

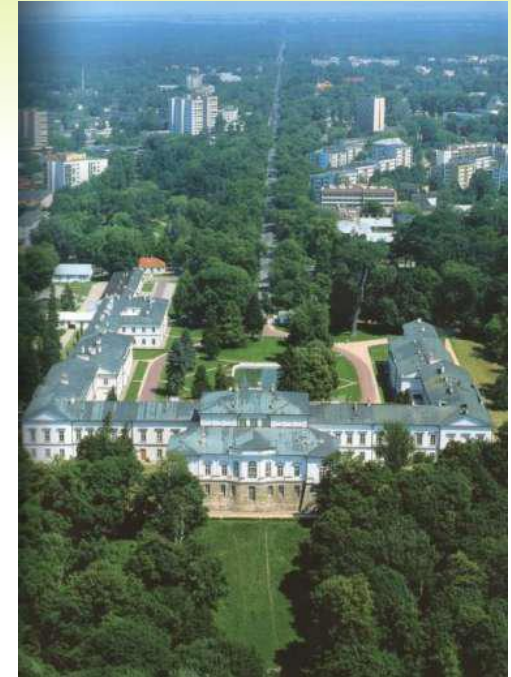
Soil monitoring in Poland – long term and new approaches



***Grzegorz Siebielec, Radosław Kaczynski,
Artur Łopatka, Bożena Smreczak***

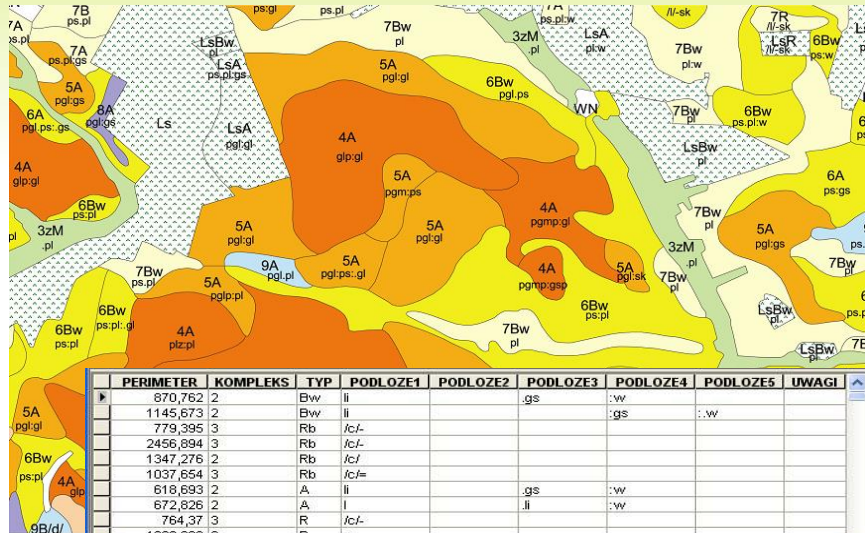
Institute of Soil Science and Plant Cultivation (IUNG) State Research Institute

- Agro-microbiology
- Herbology and Soil Tillage
- Agrometeorology and Informatic Systems
- Cereal Production
- Forage Crop Production
- Plant Breeding and Biotechnology
- Plant Nutrition and Fertilization
- Systems and Economics of Production
- Biochemistry and Plant Quality
- **Soil Science and Land Protection**



SOIL DATABASES IN POLAND

Digital soil map 1:25000



PERIMETER	KOMPLEKS	TYP	PODLOZE1	PODLOZE2	PODLOZE3	PODLOZE4	PODLOZE5	UWAGI
870,762	2	Bw	li		gs	:vw		
1145,673	2	Bw	li			gs		
779,995	3	Rb	/c/-					
2456,894	3	Rb	/c/-					
1347,276	2	Rb	/c/-					
1037,654	3	Rb	/c/=					
818,693	2	A	li		gs	:vw		
672,826	2	A	l		li	:vw		
764,37	3	R	/c/-					
1020,298	3	R	c-					
1425,292	2	Rb	/s/=					

