CHAPTER 6
RETHINKING WATERSHED DEVELOPMENT IN INDIA: STRATEGY FOR THE TWENTY-FIRST CENTURY

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Soil degradation on large tracts of cultivable land is seriously undermining millions of people's livelihoods. Attempts to overcome this problem have been made through large investments in watershed management throughout Asia, Africa and Latin America (Lal, 2000). In India in the last three decades, watersheds have become the pivotal unit for rural development programmes. In India, about 6.2 million ha of rainfed land in 5 200 micro-watersheds was under treatment in financial year 2001/2002 at an estimated cost of US$175 million. Yet, the coverage is far from complete.

Of India's total cultivable area of 142 million ha, 89 million ha of unirrigated land needs similar investments. This land grows 45 percent of India's foodgrains. The irrigated area has reached a production plateau of about 110 million tonnes; so, efforts to increase foodgrain production need to focus on improving the productivity of rainfed agriculture.

THE RECORD SO FAR

India's guidelines for watershed development programmes have been revised three times since their introduction in 1986. They aim to make investments in watershed management have a long-lasting impact on crop production and rural livelihoods in rainfed cropping areas. They are reviewed periodically, but only to accommodate cost escalations and revise targets. The current guidelines were introduced in November 2000, renamed as the National Watershed Development Programme for Rainfed Areas (NWDPRA) of the Ministry of Agriculture. In addition to setting a framework for watershed development in the country, the guidelines proclaim a blanket investment per unit area for diverse land–water interventions and make special provisions for promoting income generation for landless people. They recommend a budget of US$49 000 for a watershed area of 500 ha on land with a slope of up to 8 percent, and US$65 220 for land of a slope greater than 8 percent, to cover all implementation costs. The investment level was revised from the previous US$87 per hectare to a maximum of US$130 per hectare.

These new guidelines have increased investment levels and promote programmes to benefit landless people; but they do not guarantee that the new programme-based top-down approaches will be successful. People's participation is largely stuck in the "you will participate in the programme" mode, and project sustainability is questionable even after two decades of experience in watershed management. The resulting lack of community ownership has meant that the investments in rural development and natural resource regeneration have mostly only realized

short-term benefits. India's large investments in rural development have not produced a matching transformation on the ground. Investment thrusts in recent watershed development programmes are trying to reverse the inefficient use of resources in many integrated rural development programmes.

TARGETS MISSED

Watershed management needs to take a multipurpose approach to improving land and increasing water availability for crop growing, livestock and human use through soil and moisture conservation measures. An effective watershed project should aim to drought-proof areas by capturing every falling raindrop. This is technically possible.

An assessment by the Centre for Science and Environment (Agarwal, 2000) estimates that if half of India's average annual rainfall of 1 170 mm were captured over 1.12 ha of land in each of the country's 587 226 villages, then the 6.57 million litres of rainwater thus collected would meet the annual cooking and drinking needs for an average village of 1 200 people. Doing this would help both to sustain surface water supplies and to recharge aquifers.

However, the National Sample Survey (NSS, 1994) reported that despite the extensive programmes carried out to provide drinking-water to rural areas, 140 975 villages (24 percent of India's total) still had a drinking-water problem. Even the watershed development programmes set up to complement the drinking-water programmes in villages did not improve the situation. As a result, much of the 420 billion hectare metres (mham) of average annual available precipitation flowed uninterrupted to the sea without fulfilling its ecological functions of enhancing surface water supplies and recharging groundwater to any appreciable extent.

The experiences of watershed development projects have been quite varied. The few successful projects are outnumbered by the many unsuccessful ones. There are situations where some successful watershed projects have not even provided for the minimum amounts of drinking-water and fodder. Many watershed projects, designed to conserve rainwater to improve irrigation, have tended to ignore communities' primary need of access to drinking-water. On similar lines, some projects have neglected to develop pastureland and propagate soil-moisture conservation practices.

A few community groups have taken the initiative themselves with some external assistance. For example, the villages of Sukhomajri in Haryana and the Chakriya Vikas Pranali scheme in Jharkhand (Box 1) have improved their socio-economic conditions in a relatively short time by linking improved *in situ* moisture conservation with economic activities that build up social capital. These examples show that watershed development is a viable model for the economic development of poverty-stricken rural areas.

