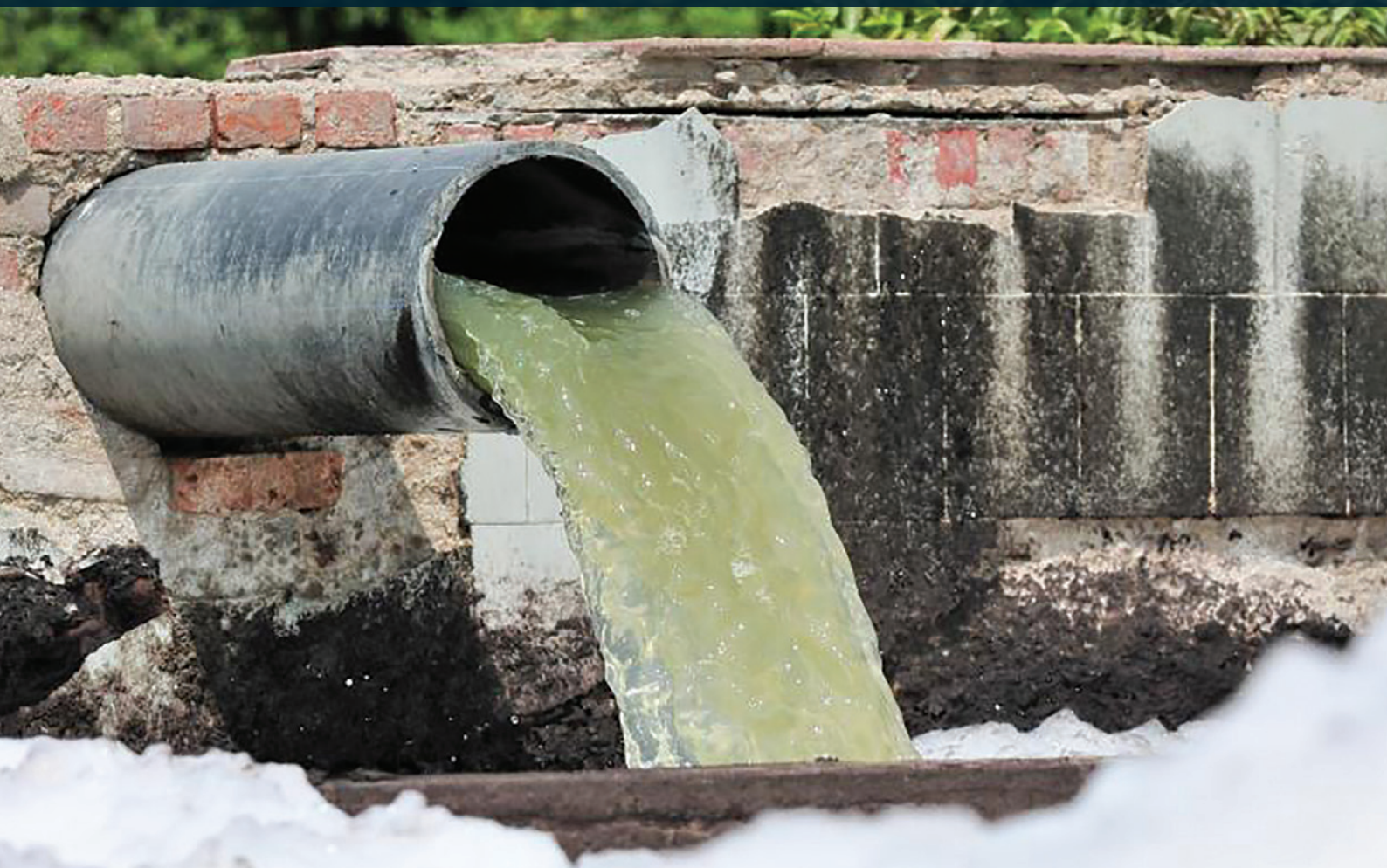
CGIAR

RESEARCH PROGRAM ON Water, Land and Ecosystems

LED BY: IWMI International Water Management Institute



WASTEWATER REUSE IN NUMBERS

Photo: Neil Palmer/IWMI

MAKING THE MOST OF AGRICULTURE'S ONLY EXPANDING RESOURCE

IN PARTNERSHIP WITH:

