The Hungarian experience in combating nutrient run-off from rural areas

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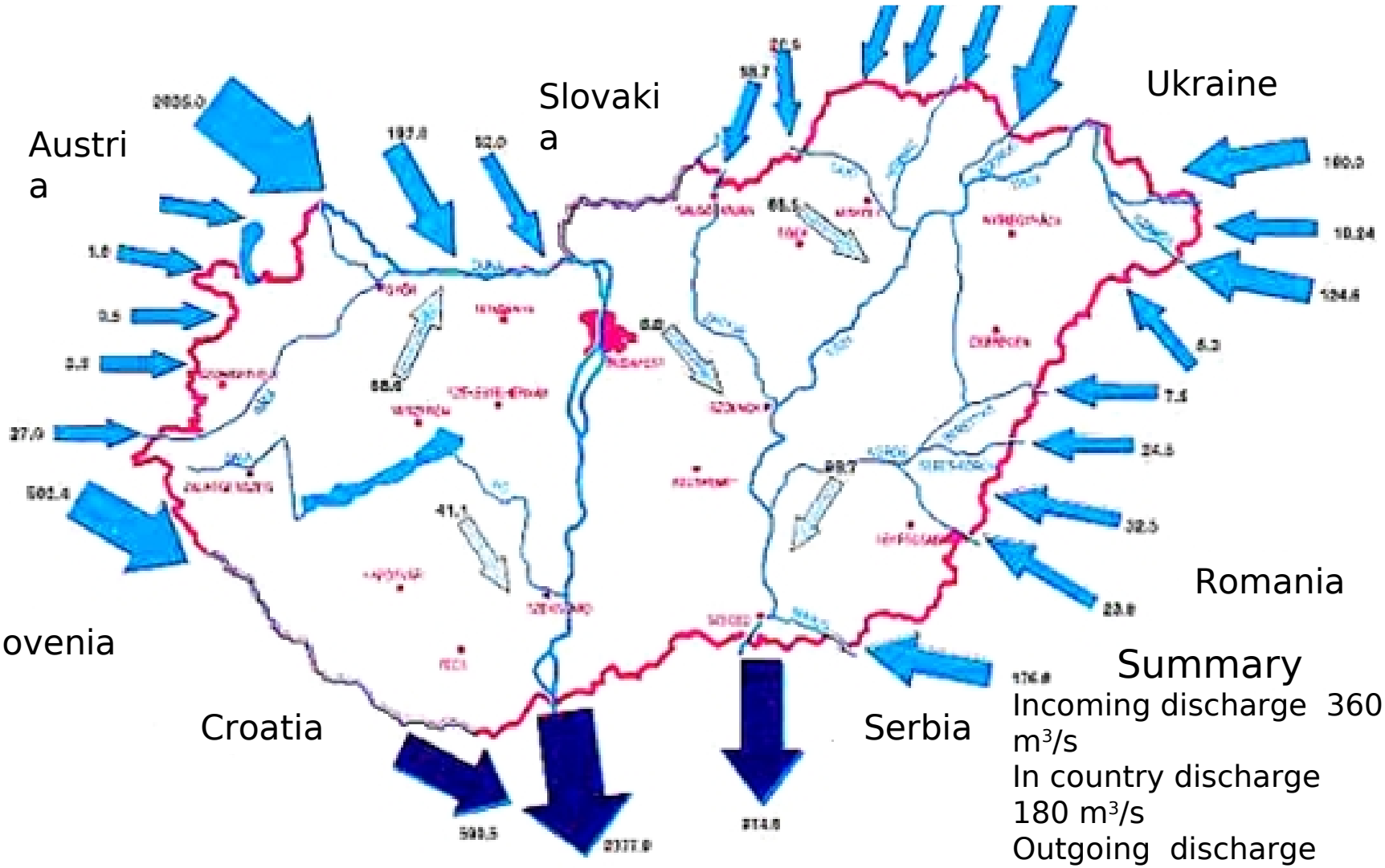
Brief characterization of surface and sub-surface resources in Hungary

- Both surface and subsurface water resources of Hungary are vulnerable.

- About 95% of the surface waters originate from upstream countries, thus Hungary very much is dependent on the actions that upstream countries are taken.

Yearly average discharges of transboundary rivers in Hungary [m3/s]



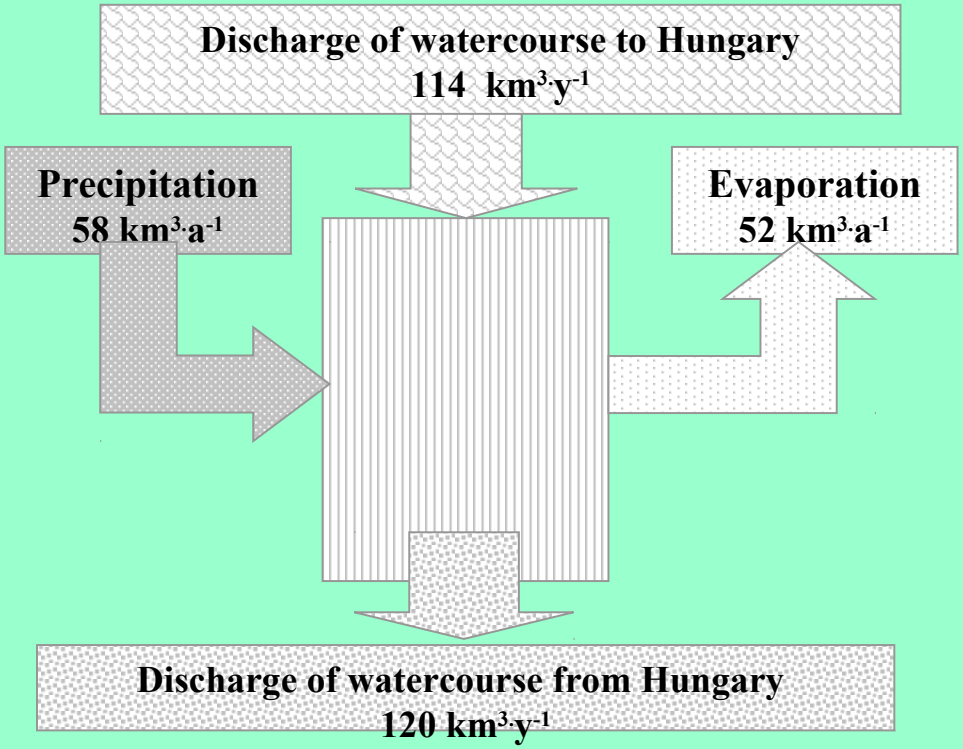
Summary

Incoming discharge 3602 m^3/s

In country discharge 180 m^3/s

Outgoing discharge 3782 m^3/s

Water budget of Hungary



$58\ km^3 + 114\ km^3 = 52\ km^3 + 120\ km^3$

Brief characterization of surface and sub-surface resources in Hungary

- Both surface and subsurface water resources of Hungary are vulnerable.

- About 95% of the surface waters originate from upstream countries, thus Hungary is very much dependent on the actions that upstream countries are taken.

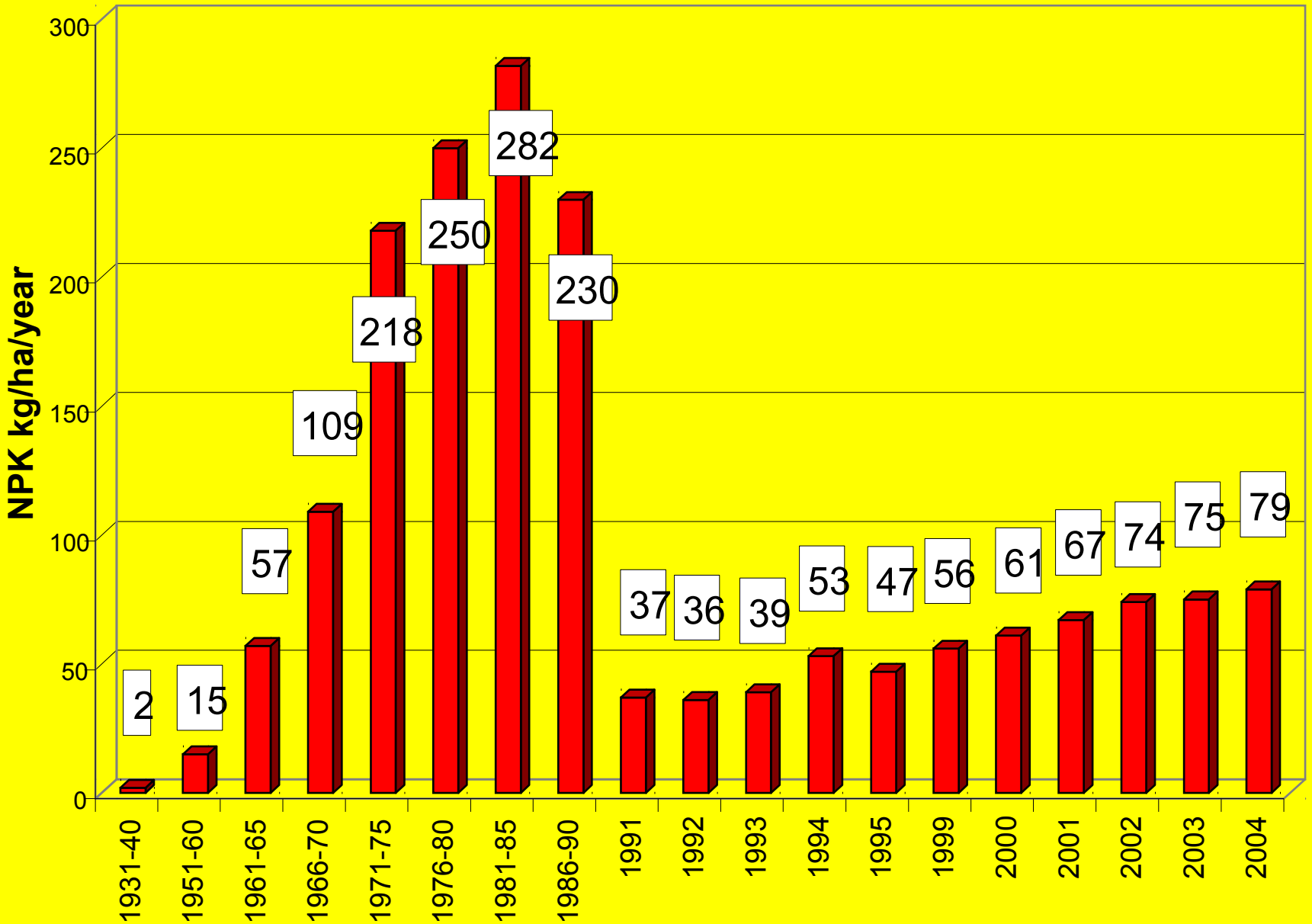
- About 90% of public water supply is based on groundwater resources.

- Significant portion of the groundwater bodies are located in vulnerable areas.

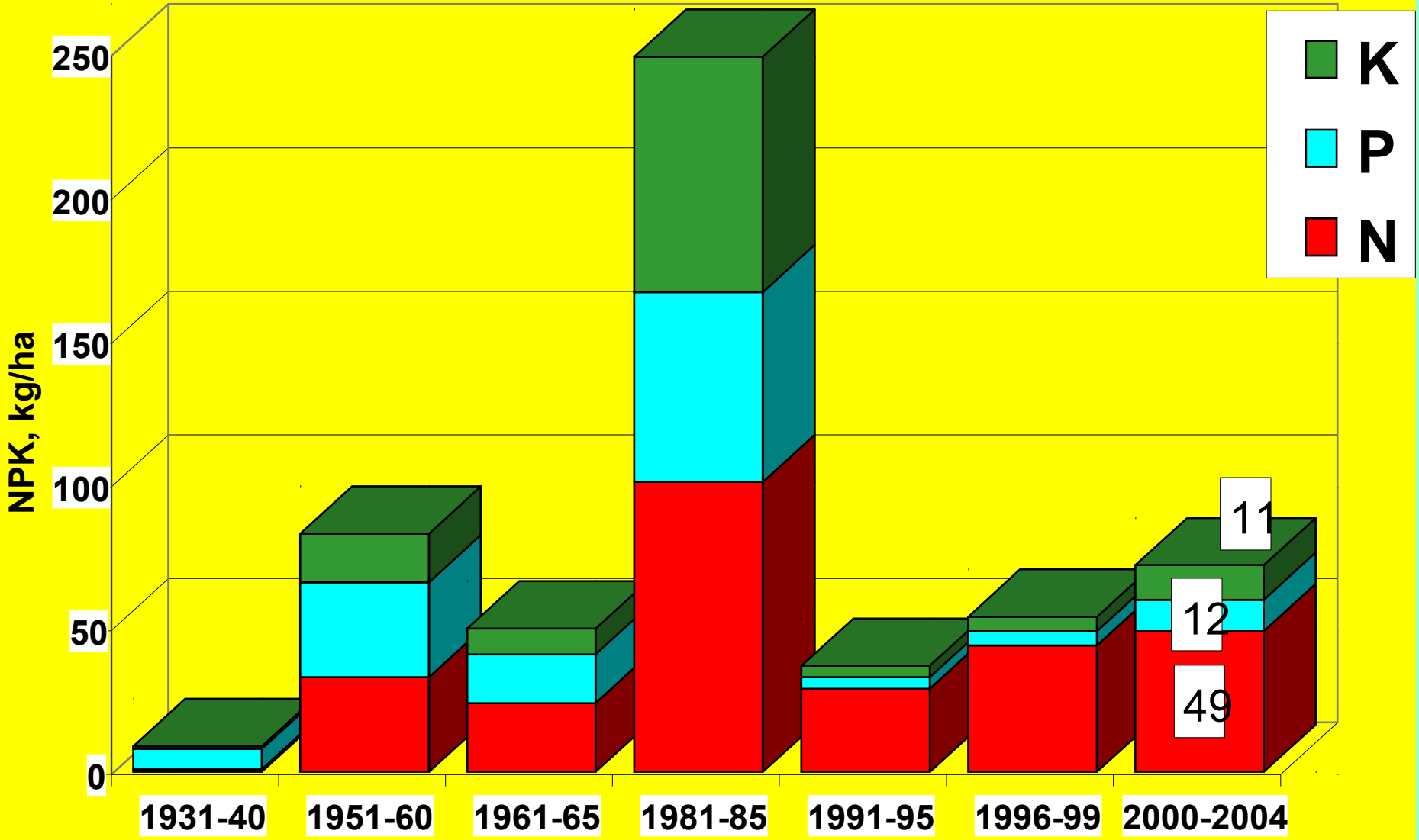
Distribution of land by type of use (2008)

Designation	Thousand ha	Distribution %
Arable-land	4 503	48,4
Garden	96	1,0
Orchard	99	1,1
Grape	83	0,9
Grass	1 010	10,9
Agricultural land	5 791	62,2
Forest	1 883	20,2
Reed, Fishpond	94	1,0
Crop land	7 768	83,5
Unused agricultural land	1 535	16,5
Total	9 303	100,0

