



Presentation from
**2016 World Water
Week in Stockholm**

www.worldwaterweek.org

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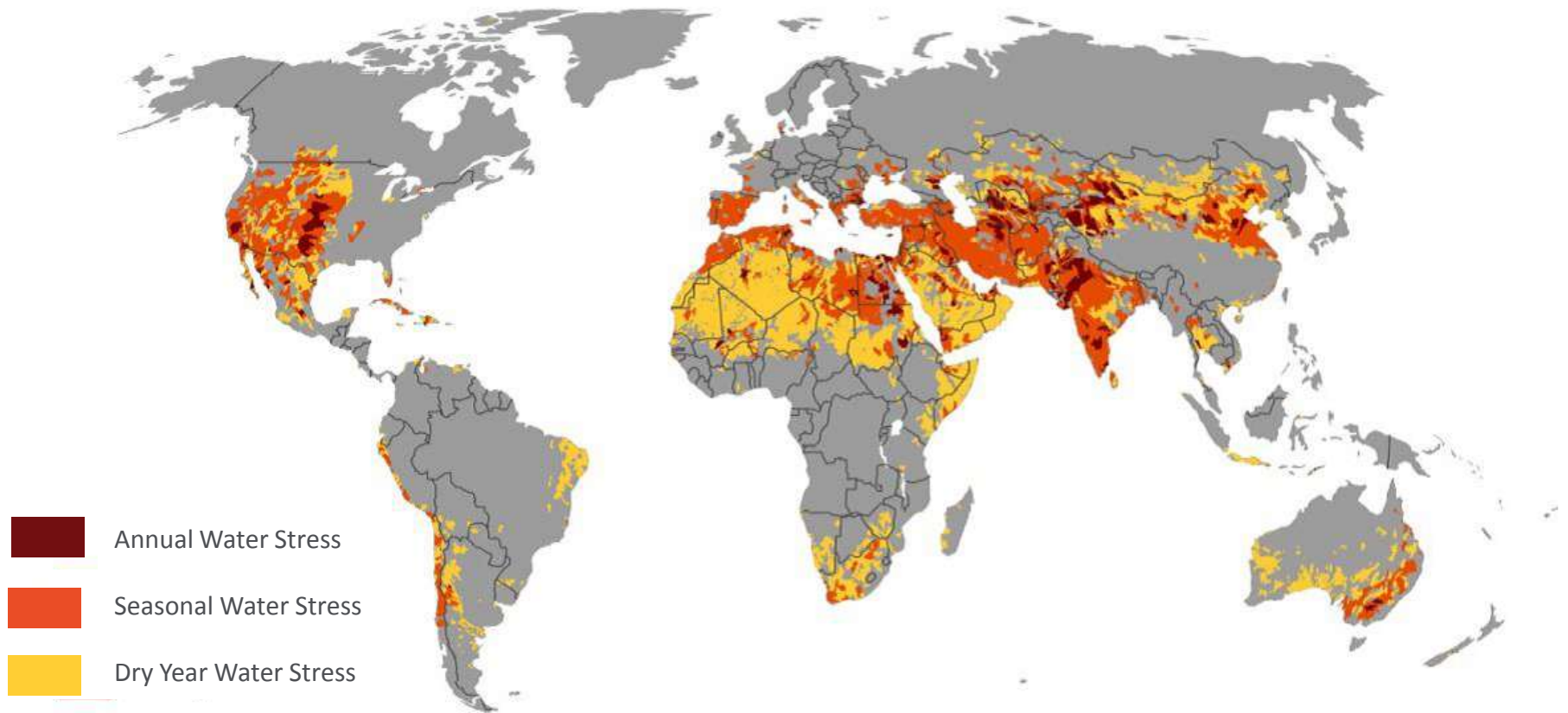
Managing Green Water for Resilience



