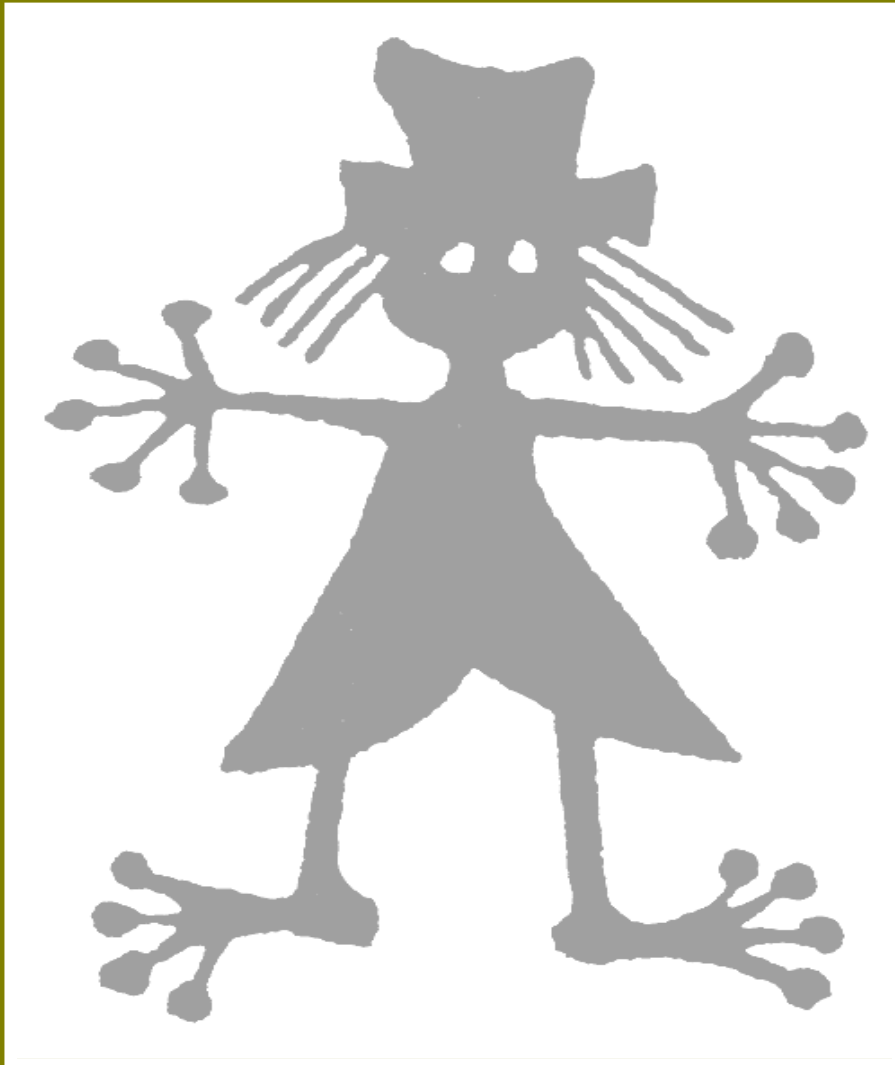# Wetlands

- Global aspects

- Wetland types

- Role of wetlands

- Conservation, degradation, restoration

Martina Eiseltová
Jan Květ

What is a wetland?

Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water

Cowardin et al., 1979

A wetland is a shallow, seasonally or permanently waterlogged or flooded area which normally supports hydrophytic vegetation

Denny, 1995

A wetland is an area dominated by herbaceous macrophytes, which photosynthesize predominantly in the aerial environment and root in a soil which, generally speaking, is entirely saturated with water throughout the greater part of the growing season.

IBP

Areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed 6 m.

IUCN, 1972

Attributes of wetlands

wetlands support predominantly hydrophytes and hygrophytes

and /or

the substrate is predominantly undrained hydric soil

and /or

the substrate is nonsoil and is saturated with water or covered by shallow water

Factors affecting wetlands
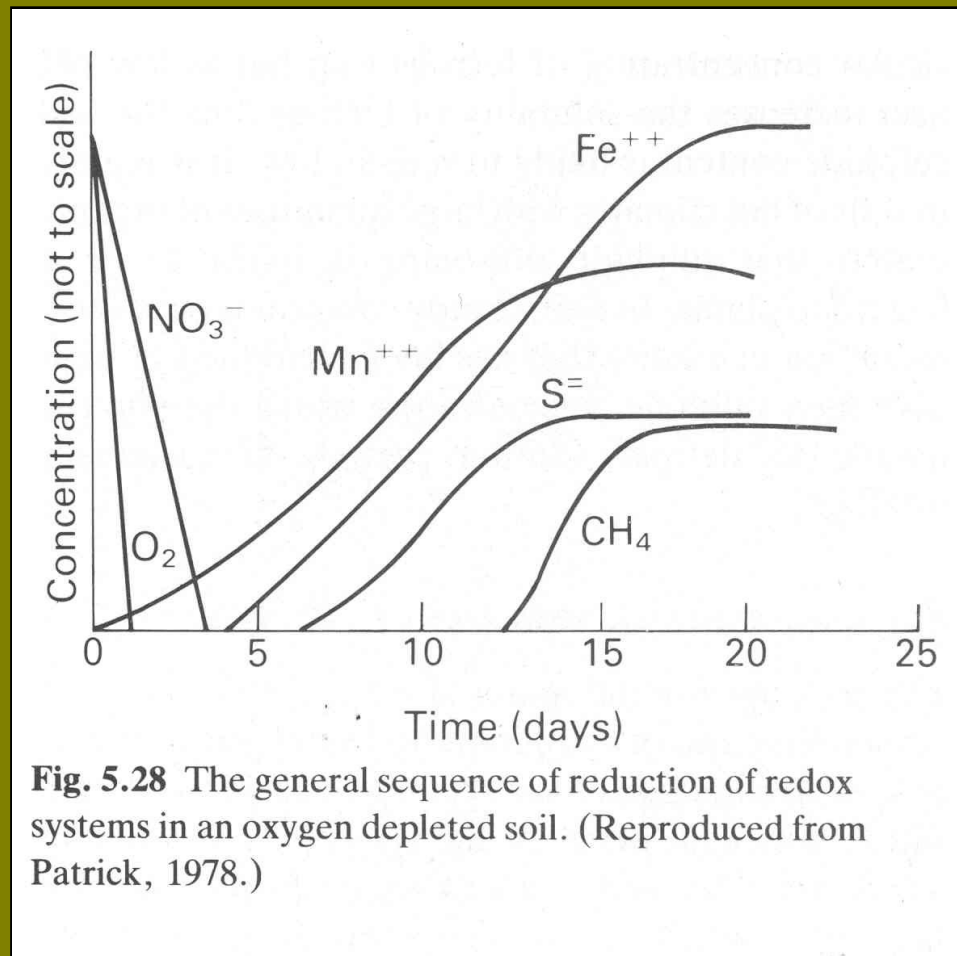
hydrology

trophy

redox potential

Wetland biotopes are determined mostly by hydrology

- Source of water (precipitation, groundwater, surface water)
- Water depth
- Flow rate
- Timing of flooding

Hydrology influences chemical and physical traits of wetlands (soil anaerobiosis, nutrient cycles and their availability, organic matter accumulation)
        - which influences plant species composition

BUT, in turn: plants affect hydrology – ET, retarding flow rate

i.e. there are feedbacks !!

