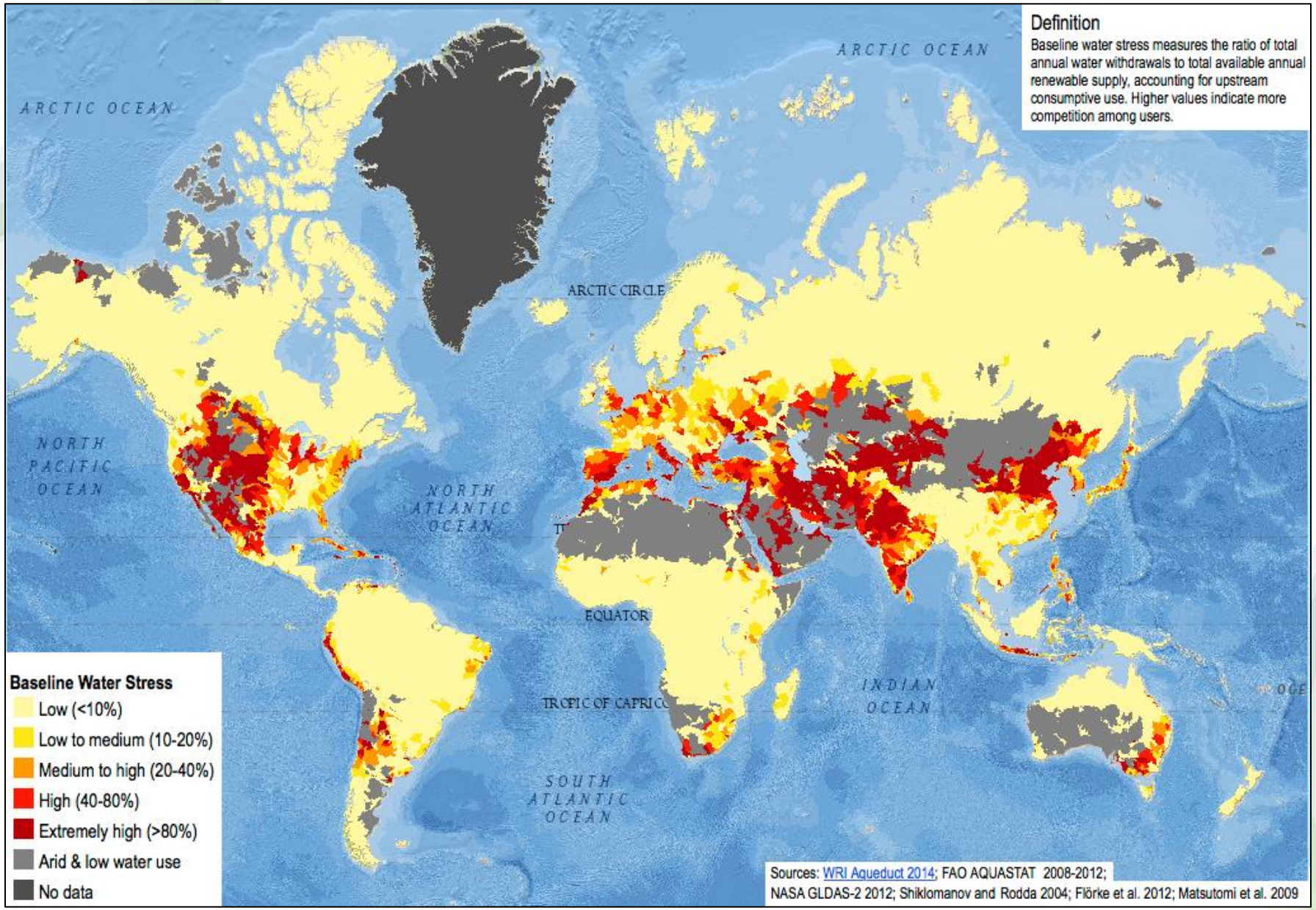
