Vulnerable basins for global prioritisation: Hotspots for social and ecological impacts from freshwater stress and storage loss

EGU General Assembly
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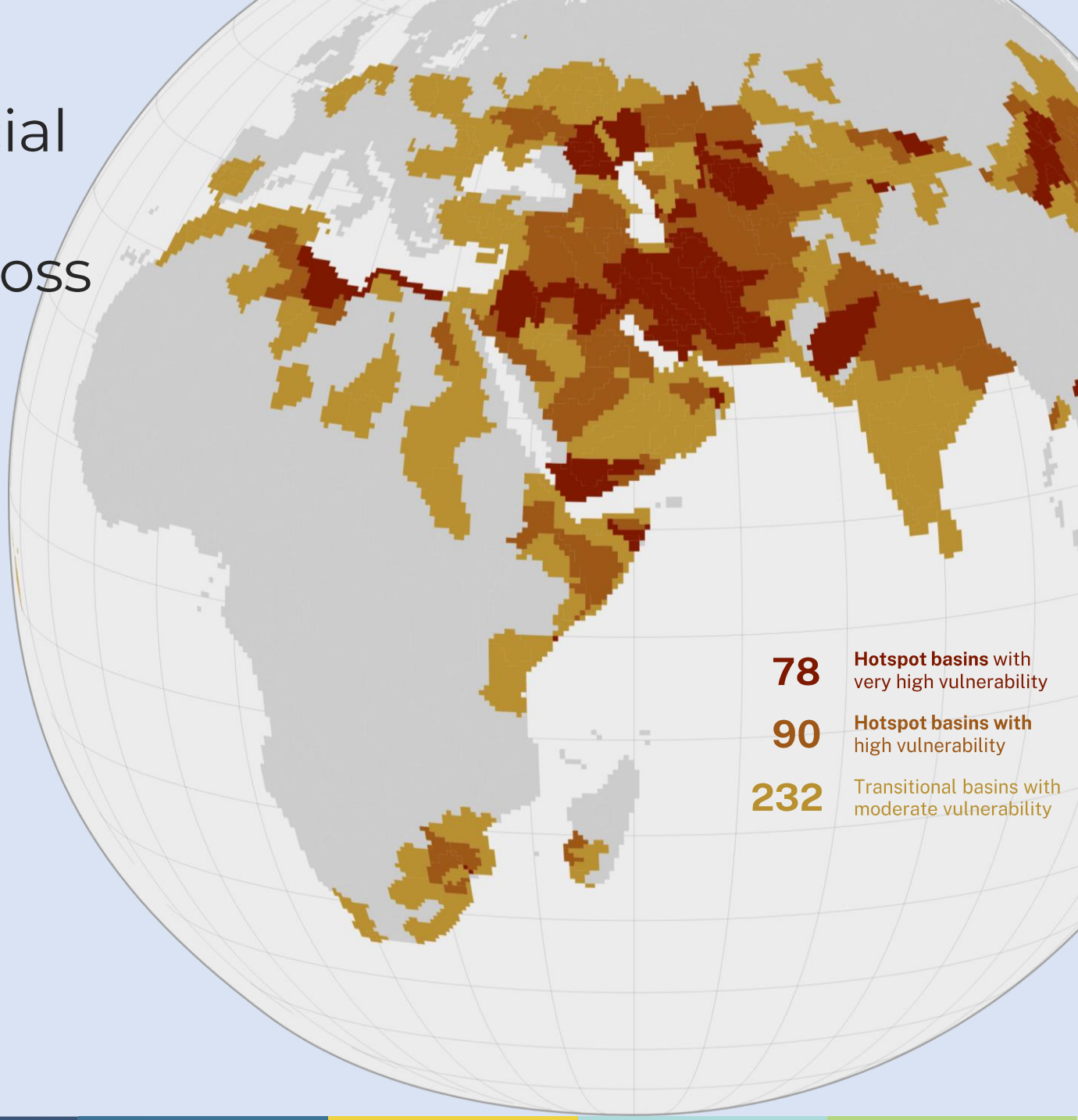
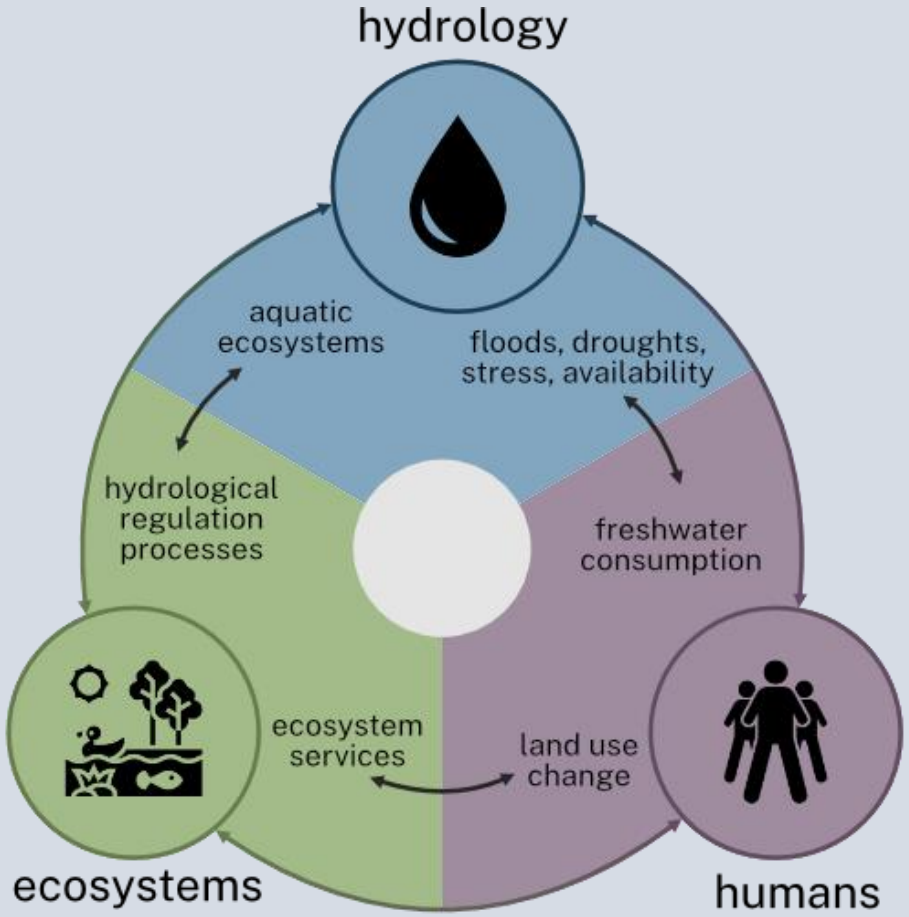
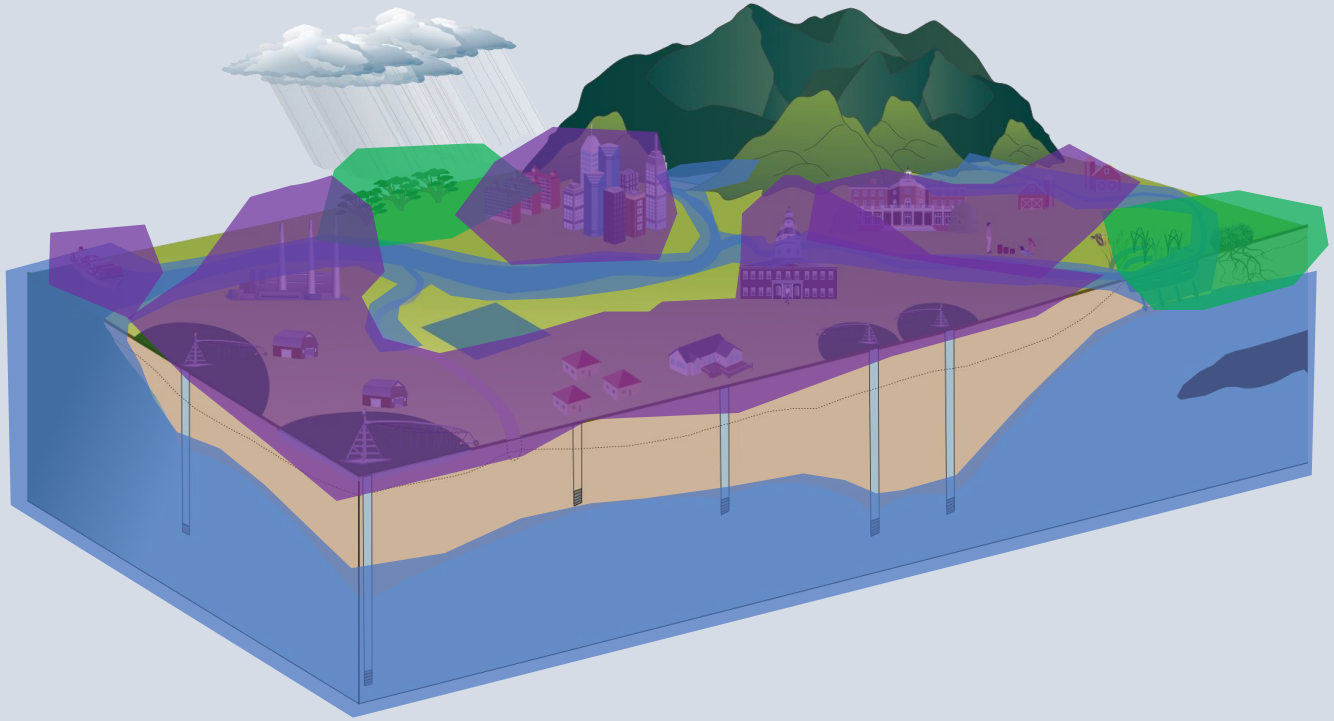
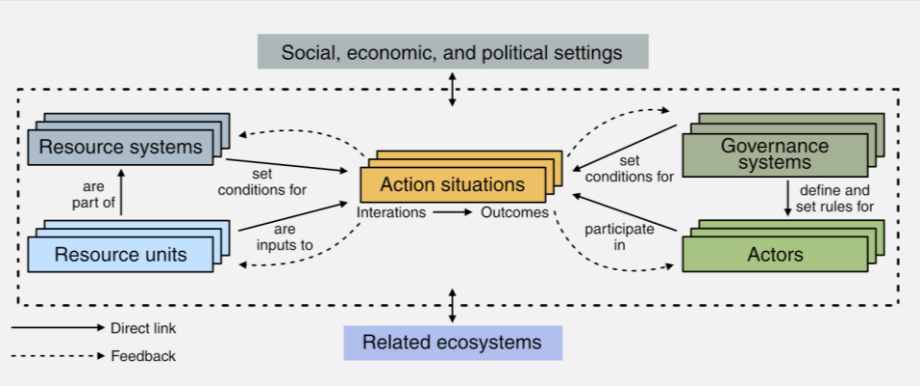


