ENHANCING COMPETENCIES OF CENTRAL ASIAN UNIVERSITIES IN AGRICULTURAL POLICY FOCUSED ON ENVIRONMENTAL PROTECTION & LAND MANAGEMENT
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LAND DEGRADATION: Facts and Figures

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SOIL DEGRADATION IN LAND

(first paradigme)

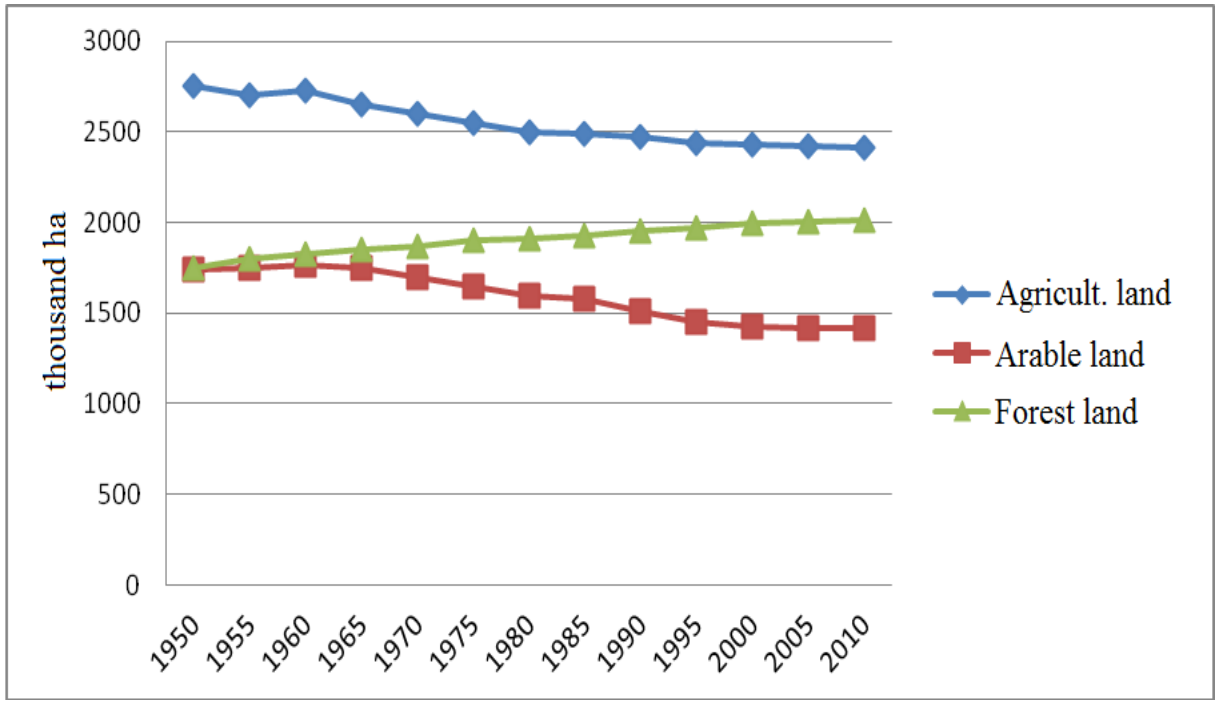
Soil Sealing in Slovakia

1945-2010 sealed 367 th. ha
it was about 5 th. ha per year
sealed mainly good soils.

Soil sealing now:
about 4-5 ha per day

Area of soil per capita now:
0.42 ha of agricultural soils
0.37 ha of forest soil

Slovakia has still enough soil for selfsufficient food production (potentialy for 6.7 mill., now is 5.3 mill.inhabitants)



