

Community Watershed as Growth Engine for Development of Dryland Areas

Executive Summary

A Comprehensive Assessment of Watershed Programs in India



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**Suhas P Wani, PK Joshi, KV Raju, TK Sreedevi, Michael J Wilson
Amita Shah, PG Diwakar, K Palanisami, S Marimuthu,
YS Ramakrishna, SS Meenakshi Sundaram and Marcella D'Souza**



INTERNATIONAL CROPS RESEARCH INSTITUTE FOR THE SEMI-ARID TROPICS

Science with a human face

Patancheru 502 324, Andhra Pradesh, India



Ministry of Agriculture and Ministry of Rural Development

Government of India, New Delhi, India

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Foreword

The world is facing multiple and complex challenges that are threatening social and political institutions. Current global food stocks are at their lowest in the last two decades. Food prices have skyrocketed. Countries such as Vietnam, Thailand, India and China have banned rice exports to ensure domestic availability at decent prices. Meeting the Millennium Development Goal of halving the proportion of people who suffer from hunger by 2015 is becoming a daunting challenge for planners. Water scarcity too is staring us in the face. A recent global assessment of Water for Food and Water for Life indicates that the goal of food security can be met with the available water resources only with drastic and urgent changes in the way we produce food worldwide, more so in the developing arid, semi-arid, sub-humid and humid tropics.

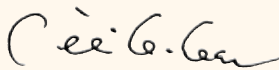
There is an urgent need to harness the vast untapped potential of rainfed agriculture in Asia and Africa by substantially boosting financial and technical investments on it. In India, 65% of the 142 million hectares of arable area is rainfed with very low productivity (1 to 1.5 t ha⁻¹), largely due to low rainwater use efficiency (35-45%) for crop production. Current yield levels in rainfed farmers' fields are far below achievable yields, requiring technologies, institutions and policies to bridge the yield gap.

The last two decades have seen the Government of India adopting a watershed management approach. During the 11th Five Year Plan, the Government of India decided to increase its investments in rainfed areas. To date, watershed programs in India have had impacts such as increased water availability, reduced soil erosion, increased cropping intensity, more rural employment and increased crop productivity and incomes. However, these benefits have been largely confined to a few successful watershed programs.

In fact, almost two-thirds of the watershed programs performed below average, as indicated by a meta-analysis jointly undertaken by ICRISAT and ICAR. Two nodal ministries of the Government of India implementing watershed programs, namely the Ministry of Agriculture and Cooperation and the Ministry of Rural Development, jointly sponsored a Comprehensive Assessment (CA) of their impacts. ICRISAT in partnership with ICAR institutions, state agricultural universities, a number of state Government departments and non-government organizations, undertook the assessment during the last two years, and concluded that community watershed programs could serve as growth engines for the development of rainfed areas with prospects of doubling productivity.

The 11th Five Year Plan provides an opportunity to build on the past achievements in watershed work by seeking to address issues of production, environment, poverty and resilience within the watershed context. At the same time, it recognizes that the approach is applicable to all rainfed regions, with specific technical and social interventions tailored to suit different rainfall regions. Hence a paradigm shift is called for in approaching watershed development not just as another scheme but as a *sine qua non* for rainfed areas.

This comprehensive publication, which is a must read for policy makers, development investors, researchers and development workers, highlights the recommendations of the CA for developing watersheds as a business model and not merely as a soil and water conservation structure, paving the way for inclusive and sustainable growth of dryland areas worldwide.



William D Dar
Director General
ICRISAT



Mangala Rai
Secretary, DARE and
Director General, ICAR

Team for the Comprehensive Assessment of Watershed Programs in India

Contributory Authors

AK Jha, GP Juyal, Ravindra Singh, Piara Singh, P Pathak, Crispino Lobo, RC Sachan, Kiran P Raverkar, FA Shaheen, Sachin Sinha, K Tirupataiah, A Santhi Kumari, Sandeep Dave, Subhash Chandra, HN Singh, Abraham Samuel, J Joy, Suhas Paranjape, Ruchi Srivastava, Sachin Oza, Viren Lobo, Suwendu Rout, Madhushree Sekhar, Abdul Aziz, TK Bhati, Suresh Kumar and KL Sahrawat

Supporting Authors

Ram Chandradu, Dharmishta Chowhan, Jyotsna Sitling, JS Samra, Prabhat Kumar, Shailendra Tewari, Prem Narain, Chaya Datar, AVR Kesava Rao, Ch Srinivasa Rao, Kanchan Chopra, Saroj Mahapatra, David Redcliffe, Michel Gluek, NK Sanghi, DK Marothia, KV Rao, MD Osman, Srinath Dixit, VN Sharada, B Venkateswarlu, PK Mishra, AV Padmanabhan, G Subba Reddy, GR Korwar, MA Shankar, A Subba Rao, KPR Vittal, GV Ranga Rao, Suresh Pande, OP Rupela, S Desai, Peter Bezkorowajnyj, LK Teweari, B Rath, AK Mishra, Deep Joshi, SP Tucker, R Parthasarathy, S Nedumaran, Rosana P Mula, RL Shiyani, RS Dwivedi, Tushar Shah, KN Reddy, RS Deshpande, Anupam Das, PV Veera Raju, A Ravindra, TS Vamsidhar Reddy, V Venkatesan, Renu S Parmar, Shankar Rao, Suresh Pal, Rakesh Behari, GV Reddy, Ravishankar Kumar, Prabhjot Sodhi, Pradeep Bhargava, HL Prajapati, Radha Singh, Nitin Kumar Yadav, RP Mathur, PP Kumbhare, DS Kushawaha, Kuhu Chatterjee, Prema Gera, Dinesh Reddy, Harbir Singh, Dinesh K Marothia, KR Dhandapani, KK Datta, J Bhattacharjee, Bharat R Sharma, Bharat R Kakade, BC Barah, Bhabani Prasad Das, KS Ramesh, AK Sikka, Bharathi, S Sihag

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Executive Summary

This Executive Summary is to provide policy makers with a brief, non technical, action-oriented synthesis of the comprehensive assessment and of the options it presents. Our aims are to be clear, succinct, comprehensive yet comprehensible, to point what is good in current watershed practice and what could be built upon in order to add value. The foregoing recommendations are rigorous and self explicit and will not be repeated in what follows.

