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CPF Collaborative Partnership on Forests

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Forests, soil, water, and their linkages through the biosphere

GFEP Report on Forests and Water (2018)

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GLOBAL FOREST EXPERT PANELS (GFEP)

https://www.iufro.org/science/gfep/

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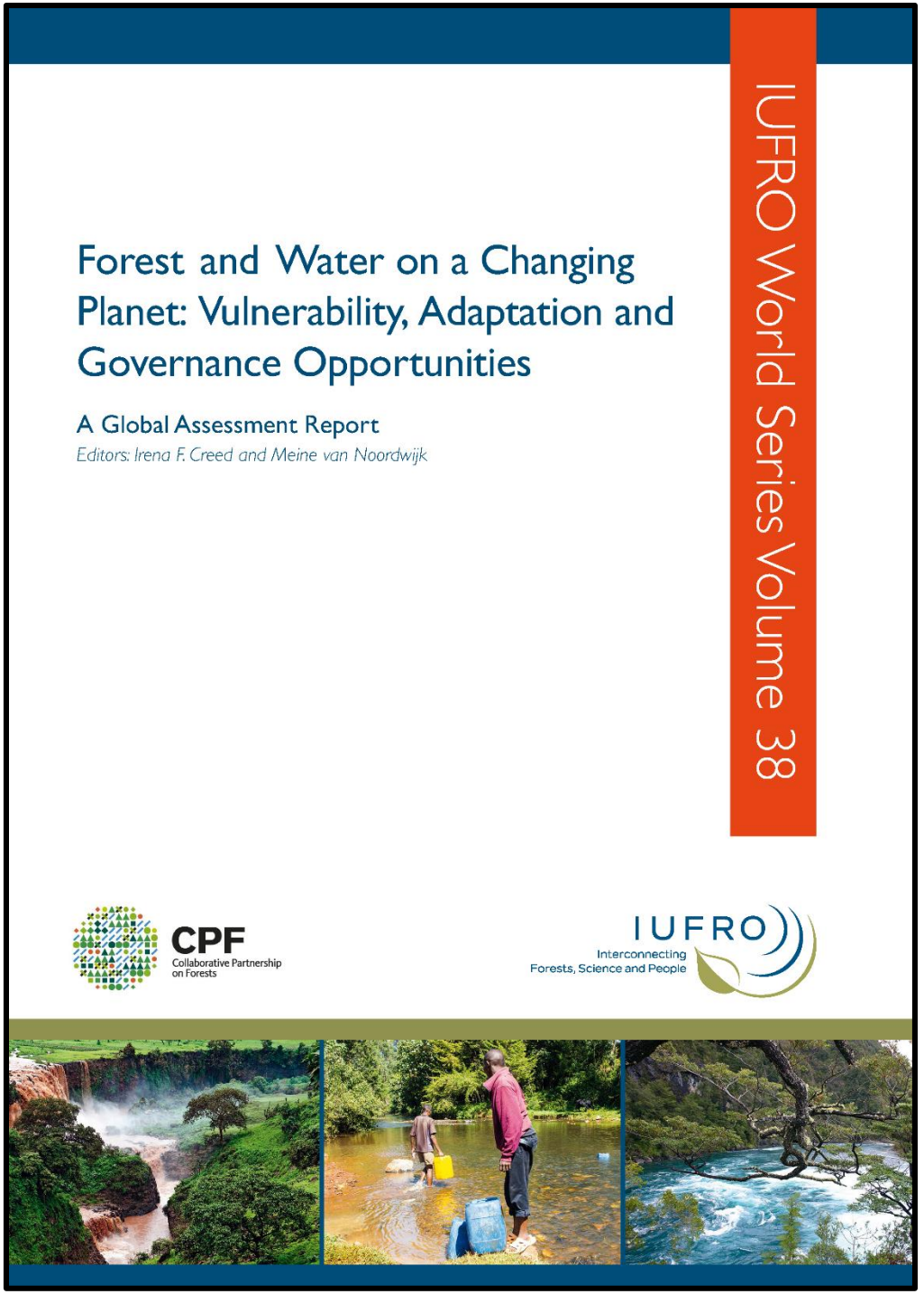
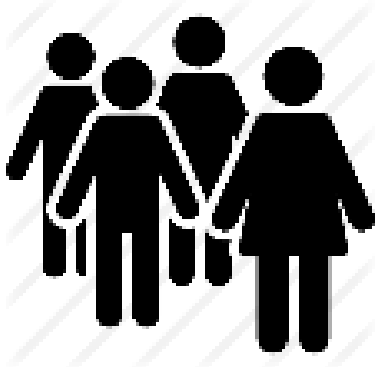


Humans and trees have to share the planet´s water resources

7 billion people on the planet

1,736 billion trees on the planet

4 billion people suffers from water scarcity



Very few trees on arid regions

The relationships between forests and water have long been recognized as important, and the debate keeps going on

Would planting trees help to increase water availability?

Are floods, droughts and trees connected?

Would planting trees reduce water availability?

Does it matter what type or trees, or where they are planted?

The latest Global Forest Expert Panel on Forests and Water try to answer three questions:

