NEWS AND NOTES

RIVER REJUVENATION: Innovative Methodology and Socioeconomic Impact – Subhajyoti Das, Geological Society of India, Bangalore - 560 019 (*E: subhajyoti_das@hotmail.com*)

"The source of river is in the mountain springs or glaciers and from there it flows as a small stream. While flowing she joins hands with other rivers and streams (called tributaries) and she expands herself to become a big river. The rain feeds her for a healthy journey. She chooses her own way and the path she travels is called riverbed, where she does not sleep. But when she rests, she rests in the form of lakes or water pools. While going she nourishes the land and the people on her way. But if she is not nurtured as groundwater, she won't survive and she will die." (Jalavahini, Published by Art of Living, Bengaluru, 2017).

Ancients knew how to conserve river resources and protect their flows from abuse. But with population growth and industrialization the rivers are increasingly in distress, their catchments destroyed, hydrological cycle interfered with, sapping the flows and losing their self-cleaning capacity. A shining example is the Ganga. Hence there is overwhelming uproar for rejuvenation of rivers to save humanity and biodiversity on earth from ultimate disaster. However a river is an integral part of environment and ecology in the basin or watershed. Its revival needs coordinated efforts to conserve river resources along with environment and ecology. Watershed is the smallest basic hydrological unit to start integrated management. Based on this concept community-based watershed development including water conservation and rainwater harvesting under the aegis of Tarun Bharat Sangh of Alwar changed the face of Arwari watershed from abject poverty to affluence which also saw the dry river coming to life. This has been replicated in Ichalahalla watershed in Gadag district of Karnataka and many other places. This concept has been invoked by 'Art of Living International' in their efforts to revive dry river Arkavathy to save drinking water supply to Bengaluru. Similar Projects are now in progress in Vedavathy, Palar and several other river basins across the country.It is in this context that the conference on 'River Rejuvenation: Innovative Methodologies and its Socio-economic impact' was held at Bangalore on 5th & 6th December 2017 under the auspices of 'Art of Living International' in association with Geological Society of India to assess the efficacy and success of the methodology of Kumudvathy river rejuvenation as prototype model for other basins in granitic and basaltic terrains of Peninsular India. About 400 delegates from India, Nepal, Australia and United Kingdom including Earth scientists, Engineers, Remote Sensing & GIS Technologists, Social workers, farmer groups, policy makers belonging to various national institutes such as ISRO, HAL, IIT, TISS, , ICRISAT, NRSC, CGWB, KSNDMC participated in the conference.

The conference was inaugurated by Sri Sri Ravi Shankar, founder of the Art of Living. M. N. Venkatachalaiah, former Chief Justice, Kiran Kumar, Ex-Chairman, ISRO, and T. Suvarnaraju CMD, HAL, were Guests of Honour. In his inaugural address Sri Sri Ravi Shankar, illustrating the theme of the conference hoped that the deliberations would enlighten the people about the importance of rejuvenating our rivers which are in dire straits due to overexploitation and pollution. Sri Sri Ravishankar recounted that the Tippagondanahalli reservoir, once chief source of water supply for Bangalore city in 50's and 60's became defunct as the river feeding the lake dried up. But after fifty years Tippagondanahalli lake is again full because of the Rejuvenation Projects of Kumudvathy and Vedavathi rivers. He referred to the inter-state disputes between Karnataka and Tamil Nadu on the issue of Kavery river water. So, if Naganadhi, Koushika, Palar and other rivers in Tamilnadu, and Kumudvathi, Vedavathi and Palar rivers in Karnataka are rejuvenated there will be hardly any water crisis.. The Vrishabavathi river, too, flowing into the Kavery needs to be cleaned. This can happen only through the combined efforts of the civil society, faith based organisations, Government agencies, and corporate sector with dedication and emotional connectivity.