Redox systems in wetland soils

Fig. 5.28 The general sequence of reduction of redox systems in an oxygen depleted soil. (Reproduced from Patrick, 1978.)
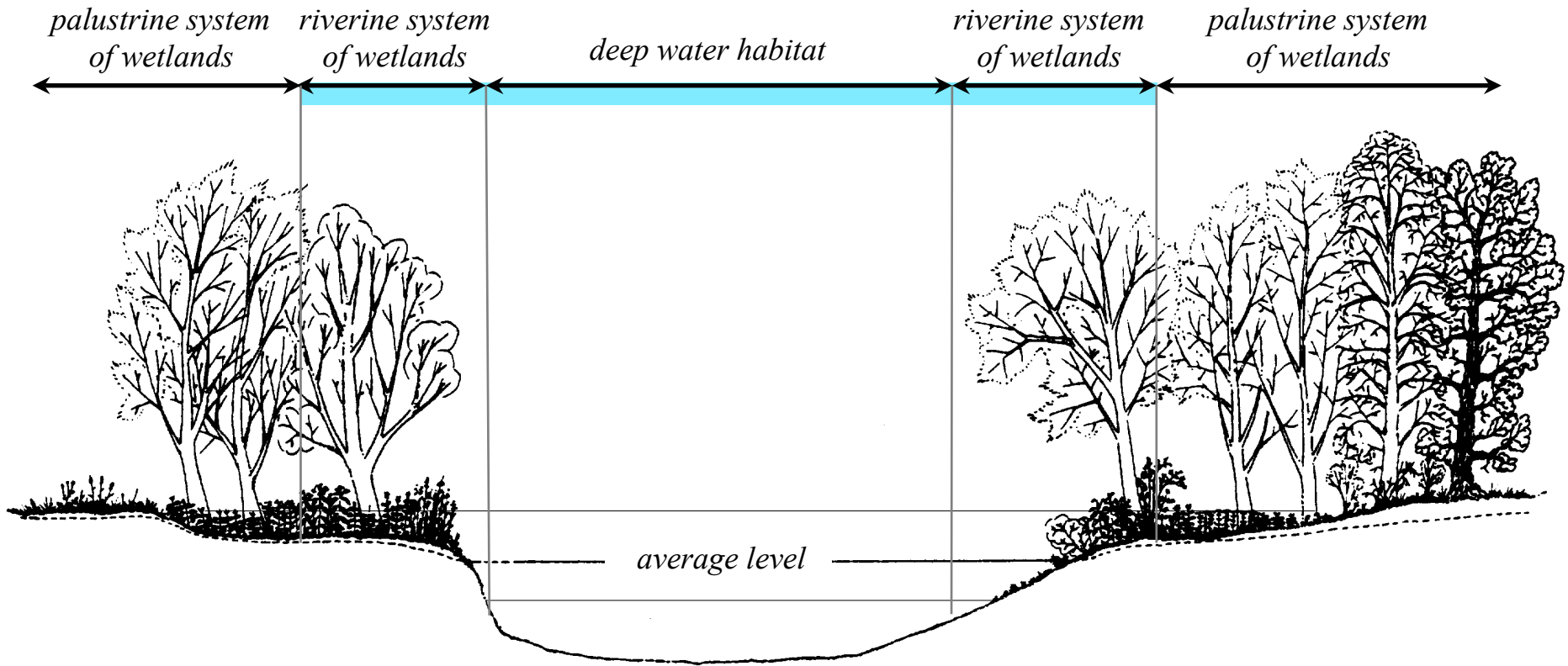
Wetland classification
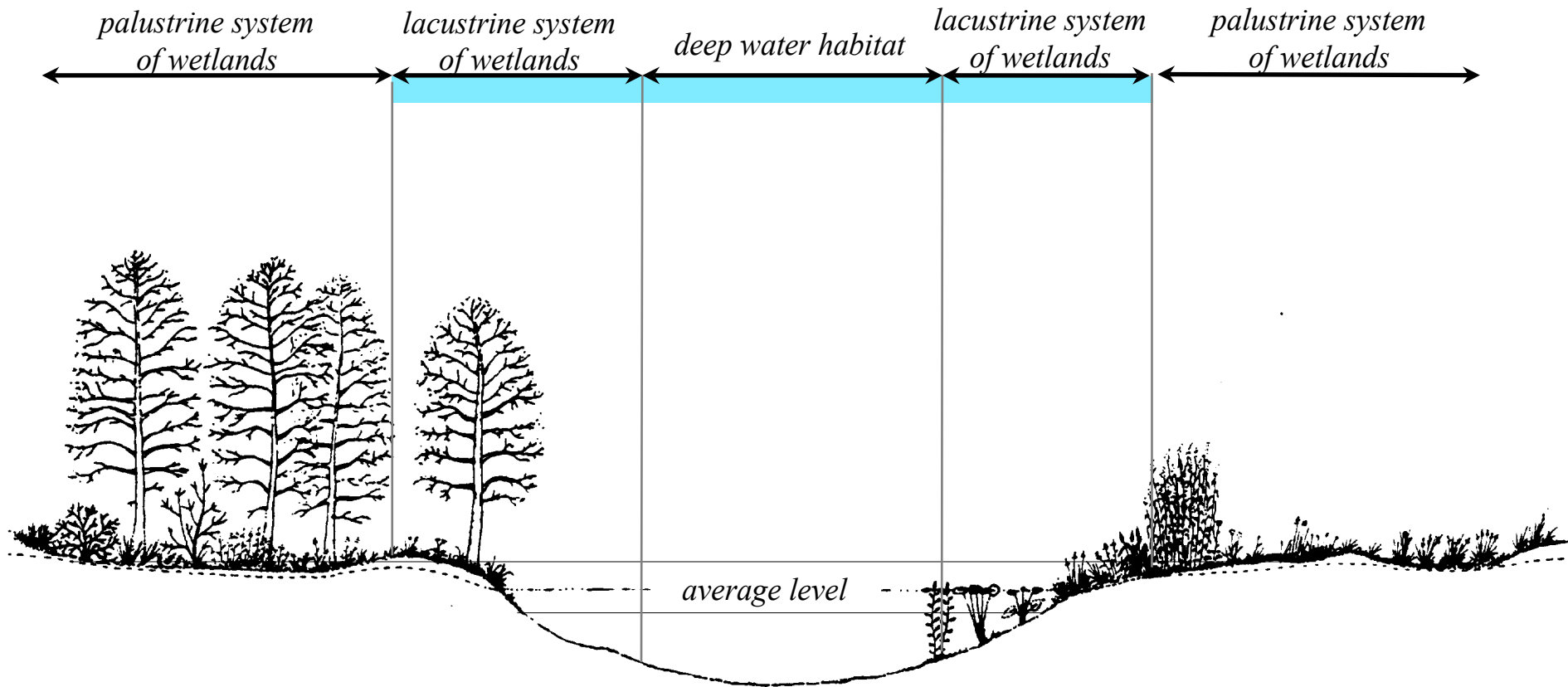
- Salt water
  - Marine
  - Estuarine
  - Lagoons
  - Inland salt marshes and shallow lakes

