Solving water management paradoxes requires a systems meta-model

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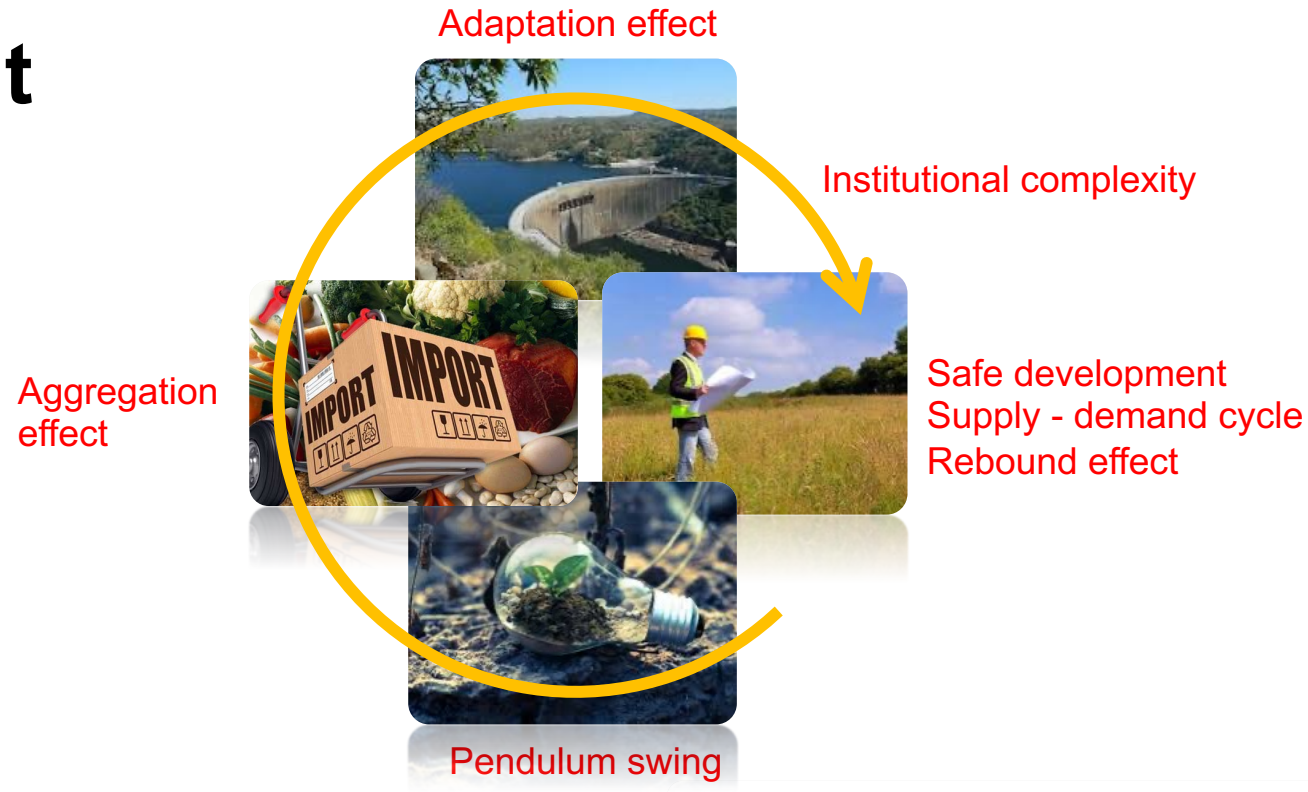
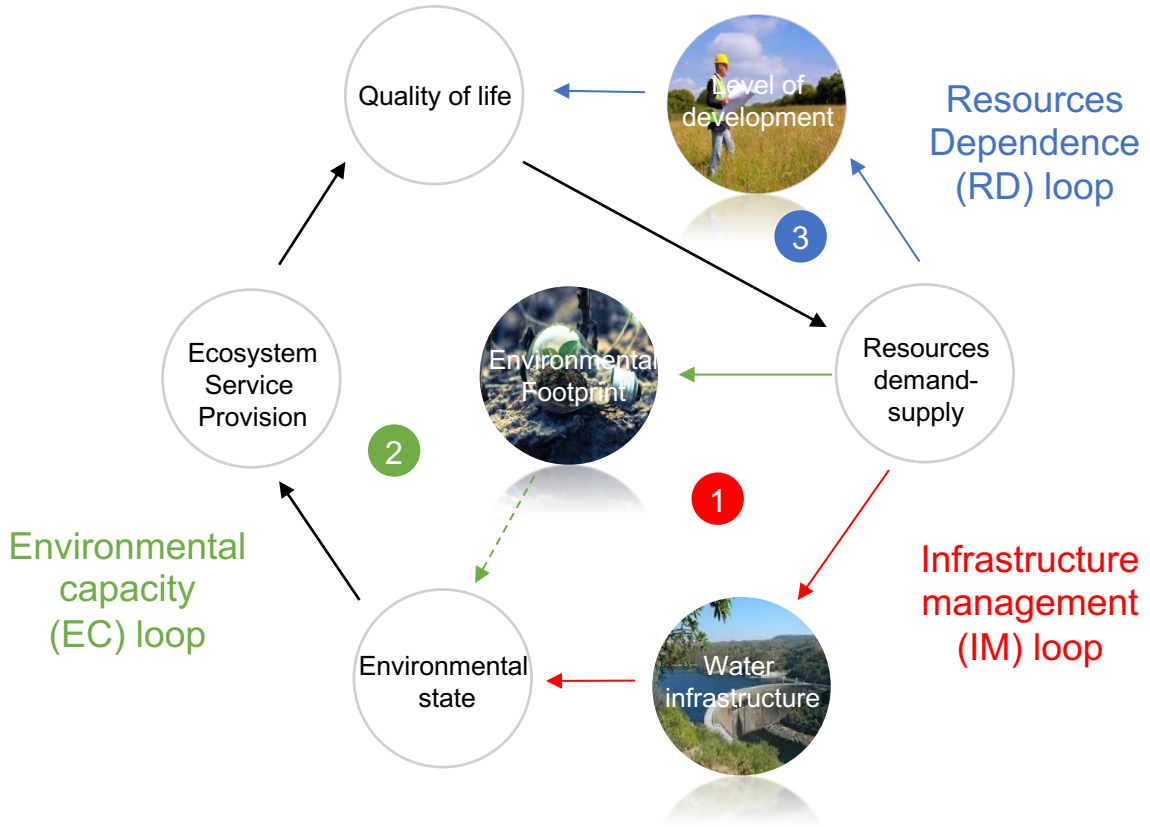