1. Do forests matter?
2. Who is responsable and what should be done?
3. How can progress be made and measured?

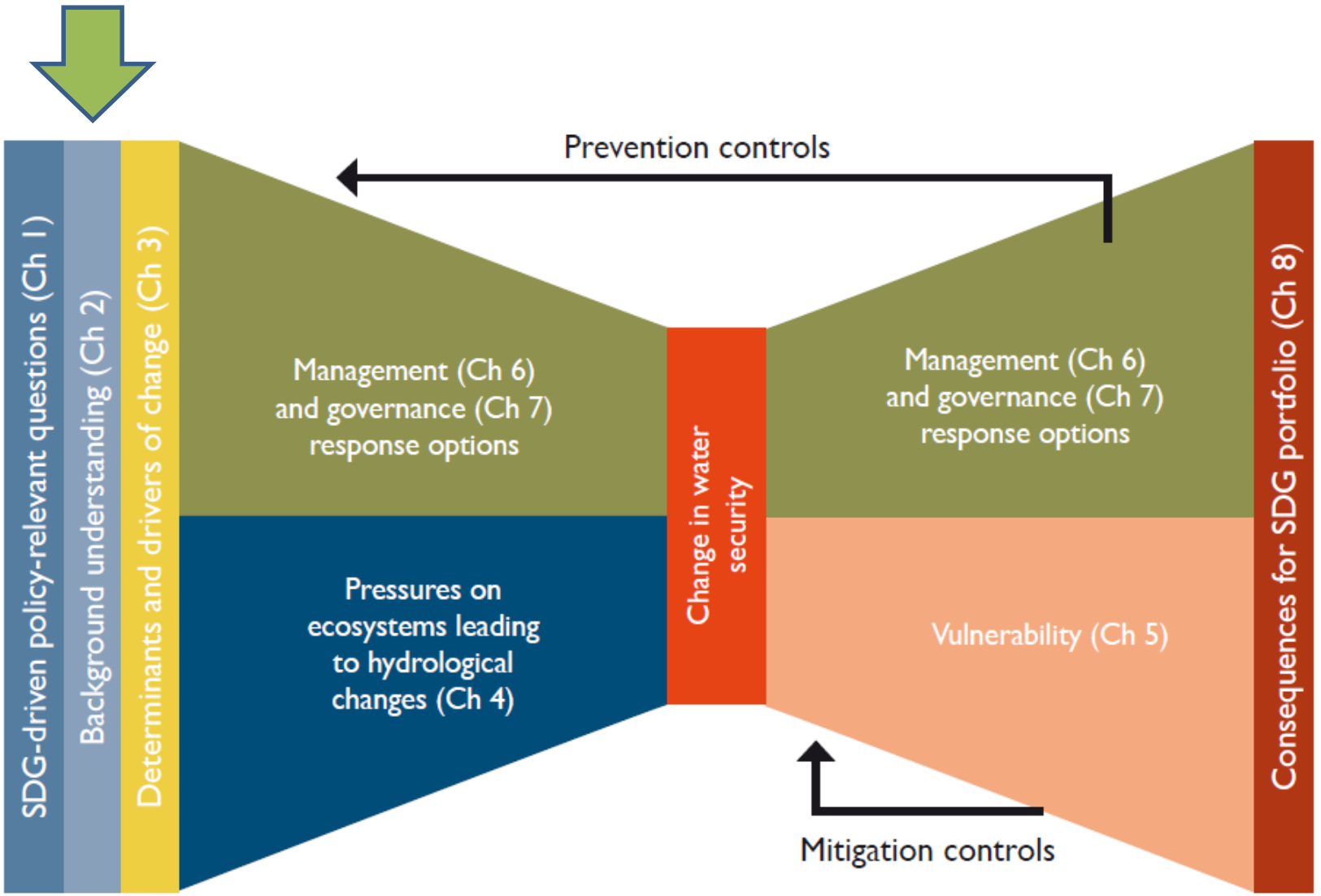
GLOBAL FOREST EXPERT PANELS

IUFRO-led initiative of the Collaborative Partnership on Forests (CPF) since 2006

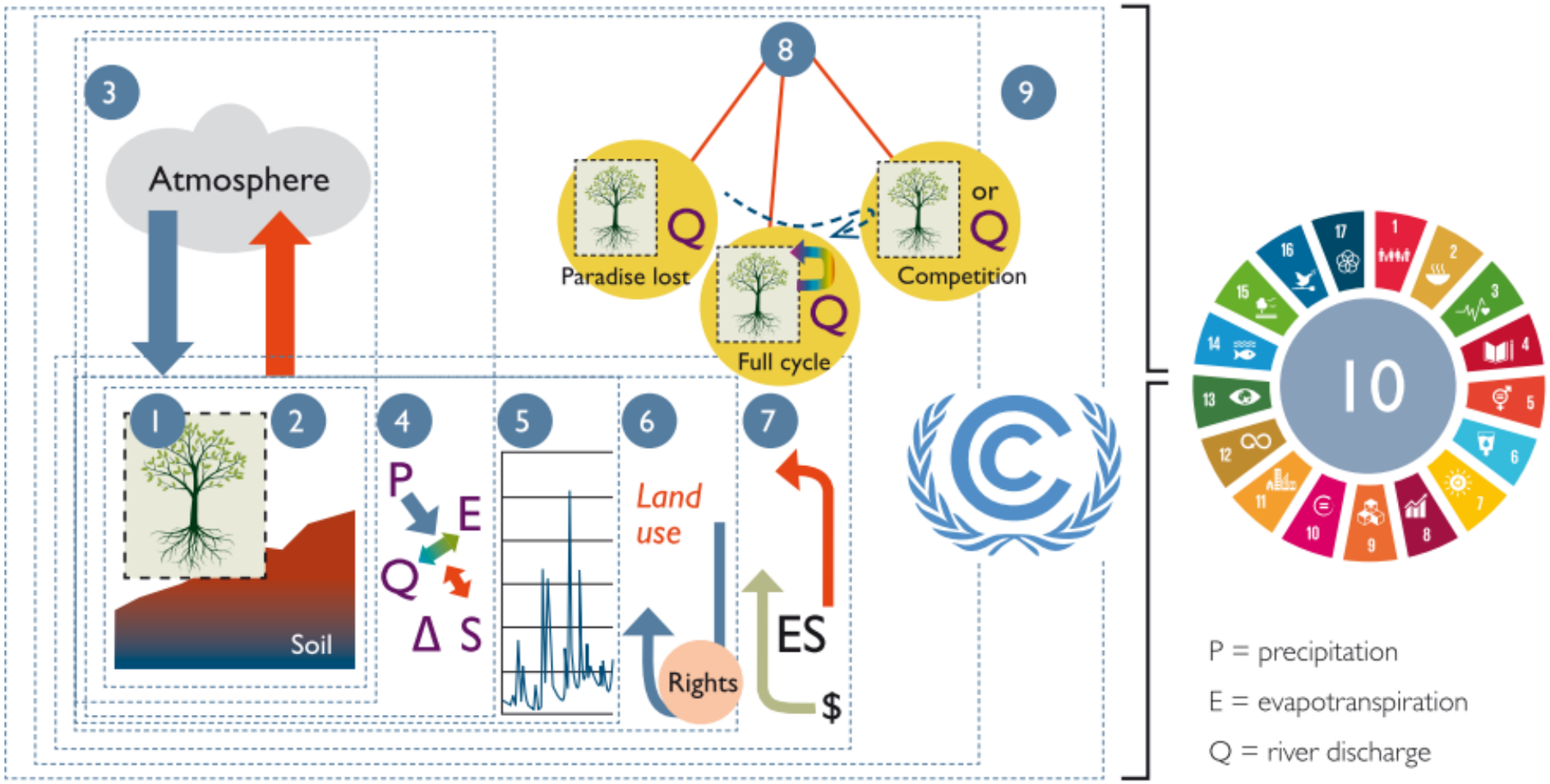
Supports forest-related intergovernmental processes by producing assessment reports on emerging global issues of high concern