- Freshwater
  - Riverine
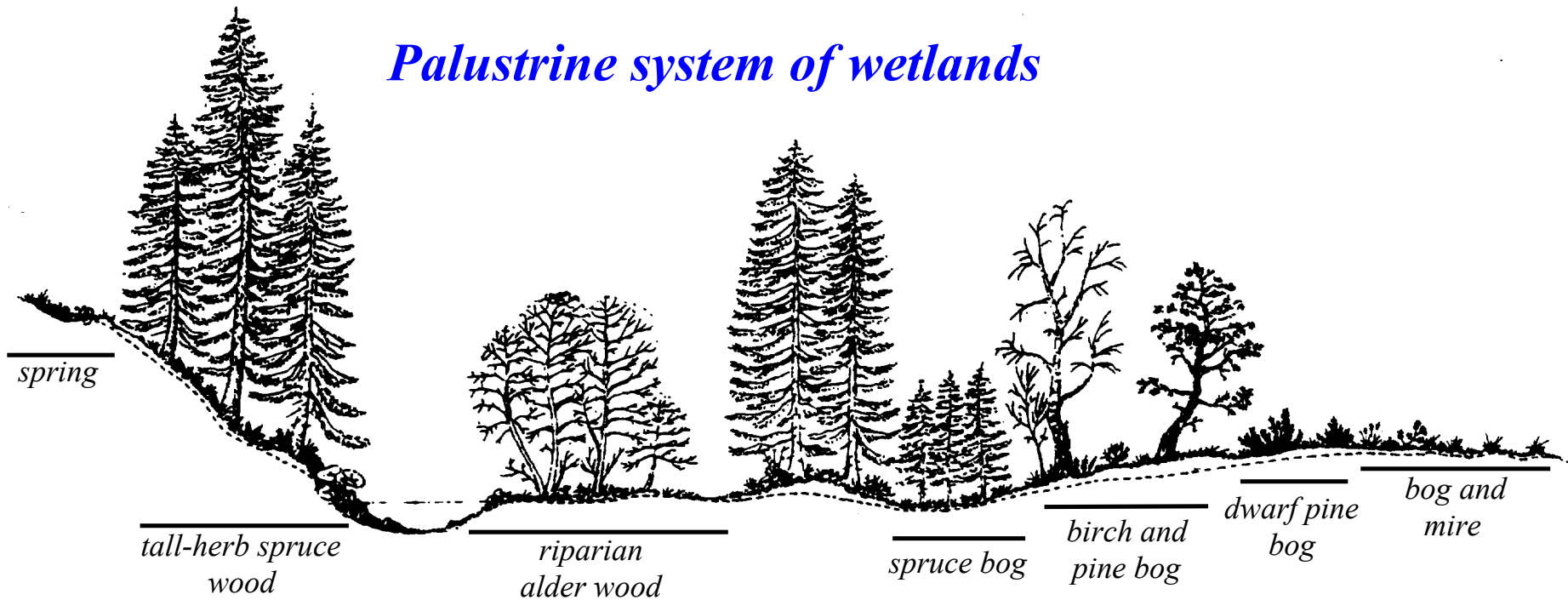 - Lacustrine
  - Palustrine
- Human-made

# Riverine system of waters and wetlands

| palustrine system of wetlands | riverine system of wetlands | deep water habitat | riverine system of wetlands | palustrine system of wetlands |

average level

Lacustrine system of waters and wetlands

palustrine system of wetlands · *lacustrine system of wetlands* · *deep water habitat* · *lacustrine system of wetlands* · *palustrine system of wetlands*

average level

Palustrine system of wetlands

spring

tall-herb spruce wood

riparian alder wood

spruce bog

birch and pine bog

dwarf pine bog

bog and mire

The source of water is groundwater, precipitation or spring water, possibly also flood water but the wetland is usually not adjacent to deep water habitats such as lakes or streams.
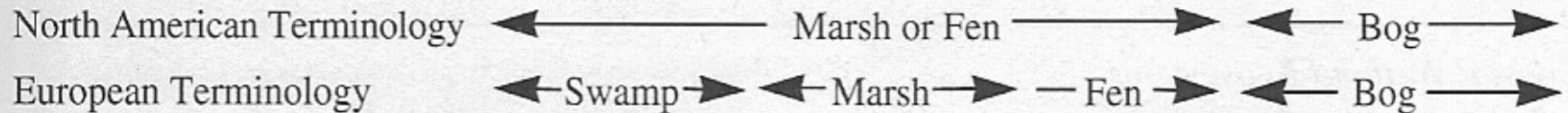
Vegetation covers more than 50% of the area.
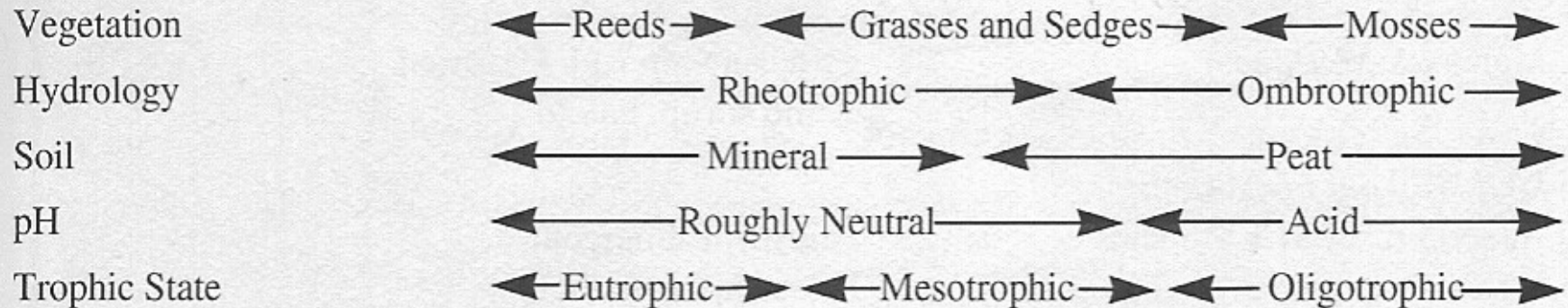
Wetland biotopes – source of water

