



**Cultivating Sustainable Cities  
Multi-Stakeholder Policy-Making and Action Planning**

*Wastewater, a Valuable Resource for Urban, Peri-urban Agriculture – A case study of Hyderabad, India*

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## Abstract

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## Section 1: Problem Situation

### 1.1 Hyderabad

Hyderabad is the capital city of the state of Andhra Pradesh, South India. It is located in the heart of the Deccan Plateau at 1760 ft (536 meters) above sea level at 78° E longitude and 17° N latitude. and receives an annual rainfall of 700-800 mm during the short monsoon and cyclone season from June-October. The city along with its ten surrounding municipalities is spread over an area of approx 500 sq km and a 6 million population has been recorded in 2001 showing a 17.2 % increase over the population of 1991 making it one of the fastest growing urban areas in India (Handbook of Statistics of Ranga Reddy, 2001:157). The population projections for 2011 for the twin cities range from 9.5 to 11.3 million people (HUDA, Draft Master Plan for 2011). Migration of people from surrounding drought prone areas and rest of Andhra Pradesh and India has been one of the main reasons for high population growth rate of Hyderabad in the last decade. There are several factors, which triggered such a migration - Hyderabad being the capital city of Andhra Pradesh, is the seat of political power; it houses 12 industrial areas; important centre for national research organizations; it also has several agricultural research institutions apart from the Agricultural University and it has as many as six universities. The forced migration of rural poor from the surrounding districts into the city is mainly due to droughts and lack of employment opportunities in the agricultural off-seasons. Thus, Hyderabad 'attracts' all sections of the society, and the unlimited scope for employment, real or perceived, has a magnetic effect (Subba Rao 2005).



Source: <http://archives.cnn.com>

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### 1.2 Rising wastewater volumes

Cities being the economic and political power centers and given priority for allocation of water (drinking water). Over the last decade from 1991 to 2004, there has been a 94 % increase from 409 to 795 Million Liters per Day (MLD) (Acharya, 2004) in the supply of potable water to the Hyderabad city dwellers [See Annex 1]. Increase in urban water supply ensures an increased wastewater generation as the depleted fraction of domestic and residential water use is typically only 15-25% with the reminder returning to wastewater (Scott et al, 2004). The groundwater pumped by most households for domestic purposes, rainwater run off and industrial effluents also adds to Municipal supply of water and together goes into the sewage system as wastewater. At present, it is estimated that, at least 600 MLD of wastewater goes into the Musi River.

### 1.3 Water treatment and quality of water

Hyderabad has two wastewater treatment plants at present. One is located at Amberpet with a capacity to treat 113 MLD of wastewater to primary level only. The other is located at the

Hussain Sagar Lake with a capacity to treat 20 MLD to secondary level. The rest of the water flows untreated into the Musi River, which flows right through the city (See Figure 1). There are 18 storm drains on either side of the river which empty the city sewage into the river. This partially treated wastewater is used for irrigation all along the river. The Hyderabad Metro Water Supply and Sewerage Board [HMWSSB] is now planning to clean the river under the National River Conservation Action Plan [NRCAP]. A total of Rs 40 million has been budgeted under the NRCAP to clean up Musi River.

Some preliminary testing of water samples in the urban and peri-urban area by IWMI, show that the BOD and COD values are quite low in Hyderabad (see Table 1). MPN values indicate high levels of faecal contamination, which increases the health risks of the wastewater to farmers and agricultural labourers in direct contact with it. The risk to the consumer is expected to be lower since none of the vegetables grown are consumed raw. However, no quality-assurance tests were done on the vegetables. The EC and TDS values are higher than those recommended by the FAO guidelines. Total Nitrogen is higher than FAO guidelines but all heavy metals are within safe limits.

