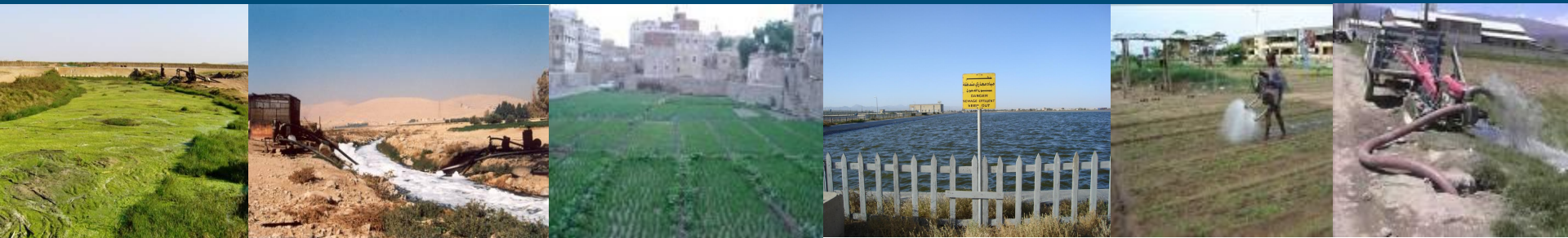


How to 'treat' domestic wastewater

Challenges in Applications of Integrated Water Resources
Management

Water and Environment Centre - 15-16 March 2010

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How to 'treat' wastewater?

... means ...

- How 'to handle' wastewater
- How 'to deal' with wastewater

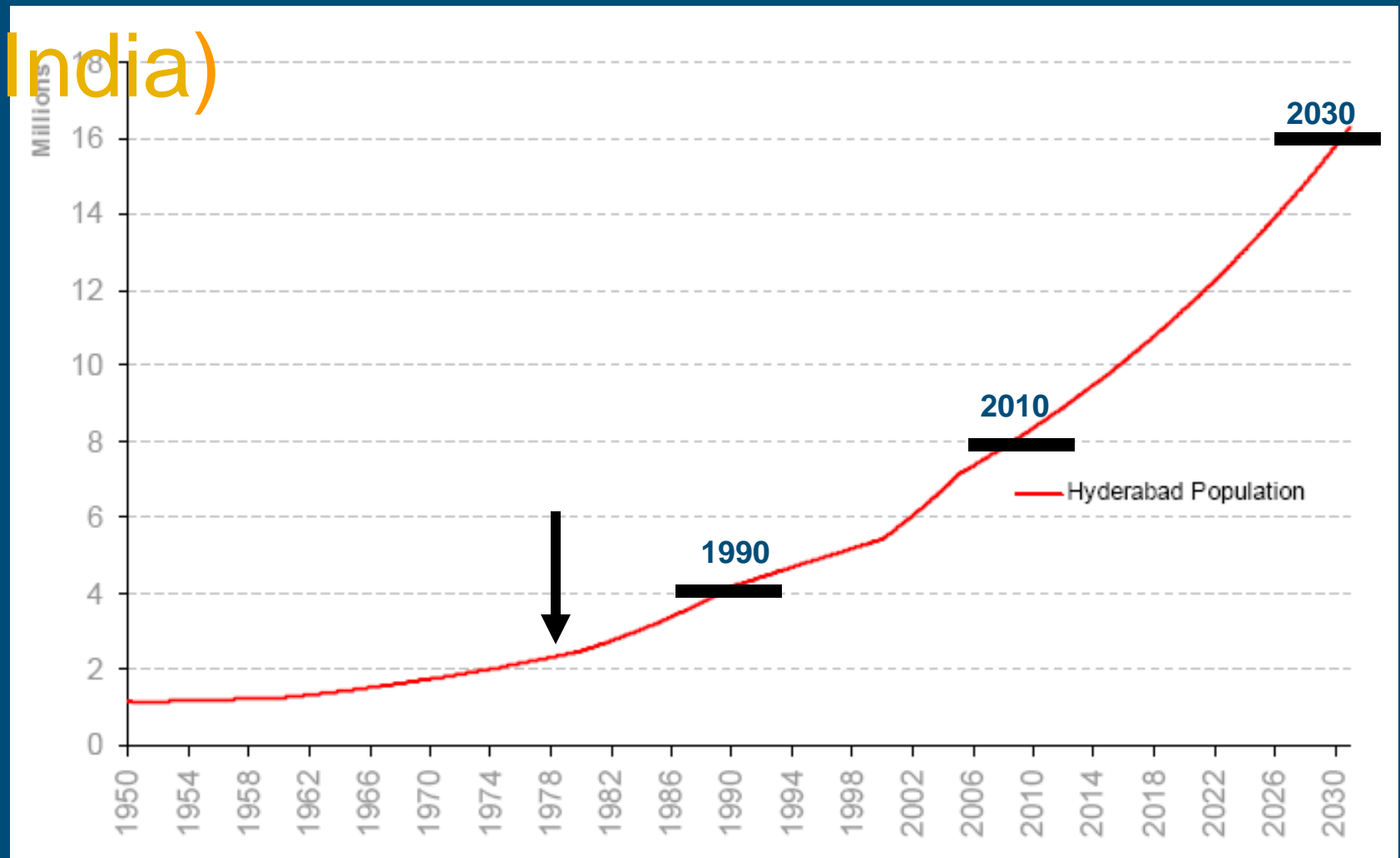
... and not ...

