MEETING REPORT

A framework for India's water policy*

'Water is a prime natural resource, a basic human need and a precious national asset', reads Section 1.1 of the National Water Policy[1] (2002). We are at the threshold of a threat to our water resources. Witnessing the water crisis in the country, it has become imperative to bring science and policy constructively together so as to reverse the damage, and prevent further peril. This was the aim of a meeting organized as a response to concerns about the state of India's water availability and use.

In the first session (chaired by Roddam Narasimha, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore), Vinod Gaur (Indian Institute of Astrophysics, Bangalore) initiated the meeting by introducing T. N. Narasimhan (University of California, Berkeley), and drawing attention to a major concern for our society – 'a highly optimistic but scientifically untenable estimate of water available for utilization to fuel 6% growth'. According to estimates based on the Ministry of Water Resources information, the utilizable water accounts for 1123 cubic km/year as against 634 cubic km/year of current water usage, indicating 'no cause for immediate concern'. However, this is a clear case of double counting[2]. Estimates based on worldwide comparison suggest a figure of 654 cubic km/year for utilizable water, indicating a cause for immediate concern. Gaur perceived the need for a policy framework which enlists all actions required to sustain harmony between the hydrosphere and the biosphere. In addition, he emphasized the necessity for water-awareness at various levels (institutional and civilian) and pointed out that water should be regarded as a 'strategic entity', and that the right of every citizen to water needs to be stated in the Constitution of India. Despite availability of a National Water Policy[1] and a report of the expert group on Ground Water Management and Ownership[3] approved by the Planning Commission, a need exists for a reform in the tenets of India's water policy.

Narasimhan presented a talk titled 'Towards a conversation on a framework for India's water policy', which paved the way for a brainstorming discussion among the participants, who were drawn from diverse backgrounds, but shared a common interest in water. Narasimhan presented water management in the context of water as a natural phenomenon, and stressed the requirement of bringing together science, engineering, social sciences and humanities to achieve the goal of equitable water management. He described the hydrological cycle: its structure, components, linkages, budget and implications to society. India, with an area of 3.28 million sq. km, receives an annual average rainfall of 1170 mm (varying from 300 mm in western Rajasthan to 2800 mm in Assam and Meghalaya). India can be divided into three hydrological provinces – the Himalayan Belt (extending from Kashmir to Himachal Pradesh and Mizoram, rugged topography, 18% of India's land area, supports 6% of India's population), the Indus–Ganga–Brahmaputra Plain (gentle topography, 32% of India's area supporting 48% of the population) and Peninsular India (hard rock, 50% of the area with 45% of the population). Drawing attention to India's water budget, he pointed out discrepancies between estimates based on information provided by the Ministry of Water Resources[1] (2002) and his own independent estimates[4] (2008) based on worldwide evapotranspiration data. A higher evapotranspiration value indicates that less water is available for human use, but the Ministry's estimates imply evapotranspiration rates lower than those provided by other sources, leading to questionable higher availability of utilizable water[4].

There is much on-going debate among the various segments of society about water development and rights to water. No simple solutions exist to India's water problems. Strategies such as linking of rivers, rain-water harvesting and desalination have their own set of advantages and limitations. Therefore, a science-based policy is the need of the hour.

Addressing the issue of water ownership, Narasimhan proposed that an inspiration can be drawn from Roman jurists, who provided a legal framework to address how humans may conduct themselves in relation to natural resources. That framework is familiarly known as public trust doctrine. Public trust is explicitly included in the constitutions of countries of Europe, USA, New Zealand and South Africa. The Constitution of India, however, does not give explicit consideration to the peculiar attributes of water that make it vital for human sustenance. Instead, water is treated as a 'state subject'. Without unifying principles that recognize water as an extraordinary natural phenomenon, a rationale for a national water policy remains elusive.

Narasimhan concluded by suggesting a few basic scientific components that are relevant to the National Water Policy. These include: short-term crisis management; long-term sustainable management; creation of archives (solely dedicated to water literature), libraries and other means of dissemination of knowledge; science infrastructure (creation of institutions, databases, manpower); and education (at primary and secondary schools, and institutions of higher learning).

The talk was followed by a brief discussion highlighting the pros and cons of the solutions provided by Narasimhan. There was vigorous discussion on the mismatch between the evapotranspiration value of 40% inherent in the Government's water budget and 65% or more suggested in worldwide hydrology literature. After summarizing current hydrological knowledge on the topic, Sharad Jain (Indian Institute of Technology, Roorkee) highlighted the need for additional studies to resolve this important issue. Ramaswamy R. Iyer (Centre for Policy Research, New Delhi) explained the Article 21 of India's Constitution, and stated that it does not explicitly assert a citizen's rights to water, although the Supreme Court of India has invoked this Article in support of public trust.

