work load was reported from 1 in Coimbatore, 3 in Namakkal, all 5 in Tirunelveli, 1 in Trichirapalli, all 5 in Vellore and 2 in Virudhunagar. In rest of the watersheds it has reduced by 1 hr. In Rajasthan districts like Baran, Dausa and Bundi falling in the rainfall zone of 600-850 mm have substantial proportion of households (35 and 43 percent respectively) reporting adequacy of drinking water in quantity as well as quality terms whereas Jalore, Jaisalmer and Barmer need to be noted for the conflicting report on the quantity along with a very poor mandate on the quality. In all other districts there is a clear mandate on the quantity but not on the quality. In case of fuel wood WSD seems to have a more even distribution of impact across the districts. More than 80 percent of the households in 11 out of 15 districts reported just enough fuel wood which is a reflection of positive impact of WSD in most of the districts. Even arid districts of Jaisalmer, Barmer, Jalore and Bikaner report improvement in the fuel wood situation. This could be attributed to high proportion of cultivable waste lands in these districts.

7. Debt reduction position

Assessment of debt reduction position is one of the important objectives of the study. Reduction of debt has many social and economic implications. This can help in reducing poverty and improving livelihood. With the absence of proper irrigation facility, the crop loss is frequent. Telengana region in Andhra Pradesh, Vidarbha region in Maharashtra, KBK region in Orissa, and Sourashtra region in Gujarat are some of the glaring examples. The crop loss after huge investment in agriculture makes the farmers dependent on moneylenders and intermediaries. Many studies on farmers' indebtedness have reported that the farmers are victims of money lending. They fall under huge debt trap after investing large chunk of money in fertilizer, hybrid seed, cultivation operations, etc. without protective irrigation facilities. In such scenario, WDPs have helped a lot in providing irrigation facilities for better agricultural operation. It is already analysed before that the WDPs have helped improving land use pattern, cropping pattern and agricultural productivity, livestock rearing, etc. The positive changes in agriculture, horticulture and livestock production have helped better income generation and debt reduction.

In Uttar Pradesh debt position reduced in 54 watersheds out of 87 sample watersheds, in remaining 33 watersheds debt position did not reduce. However, the percentage of reduction in debt position is not similar across watersheds. In majority of watersheds (37) the reduction is up to 50%, among these 37, 19 are DPAP and 18 are IWDP programs. In another four DPAP and 10 IWDP watersheds the reduction is up to 100%. Highest reduction as more than 100% is observed in one DPAP and two IWDP watersheds. Of the 45 watersheds in Tamil Nadu under study, in only 1 watershed the debt reduction was found to be 100% in Vellore. There is no reduction in 27% of which 5 each are from Dharmapuri and Salem and 2 are from Tiruchirapalli. The debt has reduced between 0 and 50 percent in 44% which includes all the 5 watersheds in Karur, 4 each in Coimbatore and Namakkal, 2 each from Thirunelveli, Tiruchirapalli and Virudhunagar and 1 from Vellore. In 27% the debt reduced between 50 and 100, 3 each from Virudhunagar, Vellore, Thirunelveli and 1 each from Coimbatore, Namakkal, Tiruchirapalli.

The income generating activities carried out under the project in Assam helped the poor people in getting some regular income. The overall poverty level was reduced from 45 percent to 36 percent in the project area. Andhra Pradesh reported 50-75% reduction in debt due to improvement in economic condition by WDP. The situation was observed to be similar in Rajasthan, Madhya Pradesh and Nagaland. However, the situation in Gujarat and

Maharashtra has not significantly improved the conditions of poor and landless. Apart from some small-time labor work during the watershed activities, there has not been much to improvement seen in their livelihood. Gujarat watershed projects have given importance to conservation objectives and very little effort is made to improve production and livelihoods on a sustainable basis. Productivity in Amravati district has generally increased due to in situ soil moisture conservation and therefore, the income has increased to some extent but as an overall observation watershed activities have been unable to make a visible impact in enhancing employment opportunities. Thus there seems to be less impact on debt position reduction of the community.

8. Involvement of Community Based Organisations (CBOs)

In watershed development programme it is essential that not only the Private Property Resources but also the Common Property Resources are developed, managed and maintained with active involvement of the local community. For this to happen, it is highly important that every stakeholder in the watershed accepts and implements the recommended management plan and is very much involved in the planning, implementation and maintenance phases of the project (Sharda, Sikka, Juyal 2006).

To increase participation, several groups like user groups, self help groups, common interest groups, watershed committee, watershed association, etc. are formed. Due representation is given to all castes. Activities are planned and implemented with the help of these groups and these groups takes care of the maintenance and sustainability of the activities. These groups need to be formed carefully and trained well so that the assets created and benefitts acrued are sustainable.

In the present study CBOs formed in all the study states were examined. The findings reveal that Watershed Committees had been actively involved in the implementation of watershed programme. User groups for all the major activity had been also formed with exceptions of Jammu & Kashmir and Himachal Pradesh. It is found in most of the cases that watershed committee exists in the villages to some extent, while user group of the major activity are not visible after completion of the project. Very few CBOs seem to have survived after the withdrawal of the project. States like Uttar Pradesh, Tamil Nadu and Andhra Pradesh have reported partially alive CBOs.

In Uttar Pradesh, CBOs are found functional till today in 12 watersheds. In remaining watershed no functional CBOs existed. However, the percentage of functional CBOs is less than 50% in two DPAP and five IWDP watersheds. In another two watersheds each in DPAP and IWDP programs, the percentage of functional CBOs is up to 100%. Only in Maighalganj watershed in Lakhimpur district, CBOs are totally functional. Yet, the role of these CBOs in Maighalganj is also fairly low.