The Importance of Rain-fed Agriculture and Watershed Management in the Realization of Government's Goals

The Government of India has before it a wealth of reviews and reports concerning agriculture in general and rain-fed agriculture and water in particular. The report of the Technical Commission on Watershed Programs in India argues for greater emphasis on a reformed watershed program in the rain-fed parts of Indian agriculture - a program which would be 'location specific' and which offers the greatest potential for productivity increases, to help meet food security in 2020 and alleviate poverty. The reports of the National Commission on Farmers talk in similar vein about the importance of the rain-fed areas. The Comprehensive Assessment of Water Management in Agriculture highlights the need for urgent action in improving water management and the opportunity in this for 'low yield farmers' to raise their yields to 80% just as what 'high yield farmers' obtain, with the greatest potential increase in yields being in rain-fed areas.

Certainly, governments' policy makers have a number of hoops to jump through to attain various goals: the millennium development goal (it is especially important for India to achieve these goals on a global scale); the production goal of four per cent annual growth in agricultural output if food self-sufficiency is to be maintained; environmental goal, including a mandate to reduce the amount of wasteland; and a goal to address rural poverty.

The various other reports and the comprehensive assessment (CA) of watersheds contend that effective watershed management of rain-fed areas can simultaneously address all these goals and address them in a fashion which builds resilience in the social structure as well as in the natural resource base such that future economic changes or of climate can be better met.

Current 11th Five Year Plan recognizes the 'rain-fed cum watershed' theme. This report may help with guidance to operationalise the theme for the

11th Five Year Plan, providing an opportunity to build on what has already been achieved in watershed work and giving a momentum by consciously seeking to address these different goals: production, environmental, poverty and resilience within the watershed context, while recognizing that the approach is applicable to all rain-fed regions though the specific technical and social interventions are different in areas of different rainfall and that a paradigm shift in thinking is needed, to approach watershed development not just as another scheme but as a *sine qua none* for the rain-fed areas.

This would seem a perfectly feasible policy to run parallel to that of focusing in irrigated areas like the Gangetic Plain on the better utilization of groundwater. In the rain-fed areas as in the Gangetic Plain, soil and water conservation and technology alone cannot achieve the desired result, a complete integrated package is needed for natural resource management, social upliftment and connection to markets and infrastructure. The watershed approach is not a new fad, its tenets have been tried and tested and its weak points identified.

Watershed Programs in India and Evolution of the Concept

The importance of watersheds to Government of India is witnessed by the resources being invested and the constant interest in improvement. Government has spent US\$ six billion on watershed programs through the ministries of Agriculture, Rural Development and Environment and Forests. The expenditure was augmented due to the efforts of various research and donor agencies and some non-governmental organizations (NGOs). Current intentions are to invest Rs 360 billion over the next five years on 38 m ha/watersheds. The start of the 11th Five Year Plan provides an excellent opportunity to augment the program and greatly enhance its impacts.

The watershed concept was introduced in the late 1950s as an approach for increasing the productivity of rain-fed areas by the physical management of soil, water and forest in its natural context - from a ridge to a watercourse. Research into watersheds started in the '70s, there was increasing donor and NGO experimentations in the 1980s and the involvement of major donors and national institutions in the late 90's. The new millennium saw the start of involvement by private sector too.

In common with general rural development theory and practice, the watershed approach has evolved. At first there was single discipline interventions of specific aim – primarily starting with soil and water conservation and moving to more food from higher yielding crop varieties. This concern broadened

to embrace the cropping system and then the farming system of crops, grazing, forest and income generating enterprises. From the mid 90's came a greater consideration of the people of the watershed and their livelihoods, especially the poor, and the realisation that the land and water focused activities of watershed program excluded significant numbers of landless and thus emerged a requirement to do more about equity, women, the poor and non-land based income generation activities. Now best practice embraces the total environment of the watershed and the livelihoods of all the people within it.

The government has moved the watershed agenda forward in various ways: with constitutional amendment to put more responsibility for rural development in the hands of panchayati raj departments; by refining watershed guidelines as lessons have been absorbed; by converging the drought prone area, rural employment guarantee and watershed programs around unified watershed guidelines; and most recently by unifying the guidelines and establishing a National Rain-fed Area Authority (NRAA). Further, the Planning Commission has taken cognisance of the recommendations of various task force groups. There are studies of public-private sector partnerships in watershed execution. The Government of Andhra Pradesh (AP), which accounts for 40% of the national total of watersheds being implemented, has adjusted watershed budgetary allocations so that 27% goes to women; and the Government of Madhya Pradesh (MP) appointed NGOs as watershed implementing agencies throughout the State. Since 2003, several countries have approached India for assistance in piloting watershed work.

The Common Features of the Watershed Development Model

Government agencies, development thinkers, donors, researchers and NGOs have gradually learnt one from another, (though some are ahead of the field and others deficient in some aspect or other, principally in people participation or in the science.) But generally nowadays the better models have some or all of the following features in common:

- participation of villagers as individuals, as groups or as a whole, increasing their confidence, enabling their empowerment and their ability to plan for the future and thereby enhancing their self determination
- capturing the power of group action in the village, between villages and from federations, e.g. capturing economies of scale by collective marketing
- the construction of basic infrastructure with contributions in cash or labour from the community

- better farming techniques, notably the improved management of soil, water, diversifying the farming system and integrating the joint management of communal areas and forest
- the involvement of the landless, often in providing services
- arrangements for the provision of basic services and infrastructure
- the establishment of village institutions and links with the outside world
- improved relationships between men and women
- employment and income generation by enterprise generation in predominantly but not exclusively agricultural-related activities.

And sometimes:

- the fusion of research and development (R&D) by capturing the extraordinary power of participatory technology development, including variety selection and breeding with direct links to germplasm collections
- complete avoidance of corruption so that trust is engendered and all the benefits pass to the community
- involvement with enforced migration.

