REVIEW OF RESEARCH

A GEOGRAPHICAL REVIEW OF WATER MANAGEMENT

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ABSTRACT:

The last few years have seen dramatic rise in the demand for water in India due to a variety of socio-economic processes and demographic trends. Supplies have also grown manifold, to keep pace with the demand through exploitation of surface and groundwater. The result: groundwater resources are over-exploited in many arid and semiarid regions, leading to falling water levels, deteriorating groundwater quality causing groundwater scarcity. Surface water resources are over-appropriated in many basins. Surface reservoirs are fast depleting due to siltation. Freshwater supplies are increasingly coming under threat of pollution from industrial effluents and municipal waste.

The situation has developed steadily and dramatically with the per capita freshwater availability declining from 6008 M3 per year in 1947 to approximately 2200 M3 per annum after 50 years. Water scarcity is becoming a major constraint in producing food for growing population, ecosystem protection, and maintaining health and social security. Increasing competition and conflicts pose social and ecological risks.In this paper, the authors analyze the water problems, emerging issues and management challenges in India. The authors argue that the demand for water will grow by leaps and bounds during the next few decades due to population growth, especially in urban areas, concentration of urban population in a few urban cities, rising income levels, and rapid industrial growth. While water resources would continue to deplete due to groundwater degradation, surface water pollution, and depletion of existing surface reservoirs, water scarcity problems would grow in terms of both intensity and extent. Along with scarcity, the conflicts are likely to grow not only between sectors, but also within sectors.

Challenges to evolving sustainable, equitable and efficient management of India's water resources are several. First, the non-availability of adequate scientific data on quantity and quality of water, demand for water in different sectors, nature and extent and causes of water problems become major hindrances to developing sustainable water management strategies. Technology poses another set of challenges. Advancements in water technology aimed at evolving technically feasible, economically viable, environmentally and ecologically sound and socially acceptable solutions in water management are not occurring. Secondly, existing institutions in the water sector are technically oriented, sectoral, and centralised, having the mandate of managing supplies. They adopt piece-meal approaches to solve sectoral problems, and seriously lack capabilities to alter social systems to promote efficient water use and control pollution. The agencies fail to respond to the conflicting needs and interests of different stakeholders due to poor organizational co-ordination. They also lack institutional capabilities to ensure equitable allocation and efficient use of water across sectors and to resolve conflicts.

KEYWORDS: *water management, resources, review .*

INTRODUCTION

Water is a key natural resource for human survival. Water plays a vital role in sanitation for

our rural and urban communities. Water is also an important economic resource. It is necessary for all forms of agriculture and most of the industrial production processes (Merrett 1997; Kay et al. 1997). Water also provides a wide range of ecosystem and environmental services (Frederick 1993; Seckler et al. 1998). It is essential for assimilation of pollution caused by industrial effluents and domestic sewage. Pressure on freshwater resources is increasing across the globe (WRI 1995; Brown et al. 1998). During the first 8 decades of this century, consumption of water increased fivefold, 75 percent of which was during the second half of the century (Frederick 1993). From a macro perspective, the overall fresh water availability across the globe remains more or less constant. But, from a micro-perspective, the freshwater supplies in many regions and localities are dwindling due to alterations in hydrologic balances, over-exploitation and increasing pollution of freshwater reserves. Many third world countries are already facing serious water shortages (Brown et al. 1998; Seckler et al. 1998). Increasing freshwater scarcity is becoming a major constraint in producing food for growing world population, ecosystem protection, and maintaining health, social and food security and peace among nations (Postel 1996).

India is not an exception to this impending crisis. The growing population, which is about to touch the billion mark, the preference for water intensive agriculture and rapid urban industrialisation are putting enormous pressure on the fragile freshwater resources (Kumar 1997; World Bank 1998). Growing water scarcity problems pose serious threat to ecosystem management, social sustainability and economic growth.

Community managed and autochthones system of water management existed in Bharat for several centuries, meeting the irrigation, drinking and domestic water supply needs of the community (Agarwal and Narain 1997; Singh 1991; Shankari and Shah 1993). The colonial rule was marked by a serious shift from ancient community based mostly water management.