BOX 1

CYCLE OF SUSTAINABLE BENEFITS

The Chakriya Vikas Pranali (CVP) – the cyclic system of development – is a pioneering method for village development. It was developed in Jharkhand, north India and promotes ecological regeneration as a source of economic growth. It offers villagers returns of more than 20 percent on their investments. Its basic strategy is for locals to make a one-time investment in the form of cash, plants and technology, and to convert it into a self-propelling process of production and reinvestment via a common village fund.

Investments in multi-tiered, multi-rooted and multi-layered planting cycles provide year-round employment for village people and provide short-, medium- and longer-term returns from grass, vegetables, fruit trees and timber, respectively. This successful system has spread to more than 600 villages in Palamau district, Jharkhand.

A typical block of 6 to 12 ha of pooled land is divided by water-retaining tie-ridges into smaller quadrants. It is then filled with plants that are intercropped to maximize the symbiotic relationships of nitrogen-fixing and nitrogen-hungry species. Yams and tubers go underground, and pulses, beans, fruits, bamboo and timber spring up from the earth. The different root systems are carefully grown together to prevent overcrowding and to maximize rainwater use.

Harvest returns are shared under a 1:3:3:3 system, so that 10 percent goes to the village welfare fund, 30 percent to the landowner, 30 percent to the workers, and 30 percent to the common village fund for investing in further development. Studies conducted by Delhi's Institute of Economic Growth indicate that the chief value of CVP lies in retaining and reinvesting surpluses through the village funds. This ensures that land-based activities, biomass production, energy and employment are maintained on a sustainable basis.

CVP makes programme replication a reality. Most other programmes are difficult to replicate owing to lack of leadership or funding, or legal hurdles. CVP is self-financed and, after the initial investments, it generates resources to trigger similar initiative in other villages.

There is a risk that landowners may opt out and drive workers away from tilling the land after it begins to be improved. However, this has not happened in any village, as the new system is giving such good returns from land that was barren until recently.

This form of land development has shown that it is possible to transform the environment, improve economic well-being and reduce social tensions through a participatory approach. Its success and prospects for replication depend on support from central and state governments.

SPREAD ELUDES IMPACT

Between 1994 and 1999, about 10 000 watershed projects went ahead in India. This large number reflects the coverage and the amount of resources being pumped in to watershed development. Although watershed programmes are one of the largest types of investment in integrated rural development, there is no central coordination unit to provide information on the actual number of watershed projects in India at any given time.

BOX 2

BILATERAL AND MULTILATERAL WATERSHED PROJECTS IN INDIA

- UK Department of International Development's (DFID) Western India Rainfed Farming and Eastern India Rainfed Farming projects
- DFID's Karnataka Water Development Project and its proposed Western Orissa Rural Livelihoods Project
- The German Agency for Technical Cooperation (GTZ/KfW) Changar Project in Himachal Pradesh
- The Swiss Agency for Development and Cooperation's (SDC) PAHAL project in Rajasthan
- The Japan International Cooperation Agency's (JICA/JBIC) support to the Attapady Soil Conservation Project in Kerala
- The Danish International Development Agency's (DANIDA) implementation of five watershed projects: two in Tamil Nadu and one each in Orissa, Madhya Pradesh and Karnataka

The World Bank is funding the Kandi Watershed Area Development Projects in Punjab, Haryana, Jammu and Kashmir, Himachal Pradesh and Uttaranchal.

Information pooled from various sources indicates that the Government of India has allocated about US$650 million to various watershed and wasteland development programmes over a recent typical five-year period. In addition to central government funding, the World Bank, DANIDA, Sida, SDC, DFID and GTZ are supporting the rehabilitation and development of micro-watersheds (Box 2). Most programmes have been run in the drought-affected areas including parts of Andhra Pradesh and Madhya Pradesh (Table 1).

This list is not exhaustive. Some projects are more than two decades old; others are just starting. However these interventions have not been able to prevent droughts. Madhya Pradesh is seeking additional resources to sustain its ambitious Rajiv Gandhi Mission for Watershed Development. However, the government, seeing the less than satisfactory performance of its watershed programmes, is diverting funds to the new people-centred "*paani roko anbhiyan*" programme (harvest water campaign).