The two day conference had six Technical sessions on river rejuvenation project, its methodology, role of geotechnology, impact assessment, participation of corporates, public and stake holders, followed by panel discussions, in addition to valedictory sessions. The technical sessions were chaired/co-chaired by D.P.Rao/P.V.N.Rao (NRSC-ISRO), R.H. Sawkar (Geological Society)/R.Srinivasan (Current Science), Prof. Roger Falconer (Cardiff University, UK)/ Prof. Shu Quing Yang (University of Wollongong, Australia), Prof. N. K. Goel (IIT, Roorkee)/ P.V.N.Rao(NRSC-ISRO), and Yellappa Reddy , noted Environmentalist. Some highlights of the deliberations are briefly given below.

River Rejuvenation Project

Prof.K. Subramanya from IIT, Kanpur, in his key note address presented an overall scenario of Peninsular rivers in dire straits caused by human interference like construction of dams, improper irrigation systems, over-extraction of groundwater, sand mining and quarrying in the river flood plains. This has resulted in drying up and pollution of rivers across the country. Out of the river rejuvenation methodologies currently in use, the most popular one is Managed Aquifer Recharge (MAR). Leading the deliberations Subhajyoti Das of Geological Society of India gave a detailed account of the studies under taken by various agencies and the efforts made by different individuals, and civil society for river revival adopting a multidisciplinary approach. He mentioned the key role of groundwater to sustain river flow especially environmental flow, and that its overexploitation snuffs life out of the river drawing attention of audience to the Ganga rejuvenation plan. He apprised the audience how river restoration methodology was evolved through experiments and endeavors of individuals and collectively with the participation of the community since eighties. CGWB(1996) reported large scope of harvesting surplus monsoon runoff by artificially recharging desaturated aquifers and parts of vadose zone, which has potential to sustain baseflows in rivers through staggered outflows of groundwater. CWC (1999) urged improvement of water use efficiency to restore environmental flows of rivers.

River Rejuvenation Methodology

Y. Lingaraju of Art of Living, while explaining the methodology adopted by Art of Living, detailed the various steps as: (1) understanding the natural processes of the river flow dependent on geology, geomorphology, geohydrology, pedology and biological framework of the terrain; (2) study of causative factors of river degradation; (3) preparation of blue print of rejuvenation of natural processes like recharging groundwater through watershed treatment from catchment to tail end of the river ; (4) action plan adopting techniques of remote sensing, GIS, GPS, and mobile application; (5)

creating awareness and training of local community; and (6) demand side management for sustainability of water in all parts of the basin.

Role of Geotechnology

A large variety of ecological, physical, spatial and management measures and practices are aimed at restoring natural state and functioning of the river. S. K. Subramanian of River Rejuvenation Project (RRP) and P. V. N. Rao from NRSC-ISRO, spoke on the relevance of Geospatial Technology in river rejuvenation project. The surface and subsurface geology play an important role in groundwater recharge and generation of flow in river. Geospatial technology, namely Remote sensing and GIS help in designing action plans by assessing the whole catchment areas of the rivers by using various information layers. Quoting from CGWB (1996) T. G. Sitharam of IISc, Bengaluru, dwelt on the importance of geotechnology in recharging groundwater by arresting surface runoff and allowing the water to percolate into the ground which depends on detailed knowledge of geological, geomorphological, hydrological factors and aquifer constants. P. G. Diwakar, Scientific secretary, ISRO, illustrated 'Bhuvan' technology for river system studies. Roger A Falconer, Professor of Water Management, School of Engineering, Cardiff University, spoke on water security and integrated water resource modelling and management. Pratap Hegde of Telematrics4U informed that IOT (Internet of Things) is a key technology that spans multiple technology domains from data sensing to networking to data analysis, and is useful in river rejuvenation and its management.

Environmental Rejuvenation

River rejuvenation is inherently connected with biodiversity. According to Nagesh Hegde, an environmentalist, any river rejuvenation project should concurrently ensure re-establishment of original biodiversity through awareness campaigns among the village inhabitants to reconnect the link between wetlands and biodiversity. V. M. Chamola of HAL observed that the six mini watersheds in Kumudvathy Project taken up by HAL as CSR work saw restoration of depleted groundwater, increase in natural vegetation, eco restoration and environmental development leading to ecohydrological conservation.