Recent Additions to the Watershed Model

- The pragmatic use of scientific knowledge as the entry point rather than money, leading to tangible economic benefits from low-cost interventions that generate rapid and substantial returns at an acceptable low level of risk. Among these are novel interventions focusing on seeds of improved cultivars, integrated pest management, micro-nutrients, and soil conservation and water table recharge structures.
- A broad-based approach to income generation, involving private sector associated with scientific advances and markets. For instance, in the remediation of micro-nutrients deficiencies; in the marketing of medicinal and aromatic plants; with premium payments paid by industrial processors for aflatoxin-free maize and groundnut; with high sugar sorghum, and selected crops such as jatropha and pongamia sold to industry for ethanol and bio-diesel production; the production for sale of commercial seed, hybrid varieties and bio-pesticides.
- Using new science methodologies to improve performance like remote sensing for monitoring and feed-back to farmers, yield gap analysis, rapid assessment of the fertility status of the watershed.

- Building productive partnerships and alliances in a consortium for research and technical backstopping, with the members brought together from the planning stage.
- A concern to create resilience in the watershed and its community to climate change and to events post program intervention.

Where best applied, the model has led to profound farming system changes, improved food self sufficiency, expanded employment and commerce and enhanced incomes. Where indifferently executed the approach has led, as we shall see in what follows. There is indeed something here analogous to the 'yield gap' exhibited between research station and farmers' yields. Much of the difference can be captured by implementing agencies 'catching up' with best practice. The more recent linking of natural resource science with the private sector, markets and with people's broader livelihoods in consultation with them, is transforming the dynamic and success rate of development efforts.

The Comprehensive Assessment Objectives and Methods

This comprehensive assessment reflects the importance of watersheds to government and was commissioned jointly by the Ministries of Rural Development and Agriculture in order to assess the impact of the various watershed programs, identify the drivers of success and make suggestions for policy, institutional and technical change to improve performance. The context is of using the watershed approach to help achieve government's goals in agricultural productivity increase, poverty reduction, and environmental improvements. To these we have added a fourth assessment consideration - of using watersheds to generate social and eco-system resilience to future change and shock.

The assessment has comprised:

- inventory and review of existing evidence
- macro and micro level studies
- case studies - issues, methods and practices
- the use of new science tools.

Broad Overall Conclusions about Watershed Performance and Impact

The importance of rain-fed agriculture to India has been underscored by a multiplicity of recent studies. The watershed approach is a paradigm that works in all rain-fed circumstances, has delivered important benefits and impacts and needs to be implemented on a large scale. But watershed impact covers a spectrum from 'no better than *ad hoc* development schemes' to impressive improvements of the natural resource endowment and of agricultural production, and a transformation of the socio-economy.

The difference in result between indifferent and best watershed practice is analogous to the 'yield gap' in crop production. In part, this is because the watershed approach has been rapidly evolving and the assessment has been looking at a field in which the goal posts have repeatedly been moved. In part, it is also due to deficiencies in execution.

To consolidate and build upon the foundation already laid and universally gain the impact that is possible, requires government to do some difficult things, most noticeably introducing a new 'mindset' or different form of approach that accepts:

- watershed development is not just a means to increase production or to conserve soil and water but an opportunity for the fully integrated and sustained development of human and natural resources
- the approach is valid across various rainfall regimes over vast tracts of India and can contribute in large measure to the simultaneous achievement of government's production, environmental and social goals
- sustainability and better social impact and equity are very important issues with pro-poor interventions not as a spin-off or after-thought but planned and integral to the whole
- there are vast opportunities to reduce costs and increase output by improving the appropriateness and reach of technology
- there is an obvious value in converging government schemes in the interest of impact and sustainability, rather than a spread of activity. This is particularly important in the case of water and of schemes aimed to reach the poor.

Watersheds should be seen as a business model. This calls for a shift in approach from subsidised activities to knowledge-based entry points and from subsistence to gaining tangible economic benefits for the population of the watershed at large. This is being done with productivity enhancement, diversification to high-value enterprises, income-generating activities, market links, public-

private partnerships, micro-entrepreneurship and a broad-based community involvement.

Moving forward requires that a lack of capacity to effectively implement programs is addressed.

Implementing agencies need to expand and broaden their capacities and skills and reach; while communities need to strengthen their institutions and their skills. This will require a longer implementation period of seven to eight years with more time spent in preparation and in post intervention support. It also requires additional funds and more flexibility in using budgets and the engagement of specialist service providers.

One of the weakest aspects lies in the generation and dissemination of technology. A big improvement is needed in making appropriate technology and information accessible to the watershed community. The remedy lies in devising technology for the drier and wetter parts of the rain-fed area, more participatory development and research and in forming consortia, and employing agencies to provide specialist technical backstopping.

There is a crucial need to improve monitoring and evaluation (M&E) and the feedback of the information obtained to constantly improve performance. Only a few key indicators need to be monitored in all watersheds. At one or two representative watersheds in each district, a broad range of technical and socio-economic parameters should be measured to provide a scientific benchmark and a better economic valuation of impact than is currently possible.

Main Findings of the Meta Analysis

First a word about the statistical veracity of the conclusions reached by the comprehensive assessment. Outside of research watersheds, the assessment faced a lack of baseline data. Further, because of the evolution of the watershed approach, there is little uniformity in objectives and approach, and in what others have measured. Many findings are qualitative or subjective rather than quantitative or objective. Extraneous activity in watersheds poses the difficult problem of attribution. All this leads to statistical imperfections. Nevertheless, there are many watersheds and many studies and we have sufficient confidence in the findings to make our recommendations. However, perhaps the statistical 'credibility index' is less than optimum.

The assessment has shown a benefit to cost ratio of 2.01 and internal rate of return of 21.43% with rural incomes enhanced by 58%, agricultural productivity increased by 35% and additional environmental and social benefits. There is

vast scope to improve upon these figures since only 35% of watersheds are performing above average while 65% of watersheds are below the average.

Macro watersheds (>1,200 ha) achieved better impact than micros of 500 ha. Development needs to be undertaken in clusters of at least four to six micro-watersheds together (2000-3000 ha) and the new guidelines might be useful to propose this. Macro units offer economies of scale, more technical options and greater hydrological efficiency and, would ease collaboration between agencies and their interface with the community.

Between 700 mm and 1,100 mm of rainfall, there is good technology available. Above and below this, the appropriateness and range of current technology is not good enough and needs to be researched in concert with watershed communities. The 11th Five Year Plan could direct that this is attended to.