TABLE 1

Distribution of watershed projects 1994 to 1999

State	Share of nationwide watershed projects
Andhra Pradesh	24.0 %
Madhya Pradesh	17.0 %
Uttar Pradesh	10.0 %
Gujarat	8.6 %
Tamil Nadu	7.0 %

Source: Hanumantha Rao, 2000

The two main problems of watershed development programmes have been the lack of any consistent criteria for selecting villages and the process of implementation. This raises several management-related questions.

The poor performance of many watershed projects has not reduced the number of new projects. Andhra Pradesh has taken up an additional 2 090 projects to treat 1 million ha since the November 2000 revised guidelines were issued. Typically, each watershed project is restricted to an area of 500 ha. Bilateral- and multilateral-funded projects usually cover many such sub-projects. For instance, the World Bank's Kandi Watershed Area Development Project in Haryana covers 619 separate watershed projects.

One of the most intractable problems in watershed development has been the lack of project sustainability. Many projects have failed to build in strategies to maintain their assets once project support ends. Feedback from several projects indicates (Joy, 2003) that many farmers only benefit from watershed projects by getting short-term paid labouring work. Because communities see few long-term benefits emanating from these projects, they have little interest in operating and maintaining project assets. This issue is being confronted by some donors in their projects.

Many watershed projects have failed in their primary objective of arresting land degradation. One study indicates that the rate of land degradation in rainfed areas in the 1990s is likely to have been more than twice the rate in the 1980s, largely because of increased soil erosion (Reddy, 2000). At the other extreme, many projects have failed because the guidelines provided a pattern of uniform treatments across diverse agro-ecological conditions, leading to a less than desired impact.

The continued lack of drinking- and irrigation water in several Indian states shows that drought-proofing interventions have failed to stop land degradation in rural areas and have failed to improve rainfed agriculture and the availability of drinking-water.

INEQUITABLE SHARING

The National Sample Survey (NSS, 1994) reported that 80 percent of rural households had landed property and earned more than 50 percent of their incomes from farm labour. This is owing to the typically small average size of landholdings (less than 0.1 ha), unfavourable moisture regimes and lack of technological inputs.

Watershed development is a rational technical concept based on the need to regenerate natural resources. However, property regimes exist that are in contradiction to the requirements of watershed management. Land is inequitably distributed and, as rights over groundwater are bundled with landownership, the landless do not benefit from any appreciable gain in groundwater recharge. With common property resources having degenerated into open access resources, the concerns of landless villagers often go unaddressed in watershed projects. Landless people's concerns rarely get addressed, as these projects are based on government guidelines that emphasize per hectare cost of land treatment.

The guidelines' fixed budgeting often fails to account for wide biophysical and socio-economic variability. Consequently, the design of most projects fails to account for local variability, and a fixation on following the guidelines rules out learning from other projects' experiences.

Watershed projects channel their limited investments into a range of on- and off-farm activities, often involving trade-offs among the interests of different stakeholders. The wide range of works now being carried out by watershed development projects means that impacts are often slow to materialize and often intangible.

These projects have gone well beyond the scientifically determined methods of soil and water conservation. This has increased the per hectare cost of conservation by taking on a new range of strategies, and has made them more complex to implement.

One study of a watershed project in Chhattisgarh showed the implementing agency's predicament in trying to complete the diverse range of activities on time (Sharma, 2001). Subsidies were made available to all households, irrespective of their economic status. Those with larger areas of land benefited most. This inequitable spread of benefits had a negative impact on local people's sense of ownership of the project and on the project's sustainability.

The long-term impact and sustainability of watershed projects is threatened by the lack of well-defined institutional spaces for the landless, only partial responses to the concerns of small landholders and inequity in benefit sharing.

The successes of the innovative project in the village of Sukhomajri, Haryana, which was completed in the early 1980s, shows how landless people can also benefit. In this project, the community designed a system that paid equal attention to the needs of landed and landless people. The rights to impounded water in the three local check dams were equally shared between the landed and the landless, and the benefits of rainwater harvesting were equally shared out by ensuring that a portion of the incremental gain (from improved crop harvests) was ploughed back into creating a fund (social capital) for community development. This held the key to sustaining project benefits. The landless in Sukhomajri village benefited by selling their share of water to the landowners.

In the same project, a sound land care system, based on the principle of social fencing (local agreements not to exploit certain areas such as no-grazing areas), helped to regenerate biotic resources and promoted a range of farm and non-farm activities that were not in the original project design. It was then for the community to make informed choices about using the rejuvenated natural resources for their benefit.

