MANAGEMENT OF LAND AND WATER RESOURCES FOR FOOD, LIVELIHOOD AND THE ENVIRONMENT

K. Kumarasivam Endowment Fund (KKEF)
Young Environmentalist Internship Award 2011 Report
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1.1 INTRODUCTION

1.1.1 International Water Management Institute (IWMI)

The International Water Management Institute (IWMI) is a scientific research organisation focusing on the sustainable use of land and water resources in agriculture, to benefit poor communities in developing countries. The work at IWMI contributes to the UN Millennium Development Goals (MDGs) of reducing poverty, hunger and maintaining a sustainable environment. The IWMI headquarters is located in Colombo, Sri Lanka while regional offices are located across Asia and Africa. IWMI is one of the 15 international research centres supported by the Consultative Group on International Agriculture Research (CGIAR), which is a non-profit organisation made up of a collection of 60 governments, private foundations and international and regional organisations. IWMI's mission is "to improve the management of land and water resources for food, livelihood and the environment" while IWMI's vision is "water for a food secure world".

Research agendas at IWMI is organized around four priority subjects including water availability and access, productive water use, water quality, health and environment and water and society. Cross cutting activities in all themes include, assessment of land and water productivity and their relationship to poverty, identification of interventions that improve productivity as well as access to and sustainability of natural resources, assessment of the impacts of interventions on productivity, livelihoods, health and environmental sustainability.

1.1.2 The Issue with Water and Agriculture

Water scarcity is a fast growing issue in the world today. It is without doubt that water is essential for life. Without water, the world may not be liveable and living beings will not be in existence. Though earth is fundamentally known as the water planet, freshwater supply is scarce. Approximately 97.5% of water on earth is salty or otherwise undrinkable, and of the remaining 2.5%, almost three quarters is locked away in ice caps (UN, 2003). That does not leave much left for human use.

With the advancement of human civilisation, demand for water is becoming increasing significant. Amongst the largest demand for water comes from

agriculture. According to the United Nations (UN) International Year of Freshwater Factsheet 2003, about 70% of all available freshwater is used for agriculture, with a 60% increase in water withdrawals for irrigation since 1960. Of the 70% of freshwater used in agriculture, approximately 60% is reportedly lost to evaporation or returned to rivers and groundwater aquifers due to inefficient irrigation systems particularly in developing countries (UN, 2003). Furthermore, water losses due to leakage, illegal water hook-ups and waste reportedly totals up to about 50% of the amount of water used for drinking in developing countries. It is estimated that about 40% of the world's population currently lives in areas with moderate to high water stress and by 2025, this number is estimated to increase to about two thirds of the world's population (about 5.5 billion people) who will be living in areas facing such water stress (UN, 2003).

1.2 MY INVOLVEMENT AT IWMI

The two weeks spent at IWMI was largely utilised to assist researchers, Pay Drechsel and Anne Thebo on an ongoing research project titled Global Assessment of Wastewater Irrigation. My involvement was primarily related to data review, compilation and analysis as well as data mapping using ArcGIS.

1.2.1 What is the Global Assessment of Wastewater Irrigation?[1]

Cities in the developing world are growing at an unprecedented rate. More than 50% of the worlds' population now lives in urban centres. The extraordinary rates of urbanisation has simultaneously resulted is a massive concentration of the production of wastewater and fecal sludge. It is estimated that approximately 2.6 billion people in the world do not have access to proper sanitation facilities (WHO and UNICEF, 2006). Among those who have access, it is estimated that only about 20% of the wastewater produced receives any form of treatment (UNStats, 2009). As a result, about 90% of sewage and 70% of industrial wastes in developing countries are discharged without treatment, often polluting the usable water supply (UN, 2003). In addition to this, according to the UN International Year of Freshwater Factsheet, 2003 water use increased six-fold during the last century, more that twice the rate of population growth and by the year 2025, it is predicted that water withdrawal will increase by 50% in developing countries and 18% in developed countries.

Numerous studies have demonstrated that irrigation with untreated wastewater is extremely common across the developing world and can lead to significant health risk to farmers and consumers if proper safeguards are not in place. Ironically, these same wastewater flows prove instrumental in the livelihoods of urban and peri-urban farmers (RUAF, 2009). Nutrients and water in wastewater reduces the need of external inputs such as chemical fertilizers that must be purchased and allow for the cultivation of higher value vegetable crops (which demand more water), facilitate multiple harvests each

[1] Extracted from Anne Thebo's project report on Global Assessment of Wastewater Irrigation

year, and provide a remarkable contribution to urban food security (Van der Hoek et al., 2002).

In spite of the wide reaching implications of the practice of wastewater irrigation, many foundational knowledge gaps surrounding the practice remain. Amongst the many gaps is the fact that there is not yet one comprehensive estimate of the global extent of urban wastewater irrigation developed using a globally consistent methodology. Jimenez and Asano and Raschid-Sally have completed surveys of case studies on wastewater irrigation in many cities and countries across the globe. However, in both cases their work has been challenged by a lack of a consistent definition of wastewater irrigation between countries, quality of reported data, the difficultly of using survey based research methods to conduct a true census of wastewater irrigation at larger scales, and an overall unwillingness of many countries to openly admit to practicing wastewater irrigation. Extrapolating from case studies they estimate that the area irrigated with wastewater is between four and twenty million hectares, though there is tremendous uncertainty in these numbers.