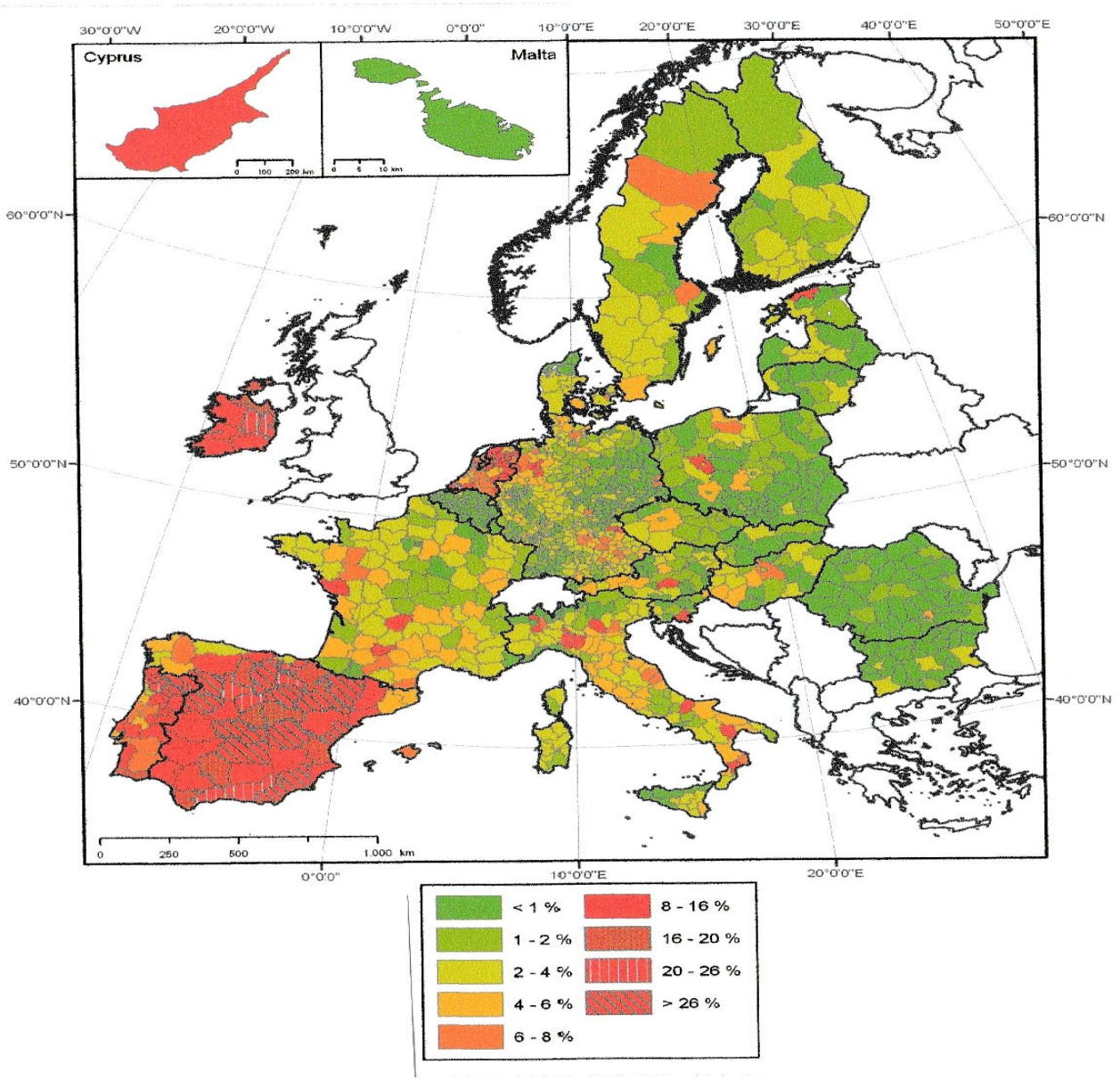
Act No.220/2004 on soil protection (system of taxes for sealed soil)

During of 1990-2006 urban area of EU was increased for about 8 %, but number of popullation only about 5 %.

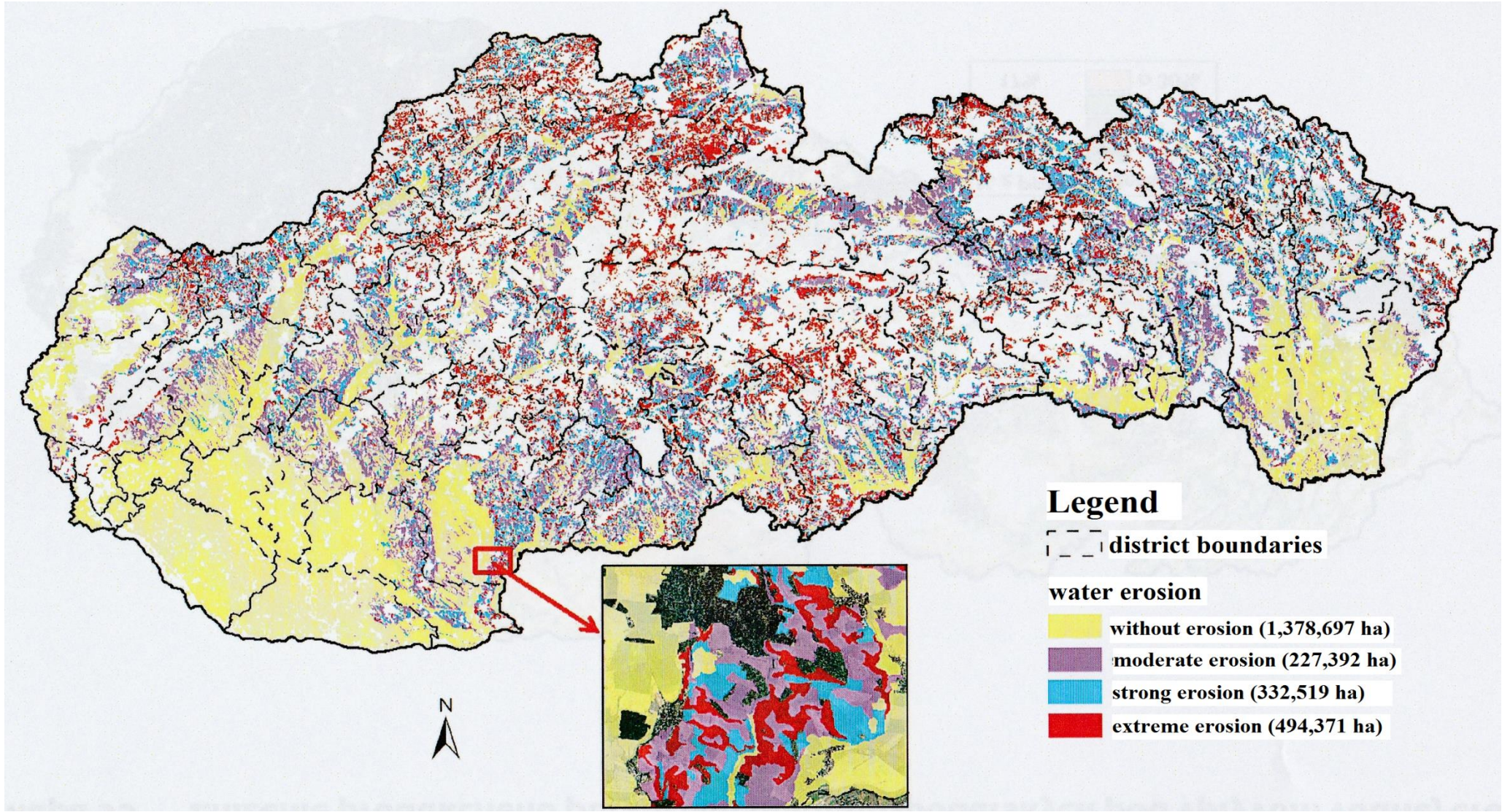
In 2006 in EU was 389 m² of settled area per capita, in 1990 it was 331 m²