FRESH WATER AND FOOD SECURITY

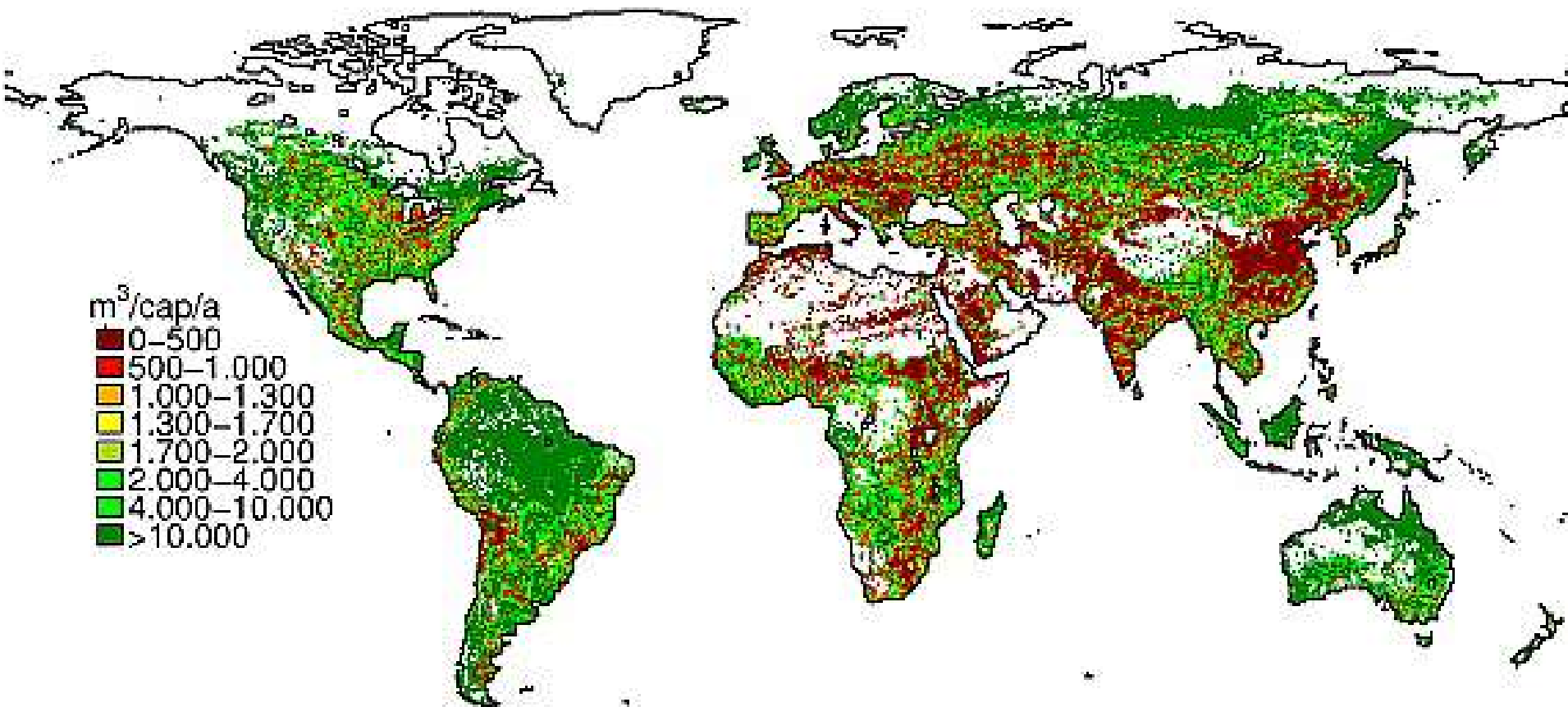
MANAGING FOR RESILIENCE

1/3 of humanity lives under blue water stress



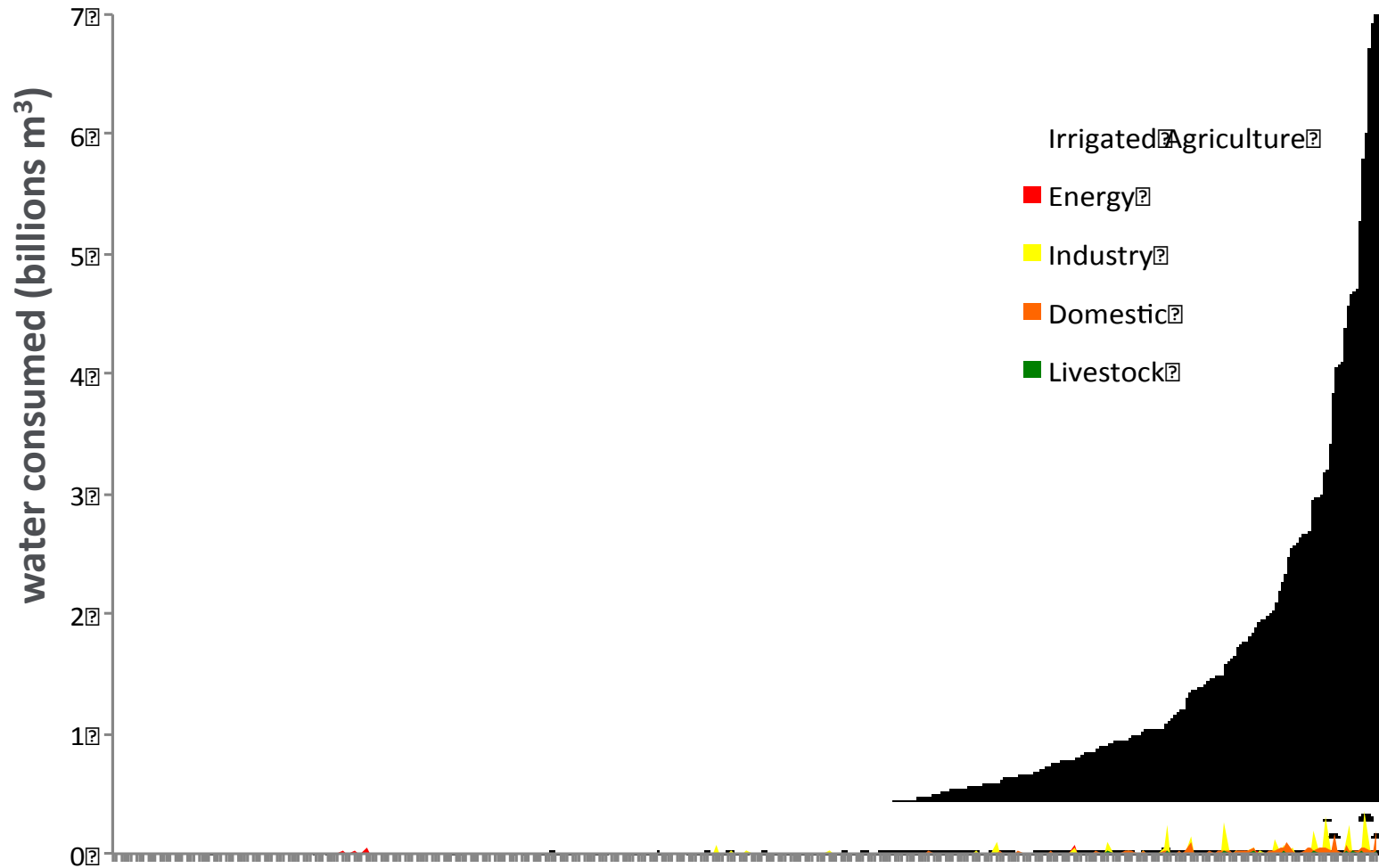
Brauman et al. 2016. Elementa: Science of the Anthropocene 4(1)

blue water availability for agriculture



Rockström et al. 2009. *Water Resources Research* 45(7)

