Recent methods, input data and modeled nutrient emissions and potential of measures to reduce these in the Danube catchment

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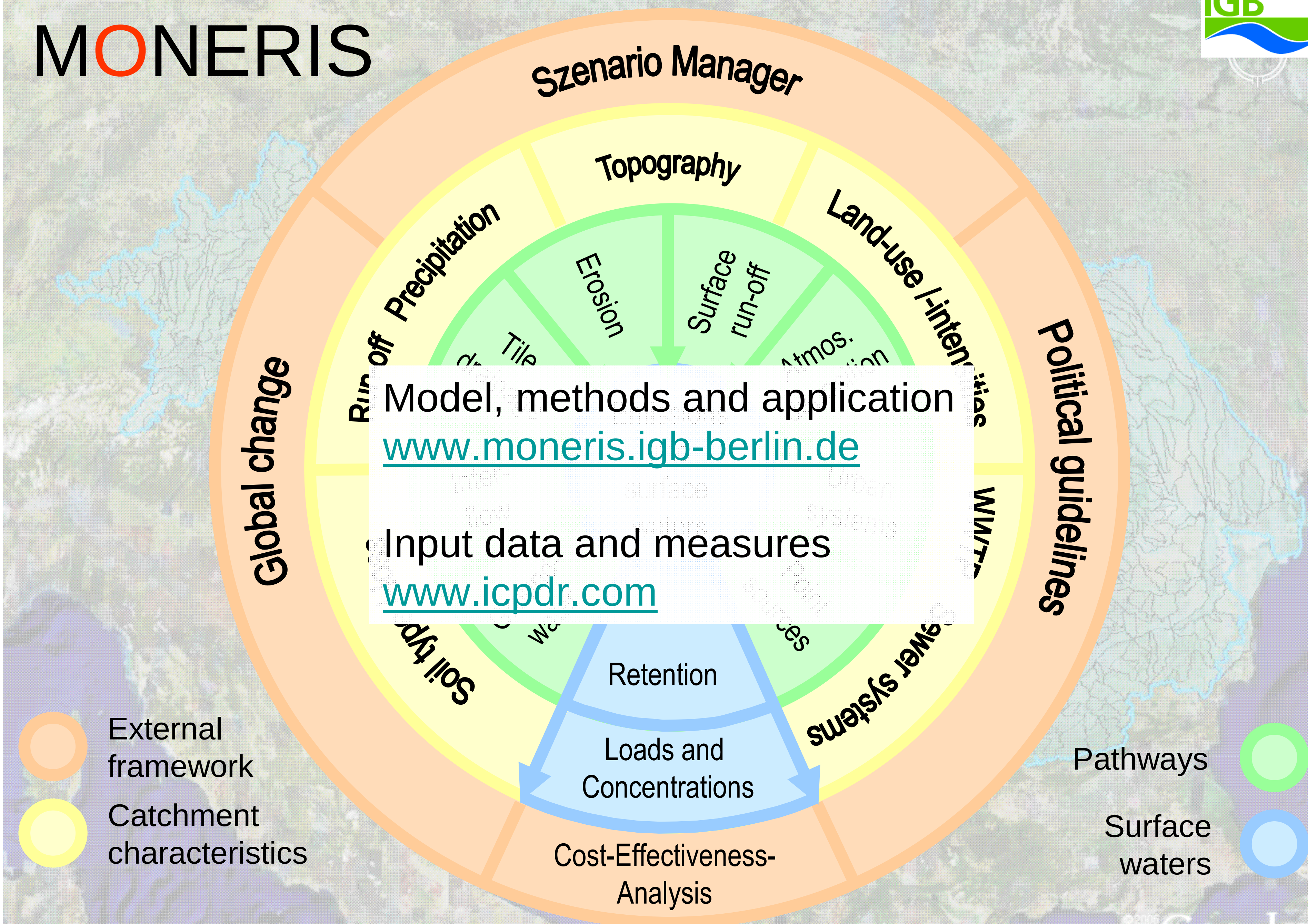
MONERIS



Model, methods and application
www.moneris.igb-berlin.de

Input data and measures
www.icpdr.com

Used data set

Input data	Description data source
River and lakes	• CCM River and Catchment Database, JRC, 2007
Precipitation	• Global Precipitation Climatology Centre (GPCC)
Land use	• Corine 2006 and Global Land Cover 2000 (Hartley et al., 2006)
Drainage	• Artificially Drained Agricultural Areas – Univers. of Frankfurt (2005)
Atmos. deposition	• EMEP - European Monitoring and Evaluation Programm
Evapo-transpiration	• Ahn & Tateishi (0,5*0,5° grid) potential evapotransp iration data set
Elevation	• SRTM data V1, CIAT (2004) - (90*90 m)
Population	• Gridded population, SEDAC (NASA), adjusted to match UN totals
Hydrogeology	• Map of BGR / RIVM Niederlande
Soil type	• Digital Soil Map of the World – FAO
Soil loss	• soil loss map derived for different slope classes according to USLE
Discharge	• calibrated on basis of monitoring data and evapo-transpiration
Monitoring data	• Provided by countries
Water temperature	• mean annual water temperature from all monitoring
Connected inhabitants	• EUROSTAT data on connection rates, updated where available
DCTP discharge type	• is calculated on basis of the geological conditions per AU
WWTP	• inventory according to UWWTD (91/271/EEC)
P /N-surplus	• calculated as country specific data according to FAO and OECD data
CS storage	• Estimated and discussed with countries

Model developements / corrections after last application of MONERIS to Danube river basin

Water surface area

•Approach has been re-calibrated with new data covering a wider range of river widths
→ Large water surface areas
→Increased direct atmospheric deposition and in-stream retention

Urban systems

•Combined sewer overflow – water component equation correct
•Approach to estimate share of DCTPs discharging via soil-groundwater-passage or directly to surface waters has been corrected
→error led to exactly the opposite share of connection types

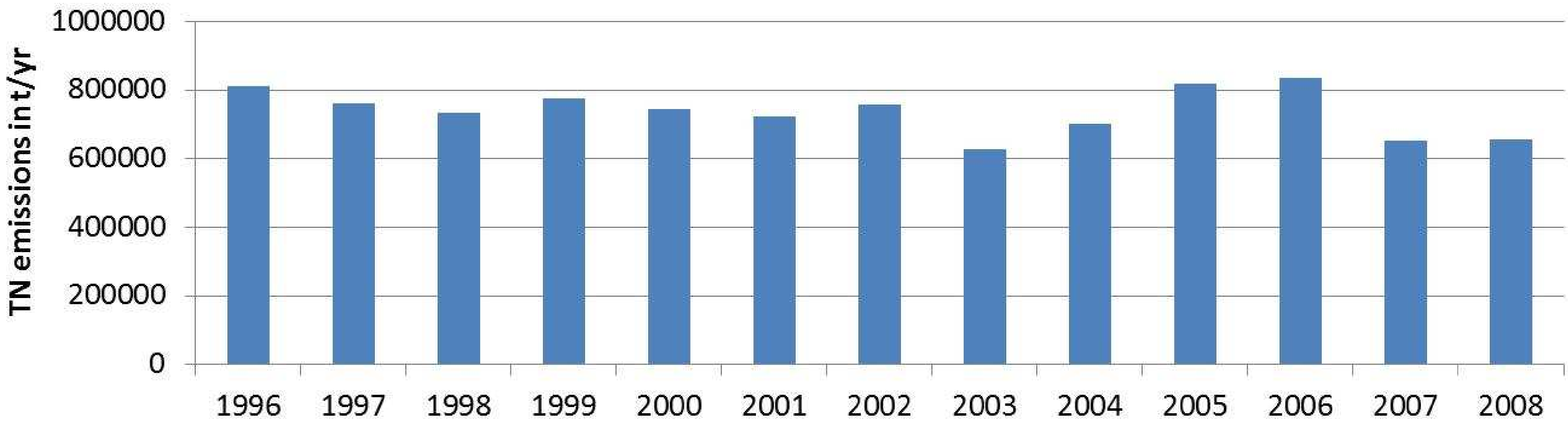
Erosion

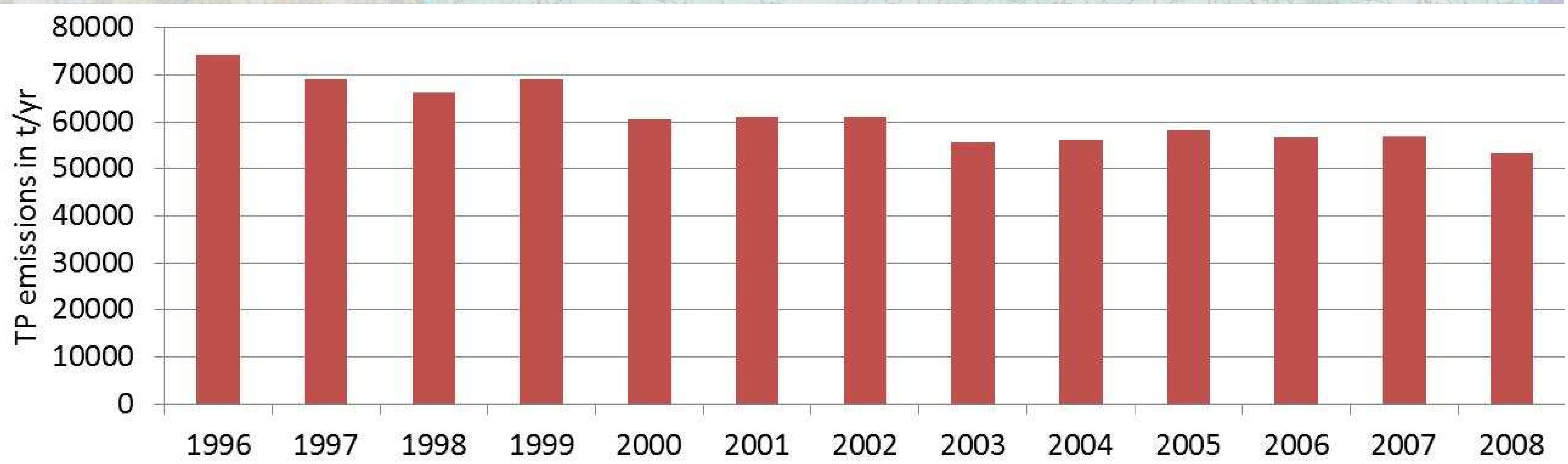
•SDR was only considered for arable land
•SDR is also introduced for natural covered area.
→reduction of nutrient emission via erosion