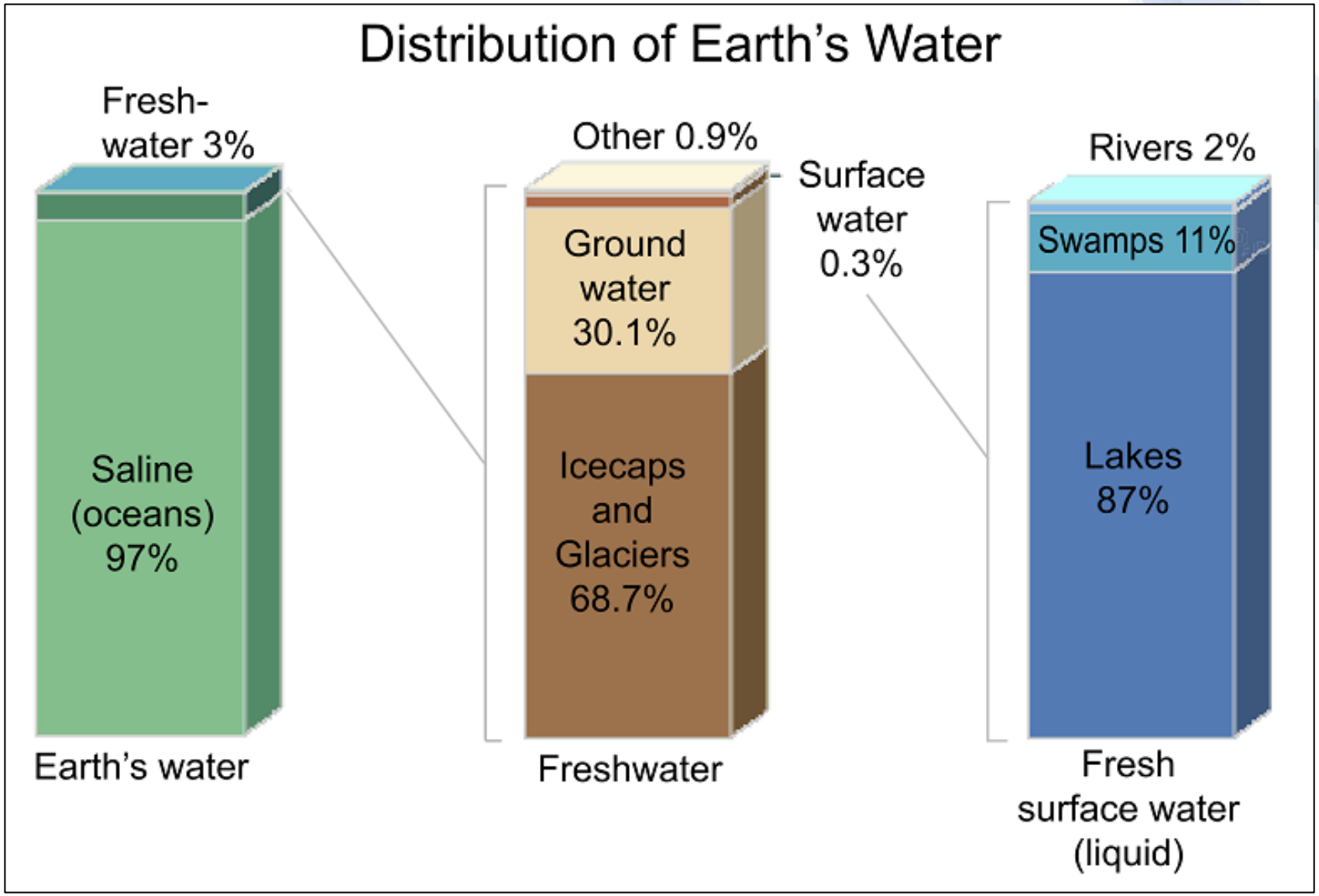
Water Scarcity

