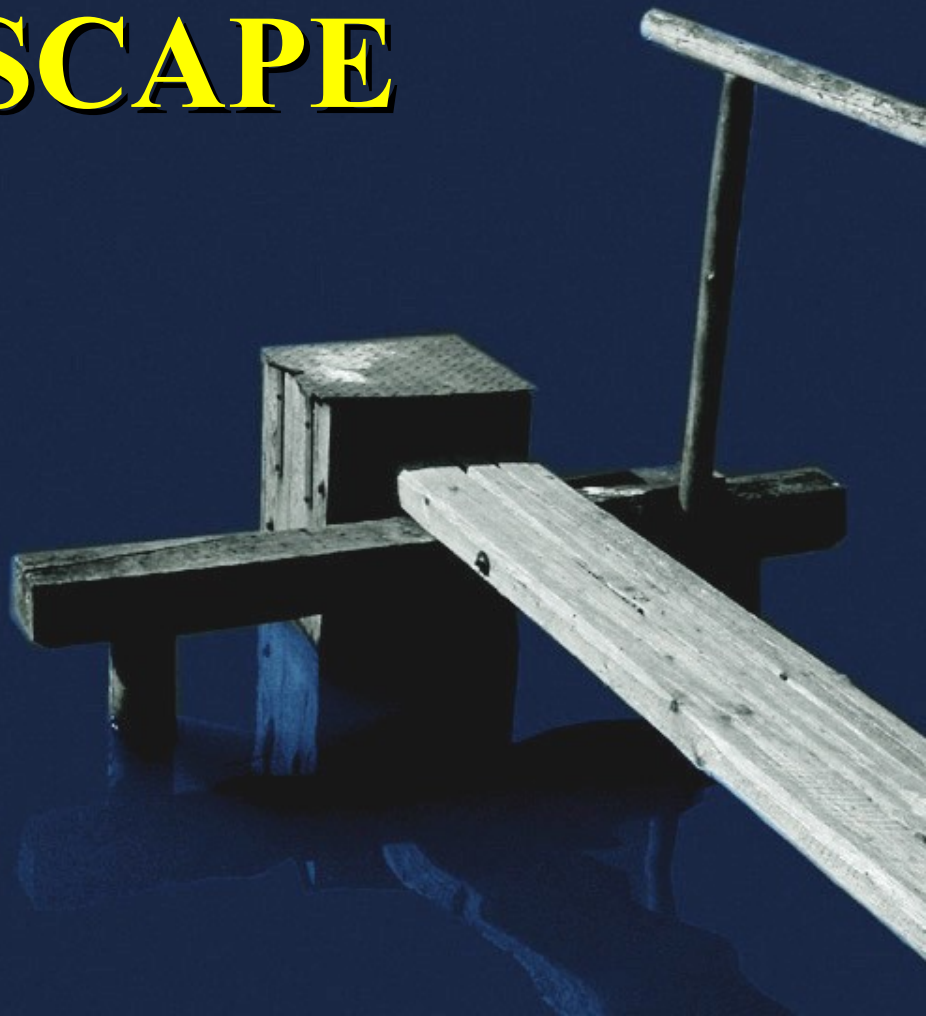
THE ROLE OF FISHPONDS IN THE LANDSCAPE



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Jan **KVĚT** - wetland ecology, orator

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public benefic corporation
ISBE
Academy of sciences of CR
Trebon
CZECH REPUBLIC

WHAT IS A FISHPOND ?

WHAT IS A FISHPOND ?

An artifical water reservoir used for fish production, with the possibility of a complete and periodical drawdown.

USUAL TECHNICAL EQUIPMENT

Dam – usually earth with stone rip-rap, stabilized with trees

Outlet – originally wooden (fir), now concrete or steel

Spillway – controls normal water level

Fish collection – with nets

Period of fishing – 2 or 3 years (summer seasons)

Size of ponds – from several to hundreds of hectares

SMALL FISHPOND

LARGE FISHPOND

Rybník Svět

Fish pond Svět/World

FISH SPECIES REARED IN FISHPONDS

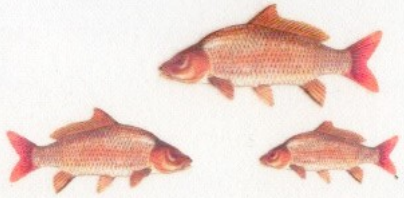
Common carp (*Cyprinus carpio*)
88 % (17 000 t/y)

Grass carp (*Ctenopharyngodon idella*)
Silver carp (*Hypophthalmichthys molitrix*)
4 %

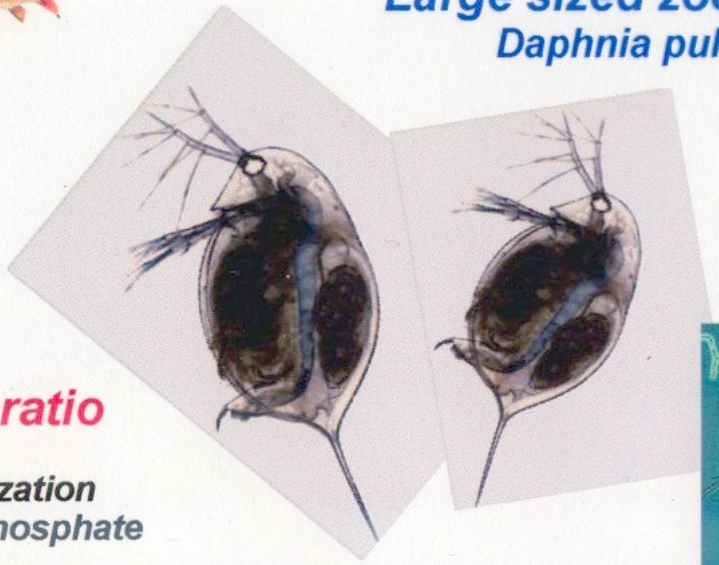
Tench (*Tinca tinca*)
1 %

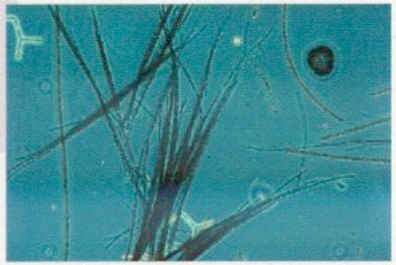
Pike (*Esox lucius*)
Pikeperch (*Stizostedion lucioperca*)

Small biomass of fish



Large sized zooplankton
Daphnia pulicaria



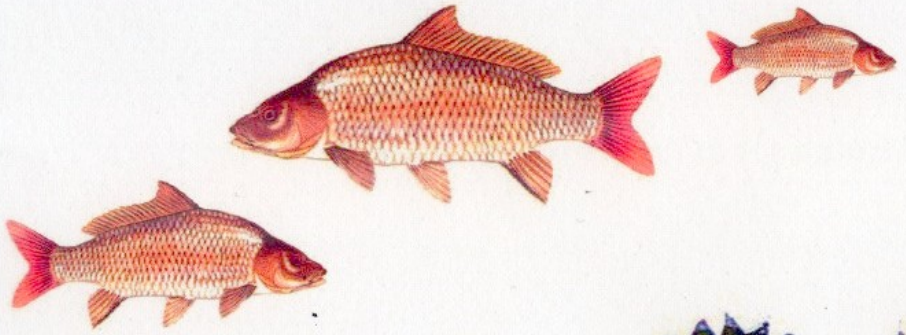


Low N:P ratio

Due to fertilization with superphosphate

Bloom of Aphanizomenon flos- aquae var. flos-aquae

Higher biomass of fish



Small sized zooplankton

Ceriodaphnia affinis
Bosmina longirostris
Moina micrura

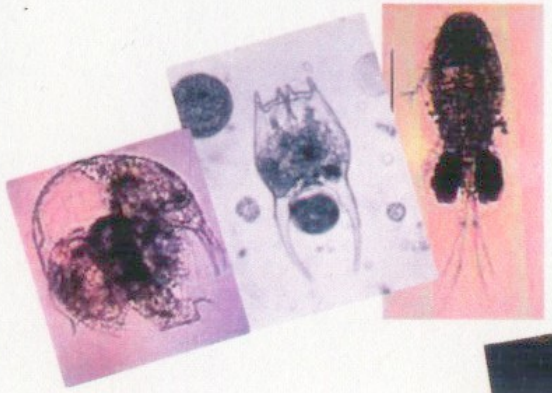
More than 29:1 ratio

Due to fertilization with mainly manure

Dominance of Chlorococcales and small sized blue-greens like Aphanizomenon flos- aquae var. klebahniii

High biomass of fish

Small to very small sized zooplankton



Less than 29:1 N:P ratio

High to very high amounts of manure
High pH and low carbondioxid
dense phytoplankton blooms

Dominance of Planktothrix agardhii and Anabaena spp.