Surface runoff

•runoff from snow and ice-covered areas adapted according to Zessner et al. (2010)
→ Lower specific surface runoff and nutrient emissions from snow or ice covered areas

Nutrient emissions 1996-2008





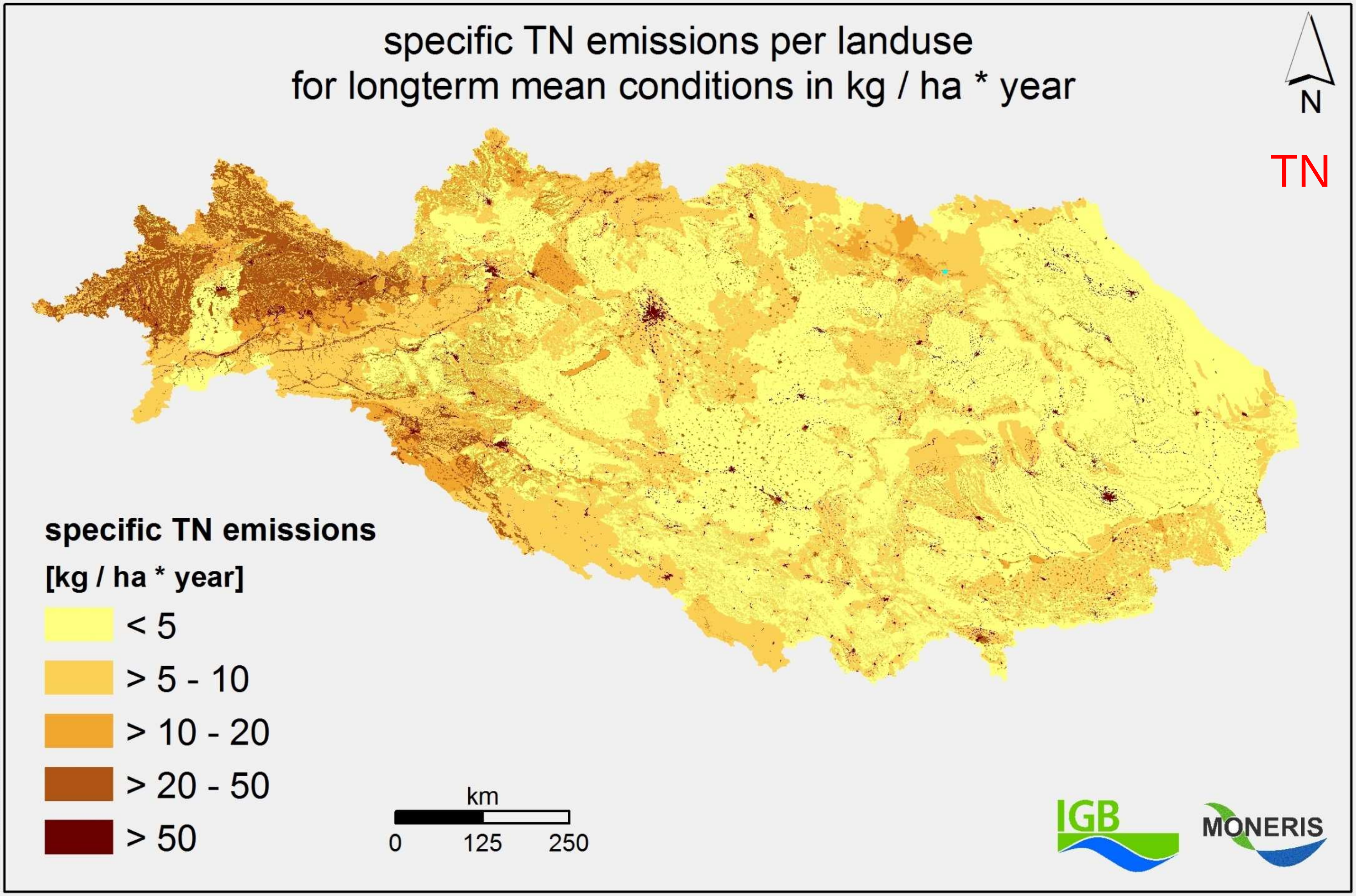
Share of TN Emissions – Pathways

	TN	TP
	Long term, 2005	Long term, 2005
	t/yr	t/yr
Atmos. Depo	13830	329
Overland flow	57595	377
Tile drainage	65531	462
Erosion	15435	11975
Groundwater	369990	4768
WWTP	130743	17823
Urban systems	80405	19253
Total	733530	54987

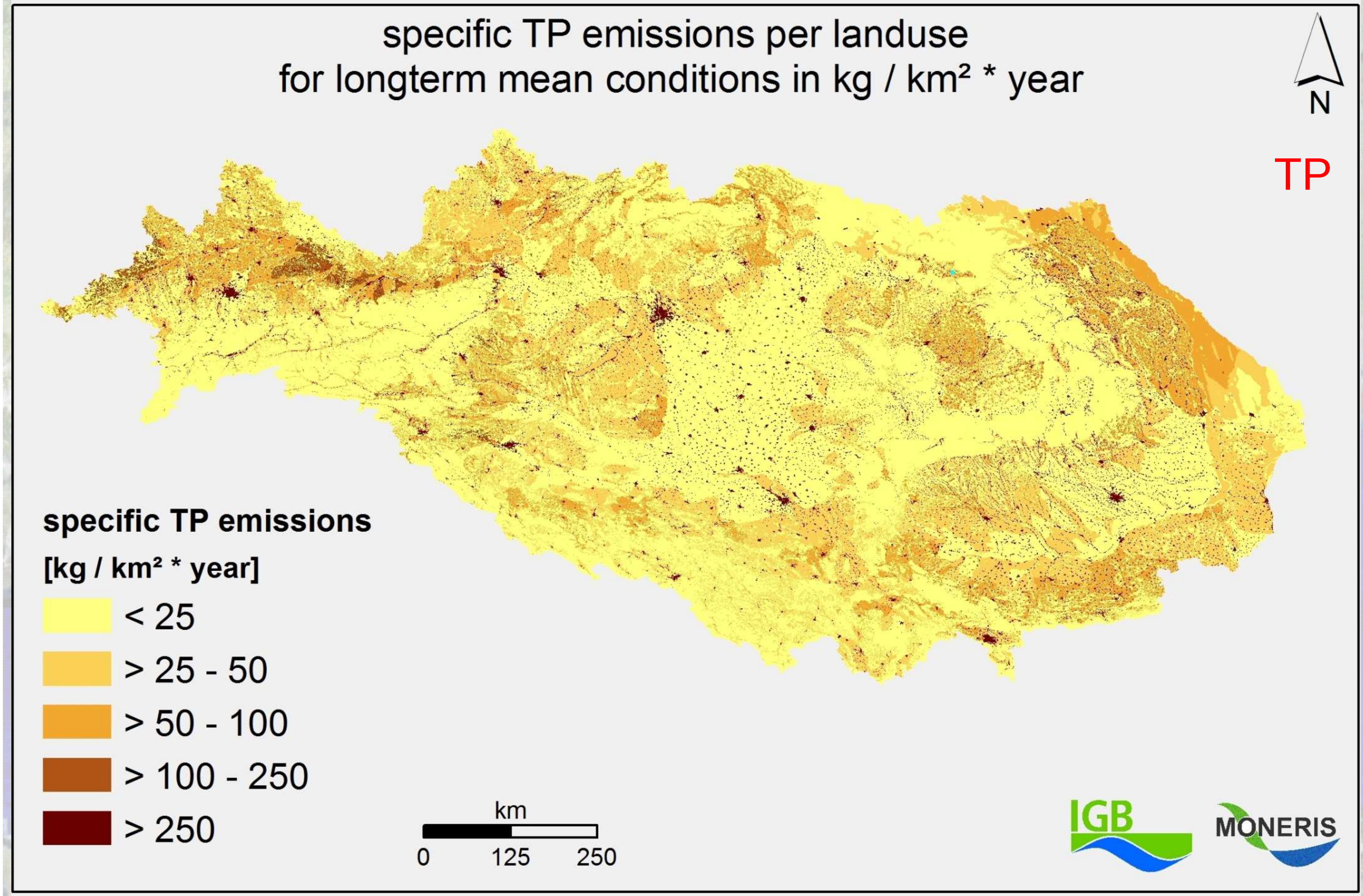
Source apportionment of TN and TP emissions at long term mean conditions

Sources		TN		TP	
		t/yr	%	t/a	%
natural background		46395	6	3997	7
urban sources		205975	28	37076	67
agricultural areas		199504	27	13435	24
...from these	NHy	72118	10		
	NOx	58977	8		
other areas	NHy	79932	11	479	1
	NOx	68593	9		

