River basin management and planning

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IHE DELFT Institute for Water Education
under the auspices of UNESCO

River basin management and planning

Outline

River basin management

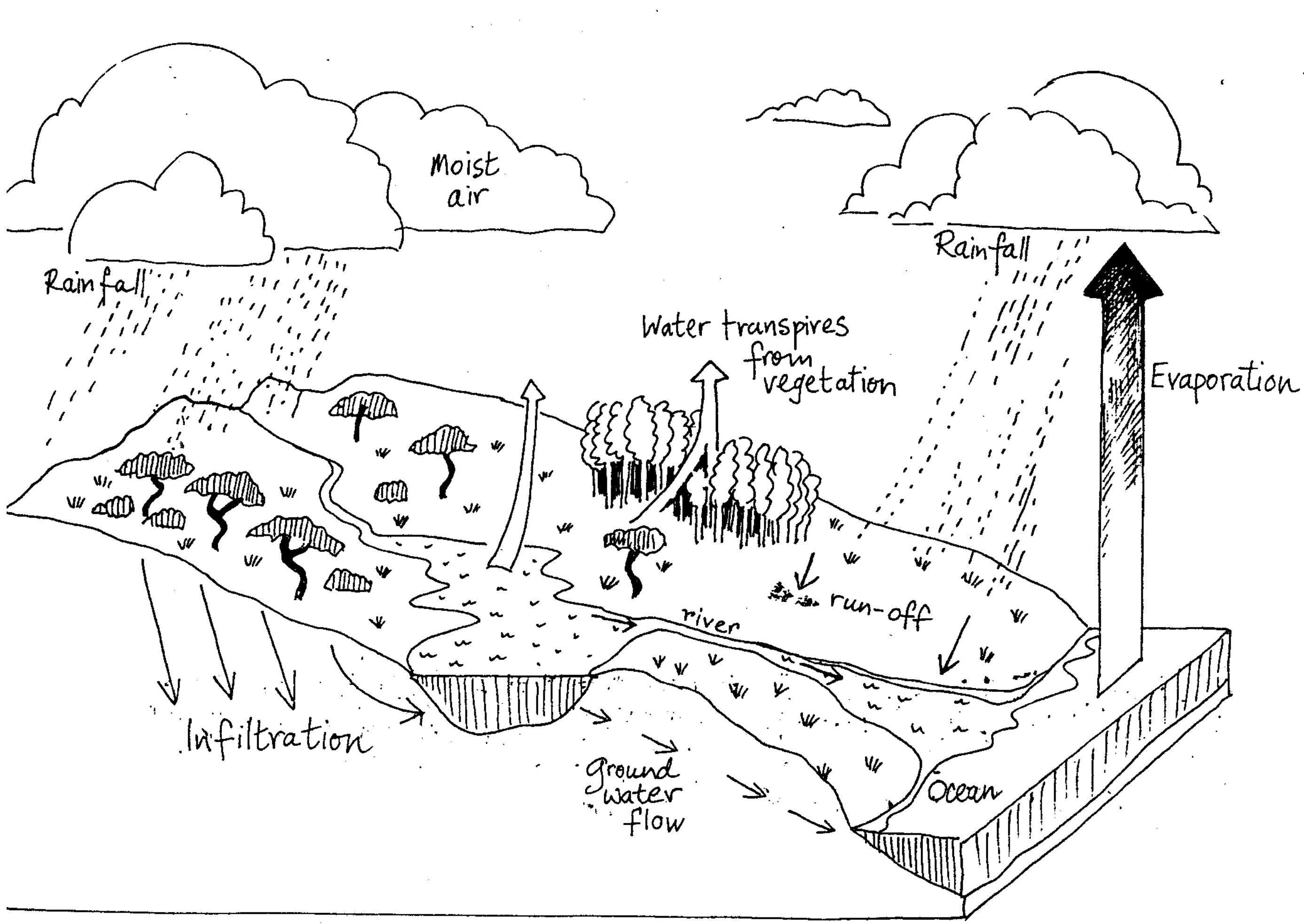
- Hydrological cycle
- IWRM
- River basin a natural management unit?
- Basin trajectories, basin closure and basin crises
- Responses to basin closure and pitfalls

