THE ROLE OF FISHPONDS IN THE LANDSCAPE

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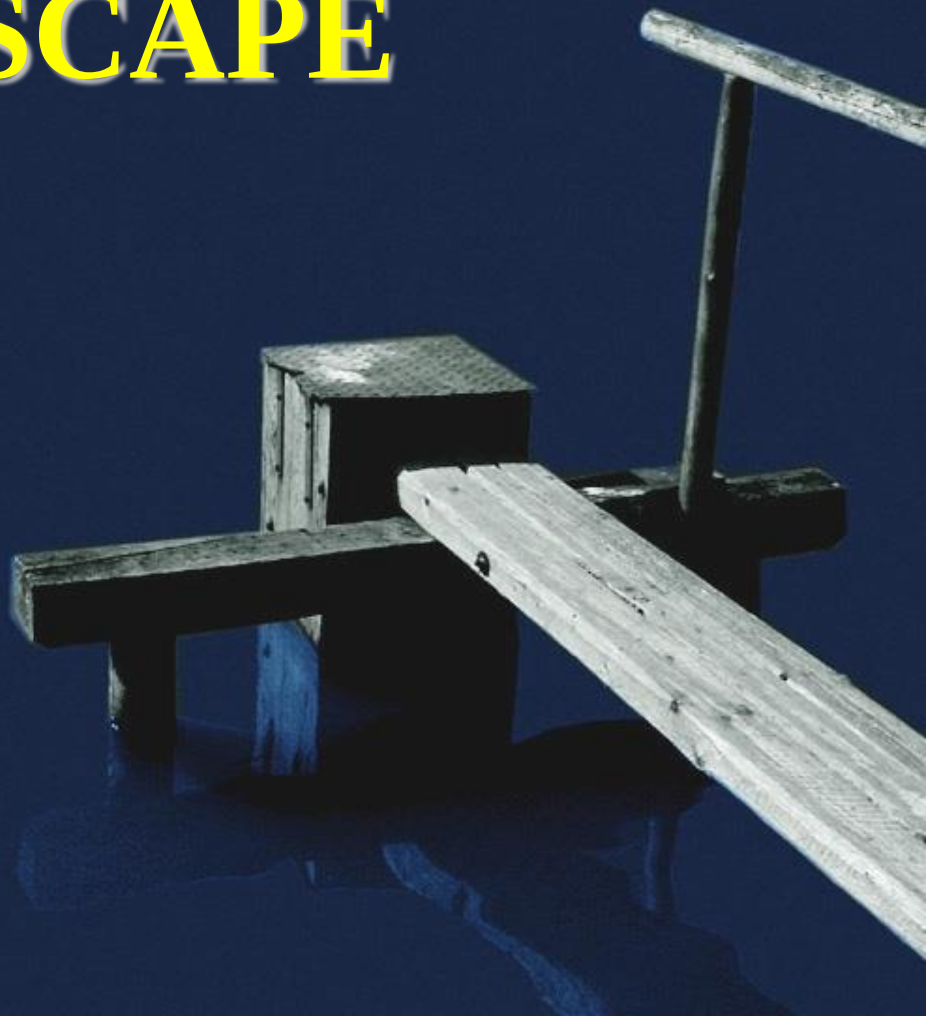


Fishponds are managed ecosystems

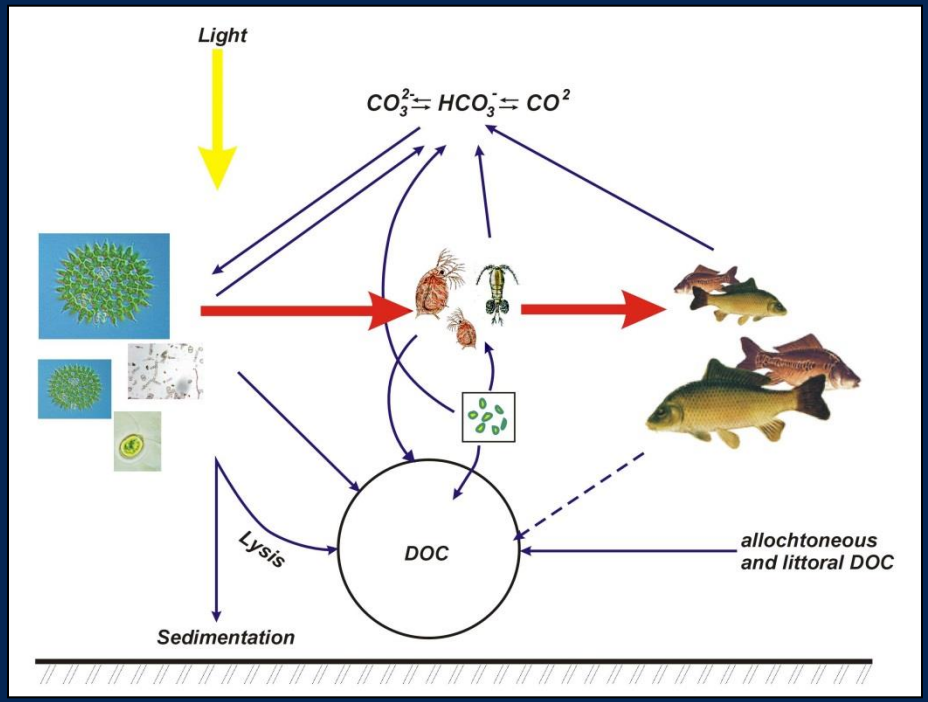
- *Water level*
- *Fish stock*
- *Basic water chemistry*
- *Nutrient input*

are under control of fishery managers

but not driven like aquacultural systems

Natural production procesess in fishpond ecosystem are basic for fish rearing

To maintain natural ecosystem functioning in hypertrophic fishponds –
actual challenge to fishery management and research



