Living within our means: Taking account of catchment context

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UWE / CSE ‘Knowledge Conclave’ (virtual)
Living within our means:
Taking account of catchment context

- Mining nature
- Regenerative landscapes
- Water transitions
- Living within catchment capacities
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Homo sapiens, the ‘wise man’
Genesis 1:28

God blessed them and said to them, “Be fruitful and multiply, and fill the earth and subdue it; rule over the fish of the sea and the birds of the air and every creature that crawls upon the earth.”
Humans appropriation of potential net planetary primary productivity:

- **Doubled in the 20th century**
  - 13% in 1910
  - 25% in 2013

96% of global mammalian biomass comprises humans and their livestock

70% of global bird biomass comprises domesticated poultry

Water as utility, not living resource
Humans & The Extinction Crisis


https://www.biologicaldiversity.org/programs/population_and_sustainability/extinction
A. Nature and its vital contributions to people, which together embody biodiversity and ecosystem functions and services, are deteriorating worldwide.

B. Direct and indirect drivers of change have accelerated during the past 50 years.

C. Goals for conserving and sustainably using nature and achieving sustainability cannot be met by current trajectories, and goals for 2030 and beyond may only be achieved through transformative changes across economic, social, political and technological factors.

D. Nature can be conserved, restored and used sustainably while other global societal goals are simultane and concerted efforts fostering transformative change.

IPBES (2019): a sobering global overview

https://ipbes.net/system/tdf/ipbes_global_assessment_report_summary_for_policymakers.pdf?file=1
<table>
<thead>
<tr>
<th>Provisioning services</th>
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<td>Erosion regulation</td>
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<td>Water purification and waste treatment</td>
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<td>Pollination</td>
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<td>Salinity control</td>
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**Land, landscapes and water as critical ‘natural infrastructure’**

**Supporting services**
- Soil formation + nutrient cycling + water recycling + provision of habitat
- Primary production
- Photosynthesis (production of atmospheric oxygen)
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- **Ecological degradation**
- **Social degradation**
  - Equity between stakeholders and generations
- **Economic degradation**
  - Short-term, narrow utility trumps sustainable value

**Supporting services**

- Soil formation + nutrient cycling + water recycling + provision of habitat
- Primary production
- Photosynthesis (production of atmospheric oxygen)

**Dr.**

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All ecosystems services are part of a system

Ecosystems: living and non-living components

Ecosystem functions: physical, chemical, biological, etc.

Ecosystem services: benefits to people

Benefits: economic and non-economic

The economy: subset of traded services

‘Degenerative landscapes’

Focus on exploitation in a linked socio-ecological system

Degrading foundational resources → Declining security

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- ‘Phiri Pits’ (Zimbabwe)
- Zai’ (Burkina Faso)
- Bofedales and Qochas (Peru)
- Sand dams (Kenya)
- Terracing (particularly Asia)
- Etc…
‘Regenerative landscapes’

Focus on renewability of a linked socio-ecological system

Investment of foundational capital  Increasing security

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Community and ecosystem-centred

Mechanised and competitive
Technology and policy: The ‘civil engineering paradigm’

As cities grow:

• Engineering-based approach dominates
  • Depletion of urban resources
  • “...taking more from further” resource exploitation
  • Conflicts with rural communities denied access to resources


1. Water as a finite, living resources
   - Recognises catchment context
2. Involving multiple sectors of society
3. Specifically role of women
4. Economic contexts (uses)

- ‘Non-use’ values are not explicit
- Perceived as promoting industry interests
- Stewardship = recharge + exploitation
Integrated Water Resource Stewardship (IWRS)

A socio-ecological framework supporting catchment-scale water resource stewardship.
Environmental Science and Policy, 91, pp. 50-59.

- Principle No.1: Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment
- Principle No.2: Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels
- Principle No.3: Women play a central part in the provision, management and safeguarding of water
- Principle No.4: Water has an economic value in all its competing uses and should be recognized as an economic good
- Principle No.5: Sustainable stewardship of fresh water systems includes protection or enhancement of resource regeneration processes, safeguarding or increasing the resilience and socio-ecological systems
### Engineering or ecosystems? A false dichotomy

