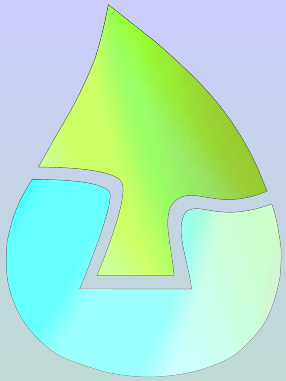
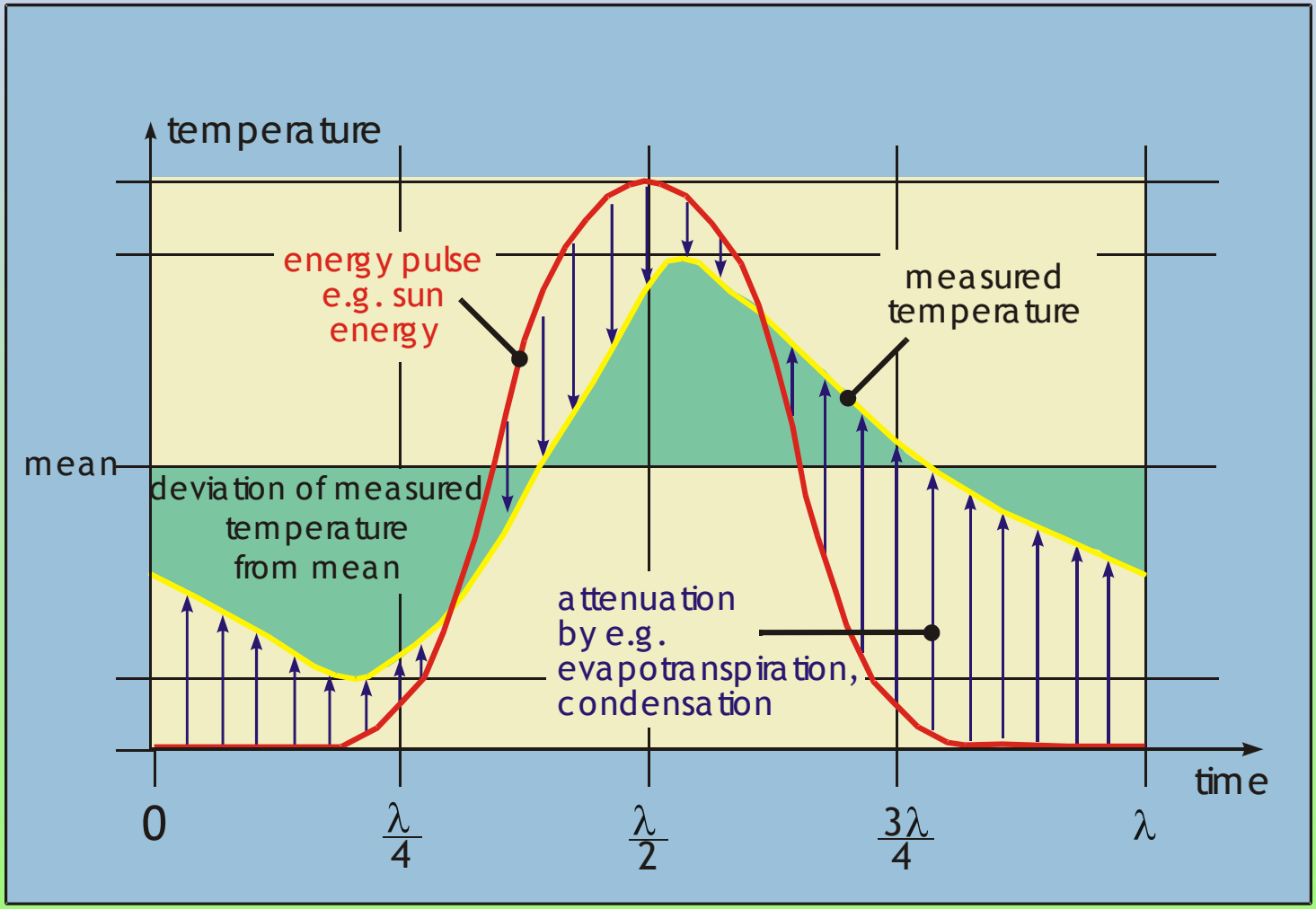


Watercycle- and Vegetation control, approaches for a sustainable Ressourcemanagement

W. Ripl

Attenuation of an energy-pulse to the mean



Source: Hildmann 1993

Einlk1e.cdr, 26.9.94

ETR-concept an ecological concept based on the energetics of water

- Dissipative structures are the optimized energetic answers to material interaction problems, far from thermodynamic equilibrium. Patterns are created.

- The efficiency criteria (closed localized material cycles related to irreversible linear material flow) determines sustainability of dissipative structures

- Periodically moving water in nature, metabolizing cells, reproducing organisms, coenotic structures competing for sustainability are selfoptimizing systems and dissipative structures in different fractal organization levels

Nature as a dynamic energy-dissipative process

- Structures and distributes processes by means of the dynamic medium water in landscape
- It controlles the atmosphere with respect to its process dynamics,
composition und distribution
- It controlles mechanical and chemical processes close to the soil surface and distributes thereby organisms, it eliminates randomness, minimises material flows, and increases sustainable development
- It controlles temperature- and moisture patterns in space and time as a niche for all organisms

Processor properties of water

Alternating current
periods
day/year

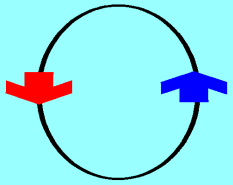
Energy

Mean
energy
350 Watt/m^2

energy-dissipative processor water and biological cells

physical property

condensation



Evaporation

Carnot cycle

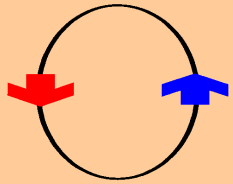
atmosphere

continents → sea

cooling function
almost no losses
space related

chemical property

precipitation



dissolution

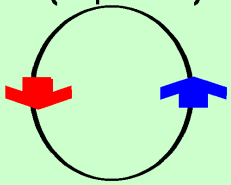
charge loss process

continents → sea

irreversible
loss process
space related

biological property

reassemblage of water
(respiration)



cleavage of water
(photosynthesis)

