

INSTITUTE ON THE
ENVIRONMENT

UNIVERSITY OF MINNESOTA

Driven to DiscoverSM

WATER SUPPLY,
DEMAND, and RISK

Dr. Kate Brauman

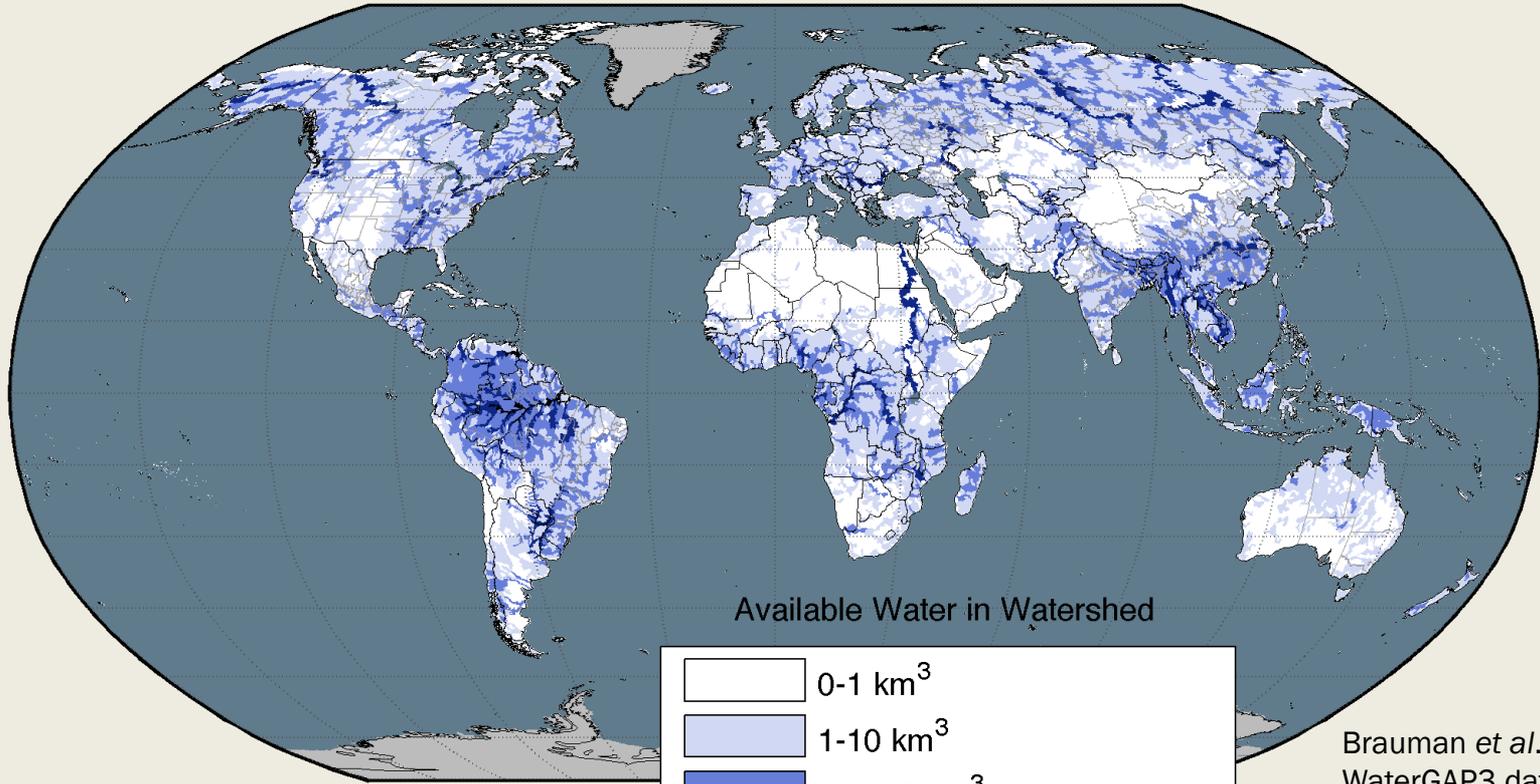
Lead Scientist

Global Water Initiative

UMN Institute on the Environment

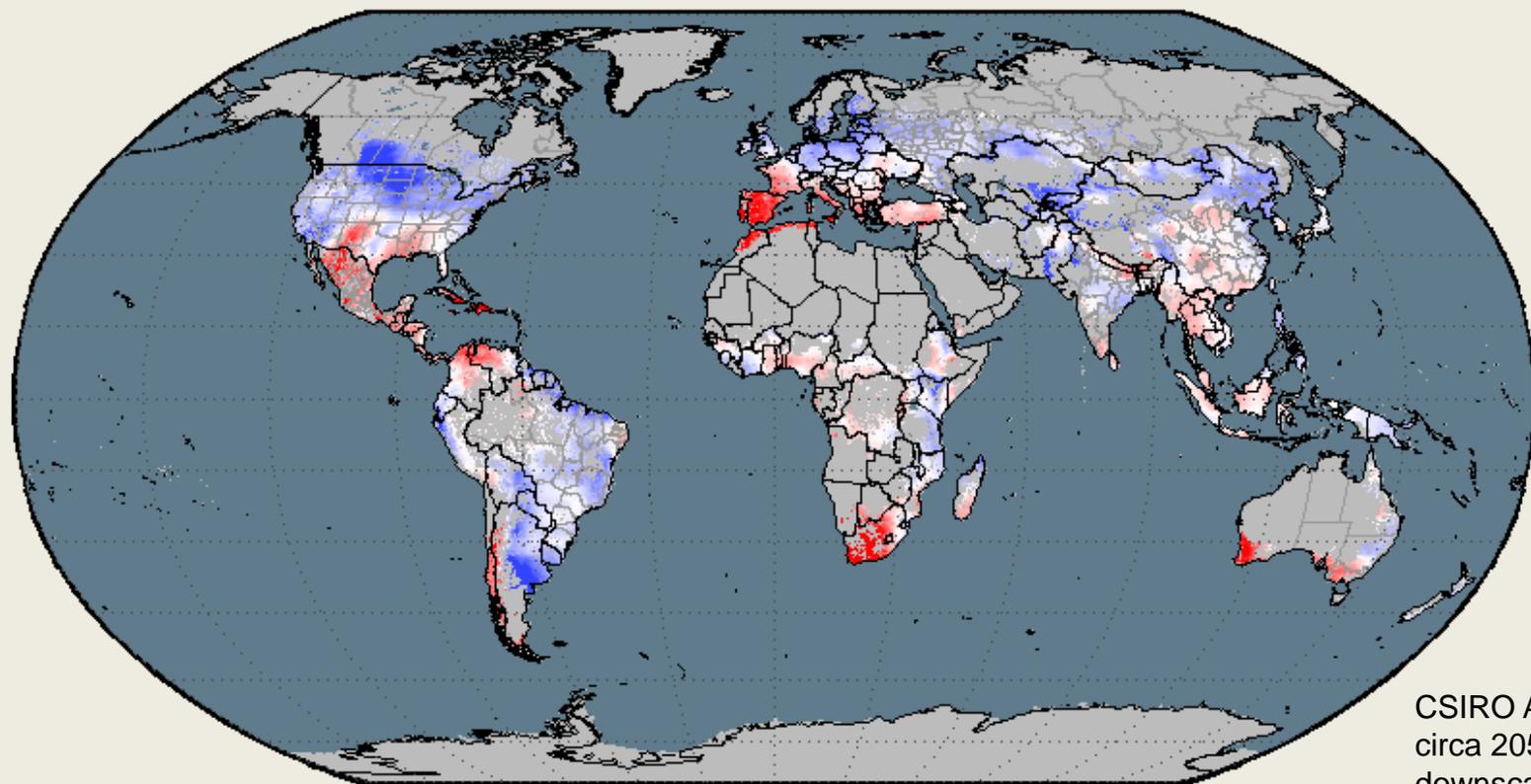


Global Water Availability



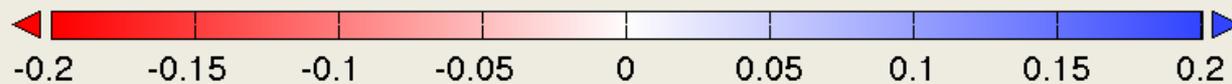
Brauman *et al.* (in review)
WaterGAP3 data