NPK use in Hungary

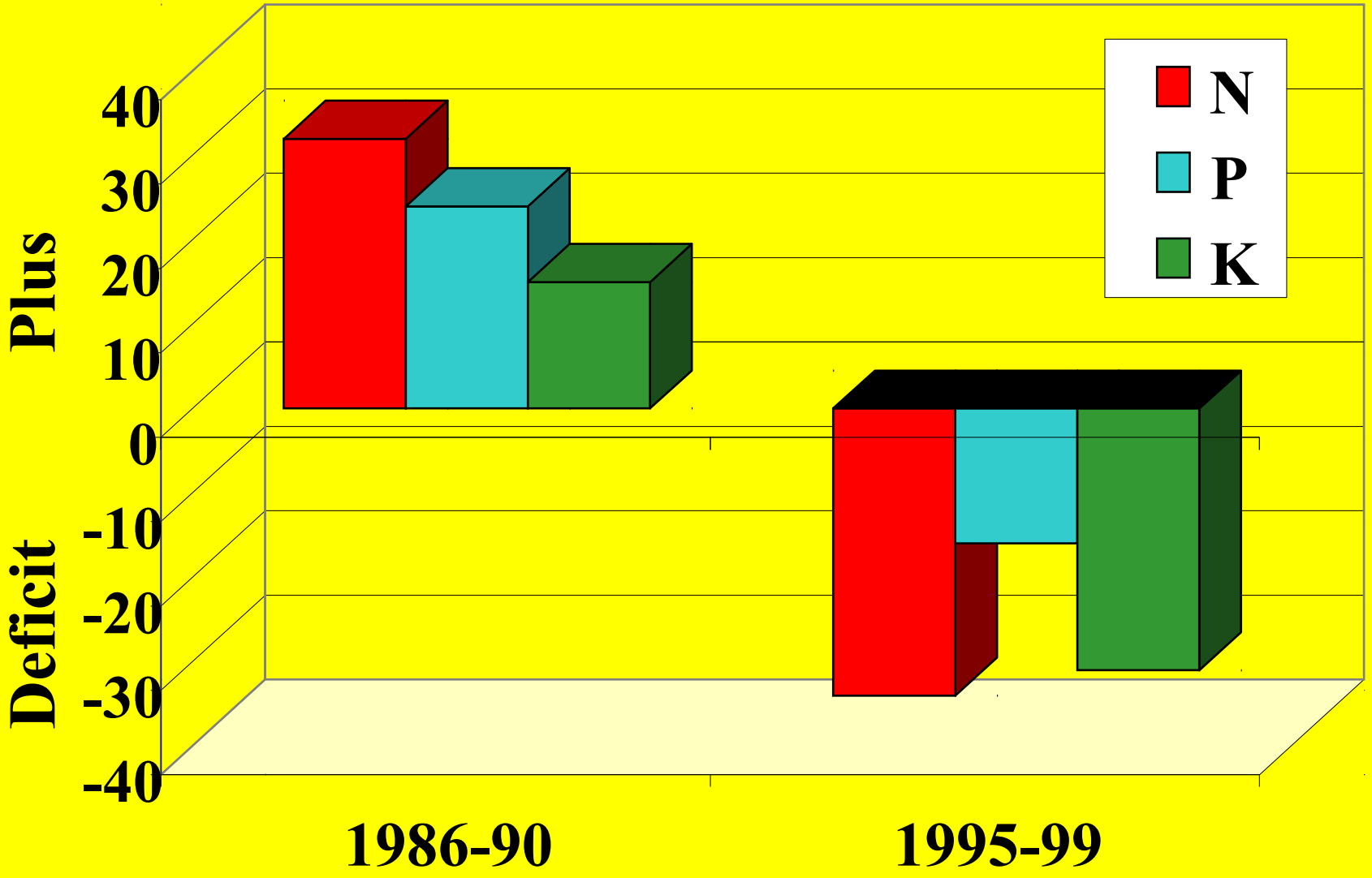


Specific use of NPK-fertilizers on agricultural land



NPK balance of soils in Hungary (kg/ha)

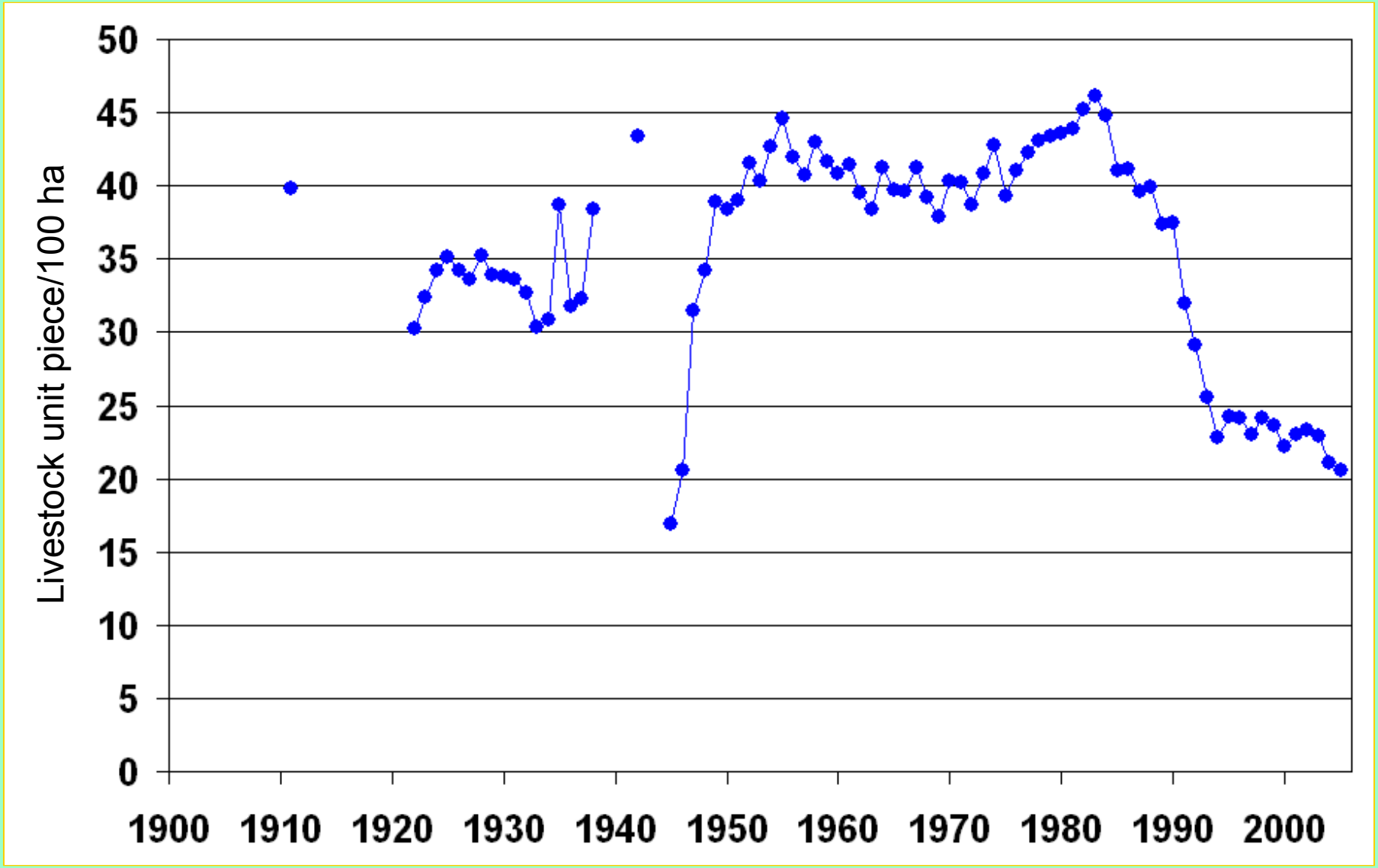
(1986-1990 and 1995-1999)



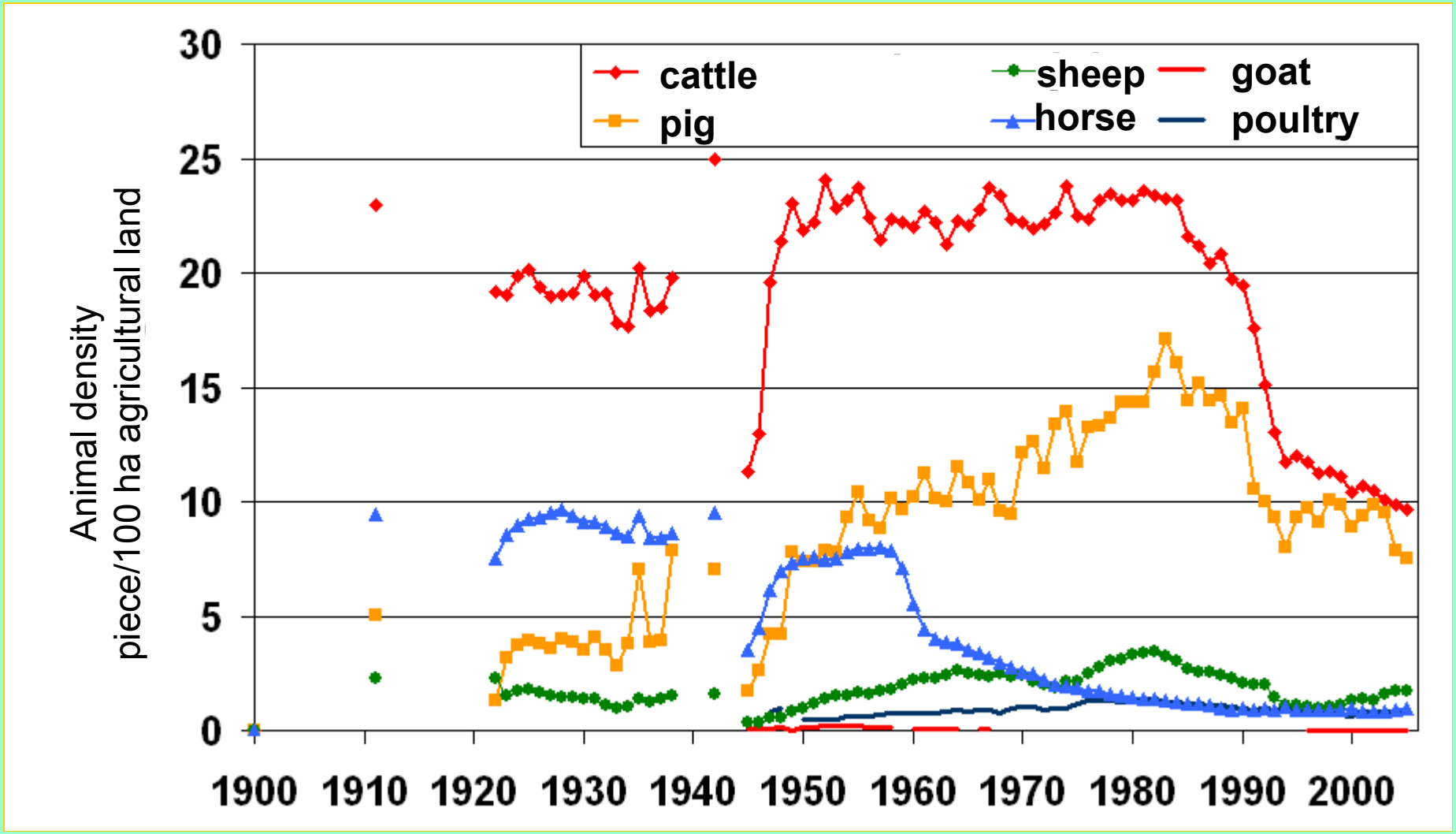
Nutrient balance of Hungary

Time	N	P_2O_5	K_2O	Total
1986-1990	+ 97	+ 141	+ 43	+ 281
1999	- 114	- 1 112	- 252	- 478
Decrease (kg/ha)	211	1 253	295	759
%	54	89	85	63