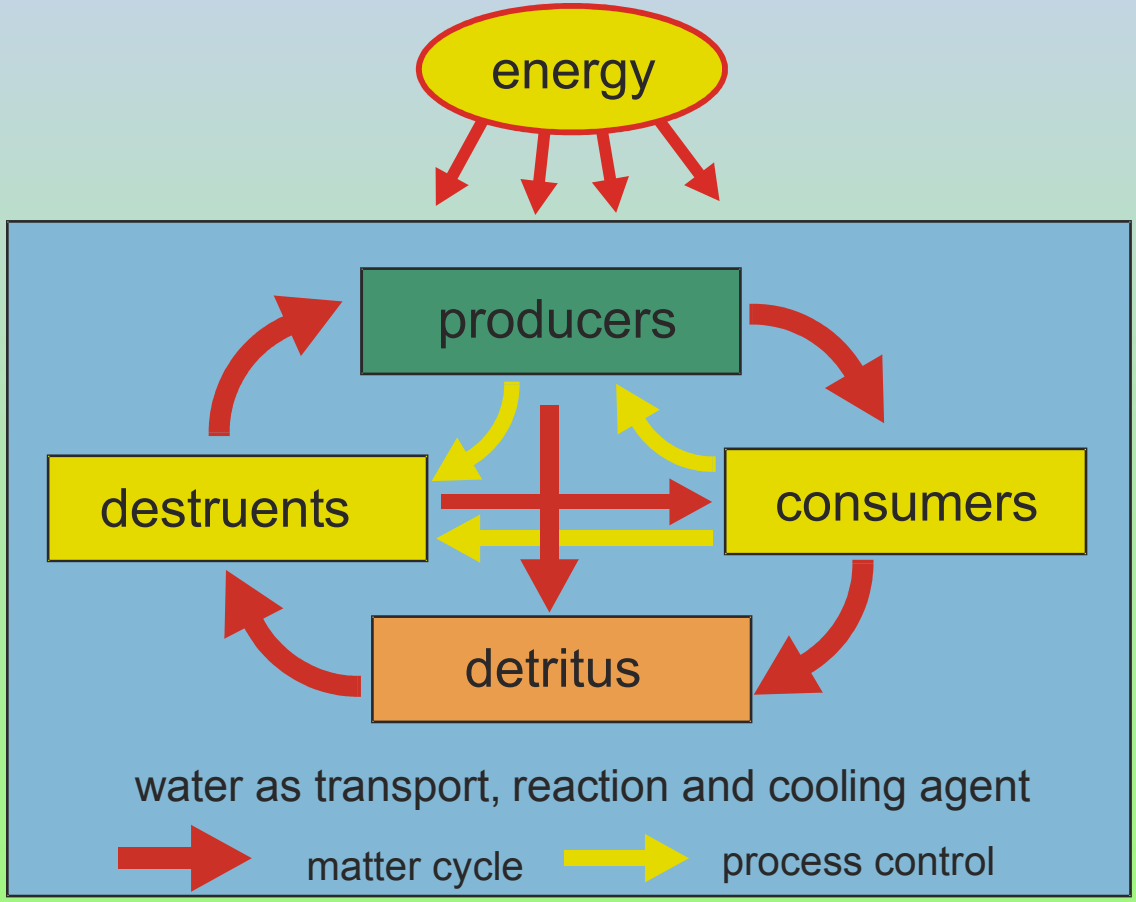
Carnot cycle

sea ⇄ continents

short cycles

dissipation of energy
minimal losses
time related

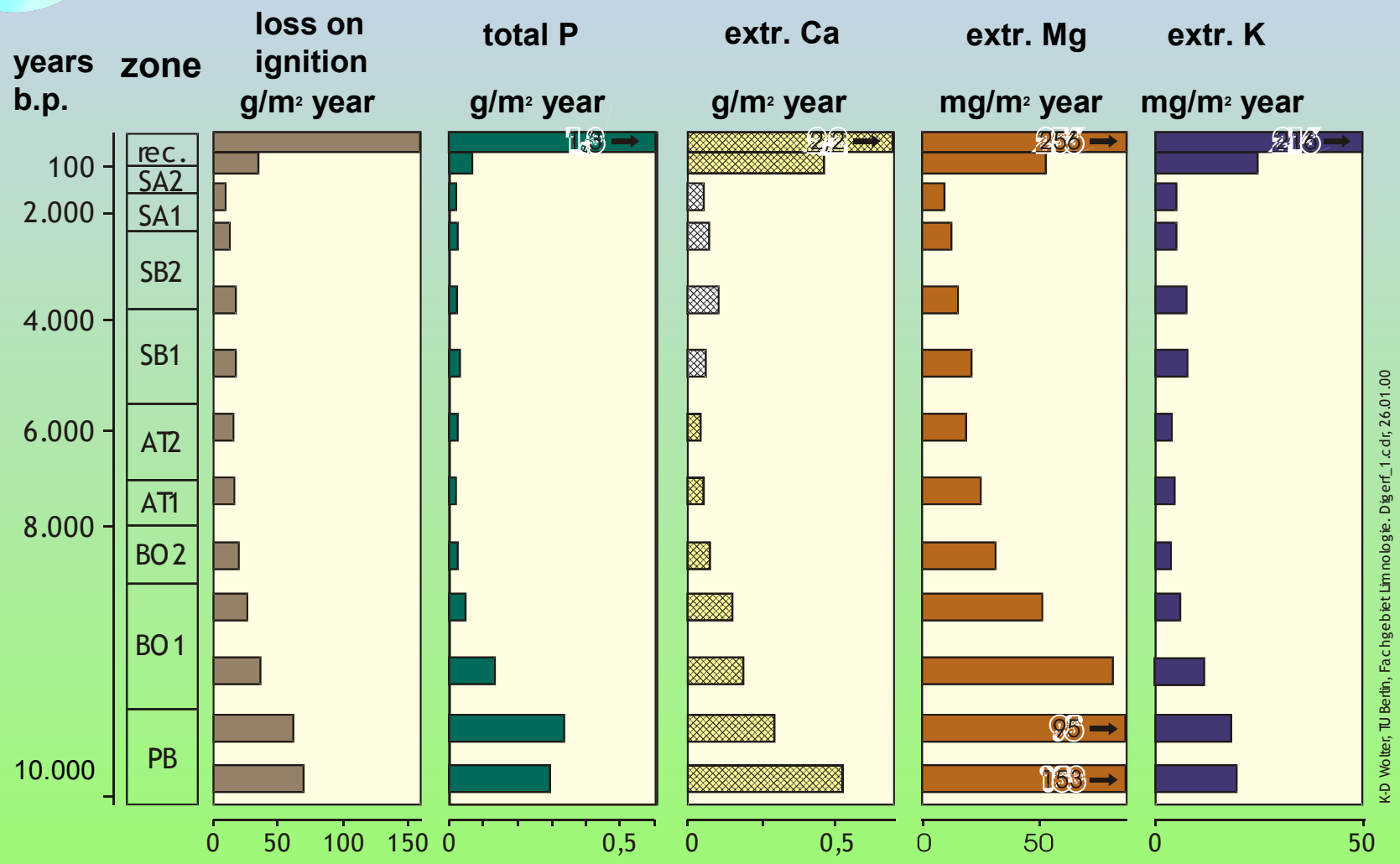
Dissipative Ecological Unit (DEU)



Source: Ripl & Hildmann 1993

ZKS4_a.cdr, 28.06.00

Postglacial development of Lake Trummen (Sweden). Yearly deposition according to G. Digerfeldt (1972)



Efficiency and selfoptimization in nature (ETR-concept)

- Dissipative structures are the optimized material answers to energetic interaction problems far from thermodynamic equilibrium
- The efficiency criteria (closed localized material cycles related to irreversible linear material flow) determines sustainability of dissipative structures
- Periodically moving water in nature, metabolizing cells, reproducing organisms, coenotic structures competing for sustainability and selfoptimizing ecosystems are dissipative structures in different fractal organization levels