Feature Article | Open Access

Sociohydrology: Scientific Challenges in Addressing the Sustainable Development Goals

Giuliano Di Baldassarre, Murugesu Sivapalan, Maria Rusca, Christophe Cudennec, Margaret Garcia, Heidi Kreibich, Megan Konar, Elena Mondino, Johanna Mård, Saket Pande, Matthew R. Sanderson, Fuqiang Tian, Alberto Viglione, Jing Wei, Yongping Wei, David J. Yu, Veena Srinivasan, Günter Blöschl

Systems meta-model as a framework to explain mechanisms behind the paradoxes and support integrated water planning



We argue that water management paradoxes are a result of lack of integration and coordination of three loops within the Systems Water Management meta-model

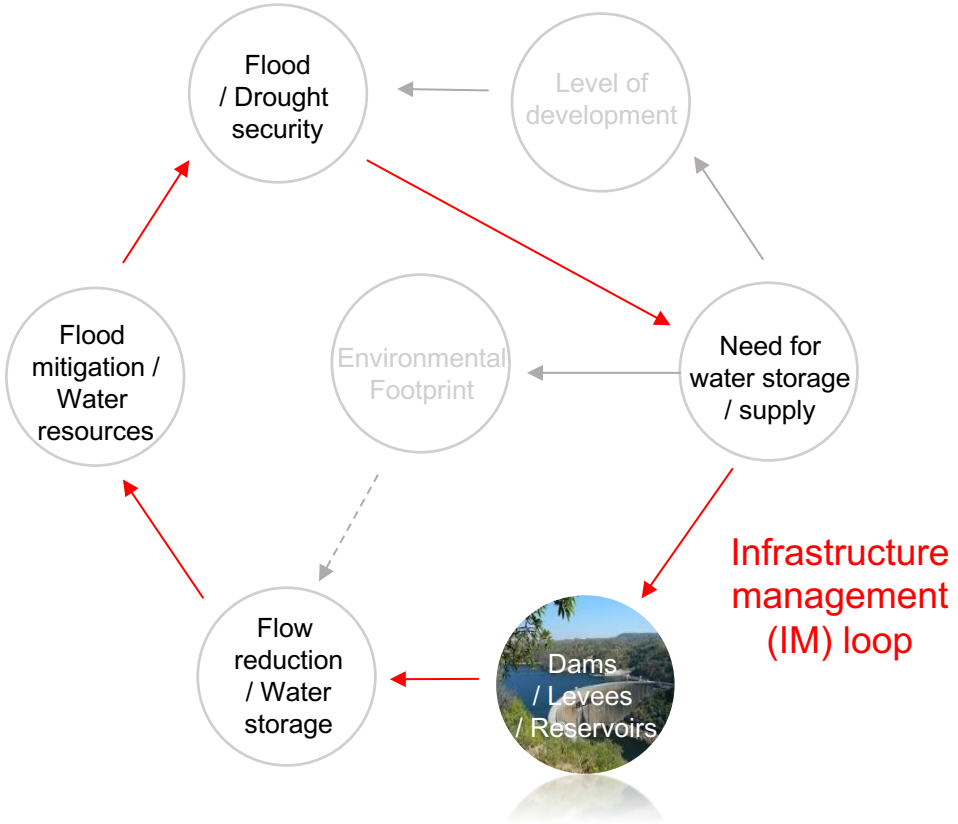
Component

Positive link

Negative link

We *explain* **paradoxes** using the systems meta-model and propose three system water management archetypes