Livestock in Hungary
1901-2005

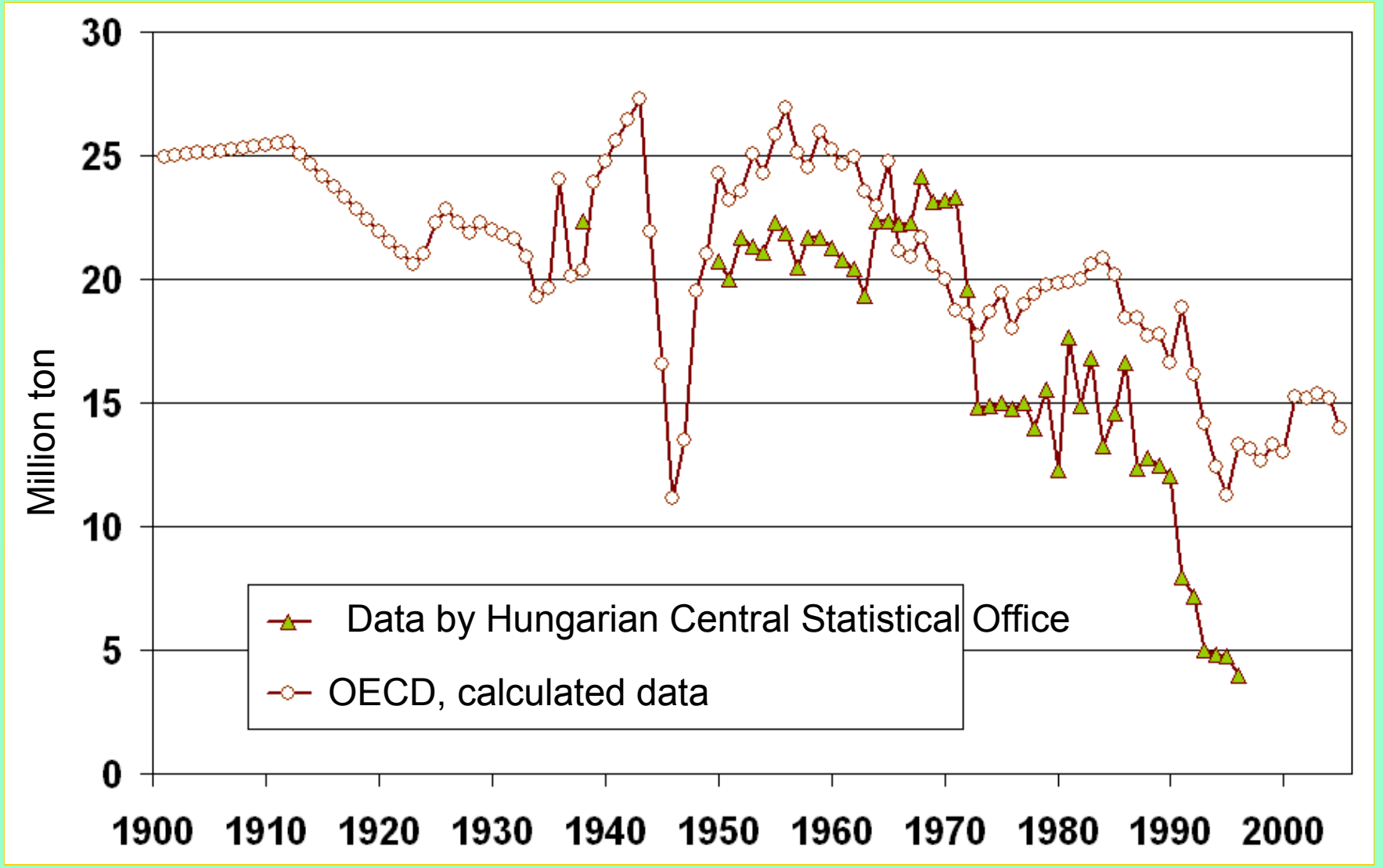


Animal density in Hungary 1901-2005

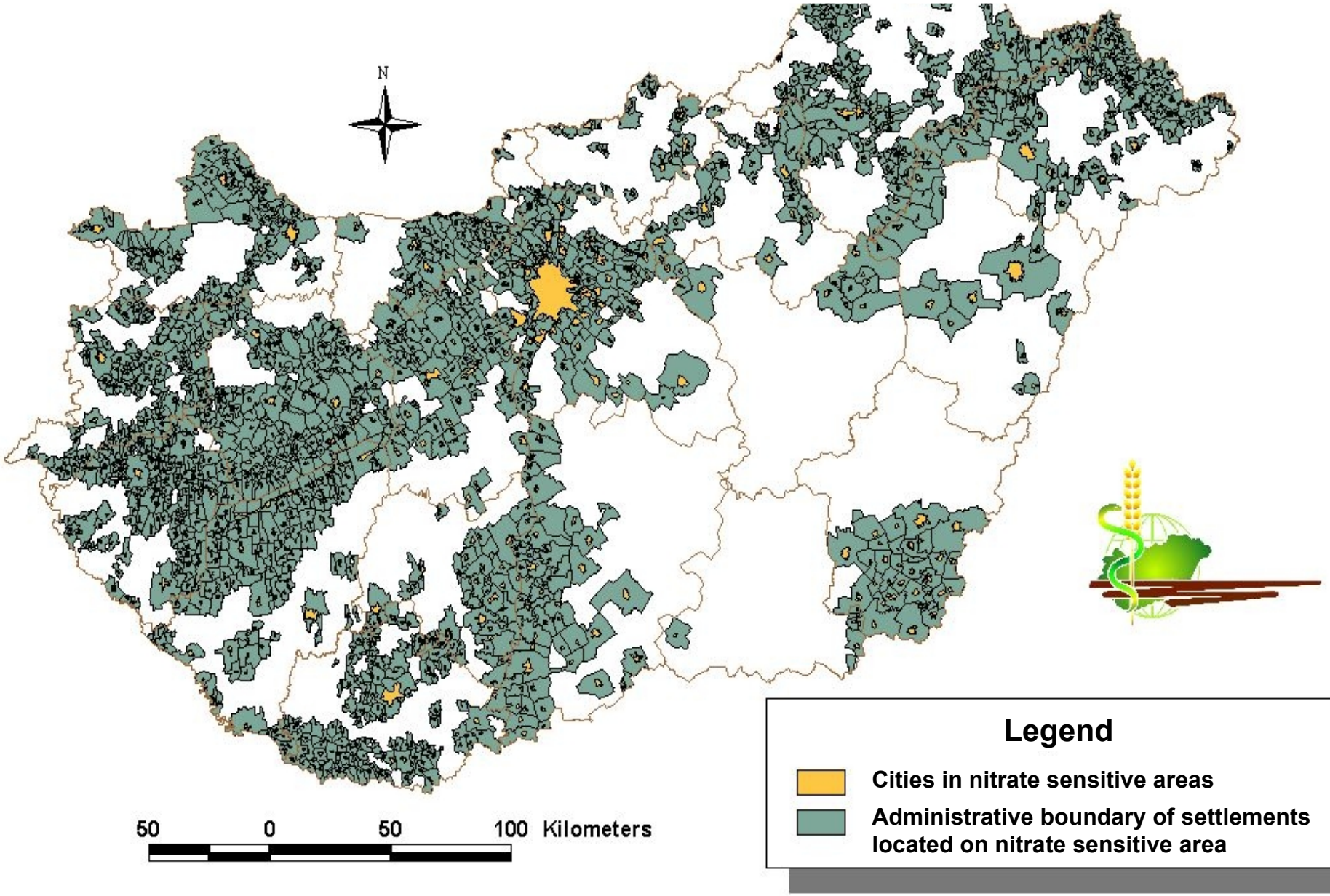


Manure produced in Hungary 1901-2005

(Csathó and Radimszky, 2008)



Nitrate sensitive settlements – listed in Gov. Decree 49/2001 (IV.3.)

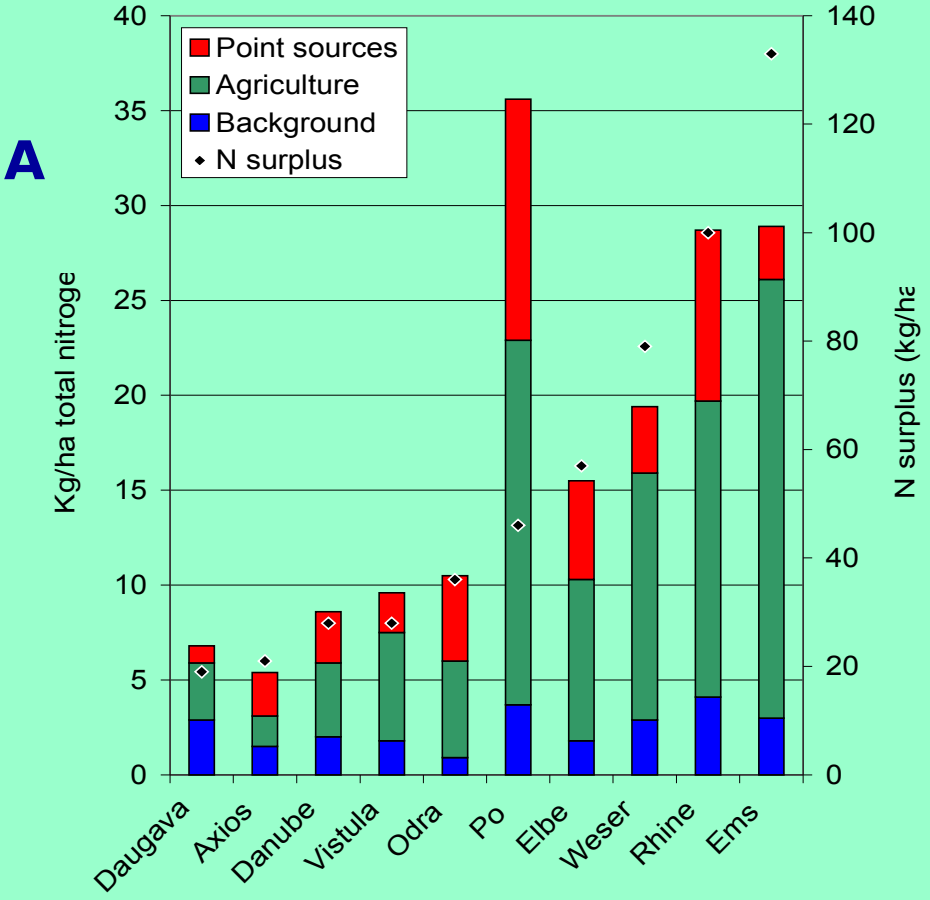


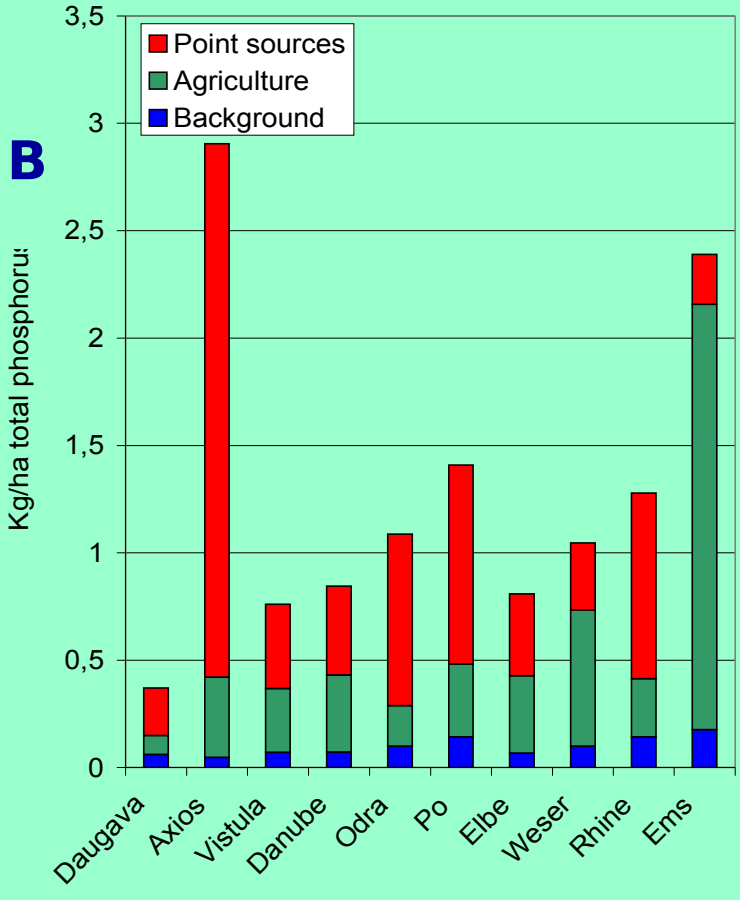
The rules of Good Agricultural Practice:

1. Quantity limit (170 kg/ha N).
2. Fertilization ban periods (12.01. - 02.15.).
3. Fertilization on slope (20%).
4. Fertilization on saturated soils, melt, frozen, snow covered soil surface.
5. Fertilization rules in the neighbourhood of water bodies (10 m).
6. Rules of manure storage in animal farms.
7. Rules of fertilization on arable-land.
8. Other requirements (erosion, irrigation).

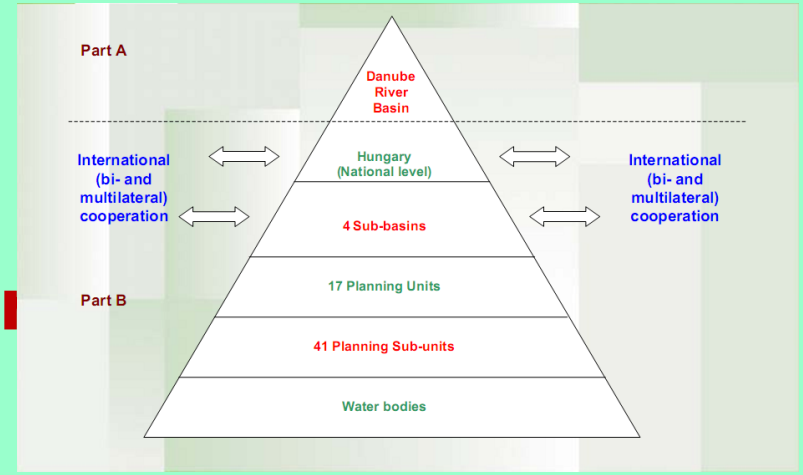
Assessment at European scale

Annual load of nitrogen (A) and phosphorus (B) in large river catchments



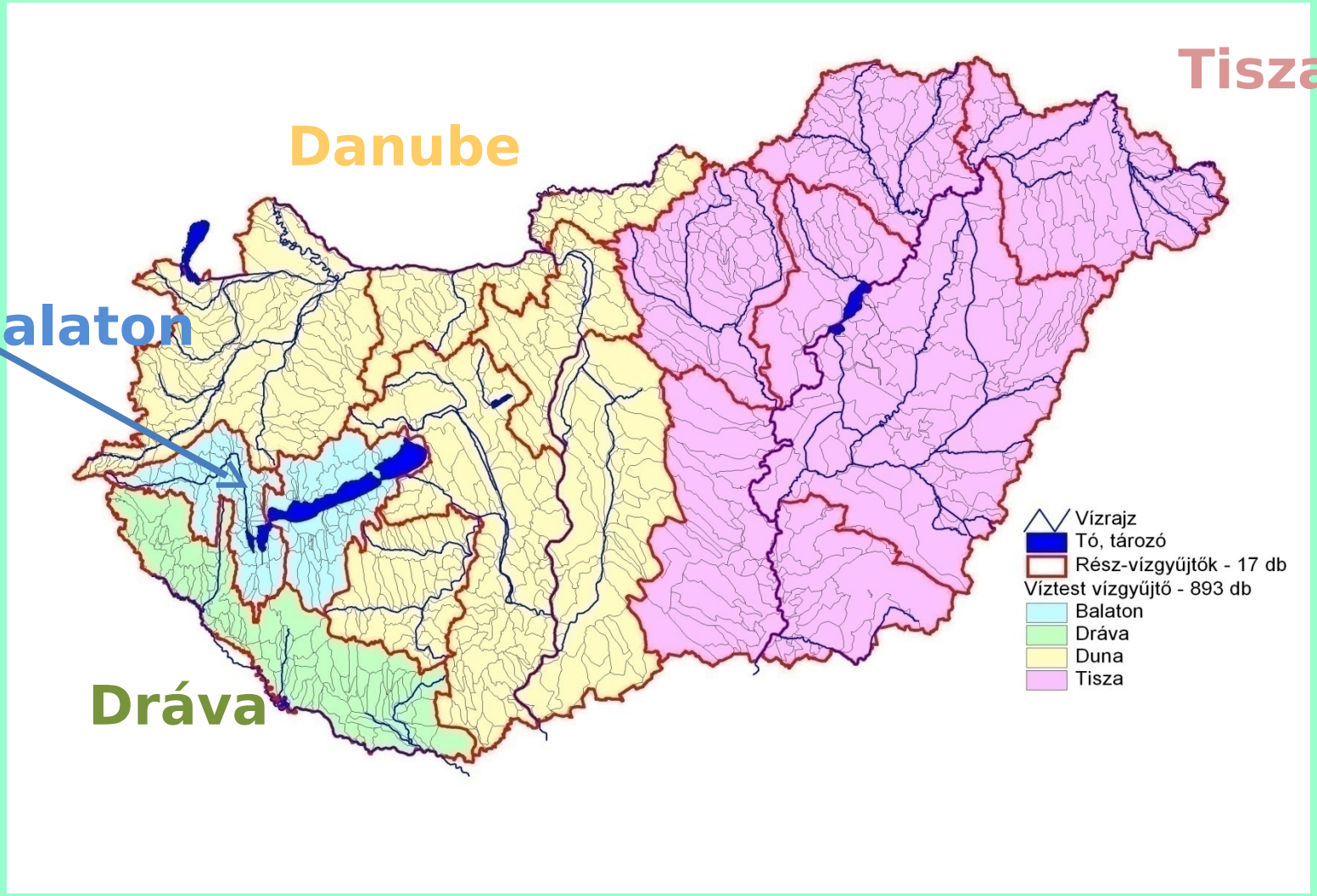


Hungary prepared three level of river basin management plans as par WFD implementation:

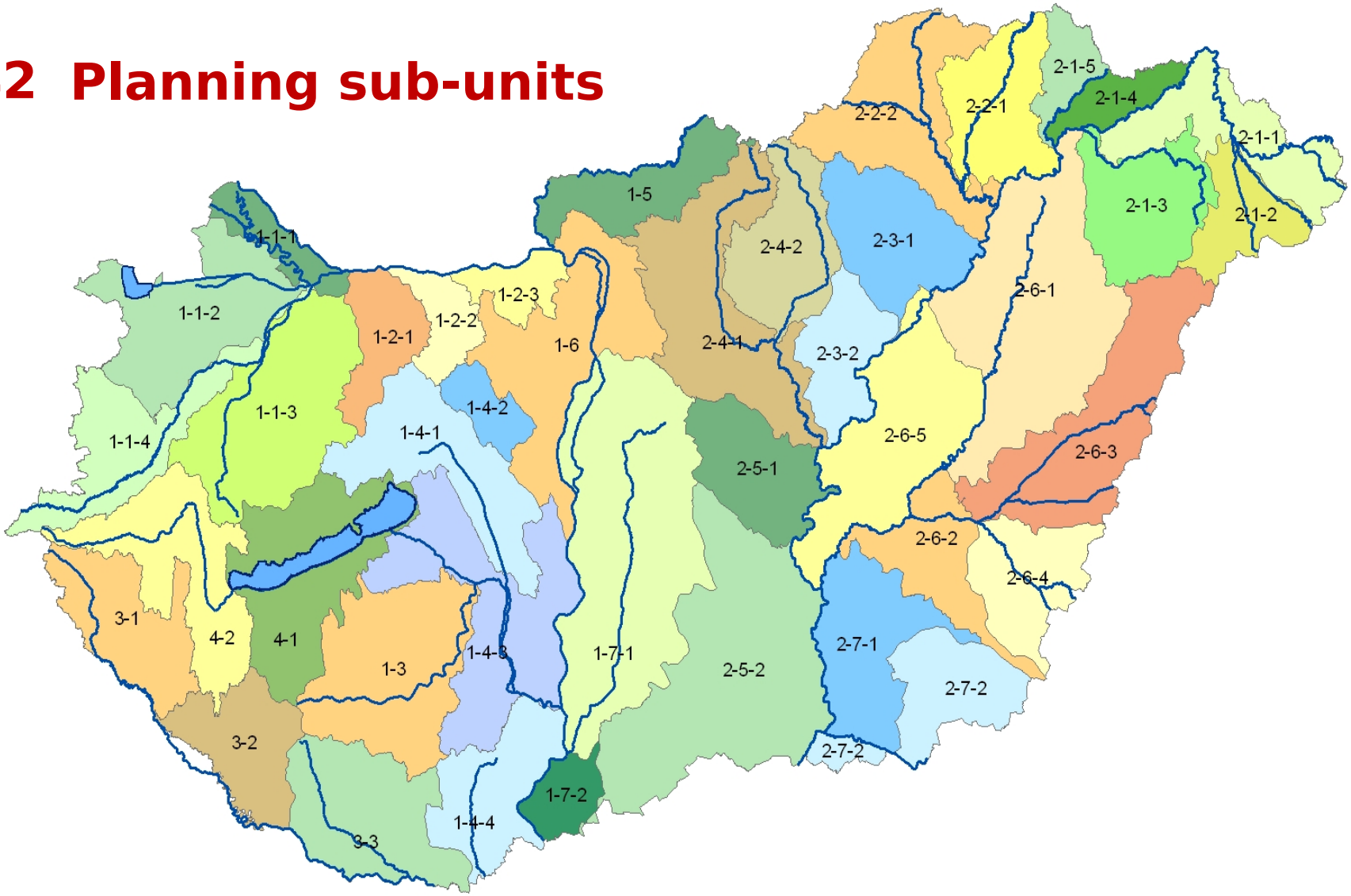


- **Danube RBM Plan**
  - Scale: 4 000 km²
  - Programme of measures includes hydromorphological measures:
    - interruption of river and habitat continuity
    - disconnection of adjacent floodplains / wetlands
    - hydrological alterations
- **4 sub-basin plans** (Danube, Tisza, Balaton and Drava)
  - Scale: 1 000 km²
  - Programme of measures on hydromorphological measures deals with:
    - interruption of river and habitat continuity
    - disconnection of adjacent floodplains / wetlands
    - hydrological alterations
    - Future infrastructure projects
- **42 planning units**
  - Scale: much less than 1 000 km²
  - Programme of measures includes hydromorphological measures deals with:
    - As above in Danube and 4 sub-basin plans

4 sub-basins concerning RBM planning in Hungary

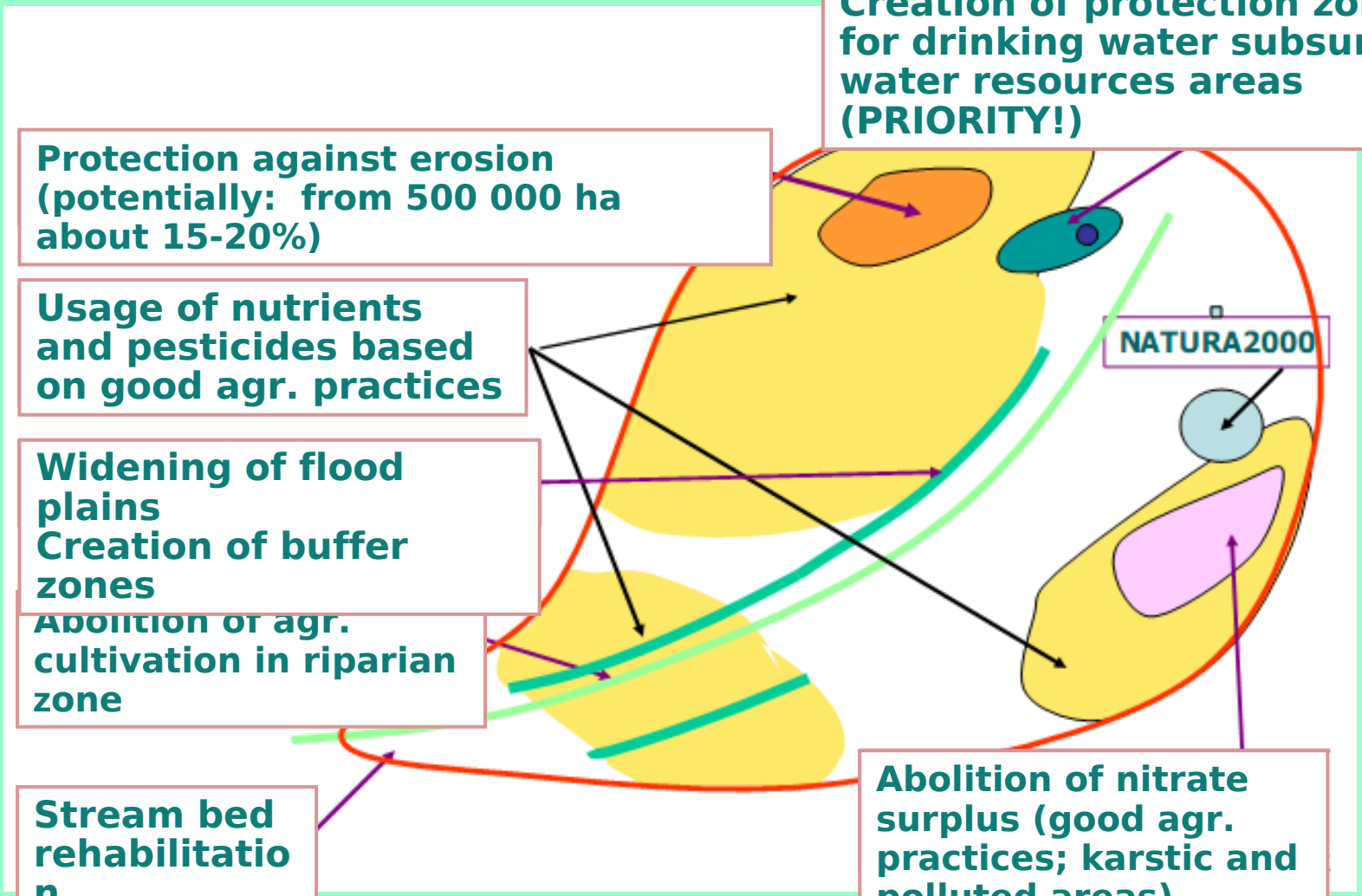


42 Planning sub-units

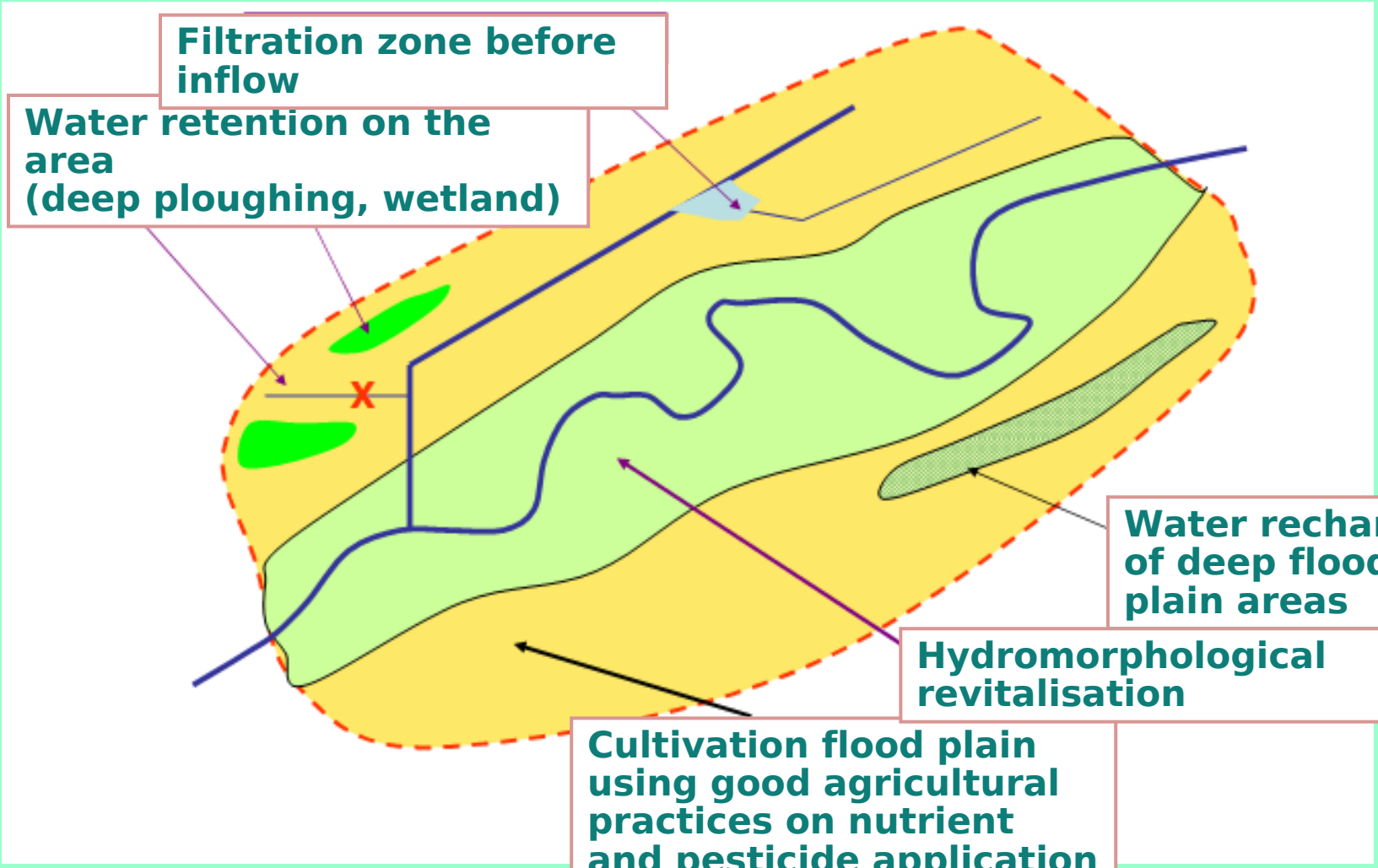


1-1-1 Szigetköz
1-1-2 Rábca és a Fertő-tó
1-1-3 Marcal
1-1-4 Rába
1-2-1 Bakony-ér és Concó
1-2-2 Általér
1-2-3 Gerecse
1-3 Kapos
1-4-1 Észak-Mezőföld és Keleti-Bakony
1-4-2 Velencei-tó
1-4-3 Sió
1-4-4 Alsó-Duna jobb part
1-5 Ipoly
1-6 Közép-Duna
1-7-1 Duna-völgyi főcsatorna
1-7-2 Felső-Bácska
2-1-1 Felső-Tisza
2-1-2 Szamos-Kraszna
2-1-3 Lónyai-főcsatorna
2-1-4 Bodrogköz
2-1-5 Tokaj-hegyalja
2-2-1 Hernád, Takta
2-2-2 Sajó a Bódvával
2-3-1 Bükk és Borsodi-Mezőség
2-3-2 Hevesi-sík
2-4-1 Zagyva
2-4-2 Tarna
2-5-1 Nagykőrösi-homokhát
2-5-2 Alsó-Tisza jobb part
2-6-1 Hortobágy-Berettyó
2-6-2 Hármas-Körös
2-6-3 Sebes-Körös és a Berettyó
2-6-4 Kettős-Körös
2-6-5 Nagykunság
2-7-1 Kurca
2-7-2 Maros-hordalékkúp
3-1 Mura
3-2 Rinya-mente
3-3 Fekete-víz
4-1 Balaton közvetlen
4-2 Zala

Elements of agriculture related measures in river basin management plans



Elements of nutrient run-off control in river basin management plans



Who is doing what in WFD implementation

Responsible for the planning	Ministry of Rural Development; VKKI
Coordinator of the planning	Env .and Water Management Directorates
Other participants in the planning	Env. Inspectorates; National Park Directorates
Partners	Other ministries, national and regional authorities, neighbouring countries
Stakeholders	Municipalities; Water Management Associations; Other professional associations; civil organisations; productive sector; public.
Approver of the plan	Water Management Committees (National, Regional); MoEW.
Participants in the implementation of the plans	Regional Env. and Water Management Directorates; Designers, Contractors, Operators of investment projects

Message of Water Frame Directive for the agricultural water management

- water is a natural resource, not a human product
- its quantity and quality are limited
- as a factor in production, it cannot be substituted
- it is a renewable resource referring to both its quantity and quality,
- it is the property of the society, and good water management is its responsibility
- increase of its value started in the mid XX century, and will accelerate in the XXI century

Water resource of Hungary as a basis of water supply

- Specific surface water resource: 11.000 m^3/capita/year
- Formed within the country 600 m^3/capita/year
- Its distribution in space and time is extremely variable
- Management reduces variance in space
- Extra resource is present, protection against high water is required
  - Plain area of 44.5 thousand km^2
  - 2.5 million people living in potentially flooded area of 20 thousand km^2
  - 47% of the infrastructure, and 1/3 of the agricultural land are is affected
  - 60% of the plain area has risk of excess inland water

Adequate water drainage is primarily task of the State, that can be provided by management and maintenance of 99,582 km river bed and drainage channel.

Properties

Owner	Length of river (km)
Exclusively state property (not negotiable)	12,288
Not exclusively state property (negotiable)	35,499
including: property of Ministry of Land Management	4,395
handled by associations	31,140
Property of local governments	8,600
Property of agricultural producers	43,195
Total	**99,582**

CONCLUSION:

Providing available natural resources is financed by the state, the local governments, and stakeholders in the economy.