During the second session (chaired by T. V. Ramakrishnan, Banaras Hindu Uni-

*A report on the one-day discussion meeting on 'Formulating India's Water Policy', held on 10 August 2009 at NIAS, IISc Campus, Bangalore. The meeting was sponsored by the Indian Academy of Sciences in collaboration with the National Institute of Advanced Studies.

versity, Varanasi), there was a discussion on water budget related to agro-ecological systems. Most of the water available is utilized for agricultural activities. Strategies such as cropping in dry and barren lands like those in Rajasthan have greatly elevated water requirement. These have turned out to be futile activities, far from the expectations of bringing in productivity in such areas. Sharad Jain opined that water is a creator as well as a user of energy. Crop subsidies need to be assessed with care and their wastage has to be avoided. B. G. Verghese (Centre for Policy Research, New Delhi) and others expressed concern over the lack of geological knowledge in the context of water resources. It is essential to create general awareness of geography, not only for the public but also for policy makers. According to Narasimhan, the earth sciences has not received the importance it deserves; physical and biological sciences enjoy much attention. He cited the concerns expressed by Balaram[5]: 'Understanding the science of the earth, oceans and atmosphere must of course be a high priority and the disciplines of physics, chemistry, biology and mathematics must contribute in substantial measure. However, at present the study of earth sciences in India is at its lowest ebb. Geology is a subject that is taught classically and traditionally in many places, dull, descriptive and untouched by the excitement of modern science. These courses have few takers, students coming towards the earth sciences only after many other options have been exhausted. While science courses in universities have been generally struggling, I suspect the plight of earth sciences is particularly poor.'

The question of utilization of deep aquifers was raised, and it was agreed that for political reasons related to sharing of waters with neighbouring countries, these are not being exploited. 'India needs to draw inspiration from the strategies adopted by Europe to manage its water. Twenty seven nations of the European Union have come together to manage water in a better way as a common cultural tradition. The best available scientific knowledge needs to be implemented in creating a water policy for our nation'[6]. According to Narasimhan, a philosophical approach is required and a unifying principle defining water policy is needed.

Ashok Madhukar (Afro-Asian Consortium, New Delhi) presented a talk on 'Ideas on water policy development: a demand based approach', in which he highlighted the fact that it is the need that creates demand, which in turn creates pressure on our resources. He suggested that measures of managing demand are an answer to overexploitation in some areas and unavailability in others. He cited an example of Delhi, where introduction of CNG (compressed natural gas) as automobile fuel has reduced pollution levels to a great extent. He referred to water usage in various sectors, namely agriculture, industry, household, etc. and mentioned that agriculture demands 80% of the supply. There are certain self-limiting policies like demand management (leakages, slabs, pricing and support for the economically weak), destination management and pollution control. He opined that over-regulation serves to keep many of India's national policies from being followed by the public, and provided an analogy to the 'no parking' rule: if there is a 'no parking' zone, a parking zone should be provided in place, otherwise no one would be able to follow the rule. Thus, the regulation approach does not work. Steps like moving from use of water cooling systems in industry to air cooling ones, can bring down industrial water consumption and at the same time prevent pollution of nearby water bodies.

Shanta Mohan (NIAS, Bangalore) spoke on behalf of those who have no say in policy-making: women, scheduled castes and tribes, and other excluded groups. She also asked, 'Whose rights are protected? There have been examples in the US where the rights of native Americans have been protected by the Federal Government. Chiranjeev Singh (Government of Karnataka) drew attention to interstate disputes over river water, quoting the Cauvery water issue between Karnataka and Tamil Nadu.

What was striking about the third session (chaired by B. V. Sreekantan, NIAS, Bangalore) was its emphasis on the non-availability of data, for which the foundation was laid by R. Vaidyanadhan (Andhra University). A vigorous discussion followed over the causes of secrecy of data. All data on water resources are 'classified', and it is ironic that the policy makers do not have any access to them either, let alone the public. The Survey of India is a central government organization and the nodal centre for generating, storage and dissemination of geographical data in India. But it restricts scientists and public from accessing its data on the grounds of national security and copyright law[7].

Ramaswamy R. Iyer cited the case of California, where 'there is a horrendous diversion of rivers', that sets an example of misdevelopment to the world. He suggested a popular publication titled, '*Rivers of Empire*' by Donald Worster (1985) to learn how capitalism affected the state of California. He also regretted that water has become a commodity, rather than a right, for commercial purposes like agriculture and industry. Referring to the Rajasthan Canal Project, he mentioned that its first phase was certainly misconcieved and this realization came later. There were problems of water logging when agriculture was brought into the state. Projects and schemes like the Bhakra Nangal, Damodar Valley, Nagarjunasagar, Rajasthan Canal Project, etc. were implemented with an aim of maximizing the agricultural production by increasing the irrigation potential[8]. Due to the preference given to these projects, the traditional and local regards go undermined.

India is in need of a nested approach for local water harvesting. A national principle and not the existing state-wise acts, is the urgent requirement. The concept of 'virtual water', which refers to diverting water from one state to another, was brought to light and condemned. Unfortunately, this practice is prevalent because states tend to draw revenue out of it. A standard methodology to assess the water resources thus needs to be adopted.