POND MANAGEMENT CYCLE

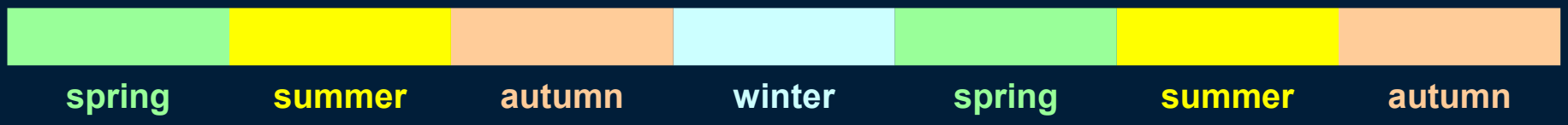
Manuring for phyto- and zooplankton promotion

POND MANAGEMENT CYCLE

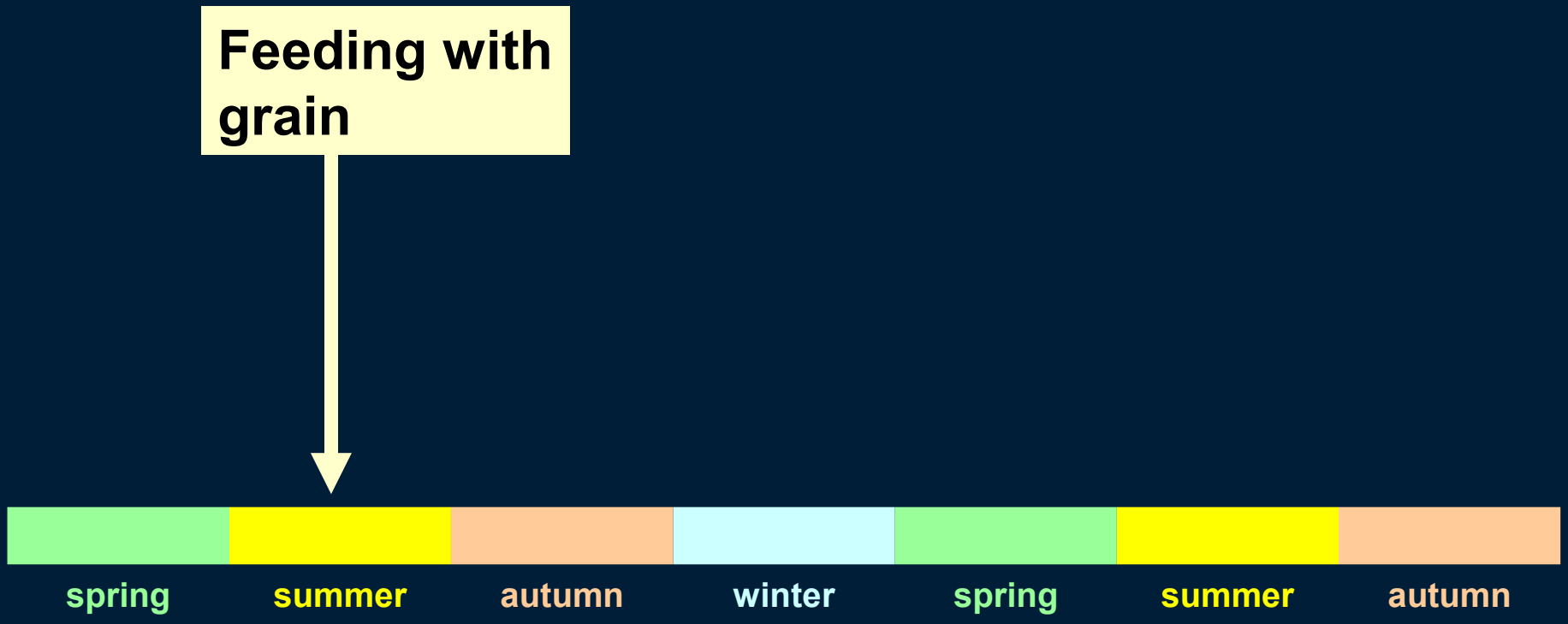
1 or 2 years old fingerlings into main ponds

POND MANAGEMENT CYCLE

Use of natural food
- zooplankton



POND MANAGEMENT CYCLE



POND MANAGEMENT CYCLE

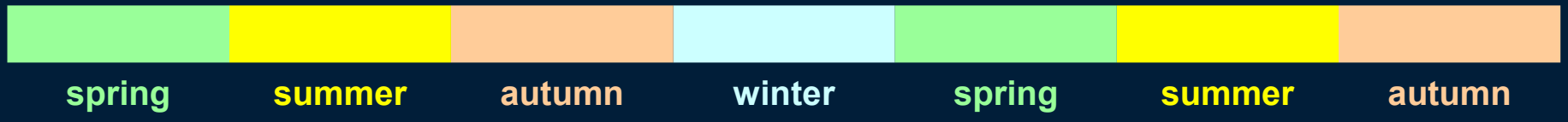
Sample fishing
- growth control
- market demand

