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International Water Management Institute

# Wastewater:

## *Global Issues, Trends, and Impacts*

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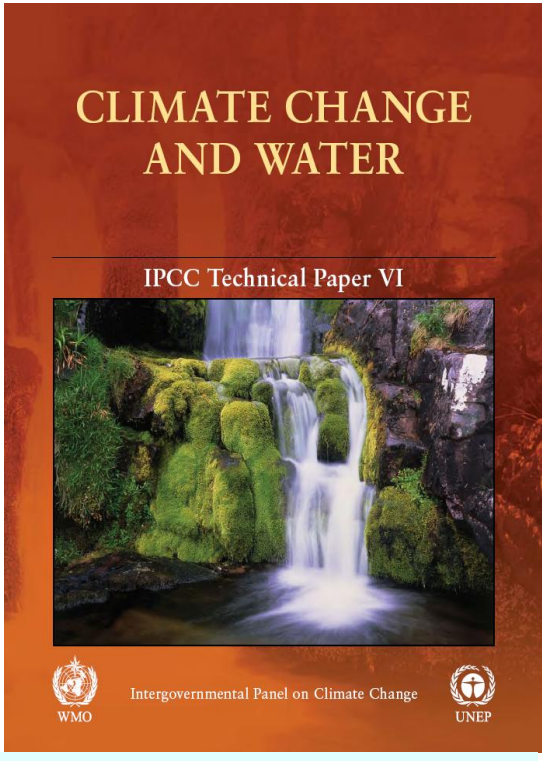
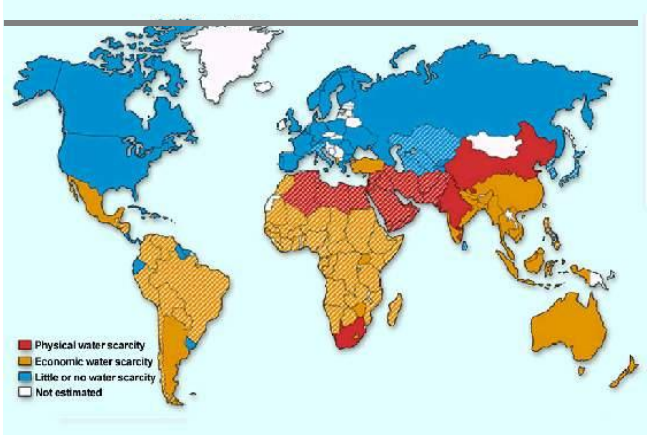
# Presentation Outline: *Issues, Trends, and Impacts*

- Global issues regarding water quality deterioration
- Key challenges in developing countries while using wastewater in **AAAAs**
- Biophysical trends for wastewater production, treatment, and use
- Policy and institutional dimensions of wastewater use
- Farmers' perspectives on wastewater use
- Environmental and health risks associated with wastewater use in agriculture in untreated or inadequately treated forms
- Conclusions and perspectives

# Climate driven global issues related to water quality

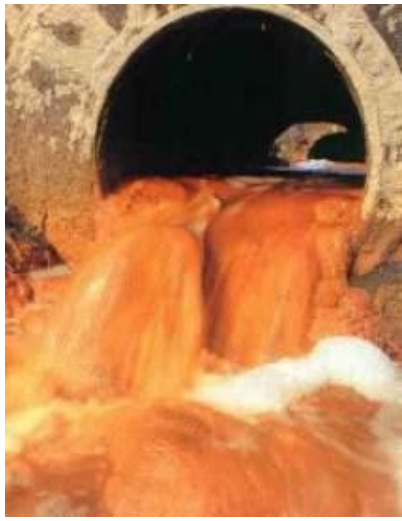
- Higher temperatures and changes in floods and droughts affect water quality leading to many forms of water pollution
- Rising seawater levels and seawater intrusion affect water quality negatively in coastal areas
- Dry areas are expected to become drier; implications for aggravating water scarcity
- Most dry areas have saline aquifers; implications for water quality deterioration

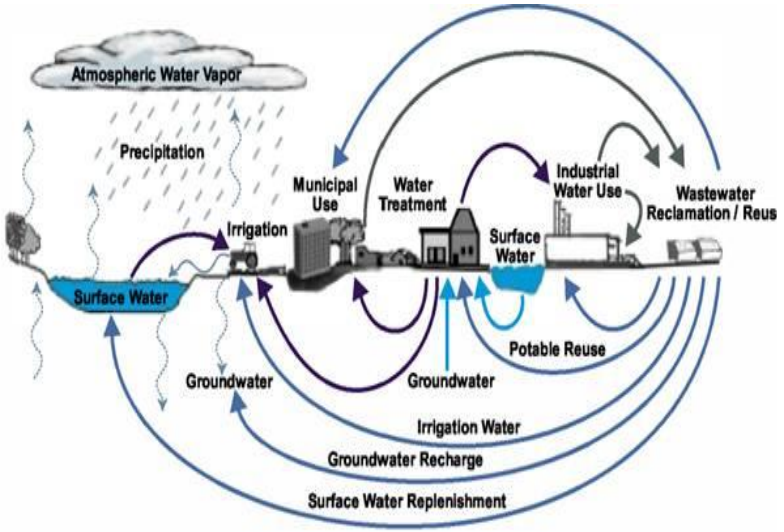


# Human activities influencing water quality

- Agriculture and land-use changes
- Management of water reservoirs
- Pollutant emissions from point and non-point sources
- Limitations with wastewater collection and treatment systems
- Use of untreated or inadequately treated wastewater





# Wastewater and Challenges in Developing Countries

- Most developing countries and countries in transition have yet to reach full-capacity wastewater treatment
- Limited allocation of funds for wastewater collection and treatment systems
- Policies and regulatory measures that encourage treatment and use of treated wastewater are lacking
- Critical shortage of skilled professionals
- Wastewater is available to the farmers in untreated or inadequately treated forms