Theoretical basis for thermal efficiency

$$\frac{\text{mean temperature} - \text{temperature deviation}}{\text{mean temperature}}$$

increasing efficiency = minimal temperature deviation

decreasing efficiency = maximal temperature deviation

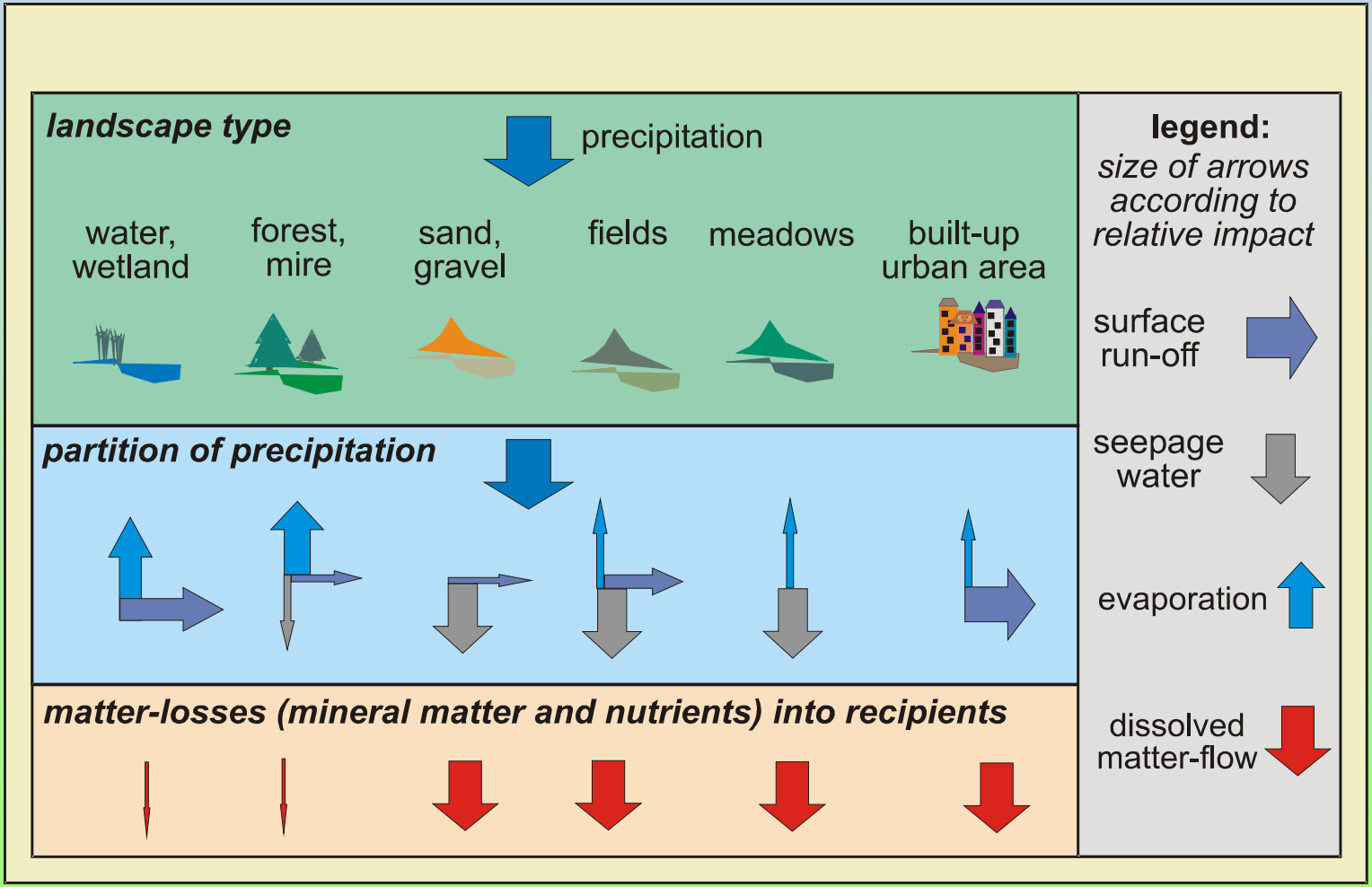
mean temperature = because of vertical gradients and different heat capacity of air, soil and water mean temperature is difficult to estimate in practice

temperature deviation = deviation of real, actual temperature from the mean temperature

Source: modified from Hildmann 1993

wkgd_T, 14.9.95

Irreversible matter losses by precipitation and run-off in different landscape types

