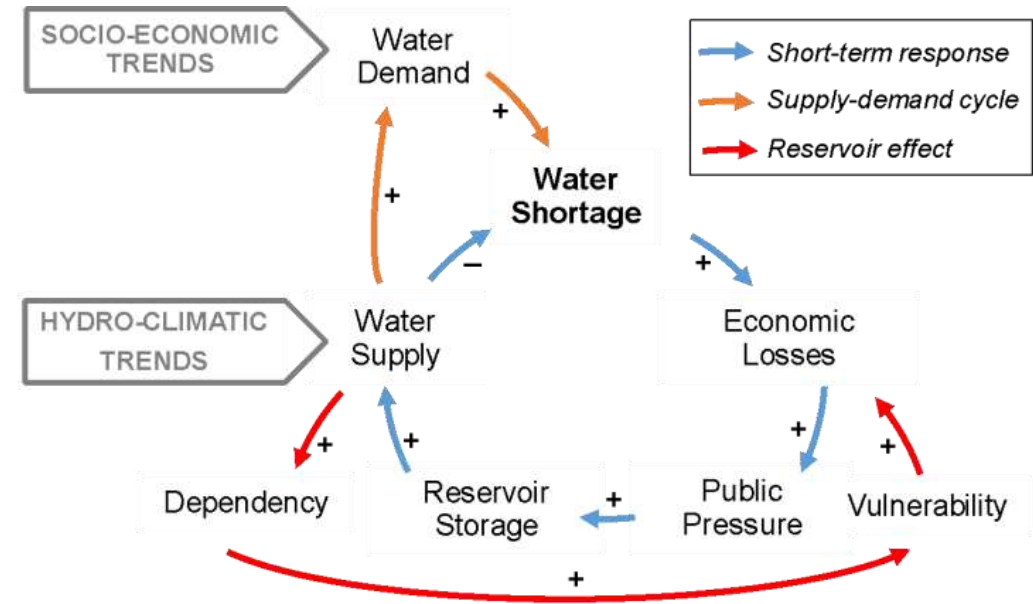
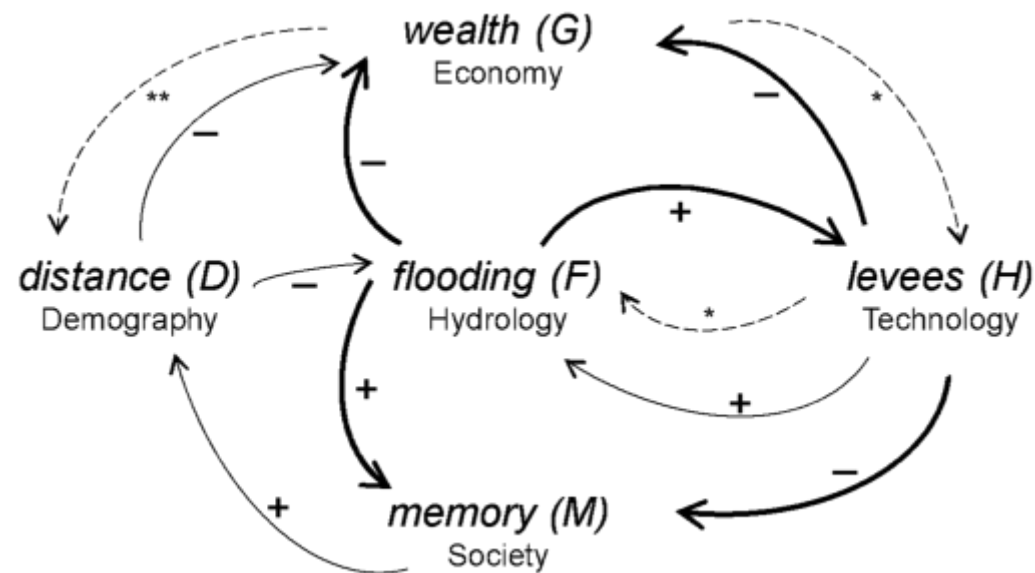