Rainfall is changing

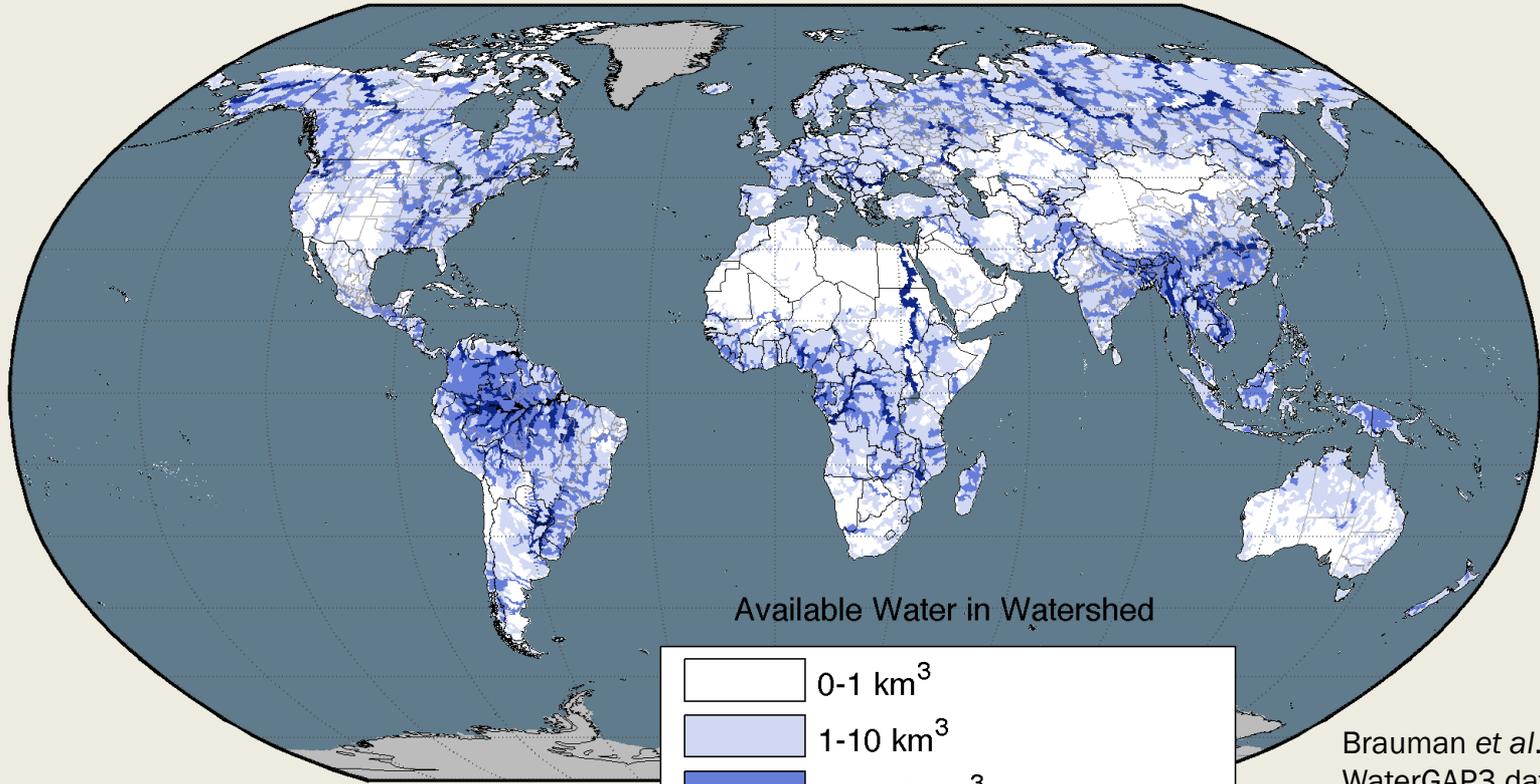


CSIRO A1B,
circa 2050,
downscaled

Fractional Change in Annual Precipitation

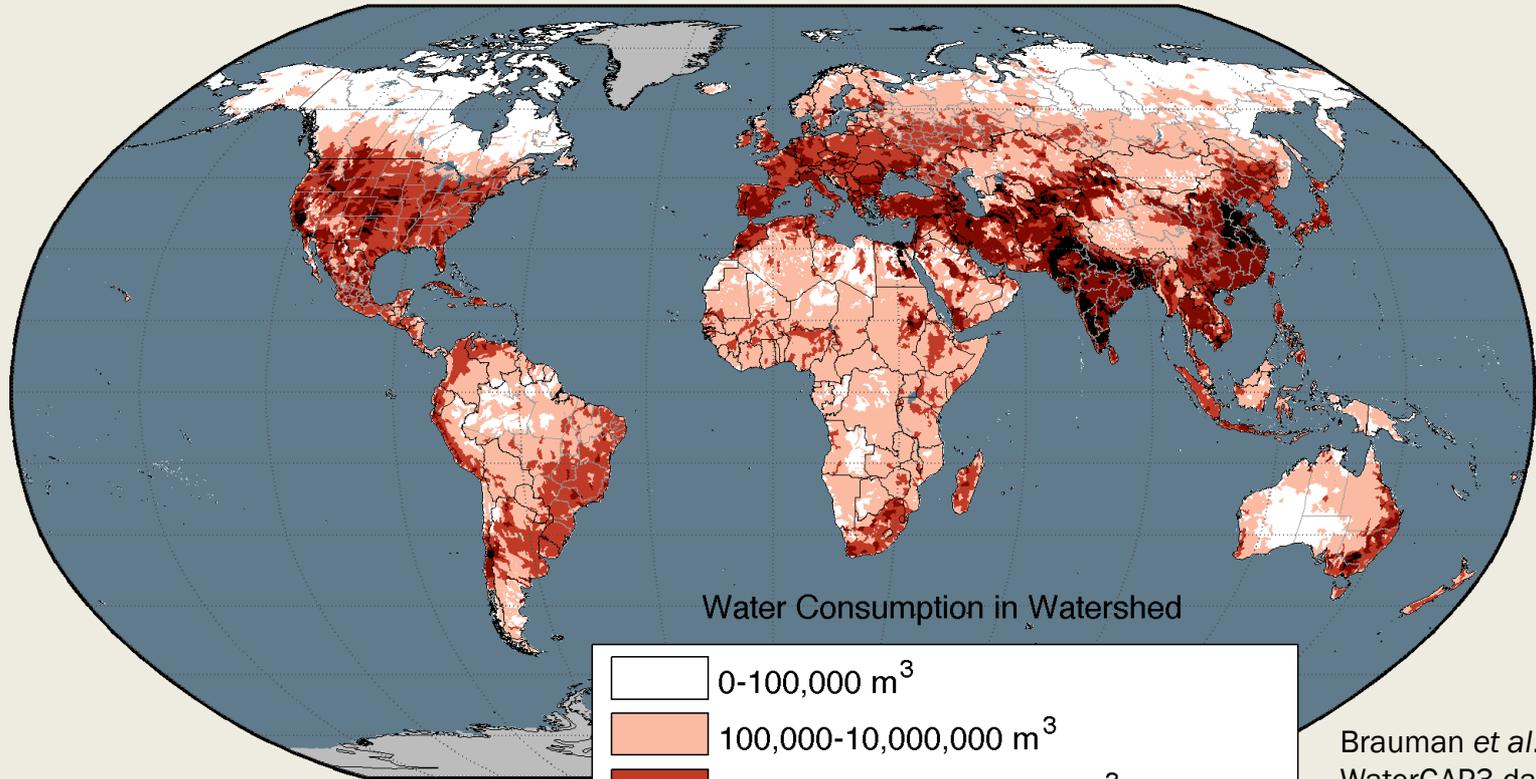


Global Water Availability



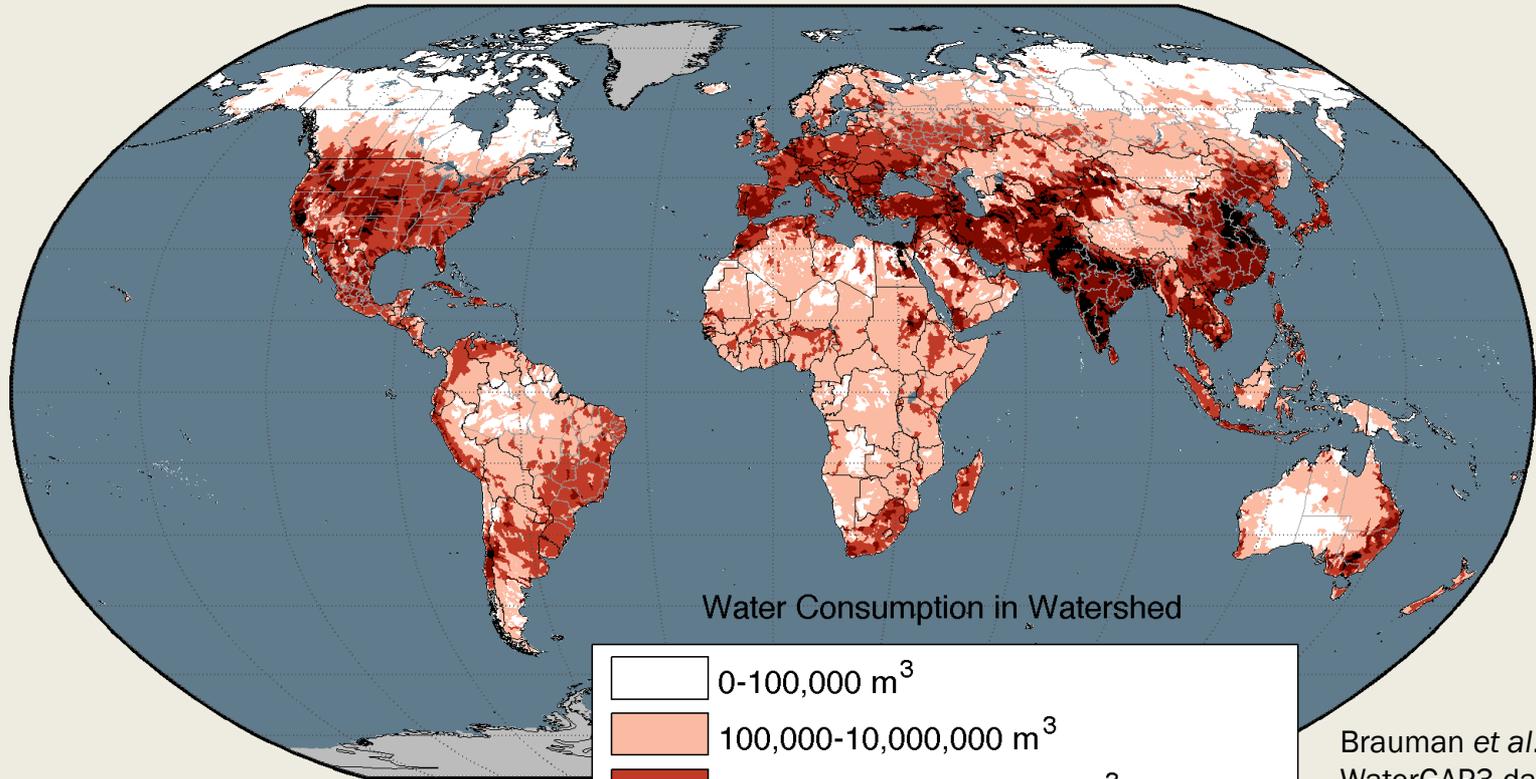
Brauman *et al.* (in review)
WaterGAP3 data

Global Water Consumption



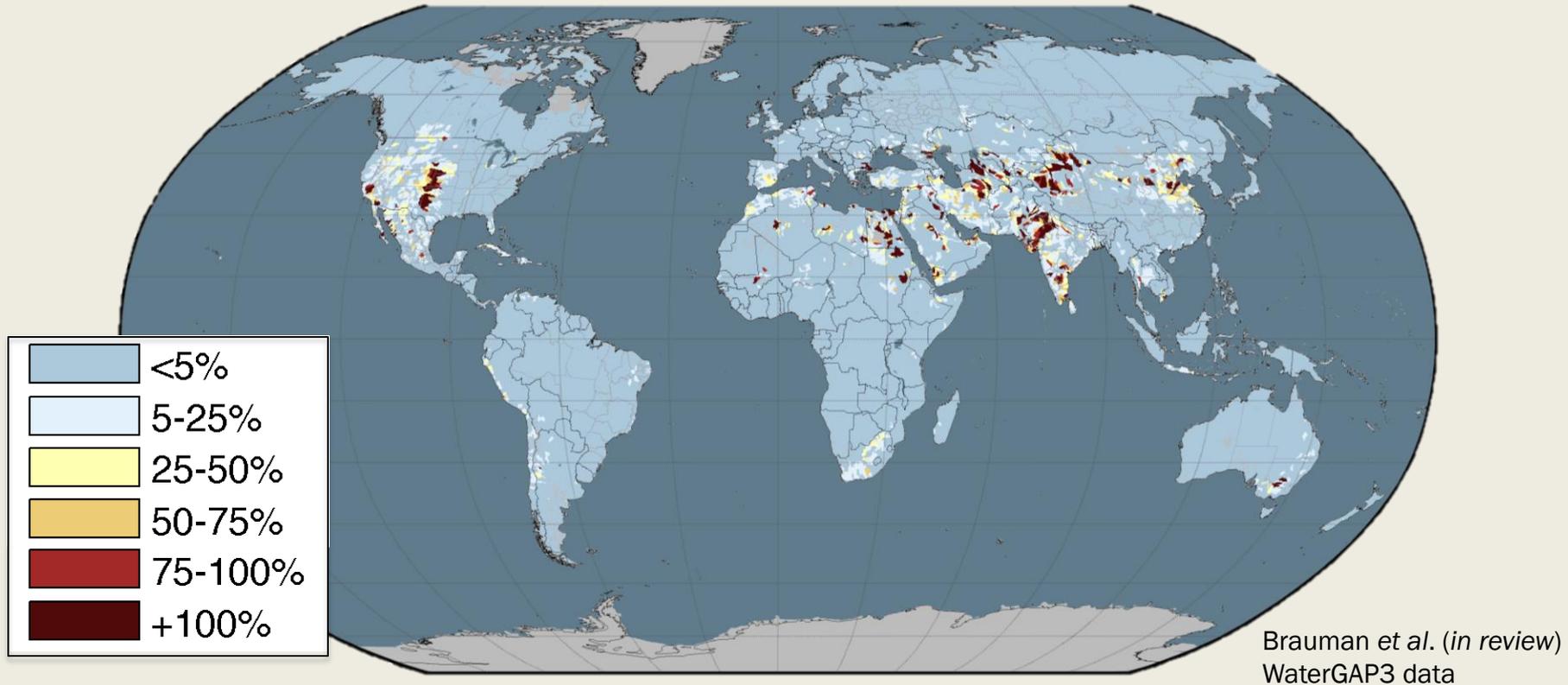
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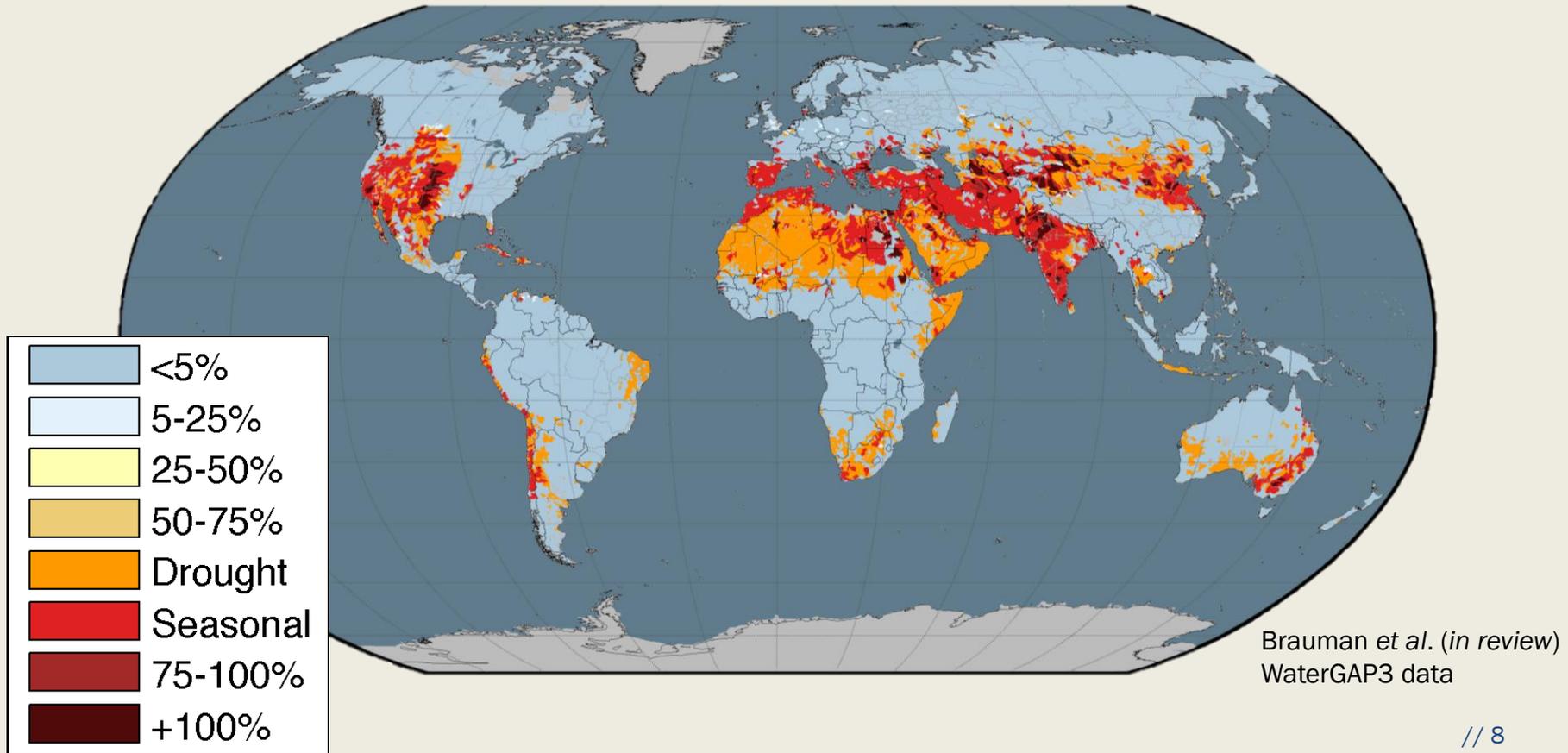


