Ind. Jn. of Agri. Econ
Vol. 59, No. 3, July-Sept. 2004

SUBJECT I

WATERSHED DEVELOPMENT

Watershed Development in India: Synthesis of Past Experiences and Needs for Future Research*

P.K. Joshi,† V. Pangare,* B. Shiferaw,‡ S.P. Wani,‡ J. Bouma and C. Scott****

I

INTRODUCTION

A large portion of the rainfed areas (65 per cent of arable land) in India is characterised by low productivity, high risk and uncertainty, low level of technological change and vulnerability to degradation of natural resources. The region houses a sizable number of unemployed, poverty ridden and undernourished population. The majority (about 70 per cent) of the population in the region is dependent on agriculture, which is still under subsistence and prone to weather and market uncertainties. Ironically, the rainfed areas were by-passed with respect to investment on infrastructure and technology intervention as compared to irrigated areas. Policy initiatives were inappropriate, lethargic and often unattended for this vulnerable region. Such a scenario has impeded the growth performance of the rainfed areas as compared to irrigated agriculture.

Water is critical for rainfed areas. Not because of scarcity *per se* but lack of proper management that accelerates shortages. Broadly, the rainfed areas are confronted with two major technical and water-related problems: (i) heavy and intense rainfall and surface run-off during the monsoons leading to soil erosion and siltation or pollution of water bodies downstream, and (ii) severe drought in the summer season leading to acute scarcity of water for post-rainy season crops. These two extreme eventualities need to be managed for enhancing agricultural productivity, augmenting income and preventing degradation of soil and water. The watershed programme was initiated with the basic premise to overcome such anomalies in the country. It was viewed as the key programme, which could meet the

---

* Keynote paper.

† South Asia Co-ordinator, International Food Policy Research Institute, IFPRI-Delhi, New Delhi-110 012; * World Water Institute, Pune, ‡ International Crops Research Institute for the Semi-Arid Tropics, Patancheru, Hyderabad – 502 324 (Andhra Pradesh) and ** South Asia Regional Office, International Water Management Institute, Patancheru, Hyderabad (Andhra Pradesh), respectively.

The paper is drawn from Joshi *et al.* (2004).

emerging and complex challenges of rainfed areas: deplorable poverty, huge unemployment and acute degradation of natural resources. The programme was reckoned as a catalyst to bring the second-generation green revolution in the rainfed areas. The programme was expected to benefit the poor farmers dependent on marginal areas and bridge the gulf between irrigated and rainfed areas.

Though the watershed programme in India was initiated more than four decades ago, the vigour and seriousness came only during the 1990s; particularly after the worst drought in 1987. The nature and scope of the watershed programmes were modified over different plan periods and recently tuned to encourage people's participation. The Government of India through different ministries have invested more than US$ 2 billion during the last 50 years for the watershed development under various programmes until 1999-2000. In the past, several useful studies have been conducted to assess the impact of watershed programmes, and to examine the people's participation (e.g., Chopra *et al.*, 1990; Farrington and Lobo, 1997; Marothia, 1997; Samra, 1997; Deshpande and Thimmaiah, 1999; Hanumantha Rao, 2000; Kerr *et al.* 2000; and Ratna Reddy, 2000). These studies have mixed conclusions on the performance of watershed programmes in achieving the expected economic and environmental outcomes. These evaluation studies provided useful insights on the performance of numerous watersheds and examined the conditions for the success of the watershed programmes across different geographical regions of the country. This paper draws from many such studies and attempts to synthesise the major lessons and experiences through a fresh assessment of the existing literature. It intends to review the past experiences in watershed development in the country and synthesise lessons from diverse experiences, and identify knowledge gaps for future watershed research and development.

The paper consists of five sections. A brief introduction is followed by a section on the evolution of watershed development in India. The impact of watershed develop-ment programme on efficiency, equity and sustainability of natural resources are reviewed in Section III. The following section synthesises the lessons learnt from numerous experiences in the past. The last section outlines the issues for future research and development in watershed development.

II

BRIEF HISTORY OF WATERSHED DEVELOPMENT IN INDIA

The concept and history of watershed management in India started way back in 1880 with the Famine Commission, and then with the Royal Commission of Agriculture in 1928. Both Commissions laid the foundation for organised research in a watershed framework. After Independence, the Government supported programme started in mid-1950s, when the focus on watershed programmes was sharpened with the establishment of the Soil Conservation Research, Demonstration and Training Centres at eight locations. In a landmark decision, the Central Soil and Water

Conservation Research and Training Institute (CSWCRTI) was established by linking all the eight centres in 1956. The Centre started watershed activities in 42 locations mainly at a small-scale to understand the technical processes of soil degradation and options for that contribute to soil conservation (Samra, 1997).