www.iufro.org/science/gfep

The ISO-31010 Bowtie Risk Management Tool inspired the structure of the report



Ten nested systems of increasing complexity and scale

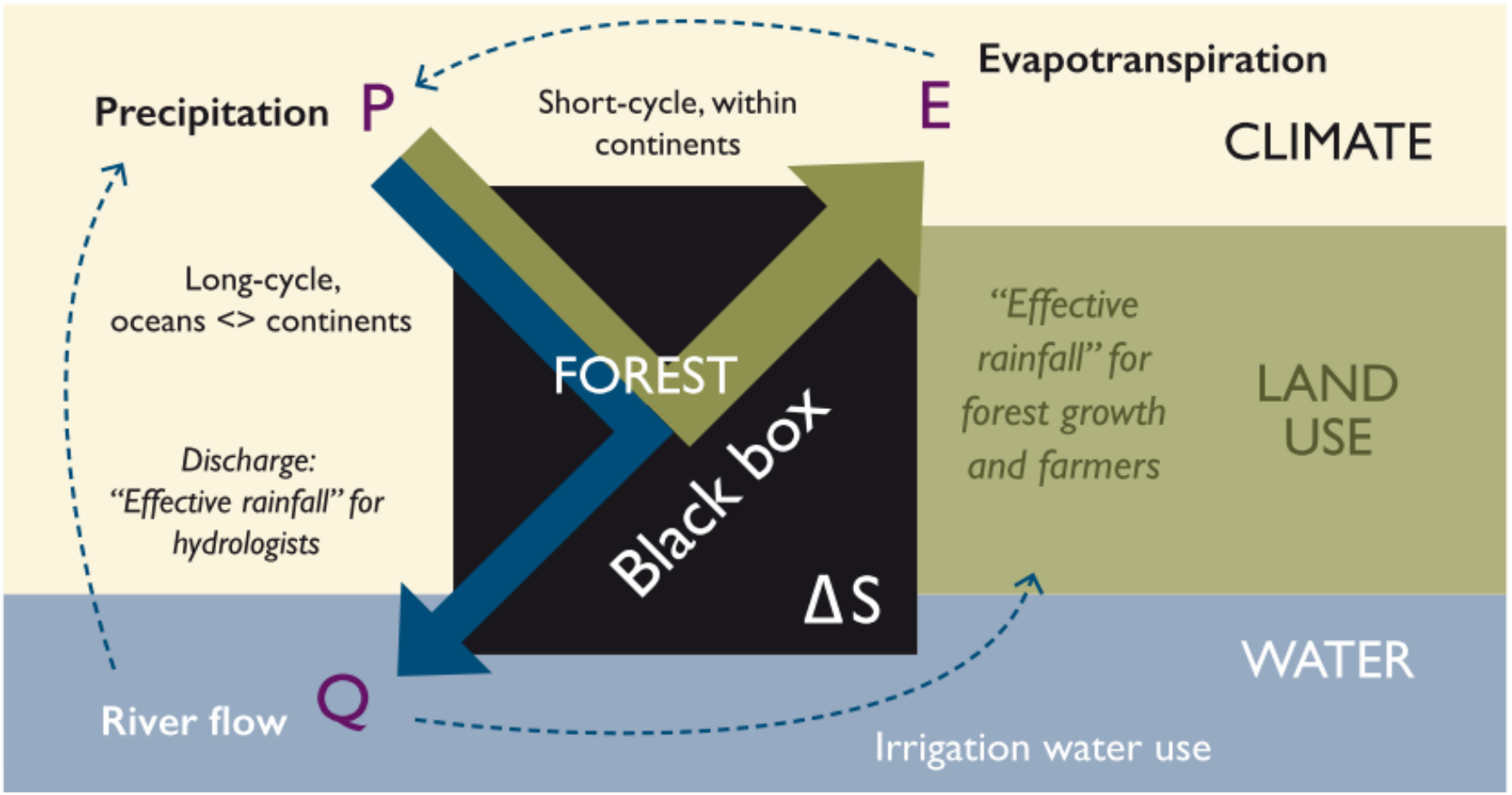


Source: Authors' own elaboration

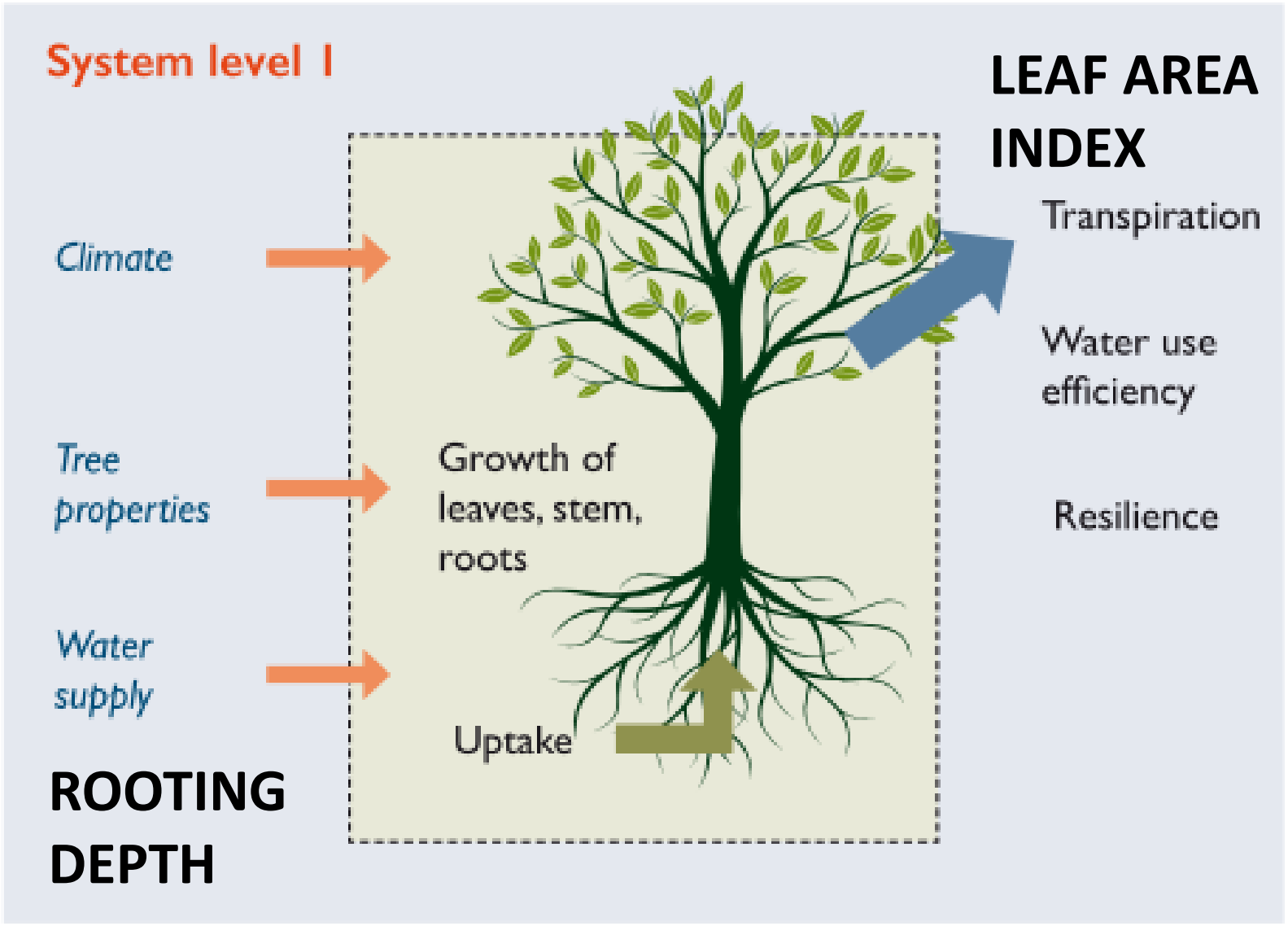
GFEP REPORT ON FORESTS AND WATER (Ch. 2)

- Forest influence the local hydrological cycle
- Forest influence the global hydrological cycle
- Forests influence water provision for human activities
- Forest management can influence the local/regional hydrological cycle
- Take-home messages