TECHNOLOGY BENEFITS FEW

Many project implementing agencies know that rainwater harvesting needs to be a priority in low-rainfall regions. However, *in situ* conservation does not help much if rainfall is scanty and erratic. Consequently, most watershed projects mainly concentrate on installing water harvesting structures such as check dams. The literature shows that the success rate of technology-based projects is no more than 25 percent (Shah, 2001; Reddy, 2000).

A recent study in Gujarat found that check dams – the favoured technology for watershed projects – directly benefited only 15 percent of target households (Shah, 2001). While the benefits of check dams can easily be computed, benefits to individual farmers from structures

such as nala plugs (gully plugs) and contour bunds may not be so immediate and substantial. Consequently, a significant portion of project costs are invested in structures such as check dams, whose costs are high and that benefit only a few – in contrast to and at the cost of structures such as gully plugs that are less expensive and benefit more people.

A typical check dam may account for 50 percent of a project's costs. The remaining budget is thinly distributed over other project components. The social activities, including self-help groups and income-generating activities, often benefit only a few families. Households and communities that have not benefited from a project should not be expected to contribute towards sustaining project initiatives.

The package of measures taken by watershed projects, from building check dams to promoting income-generating activities, has become too large and difficult to manage. Reducing the number of activities in favour of those that provide most benefits would bring down the per hectare cost of land treatment. Activities should be selected according to the relation between their costs and their benefits. Ironically, long-term environmental benefits are rarely computed in the benefits that might accrue from project interventions.

Most donors require that communities contribute about 10 percent of project costs. Choosing activities that provide the most financial benefits encourages local people to contribute, as they know that they will get a return on their investment. Once a return is attached to each activity, the community can be asked to plough back a portion of the incremental gain. This is what happened in the Chakriya Vikas Pranali scheme, and was a main reason for its success (Box 1).

The design of watershed development projects should not ignore traditional water harvesting structures. Projects can gain a lot from supporting the rehabilitation of traditional water harvesting structures. This is less costly than building new structures and gives a focus for communities' contributions and participation. Reviving community structures can lead to the rebirth of community spirit and community management, things that are crucial to sustaining the achievements of watershed projects.

Watershed development has been associated more with a technological approach. Communities and local institutions have yet to come to terms with the philosophy of watershed development. The technological approach has not realized the expected benefits and the need to integrate local wisdom and traditional systems.

CONCLUSION

The continuing drought problems in India suggest that the country's two decades of drought-proofing efforts through the watershed approach have not worked. The central and state governments are still allocating large budgets to rehabilitating and developing micro-watersheds. There needs to be fresh thinking about the watershed approach to drought proofing.

Many watershed projects have basic design flaws and implementation problems. Despite frequent reviews of the government's guidelines, watershed projects still fail to deliver. Many initiatives have only benefited a limited number of households, and rely on technological fixes that often lead to lack of community ownership.

Better-performing projects have been based on promoting communities' traditional water harvesting and conservation practices. These have had good community participation and low implementation costs. They have benefited a larger number of people and are usually based on promoting equity and ecological principles. In contrast, most watershed development programmes have a clear hierarchy of benefits and beneficiaries. Farm households benefit most from improved irrigation, followed by those farmers who get on-farm treatments such as field bunds. The landless and those who do not own livestock benefit the least. These issues are treated as more or less inevitable and have not been placed at the centre of a participatory process. The need is to initiate negotiations among different beneficiaries and stakeholders.

A review of watershed projects in Karnataka and Maharashtra concluded that watershed development is of crucial importance in India (Joy, 2003). The progress of globalization and privatization means that local natural resources, synonymous with watershed ecosystem resources, are often the last productive resources that the rural poor have access to.

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CHAPTER 7
POLICY CHALLENGES AND RECOMMENDATIONS FOR WATERSHED DEVELOPMENT IN INDIA

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INTRODUCTION

India has about 16 percent of the world's population but only 4 percent of its freshwater resources (Planning Commission, 2001). In India, the estimated rate of groundwater extraction in the 1990s exceeded the replenishment rate by 104 billion m^3yr^{-1} compared with 30 billion m^3yr^{-1} in China and 10 billion m^3yr^{-1} in northern Africa (Postel, 2000). Currently, more than 10 percent of central groundwater board blocks (the smallest administrative units for water resource management in India) are overexploited. The World Bank (1999) has calculated that blocks where exploitation is beyond the critical level have been increasing at a rate of 5.5 percent each year.