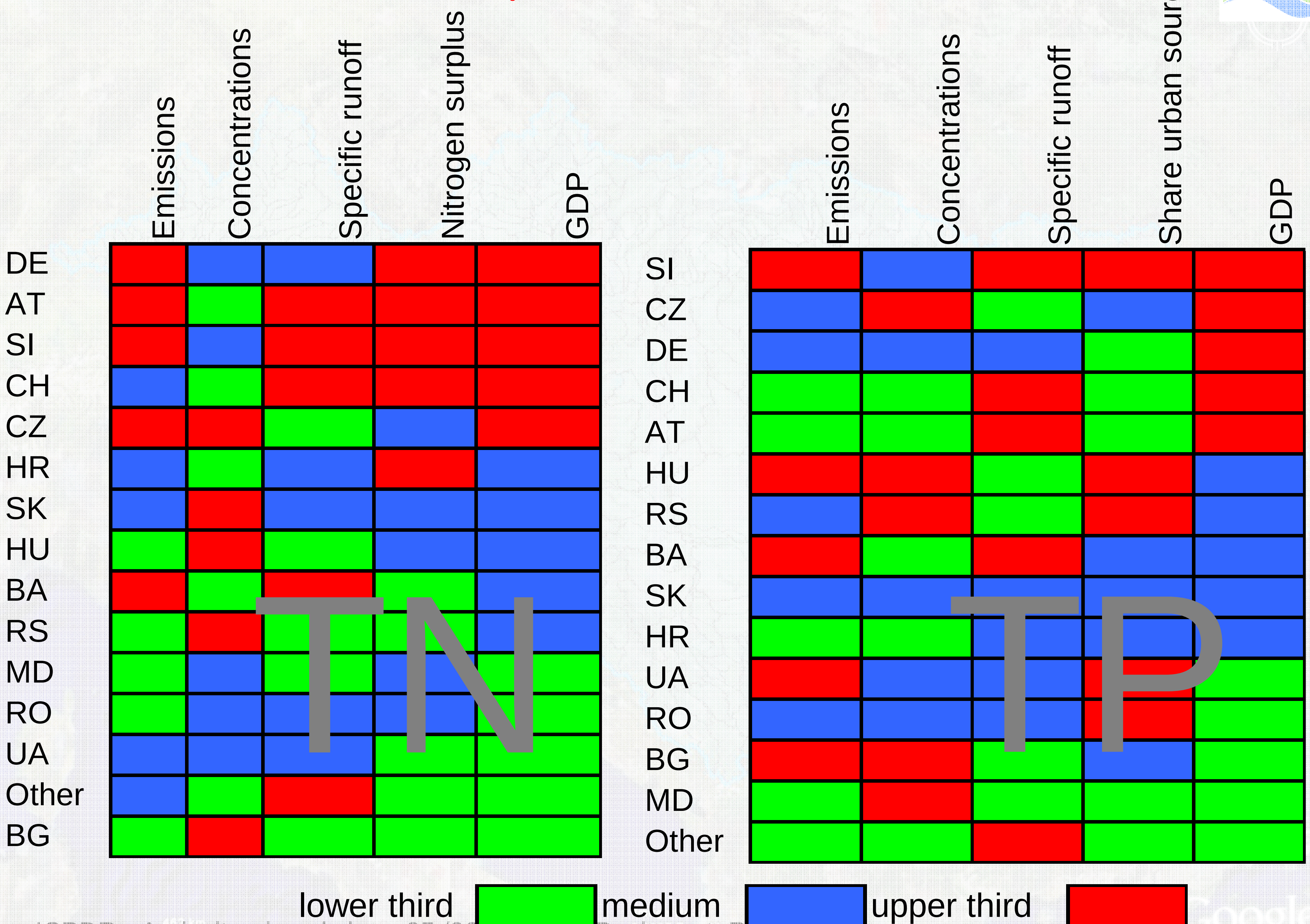
Nutrient emissions by land-use



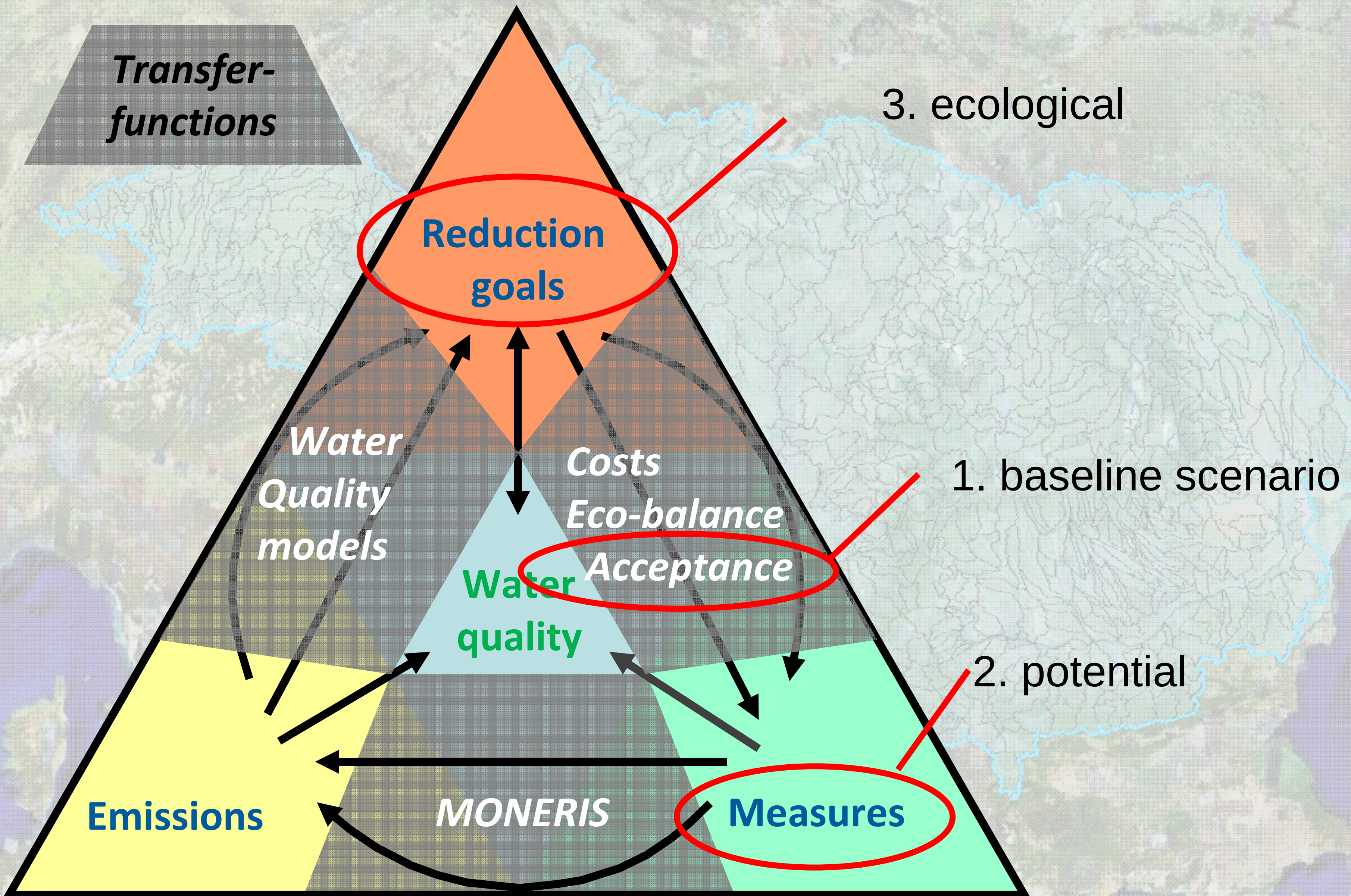
Nutrient emissions by land-use



Comparison of countries



The management puzzle



The management puzzle

Ecolgoical target concentrations:

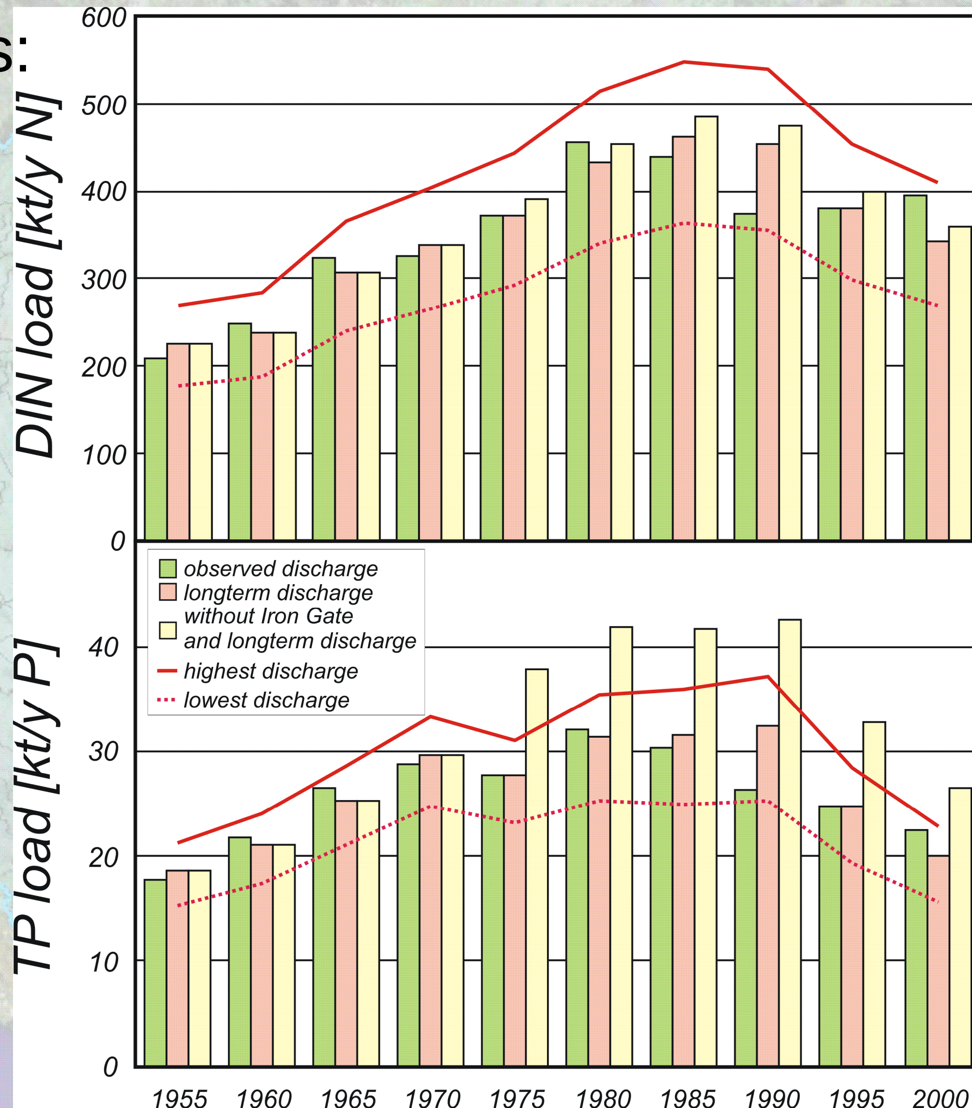
TN < 1.5   mg/l

TP < 0.09 mg/l

Load reduction for 2008 by:

TN - 17 %

TP - 18 %



The ecological target agrees with the state of 1960s for TP

Scenarios to reduce emissions

scenarios	DE	CH	AT	CZ	HU	SI	HR	SK	RS	BG	BA	MD	UA	RO	Other

Baseline (acceptance)

WWTP, N-surplus
Most realisitc scenario, developed by countries

potential

additional moderate measures
Soil loss, catch crops, sewage systems

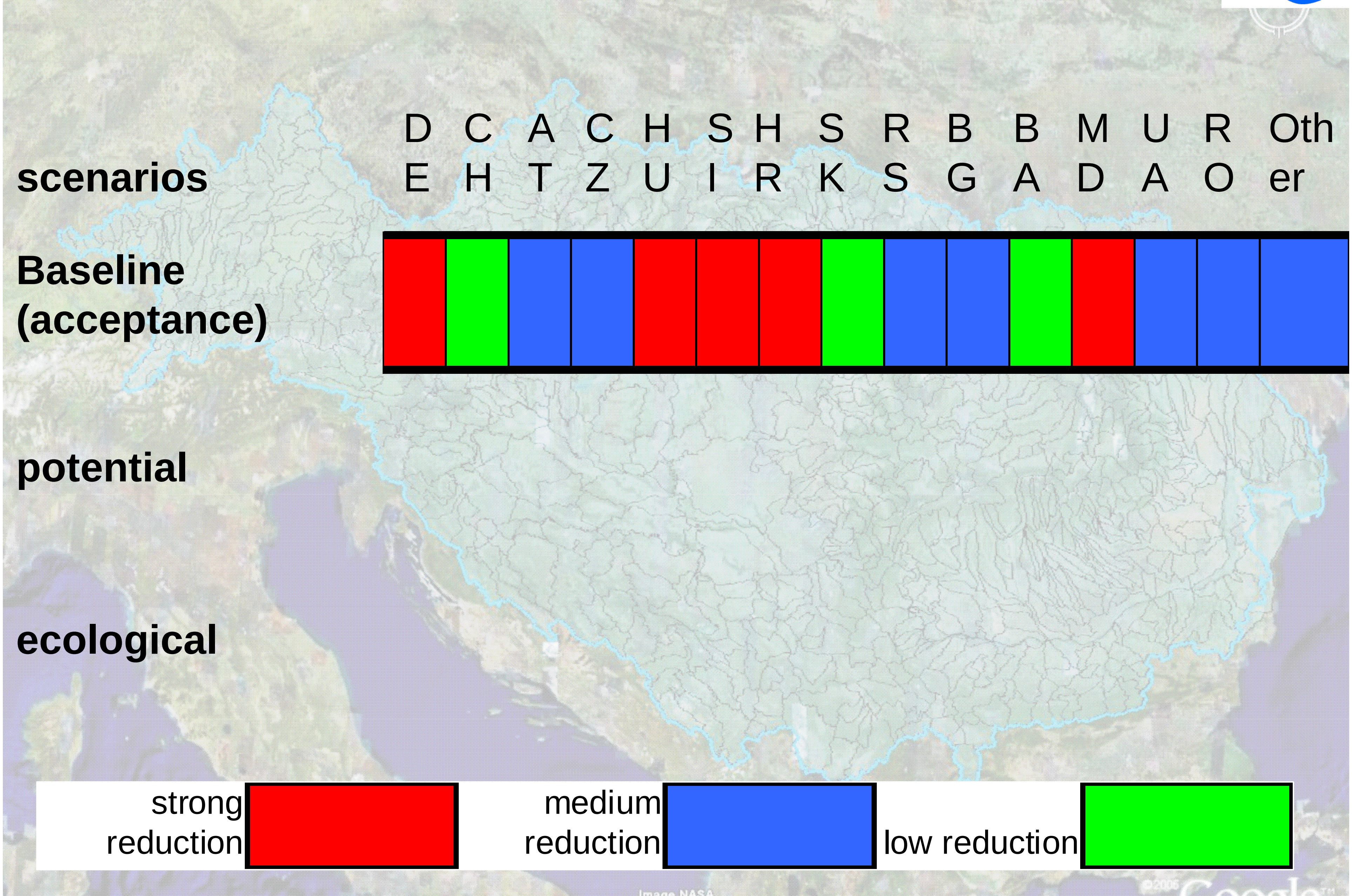
ecological

max. concentrations in sub-catchments to meet max. concentration at outlet

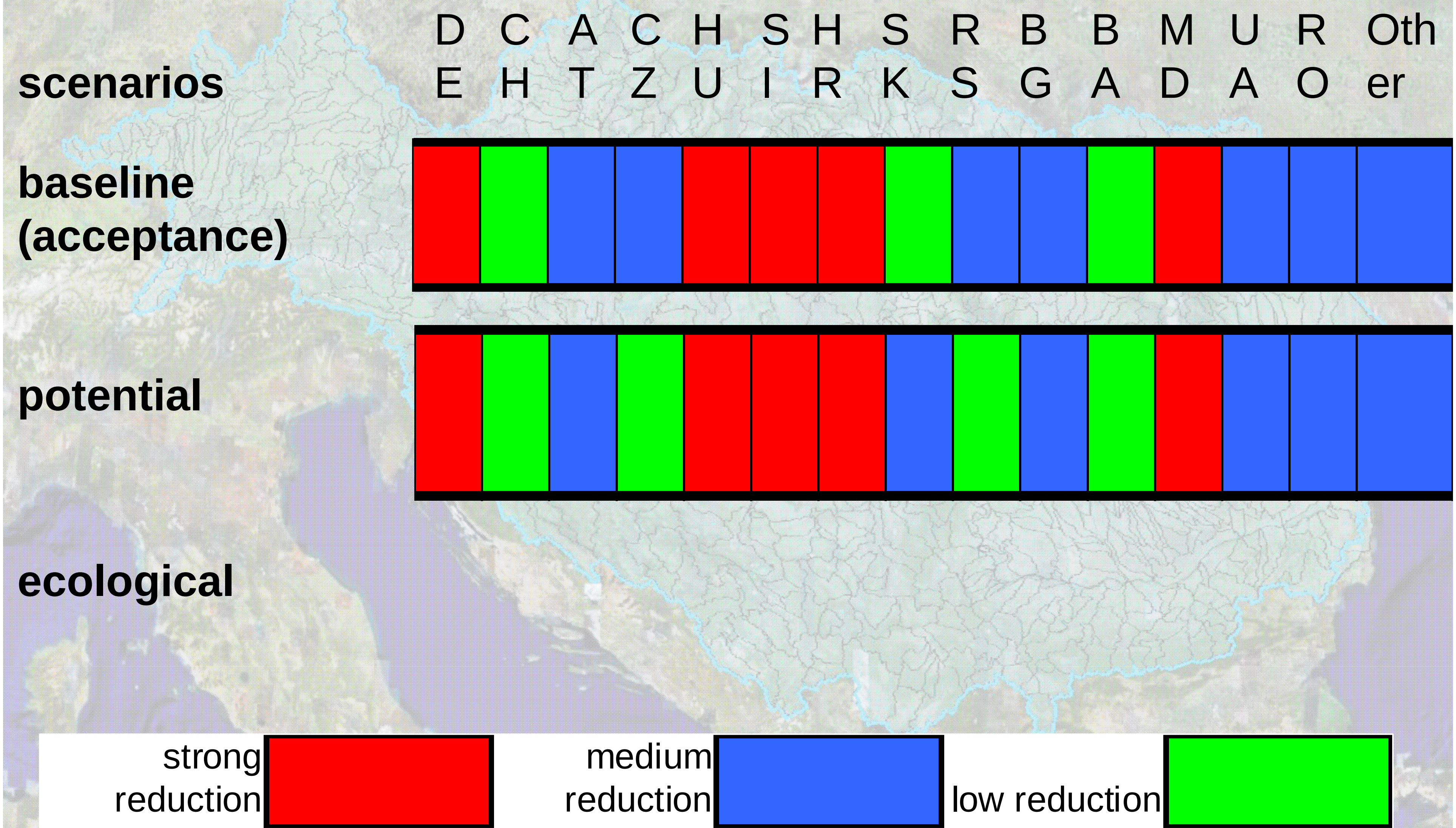
N surplus developments for three scenarios and effects on emissions

		Baseline	
	2005	2015	change
	kg/(ha·yr)	kg/(ha·yr)	%
DE	81.6	65.7	-23
AT	43.6	51.9	-18
CZ	47.4	44.3	-12.8
SK	26.5	21.1	19.5
SI	73.8	52.2	-20.1
HR	34.1	16.8	8.6
BA	17.5	19.6	14.2
RS	13.3	14.5	35.4
HU	22.5	20.9	14.9
RO	22.8	25	36.8
BG	15.5	14.2	18.0
UA	13.4	12.1	42.7
MD	20.0	18.6	18.2