The drivers of success are: tangible economic benefits; empowerment through knowledge; equal partnership, trust and shared vision; good local leadership; transparency and social vigilance in financial dealings; equity through low-cost structures; pre-disposition to work collectively; activities targeted at the poor and women; increased drinking water availability; income-generating activities for women.

The current allocations are insufficient to 'treat' a complete watershed or to adopt the livelihood approach. To make watersheds engines of growth need at least Rs. 20,000 per ha. However, some of the additional funds required can be raised in cash or kind by the community; or come from leveraging private sector money or from cost savings. More timely release of funds and creating sufficient flexibility so that money can be vired between tasks would also help.

There is opportunity to reduce costs through more cost-effective water structures; economies of scale from using the macro watershed as the development unit; convergence of action to avoid duplication; getting things right first time to avoid repeat expenditures; avoiding the adverse costs of environment deterioration. The cost benefit ratio would be much improved by more efficient use of technology to increase productivity; by bringing wasteland into productive use; and by a total accounting of socio-economic and environmental benefits.

Interventions to benefit women and vulnerable groups developed social capital and increased sustainability.

National and state planning for and selection of watersheds might best be based on a matrix of the potentials for impact on production, poverty, environment, and community involvement.

The Impact of Technology

Technologies for Four Agro-Climatic Zones

The Comprehensive Assessment clearly points to the watershed approach being applicable to four principle rain-fed agro-climatic zones: the arid; the dry semi-arid tropics (SAT), the moist SAT and the sub-humid. It also points to the need for distinct technical approaches and recommendations for each of these zones. Technical emphasis and success to date has principally been in the 700 to 1,100 mm rainfall areas but a different water management approach and different emphases are needed in the drier and wetter zones.

In the drier rainfall areas, the end-use of water will likely be more towards high-value fodders, micro-irrigated horticulture, and the strategic irrigation of short duration varieties. Beyond this, dryland horticulture, agro-forestry, improved dryland grazing and non-agricultural sources of income will clearly be important.

Soil and water conservation practices vary with rainfall and soil type: the driest areas require arid land technologies. With low rainfall and soil-profile storage water-harvesting become even more important. Drainage is important in wetter areas. Clearly multidisciplinary, participatory and poverty focused research is needed for each different zone, leading to broad recommendations for implementation.

Information Generation and Flows

The 'Yield Gap', the difference between performance during research and that on farms has been well recorded and analysed. Current rain-fed farmer yields are lower by two to five folds than achievable yields. In general, the yield gap is wider with higher rainfall. In the better managed watersheds, the gap is being narrowed by a combination of physical improvements to the natural resources, the use of a broad spread of technology, changes in social awareness and access to knowledge, and by community activities which improve the servicing of agriculture. For many crops, major increases in yield result from transfer of information and materials from the best farmers.

But in general in India, knowledge is not percolating to villages. Only 8% of farmers get agricultural extension as revealed by National Sample Survey and watershed programs are often the only time that poor people get exposed to technology improvements. This is one reason for the yield gap between the

research station and farmer's field. There is need to enhance the reach of technology.

How best can the watershed community access information and remedy one of the weakest links in all watershed programs? All the ideas are out there: farmer field schools for capacity building; computer information hubs in the village; participatory technology development. One particular promise is promotion of information and communication technologies (ICT)-based knowledge-sharing and agricultural extension to speed up transfer of agro-technologies to watershed villages and link farmers to markets and to research and development agencies.

As development has become more inclusive, it has demanded contributions from new disciplines and from multiple disciplines. Hence, the emergence of such terms as farming system and livelihood system, integrated and holistic. But the current system of research and extension has the intrinsic problems of specialist institutions dealing with one science or crop or theme being separated one from another, and of scientists separated from extensionists and from direct contact with the people they are aiming to help. Institutional walls and barriers may separate one discipline from another, even with the multi-discipline institutions like Central Soil Water Conservation Research and Training Institute (CSWCRTI), Central Research Institute for Dryland Agriculture (CRIDA), Central Arid Zone Research Institute (CAZRI) and ICRISAT.

If it is to be taken up, especially by the resource poor, technology has to be appropriate and this requires participatory technology development. Participatory methods to identify and develop pro-poor and gender-sensitive technologies have proven to be particularly effective and powerful, but require a change of mindset in researchers and the acquisition of new sets of skills.

In keeping with the concept of watersheds as a business model, research and development of commodities should be viewed as a value chain from production through processing and packing to marketing.

All this implies a shift of resources towards technology development and dissemination, either by revisiting budget allocations within the watershed regime or an additional budget. Noteworthy here is the difference in ability between Ministry of Agriculture (MoAg) and Ministry of Rural Development (MoRD) to flexibly use budgets. In fact, a lot of watershed money seems currently unused.

Quick Returns from Proven Productivity Enhancing Initiatives

From watershed practice to date a number of best-bet technical options have emerged. These, together with those adumbrated on pages 156/7 of the Parthasarathi report, provide a cafeteria of tried and tested technologies and approaches which would offer quick and substantial returns were it mainstreamed by a concerted effort. Here is a selection:

- combining an improved variety with water conservation and appropriate fertilization
- the integrated management of nutrients and pests and diseases, including biological pest control and the application of micro nutrients
- *in-situ* moisture conservation with broad-bed and furrow, contour furrow cultivations and other suitable landforms
- supplemental irrigation from harvested water for high-value crops
- chickpea grown on residual moisture in the rice fallow system
- commercial horticulture and post harvest crop management
- improving the availability and timeliness of use of inputs and of marketing with community organization.

Integrated nutrient management with an improved variety gives between 30% and 250% yield increase, land management 8% and 30%, supplementary irrigation 18% and 80%, and integrated pest and disease management of 18%. Using these technologies often created an opportunity to grow more cash crops and had environmental benefits.

The speed, economy and impact of participatory crop selection and participatory cultivar selection has been well demonstrated and needs to become the norm for poor rural communities.

From watershed work has emerged the realization of how all-pervasive are micro-nutrient deficiencies, how easily they may be remedied, and what an opportunity there is for a major national impact if a remediation campaign was mounted.

Beyond all this, is a rich vein of technologies and income-generating ideas generated by Indian Council of Agricultural Research (ICAR) institutes, ICRISAT, state universities and other players like the larger NGOs and the UN Small Project Scheme. All of these really need to be collected, collated, assessed and put to wider use. The National Agricultural Innovation Project (NAIP) may be able to play a vital role in this work.