Soil sealing in EU is 275 ha per day.

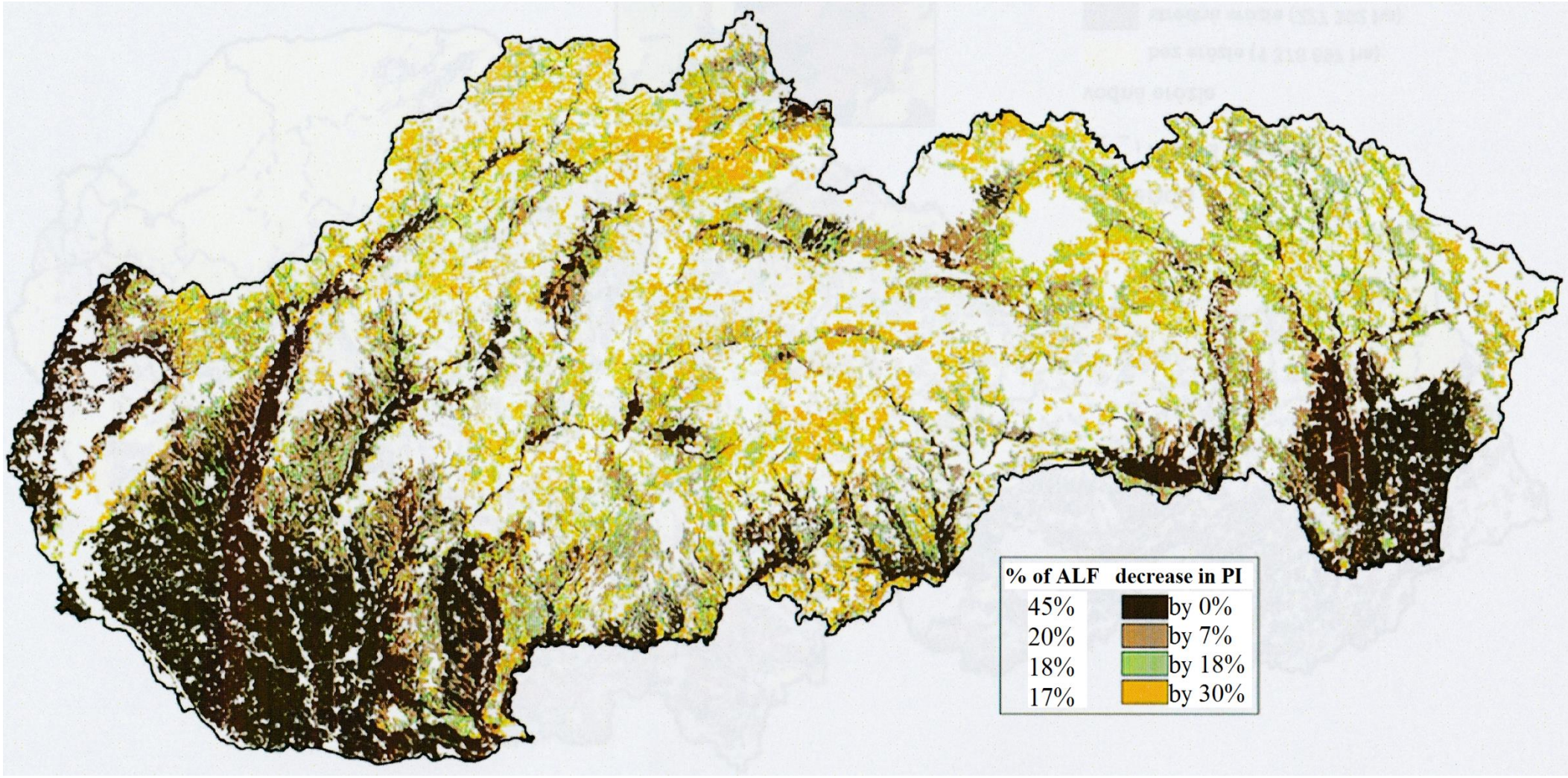
Source: Soil sealing in EU during of years of 2000-2006 (Prokop et al. 2011)