River basin planning

- Objectives
- Potential benefits
- Potential pitfalls

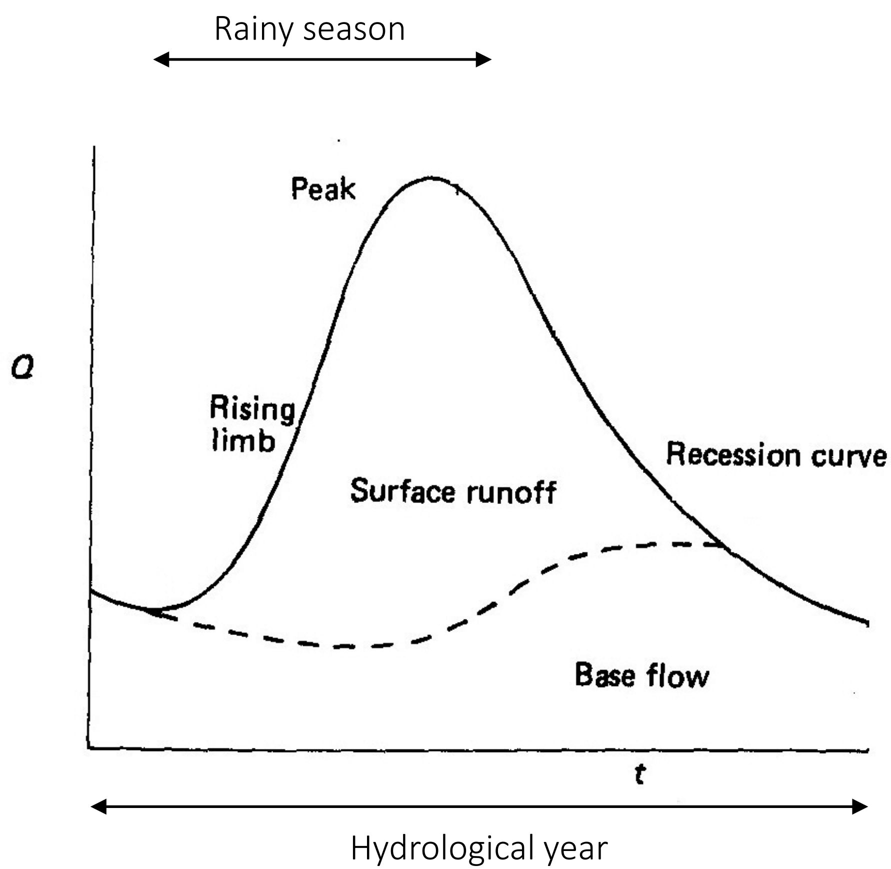
Exercise

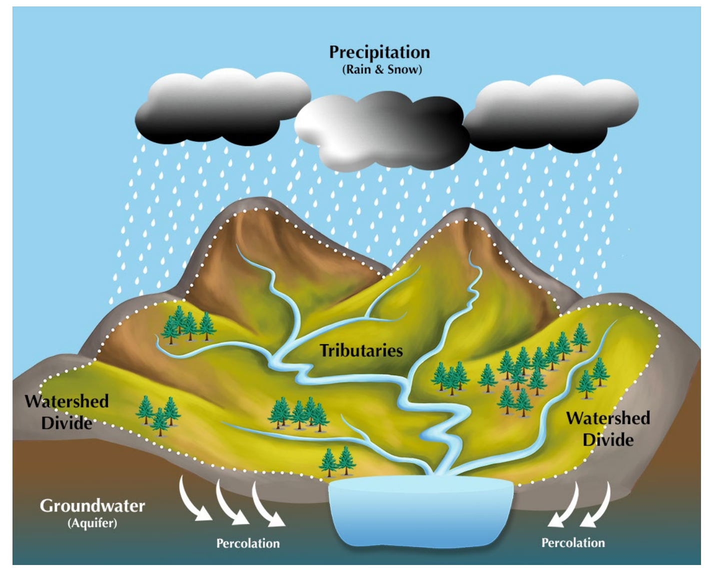
Hydrological cycle



Source: Pallett et al., 1997

Hydrological cycle



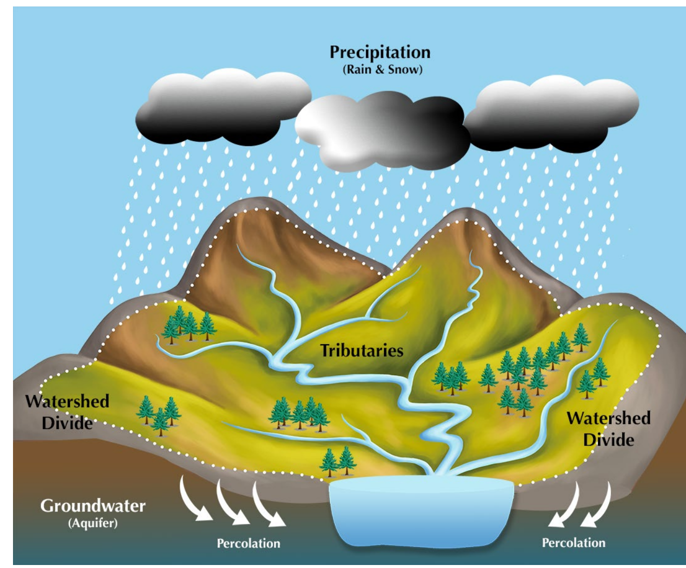


Source: Kim Roberts, Center for Watershed protection. https://www.cwp.org/watershed101/

Hydrological cycle

- River basin/drainage basin/catchment area/watershed

Source: United Nations Environment Programme (UNEP); World Conservation Monitoring Centre (WCMC); World Resources Institute (WRI); American Association for the Advancement of Science (AAAS); *Atlas of Population and Environment*, 2001.



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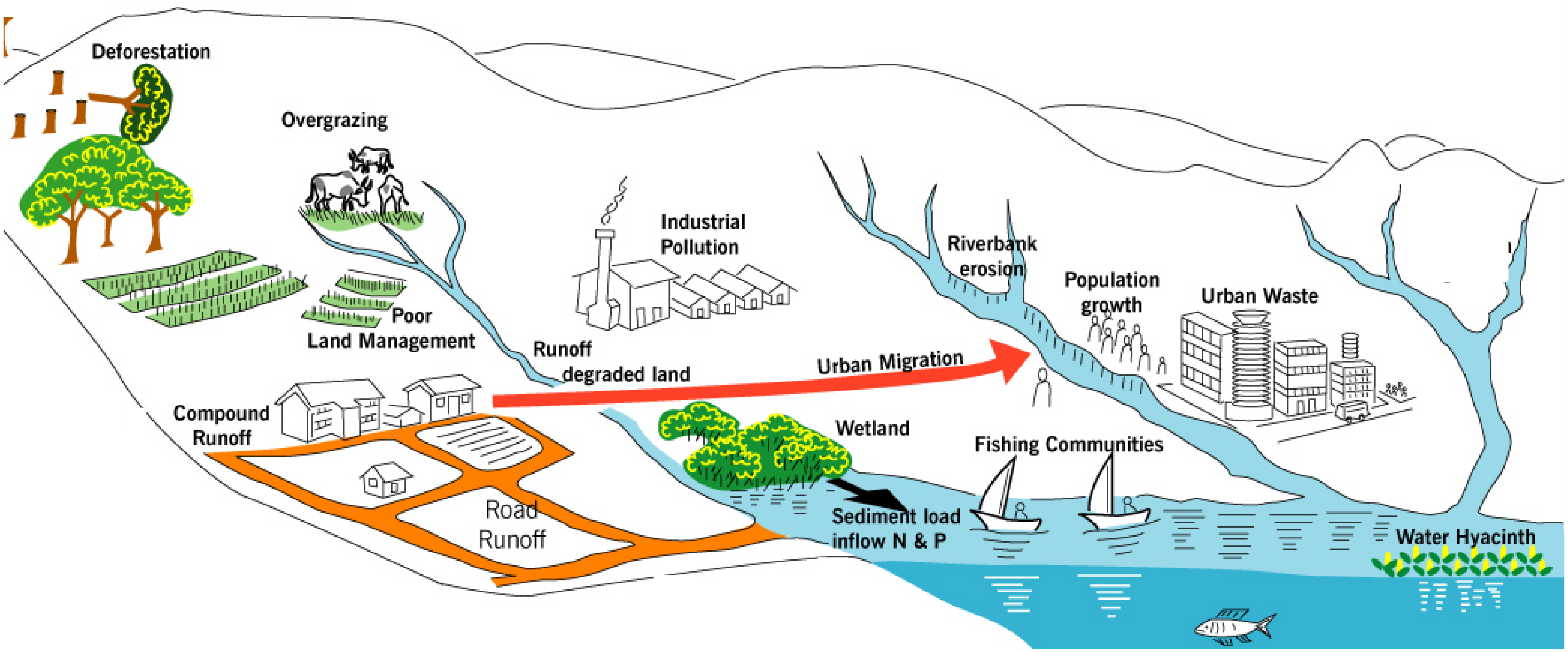
Integrated water resources management



All water flows are embedded in drainage basins

- creating interdependencies between uses and users

Integrated water resources management

UN Conference on Environment and Development (Rio, 1992)

adopted Agenda 21 (Chapter 18)

"Integrated water resources management is based on the perception of water as an integral part of the ecosystem, a natural resource and a social and economic good..."

"Integrated water resources management, including ... land- and water-related aspects, should be carried out at the level of the catchment basin or sub-basin."

Integrated water resources management

Four dimensions

- **Water Resources:** the entire water cycle
- **Water Users:** all users, all sectors
- **Spatial:** spatial distribution, management scales, spatial planning
- **Temporal:** variation in availability and demand, physical structures

Integrated water resources management

Four dimensions

- Water Resources: the entire water cycle
- Water Users: all users, all sectors
- Spatial: spatial distribution, management scales, spatial planning
- Temporal: variation in availability and demand, physical structures

Integrate these dimensions in decision-making

by means of institutions that are considered legitimate; and with active stakeholder involvement

Integrated water resources management

Definition of GWP:

"Integrated Water Resources Management is

a process which promotes the coordinated development and management of water, land and related resources,

in order to maximise the resultant economic and social welfare in an equitable manner

without compromising the sustainability of vital ecosystems."