Agricultural water use (from channels and wells), 2008

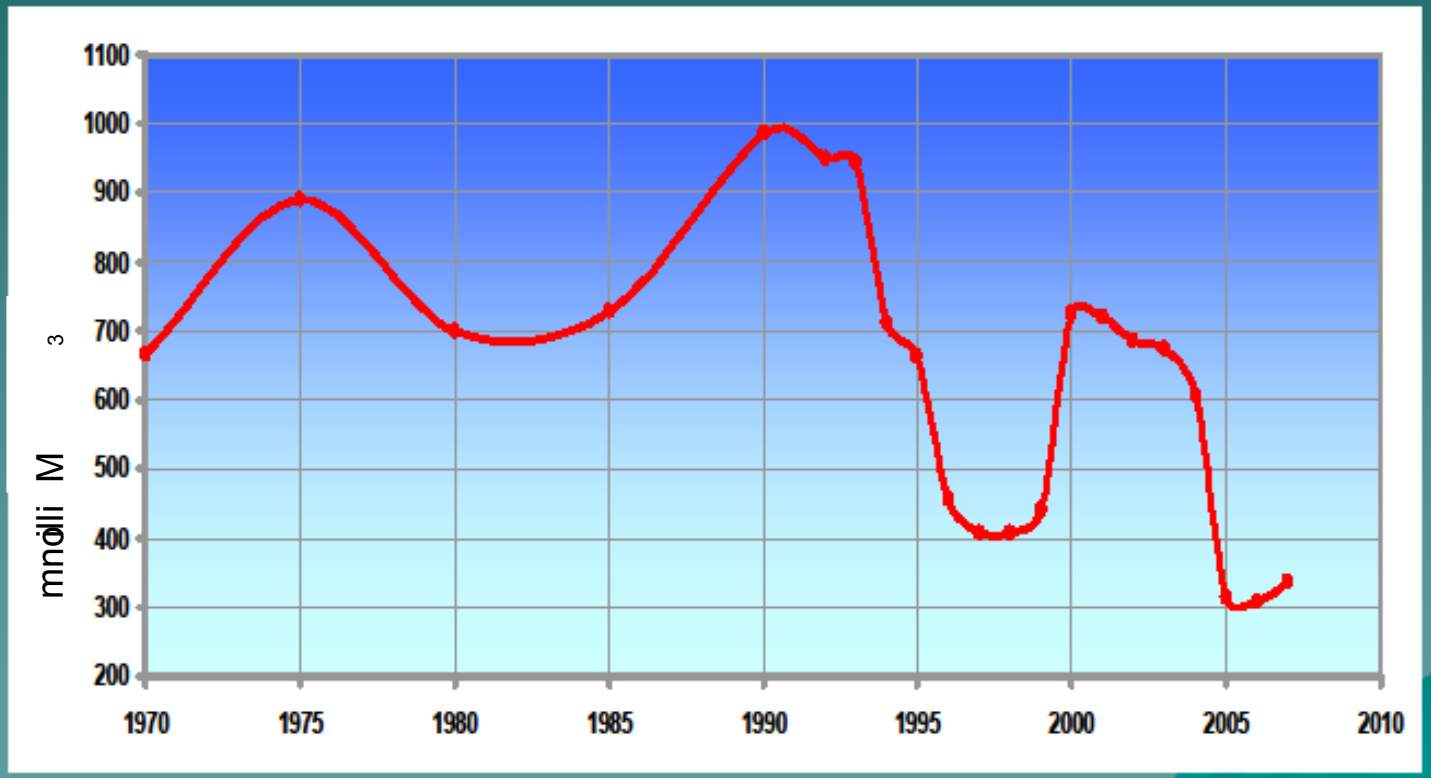
Type	From channels	From wells	Total
Area with water rights implementation limit			
Equipped for irrigation	142,588	65,526	208,114
Fishing pond	19,370	12,720	32,090
Area with water supply			
Equipped for irrigation	69,669	24,002	93,671
Fishing pond	14,369	11,524	25,893
Water quantity provided (thousand m^3)			
Used for irrigation	114,975	28,329	143,304
Used for maintenance of fishing pond	159,970	137,861	297,831

Average use of total capacity : 45%

Water use for 1 ha of irrigated area: 153 mm

Water use for 1 ha of fishing pond: 1150 mm

Trends in agricultural water use between 1970 and 2007



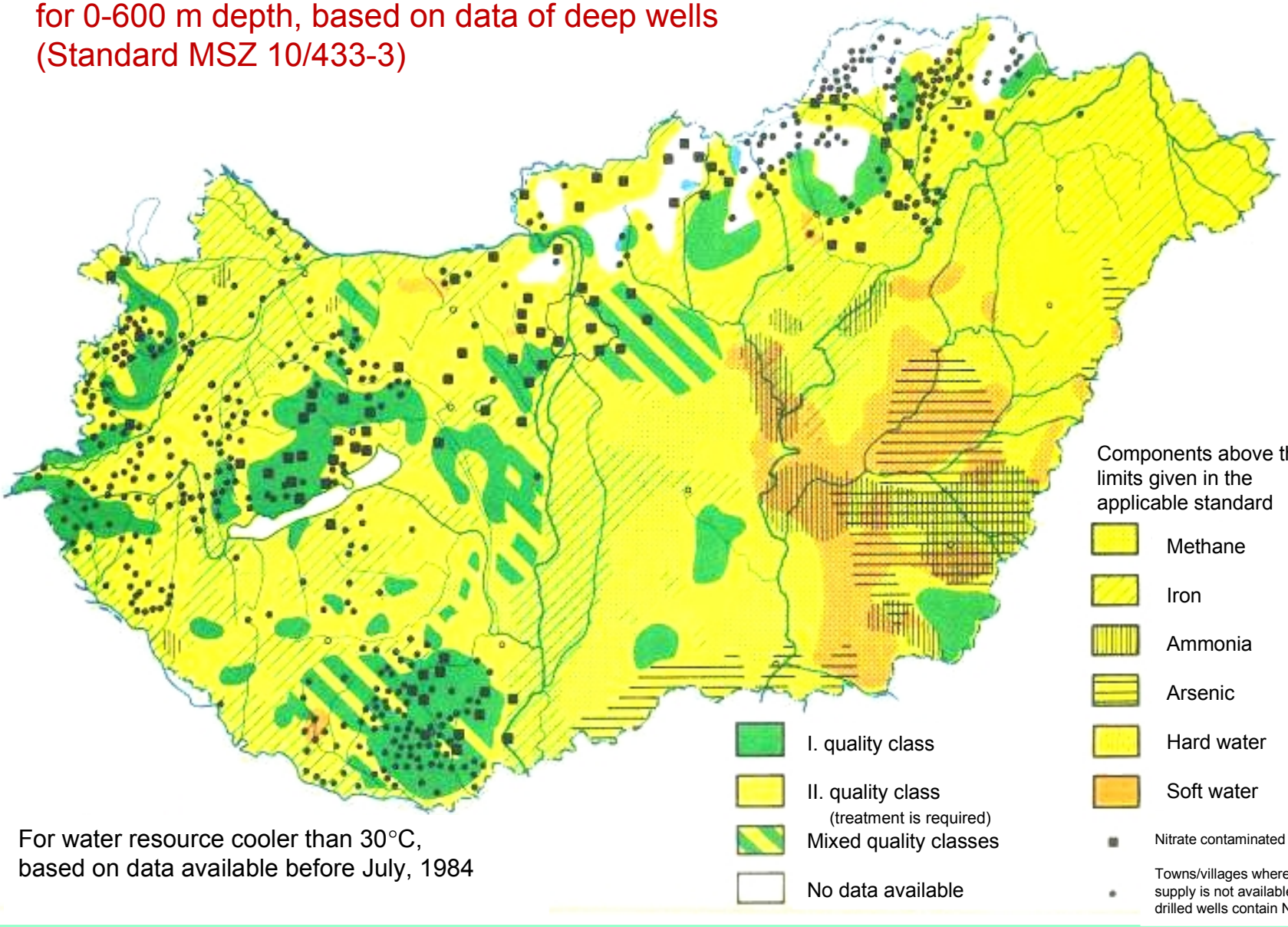
Agricultural water use by segments, in 2007

Aim of water use (million m³)	2000	2001	2002	2003	2004	2005	2006	2007	Ratio in 2007
Fishing pond	505.5	502.4	463.2	456.3	385.9	226.8	229.5	201.4	59.7%
Irrigation	178.0	180.2	186	184.5	182.2	46.4	39.7	91.4	27.1%
Animal husbandry	28.7	29.3	28.9	29.2	27.9	20.9	19.9	19.8	5.9%
Other	8.5	4.4	1.5	0.0	6.4	17.4	16.5	21.9	6.5%
Own agricultural water resource	720.7	716.3	679.6	670.0	602.4	311.5	305.5	334.5	99.1%
Water bought from the water works	4.8	4.1	4.7	3.8	3.4	2.6	2.6	2.9	0.9%
Total	725.5	720.4	684.3	673.8	605.8	314.1	308.0	337.5	100.0%

Source: VKJ statistics

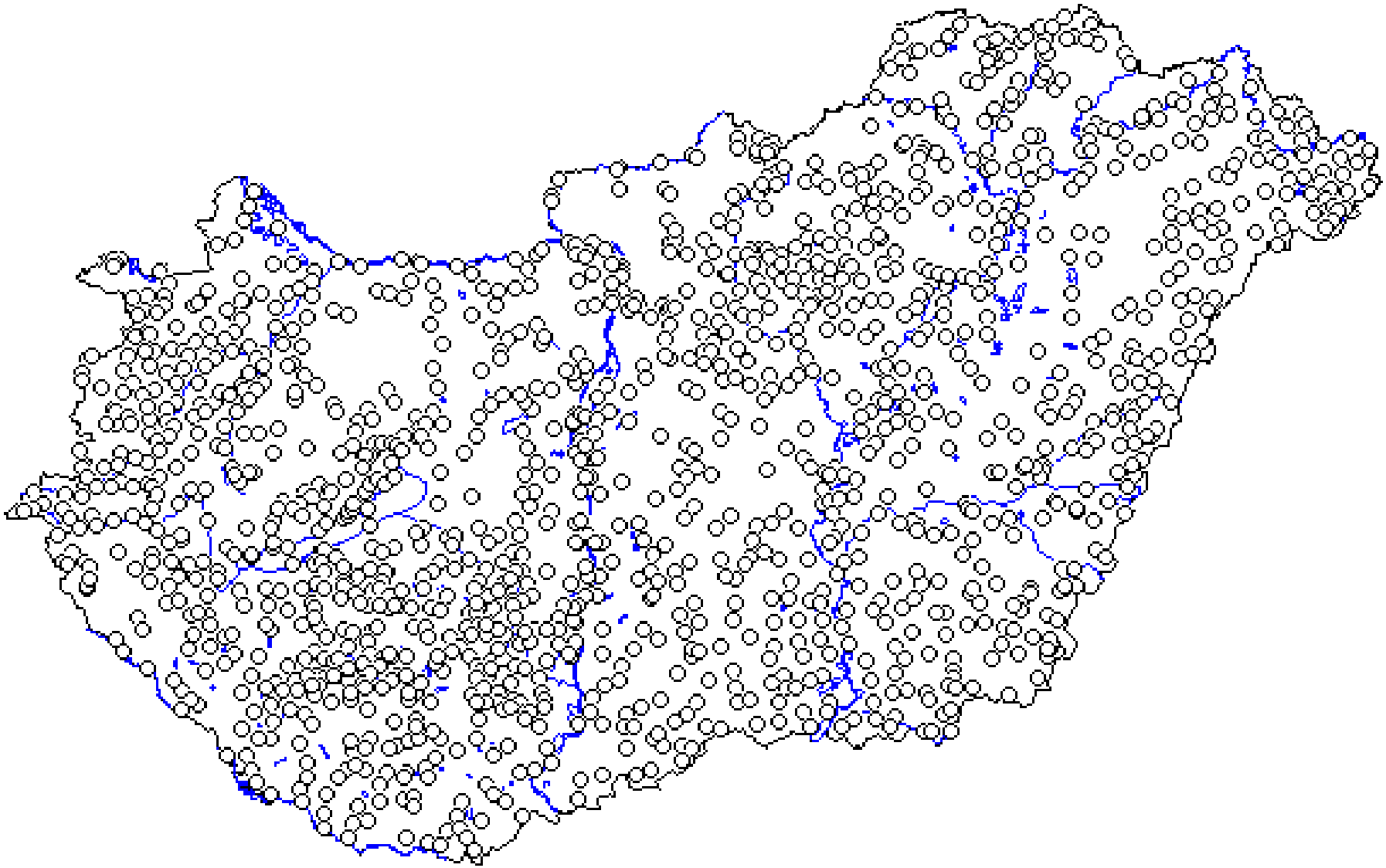
GROUNDWATER QUALITY IN HUNGARY

for 0-600 m depth, based on data of deep wells
(Standard MSZ 10/433-3)

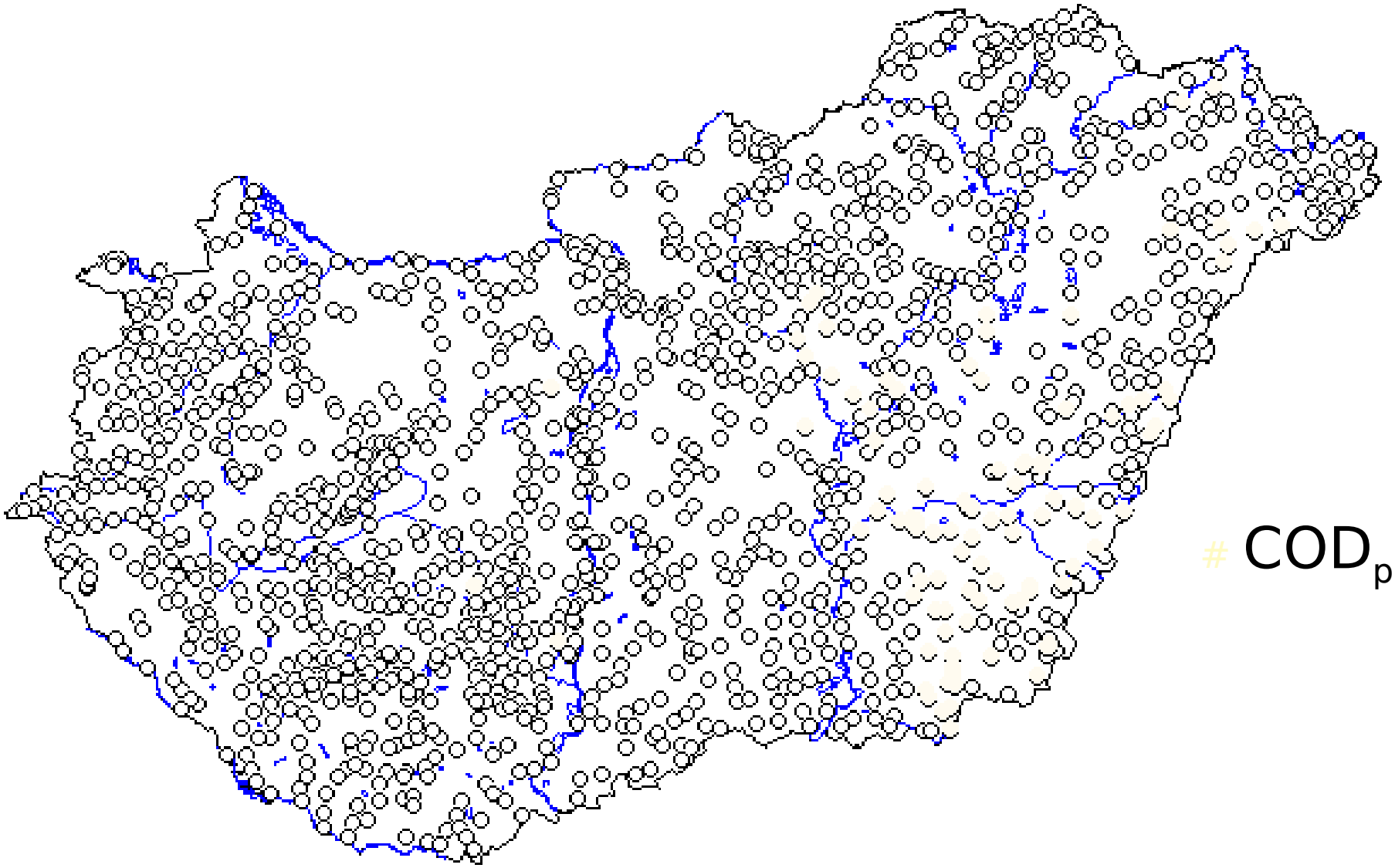


For water resource cooler than 30°C,
based on data available before July, 1984

ASSESSED WATERWORKS (WATER BASE – UNTREATED WATER)