Table 1: Musi Water Quality

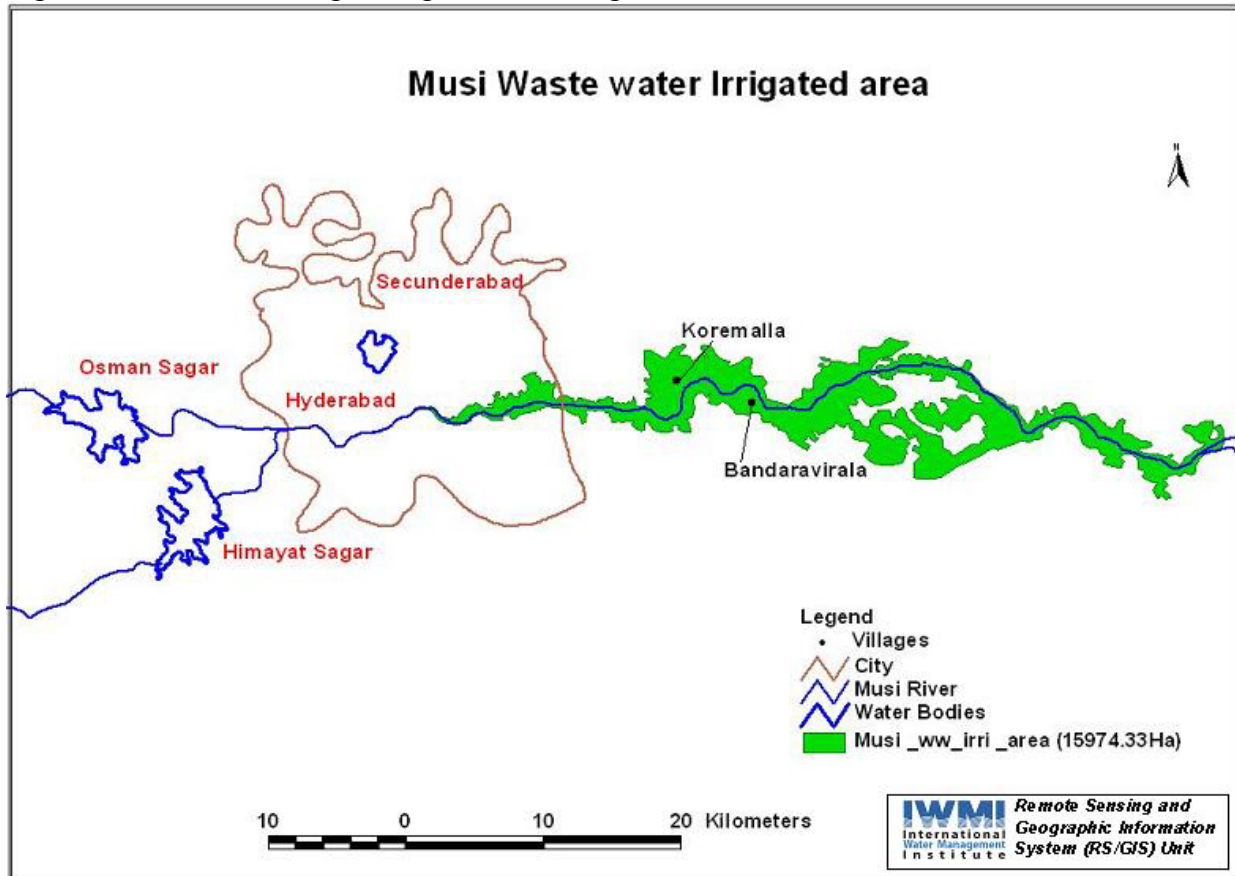
	BOD (mg/l)	Total coliform (MPN)	EC (dS/m)	TN (mg/l)	Cr (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)
Urban	105	4.6 * 10 <sup>10</sup>	2.1	25	0.04	0.13	0.07	0.32
Peri-Urban	70	2.4 * 10 <sup>7</sup>	2.6	17	0.00	0.02	0.03	0.09
Rural	45	4.0 104	2.6	16	0.02	0.03	0.00	0.02