All CBOs formed were not functional in all the watersheds in Tamil Nadu either. SHGs are functional in all the villages in Namakkal district except in one microwatershed of Namakkal. In all the villages in Dharmapuri, Salem, Tirunelveli, Vellore, Virudhunagar and Tiruchirapalli SHGs are partly functional. In all the villages in Dharmapuri, Salem, Tirunelveli, Tiruchirapalli, Vellore user groups are partly functional where as in Virudhunagar it is partly functional in 3 microsheds of Virudhunagar. With the completion of WDP in Andhra Pradesh, most of the CBOs have become defunct, only less than 50% CBOs were found to be functioning satisfactorily.

In Assam altogether 328 nos. of user group were constituted. They were involved in preparing the watershed plan and execution of work. To make sure that women participated in the planning and decision making of watershed development work, a woman volunteer was engaged in each watershed committee. Women volunteer was engaged to ensure women's participation. In the project area, 178 SHGs were constituted with the initiation of Block Development and NGOs. From the survey, it was found that the SHGs and UGs though it was formed by group of people, the leaders dominated of the funds received for watershed development. In some micro-watershed, it was found that the President and Secretary played active role while other members just joined the group for the sake of entering their names. So participation of community became minimal. Participation during post project implementation phase is negligible, which is a serious drawback needs to be addressed.

In Rajasthan although people were involved in the implementation still CBOs mainly SHGs became un-functional within first year of their formation. Preliminary trainings were given to these groups by Project Implementing agency but sincere efforts were not made for linking them with banks, markets and other related outlets. Training and capacity building activities have not achieved the desired results. At present most of the SHGs are not functional.

Study revealed in Gujarat that involvement of SHGs in social action is significant. It shows awareness, empowerment and involvement of women in social process but these activities are neglected. At present almost all SHGs are non-functional only few female members merged into other groups like Sakhi Mandals.

In Amravati (Maharashtra) under IWDP project, Watershed Committee and Watershed Association were active during the project period. The User Groups were not found very active. These were formed for different activities such as watershed conservation structures, farm ponds, horticulture, etc. In most of the villages these user groups were found to be idle and lacked any agenda. 286 UGs were reportedly formed during the project period. Only few SHGs were found to be active after the completion of the project. Though some of the SHGs were found to be active but there is role of other organization in promoting and sustaining these groups. In Yavatmal and Satara districts of Maharashtra under DPAP Programme, it was found that the users groups are not functioning post project.

It was found in MP that in most of the cases Watershed Committee still existed in the villages to some extent, while User Groups (UGs) of the major activity were not visible in real sense at a field level after completion of project. It is learnt that although UGs have been formed and they have also participated during implementation of programme but they have not been sufficiently trained and prepared to do post management of watershed programme. Self Help Groups (SHGs) were constituted under the programme. Different types of income generating activities were selected for them. The results are mix. Activities like vegetable cultivation, etc has sustained while other activity in general have not sustained after withdrawal. It reflects that activity should be selected in such a way in which people have skill and market at local level. All classes of the village community were represented in the watershed committee. There has also been at least 33% women representation in the watershed committee. One volunteer from the other categories has been selected under the Programme.

In Nagaland also CBOs were formed. SHG consisted of 10-12 members and was provided with a revolving fund of Rs.10,000/- each. The maximum number (72) SHGs were formed in the Mon district. The SHGs condition was not found so good in Helipong and Angangba village in Tuenchang district and Kuhuboto, Seithekima old and Chumukedima village of Dimapur district. Most of the SHGs were found to be self-dependent in Chunlikha and Phenwhenyu of Kohima, Longsa and Shaki of Wokha district. The SHG of Sapoti, Sutemi and Chisilimi of Zunheboto district have created marketing

shed in the locality. They are practicing mixed agriculture along with bee keeping. They are also involved in social work like helping poor and disable people. Before Christmas they even distribute gifts in their locality. The Watershed Association and Watershed Committee were found to be defunct after the completion of the project. The new WA or WC were formed for the new project.

No effective community development approach for developing village level institution is noticed in some states like Andhra Pradesh, Jammu & Kashmir and Himachal Pradesh amongst others.

In Jammu & Kashmir and Himachal Pradesh no user groups were formed and all the self-help groups stopped working as the watershed project got over. Now there are no CBOs functional in any of the watersheds.

It can be concluded that the success of watershed program would not only rely on the watershed institutions, but depend more on how effective are the credit delivery system, input delivery system, output markets, and technology transfer mechanisms. It is, therefore, imperative to ensure that watershed projects/institutions should also have a strong linkage with various institutions like markets, banks, etc. (ICRISAT Report no.46)

9. People's Participation

Participatory approach is essential in the planning and development of the watershed management programme so that it becomes the peoples programme with the government participating in it as a facilitator only. Active people's participation is, therefore, highly critical in the success of the watershed program (Kerr et al. 2002, Sreedevi et al. 2004; and Joshi et al. 2005). The available evidences confirm that there existed a positive relationship between people's participation and benefits from watershed program. The results of this study showed that the benefits were the highest from the watersheds where people's participation was high. At majority of the places it was moderate and in few it was conspicuous by absence. The other impact indicators were also far ahead in watersheds having greater people's participation.

People's participation in planning, developing and executing the watershed activities is indispensable (Wani et al. 2003; and Joshi et al. 2005). Active and voluntary participation of all stakeholders guarantees the successful implementation of watershed program. Activity in one location affects

adversely or favorably in different location. Watershed development cannot be done in isolation. Land being a natural entity and its treatment in a scattered manner will not lead to any kind of development. These lands can be treated on "ridge to valley" approach. A land lying in a valley cannot be improved if the land at upper reaches is not treated. To synergies the process of development all the stakeholders should develop their own rules to maximize the benefit of the programme. It is believed and observed that better organized and effective people's participation would yield higher benefits.

