Three Steps Out of Water Scarcity

FLOW 2018 – April 2018

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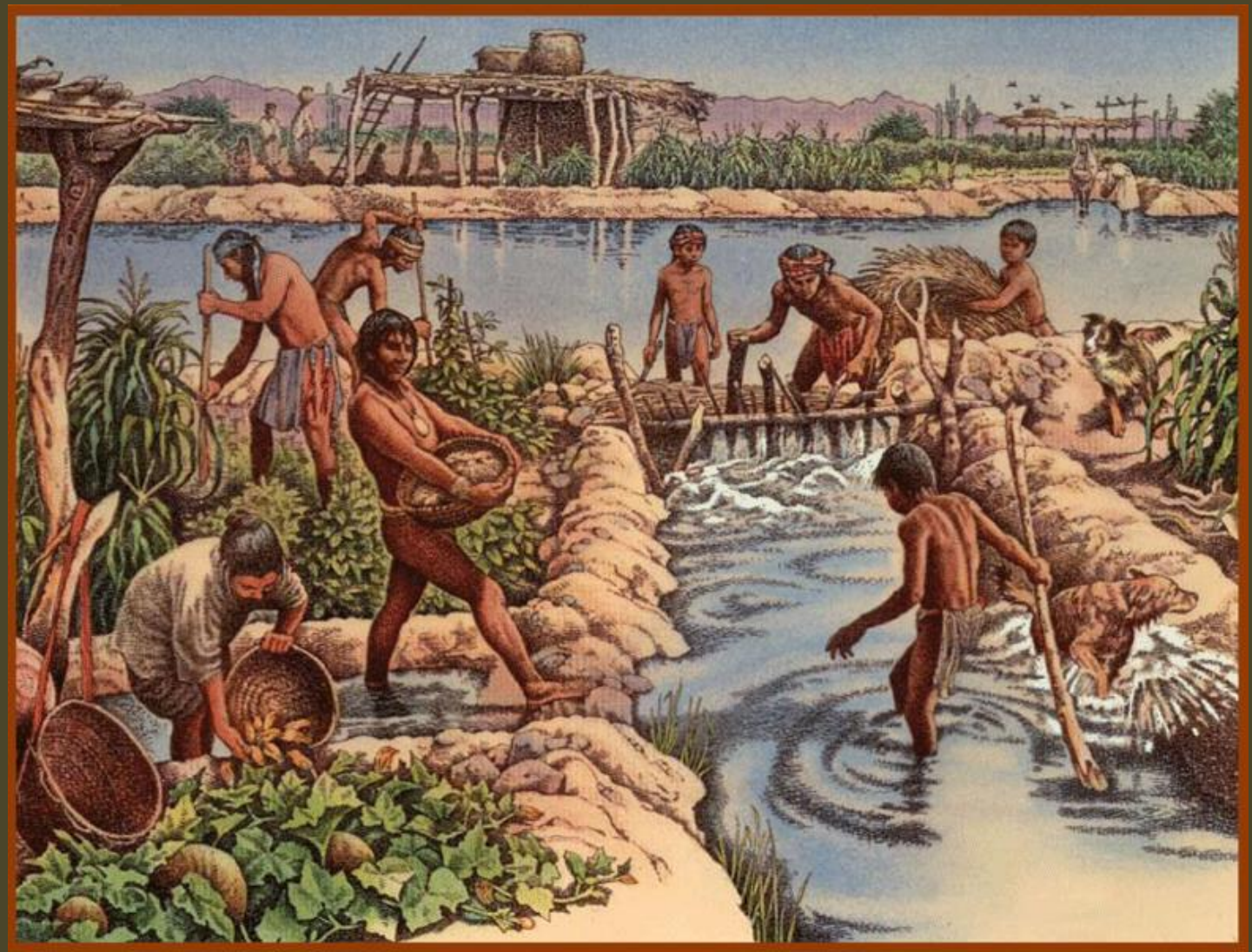
The Natural Flow Regime

A paradigm for river conservation and restoration

SPECIAL APPLIED ISSUES SECTION

How much water does a river need?