# Global Trends for Wastewater

- **Production**
- **Treatment**
- **Use in AAAAs**





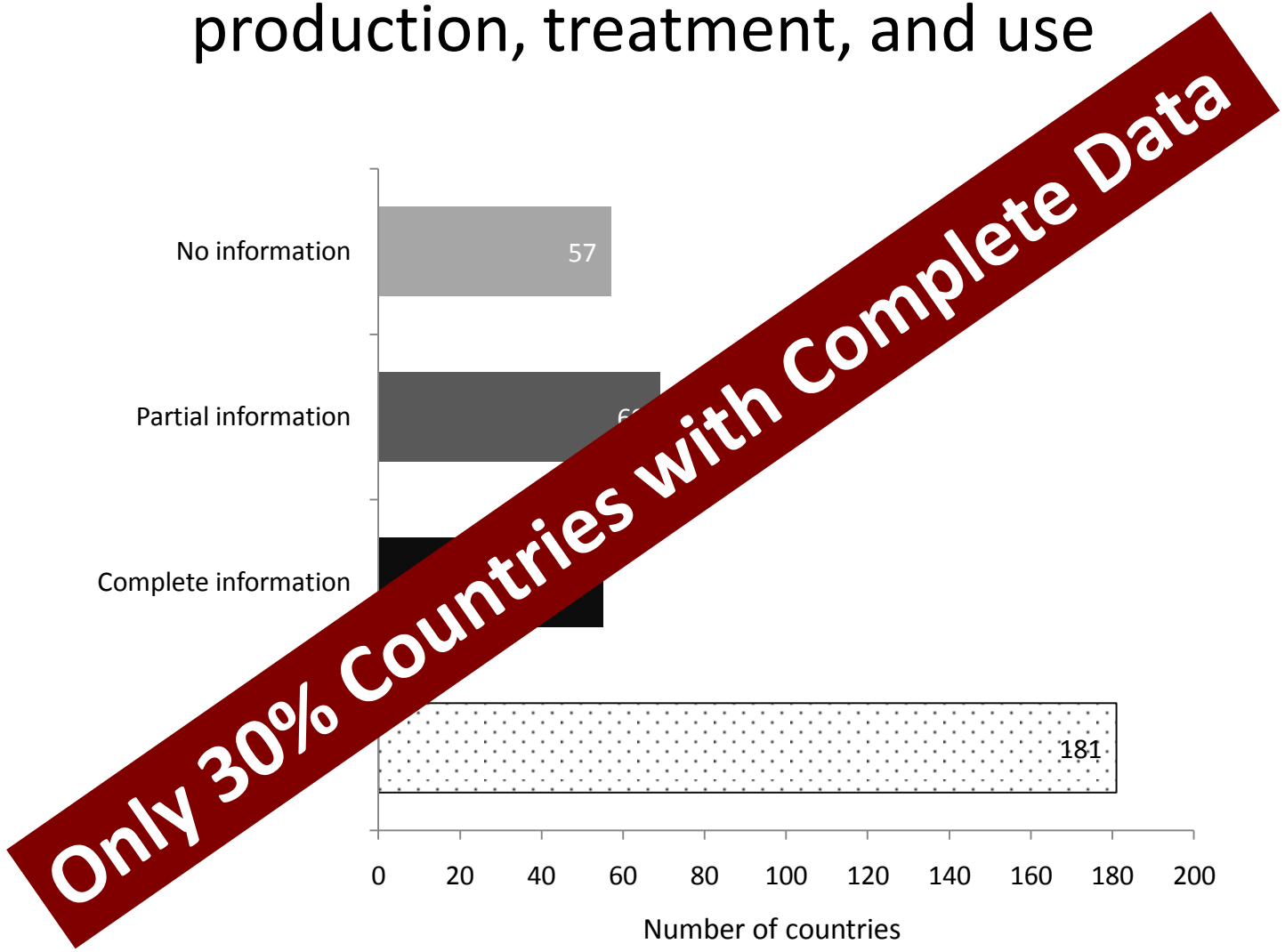

- **A**griculture
- **A**groforestry
- **A**quaculture
- **A**quifer recharge

# Global, regional, and national trends for wastewater production, treatment, and use



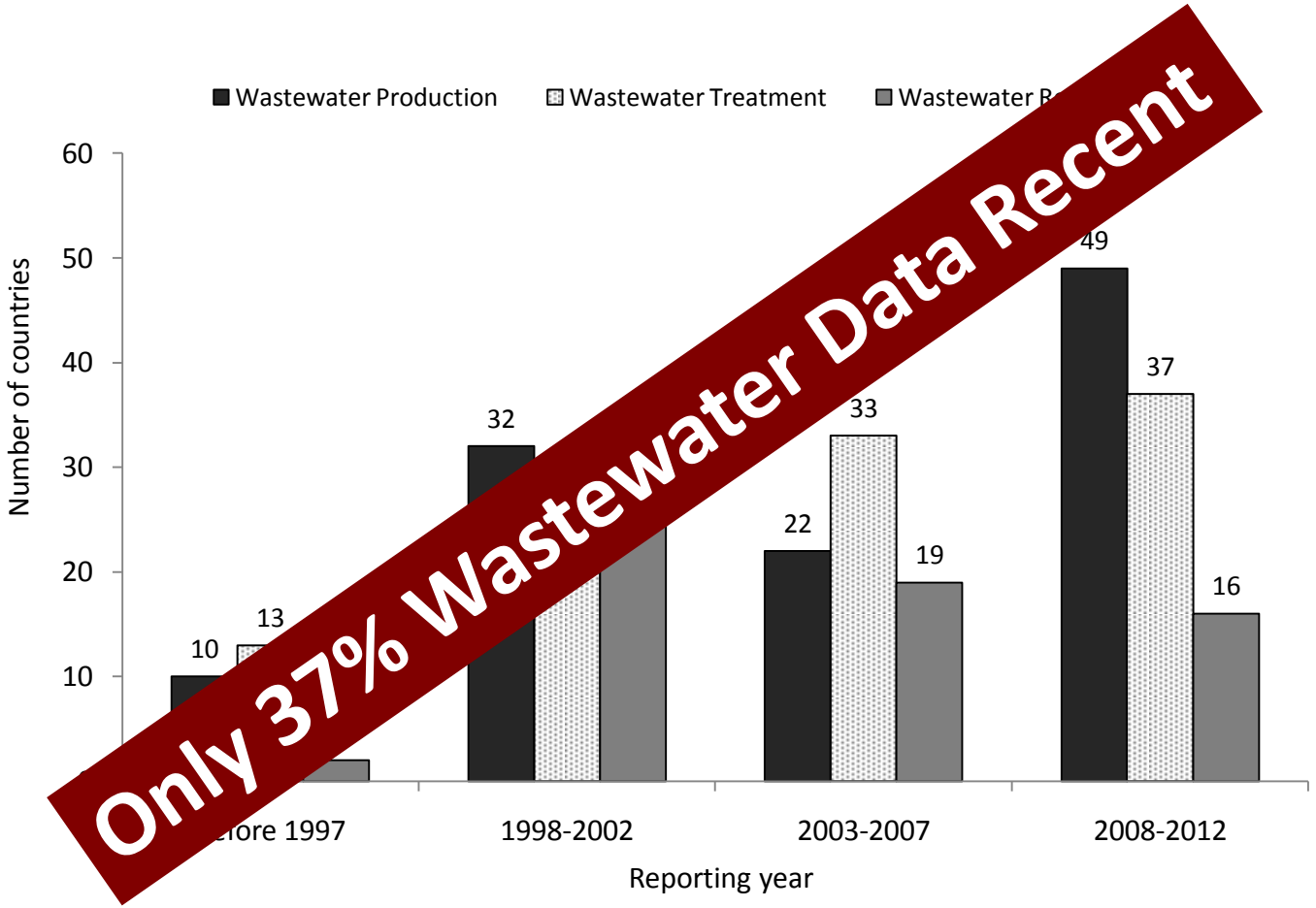

- *Based on*
  - Databases from **181** countries