Keddy 2000
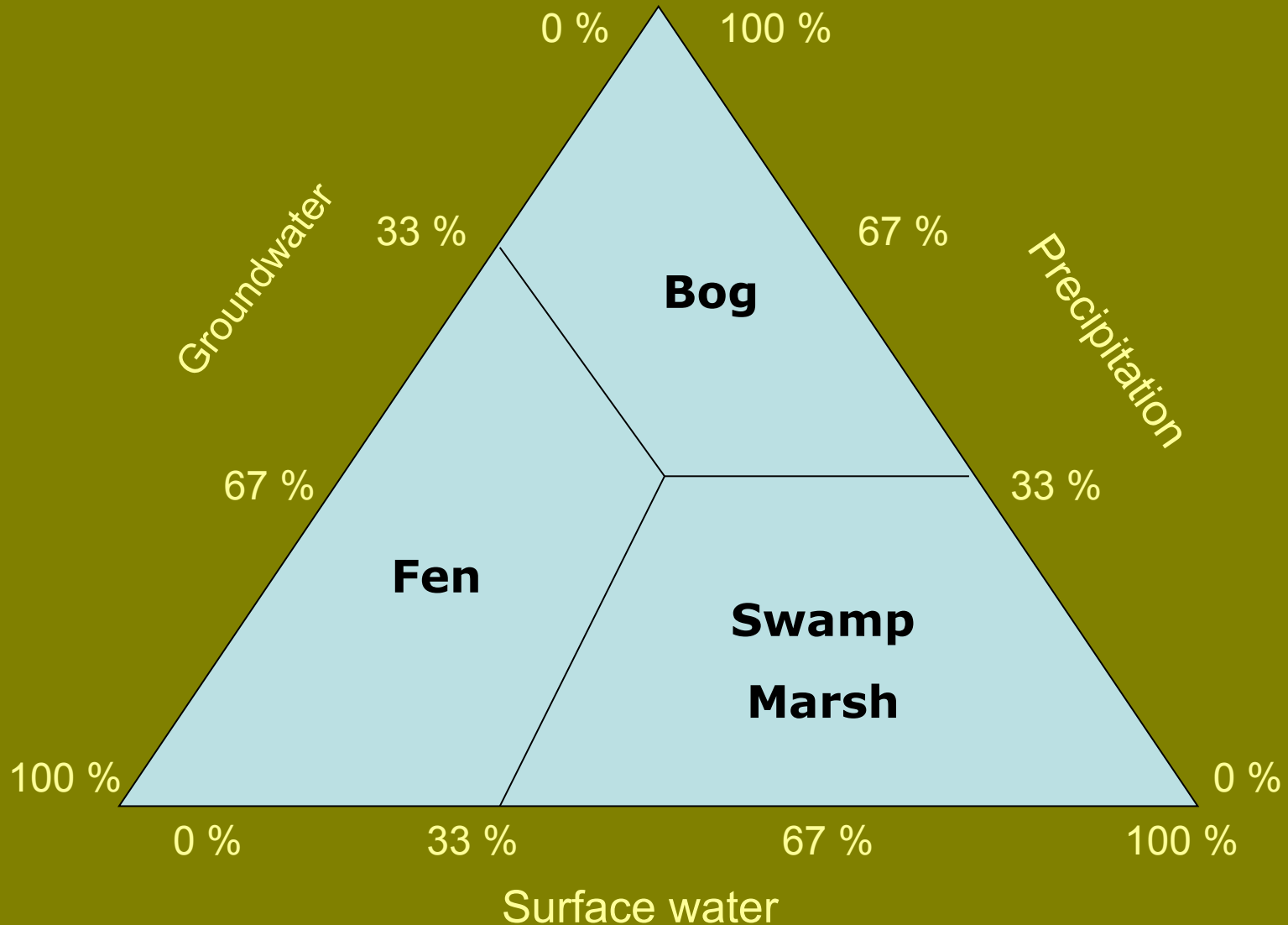
Nonforested Freshwater Wetlands
American vs. European terminology

North American Terminology	← Marsh or Fen →	← Bog →	
European Terminology	← Swamp →	← Marsh →	— Fen →	← Bog →

CHARACTERISTICS			
Vegetation	← Reeds →	← Grasses and Sedges →	← Mosses →
Hydrology	← Rheotrophic →	← Ombrotrophic →	
Soil	← Mineral →	← Peat →	
pH	← Roughly Neutral →	← Acid →	
Trophic State	← Eutrophic →	← Mesotrophic →	← Oligotrophic →