The British built large barrages and canals, but the irrigation systems were governed rather than managed. Also, they were too large for the communities to play any significant role in their management (Chitale 1991). The undivided India had 28.2 million hectares (mha) of net irrigated land, including 15.2 mha of canal irrigated land. In the partition, the country lost a part of the irrigation sources to Pakistan (Bharadwaj 1990). The foodgrain production in the country during 1949-50 was nearly 62 million tons (Sarma and Roy 1979). In order to boost agriculture production and achieve self-sufficiency in food, irrigation development was given a major investment priority during the subsequent five-year plans (Bharadwaj 1990; Vohra 1995). Several major, medium, and minor irrigation schemes were built. As a result, the net irrigated area increased from 21 m. ha to 46.2 m. ha from 1951 to 1991 (Vohra 1995), enabling an annual growth of 2.42 percent in food production to reach 180 million tons by 1995. During 1964-65 to 1970- 71 food-grain production grew at a record rate of 3.3 percent, mostly due to expansion in irrigated area (Sharma and Roy 1979). The last few decades have seen a dramatic rise in the demand for water in India, triggered by the rise in population, especially in urban areas, causing increased demand for food production and domestic water supplies; and industrial growth resulting in increased demand

WATER RELATED PROBLEMS IN INDIA

At the time of Independence, India was faced with the dual challenge of enhancing food- grain production and providing safe drinking water supplies. Irrigation development was a major investment priority in the five-year plans. Since 1951, India had made remarkable achievements in irrigation development (Bharadwaj 1990; Varghese 1990; Vohra, 1995). The net irrigated area had almost doubled during the period of 1951 to 1991 from 21 m. ha to 45.6 m. ha in 1991 (Vohra 1995). The annual foodgrain production increased from a meagre 50.8 million tons to 198 million tons in 1996-97. Substantial achievements had also been made in water supplies through the development of surface and groundwater resources. While at the time of independence, only 6.15 percent of the country's population had safe drinking water supplies (source: Five Year Plans as quoted in TERI 1998), by the year 1997, about 81 percent of the total population had access to safe drinking water supplies (CSE 1997). However, the development had also brought to the fore several physical, social and

management problems. In this section, we attempt to analyse the major water related problems that pose challenge to meeting the future water supply needs.

2.1 Water Resources under Stress: Declining Potential of Surface Water

2.1.1 Reducing Scope for Augmenting the Existing Supplies Though the overall level of utilization of natural runoff is very low, the scope for further utilization is greatly limited due to several reasons. First, almost all the viable sites are already exploited (Kumar 1992) and the utilisation is quite intensive. Construction of any new water storage facility is more likely to provide a means of re-allocating the available supplies among different uses than adding to the aggregate supplies (Frederick 1993).

The social and environmental costs of future exploitation are very high (World Bank 1991; Kumar 1992; Frederick 1993). Construction of big dams, while creating large submergence, had resulted in large-scale displacement and uprooting of human communities, depriving them of their traditional livelihood sources and opportunities (WRI 1995). The issues of fundamental human rights, equity and social justice that are inherent in such patterns of development are far more serious than the narrow issue of displacement. The underlying principle is that the people who derive the fruits of development are not those who bear the cost. Second, large water projects in India are increasingly coming under the scrutiny of environmentalists and social justice activists (Paranjape and Joy 1995). The threats to environment and ecosystems posed by large dams are well understood. The conventional wisdom suggests that large dams, involving large-scale submergence have serious negative environmental consequences, while the positive environmental and ecological impacts of irrigation were ignored (Kay et al. 1997). Third, availability of funds for large water projects is also open to question. Greater awareness among the world community about the social and environmental consequences of large dam projects is putting international aid agencies under increasing public scrutiny. This has also adversely affected international financial assistance for large dam projects in India. As of today, there are 400 big and small dam projects in India held up due to lack of funds or opposition from the environmental lobby (source: Journal of Indian Water Resource Society, Vol. 19 (5), No.2, April 1999).

Reducing Potential of Existing Supply Schemes There are numerous problems facing the large reservoir projects in India that have Implications for the potential of existing supply schemes. Accelerated soil erosion in the Catchments and subsequent faster silting up of reservoirs, a serious concern for hydrologists, is one among them. Most often, the actual rates of soil erosion and siltation were found to be much higher than the estimates arrived through hydrologists' calculations. For example: the estimated rate of siltation for Dharoi reservoir built on Sabarmati River was nearly 1.6 MCM per year at the time of planning. But, twenty years down the line, catchment surveys conducted in 1994 showed that siltation in the catchment was occurring at a rate of nearly 10 MCM per year (GOG 1994). The net result is the depleting storage and reduced life of Further, the approach to planning, and development and management of water resources has been, by and large, centralized, scrotal and segmented. This approach has not only led to unsustainable development of water resources, but also caused several negative social, economic and environmental problems (Kumar and Blabs 2000; World Bank/GOI 1998). As a matter of fact, Sandra Postal argues that most of the environmental problems associated with large water resource development projects are the result of poor water resource development and management, and not inherent in irrigation (Postal 1999)

So far as adding to the existing capacity is concerned, the potential is fast reaching the limits. The reasons are many: viable sites for building new reservoirs are almost absent; the social and environmental costs of surface water resource development projects are prohibitively high; the storage of existing reservoirs is dwindling; and groundwater resources are showing increasing signs of depletion (Kumar and Blabs 2000). On the other hand, demand of water for agriculture is growing due to the increasing food grain needs of the growing population, and the growing preference for growing water intensive cash crops.

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