Introduction

Water Stress is high in the US SW\(^1\)

Groundwater Depletion is a concern in many western US states\(^2\)

Water Supplies are increasingly inadequate to meet demand in many western US communities\(^3\)

The new reality of higher temperatures, increased water loss due to evaporation and transpiration, and less precipitation due to climate change is occurring in the western United States and other parts of the world. Water conservation and nonpotable water reuse might not be sufficient to adequately stretch water supplies in water-scarce parts of the industrialized world. In the United States, planned potable water reuse (i.e., purification of domestic wastewater for reuse as drinking water) is emerging as a way to mitigate water shortages without significant changes to lifestyle, behavior, or infrastructure. Potable reuse is not the only solution: paradigm shifting and disruptive options that more holistically address water scarcity, such as composting toilets and market-based approaches to water use, are also gaining traction. In the absence of large-scale implementation, these options considered offer advantages, each one comes with new concerns and challenges related to cost, public perception, social norms, and policy.

The goal of this work is to consider a number of plausible solutions to the water scarcity problem. The options considered offer advantages, each also generates new concerns and challenges related to cost, public perception, social norms, and policy. While by combining multiple plausible solutions to water scarcity—partial and complete, traditional and disruptive—we hope to stimulate forward-looking thinking about the impending global problem of water scarcity.

Suites of Future Options to Address Water Scarcity

Technological

Planed Potable Water Reuse

Water Reuse in Individual Buildings

Market-based

Cap & Trade

Policy & Regulation

Safety

Point Source

Sewage Treatment Plants

Dewatering

Land Farmers

Nonpoint Source

Action Plan

Permitting Research Funding Data Sharing

Infrastructure

Decentralization\(^7\)

A modeled water and wastewater system of Houston, TX in which wastewater is treated at nine wastewater treatment plants (WWTPs) across the network (green recycle symbols).\(^7\) - Graphic Source: SF Chronicle, 2015

Market-based

Cap & Trade\(^11\)

The world is facing a new climate reality:

- Water management, use, infrastructure, and governance systems must be upgraded and adaptive.
- Design solutions must be holistic and tailored to local needs and agency for greater resiliency, especially for small and under-resourced communities.
- Aging-out infrastructure can be replacing with sustainable options.
- Iterative implementation linked to ongoing research is imperative.

Change is difficult as new ideas can be paradigm-shifting, disruptive, and controversial. While each option considered offers advantages, each also generates new concerns and challenges related to cost, public perception, social norms, and policy. But by combining multiple plausible solutions to water scarcity—partial and complete, traditional and disruptive—we hope to stimulate forward-looking thinking about the impending global problem of water scarcity.

Possible Solutions for a Water-Scarce Future

Conclusion

Sustainably Address Water Scarcity

Water reuse at household/building

Waterless Flush

Waterless Flush

About a quarter of the drinking water used by a typical household is for toilet flushing.\(^11\) - Graphic Source: Stanford. https://waterinthewest.stanford.edu/

References

1 Hofstra et al. 2019
2 High Country News, 2013
8 The Shared Knowledge Conference
9 https://www.barnstablecountyhealth.org/resources/publications/compendium-award-number-1345169