POND MANAGEMENT CYCLE

Hibernation in main or special ponds

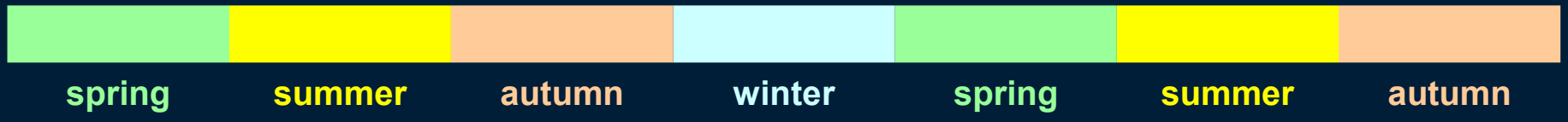
POND MANAGEMENT CYCLE

Manuring for phyto- and zooplankton promotion

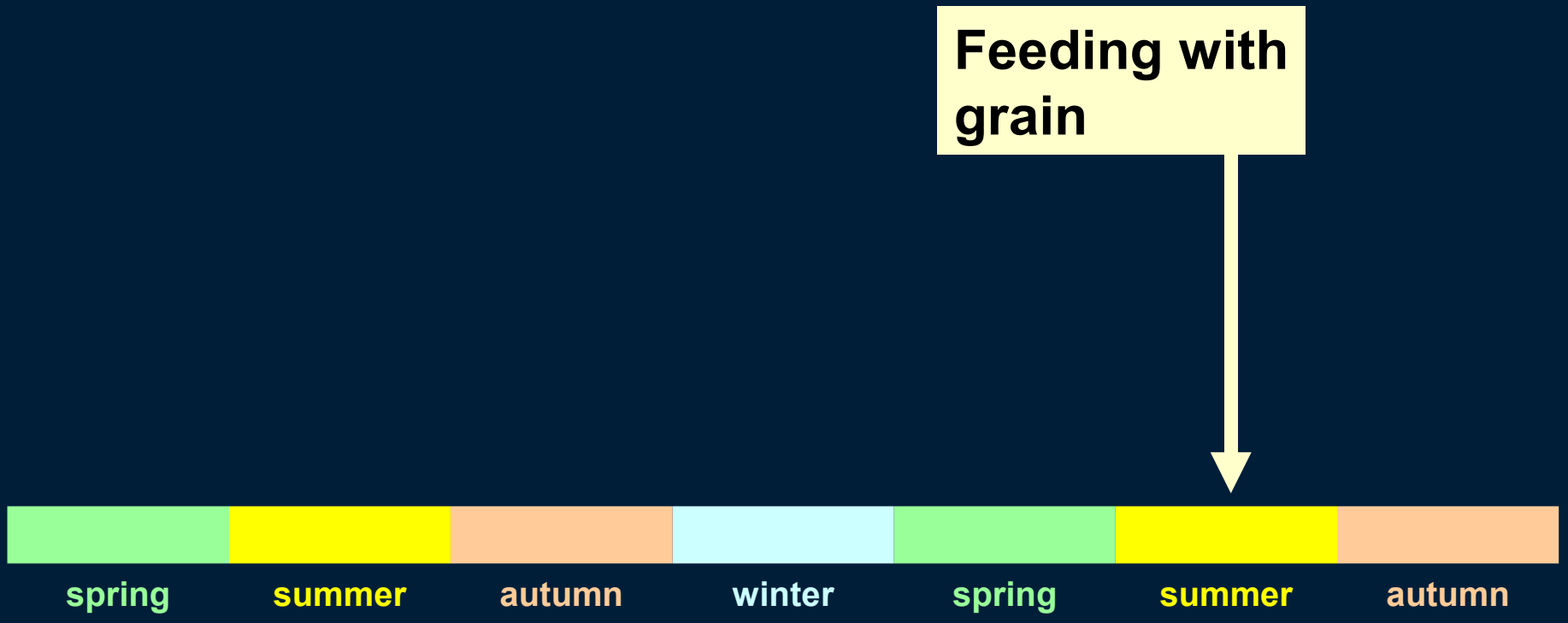


POND MANAGEMENT CYCLE

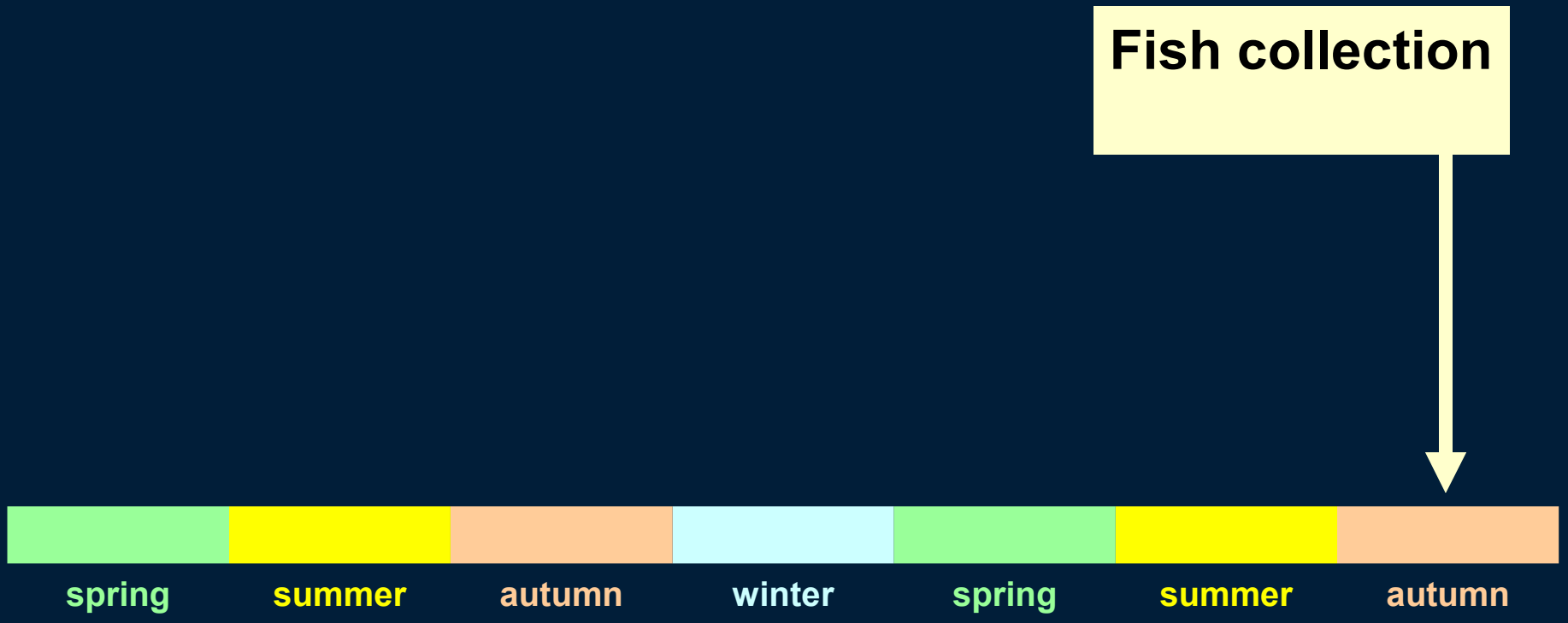
Use of natural food - zooplankton



POND MANAGEMENT CYCLE

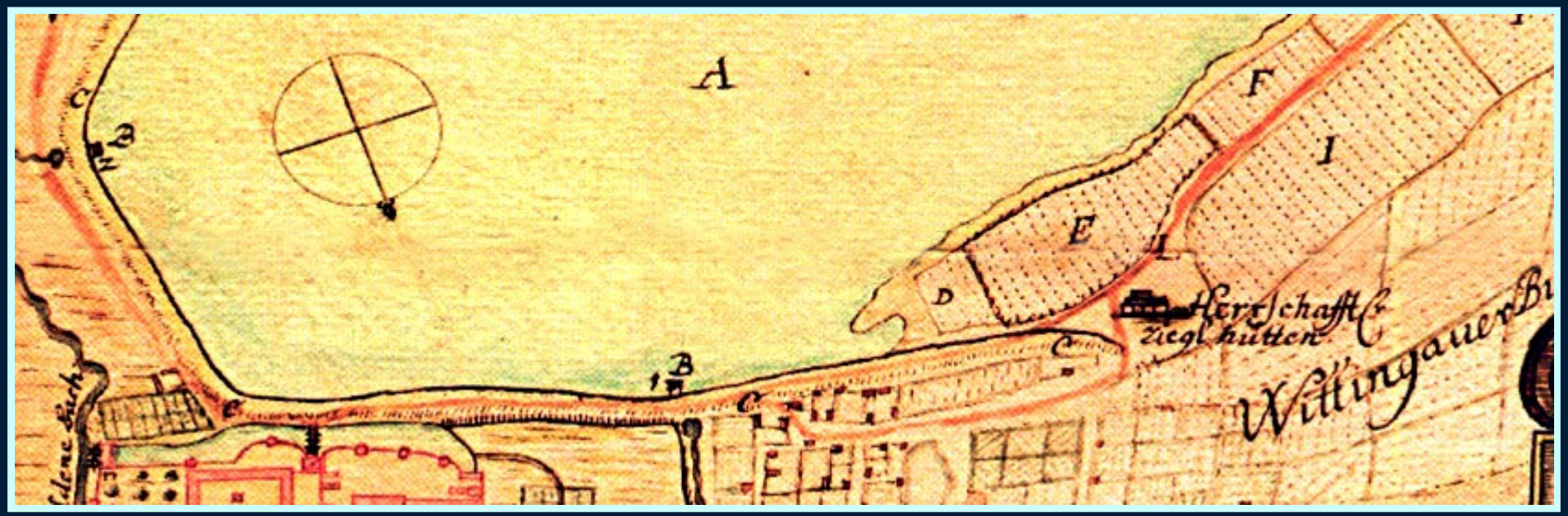


POND MANAGEMENT CYCLE



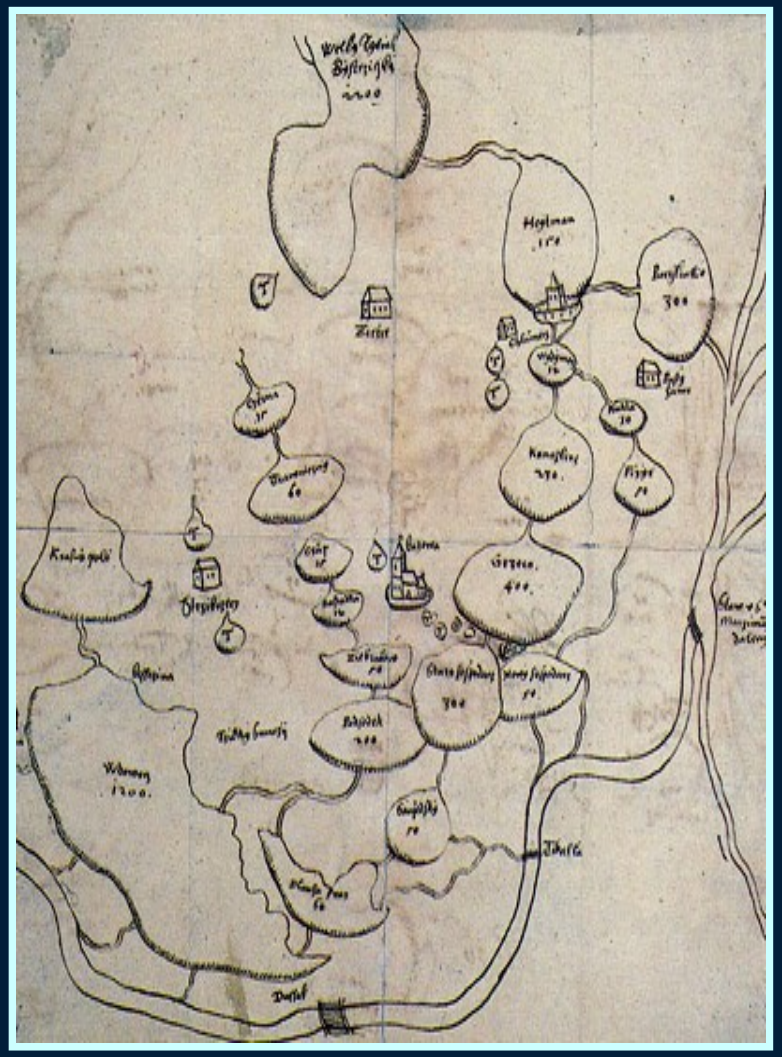
POND FISHING

MAIN FISHPOND AREAS IN THE CZECH REPUBLIC



HISTORY OF FISHPONDS

HISTORY OF FISHPONDS



First fishponds in the Roman period

First reservoirs in 3rd centrury (Celts)

Start of pond construction in Bohemia in 10th century

Main fishpond systems in Bohemia – 16th century

Fishpond destruction:
17th century – 30 years´ war
19th century – sugar beet culture

DEVELOPMENT OF FISHPOND MANAGEMENT

Period	Area *thous. ha*	Production *kg / ha*
12th cent.	unknown	
14th cent.	75	40
16th cent.	180	40
18th cent.	79	30
1850	35	25
1924	44	81
1956	50	137
1965	50	210
1975	51	328
1985	52	393
1995	52	423

FUNCTIONS OF FISHPONDS

HISTORICAL FUNCTIONS OF FISHPONDS

Accumulation – drainage of land and water collection

Storage – streaming of ores

Fish culture – Rome, France, Germany, Bohemia

Fortification – part of castle and town fortifications

Energy – mills, mine pumps

Retention – flood control

CONTEMPORARY FUNCTIONS OF FISHPONDS

Erosion control

Strorage – irrigation, water supply

Energy yield – small hydroelectric plants

Stabilization of water discharge

Recreation

Climate modification

Landscape formation

Biodiversity preservation – Natura 2000

CLASSIFICATION OF FISHPONDS

Basic classification since mid- 16th century
„De piscinis“ by Czech bishop
Jan Dubravius (1486 – 1553)

- **Spawning ponds**
- **Nursery ponds**
- **Fingerling ponds**
- **Rearing (Main) ponds**
- **Hibernation ponds**