  - Published and web-based country level databases and sources such as FAO-AQUASTAT, Eurostat, and USEPA

# National level data for 181 countries on wastewater production, treatment, and use




Sato *et al*. 2013. Agricultural Water Management 130: 1-13

# Timeline for data availability on wastewater in 181 countries

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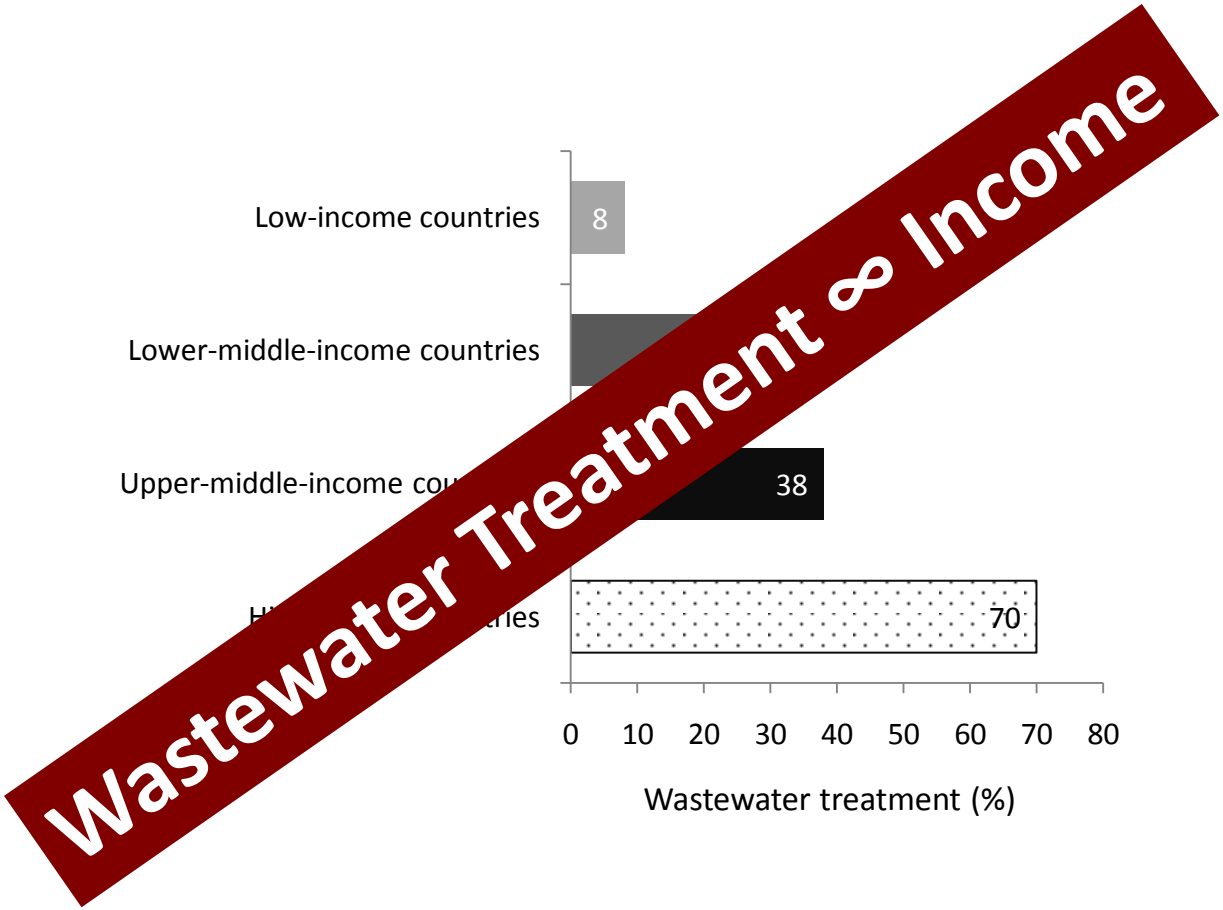
# Wastewater treatment associated with national level economic situation