Community Participation

"For any change to be sustainable, emphasis should be on empowering the local communities and making them torch bearers of change. Emerging from these empowered rural communities are innovative approaches in solving some of the biggest problems of water security, sanitation, and agriculture". Nagaraj Gangolli, famed environmentalist and Ravindra Desai of River Rejuvenation Project (RRP) referred to the Village Lab, an Art of Living think tank comprising industry experts, technology leaders, scientists, and financiers who aim at skill development, technology enablement, motivation of the community, and continuous monitoring and evaluation of the projects. Prabhash Chandra Ray, IFS, explained how convergence of MGNREGA and watershed development schemes resulted in a miracle of success in Chikmagalur, Chitradurga and Hassan districts of Karnataka working on the Kumudvathy methodology. Apart from river rejuvenation, increase in borewell yields, improvement in crop production and economic status of the people were the direct outcome of the project.

Impact Assessment in Kumudvathy Project

The intervention for generation of stream flows is in the nature of direct and indirect recharge, preferential recharge, and induced recharge which effect rise of water table and in stream flows. Referring to the predominant indicator of the socioeconomic impact as the agriculture income, Guru Balamurugan from the Tata Institute of Social Sciences reported that the cropping pattern changed from single to double and multicrop, and food parks had been set up. There is need for regular impact assessment to monitor groundwater condition in the study area. V. R. Hegde of Pixel Softek Pvt. Ltd., attempted at establishing a mechanism of concurrent impact assessment in Kumudvathi project.

Valedictory addresses were delivered by M. N. Venkatachaliah, former Chief Justice of India, Prof. Roger Falconer, and Commodore H.G. Harsha, CEO, Social Projects, The Art of Living.

Water conservation and management are at the core of rejuvenating debilitated river flows. The speakers introduced the audience to the objectives, designs and protocols of river rejuvenation methodology. The speakers reaffirmed the viability of the methodology adopted in the Kumudvathy river rejuvenation project with area-specific fine tuning as a prototype model for other basins or watersheds in granitic and basaltic terrains. The deliberations highlighted several vital issues and strategies in this regard.

1. Surface water and groundwater are integral parts of the water cycle. In monsoon river recharges groundwater and vice versa in non-monsoon months. The balance should not be interfered with, which results in death of the river.
2. Human interference with natural water cycle by construction of dams and canals obstructing and diverting flows; overexploitation of ground water; degradation of catchment through deforestation, soil erosion; and siltation in river channel has to be addressed to revive the natural system .
3. Hydrogeological studies aided by Geotechnical tools like Remote Sensing, GIS, IOT, are basic to understanding of the hydrological cycle, causes ailing the system, and preparation of plan to address the problems.
4. Generation of flows is an interactive product of the elements of environment and ecosystem of the watershed, namely rainfall, landform, forest, soil, vegetation, geology and subsurface water. Hence river rejuvenation is interlinked with integrated water shed development.
5. Groundwater plays a key role in restoration of natural water cycle. Artificial Recharge through rainwater harvesting and watershed treatment is the principal technique of rejuvenating groundwater and river flow. Traditional methods of water conservation supported by geotechnology prove to be cost effective, ecofriendly, technically simple and easy to implement.
6. Catchments should be carefully protected from degradation such as mining, quarrying and deforestation.
7. 'Village Lab', an Art of Living Think Tank comprising industry experts, technology leaders, scientists will enable skill development and motivation of village community in implementation of the project. Community empowerment and participation is a vital aspect of the project.
8. River basin is a live system, so it is important to treat them agro climatic zone wise, planning different models for different terrains.
9. The methodology needs to be continuously reviewed based on field experiences. Shared experiences of integrated hydroenvironmental modeling in other countries may reinforce the methodology.
10. Water quality should be periodically monitored. Quality degradation or pollution should be expeditiously treated. Open defecation and discharge of untreated industrial and municipal waste waters into the river should be prohibited.

The conference cocluded with a vote of thanks from Y.Lingaraju, Director, River Rejuvanation Project. It succeeded in sending out the message of Sri Sri Ravishankar : "*Water is the basis of life force…We need to protect the sources of water, whether it is rivers or lakes or ponds*".