Importance of summer and winter drainage

FISHPOND MANAGEMENT

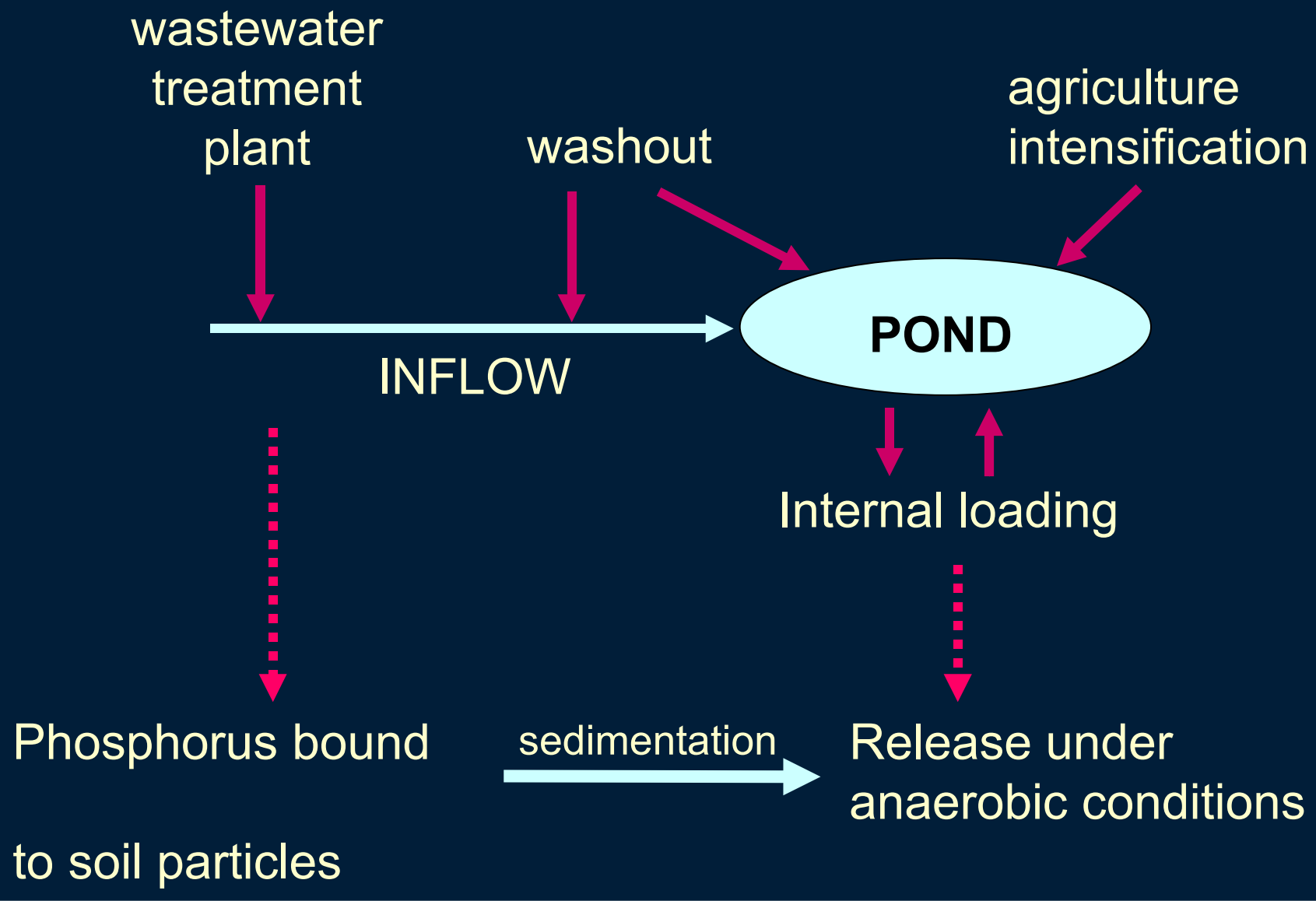
FISHPOND MANAGEMENT

1. Management is a **CRUCIAL** condition for sustainable existence of fishponds

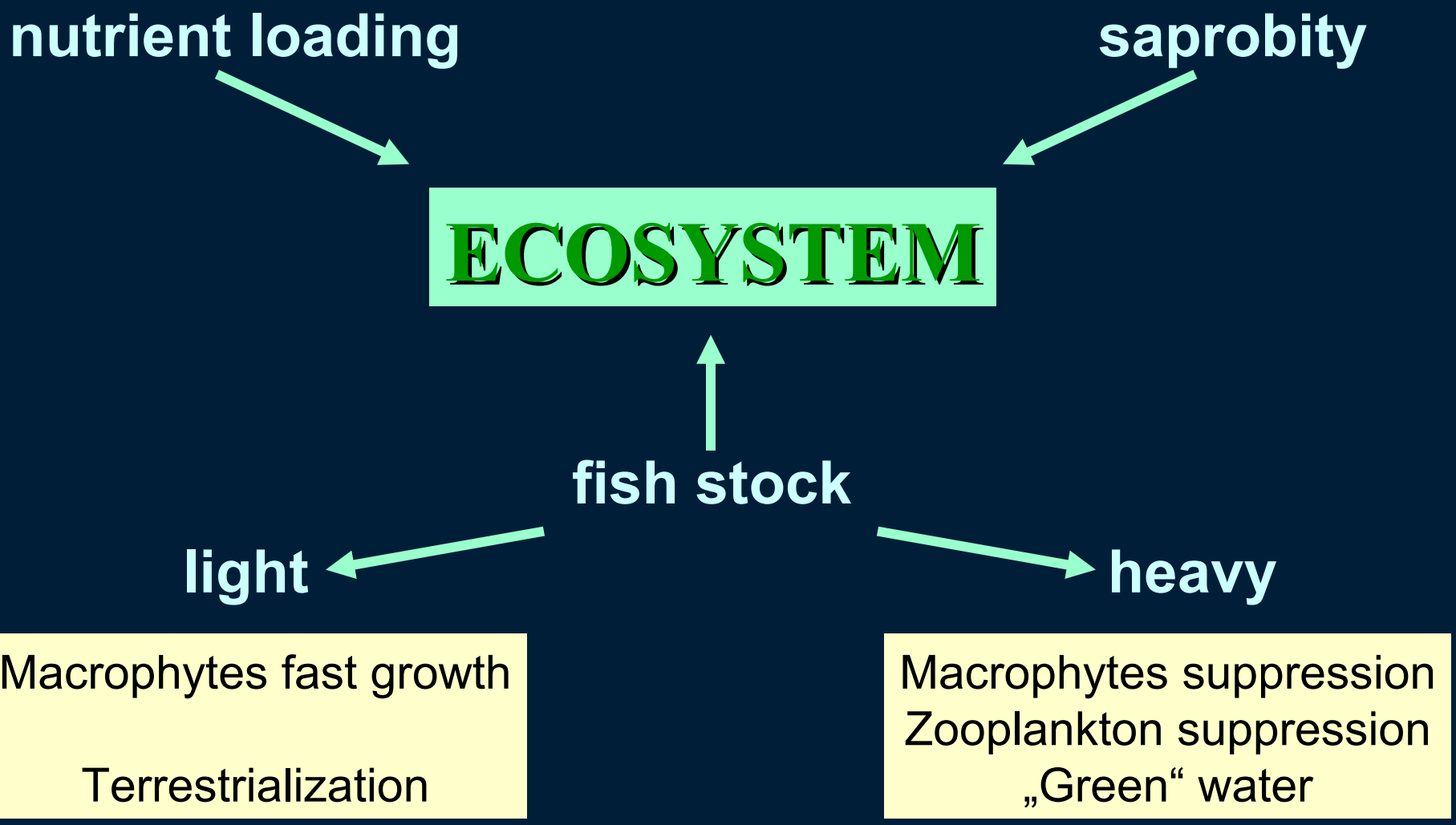
2. Lack of management = terrestrialization and eventual extinction of a fishpond

3. Fishpond management affects the water quality

HYPERTROPHY OF FISHPONDS



FISHPOND ECOSYSTEM



BIODIVERSITY DECLINE IN FISHPONDS

Increased intensity of fish farming brings about a decline of biodiversity

Plants of clean water → Ruderal plants

High fish feeding pressure → Benthos decline

Decline of bird species variety

KEY TO SUCCESS

To define a SUITABLE fish stock
(*not only a light one!*)
facilitating an effective
transfer of energy and matter
from primary producers
to zooplankton
and then to the fish

HYPERTROPHIC FISHPONDS MANAGEMENT

Can we achieve a harmony between production – biodiversity – hygiene ?

No standard solution !

The fish stock dynamics must be defined for biologically valuable fishponds

OLIGOTROPHICATION

Phosphate fertilizer application ended in the 1970s.

Since 1980s, organic manuring has prevailed, being accompanied by the accumulation of a fertile sediment.

Available phosporus is released back to the water.

OLIGOTROPHICATION

Large amounts of nutrients move into the fishponds.

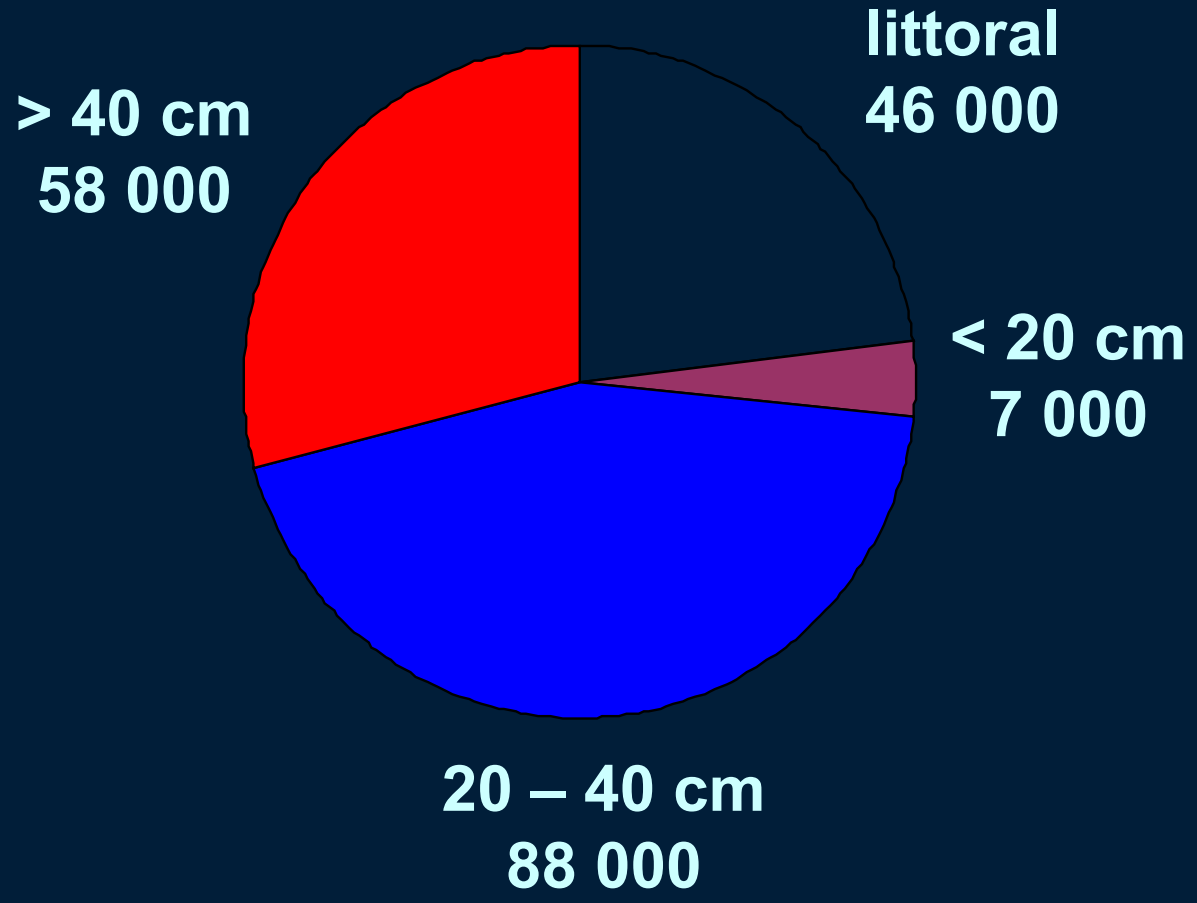
80 % of Czech fishponds have a surplus of nutrients.

