Mykolaiv Water Hub

Water Leaders Course

National University of Water and Environmental Engineering

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Module 3: Water Reuse, Part 1

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Presentation Outline

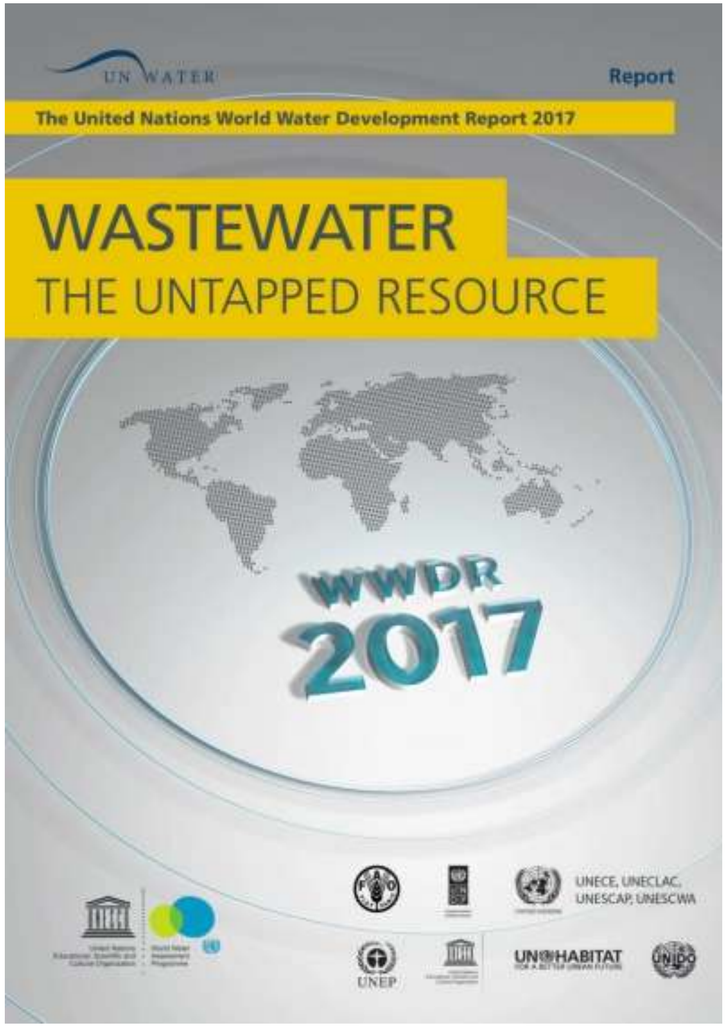
- Global wastewater production
- What is water reuse?
- Types of water reuse
- Benefits and challenges



Water is not *just* water.

Clean water is the foundation for human and ecosystem health, economic development, political stability and national security.

Wastewater: The Untapped Resource



In a world where demands for freshwater are continuously growing, and where limited water resources are increasingly stressed by over-abstraction, pollution and climate change, neglecting the opportunities arising from improved wastewater management is nothing less than unthinkable in the context of a circular economy.

UN World Water Development Report 2017: Wastewater: The Untapped Resource

Global Wastewater Production

- Globally, 380 billion m^3 of municipal wastewater is generated annually
- 52-56% of global wastewater is treated
  - High-income countries (74%)
  - Upper-middle income countries (43%)
  - Lower-middle income countries (26%)
  - Low-income countries (4.3%)