Which new science tools and methods should be mainstreamed?

- Use of computers in the village as information hubs is showing tremendous promise.
- Improvements in the cost and availability of remote sensing and GIS now render their routine use in monitoring and evaluation and in system modeling.
- There is now a capacity to undertake preparatory work to characterize each watershed in terms of its natural resources, soil and hydrological resources and their potential, constraints and opportunities. Such a base data would identify needful action and, for example, permit locally specific fertilizer recommendations to be made with confidence, and to avoid unnecessary activities and waste, to continue the fertilizer example, like applying potassium when it is not needed.

Water Considerations

Some facts and observations:

- they say there are three things important to poor villagers in the rain-fed areas, 'Water, water and water'. Water is used for human and livestock drinking, for irrigation and supplementary irrigation, for domestic and village industrial use and for sanitation
- irrigation accounts for one third of the water used in agriculture, two thirds is rain-fed, yet water management is commonly talked about in irrigated areas but rarely for rain-fed areas. This is an example of how the distinction between irrigated and rain-fed areas is unhelpful. The Comprehensive Review of Water for Food Production commends that the distinction be broken
- the water component of watershed programs, often one of the most costly budgetary items, has tended to be supply led when what is needed is better management of what falls from the sky, more efficient use of it, and avoidance or reduction of losses to the system
- the number of people benefiting from water schemes is very small
- the watershed guidelines don't describe what water structures should be built. So the influential in the community vote for concrete structures
- groundwater is an efficient way to store water as it does not suffer the evaporation losses of surface storage, and its controlled use should be part of every watershed program. Its overuse for economic gain is a precarious development strategy.

The Comprehensive Assessment has clearly shown the following:

- widespread improvements to groundwater tables and soil and surface water storage, but, especially in the drier areas, dropping groundwater levels due to over-exploitation by bore wells, first leave the drinking water supplies of the poor high and dry and then pose environmental problems. The remedy would be to regulate and introduce management strategies, including pre-negotiated social regulation
- an opportunity to substantially improve the productivity of rainfall with an integrated approach to soil-rainfall harvesting and soil fertility management which embraces seed choice, seed priming, balanced nutrient management, agronomic and husbandry techniques, strategic or supplementary irrigation, and the avoidance of waste
- that effort to date has primarily focused on people endowed with the resources to take advantage of modern technology. There is great scope to profoundly improve equity in the access and use of water with pro-poor and gender-sensitive technology and communal management of water supplies, small scale irrigation schemes and capacity building of communal water management institutions
- how moving the average location of water harvesting structure towards the upper parts of the watershed and the average type more towards pits, earthen checkdams and cheaper concrete structures, the cost to harvest a m³ is lowered, the distribution of benefits is more equitable and fewer professional engineers are needed
- the main recommendation emerging (20) is for the perception about water in rain-fed areas to change, and for water policy to expand from augmentation of supply to water demand management and water use efficiency, paying especial attention to prioritizing drinking water needs, regulating groundwater extraction, providing incentives for efficient irrigation methods and low water requiring crops and disincentives for the opposite, and promoting participatory monitoring and management of all water resources in the watersheds
- as with other aspects of watershed implementation, the joint planning and execution of water schemes would bear dividends and the Department of Water Resources may wish to consider how this might best be brought about. Using the macro watershed as the implementing unit would assist collaboration, improve the efficiency of hydrological management and the synergy between hydrological and social objectives.

Drought and Dry Spell Proofing

Climate change seems destined to move some parts of the SAT towards aridity and most parts to more frequent fluctuations within the average and an increased frequency of extreme events. This poses challenges and opportunities. Against this backdrop, working towards eco-system and livelihood adaptation and resilience to the changes in store would seem prudent.

'Managing Water in Rain-fed Agriculture' (Rockström et al., 2006) makes clear the distinction between meteorological and agricultural droughts, and between droughts and dry spells. Meteorological droughts result in complete crop failure once or twice every decade and require social resilience and coping strategies. A component of every watershed program should be to help communities prepare to deal with these inevitable events by encouraging alternative livelihoods, financial resilience, seed banks and local food storage.

Dry spells on the other hand, whether of climatic or human cause can be bridged by improved water management and offer an opportunity for large increases in yield. Villages benefiting from watershed management increase food produce and market value by 63% as compared with non project villages, even during dry spell years. (Wani et al., 2006).

Beyond this is a major opportunity to bring in predictive science and information technology and advise farmers before and during the season of the likelihood of rain being above or below average so that they may reduce investment in bad years to avoid waste and capitalize on the best years by improving yields. The success rate of predictions, the speed of information flow, the channels used for it, the optimal size of the zone for recommendations and how information hubs can be brought to bear, all need further work.

One key implication of meteorological predictions lies with seed supplies and availability of seed. Seed banks offer a solution.

By integrating the management of moisture stress and nutrients and seed, and with life saving irrigation from farm ponds or wells that are recharged by improved watershed management, farmers can make better use of what they have got and change the common ratio of five years good, three poor, and two failure.

The likely increased frequency of both droughts and dry spells with climate change, underscores the importance of all this work.

The Impact on Gender and Vulnerable Groups

The reality of poverty in the rural areas is stark. The landed poor are the small and marginal farmers on the upper reaches of the watershed on poor soils. The landless, frequently women, unemployed youths, the disabled and the socially marginalized, comprise the other major vulnerable group. These often have no easy access to drinking water and the common property resources that are so important to them. Drudgery, indebtedness, ill health, under-nutrition, lack of self worth and lack of influence are the common problems. In Orissa, South Bihar and Eastern MP, such people often comprise 50% of the rural community.

This is not new, and the Comprehensive Assessment points to the opportunity to better engage these vulnerable groups in the rural economy through the medium of watershed work.

There are clear opportunities to strengthen policy statements on women's active participation which should start right from the outset, rather than being an 'add-on' and with increased clarity among watershed staff about what are the ends-in view. Indeed gender concerns should form non-negotiable components of the initial phase and of the monitoring framework throughout the project cycle. Similarly, the landless, by definition excluded from landed activities, need mainstream inclusion.