The participation of beneficiaries in planning and execution of the watershed was seen more from LMF group. This implies that poor rural households were less involved in planning and decision making processes in the watersheds. However, the rural poor were offering their labor in various activities launched in the watershed. In fact, for the smaller farmers and the landless laborers in the watershed, there is often little prospect for development beyond the employment generated from the watershed works over the project period (Farrington et al. 1999). For gaining higher benefits from the watershed related activities, greater involvement of the beneficiaries would be the important factor.

Foregoing analysis reveals that people's participation is the key determinant in the success of the watershed development program. People's participation is not only critical during the implementation phase of watersheds but also ensures conservation and development of Common Property Resources. Peoples' involvement is the key to success, which brings about sustainable development.

10. Social audit

The exercise of Social audit seems all the more important when the stakes are high both in terms of investment and benefit. It also helps in making the program transparent. Social audit is conducted jointly by the government and the people, especially by those people who are affected by, or are the intended beneficiaries of, the scheme being audited.

The scope of social audit:

- A social audit is conducted over the life span of a scheme or programme, and not just in one go or at one stage
- It audits the process, the outputs and the outcome

- It audits planning, implementation, monitoring and evaluation

During the analysis it was revealed that out of the total 12 study states, social audit was carried out at two states namely Uttar Pradesh and Tamil Nadu. Further at both these places there was lack of awareness among the community about such an exercise that was ever carried out.

In Uttar Pradesh social audit was carried out only in one district, Balrampur, Badagoan watershed funded under DPAP program. However, community in Badagoan watershed did not seem to be aware of such an exercise carried out ever during the implementation of the project. In the remaining 86 watersheds social audit was not conducted at all.

There is no proper social audit measures developed in many of the states. For example, in Assam, there is no maintenance of muster rolls for employment generation activities undertaken in the watershed regions.

Tamil Nadu reported that of the 45 watershed, social audit happened only in 27%. In rest of the 73% watersheds it did not happen. Only few people were aware of all the items that happened under the watershed activities. Social audit was performed in 4 watersheds in Namakkal, 3 each in Tirunelveli and Vellore and 1 each in Tiruchirapalli and Virudhunagar.

It is pertinent to mention here that the purpose of conducting Social Audit is not to find fault with the individual functionaries but to assess the performance in terms of social, environmental and community goals of the organization.

All the foregoing measures can bring on board the perceptions and knowledge of the people, can look at outcomes and not just outputs and can involve the people in the task of verification, also, much greater acceptability by the government. Government audit remains the basic audit, but becomes more transparent and participatory. Social audit must be conducted in addition for certain types of schemes and activities, especially those involving huge and/or disaggregated expenditure.

Social Audit provides an assessment of the impact of organizations non-financial objectives through systematic and regular monitoring, based on the views of its stakeholders. The foremost principle of Social Audit is to achieve continuously improved performances in relation to the chosen social

objectives. Thus, it is evident from the analysis that the position leaves much to be desired and therefore, calls for concerted efforts from the authorities concerned in terms of policy, planning and post implementation.

11. Management of common property resources (CPR)

Common Property Resources refer to the resources in which all the villagers have equal rights. The villagers maintain, protect and enjoy the usufructs with equal rights and responsibility. They however do not have any legal right over the resources. Several common property resources are developed under watershed development programme such as pastures, development or renovation of water bodies, plantations in common land. While these resources are being developed these provide employment to the folks and once it is developed it contributes directly towards livestock management and non-farm activities besides agricultural production.

The Common Property Resources are analyzed and presented here to understand the position in regard to the way the community land is used for fodder, fuel wood, etc., their maintenance and the role played by the community with regard to CPR.

In Uttar Pradesh, only in two watersheds Common Property Resources are maintained by Gram Panchayat out of the total 87 sample watersheds. These watersheds are situated in Balrampur and Sonbhadra districts funded by DPAP program. In remaining 85 watersheds there was no conscious effort from Gram Panchayat or the Community.

Gujarat, Andhra Pradesh and Rajasthan report more than half of the watershed common assets to be partially destroyed. By and large, no maintenance was carried out in most of the micro-watersheds. With regards to CPR situation in Karnataka, it was revealed that there is a scope for improvement. Hassan district is seen to be ahead of other districts. Jammu & Kashmir observed no repair and maintenance. Villagers allow their cattle to openly graze in the community lands. The participation of woman was found to be nil and social fencing of community lands was not possible because of less cooperation. After completion of the Project, Operation and Maintenance of the activities was not seen to be effective in Maharashtra.

Process of maintenance of structure during and post construction is not clear at village level in Madhya Pradesh. People are managing activity on their own

in the private land but structure made in the common land is not being maintained properly in general. In a very few cases people have taken initiative to do maintenance of structure in the common land.

The community participated in planning and execution of project in their own villages. In Assam, however, there was lack of contribution in the matter of money, labour or kind. They never collected user charge for using the assets created under the watershed project. Thus, the community could not save money other than the watershed development fund, which was deducted from their sanctioned amount. The maintenance of the assets though was handed over to the user group; they lack money for repair and maintenances of the assets.

The study in Tamil Nadu reports that all assets created under the project were accessible to all the people except in 3 watersheds of Salem where it is limited only to the user groups. The assets created are used on sustainable basis whereas in Virudhunagar only one watershed there seems to be a case of exploitation.