Hoover Dam & Lake Mead

Imperial Irrigation District, California

Dakar, Senegal

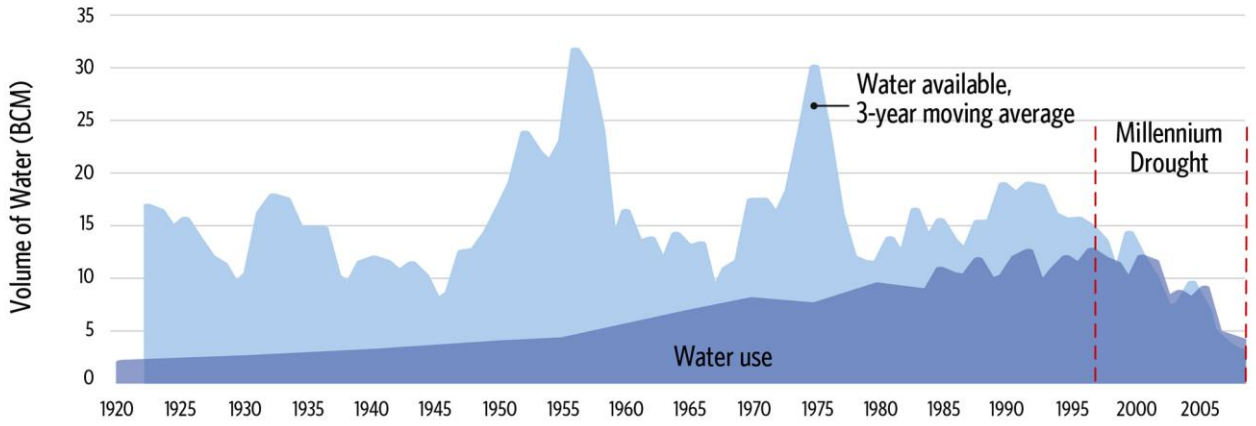
High Plains Aquifer, KS

Pont du Gard aqueduct in Nimes, France

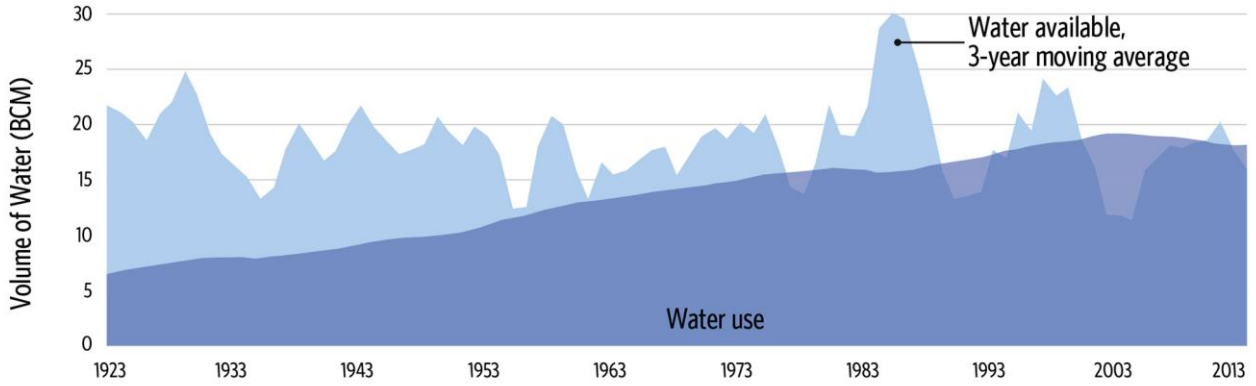
State Water Project, California

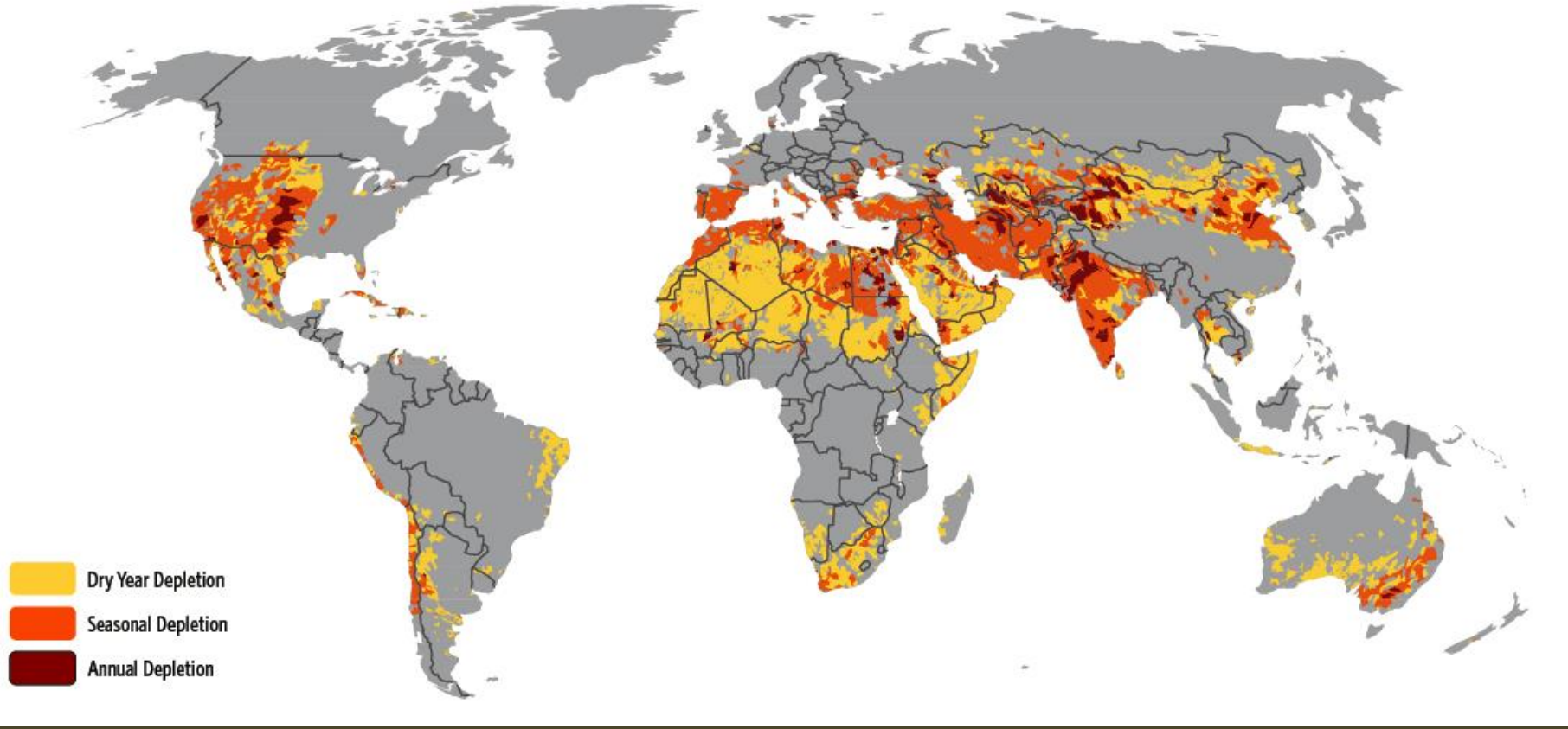
Phoenix, Arizona

Water availability and use in the Murray-Darling Basin of Australia



Water availability and use in the Colorado River Basin of the United States