Database of 60000 soil profiles



Opis do mapy glebowo-rolniczej w skali 1:5000

Obiekt: Borohów
Powiat: Lubaszów
Próbnictwo: M. Dziwik

Rekord: 1 | Pokaż: Wszystkie Wybrane Rekordy (0 wybrany(e)(y)ch z 8995

Nr od-krzynki	Użytek, kompleks, klasa, typ, położenie odgrunok	Glebo-kość pobrana w cm	Postom gleb	Skład mecha-niczny	Nr labo-ratoryjny prób	Procentowa zawartość frakcji mechanicznych średnica w mm													Próchnica %	CaCO ₂ %	pH			mg. równ. 100g gl.				Mn ppm przp. su.
						1.0	1.0-0.5	0.5-0.25	0.25-0.10	0.10-0.05	0.05-0.02	0.02-0.006	0.006-0.002	0.002	1.0-0.1	0.1-0.02	0.02	Kwasowość -			mg. w 100g Egnera							
						7	8	9	10	11	12	13	14	15	16	17	18	19			hldr.	wym.	A1 wym.	P ₂ O ₅	K ₂ O	Mg przp. su.	27	
2	B-Ax-p2eski	20	Ap	p2s	1566	0.9	0.2	1.5	11.8	16.5	40	18	5	7	13.596.5	30	1.61	-	5.7	4.2	3.07	0.25	0.17	2.3	4.0	5	36	
2	"	40	A ₃	p2s	1560	0.0	0.0	1.2	15.9	6.9	46	19	5	6	17.152.9	30		-	6.1	4.6				0.8	1.0	7		
2	"	40	B ₁	p21	1562	0.0	0.0	0.5	12.1	12.4	39	19	4	17	12.647.4	40		-	6.2	4.6				0.4	6.5	26		
3	"	70	B ₁	p21	1564	0.0	0.2	0.7	16.2	12.9	38	16	3	13	17.150.9	32		-	6.3	5.1				1.6	5.0	21		
5	B-Ax-p2eski	20	Ap	p2s	1561	0.0	1.2	4.4	23.2	21.2	28	13	3	6	28.049.2	22	1.55	-	6.3	4.2	3.15	0.62	0.53	0.4	9.8	4	36	
5	"	25	A ₃	p2s	1563	0.0	0.5	2.9	23.6	18.0	35	13	3	4	27.053.0	20		-	6.4	4.9				0.4	1.5	8		
5	"	35	B ₁	p2s	1558	0.0	0.5	5.2	18.6	19.7	30	7	4	15	24.349.7	25		-	5.4	3.9		2.60	2.48	1.3	7.8	16		
5	"	150	C	p21	1556	0.0	2.9	4.7	18.8	18.6	32	11	4	11	23.450.6	28		-	5.2	3.9		2.55	2.90	2.0	4.0	12		
8	B-Ax-p2eski	20	Ap	p2s	1559	0.0	0.5	1.7	13.1	17.7	36	16	7	8	15.353.7	31	1.95	-	5.6	4.3	4.35	0.54	0.43	2.5	13.0	6	91	
8	"	30	A ₃	p2s	1565	0.0	0.0	0.2	14.2	20.6	36	19	4	6	14.456.6	29		-	5.9	4.4		0.52	0.47	3.7	2.2	3		
8	"	70	B ₁	p21	1560	0.0	0.0	0.2	12.4	16.4	37	18	4	15	12.693.4	34		-	5.4	3.8		2.37	2.41	3.0	7.2	14		
8	"	150	C	p21	1567	0.0	0.0	0.7	10.1	15.3	39	15	5	15	10.834.2	35		-	5.5	3.8		1.64	1.90	4.7	9.8	14		