Water erosion potentials of soil in Slovakia (using of DTM slope model)



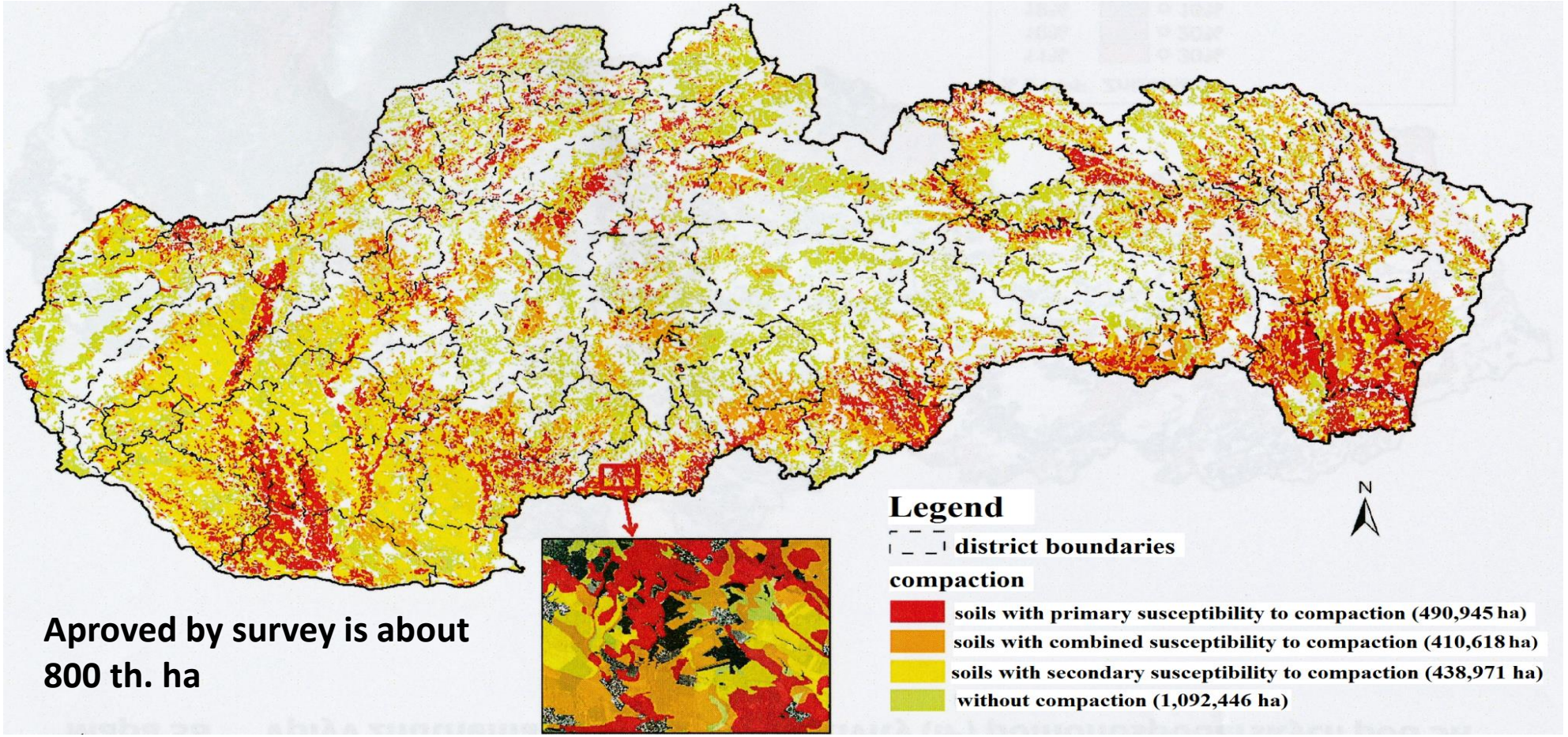
Reduction of soil production potentials due to erosion