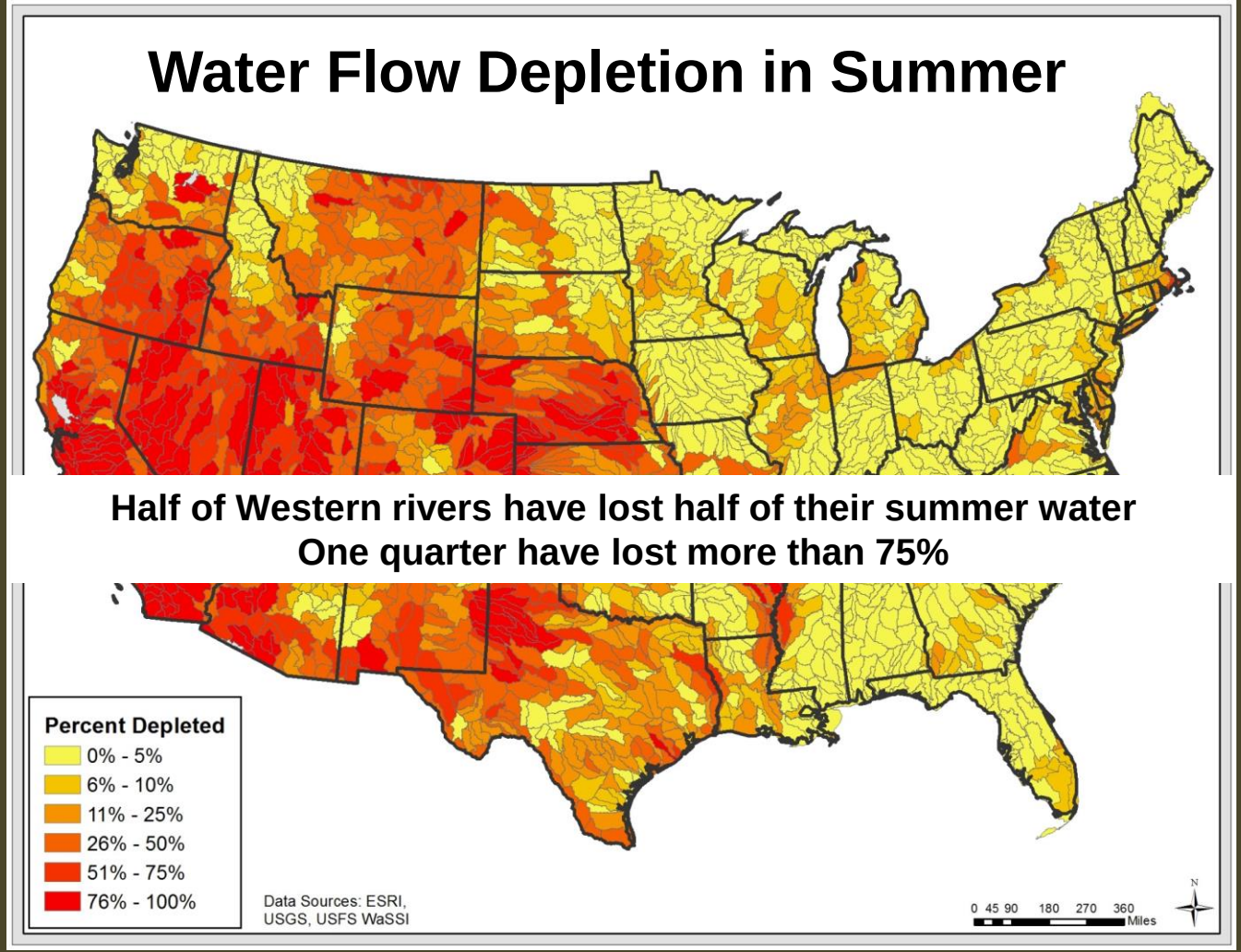




Water shortages are occurring in 1/3 of the planet's watersheds and aquifers
1/2 of the world's population is affected
3/4 of the world's irrigated acreage is affected
Freshwater species are gravely imperiled

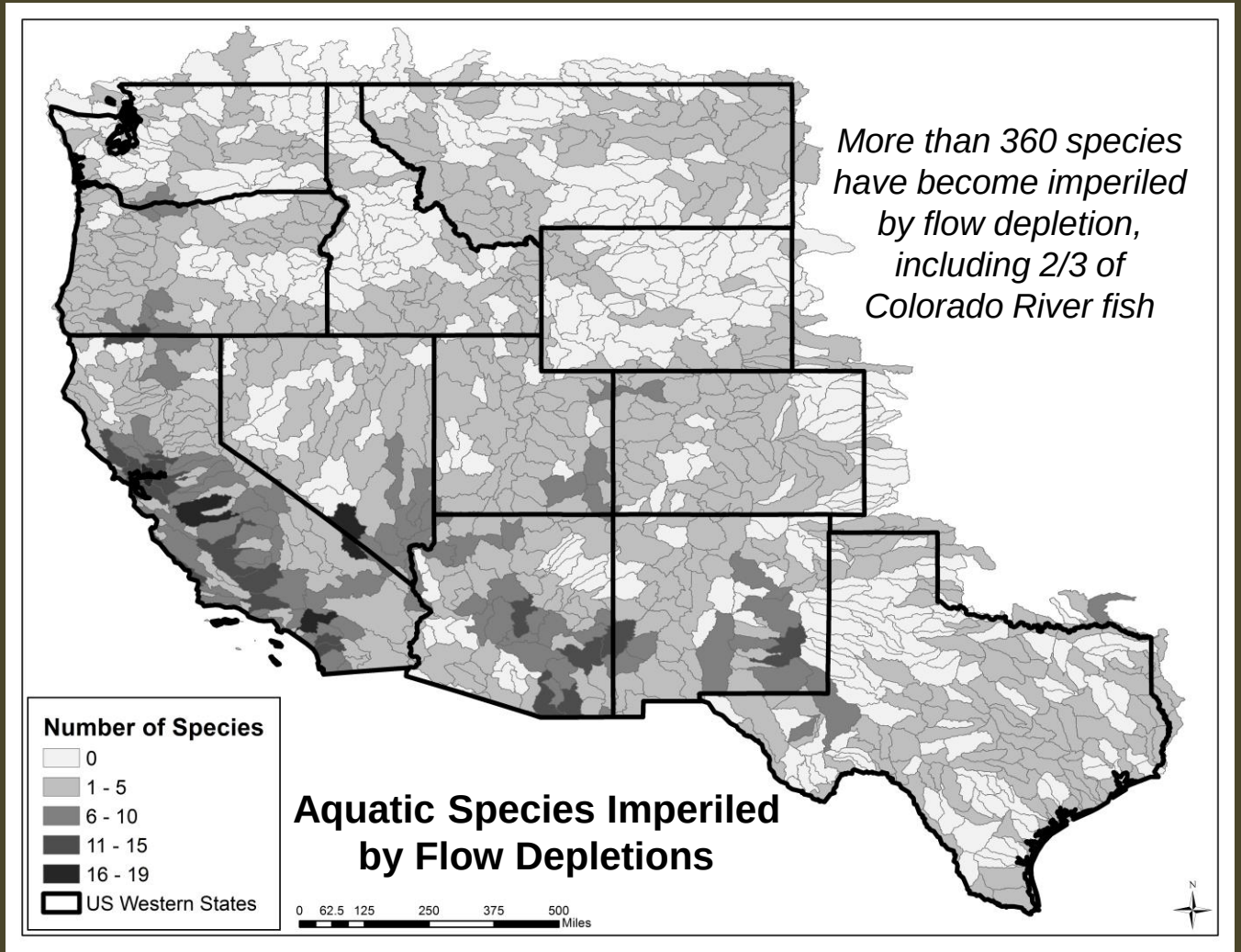
Source: "Water Depletion: An improved metric for incorporating seasonal and dry-year water scarcity into water risk assessments." Brauman et al, 2016, *Elementa*