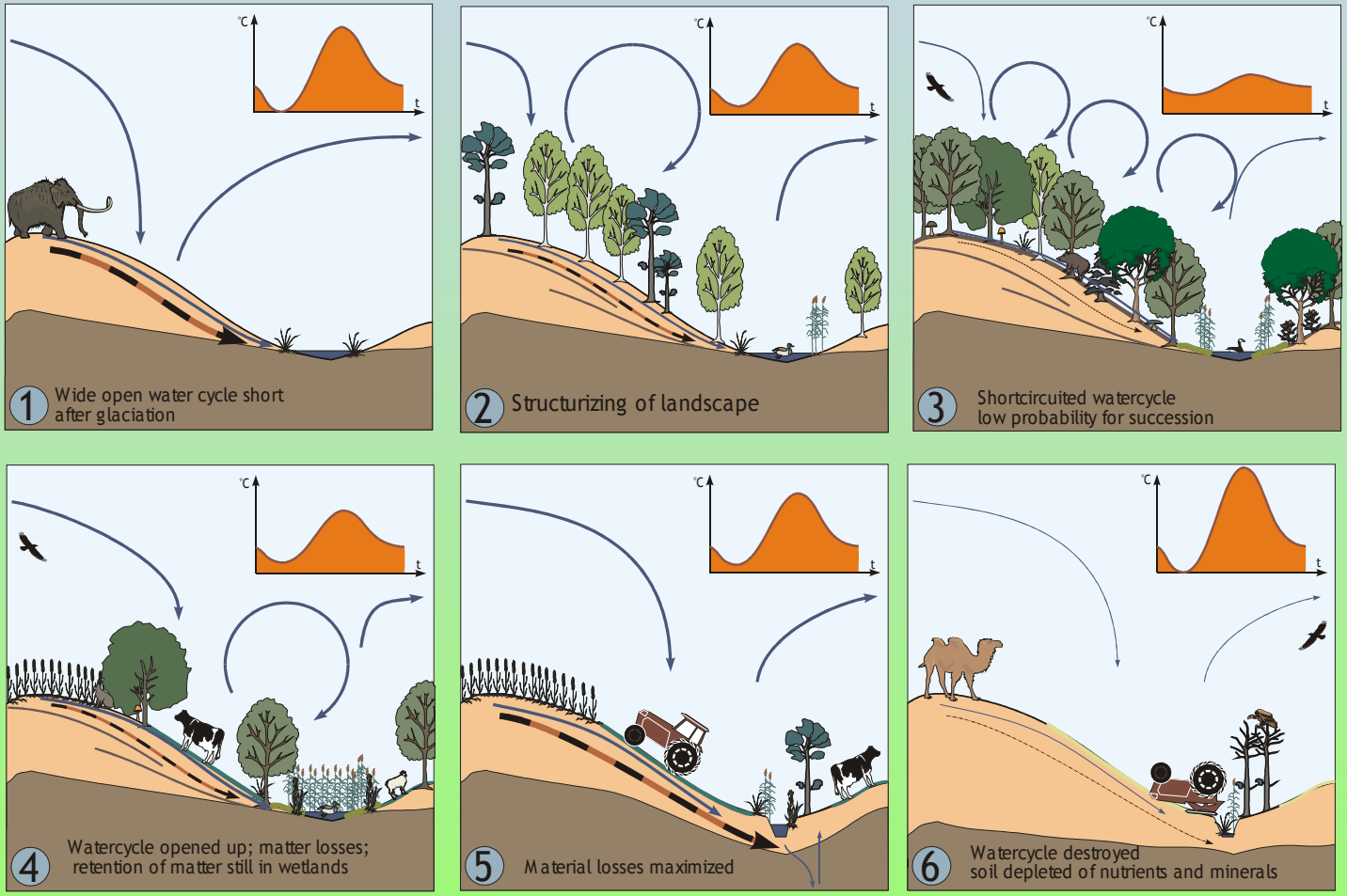


Source: Ripl 1995

K-D Wolter, TUB - Limnologie; Transp_1.cdr, 11.12.00

Development and Desertification of Landscape after glaciation had ceased

Water cycle, matter budget and temperature balance

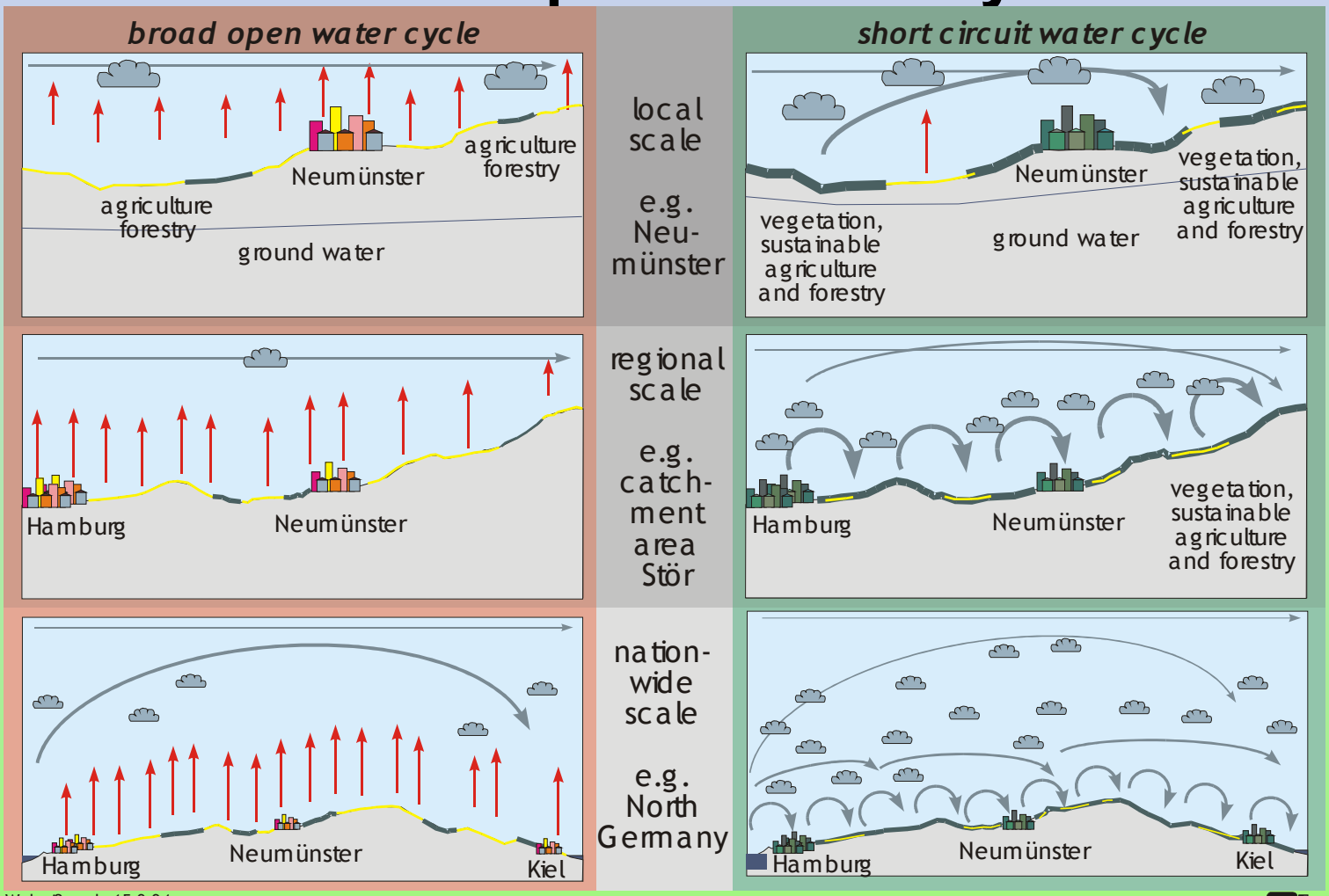


histor3a.cdr 20010810, Christian Hildmann

ETR an ecological concept based on the energetics of water

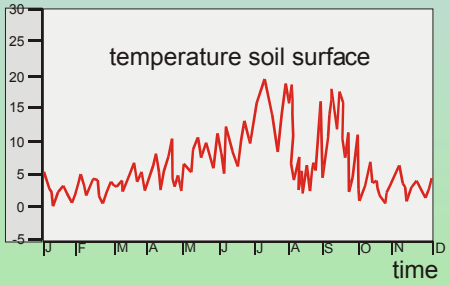
- Water in interaction with solid surface leads to sorting processes according to energetic dissipative properties (particle size, dissolution equilibria)
- stagnant water leads to conservation of structures (achievement of equilibrium)
- high and random water dynamics at liquid-solid interfaces lead to erosion of structures (increased mechanical and chemical interactions)
- optimized dissipative structures are dynamic metabolizing structures at lowest energy flow density