Since 1995, the Government of India has moved towards creating common guidelines as a framework for watershed development. However, concerns remain that legislative measures to protect and manage India's water resources are hindered by the lack of an integrated framework for watershed management, a lack of effective departmental coordination, and a focus on supply- rather than demand-side mechanisms. Another major problem is that disparities between the scientific and the public perceptions of the role of forests are embedded within water and watershed policy (Calder *et al.,* forthcoming).

This paper critically evaluates the current watershed policies by highlighting fundamental issues about the management of India's watersheds[1]. An integrated watershed management approach is sought through the suggested policy recommendations.

BACKGROUND

Since the breakdown of traditional resource management systems began in colonial times, the main approach to managing India's natural resources has been through regulation. Until recently,

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the management of land, water and forests happened in a top-down, centralized way with little or no involvement of local people. There was also no integrated approach to managing these resources, with responsibilities spread across several government agencies, ministries and line departments (Amezaga *et al.,* forthcoming).

There has been an increasing emphasis on watershed development in India in the past two decades. This seeks to integrate land and water management in order to reverse the continued degradation of the country's land, water and forest resources. This degradation is caused by pressures from increasing population and economic development and manifests as increasing soil erosion, declining land productivity, lowering groundwater tables, lowering quality and quantity of drinking-water, and loss of forest cover. Frequent floods and droughts are further evidence of improper catchment land use (MoA, 2002).

India's approach to watershed development has arisen from the policy level and donor preferences, and not from grassroots needs (ODI and partners, 2000). Participatory watershed management was only institutionalized in government policy in the 1990s. This has led to the emphasis in many projects shifting from technological to social interventions. The Hanumantha Rao Committee, in its review of the Drought-Prone Areas Programmes (DPAP) and the Desert Development Programme (DDP), recommended increasing people's participation. This led to the Guidelines for watershed development (MoRD, 1994), which were adopted by the Ministry for Rural Development (MoRD) in 1994. The Ministry of Water Resources' (MoWR) 1987 and 2002 national water policies have driven water resource policy at the national level (ODI and partners, 2000).

The MoRD's 1994 guidelines advocate a radical shift towards more participatory approaches to watershed development. They also call for it to happen in a more holistic way, following a ridge-to-valley approach. Unlike earlier approaches, where revenue or administrative boundaries were the unit of development, participatory watershed development programmes now take entire watersheds as their development units. This new approach seeks to improve all types of lands, including revenue, forest, community and private lands in a watershed (Amezaga *et al.,* forthcoming).

A 1999 review by the MoRD and the Ministry of Agriculture (MoA) led to a common set of operational guidelines, objectives, strategies and expenditure norms being established in 2001 for watershed development programmes. The revised 2001 watershed guidelines frame a uniform and unambiguous commitment for integrated land and water management using participatory approaches. However, the new approach is weakened by the continuing lack of interdepartmental coordination (Amezaga *et al.,* forthcoming). The new Hariyali guidelines issued by the Government of India in March 2003 seek to approach this problem by giving more emphasis to the role of the panchayat local government bodies (MoRD, 2003).

DEPARTMENTAL COORDINATION

The MoA, MoRD and Ministry of Environment and Forests (MoEF), along with their respective line departments in the Indian states, are the three main government ministries in charge of protecting and developing watersheds. Each of these ministry's programmes focuses on different aspects and activities within their subject area. The links among the government agencies with

responsibilities for India's water resources are shown in Figure 1. The National Water Development Agency was set up in 1982 to carry out detailed studies and surveys and to prepare feasibility reports of the links under the National Perspective Plan. In 1980, the Ministry of Water Resources (then known as the Ministry of Irrigation) formulated a National Perspective Plan for water resources development, which recommended transferring water from water surplus basins to water deficit basins/regions by interlinking rivers.

The MoA has worked in watershed development since the 1960s and focuses on erosion-prone agricultural lands, optimizing production in rainfed areas and reclaiming degraded lands (ODI and partners, 2000). The MoRD has been implementing watershed projects since the late 1980s (ODI and partners, 2000). It attends to non-forest wastelands and poverty alleviation programmes by working on soil and water conservation. The MoEF's remit covers forest and wasteland issues. The MoWR's mandate covers water policy, but not watershed development (Figure 1). Water is overall regarded as a state responsibility (Richards and Singh, 2001), and so the administrative control and responsibility for water development rests with state-level departments.