Humans, ecology, and hydrology: **three intertwined systems**

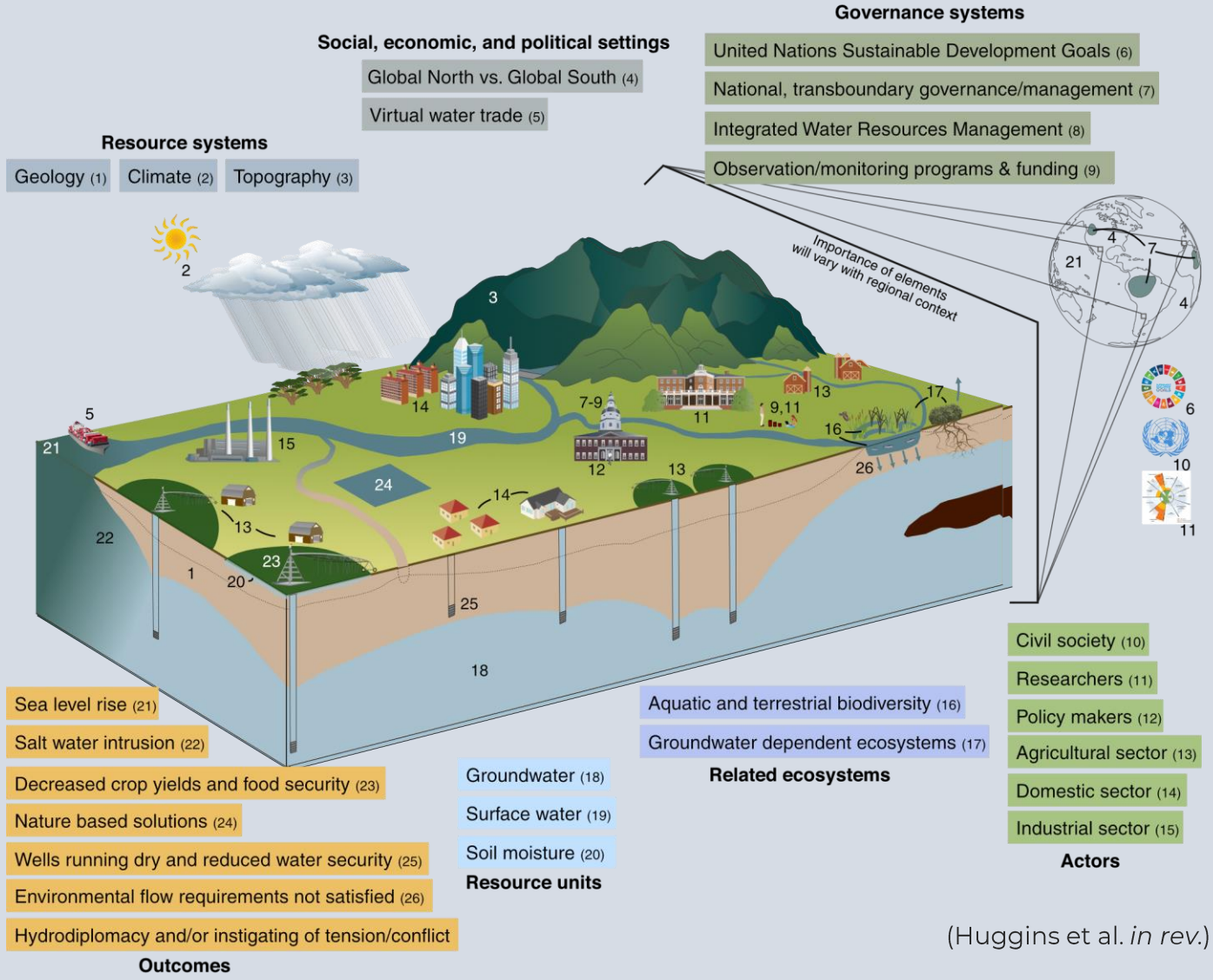




Freshwater is embedded in social-ecological systems

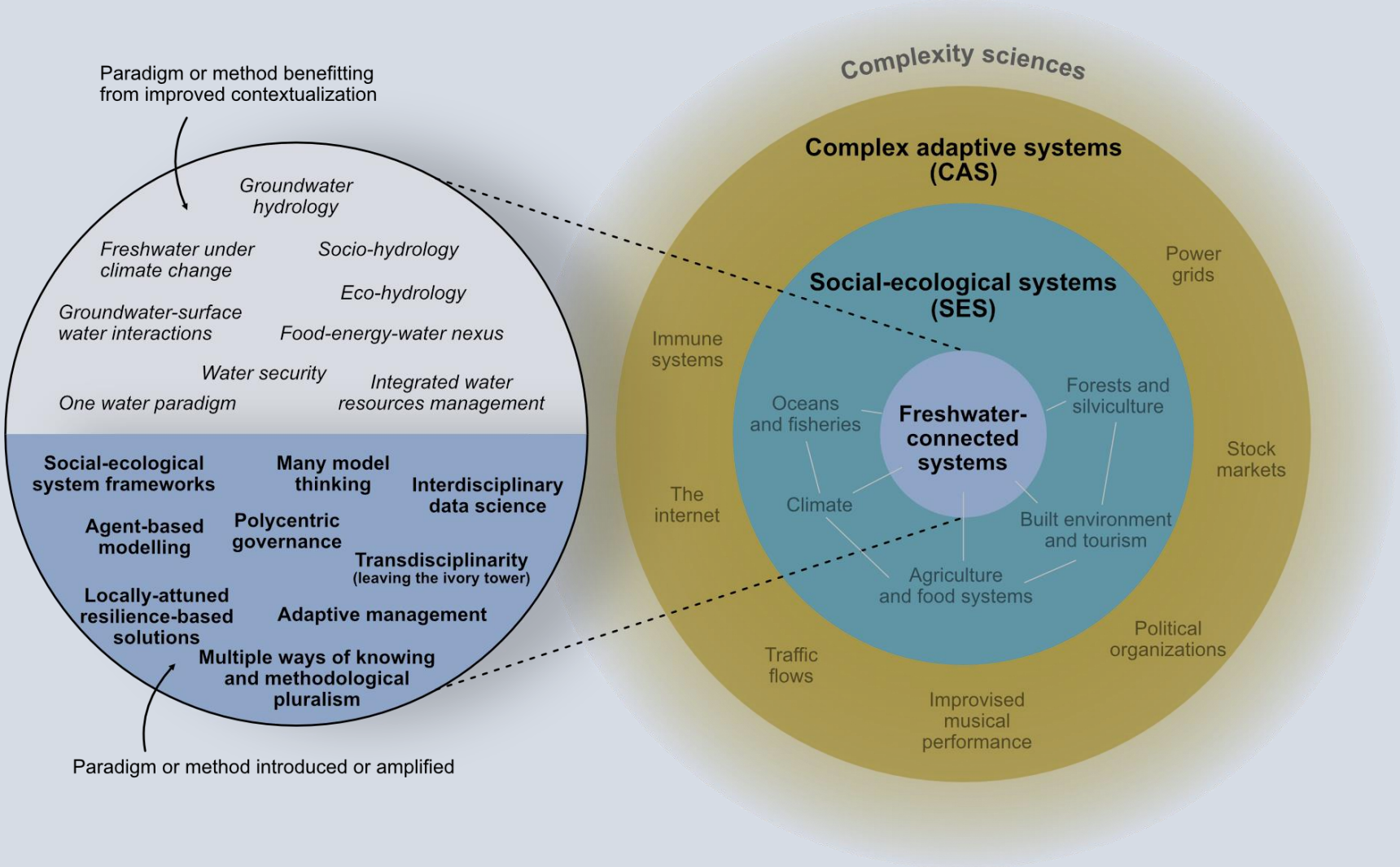


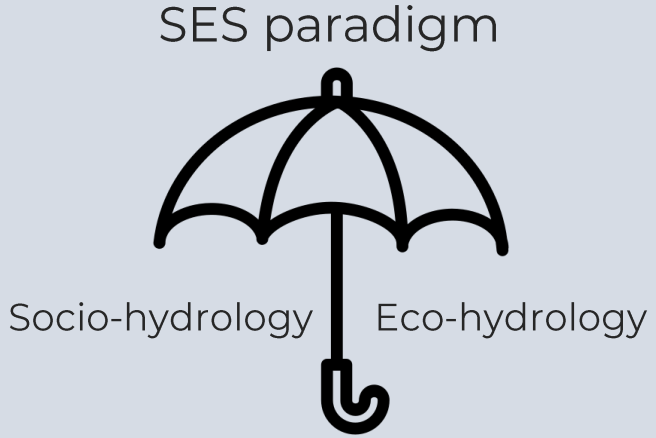
Interpreted for a freshwater-connected environment



(Huggins et al. *in rev.*)

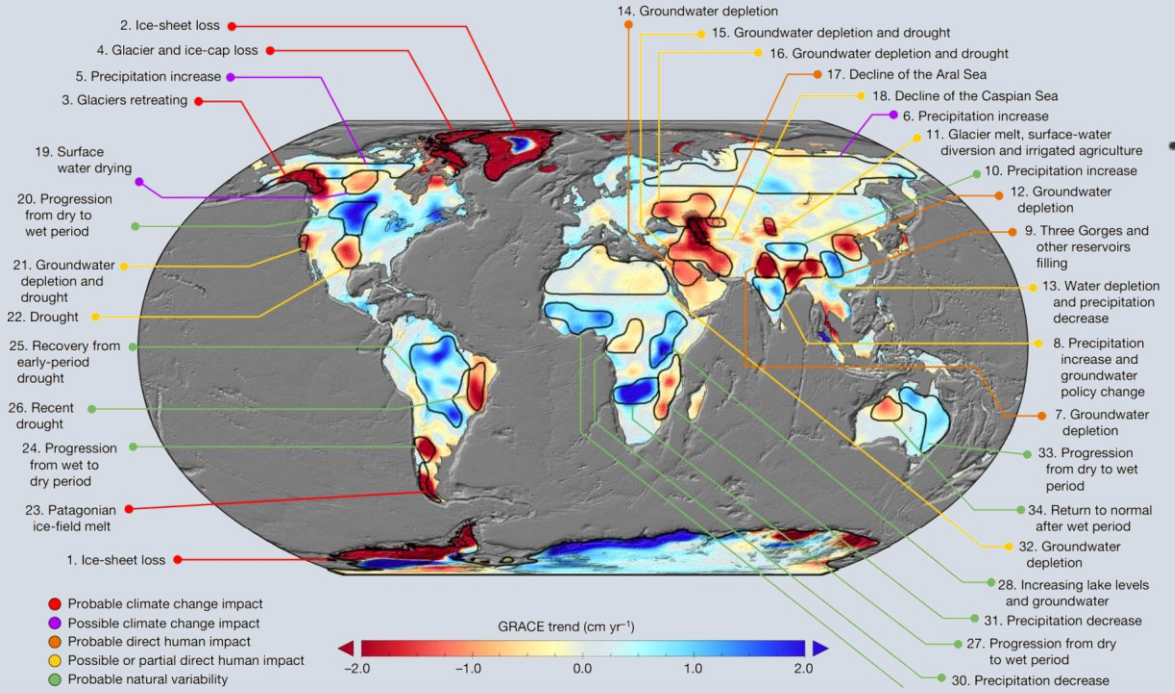
Embracing the SES perspective would benefit sustainability-oriented freshwater work in a number of ways



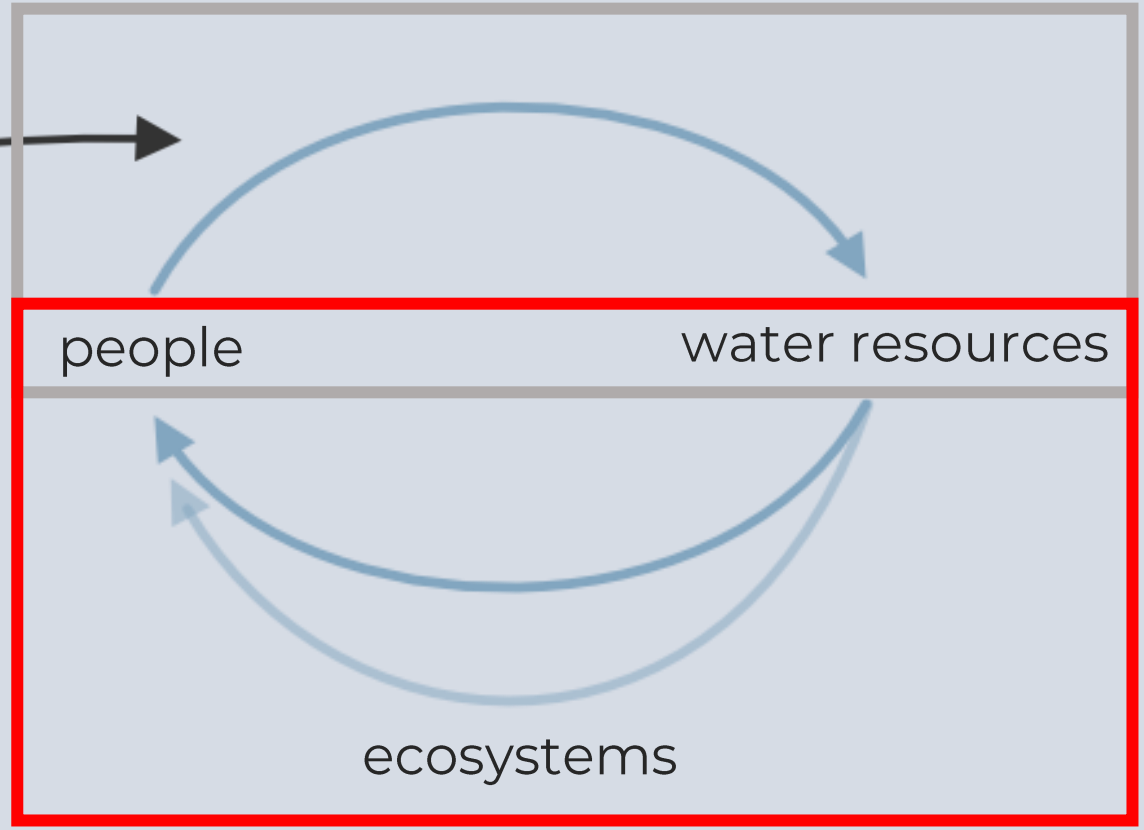


(Adapted from Huggins et al. *in rev.*)

Global hydrological change affects humans and ecosystems



(Rodell et al. 2018)

