

GLOBAL GROUNDWATER RESOURCES AND MANAGEMENT by B.S. Paliwal
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The book contains selected papers from the 33rd International Geological Congress General Symposium: Hydrogeology HYH-2, held at Oslo, Norway in August 2008. The papers give an overview of global issues relating to groundwater management in a world faced with population explosion and escalating developmental needs. Editing such a book, uncommon in many respects, is no doubt a challenging task. The excessive dependence on groundwater in the third world countries without any understanding of the system and its dynamics, has resulted in hazards of overexploitation and pollution raising global concern. Thus the need of the hour is for its conservation, protection and optimal utilisation. Many innovative techniques have been evolved through case studies to tackle

the crises of groundwater management. True to his preamble in the book, Paliwal has successfully brought out this message through deft handling and editing of the papers. There are in all 31 papers in this volume organized in five sections.

The first Section on Groundwater Resources and Management contains 9 papers dealing with groundwater management scenario in varied hydrogeological and climatological environs. This Section reports several cases starting significantly with the paper of Paliwal and Paliwal (1) on water scarce Thar deserts, bringing out the critical groundwater situation there in the wake of arid environment, – limited rainfall recharge, rising groundwater draft to meet the needs, deepening water levels, and increasing salinity,

– calling for groundwater conservation. Mylopoulos and Sidiropoulos (2) have used stochastic modeling and predictive simulation to generate aquifer management scenarios working on an example of an overexploited aquifer in Greece. Afia Akhtar (6) has discussed rational use of groundwater in the deltaic plain of Bangladesh in view of rapidly exhausting groundwater resources, stressing use of geosciences and social knowledge with public participation. Lucio, Walter, Cecilia and Massimo (5) have studied the impact of water utilization and climate change on Vulsino aquifer and the Bolsana lake water resources based on monthly water level simulation model. More such studies are imperative to find out possible effects of climate change and global warming on water cycle and environment to frame management strategies. Realistic resource estimation is basic to its management. Feng, Hu and Wan (4) have illustrated this method by base flow separation in Ordos Basin of China. Coastal groundwater development is always beset with possibility of seawater ingress. In a study of coastal groundwater management Gunner Jacks, Shammass and Warriar (8) have shown divergent options depending on recharge rate and hydrogeology citing examples of Salalah aquifer of Oman and coastal Kerala. The papers in this section present typical and varied groundwater management problems and solutions relevant to India and developing world.

The second section has seven papers on more specific aspects of Hydrogeological conditions, Groundwater assessment and Modeling. Ligotin and Savichov (10) in a study on the Ob river basin of Western Siberia, Russia, have shown that global warming and climate change need not necessarily have adverse impacts on water cycle and environment. Furnari, Martarelli and Moroni (12) have presented step by step procedure in modeling and simulated flow field construction in a test area of the Alban hills, Rome, Central Italy which may be an indispensable tool in rational water management in complex hydrogeological systems. Teixeira, Chamine, Marques, Gomes, Carvalho, Alberto and Rocha (14) have given an example of hydrogeomorphological cartography and use of GIS in aiding groundwater mapping and management in Caldas da Cavala of NW Portugal. In a valuable study, Afonso, Pires, Chamine, Marques, Guimaraes, Guilherme and Rocha (16) have demonstrated a multidisciplinary approach based on GOD and DRASTIC techniques using GIS based cartography to understand aquifer vulnerability to pollution in Porto City of Portugal. As known sources of freshwater are fast exhausting, finding out new potential sources in otherwise complex hydrogeological terrain is emerging as a challenging option. Further, with proliferation of

developmental activities risk of groundwater pollution is also increasing. All these necessitate groundwater investigations, exploration and management based on a multidisciplinary approach.