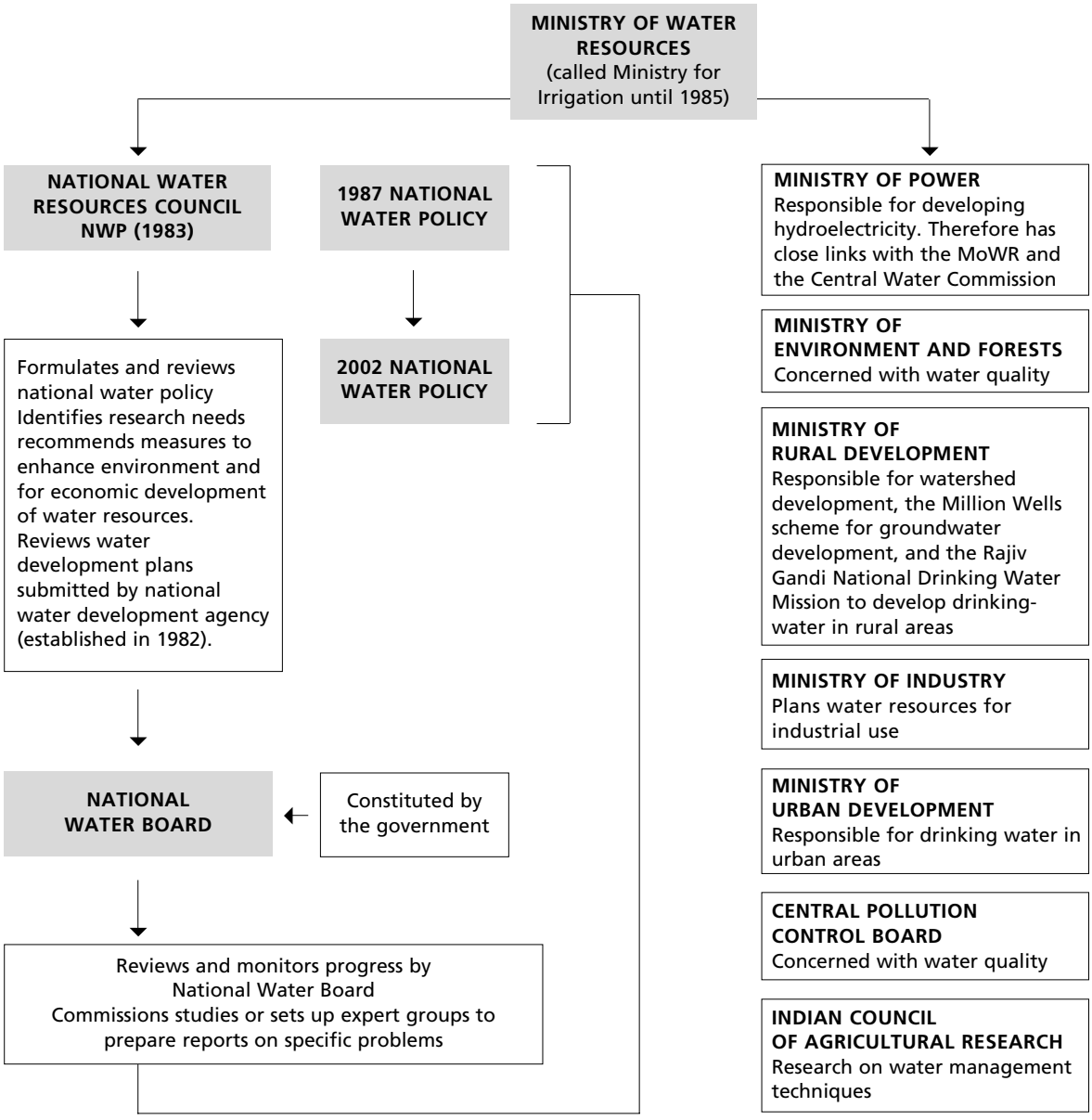
The Government of India has been advocating the integrated management of watershed programmes since the mid-1990s. The tenth plan's Working Group Report on Watershed Development: Rainfed Farming and Natural Resource Management (Planning Commission, 2001) recognizes the importance of macro-management for watershed development. It calls for watershed development programmes to focus on regenerating the productivity of degraded lands through a single national initiative.