Bioversity International, CIFOR, CIAT, CIP International Potato Center, FAO, ICARDA, ICRISAT International Crops Research Institute for the Semi-Arid Tropics, IFPRI International Food Policy Research Institute, ILRI International Livestock Research Institute, RUAF Foundation, World Agroforestry Centre, WorldFish

WASTEWATER WORRIES

Rapid urbanization in the developing world is pushing up demand for water and food, while also generating ever larger volumes of wastewater. Especially near cities, farmers are intensifying food production to meet increased demand, often using treated or untreated, raw or diluted wastewater to irrigate crops all year round. This practice offers significant benefits, providing farmers with a steady supply of the water and to some extent the nutrients that are needed to achieve high yields. However, because wastewater irrigation is not well managed in many low- and middle-income countries, it can pose serious risks to the health of farmers and consumers as well as to the environment.

- To feed a rapidly urbanizing global population of 9 billion by 2050, farmers will have to produce 60-70% more food (Alexandratos and Bruinsma 2012).
- Worldwide, more than 330 cubic kilometers (km^3) of municipal wastewater are generated annually, theoretically enough to irrigate 40 million hectares (Mha) of cropland or to power 130 million households through biogas generation (Mateo-Sagasta et al. 2015).
- This waste also contains enough nutrients to replace 25% of the nitrogen currently applied to crops in the form of synthetic fertilizers plus 15% of the phosphorus (Mateo-Sagasta et al. 2015).

An irrigated area the size of Germany is affected by municipal wastewater (ca. 36 Mha). Of this, about 29 Mha are in countries with very limited wastewater treatment (Thebo et al. 2017).

COMBINING SOLUTIONS

Most developing countries lack the means to invest in conventional facilities for wastewater treatment on the scale needed to address the risks to human and environmental health. As societies seek a way out of this predicament, the following steps are needed:

1. Reducing pollution – Aside from efforts to improve sewage management, the collection of fecal matter from septic tanks and pit latrines requires special attention. Resource recovery and reuse can provide financial and economic incentives for required investments.

    - About one-third of all rivers in developing countries are seriously polluted by fecal pathogens from poor sanitation (UNEP 2016).

2. Accepting common reality – Where farmers' water bodies are polluted, wastewater reuse is a common reality. In and around 74% of cities in developing countries, crops are irrigated with raw or diluted wastewater (Raschid-Sally and Jayakody 2008).

3. Reducing reuse risks to farmers and consumers of crops eaten uncooked, which can be done through low-cost options from "farm to fork" such as safer irrigation practices and careful food washing.

    - Best practices can reduce the disease burden by up to 70%, depending on the adoption rates, and can achieve even greater reductions if accompanied by an expansion of treatment capacity (Drechsel and Seidu 2011).

4. Wastewater treatment plants need not be expensive. The investment costs for appropriate facilities are just 20-50% of those for conventional sludge treatment plants, and the operation and maintenance costs are 5-25%, with comparable treatment efficiency (Libhaber and Orozco-Jaramillo 2013).

SIZING UP NATIONAL EXPERIENCES

INDIA

Despite significant investments in treatment capacity, keeping pace with urban growth remains a major challenge in India. As a result, the use of untreated or partially treated wastewater for irrigation continues to be very common in this country. Particularly urgent and important is investment in the treatment of fecal sludge from on-site sanitation systems, which consist of latrines and septic tanks. Such treatment can generate significant benefits for farmers and improve urban food supplies, while also lowering threats to human and environmental health.

- According to Thebo et al. (2017), 8.9 Mha of India's cropland depend on surface water in which at least 20% is wastewater.
- Irrigation with largely untreated wastewater provides farmers with nutrients that enable them to boost yields of staple grains and horticultural species (by 30-40%) and reduce reliance on synthetic fertilizers (potentially by 40%) in areas irrigated with wastewater (Amerasinghe et al. 2013).
- More than 90% of the pathogenic pollution of surface water in India has been attributed to the approximately 100 million septic tanks and 60 million latrines in urban areas, which are poorly maintained and desludged (Locussol et al. 2006).