Sources: UNU, WHO, Unicef, UN-Water

Global Wastewater Production, Collection, Treatment and Reuse

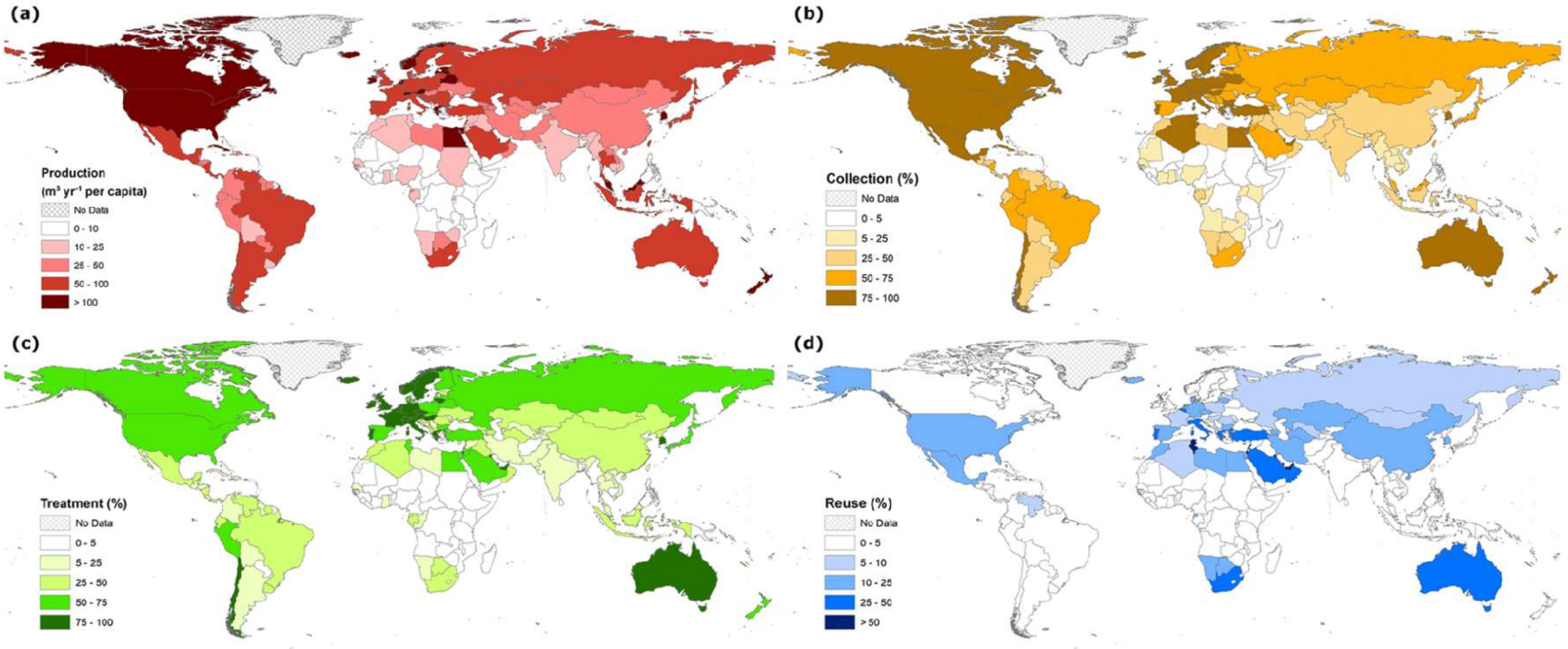


Figure 3: Wastewater production (m3 yr−1 per capita) (a); collection (%) (b); treatment (%) (c); and reuse (%) (d) at the country scale.

Source: Jones ER, et al. 2021. *Earth Syst. Sci. Data*, 13, 237–254.

