BOOK REVIEW

WATERSHED MANAGEMENT FOR SUSTAINABLE DEVELOPMENT. R.N.Tiwari and G.P. Pandey (Ed.), Excellent Publishing House, New Delhi, June 2014, ISBN-978-93-83083-82-4,171p.

With the realization of village level planning as core of rural development, and seeing the success of planning and implementation of water conservation and water harvesting in the drylands of Arwari basin in Rajasthan , many activists or NGOs are now coming forward for simulating similar development planning on watershed model turning it into a people's movement. Most of such community based plans of water harvesting and conservation unfortunately fail to involve scientists and technologists, being based on only people's "gut feeling" or traditional knowledge, in short lack requisite technical base with consequent failures in cases (Duraiswami, Das et al. Mem 80, GSI, 2012, p.13&14). Hence more and more scientists are now coming forward to fill in the gap through conduct of field level studies developing replicable models to provide essential technical base to this public endeavor. The book under review is a product of such enterprise aimed at expanding the knowledge base of watershed management and contains twenty four peer reviewed papers presented in a National Seminar on 'Watershed Management for Sustainable Development' held at Rewa, Madhya Pradesh in February, 2014. It is noteworthy that the unique hydrogeological complexity starting from Archaean/Proterozoic to Gondwana/Deccan Traps and Recent has rendered this water-scarce semiarid terrain, as hub of water management studies. Hence, justifiably the book's emphasis is on Central India and its adjoining territory to address its endemic water insecurity.

Groundwater constitutes an invaluable input in the watershed management in the arid and semiarid terrains of the country. But it is also an integral part of the watershed's ecosystem and environment. Scientific management of the watershed needs an evaluation of all these related parameters as also the methods of harnessing of the resources (Das, *JGSI*, March 2015, pp.387-389). There are several well researched and well written papers in the book on the study of morphometry and hydrogeomorphology using the latest remote sensing tools as the initial step. Hydrogeomorphology is geomorphology interpreted in terms of hydrogeology giving significant clues in protection of the watershed from soil erosion, conservation of soil moisture, conservation of surface and subsurface runoff, and artificial recharge, designing methodology and water harvesting structures at scientifically suitable places starting from ridge to valley in the watershed. For example, terracing, mulching, bunding are suitable under high slope gradient, percolation tanks, check dams in moderate slopes, and sub-surface dykes in the basin discharge areas. Hydrogeological study includes aquifer mapping, study of water level fluctuations and time series, estimation of aquifer parameters and resources, water quality, mode and status of development. Integrated water management, namely conjunctive use and artificial recharge, is part of the study.

Spearheading the studies P. Kundal et al. (p.1) elucidates the various influencing parameters in watershed evaluation which control groundwater development using satellite data and analyzing on GIS platform through Analytical Hierarchy Process which shows appropriate methods of recharge which will optimize process of groundwater recharge scientifically. S.F.R. Khadri et al. (p.27) reiterates the same in Burhanpur district , Uttar Pradesh to analyse drainage morphometry, land forms and land resources , and to understand their interrelationship for planning and management at river basin level. This is more than highlighted by S. Tripathi et al. (p.97) in their article on "Village level based water security plan" using Geospatial Technology in Banda district, Uttar Pradesh. The predominantly low relief and high infiltration in Maihar region of Madhya Pradesh as studied by R.N. Tiwari et al. (p.57) present a promising scope of groundwater development and artificial recharge plans. There is need to adopt a crop-water plan to harness the limited rainy cycle. These are some of the typical case studies on water conservation in this terrain.

The chemical quality, too, that is suitability of water for drinking, industries, and irrigation constitute the other major control on sustainable use of water. Several papers deal with these aspects including pollution. The chemical quality of water mainly depends on aquifer lithology and residence time, as also extraneous anthropogenic influences like agricultural chemicals, untreated waste waters or industrial wastes. The quality of water must conform to the BIS specifications for various uses, namely domestic, irrigation and industrial. Excessive usage of agrochemicals in agriculture often leads to nitrate and pesticides contamination of groundwater. R.K. Tiwari et al. (p 92) present site specific nutrient management for crops as potential remedy of nitrate pollution. Of course nitrates may be sourced from industrial effluents or animal wastes too. Srivastava et al. (p.52) observes that the "pesticides route and rate of entry into environment as also its degradation capacity" need to be assessed for remedial actions. In urban areas industrial and municipal wastewaters contaminate the water beyond human use. As studied in Lucknow and Rewa cities (A. Saxena et al., p.55, R.N. Tiwari p.61) wastewaters should be properly treated to the prescribed specifications before discharge. Heavy metals in groundwater derived from industrial wastes become lethal when they enter food chain or when ingested through drinking water (I. P. Tripathy et al., p.61). Fluoride pollution is generally of geogenic sources, but also derived from phosphatic fertilisers. Nitrate and fluoride in toxic concentrations are constraining use of groundwater as in Beehar basin in Madhya Pradesh (S. Shukla et al., p.167). Rakesh Singh et al. (p.44) prescribe S&T intervention through construction of gravel packed shallow wells for fluoride free drinking water in Seoni district, Madhya Pradesh. For evaluation of pollution potential Drastic Index modeling should be adopted (R.N. Tiwari, p.16). These articles bring out the major water quality concerns in central India posing a big challenge to sustainable water use.

Thus, in the quest for water conservation hydrogeomorphic and hydrogeologic appraisals are intertwined. This is more than highlighted by Yamuna Singh et al. (p.122) in their article on "Hydrogeology of Rewa region, Central India", presenting a typical integrated groundwater management study in the hard rock terrain.

All the articles are lucidly written and well edited with neat illustrations, and valuable data tables. The articles provide an overview of various aspects of watershed management in the hydrogeologically complex terrain of Central India. The central theme of the book, – "better management of groundwater resources in judicious manner", – has its resonance in all the articles. But a major drawback of the book is an uncared for aspect of community based watershed development, that is linkage with technical and financial institutions, lack of which may bar sustenance of the programs in the long run (UN-IAWG-WES: 'Johads', 1996, pp.1-24; S. Das, *JGSI*, March 2015, pp.387-389). However, the editors, R.N. Tiwari and G.P. Pandey do deserve acclaim for this otherwise excellent compilation of authoritative and highly educative articles.

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