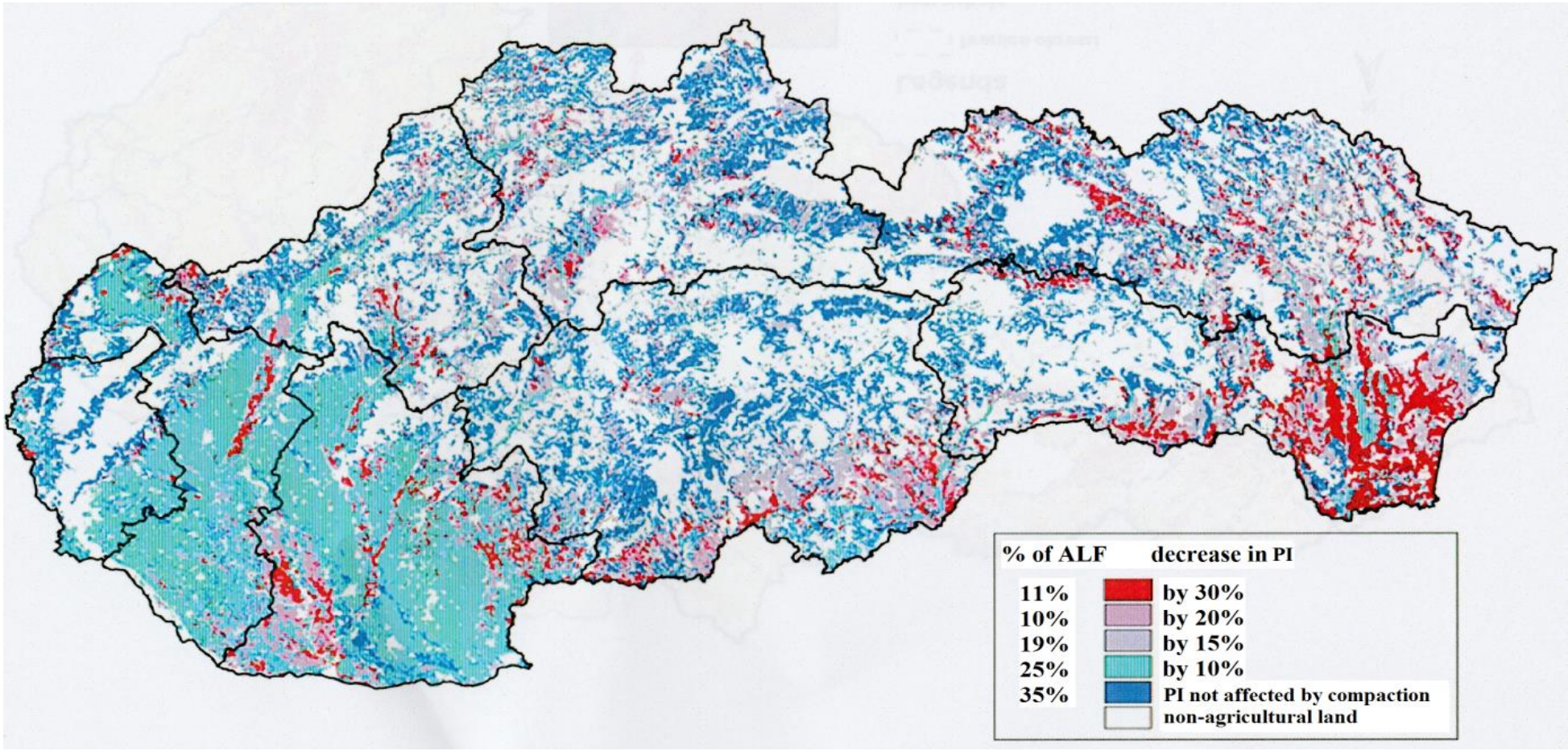
Soil compaction

Causes : primary : by natural reasons
secondary : by heavy machine use mainly

Potentials of pedocompaction of agri. soils of Slovakia (more than 1.3mill.ha)



Impacts of soil compaction on soil production potential expressed by index of production (PI). Generalized from experimental study.



Soil pollution areas in Slovakia

Area of pollution	Districts	Area in thousand ha	Contaminants
Bratislava	BA, DS	17	SO_2, NO_x, CS_2,F, Pb, Cd, As
Trnava and Galanta	TT, GA	3	SO_2, NO_x, Ni, Cr
Upper Nitra region	PD, TO, NR	40	SO_2, NO_x, As, Cd, Pb, Cu
Upper Váh river region	ZA,DK, MT, LM	14	SO_2, NO_x, Cr, Mn, Fe, Cd, Ni,
Middle Hron river region	BB, ZV	15	F, SO_2, NO_x
Middle Spiš region	SN, RV	17	Hg, Cu, Pb, As, Zn, Cd, SO_2
Middle Gemer region	RV, RS	21	Mg, SO_2, NO_x
Košice	KE, RV, TV	12	SO_2, NO_x, Mg, Mn, Cr
Middle Zemlín region	MI, HN	12	SO_2, NO_x, F, NH_3, org. poll.
In total	SR	151	

Threats for Slovakian soils

Type of degradation	Extent
Soil sealing	up to 5-7 ha per day
Water erosion	almost 50% (agricultural land)
	90% of forest land
Wind erosion	5-6% of the agricultural land area
Loss of humus	approximately 60% of the agricultural land area
Soil compaction	approximately 30% of the agricultural land area
Contamination	30 thousand ha above the limit

Land degradation by soil

(second paradigme)

Pollution by soil (soil as threat)

natural contaminantions:

- by microorganisms
- by in soil produced chemicals (nitrites, nitrates, NOx)

by artificial contaminats:
- from agriculture (fertilizers, pesticides,...)
- from industry (pollutants)

what is polluted: -water sources, -plants, -air,

the way of pollution: -by soil matter, -leaching, -emission, -floods

Soil degradation as global problem of world

Food security (by FAO)

as *a situation when all people at all times have physical, social and economic access to sufficient food ensuring their nutritional and energy need for active life and good health*.