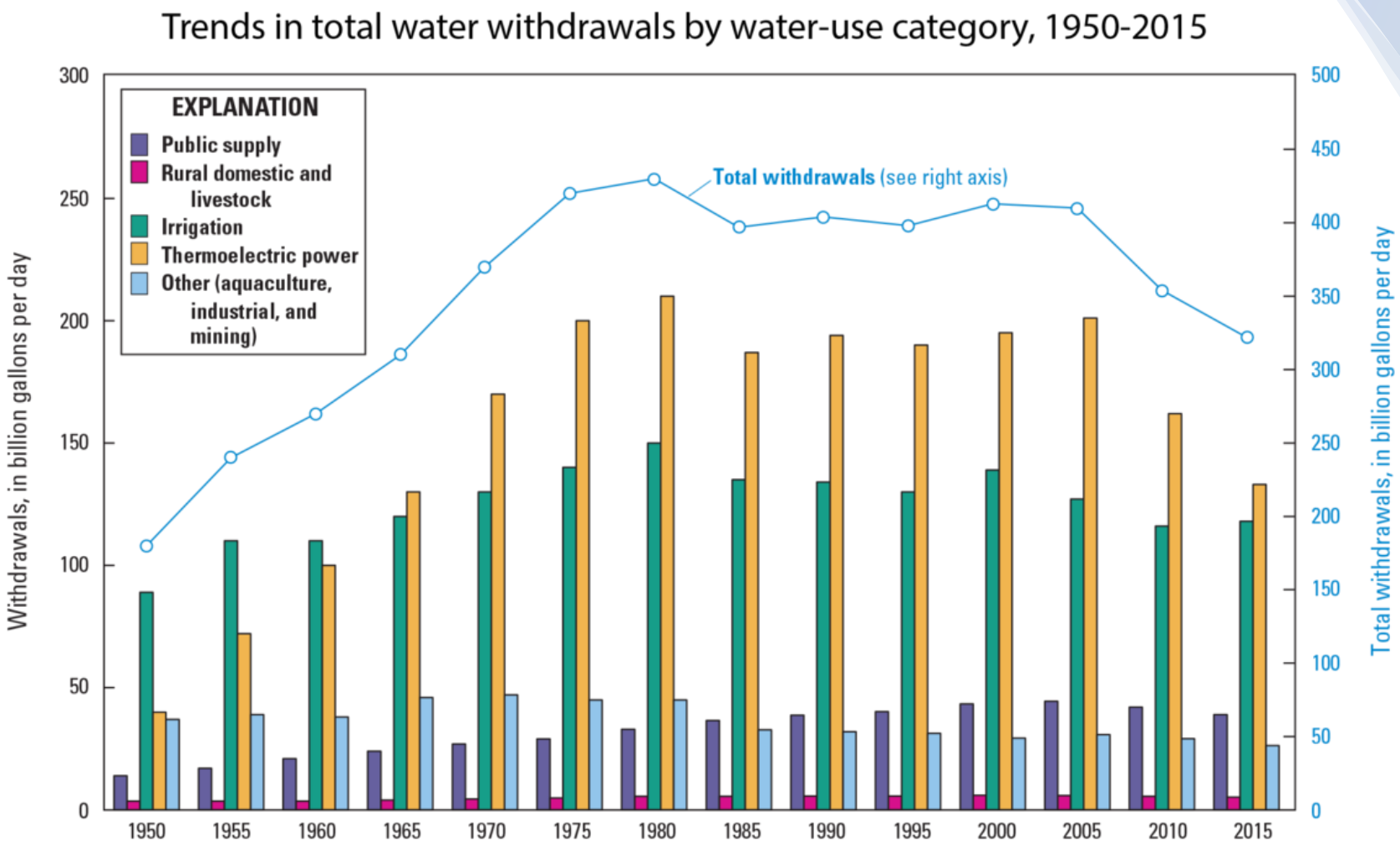
By Sydney Walker

Outline

- Water Scarcity, Resources, and Trends
- High-Water Stress Examples
- Drought Management Techniques
- Discussion


Definition
Baseline water stress measures the ratio of total annual water withdrawals to total available annual renewable supply, accounting for upstream consumptive use. Higher values indicate more competition among users.
ARCTIC OCEAN
ARCTIC OCEAN
ARCTIC CIRCLE
NORTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
EQUATOR
TROPIC OF CAPRICO
INDIAN OCEAN
SOUTH ATLANTIC OCEAN
Baseline Water Stress
Low (<10%)
Low to medium (10-20%)
Medium to high (20-40%)
High (40-80%)
Extremely high (>80%)
Arid & low water use
No data
Sources: WRI Aqueduct 2014; FAO AQUASTAT 2008-2012;
NASA GLDAS-2 2012; Shiklomanov and Rodda 2004; Flörke et al. 2012; Matsutomi et al. 2009