(Global Water Partnership, 2000)

Integrated water resources management

Decision-making:

involves the integration of the different demands where possible, and

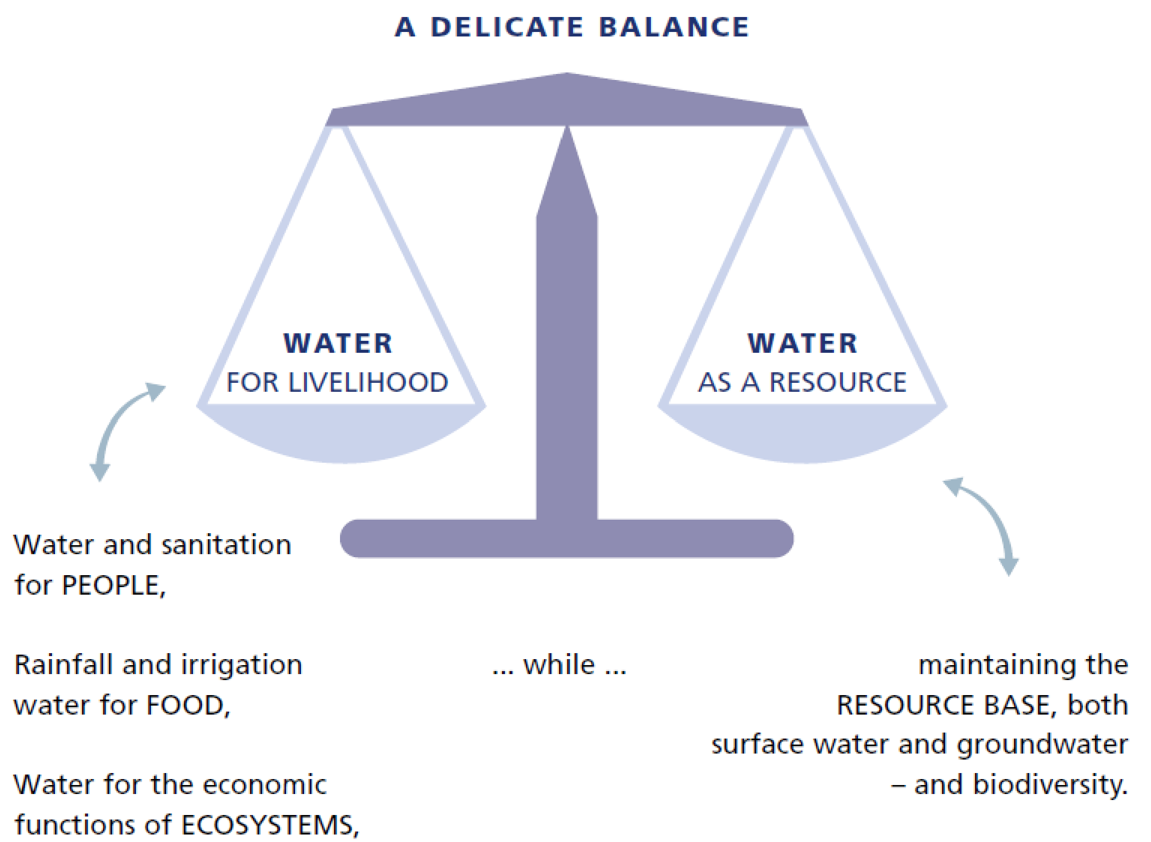
a trade-off or priority-setting where necessary,

by carefully weighing these in an informed and transparent manner,

according to societal objectives and constraints

Integrated water resources management

Which societal objectives?



Source: GWP, n.d.

Integrated water resources management

Policy principles

- **E**quity (or social equity)
- **E**cological integrity (or sustainability)
- **E**fficiency (or economic efficiency)

South Africa:

"Some for all forever"

Integrated water resources management

Equity x Ecological integrity x Efficiency

Not only tradeoffs, there are also synergies, e.g.

- water demand management
- increasing block tariff pricing system for drinking water
- soil and water conservation measures
- human capacity development

Integrated water resources management

Often (but not always) involves three shifts in water governance:

1. Hydrology: managing water along hydrological boundaries
2. Democracy: public participation in decision-making
3. Economy: water is priced, so that its management is self-financed by the water users

Source: Bolding and Vincent, 2004

Integrated water resources management

Emerging consensus:

Water management requires a holistic, integrated approach

Water management needs to be aligned to land use planning and broader socio-economic development policies

Water management requires a participatory approach

In terms of water allocation, basic human needs normally have priority; other uses will normally be prioritised according to societal needs and socio-economic criteria.

The river basin is often accepted as the logical management unit, *but not always*.

The basin as “the logical” management unit

Conventional administrative structures *vs.* specialised catchment-based institutions

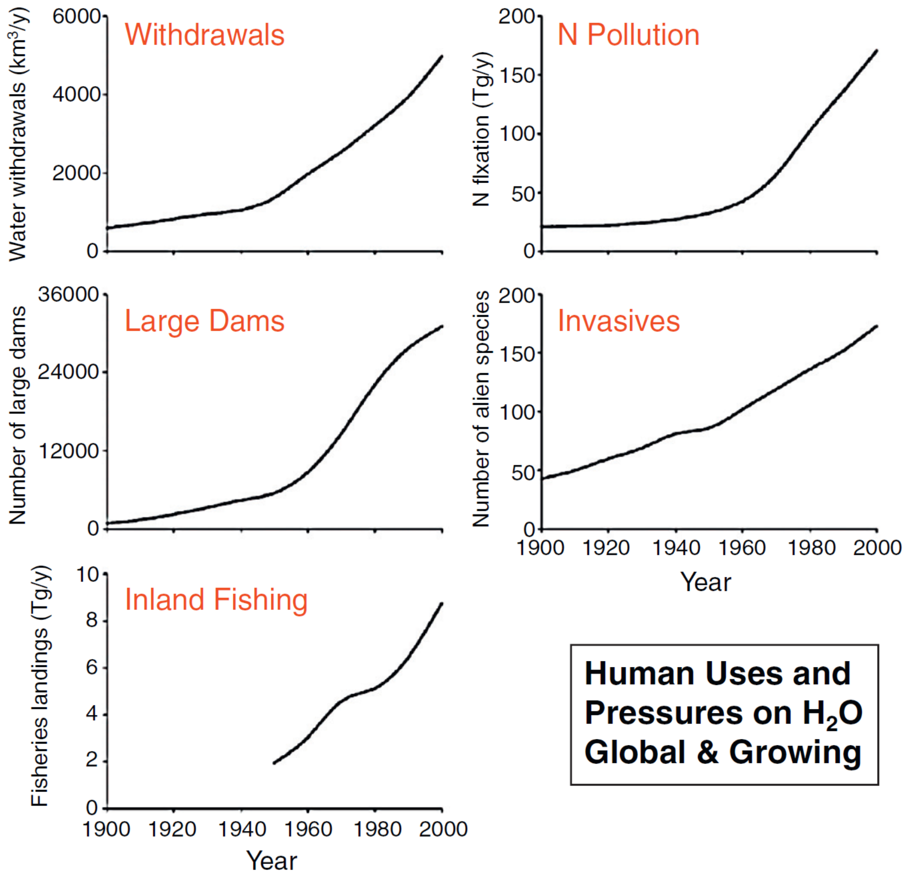
The dilemma of horizontal integration / institutional fit;

- Executive, coordinating or consultative roles for river commissions / councils / organisations / authorities?
- What role for the “District”, the conventional locus of integrated rural development?

Catchment Commission (France)	Catchment Council (Mexico, Brasil)	Regional Water Authority (Netherlands)	Catchment Authority (USA, Spain)