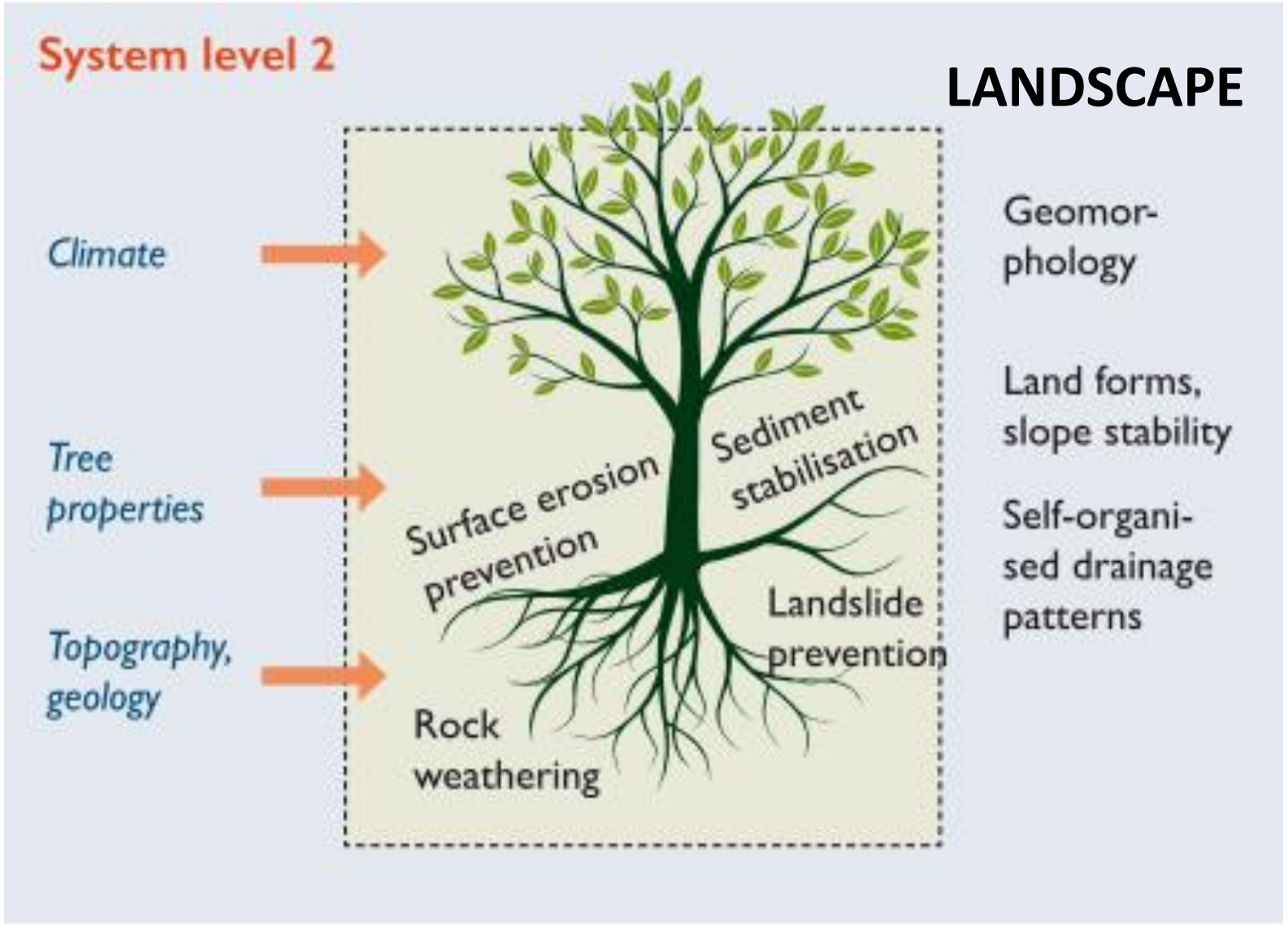
Precipitation (P) is partitioned over evapotranspiration (E) and river flow (Q) at time scales in which the change in soil water storage (ΔS) is considered to be negligible



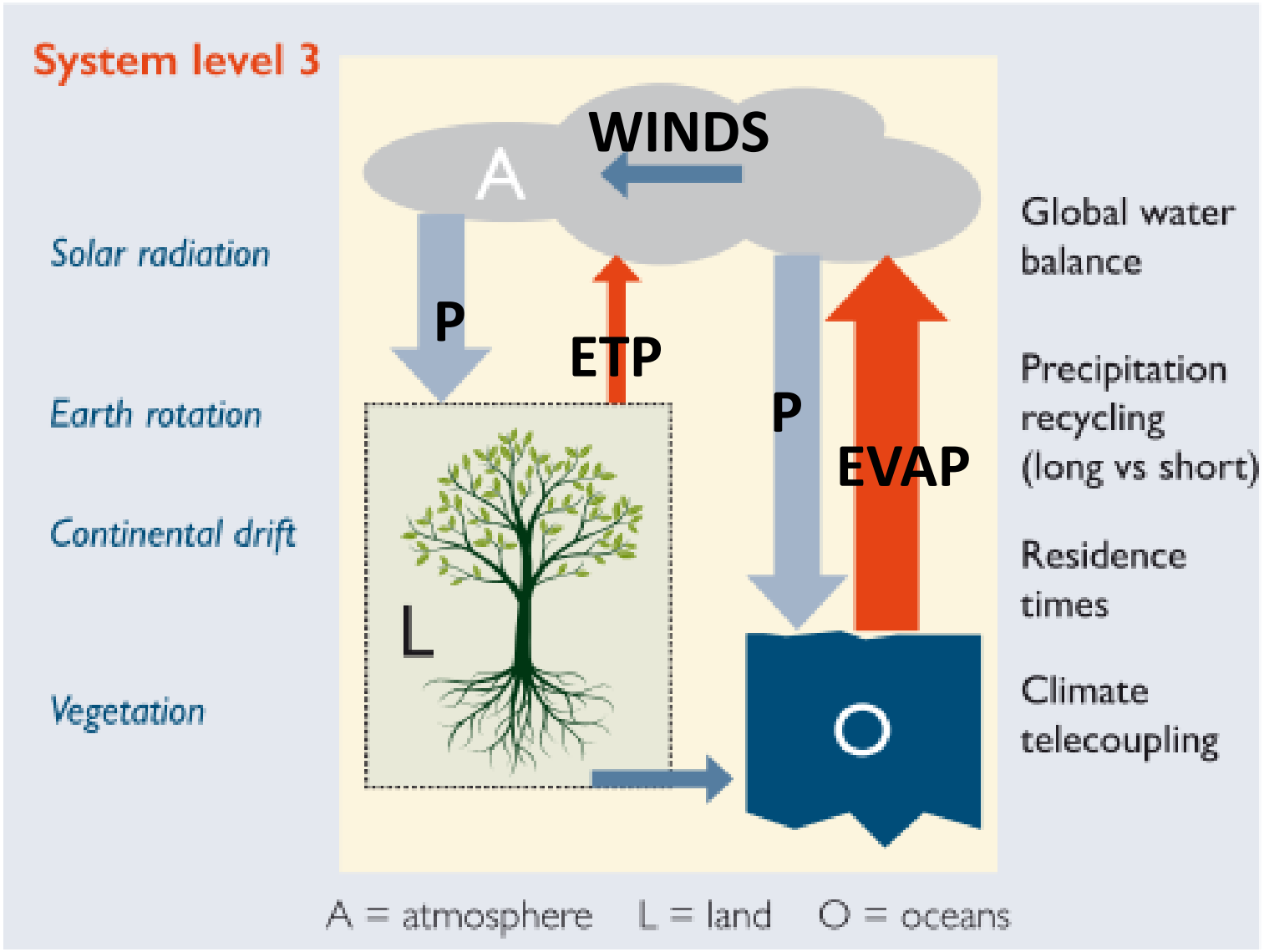
Trees are biological entities that need water to survive: they take water from the roots, lose it from the leaves



