Prevailing realities

Italy drought: Water cuts pose Rome 'health risk'

Barcelona forced to import emergency water

Source: Wantedinrome, 2017

Source: Manu Fernandez, 2008
Absence of sufficient water

- Water scarcity
- Water stress
- Water poverty
- Water insecurity

Babylonian scoping

- Agriculture
- Energy
- Eco-systems
- Industry
- WASH services

- Health Well-being
  - Economic development
  - Livelihoods
  - Community resilience
  - Equity

- Economic development
- Livelihoods
- Community resilience
- Equity
Global pressures & water-energy-food nexus

- Each 1°C increase caused by global warming is to result in a 20% reduction in renewable water resources
- By 2025, 1/3 of the world’s population is estimated to live in water-stressed areas
- EU areas under water stress are to increase from 19-35% (by 2070s), with an additional 16-44 million people affected

Water scarcity impacts

**QUANTITY**
- Dehydration
- Poor hygiene practices
- Physical harms
- Intermittent water supply services

**QUALITY**
- Impacts of low flows
- Algal blooms
- Salinization

**RESPONSES**
- Reuse of water
- Use of alternative sources
- Increasing water storage
- Improving water efficiency

- Food security
- Nutrition
## Water scarcity impacts

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>QUALITY</th>
<th>RESPONSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dehydration</td>
<td>Impacts of low flows</td>
<td>Reuse of water</td>
</tr>
<tr>
<td>Poor hygiene practices</td>
<td>Algal blooms</td>
<td>Use of alternative sources</td>
</tr>
<tr>
<td>Physical harms</td>
<td>Salinization</td>
<td>Increasing water storage</td>
</tr>
<tr>
<td>Intermittent water supply services</td>
<td></td>
<td>Improving water efficiency</td>
</tr>
</tbody>
</table>
## Hydration and hygiene

<table>
<thead>
<tr>
<th>Service level</th>
<th>Distance/time</th>
<th>Likely volumes of water collected</th>
<th>Needs met</th>
</tr>
</thead>
<tbody>
<tr>
<td>No access</td>
<td>More than 1 km and/or more than 30 min round trip</td>
<td>Quantity collected often below 5 l/c/d</td>
<td>- Consumption – cannot be assured&lt;br&gt;- Hygiene – not possible (unless practised at source)</td>
</tr>
<tr>
<td>Basic access</td>
<td>Within 1 km and 30 min round trip</td>
<td>Average quantity unlikely to exceed approximately 20 l/c/d</td>
<td>- Consumption – should be assured&lt;br&gt;- Hygiene – handwashing and basic food hygiene possible; laundry/bathing may occur off-plot</td>
</tr>
<tr>
<td>Intermediate access</td>
<td>Water provided on-plot through at least one tap (yard level)</td>
<td>Average quantity of approximately 50 l/c/d</td>
<td>- Consumption – assured&lt;br&gt;- Hygiene – all basic personal and food hygiene assured; laundry/bathing likely to occur on-plot</td>
</tr>
<tr>
<td>Optimal access</td>
<td>Supply of water through multiple taps within the house</td>
<td>Average quantity of 100-200 l/c/d</td>
<td>- Consumption – all needs met&lt;br&gt;- Hygiene – all needs should be met</td>
</tr>
</tbody>
</table>

Source: Howard & Bartram 2003
Hydration and hygiene

Dehydration and physiological effects

- Physical performance (fatigue)
- Cognitive performance (concentration)
- Delirium (dementia in the elderly)
- Gastrointestinal function (constipation)
- Kidney function
- Risk of urinary stone formation
- Headache

Compromised personal, domestic and food hygiene

HEALTH CARE FACILITIES

- Safe childbirth
- Maternal and new born health
- Infection prevention control
- Operation theatre
- General hospital hygiene
Carrying the weight of water

- Common among the rural poor
- Longer distances to (alternative) sources
- Carrying heavy containers causes pain, physical injury, and contributes to musculoskeletal disorders
- Impacts on children's school attendance
- Woman and girls may be subject to harassment

Source: NRC, 2015
## Water scarcity impacts

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>QUALITY</th>
<th>RESPONSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dehydration</td>
<td>Impacts of low flows</td>
<td>Reuse of water</td>
</tr>
<tr>
<td>Poor hygiene practices</td>
<td>Algal blooms</td>
<td>Use of alternative sources</td>
</tr>
<tr>
<td>Physical harms</td>
<td>Salinization</td>
<td>Increasing water storage</td>
</tr>
</tbody>
</table>