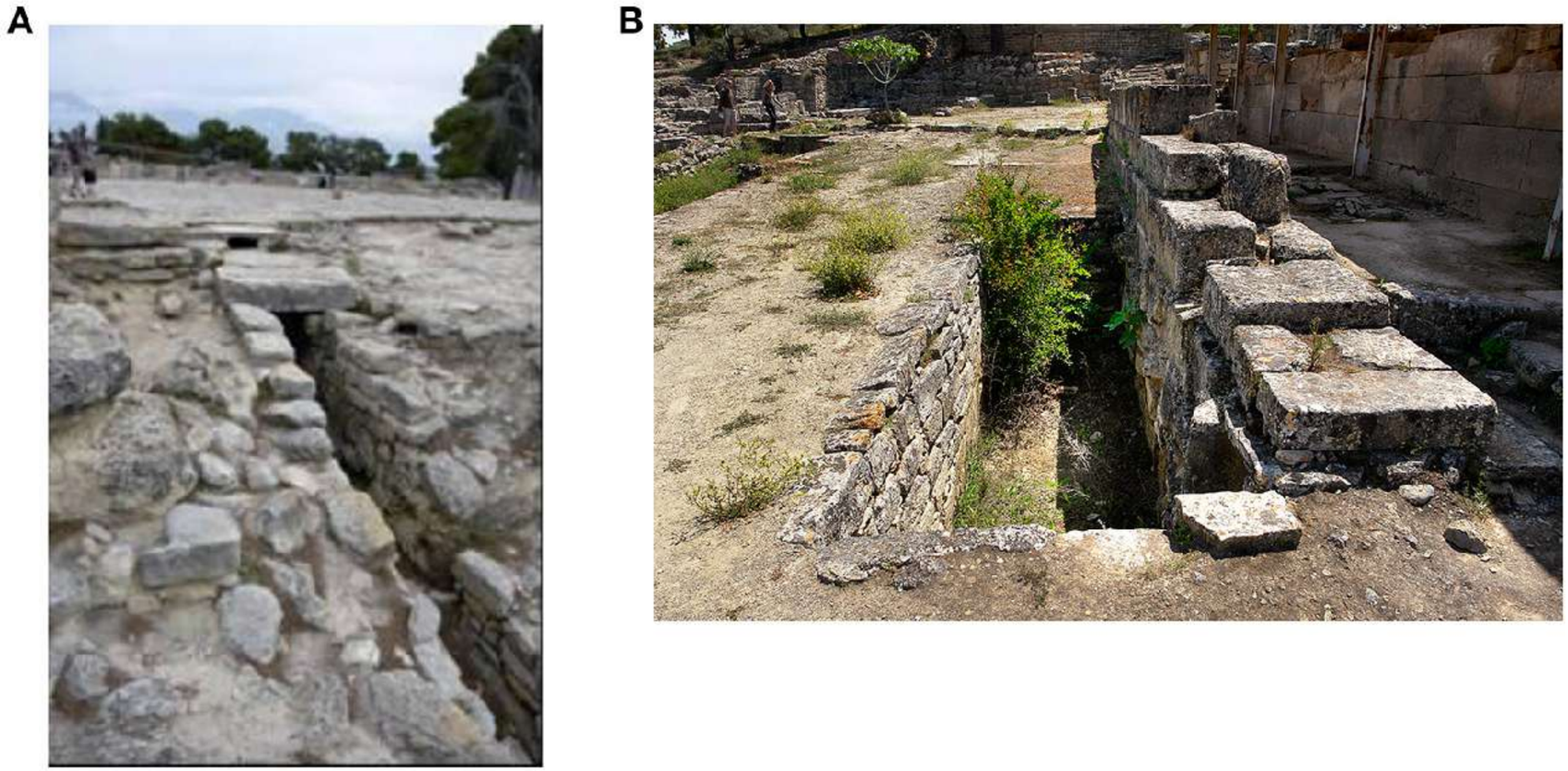
Water Reuse: Shifting From Wastewater “Disposal” to “Resource Recovery”

- Water reuse = recycled water = reclaimed water = advanced treated wastewater or greywater
- “One Water Approach” = All water has value and should be managed in a sustainable, inclusive, integrated way
- “There is no bad water.”