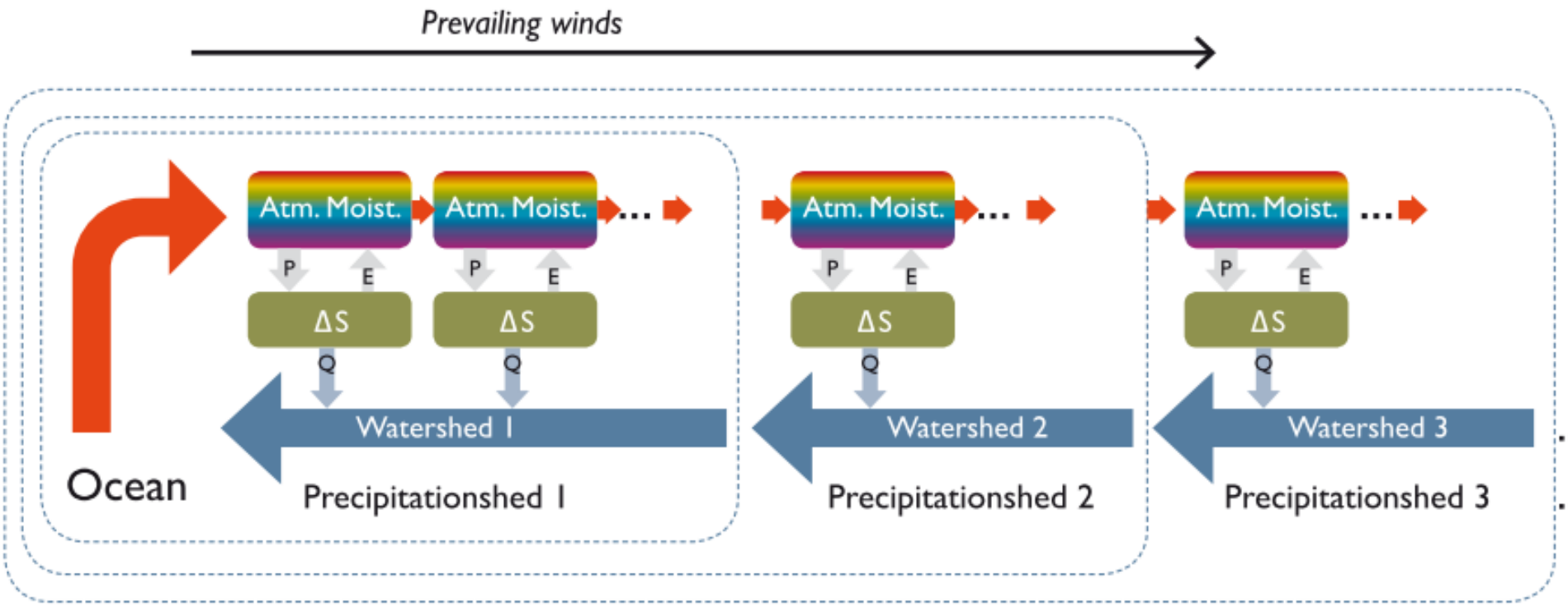
The forest + soil system = a sponge that stores water



Forests are terrestrial ecosystems that are linked to ocean systems through precipitationsheds

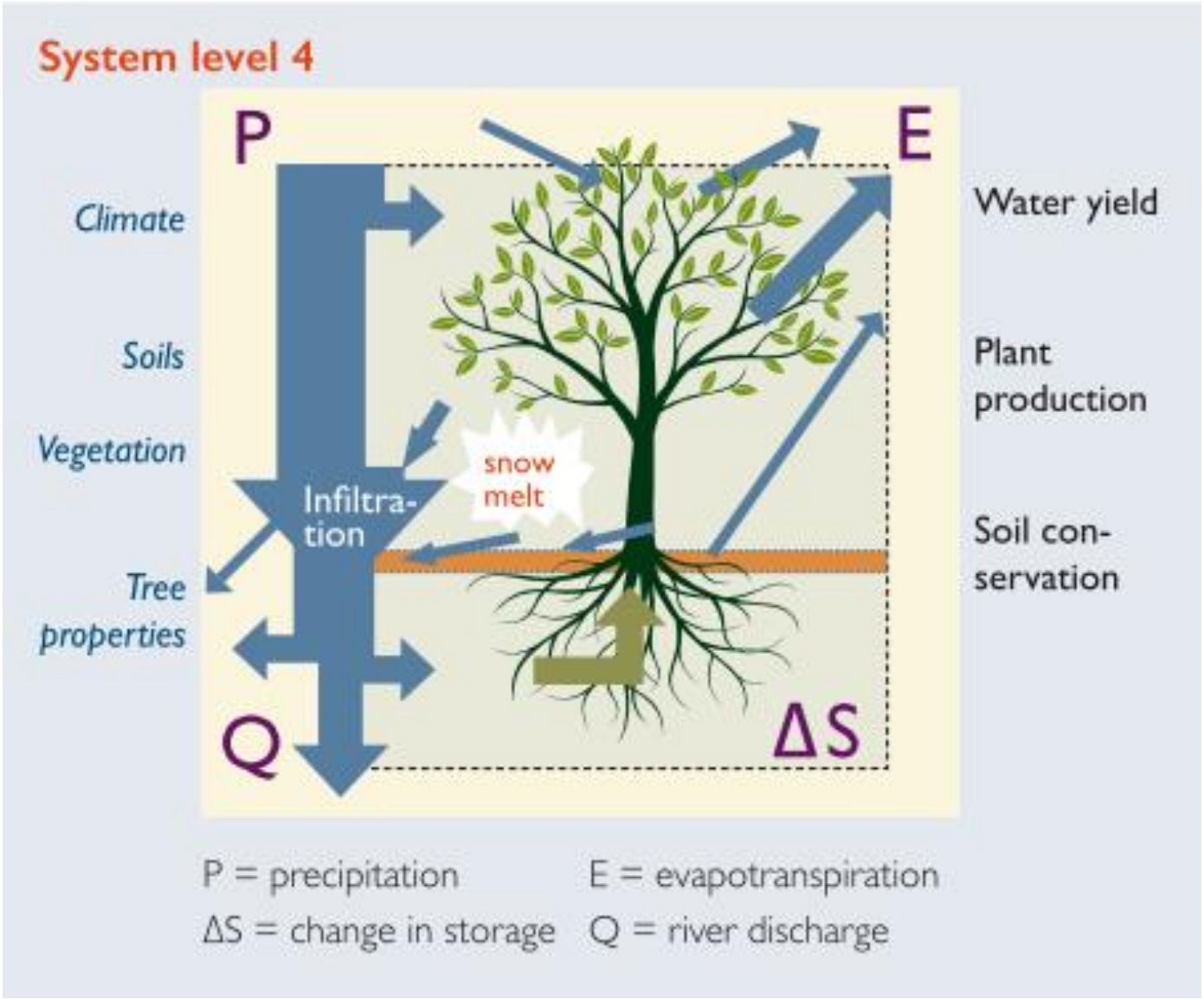


The “Short cycle” (water recycled over land systems) means that water is used 2.7 times before returning to sea