Source: Dr. Robert Simmons, IWMI, 2002

#### 1.4 Wastewater use in irrigated Urban and Peri-urban Agriculture [UPA]

Treated, partially treated and untreated wastewater in Hyderabad is being utilized for irrigation by farmers and Government institutions. The secondary treated wastewater from the Hussain Sagar Lake is being used by the Urban Forestry Division of Hyderabad Urban Development Authority [HUDA] [[www.hyderabadgreens.org/parks.html](http://www.hyderabadgreens.org/parks.html)] and Municipal Corporation of Hyderabad [MCH] (<http://www.ourmch.com>) for irrigation of avenue trees and parks. The untreated and partially treated wastewater is being used by urban, peri-urban farmers for cultivation of mainly para grass, a kind of fodder grass and on a smaller scale, leafy vegetables, coconut palms and banana plants. According to the Landsat image February 2005 (See Figure 2), about 2100 ha para grass in and around Hyderabad and approx 10,000 ha of paddy along the 'Musi River Corridor' is irrigated with wastewater. Preliminary studies conducted by IWMI show that there is a very small area under wastewater irrigated peri-urban vegetable production mainly by women farmers. However, fodder and vegetable production contributes significantly to livelihoods and food security of resource-poor urban and peri-urban women and men. In and around Hyderabad, women constitute the majority of both vegetable producers (they rent the land) and vendors. Women tend the buffaloes and men harvest or purchase the fodder. Livestock rearing is on the rise in these regions.

Figure 2: Wastewater irrigated agriculture along Musi River



Source: Landsat Image. 2005. IWMI

### 1.5 Rationale of wastewater use in agriculture

A number of factors drive farmers to use wastewater for irrigation although wastewater is of inferior quality due to its high content of salts, pathogens and also toxic materials resulting from illegal dumping of industrial effluents into it. In most cases, wastewater is the only source of irrigation for the urban and peri-urban farmers. It is highly reliable contrary to the formal irrigation schemes and monsoons. All the urban and peri-urban farmers along Musi River in Hyderabad, farm year round due to wastewater availability. High prices for vegetables in the dry season, encourages farmers to cultivate vegetables with wastewater. Wastewater has high nutrient (nitrogen content) value which helps faster growth of the plants and also helps farmers to save on fertilizer cost. In a study conducted in Dakar, farmers saved up to 23% of farming costs, which they would otherwise spend on purchase of artificial fertilizers (ENDA-IFAN, 2002:10).

In addition to the above-mentioned benefits, wastewater saves fresh water, which would otherwise be used for irrigation, recycles nutrients and recharges ground water. Farmers also innovate in the face of adversity. It was found that groundwater farmers in close proximity to the wastewater irrigated areas in peri-urban Hyderabad, engage in innovative practices including the stage-wise use of wastewater and groundwater and the mixing of groundwater and wastewater

for paddy production which mitigates the negative effects of wastewater use on the crop and for the irrigators and increases yields and incomes (Buechler and Devi, forthcoming).

## **1.6 Impact of wastewater use in agriculture**

Wastewater use in agriculture supports thousands of livelihoods and contributes to their food security. There are a chain of beneficiaries who derive their livelihoods from wastewater irrigated UPA which includes landowners, tenant farmers, labourers (mostly women labour), transporters who carry the produce from the fields to the market, vendors, brokers in the markets and finally the consumers as they get a fresh produce at cheaper prices as the transportation cost is minimized. The main crop irrigated with wastewater is para grass, a kind of fodder grass which thrives on nutrient rich wastewater. Due to high demand for milk in the urban areas, fodder grass has a year round demand. It has been estimated that an urban farmer can earn an average annual income of Euro 330 per milch buffalo. Some preliminary estimates by IRDAS, an NGO reveal that, of the 1.8 million litres per day of milk consumed by the Hyderabad city dwellers, 100,000 litres per day are supplied by private vendors within HUDA area. Typically, 25% of the milk produced (assuming a household of 6 members owns one buffalo) is retained for household consumption and 75% is sold ((Buechler and Devi, 2003a). For dairy producers livestock is an asset that serves as a security asset in times of need. Area under production of vegetables with wastewater is small but plays a significant role in the livelihoods of the producers. Vegetable producers in the urban and peri-urban areas earn an annual average income of Euro 830 and save about 20% of household expenditure which they would have had to spend on the purchase of vegetables. On a very small scale, banana plants and coconut palms are grown in the urban area. These farmers earn an average annual income of Euro 208 per 100 coconut palms and Euro 470 per 100 banana plants (Buechler *et al*, 2002:16b).