Water Flow Depletion in Summer



Half of Western rivers have lost half of their summer water
One quarter have lost more than 75%

Source: “Protection and restoration of freshwater ecosystems, Richter et al 2016. Chapter 7 in *Water Policy and Planning in a Variable and Changing Climate,* CRC Press



Source: “Protection and restoration of freshwater ecosystems, Richter et al 2016. Chapter 7 in *Water Policy and Planning in a Variable and Changing Climate,* CRC Press

21st Century Reality

In water-scarce regions of the world, there is no more ‘surplus’ water

We must now aggressively shrink the water footprints of cities and farms to bring them into balance with sustainable water supplies and restore river ecosystems

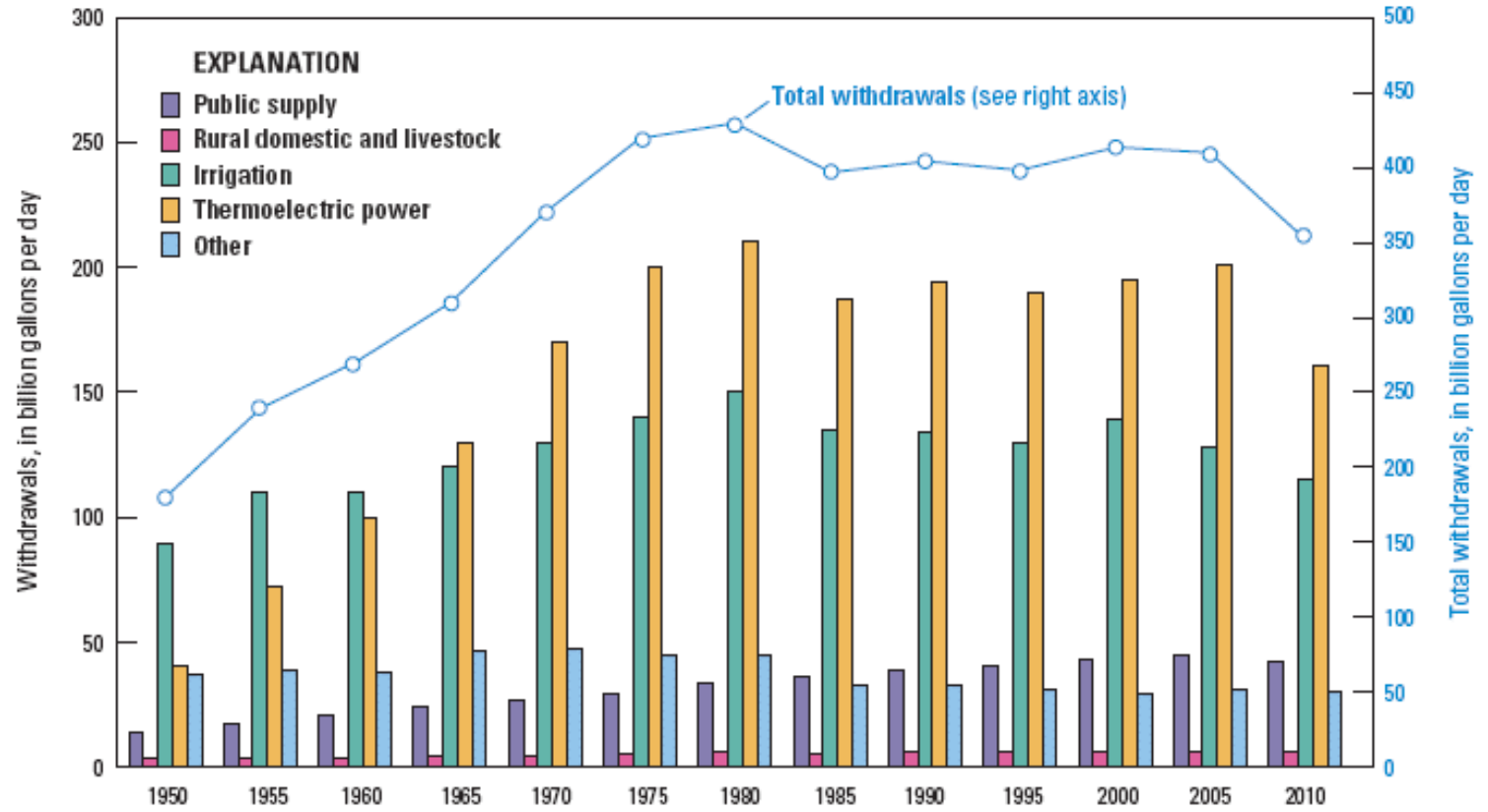


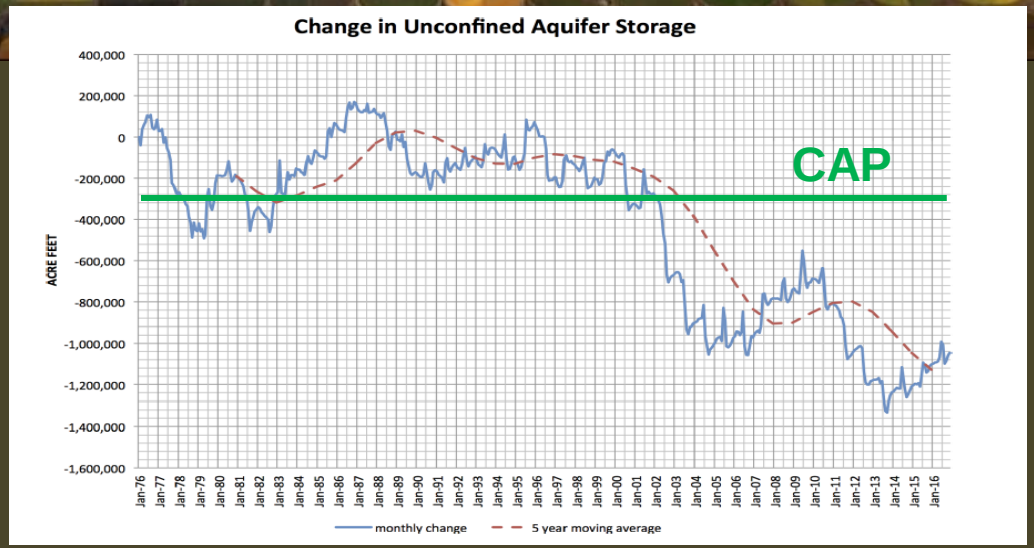
Figure 14. Trends in total water withdrawals by water-use category, 1950–2010.

Source: US Geological Survey

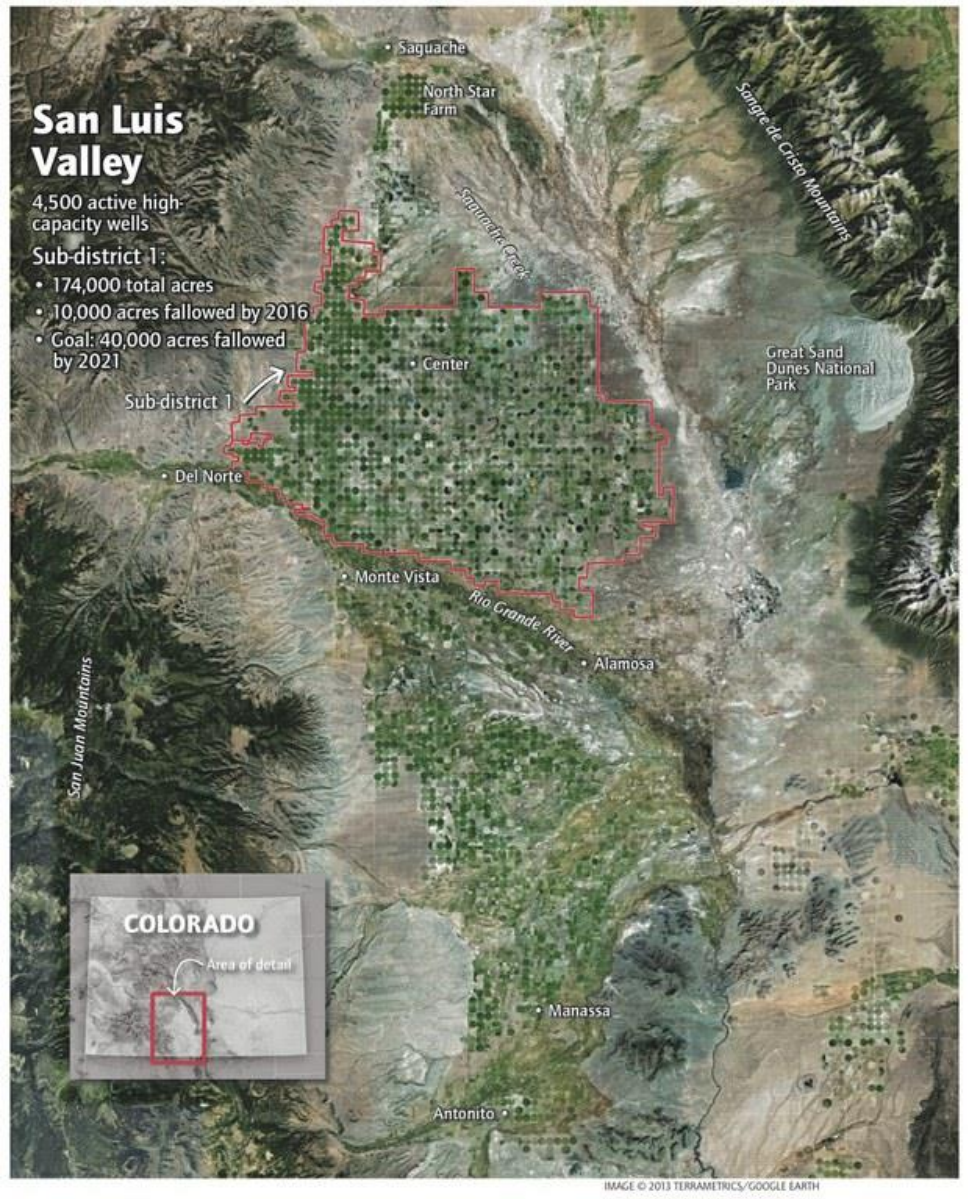
Three Steps Out of Water Scarcity

Step 1: Establish caps on water use

San Luis Valley, Colorado



Source: Davis Engineering, 2016. Change in Unconfined Aquifer Storage
Rio Grande Water Conservation District