Coupling human-water systems for actionable science



Giuliano Di Baldassarre

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European Research Council

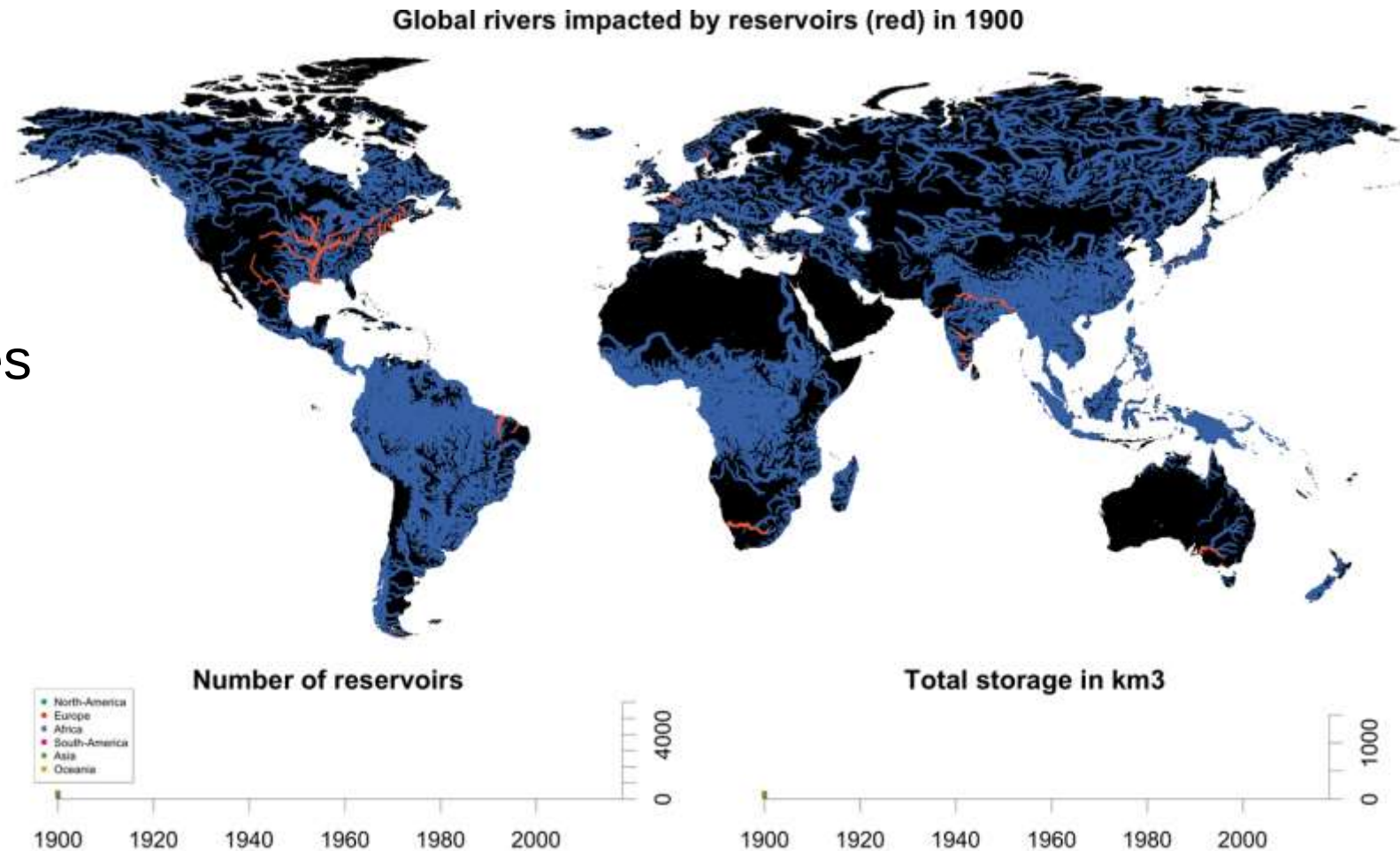


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Society shapes hydrology

Humans influence water systems

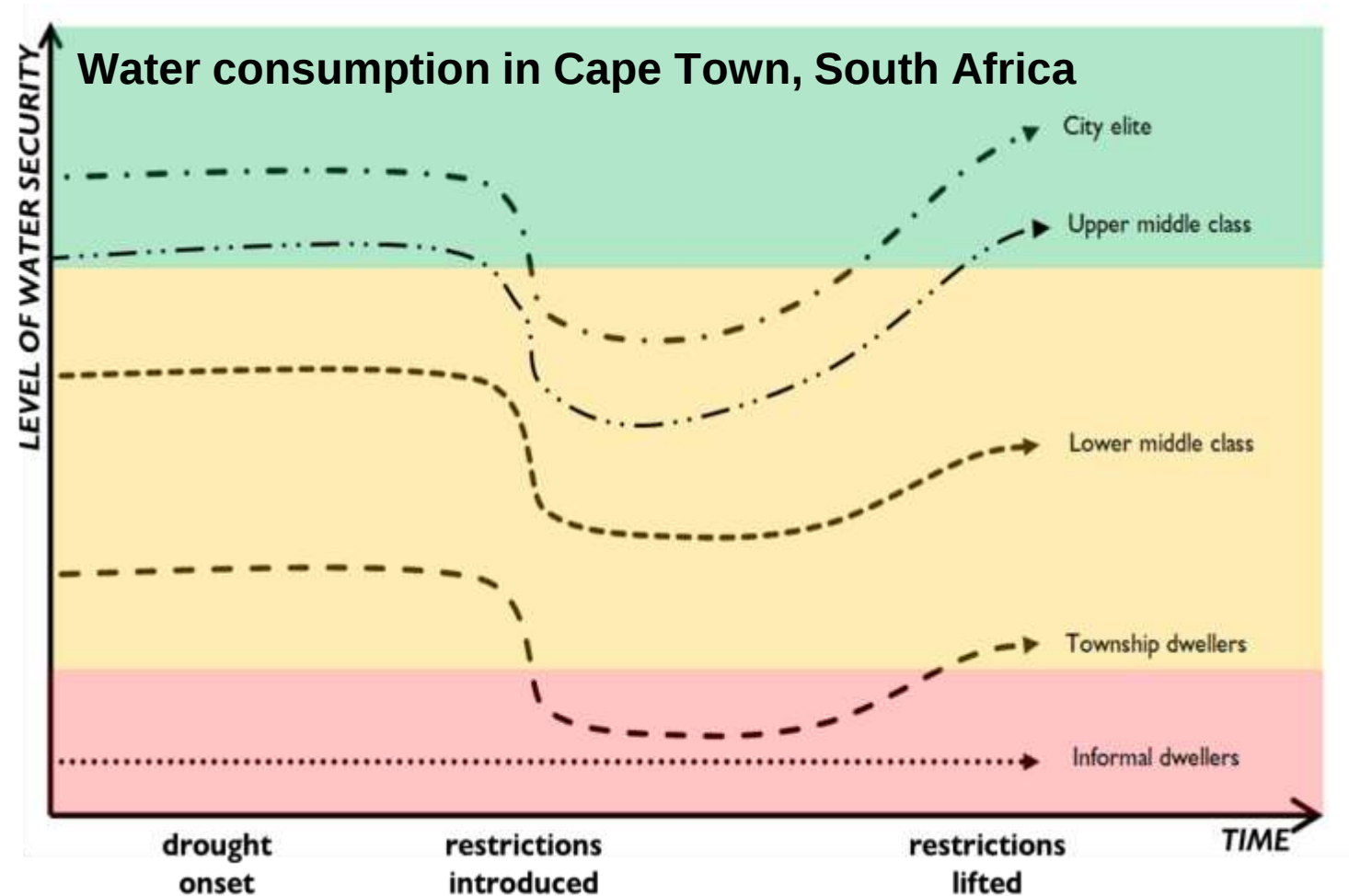
- **Deliberately**
 - Water infrastructure
 - Risk reduction measures
- **Accidentally**
 - Land-use change
 - Unintended effects



Hydrology shapes society

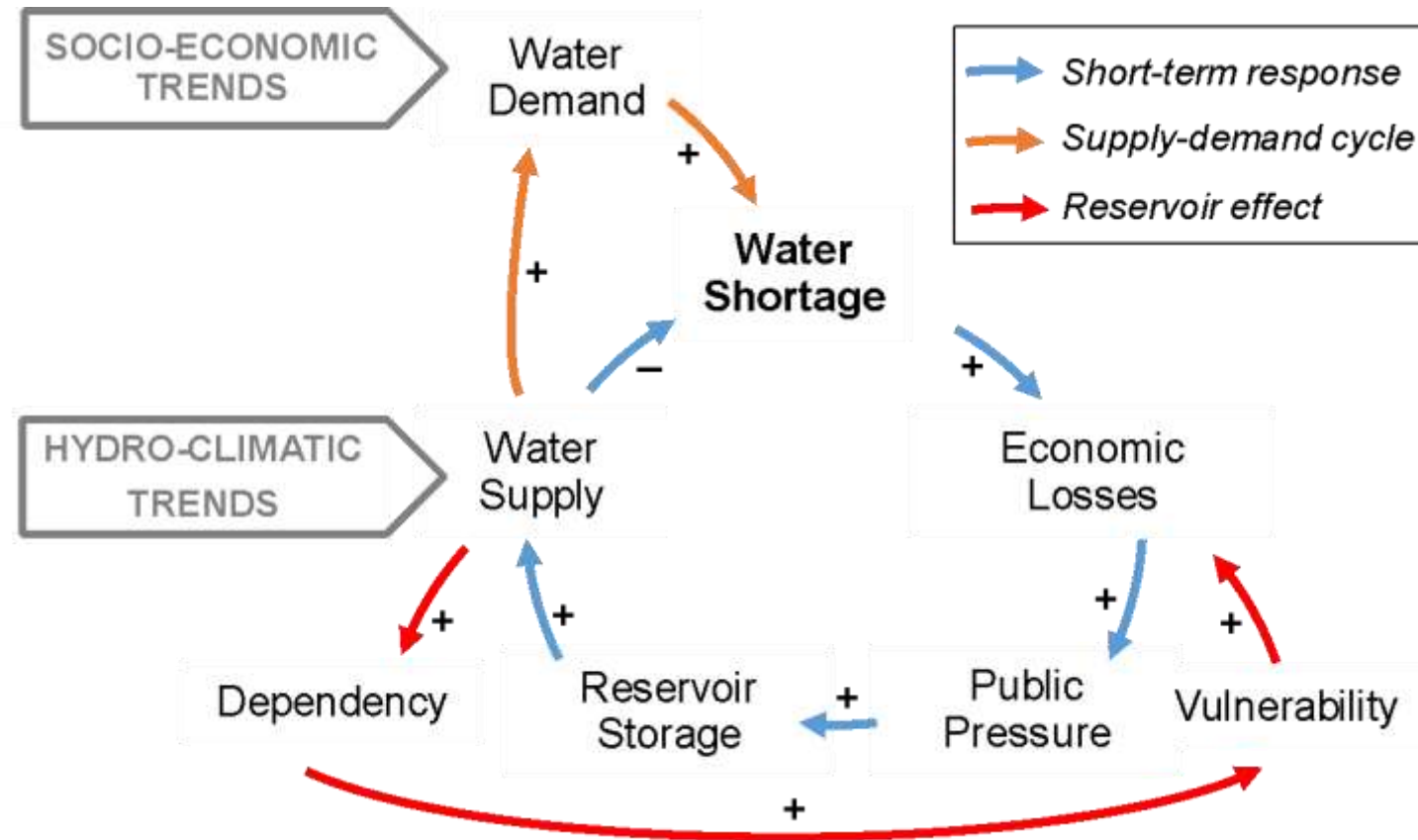
Humans respond to water systems

- **Formally**
 - Policy change
 - Water infrastructure
- **Informally**
 - Spontaneous processes
 - Migration