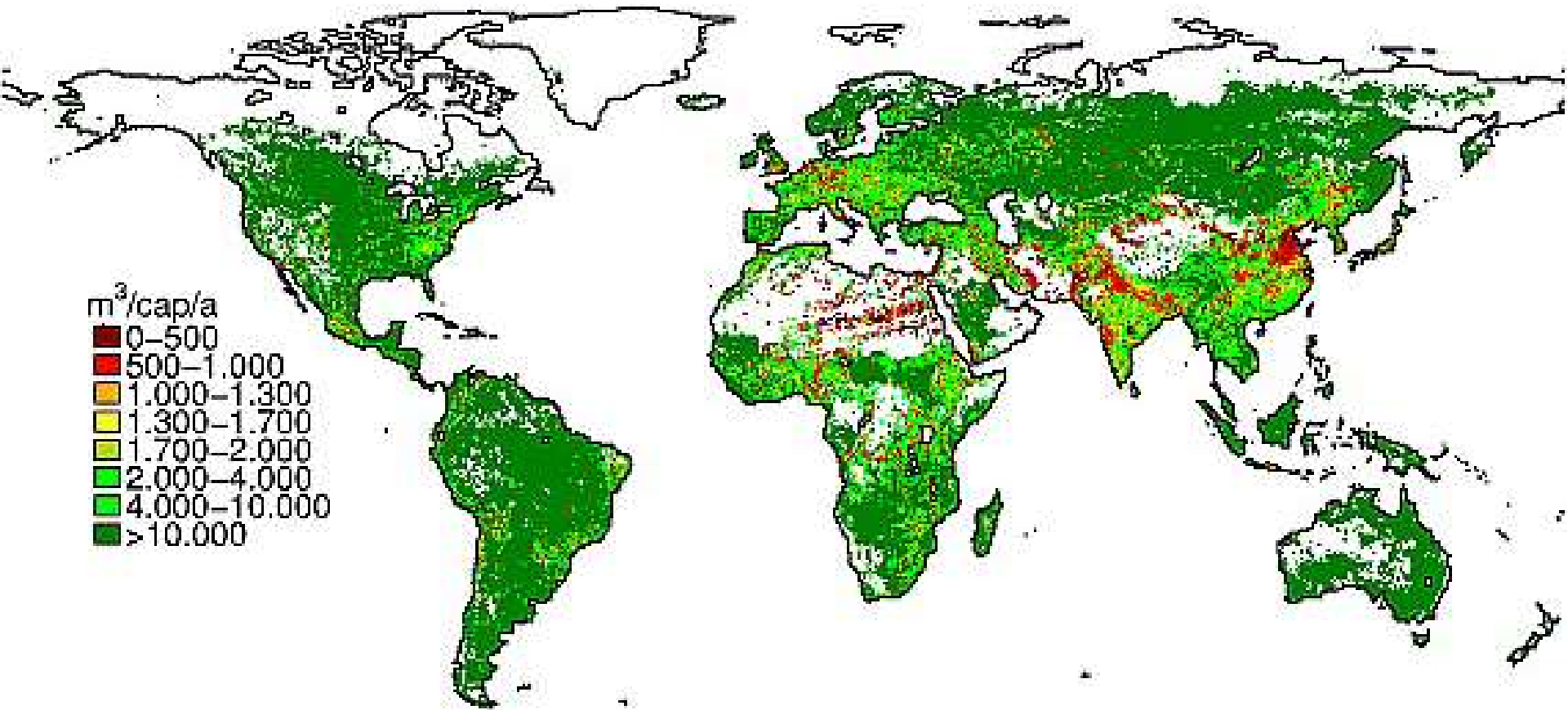
“market failure”: irrigated agricultural water use



327 most water-stressed basins globally by level of consumption

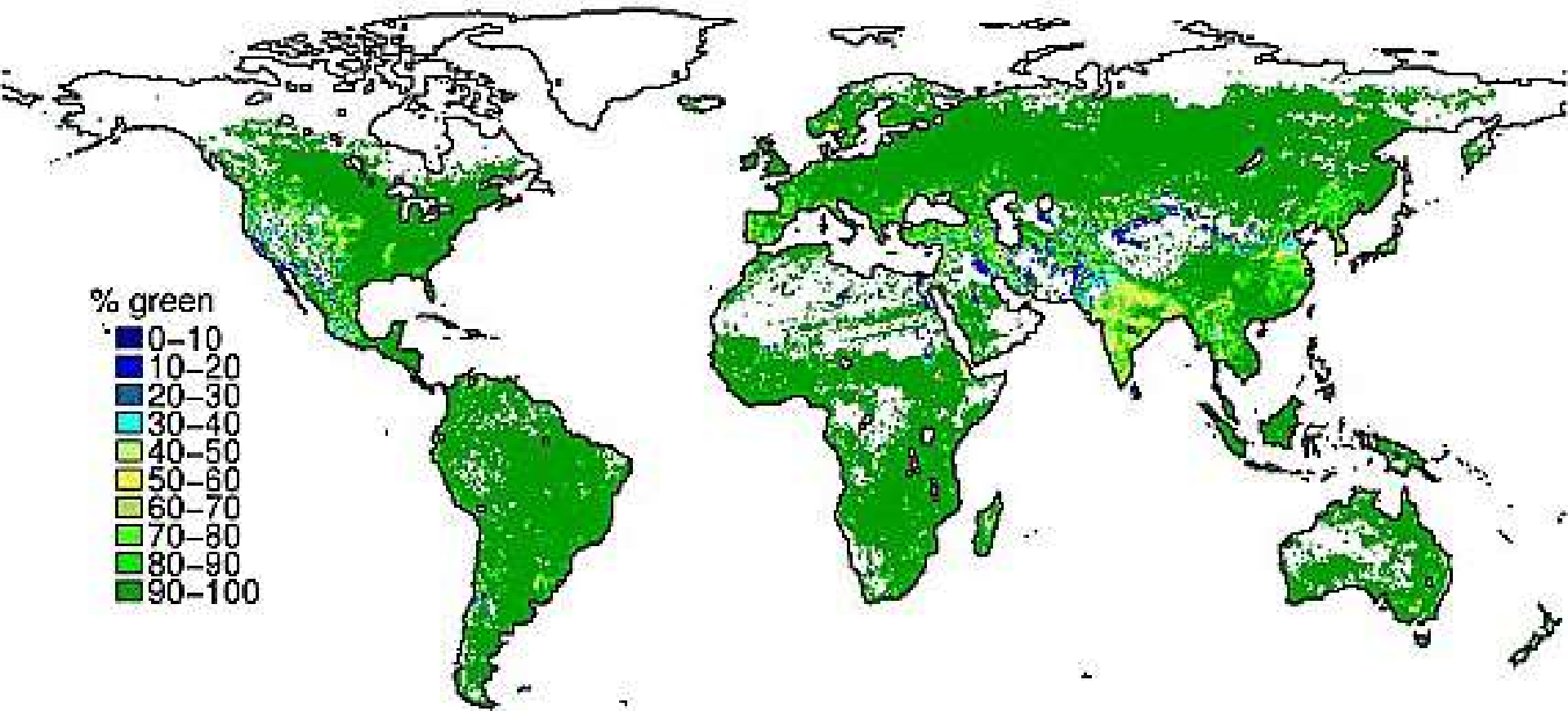
derived from Brauman et al. 2016.