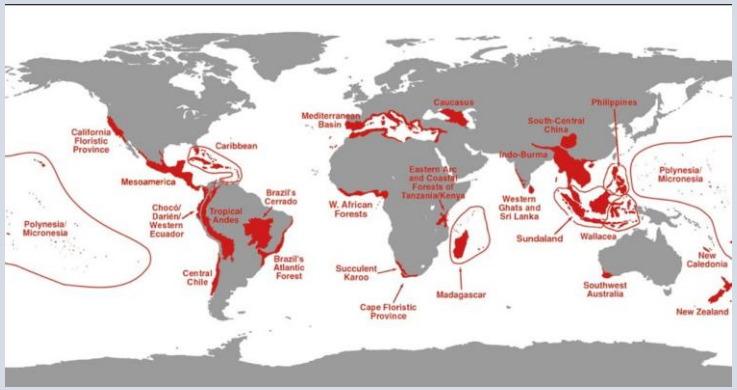


Clear human fingerprint on global water resources

Adapting the **hotspots** concept from conservation biogeography

Interpreted through the lenses of:

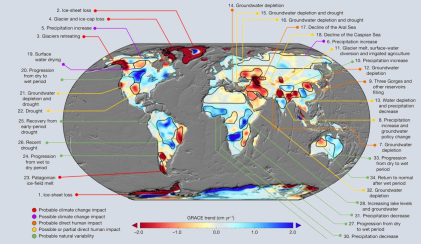
Biodiversity hotspots
(Myers et al. 2000)



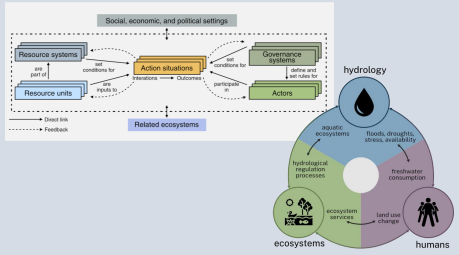
"maximize the number of species "saved" given available resources"

by asking:
"where are places rich in species and under threat?

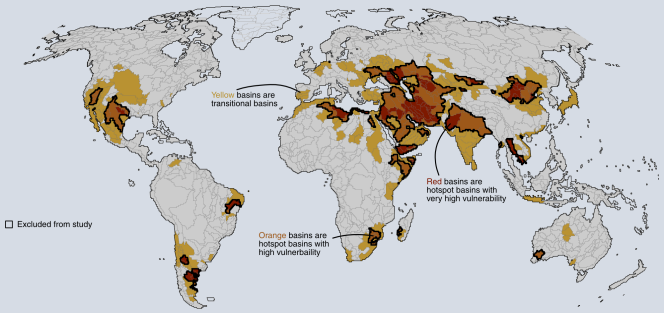
Global Hydrological change



Freshwater-in-SES paradigm



Hotspot basins for social and ecological impacts
(Huggins et al. 2022)



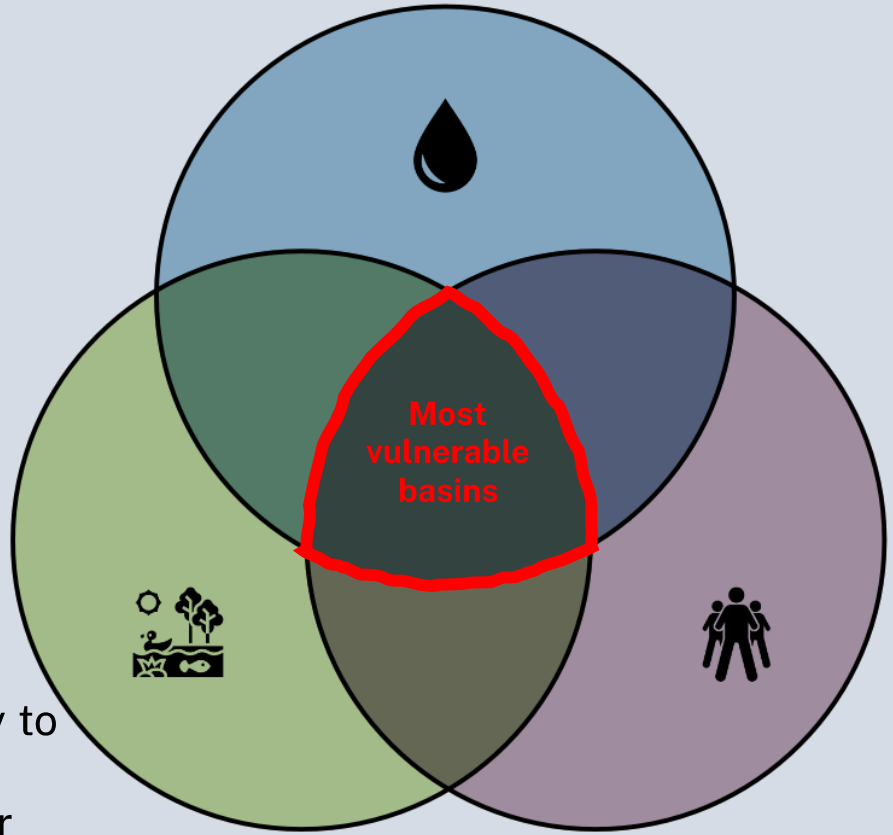
"minimize social and ecological impacts from freshwater stress and storage loss, given available resources"

by asking:
"what basins with sensitive ecosystems and limited social adaptive capacity are exposed to freshwater stress and storage loss?

Vulnerability as framework to consider **impacts**

"Vulnerability is the degree to which a system, subsystem, or system component is **likely to experience harm** due to **exposure to a hazard**, either a perturbation or stress/stressor" (Turner et al. 2003).

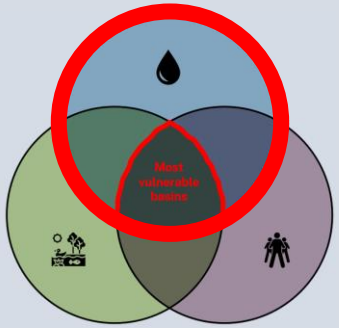
Exposure: to freshwater stress, storage loss