Food safety (by FAO)

as high quality food production with no consequences on the environment

Food sovereignty (by OECD)

as liberalized use of soil for food and another concerns

Disruption of nitrogen cycle

Impact on air quality:

- ammonium volatilization (about 2-3 kg N/ha/year)
- N_2O emissions (after denitrification), from 100 kg N/ha fertilizers it is about 0.225 kg/ha/year (coefficient by Bouwman), 300x stronger GHG than CO_2, (more than 50 % of world-wide N_2O emmissions is from soil)

Impact on water resource quality:

- nitrate productions

  in SK soils is produced about 30-50 kg N-NO_3/ha/year,

  in case of N fertilizers application it is about 60-90 kg N-NO_3/ha/year

- leaching 5-10 kg, but 20-30 kg N-NO_3/ha/year after over 100 kg N /ha per year mineral fertilizers use

Impact on plant production quality:

in food and forage could be higher contents

of nitrate and nitrite

Impact on human health:

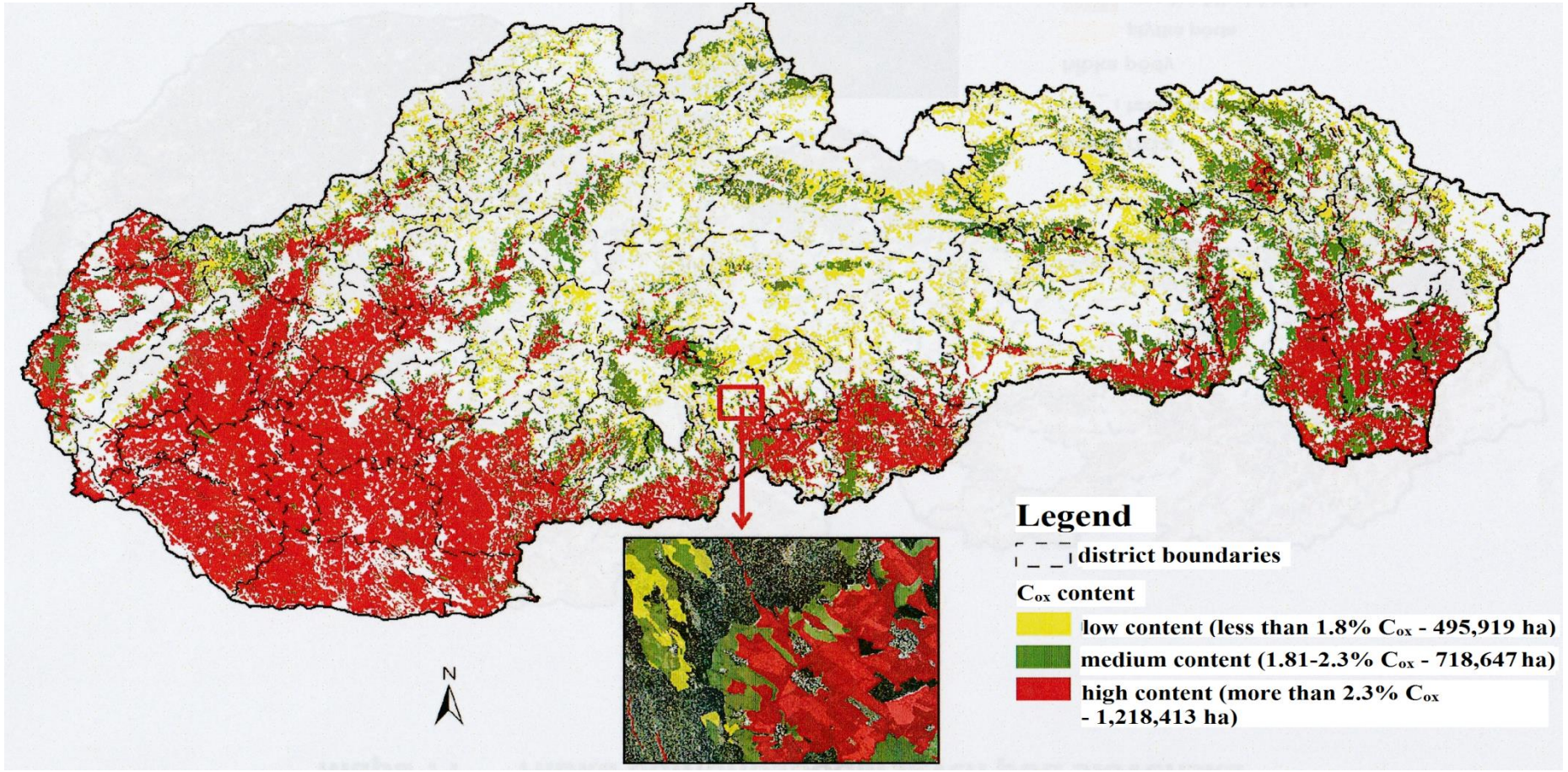
because of **air** pollution – human respiration problems

because of **water** pollution - methemoglobinemie

and **food** pollution - gastro-intestinal diseases

Disruptions of carbon cycle in soil

C_{ox} contents in agricultural soils of Slovakia



Emissions of carbon from soils (as CO_2) are about 3-5 tons C-CO_2 /ha/year (identified by long term determinations), more in poor than best soils

In conditions of intensified agriculture could be appeared deficit in balance of carbon content in soils.