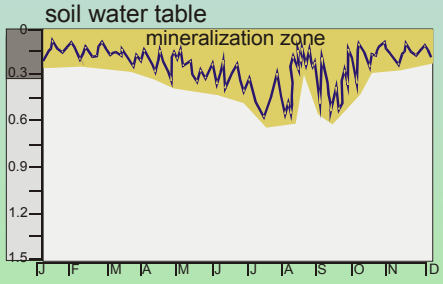
The dissipative water cycle

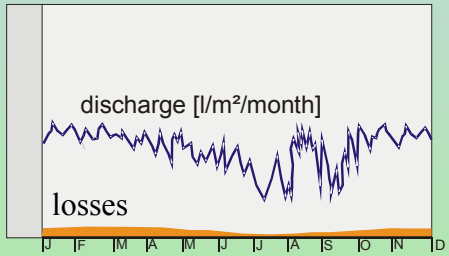


Indicators for sustainable and non-sustainable water cycles and landscapes

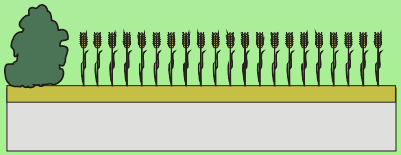
Natural ecosystem

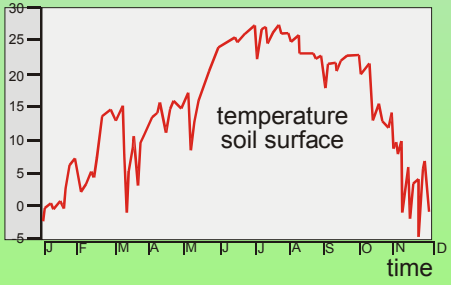


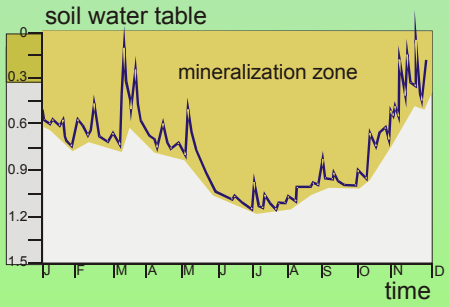


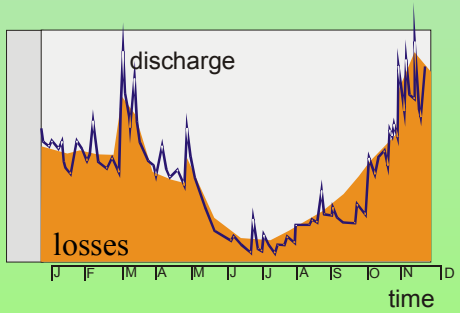