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

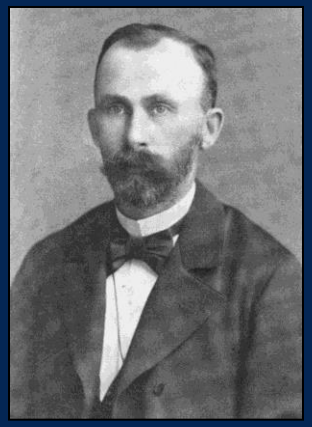
FISH SPECIES REARED IN FISHPONDS

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

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

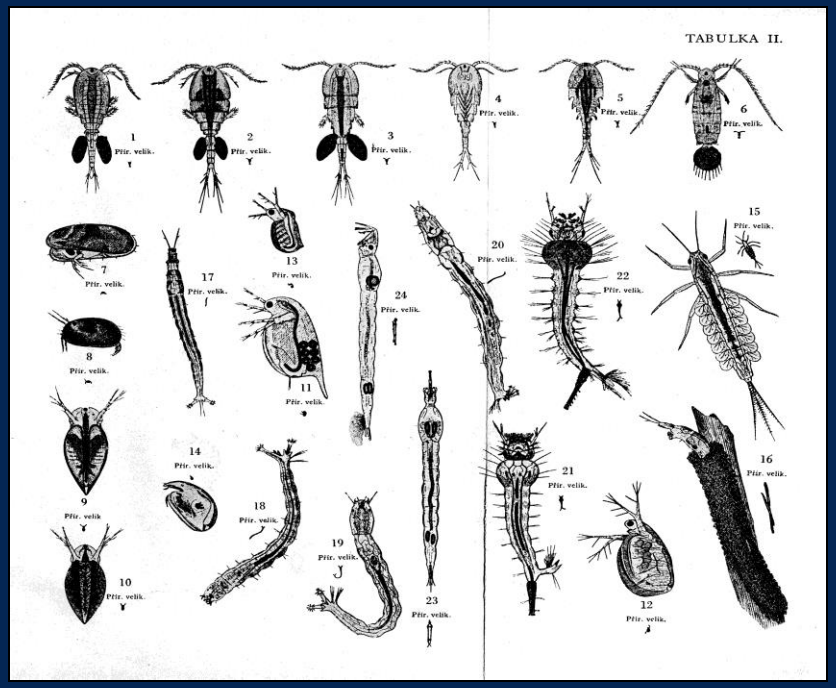
Tench (*Tinca tinca*)
1 %

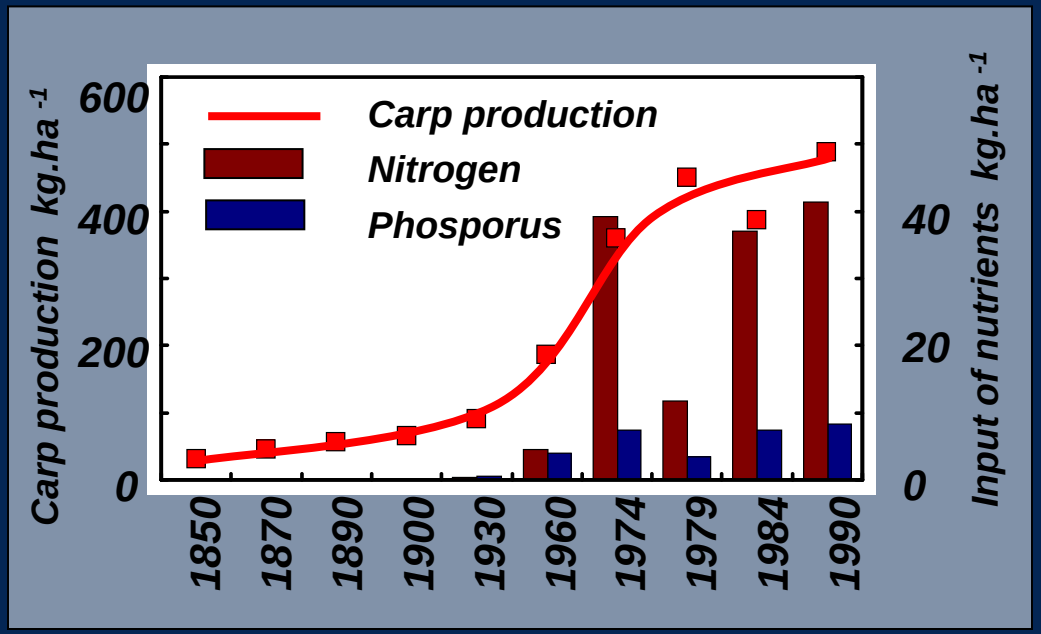
Pike (*Esox lucius*)
Pikeperch (*Stizostedion lucioperca*)

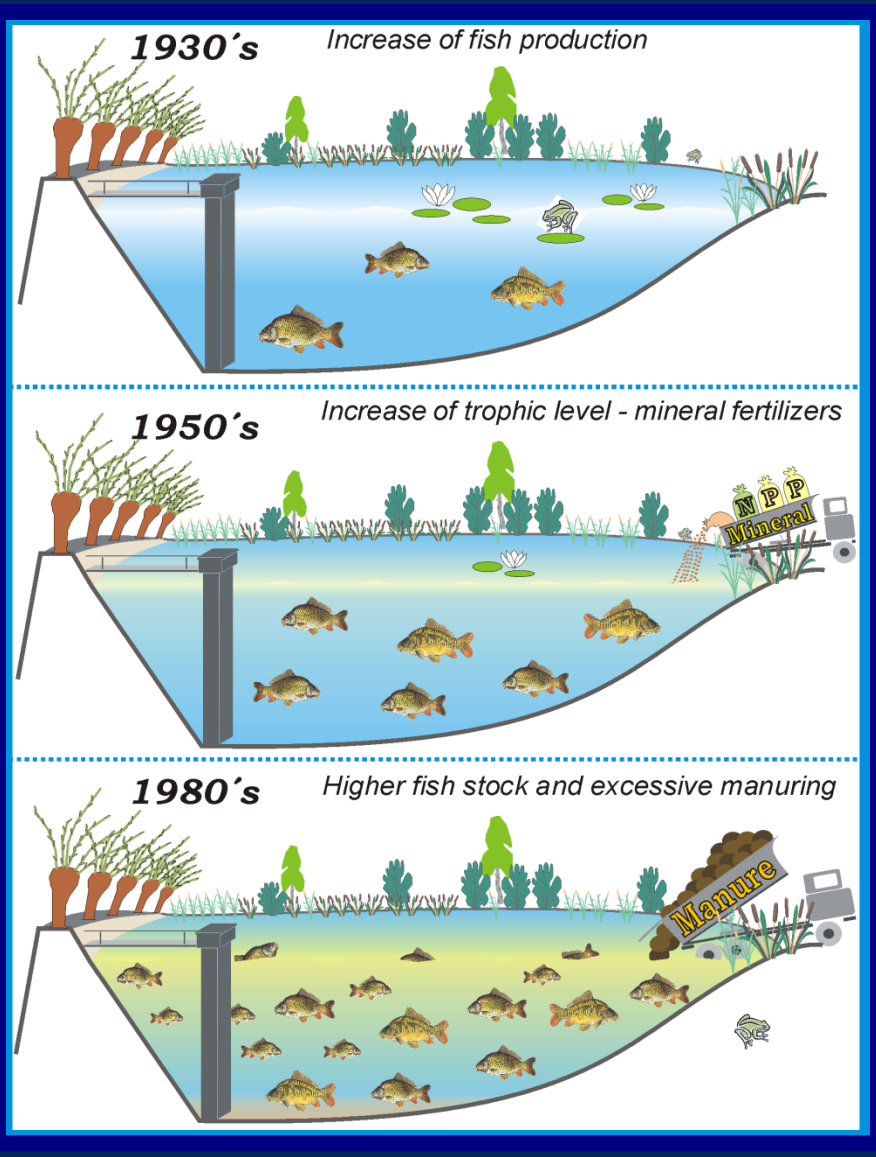


Josef Šusta (1835 – 1914)