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WaterGAP3 data

Global Water Depletion = Consumption/Availability

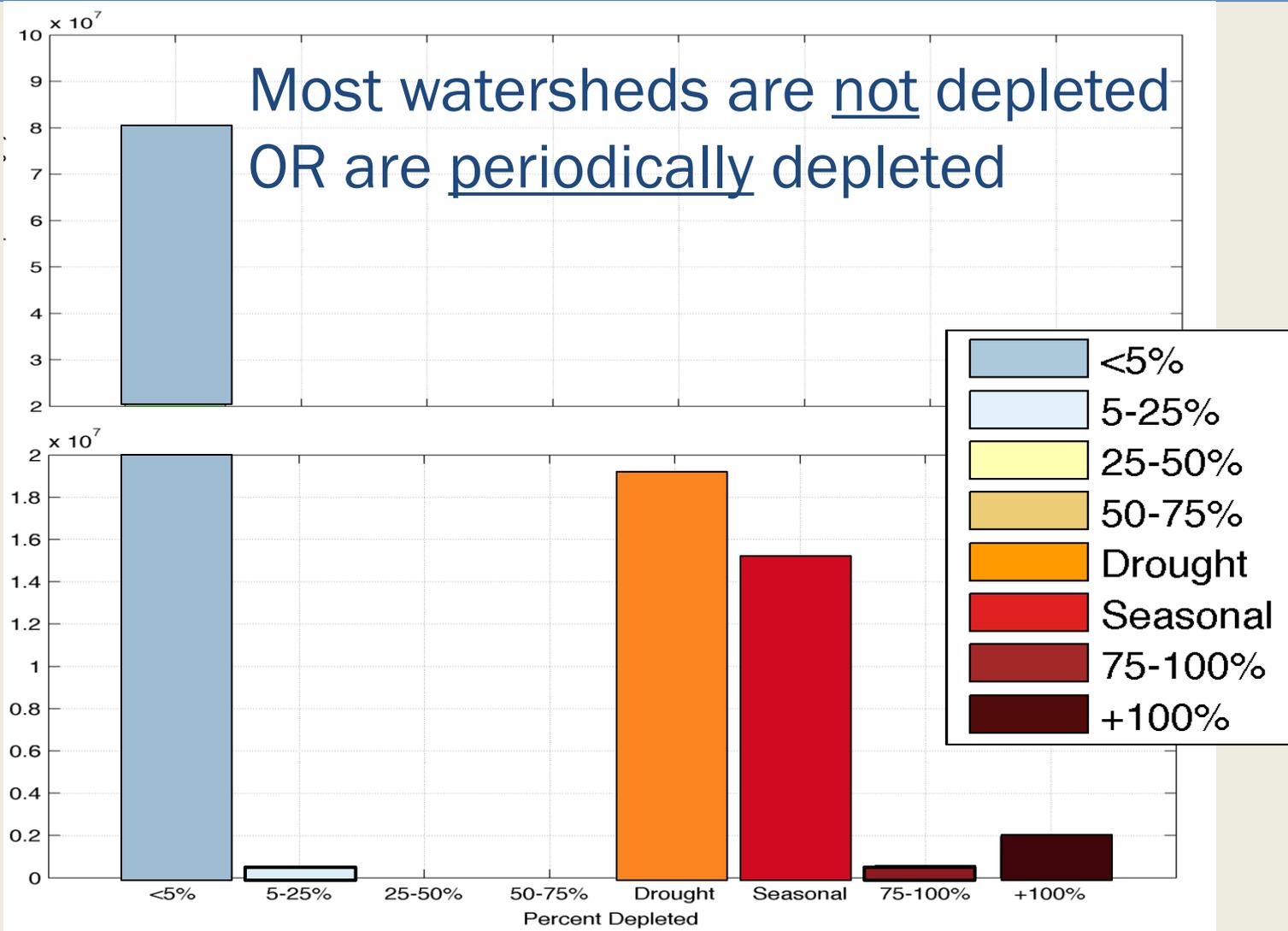


Global Water Depletion = Consumption/Availability



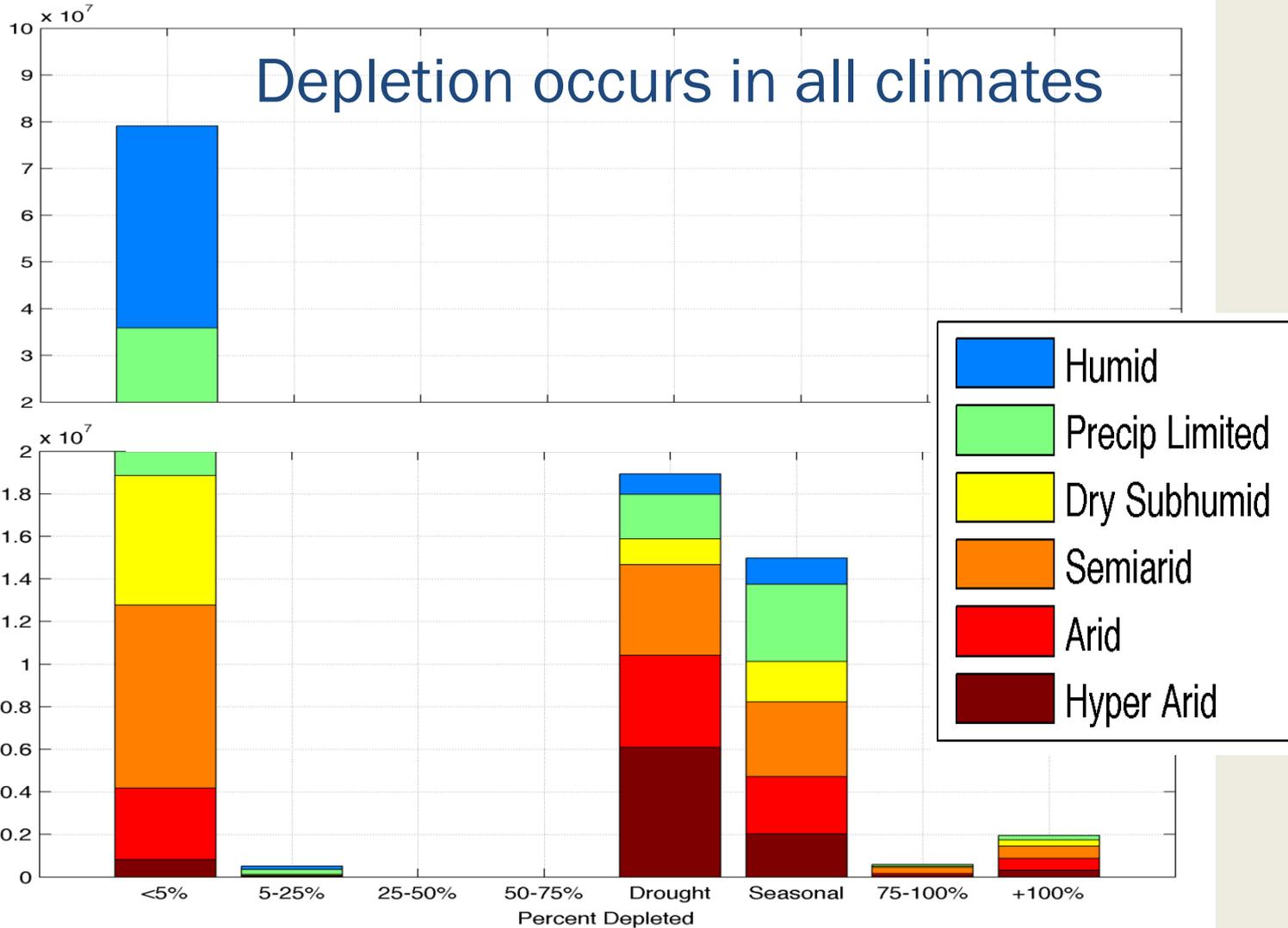
Most watersheds are not depleted
OR are periodically depleted

Area in Depletion Category (km²)

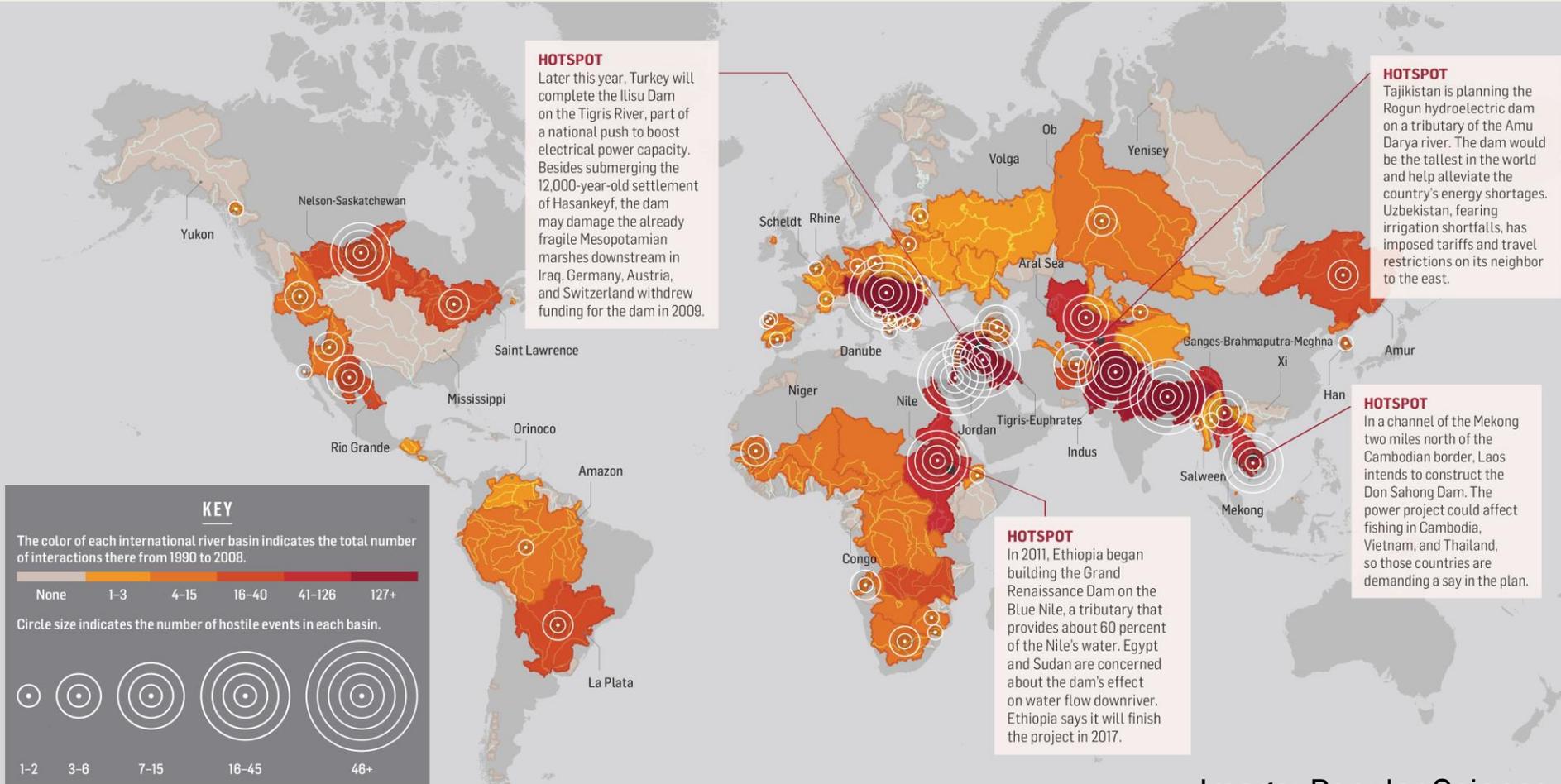


Depletion occurs in all climates

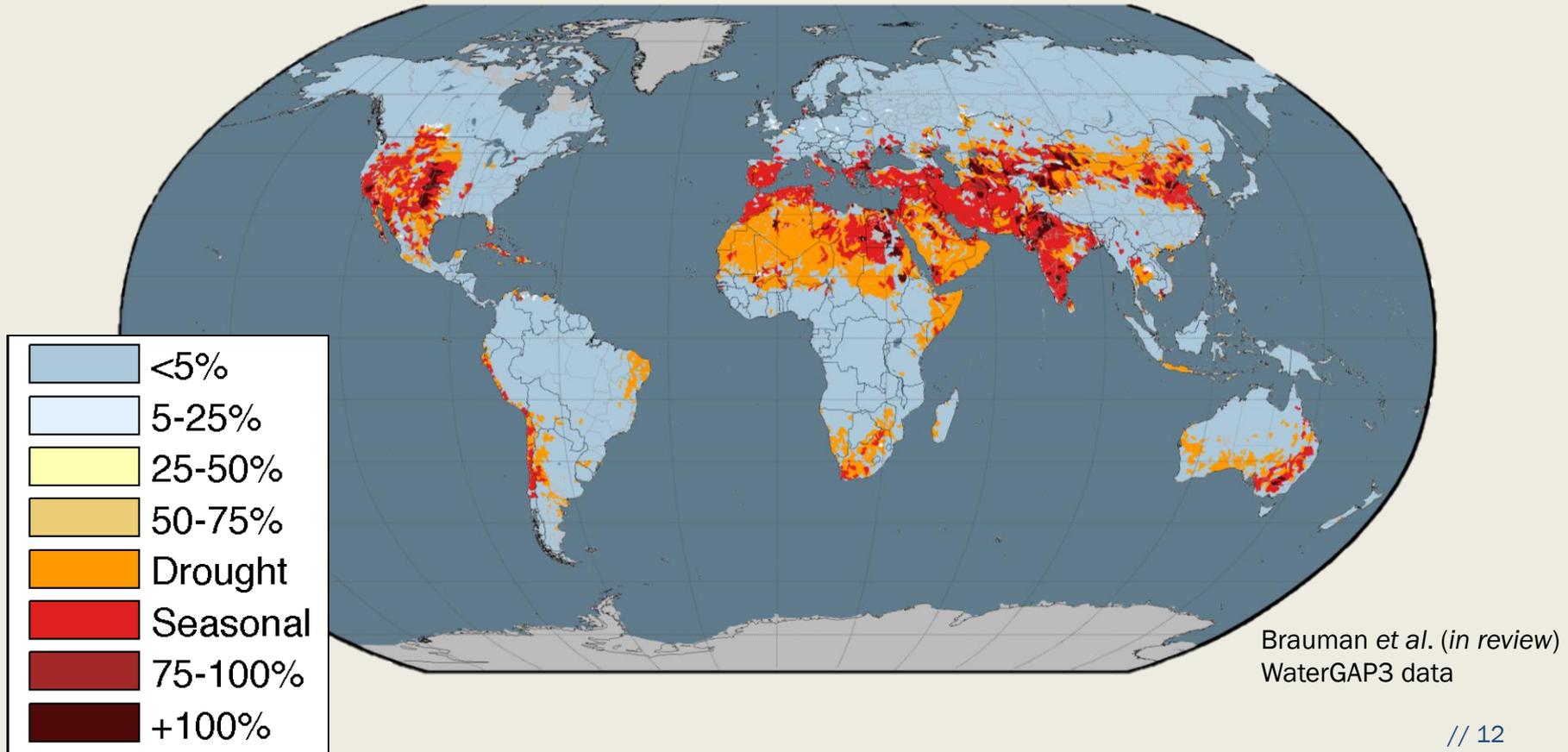
Area in Depletion Category (km²)