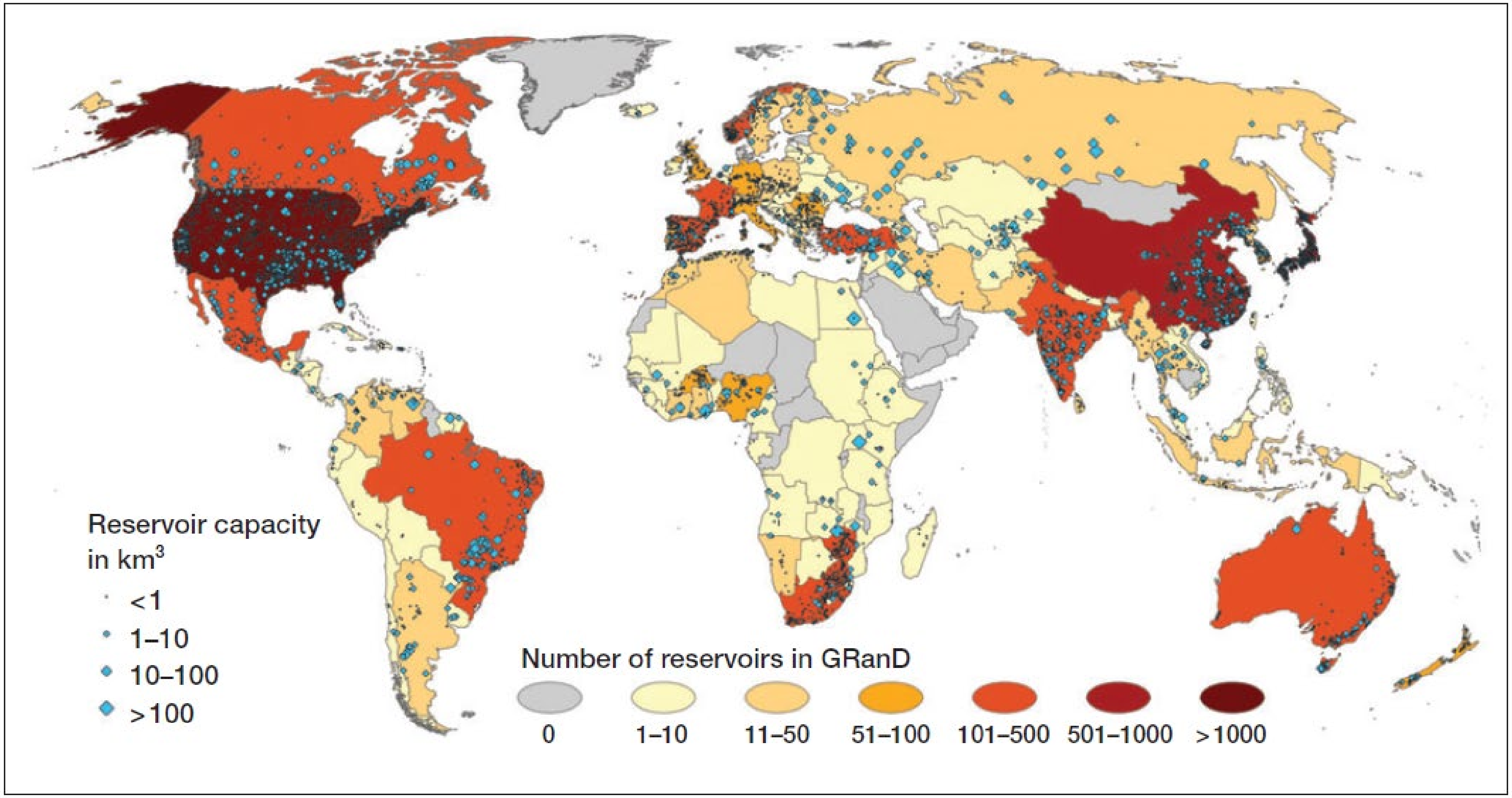
Coordinating ⟷ Executive

Basin trajectories



Source: Vörösmarty et al., 2013, p. 540

Basin trajectories



Global distribution of large reservoirs

Source: Lehner et al., 2011; p. 496

Basin trajectories

In many river basins water use is constantly increasing.

This has all kinds of consequences

→ Basin trajectories (François Molle)

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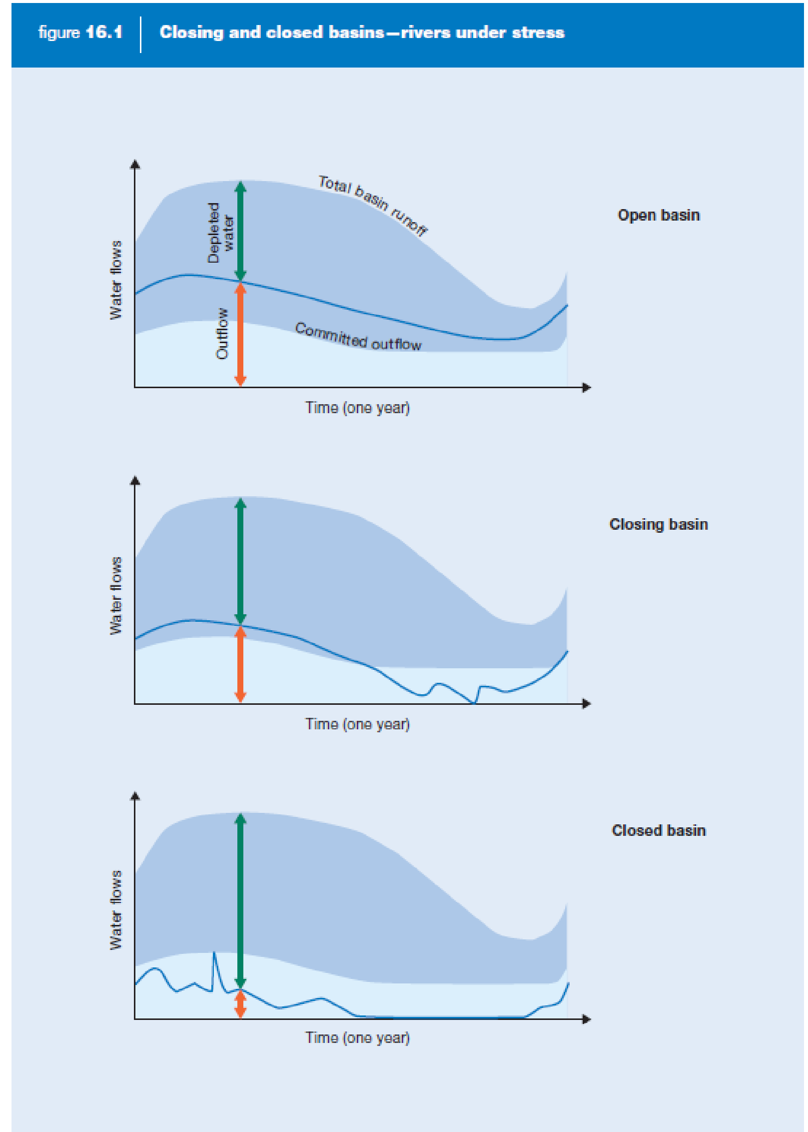
This has all kinds of consequences

→ Basin trajectories (François Molle)

Basin closure:

- when an additional use of water by one reduces the water availability for another