Archetype 1: Infrastructure Management Segregation

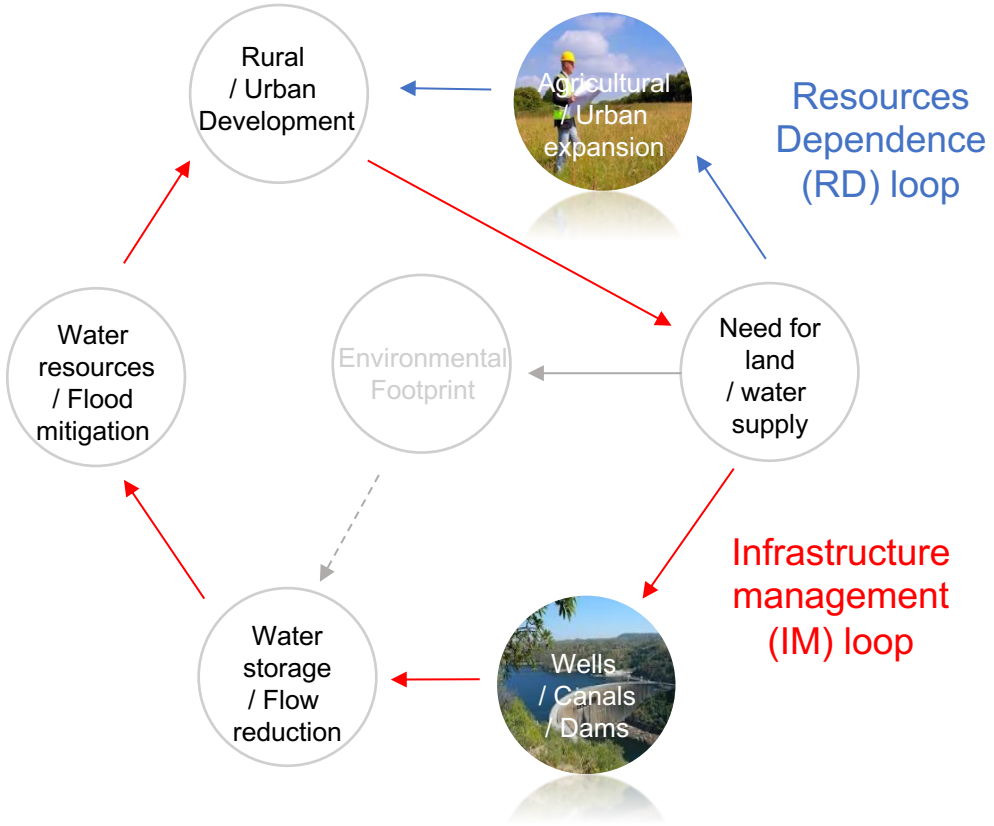


Adaptation Effect:
Flood and drought management examples
(Kreibich et al. 2017)

Perpetual development achieved by focusing only on water infrastructure within IM loop

We *explain* **paradoxes** using the systems meta-model and propose three system water management archetypes

Archetype 2: Environmental Capacity Ignorance



Safe Development / Supply Demand Cycle / Rebound Effect:
Rural and urban development examples
(Kallis 2010, Gohari et al. 2013)

Perpetual development achieved by using water infrastructure to support land development within RD loop

We *explain* **paradoxes** using the systems meta-model and propose three system water management archetypes

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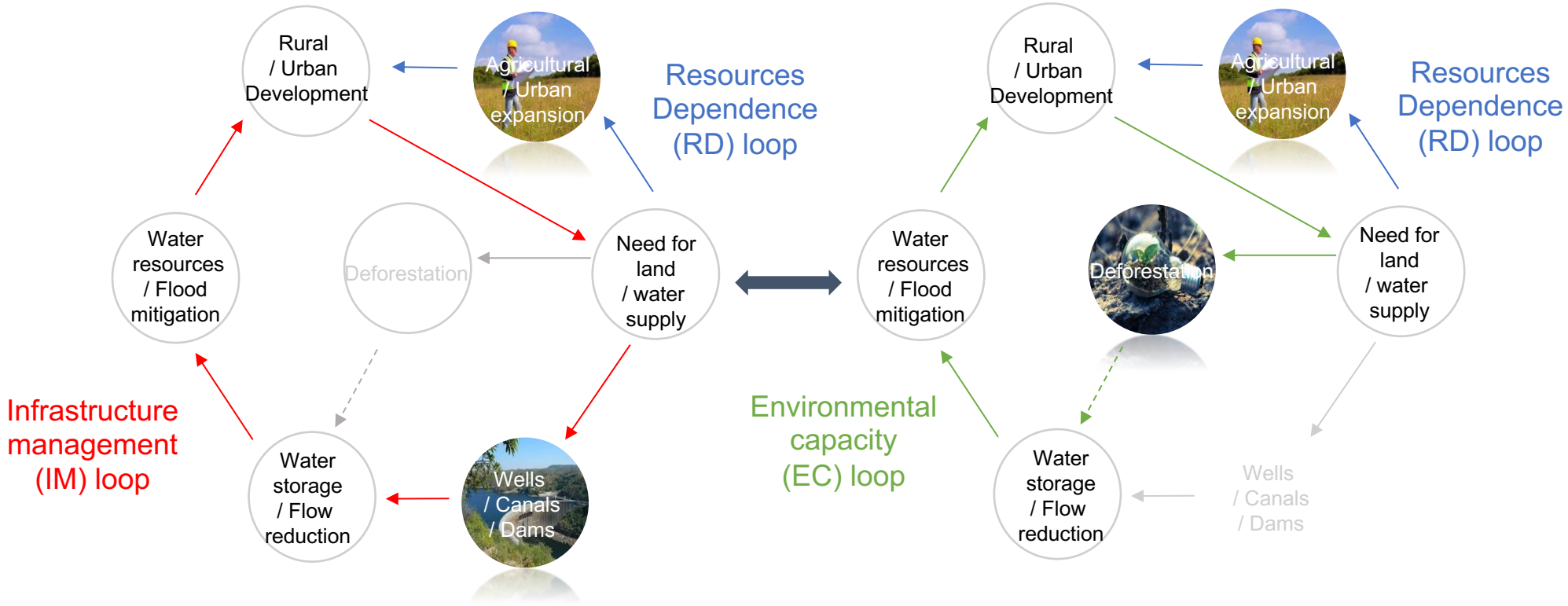