The first large-scale government supported watershed programme was launched in 1962-63 to check siltation in the multi-purpose reservoirs as "Soil Conservation Works in the Catchments of River Valley Projects (RVP)". This was followed by another mega-project on 'Drought Prone Area Development Programme' (DPAP) in 1972-73. The main purpose of this project was mitigating the impact of drought in vulnerable areas. On similar lines, the 'Desert Development Programme' (DDP) was added for the development of desert areas and for drought management in the fragile, marginal and rainfed areas. These schemes were implemented in 45 catchments spread over 20 states in about 96.1 million ha area (Government of India, 2001).

Meanwhile, the CSWCRTI started demonstration of its technologies in actual village conditions at four locations from 1974 onwards (Samra, 1997). The success of these programmes was responsible for launching a scheme of propagation of water harvesting and conservation technologies in rainfed areas in 19 identified locations in the country by the Department of Agriculture and Co-operation, Ministry of Agriculture. This in turn led to the CSWCRTI and the Central Research Institute for the Dryland Agriculture (CRIDA) jointly with the state departments to take-up additional 47 Operational Research Projects (ORPs) to validate soil and water conservation technologies under different agro-ecoregions and demonstrate the benefits of watershed activities to the farming community in the rainfed and hill areas (Samra, 1997). Recognising the importance of watershed programmes, the Ministry of Rural Development also adopted the approach in 22 locations in the rainfed areas in 1984. During the 1980s, several projects assisted by bilateral donors and international funding agencies, like the World Bank, were also launched. Besides, a number of non-government organisations (NGOs) also started working for the Integrated Watershed Development Programme in different parts of the country.

In 1986-87, the National Watershed Development Project for Rainfed Areas (NWDPRA) was launched for optimising the production of important rainfed crops. The programme was launched in 99 selected watersheds to enhance crop productivity in arable rainfed areas. The severe drought of 1987 forced the Government of India to give more thrust to rainfed areas. During the Eighth Five Year Plan, an area of 4.23 million ha in about 2554 watersheds covering 350 districts in the country was treated and developed with an expenditure of Rs. 9,679 million. In the Ninth Plan, an outlay was raised to 10,200 million to treat 2.25 million ha, which was slightly more than half of the area treated in the Eighth Plan. The Ministry of Rural Development also launched a new initiative known as Watershed Areas for Rainfed Agricultural Systems Approach (WARSA), which also allowed the participation of NGOs as implementing agencies. It was subsequently decided to adopt a common approach for implementation of various programmes, which led to the formulation of the Water-

shed Development Guidelines in October 1994 drawn up by the Ministry of Rural Areas and Employment.

The Ministry of Environment and Forest also implemented a programme on watershed basis for sustainable ecosystem development in rainfed and degraded areas of the country since 1989-90. The programme was launched as the Integrated Afforestation and Eco-development Projects Scheme (IAEPS) to promote afforestation and development of degraded forests by adopting integrated watershed approach. Under the scheme, approximately 0.3 million ha land was regenerated through afforestation with an expenditure of Rs. 2,031 million up to the end of the Eighth Plan. During the Ninth Plan, an area of 0.227 million ha land was targeted for regeneration with budgetary provision of Rs. 2,470 million. The cost of watershed development under various schemes is given in Table 1.

TABLE 1. OPERATIONAL COST OF WATERSHED DEVELOPMENT UNDER VARIOUS SCHEMES IN INDIA

(Rs./ha)

Ministry (1)	Up to VII Plan (2)	1997-2000 (3)
Department of Agriculture and Cooperation	2,678.28	7,540.75
Department of Land Resources	2,978.15	3,424.81
Ministry of Environment and Forest	6,816.10	11,507.30
Average of all programmes	2,880.38	5,640.87

To integrate all watershed programmes in 100 priority districts, a Watershed Development Fund (WDF) was established in 1990-91 at the National Bank for Agriculture and Rural Development (NABARD). A total of Rs. 2,000 million, which includes Rs. 1,000 million by NABARD and a matching fund by the Ministry of Agriculture, was made available under the fund. The WDF was set-up to help the state governments to augment their watershed development programmes over and above the support they receive through budgetary resources (Sharma, 2001).

Hence, different ministries and national and international research and development organisations were involved in watershed research and development (R&D) programmes. These mainly include the Ministry of Agriculture, the Ministry of Rural Development, the Ministry of Environment and Forests, the Indian Council of Agricultural Research, International Crops Research Institute for the Semi-Arid Tropics, non-government organisations and international agencies. The priority for watershed development is also clearly reflected in the national level policy documents, namely 'Agricultural Development Policy', 'Water Policy', 'Land Policy', 'Forest Policy' and 'Watershed Development Guidelines'.

III

IMPACTS OF WATERSHED MANAGEMENT PROJECTS

The watershed programmes in the country were undertaken with multiple objectives ranging from the rehabilitation of degraded areas to conservation of the

resource base and improvement of the productivity in agriculture. In recent years, the watershed programmes have increasingly become more poverty focused. There has been a shift from assessing the impact of watershed management on the regeneration of the natural resource base, health of the environment and agricultural productivity to enhance the overall impacts on poverty and livelihood security.