- Which treatment plant to construct



Urban population in Hyderabad

(India)



Hyderabad

+40 Km



Picture: IWMI

Increasing wastewater flows in

Sana'a

Expected increase over a period of 25 years:

- Population growth (3%) > x 2
- Urbanisation (3%) > x 2
- Economic development > x ?

What happened and will happen to Sana'a and other Yemeni cities???

- Last 25 years
- Coming 25 years



Country	Wastewater use (Mm ³ /day/million)	Renewable water resources (m ³ /cap/yr)
Yemen	3	125
Morocco	3	917
China	11	2104
Egypt	26	703
Jordan	40	153
Tunisia	51	452
Syria	55	791
Mexico	136	4214
Israel	166	252
Qatar	170	45

Prospects of wastewater use

- Wastewater is a reliable water source, replacing the use of fresh water resources (closing basins)
- Nutrients in wastewater may (partly) replace chemical fertilizers (recycling)
- Irrigation with wastewater is a treatment step (environmental protection)
- Many (poor) farmers depend on wastewater (livelihood)

Wastewater use (from safe to risky)

- Groundwater recharge
- Landscaping, incl. golf courses
- Industrial crops
- Fodder crops
- Food crops
 - Processed before consumption
 - Tree crops
 - Raw consumed vegetables