Disturbed ecosystem



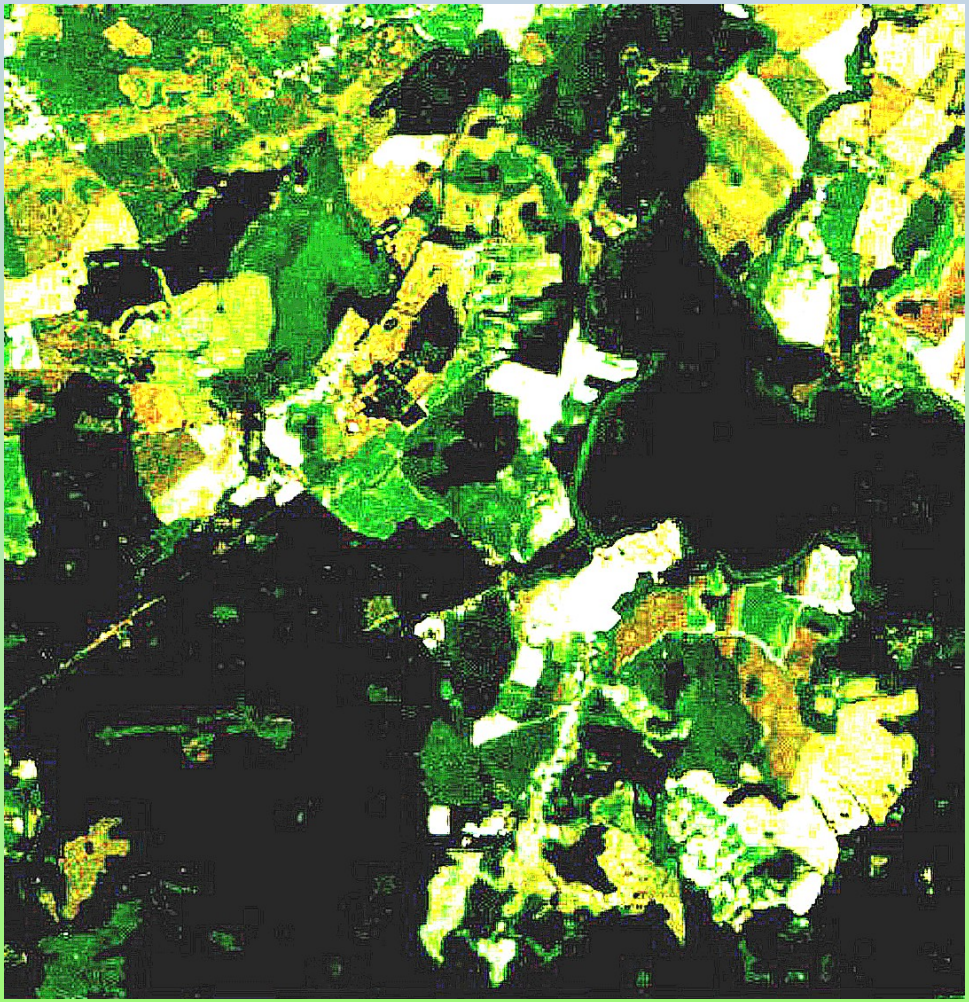




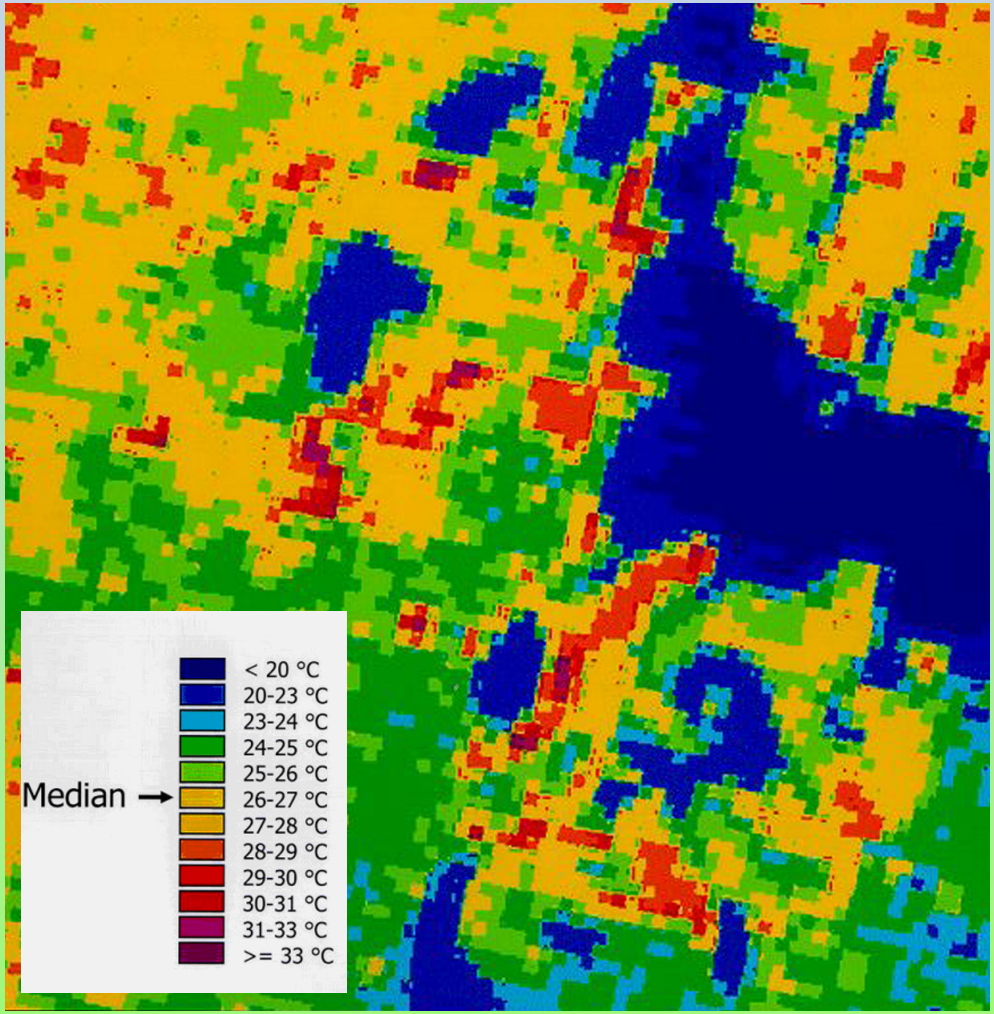


Lo_pr_1e.cdr, 94, 05.07.00

Brodowin RGB Composit July 1989 TM5

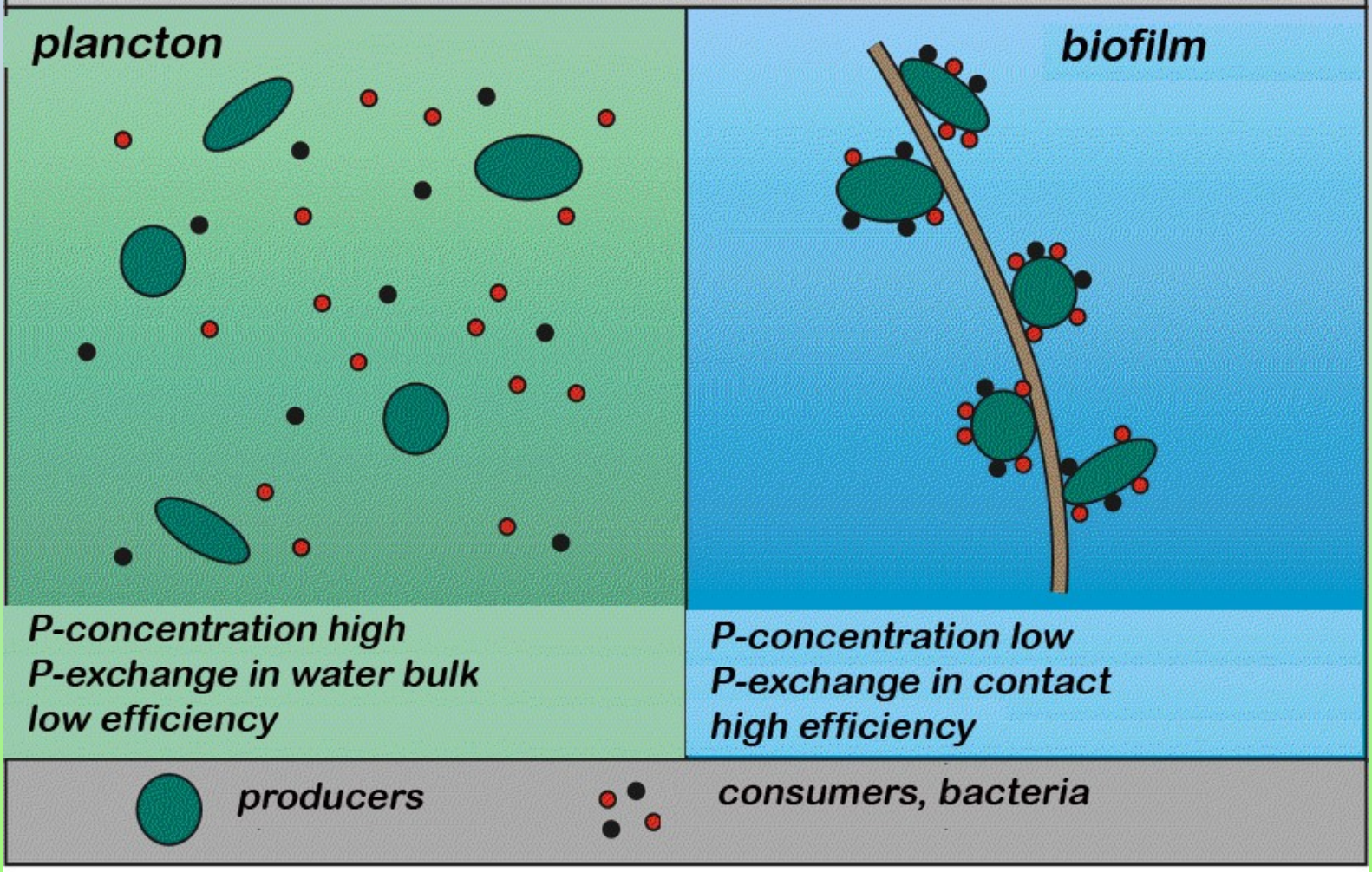


Brodowin July 1989 Kanal 6 TM5



phosphorus concentration and organism socialisation

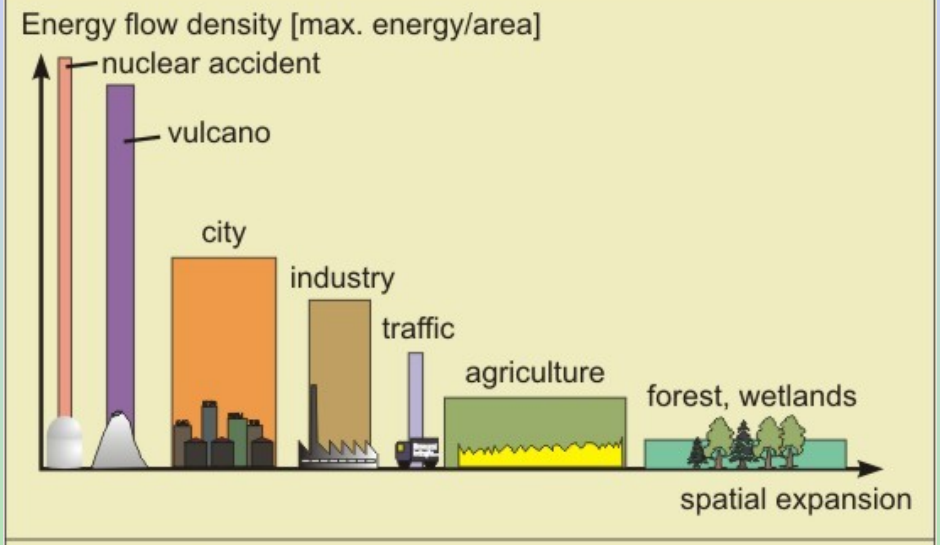
In both compartements is the same phosphorus content