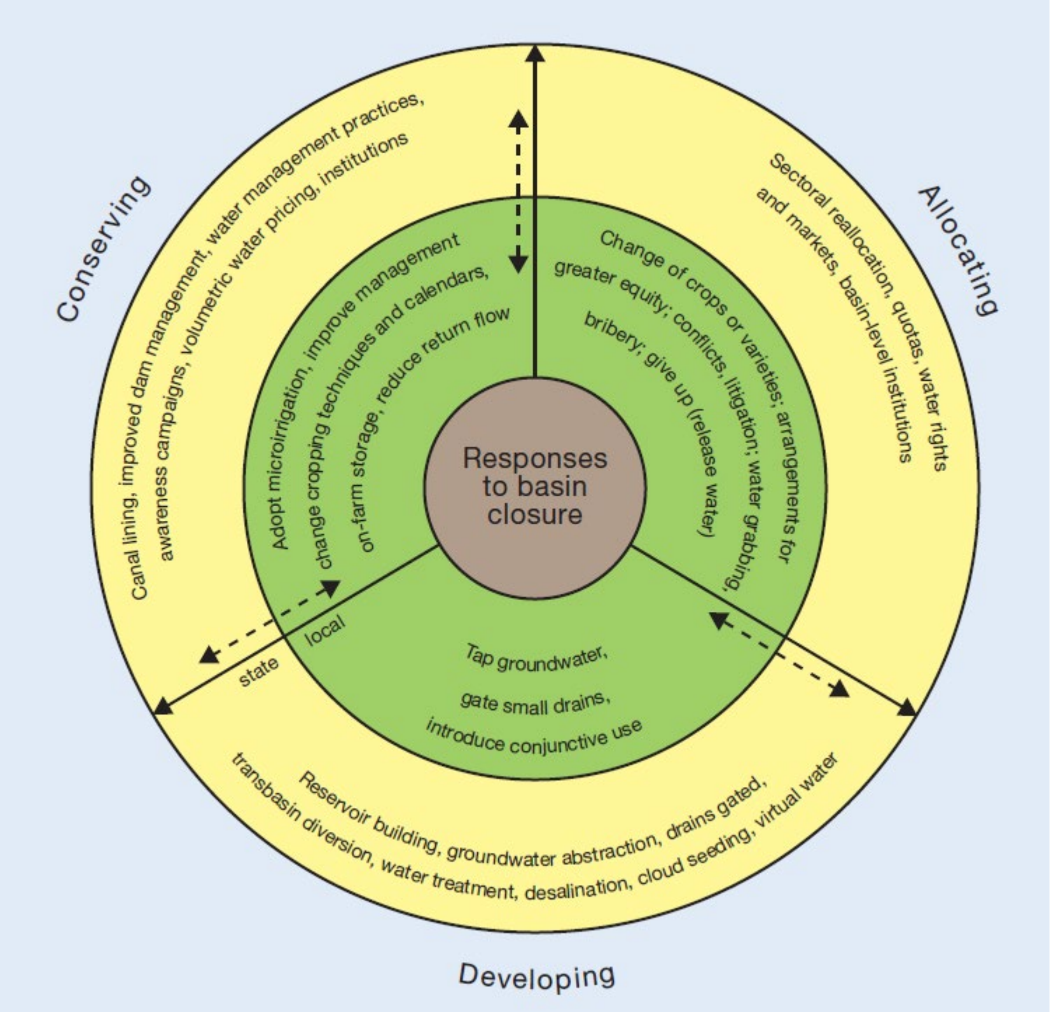


Source: Molle et al., 2007

Basin trajectories

Responses
to basin closure:

- Supply-oriented:
  develop new infrastructures
- Demand-oriented:
  - conserve water
  - soil and water conservation
- Allocation:
  - sectoral re-allocation
  - water permits
  - water markets?



Source: Molle et al., 2007

Basin trajectories

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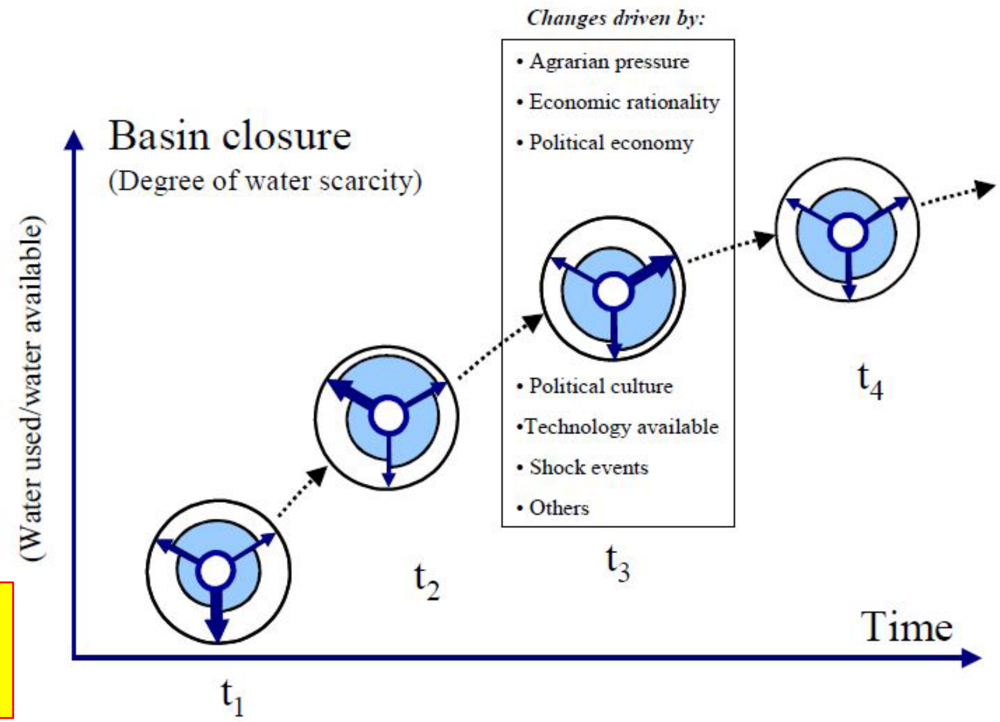
LEARN!



Source: Molle , 2003

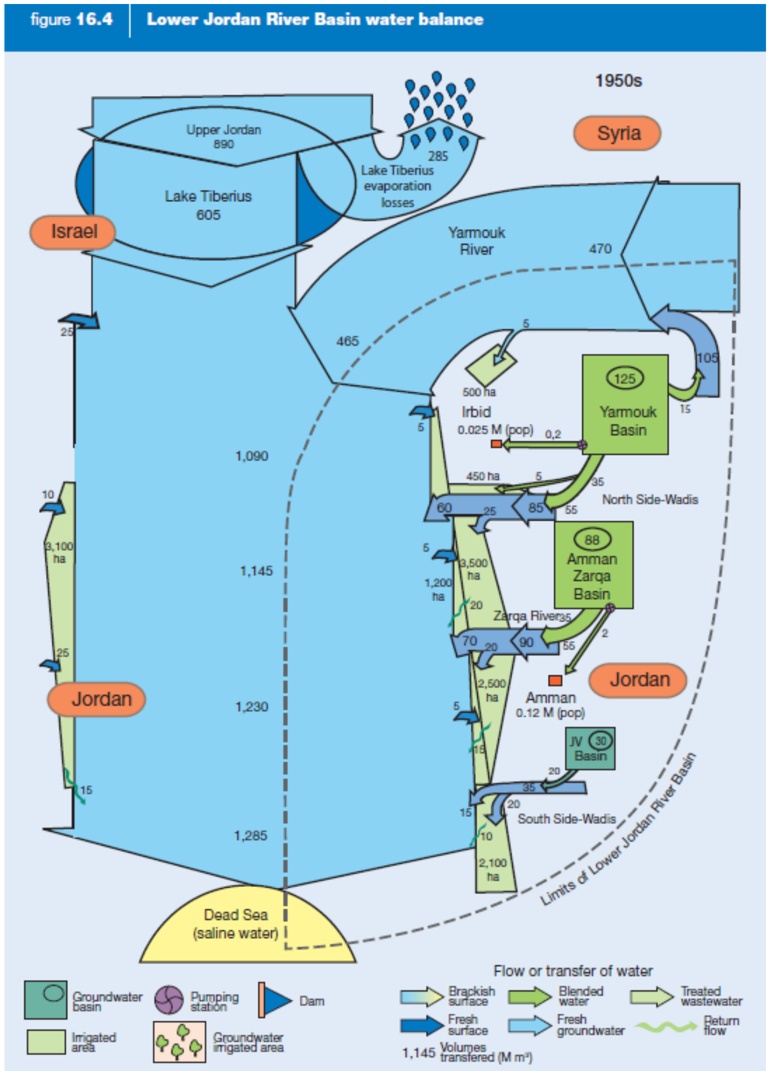
Basin closure and basin crises

Basin closure:

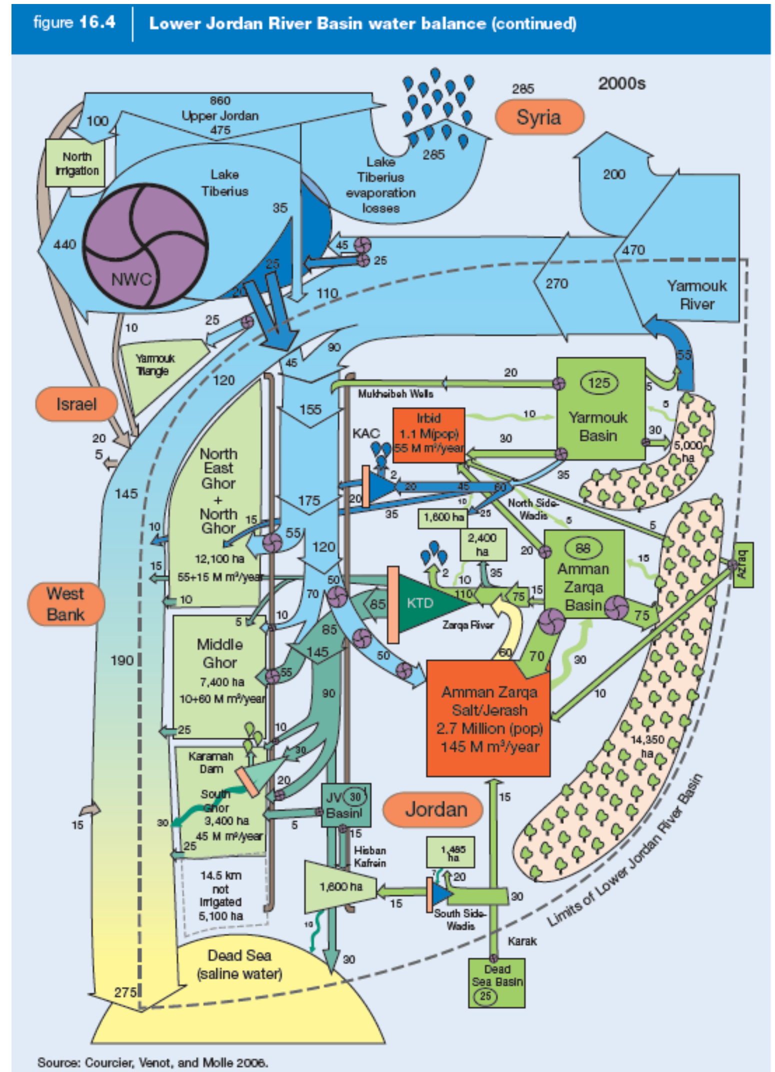
- leads to crises
- requires change

- Examples:
  - Jordan river basin (Molle et al., 2007)
  - Guadalajara, Mexico (Godinez Madrigal et al., 2022)

Basin closure and basin crises



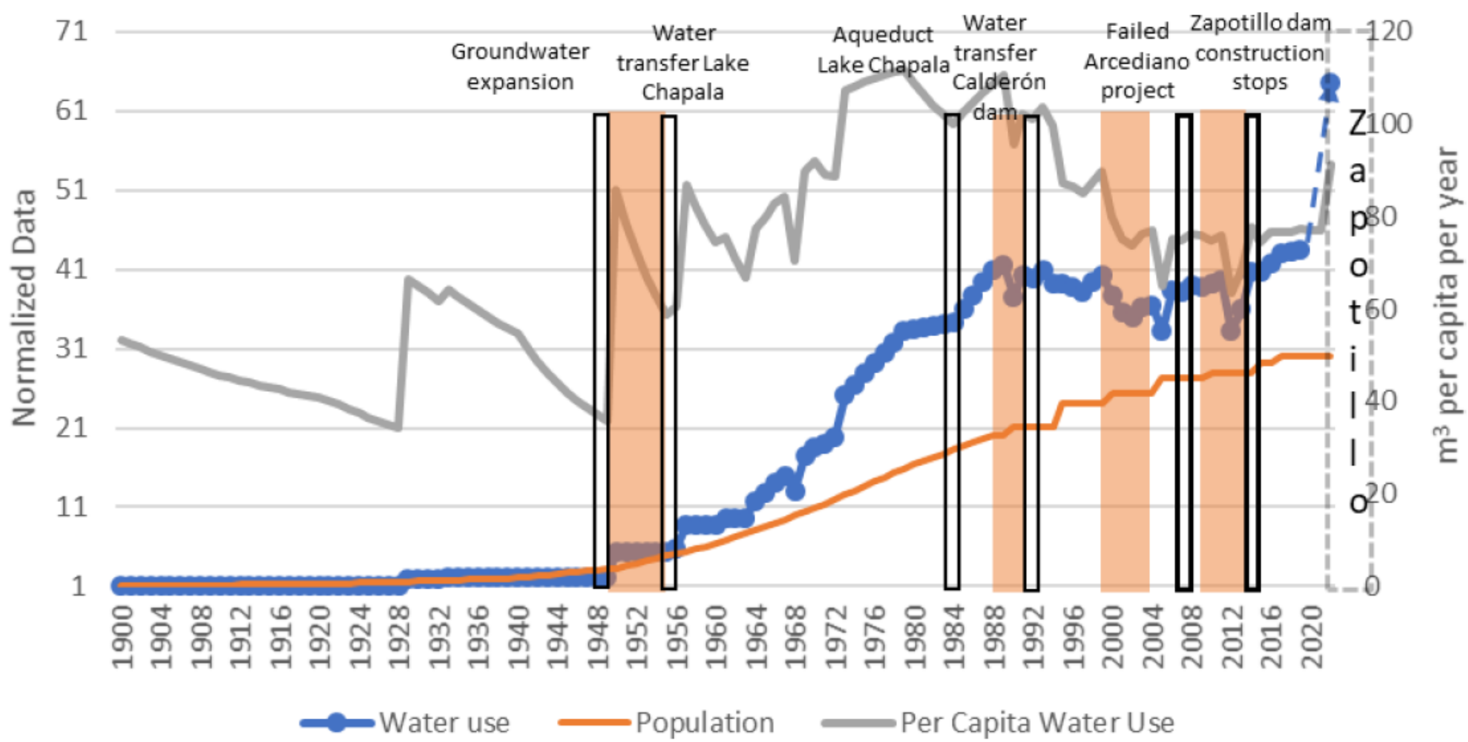
1950s



2000s

Source: Molle et al., 2007

Basin closure and basin crises



City of Guadalajara, Mexico

Source: Godinez Madrigal et al., 2022

Responses to basin closure and pitfalls

Basin closure:

- leads to crises
- requires change

- Common responses:
  - New dams to increase supply
  - Interbasin water transfers (e.g. Ebro, Spain; South-North project China; India's river linking program (see Verma et al. 2009))
  - Increasing water use efficiency in agriculture

Responses to basin closure and pitfalls

Basin closure:

- leads to crises
- requires change

- Com...

...al., 2018)

Such responses make no fundamental change!
They tend towards business as usual.
Yet eternal growth of water use is impossible.
The said responses often postpone the tensions,
but may create even bigger crises later,
which will be increasingly difficult to resolve...