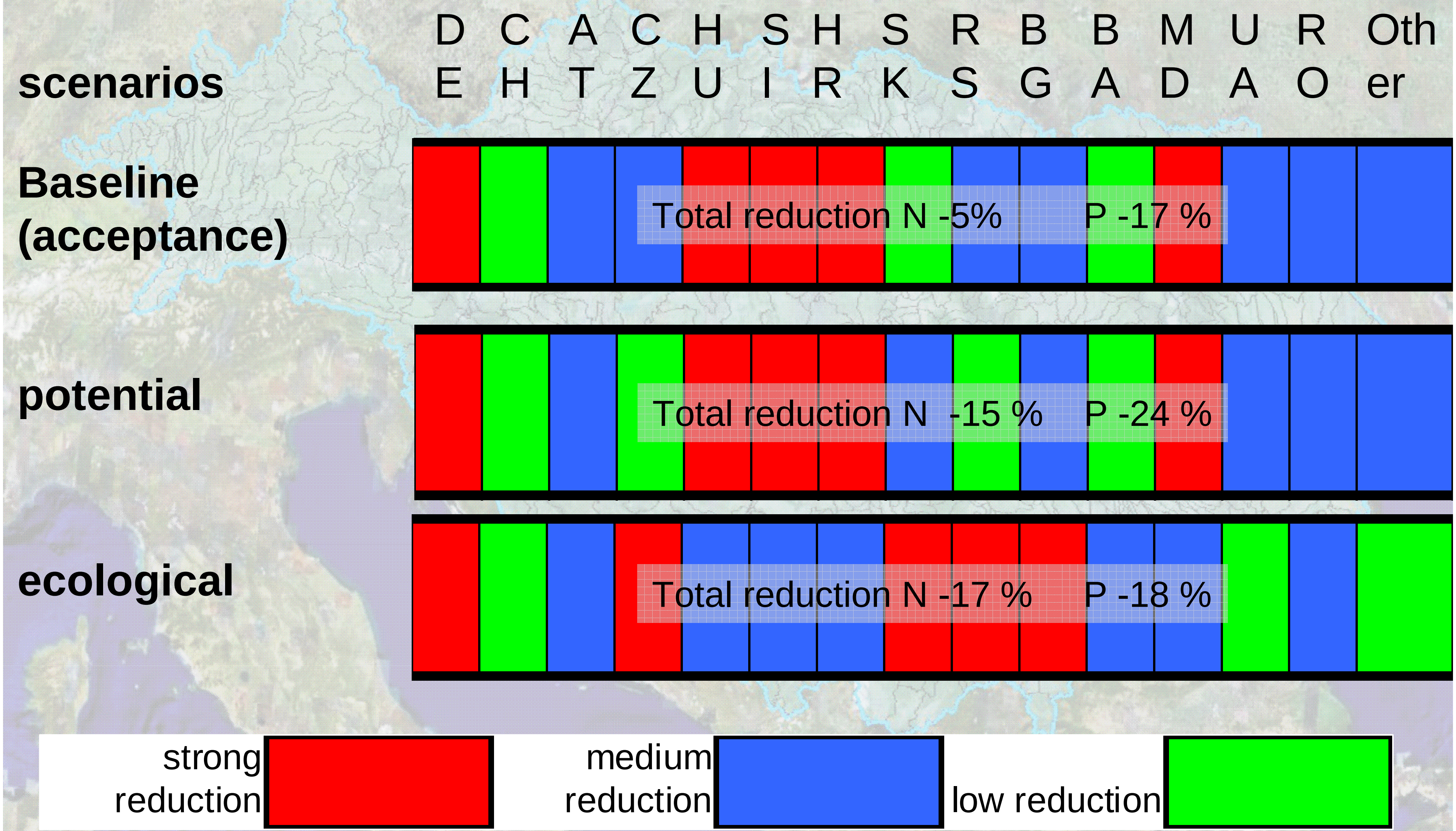
Scenarios to reduce emissions



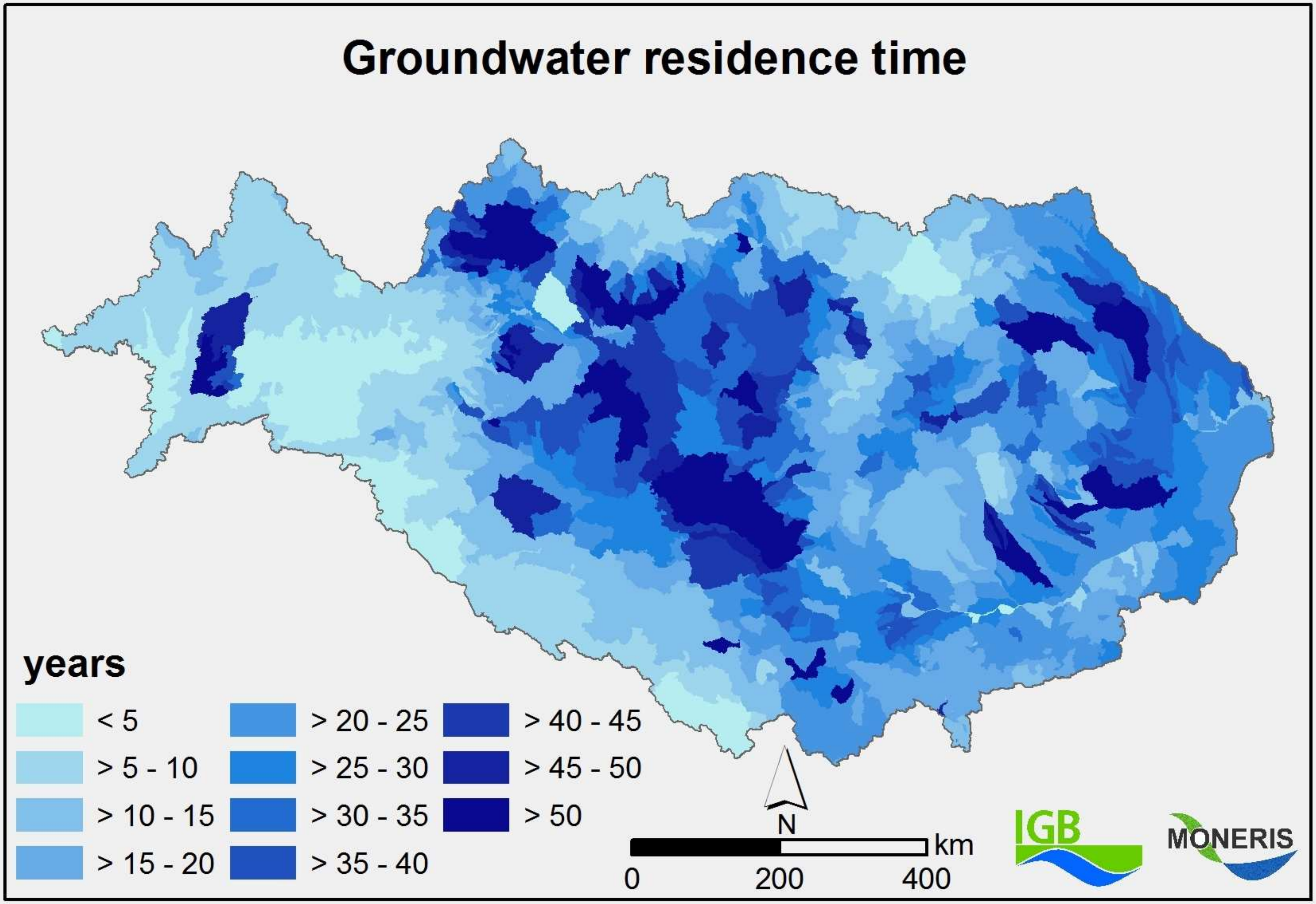
Scenarios to reduce emissions



Scenarios to reduce emissions

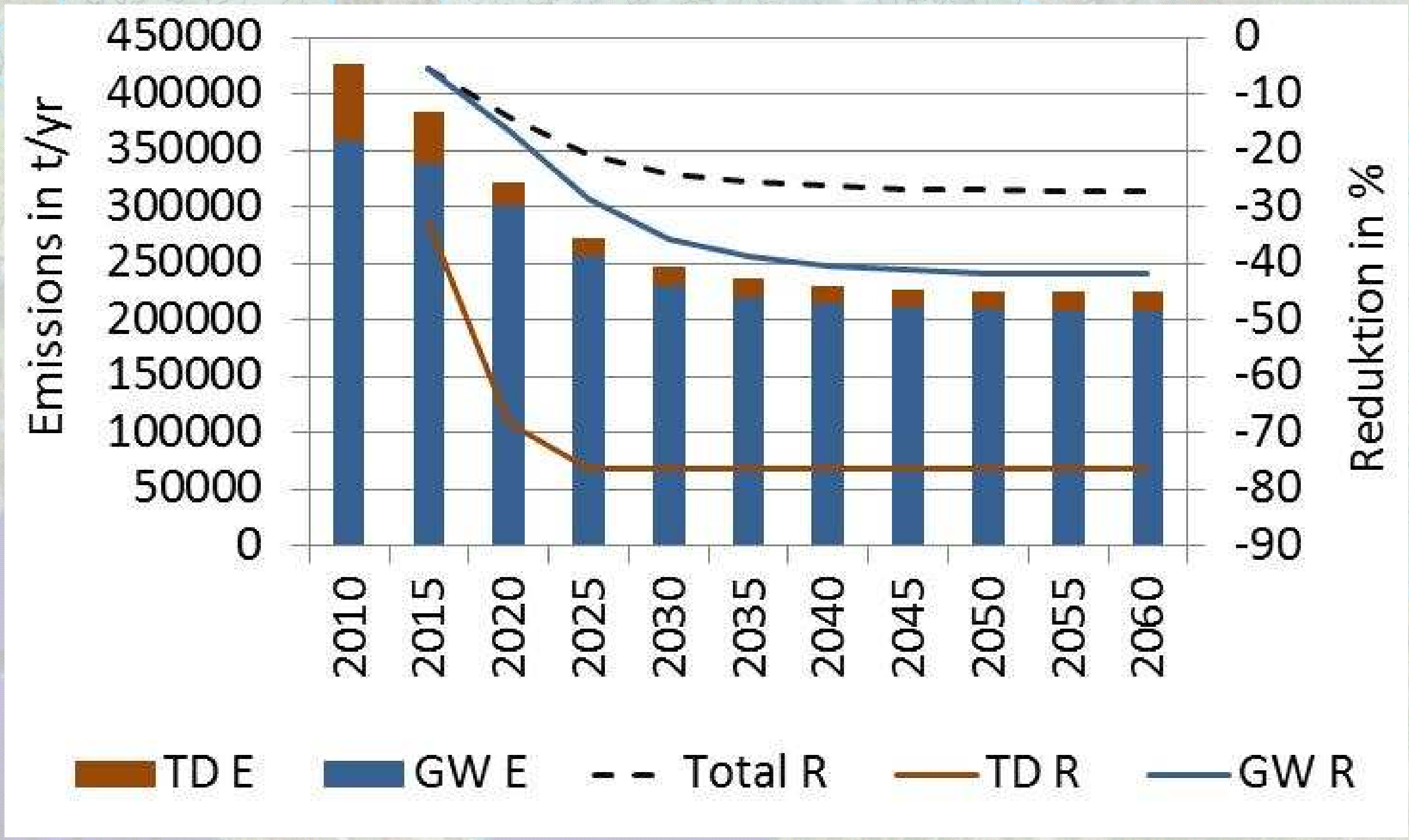


Time lag between application of measures and reduced emissions