Water Reuse Extends Back *ca.* 5,000 Years to Bronze Age Civilizations

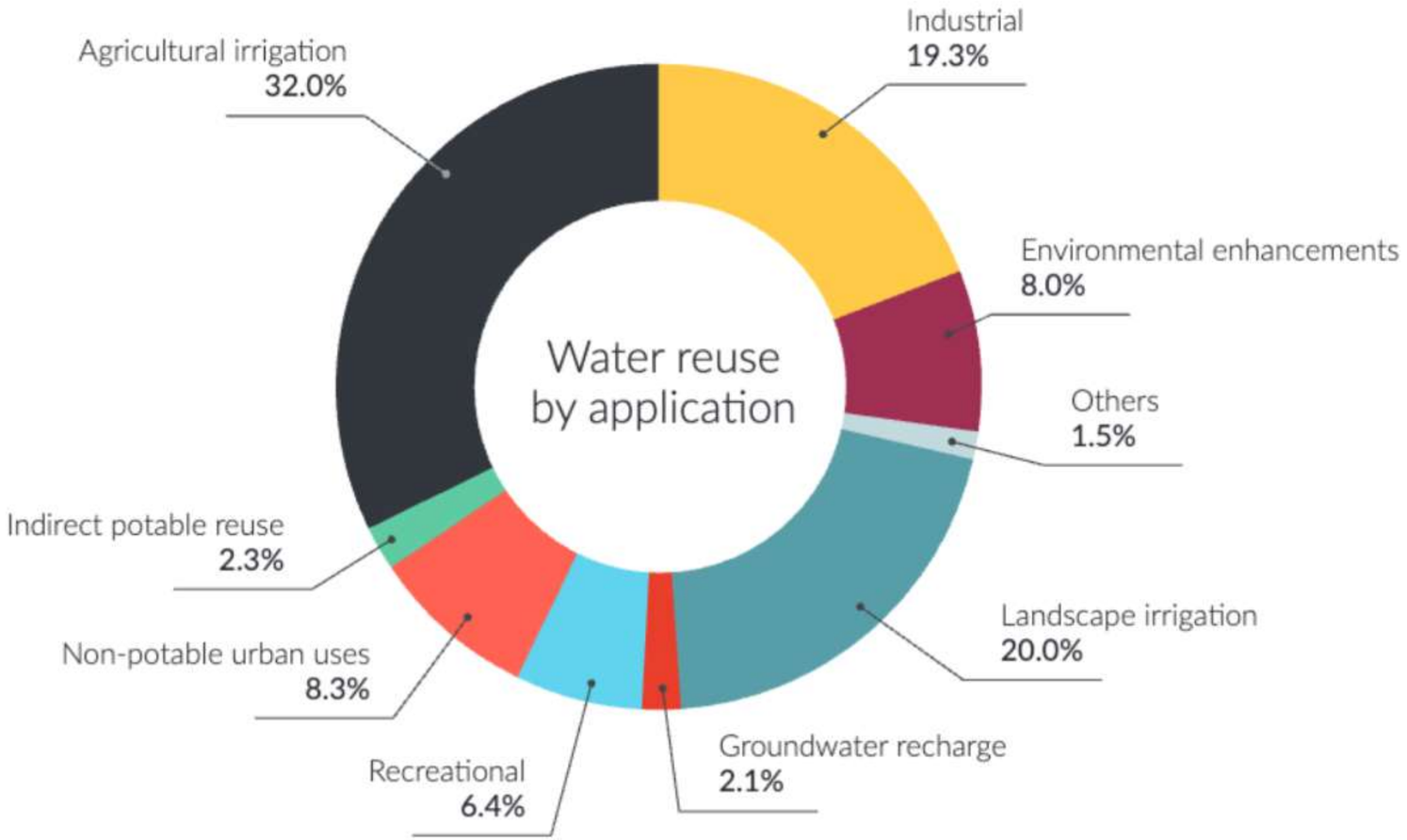


Facilities used for water reuse in prehistoric times **(A)** water and wastewater conveyance facilities in the palace of Phaistos used to transport water to farmland and **(B)** cistern in the villa of Hagia Triada used for water storage for subsequent land application purposes.

Source: Angelakis et al. *Front. Environ. Sci.*, 10 May 2018.

Current Global Water Reuse Applications

Figure 16.1 Global water reuse after advanced (tertiary) treatment: Market share by application



Source: Lautze et al. (2014, Figure 2, p. 5, based on Global Water Intelligence data).

Source: UN World Water Development Report 2017: Wastewater: The Untapped Resource.