These are very recent considerations for Government of India but the watershed guidelines now cover employment and common property activities for the poor, and the 11th Five Year Plan addresses vulnerable groups as an important issue.

Nevertheless, there is a gap between intention and practice and outcome, and a multi-pronged approach is required, which follows a development path within the project and provides policy change, additional investment in support organisations, and a longer time frame than is current.

Policy changes could easily:

- promote the representation of vulnerable groups in watershed management so as to leverage benefits for them during and after the program
- target interventions and budgetary allocations within the watershed program for capacity building, institutional support and post implementation activities
- promote labour intensive conservation measures and sustainable farm practices by gradually shifting the subsidy for intensive use of inputs.

Staff should have a list of outcomes which might include functional literacy and numeracy; reduced drudgery, measured as freed up time and energy; adequate representation (page 68-69 of Parthasarathy report) in decision making committees and in the development and regeneration of common property resources, especially water, grazing and forest, and the upfront allocation of long-term user rights to them, so that the benefits last beyond project period.

Where water supplies are augmented, particular attention is needed to allocating an equitable share to vulnerable groups. Gram sabhas should set priorities and norms for water use and women's groups may play important role in managing water allocation.

Small livestock are often important to the poor and there should be special support for fodder banks and seed money for women's self help groups (SHGs) to enable them to enhance income from livestock.

Other measures include participatory technology development for vulnerable groups. For example in tools and homestead enterprises. Vulnerable groups benefit from new opportunities emerging with development of natural resources and market-led diversification.

There could be better co-ordination among government programs, especially those dealing with employment, literacy and numeracy, sanitation, child care and nutrition.

Access to finance is crucially important, as revolving funds to teach financial skills and as credit to fund enterprise and initiative and support community resilience to events post project. Subsidies are a separate issue.

Institutions and Policies

What do we know about watershed institutions? They operationalise the program and play a key role in sustaining what is done. They are formal or informal. They belong to the implementing agency or to the community or are linked to external institutions like federations and banks. They only need to exist as long as they have a clear role; i.e. sustainability *per se* is only useful so far. They need an enabling environment. What has the Comprehensive Assessment added to this understanding?

Firstly, a variety of institutional mix is possible and even desirable but the common denominator seems to be flexibility rather than straight-jacketing. A major breakthrough was to make things participatory.

The *Gram Sabha* rather than the *Gram panchayat* has proved the most democratic and effective village institution. Capacity building needs to focus on them and their role and responsibility needs to be clarified. The Parthasarathy report (page 136) reached the same conclusion. The *Gram panchayat* of course has the advantage of being integrated with government and may be concerned with more than one watershed. It should play an important role in the governance of watersheds and in post-project support.

Both at the outset and post-program, support is needed to enhance the ability of institutions to operate and evolve and to generate and manage finance. With a phased approach, community-based organisations (CBO) can evolve from user and SHGs into a watershed committee, a common interest group (CIG), federation and even a resource centre. Federations of local organizations seem to have the best links with the technical line departments which operate at cluster level. Institutional arrangements, which provide a location at which information and knowledge is accessed, have also proved invaluable.

Self-help groups may or may not be land based but where they are landless, they have tended to dissolve after the generation of employment once watershed implementation has ceased. The performance and sustainability of watersheds might be substantially improved by strengthening and supporting small area groups (AGs) in place of user groups (UGs).

When inputs and other things have been given free, only a small proportion of the community get them and these are often the ones who are able to pay. This should be the case with the money put into the watershed development fund or a revolving fund.

We are conscious of policy makers being pulled in several directions at once. In general, we see advantage in reducing the number of government policies and schemes and institutions and to concentrate on the pragmatics of execution and reducing the conflicts of interest caused by different agencies operating on watershed areas. An example here would be small dam and tank construction independent of the watershed plan.

How this convergence is best achieved is a moot question but there are clear opportunities to use watershed programs to improve co-ordination between government agencies and programs. The efficient and equitable management of surface, ground and drinking water and of sanitation requires the various agencies concerned to plan and interface for common purpose and help establish community institutions which manage water, and water and energy policies which regulate groundwater exploitation. Programs dealing with employment, literacy, numeracy, child care and nutrition would similarly benefit from

joint planning and execution. If the macro watershed becomes the common implementing unit, then this should make co-ordination easier and promote easier inter-village collaboration and the evolution of apex institutions.

Watershed implementing institutions need to change their perception of watershed work from the current focus on agricultural production to a fully-integrated development of human and natural resources, and strengthen their understanding of objectives, their capacity to attain them and their ability to access, experiment with and disseminate multi-disciplinary information and to undertake M&E. National and state consortia of agencies from research and development, civil society and the private sector would help in this, as would engaging service providers of capacity building, technical backstopping, knowledge dissemination and program evaluation. Local specialists, termed para-workers or barefoot doctors, have repeatedly proven their worth. They often develop into influential members of the community, and should be seen as an important component of this work.

Finally, the initial capacity building, collection of baseline information, and preparatory work all take time and we recommend the implementation period be extended from five years to seven or eight years.

The Haryali Guidelines have introduced complications as many watershed programs are implemented by credible NGOs, whereas Haryali operates through village panchayat government and district institutions. Recent common watershed guidelines from NRAA have corrected this and good NGOs involvement for implementing watersheds is recommended.

Monitoring and Evaluation

The Comprehensive Assessment has identified a weakness in the current M&E of watershed programs and opportunity to improve the feedback of information, which government can use at a macro scale to inform itself of the progress with this major budget item, and which implementers of watershed programs may use in their work.

A major problem with the assessment was the lack of uniformity in what was being measured. The concept and practice of watersheds evolved over the years, and most especially over the last five years, that evaluators are chasing a moving target. Apart from this, different sponsoring ministries have different objectives. Clearly, a more standardized approach with common objectives would overcome this.

There is a profound lack of baseline data against which progress can be monitored. A few monitoring stations exist in each agro-ecological zone but baselines need to concern social as well as physical attributes and an assessment of the total environmental and socio-economic impacts needs to be taken rather than the current focus on income, productivity, water enhancement, and employment generation. It also means the inclusion of qualitative parameters.