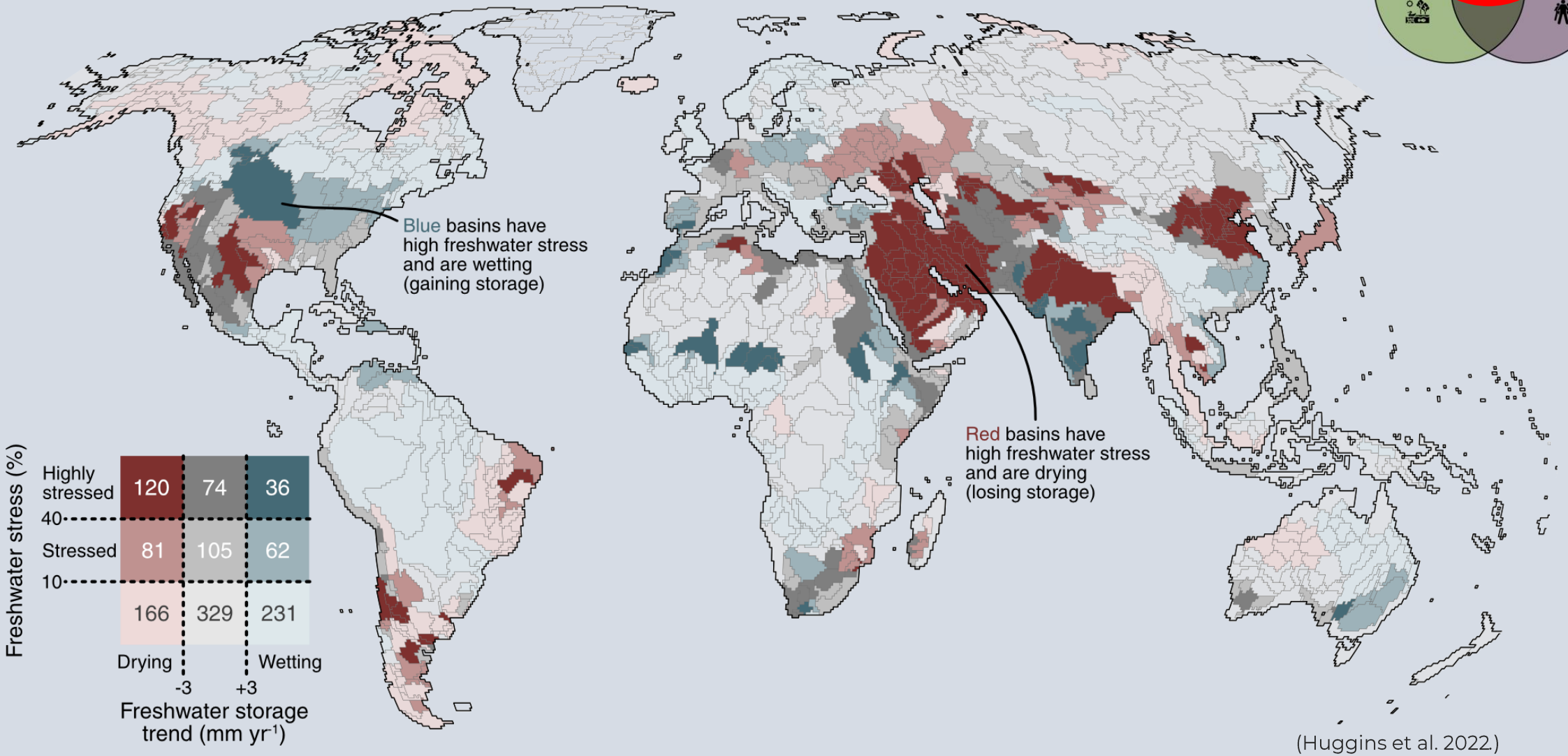


Ecological sensitivity
"relative indicator of ecological sensitivity to freshwater storage and use"
- Environmental flow sensitivity to groundwater head changes
- Vegetation sensitivity to water availability anomalies

Low social adaptive capacity
Adaptive capacity = "ability of social system to respond to disturbances"
- Strength of economy
- Good governance
- Human development

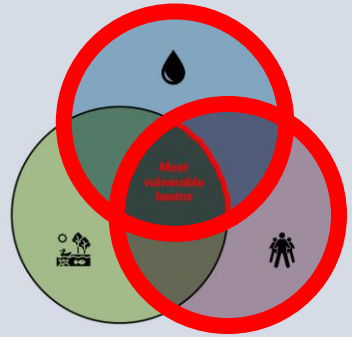
Co-occurrence of freshwater stress and storage loss

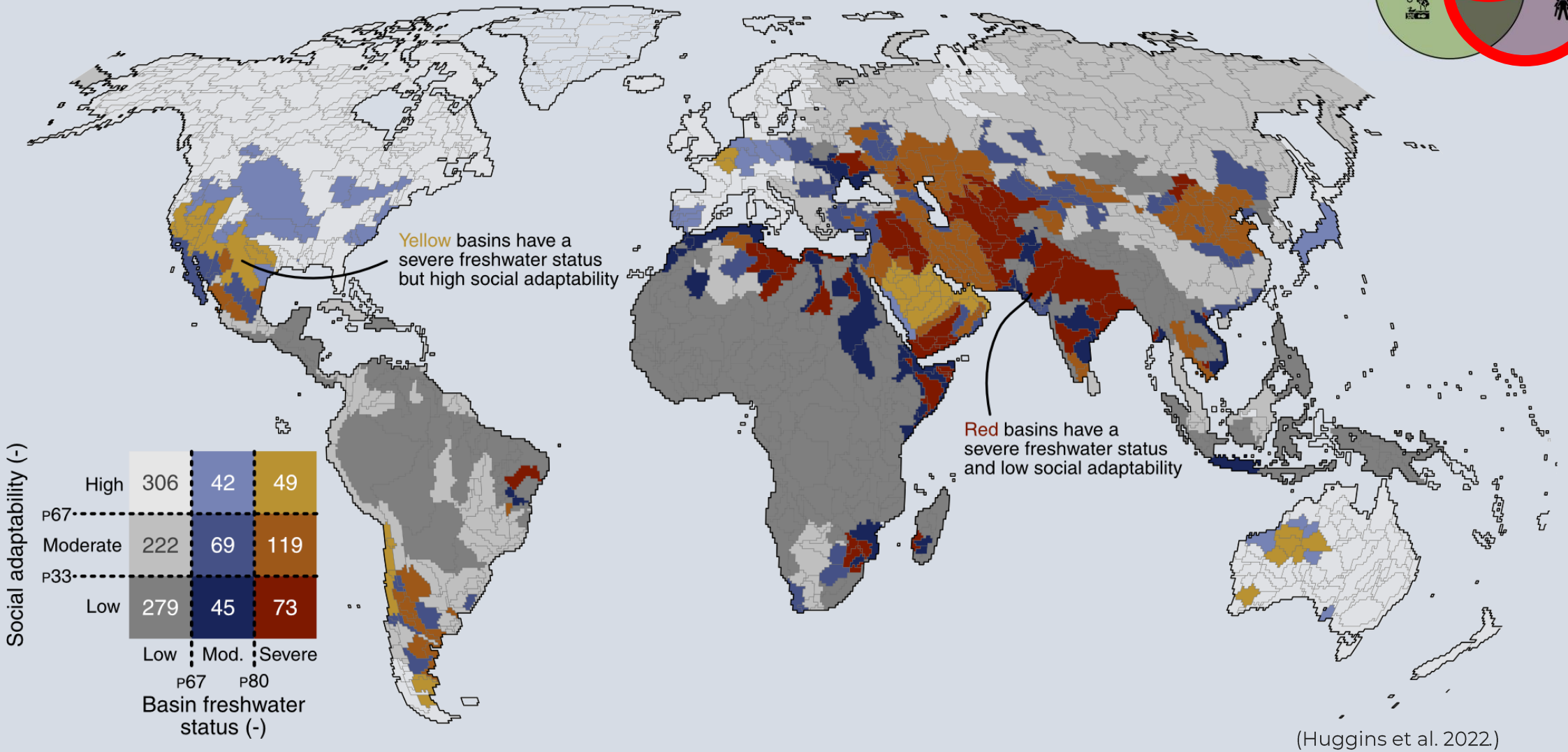




(Huggins et al. 2022.)

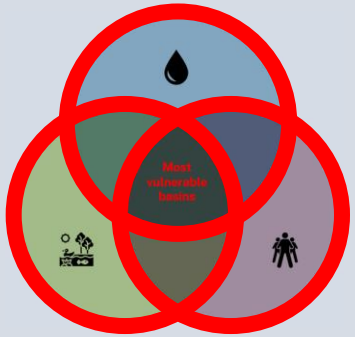
Adaptive capacity to consider social vulnerability