Agricultural Water Reuse

Benefits:

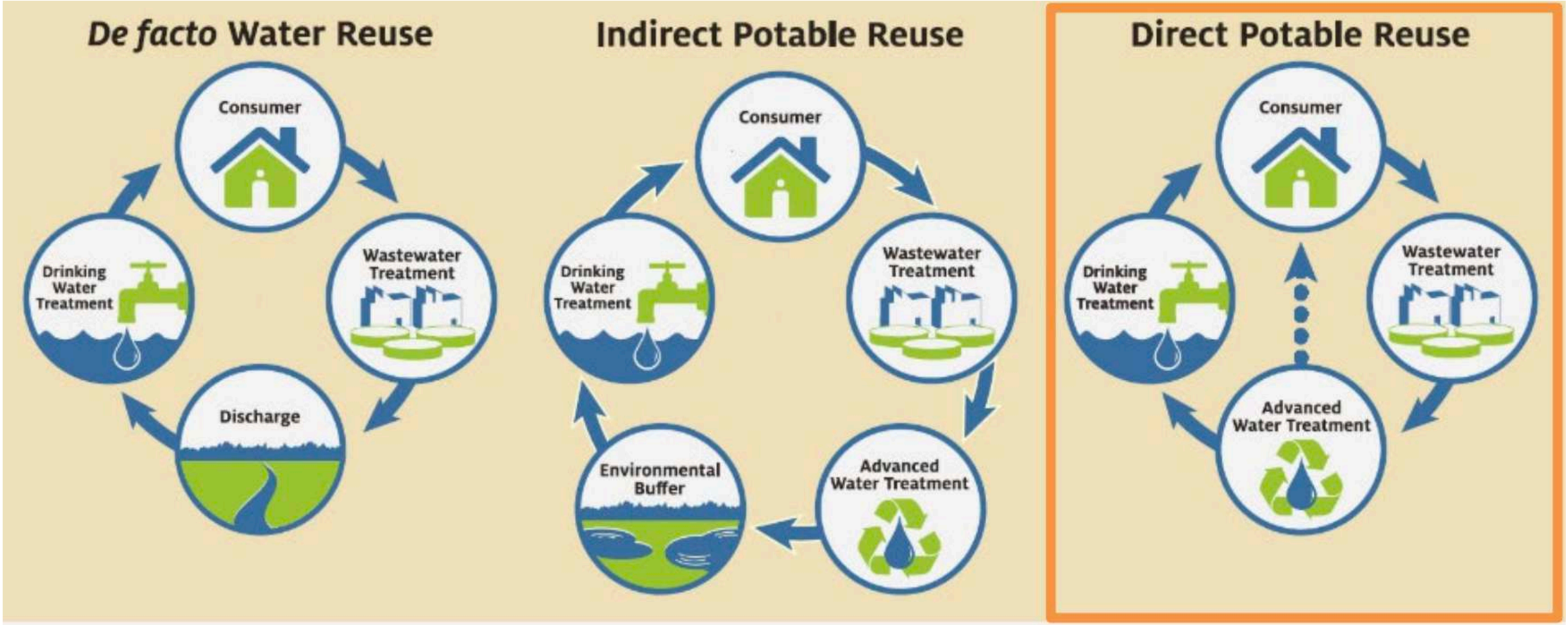
- Water conservation
- Pollution prevention
- Supply of nutrients and savings in fertilizer costs
- Improved crop yields
- Improved climate resilience

Challenges:

- Soil salinization
- Residual chemical and microbial contaminants



Potable Water Reuse: Three Main Types



Types of Potable Reuse. Source: Texas Water Development Board

Potable Water Reuse: Benefits and Challenges

Table 2. Benefits and challenges of potable water reuse.

Benefits	Challenges/concerns
Reliable additional sources of clean water	Health and environmental concerns
Reduction of water pollution discharges	Knowledge gaps regarding mixture of contaminants and emerging contaminants
Preservation of aquatic life and biodiversity by reducing water pollution	Psychological barriers
Advancement of scientific knowledge and technology	Technical, managerial and financial viability of water reuse schemes

Source: Tortajada. *Clean Water* (2020) 3:22 ; https://doi.org/10.1038/s41545-020-0069-3.

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Thank you!

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