Pendulum swing:
Regional water governance (e.g., Murrey-Darling basin) (Zhou et al. 2015)
Swing between water infrastructure supported perpetual growth (left) and low growth environmental protection focus (right)

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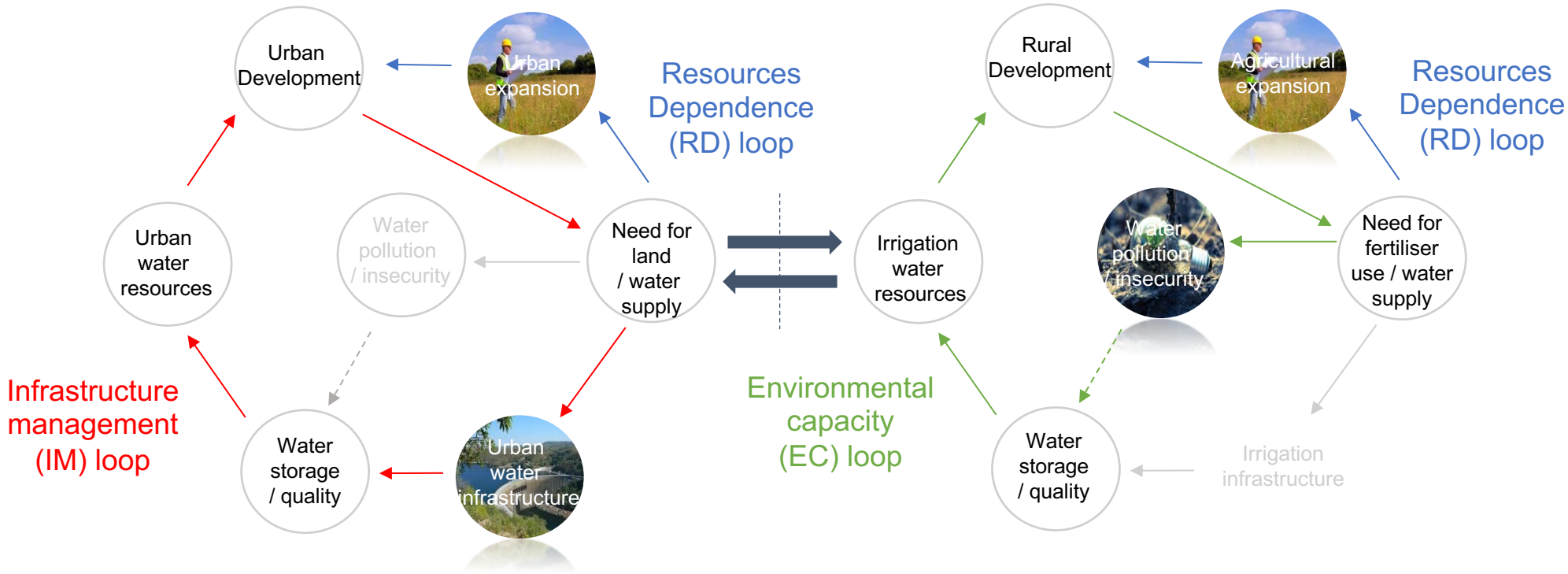
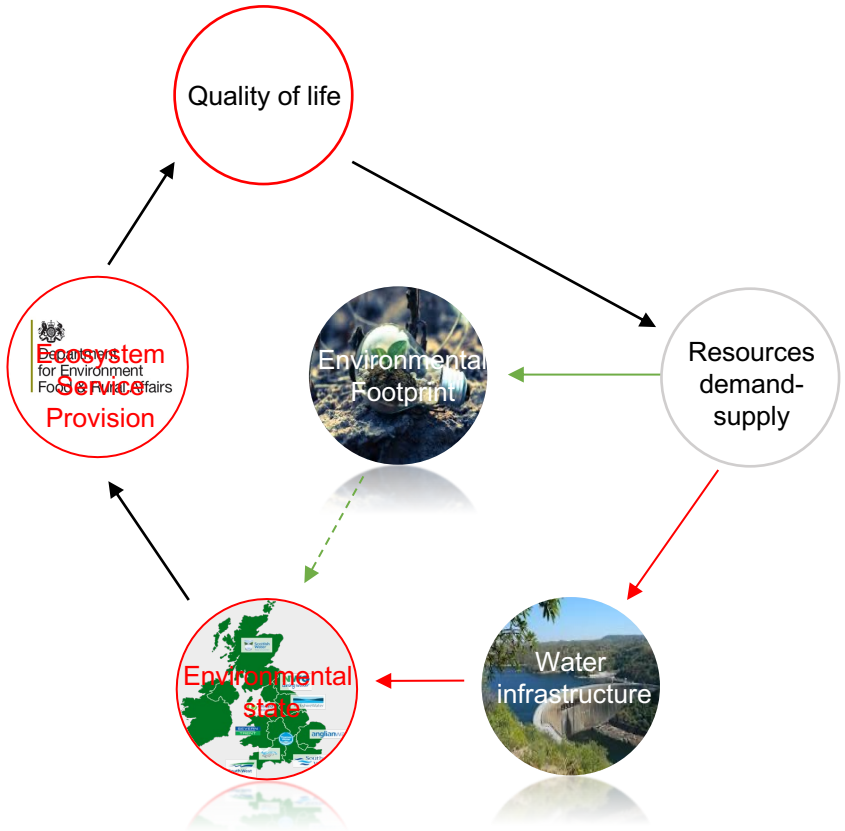
Archetype 3: Water Systems Discord



