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# **Urban Water Footprints and Sustainable Water Systems**

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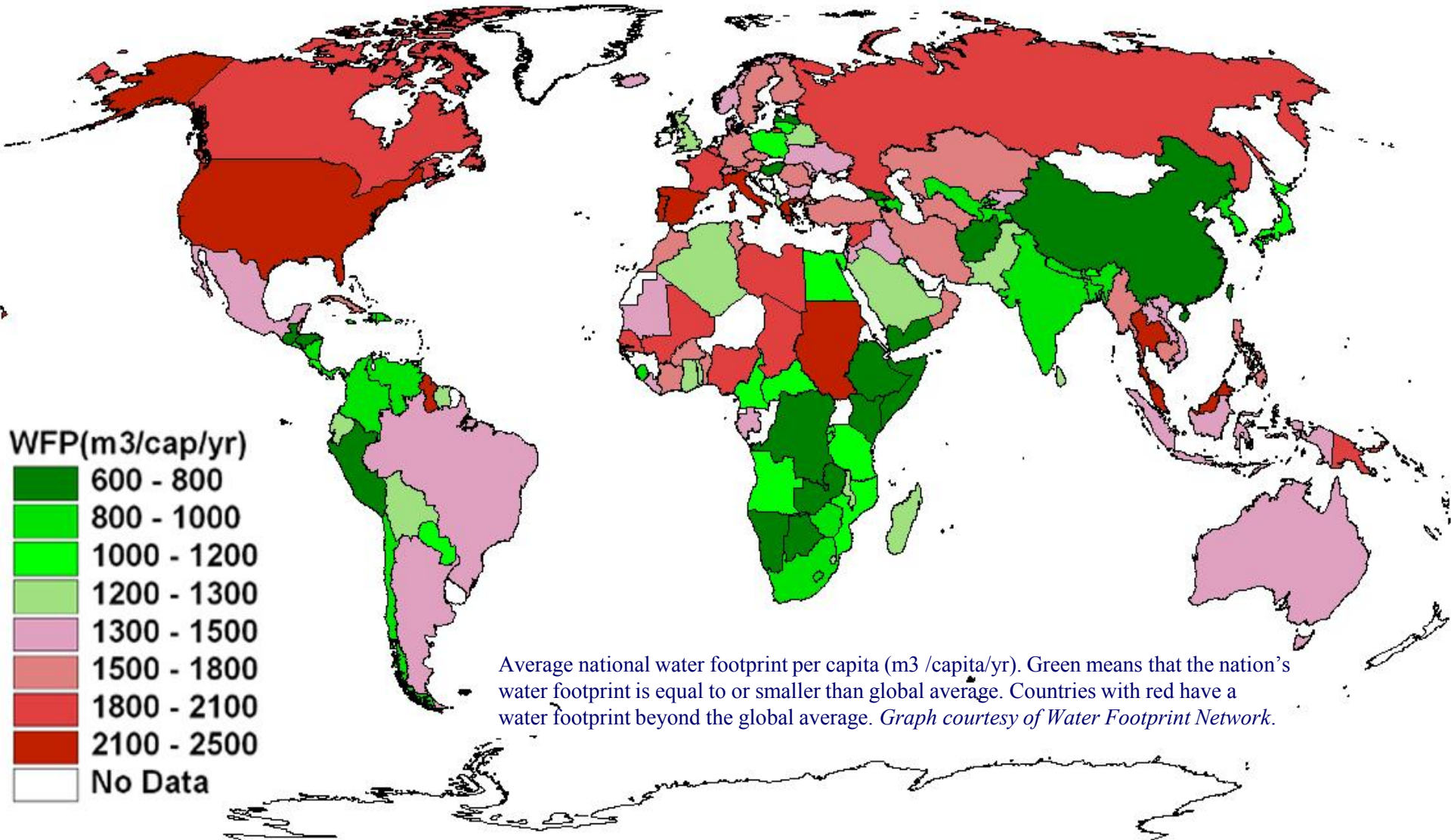
# Urban Water Context



With increasing urbanization in developing countries come associated increases in:

- municipal demand for potable and non-potable water
- water scarcity due to increased demand and climate change
- need for infrastructure construction and rehabilitation
- need for sanitation and wastewater treatment to protect human and ecosystem health