The third section on Hydrogeochemistry and Contamination of Groundwater Resources contains five papers in all. Gorla (17) has developed a new method of determining age of groundwater samples using Cl, Na, and K concentrations and correlating tritium (TU)/ time (years) with the ionic ratios. This may find much use in tracing hydrochemical changes and intermixing of waters over time. Chebnokov, Kharitonova and Taran (18) have studied hydrogeochemistry of mineral water and associated gases in Lotus aquifer of Far East Russia tracing the geochemical and biogeochemical processes in their generation. Silva, Albuquerque and Rebeiro (21) in another study in Lower Valley, Lisbon, have used Water Quality Index to evaluate anthropogenic contamination on groundwater of shallow aquifer, based on multivariate statistical analysis and kriged maps. Hydrogeochemical quality evaluation is gaining momentum day by day. Quality evaluation of groundwater is indispensable for its optimal utilization. With increasing development of groundwater, its pollution and quality degradation are essential irritants which owe to either ambient subsurface hydrochemical environment or contamination from extraneous sources. To understand, rectify or remedy such infirmities knowledge on its quality evolution, and pollution mechanism is a must.

In the fourth section on Exploitation of Groundwater and Recharge there are seven papers dwelling on the topic. Paliwal, Shrivastava, Baghela and Khilnani (22), and Shandilya and Kumar (25) have dealt with unplanned recharge from anthropogenic activities leading to bizarre developments. The Canal seepage from IGNP in North Western Rajasthan might have improved the water quality in places by displacing saline water, but has also led to rampant water logging with associated environmental hazards. Limaye (27) has presented a different scenario describing the scope of planned artificial recharge through percolation tanks in hard rock areas in providing sustainability to groundwater in summer months. He has discussed the 'Best Practices' in hard rock terrain as identified in GROWNET Project which may be adopted in all low income group countries, where development and agriculture are constrained due to water scarcity being the cause for endemic poverty. Silvina and Eduardo (23) have described aerial exploitation of groundwater in coastal dunes in Buenos Aires, Argentina, through Ranney wells and well point system without disturbing the natural water cycle which is an important management principle in the sensitive

coastal environment. Stasko, Tarka, Olichwer and Lubazyansky (28) have estimated recharge as 50-60% of rainfall in small mountainous hard rock catchments. Thus sustainability of water supplies demands optimal and planned use of total water resources which in turn needs groundwater and surface water be developed in an integrated manner. Harnessing of either in isolation may lead to environmental disbalance and disasters. Exploitation should not exceed natural flows.

The fifth section is on Hazardous Groundwater Conditions. Galitskaya, Pozduyakova and Toms (29) have developed a conceptual model which allows understanding stages of hydrochemical hazard and risk formation, and estimates probabilities of each component of hydrochemical risk, and development of principles of management of geochemical risk. Lunkad and Sharma (31) have analysed the negative impact of green revolution on groundwater, soil and land in Haryana. The remedial measures involve a multilateral approach like dryland farming, micro irrigation, conjunctive use, application of organic fertilizers, and reduction in groundwater draft. Thus, development invariably has its toll on environment unless it is judiciously planned. This becomes all the more critical when the fall outs are not physically perceptible, at least initially as in groundwater regime. Analysis, assessment and management of risk are basic elements providing sustainable development.

The papers are on diverse topics seeking answers to tricky issues relating to groundwater development and management including even impact of climate change on water resources and environment which have raised global concern. Today sustainable groundwater development is a priority in the third world countries marked by continuous upswing in groundwater draft as the principal source for

drinking and irrigation among the economically weaker sections. Further groundwater being a common property resource tapped by millions, its management problems are multifaceted and need both innovative technical solution as well as social mobilization. The case studies provide valuable inputs in understanding the groundwater dynamics and in framing its management principles. The Editor deserves credit for organizing the papers thoughtfully, more or less in a logical sequence.

The papers have enormous relevance in the context of this subcontinent. This country happens to be one of the largest consumers of groundwater in the world. Its varied hydrogeological environment lends complexity in harnessing the resource. Groundwater is overexploited and contaminated in several parts of the country. The case studies in the book will provide valuable clues in rectifying these aberrations.

On the negative side, innumerable grammatical and printing mistakes, substandard reproduction of figures in places, which are uncommon in international publications, have sometimes strived to dilute the quality of the publication, which is otherwise a priceless research document. However, notwithstanding these shortcomings, this book is a valuable compendium of articles on groundwater management for economic well being and sustenance of humanity in the developing world. The data tables, illustrative figures, maps and colorful photographs will prove to be highly useful for researchers and students. If the objective of the print media is to disseminate knowledge and bring science to the doorstep of common man, unhesitatingly, this has been achieved.

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