Introduction: Global Water Crisis

Global Connect
H2OOutreach at UCI
Why is clean water important?
Average American Household Water Usage

- Outdoor: 30%
- Toilet: 17%
- Shower: 14%
- Clothes Washer: 13%
- Faucets: 12%
- Leaks: 8%
- Other: 6%
-Leaks: 6%
What is Access to Water?

We Have a Human Right to Water and Sanitation
Understanding Water Resources

The Water Cycle & Water Availability
http://www.eschooltoday.com/water-cycle/the-water-cycle.html
World Water Distribution

A World of Salt

Global saltwater and freshwater estimates

- Saltwater 97.5% (1,365 million km³)
- Freshwater 2.5% (35 million km³)

Freshwater storage

- 68.9% glaciers and permanent snow cover
- 30.8% groundwater, including soil moisture, swamp water and permafrost
- 0.3% lakes and rivers

Source:
Igor A. Shiklomanov, State Hydrological Institute (St. Petersburg) and UNESCO (Paris) 1999
Population growth leads to greater demand for resources.
Water Stress Worldwide

Causes for Lack of Access to Clean Water

- Climate and Geography
- Lack of Water Systems and Infrastructure
- Inadequate Sanitation
- Pollution
- Political Instability and War
Water is unequally distributed spatially and temporally.

Most of CA’s population is in areas of lower precipitation, but typically rich in groundwater.
Climate and Geography: Groundwater

- Groundwater is a vital water storage resource
- We are pumping out groundwater faster than it can be replenished (overdraft).

A man in India mines groundwater instead of farming [link](http://news.nationalgeographic.com/news/2012/12/121218-grabbing-water-from-future-generations/)

Subsidence in the Central Valley [link](http://water.usgs.gov/edu/earthgwlandsubside.html)
Climate and Geography: Impacts of Climate Change

- Unpredictable weather i.e. dry areas get drier, wet areas get wetter.
- Higher temperatures mean more evaporation, less snowpack, and earlier snowmelt.
- Extreme weather events damage infrastructure and contaminate and disrupt water supplies.
Climate and Geography: Effects of Climate Change

Change in water availability compared with average 1961–1990 (%) 2050 based on IPCC scenario A1

more than 20
20 to 0
0 to −20
−20 and more

Lack of Water Systems and Infrastructure

1.1 billion people do not have access to improved water sources

Mali http://www.wateraid.org/where-we-work/page/mali
Inadequate Sanitation

- 2.4 billion people have no basic sanitation
- Bacteria, viruses, and parasites spread through contaminated water
- Diarrhea kills 2.2 million globally per year (among the top 10 causes of death)

An alley in Kenya
Water Quality & Pollution

- Population growth
- Lack of regulations
- Chemicals
  - Industry
  - Trash/road pollution
  - Lack of sanitation
  - Agriculture
- Environmental degradation

Urban Pollution in Zhugao, China
http://www.nytimes.com/2010/02/10/world/asia/10pollute.html?_r=0
After the devastating floods from Hurricanes Harvey and Irma, we’re hearing a lot about the houses and other structures that have been destroyed. But what if your house was flooded and is salvageable? It’s not only water you’re dealing with—which would be bad enough—but also the many toxins and pathogens it carries.

Janice Kaspersen Forester Daily News Sept 19 2017
Political Instability & War

Malaysia & Singapore

5 NEWater Reclamation Plants in Singapore
http://www.pub.gov.sg/

Israeli-Palestine Conflict

Gaza Strip
Impacts of Clean Water and Sanitation

#3 Good Health and Well-Being
#4 Quality Education
#5 Gender Equality

#14 Life Below Water
#15 Life on Land
GENDER EQUALITY

In Africa, 90 PERCENT of the work gathering water and wood is done by women.

Women and girls often spend up to SIX HOURS EVERY DAY fetching water.

This amounts to 40 BILLION HOURS spent every year walking for water in Africa alone.

In some nations, ONLY 50 PERCENT OF GIRLS are enrolled in school due to lack of toilets.

http://thewaterproject.org/
3 Methods to Mitigate & Solve Lack of Access to Water

- Engineering (Technology)
- Governance & Regulations (Policy)
- Education & Outreach
Education and Outreach

● Educate individuals who don’t have access to water about household water treatment

● Public awareness campaigns i.e. for conservation

SODIS in Indonesia

http://www.scpr.org/news
Governance & Regulations

- Rebates and Incentives
- Water use restrictions
- U.S.A & Mexico

hydrological boundaries ≠ political boundaries

http://www.transboundarywaters.orst.edu/research/case_studies/US_Mexico_Aquifer_New.htm
Governance & Regulations

- Nile Basin Initiative
  - agreement to develop along the Nile sustainably
- Research Funding
  - influences technology advancement

http://www.africanwater.org/nile.htm
Engineering Solutions: Water Supply

Desalination

Pipelines and Aqueducts (transfers)

Rainwater Harvesting

Water Recycling/Reclamation
Engineering Solutions

Desalination removes salt from seawater to make drinking water

• Expensive
• Energy-intensive if stand alone
• Public opinion

Desalination plant
(Victoria, Australia)
Engineering Solutions

Pipelines and aqueducts move water over long distances

- Heavy infrastructure
- Energy for water transport
- Water rights
- Unreliability: earthquakes and climate change

California Aqueduct
(moves water from northern CA to southern CA)
Engineering Solutions

Water recycling treats wastewater for non-potable reuse, e.g., irrigation.

Water reclamation treats wastewater for potable reuse.

- Moderately Expensive
- Reclamation requires additional energy
- Public opinion

Orange County Groundwater Replenishment System
Engineering Solutions

Rainwater harvesting captures water during rainstorms to use during dry weather

Rainwater tank in Ghana

- Low cost
- Small scale
- Individuals must maintain
- Rain is not always reliable
- Low energy
Engineering Solutions

Stormwater treatment and harvesting with a biofilter

Biofilter in New Zealand
Summary

1. Importance of clean water
2. Problems & causes of global crisis
   ● Climate and geography
   ● Inadequate sanitation
   ● Pollution
   ● Political instability and war
   ● Lack of water systems and infrastructure
3. Possible Solutions
   ● Engineering
   ● Education
   ● Governance & Regulations
Thank you!

Questions?

Contact: h2outreach@uci.edu
Resources