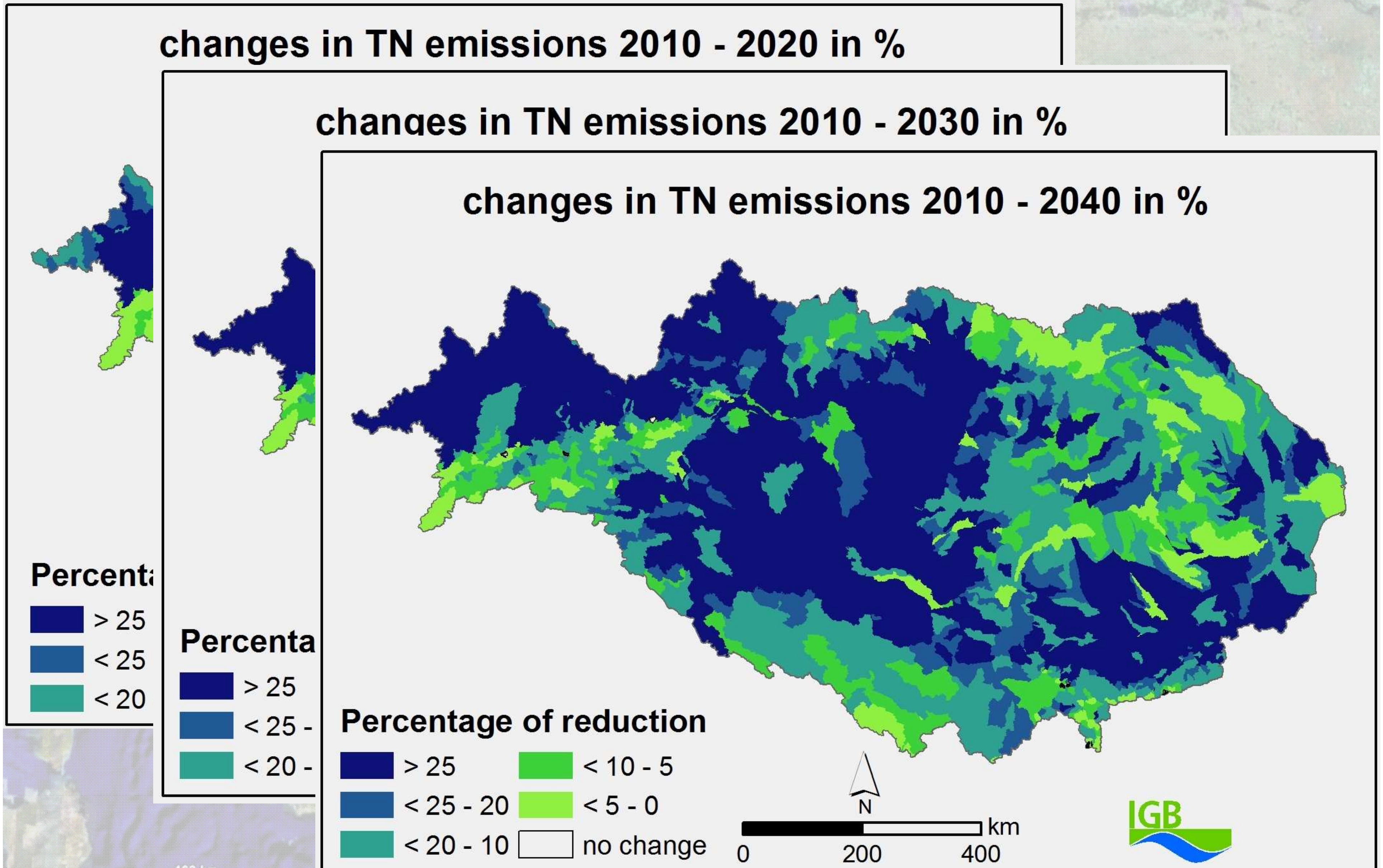


Time lag between application of measures and reduced emissions

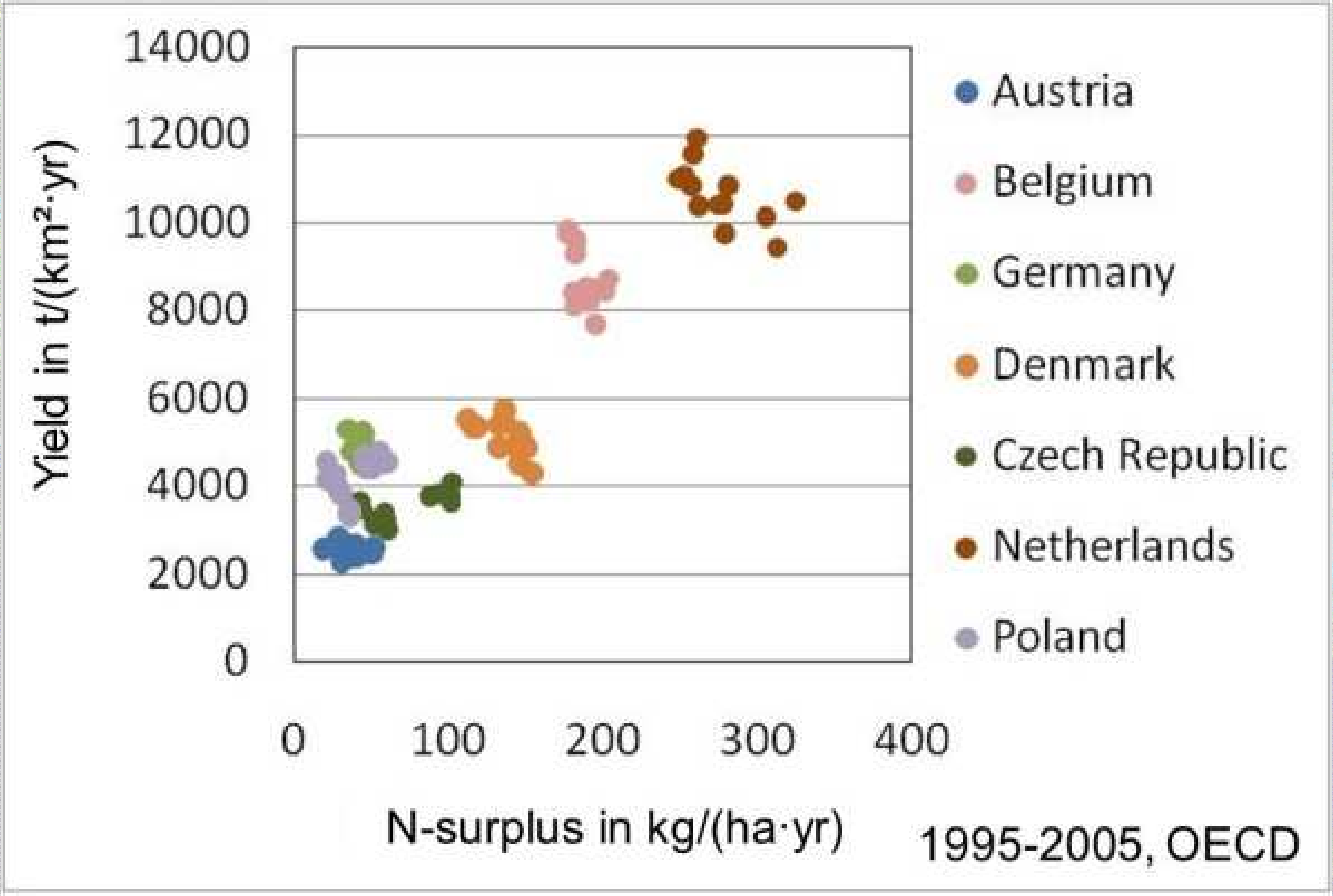
Assumption: linear reduction of N surplus from 2010 to 2020 to a level of 5 kg/(ha·yr).