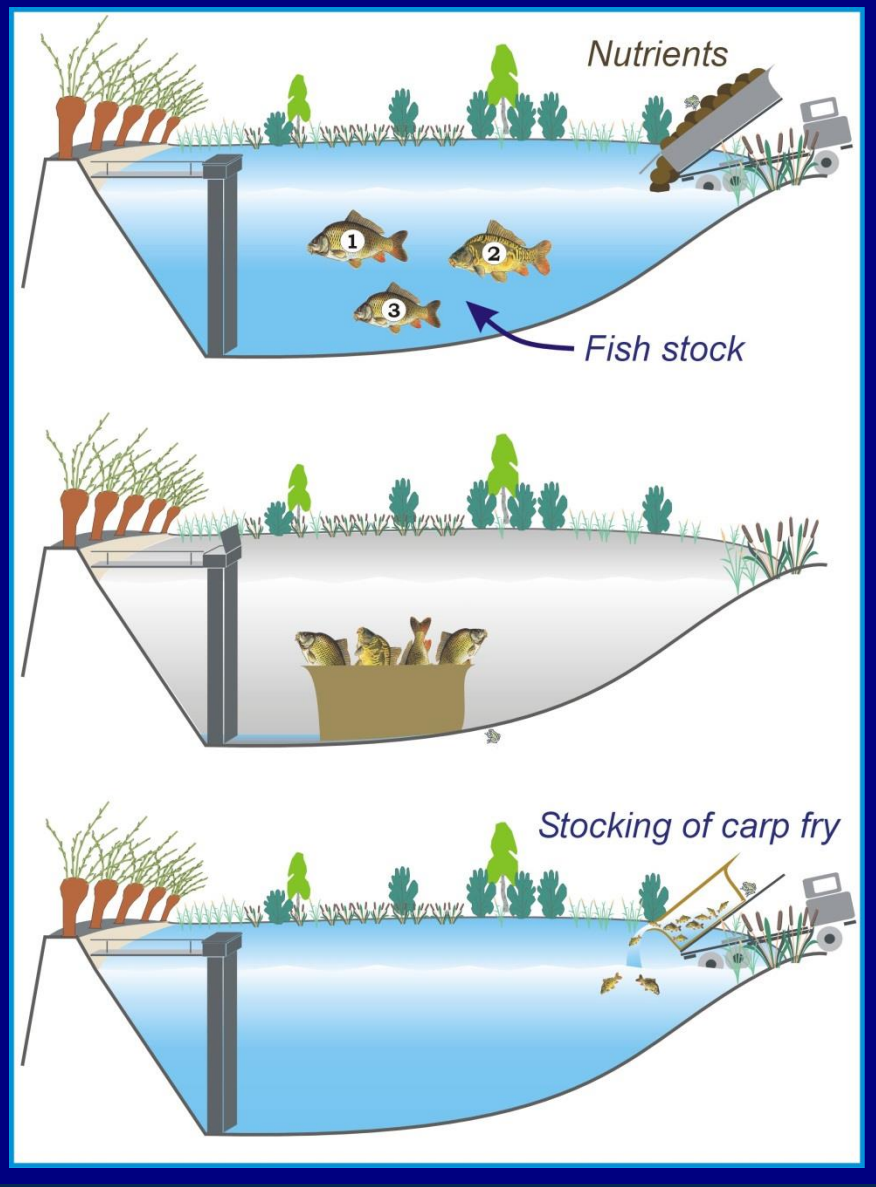
Šusta introduced modern scientific methods based on understanding of the role of the natural food chains in fish production. He proposed liming and fertilization to enhance pond productivity.







Changes in the fishery management in the 20th century

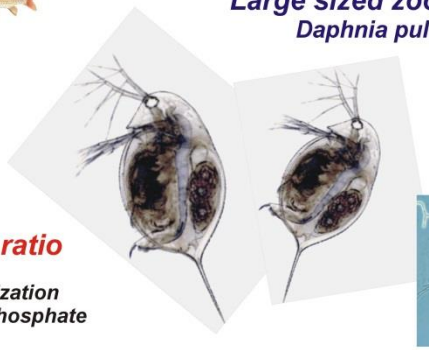


Fishery management principles

High transparency
excess of inorganic nutrients

Small biomass of fish

Large sized zooplankton
Daphnia pulicaria

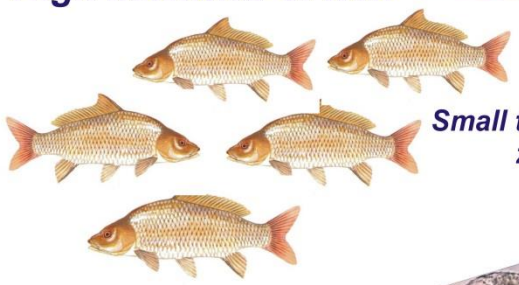


Low N:P ratio

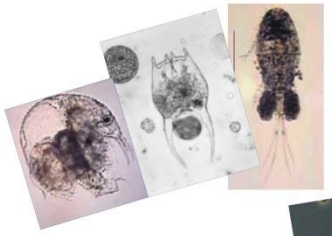
Due to fertilization with superphosphate

Bloom of Aphanizomenon flos- aquae var. flos-aquae

High biomass of fish



Small to very small sized zooplankton



Less than 29:1 N:P ratio

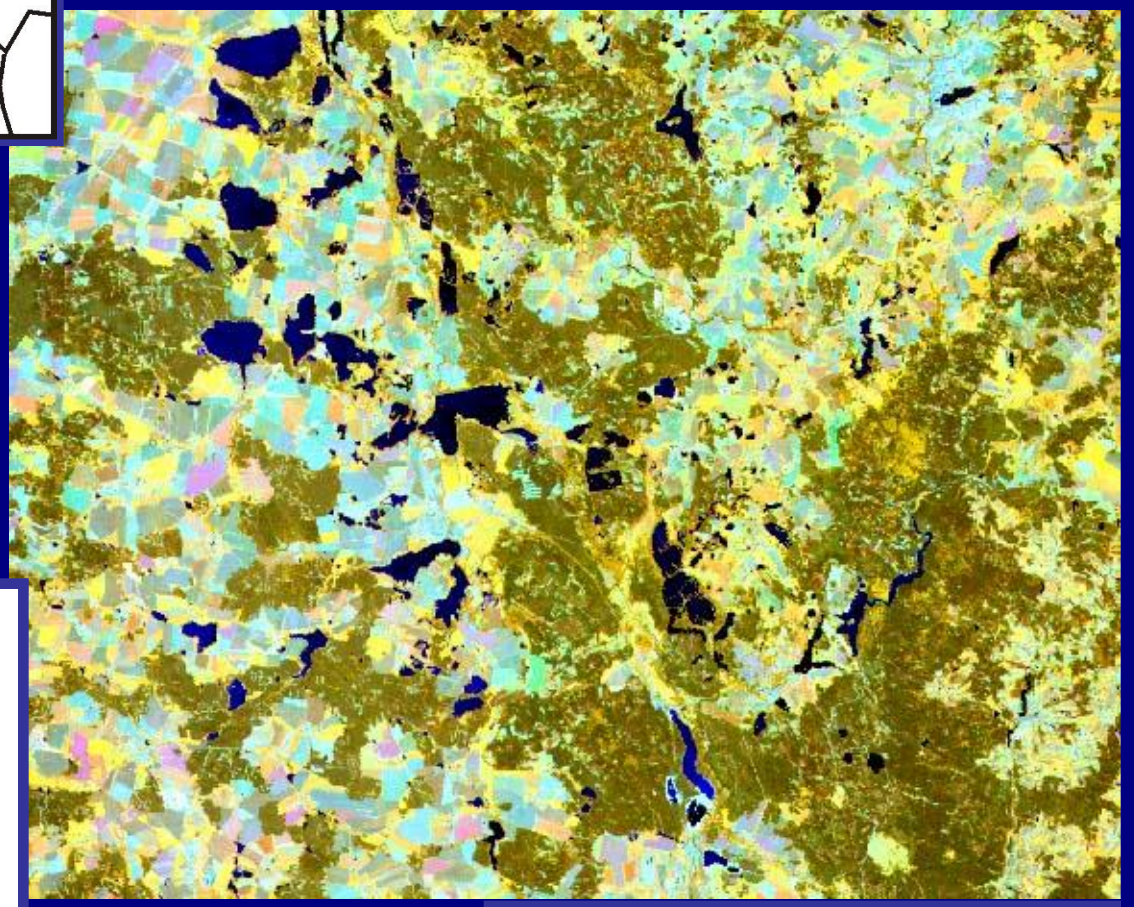
High to very high amounts of manure
High pH and low carbondioxid
dense phytoplankton blooms

