Managing Groundwater Resources for Human Security

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Abstract

Groundwater resources represent as close to 99% of the available freshwater resources and 30% of freshwater use worldwide. It is widely used for drinking water, in industries, and dominantly for agriculture. It is estimated that groundwater supplies 50% of current drinking water and 30% of water for irrigation (UNESCO-WWAP, 2003), with much higher shares in the arid, and drought prone groundwater dependent regions. The past decades have seen an increased exploitation and reliance on groundwater resources, which has allowed many people to secure their livelihoods and for regions to develop agricultural production or their industry. In the current situation, however, many people more than 1.2 billion in developing counties don't have access to safe drinking water or basic sanitation. Groundwater is conceived to secure human security as well as to sustain safe water supply in the developing countries. Groundwater is either opportunities or threats to human security as well as compromise or conflict to international society. Certain policies and strategies to sustain the development and management of groundwater resources in the developing world will have to be elaborated through this study to secure the safe water supply.

1. Introduction

Groundwater resources represent as close to 99% of the available freshwater resources and 30% of freshwater use worldwide. Its has many attractive characteristics such as limited evapotranspiration losses and availability in large stored volumes for multi-annual flow regulation; protected and less vulnerable from surface induced pollution; and a generally widely accessible resource that can be developed by limited and privately driven investments in close relation to land use and land ownership. It is widely used for drinking water, in industries, and dominantly for agriculture. It is estimated that groundwater supplies 50% of current drinking water and 30% of water for irrigation (UNESCO-WWAP, 2003), with much higher shares in the arid, and drought prone groundwater dependent regions. Large parts of the groundwater resources are trans-boundary and shared between two or more sovereign states and therefore referable to international and domestic level groundwater management. The past decades have seen an increased

exploitation and reliance on groundwater resources, which has allowed many people to secure their livelihoods and for regions to develop agricultural production or their industry. In the current situation, however, many people more than 1.2 billion in developing counties don't have access to safe drinking water or basic sanitation. Groundwater is conceived as a basic key element and measure to sustain safe water supply in rural areas in the developing world. The workshop on groundwater resources and human security has been carried out at Bonn in 23-25 January 2006 to identify the following three major objectives.

1. *Investigate the possibilities to develop and carry out projects that relate groundwater degradation (including pollution) to human security by identifying specific areas of collaboration with perspectives of human security and water poverty.*
2. *Determine what additional efforts are required by the academics and scientific community to raise the issue of unsustainable groundwater, water poverty and human security.*
3. *Determine the significance of socio-economic and political drivers and of established institutions and mechanisms for effective policy and process and governance intervention to enhance human security*

2. Groundwater Management and Millennium Development Goals (MGDs)

Although groundwater resources are abundant on a global scale, it is, like all other freshwater resources, not homogenously distributed around the world. Some regions have large aquifers covering an extensive area; others have no or very little groundwater. In many instances, groundwater resources are being overexploited, with withdrawal rates exceeding recharge rates and depleted or polluted by anthropogenic activities such as industrial wastes, urban wastewater, land use changes which affect recharge, and/or agricultural pesticides and fertilisers, and as a consequence the resource will lose its attractive characteristics, as mentioned above. Pollution can be so great that recent press releases from the Chinese Government [1] mention that 90% of Chinese cities have polluted groundwater and that this situation is bound to get worse with the continuous economic boom experienced in the country, unless pollution mitigation methods are put in place. In as much that the increased use of groundwater contributes to the achievement of the Millennium Development Goal (MDG) to "halve the proportion of people who are unable to reach or to afford safe drinking water", these resources should be managed by sustainable way to support the achievement of the MDGs.

3. Sustainability of Groundwater

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anthropogenic activities either have direct consequences on populations (e.g. polluted drinking water, land subsidence in mega-cities), or represent a “creeping” threat that will materialise in the long run (sometimes known to decision-makers – e.g. mining of fossil water, sometimes not). In some regions, the consequences of unsustainable groundwater use impact on human livelihoods, human health and food security, three of the seven pillars of the definition of Human Security as defined by UNDP (1994). These impacts are either direct or indirect by compromising the services that can be provided by the environment to communities (e.g. MEA, 2005). Superimposed on this, climate change, by affecting the hydrologic cycle (changes in precipitation patterns and its consequences on the biosphere), could make a difficult situation even worse in the future. However, the IPCC recognised that “…there has been very little research on the potential effects of climate change…“ on groundwater resources and that the panel could only present “…a series of hypotheses” in its final report (IPCC, 2001; p 199). Problems in unconfined aquifers linked to recharge (climatic conditions) and see-level rise are nevertheless mentioned in the report. A complicating factor when it comes to groundwater degradation is the variability in temporal scales of the different processes affecting the resource. For example, groundwater flow is much slower than surface water flow and pollution can either be immediate or take a long time to materialise. It often also takes little time to degrade an aquifer and much longer time periods to reclaim it. The related practical issues include the capacity to clean and apprehend persistent biological and chemical pollutants in the unsaturated and saturated groundwater zones.