GROUND WATER RESOURCES NOT IN CONFORMANCE WITH THE EU DIRECTIVE ON DRINKING WATER QUALITY



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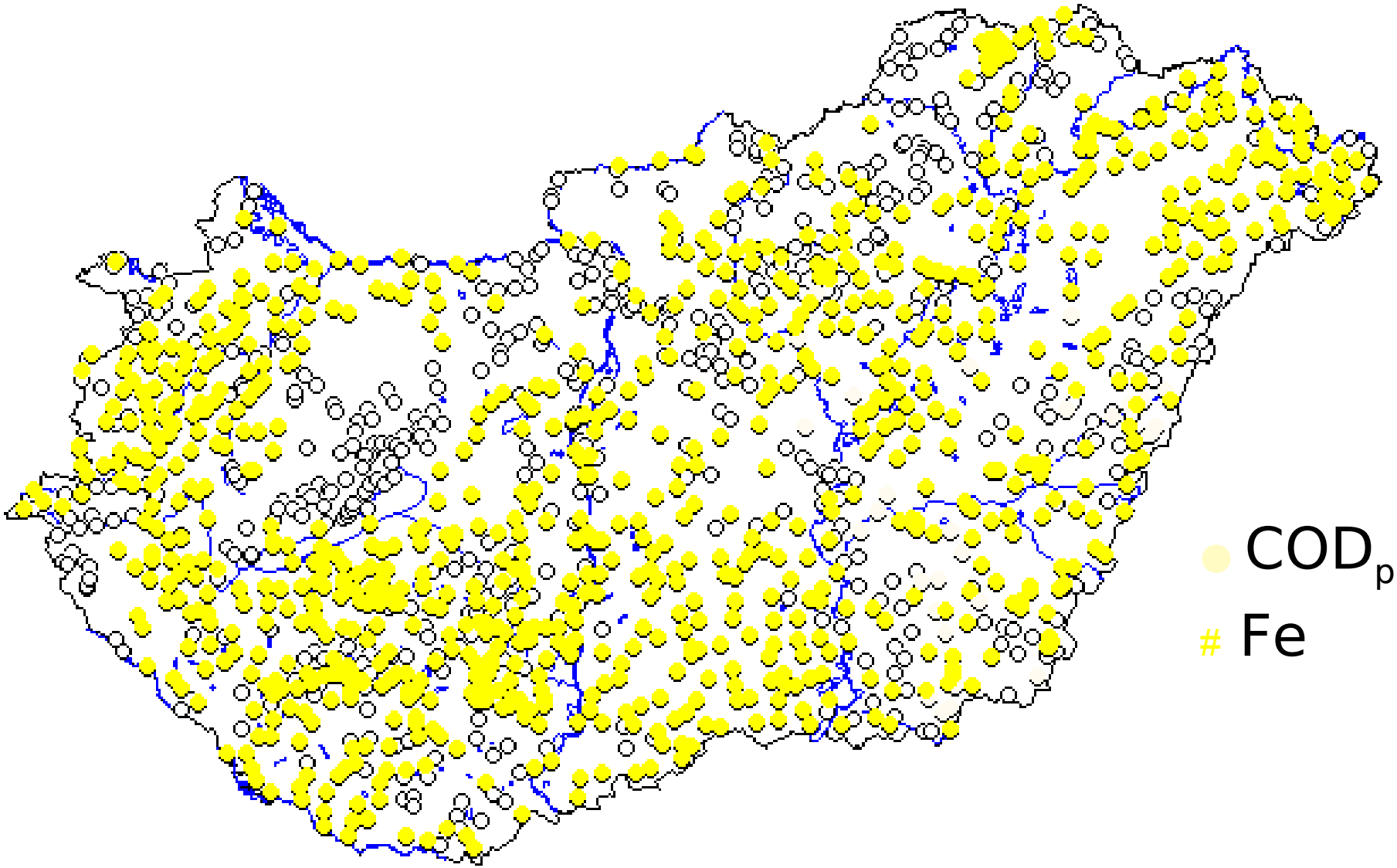

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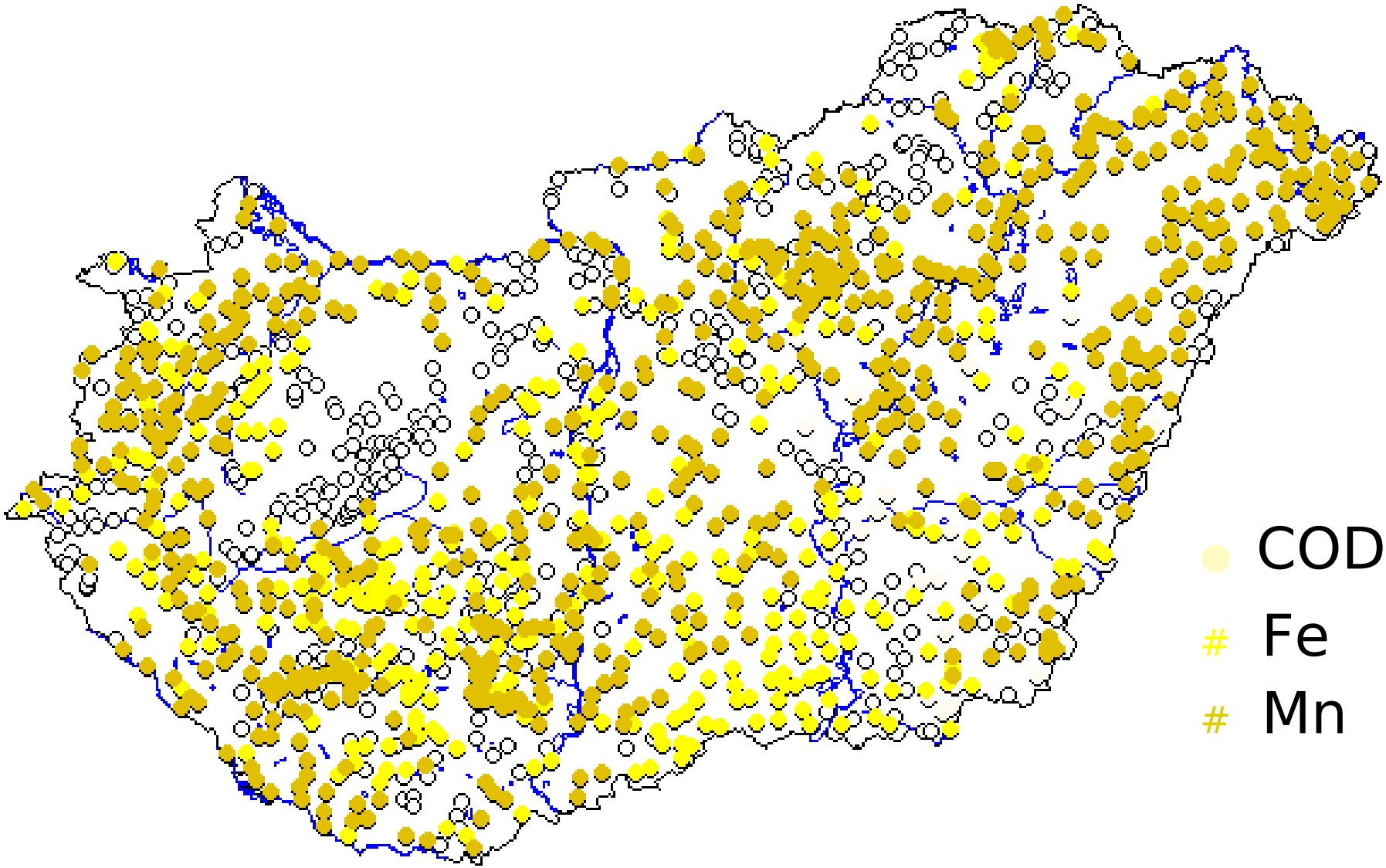

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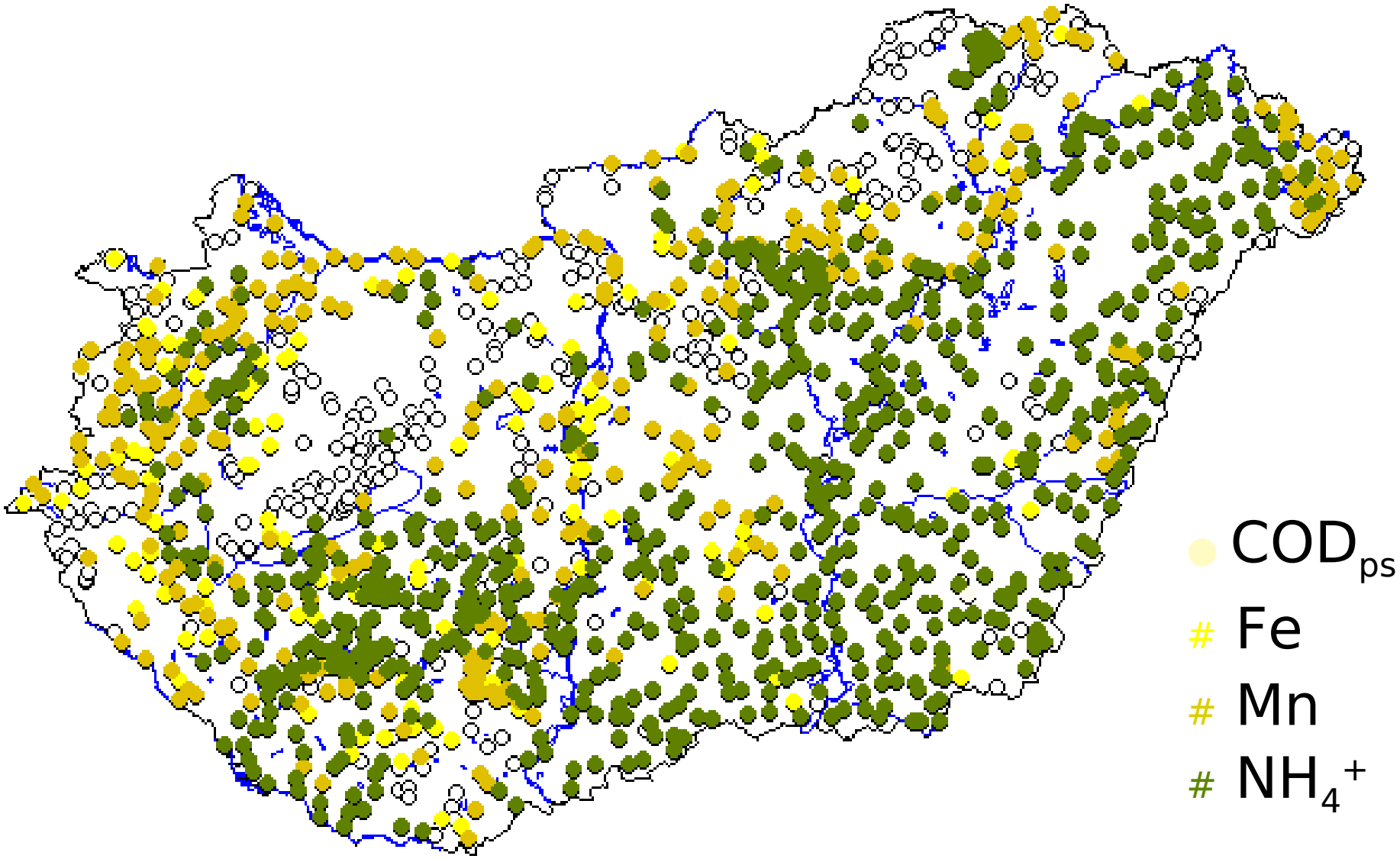

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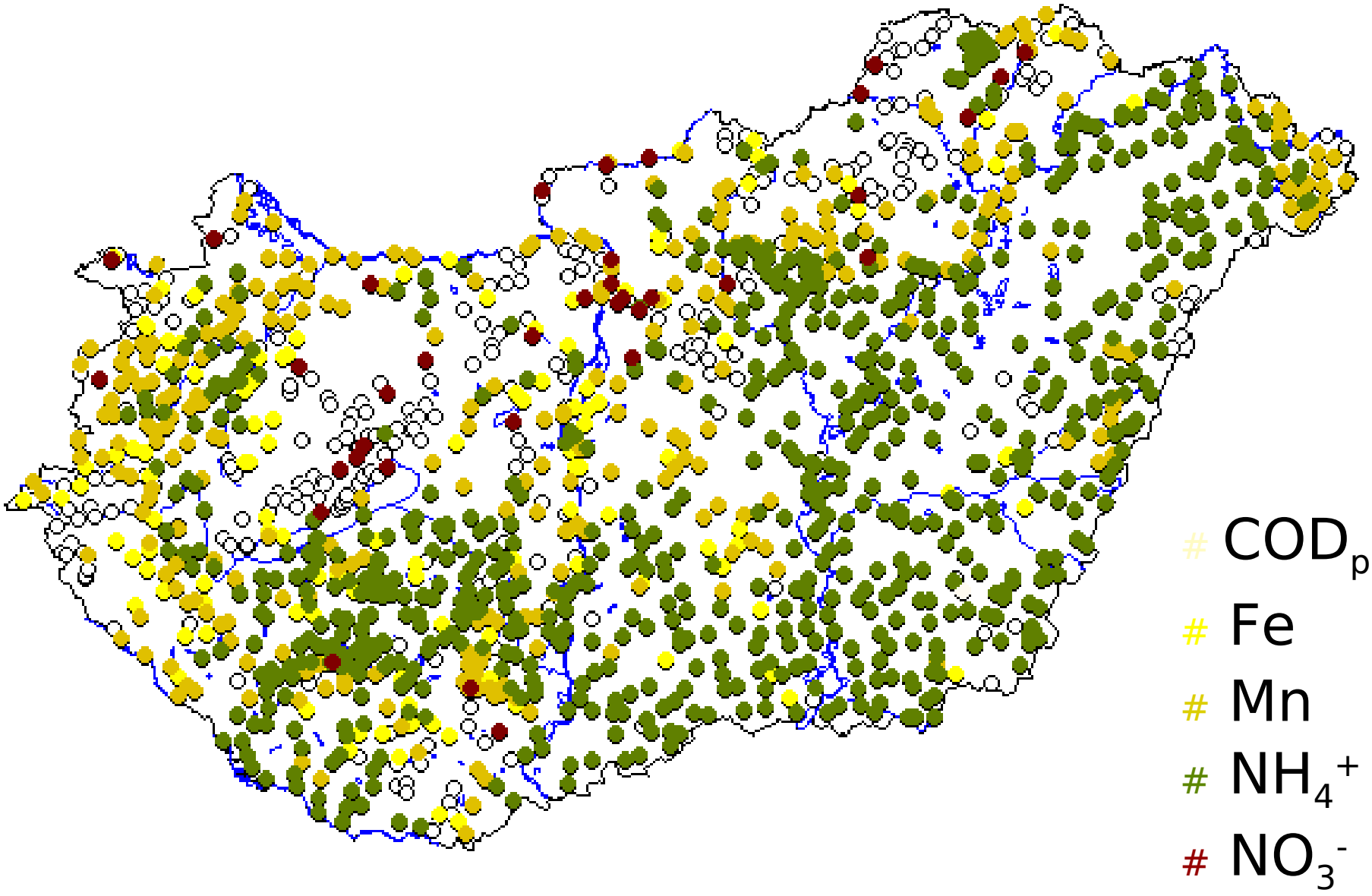