LARGE PROGRAMME FOR SOIL ASSESSMENT AT NATIONAL SCALE

Initiative of Ministry of Agriculture

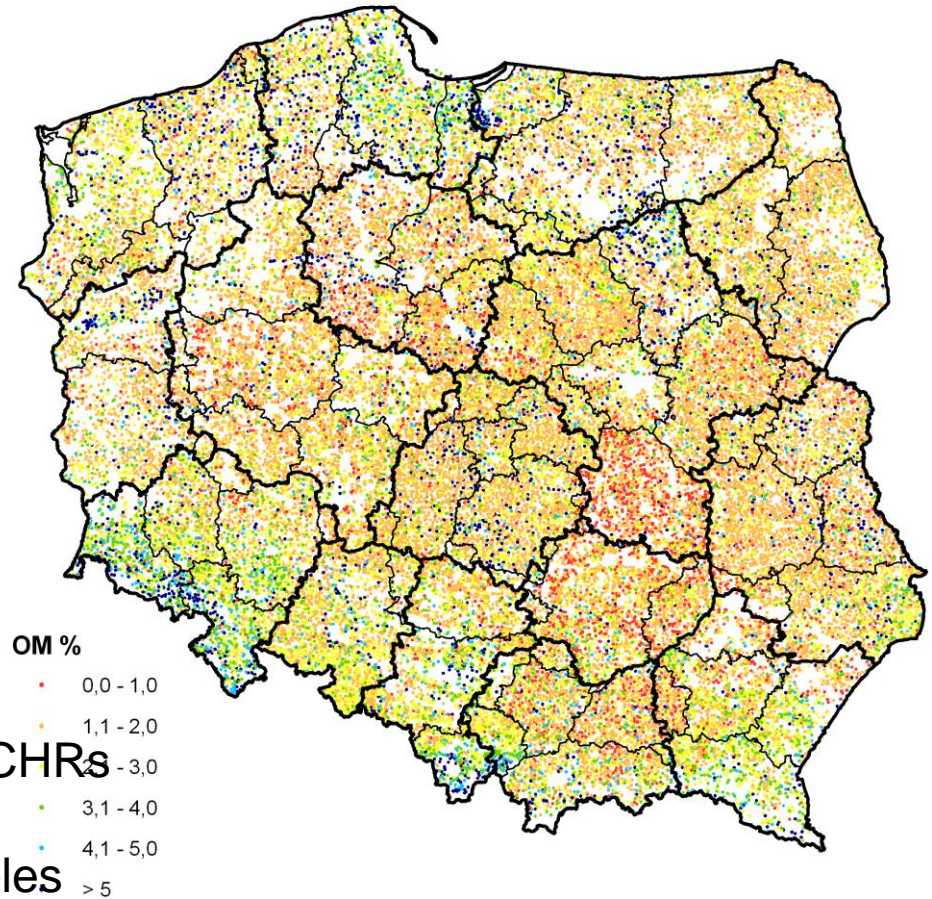
Years 1995-1998

Coordination IUNG-PIB, Analyses OSCHR

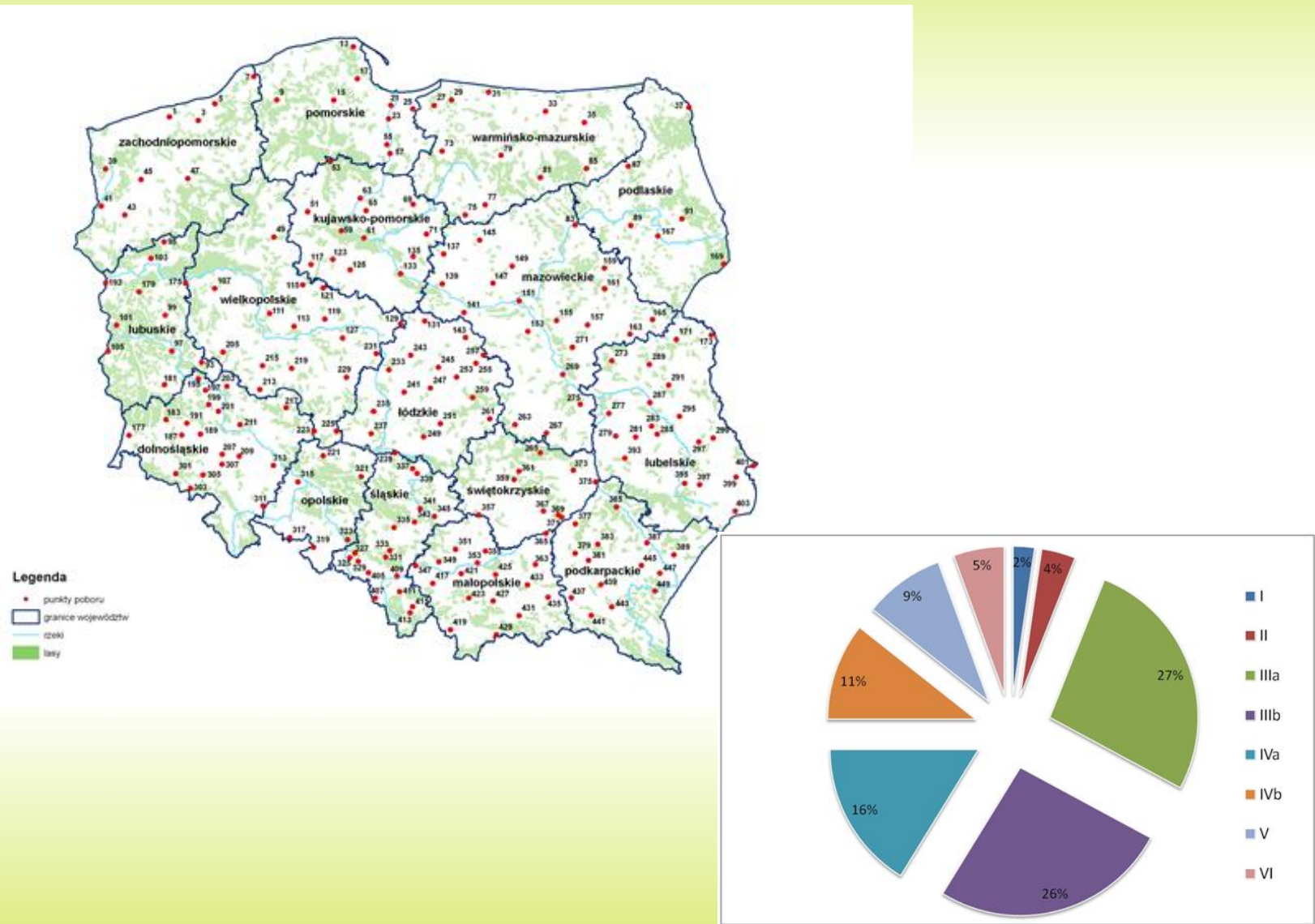
45000 soil samples, 35000 plant samples

1 average soil sample per 400 ha

Parameters: soil texture, pH, SOC, Cd, Pb, Zn, Cu, Ni, S; plant composition



PERMANENT NATIONAL MONITORING 1995-2015; 216 LOCATIONS



PERMANENT MONITORING OF SOIL QUALITY

„Soil Monitoring„ is an element of the State Monitoring of the Environment

Aim: to observe changes in soil quality under agricultural and non-agricultural anthropogenic pressure

Obligation of monitoring, observation of changes and soil quality written in the Environmental Protection Law

Criteria for TE content in the Regulation of Min of Environment (2002) soil quality standards. New regulation in 2016.

Editions: 1995, 2000, 2005, 2010, 2015

Performed by IUNG

Financed by State Fund for Env. Prot. and Water Management.



Granted by Chief Inspectorate of Environmental Protection



Monitoring data – available for public