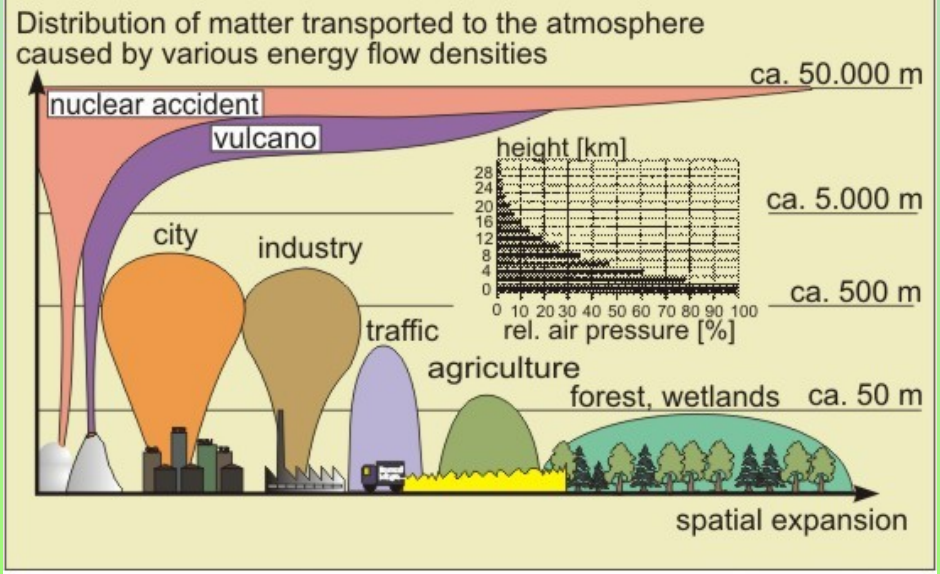


Quelle: Ripl mdl.

K-D Wolter, TU Berlin, P_OVerg1.cdr, 22.11.99

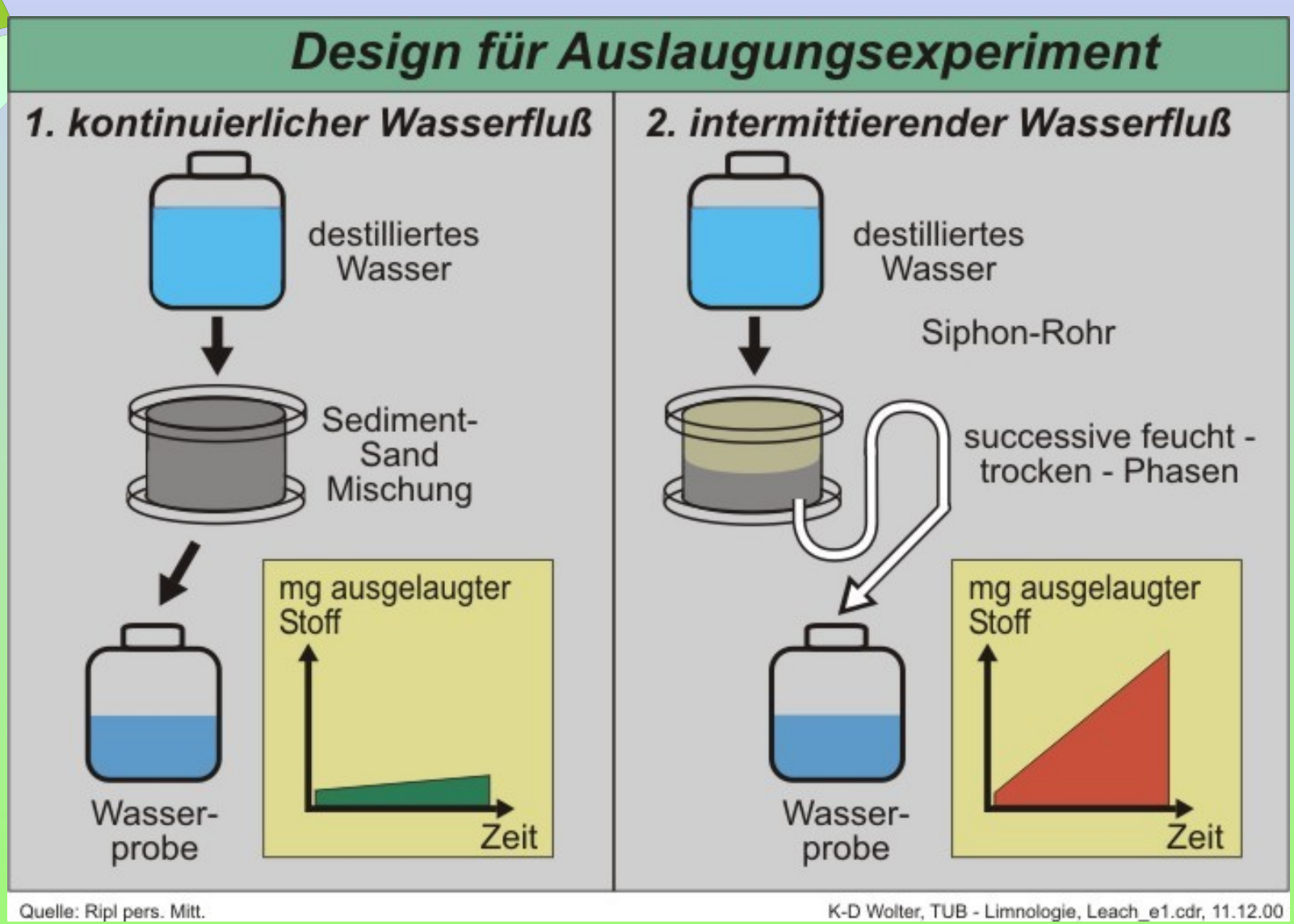
Energy flow density and matter flow in the atmosphere