Despite the long history of the watershed development programmes, there are no systematic and large-scale impact assessment studies on the performance of watershed programmes. Individual scholars, NGOs, and international agencies undertook some studies largely on a project basis. Others are conclusions derived from qualitative assessments and impressions. There is lack of proper indicators and evaluation methods to assess the tangible and non-tangible economic, social and sustainability impacts of the programmes. The Mid-Term Appraisal of the Ninth Plan of the Planning Commission articulated satisfactory and unsatisfactory performance of watershed programme on different dimensions (Government of India, 2001). On a satisfactory note, it stated that the impact was visible in increasing cropping intensity, changing cropping patterns, increasing crop productivity and augmenting underground recharge. On social aspects, the impact was noted in generating employment and increasing family incomes through diversified farming system such as livestock development, dryland horticulture and household production activities. On the other side, the Mid-Term Appraisal stated ".... the increase in agricultural production did not last for more than two years. Structures were abandoned because of lack of maintenance and there was no mechanism for looking after common lands. Projects have failed to generate sustainability because of the failure of Government agencies to involve people".

The results of other studies were also of similar nature. For example, Deshpande and Ratna Reddy (1991) concluded that: (i) location-specificity was an extremely important aspect of watershed planning, (ii) watershed treatments alter the structure of income, stabilise income flows by avoiding overt fluctuations and have positive impact on income distribution, and (iii) people's participation and scientific input were two most important components of watershed planning that enhance impacts. Similarly, Palanisami *et al.* (2002) reported that watershed programmes did not perform well in terms of controlling reservoir siltation, mitigating the impact of drought and improving/stabilising the production of crops (like pulses and oilseeds) generally grown in rainfed areas. The production of many rainfed crops fluctuates depending on the pattern and quantity of rainfall, adding that reservoirs are silting at alarming rates, and droughts are causing hardships over large areas.

Similar findings were noted by Kerr *et al.* (2000) on the impact of watershed development programmes. Contrary to rhetoric, the authors observed that few participatory watersheds were successful and the overall impact of the programme was limited. Also participatory watersheds performed better than the more technocratic, top-down counterparts, and that the programmes with a combination of people's participation and sound technical input performed best. Similar observation

was made by the Mid-Term Appraisal of the Ninth Plan, which stated that 'projects have failed to generate sustainability because of failure of government agencies to involve the people. For watershed projects to be sustainable community management systems are needed and they can succeed only with farmers contribution and their commitment of time and resources' (Government of India, 2001). Based on a qualitative assessment of the impacts of the DPAP, Hanumantha Rao (2000) noted an overall positive and significant impact of the programme.

The results from a meta-analysis comprising 310 watersheds revealed that the mean benefit-cost ratio of watershed programmes was quite modest at 2.14 (Table 2). The average internal rate of return was 22 per cent. The study further revealed that the watershed programmes generated employment opportunities, augmented irrigated area and cropping intensity and conserved soil and water resources (Joshi *et al.*, 2000). The study observed that the performance of watershed programmes was best in regions with a rainfall ranging between 650-1000 mm, jointly implemented by the state and central governments, targeted in low and medium income regions, and had effective people's participation.

Farrington *et al.* (1999) also provided an overview of the recorded impact of watershed development programmes in the country. The results indicate that successful projects have in fact reduced rainwater run-off 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. The impact of these projects on poverty alleviation and the long-term sustainability were however less clear.

The above evidence suggests that the watershed programmes successfully met the initial three principal objectives of raising income, generating employment and conserving soil and water resources. The long-term sustainability of majority of watersheds is still unsatisfactory. However, the socio-economic benefits have far reaching implications for rural poor in the poverty-ridden rainfed and marginal environment.

IV

LESSONS DRAWN FOR THE SUCCESS OF THE WATERSHED DEVELOPMENT

Historical evidence of watershed development programmes provides useful insight for future planning. There is increasing evidence on factors determining the success and sustainability of the watershed management programmes in the country. This section uses the information collated from earlier studies to draw lessons for targeting future watershed management programmes in the country. The important lessons drawn from the earlier studies are documented and listed below:

TABLE 2. SUMMARY OF BENEFITS FROM THE SAMPLE WATERSHED STUDIES

Indicator	Particulars	Unit	Number of studies	Mean	Mode	Median	Minimum	Maximum	t- value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Efficiency	B/C ratio	Ratio	128	2.14	1.70	1.81	0.82	7.06	21.25
	IRR	Per cent	40	22.04	19.00	16.90	1.68	94.00	6.54
Equity	Employment	Mandays/ha/year	39	181.50	75.00	127.00	11.00	900.00	6.74
Sustainability	Irrigated area	Per cent	97	33.56	52.00	26.00	1.37	156.03	11.77
	Cropping intensity	Per cent	115	63.51	80.00	41.00	10.00	200.00	12.65
	Rate of run-off	Per cent	36	-13.00	-33.00	-11.00	-1.30	-50.00	6.78
	Soil loss	Tonnes/ha/year	51	-0.82	-0.91	-0.88	-0.11	-0.99	39.29

Source: Joshi *et al.* 2000: derived from various case studies (bibliography is available with the authors).