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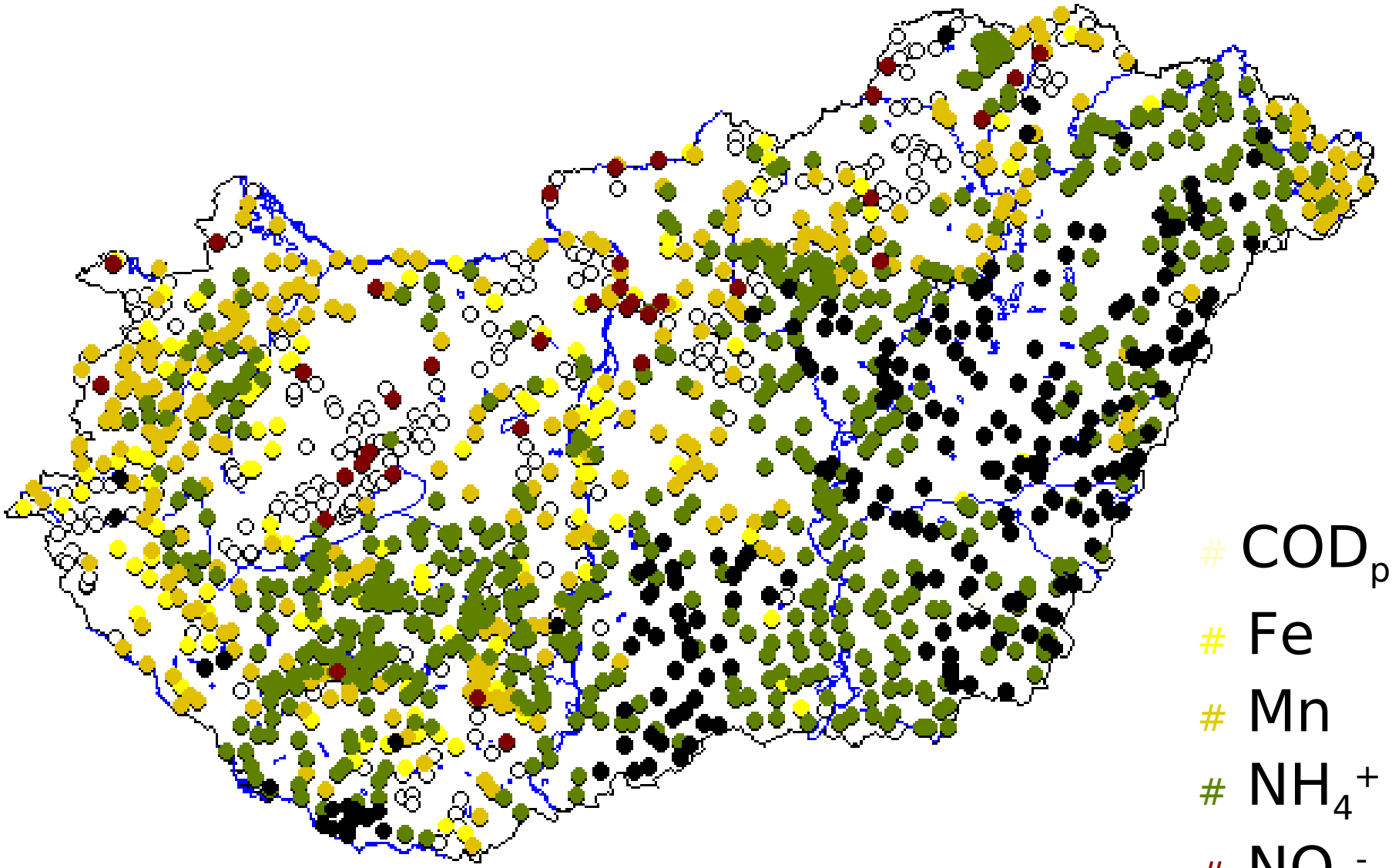
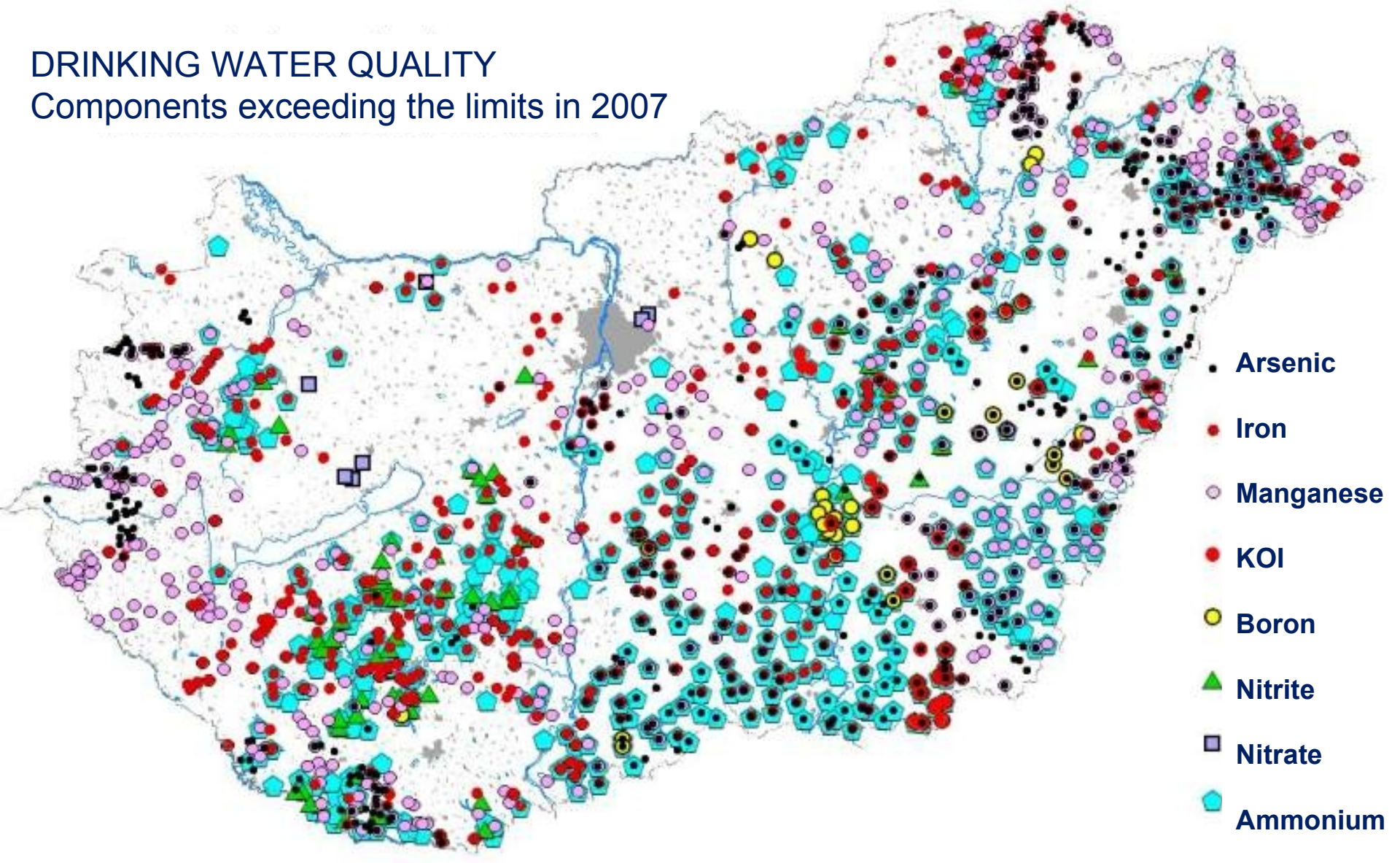


Waterworks where drinking water limits for given components are exceeded



Nitrate contamination

In the EU – significant problem (91/676/EGK – Nitrate Directive)

Government Decree 49/2001. (IV. 3.) on protection against the nitrate contamination of waters from agricultural sources, modified by the Gov. Decr. 81/2007. (IV.25.)

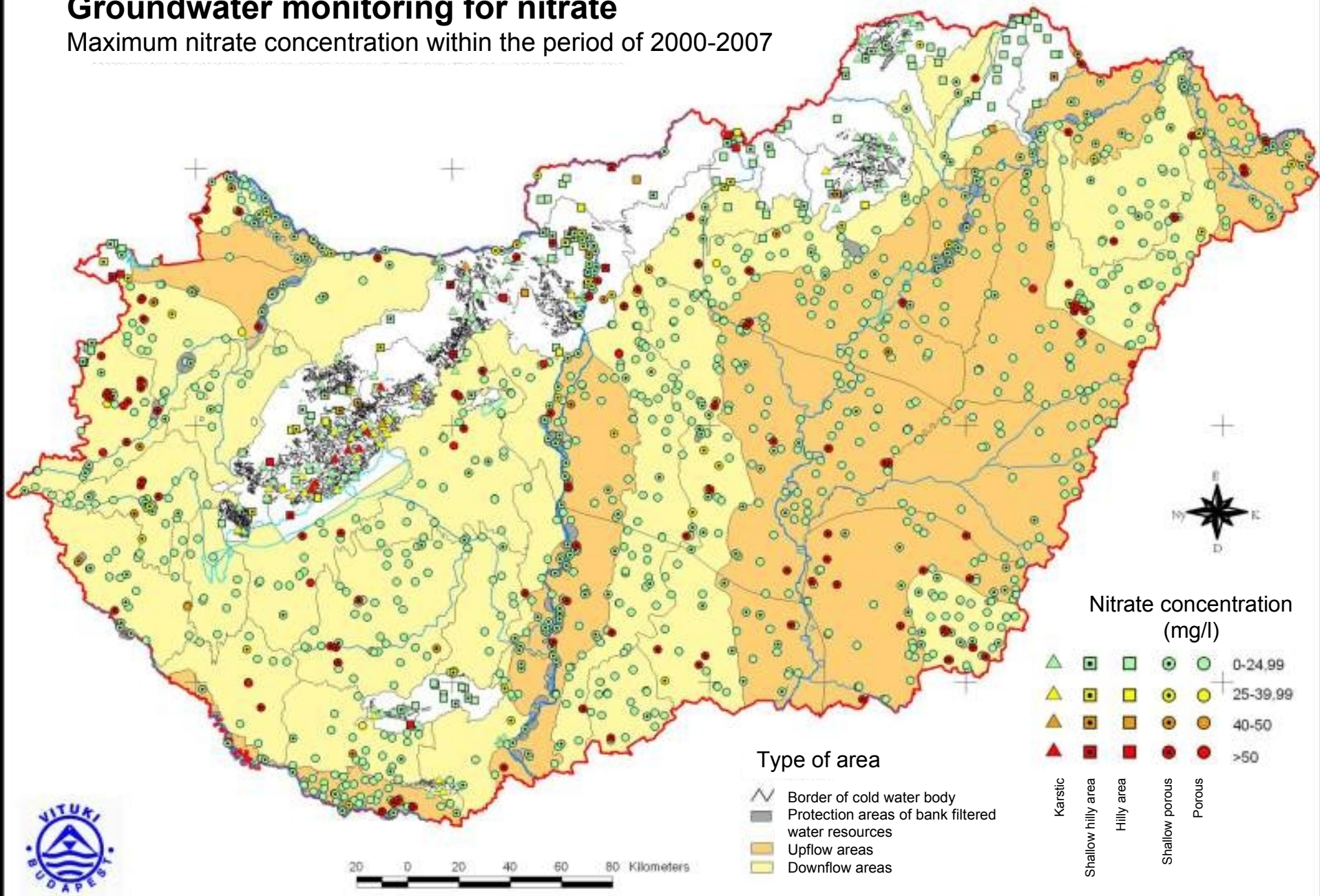
Limit value for ground water: 50 mg/l

Nitrate in groundwater, in Hungary:

Nitrate concentration has been increasing since 1950s (towns/villages, intensive animal husbandry, arable lands – fruit plantations)
Based on the data of VITUKI Environmental Protection and Water Management Research Institute for 2008, one fourth of the shallow aquifers have nitrate concentration above the limit of 50 mg/l

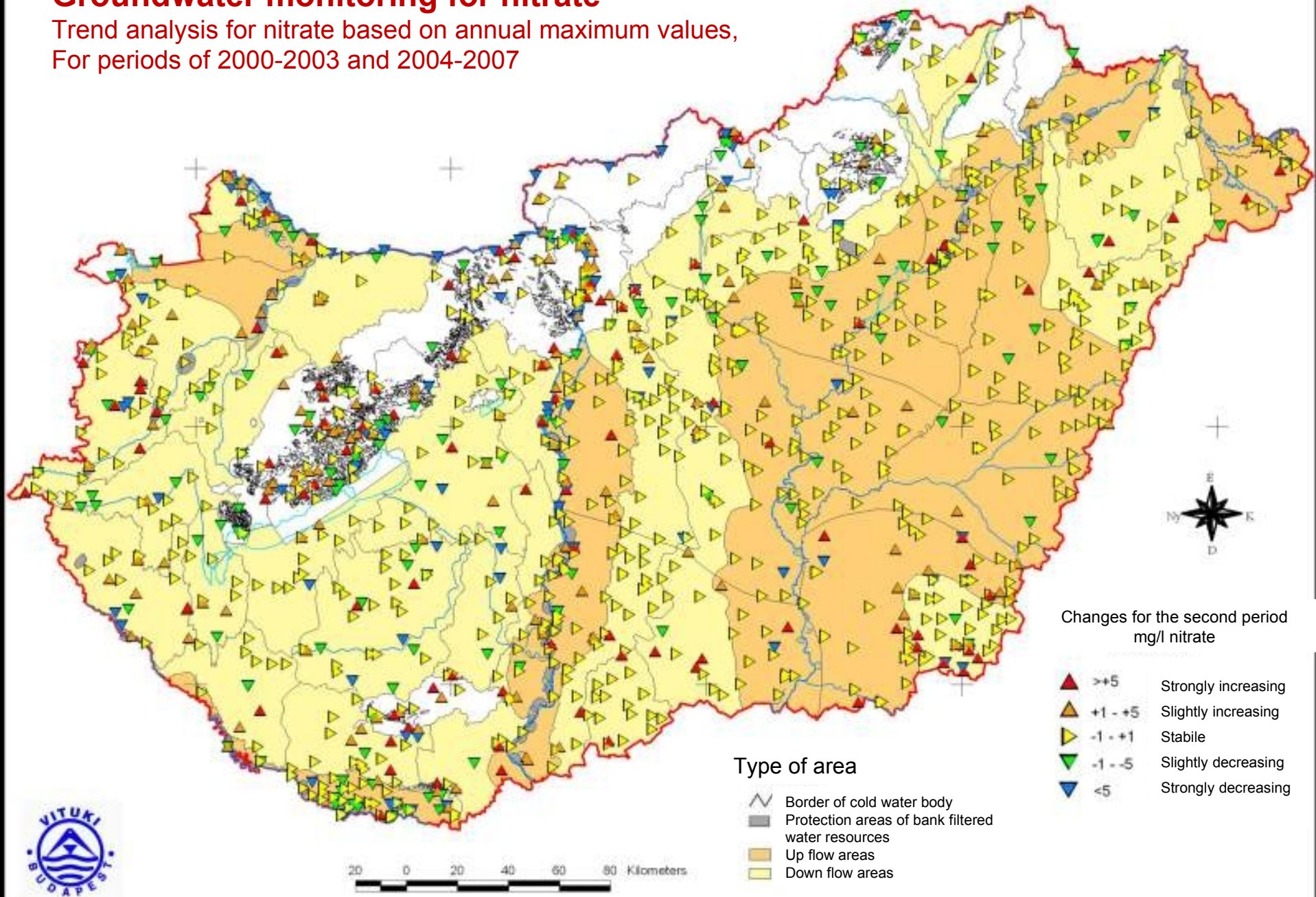
Groundwater monitoring for nitrate

Maximum nitrate concentration within the period of 2000-2007



Groundwater monitoring for nitrate

Trend analysis for nitrate based on annual maximum values,
For periods of 2000-2003 and 2004-2007



EU Directive on Ground Water Protection (WFD and its subsidiary)

According to the WFD and is subsidiary, a ground water body is in good condition, if

- **contaminant above limit does not pose risk on any receptors**

  (drinking water supply, aquatic ecosystem, terrestrial ecosystem)

- **within the water body, ratio of contamination is less than 20% (in certain situations, 50%)**

- **tendency in decreasing water quality cannot be shown**

Today, the subsidiary directive declares two environmental limit values: for nitrate, 50 mg/l, and for pesticide 0.1 µg/l

Emission norms

- Joint Decree of Hungarian Ministry of Environment and Water, Ministry of Health, and Ministry of Agriculture and Rural Development, No. 6/2009. (VI. 2.) on limit values for the quality protection of ground water and geological media

- Decree of the Hungarian Ministry of Environment No. 28/2004. (XII. 25.) on the limit values for the discharges of water contaminants, and rules on their application (superseding Decree No. 3/1984 (II.7.))