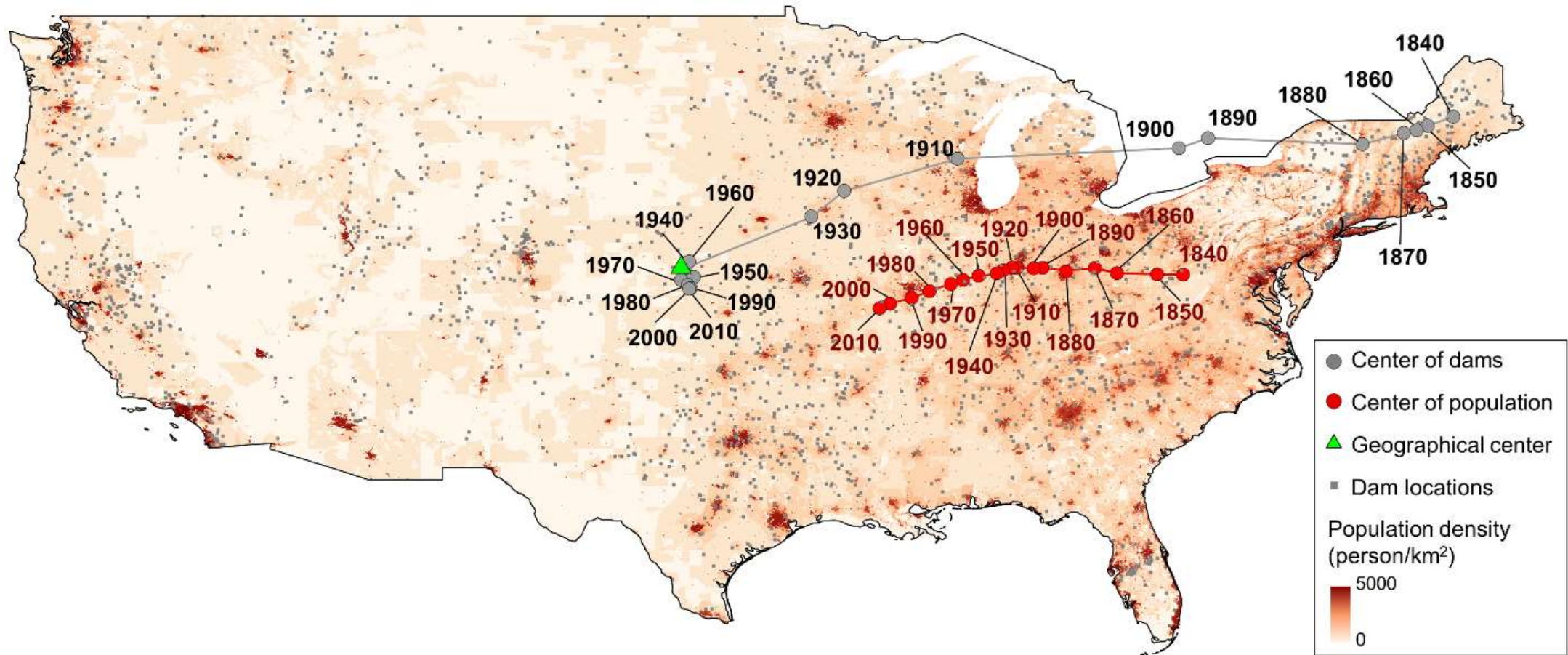


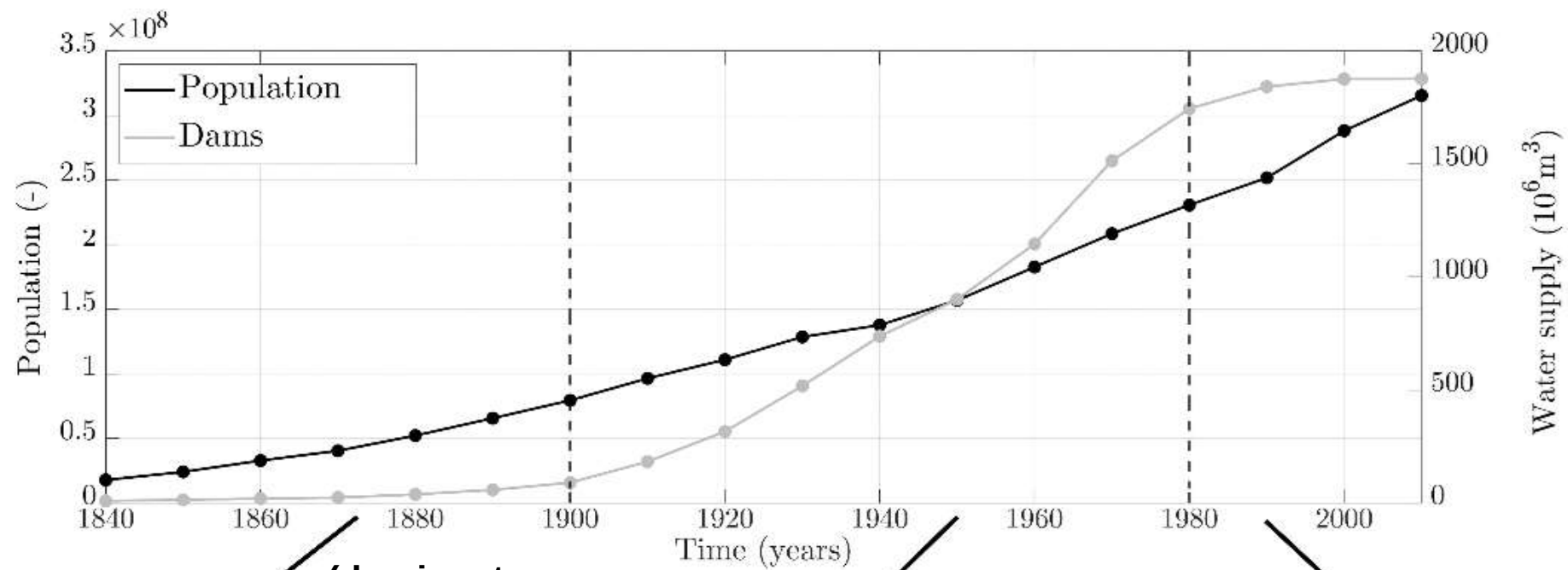
Unraveling human-water systems: Droughts & water scarcity