Peoples' Participation

People's participation in watershed planning, implementation, monitoring, execution and management is as vital as the scientific input in deciding the technology intervention (Deshpande and Ratna Reddy, 1991). It is because the sum of individual choices has collective consequences on the management of natural resources. Insufficient participation leads to inadequate watershed management of an agricultural parcel (or piece of land), and to environmental degradation, while sufficient participation yields joint benefits in the form of reduced erosion and increased productivity (White and Runge, 1994). In community participation people act collectively and influence the outcomes. Collective action in the watershed development is necessary because many activities require co-ordination between neighbours and among members of the community (Kerr *et al.*, 2000).

It was noted that effective people's participation was achieved where smaller and homogenous groups were formed. In such cases the interests of marginalised groups were better represented. In most watershed associations that were large and heterogeneous, the interests of poor were marginalised while the interests of the affluent groups were addressed. Equity considerations were also better achieved through smaller groups. The evidence revealed that lack of people's participation was often responsible for the failure of the watershed programme. Even the Mid-Term Appraisal conducted by the Ministry of Agriculture, Government of India, revealed that projects have failed to attain sustainability because of failure of government agencies to involve the people (Government of India, 2001).

The results of meta analysis in India showed that the benefits were highest in the watersheds where people's participation was high (Joshi *et al.*, 2000). It was noted that the benefit-cost ratio was much higher (2.4) in watersheds where people's participation was high in contrast to the watersheds with low participation (1.24). Equally important is the typology of the beneficiaries coming together for sustainable management of the watershed.

It is important to understand the conditions when people participate in watershed related programmes. These are: (i) making people aware about the potential benefits of collective action in conserving and managing natural resources, (ii) including demand-driven activities in the watershed programme, (iii) empowering people in planning, implementing and managing watershed programmes, and (iv) expecting high private economic benefits.

The evidence suggests that people came together for immediate and private gains rather than the long-term and social gains. As long as the collective action yielded sufficiently higher private gains, people participated actively in watershed programmes. There are many conflicting objectives among the stakeholders in a watershed. Often there are problems of free riders. These arise because the benefits are not commensurate with the cost incurred and the labour invested in the watershed activities. Sharing of benefits in accordance to the costs will go a long way in sustaining the watershed programmes. Another complicating factor is how to benefit

the landless, the resource poor, etc. with low ability to pay for the different programmes.

Technology Targeting

Identifying appropriate target locations and technologies for watershed development are critical for the success of the watershed programme. Target locations can be identified based upon the potential benefits from different agro-ecoregions. It was noted that watersheds performed better in low-income regions having rainfall ranging between 650 and 1000 mm (Joshi *et al.*, 2000). It was also noted that the benefits (in terms of benefit-cost ratio and internal rate of return) from watershed management programmes were higher in low (<US$ 300/capita) and medium (between US$ 300 and 500/capita) income regions than in higher income areas (>US$ 500/capita). Employment generation was also higher in watersheds located in low-income regions, where the beneficiaries effectively participated with the government and/or non-government organisations in various watershed activities. In the low-income regions, the beneficiaries own substantial unemployed and under-employed family labour, which could be used to undertake labour-intensive watershed management activities. Such an approach of interfacing beneficiaries and government and/or non-government organisations has a multiplier effect on returns to investment in watershed management programmes. These results suggest that states and regions falling in low-income category should be given more emphasis.

On technology, it was noted that the regular flow of improved technologies has generally raised the farm income. Periodic updating of the technology based on market trends is also important for the sustainability of the watershed programme. The examples are quite revealing from the watersheds supervised by the research institutions. The continuous change in the production portfolio as a result of strong technology back-up from research institutions seems to have strengthened livelihood security and increased farm income.

Sharing Cost and Benefits

Individuals must derive private tangible benefits from the watershed activities. These include raising agricultural productivity, augmenting income, meeting food security and controlling land degradation (Boyd and Slaymaker, 2000). It was noted that one of the key determinants for the success of the watershed activities was that the expected private benefits must substantially exceed the expected private costs. In this context, the famous Sukhomajri watershed is unique where the benefits were distributed equally to all the villagers (Arya and Samra, 2001). In the village, the benefits generated from grasses, fodder and water were equally distributed to each household regardless of land size. In such schemes, the landless labourers and the marginal farmers sell their excess water and grass to other farmers. Under such an arrangement, every household in the watershed has the incentive to conserve grass, fodder and water.

Similarly, sharing of benefits proportional to the costs will go a long way in sustaining the watershed programmes. For example, in the watershed framework, the farmers located at the upper reaches have to invest more but gains from this action are more to farmers at middle or lower reaches (Joshi *et al.*, 1996). A necessary condition for the success is that the benefits must commensurate costs or the benefits should be more than the costs incurred by the individual household. Singh (1991) reported similar findings based on few watersheds in the country. It is therefore necessary that formal systems for sharing the benefits from collective action among the local people involved should be evolved and enforced by the people themselves and backed by legal provisions or appropriate policies (Singh, 1991).