Responses to basin closure

Response to Guadalajara's supply-oriented solution:

Responses to basin closure

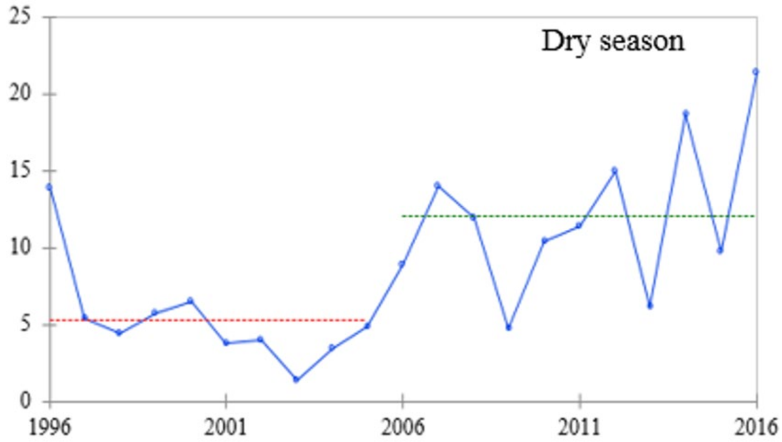
Response to Guadalajara's supply-oriented solution:

Responses to basin closure: SWC

In search of a sustainable solution: soil and water conservation measures

Responses to basin closure: SWC

In search of a sustainable solution: soil and water conservation measures



Re-construction of the base flow in Agula micro-catchment, Tekeze-Atbara river, Nile river basin

Source: Gebremicael et al., 2020

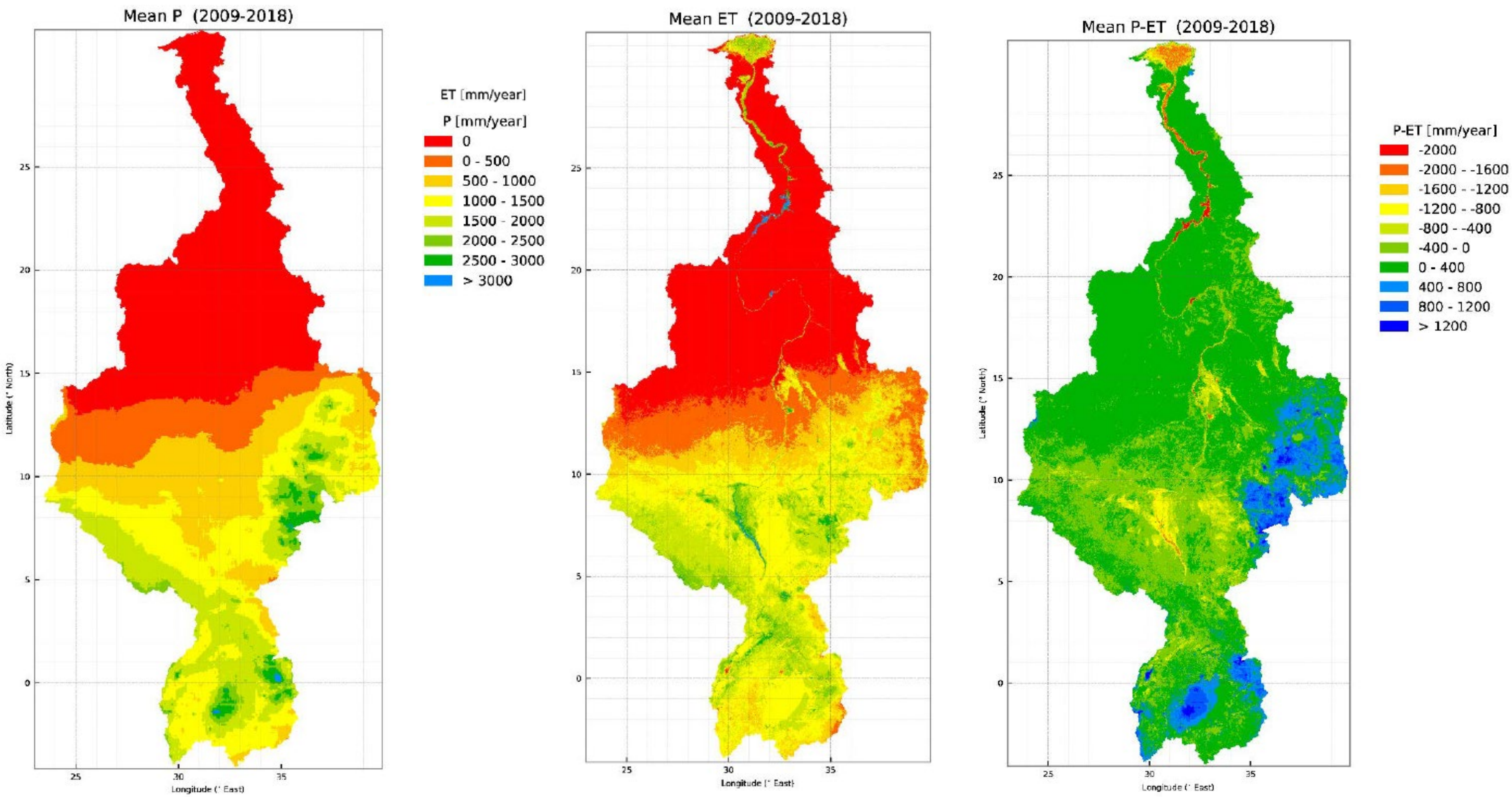
RBM: by way of conclusion

In river basin management:

- Good spatial information on water availability and water demand is critical

RBM: by way of conclusion

In river basin management:

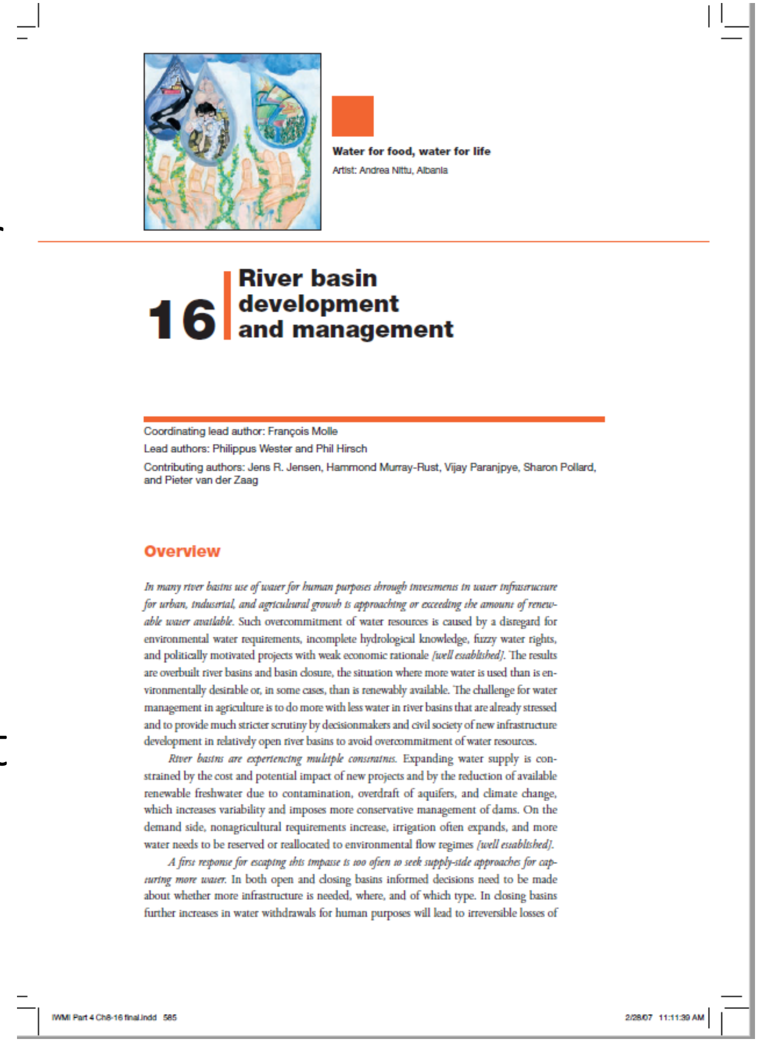


See further: https://wateraccounting.un-ihe.org/

RBM: by way of conclusion

In river basin management:

- Good spatial information on water availability and demand is critical
- Agriculture often consumes the most water
- Catchment management and soil & water conservation is important
- Water allocation is a critical aspect
- Finding ways of making water demand flexible, allows to respond to droughts



Water for food, water for life

Artist: Andrea Nitu, Albania

16 River basin development and management

Coordinating lead author: François Molle

Lead authors: Philippus Wester and Phil Hirsch

Contributing authors: Jens R. Jensen, Hammond Murray-Rust, Vijay Paranjpye, Sharon Pollard, and Pieter van der Zaag

Overview

In many river basins use of water for human purposes through investments in water infrastructure for urban, industrial, and agricultural growth is approaching or exceeding the amount of renewable water available. Such overcommitment of water resources is caused by a disregard for environmental water requirements, incomplete hydrological knowledge, fuzzy water rights, and politically motivated projects with weak economic rationale *[well established]*. The results are overbuilt river basins and basin closure, the situation where more water is used than is environmentally desirable or, in some cases, than is renewably available. The challenge for water management in agriculture is to do more with less water in river basins that are already stressed and to provide much stricter scrutiny by decisionmakers and civil society of new infrastructure development in relatively open river basins to avoid overcommitment of water resources.