# Water Footprint Concept



# Water Footprint Concept



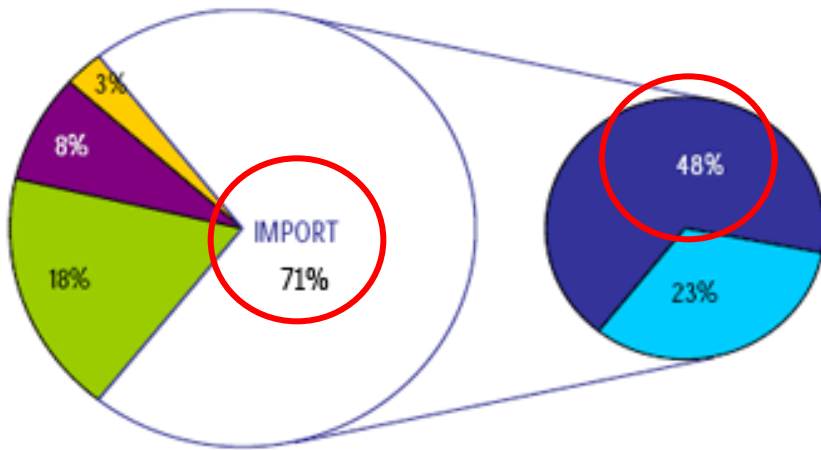
- Definition: total volume of freshwater used for direct and indirect water uses
- Includes domestic water use (indoor and out, drinking and nondrinking), food consumption, industrial goods consumption
- Can be calculated on global, regional, national, local, institutional, or individual basis
- Blue, green, and gray water footprints