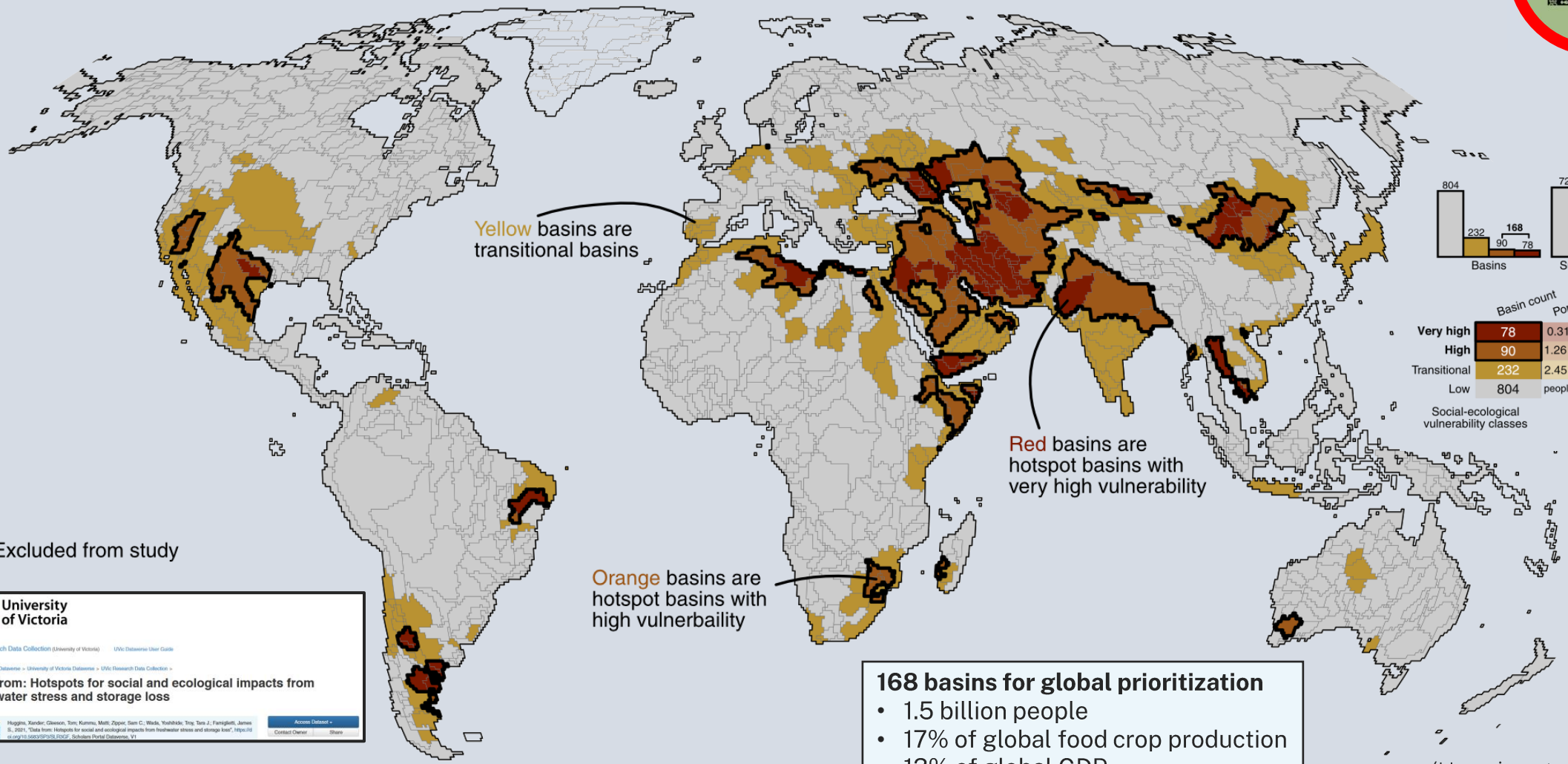


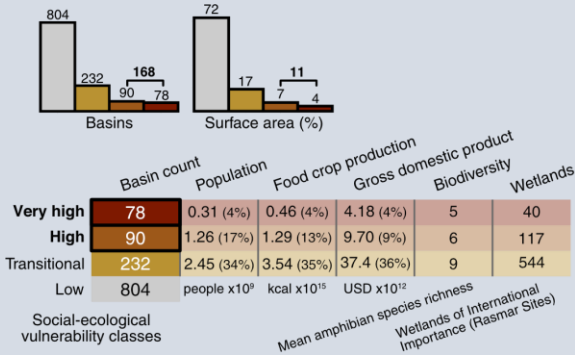


(Huggins et al. 2022.)

Hotspots for social and ecological impacts from freshwater stress and storage loss







Data are available for download on UVic's Dataverse

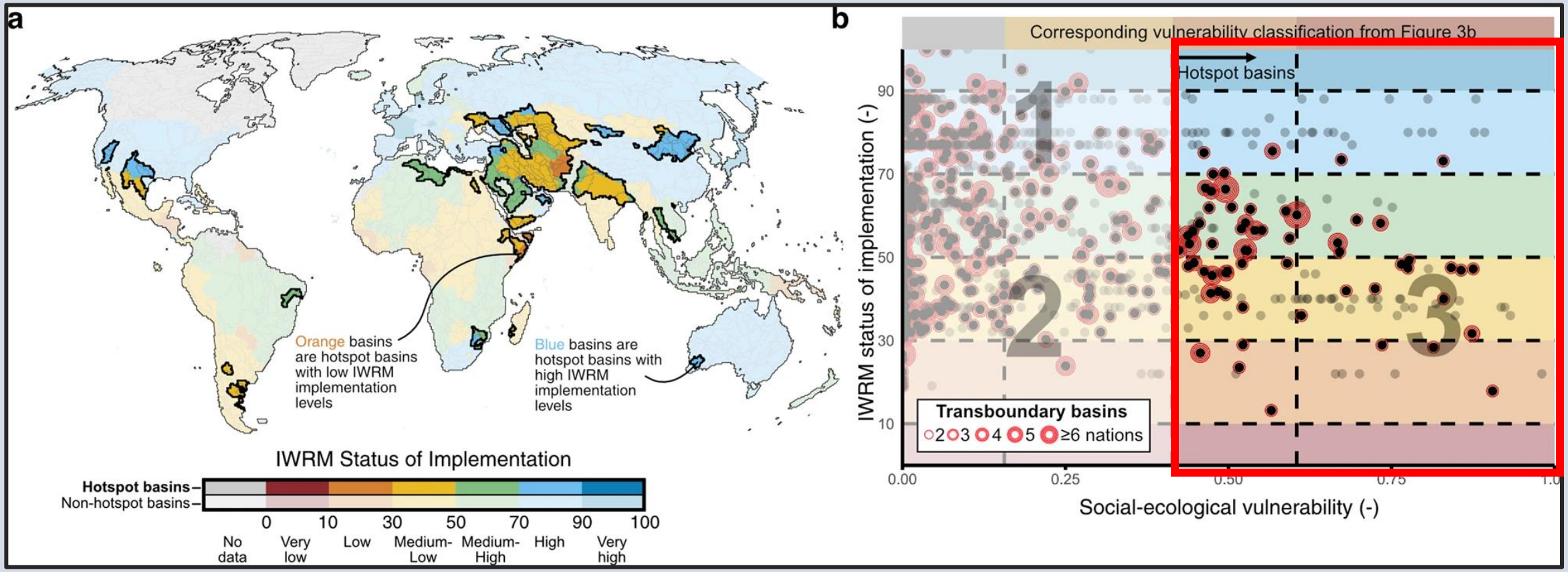
168 basins for global prioritization

- 1.5 billion people
- 17% of global food crop production
- 13% of global GDP
- 157 Ramsar Sites

(Huggins et al. 2022.)

IWRM is less implemented in transboundary hotspot basins

"coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems" (Hassing et al. 2009).



(Huggins et al. 2022.)

danke!

to the wonderful co-authors of the study:


Tom Gleeson


Matti Kummu


Sam Zipper


Yoshihide Wada


Tara Troy


Jay Famiglietti

and to the funding bodies/institutes of the work:

NSERC CRSNG

Global Institute for Water Security

UVIC

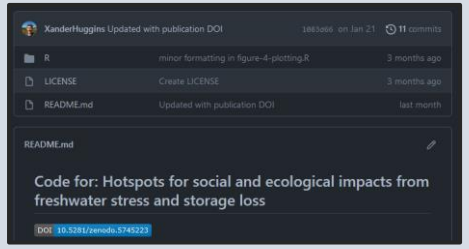
Interested?

Created by Saeful Muslim from the Noun Project

for more about the work...

1. Read the paper (open access!)

2. View/use the data



3. Use/modify the methodology

let's talk over coffee!

- How can these concepts be applied to other global freshwater trends with social-ecological impacts and at other scales of analysis?
- How can we use the hotspots concept to improve integrative management/planning, particularly in transboundary basins?
- How to generate greater process knowledge about social-ecological feedbacks with hydrologic change, and to scale this knowledge globally?