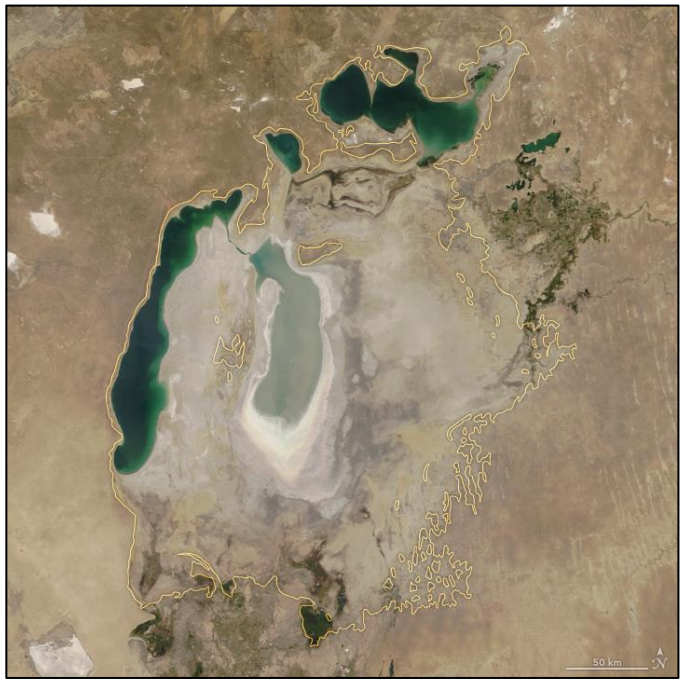

Distribution of Earth's Water
Fresh-
water 3%
Saline
(oceans)
97%
Earth's water
Other 0.9%
Ground
water
30.1%
Icecaps
and
Glaciers
68.7%
Freshwater
Surface
water
0.3%
Rivers 2%
Swamps 11%
Lakes
87%
Fresh
surface water
(liquid)