Intended benefits and **unintended consequences**

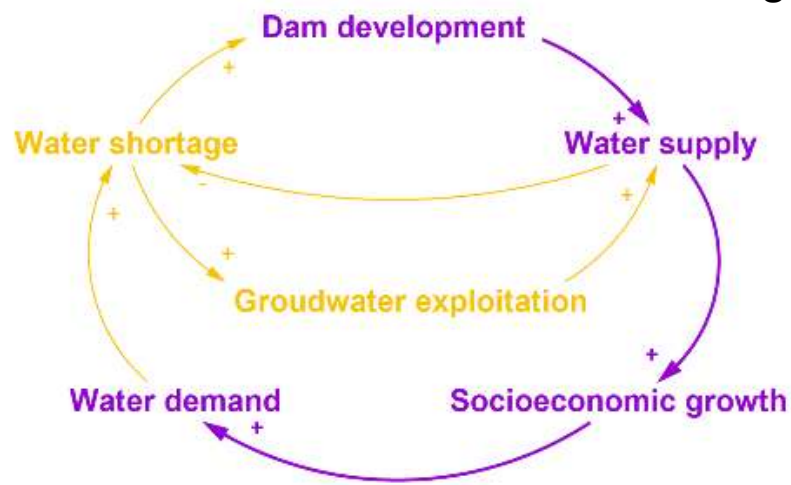


Legacy of dams in the US

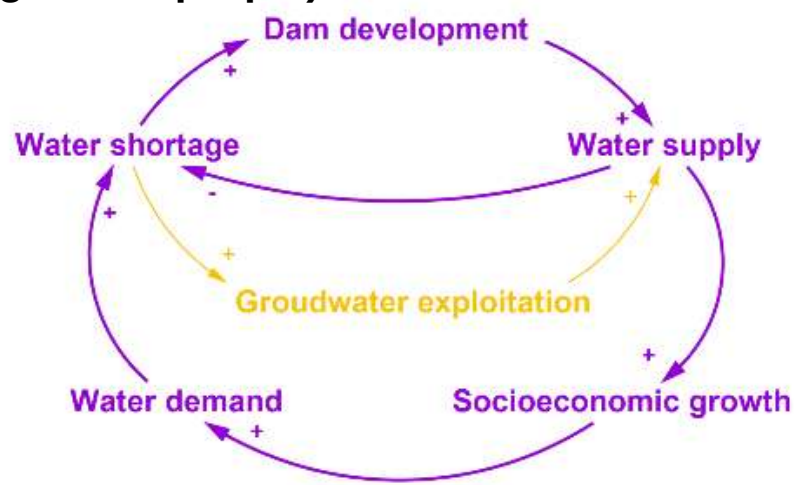




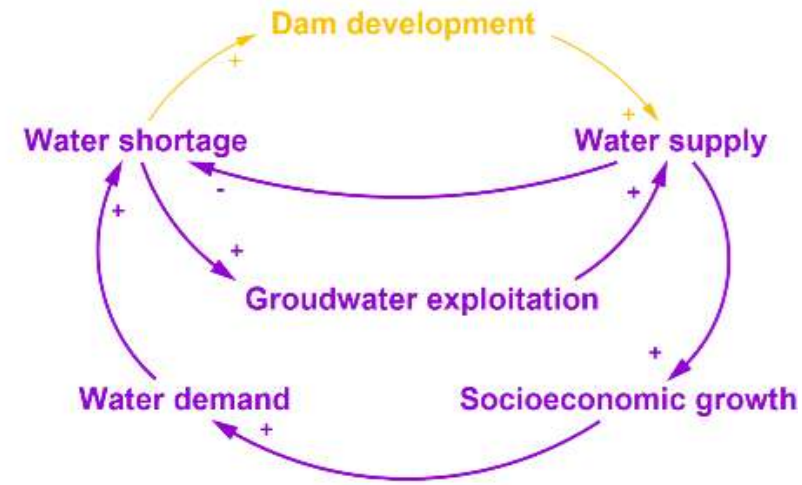
(dominant processes
are highlighted in purple)



Go West Young Men (19th Century)



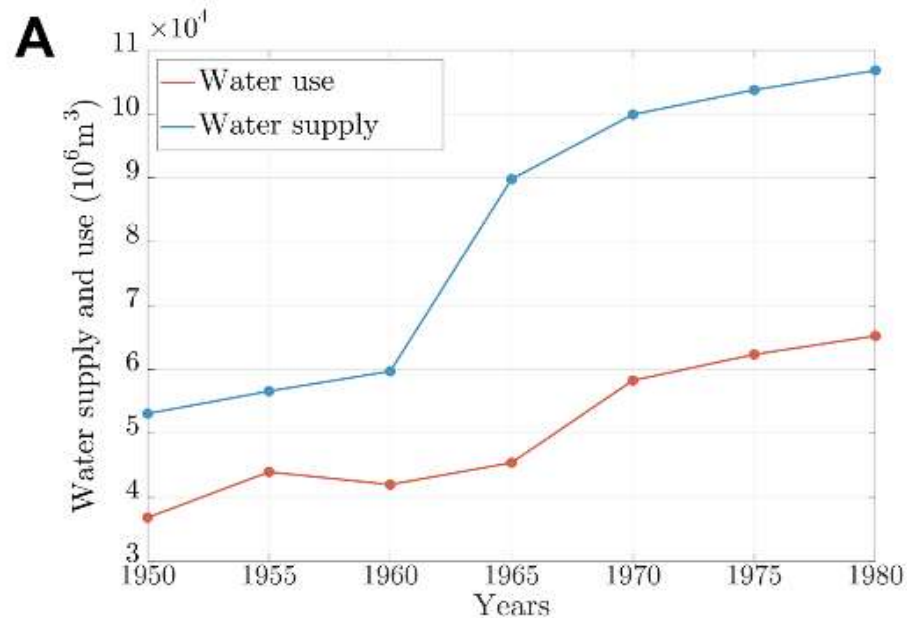
Hydraulic Mission (1900-1980)



Plateau Phase (1980s – ongoing)

Supply-demand cycles in the Southwest region

- Some: *water infrastructure as a response to the growing demands*
- Others: *water infrastructure has actually driven unsustainable growth*
- **Large-scale analysis of this egg-and-chicken problem**
- None of these two hypotheses can be rejected