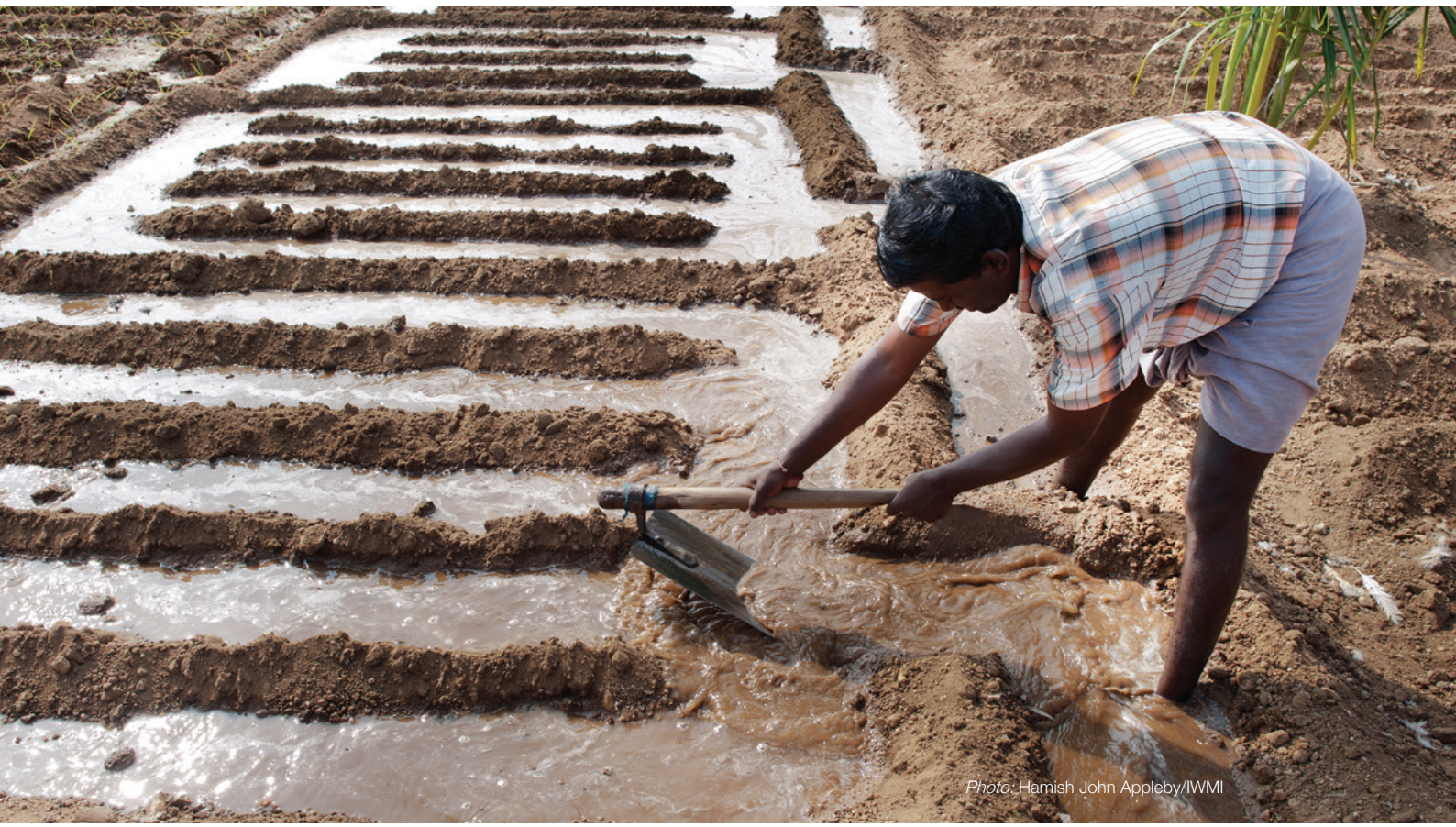


Photo: Hamish John Appleby/IWMI

Photo: Catalina Maya Rendón

MEXICO

Given that rainfall is scarce in much of the country, many of the waterways lying downstream from cities are highly dependent on municipal wastewater, at least half of which are not treated adequately. This poses serious health risks, whose severity depends on the crop grown (with high risk for fruits and vegetables versus virtually none for cotton, for example) and the distance from urban areas, since some natural cleaning takes place along the way.