It is result of : low organic fertilizers use

high mineral fertilizers use

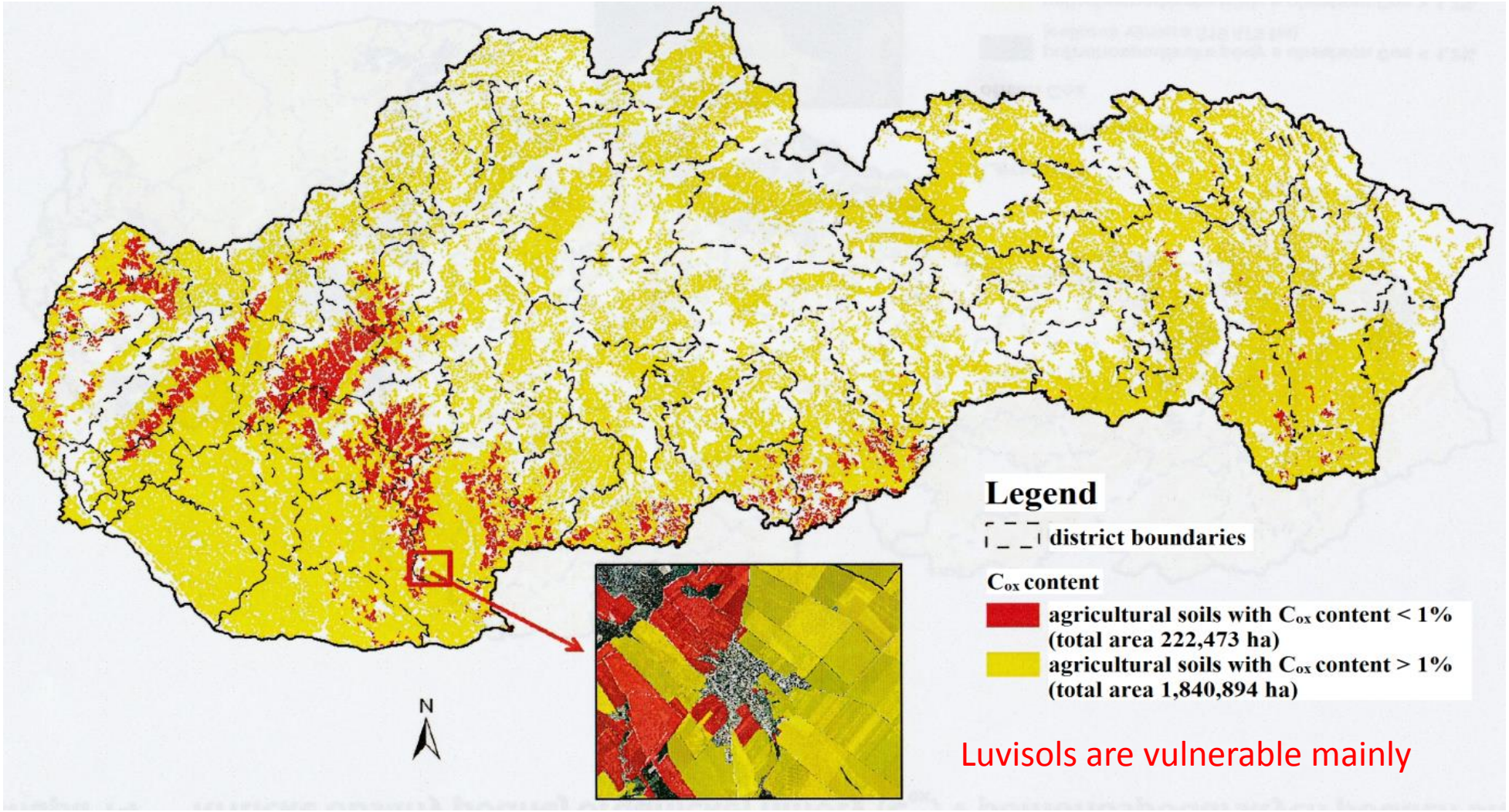
high soil cultivation activity

mistakes of plant rotation

Interesting is that some soil-ecological conditions are more vulnerable for carbon content decrease than others. In Slovakia Luvisoils suffering mainly.