Overall state of CPR can be put in two categories-the watersheds with no maintenance at all and with not adequate maintenance mostly because of lack of awareness among the community about clear cut procedure laid out for maintenance of common property resources. Maintenance of assets and management of Common Pool Resources especially land resources play a crucial role in ensuring asset sustainability which in turn contributes to environmental sustainability and equity and benefits to the resource poor in the watershed. Thus, it is evident from the analysis that the position leaves much to be desired and therefore, it calls for concerted efforts from the authorities concerned.

12. Reduced migration

The latent aim of this project was also to reduce migration and generate sufficient employment opportunity. Migration had completely stopped during the project implementation stage. Since employment opportunities in form of labor were available. But after implementation, though productivity and income has increased to some extent, it was unable to reduce or stop migration altogether. The project was not able to provide alternative employment opportunities to the villagers. Promotion of non-farm sector activities like dairy, poultry, goatry was found to be negligible which could

have provided some employment opportunities. Tree based farming or agro-forestry and horticulture can also form a major source to provide employment opportunity and reduce migration. But the projects attempted it on a meager scale. Attempt to mitigate migration is required on a major scale.

13. Women empowerment

Empowerment is a multi-faceted, multi-dimensional and multi-layered concept. Women empowerment is a process in which women gain greater share of control over resources such as material resource, human and intellectual resource, information, and financial resources amongst others. According to the Country Report of Government of India, "*Empowerment means moving from a position of enforced powerlessness to one of power*". Since empowerment is a latent phenomenon and cannot be measured directly so aspects like participation, mobility, voice in decision making in home, community, society were taken into consideration.

The analysis of this aspect reveals that women participation was not adequate. They were part of SHGs, UGs, WCs, WAs also but it was nothing more than mere presence. Mere presence of women members on the watershed committee had no real impact as they were not effective in decision-making process in the committee (Seeley et al. 2000). Women in SHG did not feel confident to interact with people, officers, panchayats, bank, etc. Only in case of Nagaland women seemed confident enough. A hearting change resulted from the awareness created is that the community has started paying attention to girl's education.

The World Bank defines empowerment as "the process of increasing the capacity of individuals or groups to make choices and to transform those choices into desired actions and outcomes. Central to this process is actions which both build individual and collective assets, and improves the efficiency and fairness of the organizational and institutional context which govern the use of these assets." In order to enlist active participation of women and vulnerable groups targeted activities benefiting these groups economically are suggested by Sreedevi and Wani (2007). Harnessing gender power by balancing activities for men and women, farmers and landless people was found effective to enhance the impact of community watershed programs (Sreedevi and Wani 2007; Sreedevi et al. 2007).

Thus, as the World Bank (2001) report confirms societies that discriminate on the basis of gender pay the cost of greater poverty, slower economic growth, weaker governance and a lower living standard of their people.

14. Impact on landless community and livelihood improvement

Landless community should not be ignored in the developmental process. These marginal families can be the part of indirect benefits and can be included in the users groups, SHGs and other institutions. Most of them are part of SHGs but not included the users groups in the project area. It seems that watershed activities have not improved conditions of landless community significantly. Apart from some minor labour work, there has not been much to improve their livelihood.

Findings presented in other studies such as J.S.Samra (1999), Jacob Nirmala (2003), Sangameswaran and Priya (2006), Roy and Iyer (2001), Parikh, S. Acharya and K. Maiteraie (2004) also made similar observation that since most of the watershed development programmes are essentially land-based, and landless as well as weaker sections of the society in many cases feel left out of the programme. Further it is seen that women benefit somewhat less than men, though all benefit.

15. Employment Generation

According to the watershed guidelines, livelihood promotion is a very important outcome of the project. Under this study, additional employment as labor days is considered as a parameter for livelihood promotion.

Uttar Pradesh reported 20% to 40% increase in 18 DPAP and 15 IWDP watersheds. Six DPAP and 10 IWDP watersheds observed maximum increase of 40%. Less than 20% increase in labor was observed in 13 watersheds each in IWDP and DPAP. Tamil Nadu observed increment in employment up to 40 days per year in only 5 watersheds (two are in Tirunelveli and 3 in Virudhunagar). In rest of the 40 watersheds it was between 20 and 40 days per year. Total 45 watersheds belong to IWDP. Here also agriculture employment as well as female employment has increased.

Study in Himachal Pradesh reveals that WDP was able to generate employment amongst the community. It was observed that Sirmour, Bilaspur and Kangra performed adequately and rest of the districts like Kinnaur,

Shimla and Hamirpur could not generate enough employment. The reason could be attributed to the fact that these areas were allocated less work pertaining to watershed development. The findings also reveal that LMF benefited more in terms of employment generation than SMF in the state.

In Maharashtra Satara district it was reported that during the implementation of DPAP, earthen nalla bunding generated 168190 days in the 15 watersheds. About 30389 man-days have been generated on the skilled activity of cement nalla bunding and about 36630 man-days have been generated on the activity of K.T. weirs. In Amravati district, it was reported that no other employment opportunity was created apart from the ones during the implementation of the IWDP. Here all are marginal farmers with very low irrigated percentage of irrigated land. There is also Korku community who depend completely on agriculture for their livelihood. There are no special efforts made for generating employment opportunities in long term for the marginal and landless farmers. According to an estimate by the evaluating agency, a total number of 2.34 lakhs employment man-days are generated in all 20 watershed Project from Nine Villages, and approximately 2342 persons have got employment for 100 days in a year and could earn around average of Rs. 5700/-in a year in Yavatmal district .

In Madhya Pradesh, It was revealed that 95% of watersheds reported an increase in availability of labour. Khargone, Raisen and Khandwa observed employment up to 40 days per year. Under IWDP in Nagaland 209.5 lakhs were spent on labor while generating 121630 male and 79690 female man-days. Employment generation activity in Andhra Pradesh was reported to be between 20-40 days per year for majority of the watersheds.