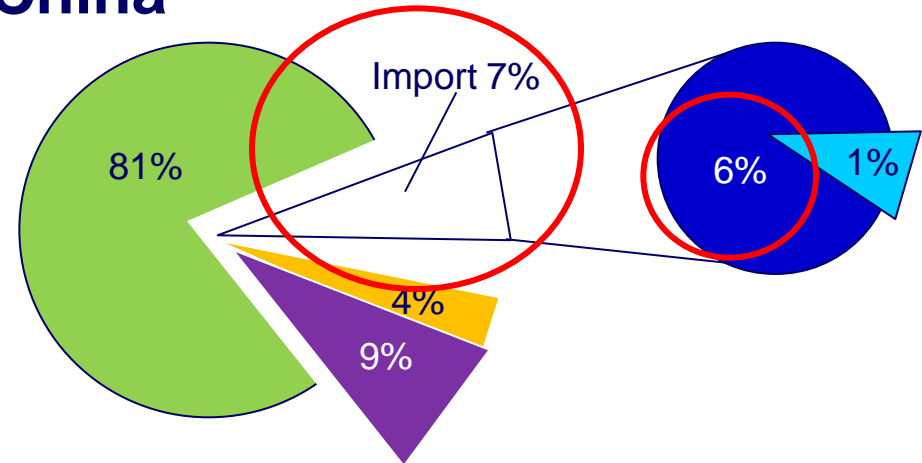
# Country Water Footprints








## UK



## China



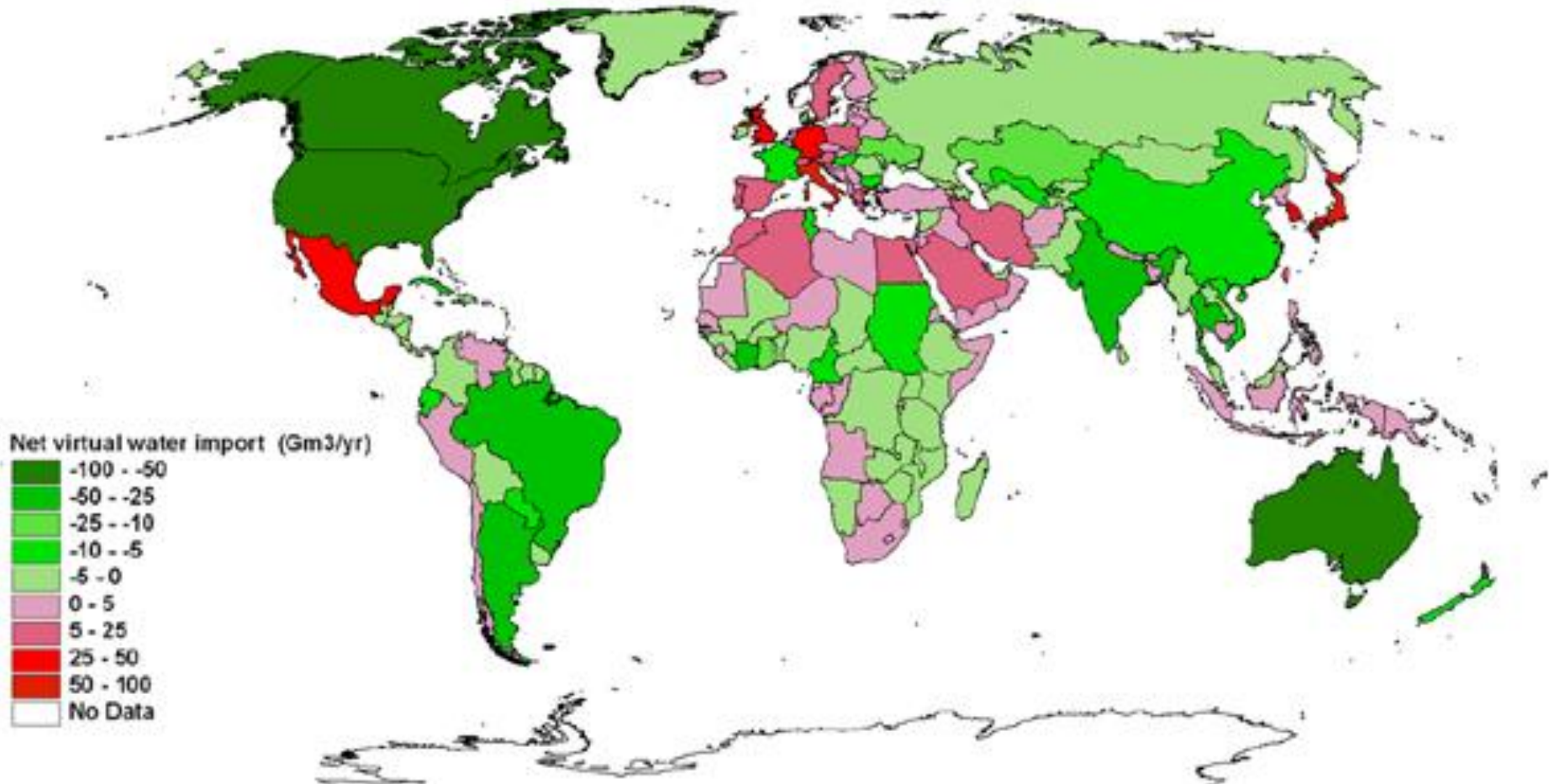
Data from 1997-2001

-  Agricultural goods produced & consumed internally
-  Industrial goods produced & consumed internally
-  Domestic water consumption
-  Water consumed through import of agricultural goods
-  Water consumed through import of industrial goods

# Virtual Water



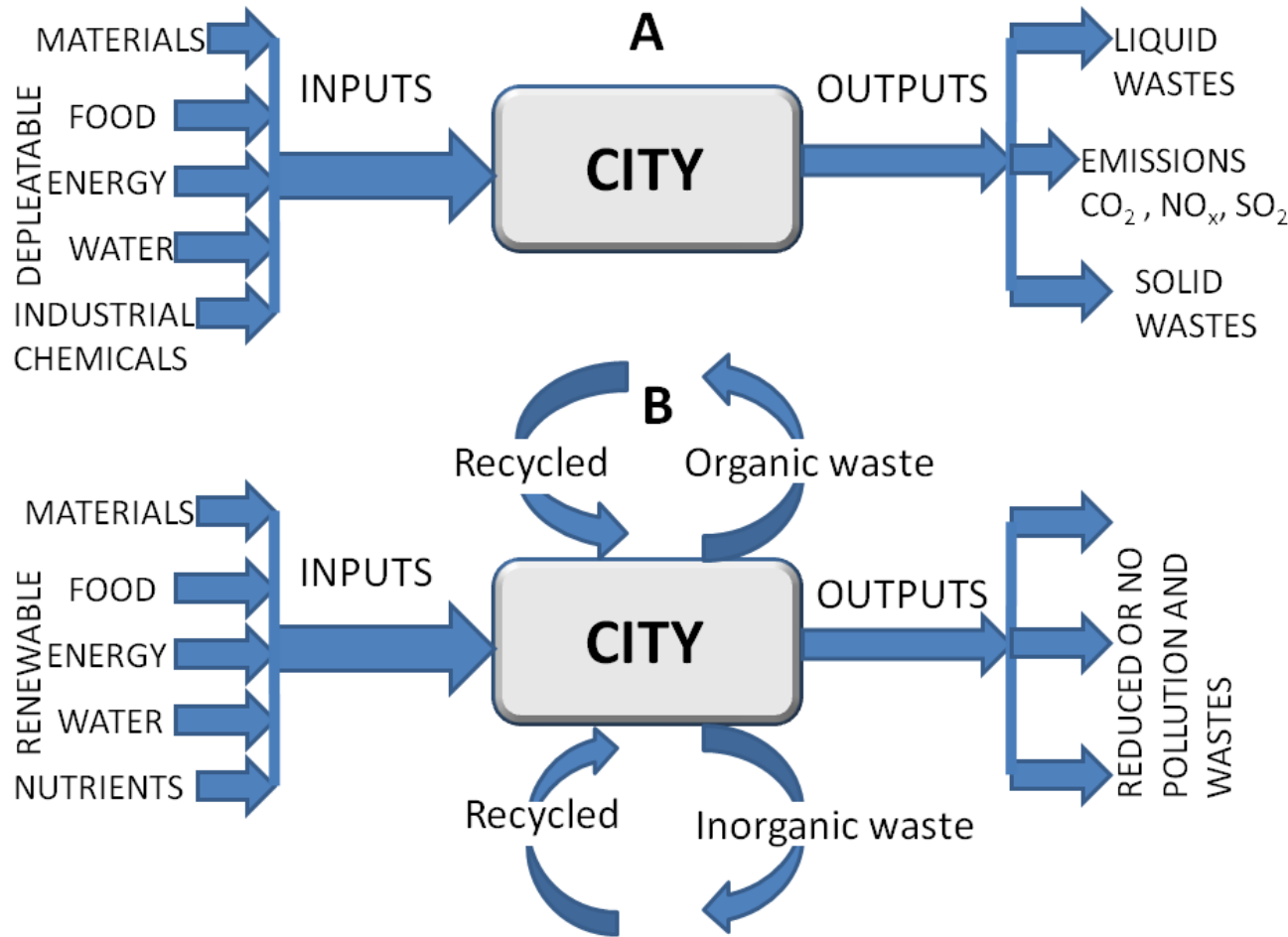
“The world and its cities are thirsty for water, but too often it is forgotten that they are far more hungry for water.” Varis 2006