Private Benefits vs Social Benefits

Individuals always give more importance to immediate and private gains of any action and/or efforts. Less emphasis is accorded to long-term social benefits. One of the determinants for the success of the watershed programmes is that each community action must generate high private gains. It was noted that tangible benefits from investment on common and private lands induced the community to actively participate for the sustainability of the watershed project. The studies showed that households were not much concerned if soil degradation is prevented or not. Their interest was how they maximise their production and income. It is therefore necessary that appropriate arrangements be made to convert as much of collective benefits into tangible private benefits. This can be done through developing need-based institutional arrangements, which assess the needs of the stakeholders in the watershed and accordingly plan distribution of benefits.

Property Rights (Water vs. Land)

Property rights and collective action institutions fundamentally shape the outcomes of resource governance (Knox and Meinzen-Dick, 2001). Rights to land and water are important incentives for the household to undertake private soil and water conservation investments. When rights are properly defined and secured, there is an incentive to invest on fixed assets and optimally allocate these for enhancing input productivity and augmenting income. Appropriate institutional arrangements are required for strengthening property rights.

Sukhomajri watershed is an ideal model of property right, where the rights on water, fuel and fodder were accorded to each household in the village irrespective of land ownership (Arya and Samra, 2001). Each household was allocated equal rights on water, fuel and fodder. Even the landless labour was enjoying such rights. Such arrangements provide incentive to every household (including landless labour) to conserve and judiciously use natural resources. Another example was observed in ICAR watershed (Fakot) on fuel and fodder (Dhyani *et al.*, 1997). In both the cases, the number of goats declined to avoid grazing, and number of cows and buffaloes increased. On the other hand, in the absence of appropriate property rights in majority

of the watersheds, the grazing could not be controlled in the forest lands. It is therefore important that the interest of all households in the watershed is protected, and equal rights of regenerated natural resources is accorded to them.

Access to Knowledge

Regular flow of information about improved technologies and markets is the key to the success of watershed programmes. The experiences from the ICRISAT's on-farm watersheds in Madhya Pradesh, Maharashtra and Andhra Pradesh during 1980s revealed that there is a need for strong co-operation between various stakeholders (researchers, administrators, extension workers and bankers) to enhance farmers' participation and to realise the potential benefits of watershed based technologies in SAT regions (Kshirsagar and Ghodake, 1991). Recently, a strong information and communication technology (ICT) has been provided by ICRISAT through launching a 'Virtual University for Semi Arid Tropics'. This provides information on a wide range of issues related to rainfall, crop planning, improved technology and their availability, market and price trends, etc. The farmers located in any watershed can access the decision support tools.

Sukhomajiri watershed is also a classical example of lack of information that adversely affected the sustainability of the watershed in the recent times. The village community was ignorant on what was happening in the industry where they were supplying raw material (i.e., grass) for paper manufacturing. The paper industry changed the technology from grass-based to eucalyptus-based, that threatened the disposal of grasses, which was the main source of income in the watershed. If the villagers in the watershed had the information that the industry was switching-over to more efficient technology, they could also have started cultivating eucalyptus for the industry.

Market Opportunities

Access to both input and output markets is one of the most important conditions for the success of the watershed activities. This enables the beneficiaries to buy inputs and sell their produce at reasonable prices. Improved access to markets often induces farmers to diversify agriculture in favour of high-value commodities. In this context, the example of Fakot watershed is worth mentioning (Dhyani *et al.*, 1997). It demonstrated a perfect blending of water and market availability for the local produce that has completely transformed the women-dominated subsistence coarse cereal-based agriculture into a commercial and export oriented enterprise. Another example is of Sukhomajri watershed, where market access for grasses in the paper industry generated enormous profit that encouraged households to make every effort to conserve the grass in the upstream areas of the watershed. As mentioned earlier, the marketing of grasses has become a serious problem when the paper industry has changed the technology from grass-based to eucalyptus-based system. It has adversely affected the repair and maintenance of the Sukhomajri reservoir and

surrounding watersheds. Lack of appropriate prices and markets has threatened the sustainability of the watershed. Often in the watershed programmes, conservation and production are given considerable importance. Access to markets is taken for granted. Invariably, conservation, production and markets are not linked perfectly in watershed programmes. There is a need to integrate production with the market for the success of the watershed programmes. It is observed that availability of water, marketable products and markets bring the households together for collective action in the watershed area. Boyd and Slaymaker (2000) have advocated a similar point and suggested that policy must provide market access and attractive producer prices as an important condition for the success of soil and water conservation programmes in Burkina Faso. The authors further stated that market access explained the difference in adoption rates between the sites in Burkina Faso. In Uganda, the collapse of markets for cash crops and general reduction in commercialisation activity proved a major constraint to investment in agriculture and consequently soil and water conservation programme (Boyd and Slaymaker, 2000).