In Assam watershed project did not maintain record for employment generation. The muster roll was not maintained as the works are executed by the watershed committees. There has not been any additional employment generation in Jammu & Kashmir due to watersheds.

In Rajasthan, additional employment has increased in 91 percent of the watersheds, but the increase is less than 20 percent in 72 percent of the watersheds. Though additional expenditure and debt reduction also reported, attributing the impact entirely to WSD could be difficult. Though additional expenditure got a score of 76 percent, it may not be entirely due to WSD, as there could be due to other factors like inflation. Employment generation activity was reported to be between 20-40 days per year in 19 watersheds. Seventy five percent of projects from Gujarat report a moderate increase of

20-40 days per person per year. More than 40 person days increase is reported from the northern districts and mainly from the projects that report good impacts on other components, especially those from IWDP and DDP.

Andhra Pradesh has positive impact on consumer durables, consumption pattern with implementation of WDPs. Many households were benefitted from income generating activities.

It can be concluded that majority of the employment was generated between 20-40 days, among the sectors it was agriculture sector and women had equal opportunity to participate in gaining benefit from employment generation. Economic impacts across the schemes reveal that the performance of DPAP watersheds is as good as that of IWDP watersheds. DDP watersheds have scored less given the fact that this scheme is implemented in the extreme environmental conditions. Considering this even the limited impact can be judged as positive indication. Nevertheless, there is a need to find the gaps and reasons so as to make it even more effective and realize full benefits of the programme.

16. Poverty Alleviation

The data with respect to poverty alleviation as directly observed from the field was only made available in the state of Assam. According to which there was reduction of poverty level from 45 percent to 36 percent in the project area. The income generating activities carried out under the project helped in providing some regular income. Farrington et al. (1999) also observed that the impact of these projects on poverty alleviation and the long-term sustainability was however less clear. Even though the results indicate that successful projects have in fact reduced rainwater runoff and recharged ground and surface water aquifers, improved drinking water supply, increased the irrigated area, changed cropping patterns, crop intensity and agricultural productivity, increased availability of fuel and fodder, improved soil fertility and changed the composition of livestock.

17. Improvement in Standard of living

Successful implementation of the watershed programme is realized in the fact that it brings more lands under cultivation, improve the quality of the land thereby the productivity. All the positive impacts of WSD are expected to culminate in improved standard of living at the household level. People are

able to get some regular income perhaps some additional income which leads to additional expenditure. Raised income enables a better life in terms of better food, clothes, education, health, more spending at the time of festivals and marriages, physical assets and amenities acquired.

Findings of the study revealed that majority of the households across all the study area have reported only slight improvement in the standard of living. The benefits of WSD have not fully translated into disposable income or net gains to improve the standard of living.

The performance of Tamil Nadu was seen to be better than that of the other states. 82% people experienced slight improvement in their life, whereas 7% responded to have improved well. 11% experienced no improvement. 2% of the farmers have purchased new land, 4% respondents have invested on tractor. 52% have purchased cycles and 75% respondents have procured new television sets. Health and education has also shown improvement but it cannot be attributed completely to the watershed development programme as other targeted governmental programmes are also being implemented in the study areas.

18. Other impacts: Impact on SMF and LMF

Watershed Development being a land based activity affects all categories of farmers. Mostly it has seen to benefit the large and medium farmers more than that of small and marginal farmers. This could be attributed to the fact that large and medium farmers have more land in terms of quantity as well as quality and can make investment towards irrigation equipment etc.

To gauge the differential impact between small and marginal farmers (SMF) and large and medium farmers (LMF), study performed in Rajasthan can throw some light. It was examined with respect to bio-physical or environmental indicators. SMF seem to have performed better with regards to soil erosion, runoff reduction, accruing benefits of drinking water facilities whereas large farmers are able to gain more from the irrigation impact of WSD because of their better investment capabilities. The benefit of availability of fodder was found to be neutral. Whereas, the benefits accrued in terms of fuel and manure were seen to be more to LMF than SMF.

The study by LNRMI in Rajasthan has noted that the impact of WSD is neither in favour nor against any particular group though variations can be observed across the districts. At the aggregate level SMF seem to have gained more in

the case of runoff reduction, drinking water and vegetative cover, while LMF gained more in terms of fuel and manure. Across the districts, LMF have gained more in terms of most indicators in six (Baran, Tonk, Bikaner, Jalore, Jaisalmer and Udaipur) of the 15 sample districts, while SMF gained more in only one district (Dholpur). As far as the overall impact at the district level is concerned LMF have reported significantly better impacts in five districts while SMF reported significantly better impact in two of the districts. In the remaining eight districts the differences are not statistically significant. Majority of the districts where LMF benefited more are from arid and low rainfall regions. This points towards a disturbing fact that benefits from WSD in poor and backward regions not only low but are mostly cornered by large farmers resulting in aggravation of inter and intra regional inequalities.

Findings from Karnataka study also reflect that large farmers seemed to have benefited more from the implementation of watershed programme, where 76% farmers were small farmers and 24% were large farmers.

Conclusion

Watershed Development Programme (WDP) is one of the most popular development programmes implemented across the country. It is widely admitted that WDP is seen as the panacea. This programme has been directed towards the promotion of overall economic development and improvement of the socio-economic conditions of the resource poor sections of people inhabiting the programme areas through natural resource enhancement (Gol, 2001b). Over the years there is much visible impact of watershed development programmes among different communities across various regions.