Aggregation Effect:
Urban – rural interactions (Srinivasan et al., 2013)
Perpetual growth (left) is sustained by exporting footprint to external systems / regions / countries (right)

Integration and coordination of meta-model loops can be achieved by following three SYWM principles



Principle 1. Setting environmental management targets with the understanding of role of water infrastructure planning and operation (e.g., Dobson & Mijic, 2020)

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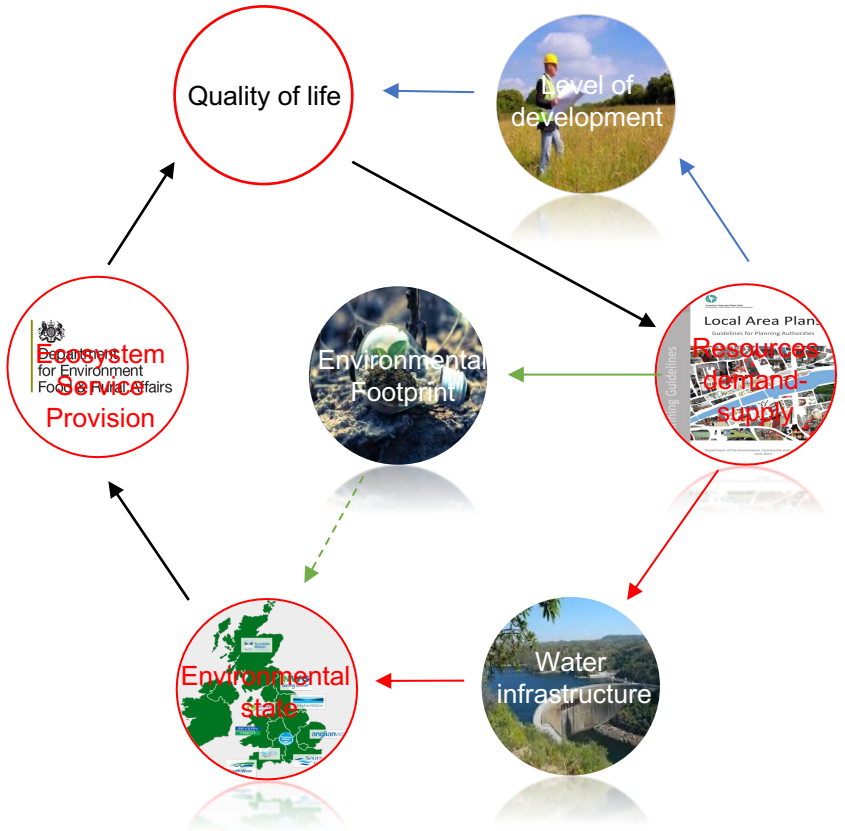