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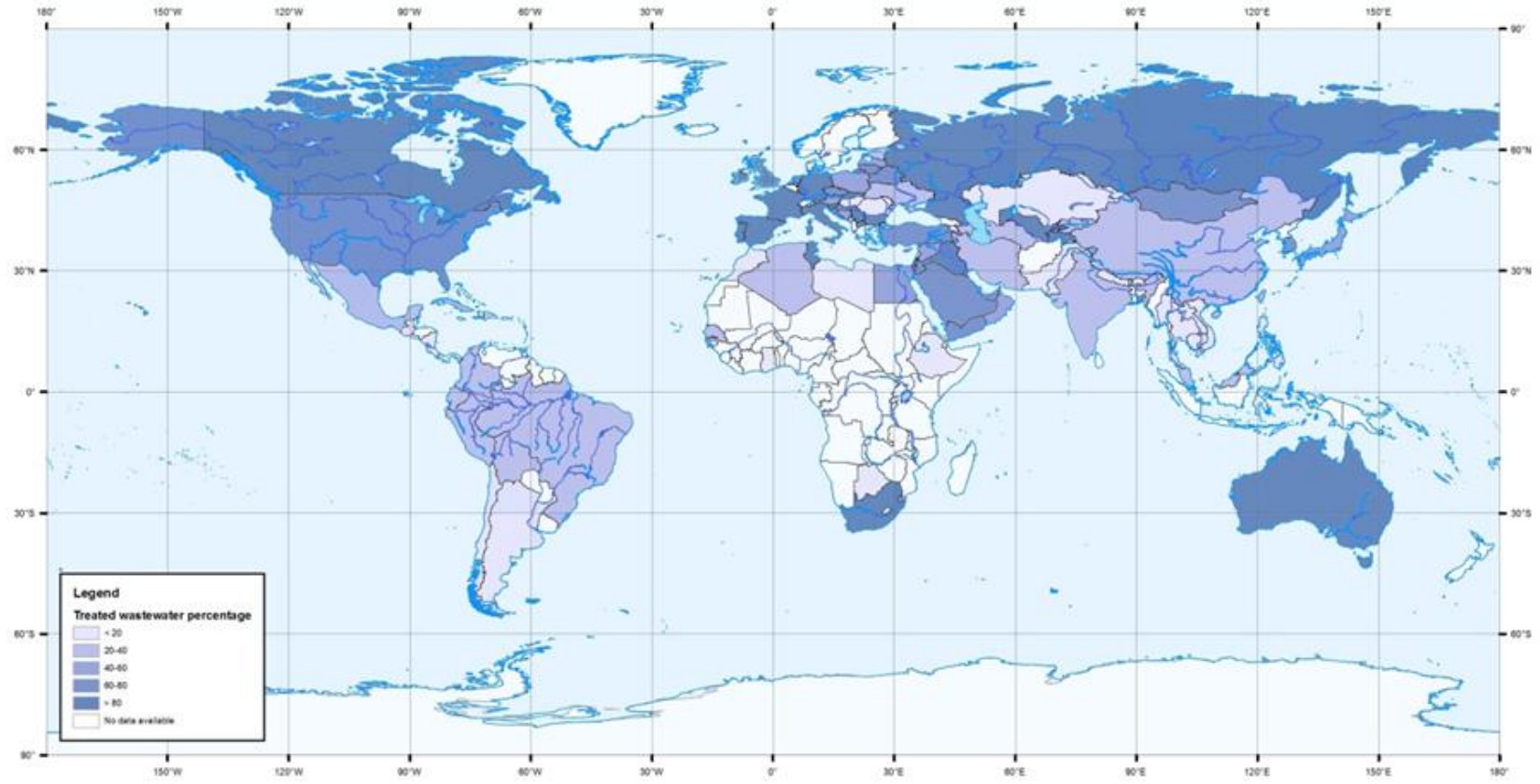
# Ratio of treated wastewater to total wastewater

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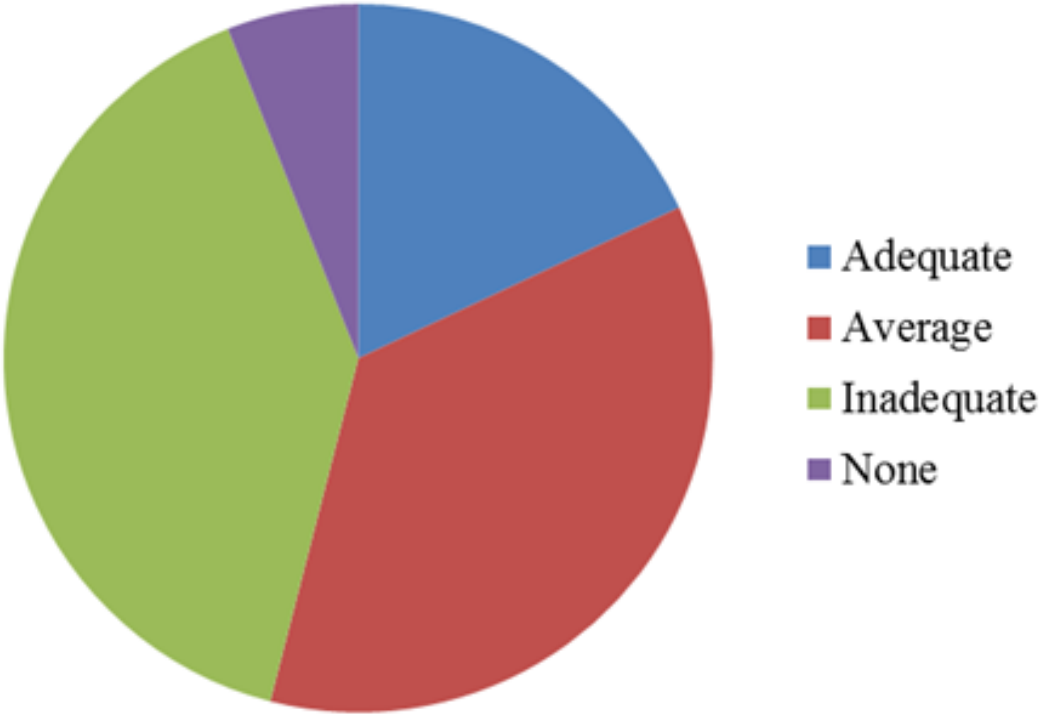
# Institutional and Policy Dimensions of Wastewater Use