Dominance of Planktothrix agardhii and Anabaena spp.

Excessive bloom, very low transparency,
overloading of organic matter

Geographic location of the Trebon Basin

Trebon Basin and UNESCO Biosphere Reserve
more than 2 000 fishponds
Total area about 7 500 hectares

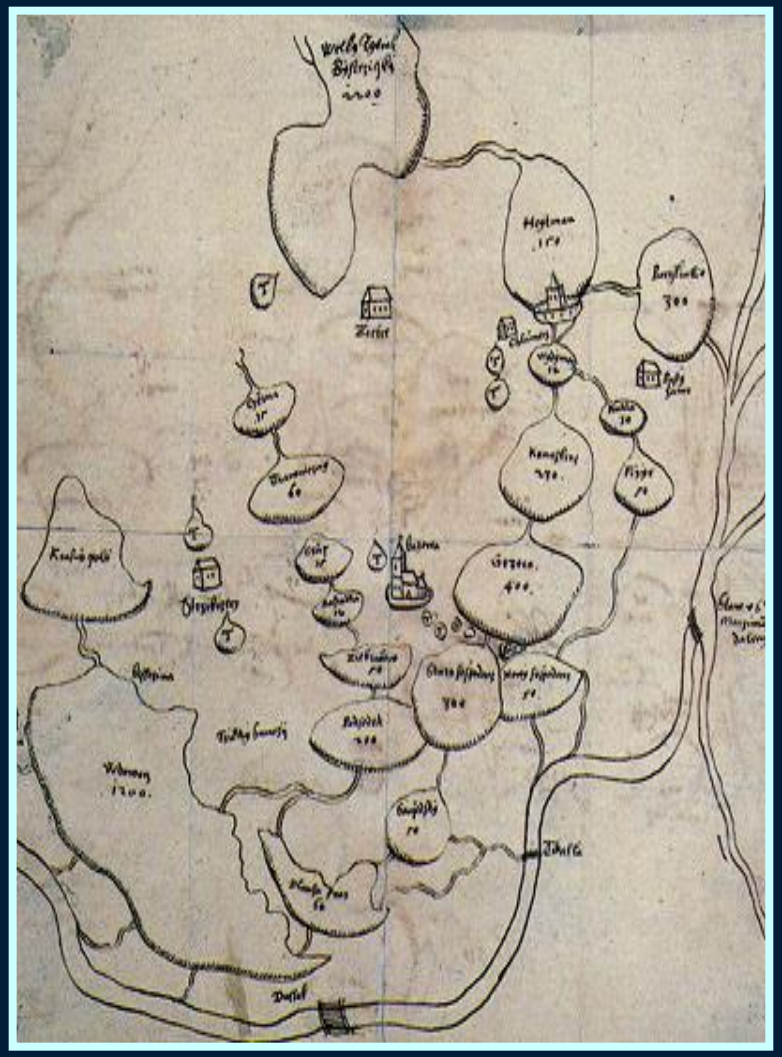


Landsat (TM), RGB synthesis 4,3,5 channels

In the Czech Republic
total water area of the fishponds reaches 51 000 ha

Trebon basin represents the most important fishpond region

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