- Urban areas in Mexico generate about 7.21 million cubic meters (Mm^3) of municipal wastewater annually, of which 6.65 Mm^3 are collected and 3.51 Mm^3 receive some level of treatment (Mateo-Sagasta, Forthcoming).
- About 1.8 Mha of irrigated cropland lie within a radius of 40 kilometers from urban areas, according to Thebo et al. (2017).
- Up to 1.45 Mha of the country's irrigated cropland present some level of health risk from irrigation with polluted water (Mateo-Sagasta, Forthcoming).

Photo: Nana Kofi Acquah/IWMI

GHANA

Since sub-Saharan Africa is the world's most rapidly urbanizing region, countries in this region are on a trajectory similar to that of India and Mexico, with respect to wastewater irrigation. In Ghana, for example, the practice and its hazards are already widespread. However, the country is also well along in the search for solutions. Intensive studies carried out by the International Water Management Institute (IWMI) together with the World Health Organization (WHO) and the Food and Agriculture Organization of the United Nations (FAO) have helped identify a set of low- or no-cost options for risk reduction. To implement these best practices will, however, require major efforts in capacity development, aimed at changing risk perception and behavior among farmers and consumers.

- Of the 74 wastewater and fecal sludge treatment facilities identified in a 2013 IWMI survey conducted across the country, only 16% were found to be fully functional. Although about 27% had some capacity, it was insufficient to render the effluent safe for environmental and public health. Of the majority (57%) that were no longer functioning, most had not been officially decommissioned and were still receiving wastewater or sludge (Drechsel and Keraita 2014).
- Up to 90% of perishable vegetables consumed are grown in or near cities under irrigation with highly polluted water (Drechsel et al. 2006).
- Lettuce production involves about 2,000 urban farmers and 5,300 street food vendors, and benefits about 800,000 consumers daily within major cities. The related annual burden of disease has been estimated at 12,000 disability-adjusted life years (DALYs) for urban Ghana (Drechsel and Seidu 2011; Drechsel and Keraita 2014).
- Estimates for Ghana indicate that every USD 1 invested in creating on- and off-farm pathogen barriers yields a return of USD 5 in terms of public health (Drechsel and Keraita 2014; Drechsel and Seidu 2011).

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Global Wastewater Data

More wastewater data from countries across the globe can be found in our joint database with FAO at:

www.fao.org/nr/water/aquastat/wastewater/index.stm

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IWMI International Water Management Institute

Food and Agriculture Organization of the United Nations

Photo: IWMI

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CGIAR Research Program on Water, Land and Ecosystems

The CGIAR Research Program on Water, Land and Ecosystems (WLE) combines the resources of 11 CGIAR centers, the Food and Agriculture Organization of the United Nations (FAO), the RUAF Foundation, and numerous national, regional and international partners to provide an integrated approach to natural resource management research. WLE promotes a new approach to sustainable intensification in which a healthy functioning ecosystem is seen as a prerequisite to agricultural development, resilience of food systems and human well-being. This program is led by the International Water Management Institute (IWMI) and is supported by CGIAR, a global research partnership for a food-secure future.

International Water Management Institute

The International Water Management Institute (IWMI) is a non-profit, scientific research organization focusing on the sustainable use of water and land resources in developing countries. Headquartered in Colombo, Sri Lanka, with regional offices across Asia and Africa, the Institute works with governments, civil society and the private sector to develop scalable agricultural water management solutions that have a real impact on poverty reduction, food security and ecosystem health. www.iwmi.org

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