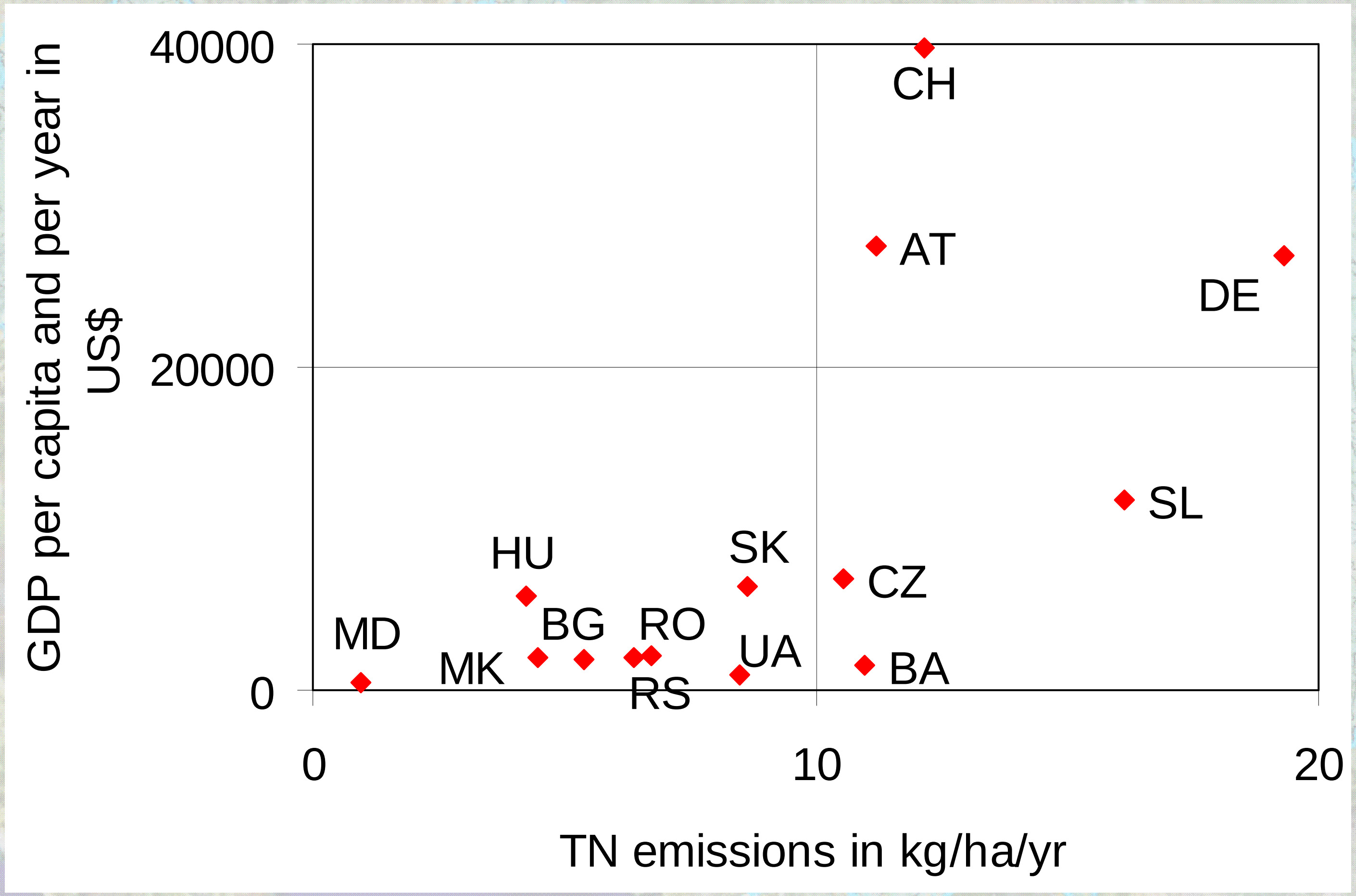
Time lag between application of measures and reduced emissions



Will a change in N-surplus lead to change in yields?



… and will it have an impact on the economics?



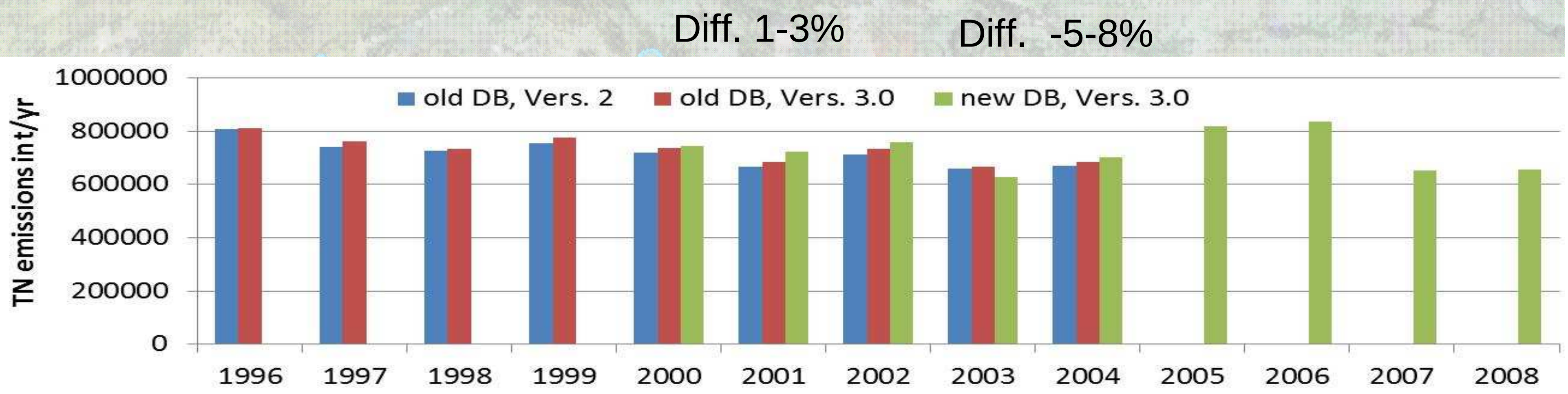
Thank you for your attention

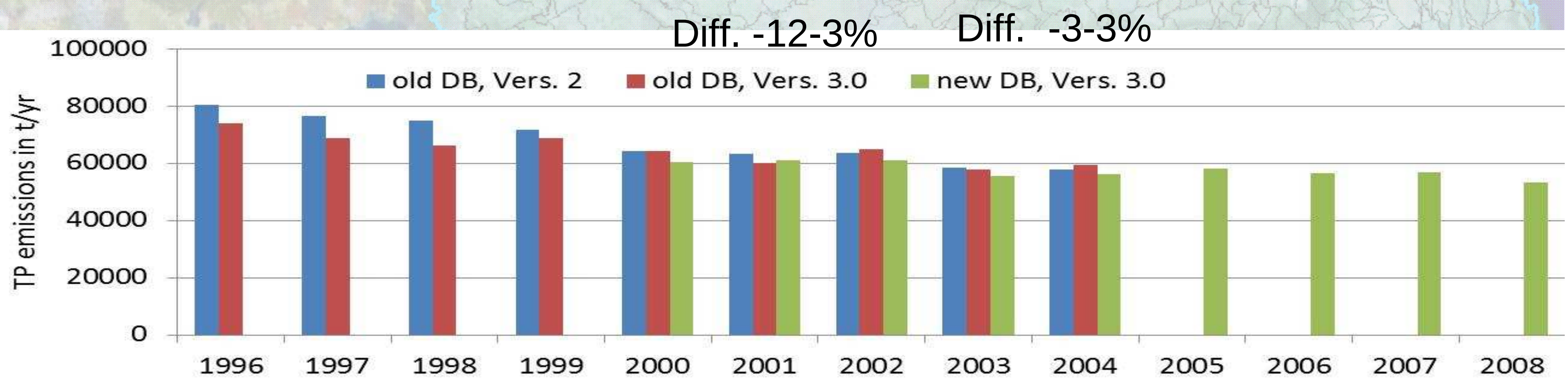
Model, methods and application
www.moneris.igb-berlin.de