Wetland types

Bog

Fen

Floodplain

Wet meadow

Floodplain forest

Alder carr

© Jan Ševčík

River delta
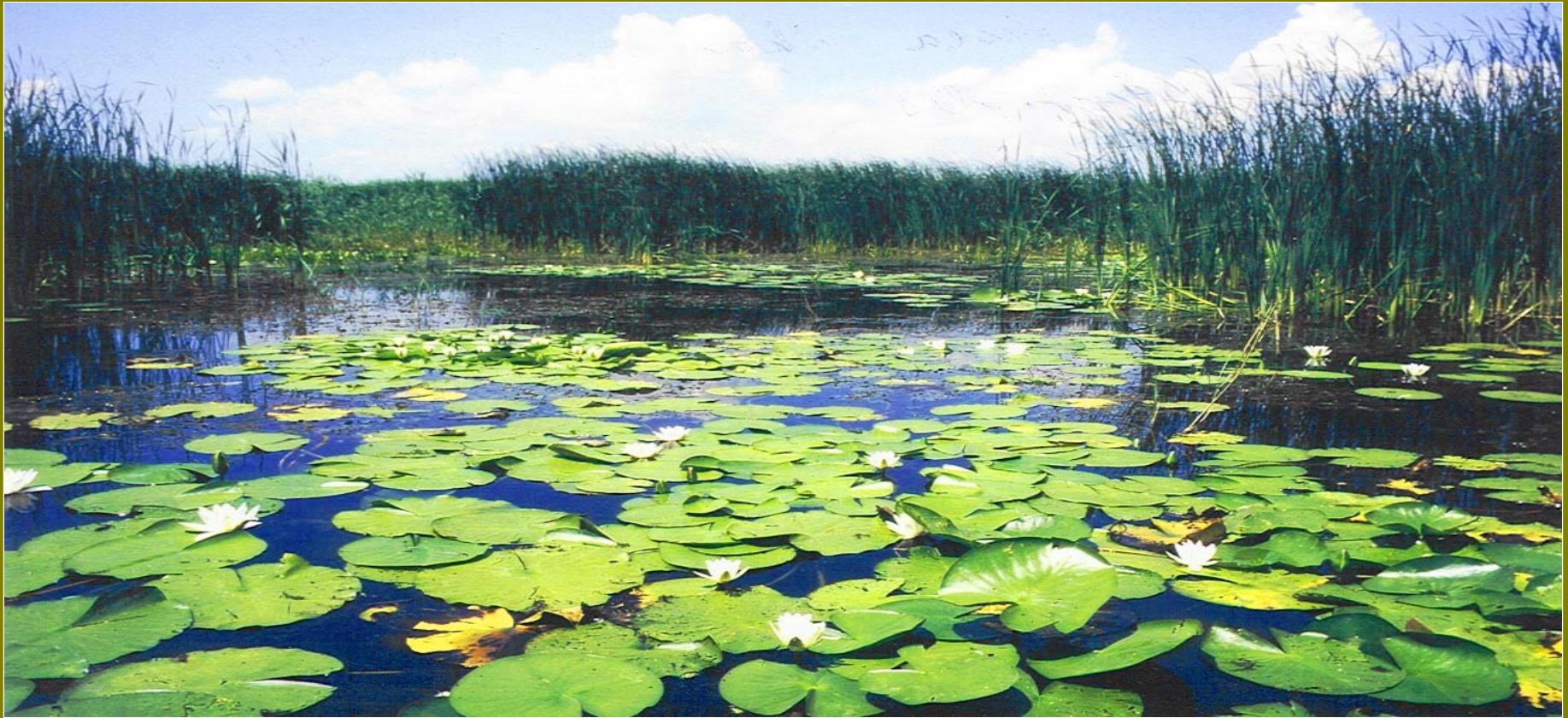
Fishpond

Fishpond complex

© Jan Ševčík
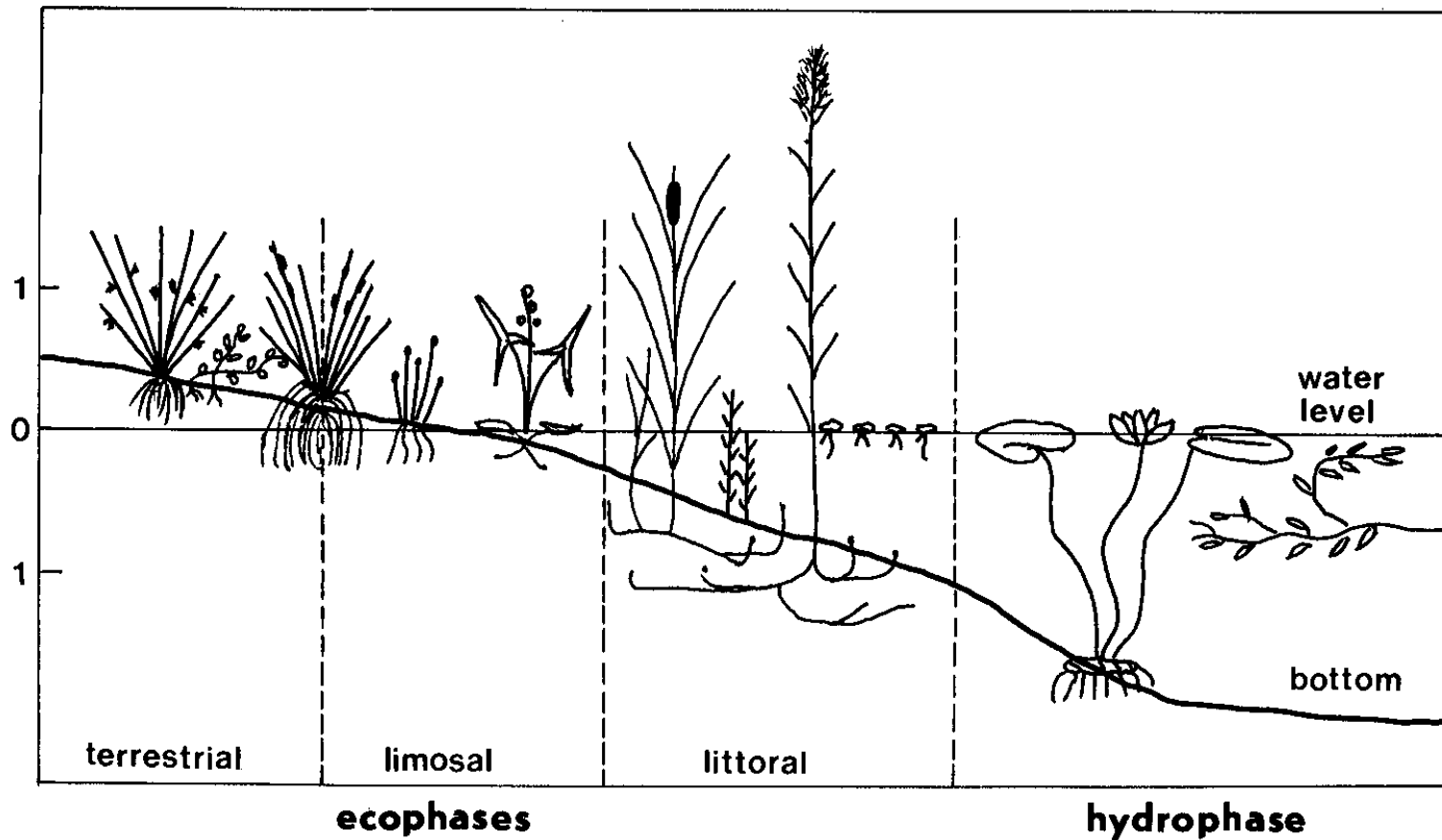
Lake or fishpond littoral

Vegetation zonation

Fig. 1. Schematic illustration of ecophases in a fishpond littoral. *Vertical axis*: distance from actual water level in m
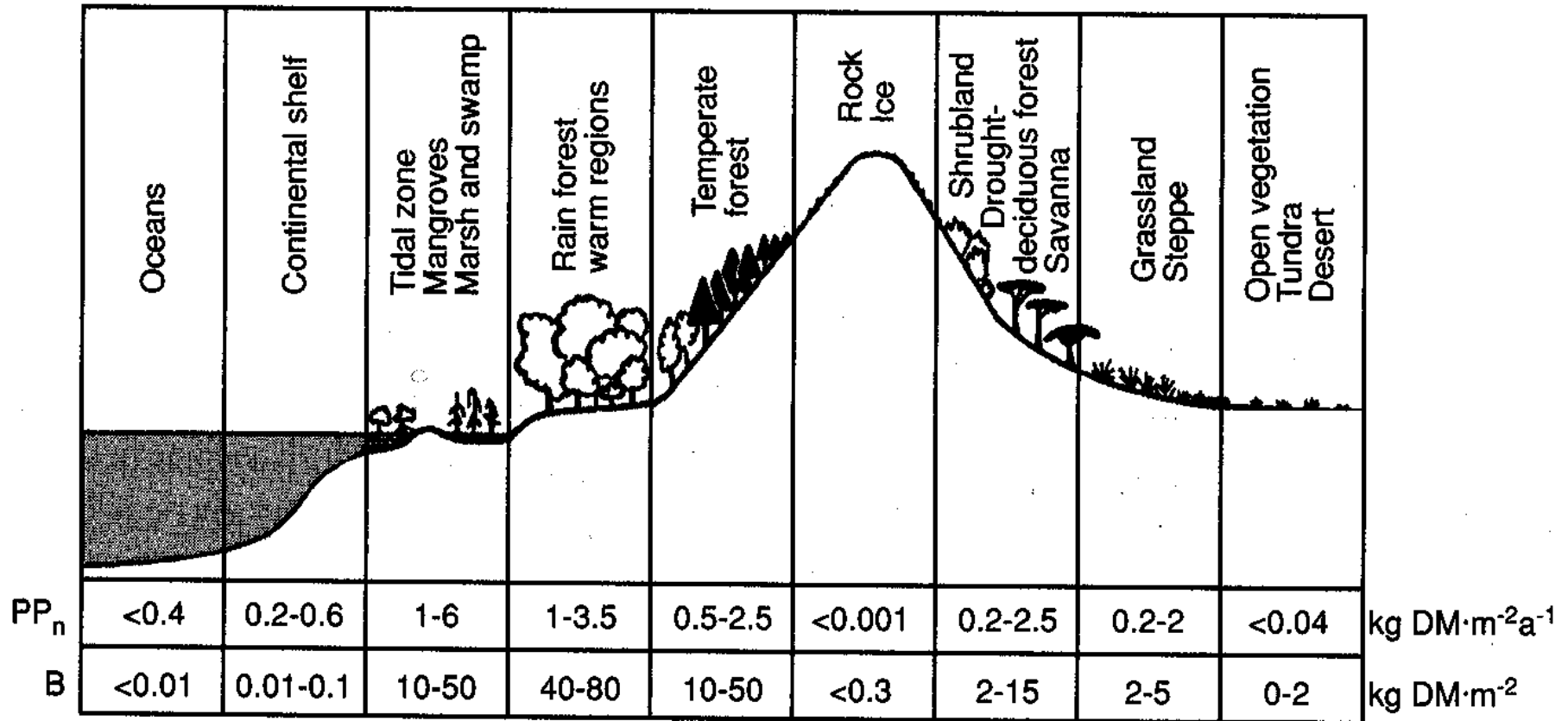
Flooded sandpit