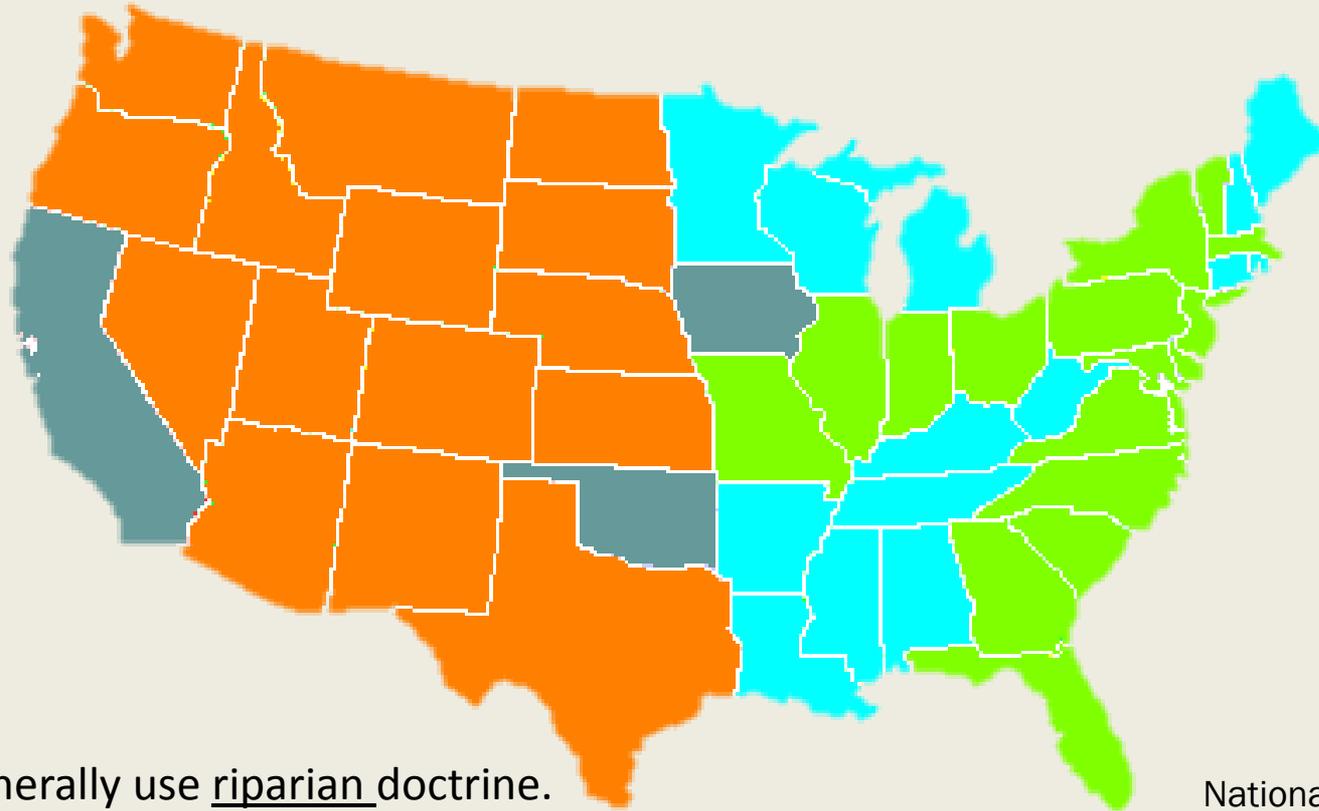
Water conflict occurs globally



Global Water Depletion = Consumption/Availability



Arid places (mostly) have governance to deal with shortage



BLUE states generally use riparian doctrine.

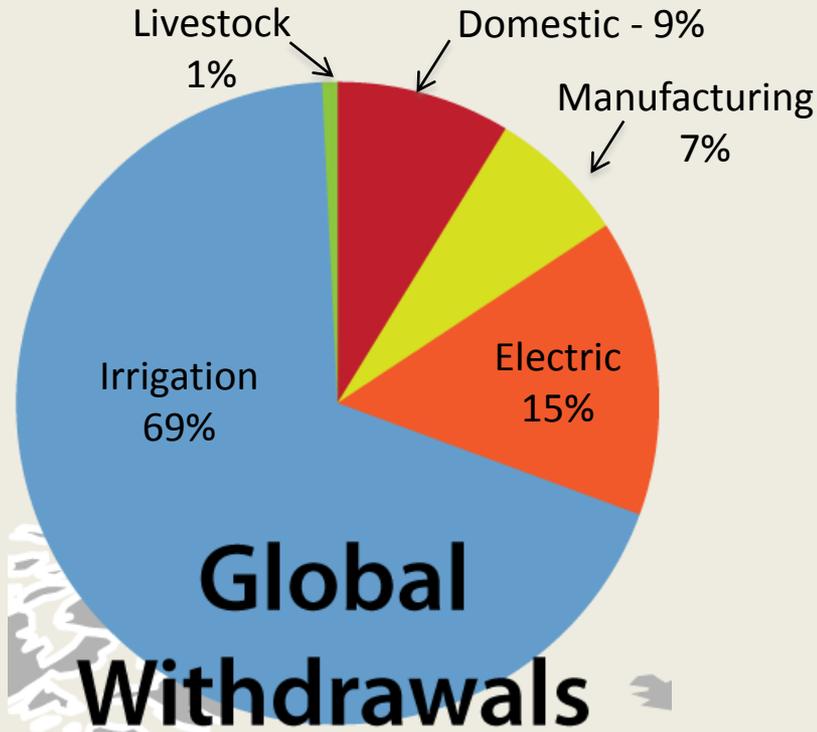
GREEN states generally are considered regulated riparian.

ORANGE states generally use the prior appropriation doctrine.

GRAY states use mixed approaches.

National Water
Rights Digest

Global Water Demand

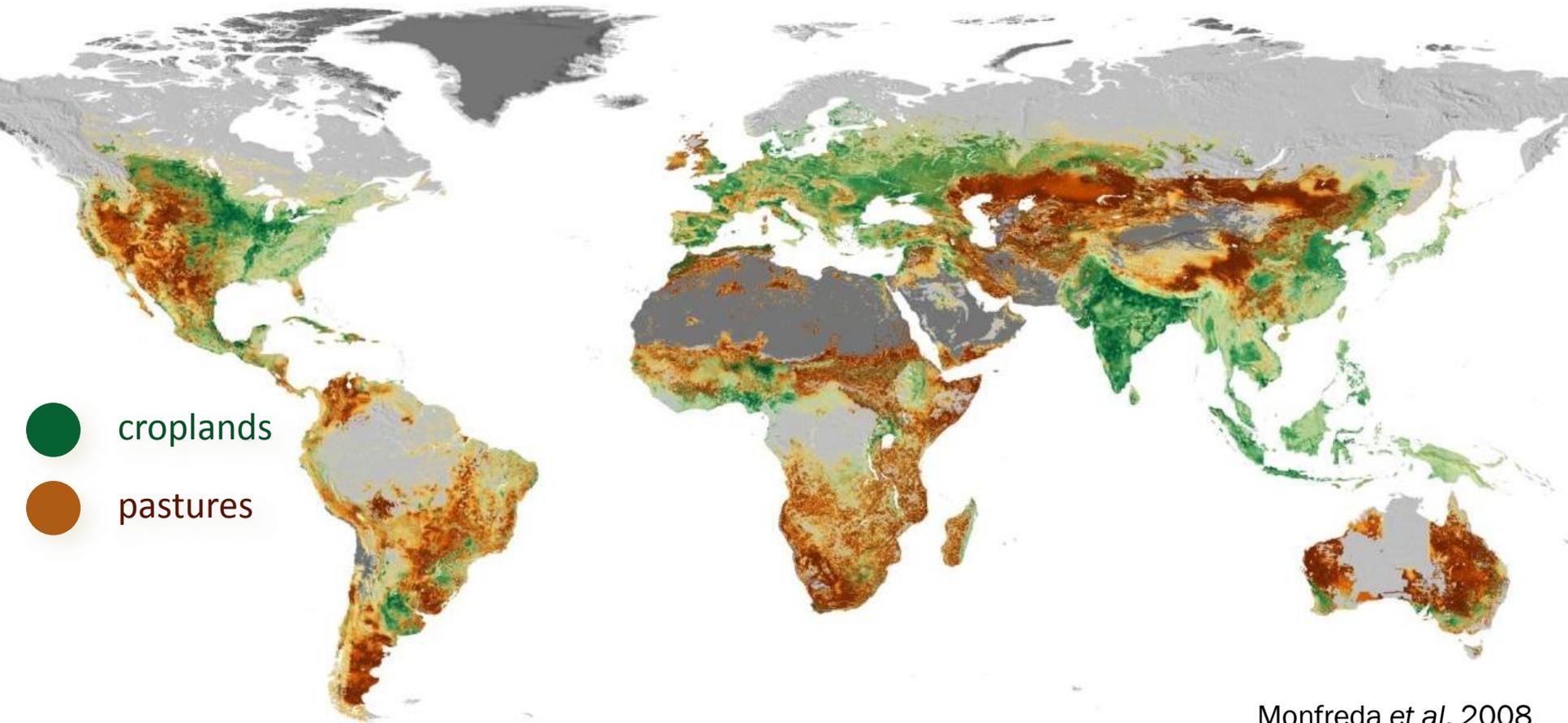


Brauman *et al.* (in review)
WaterGAP3 data

Agriculture Matters



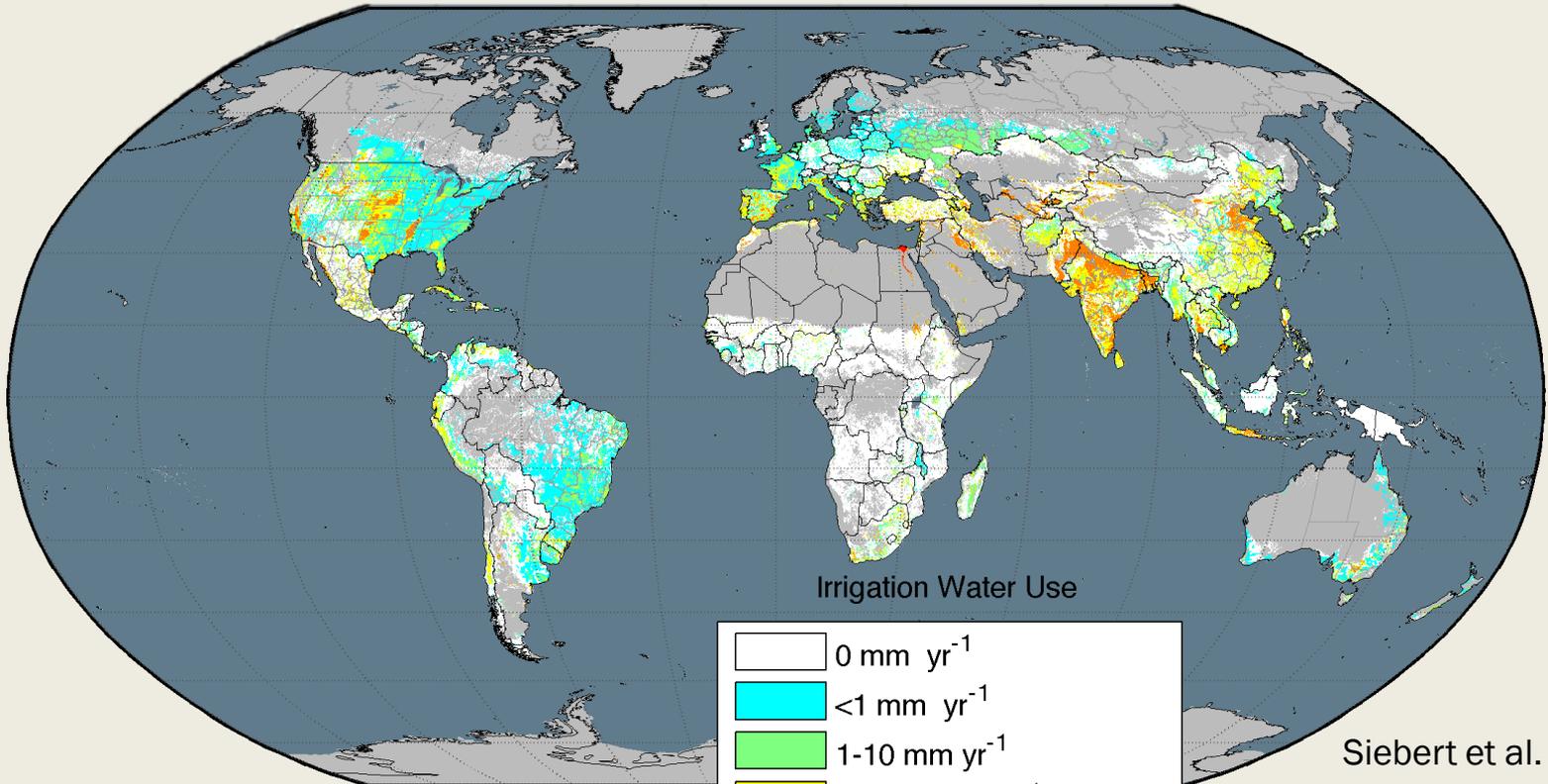
Agriculture has a big footprint



Monfreda *et al.* 2008

About 40% of land surface is cultivated

Agriculture consumes a lot of water



Siebert et al. (2010)