Cost-effectiveness-analysis by TU-Berlin
www.glowa-elbe.de

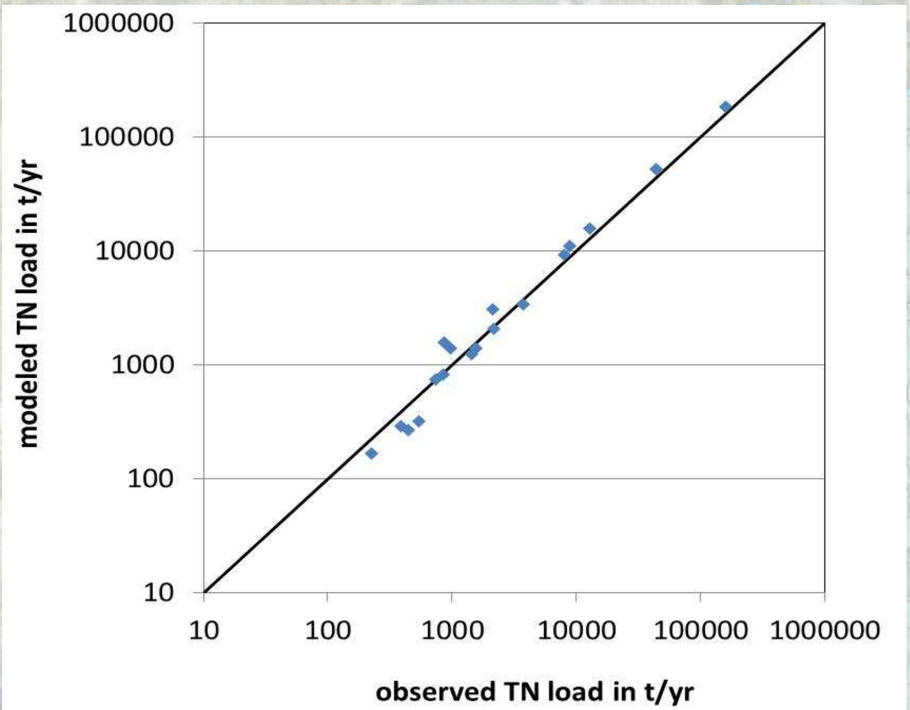
Input data and measures
www.icpdr.com

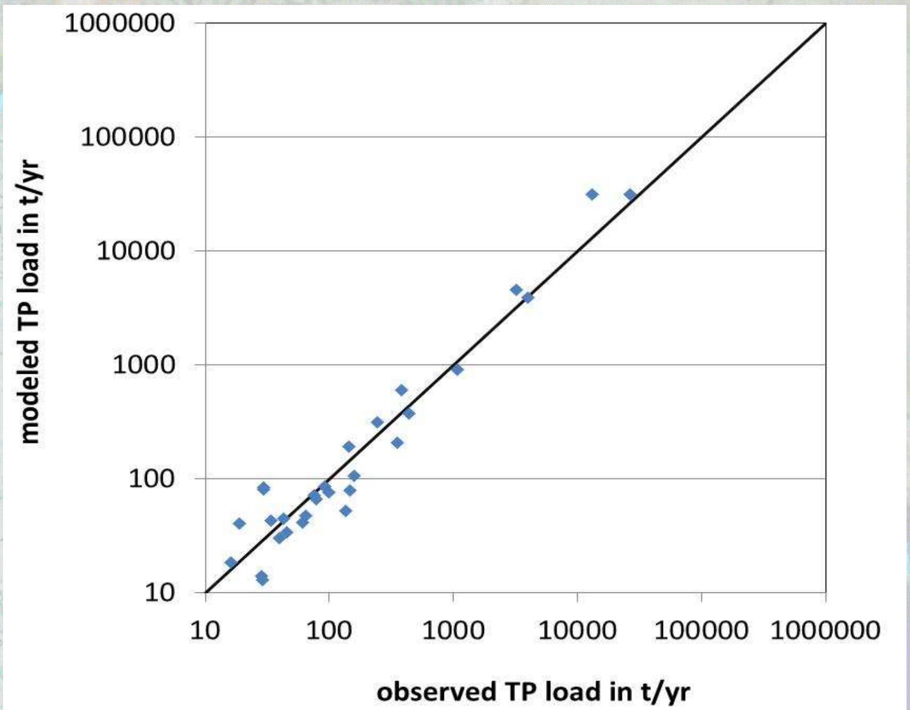
Nutrient emissions 1996-2008





Model evaluatin long term

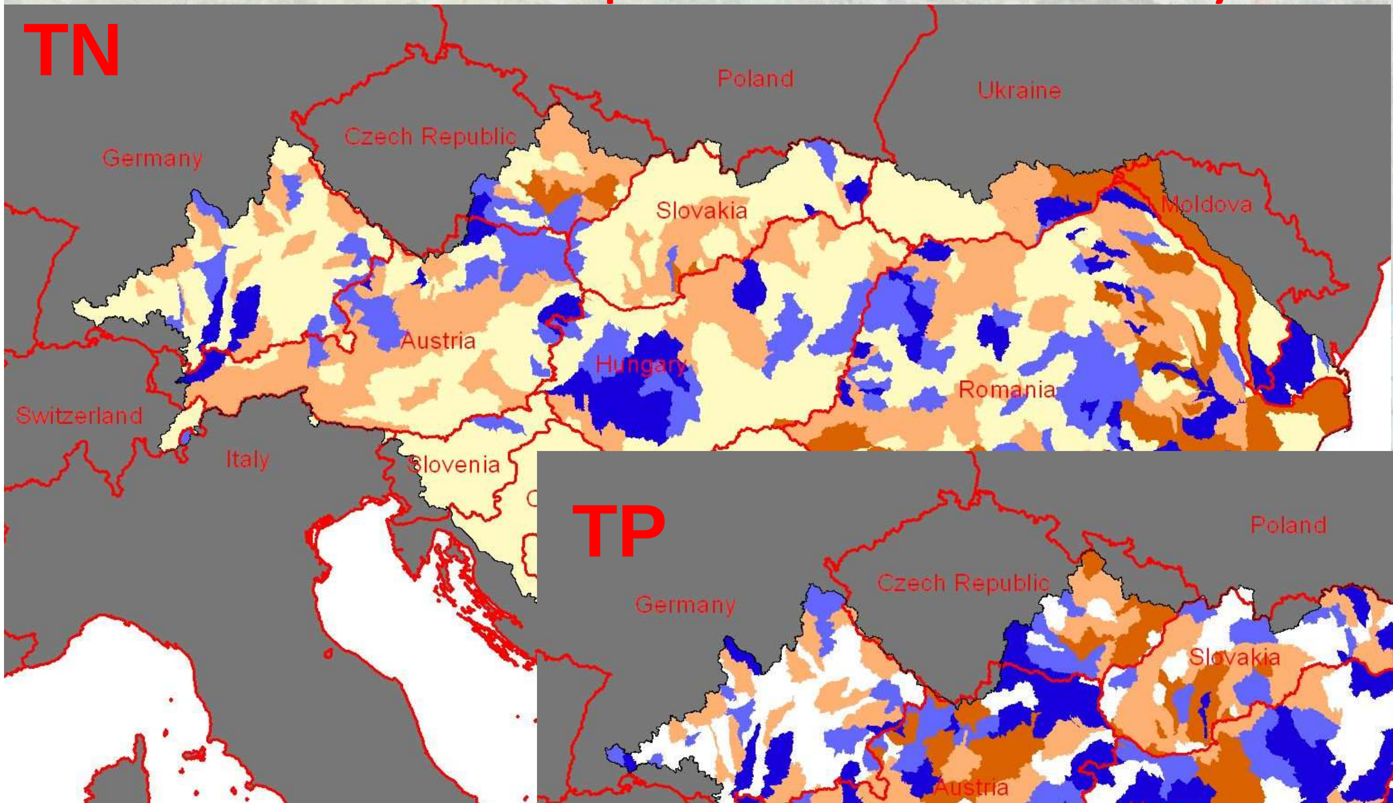


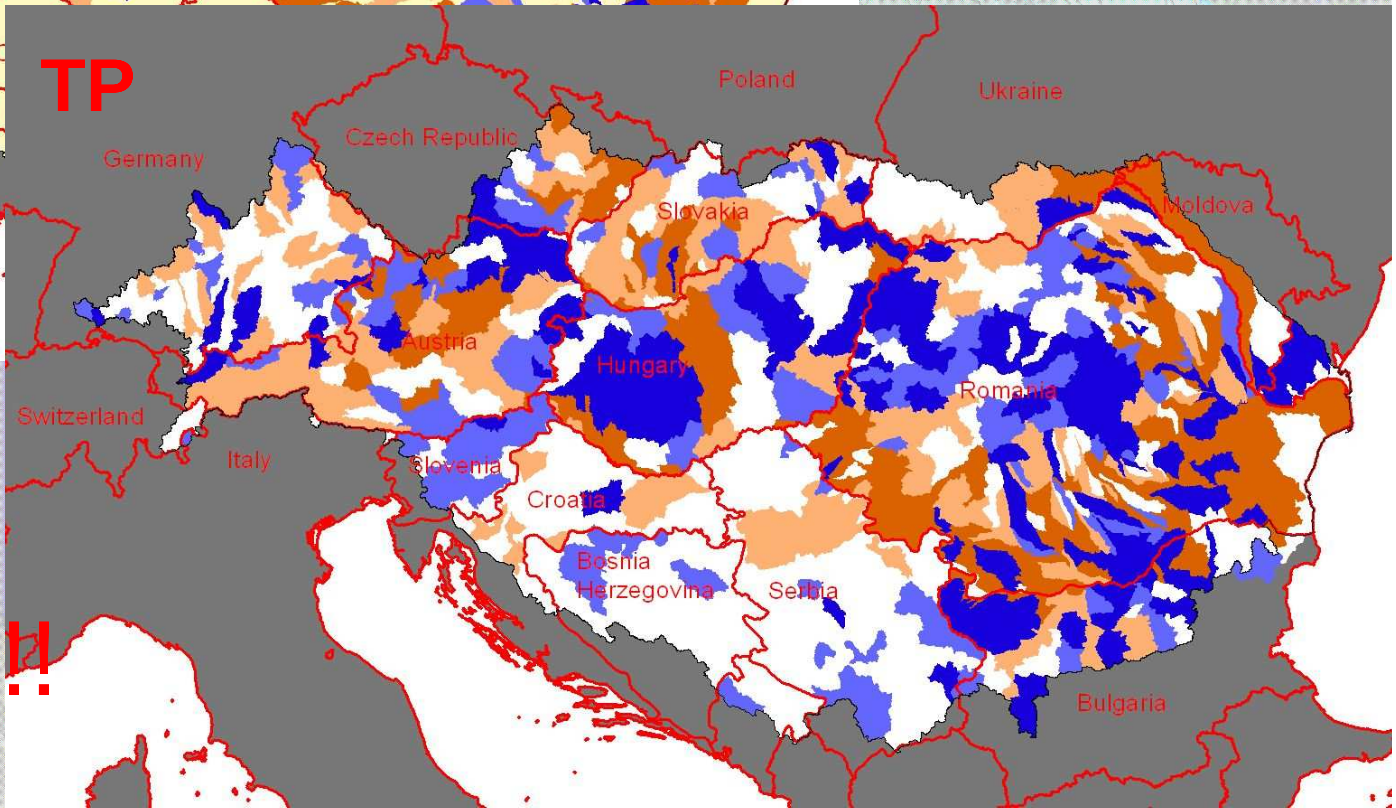


		Dev.	r^2	EF	n
TN	t/yr	24.2	1.00	0.97	18
DIN	t/yr	46.0	0.91	0.43	67
TP	t/yr	43.5	0.95	0.51	31

Impact ratio on country level

$$IR = \frac{L\%}{E\%}$$





LEGEND!!

Share of TN Emissions – Pathways

TN	Danube report (2009)	new data base, Vers. 3.00	Changes
	2000-2004	Long term, 2005	
	t/yr	t/yr	%
Atmos. Depo	13000	13830	6,4
Overland flow	67600	57595	-14,8
Tile drainage	27000	65531	142,7
Erosion	16900	15435	-8,7
Groundwater	373000	369990	-0,8
WWTP	105700	130743	23,7
Urban systems	82700	80405	-2,8
Total	686100	733530	6,9

Share of TP Emissions – Pahtways

TP	Danube report (2009)	new data base, Vers. 3.00	Changes
	2000-2004	Long term, 2005	
	t/yr	t/yr	%
Atmos. Depo	340	329	-3,2
Overland flow	2370	377	-84,1
Tile drainage	160	462	188,8
Erosion	12330	11975	-2,9
Groundwater	4410	4768	8,1
WWTP	17070	17823	4,4
Urban systems	24920	19253	-22,7
Total	61590	54987	-10,7