There are spatial and time scale dimensions too. Our recommendation to increase the size of management unit to the macro watershed will have M&E implications. The spread of benefits beyond the watershed also needs to be observed. There would be great value in a sequence of 'photographs' of what is going on: mid term, immediately after project completion and then beyond this. In monitoring hydrological and environmental quality, for example, it may take ten to fifteen years to observe effects.

Any improvements to this state of affairs need to be pragmatic i.e. expenditure should be proportional and cost effective, and the data collected commensurate with what will serve the purpose and can realistically be analyzed. Essentially, this means only a few indicators need to be tracked, some by participatory methods and process monitoring of a random selection of watersheds to support the more usual practices.

Indicators must relate to program objectives and would therefore embrace access to drinking water, increases in food production and incomes, reduction in drudgery, improvements in soil and biomass, groundwater and sanitation, confidence in the community and awareness of what is going on, skills acquisition, the effect on migration. In each district, one or two representative watersheds should be monitored for runoff, soil and nutrient loss, water quality, carbon sequestration and other parameters. Monitoring hydrological and environmental data at selected benchmark watersheds for each agroeco-region is essential and needs adequate financial support. This will provide essential data needed for more cost-effective and sustainable watershed development.

There is clearly a role for high science too. Advances in remote sensing (RS) and GIS have brought down the costs of these products but remaining access problems and shortage of skilled staff may limit their use for the moment to key areas rather than having them deployed in every village. Information technology provides an opportunity for rapid feedback and analysis and to share the results with the community. Simulation modeling also will help in making a preparatory M&E work that would be part and parcel of watershed selection since the criteria to select watersheds must be based on technical, social and pragmatic concerns. Some of the concerns are the social mix and dimensions

of poverty, the availability of drinking water, the willingness of the community to work with a watershed program and their prior agreement to do or not to do certain things. Broad assessment is useful, especially across different agroecologies in areas where there has been sustained implementation of best practice and a large proportion of watersheds treated within a sub-basin.

So important is the need to improve matters that we recommend additional funds and that release of funds be contingent upon some mandatory and preparatory M&E action.

Recommendations

Watershed Policies and Guidelines

1. To enhance the impact of watershed programs, government needs to unify its effort around a new paradigm, shifting the objectives from merely drought-proofing and agricultural production to sustainably increasing agricultural productivity, reducing poverty, protecting the environment, and building human and natural resource resilience to cope with future challenges, including climate change.
2. The key-strategies required are the fully-integrated development of human and natural resources, coordinating the programs of different ministries and agencies with common guidelines, single and effective national and state mechanism, making better use of technology and moving from a subsistence to a business model by establishing market links and public-private partnerships.
3. To help meet the national goal to conserve, manage and efficiently use scarce water resources, watersheds need to be recognized as the most appropriate framework in which various agencies concerned with surface, ground and drinking water and sanitation can interface for a common purpose. This requires joint planning within an enabling framework of macro-policies and market incentives, and building watershed institutions to manage water, especially by community institutions.
4. Macro watersheds of 1,200 ha and above have achieved impacts more effectively than micro-watersheds of 500 ha. Thus, clusters of, say, six micro-watersheds together need to be the operational development unit. This can be done without by-passing social and administrative concerns.
5. Many implementers of watershed programs lack full understanding of objectives and a capacity for attaining them. Knowledge and information flows are also weak. There needs to be effort at national and state levels to address these issues. Firstly, we recommend the establishment of consortia comprising the key research and development institutions, civil society organizations and private sector. Secondly, the engagement of quality service providers to augment what can be achieved by individual programs in capacity building, technical backstopping, and knowledge dissemination for improving performance. Finally, the initial capacity building, collection of baseline information, and preparatory work all take time and we recommend the implementation period be extended from five years to seven or eight years.

6. The current approach which uses subsidy-based entry points conveys to the community an incorrect impression of project goals. The strategy should be to build self-sufficiency within the community and this is best achieved by starting with knowledge-based activities that deliver immediate tangible economic benefits, and thereby, capturing the attention and enthusiasm of the community, and resulting in collective action.
7. The current funding of watershed programs is insufficient to effectively embrace social, environmental, and sustainability objectives. The performance of watersheds would be greatly improved by attending to the following aspects of funding:
 - to augment the allocation for the capacity development of primary stakeholders and for pro-poor technologies that enhances the productivity of small and marginal farmers
 - to provide new funds for income-generating activities for landless and vulnerable groups; development of common property resources, post-project institutional support, and technical backstopping and strategic research
 - to ensure timely release and flexibility to meet location specific needs
 - to provide central and district resources for monitoring and evaluation, including for the application of new science tools.

We recommend a sum of Rs. 20,000/- hectare for integrated watershed development.

8. In order to effectively deal with sustained income generation, capacity building, monitoring, and technology generation and extending treatment coverage throughout each watershed, additional funds will be required. These may not entirely be new money but can be sourced from:
 - various cost savings identified for project implementation
 - money disparately spent by various government agencies
 - the mobilization of private sector, community contributions, and institutional finance.

Whatever the source, we believe a sum of about Rs. 20,000 per ha is required to effectively enhance the impact of watershed programs.

Institutional Arrangements

9. The project implementation agency and panchayati raj institutions, particularly the gram sabhas, should have clearer roles and responsibilities. Panchayati raj institutions should play an important role in the governance of watersheds and in post project support.
10. The performance and sustainability of watersheds can be substantially improved by exploring the option of strengthening and supporting user groups based on secondary and tertiary drainag lines and common interests in the watershed in their planning and execution.

Monitoring and Evaluation

11. Mid-term evaluation, impact assessment after program completion and post-project evaluation after four to five years will enable implementing agencies to make mid-course corrections and governments to adjust policy. M&E information should be put in the public domain.
12. Clearly, government should be able to access accurate impact information for the large sums of money spent on watershed programs. We recommend an assessment be made that takes into account of total environmental and socio-economic impacts rather than the current focus on income, productivity, water enhancement, and employment generation. Such a broad assessment would best be conducted across different areas where there has been sustained implementation of best practice and a large proportion of watersheds treated within a sub-basin. The work could be augmented by simulation modeling.
13. Baseline information and needs-assessment in uniform format must be undertaken before funds for works are released. Further, only limited numbers of separate, tangible and easily measurable indicators need to be tracked and concurrent participatory monitoring, resource mapping and social audit will enhance transparency and equity. Government may wish to make all this mandatory, use certified and independent agencies and assess the role of GIS, remote sensing and simulation modeling for various aspects of the work.
14. Cost-effective and sustainable watershed development needs hydrological and environmental data from benchmark watersheds in each agroecoregion and district. This will also enable an assessment of impacts outside the watersheds. Such work needs adequate financial support.