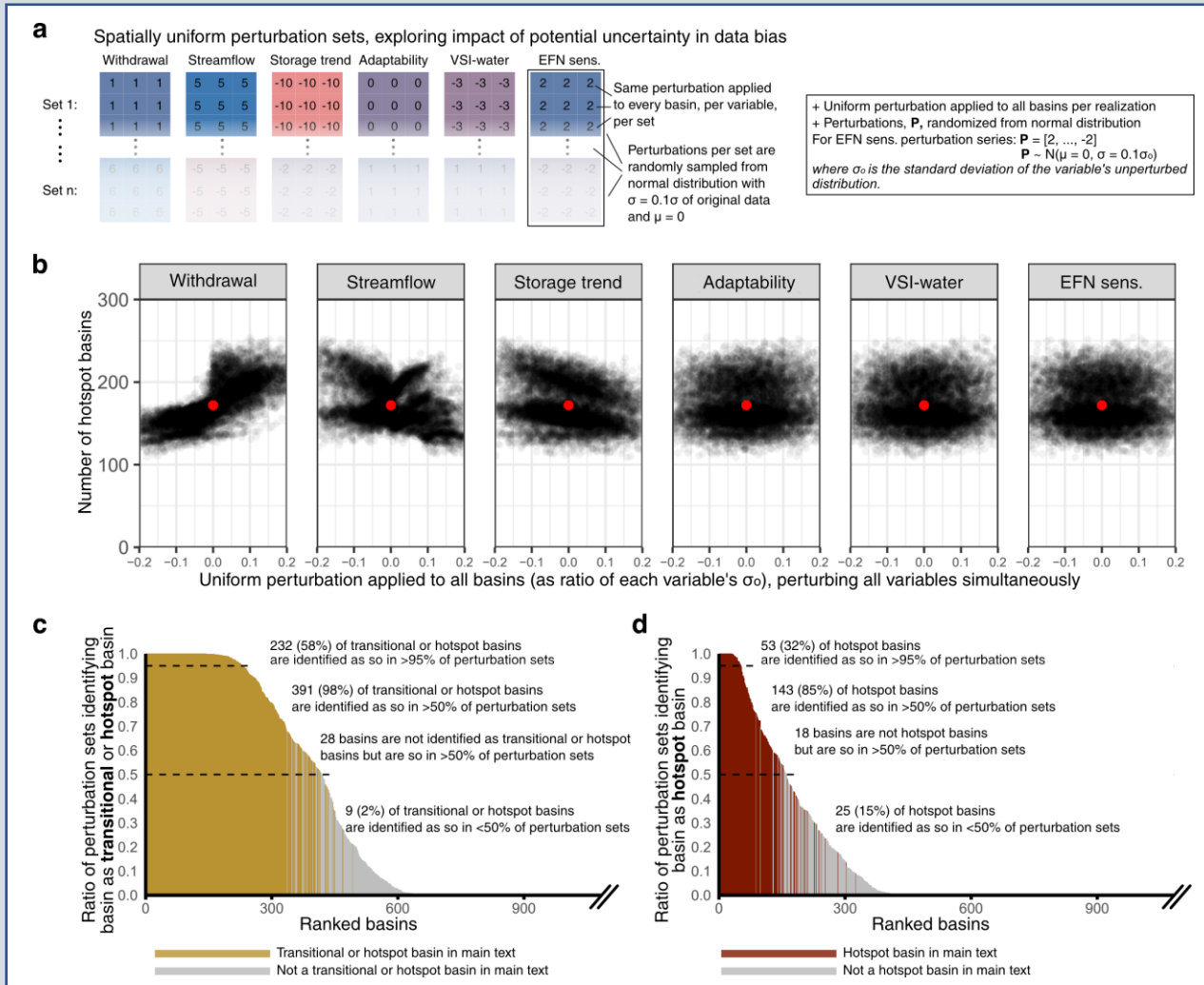
(or over twitter)