**Intermittent water supply services**
Impacts on water quality

- Lack of dilution of chemical and microbiological pollution during low flows:
  - Wastewater and land management
  - Intense rainfall after long dry spells leading to rapid runoff of chemicals and faecal matter
  - Algae proliferation, including cyanobacteria

- Accelerated demands on source water and drinking-water management and treatment
Intermittent supply

- Major determinant of water quality
- Low water pressure increases risk of ingress of contaminated water into the system and backflow
- Increases risk of waterborne disease
- Household water storage
- Use of potentially unsafe alternative sources

Source: AndrewHeiss 2006
WSP: Safely managed water services
Recreational aspects

• Recreational exposure
• Stagnation and water-based diseases:
  – Dracunculiasis (ingestion)
  – Schistosomiasis and leptospirosis (skin contact)
• Loss of health and well-being benefits of urban water environments

# Water scarcity impacts

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>QUALITY</th>
<th>RESPONSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dehydration</td>
<td>Impacts of low flows</td>
<td>Reuse of water</td>
</tr>
<tr>
<td>Poor hygiene practices</td>
<td>Algal blooms</td>
<td>Use of alternative sources</td>
</tr>
<tr>
<td>Physical harms</td>
<td>Salinization</td>
<td>Increasing water storage</td>
</tr>
<tr>
<td>Intermittent water</td>
<td></td>
<td>Improving water efficiency</td>
</tr>
<tr>
<td>supply services</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Water storage and vectors

- Increased household water storage during periods of scarcity provide larval habitats and breeding sites for mosquitoes (malaria and dengue)
- Safe storage practices

Example: Warm winter increased the number of *Aedes aegypti* breeding sites in Brazil potentially supporting Zika virus spread during a typically low-transmission season.
Safe household water storage & treatment
Use of alternative sources

• Increased reliance on poor quality sources, which are more yielding or closer:
  – Surface water (stream, dam, lake, pond, canal)
  – Unprotected springs or dug wells
• Increased risk of waterborne disease
• Rainwater harvesting at local scale
• Desalination as large scale augmentation
Water reuse

• Wastewater treated or processed to a certain standard suitable for reuse
• Quality requirements need to be tailored to the requirements of end usage
• Direct reuse and indirect reuse, including potable reuse

• Examples: Australia, Israel, Singapore, Spain and USA
# Water reuse & treatment levels

<table>
<thead>
<tr>
<th>Primary treatment</th>
<th>Secondary treatment</th>
<th>Tertiary treatment</th>
<th>Advanced treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>No uses recommended</td>
<td>Non-food crop irrigation</td>
<td>Food crop irrigation</td>
<td>Indirect potable reuse: Groundwater recharge of potable aquifer and augmentation of surface water reservoirs</td>
</tr>
<tr>
<td></td>
<td>Restricted landscape usage</td>
<td>Landscape and golf course irrigation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-potable groundwater recharge</td>
<td>Toilet flushing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wetlands and stream augmentation</td>
<td>Vehicle washing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Industrial cooling</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Increasing levels of human exposure, increasing levels of treatment*

Source: Adapted from US EPA Guidelines for Water Reuse 2012
Reuse of wastewater in agriculture

- Ingestion (unintentional) after contact with wastewater
- Dermal (skin) contact with excreta and wastewater
- Ingestion of contaminated water
- Vector-borne with flies/mosquitoes
- Consumption of contaminated produce
- Inhalation of aerosols and particles

- World Health Organization
- Organisation mondiale de la Santé
- Weltgesundheitsorganisation
- Всемирная организация здравоохранения
SSP: Safe management of reuse
Conclusions

• Ensure access to safe sources and allocate sufficient amounts of water for drinking-water supply, including for health systems
• Integrate “health needs” in bigger water management picture
• Build climate-resilient water & sanitation services in response to changing water quality and quantity patterns
• Promote WSPs and SSPs as public health benchmarks to ensure safely managed services, including in scarcity scenarios
• Establish health-based targets (regulations) guiding scarcity response strategies to prevent collateral health damages
Thank you