#### Recognition of the need for more:
- Nature-based, participatory, etc.

#### Recognition of the need to address:
- Urbanisation, population, technology

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<tr>
<td>Urban supply</td>
<td>Energy/chemical inputs</td>
<td>Local needs</td>
<td>Works at low density</td>
</tr>
<tr>
<td>Reliable flows</td>
<td>Pipework</td>
<td>Low inputs (energy, etc.)</td>
<td>Not industrial scale</td>
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<tr>
<td>Waste removal</td>
<td>Resource diversion</td>
<td>Regenerates resource</td>
<td>May be intermittent</td>
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<tr>
<td>Convenience</td>
<td>Distributional benefits</td>
<td>Ecosystem resilience</td>
<td></td>
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<tr>
<td>Established institutional processes</td>
<td>Non-focal services?</td>
<td>Collateral benefits</td>
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+ Climate resilience
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Water and soil productivity

Ecological

Natural resource degradation

Resource poverty and conflict

Uneven sharing of costs and benefits

Exploitation

Stewardship

Regeneration

Resource security

Social

Economic

Distributional equity

Uneven sharing of costs and benefits

Dr.
Living within catchment capacities: the Banas catchment

Arid or semi-arid
Issues in the rural upper Banas

**Upper Banas**
- Formerly community recharge
- Increasingly mechanised/competitive
- Village abandonment / fluorosis

**Middle Banas**
- Bisalpur Dam: built for local uses (1987)
- Urban appropriation (Jaipur, 2006-9)
- No dam releases

**Lower Banas**
- Former connectivity
- Fragmentation + depletion
- Inflows to the Chambal

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Tightly linked vulnerabilities

All facets of a tightly linked, multi-faceted socio-ecological system
# Hybridising technologies

## Ecosystem service provision by different types of water management infrastructure

<table>
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<tr>
<th>Type of infrastructure</th>
<th>Strengths and mitigation measures relating to ecosystem service provision</th>
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<tbody>
<tr>
<td>Natural</td>
<td>Provides multiple, linked ecosystem services suiting low demand</td>
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<tr>
<td></td>
<td>Can be over-ridden with increasing demand</td>
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<tr>
<td></td>
<td>Protect, restore or recreate critical habitat to retain or regenerate services</td>
</tr>
<tr>
<td>Traditional</td>
<td>Works with natural processes to augment supply of water and related ecosystem services</td>
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<td></td>
<td>May require substantial land area, and lack of innovation may not adequately address contemporary lifestyles</td>
</tr>
<tr>
<td></td>
<td>Reverse current trends towards abandonment of traditional practices</td>
</tr>
<tr>
<td></td>
<td>Innovate novel methods to apply traditional wisdom in modern contexts</td>
</tr>
<tr>
<td>‘Green’</td>
<td>Emulates natural processes to offset shortfalls in developed environments</td>
</tr>
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<td></td>
<td>Limited opportunities for retrofitting, and needs recognition of the value of services in new build</td>
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<tr>
<td></td>
<td>Requires recognition of the value of ecosystem services on a par with built assets in urban and industrial planning and development</td>
</tr>
<tr>
<td>‘Hard’</td>
<td>Provides efficient delivery of a limited set of services for dense populations</td>
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<tr>
<td></td>
<td>Tends to create many negative externalities</td>
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<td></td>
<td>Narrow presumptions in favour of ‘hard’ engineering solutions need to be challenged, considering how alternative approaches may provide more sustainable solutions</td>
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<tr>
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<td>Where ‘hard engineering’ solutions best serve identified needs, mitigation can be achieved by looking upstream to restore catchment scale processes compensating for lost or degraded ecosystem services</td>
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Treating the catchment as an integrated socio-ecological system

Potential flows to mitigate and generate ecosystem processes generating water security in the Banas catchment:

(A) Mitigation through **compensatory investment** from mainly urban beneficiaries of ‘hard’ engineering in natural and traditional the upper catchment regenerating resources;

(B) **Enhanced flows** of fresh water replenishing the catchment, dam and associated ecosystem services; and

(C) Potential for excess water enabling ‘**environmental flow’** releases mitigating downstream impacts of water diversion


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Building on political levers

How to influence across policy sectors?

**Successor schemes to...**

Mukhya Mantri Jal Swavlamban Abhiyan to ensure development of forest, land, water & fauna keeping watershed, cluster, index as a unit for natural resource management.

#DIPRRajasthan
New UN Decade on Ecosystem Restoration offers unparalleled opportunity for job creation, food security and addressing climate change.

The United Nations General Assembly declared 2021–2030 the UN Decade on Ecosystem Restoration.
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