4. Human Security

Human security is a concept that places emphasis on every individual in order to protect them from threats against their lives, livelihoods and dignity, and to help them fulfil their abundant potential. Furthermore, it emphasizes the importance of “protection” and “empowerment”. In other words, human security seeks to protect individuals from “fears” such as conflict, spread if infectious diseases, destruction of environment, and natural disasters, and “threats” such as poverty, hunger, and lack of educational and health care services. It also aims to strengthen people’s ability to choose and take action against threats on their own. Groundwater is conceived as a vital essential key element to emphasize the human security perspectives.

In order to improve situations on water and sanitation, it is important to protect and empower individuals and local communities based on the perspective of “human security”, along with the implementation of government level policies. Examples include adopting methods to encourage the capacity development and participation of inhabitants in the infrastructure develop0ment, maintenance, management, and operation of water supply and irrigation systems. The technical assistance aims to promote self-reliance of people including women and facilitate their active role as “promoters of development”, through assistance to local communities focusing on water. It is also supports the capacity development, through

such activities as organization of residents and education related to water and sanitation, taking into account the gender perspectives. Furthermore, it supports socially vulnerable including the poor who face various difficulties such as lack of access to safe water and water pollution control. In addition, protecting people from risks of floods, droughts, and other natural disasters and strengthening capacities to respond to these situations are important form the "human security" perspective.

5. Groundwater, Environment and Risk Management

Groundwater is an important issue that challenges to human security due to environmental hazards, creeping deteriorations, and inherent social vulnerability and risks" (UNU-EHS, 2005). Resource depletion and pollution is identified as a "creeping process" that can negatively impact human security and, together with land degradation, groundwater resources degradation is a priority topic to be addressed by the this study. This study will have several objectives: first to increase our knowledge on the interrelationship between groundwater degradation and human vulnerability – which will serve as a description of human in(security); second, through vulnerability assessment and working with national and local representatives in selected case study areas, identify solutions to reduce groundwater-related vulnerability of communities; and third, investigate specifically trans-boundary issues related to groundwater and community vulnerability. In addition, this study will initiate activities on vulnerability of rural communities to droughts and water poverty. . This new programme will necessarily touch on the issue of water availability and in many cases on groundwater management issues, and therefore have a link with the either experience or lesson from the past including the success and/or un-success groundwater development and management policies in Japan..

6. Groundwater Resources and Community Management

More specifically, this research proposes to study the link between vulnerability of communities and of groundwater resources, i.e. the reciprocal impacts that dictate how the resource is used and/or how the availability and quality of the resource allows for sustainable living conditions for the communities concerned. The research with capacity development activities will be carried out for the case study including Senegal, Niger, Madagascar, Tunisia, Southern Africa, Ghana, Jordan, Saudi Arabia, Pakistan, Bangladesh, Thailand, and Sri Lanka. Because groundwater degradation can take many different forms, case studies will have to reflect different scenarios (e.g. excessive drawdown, diffuse pollution, point source pollution), cover different hydro-climatic settings (arid and humid) and different socio-economic settings (notably rural and urban). Work in case study areas include (not an exhaustive list) vulnerability assessment (which can include e.g. farming system analysis if in a rural setting); precise understanding of the state and quality of the groundwater resources (including identification of all threats); and analysis of all aspects of water management (e.g. technical, socio-political).

A case of groundwater resources management has been examined to support the self-reliance of people in the community of Senegal in the West Africa including women through empowerment. The research program has been executed by Japan's ODA through Japan International Cooperation Agency (JICA). Rural residents have suffered from drying wells in Senegal, of which the region is located in the southern edge of the Sahara desert. JICA/MOFA has constructed the deep wells and water supply facilities at 109 locations in the rural region through grand aid. However, problems have been arisen afterward, including the lack of appropriate operation and maintenance and management. The technical assistance was given for the development as well as operation and maintenance of water pumps in order to maintain the water supply facilities by themselves. At the same time, the assistance aims to improve the management capacity of the community water management cooperative including the capacity building with financial independence. The cooperative, as an organization run with the participation of local people, strives to select their members democratically and to increase the transparency of their operations by through information disclosure. A women in charge of accounting for the cooperative says, "we sense a mission to protect the water supply facility, because it is us women who benefit the most from the building of the facility". Moreover, community organization deriving form the cooperative have begun such productive activities as small scale cash crop farming and poultry using the water. The use the surplus funds from the water charges which have been collected by the water management committees as start-up capital. In this manner, the residents now aim for the development of the community to take their own initiative.

7. Concluding Remarks

Groundwater is either opportunities or threats to human security as well as compromise or conflict to international society. Certain policies and strategies to sustain the development and management of groundwater resources in the developing world will have to be elaborated through this study to secure the safe water supply.

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