The general conclusions derived from the studies are as follows:

- It was found that there was good quality water harvesting structure in some watershed areas, but in some other watershed areas, it requires further attention. Maintenance of WHS during post implementation phase is poor in many states. Micro watersheds in DDP areas perform better in this regard.
- Contribution to WDF is as per norm practiced in some states. While in some other states there is variation in terms of contribution to WDF.
- There was reduction in soil erosion in the watershed areas. However, the variation in the percentage of reduction primarily depended on quality of soil and moisture conservation activities in the respective regions.
- There was marginal increase in ground water level in some states but some other states exhibit better increase in groundwater level.
- It was observed that the programme is mostly successful in maintaining runoff reduction.
- There is positive change in the land use pattern reported in most of the WDP regions. In these regions, more waste land was converted for productive use by the farmers. This has resulted increase in net sown area in majority of the states. Further, better land use pattern has helped increase in agricultural intensification and thus enhance agricultural production.

- Crop diversification is resulted out of more irrigation facilities available in the watershed areas. However, the concern is that the people invest more in good class of land. The investment in low quality land has not received much attention.
- Watershed programme resulted positively in reducing the workload of women in terms of fetching drinking water, collecting fuel wood and fodder for livestock in almost all the study states.
- The income of the community members has increased to some extent but watershed activities have been unable to make much visible impact in enhancing employment opportunities.
- The Watershed Committees had been actively involved in the implementation of watershed programme in majority states. User groups are formed in majority states, but their degree of involvement varies. The user groups are hardly visible in watershed activities after completion of the project. Very few CBOs seem to have survived after withdrawal of the project.
- The position about common property resources leaves much to be desired and, therefore, it calls for concerted efforts from the authorities concerned.
- Migration was mostly reduced during the project implementation stage. But further attempt is necessary to stop migration completely.
- The analysis of women's empowerment shows that the women participation was not adequate. Mostly, women lack in mobility, voice in decision making at home or in community. Same is the case with landless members. It seems that the livelihood conditions of landless communities have not been significantly improved. Apart from some minor labour work, there was nothing much to improve their livelihood.
- It was realized that the position with regard to flow of funds and social audit is limited to some watershed areas.
- It was realized that participation of local community member is key to success of the watershed projects. Participation also enhances community empowerment. The participation of beneficiaries in planning and execution of the watershed was seen more from LMF group. Poor rural households were less involved in planning and decision making processes in the watersheds.
- Economic impacts across the schemes reveal that the performance of DPAP watersheds is relatively as good as that of IWDP watersheds. DDP watersheds have scored better under some activities like quality of water harvesting structure but in some areas like reduction in soil erosion, runoff reduction, etc DDP has scored less. However, it must

be considered that this scheme is implemented in the extreme environmental conditions. Hence, even this limited impact can be judged as positive. Nevertheless, there is a need to find out the gaps and reasons so as to make it even more effective and realize full benefits of the programme.

- It was also found that majority of the households across all the study areas had reported slight improvement in their standard of living. The benefits of WSD have not been fully translated into disposable income or net gains to improve the standard of living.
- The study also suggests that the impact of watershed is more focused towards physical and biological achievement, but the focus on social aspects is limited. There are certain positive trends towards growth of water level, soil regeneration capacity, land use pattern, cropping pattern, livestock production, etc. However, social achievements have not been properly addressed with implementation of WDPs. Majority of the reports suggest that the positive effect of watershed development on lives of the community is greatly limited.

Figures and Tables

Figure-1: Quality of Water Harvesting Structures (Scheme wise)