Monitoring Chemizmu Gleb - Windows Internet Explorer

http://geo.iung.pulawy.pl/chemizm/index.html?mod=pomiar&p=277

O monitoringu | Metodyka badań | Podsumowanie | Wyniki szczegółowe | Objasnienia

Punkt: 277
 Miejscowość: Skowieszyn
 Gmina: Koriskowola (0614052)
 Województwo: lubelskie; Powiat: puławski

Kompleks: 8 (zbożowo-pastewny mocny); Typ: Dz (czarne ziemie zdegradowane); Klasa bonitacyjna: IIIb

Gatunek gleby wg:
 BN-78/9180-11: płg (pył gliniasty)
 PTG 2008: pyg (pył gliniasty)
 USDA: SiL (silt loam)

Uziarnienie	Jednostka	Rok			
		1995	2000	2005	2010
1,0-0,1 mm	udział w %	6	8	9	8
0,1-0,02 mm	udział w %	70	66	65	67
< 0.02 mm	udział w %	24	26	26	25
2,0-0,05 mm	udział w %	n.o.	n.o.	n.o.	20
0,05-0,002 mm	udział w %	n.o.	n.o.	n.o.	77
< 0.002 mm	udział w %	6	4	4	3

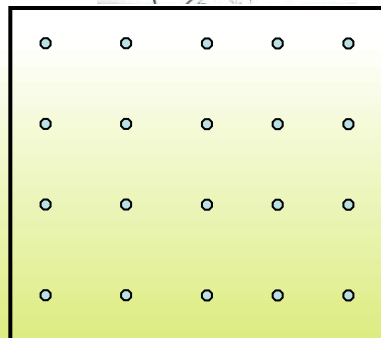
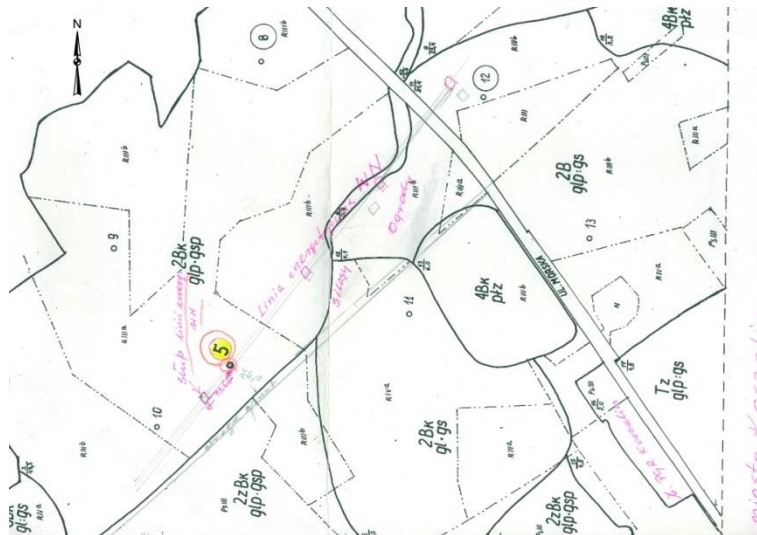
Odczyn i węglany	Jednostka	Rok			
		1995	2000	2005	2010
Odczyn "pH " w zawiesinie H2O	jednostka pH	7.1	7.5	7.0	8.3
Odczyn "pH " w zawiesinie KCl	jednostka pH	6.5	6.8	6.4	7.9
Węglany (CaCO3)	%	n.o.	1.46	2.31	2.24