blue + green water availability for agriculture



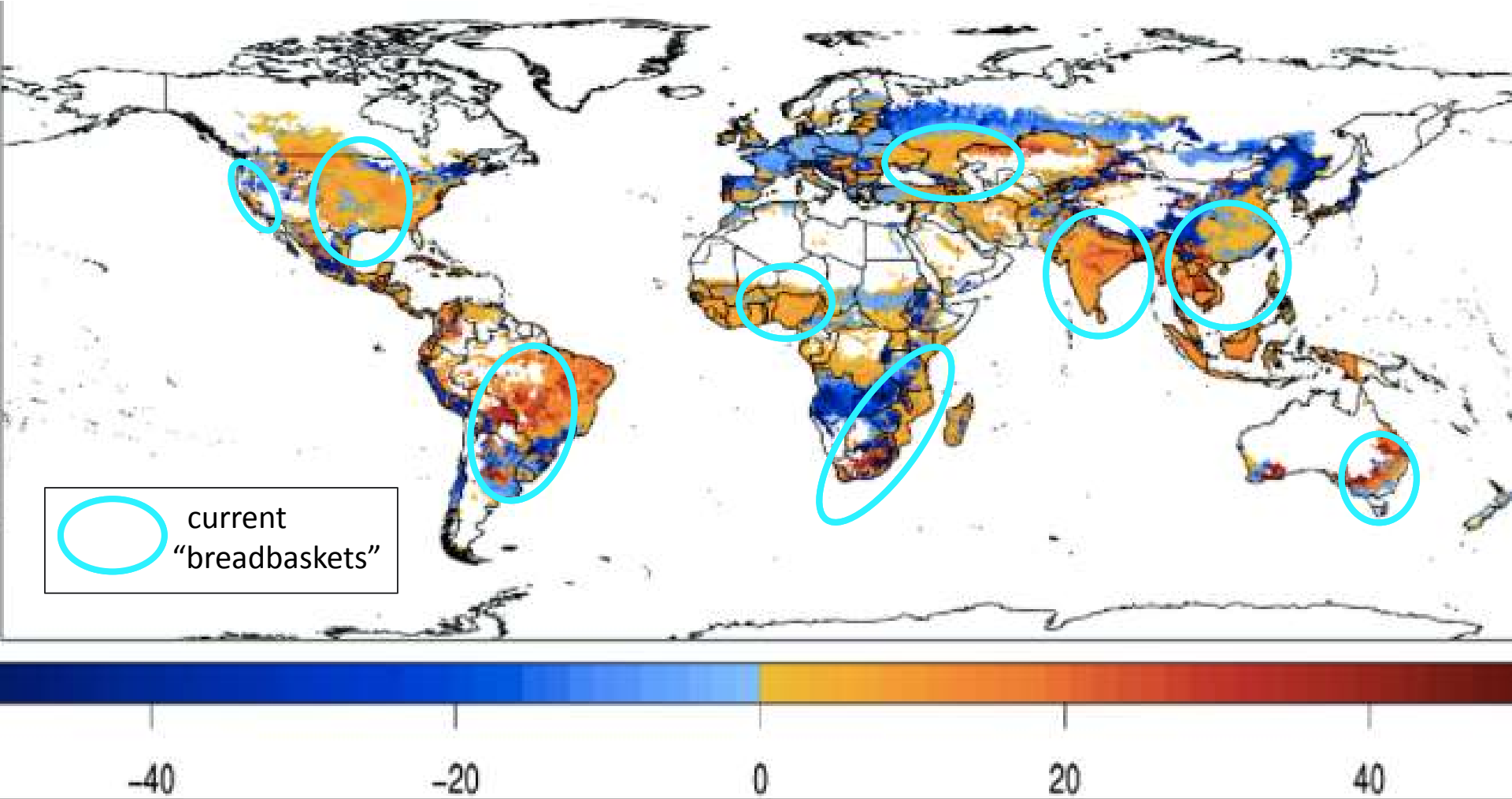
Rockström et al. 2009. *Water Resources Research* 45(7)

green water % of total agricultural water use



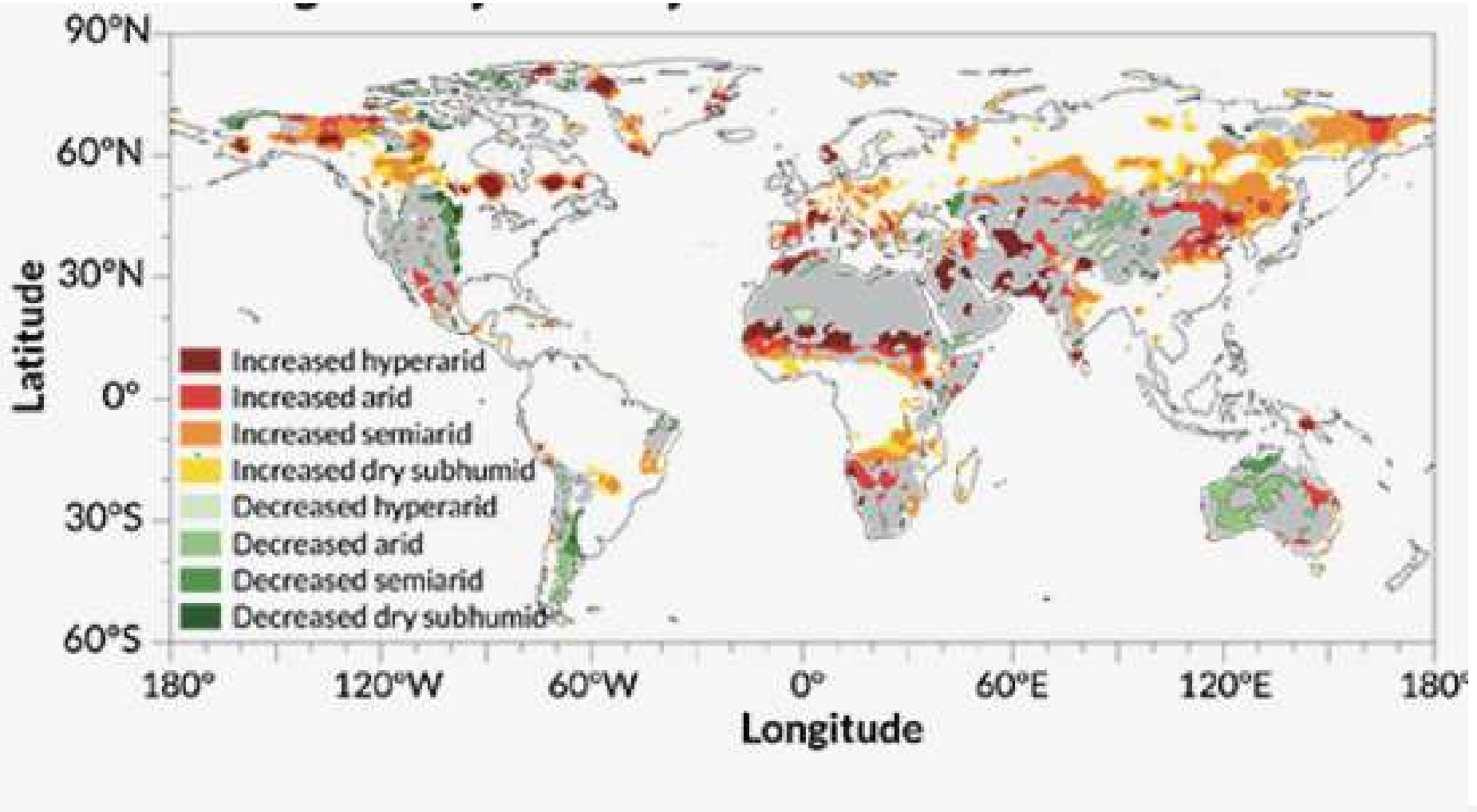
Rockström et al. 2009. Water Resources Research 45(7)