Cap set at average aquifer level from 1978-2000

Will require rotational fallowing of ~20% of farmland in valley in any given year

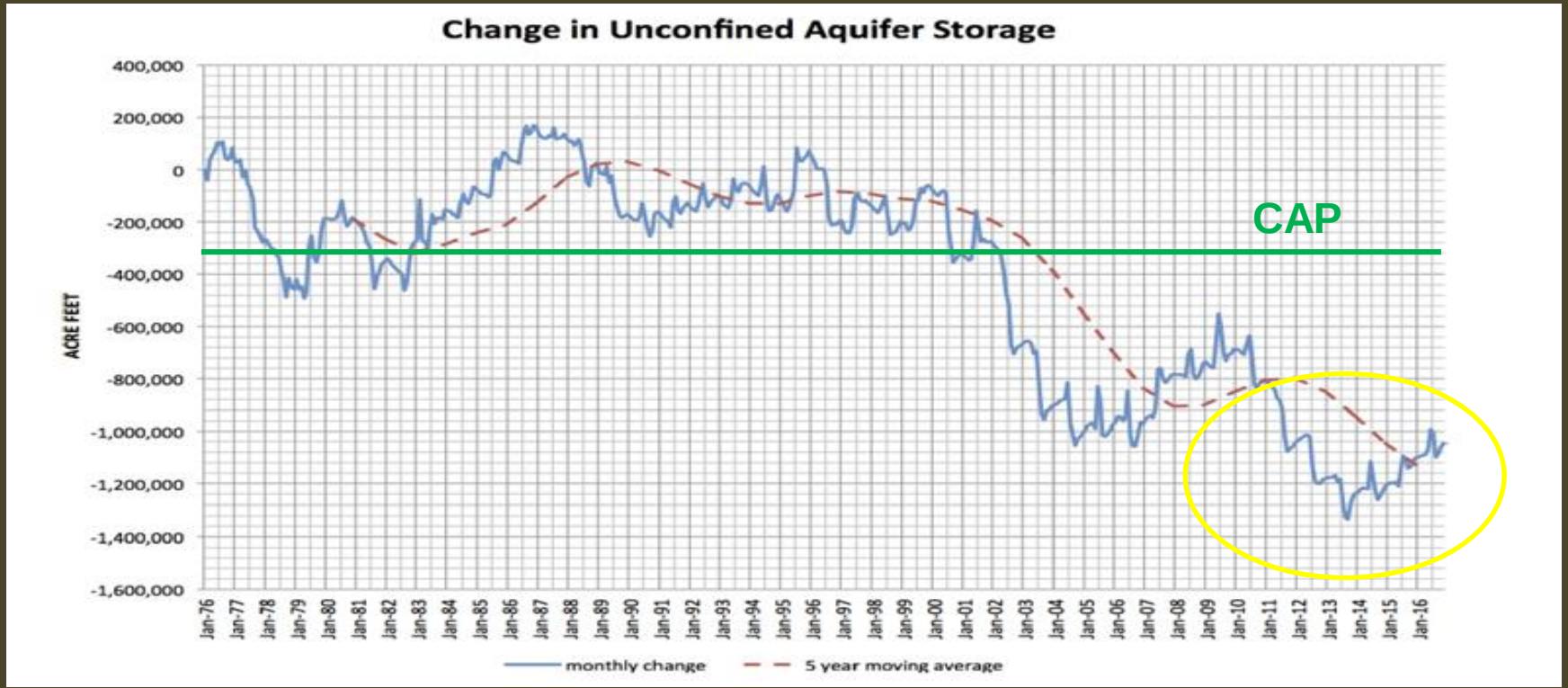
High Country News

FOR PEOPLE WHO CARE ABOUT THE WEST

After years of drought and overuse, the San Luis Valley aquifer refills

How an over-taxed basin is getting its water use under control.