How to reduce the external nutrient load ?

- **Restoration of water catchment area**
- **Removal of the internal nutrient load (pond cleaning)**

VOLUME OF FISHPOND SEDIMENTS IN THE CZECH REPUBLIC

thousands of cubic meters



SEDIMENT REMOVAL

Sediment removal is expensive.

Cleaning of 1 ha with 0.5 m of mud represents costs of building 1 ha of a new fishpond.
= about 30.000 €

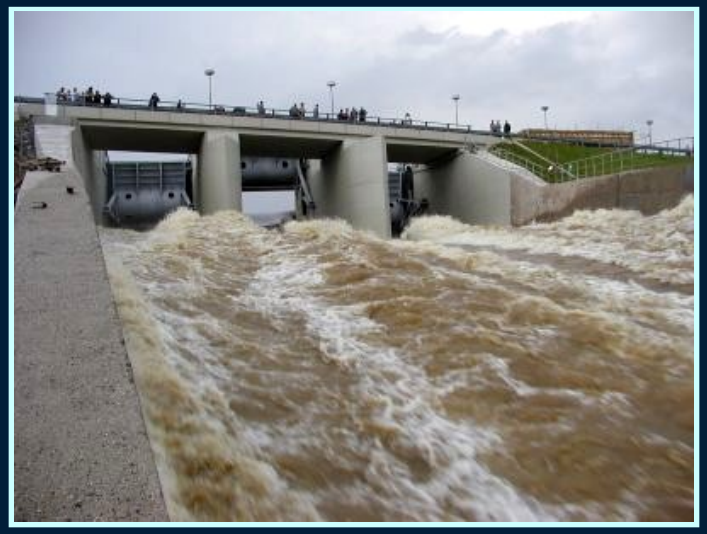
Legislation problems with the categorisation of fishpond sediments

Waste or raw material (secondary resource)?

ROLE OF FISHPONDS IN WATER MANAGEMENT

RETENTION DURING FLOOD 2002

DAMS
(Lipno I, Římov, Orlík)



Storage volume: **678.5** mil. m^3
Retention volume: **75** mil. m^3
Real retention: **220** mil. m^3

FISHPONDS
Třeboň fishpond system

Storage volume: **75** mil. m^3
Retention volume: **50** mil. m^3
Real retention: **114** mil. m^3