Technology

15. Different agroecoregions vary in their biophysical potential, constraints, opportunities and socioeconomic conditions for agricultural development. Although, watershed approaches seem to have universal application for effective management of natural resources, sustainable agricultural production and income generation, the Comprehensive Assessment showed greatest impacts in the region with 700-1100 mm of annual rainfall. Clearly, more suitable agro-technologies and interventions need to be developed for the higher and lower rainfall regions.
16. The Comprehensive Assessment has identified a range of best-bet options, some of which offer the opportunity for major and widespread impact on poverty reduction, environmental improvement, agricultural productivity and resilience. These include:
 - cost-efficient water harvesting structures
 - *in-situ* moisture conservation measures
 - increased availability and adoption of improved cultivars
 - efficient use of limited water for supplementary irrigation
 - rehabilitating wastelands/common property resources (CPRs) through community participation
 - reduced use of pesticides with integrated pest and disease management

Wide promotion and dissemination of these technologies will require that all project implementation agencies are made aware of them.

17. Widespread deficiencies of secondary and micro-nutrients are severely holding back crop productivity and efficient use of water. At a stroke, government could increase crop yields by 30-80% with an initiative to diagnose soil health in rain-fed areas and apply appropriate remediation.
18. There is a need to build capacity within the research establishment to undertake effective technology development for poor people. This requires specific financial allocation, change in mindsets, multi-disciplinary teams with participatory skills and the involvement of poor people from the outset for identifying their particular needs.
19. Current agricultural extension does not fulfill the growing need for information for rain-fed farmers and the poor. We recommend extending government's 'emphasis on Information and Communication Technology (ICT)' for the rapid transfer of appropriate information to the various stakeholders within a watershed and link farmers to markets.

20. To date, water policy has focused on augmentation of supply, but this now needs to be expanded to embrace water demand management and water use efficiency. There are a number of aspects:
- watershed programs should prioritize drinking water needs, put them as indicators of success and ensure equitable access to the water supplies to the poor
 - devise and implement policies to regulate groundwater extraction by individuals and promote participatory monitoring and management of all water resources in the watersheds
 - ban the cultivation of high water requiring crops such as paddy and sugarcane in watershed areas
 - encourage cultivation of low-water requiring crops with market incentives
 - promote efficient irrigation methods through water-saving devices and the creation of community-based water assets.
21. Advances in weather forecasting have created opportunities to reduce farming risks and mitigate the effects of climate change. The use of long-range weather forecasts for crop planning and of medium and short-range weather forecasts for crop management should become the norm.

Gender and Vulnerable Groups

22. Equity and gender concerns regarding women, the resource-less and those without adequate representation need to be brought to the forefront of watershed planning and execution. There are clear opportunities to strengthen policy statements to address this issue as follows:
- emphasis on women's active participation should start right from the beginning rather than as an add-on, with increased clarity among watershed staff about the objective
 - gender concerns should form non-negotiable components of the initial phase and also in the monitoring framework through out the project cycle
 - adequate representation of women and vulnerable groups in decision-making committees, targeted interventions, institutional support and financial allocations all need to be integral to the watershed program.

23. Common property resources can effectively be regenerated as pasture, biofuel, and energy plantations, and can be used to generate income when managed by vulnerable groups. This requires long-term leases, usufruct rights, and financial allocation for development, which may need to last beyond project period.
24. New income and market opportunities are emerging with watershed interventions. These need to be channelized to benefit vulnerable groups. This calls for a comprehensive support for capacity building, credit and market links through increased and clearly defined financial allocations.
25. Once again, there are clear opportunities to use watershed programs for improving co-ordination among government programs dealing with employment, literacy and numeracy, sanitation, child care and nutrition.



A Comprehensive Assessment of Watershed Programs in India
Project Inception Workshop, 6-7 June 2006, New Delhi, India



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About ICRISAT

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a nonprofit, non-political organization that does innovative agricultural research and capacity building for sustainable development with a wide array of partners across the globe. ICRISAT's mission is to help empower 600 million poor people to overcome hunger, poverty and a degraded environment in the dry tropics through better agriculture. ICRISAT belongs to the Alliance of Centers of the Consultative Group on International Agricultural Research (CGIAR).

Contact Information

**ICRISAT-Patancheru
(Headquarters)**
Patancheru 502 324
Andhra Pradesh, India
Tel +91 40 30713071
Fax +91 40 30713074
icrisat@cgiar.org

ICRISAT Liaison Office
CG Centers Block
NASC Complex
Dev Prakash Shastri Marg
New Delhi 110 012, India
Tel +91 11 32472306 to 08
Fax +91 11 25841294

**ICRISAT-Nairobi
(Regional hub ESA)**
PO Box 39063, Nairobi, Kenya
Tel +254 20 7224550
Fax +254 20 7224001
icrisat-nairobi@cgiar.org

**ICRISAT-Niamey
(Regional hub WCA)**
BP 12404
Niamey, Niger (Via Paris)
Tel +227 20 722529, 20 722725
Fax +227 20 734329
icrisatnc@cgiar.org

ICRISAT-Bamako
BP 320
Bamako, Mali
Tel +223 2223375
Fax +223 2228683
icrisat-w-mali@cgiar.org

ICRISAT-Bulawayo
Matopos Research Station
PO Box 776,
Bulawayo, Zimbabwe
Tel +263 83 8311 to 15
Fax +263 83 8253/8307
icrisatzw@cgiar.org

ICRISAT-Lilongwe
Chitedze Agricultural Research Station
PO Box 1096
Lilongwe, Malawi
Tel +265 1 707297/071/067/057
Fax +265 1 707298
icrisat-malawi@cgiar.org

ICRISAT-Maputo
c/o IIAM, Av. das FPLM No 2698
Caixa Postal 1906
Maputo, Mozambique
Tel +258 21 461657
Fax +258 21 461581
icrisatmoz@panintra.com

Visit us at www.icrisat.org