Substancja organiczna gleby	Jednostka	Rok			
		1995	2000	2005	2010
Próchnica	%	2.10	1.90	1.97	1.90
Węgiel organiczny	%	1.22	1.14	1.14	1.10
Azot ogólny	%	0.150	0.138	0.136	0.143

Start | odbior | III etap monitoring | Microsoft Word | Monitoring Chemizmu... | PL | 00:53

From analogue to digital information

Paper information → Spatial digital data (soil maps, land use maps, road network, aerial images) → verified georeferences → field verification → final update of locations



Shifts of sampling locations



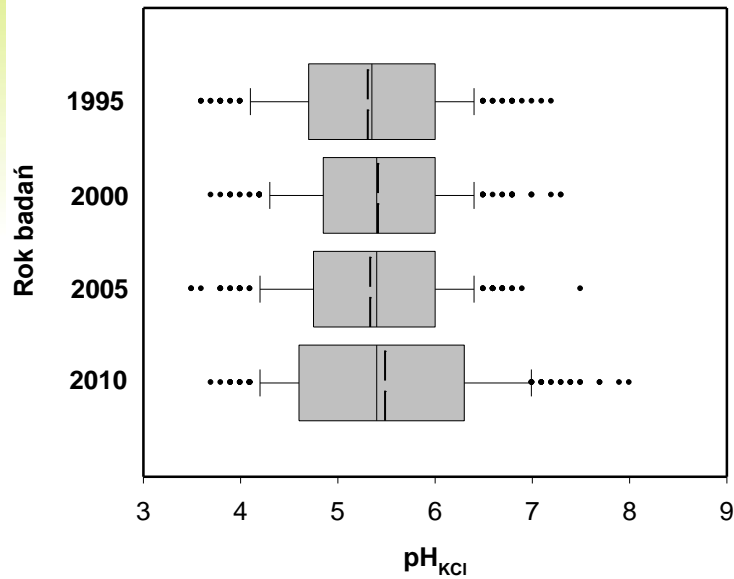
Monitoring parameters

- Texture
- SOC
- Carbonates –Scheiblera meth.
- pH in 1MKCl and water
- Hydrolytic and exchange acidity
- Exch. Al
- Available P, K, Mg
- Soluble S
- Total C
- Radioactivity
- Salinity
- Exchange cations
- Base cations
- CEC
- CEC saturation with base cations
- Total S
- Total P, Na, Mg, Ca, Fe, Mn, Al, Cu, Ni, Cr, Zn, V, Cd, Co, Pb, Ba, Be, Li, La
- PAH

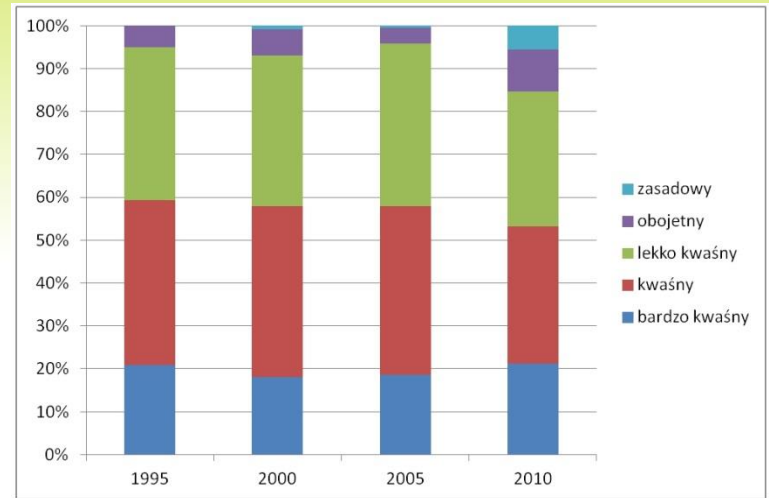
Since 2015:

- Hg
- N min
- Pesticides - carbaryl, carbofuran, maneb, atrazine
- Chloroorganic pesticides - DDT/DDE/DDD, aldrine, dieldrine, α -HCH, β -HCH, γ -HCH