Constructed wetland

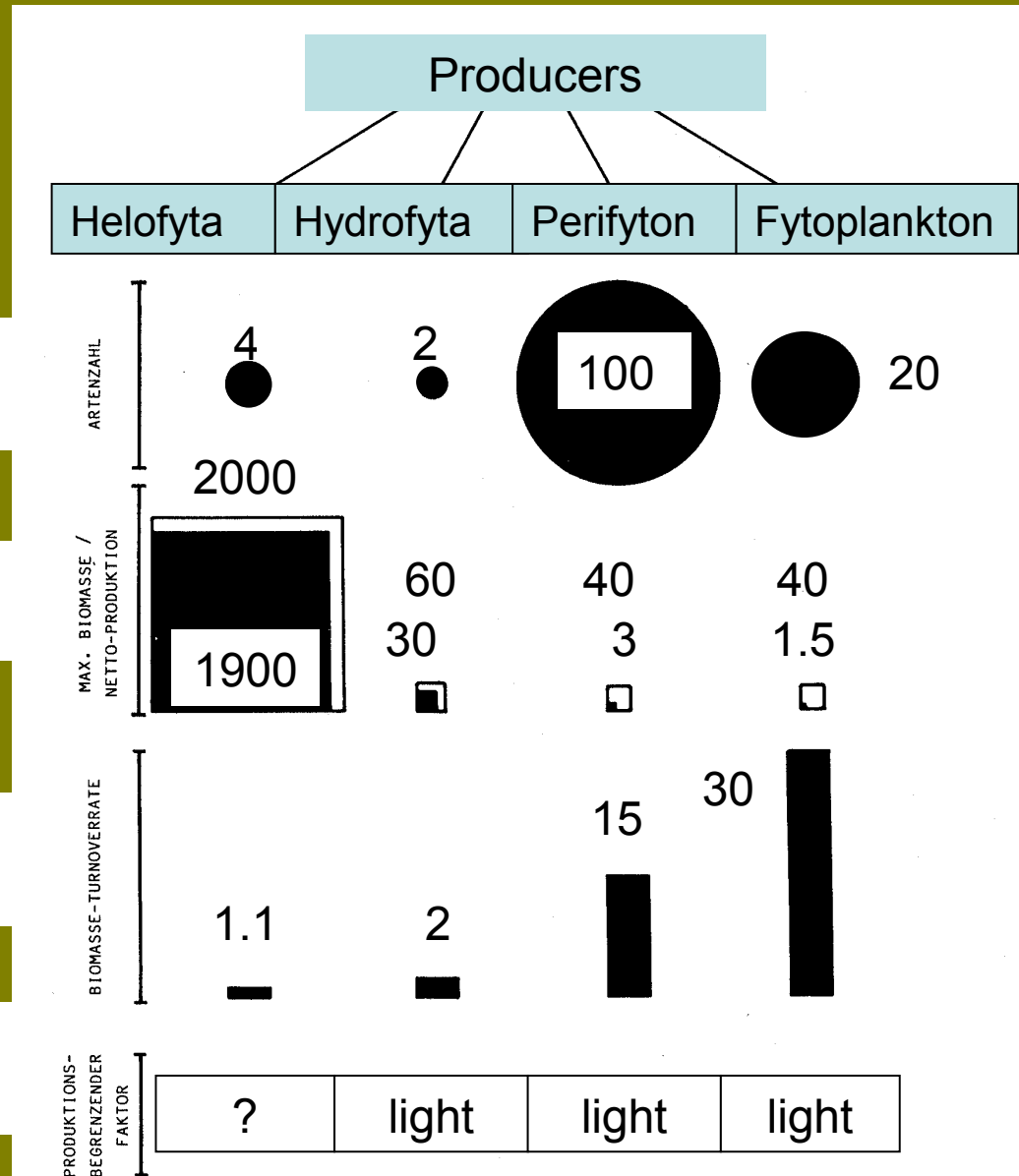# Annual net primary production (PP$_n$) and plant biomass (B) in various ecosystems

	Oceans	Continental shelf	Tidal zone Mangroves Marsh and swamp	Rain forest warm regions	Temperate forest	Rock Ice	Shrubland Drought-deciduous forest Savanna	Grassland Steppe	Open vegetation Tundra Desert	
PP$_n$	<0.4	0.2-0.6	1-6	1-3.5	0.5-2.5	<0.001	0.2-2.5	0.2-2	<0.04	kg DM·m^{-2}a^{-1}
B	<0.01	0.01-0.1	10-50	40-80	10-50	<0.3	2-15	2-5	0-2	kg DM·m^{-2}

Knowledge of plant biomass turnover is important for estimating NPP
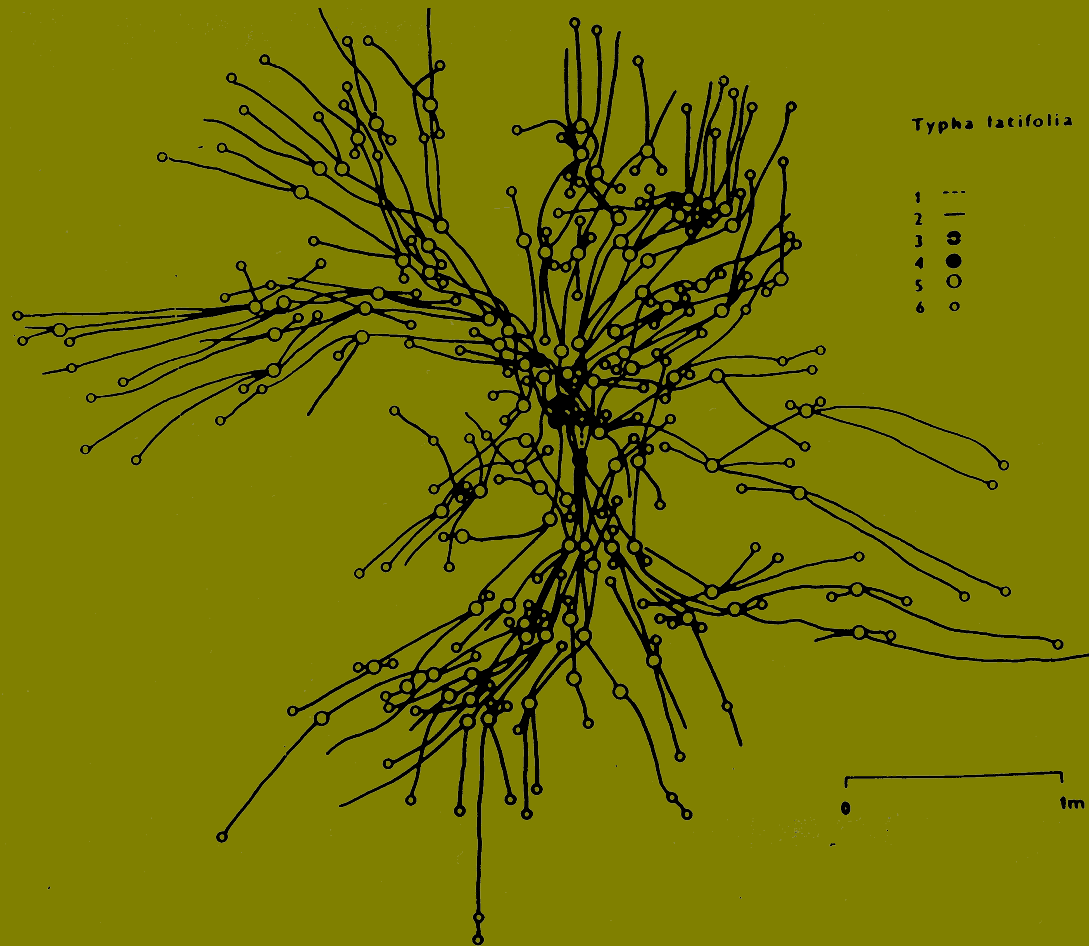
Spreading of a *Typha latifolia* clone within one year