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

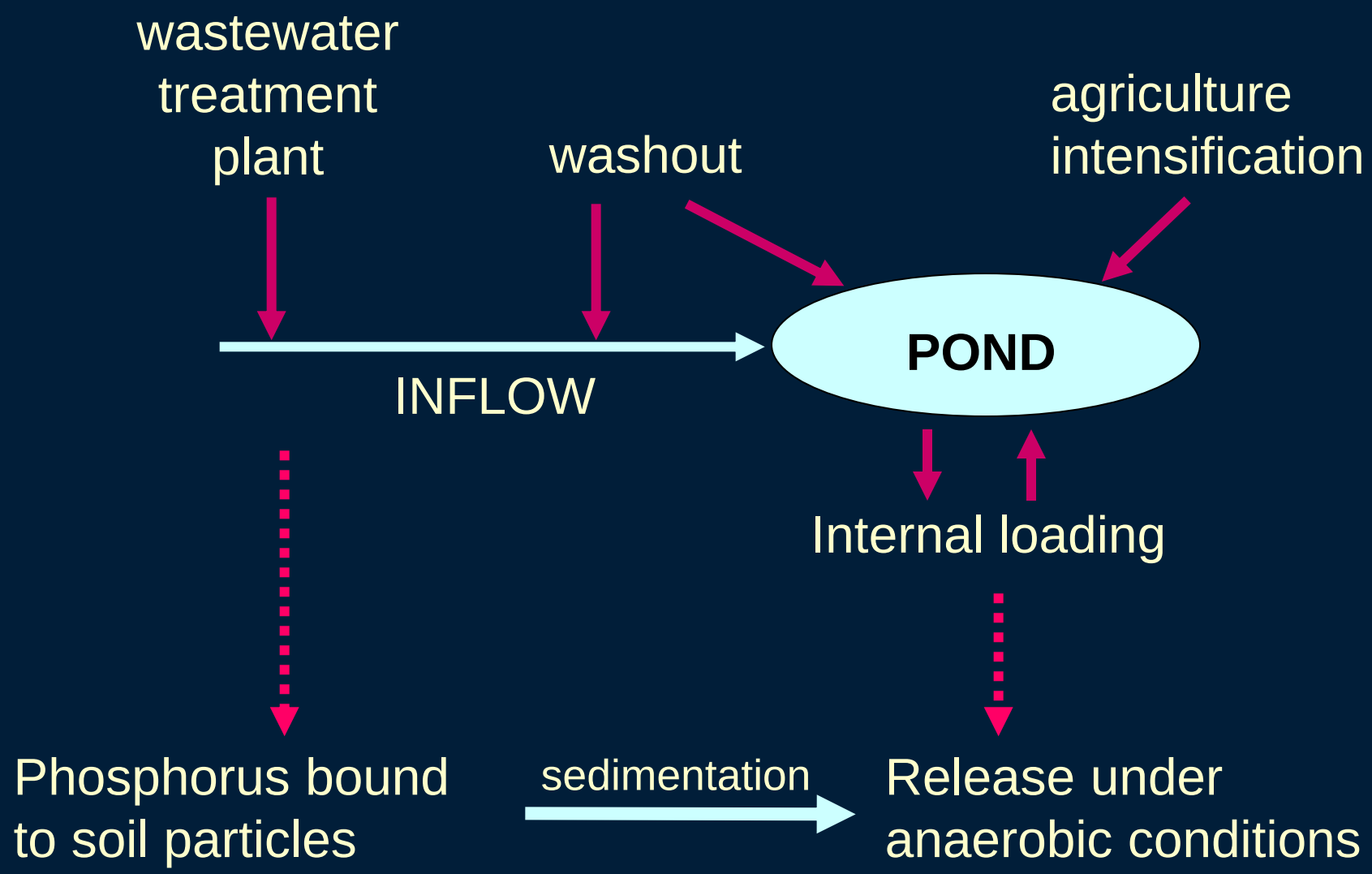
FISHPOND MANAGEMENT

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

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

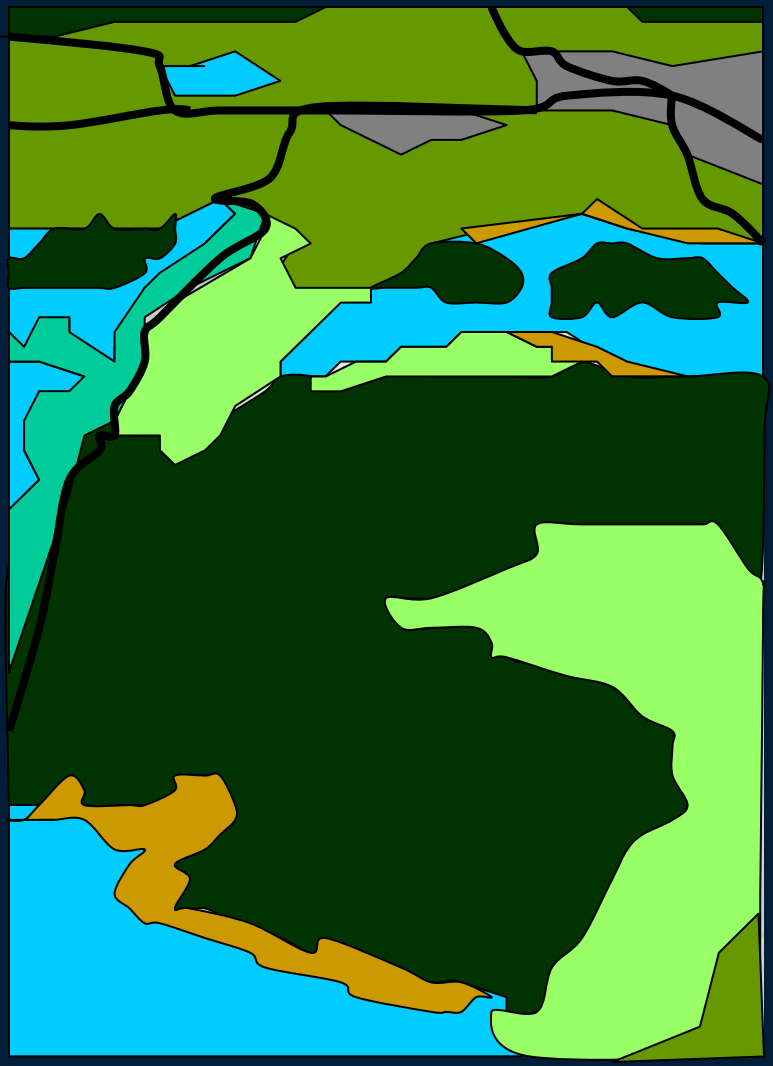
3. Fishpond management affects the water quality

HYPERTROPHY OF FISHPONDS

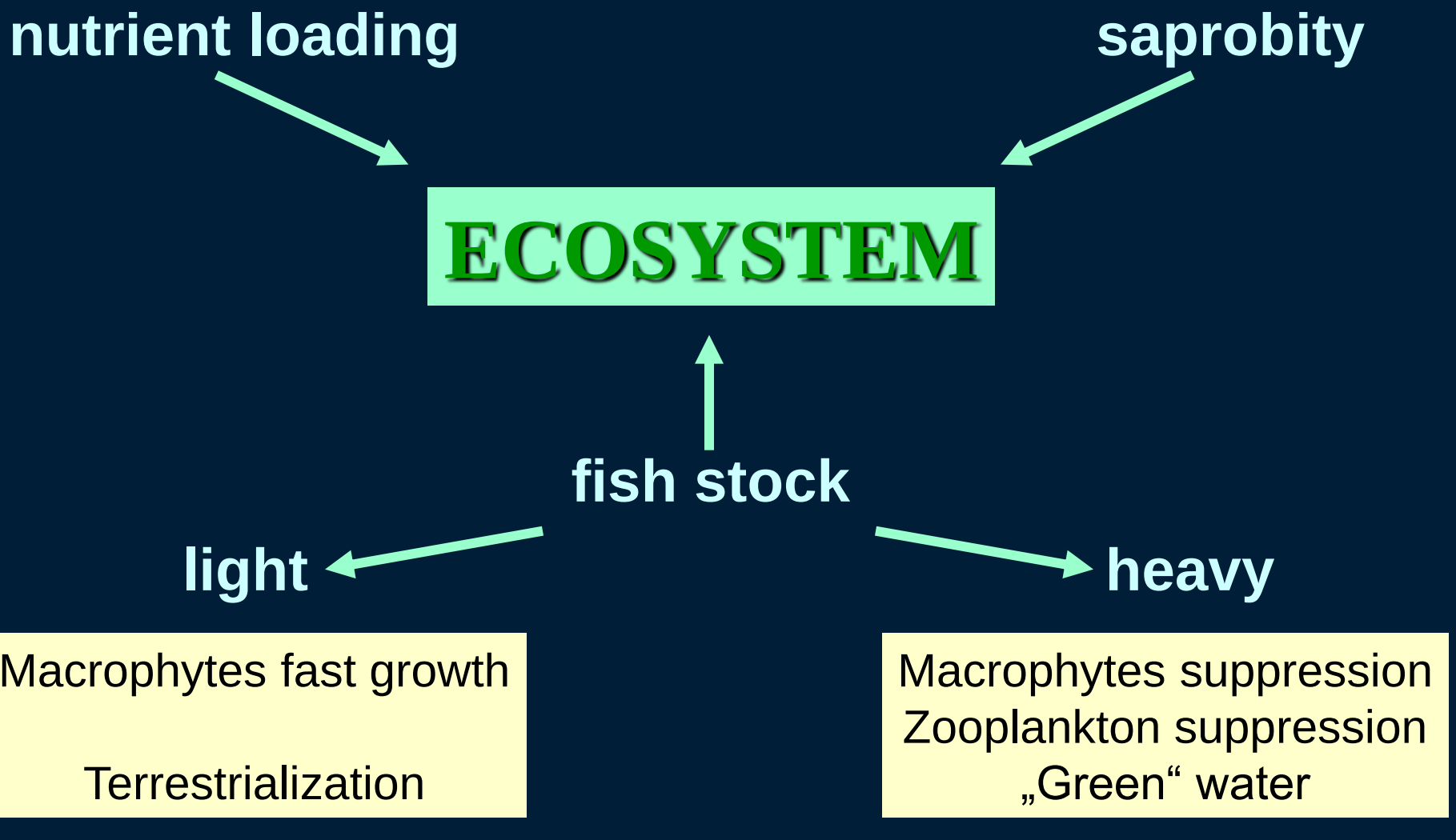


FISHPOND AS AN ECOSYSTEM

	water
	littoral
	meadow
	field
	forest
	settlement
	roads



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

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.