# Cities as Ecosystems



- Humans are integrated into urban ecosystems
- Mass balance/metabolism concept
- Linear versus cyclical systems



# Sustainable Urban Water Systems



1. Form strategic partnerships
2. Develop alternative water sources
3. Implement new technologies
4. Engage the community

| <b>Environment</b>  | <b>Community</b>   | <b>Economy</b>   |
|---|--|--|
| <ul style="list-style-type: none"><li>• watershed protection</li><li>• ecosystem balance</li><li>• wastewater and biosolids</li></ul> | <ul style="list-style-type: none"><li>• sufficient and reliable water supply</li><li>• participation in planning</li><li>• recreational use to water</li></ul> | <ul style="list-style-type: none"><li>• evolution and diversification</li><li>• sustainable and long-term growth</li></ul> |



# Sustainable Urban Water Systems



## Cities must ask themselves:

1. Do we know how our local water resources are created and sustained?
2. Do we understand how our community uses and impacts our water supply?
3. Have we conducted a thorough assessment of our existing water supply system?
4. Do we have a sustainable, long-range water plan?
5. Have we involved the community appropriately in decisions that affect their water?
6. Do we understand the technologies available to achieve a sustainable water supply?
7. Do we have the capacity to drive the changes required by our plans?
8. Do we have the expertise to operate and continuously improve our water system?

# Integrated Approaches:

## 1. Green Infrastructure



Green infrastructure:

“Strategically planned and managed networks of natural lands, working landscapes and other open spaces that conserve ecosystem values and functions and provide associated benefits to human populations.”

– The Conservation Fund



# Integrated Approaches:

## 1. Green Infrastructure

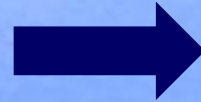


Potential benefits of green infrastructure include:

- Ecological goods and services
- Habitat and biodiversity
- Local and global climate mitigation
- Human health
- Local economic regeneration
- Education
- Amenities for liveable cities



# Integrated Approaches: 1. Green Infrastructure



Urban stream revival

Source: City of Seoul



# Integrated Approaches:

## 1. Green Infrastructure



Biofiltration strip capturing and infiltration parking lot runoff (Landcare Research)



Green Roof



# Integrated Approaches: 1. Green Infrastructure



Integrating gray and green infrastructure

# Integrated Approaches:

## 2. Total Water Management



Holistic approach to water management combining gray and green infrastructure

### 1. Green Infrastructure



### 2. Gray Infrastructure

- Rainwater harvesting
- Stormwater capture and recharge
- Water conservation

- Provide multiple grades of water
- Graywater and stormwater reuse

# Conclusions



- Existing integrated models for sustainable urban water systems have potential for application in the development context
- Technical expertise is needed to modify green and gray infrastructure practices originally designed for temperate climates

## **Contact info:**

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## **Resources:**

<http://www.waterfootprint.org>

<http://www.gdrc.org/uem/water/index.html>

<http://www.greeninfrastructure.net>