Strengthening Forward and Backward Linkages

A watershed programme is not a panacea for rainfed areas. Watershed activities alone cannot meet the objectives of augmenting production, increasing income and conserving natural resources. The success lies on how strong backward (input-delivery system) and forward (post-harvest system) linkages have been established. The backward linkages include credit delivery system, seed sector, labour markets, technology transfer mechanisms and other input delivery systems. The forward linkages include access to output markets, transport facility, agro-processing, etc. In some of the watersheds, a strong linkage of watershed programmes with various institutions yielded the desired outputs. The self-help groups, user groups and NGOs indeed strengthen backward and forward linkages.

Governance Issues

Governance issues are very critical in planning, implementing and monitoring watershed activities. The governance may be effective if all watershed programmes come under one umbrella to avoid duplication and erosion of resources. Hanumantha Rao (2000) suggested that watershed programmes should be integrated with agricultural development programmes. It would be appropriate if all the watershed activities are consolidated under single ministry. All watershed programmes, afforestation, soil and water conservation activities, should be addressed by the single ministry for effective planning, monitoring and evaluation.

Within the watershed area, village politics, group politics, conflict between different actors in implementing and managing watershed, seriously affect the efficiency and sustainability of watershed investment. Boyd and Slaymaker (2000) reported that party politics could potentially undermine village unity and adversely affect the watershed management programmes.

Other issues include appropriate coordination between different agencies, and improving the knowledge, capacity and skill of the community in planning, managing and developing watershed programmes. Singh *et al.* (1991) quoted one of the important reasons for poor performance of the Kandi Watershed Programme in Punjab was the lack of sufficient integration and cohesiveness between the line departments. It showed that the project had an excellent theoretical organisational structure but lacked in execution that led to substantial shortfall in the economic rate of returns (8 per cent) from the expected of 12 to 20 per cent for various components. Similar results are reported from several watershed projects. There is a need to develop a strong co-operation among different line-departments for the success of the watershed programmes.

Equally important is the local leadership, which plays an important role in enlisting people's participation in watershed development programmes. The evidence is glaring from the number of watershed studies that strong leadership motivated people to participate in the project activities. The need for developing local leadership is emphasised owing to the mutually conflicting interest of different groups consisting rural society (Hanumantha Rao, 2000). There is a need to identify potential leaders from the target areas and provide them adequate capacity building programme in leadership.

Capacity Building

Capacity building for watershed development through training encompasses wide-ranging tasks such as awareness building or imparting resource-literacy, development of technical skills, and reorienting motivations and attitudes of officials and political functionaries at all levels towards the need for empowering the people through decentralisation (Hanumantha Rao, 2000). The new guidelines emphasised this issue (Government of India, 2000). The need for training has been emphasised at different levels in hierarchy in the government and in the Project Implementing Agency, NGOs, Self-Help Groups, watershed committees, village volunteers and villagers. The new guidelines has also developed the criteria for selecting training institutions.

The role of government should be confined to provide financial and capacity building, basic infrastructure and enabling legal and political environment conducive to people's participation in watershed development programmes (Singh, 1991). It is important to delineate the roles and responsibilities of the government, NGOs, and local communities in watershed management activities. Institutions should be developed for capacity building. The mandate of already existing institutions should be tuned to meet the needs of rainfed areas. More pro-active role in capacity building would develop better co-ordination between departments and communities.

Political Will and Flow of Resources

Equally important in managing watershed programmes are related with political will, support and commitment to the watershed programme. Regular flow of resources and funds is critical for the success of the watershed programme. It was noted that in most of the government supported watersheds funds did not flow in time that reverted the process of watershed development. At present there is strong political will at the national level and many states (e.g., Andhra Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Uttaranchal) are following the same. Effective planning, regular monitoring and evaluation are part of strong political will. In addition to a strong political will, good governance is very crucial. It is noted that a bureaucratic approach in the implementation of the watershed programmes will jeopardise the basic objectives of participatory watershed management. There is a need for a flexible approach that takes into consideration local conditions and provides for locally adapted implementation strategies that are more successful in meeting the objectives of watershed management. Similarly, the roles of external institutions and organisations as stakeholders need to be well defined. External linkages with research institutions, credit institutions, markets, and government departments are necessary for sustainability of interventions.

V

ISSUES FOR FUTURE RESEARCH

It is clear that concerted efforts have been made in the past to make watershed programme an important source of growth in the rainfed areas. Yet, there are number of gaps in the existing framework that do not allow to reap the potential benefits of investment on watershed development. Few important gaps have been documented from the earlier studies, which need to be addressed through appropriate targeting of research in multiple areas (viz., policy, institutional arrangements and technology generation and dissemination).

Policy Research

The policy environment is favourable for watershed development to usher green revolution in the rainfed areas. The following issues need attention to revitalise policies for watershed development:

- Develop suitable methods to assess the impact of watershed development on poverty alleviation, employment generation, livelihood patterns and conservation of soil and water resources in the rainfed areas. In this context, two aspects are important: (i) develop suitable impact-assessment methodologies using knowledge-based techniques (e.g., remote sensing, bio-economic modeling and GIS); and (ii) decision support system mainly at meso-level including multiple watersheds to assess the impact of different approaches and policies and to prioritise future investments.