The contributions of the national academies of science (Indian Academy of Sciences, The National Academy of Sciences and Indian National Science Academy) and institutions like the Indian Institute of Science (IISc) and Indian Institutes of Technology towards bringing a change in policy making and in popularizing earth sciences were highlighted by R. Narasimha. IISc has a Centre for Atmospheric and Oceanic Science, and a Centre for Earth Sciences. India also has a premier institute – the National Institute of Hydrology at Roorkee. There exists a Ministry of Earth Sciences and the Earth Commission. Documents like the National Water Policy Report[1] and the Expert Group Report[3] on 'Ground Water Management and Ownership' have been created. A discussion meeting[7] on 'Public access to Indian geographical data' was

held at the Indian Academy of Sciences in July 1999. Research activities reflecting the need for conserving our water reserves have been reported in journals of national and international significance. However, knowing the plight of our water resources, these are only a few initiatives and lot more awaits to be done.

The last session was presided over by Ramaswamy R. Iyer and was aimed at focusing on summarizing ideas expressed by the participants throughout the meeting. Issues such as overlapping of data (groundwater and surface water) during estimations were discussed and set aside. Available figures[4] suggest that the annual current water utilizable is 654 cubic km and water use is estimated at 634 cubic km, but it does not imply that we can utilize the entire water available. Water needs to flow in rivers, replenish the ground water table, support aquatic life and purify itself. It was pointed out that a National Water Research Council was set up in 1980 to solve interstate disputes occurring over water, and that with the Environmental Protection Act 2006, India has enacted new laws. These have diluted the previous acts, making it easier for the industries to exploit our water resources. A concern was shown over the secrecy of data by the higher authorities. Plausible solutions were put forth: water needs to be supplied to the poor at nominal charges or for free; science can be used to trap monsoon water; water can be diverted from agriculture being the major consumer, to industry; industries must recycle the used water; and so forth. Chiranjeev cautioned that the compartmentalization of science in India was having serious consequences. The issue of early school dropouts needs to be addressed. As a matter of fact, about 50% of the children drop out of school at class V in India[9]. Groundwater depletion was also brought to the fore. In spite of awareness on the unsustainable withdrawal of groundwater, not much has been done by the Central Ground Water Authority, established way back in 1986 (ref. 10).

The meeting was a showcase of the importance of interdisciplinary sciences in framing our policies, during which there was reasonable consensus on (a) the need for awareness and education about water, (b) open access to scientific data and transparency, and (c) science-based appreciation of water management.

1. National Water Policy, Ministry of Water Resources, Government of India, New Delhi, April 2002.
2. Garg, N. K. and Hassan, Q., *Curr. Sci.*, 2007, **93**, 932–941.
3. Planning Commission, Report of the Expert Group on Groundwater Management and Ownership, Govt of India, New Delhi, September 2007.
4. Narasimhan, T. N., *J. Earth Syst. Sci.*, 2008, **117**, 237–240.
5. Balaram, P., *Curr. Sci.*, 2005, **88**, 5–6.
6. Narasimhan, T. N., *Curr. Sci.*, 2007, **93**, 1043.
7. Ramachandran, R., *Curr. Sci.*, 2000, **79**, 450–467.
8. Kumar, R., Singh, R. D. and Sharma, K. D., *Curr. Sci.*, 2005, **89**, 794–811.
9. http://www.stockholmchallenge.se/project/data/i-ict-solutions-no-school-drop-outs
10. Rodell, M., Velicogna, I. and Famiglietti, J. S., *Nature*, 2009, **460**, 999–1002.

ACKNOWLEDGEMENT. I thank Prof. T. N. Narasimhan for help.

Richa Malhotra

Bhatnagar Awards 2009

The Shanti Swarup Bhatnagar Prize for Science and Technology was announced on 26 September 2009. It was instituted in the name of the founder Director-General of the Council for Scientific and Industrial Research (CSIR). Prizes comprising a citation, a plaque and cash award of Rs five lakh each are given every year to scientists below 45 years of age.

This year winners of the Award are as follows: **Biological Sciences**: Amitabh Joshi (Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore) and Bhaskar Saha (National Centre for Cell Science, Pune); **Chemical Sciences**: Charusita Chakravarty (Indian Institute of Technology Delhi, New Delhi) and Narayanaswamy Jayaraman (Indian Institute of Science, Bangalore); **Earth, Atmosphere, Ocean and Planetary Sciences**: S. K. Satheesh (Indian Institute of Science, Bangalore); **Engineering Sciences**: Giridhar Madras and Jayant Ramaswamy Haritsa (Indian Institute of Science, Bangalore); **Mathematical Sciences**: Venapally Suresh (University of Hyderabad, Hyderabad); **Medical Sciences**: Santosh Gajanan Honavar (L. V. Prasad Eye Institute, Hyderabad); **Physical Sciences**: Abhishek Dhar (Raman Research Institute, Bangalore) and Rajesh Gopakumar (Harish-Chandra Research Institute, Allahabad).

Richa Malhotra (*S. Ramaseshan Fellow*), H. No. 10, Jaladarshini Layout, off New BEL Road, Mathikere, Bangalore 560 054, India. e-mail: rchmalhotra@gmail.com