climate driven change in agricultural water needs (by the 2080s)

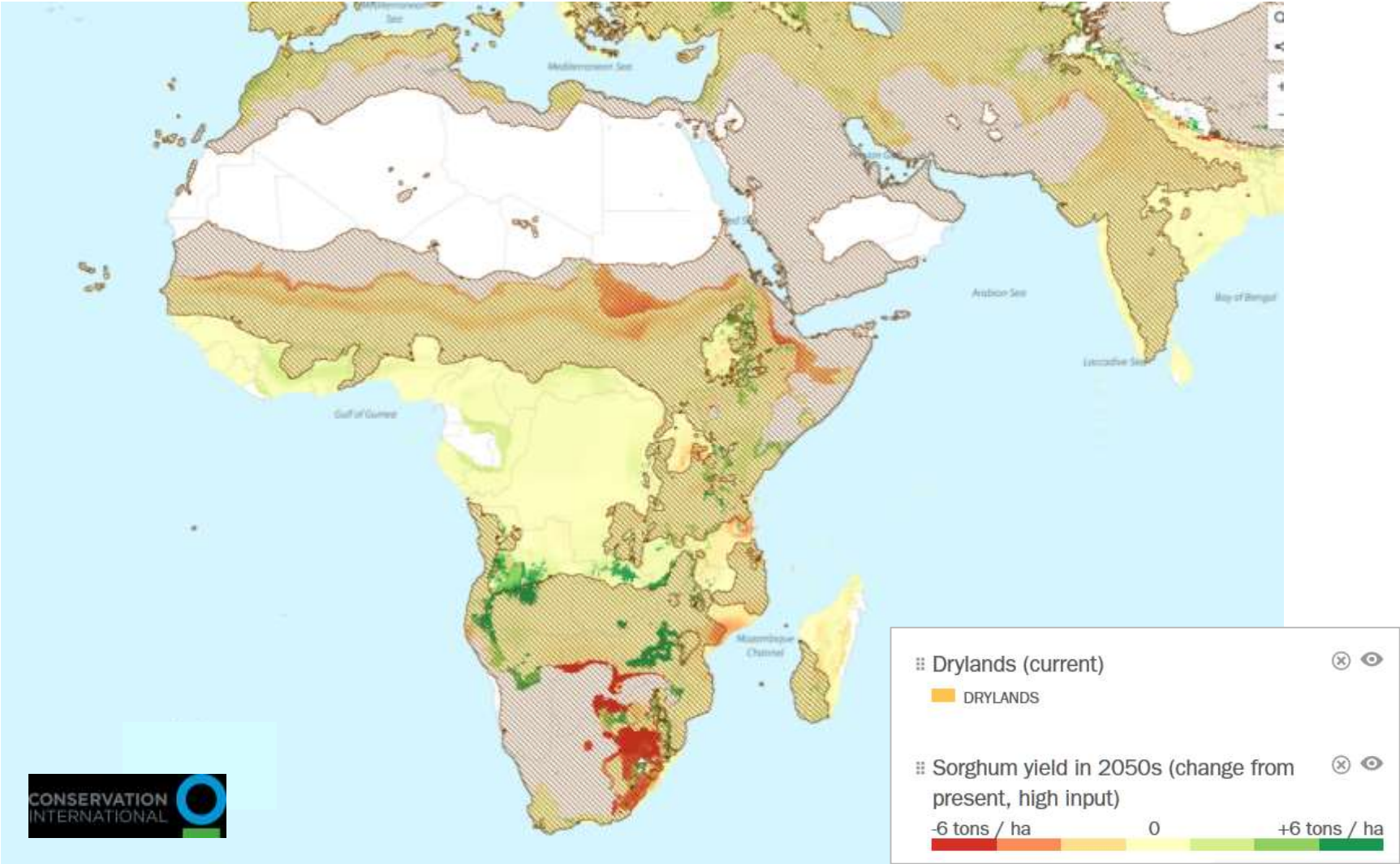


Gerten et al. 2011. J. Hydrometeorology 12(5)