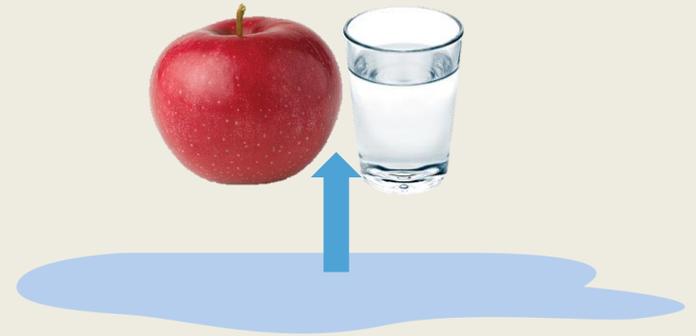
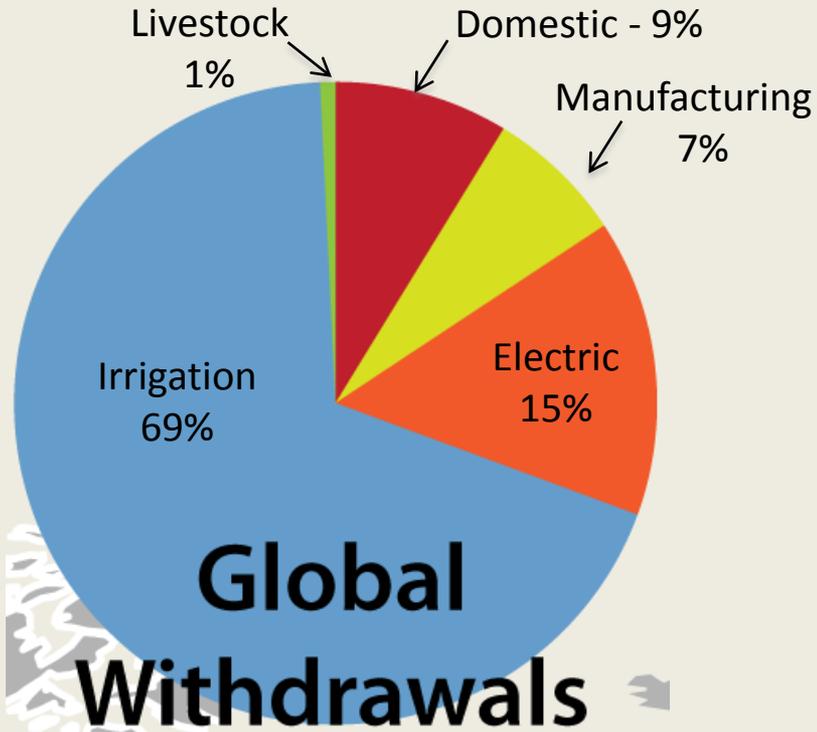




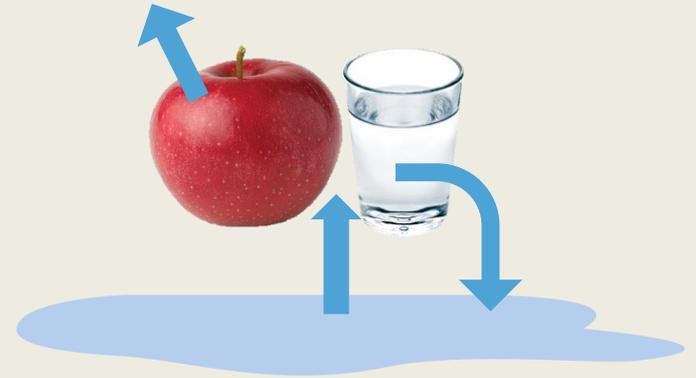
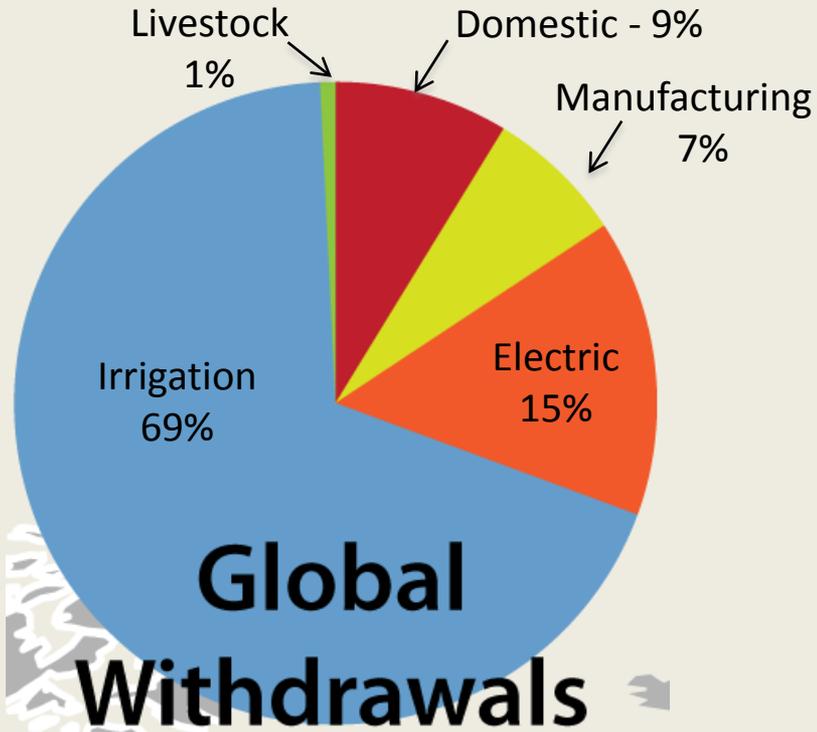




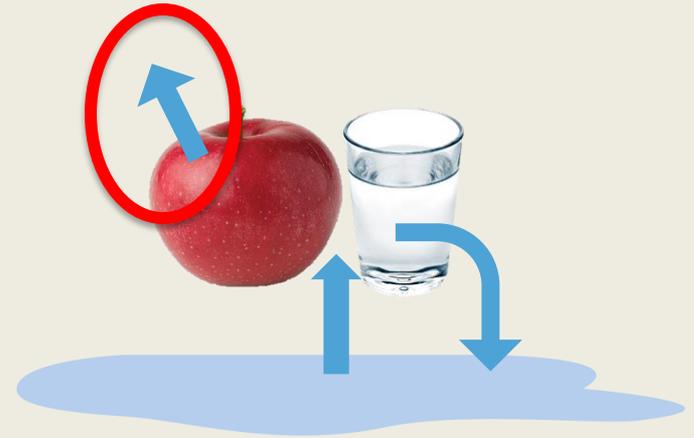
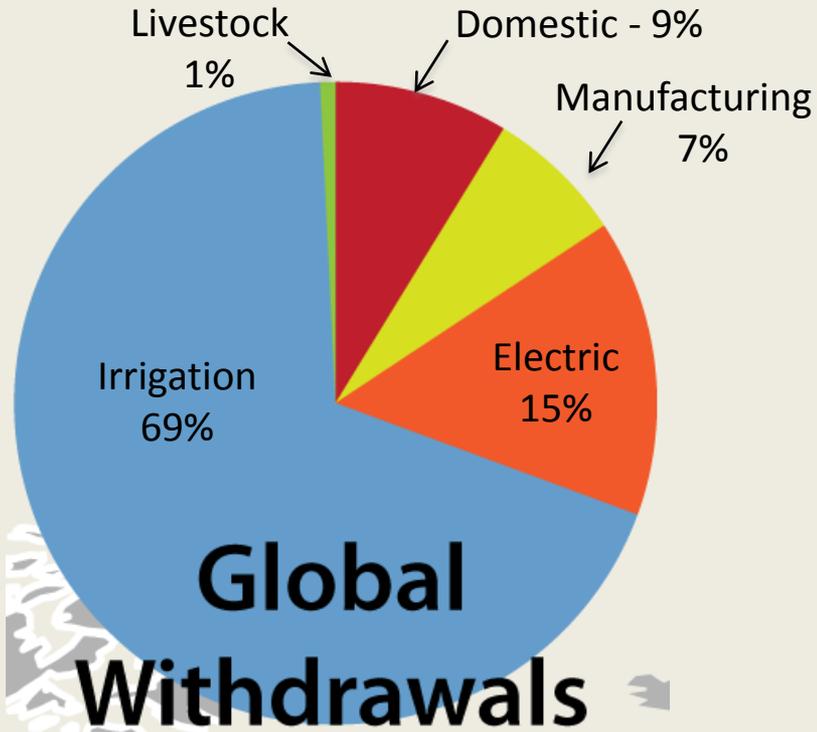
Global Water Demand



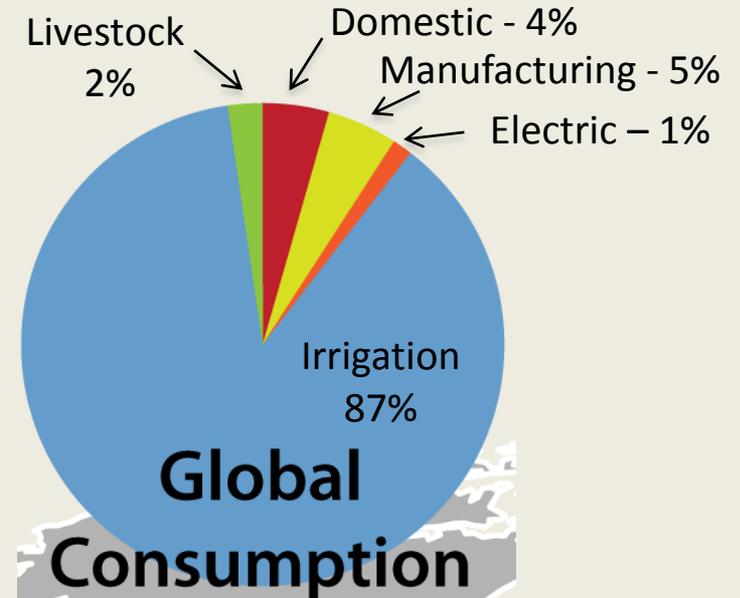
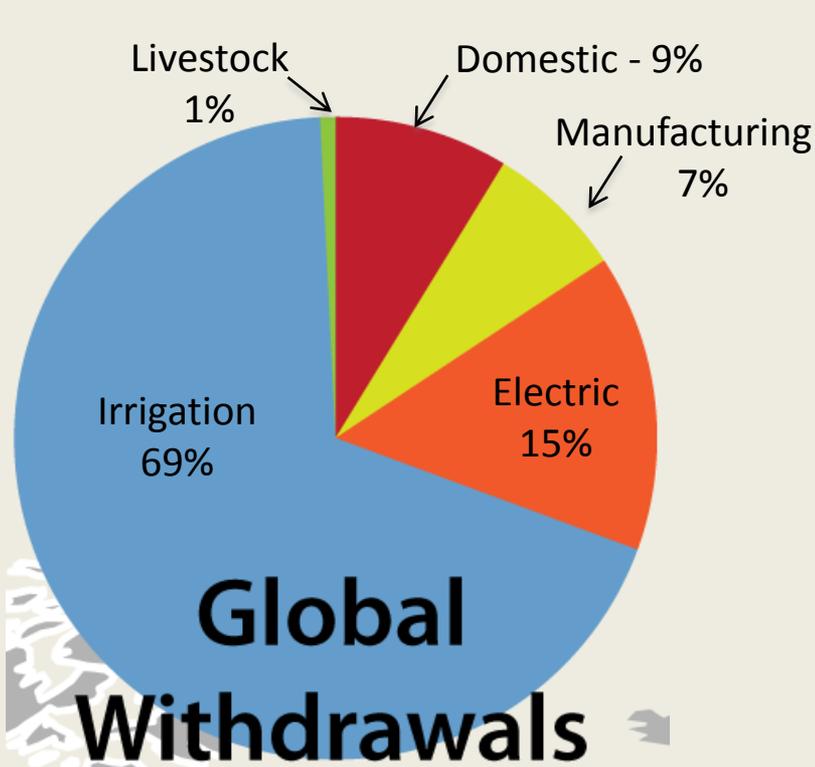
Global Water Demand