ROŽMBERK FISHPOND – FLOOD 2002

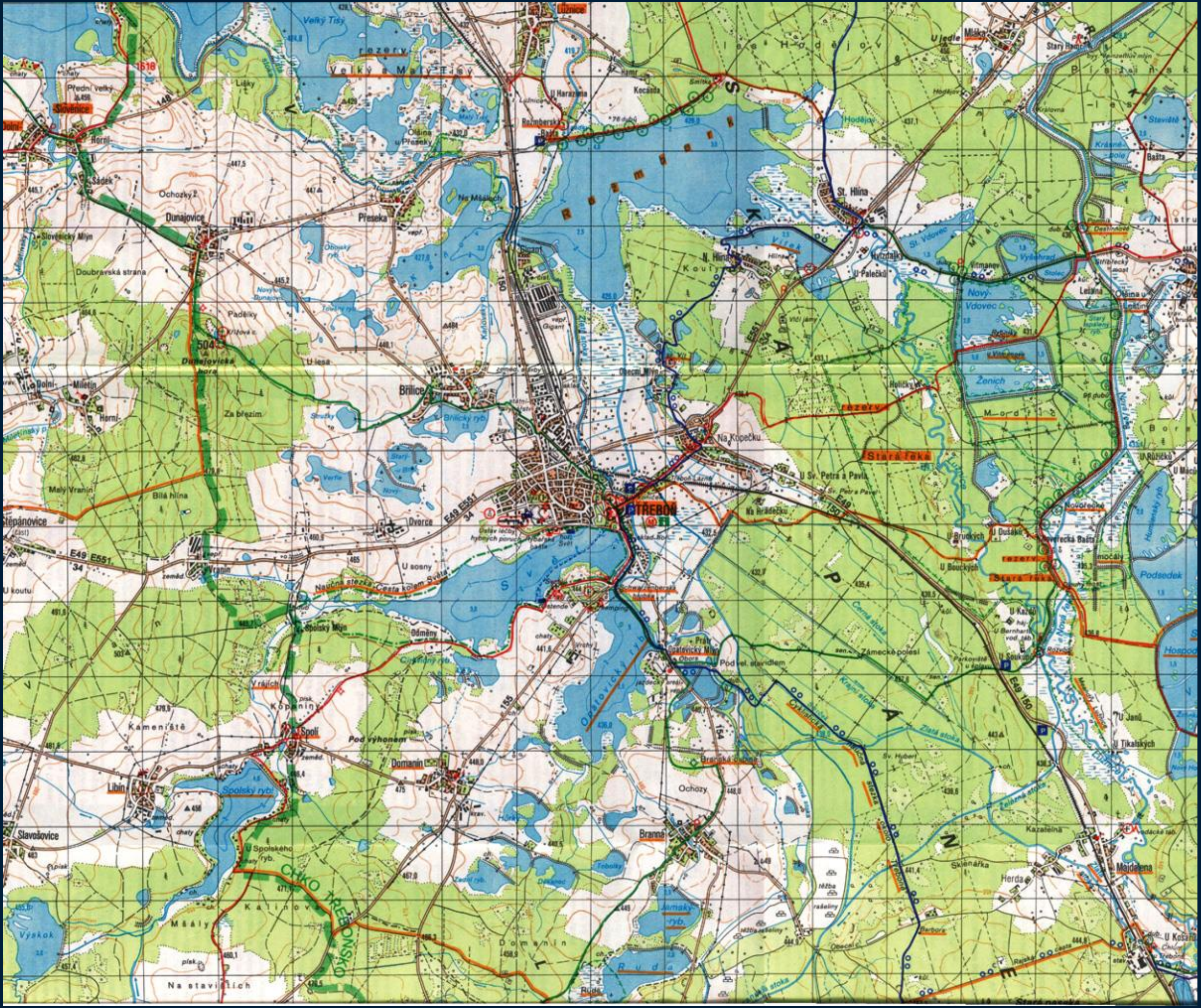
Built:
1590

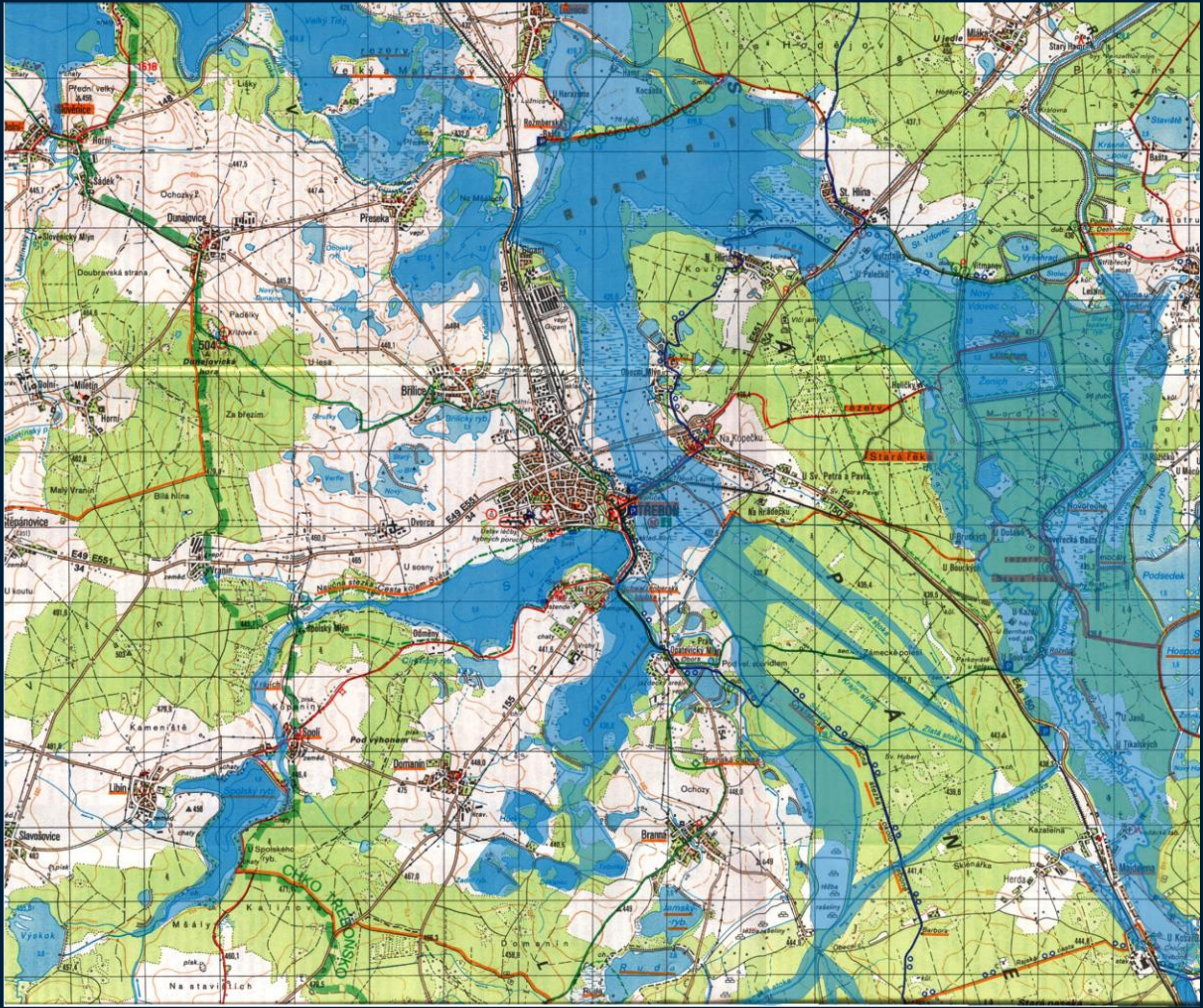
Water area:
490 ha

Normal volume:
5 mil. m^3

Manageable retention volume:
14.2 mil. m^3

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


Lužnice
Velký Tisý
Velký a Malý Tisý
rezervace
Slověnice
Dolní
Horní
Sádek
Ochozky
Dunajovice
Přeseka
Na Mšálech
Kecanda
U Harazima
Rožmberk
St. Hliína
N. Hlína
Koullé
U Palečků
Hodějov
U Jedle
Mlýnky
Starý Hospodář
Staviště
Bašta
Nový Vdovec
St. Vdovec
Vyšehrad
Stolec
Ženich
Rožmberk
Doubravská strana
Padělky
Dunajovická hora
U lesa
Břilice
Břilický ryb.
Dolní
Miletín
Horní
Za březím
Malý Vraniín
Bílá hlína
Štěpánovice
Na Kopečku
Stará řeka
U Sv. Petra a Pavla