- Governmental Decree No. 204/2001 (X. 26.) on Sewage fines

- Governmental Decree No. 49/2001 (IV.3.) on protection of water against nitrate pollution from agricultural source

Controlling wastewater dischargers

- Measured components
  - Organic parameters (COD, BOD, CCl_4-extract)
  - Nutrient forms (total-P, PO_4-P, total-N, NO_3-N, NO_2-N, NH_4-N)
  - Heavy metals
- Measurement frequency: at least four times per year (+ self control tests – OSAP data reporting)
- Measurement is carried out by the local environmental authority
- Only the „suspect” components are measured
- Principles of the new limit value system
  - Not the concentration, but the load is in focus
  - Limit values correspond to the buffering ability of the aquatic environment
  - Vulnerable water resources are taken into consideration

Limit values stated in the Decree of the Hungarian Ministry of Environment and Water no. 28/2004. (25.12.), for the 3+1 categories

Component	Special (previously I.)	Vulnerable (previously II.)	Temporary	Normal (previously III-VI.)
pH	6,5-8,5	6,5-9	6,5-9	6,5-9
COD_{Cr} g/m³	50	100	75	150
BOD_5 g/m³	15	30	25	50
NH_4-N g/m³	2	10	5	20
Total N g/m³	20	35	25	55
Total P g/m³	0.7	5	5	10
Solvent extr. g/m³	2	5	5	10
Suspended, g/m³	35	50	50	200

Place of the water resource protection in the watershed management plans

In addition to the surface and ground water, the Water Frame Directive focuses on the protected areas as well.

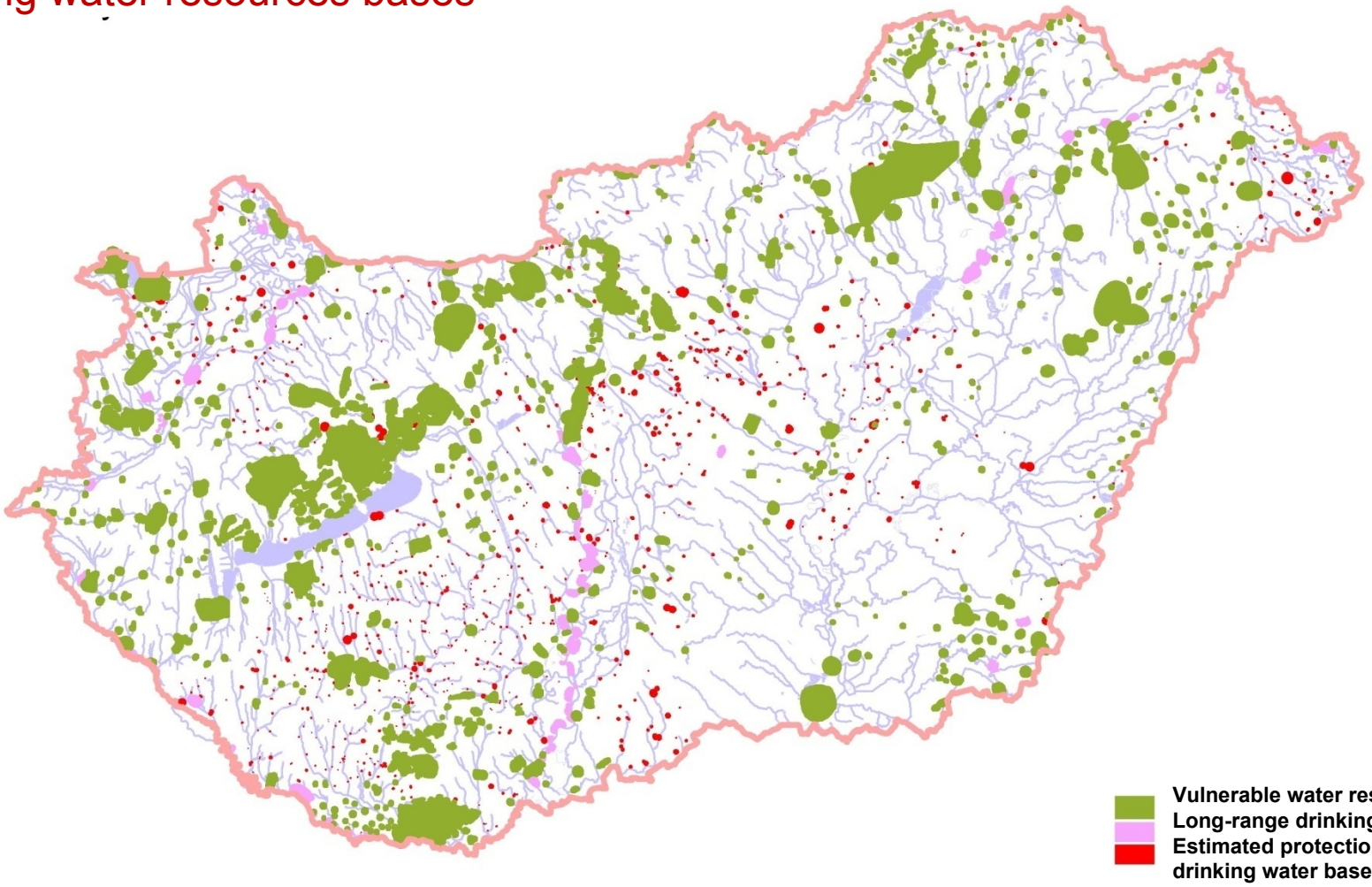
According to the WFD, the following are protected:

- groundwater protection zone and area for drinking water supply,
- nutrient and nitrate sensitive areas,
- natural places for swimming and recreation,
- protected natural areas,
- surface water for assuring living conditions for fish

Basic actions in the Water Management Plan aiming improvement in groundwater quality:

- Sewage Program
- National Implementation Program on Individual Water Treatment
- Controlling agricultural use of sewage sludge (Directive on Sewage Sludge)
- Actions in towns/villages (recultivation of waste deposits, drainage of rainwater, good water management practice in the town/village)
- Nitrate Action Program
- Modernization of big farms for animal husbandry
- Change in cultivation for areas affected by erosion
- National Environmental Clean-Up Program
- Drinking Water Quality Improvement Program
- Vulnerable Drinking Water Source Securing Program

Protective zones of vulnerable and long-range drinking water resources bases



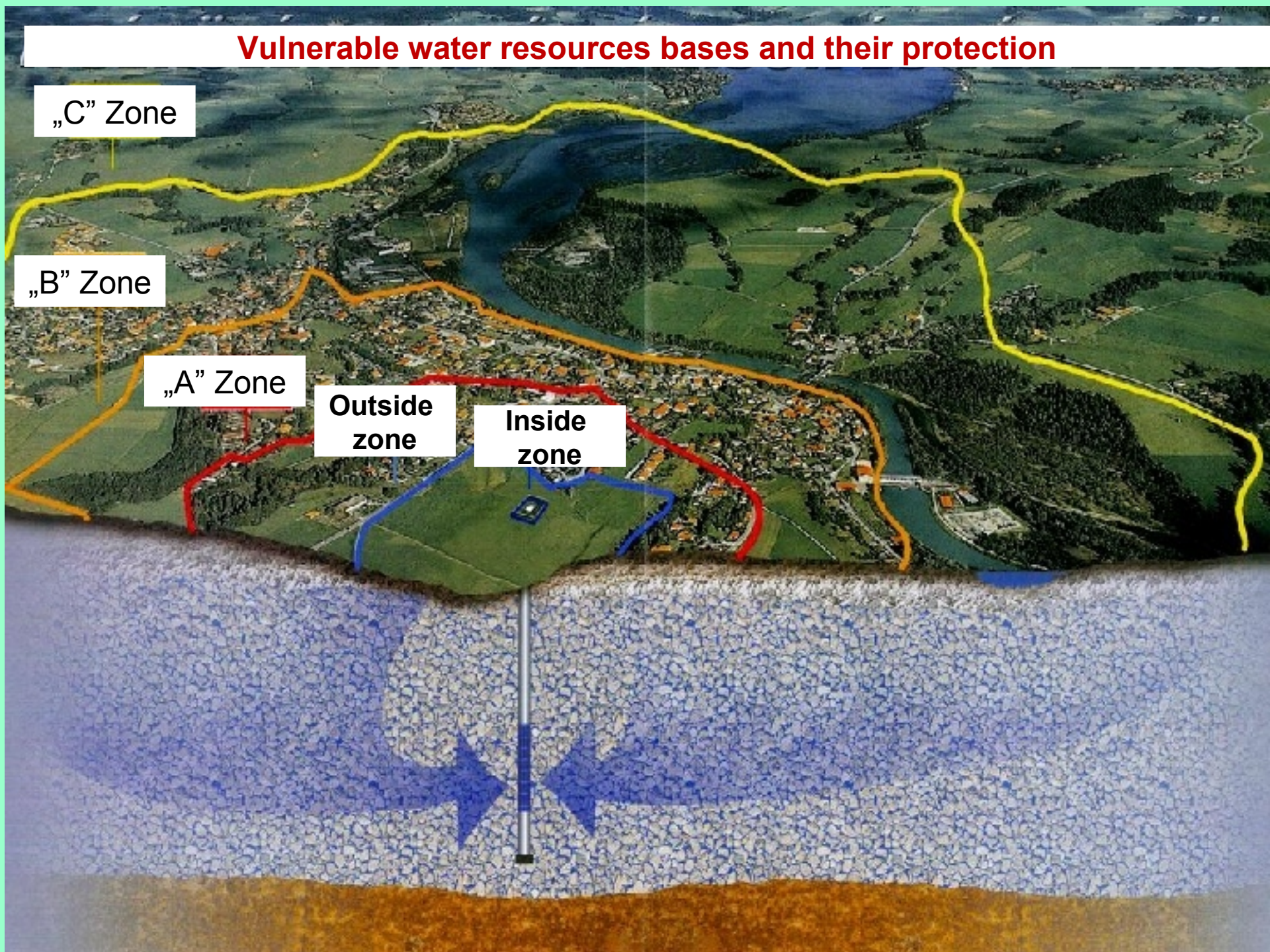
Gov. Decree No. 123/1997. (VII.18.) about the protection of water bases and facilities serving drinking water supply

According to the edict, protection areas, protection profiles have to be created sized on the bases of he approaching time in order to protect water bases

- inner protection area (20 days)
- outer protection area (180 days)
- hydrogeological protection area, zone „A” (5 years)
- hydrogeological protection area, zone „B” (50 years)
- hydrogeological protection area, zone „C” (total refilling area)

Limitation of use of immovable estates in the different zones (list of forbidden and conditionally permitted activities)

Vulnerable water resources bases and their protection



Programme for the protection of drinking water bases

- 90% of the drinking waters in Hungary originate from subsurface waters. Most of the drinking water bases are in vulnerable environment and were not protected during the last decades.
- The protection of the water bases is a highly emphasized task in accordance with the edict No. 2249/1995. (VIII. 31.).
- In the framework of the Water Base Action Programme of the vulnerable water bases of Hungary were determined (628).
- The survey of the state of the water bases was started according to a standard schedule in 1997.
- The diagnostic tasks of the water base protection process were determined according to the programme for the protection of drinking water bases.

In case of subsurface water resources

- Function of the inner protection profile:

  Direct protection of the objects and water stocks from impairment and pollution.
- Function of the outer protection profile:

  Protection against non-decomposing, bacterial and other decomposing pollutants.
- Function of the hydrogeological protection profile:

  Protection against non-decomposing pollutants in the whole refilling zone.

In case of long-term and non-functioning subsurface water bases

- The hydrogeological protection profile or the „A” zone of the protection area have to be determined only if the concrete location, depth and capacity of the planned water retrieval are known.
- The outer „B” zone of the protection area have to be always determined.

Process of drinking water base protection

- Phase of diagnostics
- Phase of the creation of the conditions of protection
- Phase of protection maintenance

Process of drinking water base protection
(I. Phase of diagnostics)

1. Delimitation of the area the refilling zone of the water retrieval. Determination of the predicted protecting area by modelling.
2. Reviewing the point-like and diffuse pollution sources.
3. Design of the monitoring system in order to get information on the status and its potential changes of the water stocks.
4. Creation and testing of the monitoring system.
5. Delimitation of the hydrogeological protection area.

Process of drinking water base protection (I. Phase of diagnostics)

6. Status assessment and forecast study

- Differentiating the real and the potential pollution sources
- In case of real pollution sources extension of the examinations can be necessary (determination of the pollution source)
- Quantification and qualification of the status of the water base

7. Elaboration of the plan for ensuring the protection of the water base

Process of drinking water base protection
(II. Phase of ensuring the safety of water bases)

8. Economical analysis of different water retrieval variations

9. Selection from the following alternatives:

- Stopping the polluting activity, maintenance of the water retrieval
- Active water base protection
- Decrease of the extent of the water retrieval
- Treatment of the retrieved water
- Dilution of the retrieved water
- Use of an alternative water source
- Other

Process of drinking water base protection
(II. Phase of ensuring the safety of water bases)

10. Creation of the hydrogeological protection area

11. Stopping the real pollution sources:

- indemnification
- Stopping the proved polluting activities
- Compromises with the land users
- Other

Process of drinking water base protection
(III. Phase of protection maintenance)

12. Safe operation

DESIGN

- Review of the monitoring network
- Determination of the necessary frequency of the status assessments (2-3 years)

OPERATION

- Continuous operation of the monitoring system
- Periodic status assessments
- Implementation of the necessary measures

According to the Water Framework Directives of the EU, the environment of drinking water retrievals exceeding the capacity of 10 m^3 per day or supplying over 50 people have to be protected.

In Hungary the public drinking water bases fall into this category.

By the completion of the subprogram KEOP2.2.3 (until the end of 2013) the proper protection profiles and areas have to be determined in case of each drinking water retrieval.

Financing of the water base protection

KEOP

Priority: Proper use of waters

2.2.3 Drinking water base protection: KEOP-2009-2.2.3/A Diagnostic examination of functioning water bases

2.2.3/B Ensuring the safety of functioning water bases

2.2.3/C Diagnostic examination of future water bases (ready)

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Thank you for your attention!

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