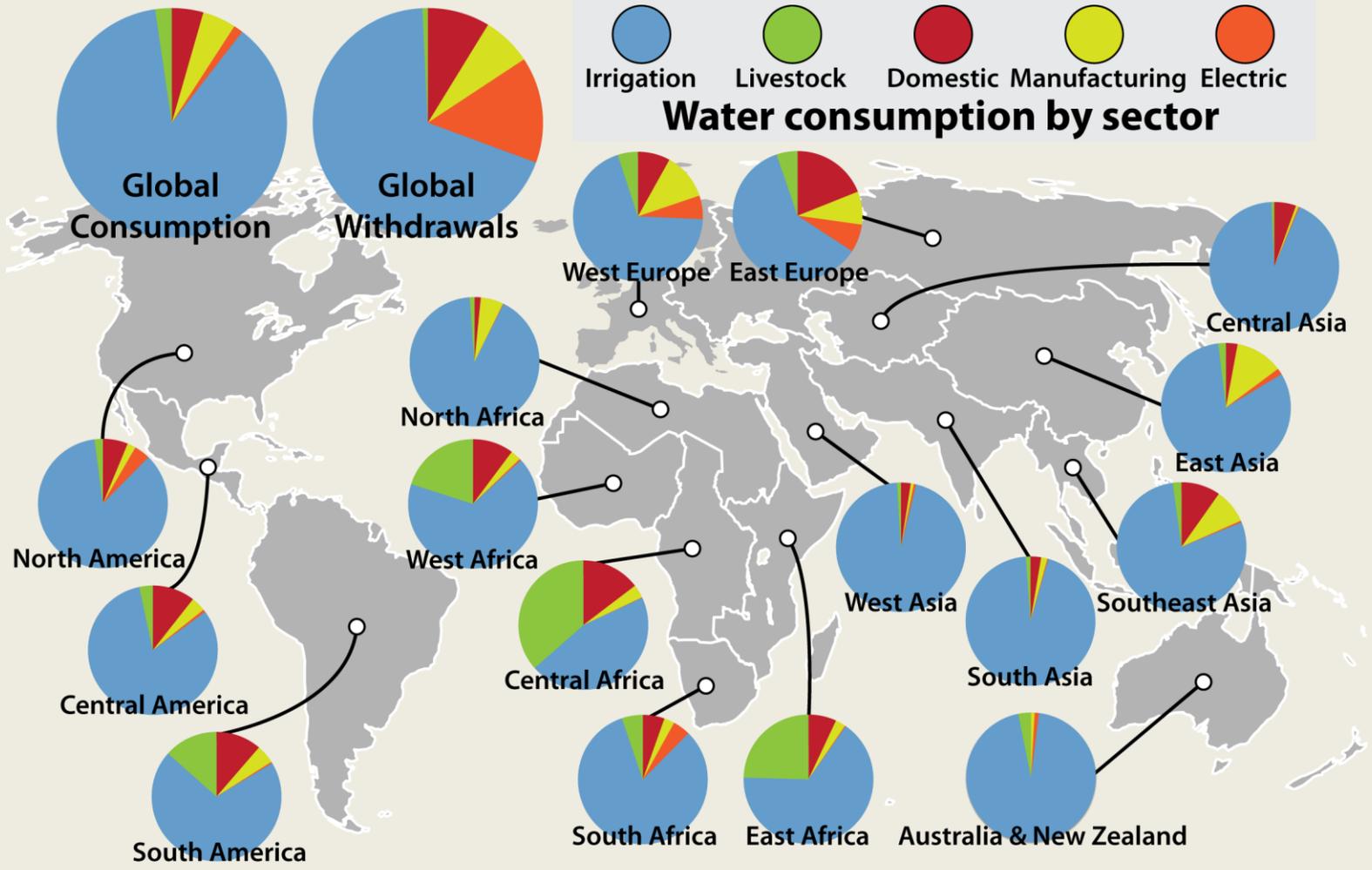
Global Water Demand



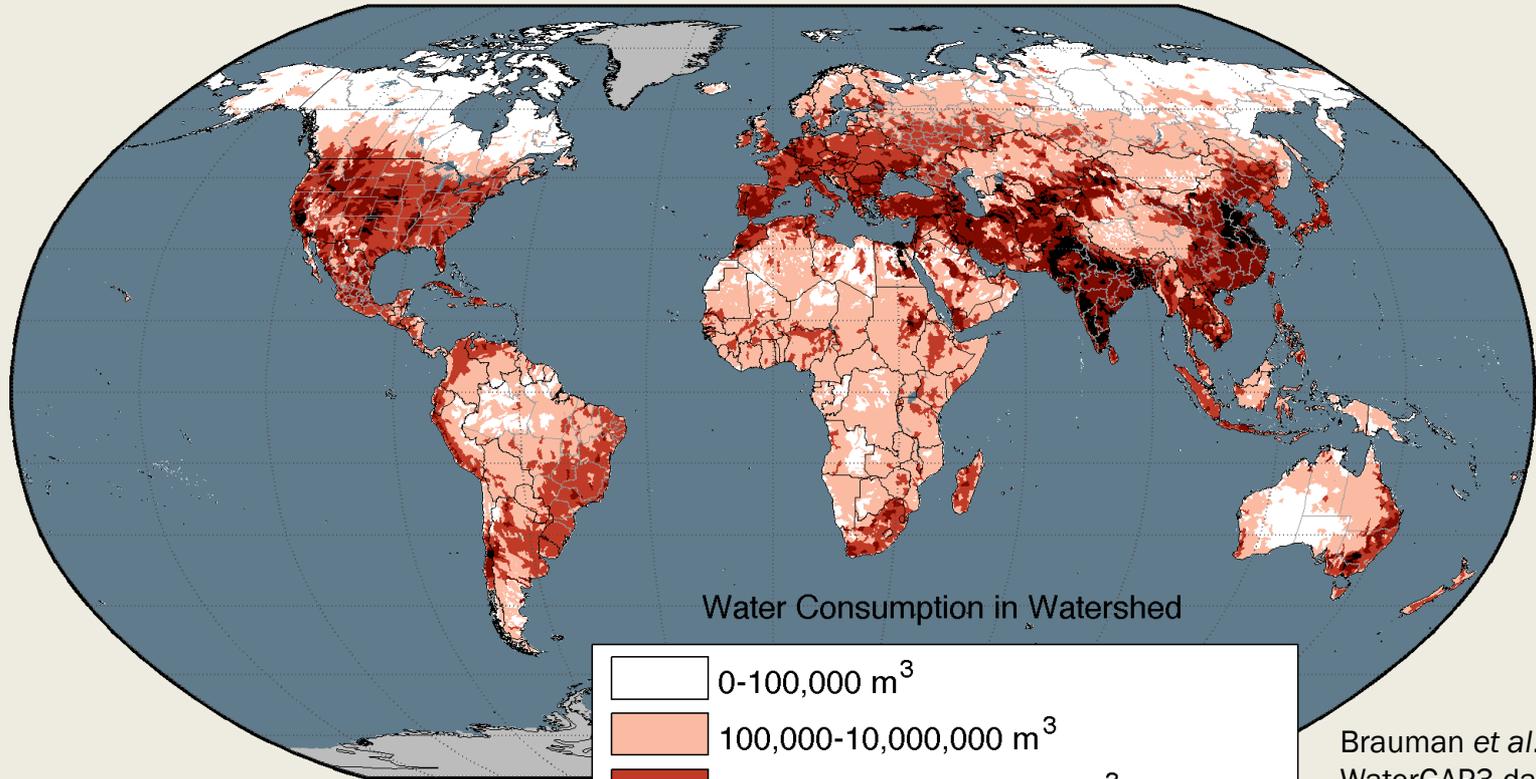
Global Water Demand



Brauman *et al.* (in review)
WaterGAP3 data

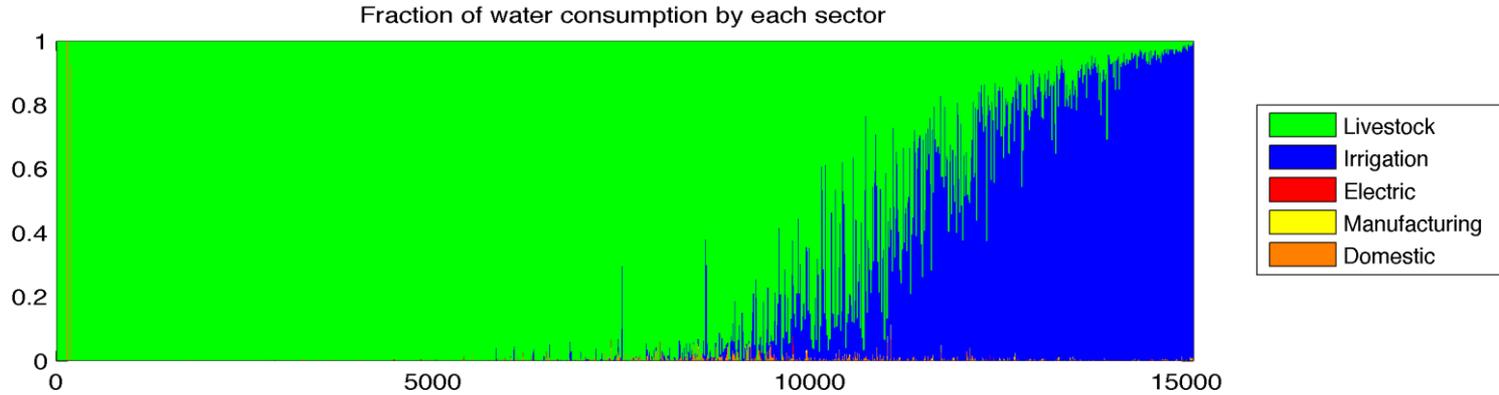


Global Water Consumption



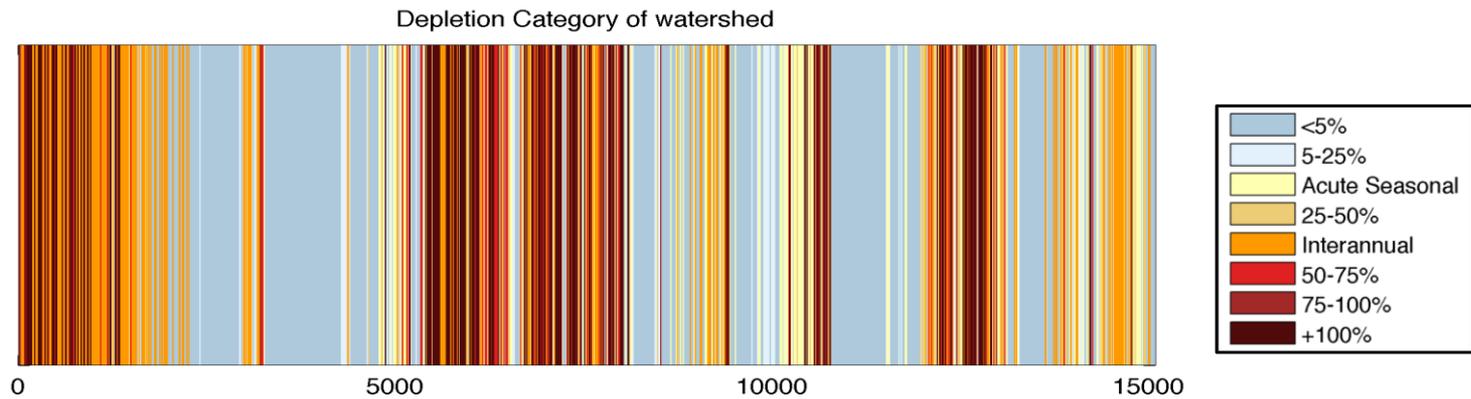
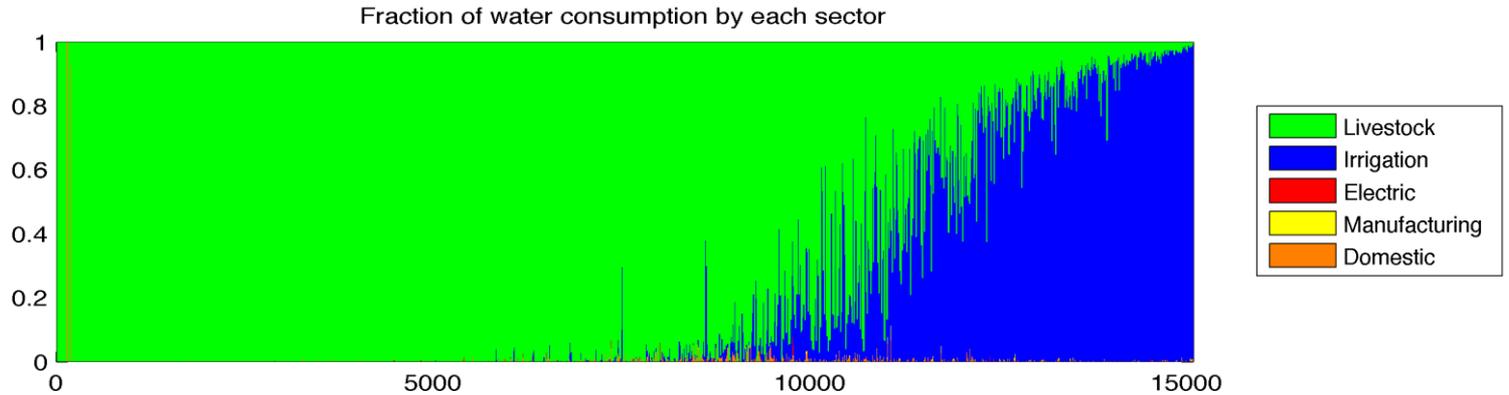
Brauman *et al.* (in review)
WaterGAP3 data