However, in spite of the development of common guidelines, no mechanism has been put in place for integrated watershed development from a water resources perspective. Furthermore, there is no effective policy-level communication at both the national level and within individual states among the various ministries concerned with watershed management. The three ministries that are most involved in watershed management (the MoRD, the MoA and the MoEF) are driven by separate and differing policy priorities. The working group report on watershed development for the Tenth Five-Year Plan recommended an integrated approach, but maintained the compartmentalization among various ministries and line departments. If one ministry is working in one implementation area, then no other ministry can work in the same area. However, the Planning Commission states clearly that "it would be desirable to have a single national initiative for the watershed development programmes" (Planning Commission, 2001).

The working group report recommends the opposite to its posited integrated approach by decreasing the overlapping responsibilities of concerned ministries and line departments. It recommends more coordination, but not improved cooperation. It also says that the MoA wants to be given the responsibility for programmes to regenerate degraded lands and wastelands because it has the required technical workforce. It claims that the Department of Land Resources (DoLR) lacks technical expertise, especially on productive activities. The DoLR, on the other hand, wants the single national initiative to happen under the MoRD. A further problem is that, although the MoEF is responsible for coastal watersheds, it does not recognize water resource management as being within its mandate.

The lack of links among the various ministries and bodies responsible for watershed development programmes means that a solution to India's water resource situation is not supported by policy. The increasing overextraction of groundwater in coastal areas is contaminating water resources

FIGURE 1
Indian government agencies concerned with water resources



with saline water, as seawater is pulled into terrestrial zones. This is recognized in the National Water Policy (MoWR, 2002) as a major problem in water resource management. The MoEF neither has the means nor is supported by policy to resolve this problem.

SUPPLY AND DEMAND MANAGEMENT ISSUES

Government and private sector efforts have focused on increasing the amount of available water, rather than reducing demand by building new wells and de-silting tanks, dams and canals to transfer water from one basin to another, and by putting in place rainfall harvesting structures (KAWAD, 2001). Water management policies seem to be based on the assumption that water will continue to flow from upper to lower catchments in unlimited quantities, regardless of the amount of water extracted or harvested. It recommends that a series of small sunken water harvesting structures be placed all over the landscape, and along drainage lines, to allow for the equitable distribution of water (Planning Commission, 2001).

Such structures retain storm flows to allow water to be used locally. However, when all the water resources of a catchment or macro-watershed are fully used on an annual basis, there is little or no flow out of macro-catchments. In this situation, further investments in water conservation structures and other measures such as bunding are less cost-effective, as water is captured upstream at the expense of downstream users (Gosain, Rao and Calder, 2003).
The guidelines of the National Watershed Development Project for Rainfed Areas (NWDPRA, 2002) define surplus runoff as that which goes outside the watershed area. It defines one of the criteria for a successful watershed project as about 50 percent of surplus runoff being conserved or harvested in the watershed. This highlights the policy focus on local benefits and the lack of attention to effects on downstream users.

Batchelor, Rama Mohan Rao and Manohar Rao (2003) conclude from water audits carried out in the Karnataka and Andhra Pradesh Rural Livelihoods Project that intensive water harvesting has altered the spatial and temporal pattern of availability and access to surface and groundwater. This has brought many benefits but, especially in semi-arid areas, these benefits have had significant negative trade-offs in low rainfall years.

Demand for water is outstripping supply owing to attitudes founded on the belief that there is unlimited scope for augmenting water resources. State policies are encouraging the inefficient, unsustainable and inequitable use of water (Batchelor, Rama Mohan Rao and Manohar Rao, 2003).

POLICY MISCONCEPTIONS

Much watershed policy is based on misconceived linkages among forests, other land uses and water. Decades of research (Bosch and Hewlett, 1982; Calder, 1992; Scott and Lesch, 1997; Brunijnzeel, forthcoming; Calder *et al.,* forthcoming) have shown the limitations of the conventional wisdom relating to forests and water. This disparity needs to be addressed before sound land and water policies can be established (Calder *et al.,* forthcoming). The idea that planting forests increases runoff, regulates flows, increases rainfall and reduces erosion is unfounded but still widely quoted in policy.