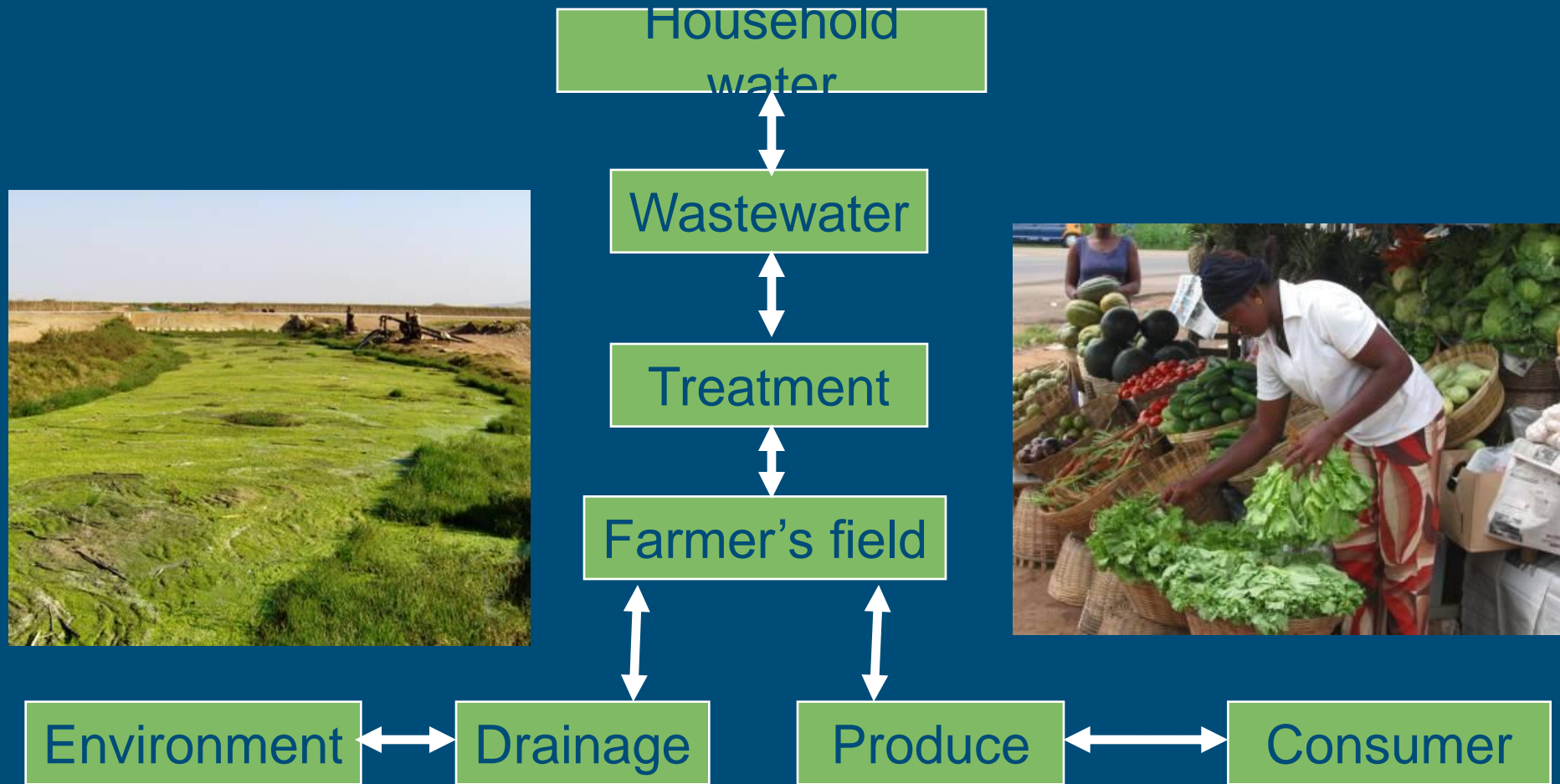


Risks of using domestic wastewater

- Farmers: helminth eggs (parasitic worms)
pathogenic bacteria
skin infections
- Consumers: helminth eggs
pathogenic bacteria
- Environment: nutrient uploading
salinisation/sodification
(groundwater - surface water - soil)



The wastewater chain



Upstream issues (collection and treatment)

- Separate domestic and industrial flows
- Collect wastewater in a sewerage system
- Transport to location where effluent can be used
- Favour a decentralised approach where feasible



Create storage in irrigation scheme

- Link between treatment and agricultural use
- Stores effluent in excess of irrigation water use (operational; seasonal)
- Is a source of irrigation water in periods of high water demand
- Acts as buffer in case of calamities
- Can act as additional treatment