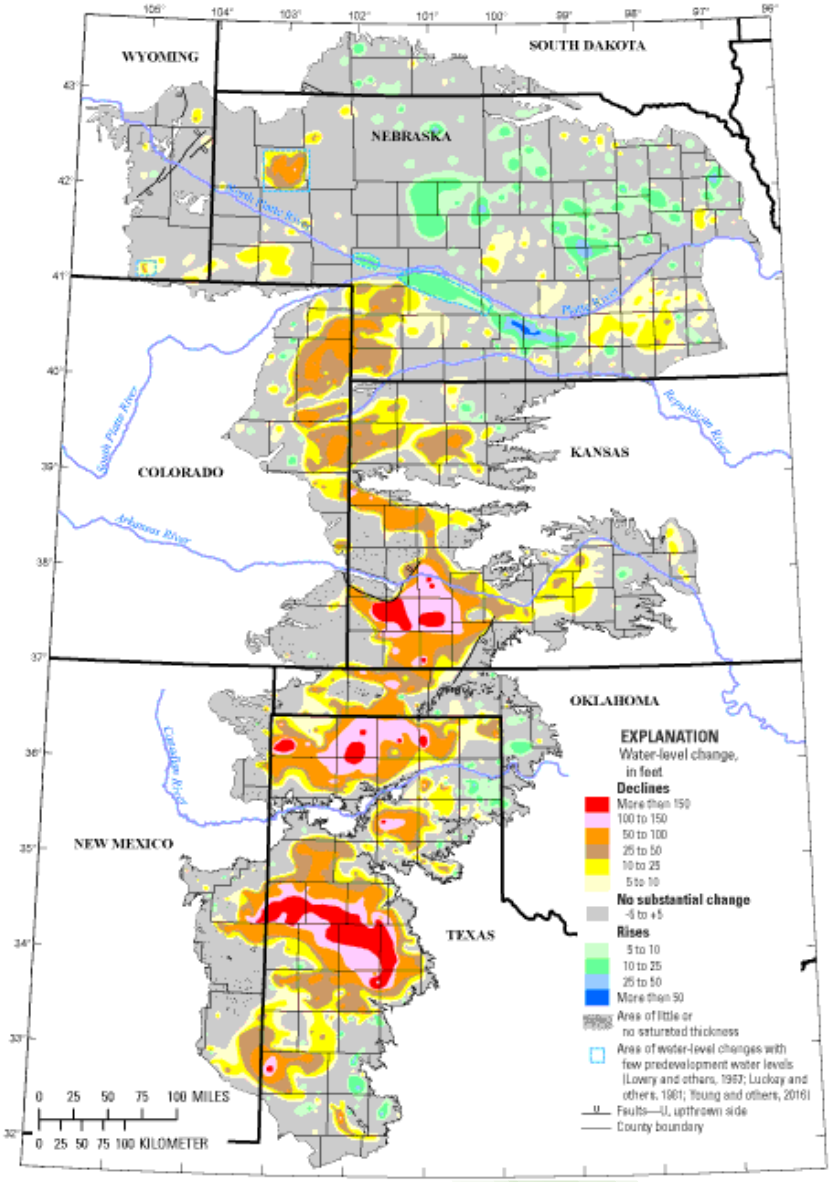

Trends in total water withdrawals by water-use category, 1950-2015
EXPLANATION
Public supply
Rural domestic and livestock
Irrigation
Thermoelectric power
Other (aquaculture, industrial, and mining)
Total withdrawals (see right axis)
Withdrawals, in billion gallons per day
Total withdrawals, in billion gallons per day
0
50
100
150
200
250
300
0
50
100
150
200
250
300
350
400
450
500
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015

Source: USGS

High-Water Stress Examples

- High Plains Aquifer
  - Aquifers refill very slowly
- Aral Sea
  - Soviet irrigation program for farms in an arid climate
  - Led to drastic reduction in size/highly polluted water
- Water Rights – Colorado River
- Cyprus





Drought Management

Water Saving and Storage

- Reducing water that is wasted
- Personal
  - Eliminate water waste/usage
  - High efficiency appliances
- Industry/Government
  - Invest in high efficiency processes (irrigation)
  - Storage of Water (Dams, reservoirs)
  - Fixing leaky infrastructure

Drought Management

- Water Reuse
  - Reusing gray water for another purpose (instead of full treatment)
  - Personal
    - Landscape watering
  - Industry/Government
    - Industrial applications where high-quality water is not needed
    - Irrigation, aquifer recharge

Drought Management

- Desalination
  - Turning salt water into potable water
    - Thermal (distillation)
    - Reverse osmosis
  - Pros
    - Near unlimited source of water
    - Obtain high quality water
  - Cons
    - Expensive to build and operate (3-6 kWh/m^3)
    - Environmental considerations (brine disposal)

Resources:

- https://energyeducation.ca/encyclopedia/Water_storage
- https://agfax.com/2017/12/26/how-politics-and-economics-affect-irrigation-and-conservation/
- https://www.epa.gov/watersense/start-saving
- https://www.ci.moscow.id.us/451/Water-Reclamation-Reuse-Facility
- http://aqwatec.mines.edu/produced_water/assessbu/matrix/recharge/index.htm
- https://www.europenowjournal.org/2018/12/10/desalination-water-for-an-increasingly-thirsty-world/
- https://www.desalitech.com/7-ways-to-dispose-of-brine-waste/
- https://earthobservatory.nasa.gov/world-of-change/AralSea/show-all

Discussion

Discussion Questions

- Topics
  - Water Scarcity
  - Relance on Desalination
  - Polices for Drought Management

Water Scarcity

Water has high natural variation and is essential for life. However, water stress is also highly dependent on local usage and is often localized whereas pollution might spread to affect the global climate. Large underground aquafers are often used as the primary water source

Should water scarcity be seen as a global issue, regional issue, or private issue (within own country)?

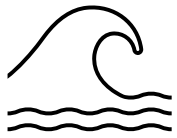
What role should other countries have in helping countries with an inherently large water stress?

Role of Desalination

Desalination provides as much high quality (potable) water as able to be processed but it is costly to build and maintain the infrastructure and uses a lot of power.

What role do active solutions such as desalination have when trying to reduce the impact of water stress? Should mitigation (water savings/reuse) be emphasized instead?

What differences/similarities are there between desalination and other suggested environmental investments, such as wind farms or emission reduction?



Role of Desalination

Desalination provides as much high quality (potable) water as able to be processed but it is costly to build and maintain the infrastructure and uses a lot of power.

Would reliance on desalination (increasing water supply) weaken the case to make processes more efficient? If so, what would be some ways to combat this?

Polices for Water Stress

Dealing with Water Stress is often done with policies, attempting to mitigate the impacts of water stress on the economy and public health.

Let's create an efficient policy plan that aims to combat water stress.

What would this plan look like for an industrialized, economically strong country who is facing high water stress?

How would this policy change for a poorer country struggling with high water stress?