Common water and water forest misconceptions include the following notions:

- *Forests increase runoff and local rainfall:* In most cases, rainfall is not linked to forests. In those situations where a positive relationship does lead to a small increase in rainfall, the increase in evaporation more than compensates for the small increase in rainfall, leading to an overall

decrease in the available water resources. The new understanding gained through transpiration and interception experiments has determined that in very moist and dry climates evaporation from forests is higher than that from shorter crops. Therefore, except in very few circumstances, runoff will consequently be reduced (Calder, 1999).

- *Water harvesting is a benign technology:* In specific cases, water harvesting structures can produce benefits. However, intensive drainage line treatment can cause significant reductions in downstream water resources, inducing severe hardship for people lower down the catchment (KAWAD, 2001).

- *Runoff in semi-arid areas is 30 to 40 percent of annual rainfall:* At scales larger than the micro-watershed, annual runoff is lower than 30 to 40 percent. In large areas of India, for example, mean annual runoff is lower than 5 percent of annual rainfall. Groundwater extraction, soil water conservation and construction of water harvesting structures have all contributed to a further reduction in mean annual runoff (KAWAD, 2001).

- *Forests increase infiltration:* Forest soils usually have a higher infiltration capacity than crops or pasture, but owing to rainfall interception they are usually drier than in clearings under grass cover (Gallart and Llorens, 2003).

A number of water- and land-related myths have a very high level of acceptance within watershed development programmes and are disseminated widely through a variety of media and political outputs (Batchelor, Rama Mohan, Rao and Manohar Rao, 2003), as shown by the following two examples from high-level government agencies:

> Watershed management through extensive soil conservation, catchment-area treatment, preservation of forests and increasing the forest cover and the construction of check dams should be promoted. Efforts shall be to conserve the water in the catchment (MoWR, 2002).

> Vegetating the upper reaches … to enhance the stream flow besides increased groundwater recharge are the other possibilities … (Planning Commission, 2001).

Rectifying the misconceived conventional wisdom incorporated in policy is crucial to advancing watershed development and management. Further efforts need to be directed at scientific research and ensuring that research findings are better disseminated and connected to land-use planning, forests policy and decision-making (Calder *et al.*, forthcoming).

CONCLUSIONS

The main problems identified in this paper could be tackled through policy change to put in place: 1) a better enabling environment; and 2) demand management incentives and disincentives. These would promote the more efficient use of water (KAWAD, 2001). A better enabling environment will involve institutional, legal, macroeconomic and sectoral policy changes. The incentives and disincentives will involve restrictions and zoning of water resources and accurate public information.

The policy focus on increasing water supply is having serious negative effects on vulnerable rural livelihoods. These effects are felt throughout basins and in catchments lower down. Policy needs to acknowledge the connectedness of watersheds through the landscape by integrating water resource management policies and associated mechanisms from source to sink. To promote equity and sustainability, watershed development needs to attend to the management of resources from the point of input through to the coastal zone. The lack of policy recognition of the close interrelationships of water resources across the landscape is a serious cause for concern. The experience of India's major watershed development projects is that well-synchronized projects will not achieve their objectives without a national framework for evaluating water resources (Gosain, Rao and Calder, 2003).

The lack of integration in watershed management mechanisms and water resource development between the national and state levels, and between ministries and their line departments, means that areas such as Karnataka will continue to suffer decreasing groundwater levels. The number of closed catchments will increase unless such a framework is adopted. Policies and practices are needed that are based on accurate information, seek long-term solutions and emphasize promoting water resource management at all levels (Batchelor, Rama Mohan Rao and Manohar Rao, 2003).

Appropriate frameworks need to be developed to evaluate the impacts of watershed development on water resources. They need to take into account impacts on hydrological functions on larger temporal and spatial scales. Taking into account the new emphasis on panchayat institutions, they will have to enable the assessment of impacts at the panchayat and catchment levels. This information needs to be regularly updated to reflect the most accurate ground-truthed data or infrastructure requirements in order to promote sound natural resource management (Gosain, Rao and Calder, 2003).

The need is for policy that facilitates institutional coordination and consistency among all parties involved in watershed development. It also needs practices based on validated scientific findings, demand- rather than supply-side mechanisms and the macrolevel treatment of watersheds as a complex sequence of interrelated units from source to sink.

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