Na Hrádečku
TŘEBOŇ
Dvorce
U sosny
U koutu
Naučná stezka Cesta kolem Světa
Spolský Mlýn
Odměny
Opatovický Mlýn
Zámecké polesí
Pod Vel. stavidlem
U Bruckých
U Dušáků
Novořecká Bašta
Podsedek
U Bouckých
U Kaziů
U Jana
U Tikalských
Kameniště
Spolí
Pod výhonem
Domanín
Libín
Spolský ryb.
Slavošovice
U Spolského ryb.
CHKO TŘEBOŇSKO
Branná
Ochozy
Kazatelna
Skleňárka
Herda
Majdalena
U Kosaře
Výskok
Mšály
Na stavidlech
Domanín
Rudá
Tobolky
Zámský ryb.
Opatovický ryb.
Svět
PANE



Dunajovice
Přeseka
Břilice
Štěpánovice
Vranín
Spolí
Libín
Slavošovice
Domanín
Branná
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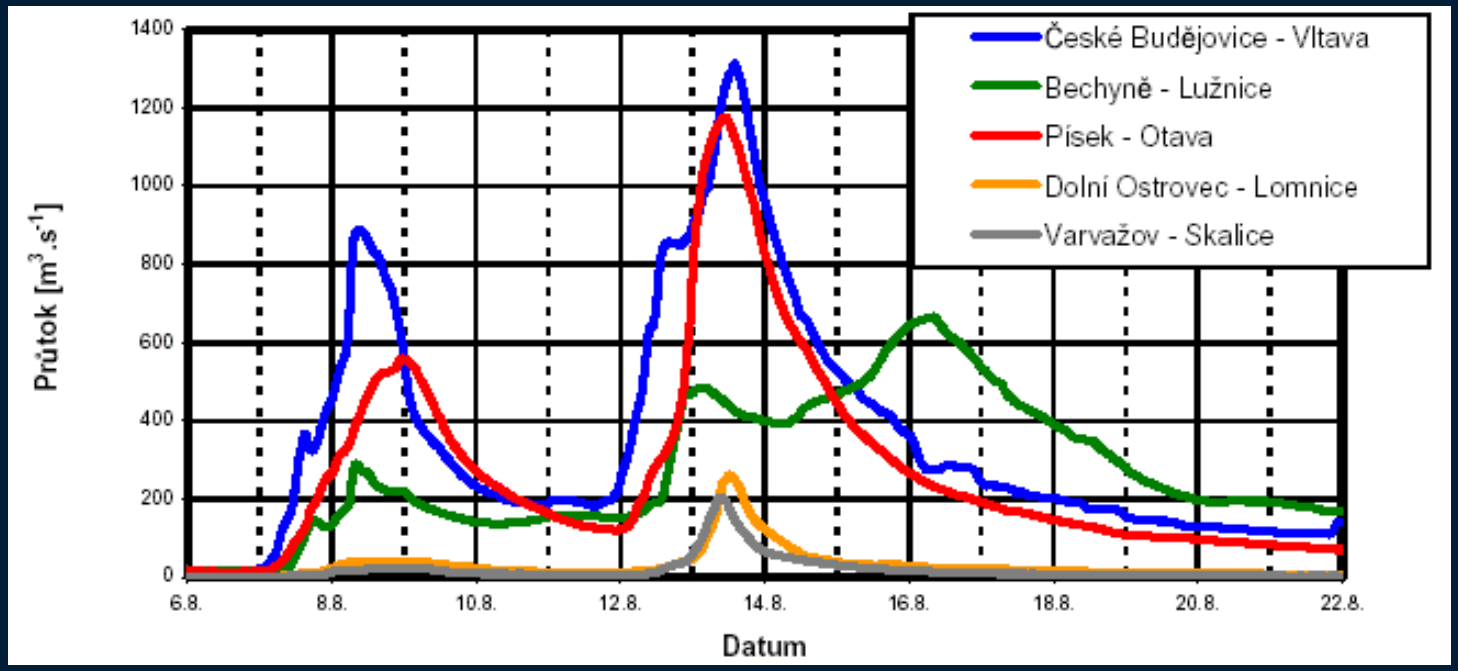
Bílá hlína
Malý Vranín
Padělky
U sosny
Na Hrádečku
Odměny
Ochozy 2