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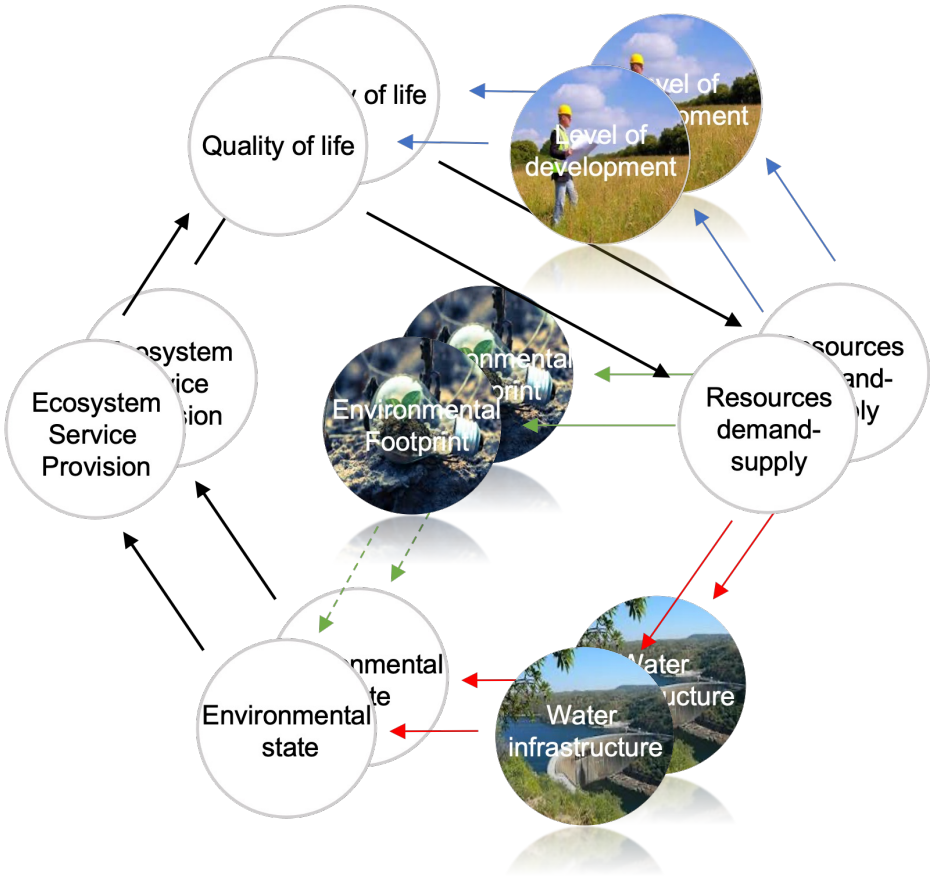
Principle 2. Land development and water infrastructure planning informed by environmental targets (e.g., Puchol-Salort et al., 2022)

Integration and coordination of meta-model loops can be achieved by following three SYWM principles



Principle 1. Setting environmental management targets with the understanding of role of water infrastructure planning and operation (e.g., Dobson & Mijic, 2020)

Principle 2. Land development and water infrastructure planning informed by environmental targets (e.g., Puchol-Salort et al., 2022)

Principle 3. Integrated cross-systems (e.g., rural-urban) water planning with maximising co-benefits and accounting for trade-offs (e.g., Liu et al., 2022)

List of references in order of appearance:

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WATER SYSTEMS INTEGRATION

Thank you!

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