- *Based on feedback from **51** developing countries*
  - Asia
  - Africa
  - Latin America and the Caribbean

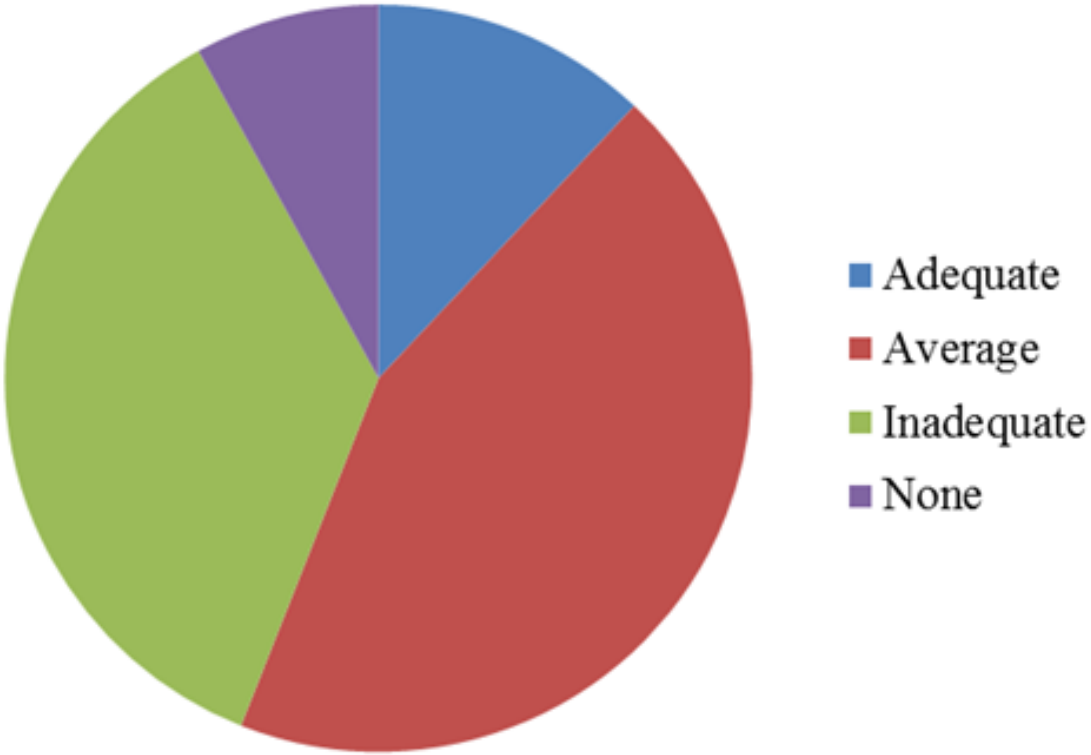
# Institutional Arrangements for Wastewater

- Great diversity at the national level ministries and local level institutions for wastewater management
- Limited inter-ministerial and inter-institutional collaboration for wastewater management



# Investments on Wastewater Management

- For governments' commitment and budget allocation to wastewater management, a trend similar to inter-ministerial and inter-institutional collaboration