Big water users irrigate



least ← Watershed Water Consumption | → most

But that doesn't mean they're depleted

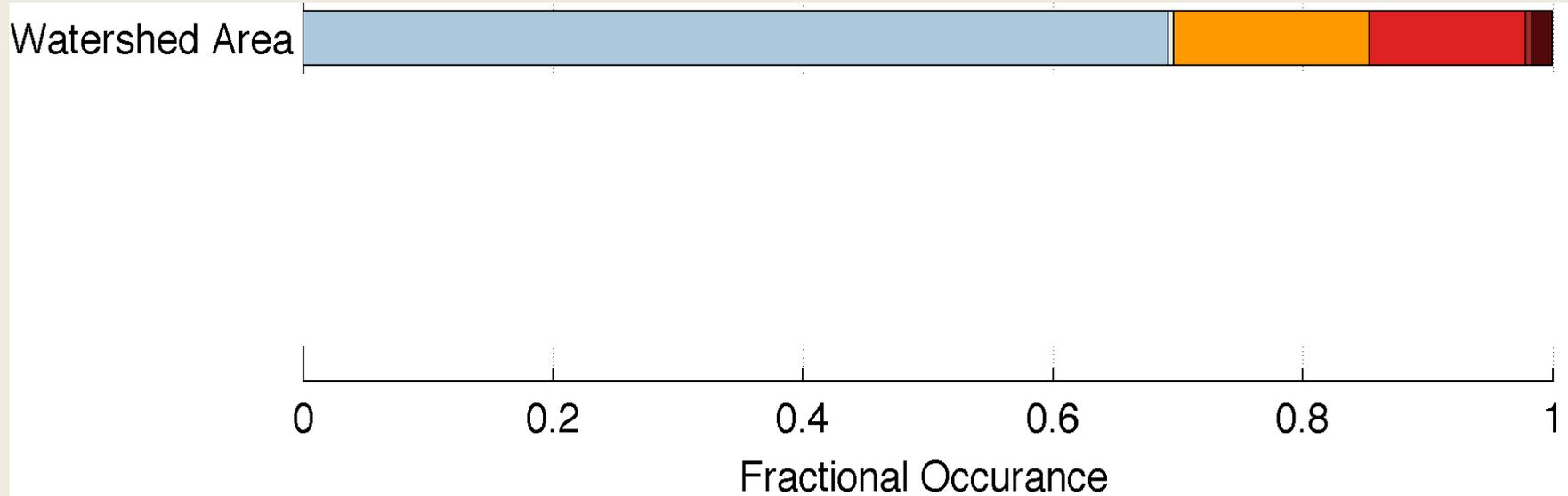


Watershed Water Consumption

least ← | → most

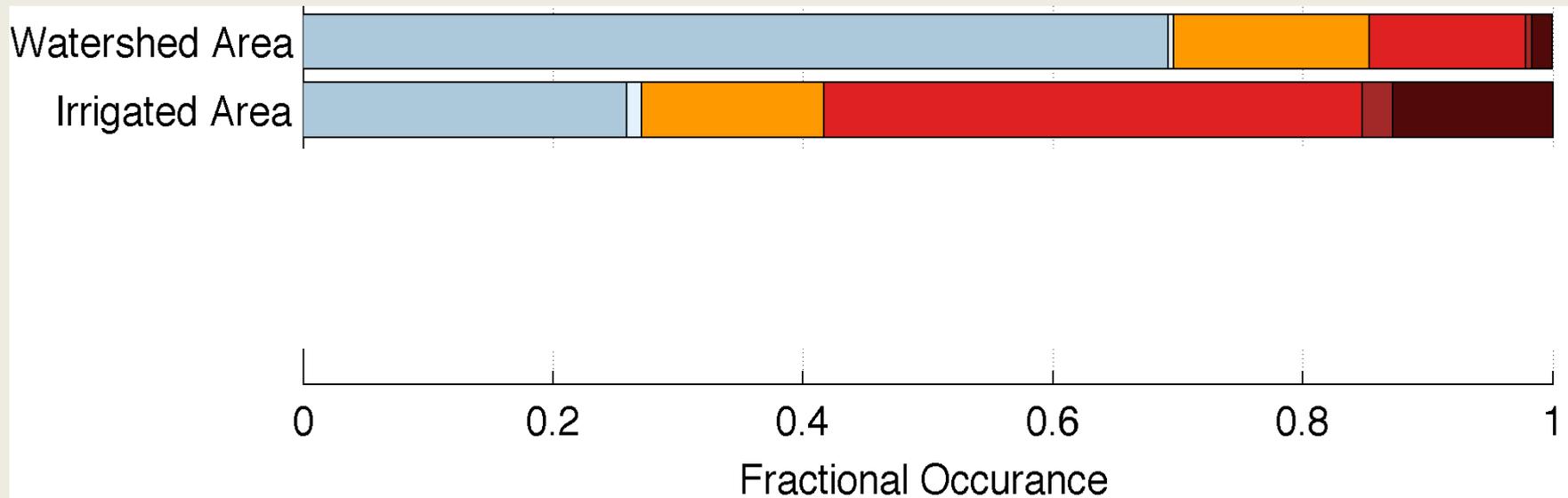
Most area is not found in depleted watersheds

Status of watershed (depletion level):



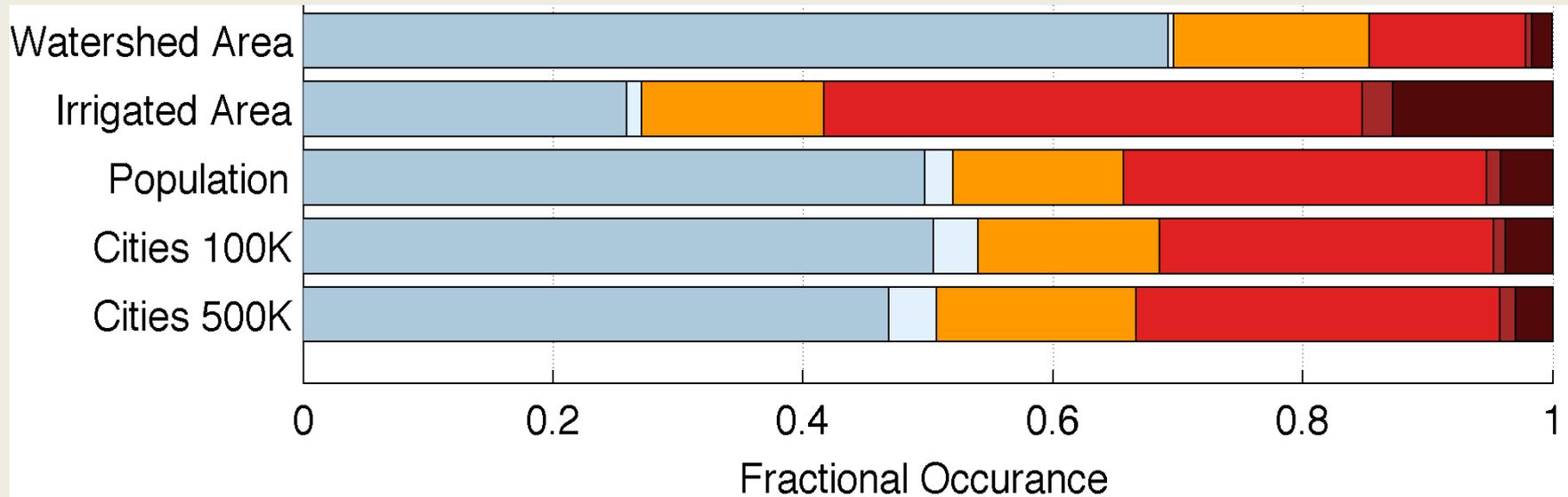
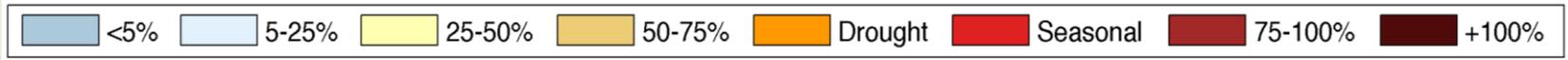
Irrigation is found in depleted watersheds

Status of watershed (depletion level):

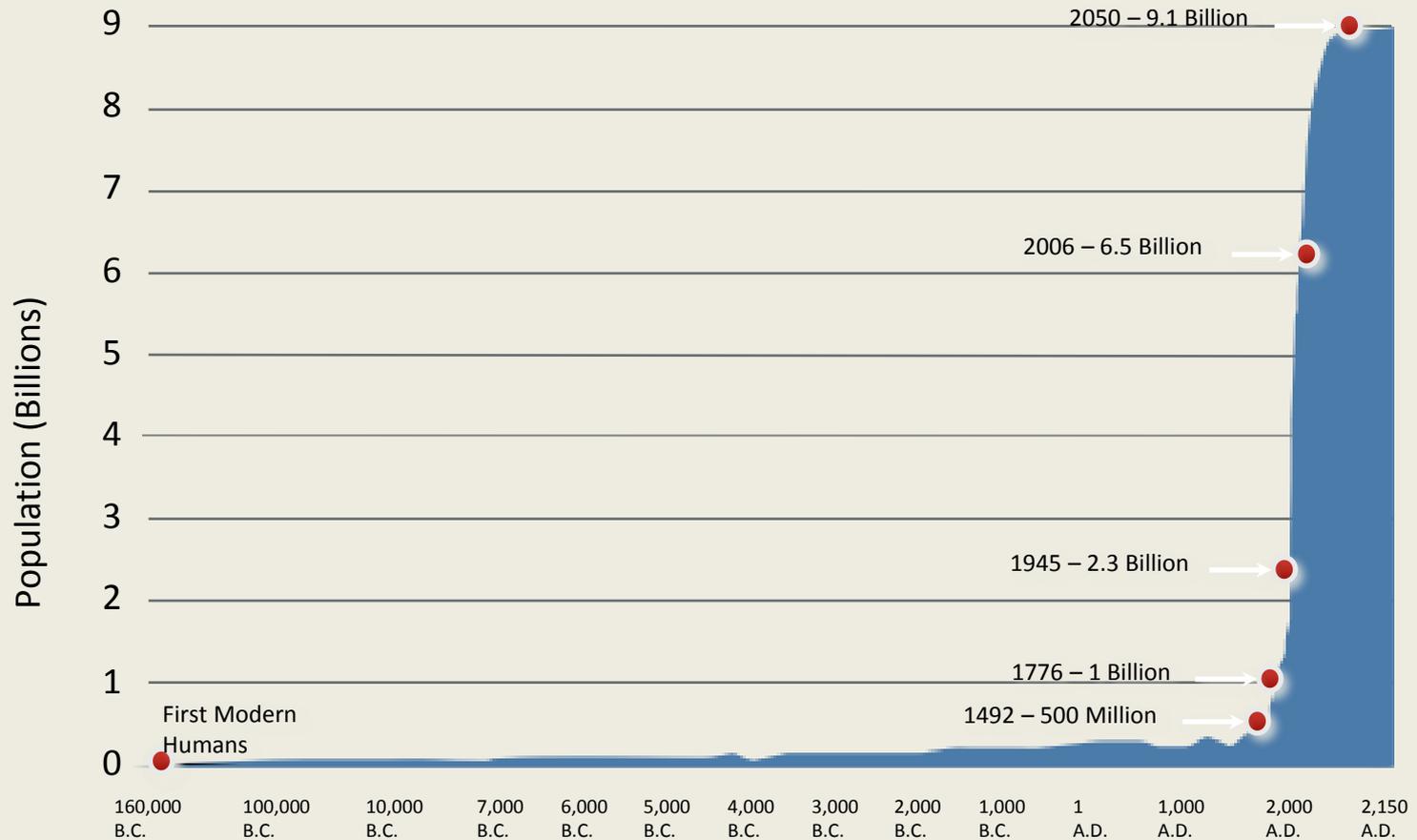


Irrigation AND people are found in depleted watersheds

Status of watershed (depletion level):