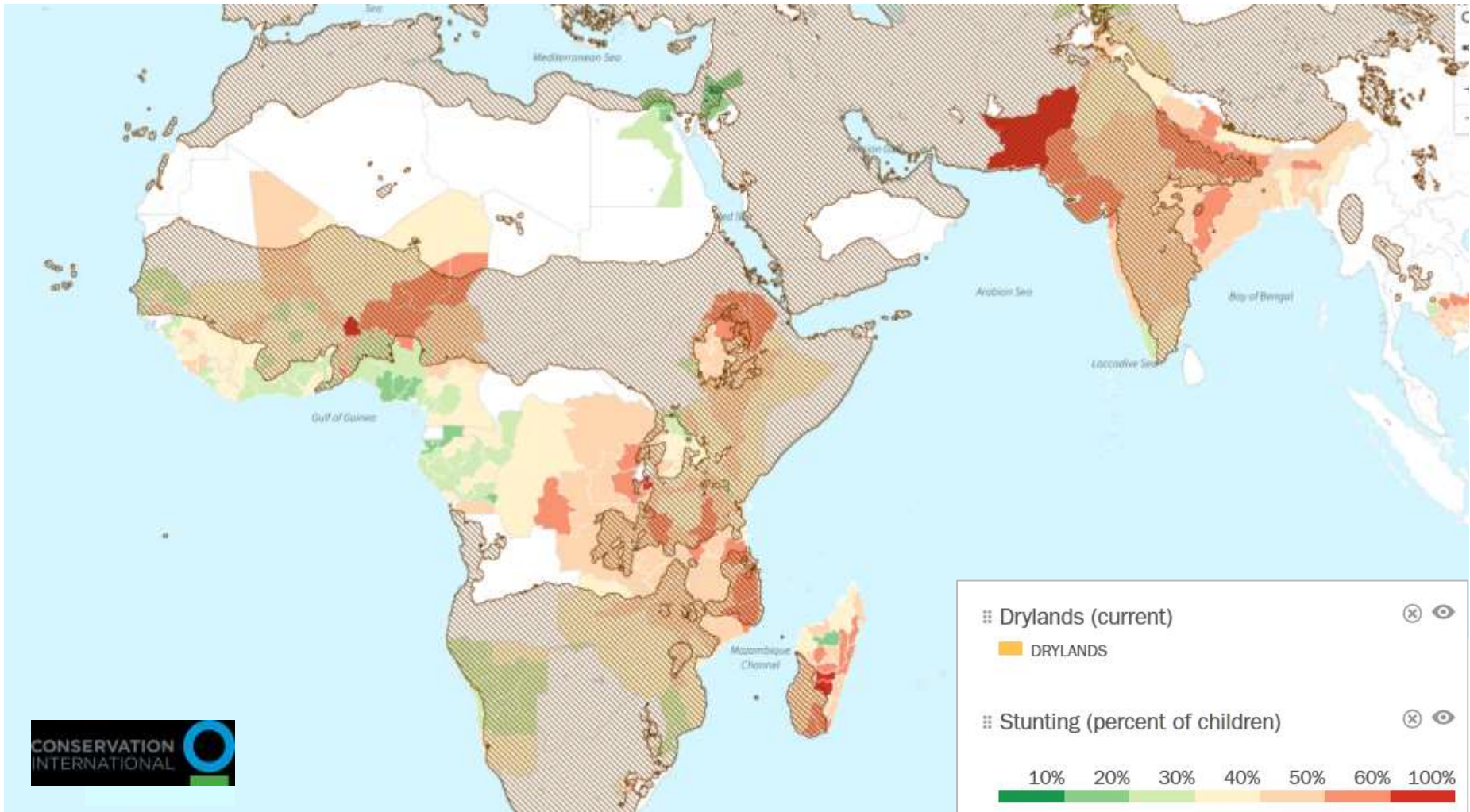
dryland expansion under climate and land use change



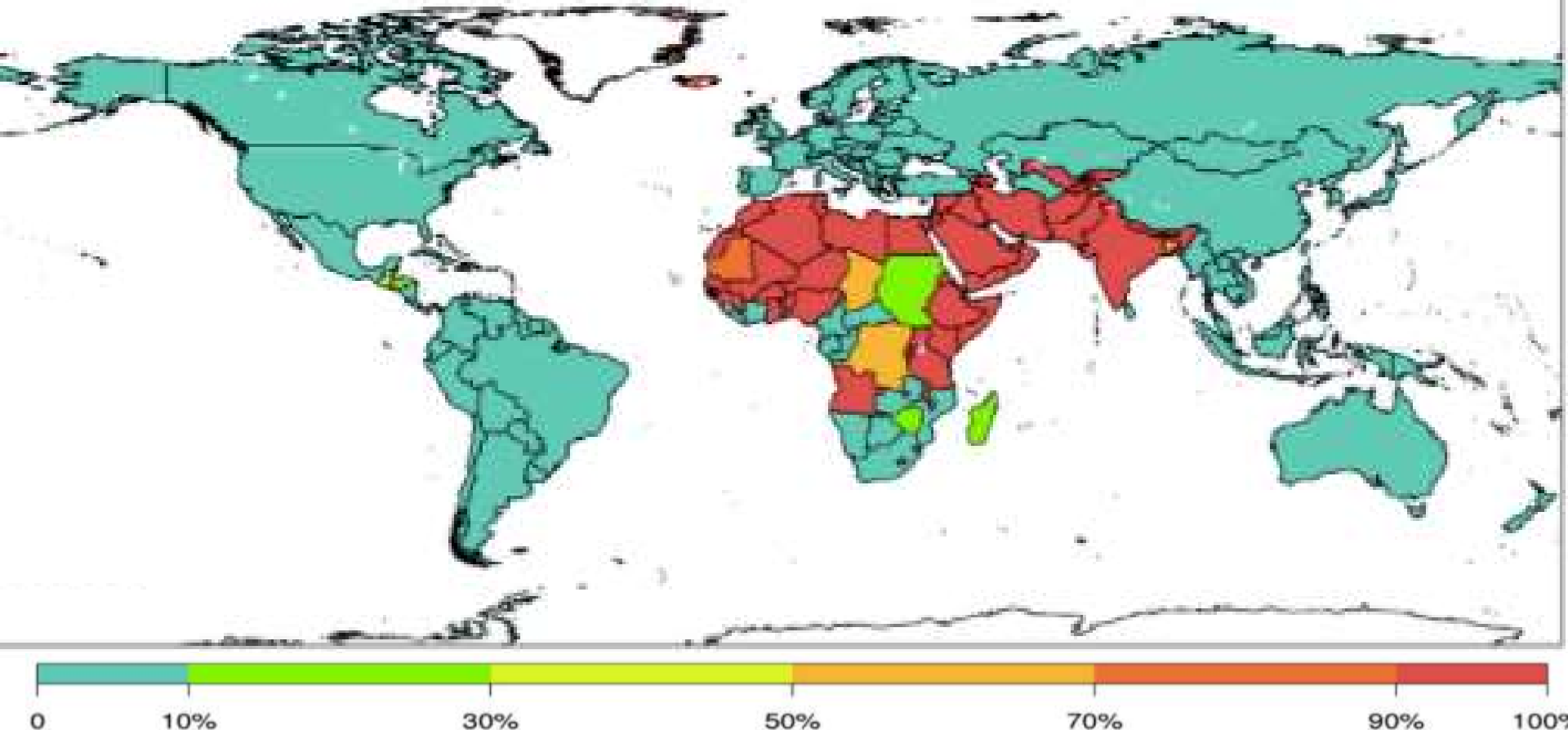
food insecurity, e.g. Δ sorghum yields in 2050s



projected health impacts (stunting)