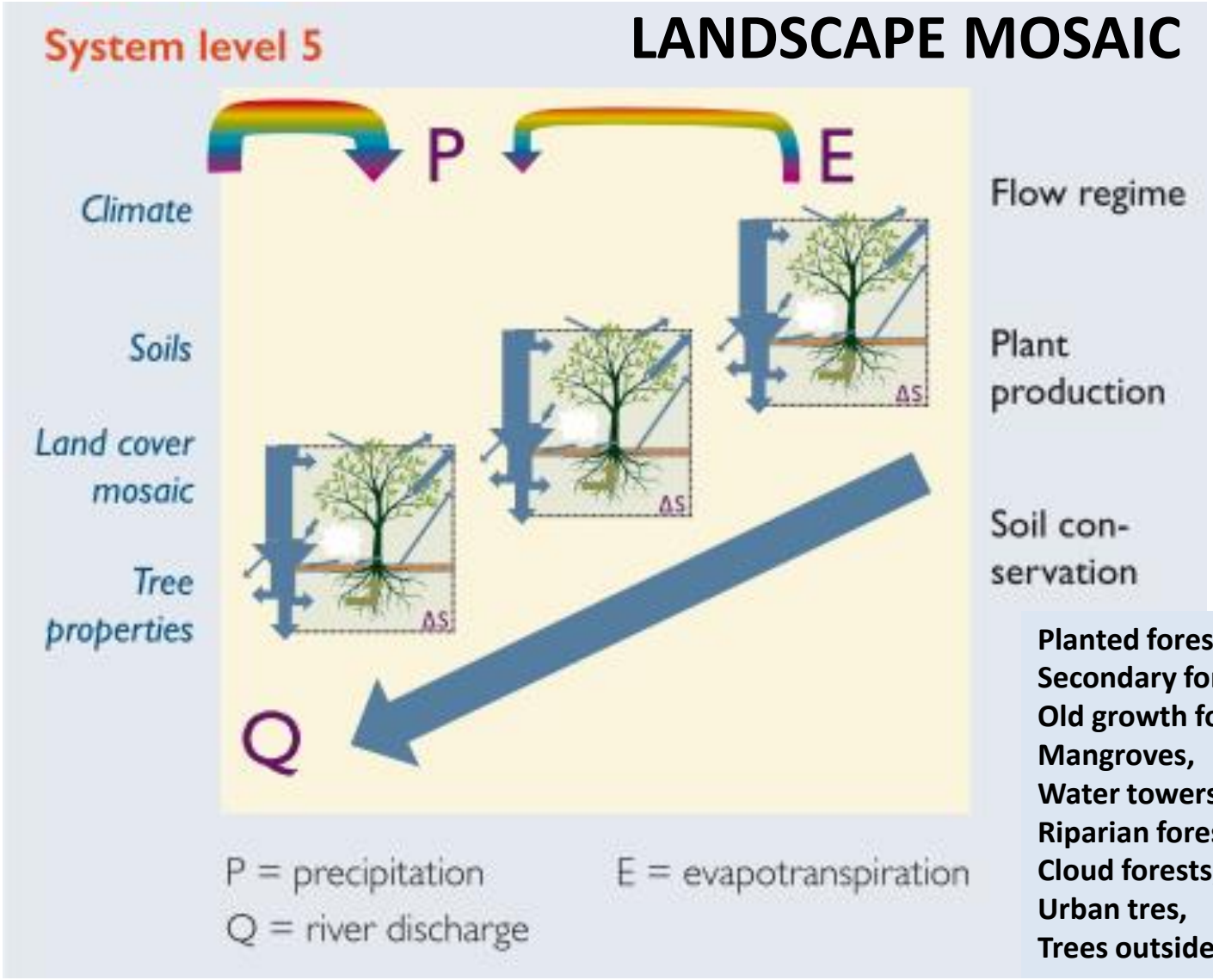


P = precipitation Q = river discharge E = evapotranspiration ΔS = variable storage term

River discharge = Precipitation – Evapotranspiration – Storage increase (soil, plants, underground)

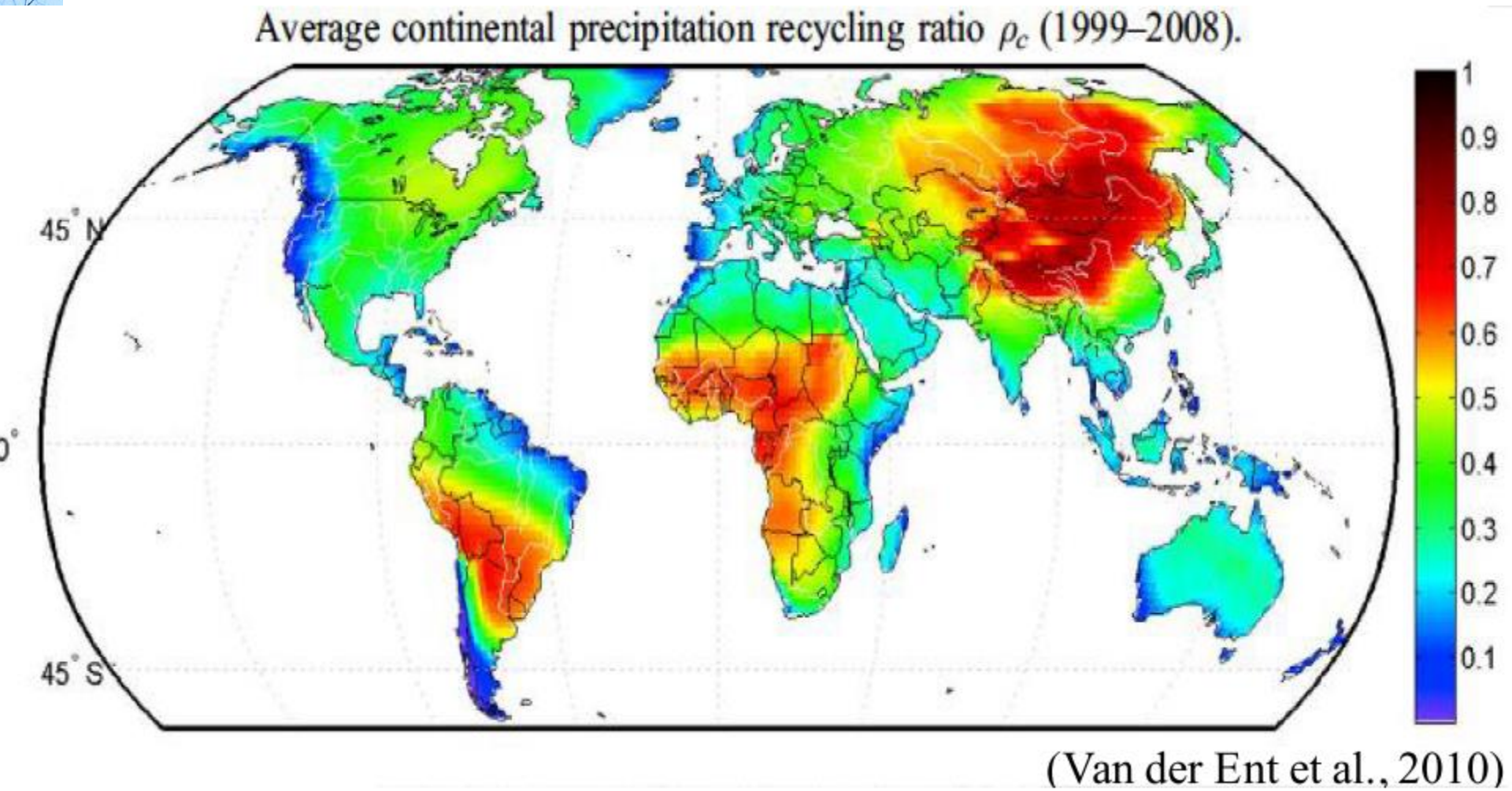


Type of forests, placement of forests, seasonal patterns, and topo-geological factors combined produce discharge