At the end of year zero there was a seedling with just one shoot and two rhizome buds

Karel Fiala

Effect of harvest frequency on total NPP of duckweeds

Experimental harvesting of 0, 25, 50 and 75% of biomass of duckweed (*Spirodela polyrhiza*) at three to five days' intervals in the course of 35 days.
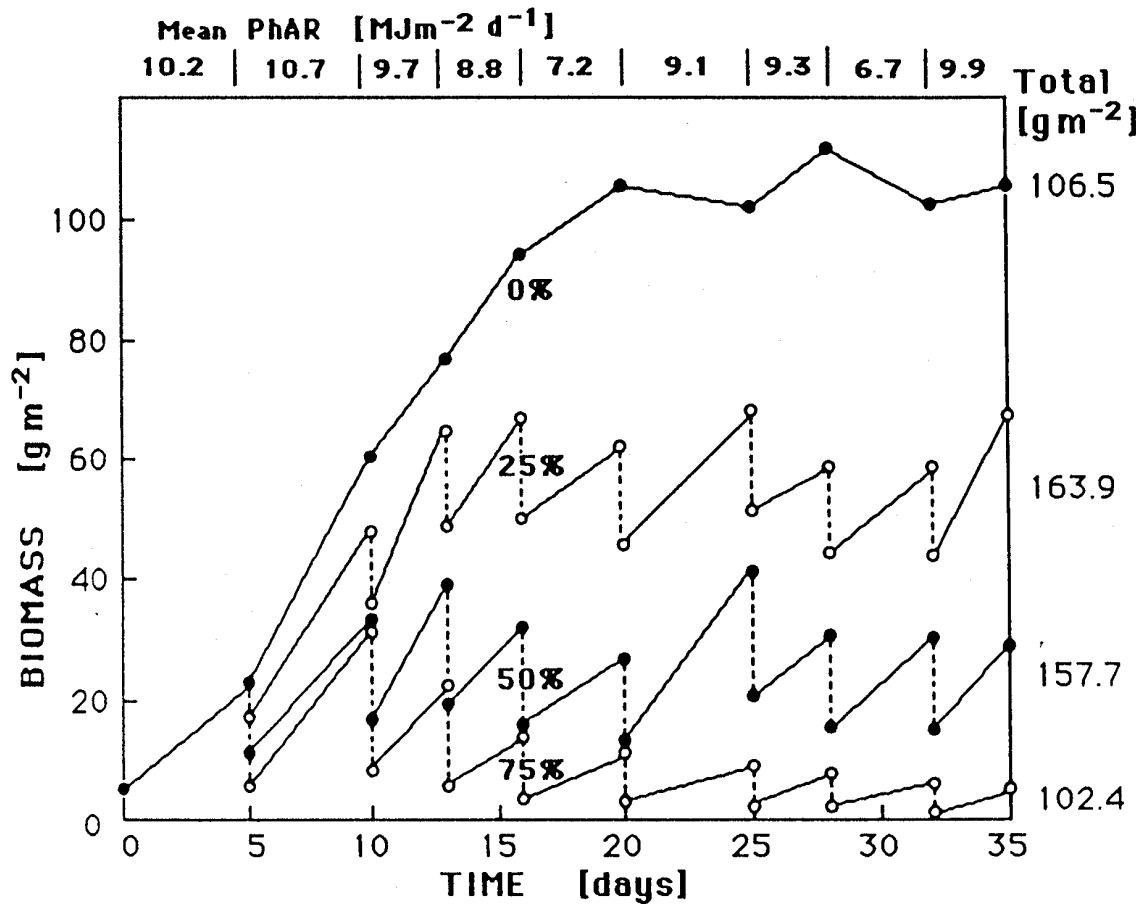

Total NPP (d.w.):

106.5 g.m^{-2}

163.9 g.m^{-2}

157.7 g.m^{-2}

102.4 g.m^{-2}

Top line: daily averages of PhAR.

Rožmberk fishpond

The Wet Meadows

Třeboň

Eddy covariance

InSituFlux system
For measuring local surface fluxes of kinetic
energy, sensible heat, water vapour and carbon
dioxide in order to assess actual functioning of the
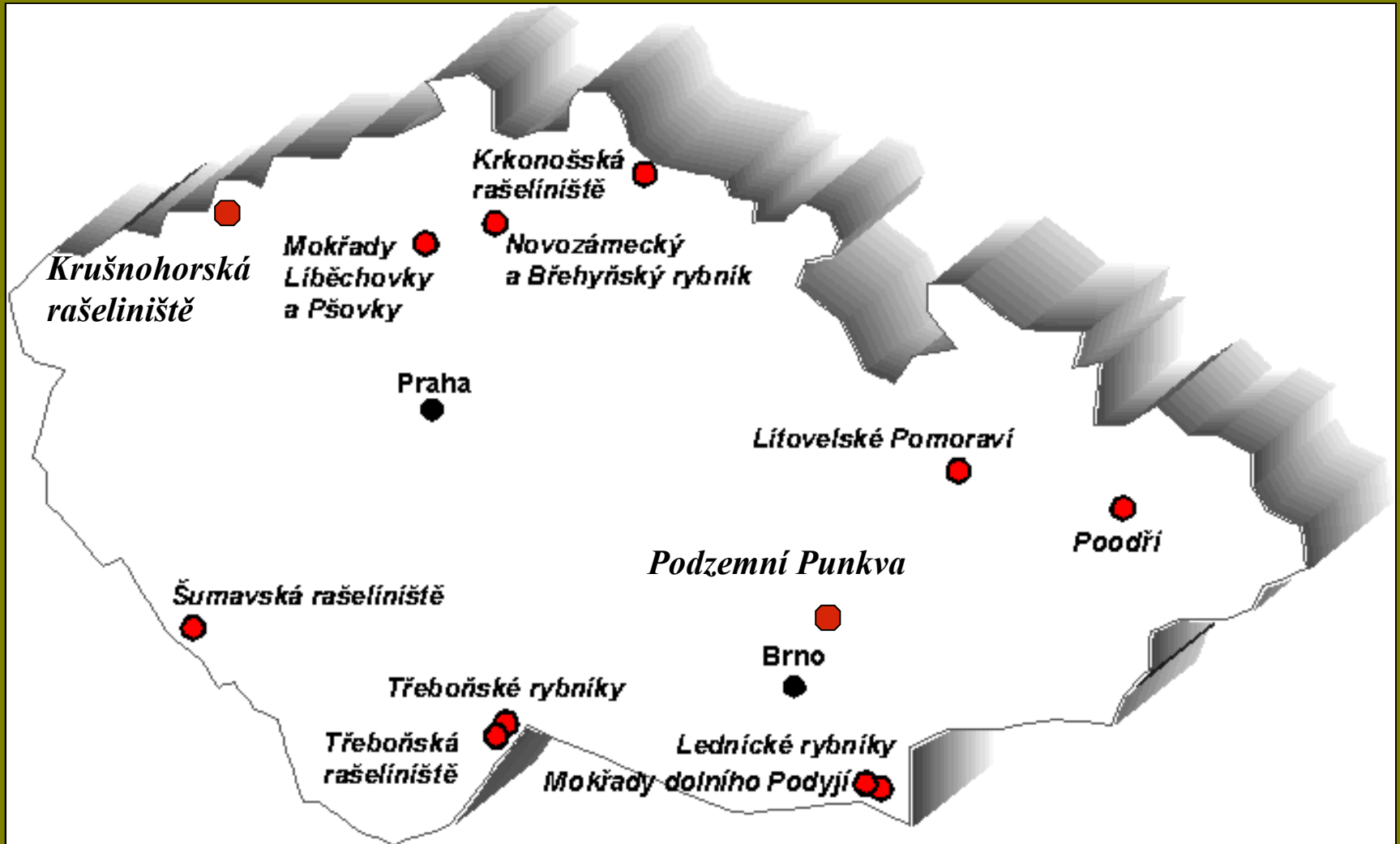Wet Meadows wet grassland.