Global population is growing



Demand is increasing



Not just tradeoffs

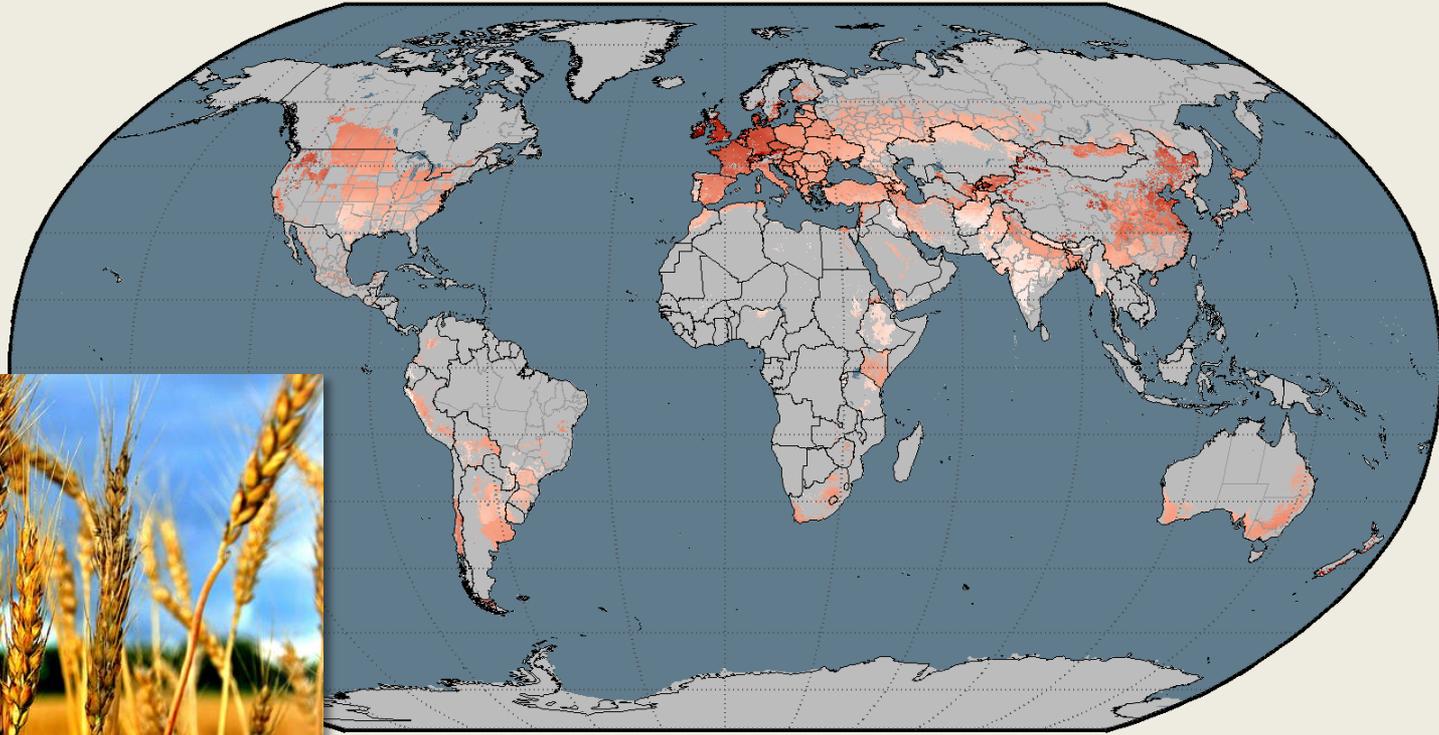


Efficiency

Less (water) in, more (food and widgets) out



“Crop per Drop” Varies Globally

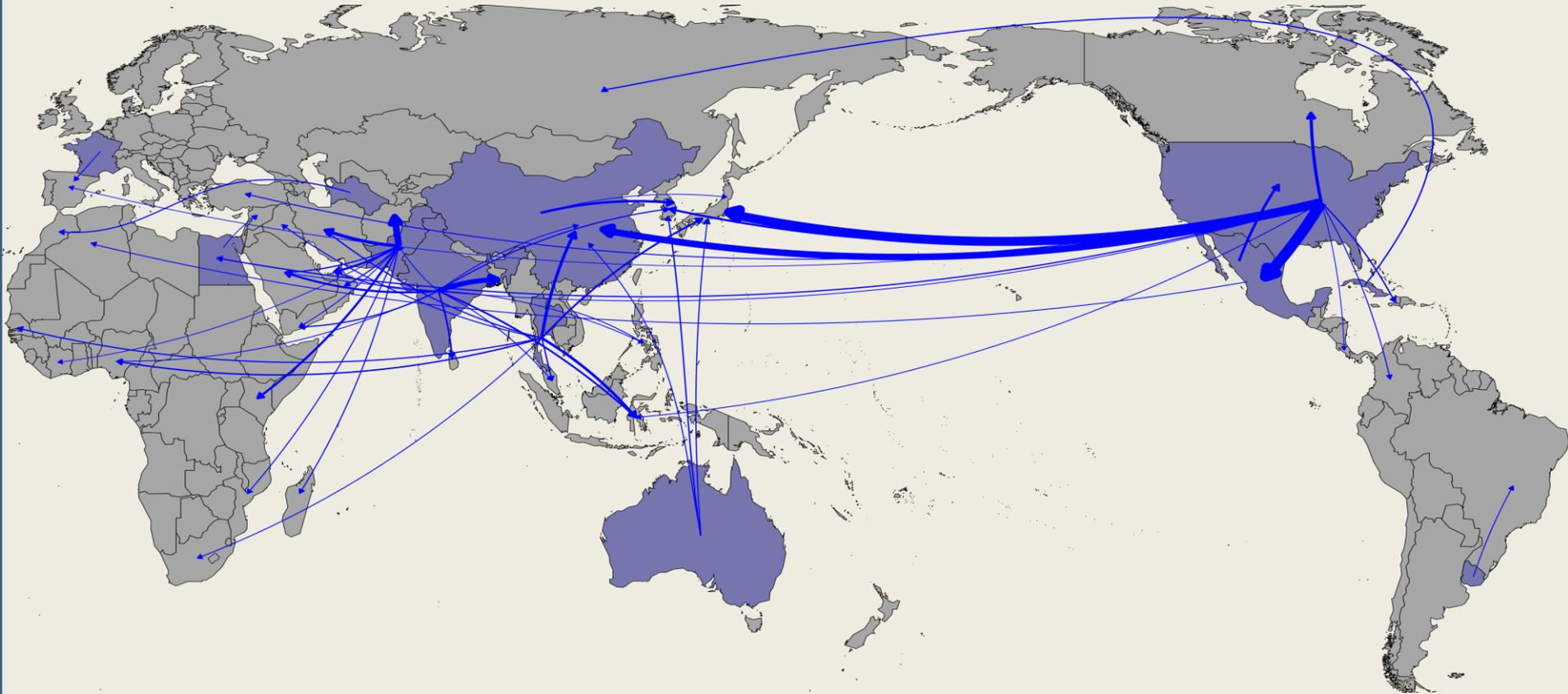


Wheat Water Productivity (kcal/liter)

Brauman et al. (2013) ERL

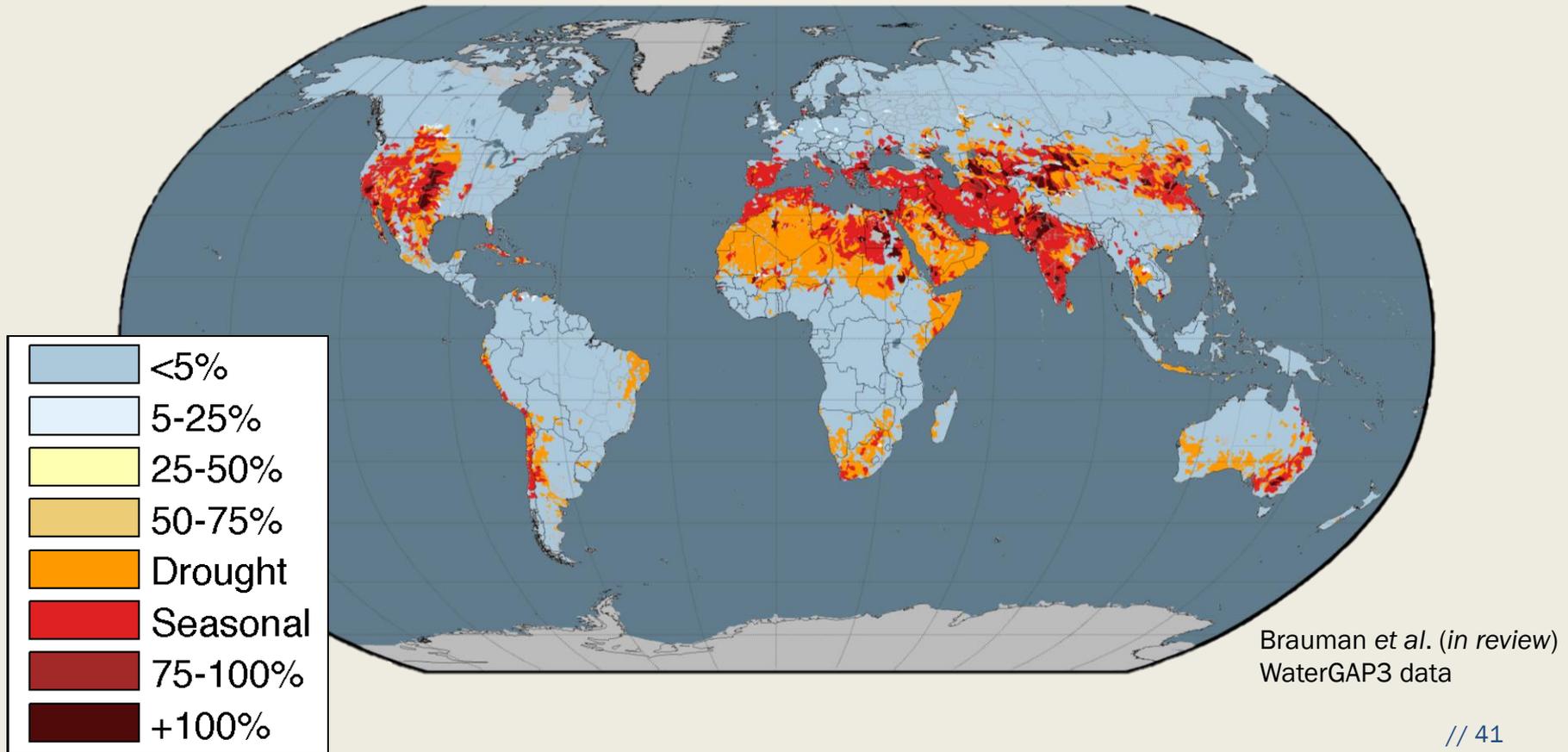


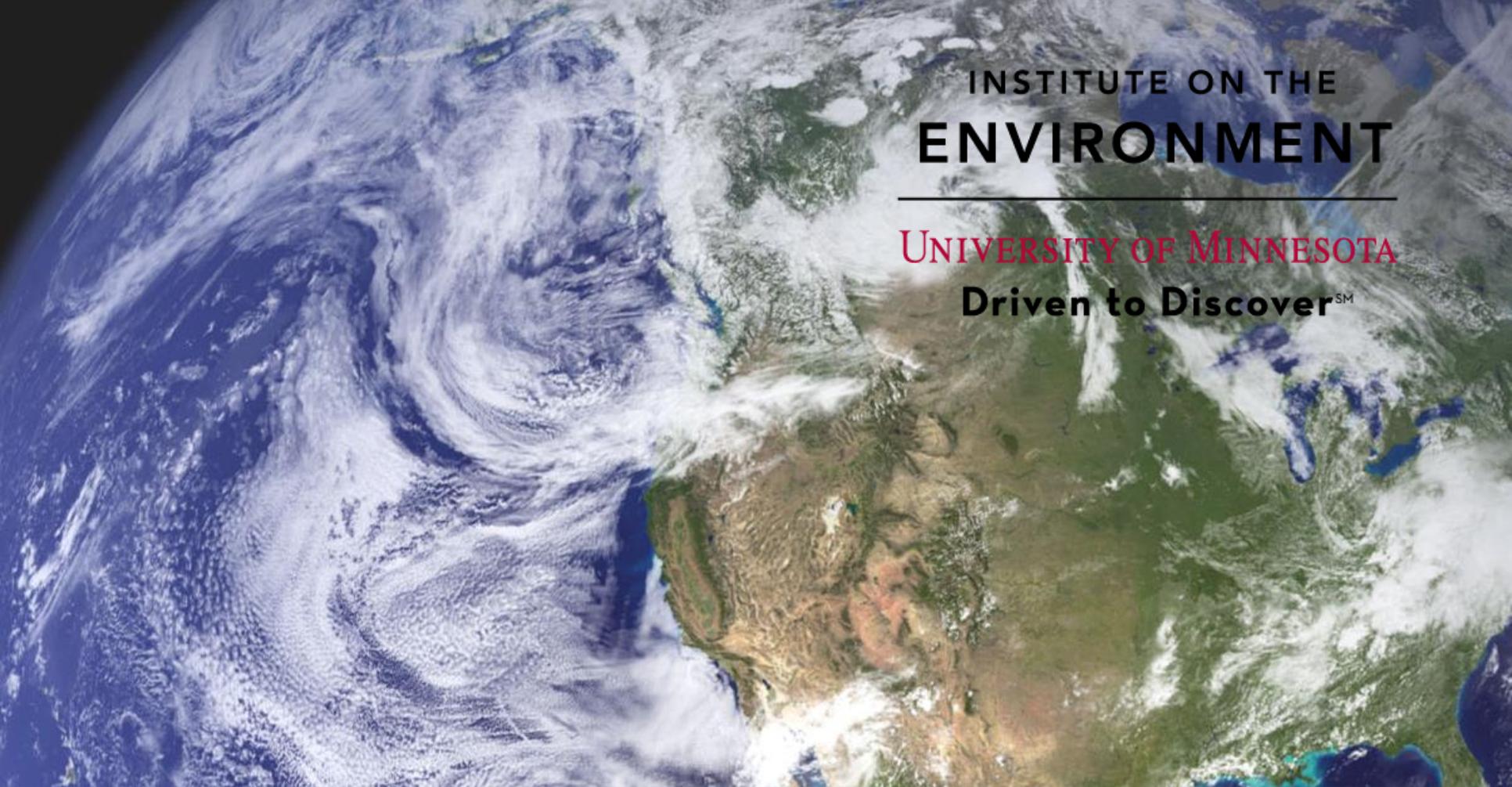
Comparative advantage



57 trades = 50% of irrigation water (major crop exports)

Global Water Depletion





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