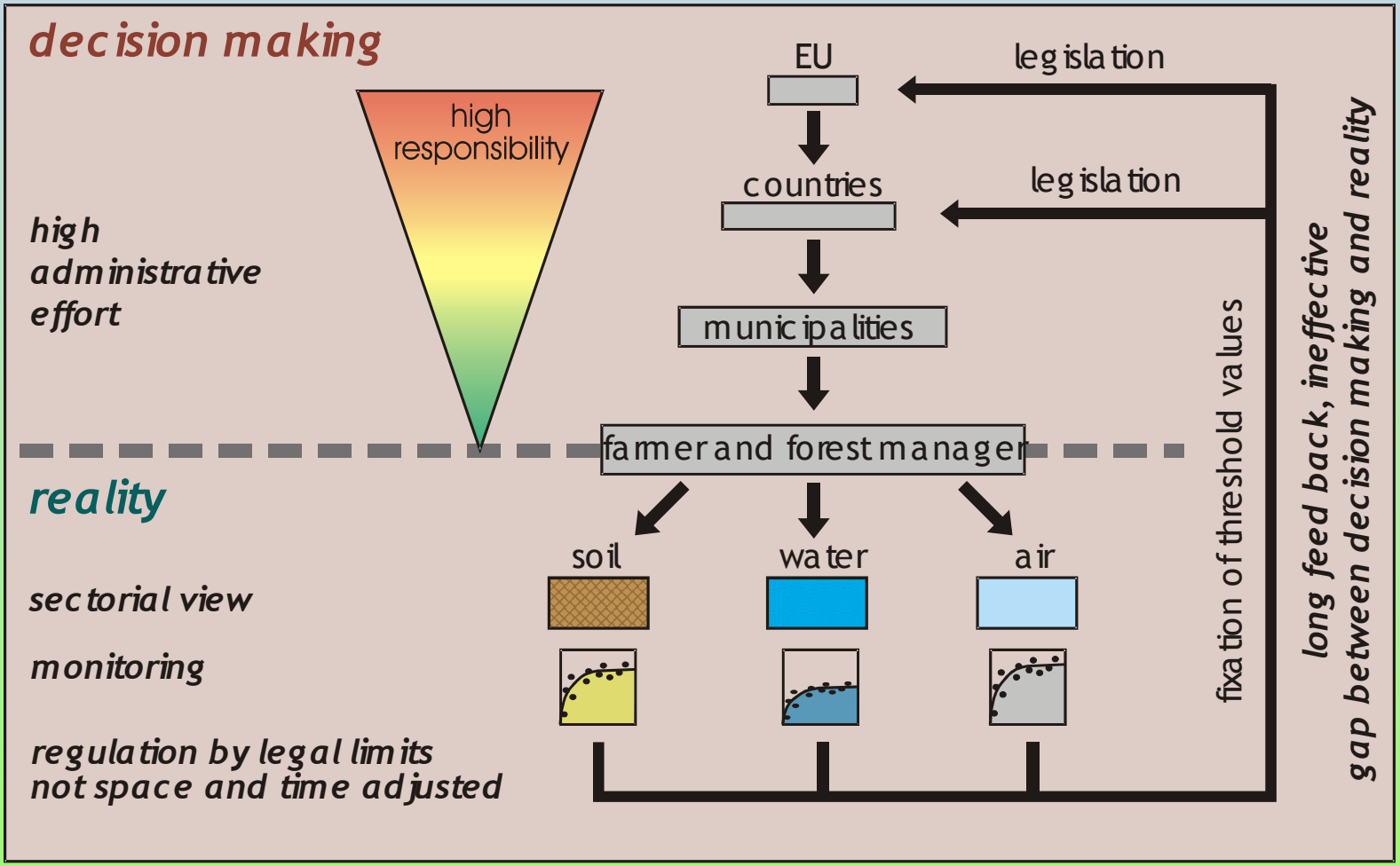


Quelle: Ripl 1995, verändert

En_atm_e.cdr, 8.8.94

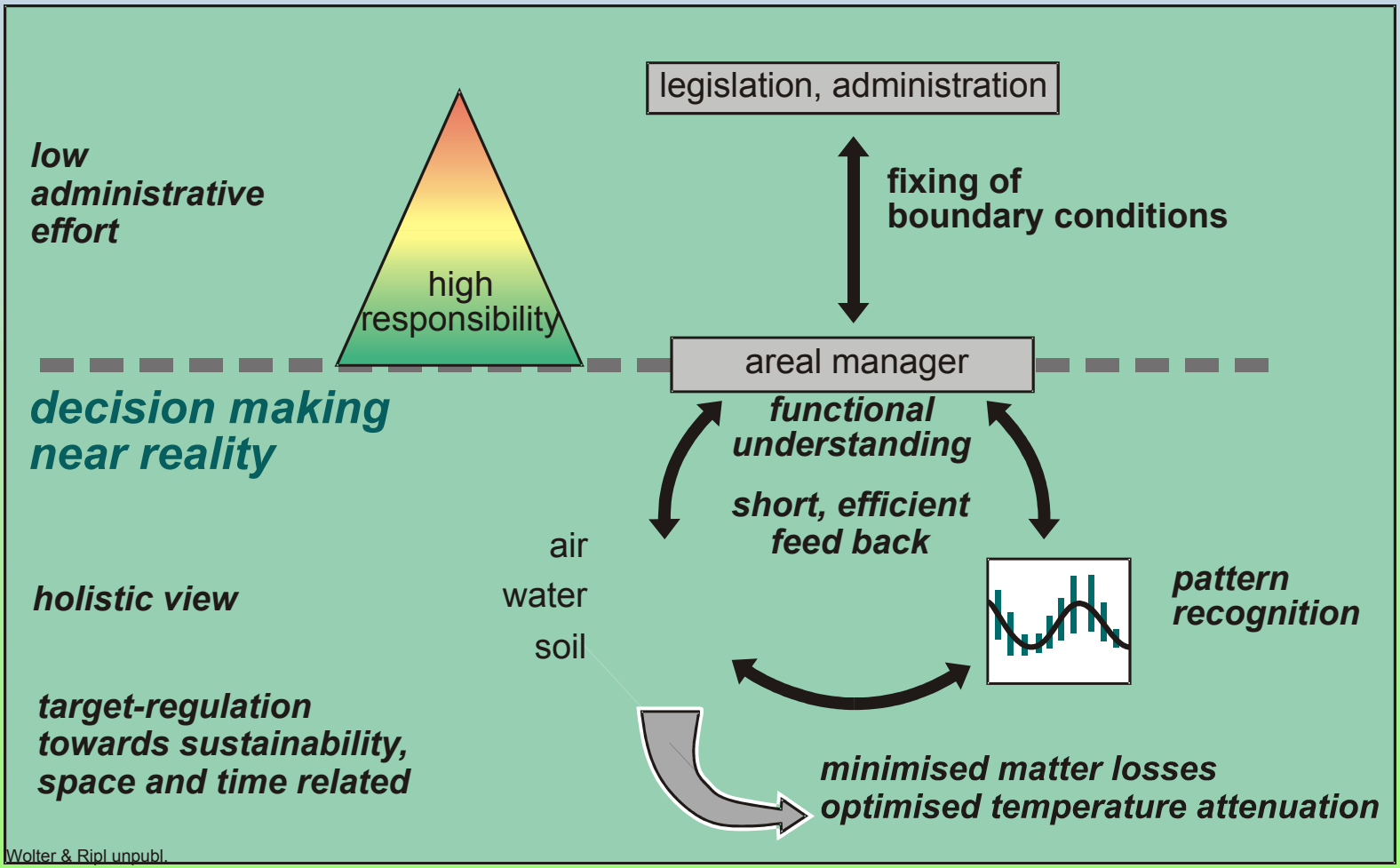

Design für Auslaugungsexperiment
1. kontinuierlicher Wasserfluß
destilliertes Wasser
Sediment-Sand Mischung
Wasser-probe
mg ausgelaugter Stoff
Zeit
2. intermittierender Wasserfluß
destilliertes Wasser
Siphon-Rohr
successive feucht - trocken - Phasen
Wasser-probe
mg ausgelaugter Stoff
Zeit
Quelle: Ripl pers. Mitt.
K-D Wolter, TUB - Limnologie, Leach_e1.cdr, 11.12.00

Present environmental politics: regulation by threshold values



Wolter & Ripl unpubl. Admin_1.cdr, 18.11.96

Future target related regulation (holistic approach)



KD Wolter, TU Berlin - Limnologie, Admin_2.cdr, 06.02.01

What are Natures ecological services for a sustainable society?

- The dissipative water cycle, evaporation and precipitation and its thermostatic function in the catchments
- The atmosphere in its composition, its distribution and its dynamics
- Soil fertility at dynamic conditions. Soil as the dynamic interface between vegetation and the minerogenic substrate under the local water-cycle conditions
- The selforganizing plant cover as the efficient protector of habitat stability