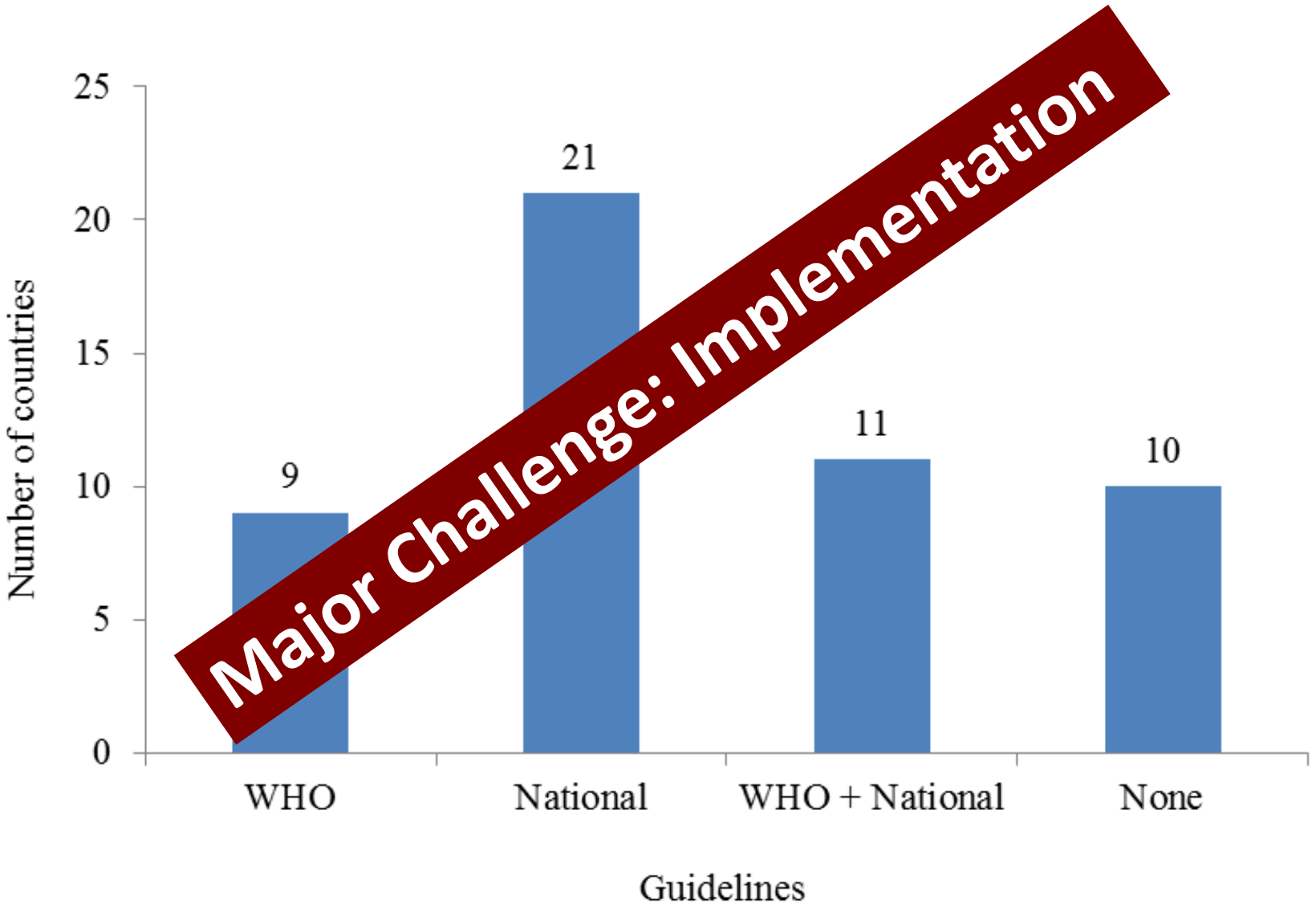
## Wastewater related Education

- Topic of wastewater management in any form as a part of the curricula in schools is still in infancy
- Most countries have yet to introduce the importance of water quality and wastewater management at the school level
- Topic of wastewater management has received some attention at higher education level in recent years with several universities' curricula addressing water quality and wastewater management in some form

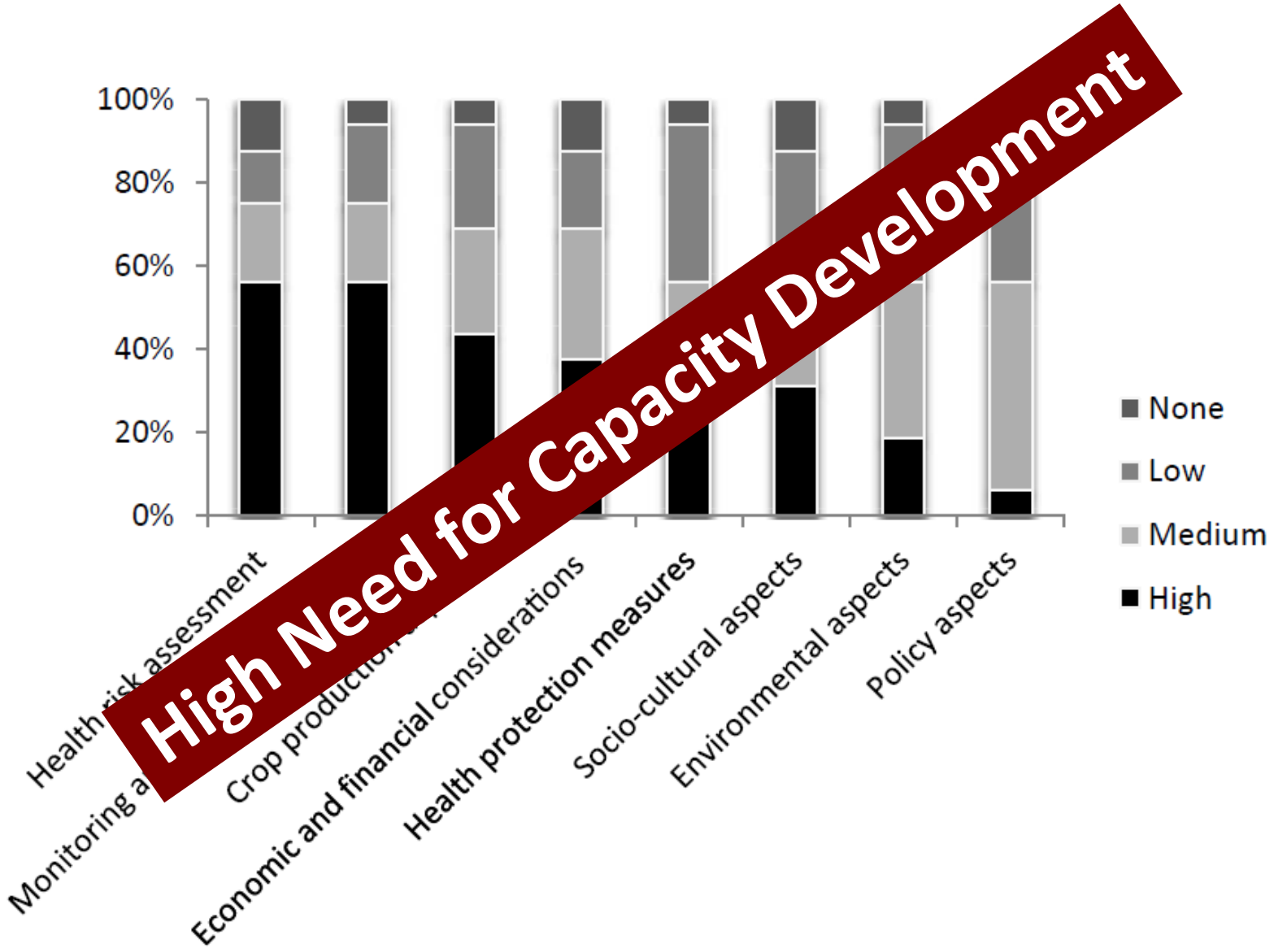
# Wastewater use by Farmers

- Only 10 countries have farmers or water users associations dealing with wastewater
- Lack of collaboration between farmers/water users associations and institutions responsible for wastewater management at the local scale
- Only in 7 countries, farmers in peri-urban areas pay to the local institutions for the wastewater they use for irrigation