Agricultural use of untreated wastewater poses various kinds of health problems depending on the kind of product produced. The most common health problems associated with consumption of wastewater-irrigated produce include cholera, typhoid, faecal bacterial diseases, bacterial diarrhoea and dysentery. Use of wastewater for irrigation accompanied with no or few protective measures could cause health problems for the farmers and labourers who come in direct contact with wastewater during irrigation and indirectly upon contact with wastewater irrigated crops and soil. There are very few studies done on impact of wastewater irrigated agriculture on health.

## **Section 2: Actions Undertaken by IWMI**

### **2.1 Research on wastewater use in irrigated agriculture**

IWMI-South Asia research on wastewater issues has been mainly concentrated in Hyderabad, India and in Haroonabad and Faisalabad, Pakistan. The studies in Hyderabad include - Exploratory study on impact of wastewater use in irrigated agriculture on livelihoods along Musi river, Hyderabad; Farmer innovations on the conjunctive use of wastewater and groundwater in peri-urban Hyderabad as a part of the DfID funded study focused on smallholder water management, promoting innovative water harvesting and irrigation systems to support sustainable livelihoods in South Asia.

### **2.2 International workshop to critically review and disseminate wastewater management options.**

IWMI-South Asia conducted an international workshop entitled “Wastewater Use in irrigated Agriculture: Confronting the Livelihood and Environment Realities” sponsored by IWMI (based in Colombo, Sri Lanka) and the International Development Research Centre (IDRC, based in Ottawa, Canada) on 14<sup>th</sup> November 2002 in Hyderabad, India. A total of 35 participants were invited including researchers, practitioners, policy makers and donors. The workshop was organized around a core set of detailed case studies of untreated wastewater use in agriculture presented by IWMI and collaborators. Assessment, criticism and reaction were sought from a range of international experts. The workshop also tied in with ongoing initiatives including a wastewater e-conference, the Virtual Water Forum, and a special edition of the Urban Agriculture magazine focusing on wastewater irrigation in urban and peri-urban agriculture, and formed part of a consolidated lead up to the Third World Water Forum in Kyoto in March 2003.

The objectives of the workshop were

- To critically review experience worldwide in the use of wastewater for agriculture
- To present lessons learned from specific field-based case studies, including the environmental and health impacts and risks of wastewater use in agriculture
- To refine a methodology developed and applied by IWMI for selected countries that seeks to assess the global extent of wastewater use in agriculture
- To evaluate the institutional arrangements, constraints, and policy implications for sustained livelihoods based on wastewater use in agriculture
- To build a wastewater “community of practice” integrating a variety of research, implementation and policy institutions and partners.

### **2.3 Creating public awareness, knowledge and information dissemination**

Based on the research work on impact of wastewater on the livelihoods of urban and peri-urban farmers a documentary has been made which has been shown on the national television, workshops and other public gatherings. In addition, about 200 CDs have been sent to a wide variety of people including researchers, policy makers, NGOs, Universities and government departments. In addition to the documentary, posters and brochures (Annex 2) have also been used to disseminate information on benefits and disadvantages of wastewater. The two main

outcomes of the International workshop on wastewater use in 2002 are the Hyderabad Declaration (Annex 3) and an edited volume of case studies and expert position papers entitled “Wastewater Use in Irrigated Agriculture: Confronting the livelihood and Environmental realities” published by CABI International, which have been widely disseminated. In addition to this, IWMI – South Asia being the regional coordinator of Resource Center for Urban Agriculture and Food Security [RUAF], distributes the quarterly Urban Agriculture Magazines. Till date 13 editions of UAM have been distributed along with a World Summit Special on “Urbanization, Poverty and Urban Food Security” and also contributes to the online information and contacts database of RUAF.