Considering the limitations of past assessments of wastewater irrigation, this study aim at assessing the following:

- The global extent of wastewater irrigation;
- The contribution of wastewater to the overall irrigation water budget;
- Quantity and value of crops that a reliant upon wastewater for irrigation; and
- Extent of health risks posed by the practice of wastewater irrigation under consideration of local diets and common risk mitigation factors.

The subject is approached by using globally available spatial datasets to define wastewater irrigation based upon the spatial co-occurrence of indicators known to be associated with an increased probability of wastewater irrigation. This approach is then followed by rigorous validation with case studies at multiple scales. The approach used for quantifying the global extent of urban wastewater irrigation employs a range of spatially explicit datasets from each of these sectors to identify areas of probable wastewater irrigation using ArcGIS with an ArcINFO license. The spatially based model is then validated using thirty well documented city-wide case studies of wastewater irrigation.

1.2.2 Contributions

Amongst my contributions to the research involved the analysis of data from the United Nations Global Environmental Monitoring System (GEMS) Water Program, to identify water quality monitoring stations at developing countries where fecal coliform were present in the water quality samples analysed. A database of sampling stations was created using Microsoft Excel. The database was then imported into ArcGIS to plot locations of sampling stations in relation to urban and irrigated areas. The spatially based models were then used to extrapolate the orientation and distances of the GEMS water quality sampling stations in relation to urban and irrigated areas.

In addition to this, I also assisted in validating the % urban sewerage numbers presented in a paper by the World Bank titled 'Guiding Principles for Successful Reforms of Urban Water Supply and Sanitation Sectors' (Locussoal and Fall, 2009). I prepared a database utilising the data extracted from the WHO/ UNICEF Joint Monitoring Programme (JMP) individual country papers and compared it against the 'Connection %' numbers for 1990 and 2004 Actual, reported in Annex 2 of the World Bank paper. The comparison and validation process revealed that most of the data reported in the World Bank paper could not be directly compared against the numbers reported by JMP. There was also no clear or definitive explanation as to how the data for each country for 1990 and 2004 was obtained and this was similarly the case for regional numbers reported. Numbers could not be directly derived from the WHO/ UNICEF JMP country papers in most cases, and the calculation and method used to reach to the numbers reported were not clearly stated to allow an understanding of the source and formulation of the data for validation.

The database prepared using the WHO/ UNICEF JMP data was therefore rigorously analysed and the data extracted further using clear and definitive methods. The data extracted was then tabulated and has been put forward to be included in the USEPA-USAID Wastewater Use Guidelines, the title of the document of which is yet to be finalised.

1.3 OTHER PROJECTS BY IWMI

IWMI is involved in numerous projects primarily related to water management and food security mostly in low-income developing countries. The ongoing projects by IWMI are too extensive to be named.

Nevertheless, a recent launch of the Ecosystem for Water and Food Security theme by IWMI and the United Nations Environmental Programme (UNEP), in partnership with 19 other organisations is one to be noted. This theme looks at a more holistic approach towards agriculture, and highlights recognising healthy ecosystems as a basis for sustainable water resources and stable food security as a means to help produce more food per unit of agriculture land, improve resilience to climate change and provide economic benefits for poor communities. This theme also calls for closer collaborations between authorities in agriculture, environment, forestry, fisheries and other sectors if ecosystems are to be placed at the centre of food security efforts.

1.4 WATER RESOURCE MANAGEMENT IN MALAYSIA

As water is becoming an increasingly scarce resource around the world, water resource management is an area that needs to be seriously considered in Malaysia. Amongst the obvious issues with water management in Malaysia is, it is not currently governed by a single agency, hence resulting in and overlapping of function and discrepancies. In addition to this, Malaysia suffers from the lack of comprehensive water law, where water legislations are currently contained within the laws enforced by various water-related government agencies. It is therefore beneficial for the government to seriously study the matter and consider revamping the countries management of water

resources before it escalates into a major issue. A holistic approach of water management for the resource planning and development, such as the Integrated Water Resources Management is therefore practical approach to begin with.

1.5 CONCLUSION

The fact that Malaysia is known to have an abundance of water resource throughout the year should not be taken for granted. We as a country have at times experienced droughts which impacted agriculture and people on the whole. As a knock-on effect of climate change, water scarcity is becoming an increasingly notable issue facing the world today and Malaysia is not exempted from this. If existing water resources are not utilised efficiently and conserved for future use, and if alternative means of utilising water is not formulated soon, we may face a future where water is so limited that it may result in significant environmental, health, economical and even political issues.