ROŽMBERK FISHPOND – FLOOD 2002

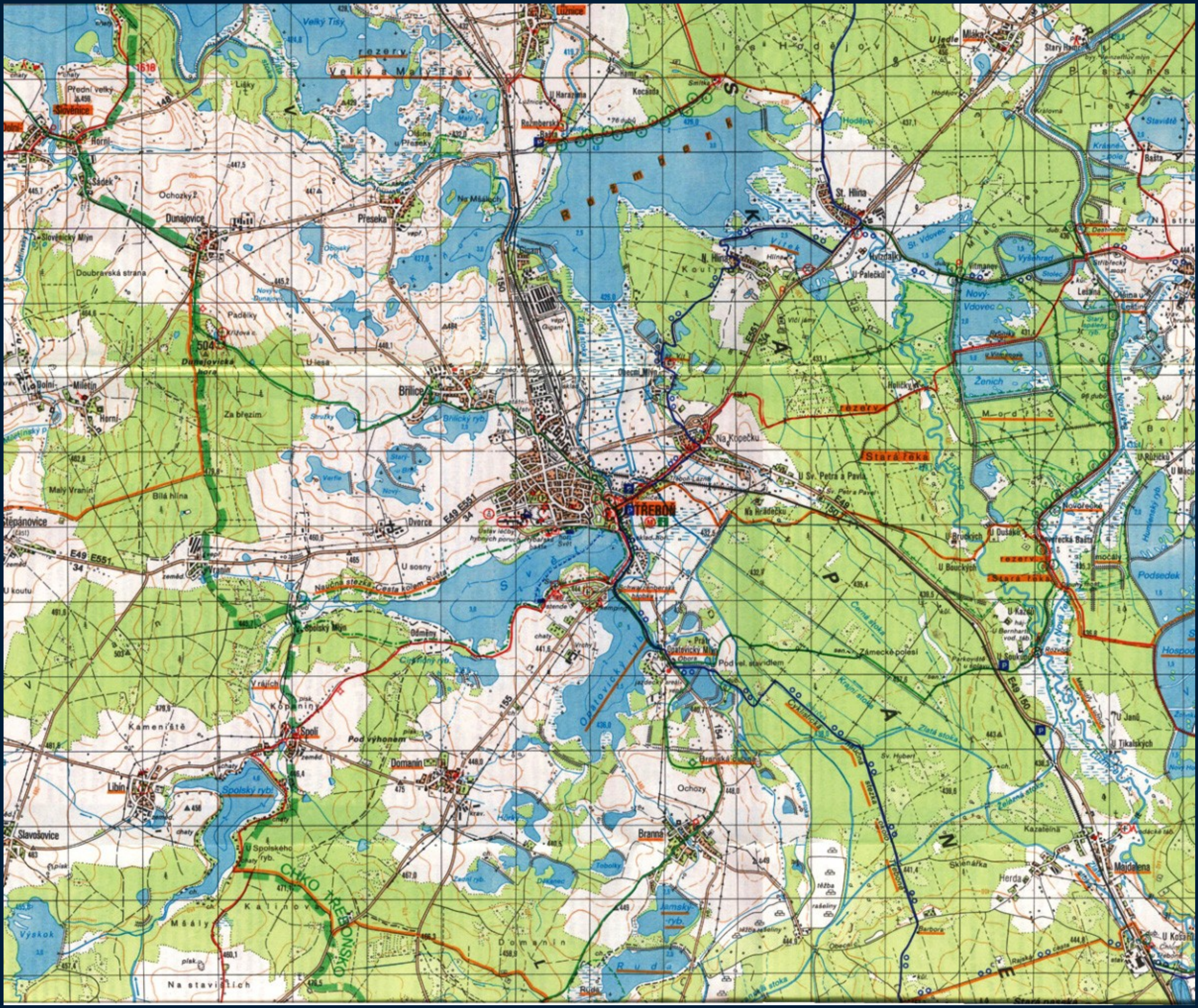
Built:
1590

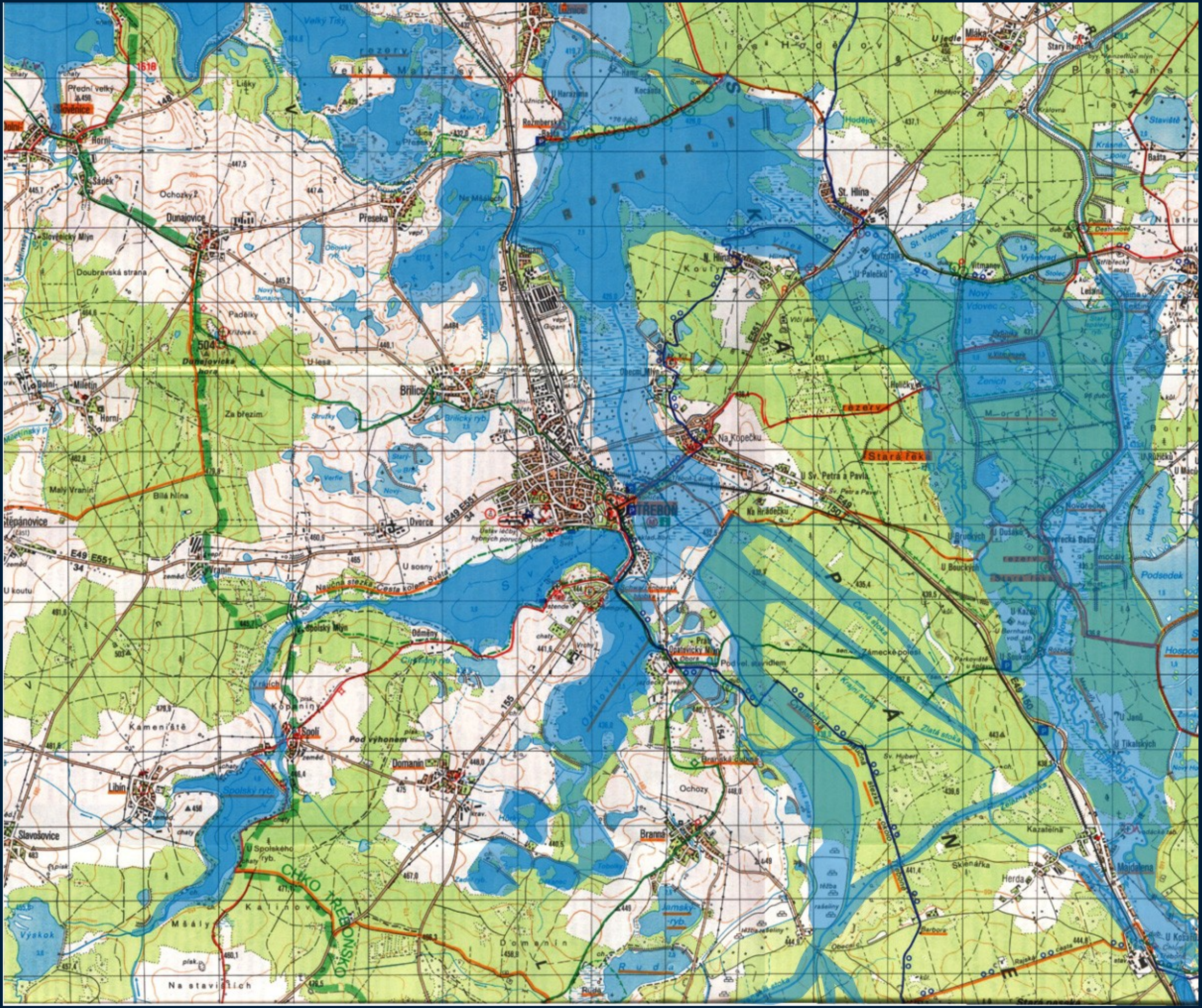
Water area:
490 ha

Normal volume:
5 mil. m^3

Manageable retention volume:
14.2 mil. m^3

Real flood volume:
about **75** mil. m^3


Velký Tisý
rezerv.
Velký a Malý Tisý
Lužnice
Slověnice
Přední velký
Lišky
Ochozky
Dunajovice
Přeseka
Slověnický Mlýn
Doubravská strana
Padělky
Dunajovická hora
U lesa
Břilice
Břilický ryb.
Za březem
Miletín
Horní
Dolní
Malý Vraniř
Bílá hlína
Štěpánovice
E49 E551
Vraniř
U koutu
Dvorce
U sosny
Naučná stezka Cesta kolem Světa
Spolský Mlýn
Odměny
Kopaniny
Spolí
Pod výhonem
Kameniště
Domanín
Libín
Spolský ryb.
Slavošovice
U Spolského ryb.
CHKO TŘEBOŇSKO
Kalinov
Mšály
Výskok
Na stavidlích
Domanín
Rudé
Jamský ryb.
Tobolky
Branná
Ochozy
Branská
Opatovický ryb.
Pod vel. stavidlem
Obora
Schwarzenberská hrobka
Svět
TŘEBOŇ
Na Kopečku
Obecní Mlýn
Gigant
Rožmberk
U Harazima
Kocanda
Smitka
Hodějov
St. Hlína
N. Hlína
Koule
Vlček
Hliník
U Palečků
Nový Vdovec
St. Vdovec
Vyšehrad
Stolec
Ženich
Mordo
Stará řeka
rezerv.
U Sv. Petra a Pavla
Na Hrádečku
Zámecké polesí
Černá stoka
Zlatá stoka
Krajní stoka
Sv. Hubert
Kazatelna
Sklenářka
Herda
Majdalena
U Kosařů
Podsedek
Hospodář
Stavište
Krásné pole
Bašta
Nástrubce
Lužnice
Novořecká Bašta
U Bruckých
U Dušáků
U Boučkových
U Kazdů
U Soukupů
U Janů
U Tikalských
U Jedlé
Mlýnky
Starý Hospodář
Lesy Hodějov
Domanín
Lesy Kalinov
Zadní ryb.
Svět
Horky
Nová řeka
E49 150
150
155
154



Rožmberk
Dunajovice
Přeseka
St. Hliník
N. Hliník
Břilice
Dunajovická hora
Na Kopečku
Staré řeka
TŘEBOŇ
Dvorce
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Štěpánovice
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Spolský Mlýn
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Vyšehrad
Hodějov
U Jedle
Baštа
Tobolka

LIMITS OF FISHPOND RETENTION

ABSENCE OF DEVICES FOR SAFE DISCHARGE OF FLOOD WATER

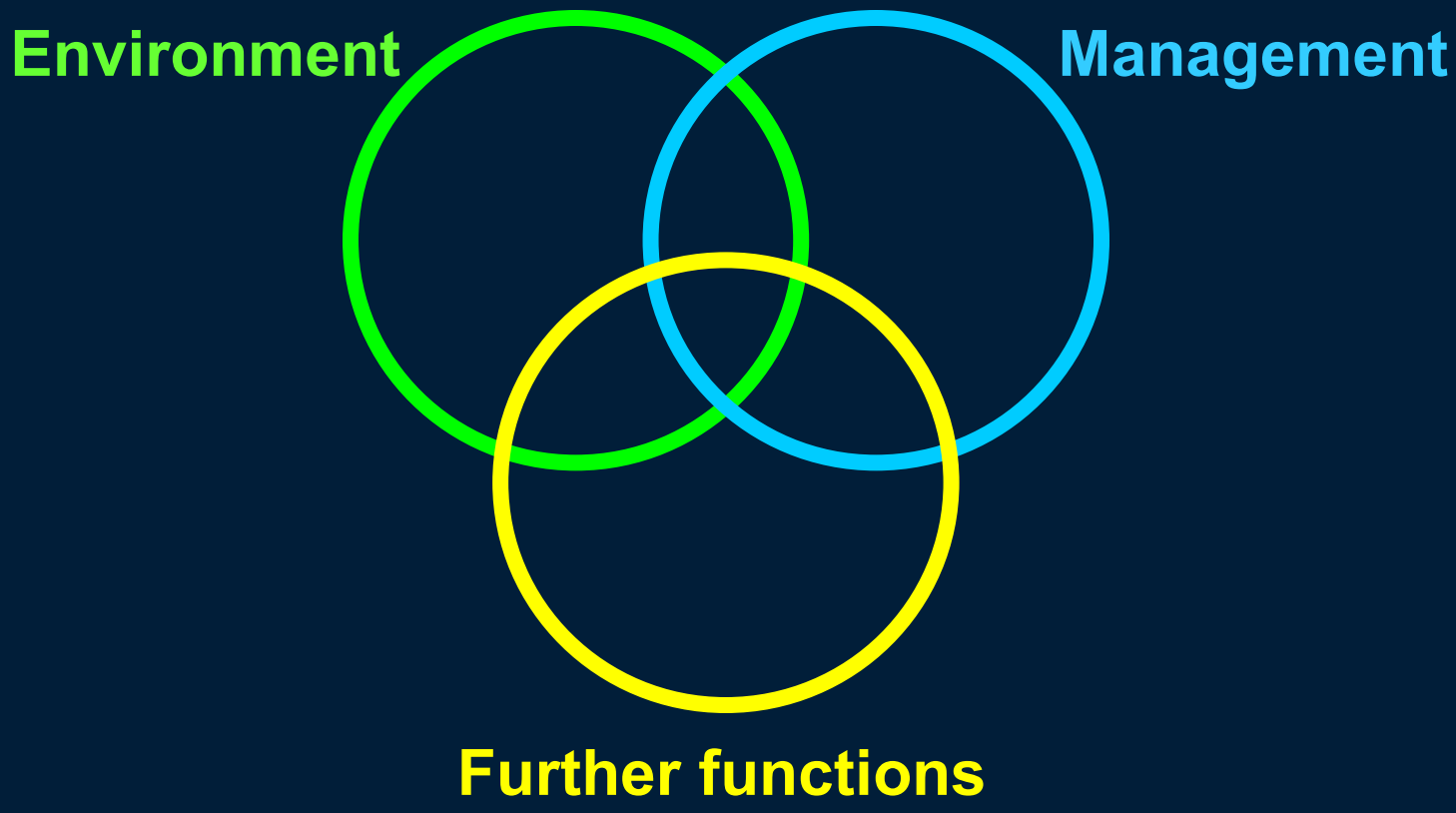
Obsolete technical devices, often wooden outlets, often no emergency spillways

UNCONTROLLED FLOOD TRANSFORMATION

Fishpond lacks a manageable retention space and the unmanageable one is filled up before the flood wave culminates

SUSTAINABLE FISHPOND MANAGEMENT

HOW TO START RESTORATION OF FISHPONDS ?



EXAMPLES OF RESTORATION

Řežabinec NNR

90 ha

Heavy fish stock (130 t/ha)

Intensive manuring

High water level

No renewal of reed stands

Decline of submerged plants

Severe decline of waterfowl

EXAMPLES OF RESTORATION

Řežabinec NNR

Foto: J. Hlásek

Stopped manuring

Adjustment of water discharge

Gradual reduction of fish stock

Lowered water level

Regeneration of reeds

Return of waterfowl

Řežabinec NNR

CONSEQUENCES FOR MANAGEMENT AND ECONOMY

Reduction of fish stock from 130 t/ha to 50 t/ha

No additional fish feeding (from 180 t grains to 0 t)

Possibility of rearing other fish species (more demanding, but more profitable)

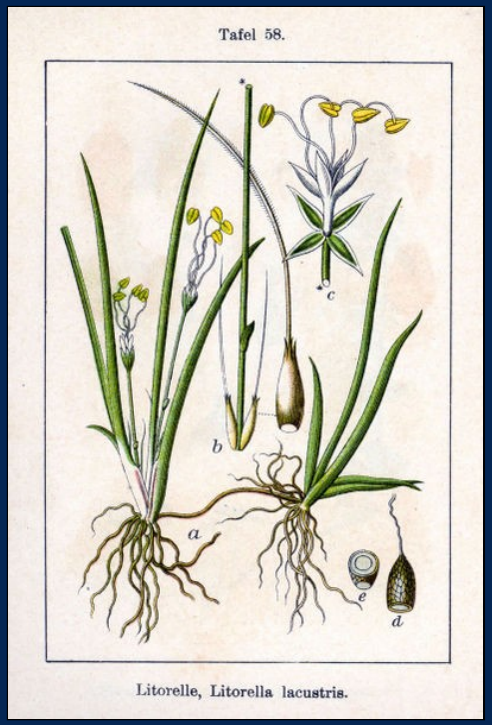
Low rent (state is the owner)

All repairs financed by the state

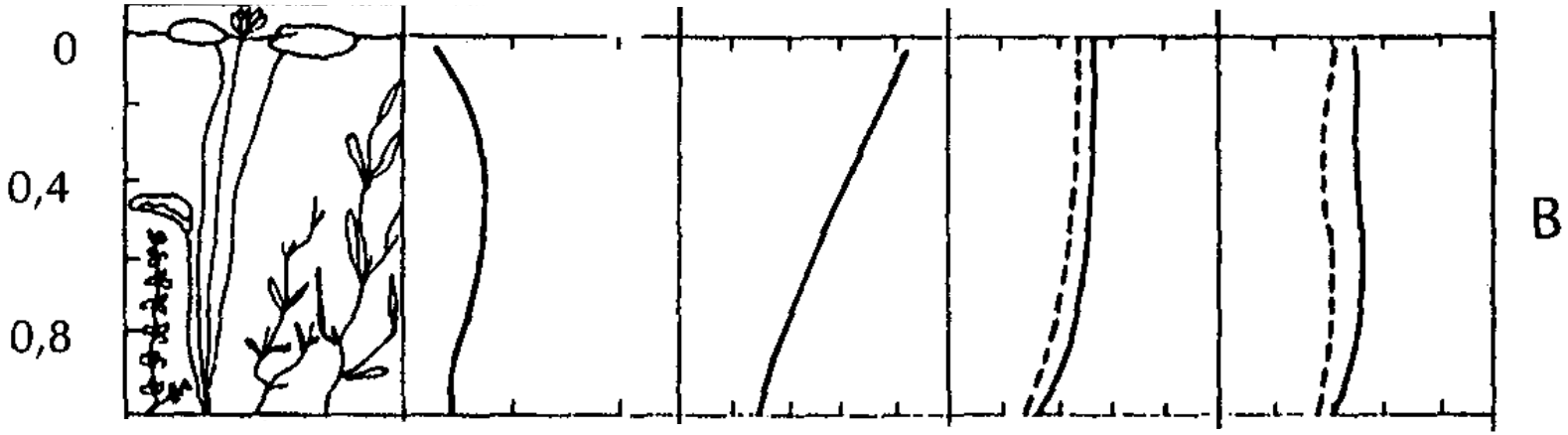
Subsidies for developing non-production functions