Paige Blankenbuehler | **May 26, 2016**


Change in Unconfined Aquifer Storage
400,000
200,000
0
-200,000
-400,000
-600,000
-800,000
-1,000,000
-1,200,000
-1,400,000
-1,600,000
ACRE FEET
CAP
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Jan-77
Jan-78
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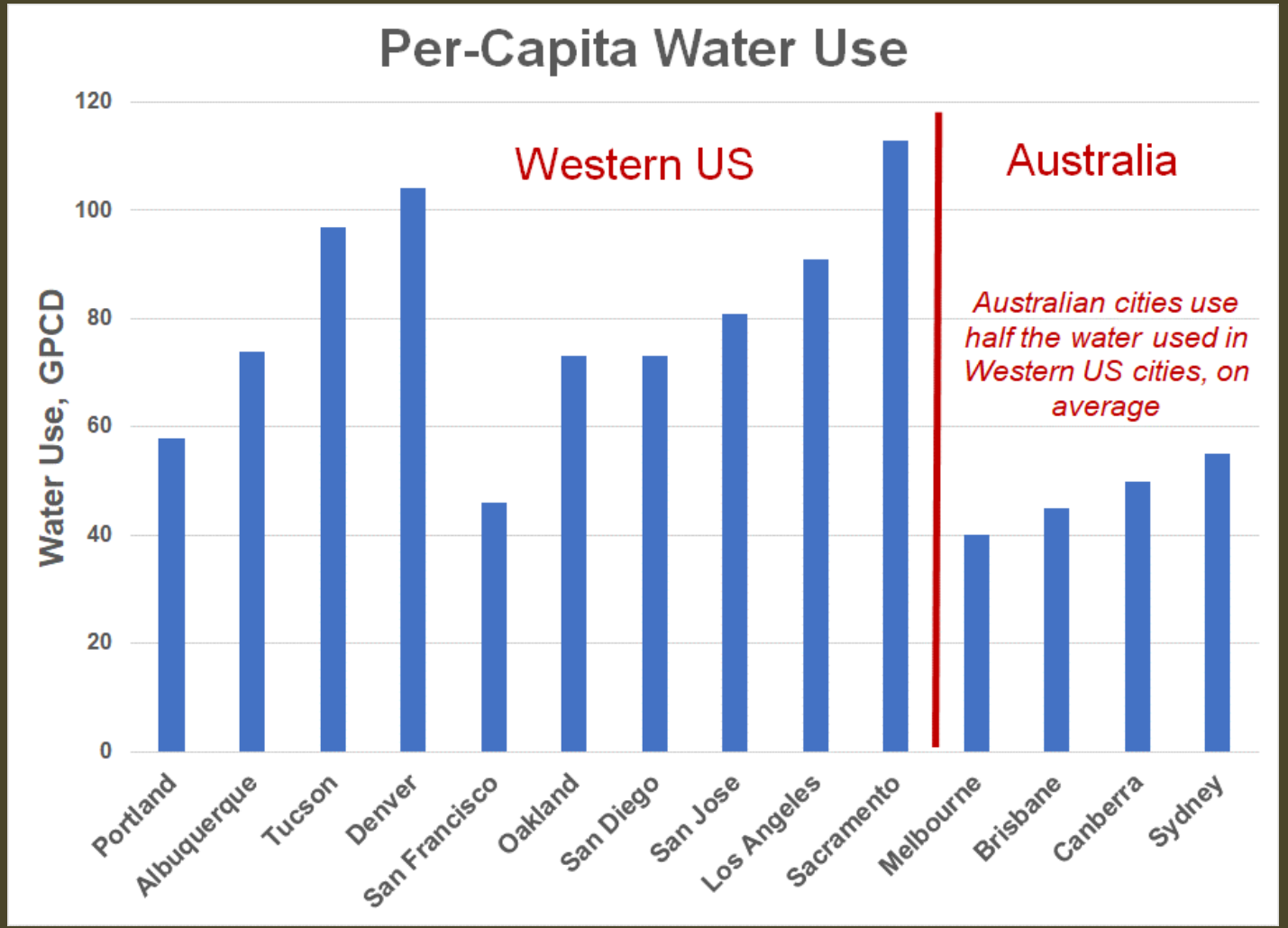
monthly change
5 year moving average

Step 2: Freeze the urban water footprint



Source: “Residential Water Conservation in Australia and California,”
Ryan Cahill and Jay Lund, 2013 Journal of Water Resources Planning & Management