@xander_huggins

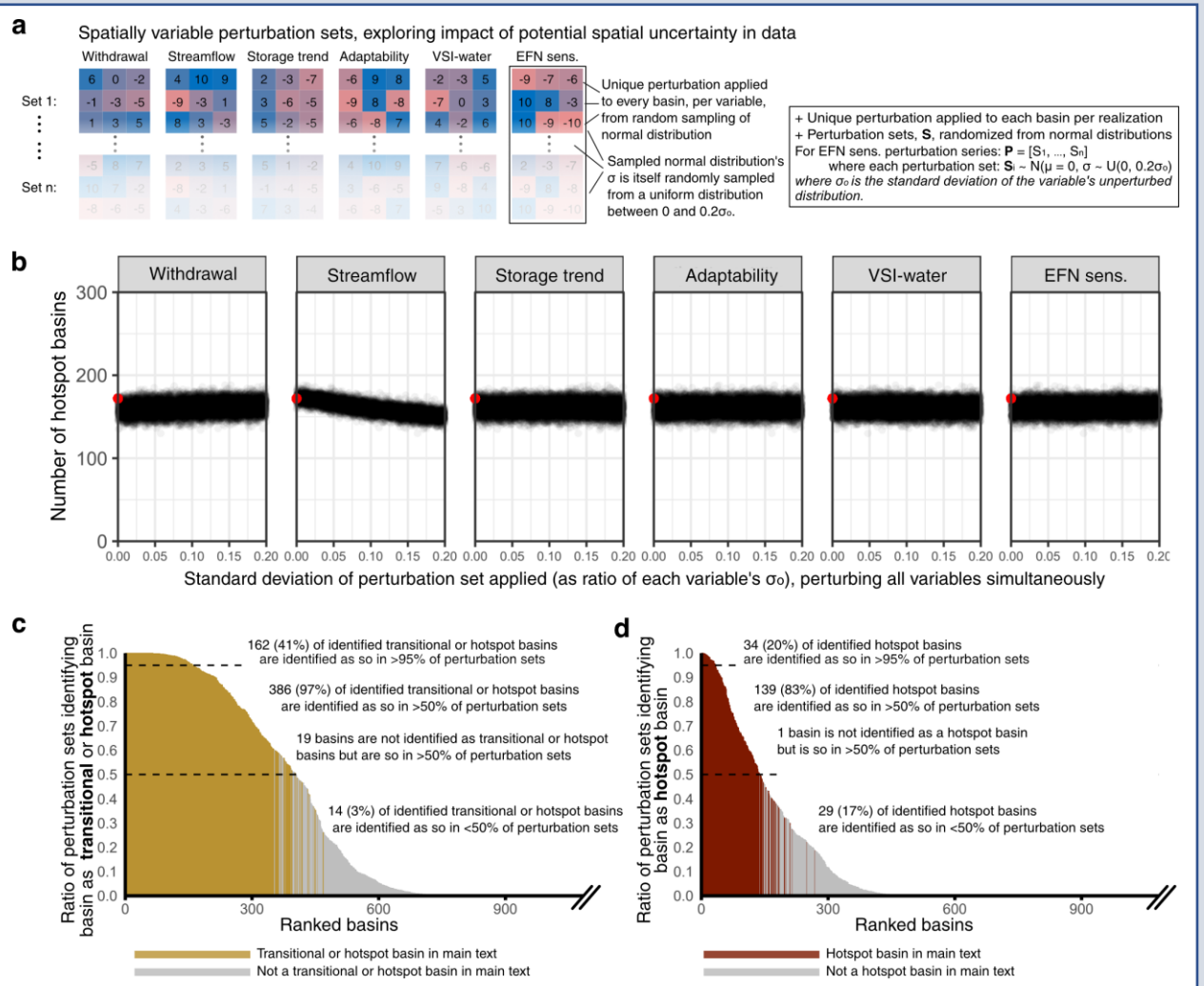
Extra slides

Sensitivity analysis

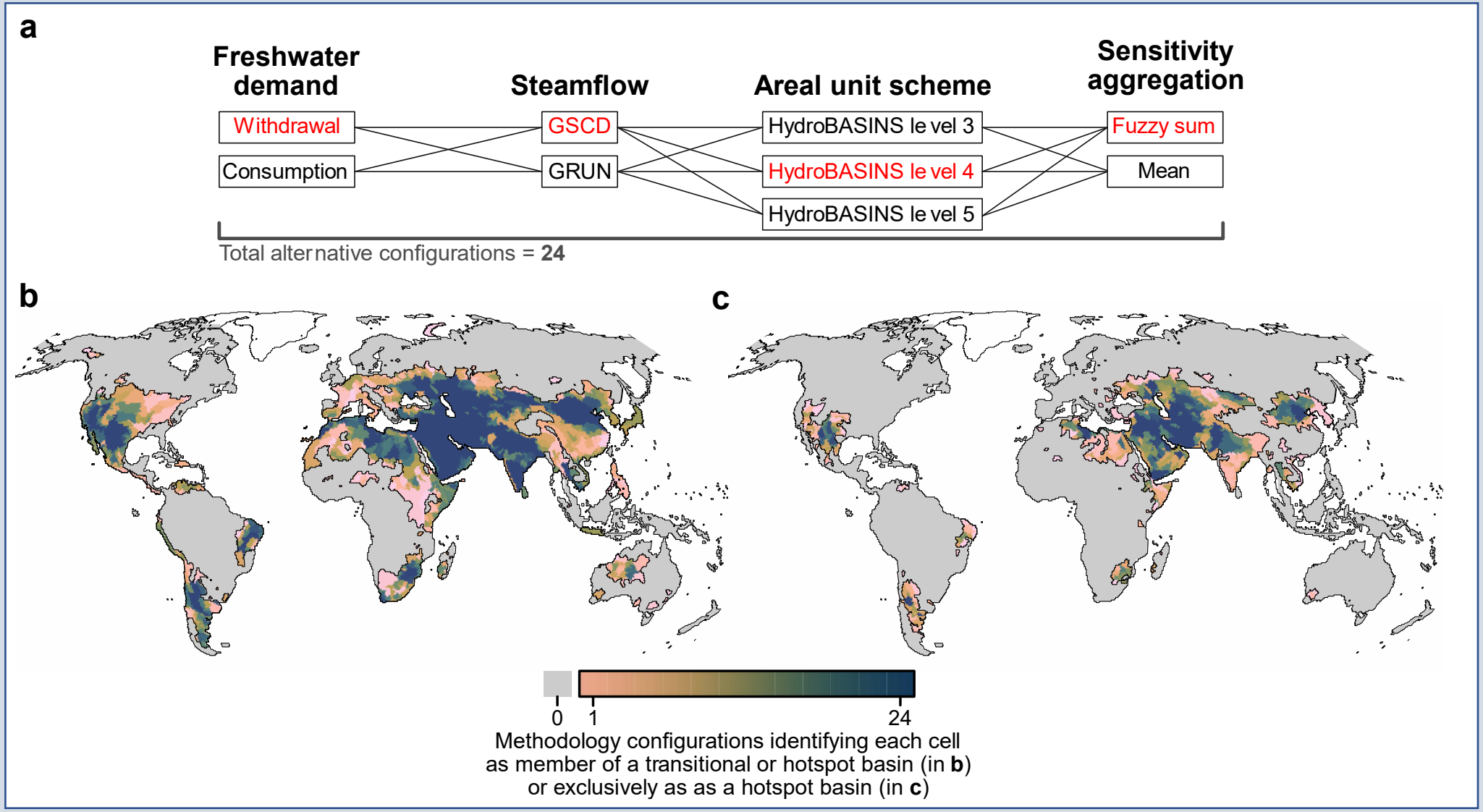
spatially uniform uncertainty



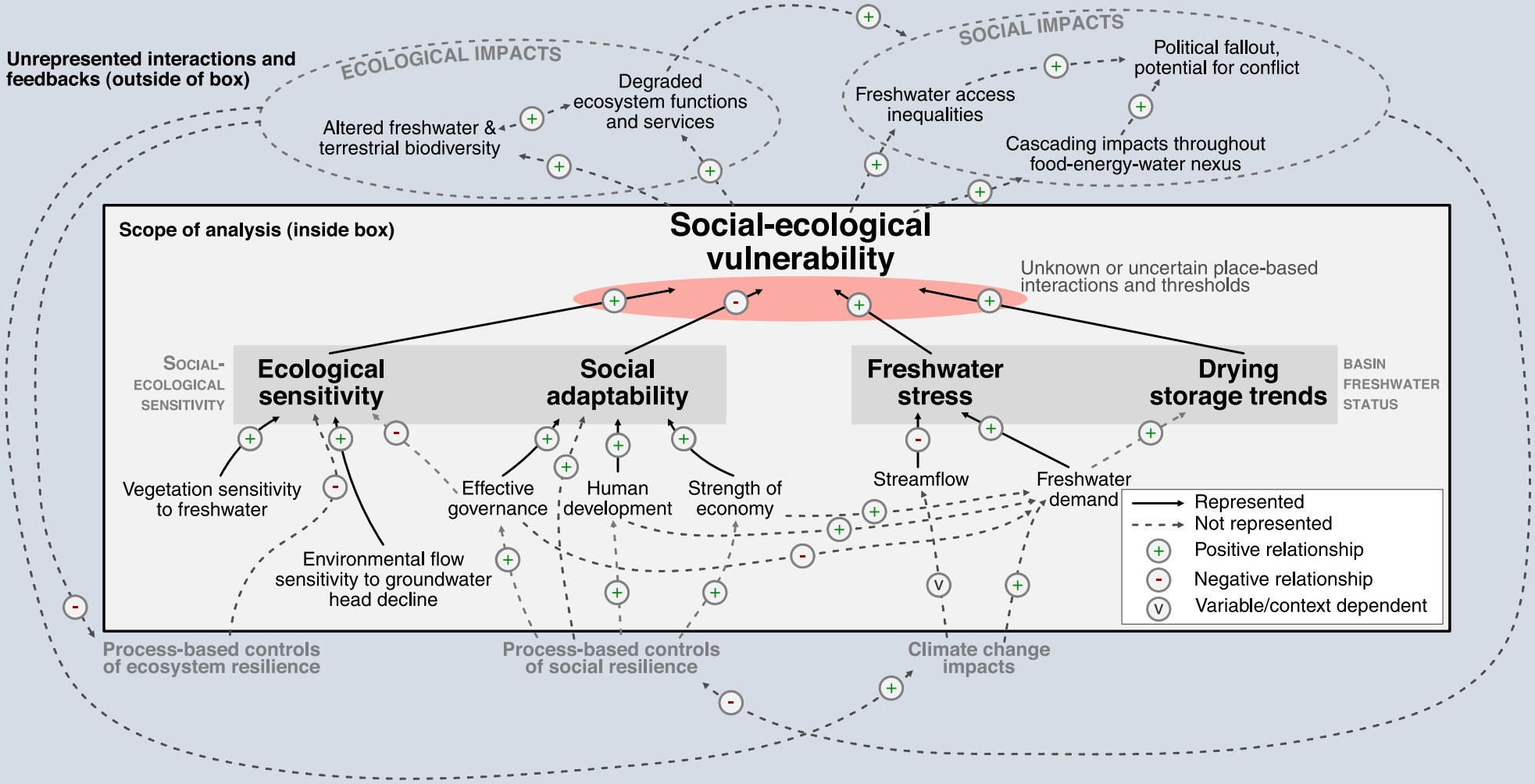
spatially variable uncertainty