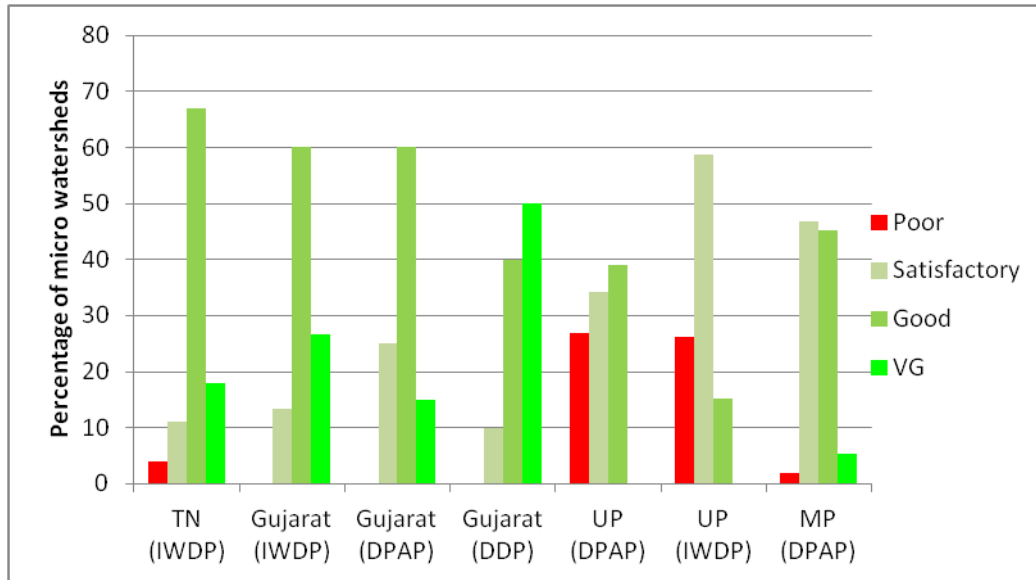


Figure-2: Change in ground water level after WDPs in different states

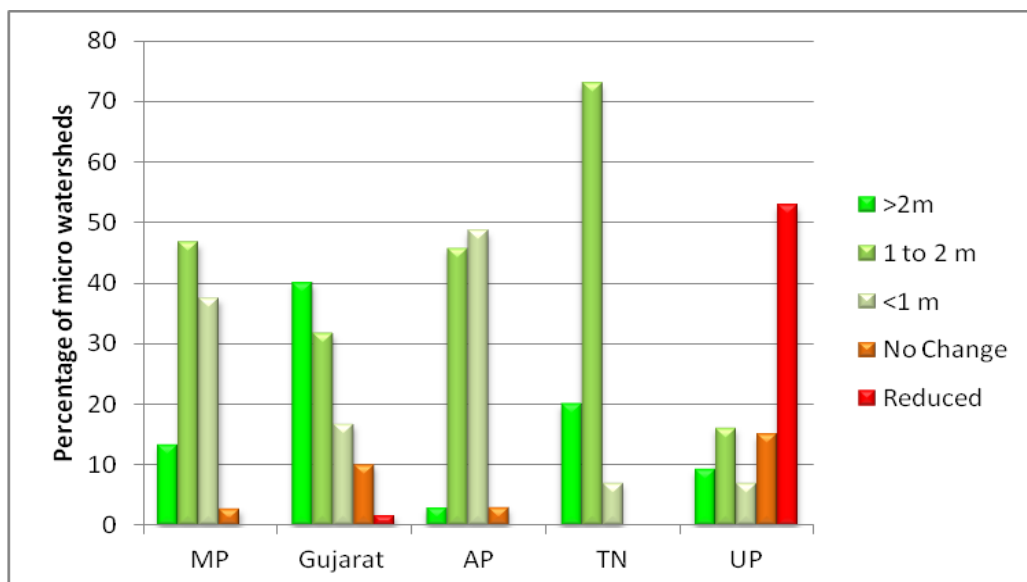


Table-1: Impact of WDPs on soil erosion reduction in different States across schemes

States	Schemes	Reduction of soil erosion in different states (percent)		
		>50%	Upto 50%	Not reduced
UP	DPAP	11 (26.8)	25 (61.0)	5 (12.2)
	IWDP	7 (15.2)	32 (69.6)	7 (15.2)
MP	DPAP	0	46 (100.0)	0
	IWDP	0	48 (100.0)	0
Gujarat	IWDP	21 (70.0)	9 (30.0)	0
	DPAP	6 (30.0)	13 (65.0)	1 (5.0)
TN	DDP	8 (80.0)	2 (20.0)	0
	IWDP	12 (27.0)	33 (73.0)	0