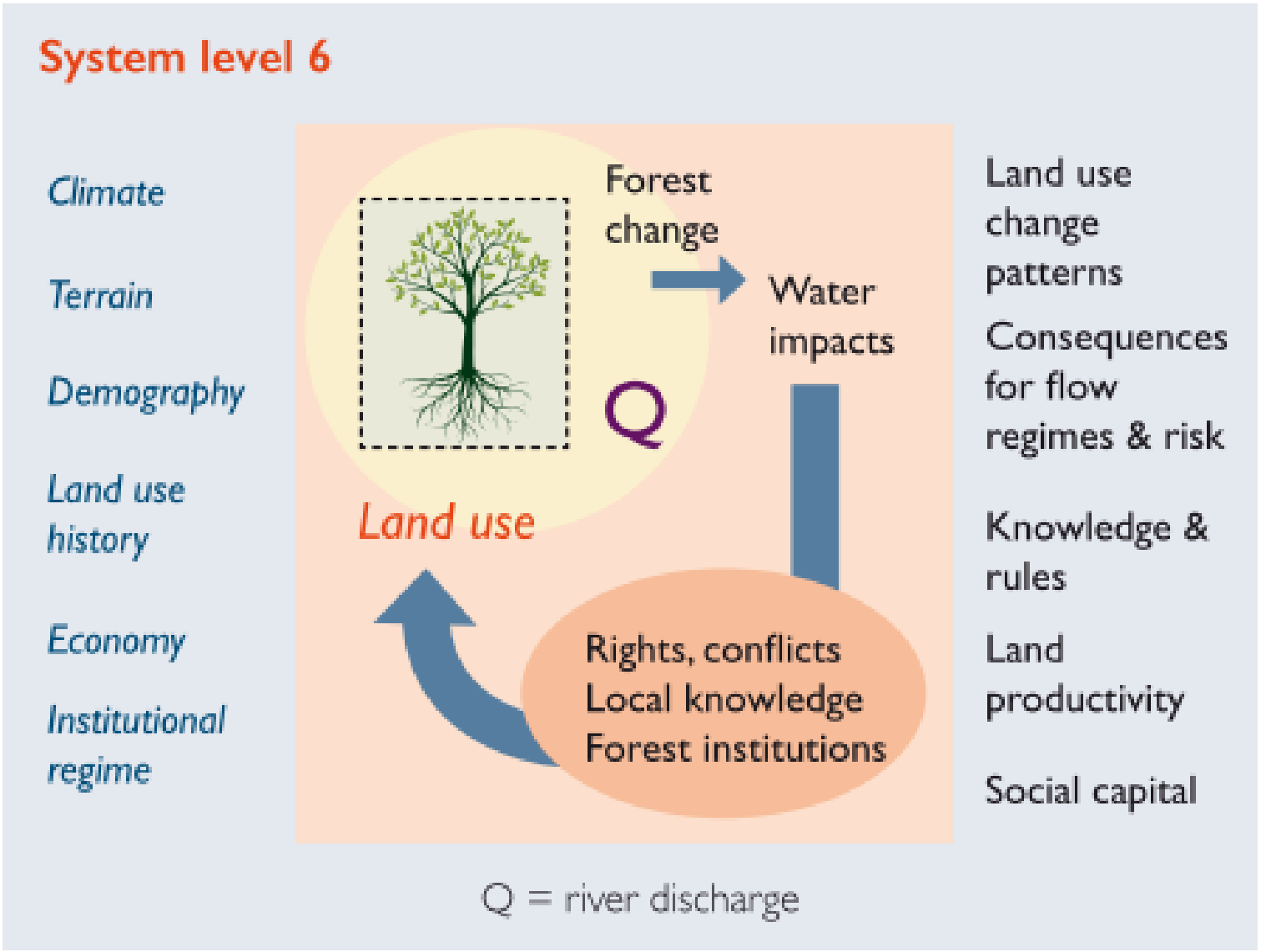
Planted forests,
Secondary forests,
Old growth forests,
Mangroves,
Water towers,
Riparian forests,
Cloud forests,
Urban tres,
Trees outside the forest…

Forests pump moisture into the atmosphere that is displaced further inland: precipitation recycling

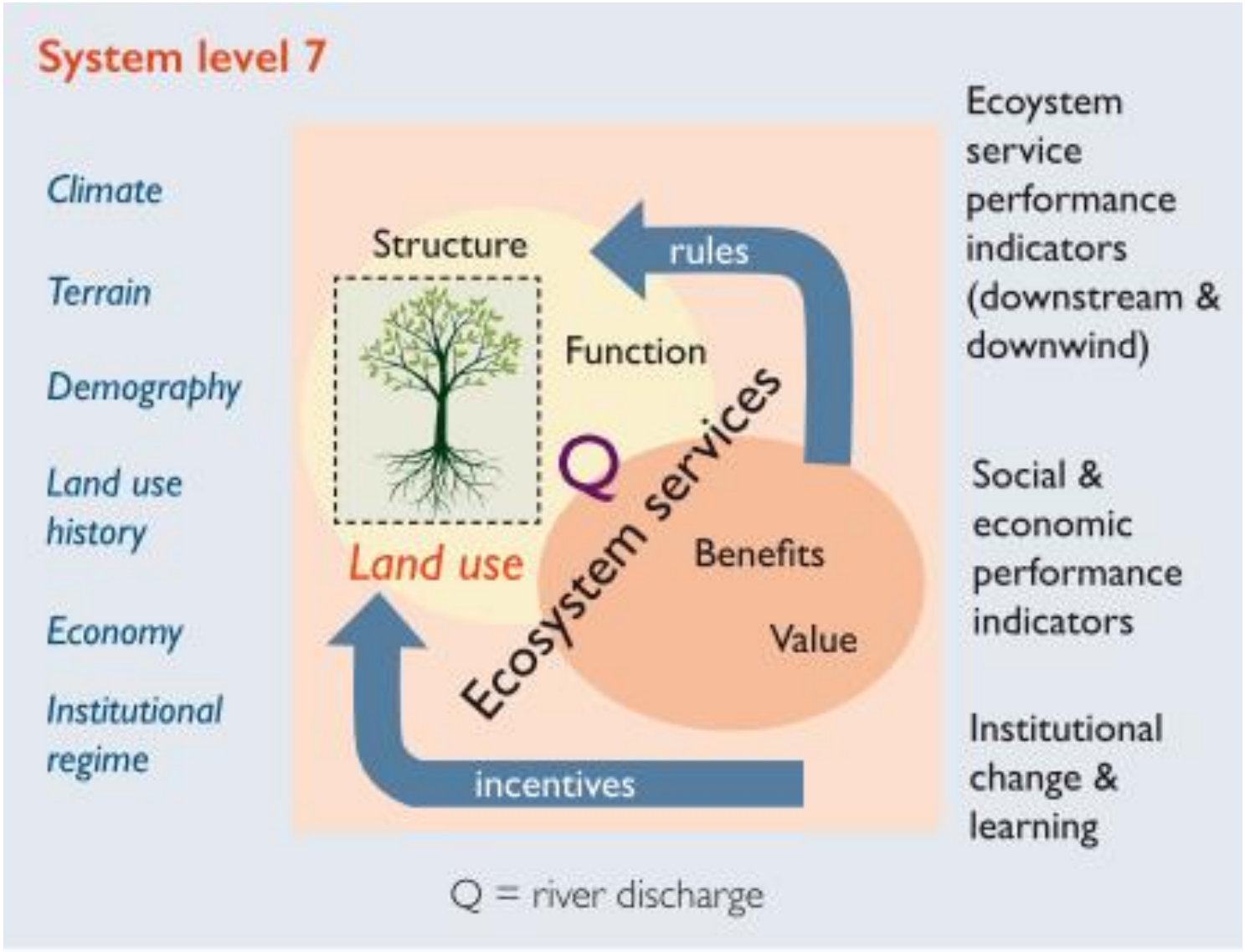


(Van der Ent et al., 2010)