Los Angeles, California

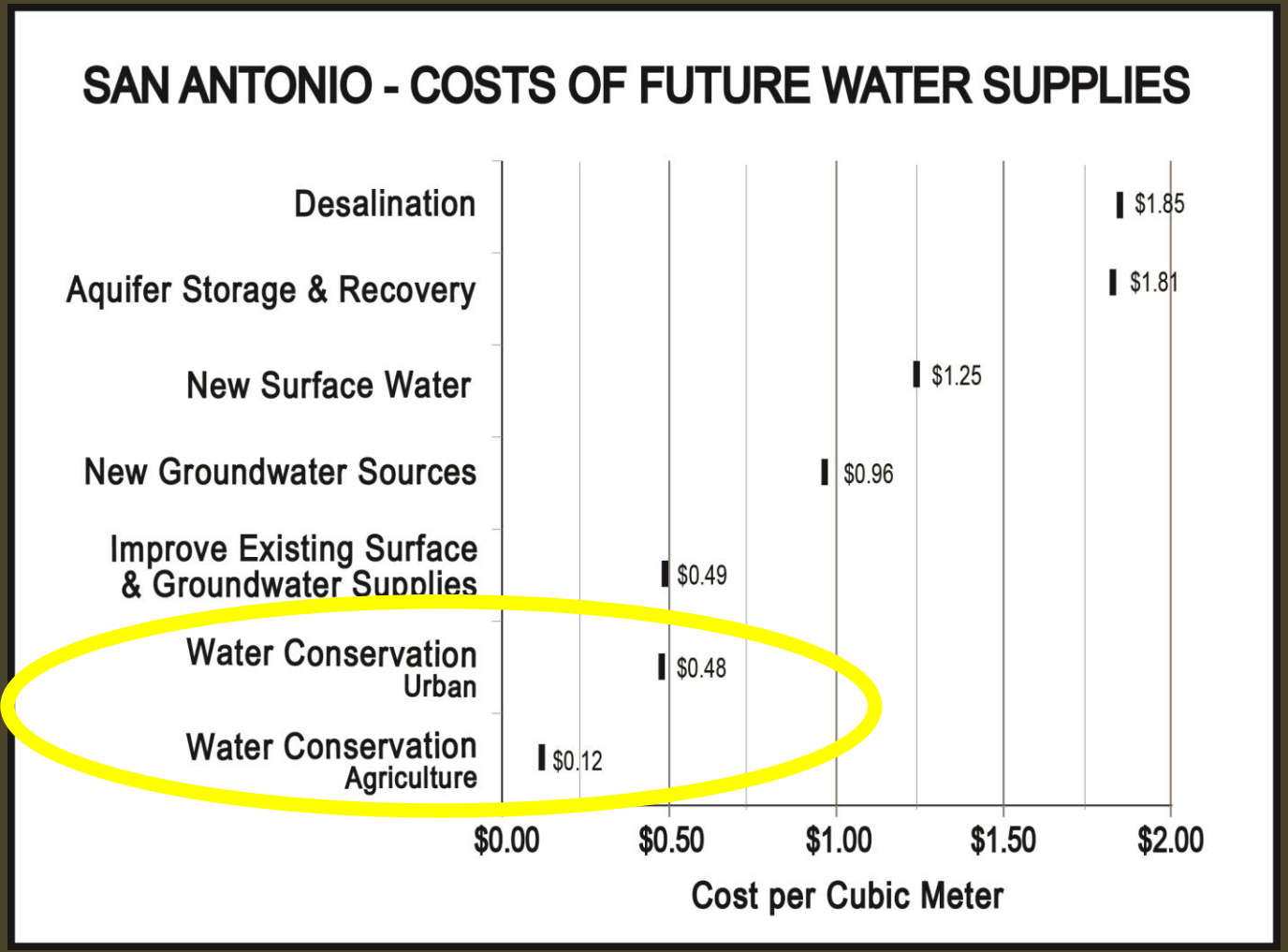
Photo: LA Times

Sydney, Australia

Outdoor landscaping

Water-efficient toilets

Water recycling, Los Angeles



Source: Richter *et al*, 2013. Tapped out: how can cities secure their water future? *Water Policy* 15 (2013) 335–363.

Step 3: Work with farmers to *reduce* consumptive use

Flood irrigation

Drip irrigation

Improvements in water application
34-57% savings in consumptive use

"Opportunities for Saving and Reallocating Agricultural Water to Alleviate Water Scarcity"
(*Water Policy*, Richter et al, 2017)

Enhanced soil health (including mulch or no-till)
13-54% savings in consumptive use

“Opportunities for Saving and Reallocating Agricultural Water to Alleviate Water Scarcity”
(*Water Policy*, Richter et al, 2017)

Cotton

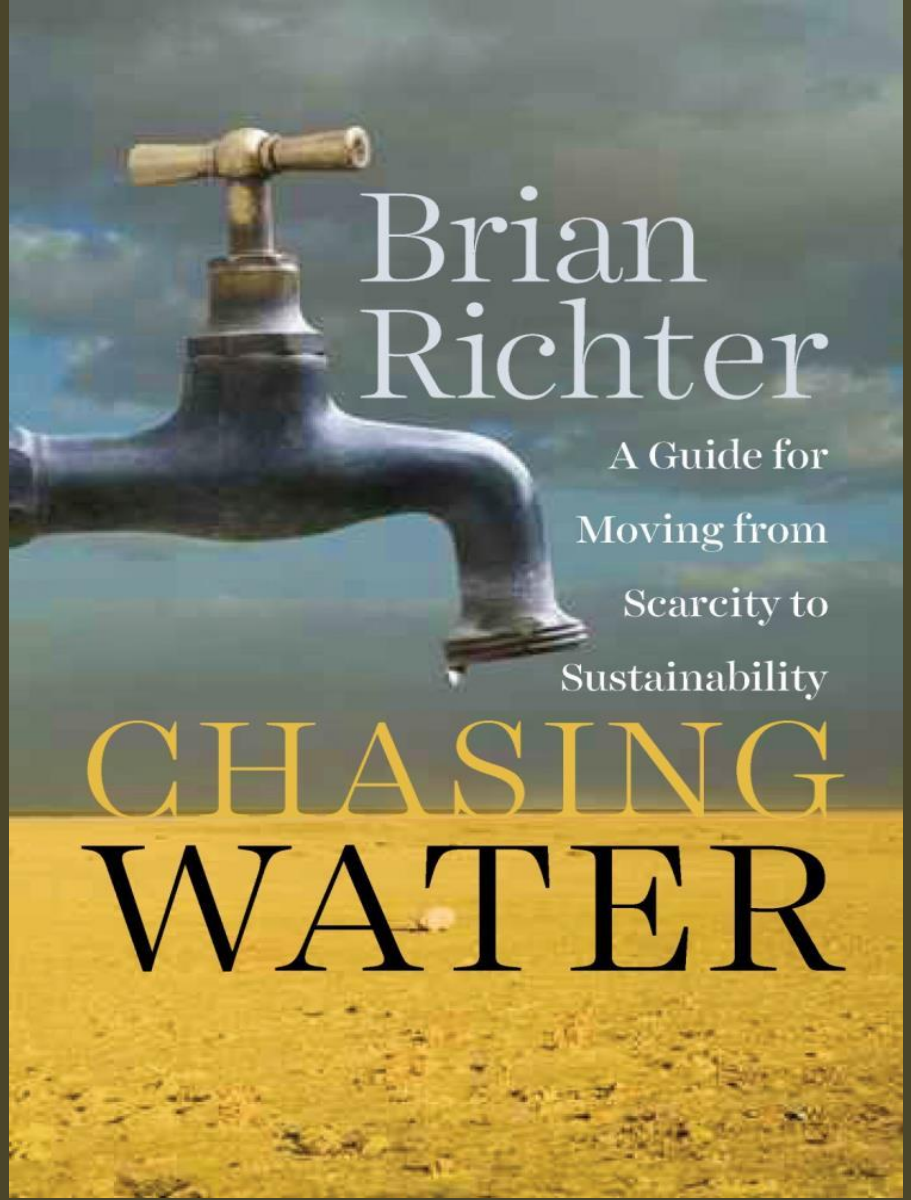
Sorghum

Saving water by crop shifting
54-87% savings in consumptive use

"Opportunities for Saving and Reallocating Agricultural Water to Alleviate Water Scarcity"
(*Water Policy*, Richter et al, 2017)

Temporary rotational fallowing with cover crop
95-100% savings in consumptive use

“Opportunities for Saving and Reallocating Agricultural Water to Alleviate Water Scarcity”
(*Water Policy*, Richter et al, 2017)


Brian
Richter
A Guide for
Moving from
Scarcity to
Sustainability
CHASING
WATER