Irrigation using treated wastewater is a potential alternative to existing practices that should be considered here in Malaysia. This allows conserving our freshwater resource by means of reducing the need to utilise existing freshwater resources, as well as reducing the need to dispose wastewater into surface water bodies, which will ultimately result in contamination of whatever's left of the little freshwater we still have. It facilitate not only the reduction of contamination of surface water bodies from disposal of wastewater, but also reduces the demand for freshwater and allows for natural forms of fertilisers to be used. The direct unregulated use of wastewater for irrigation undoubtedly has negative impacts, nonetheless, it is an option that should be considered and means of mitigating negative impacts formulated to ensure safe utilisation. There are many guidelines available on proper and safe utilisation of wastewater which can be implemented.

In addition to this, as agriculture is an imperative sector in Malaysia, we should also consider adopting the Ecosystem for Water and Food Security. This will facilitate a different approach towards agriculture with the recognition of healthy ecosystems as a basis for sustainable water resources and stable food security to increase food production, improve resilience to climate change and provide economic benefits.

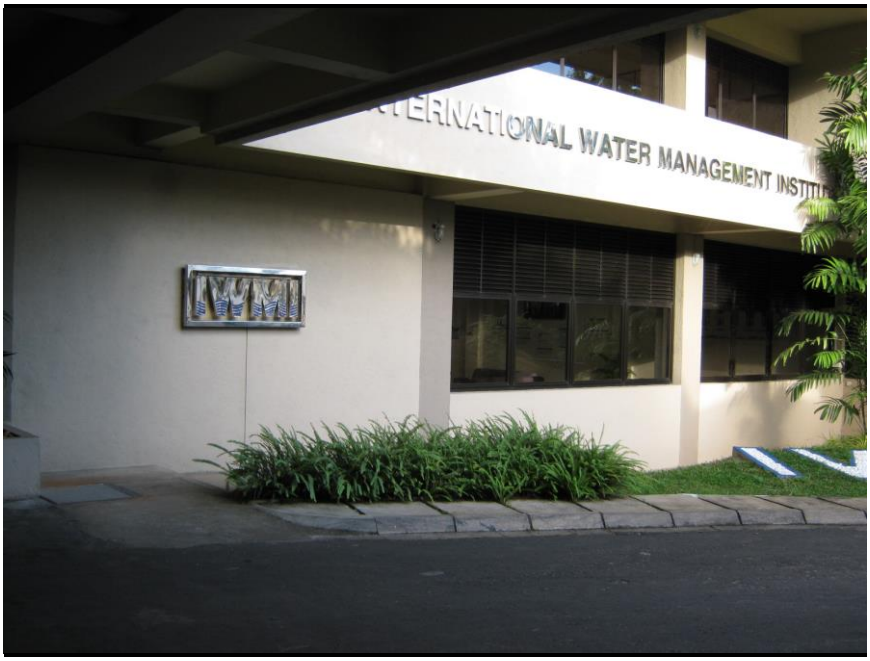

Photo 1: External View of the IWMI HQ Building

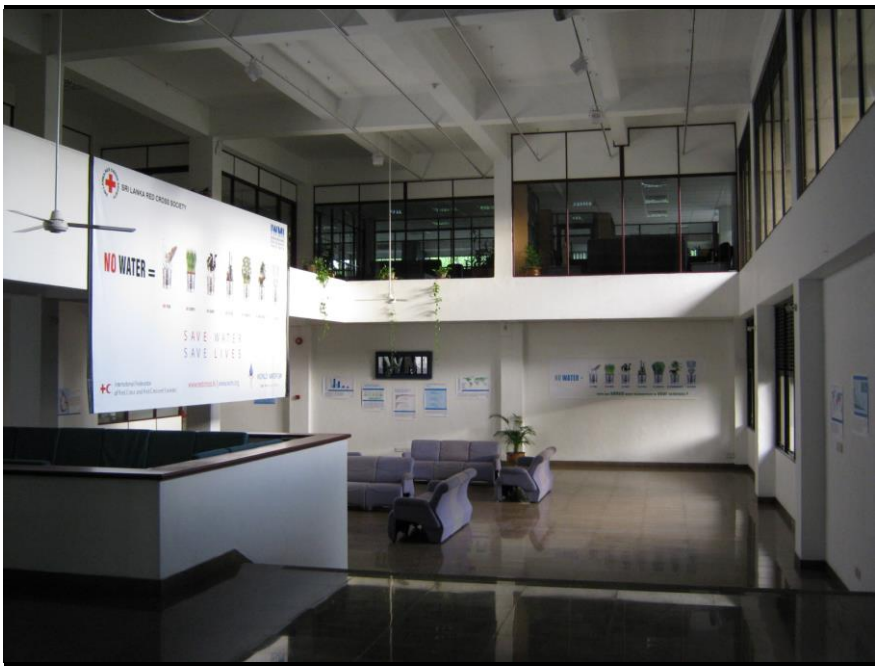

Photo 2: Lobby of the IWMI HQ Building

Photo 3: With Other IWMI Staff

Photo 4: With Fellow Interns

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