# Guidelines for Wastewater Use

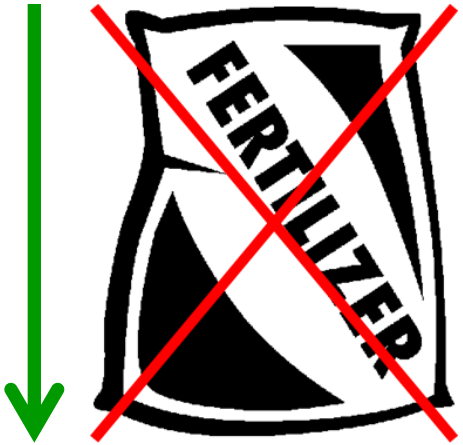


# Priority Areas for Capacity Development



## Incentives for the Farmers

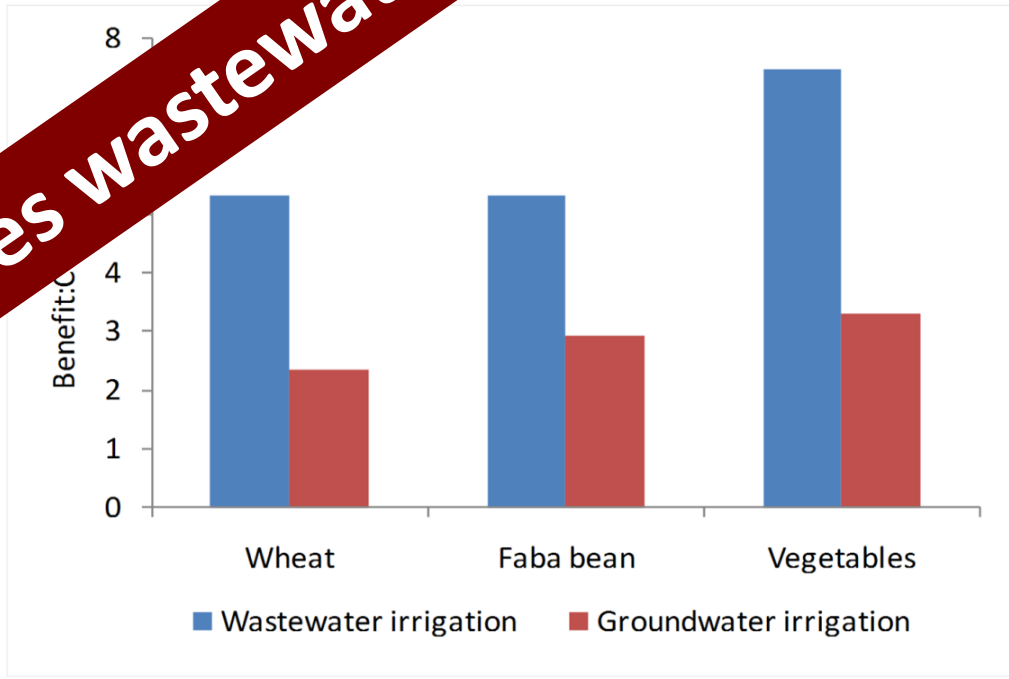
- Reliable availability of a water resource
- Savings on fertilizer use (wastewater contains nutrients)
- Less pumping cost if alternate water source is groundwater
- Additional benefits: high-value crops; increased cropping intensities
- Additional manpower employment and income generation



# Farm Level Economics of Wastewater Use in Agriculture

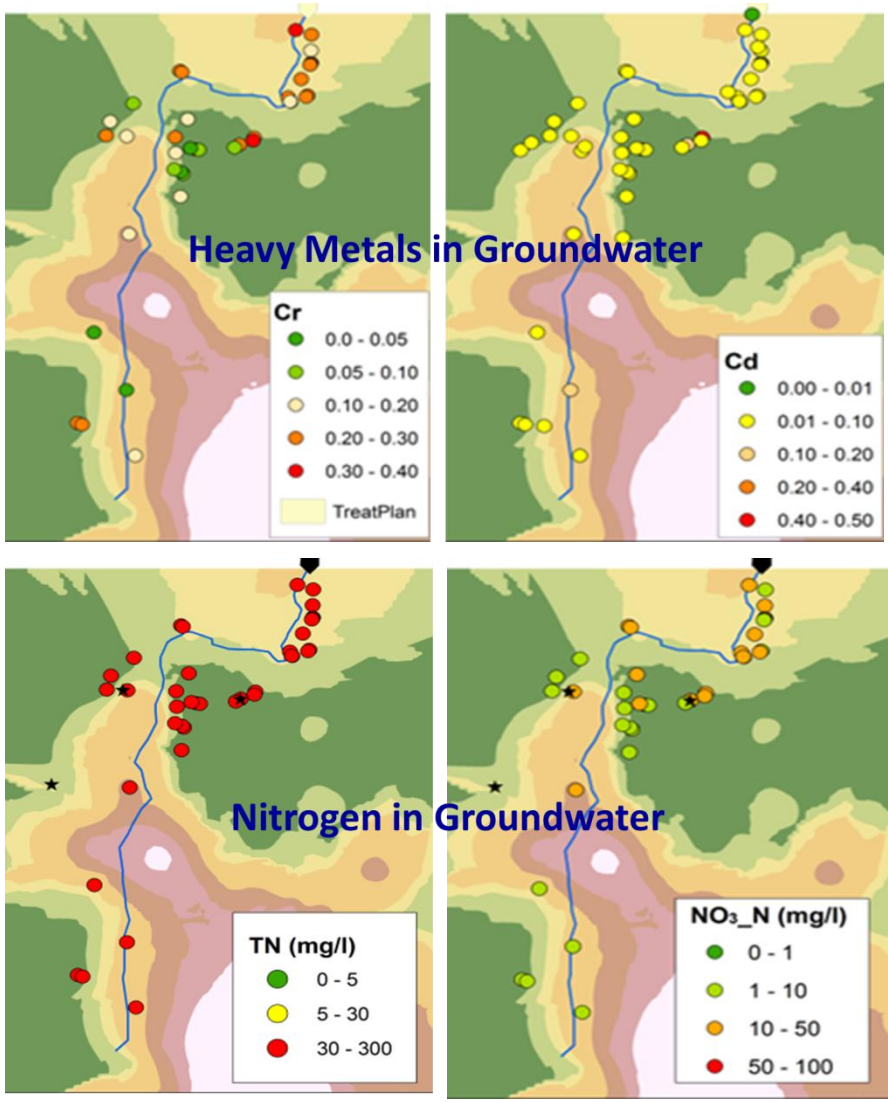
- Based on crop cultivation, fertilizer use, farm labor, and irrigation costs
- No consideration of environmental and heal costs
- Benefit:cost ost double f stewater-irrigated a ea than freshwater-irrigated area