River basins are experiencing multiple constraints. Expanding water supply is constrained by the cost and potential impact of new projects and by the reduction of available renewable freshwater due to contamination, overdraft of aquifers, and climate change, which increases variability and imposes more conservative management of dams. On the demand side, nonagricultural requirements increase, irrigation often expands, and more water needs to be reserved or reallocated to environmental flow regimes *[well established]*.

A first response for escaping this impasse is too often to seek supply-side approaches for capturing more water. In both open and closing basins informed decisions need to be made about whether more infrastructure is needed, where, and of which type. In closing basins further increases in water withdrawals for human purposes will lead to irreversible losses of

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Download Chapter 16 of the book "Water for Food, Water for Life" at https://www.iwmi.cgiar.org/assessment/Publications/books.htm

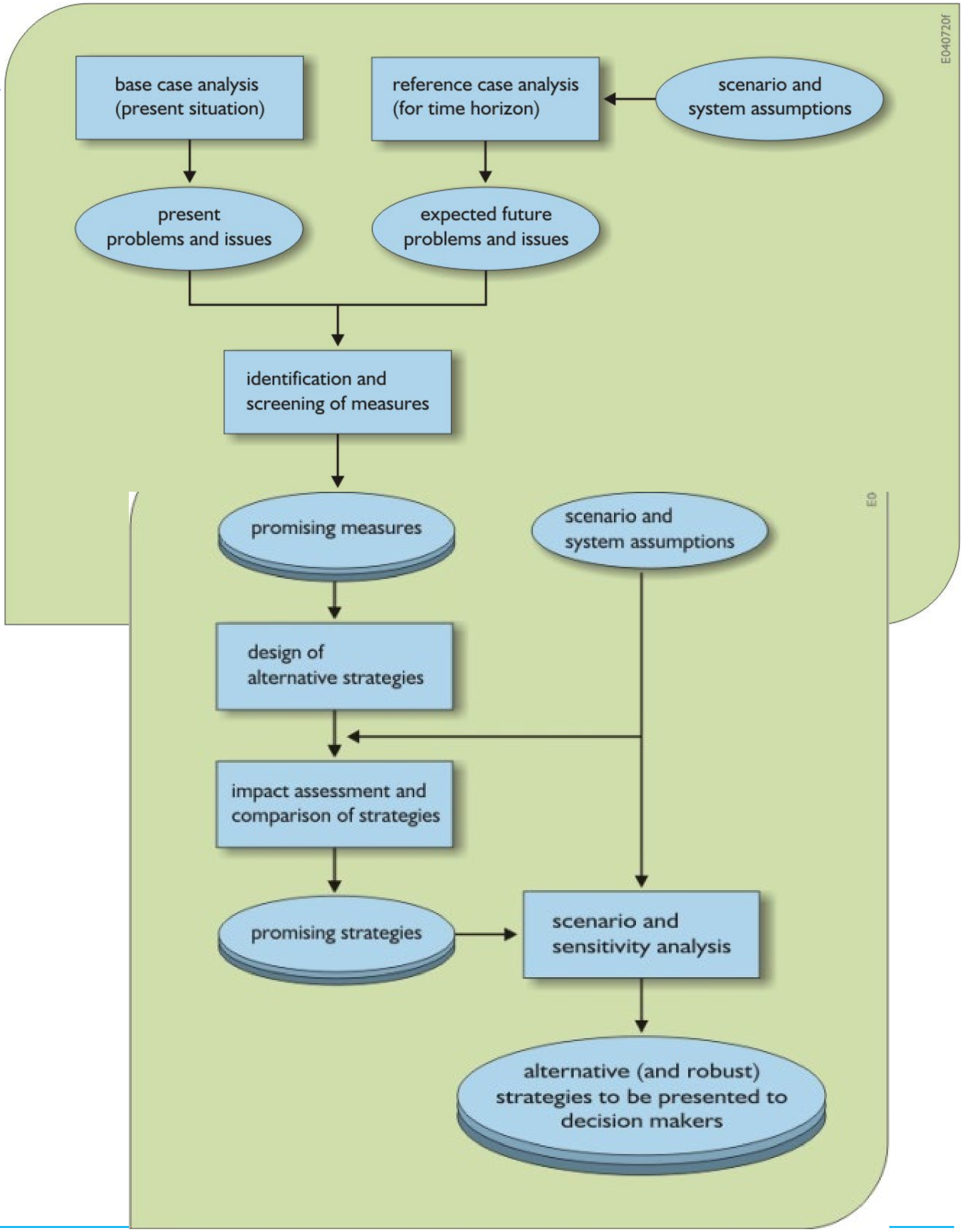
River basin planning

River basin planning

- Aims to match water demand with supply
- Considers all societal interests and all relevant sectors
- Clarifies institutional mandates, roles, responsibilities
- Is based on a critical situational analysis
- Defines objectives and limitations
- Operationalises “the rules of the game”
- Sets priorities in terms of measures (or interventions and investments) and strategy

River basin planning

Measures and strategies



Source: Loucks & Van Beek, 2008

River basin planning

Potential benefits of river basin planning:

- Makes explicit the tradeoffs between relevant sectors
- Helps to align different departments and other players
- Is anticipatory and forward-looking rather than reactive
- Reduces institutional uncertainty
- Enhances private investments

River basin planning

Potential pitfalls of river basin planning:

- The best is the enemy of the good: a plan must be feasible given available resources (time, money, data, staff etc.)
- How to deal with institutional overlaps and voids (i.e. the problem of institutional fit)?
- How to deal with uncertainties (climate, finance, institutional, markets, political, transboundary etc.) and lack of data?

River basin planning

Some preliminary observations:

- Build on what is already there; strengthen what is strong
- Concentrate efforts on the most crucial issues
- Ensure benefits reach more people
- The future will be data and knowledge intensive: invest in monitoring; empower farmers (and other users) to monitor
- If more water storage is needed, first consider nature-based storage
- Do not forget green water, rainfed agriculture, SWC!
- Ensure a financial basis and human resources basis for implementing the plan

Excercise

Take a river basin plan

- Limpopo sub-basin (South Africa)
- Murray Darling basin (Australia)
- Ord basin (Australia)
- Sind sub-basin (India)
- Lower Nile basin (Egypt)

Excercise

Take a river basin plan, scan it, and answer
at least four selected questions from the following:

1. What is the objective of the plan? What is its scale and scope?
2. Identify the boundaries of the planning (biophysical, socioeconomic, administrative)
3. Do you see a link with the water policy? If so, identify the policy that underlies this plan.
4. Identify the authority that is responsible for (a) writing the plan, (b) Implementing the plan, (c) monitoring and evaluating the plan
5. What are the quantitative data underlying the planning activities?
6. Which functions of the water resources systems are considered? Can you identify a priorization of functions?
7. Does the plan incorporate economic evaluations and budgeting of actions? How?

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Thank you!

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