Monitoring - Analysis of trends



pH

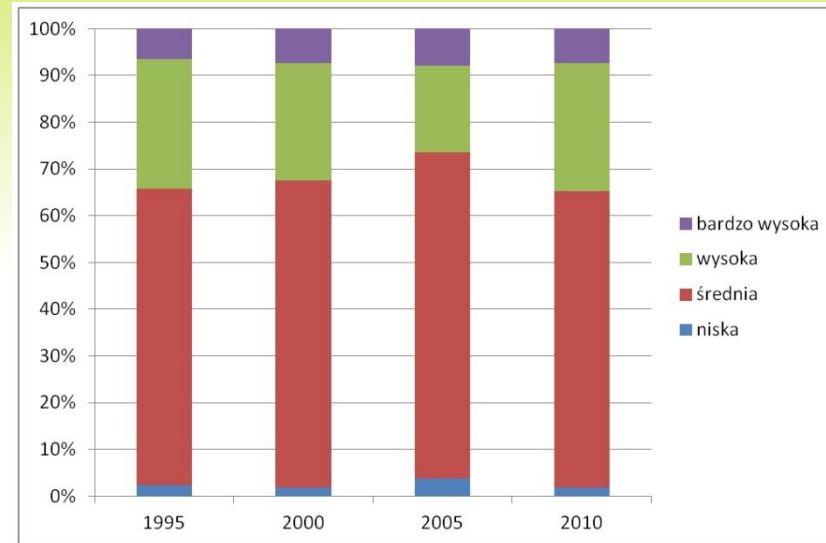
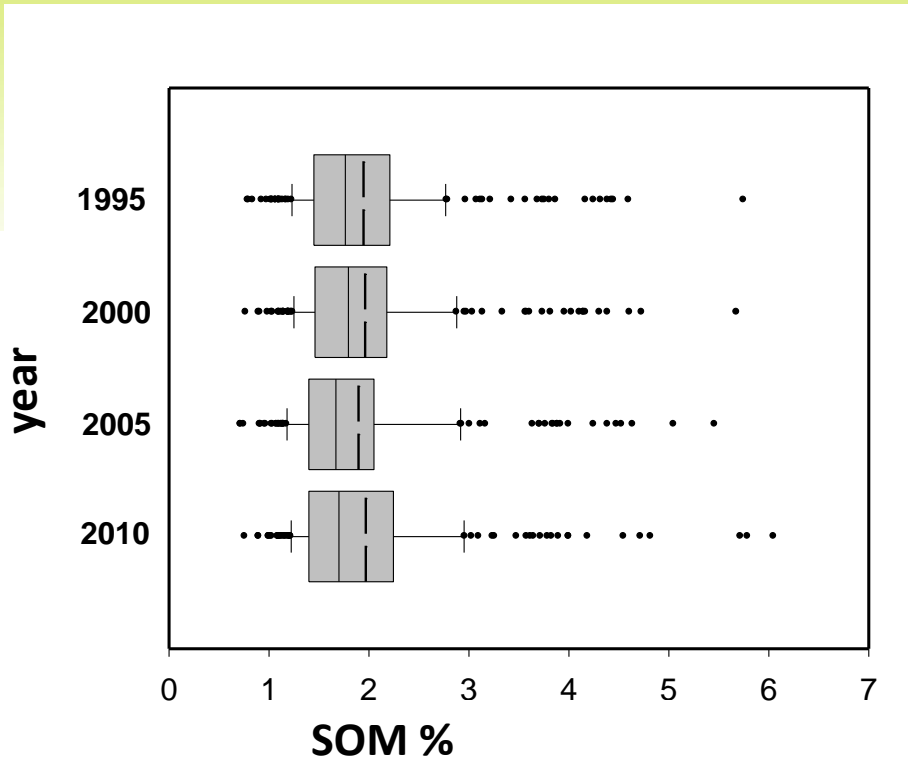


Share of pH classes (from bottom: very acidic, acidic, slightly acidic, neutral, alkaline)



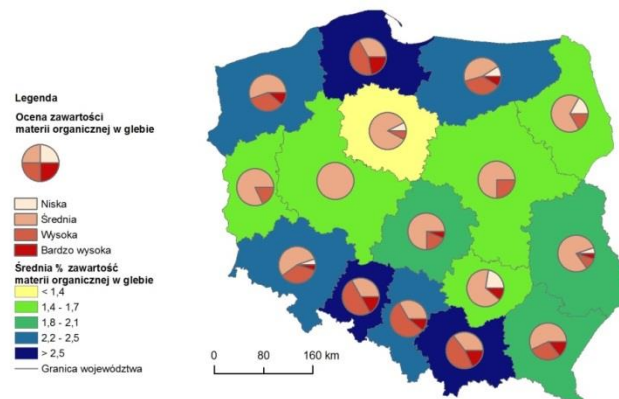
Mineral and Ca-fertilizers utilized in Poland

SOM



Share of SOM content classes (blue <1%, red 1-2%, green (2-3.5%), purple (>3.5%))