Figure-3: Overall impact of WDPs on soil erosion in different states

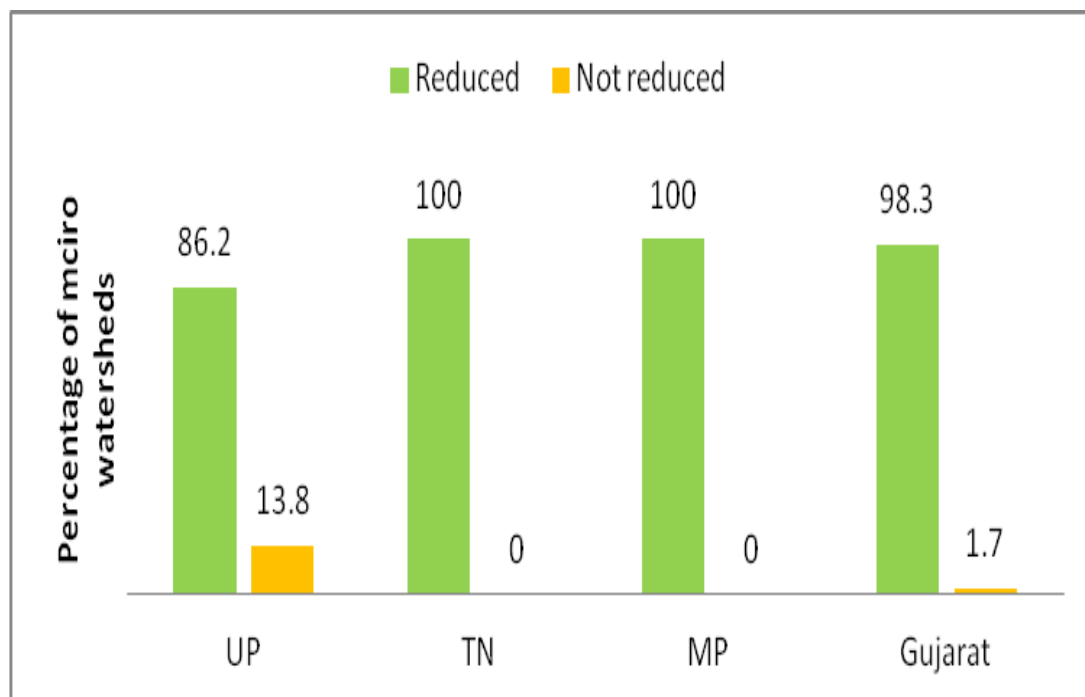


Figure-4: Impact of WDPs on soil erosion reduction across schemes in Rajasthan

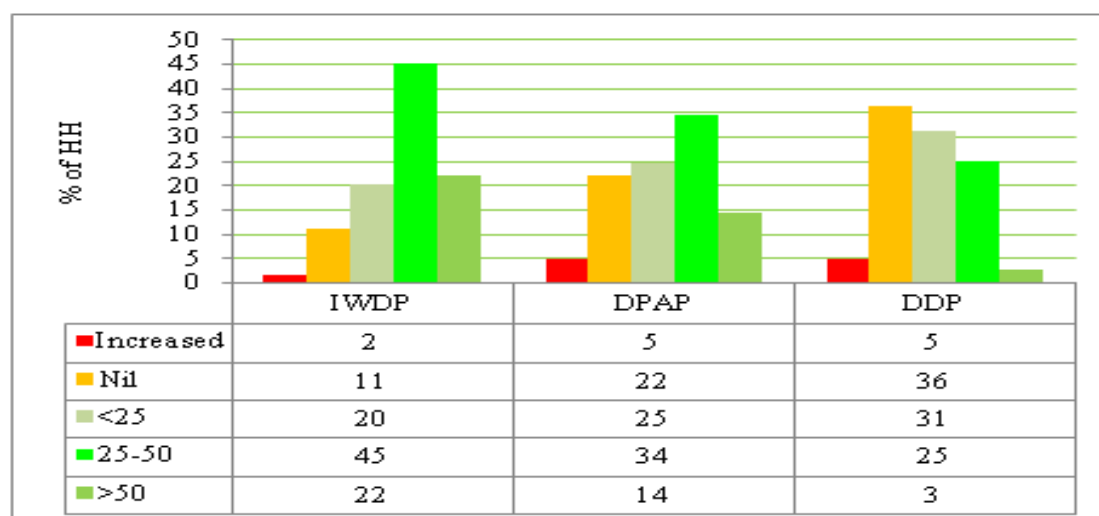


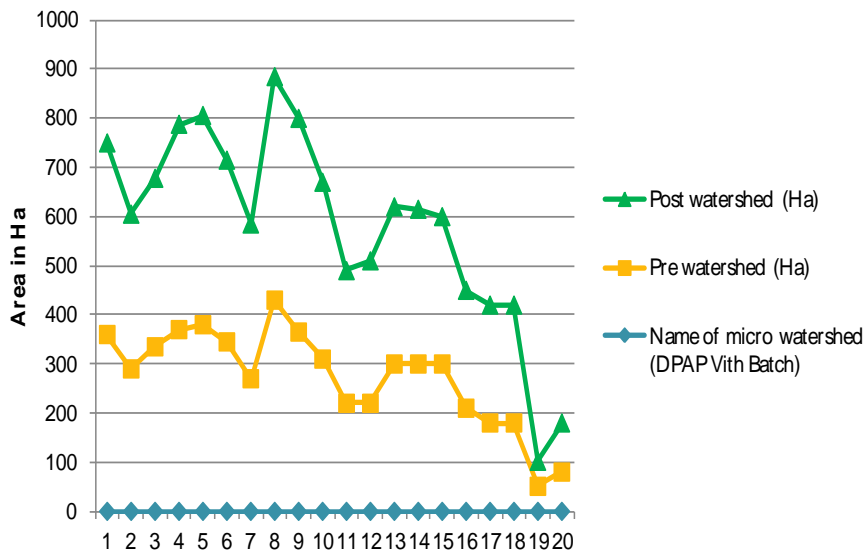
Table-2: Increase in net sown area after WDPs implementation in Rajasthan

Districts	Pre-watershed (Net sown area in Ha)	Post watershed (Net sown area in Ha)
Baran	274.8	309.65
Jaipur	333.29	346.71
Jhalawar	426.0	490.22

Table-3: Increase in the net cultivated area as well as the twice sown area under the DPAP in Madhya Pradesh

Districts	Min (in Ha)	Max. (in Ha)
Chhindwara	10	80
Damoh	10	104
Jabalpur	7	20
Seoni	7	65
Shahdol	18	178
Umaria	40	109

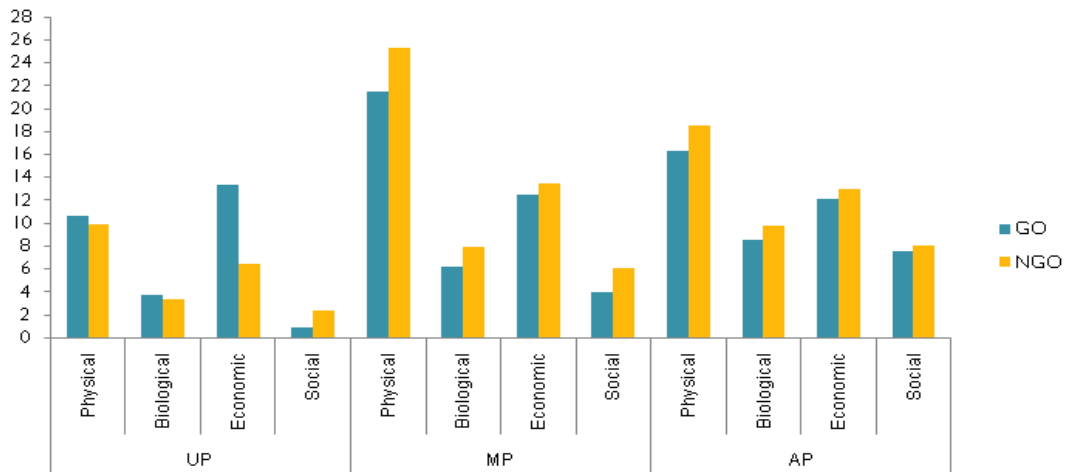
Figure-5: Increase in net sown area after WDPs (example: Baran, Rajasthan)



Micro watersheds

1. Chhabra I (B)
2. Chhabra D
3. Chhabra E
4. Chhabra F
5. Chhabra G
6. Choki D
7. Choki H
8. Halgana Balharpur
9. Mundala Umarthana
10. Nipania
11. Niwari A
12. Niwari B
13. Niwari C
14. Niwari D
15. Ghoghara
16. Ghoghara E
17. Shahabad C
18. Shahabad D
19. Shabad bhoyal
20. Sahrol Taleti

Figure-6: PIA wise performance and overall impact on different factors in UP, MP and AP*



*Total points allotted for each factor (physical-40, biological-25, economic-20, and social-15)

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