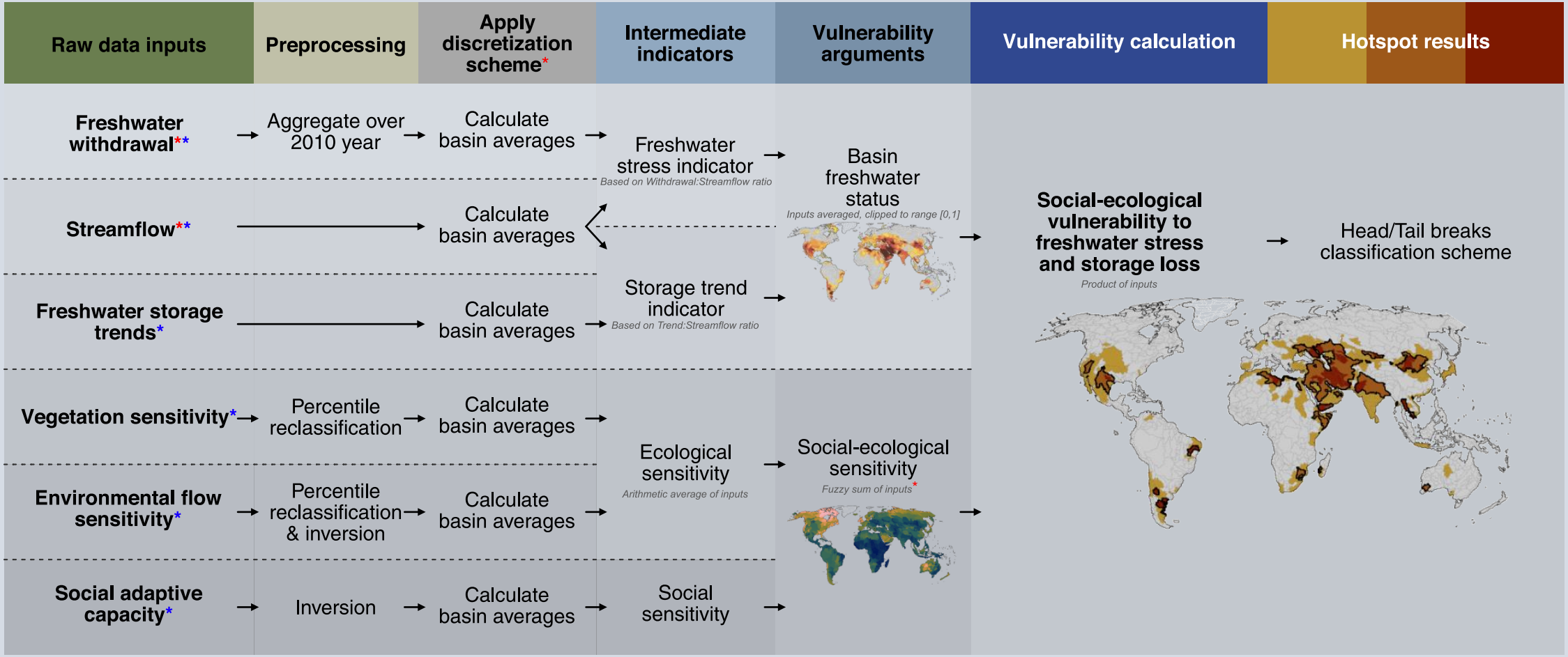
Methodological subjectivity analysis



Study mental model



Method overview



* Considered in uncertainty analysis
* Considered in sensitivity analysis

Ecological sensitivity + social adaptive capacity