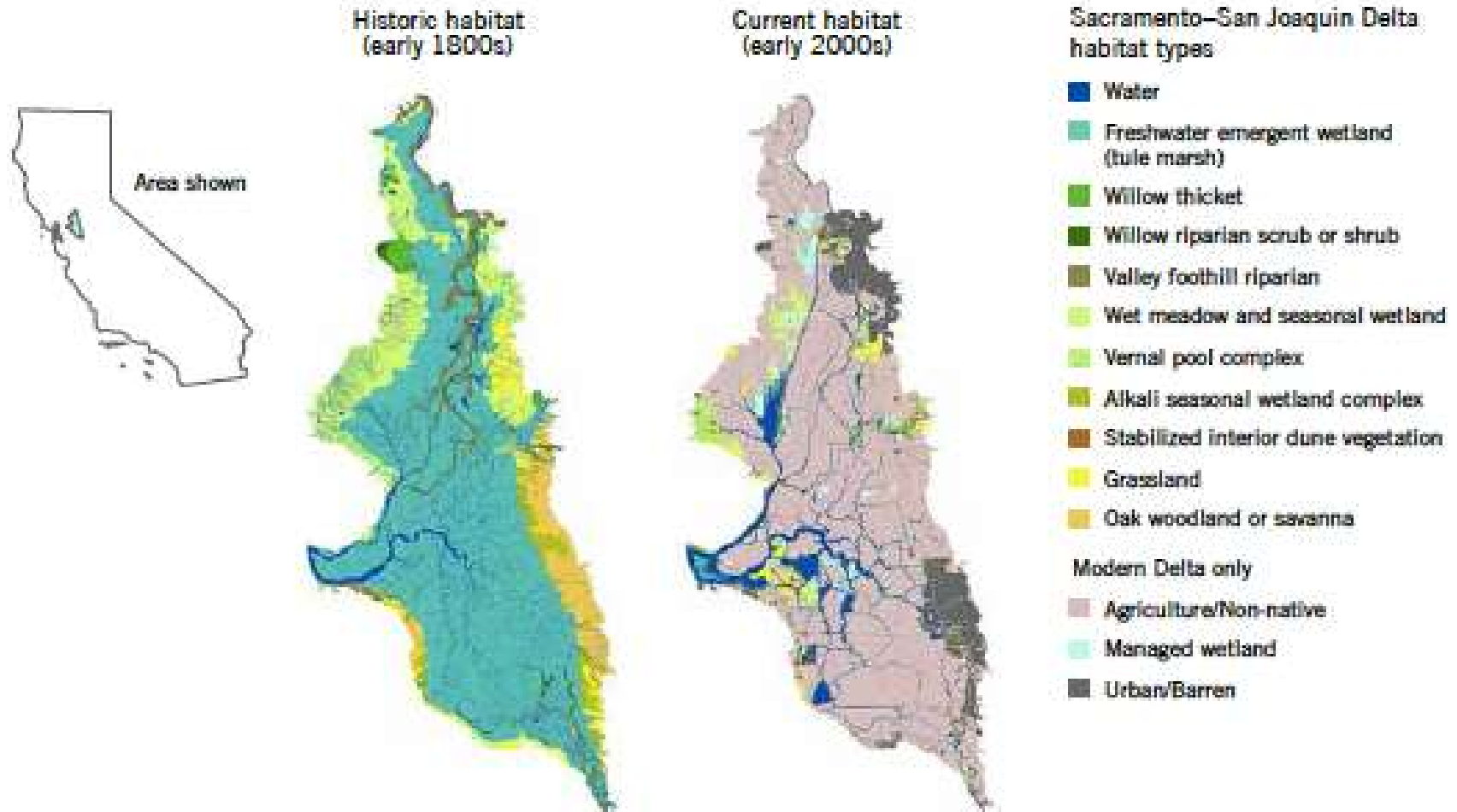


likelihood of water scarcity by the 2080s under climate and population change

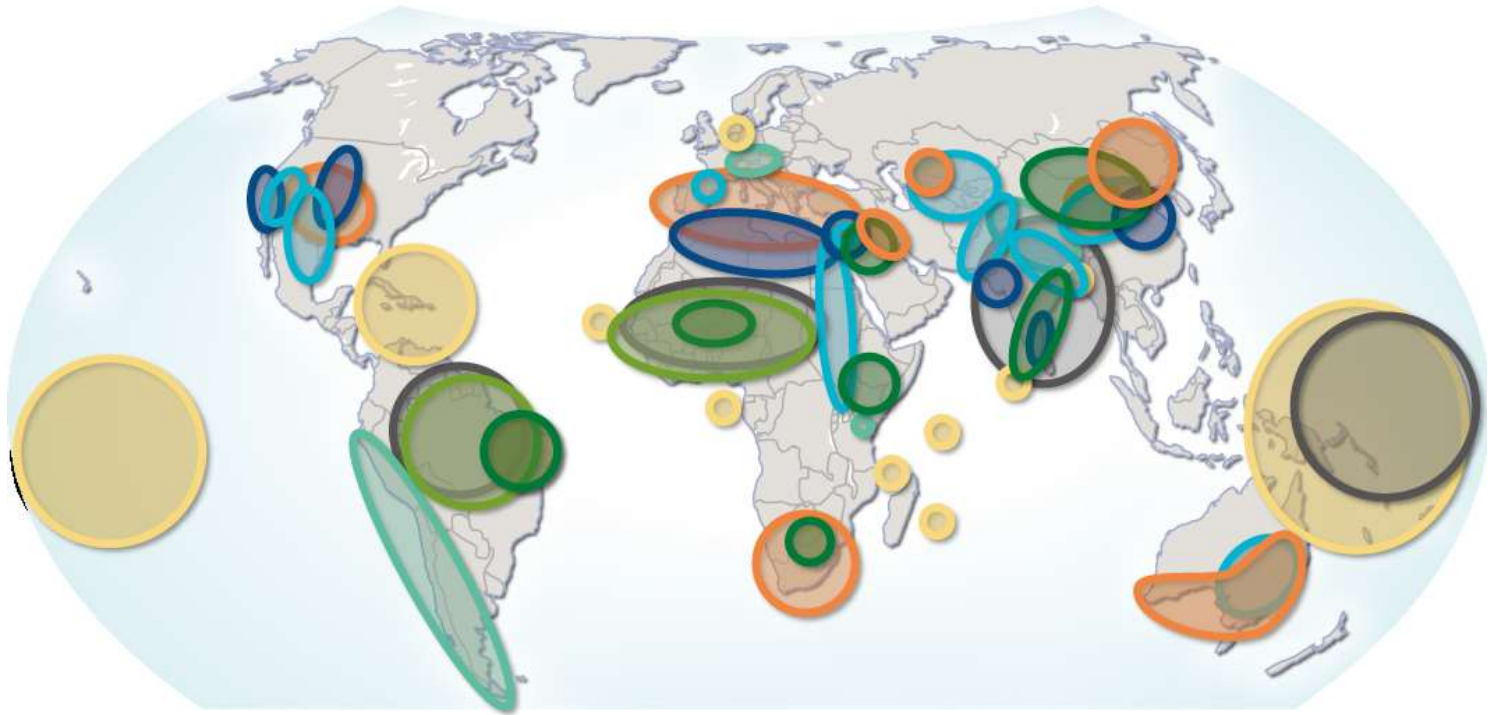


Gerten et al. 2011. J. Hydrometeorology 12(5)

agriculture transforms natural ecosystems and their blue & green water services



tipping points in the Earth system



Water related possible tipping points

- Deforestation moisture feedback
- Land mismanagement (e.g. soil loss, land degradation)
- Salinisation
- Glacier melt
- Groundwater collapse
- River basin closure/river depletion
- Regional processes
- Sea level rise and salt water intrusion
- Drastic rainfall regime change

GREEN WATER AND FOOD SECURITY

MANAGING FOR RESILIENCE

fresh water's central role in the biosphere

Water availability and variability influences the diversity and distribution of biomes and habitats that harbor the wealth of plant and animal life on Earth.



Water of specific quantity and quality is required to preserve the state and stability of ecosystems and enable their resilience to localized disturbance and to global change.

resilience

- **Resilience** is the capacity of individuals, communities and systems to *survive, adapt, and grow* in the face of stresses and shocks, *and to transform* when conditions require it.