- Formulate investment strategies for watershed development. There is a need to prioritise regions for watershed development. Delineate water-scarce and poverty-ridden areas that require government support. At present the programme is often launched based on physical conditions and characteristics. Ex-ante assessment of suitable approaches, technologies, etc., for specific locations using simulation modeling will be useful in this regard.
- Evolve policy options that ensure equitable sharing of watershed management benefits across sections of watershed community (including the landless) and for allocating water and sharing costs and benefits among upstream and downstream communities to mitigate the classic problem of externalities.
- Develop policies for introducing high-value commodities and marketing strategy in the watershed areas to enhance productivity of water and other resources. Consumption pattern of the consumers is rapidly changing in favor of dairy products, fruits, vegetables, poultry, meat, etc. Rainfed areas could quickly harness such diversification opportunities provided the production is adequately integrated with markets and agro-processing industries.

Institutional Research

Considerable emphasis has been accorded in the past to develop effective institutions for the success of the watershed concept in the rainfed areas. More research is needed to evolve innovative institutions for long-term sustainability of the watershed activities. Some of the issues on institutional reform in the context of watershed are listed below:

- Develop more effective and transparent institutional framework for enhancing people's participation. Such an arrangement is necessary to overcome the conflicting objectives, free riders' problem, and sharing costs and benefits.
- Institutionalise mechanisms for strengthening partnership between the government, private sector, non-governmental agencies, research institutions, and clearly defining their roles and responsibilities to achieve convergence and efficiency.
- Promote innovative institutions (for example, contract farming or co-operatives) to strengthen production and marketing in the watershed areas. The private sector is gradually coming up for contract farming for numerous commodities. There is a need to attract the private sector to function in the watershed areas.
- Devise innovative methods for speedy and reliable flow of information (specially technology and markets) to optimise the benefits of watershed development. Develop methods to upscale the 'Virtual University for SAT' to disseminate information by making use of ICT on latest technologies, markets, prices, etc.

Technology-Related Research

Technology is vital for the success of the watershed programme. A continuous flow of improved demand-driven technologies would transform the subsistence, low-yielding watersheds into commercial and remunerative ones. This requires developing targeted and location-specific technologies to meet the needs of small farmers based on their resource endowments. Conservation technologies become attractive to the farmers when complemented with productivity enhancing options (e.g., fertiliser use, new seeds, irrigation, etc.).

VI

CONCLUSIONS

The watershed research and development programme in the country has a long history. It is still in the process of evolution. Several Expert Committees were constituted to seek recommendations for making watershed programme a success. The seriousness of the Government's efforts is reflected in the fact that the recommendations and suggestions of all the Expert Committees were accepted and implemented in right earnest. The programme was shaped on time to meet the specific objectives in the rainfed areas with more emphasis on involving community in planning and management of watershed. Given the strengths of new policies and guidelines, it appears that the problems were largely in implementing and monitoring the programme. The challenges are more complex considering the resource endowments of the farmers in fragile and marginal rainfed areas. With some exceptions, it was observed that most of the government-managed watersheds performed poorly, while those managed by research institutions and few reputed NGOs were quite successful. It is mainly because government machinery is tuned mainly for construction and making structures not in mobilising people, disseminating improved technologies and integrating production with markets. This calls for a consortium approach of watershed development, which capitalises the synergies of government machinery, research organisations and NGOs.

One of the most important determinants that have been emphatically and repeatedly pointed out is people's participation in planning, implementing, and managing watershed activities. It is, therefore, essential to overcome the conflicting objectives and share benefits and cost, evenly in the heterogeneous rural settings. It is necessary for equitable access to the conserved water and other economic goods and services generating tangible benefits to the poor. Equity, in sharing the benefits is a vital consideration for effective community participation (collective action). The studies further revealed that the success of the watershed depends on an integrated approach where technologies, market integrations, people's participation are perfectly blended. The long-term sustainability of the watershed programme will rely on how market opportunities are integrated with the watershed development activities.

REFERENCES

Arya, S.L. and J.S., Samra (2001), *Revisiting Watershed Management Institutions in Haryana Shivaliks, India,* Research Centre, Central Soil and Water Conservation Research and Training Institute, Chandigarh.

Boyd, C. and T. Slaymaker (2000), "Re-examining the 'More People Less Erosion' Hypothesis: Special Case or Wider Trend?" *Natural Resource Perspective*, Number 63, November, Overseas Development Institute, London, U.K.

Chopra, K.; G. Kadekodi and M.N. Murthy (1990), *Participatory Development: People and Common Property Resources*, Sage Publications India Pvt. Ltd., New Delhi.

Deshpande, R.S. and V. Ratna Reddy (1991), "Differential Impact of Watershed Based Technology: Some Analytical Issues", *Indian Journal of Agricultural Economics,* Vol. 46, No. 3, July-September, pp. 261-269.