Landscape mosaics and tree cover transitions are caused by complex socio-ecologic interactions



Forests provide an important battery of water-related ecosystem services



Forests provide an important battery of water-related ecosystem services

Water-related ecosystem functions provided by vegetation and potentially perceived as 'ecosystem services' Table 2.1

	Functions	Metrics
Generic		
W1	Water transmission	Total water yield per unit rainfall
W2	Buffering peak river flows	Wet- and dry-season flow persistence (van Noordwijk et al., 2017a,b) or flashiness (Holko et al., 2011) River discharge per unit above-average rainfall
W3	Gradual release of stored water supporting dry-season flows	Dry-season flow persistence Aquifer recharge
W4	Maintaining water quality (relative to that of rainfall)	Pollutants per unit volume of water Biological water quality indicators
Site-specific		
W5	Stability of slopes, absence of land-slides	Woody roots for topsoil binding and anchorage Non-erosive pathways for overland flow
W6	Controlling soil loss by erosion	Surface runoff pathways Volume of trapped sediment in filter zones Infiltration of topsoil and subsoil (macro porosity due to worms and roots)
W7	Microclimate effects on air humidity, temperature and air quality	Wind speed; reduction in daily maximum temperature; land surface temperatures
W8	Coastal protection from storm surges, tsunamis	Retardation of waves, reduced maximum run up height
Frontier of science		
W9	Ecological rainfall infrastructure and biological rainfall generation	Recycling of atmospheric moisture; height above vegetation of rainfall generating events; ice-nucleating agents

Source: van Noordwijk et al., 2016; Lusiana et al., 2017

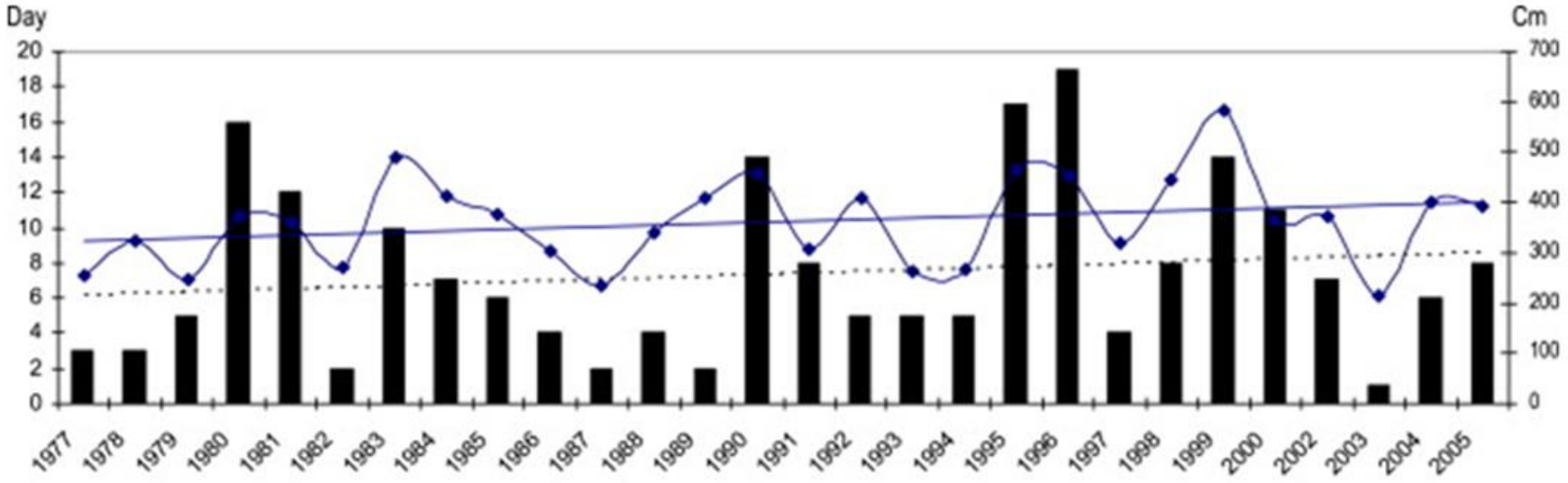
Different management strategies will have impacts at different scales

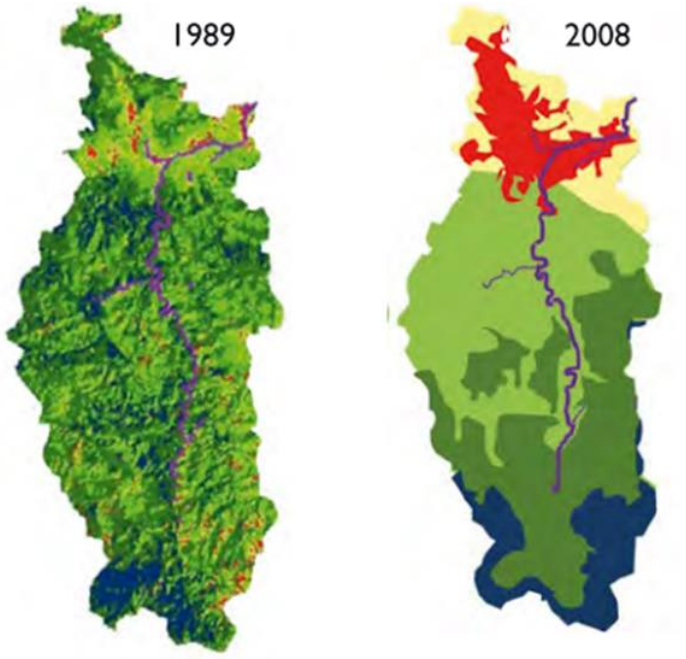
1. At watershed scale, managing for tree growth or biodiversity (carbon sequestration, forest biomass) likely would reduce water yields due to evapotranspiration. However, some degree of tree cover would increase water recharge even in arid regions.

2. At regional/continental scale forest management could be used to redistribute atmospheric water across continental areas. For example, restoring forest landscapes across a flood-prone region could reduce water flows in that watershed but transfer more precipitation to other watershed more inland.

3. Critical Water Zones must be identified and specifically managed to ensure water flow and quality (i.e. “water towers”).

Relationship between forest management and water-related issues depends on the local and regional context





Flooding in the Huong River Basin Central Viet Nam

Still, important unknowns must be clarified

1. What are the characteristics of natural and managed forests (e.g., species, ages, densities) that contribute to sustainability of water supply?

2. What are the locations of forested areas that are most important as sources of water to ecosystems and to downstream and downwind users?

3. What is the uncertainty in forest-water relations as a result of the cumulative effects of climate and land use/land cover changes across geographic regions?

4. How are forests and the water that comes from forests are perceived and valued by people?

Take-home message: we need to manage forests for water

1. **Rethink forests as sources of water:**

   Forests contribute to water supplies, both downstream and downwind, at a range of spatial and temporal scales.

2. **Reposition forest-water discussions:**

   Forest-water relations must be central to policy discussions at regional, continental and international scales.

3. **Reimagine interventions:**

   New institutional and governance frameworks that permit holistic consideration of forests and water are needed to create local policies that support global water security.

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