- When key attributes of natural ecosystems are degraded, they are prone to disruption from shocks & stresses and to the collapse of key functions and ecosystem services.
- Social and economic systems are threatened: food, energy, health, livelihoods, social cohesion, peace
- **Social-ecological resilience** characterizes this delicate balance and interdependency of humans on nature.

characteristics of resilient systems



managing green water for resilience

Aware

- green water potential
- blue water stocks and flows
- maximize green water “vapor shift” from evaporation to transpiration

managing green water for resilience

Diverse

- water sources
- crops
- native biota
- livelihoods



managing green water for resilience

Integrated

- basin-scale management of water and land use
- optimize rain-fed + irrigated agriculture
- landscape mosaics

managing green water for resilience

Self-regulating

- green-blue optimization
- maintain environmental flows
- social & economic safety nets



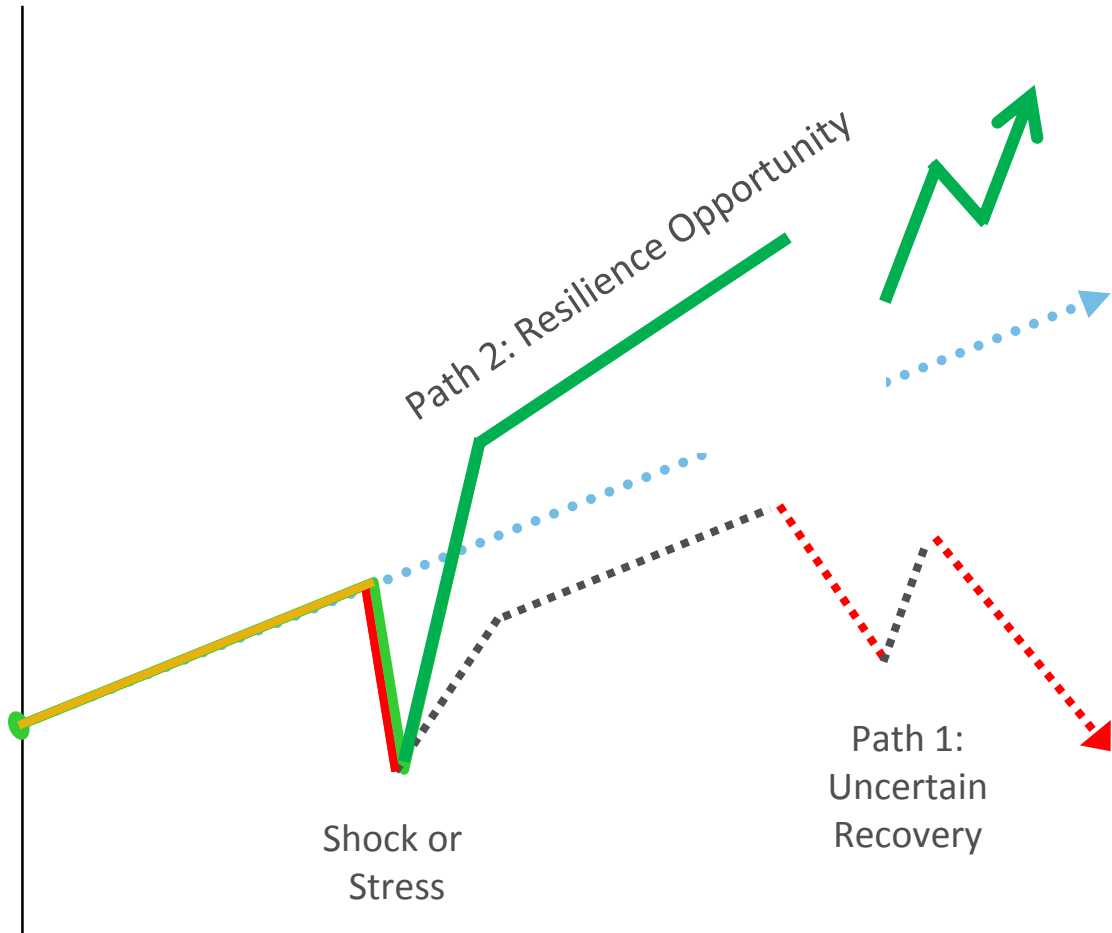
managing green water for resilience

Adaptive

- improved technology
- enhanced efficiency
- crop switching
- **decouple** food & energy production from water constraints



the resilience dividend



Shocks and stresses can reveal opportunities for systems to evolve and to transform

we can do this