Critical contents of soil organic matter in soils of Slovakia

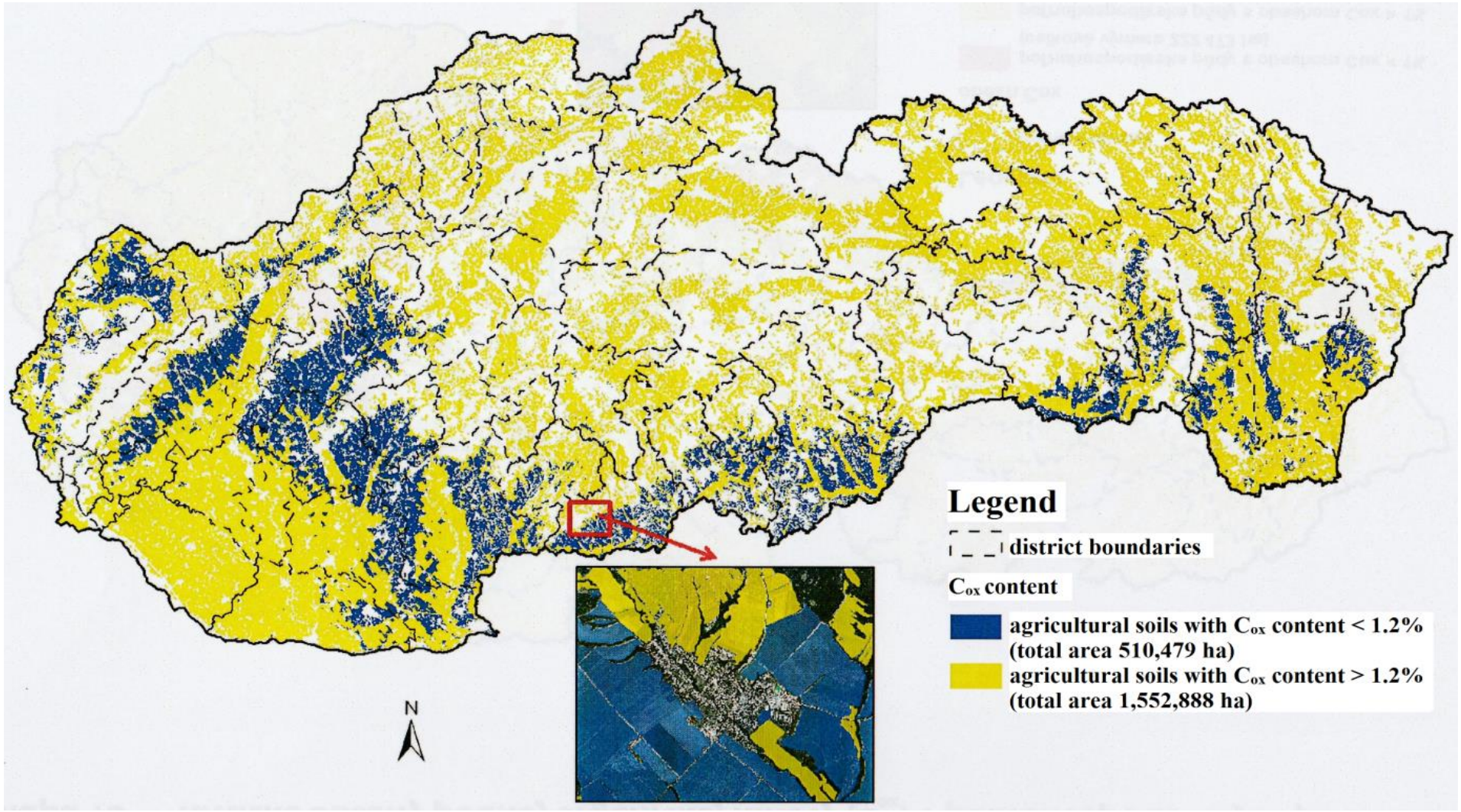
(threats of soil desertification – C_{ox} less than 1 %, Soil Thematic Strategy, EU 2006)



Luvisols are vulnerable mainly

Critical content of soil organic matter in soils of Slovakia

C_{ox} less than 1.2 % as critical level for beginning of soil desertification, EU STS,2006



Land quality improvement by soil

(third paradigme)

Remove of carbon from soil into the air is contribution of soil to climate change. It represents about 8 %(according of EU) or 11 % (according of OECD) from the total increase of GHG contents in atmosphere from the year 1750. It proves participation of soils and agriculture on climate change problems.

BUT:

Sequestration of the carbon into the soil could improve climate change problems by presented agricultural measures (in tons of C/ha/year)

(*Gumbert,2002*)

Measures	Benefits (on average)
Zero tillage	1.42
Minimum tillage	< 1.42
Setting aside of land	> 1.42
Cultivation of deep rooting plants	2.27
Application of fertilisers to soil	1.38
Ploughing of plant residues into soil	2.54
Application of sludge to soil	0.95
Addition of compost to soil	1.38
Extensification of agriculture	1.98
Organic farming	1.90
Conversion of arable land to forests	2.27
Conversion of arable land to meadows	7.03
Conversion of meadows to arable land	-3.60
Conversion of grassland on arable land	-3.66
Conversion of forests to arable land	-7.00
Absence of deep ploughing	5.00
Restoration of wetlands	17.00

Thank you for your attention!

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