Isoetes lacustris **šídlatka jezerní**

Litorella uniflora
pobřežnice jednokvětá



Mesotrophic stage



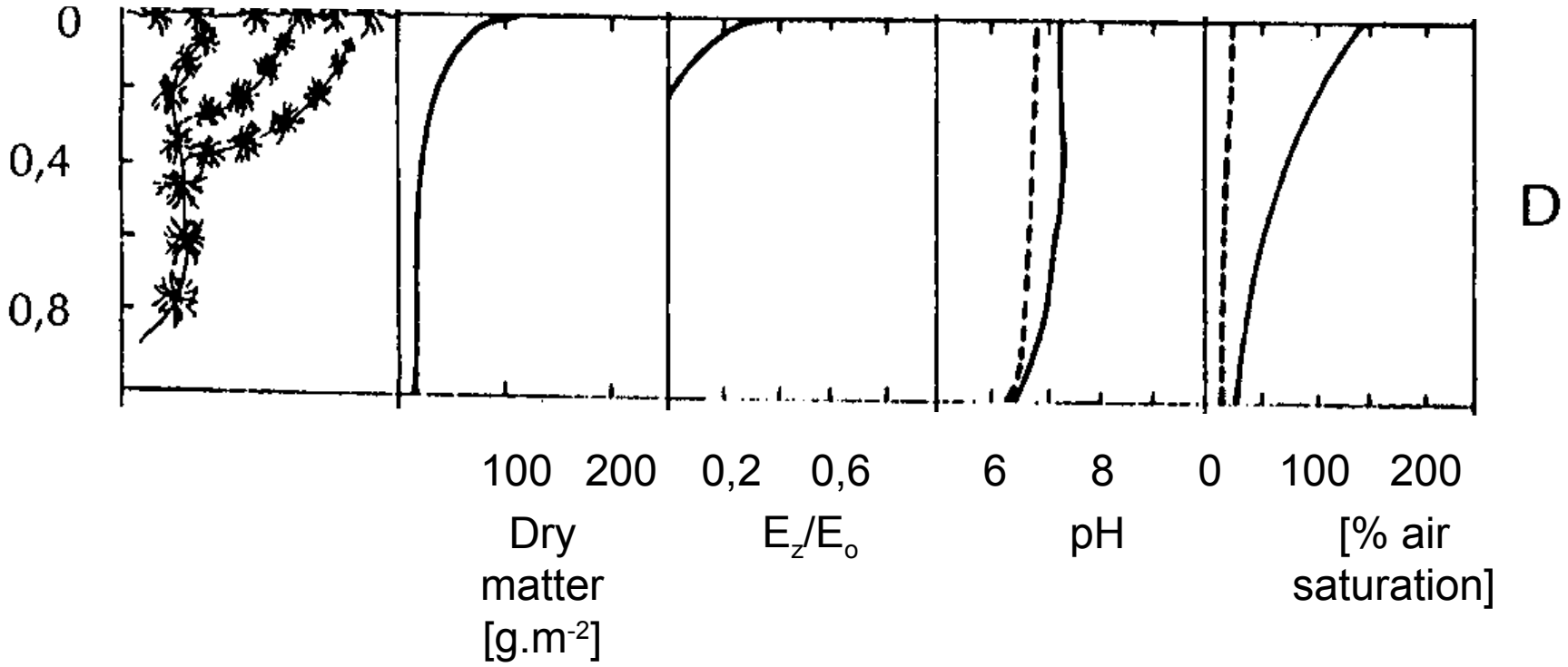
Potamogeton perfoliatus rdest prorostlý

P. obtusifolius R. tupolistý

P. crispus R. kadeřavý

P. alpinus R. alpský

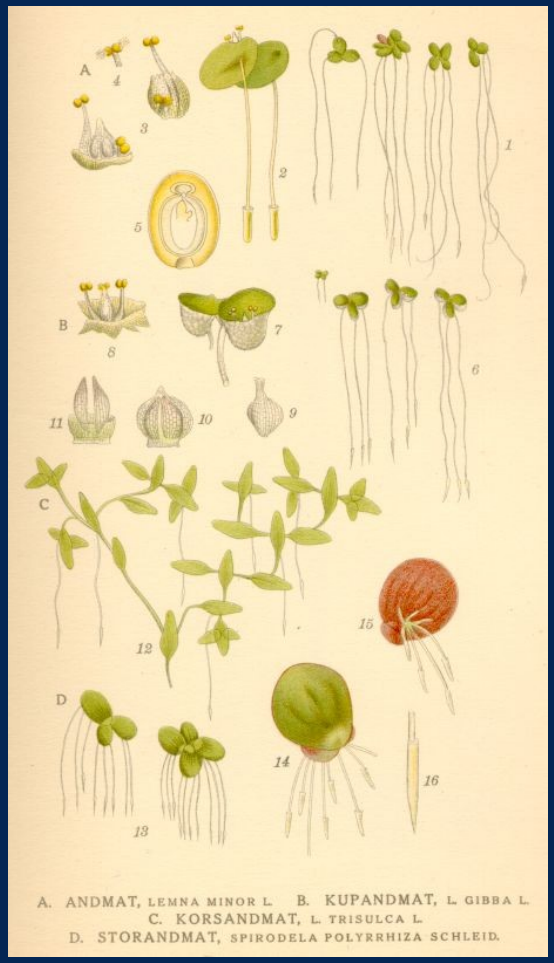
Eutrophic stage



Eutrophic stage: periphyton

Hypertrophic stage: duckweeds

***Lemna gibba* okřehek hrbatý**

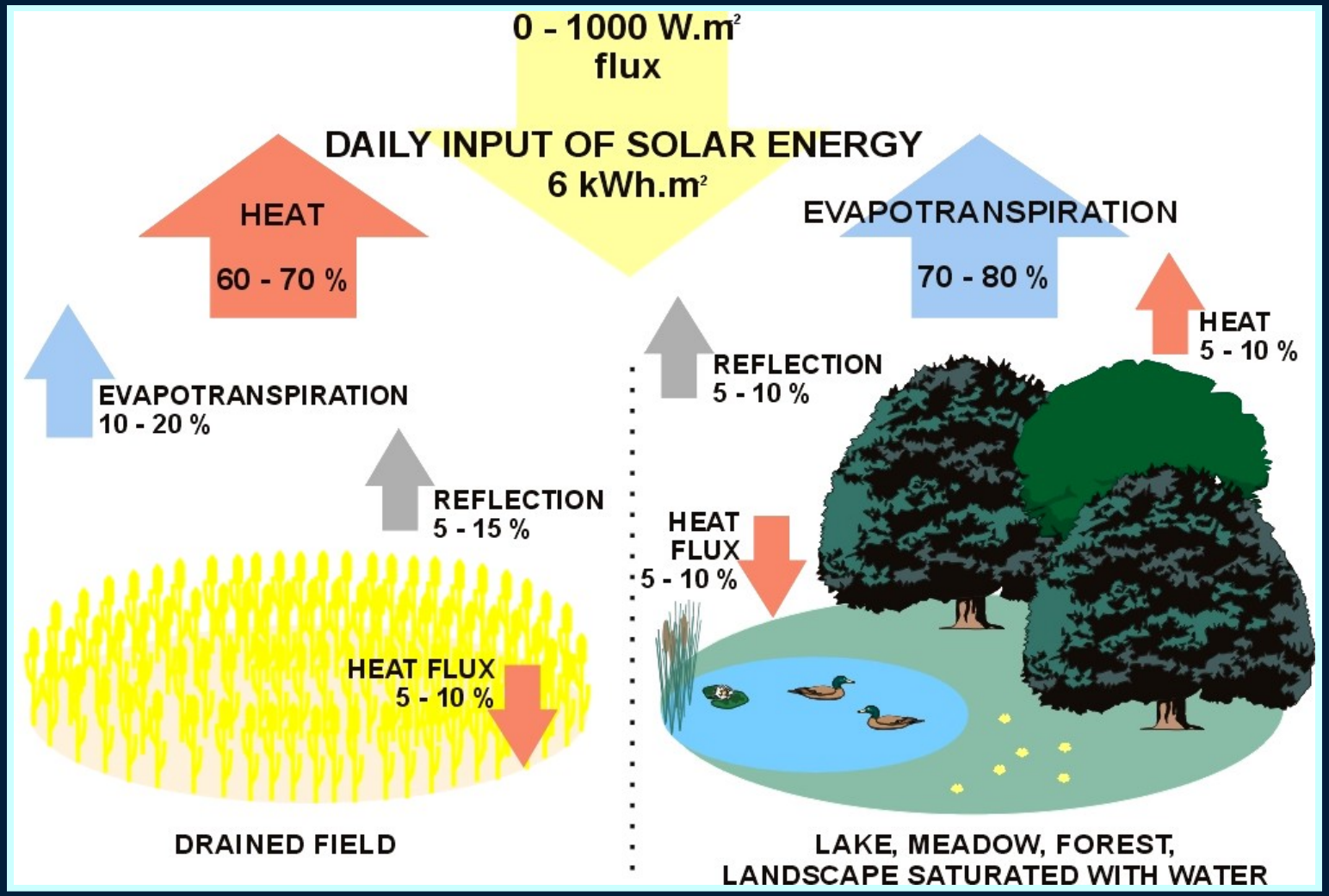


Hypertrophic stage: filamentous algae (MSc work of Martina Eiseltová)