B

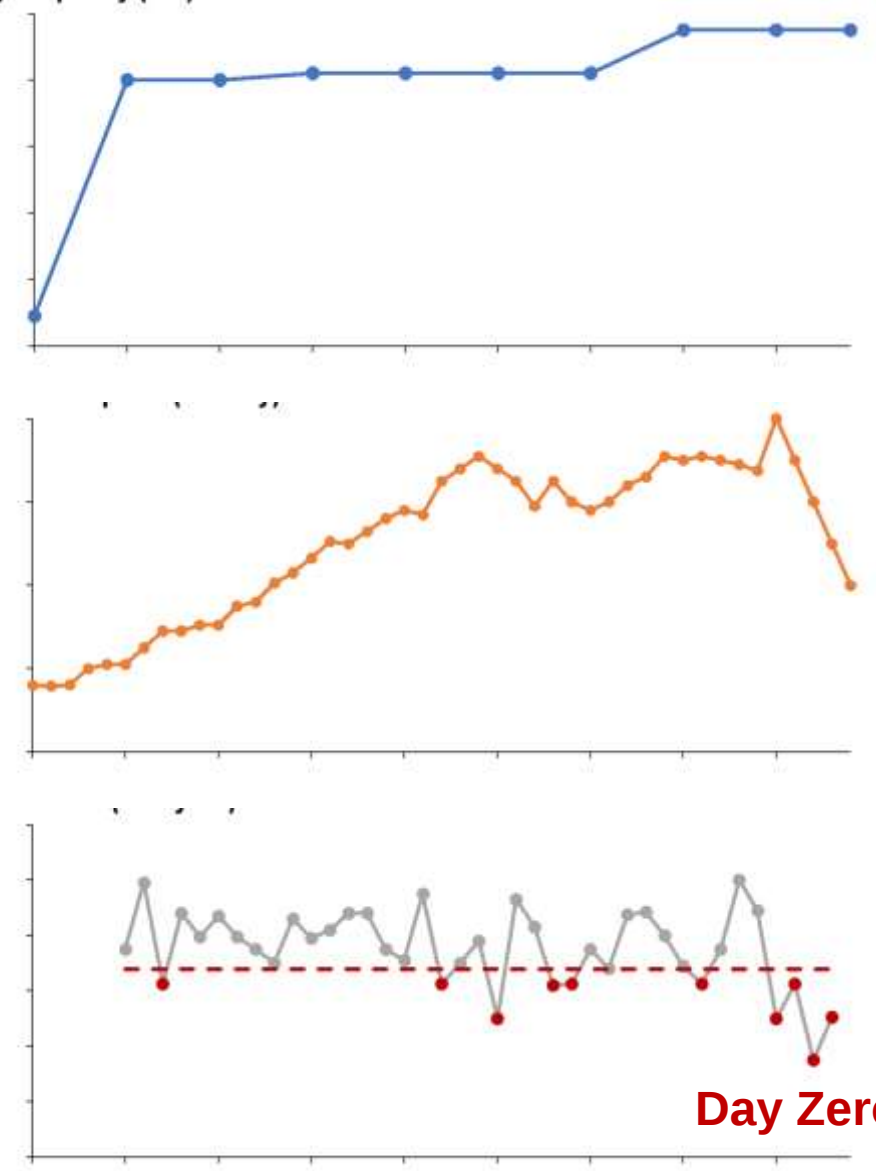
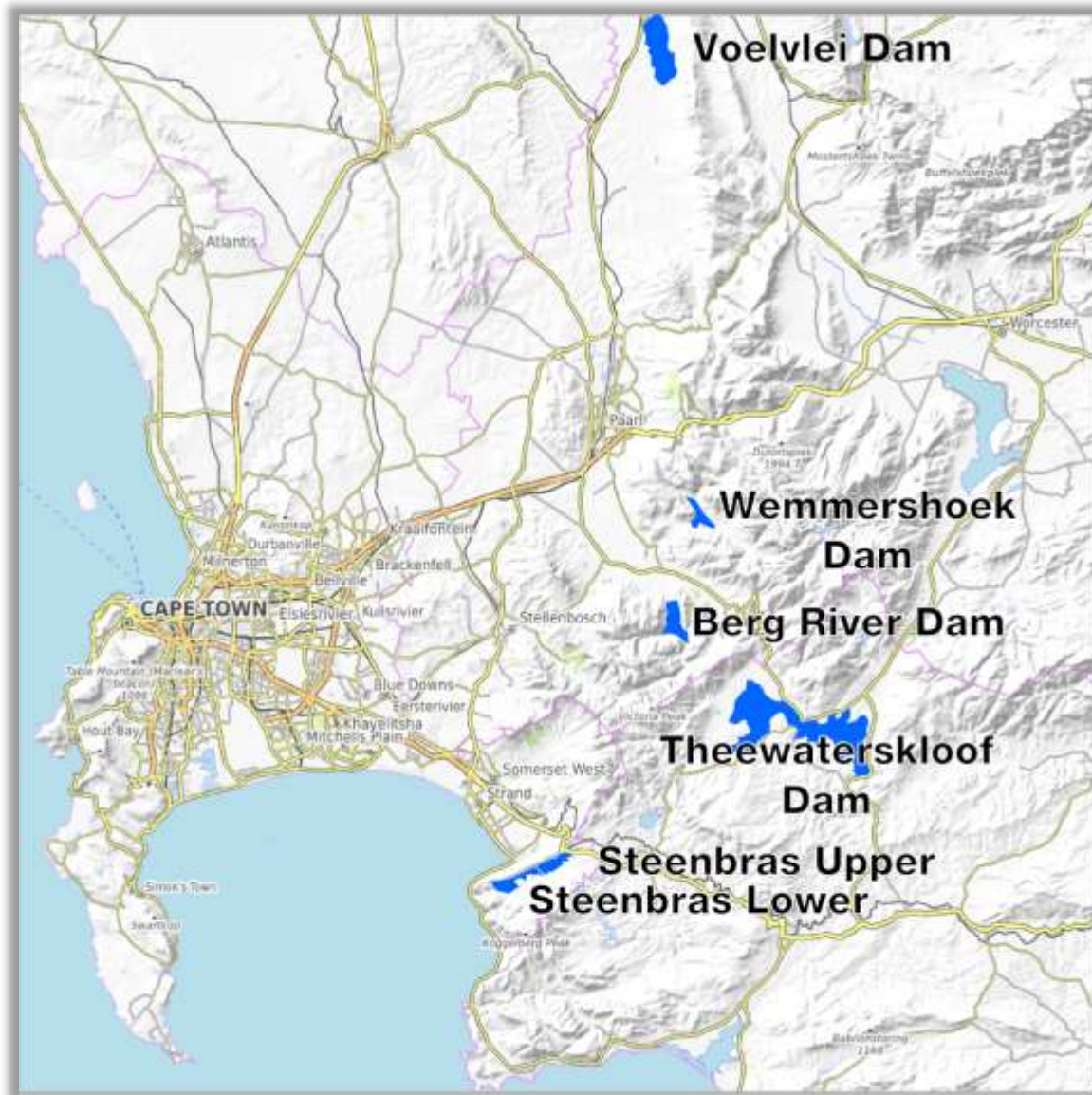
Egg-and-chicken problem of water supply and use in the Southwest

Water supply as a predictor of water use		Unlagged correlation	Water use as a predictor of water supply	
<i>Supply (t)</i> <i>Use (t+10y)</i>	<i>Supply (t)</i> <i>Use (t+5y)</i>	<i>Reference value</i> <i>(same time t)</i>	<i>Use (t)</i> <i>Supply (t+5y)</i>	<i>Use (t)</i> <i>Supply (t+10y)</i>
0.865	0.993	0.920	0.768	0.729



Cape Town, SA

Cape Town, South Africa



Drought in Cape Town: the “Day Zero” water crisis

Cape Town counts down to Day Zero as water supply evaporates

Drought-hit South African city risks becoming world's first big metropolis to go dry



Cape Town residents queue for water. Vast lawns and swimming pools in wealthy suburbs have hampered efforts to conserve resources in the drought-stricken region © EPA