**High profit drives wastewater use**



# Environmental Risks with Untreated Wastewater

- Metals and metalloids
- Nutrients
- Salts and specific ions
- Pharmaceuticals and personal care products

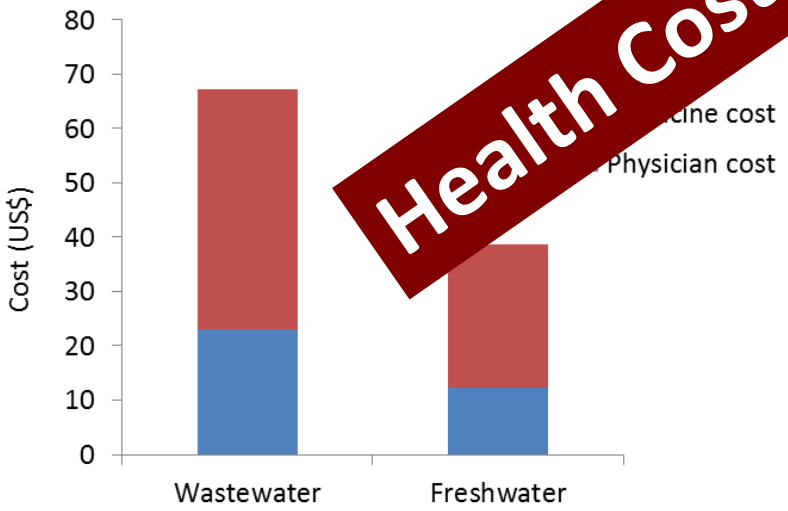


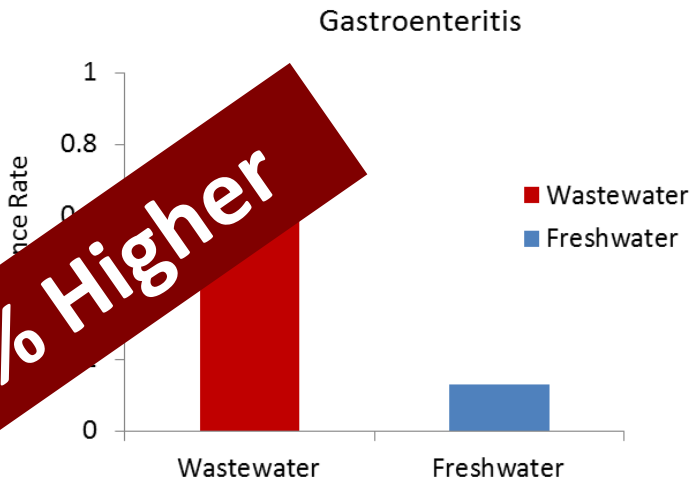
# Health Risks with Untreated Wastewater

- Target Group: Children within 8-12 years
- Wastewater *vs* freshwater irrigated area
- Waterborne and non-waterborne diseases

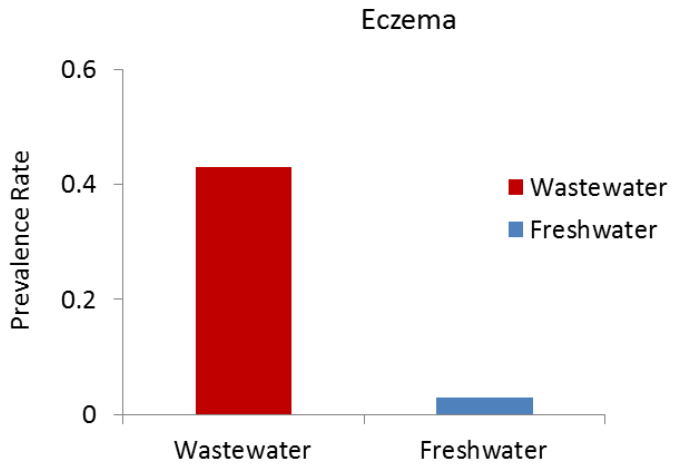
# Health Risks with Untreated Wastewater

- Waterborne diseases
- Other diseases
- Health costs




**Health Costs 73% Higher**




Grangier *et al*. 2012. Water Quality, Exposure and Health 4 (4): 187-195

## Conclusions

- Better wastewater management at the local and national levels needs updated national data and wastewater management strategy at national and local levels
- Wastewater is a valuable resource that needs:
  - Implementation of collection, treatment, and regulated use of treated wastewater
  - Monitoring systems and implementation of WHO guidelines
  - Skilled human resources and institutional capacity
  - Pertinent and flexible policy frameworks

## Perspectives

- Need for interim strategies while full capacity wastewater collection and treatments systems are developed
- Water quality protection is the key to environment and human health
- Safe and productive of wastewater can help protect water quality
- Need for business models for wastewater-based resource recovery and reuse

# Looking forward to contributing to GWI

Thanks