Wetland conservation

In Europe more than 50 %

of wetlands were lost

Flagship species

Wetlands of International Importance

Třeboňské rybníky

Kosatec žlutý (Iris pseudacorus)

Starý hospodář

Kvakoš noční (Nycticorax nycticorax)

Šumavská rašeliniště

*Typický pohled na tajemná šumavská rašeliniště v mlžném oparu.*

Pohled na centrální části rašeliniště Mrtvý luh, které je největší z českých rašelinišť (asi 300 ha).

Wetland loss and degradation

- Streams were straightened and deepened in order to promote rapid discharge of water to the sea and floodplains reclaimed for agricultural use

- Rivers were dredged to create navigational canals; dikes built to prevent flooding of adjacent land

- Waterlogged forests were subjected to surface drainage to enhance timber production

- Bogs were subjected to peat extraction; fens drained and ploughed to gain farming land

- Many springs disappeared due to large-scale drainage and agricultural intensification

- Water table in lakes was lowered and littoral zones reclaimed to gain agricultural land

Drainage of agricultural land

Drainage (ha)
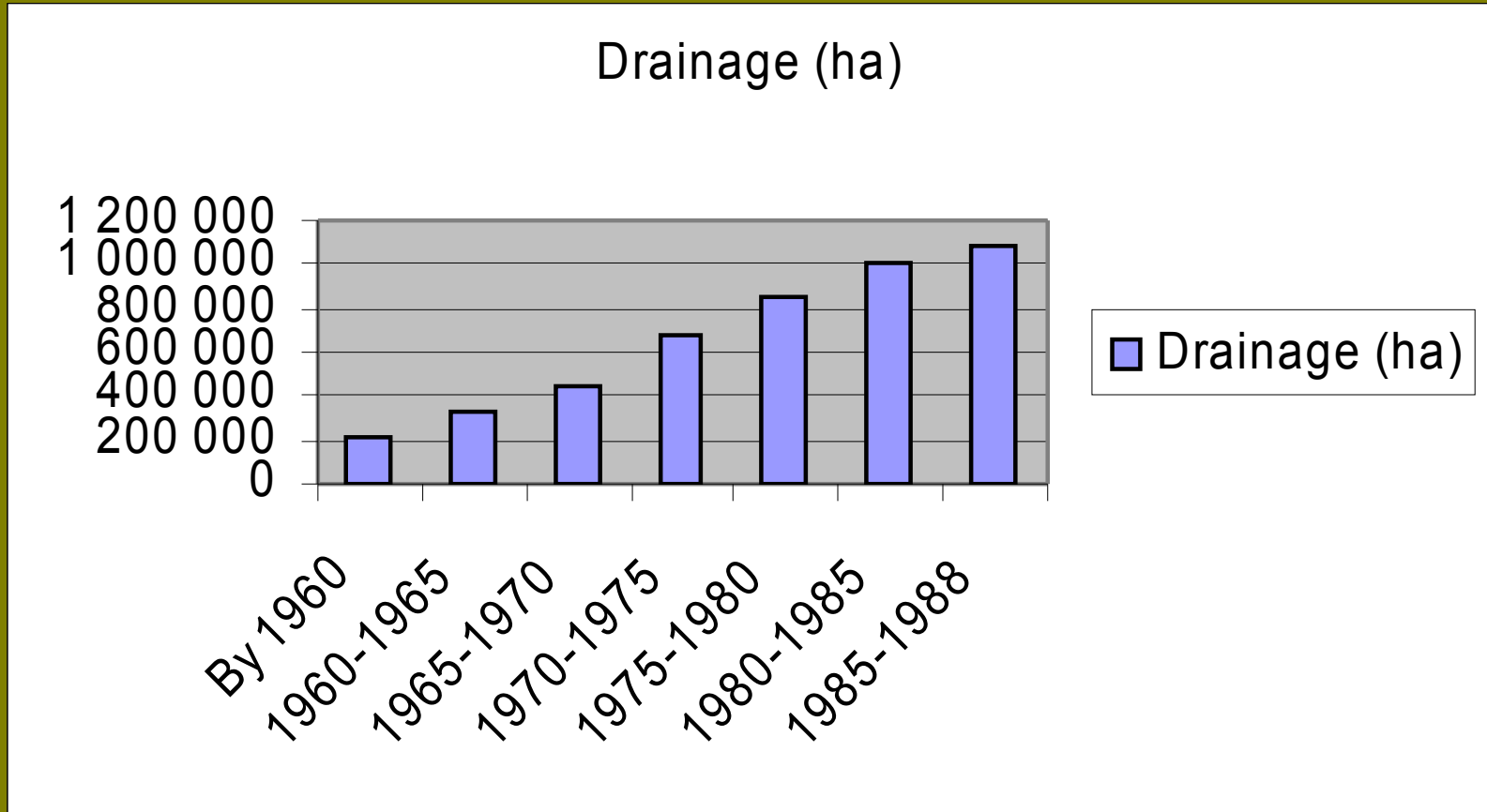
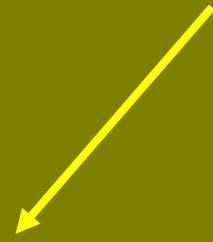# Lowering of water table in lakes

External loading

Point-sources

Non-point sources

Wastewater discharge

Agriculture intensification

Inflow

Outflow

Wetland

Losses

Harvest

Release of P

Sedimentation

Internal loading

Former meanders

Drainage canal

Stream remeandering

Peat extraction

Restoration of water table

Wetlands Goods	Wetlands Services
Water as goods • irrigation • utility water • drinking water **fish and other aquatic organisms**	**Temperature attenuation and water distribution → climate stabilisation** **Water retention → flood control**
Game	**Retention and recycling of nutrients**
Wetland plants • as building material • as food source (e.g. rice) • biomass for energy production	**Sequestration of CO_2** • in biomass • in sediments • in carbonates
Algae • as food source • pharmaceutic industry	**Biodiversity**
Wood • building material • fuel	
Medicinal plants	
Peat	

Carbon storage and sequestration

Ecosystem type	Mean soil organic matter (kg C m^{-2})	World area (ha × 10^8)	Total world soil organic carbon (mt C × 10^9)	Amount in surface litter (mt C × 10^9)
Tropical forest	10.4	24.5	255	3.6
Temperate forest	11.8	12	142	14.5
Boreal forest	14.9	12	179	24.0
Woodland and shrubland	6.9	8.5	59	2.4
Tropical savanna	3.7	15	56	1.5
Temperate grassland	19.2	9	173	1.8
Tundra and alpine	21.6	8	173	4.0
Desert scrub	5.6	18	101	0.2
Extreme desert, rock, and ice	0.1	24	3	0.02
Cultivated	12.7	14	178	0.7
Swamp and marsh	68.6	2	137	2.5
Totals		147	1456	55.2

^{a} From Schlesinger (1977).