Deshpande, R.S. and G. Thimmaiah (1999), "Watershed Development Approach and Experience of National Watershed Development Programme in the Country", *Journal of Rural Development,* Vol. 18, No. 3, pp. 453-469.

Dhyani, B.L.; J.S. Samra, G.P. Juyal, Ram Babu, and V.S. Katiyar (1997), *Socioeconomic Analysis of Participatory Integrated Watershed Management in Garhwal Himalaya: Fakot Watershed,* Central Soil and Water Conservation Research and Training Institute, Dehradun.

Farrington, J. and C. Lobo (1997), "Scaling Up Participatory Watershed Development in India: Lessons from the Indo-German Watershed Development Programme", *Natural Resource Perspective*, Number 17, February, Overseas Development Institute, London, U.K.

Farrington, J.; C. Tutton and A.L. James (1999), *Participatory Watershed Development: Challenges for the Twenty-First Century*, Oxford University Press, New Delhi.

Government of India (2000), *WARASA-Jan SAHBHAGITA: Guidelines For National Watershed Development Project for Rainfed Areas,* Department of Agriculture and Co-operation, Ministry of Agriculture, New Delhi.

Government of India (2001), *Mid-Term Appraisal of Ninth Five Year Plan,* Planning Commission, New Delhi.

Joshi, P.K.; S.P. Wani, V.K. Chopde and J. Foster (1996), "Farmers' Perception of Land Degradation: A Case Study", *Economic and Political Weekly,* Vol. 31, No. 26, June 29, pp. A-89-A-92.

Joshi, P.K.; L. Tewari, A.K. Jha and R.L. Shiyani (2000), *Meta Analysis To Assess Impact of Watershed,* Paper presented at the Workshop on Institutions for Greater Impact of Technologies, National Centre for Agricultural Economics and Policy Research, New Delhi.

Joshi, P.K.; V. Pangare, B. Shiferaw, S.P. Wani, J. Bouma and C. Scott (2004), *Socioeconomic and Policy Research on Watershed Management in India: Synthesis of Past Experiences and Needs for Future Research,* Global Theme on Agroecosystems Report No. 7, International Crops Research Institute for the Semi-Arid Tropics, Patancheru, Andhra Pradesh.

Kerr, J.; G. Pangare, V. Pangare and P.J. George (2000), *An Evaluation of Dryland Watershed Development in India,* EPTD Discussion Paper 68, International Food Policy Research Institute, Washington, D.C., U.S.A.

Knox, A. and R. Meinzen-Dick (2001), *Collective Action, Property Rights, and Development of Natural Resource Management: Exchange of Knowledge and Implications for Policy,* CAPRI Working Paper No. 11, CGIAR Systemwide Programme on Property Rights and Collective Action, International Food Policy Research Institute, Washington, D.C., U.S.A.

Kshirsagar, K.G. and R.D. Ghodake (1991), "Watershed Based Technology: Experiences and Lessons", *Indian Journal of Agricultural Economics,* Vol. 46, No. 3, July-September, pp. 272-277.

Marothia, D.K. (1997), "Agricultural Technology and Environmental Quality: An Institutional Perspective", *Indian Journal of Agricultural Economics,* Vol. 52, No. 3, July-September, pp. 473-487.

Palanisami, K.; D. Suresh Kumar and B. Chandrasekaran (2002), *Watershed Management: Issues and Policies for 21st Century,* Associated Publishing Company, New Delhi.

Rao, Hanumantha C.H. (2000), "Watershed Development in India: Recent Experience and Emerging Issues, *Economic and Political Weekly,* Vol. 35, No. 45, November 4, pp. 3943-3947.

Reddy, V. Ratna (2000), "Sustainable Watershed Management: Institutional Approach", *Economic and Political Weekly,* Vol. 35, No. 38, September 16, pp. 3435-3444.

Samra, J.S. (1997), *Status of Research on Watershed Management,* Central Soil and Water Conservation Research and Training Institute, Dehradun.

Sharma, R. (2001), "Foreward", in M.M. Joshi, S.K. Dalal and C.K. Haridas (Eds.) (2001), *Watershed at Work,* Department of Agriculture and Co-operation, Ministry of Agriculture, Government of India, New Delhi.

Singh, A.J.; A.S. Joshi, R.P. Singh and R. Gupta (1991), "An Economic Appraisal of Kandi Watershed and Area Development Project in Punjab", *Indian Journal of Agricultural Economics,* Vol. 46, No. 3, July-September, pp. 287-293.

Singh, K. (1991), "Determinants of People's Participation in Watershed Development and Management: An Exploratory Case Study", *Indian Journal of Agricultural Economics*, Vol. 46, No. 3, July-September, pp. 278-286.

White, T.A. and C.F. Runge (1994), "Common Property and Collective Action: Lessons from Cooperative Watershed Management in Haiti", *Economic Development and Cultural Change,* Vol. 43, No.1, October, pp. 1-41.