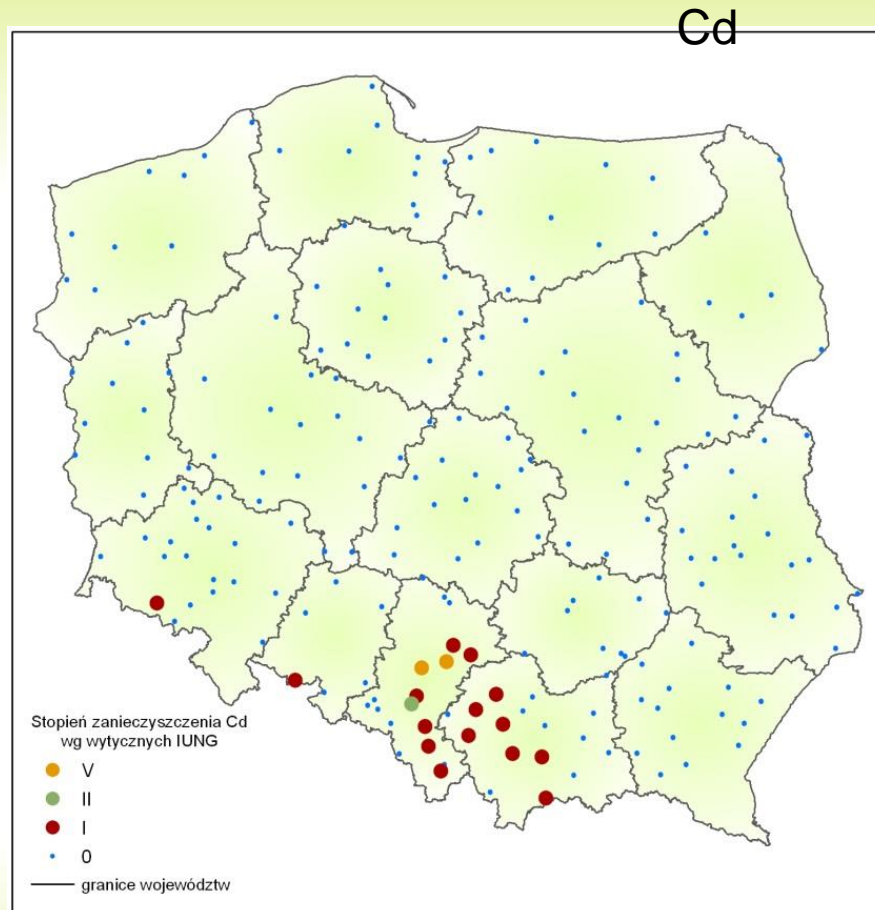
Average SOM content in regions



TE exceeding Standard criteria



TE content levels – IUNG guidelines



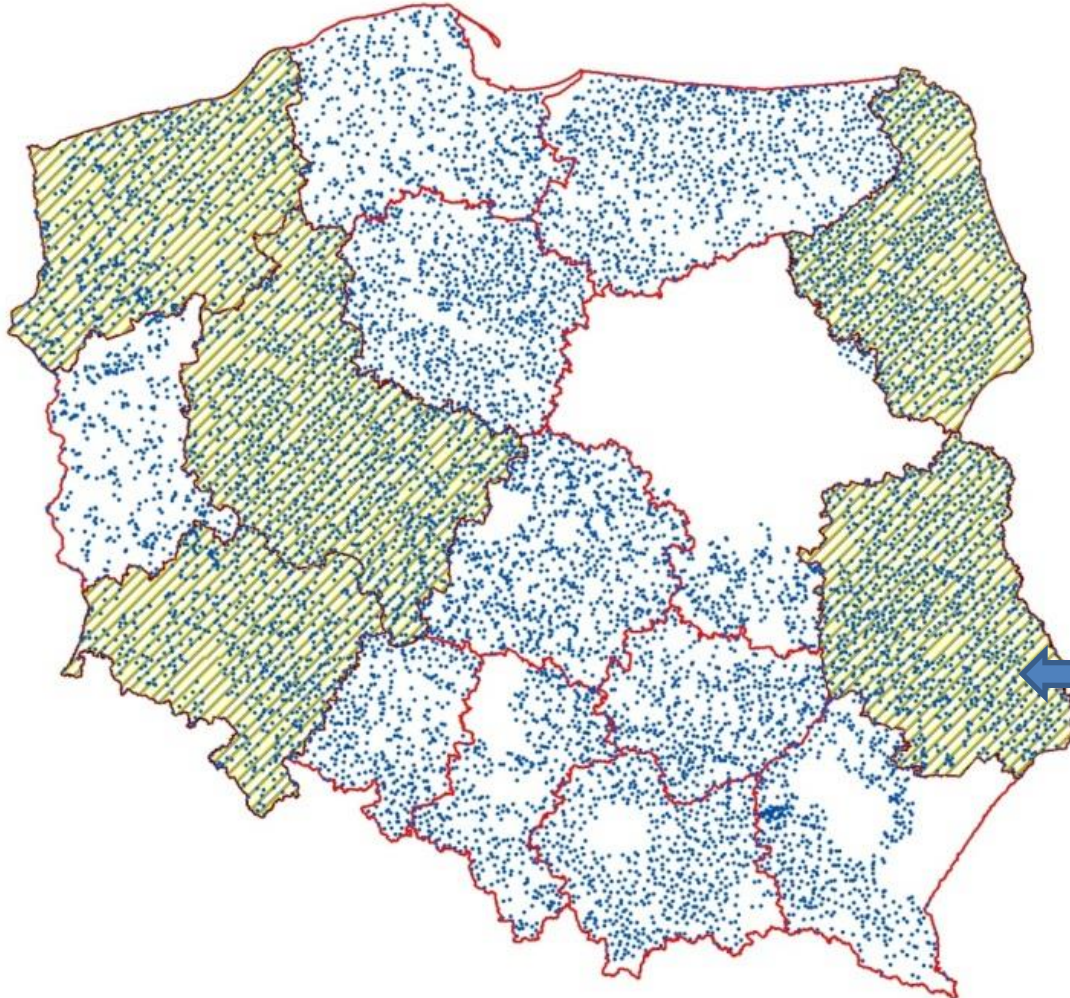
REGIONAL ASSESSMENTS FOR SOC CHANGES – HISTORICAL PROFILES

10 000 georeferenced samples

Atrybiuty punkty_glebowe25

S	HR_ID	PODL	POWAT_OK	POWAT_I	POWAT	KOMPL	TYP	P1	P2	P3	P4	P5	KTP
330	1	pgm	gostyni	gostynski	2	B	pgm		gs				2B_pgm_gs
390	2	gsp	gostyni	gostynski	2	B	gsp		le				2B_gsp_le
390	3	pgm	gostyni	gostynski	2	B	pgm		gf				2B_pgm_gf
391	4	pgl	gostyni	gostynski	4	A	pgl		gf				4A_pgl_gf
391	5	pgl	gostyni	gostynski	4	A	pgl		gf				4A_pgl_gf
391	6	pgl	gostyni	gostynski	4	A	pgl			gs			4A_pgl_gs
392	7	pgm	gostyni	gostynski	2	B	pgm		gs				2B_pgm_gs
392	8	pgm	gostyni	gostynski	2	A	pgm		gf				2A_pgm_gf
392	9	pgl	gostyni	gostynski	4	B	pgl		gf				4B_pgl_gf
392	10	pgl	gostyni	gostynski	4	Bw	pgl		gf				4Bw_pgl_gf
392	11	pgm	gostyni	gostynski	2	D	pgm		gs				2D_pgm_gs
393	12	pgm	gostyni	gostynski	2	B	pgm		gf				2B_pgm_gf