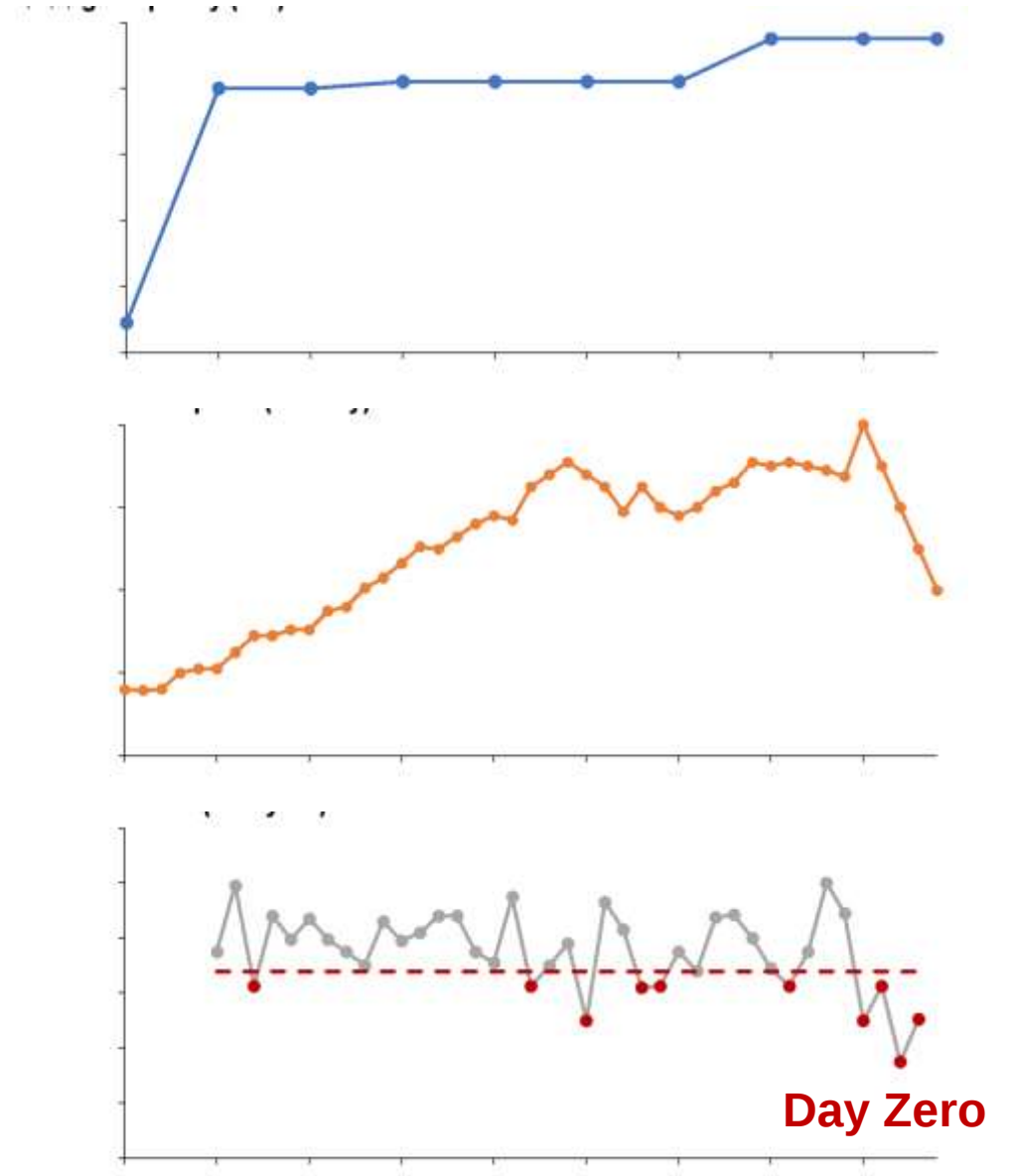
Cape Town, South Africa

- **Supply-demand cycles**

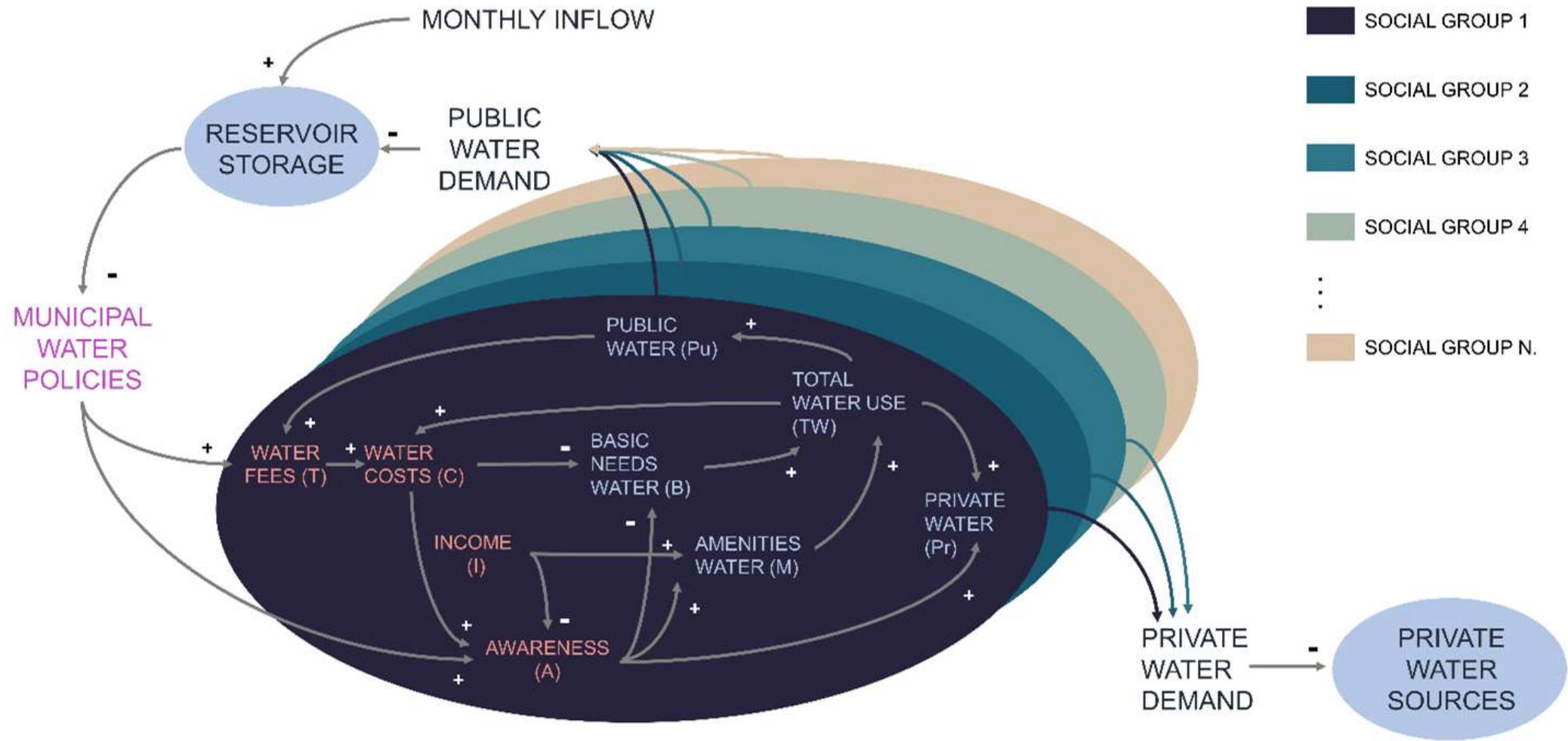
- Western Cape Water Supply System
- Lock-in condition