## **2.4 Cities Farming for Future [RUAF –CFF, 2005-08]**

The Cities Farming for the Future [CFF] project is phase II of the RUAF project and its a global initiative funded by DGIS and IDRC, that aims to “contribute to urban poverty reduction, urban food security, improved urban environmental management and empowerment of urban farmers and participatory city governance by capacity development of local stakeholders in urban agriculture and facilitating participation in multi-stakeholder policy formation and action planning on urban agriculture, including safe reuse of urban organic wastes”. IWMI continues to be the regional coordinator of the RUAF-CFF South and Southeast Asia Region. The fundamental basis of the RUAF-CFF project is a Multistakeholder Process for Action Planning and Policy Design (MPAP).

### **2.4.1 Multi-stakeholder Policy Design and Action Planning [MPAP]**

MAP is an interactive and collaborative approach for policy change. Efforts to first establish policies before initiating action planning/implementation one often end up with policies that do not work due to lack of political will, lack of resources or severe distortions during translation into actions later on in the process. Therefore, to create a favourable policy atmosphere for Urban Agriculture [UA] in Hyderabad and also to develop some action plans to promote UA, the MPAP process has been initiated. In Hyderabad, it is envisaged that the MPAP process will involve the following activities: Collection and interpretation of data and documents pertaining to various UPA activities; Evaluation of current legislative and institutional frameworks under which UPA operates; Identification of the key constraints/ opportunities to sustainable and economically viable UPA in Hyderabad; Formulation of a policy document that will be presented and discussed/ revised at a series of Multi-Stakeholder Forums to facilitate an equitable and mutually acceptable policy environment for UPA; Formation of a series of action plans that will address key constraints/opportunities to sustainable and economically viable UPA in Hyderabad; Initiation of a co-funded Pilot Project as identified during the action planning process; Development of selected action plans into full proposal documents for possible submission to international donors for co-funding support. In addition, the RUAF-CFF project will establish a Regional Advisory Panel on UPA and in 2005 undertake a Regional MPAP Training workshop and Regional Gender Workshop. Till date (20 July 05), IRDAS (a local NGO) with IWMI has started the exploratory study under the guidance of a working group chaired by Mr Bir Singh Parshera. The members of the working group include officials from Department of Agriculture, Forestry, Animal husbandry, Horticulture, HUDA and MCH.

## 2.4.2 Gender Mainstreaming

IWMI-India will function as a Technical Working Group [TWG] on gender issues. IWMI is also trying to source some additional funding to conduct a 3 day regional gender workshop in Hyderabad, India as a part of its gender mainstreaming activity. The purposes of this regional workshop are:

- To share knowledge and experiences regarding gender and social equity in urban and peri-urban agriculture (UPA), in the South and South-east Asia region
- To identify opportunities and constraints for UPA at both local and regional levels in order to enhance the role of women and other un-empowered groups undertaking UPA as a means of livelihood support and income generation.
- Facilitate regional and cross-regional networking with regards gender and social equity in UPA

The outputs expected are

- With specific focus on gender and social equity produce an assessment of the opportunities and constraints to UPA at both local and regional levels
- Generate a regionally applicable methodology for conducting gender and social equity case studies in UPA
- Develop an action plan to mainstream gender and social equity in respective institutions and future research activities

## 2.4.3 Capacity Building

An important component of RUAF-CFF is capacity building of the UPA stakeholders funded by IDRC. As a part of this component, IWMI will organize two training programmes: Training of Trainers [ToT] and MPAP training.

**Training of Trainers:** The objective of the ToT is to train staff of regional and local strategic partners that will play a role as trainers or facilitators in the implementation of the various RUAF CFF training activities in the pilot cities (specifically the MPAP training). It thus serves as a preparation for the MPAP. ToT will support selected trainers to broaden their subject matter knowledge regarding urban agriculture and MPAP, as well as enhance their capacities regarding participatory and gender sensitive adult learning methods. The ToT workshop will also be used to adapt the available training materials to the specific conditions of the pilot cities and the specific needs of local stakeholder groups that will be involved in the training programme. IWMI plans to hold ToT (tentative date 16-24 October 2005) for seven days in Hyderabad. Regional experts specializing in various disciplines with a background in UA will be invited to participate.