Different Crops and Irrigation Techniques



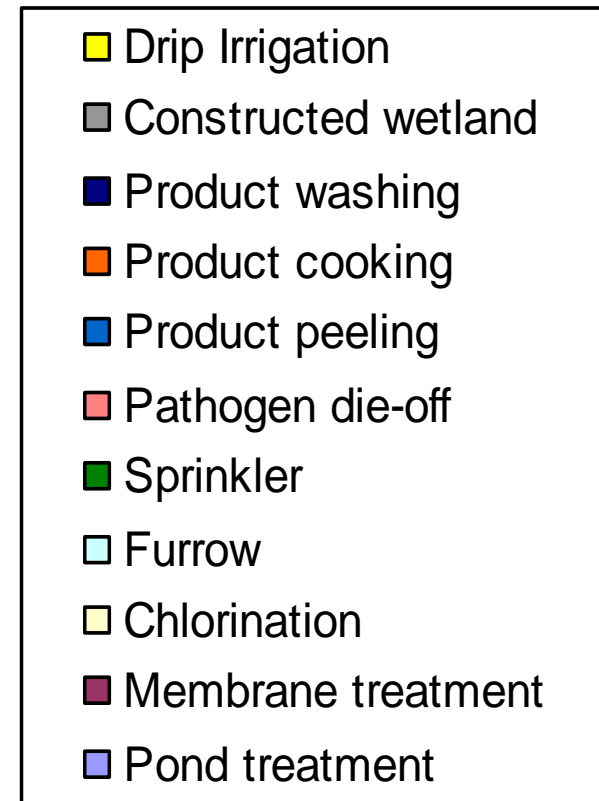
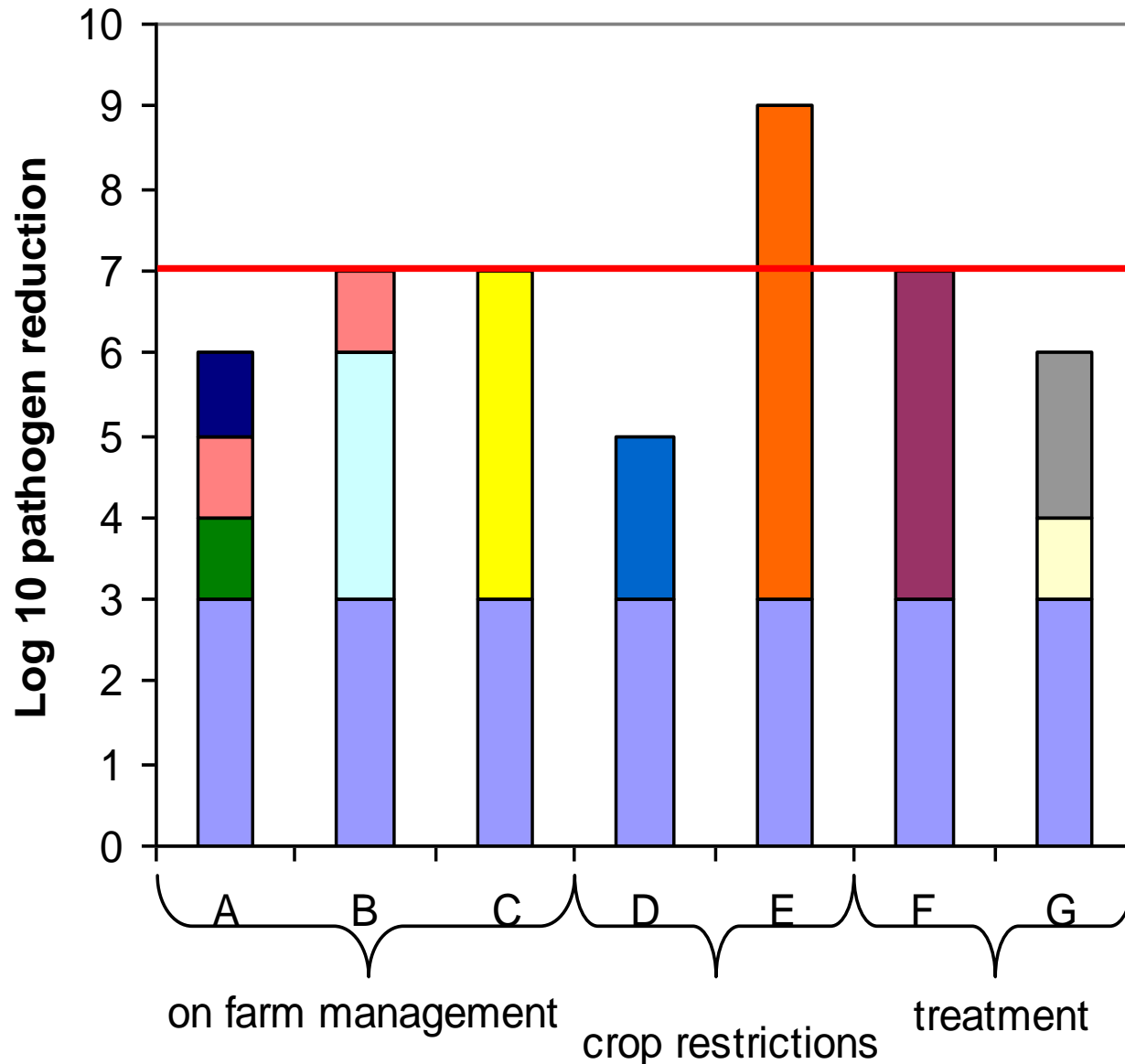
Crop handling: Contamination risks



Food chain: Market handling



QMRA with \log_{10} reduction



Slide courtesy Wolf Raber

The reverse design approach

- Effluent quality fixed by the required water characteristics in downstream irrigation (negotiable)
- The location of the treatment plant in relation to the agricultural field and additional fresh water resources
- Decentralization in view of cost reduction and the exclusion of toxic waste streams in the sewerage
- The lay-out of the water distribution system, incl. the construction of irrigation water storage basins



Research challenges

■ Technological:

- Design criteria for treatment plants serving agriculture
- How to make irrigated agriculture a treatment step

■ Environmental:

- How to control health risks for farmers and consumers
- What are long term effects on soil, surface- and groundwater

■ Socio-economic:

- Develop policies to properly involve stakeholders
- How to create required knowledge and acceptance with farmers and consumers

Aim: Make wastewater a resource!



To you it's 'Shit'. To us it is **BREAD AND BUTTER**
Shit Business is Serious Business



Thank You

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