- **Reservoir effects**

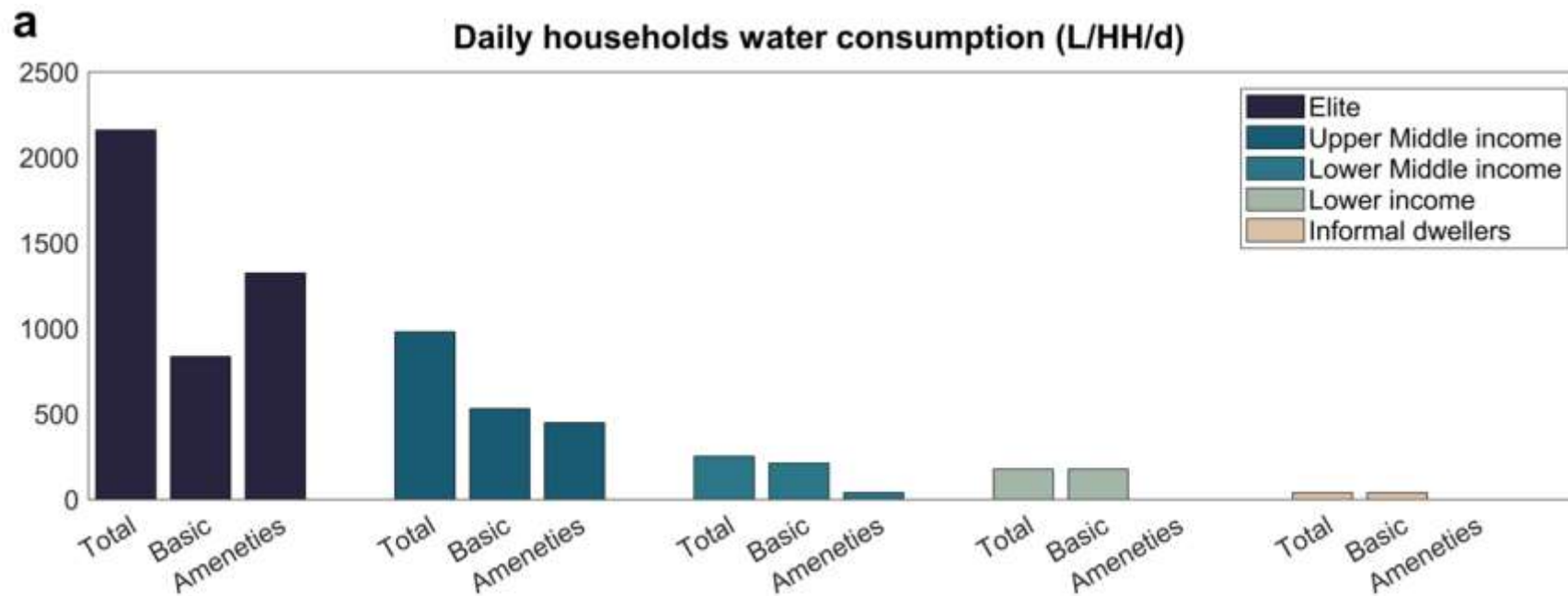
- Attenuate hydrological variability
- Delay salient information and thus response