Hypertrophic stage: blue greens

FISHPONDS AND SUSTAINABLE LANDSCAPE MANAGEMENT

FISHPONDS AND SUSTAINABLE LANDSCAPE MANAGEMENT



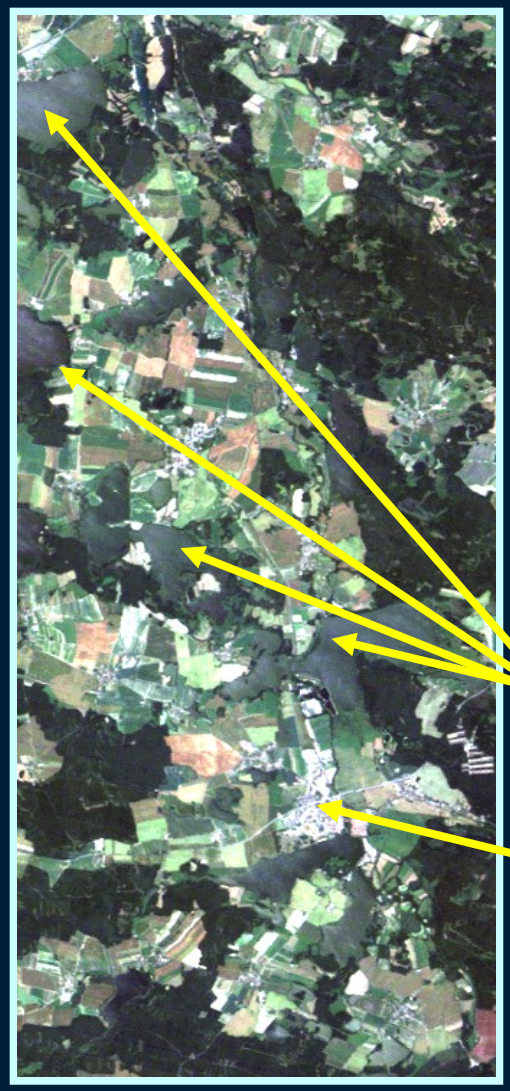
FISHPONDS AND SUSTAINABLE LANDSCAPE MANAGEMENT

FISHPONDS AND SUSTAINABLE LANDSCAPE MANAGEMENT

FISHPONDS AND HEAT DISSIPATION

MOST BASIN (N. Bohemia)

TŘEBOŇ BASIN (S. Bohemia)



FISHPONDS AND HEAT DISSIPATION

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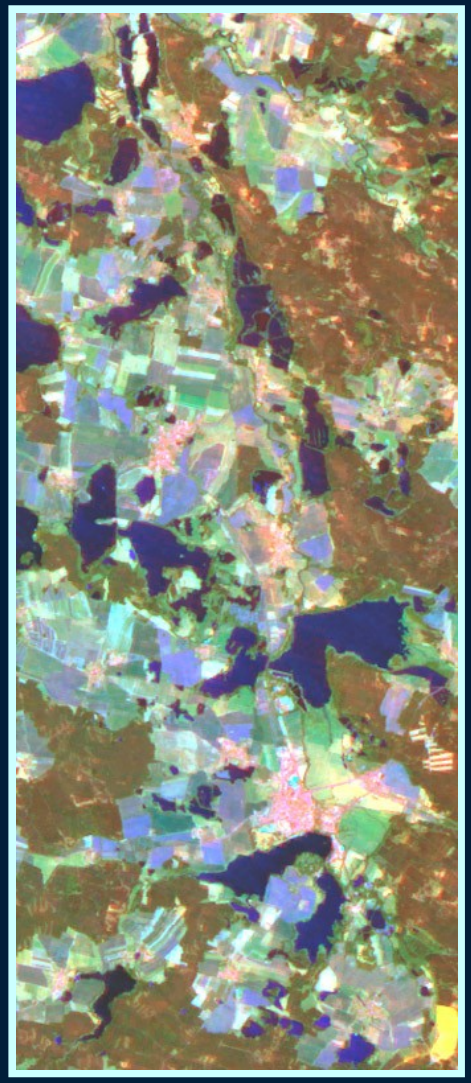
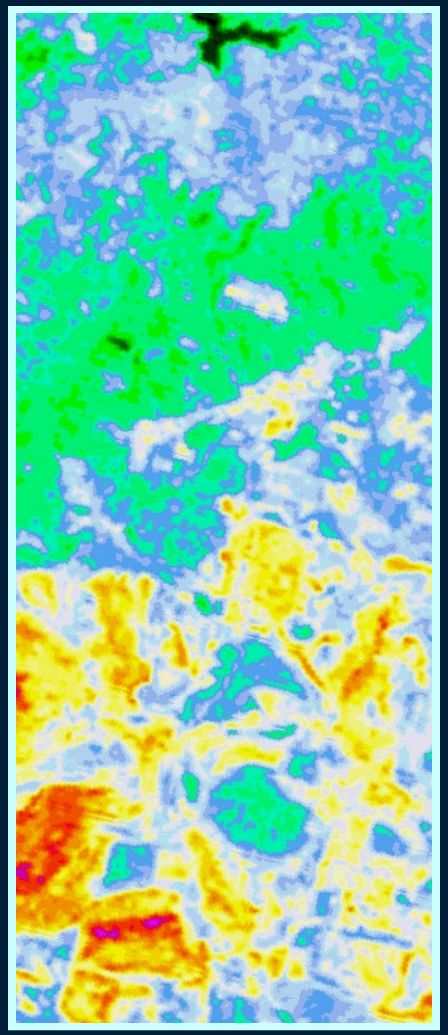
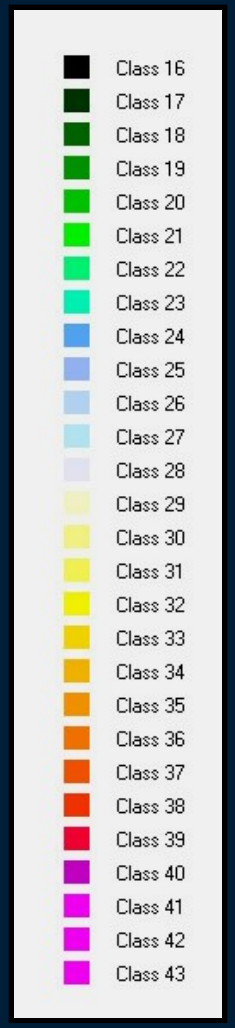
TŘEBOŇ BASIN (S. Bohemia)



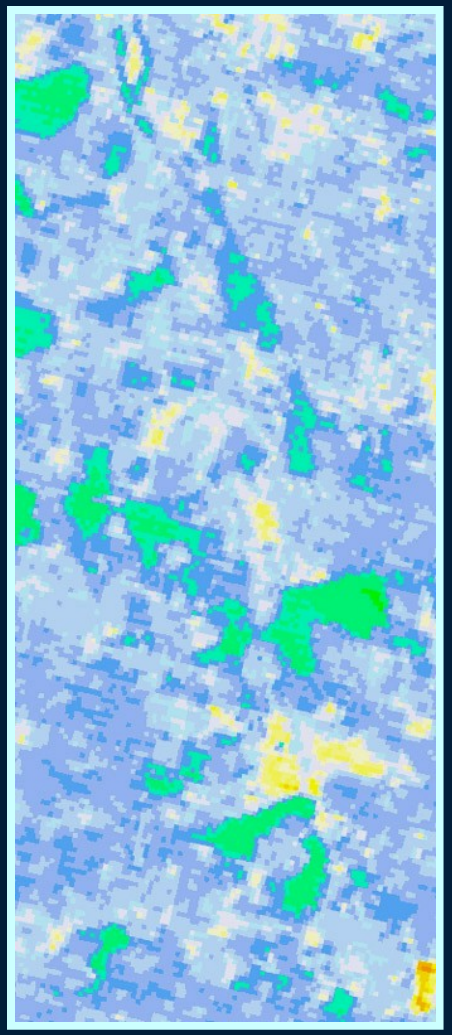
FISHPONDS AND HEAT DISSIPATION

MOST BASIN (N. Bohemia)





TŘEBOŇ BASIN (S. Bohemia)



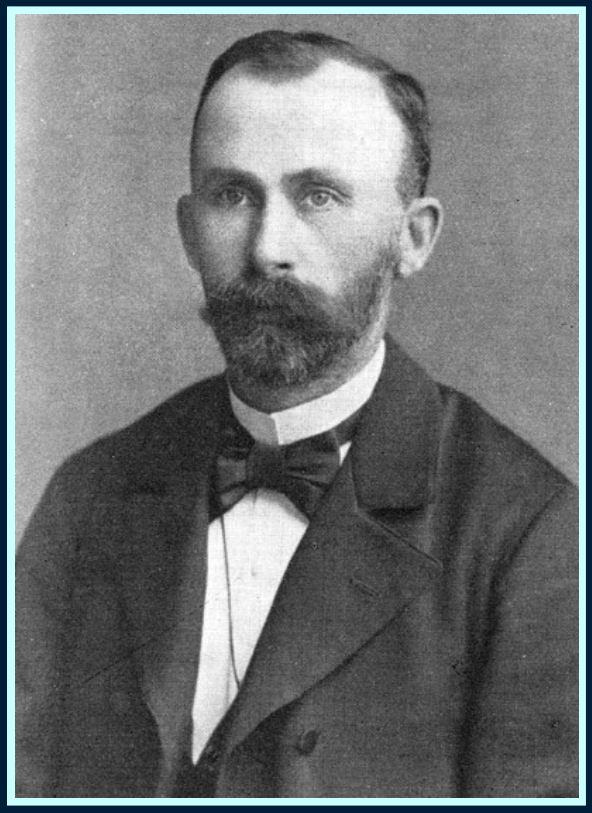
FISHPONDS AND SUSTAINABLE LANDSCAPE MANAGEMENT

To the memory of

JOSEF ŠUSTA

(1835 – 1914)

Founder
of modern European
fishpond management



„If you want to achieve great results
under unfavourable conditions,
you must assist nature in doing it…“