**Multi-stakeholder Policy Design and Action Planning [MPAP] Training:** MPAP training is for the core MPAP team and for all the key stakeholders in the pilot city and dissemination cities to enhance their capacity to collaborate and develop in a participatory way an MPAP process leading to a strategic agenda and action plan on UA, implementation of pilot projects and policy design. One seven days long MPAP training is planned to be held (tentative date 14-20 November 2005) in Hyderabad.

## **Section 3: Results Obtained**

### **3.1 Research publications and impact on WHO guidelines**

In addition to publication of papers and articles on the research work done on wastewater use, IWMI in collaboration with IDRC has edited a volume of case studies and expert position papers published by CABI International. Another important output of the international wastewater workshop 2002 is the Hyderabad Declaration which has been widely disseminated and also can be accessed on the internet.

WHO has adopted a number of findings and recommendations from the international workshop conducted by IWMI – South Asia. Through the workshop discussions, it was realized that in many situations where wastewater is used in peri-urban agriculture, the effective treatment of such wastewater might not be available for many years. WHO guidelines must therefore be practical and offer feasible risk-management solutions that will minimize health threats and allow for the beneficial use of scarce resources. It was decided that, to achieve the greatest health impact, guidelines should be revised and implemented with such other health promoting measures as: health education, hygiene promotion, provision of adequate drinking water, and sanitation etc.

### **3.2 Securing funding for follow up research**

IWMI-South Asia research and Hyderabad case study on wastewater irrigation for UPA reports has helped raise awareness and interest which helped IWMI together with the International Livestock Research Institute (ILRI) and Indian and Pakistani national partners to develop a proposal for submission to German BMZ called “Ensuring Health and Food Safety from Wastewater Irrigation in South Asia”. The goal of this project is to improve health and safeguard wastewater dependent livelihoods of resource poor urban, peri-urban farmers and consumers in developing countries through the uptake of a set of risk mitigation options based on a comprehensive assessment of risks and benefits associated with wastewater irrigation in Hyderabad (India) and Faisalabad (Pakistan). The proposal has been approved for Euros 800,000 over 3 years (2005-07).

### **3.3 Results of the MPAP process**

### **3.8 Contribution to MGDs**

## **Section 4: Lessons, Recommendations and Way Ahead**

### 4.1 Lessons learnt and key recommendations from the international workshop on wastewater use in irrigated agriculture

- Comprehensive realization of the importance of wastewater use in agriculture still on the peripheral edges of public awareness and not clear to policy makers and donors
- Insufficient understanding of the social and economic factors that drive farmers to use wastewater and thus inadequate consideration of these in policy formulation
- Individual socio-economic contexts contributes to varying levels of acceptability of wastewater use
- Protection of public health and the alleviation of poverty are not mutually exclusive outcomes when it comes to wastewater use
- Integrated, multi-barrier approaches to wastewater management can help develop effective measures to protect health and environmental quality
- Rigid wastewater use guidelines tend to become targets rather than norms
- Conventional northern treatment technologies are expensive and unsustainable. Effective low cost, decentralized treatment systems exist.
- Year round demand for fruits and vegetables and increased tourism in developed countries, make wastewater an issue for more than just developing countries.
- A lack of coordination among institutions within and outside the government and the tendency towards isolated, uni-disciplinary research on wastewater has inhibited the testing and design of integrated, workable solutions.
- Insecure land tenure mitigates against farmer investment in safer and more efficient wastewater irrigation technologies
- The informal nature of wastewater irrigation tends to leave it in institutional no-man's land
- Sound legal and regulatory frameworks requires sustained application and enforcement
- Need for a pragmatic, pro-active and forward looking perspective to manage wastewater

### 4.2 Lessons learnt from MPAP process

### 4.3 Way ahead

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