Modelling human-drought interactions

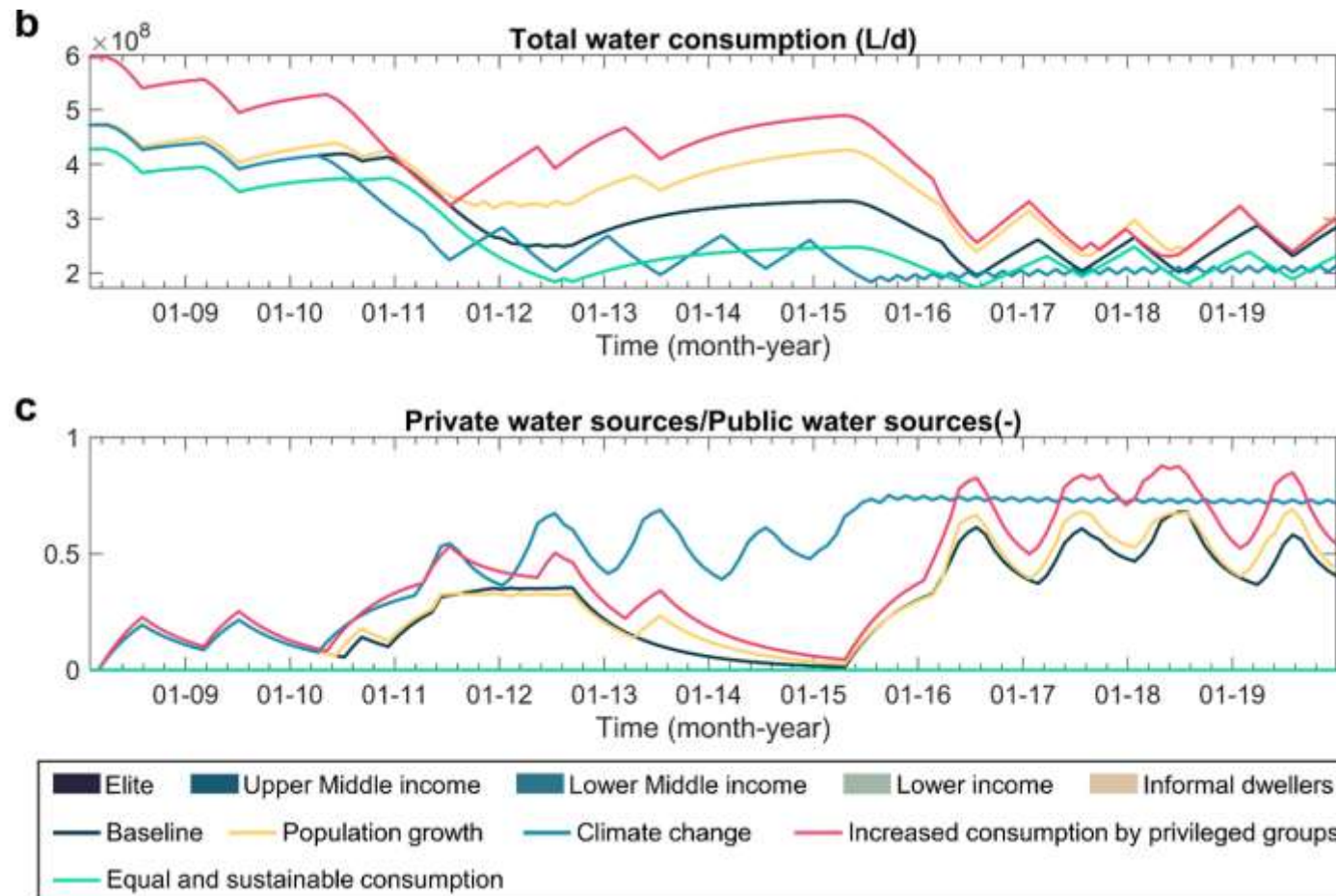


Application to Cape Town



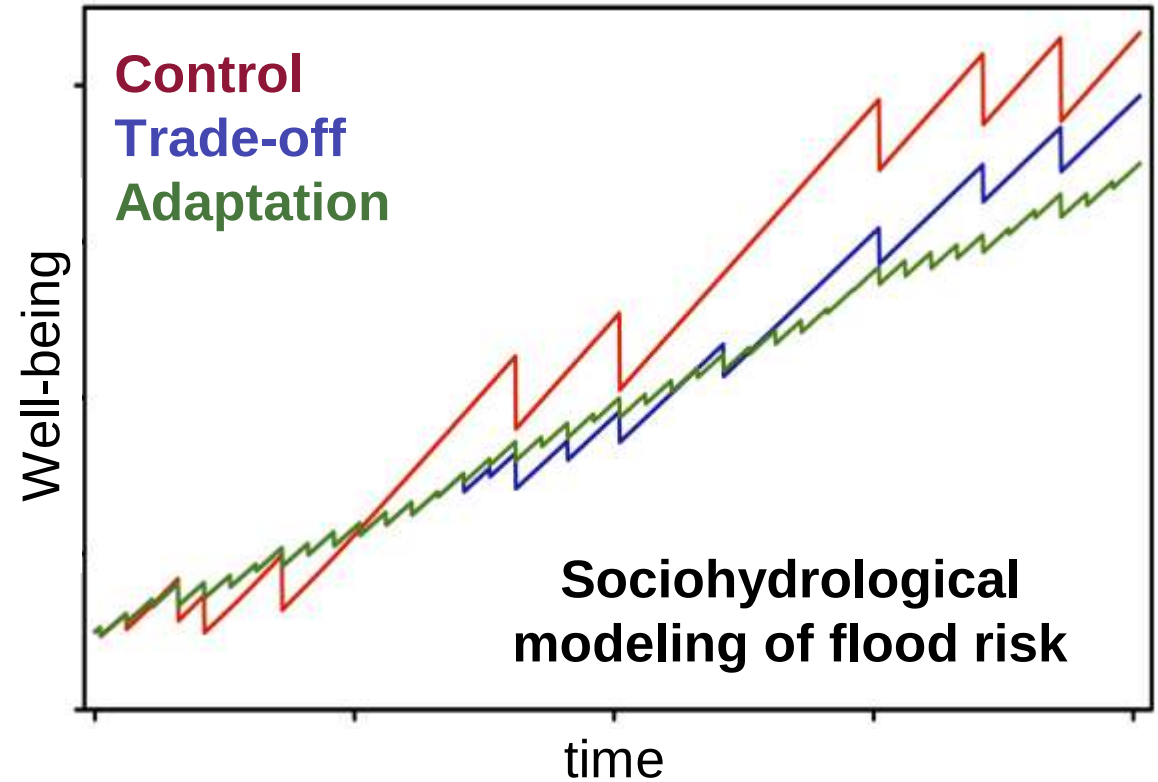
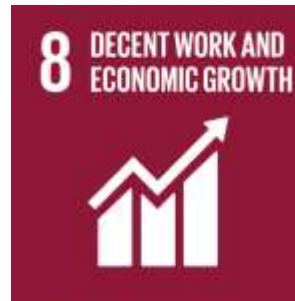
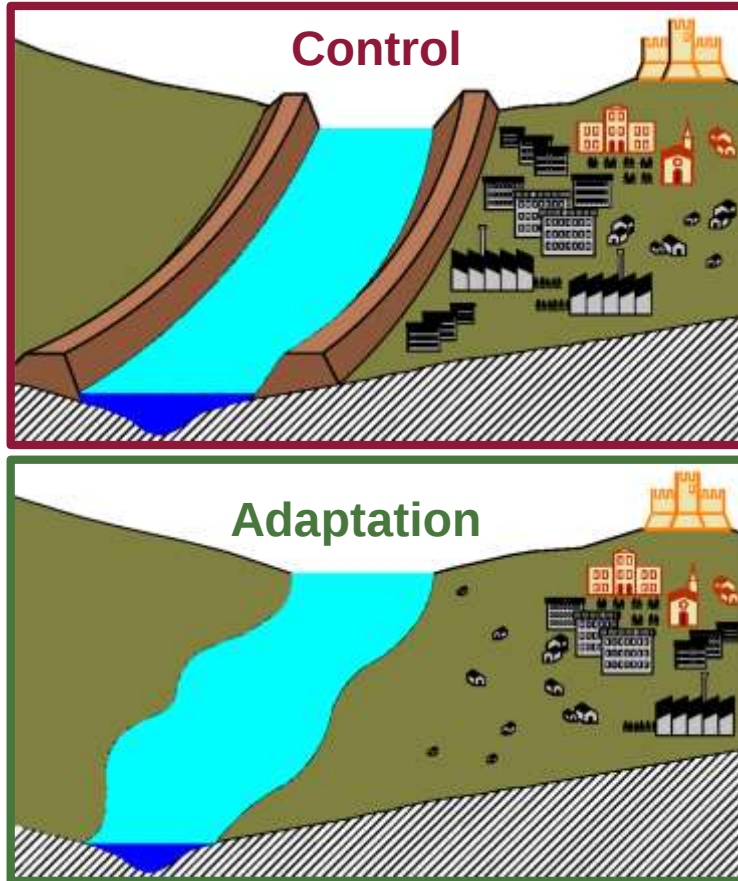
Water crises driven by elites' unsustainable consumption

Unsustainable water use by the elite can exacerbate urban water crises at least as much as climate change or population growth



Adaptation policy alternatives (and trade-offs)

Flood risk example



Human-water interactions in a changing climate

Scientific challenges

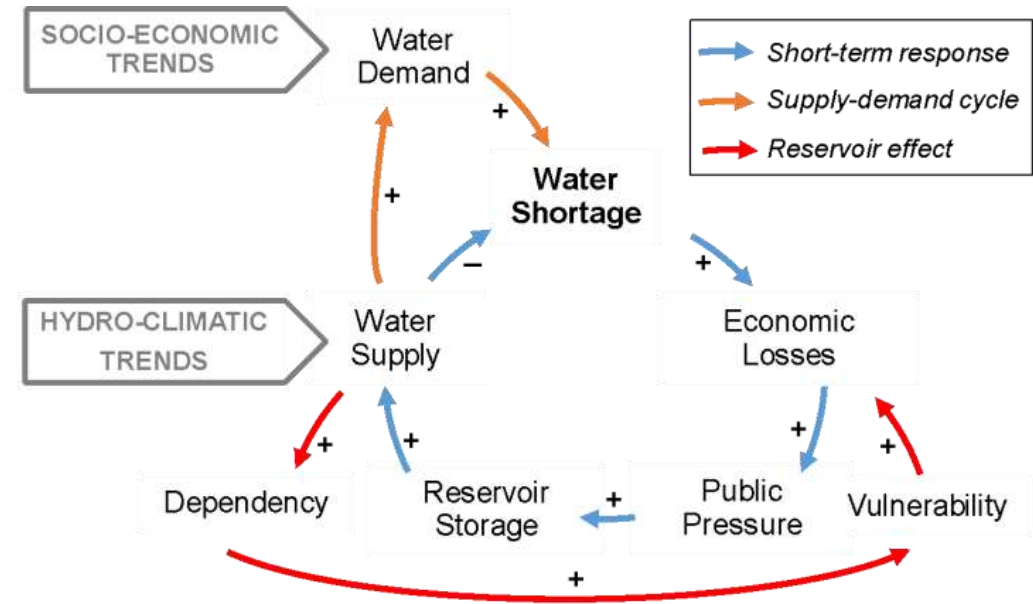
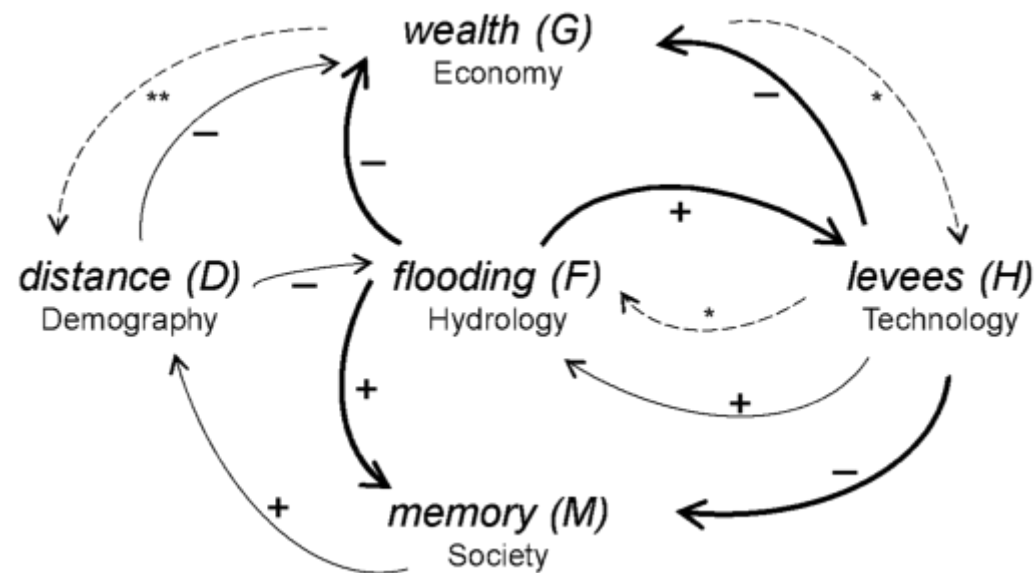
- Uncertainty: Interdisciplinary work
- Adaptation policies: Unintended consequences and inequality

Societal challenges

- Exploring trade-offs while reducing uncertainty and legacy risks
- Climate change adaptation, disaster risk reduction and SDGs



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