FLOOD WAVE CULMINATION ON MAIN RIVERS DURING SUMMER 2002



68 hrs delay

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

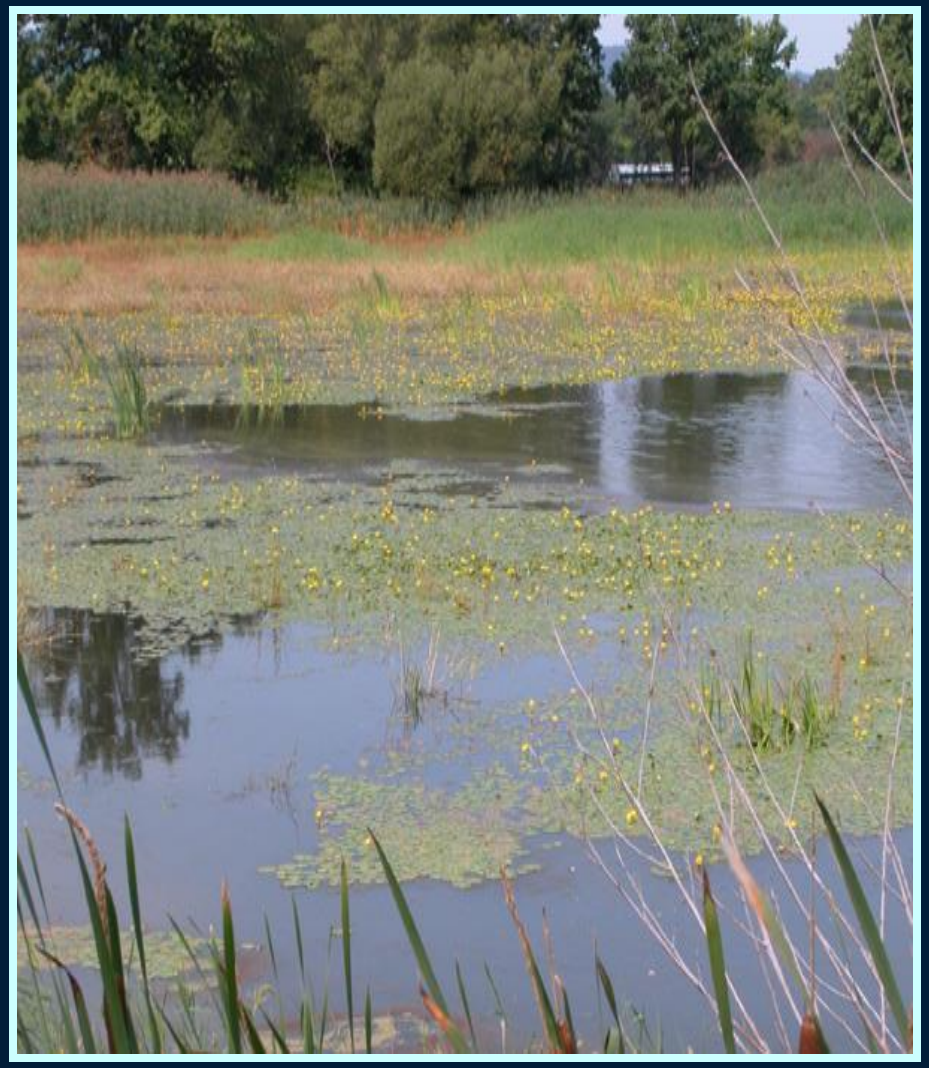
Gradual reduction of fish stock

Lowered water level

Regeneration of reeds

Return of waterfowl

EXAMPLES OF RESTORATION



Malý ústavní

Renewal of floating-leaved vegetation (*Nymphoides peltata*)

Heavy amelioration fish stock (carp + grass carp), 1t/ha

Winter drawdown

Very slow filling with water in spring

Support to semiterrestrial form of *N. peltata*

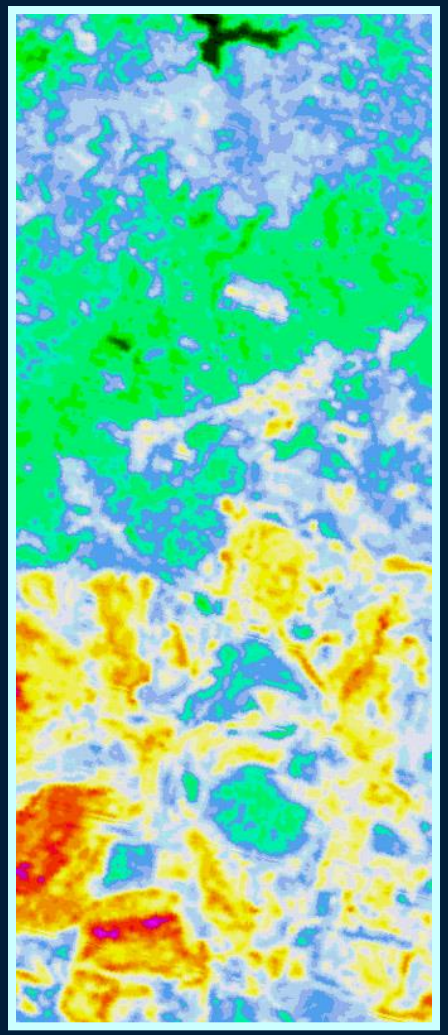
FISHPONDS AND HEAT DISSIPATION

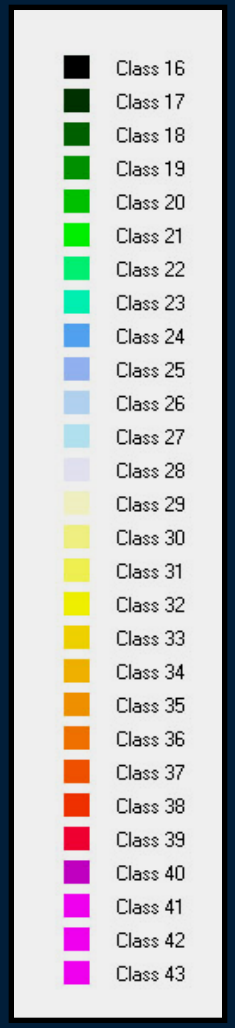
MOST BASIN (N. Bohemia)

TŘEBOŇ BASIN (S. Bohemia)

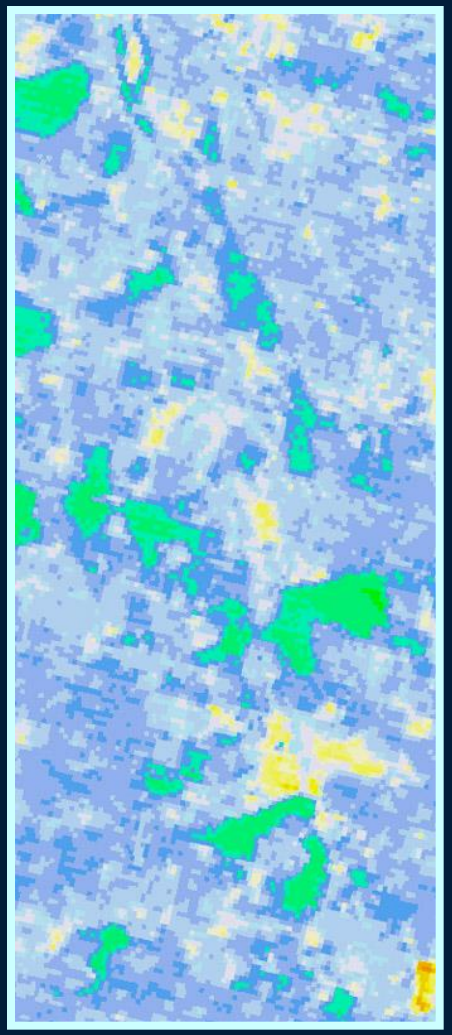
FISHPONDS AND HEAT DISSIPATION

MOST BASIN (N. Bohemia)





TŘEBOŇ BASIN (S. Bohemia)



FISHPONDS AND SUSTAINABLE LANDSCAPE MANAGEMENT