454	13	pgl	gostyni	gostynski	4	A	pgl		gf				4A_pgl_gf
454	14	pgm	gostyni	gostynski	2	Bw	pgm		gf				2Bw_pgm_gf
454	15	pgm	gostyni	gostynski	2	A	pgm		gf				2A_pgm_gf
454	16	pgm	gostyni	gostynski	1	B	pgm		gf				1B_pgm_gf
455	17	int	gostyni	gostynski	2z	E	int						2zE_int
455	18	gl	gostyni	gostynski	2	Bw	gl						2Bw_gl
455	19	pgm	gostyni	gostynski	2	Bw	pgm		gf				2Bw_pgm_gf
455	20	gl	gostyni	gostynski	2	B	gl						2B_gl
456	21	pgl	gostyni	gostynski	4	A	pgl		gf				4A_pgl_gf
456	22	pgl	gostyni	gostynski	4	A	pgl		gf				4A_pgl_gf
457	23	pgm	gostyni	gostynski	2	B	pgm		gs				2B_pgm_gs
517	24	pl	gostyni	gostynski	7	Bw	pl						7Bw_pl
518	25	gl	gostyni	gostynski	3	Bw	gl						3Bw_gl
518	26	ps	gostyni	gostynski	6	Bw	ps			gl			6Bw_ps_gl
519	27	pgl	gostyni	gostynski	4	Bw	pgl		gf				4Bw_pgl_gf
519	28	ps	gostyni	gostynski	5	A	ps			gf			5A_ps_gf
519	29	pgl	gostyni	gostynski	4	Bw	pgl		gs				4Bw_pgl_gs
520	30	gl	gostyni	gostynski	2	B	gl						2B_gl
582	31	pglb	jarocin	jarocinski	5	A	pglb			gl			5A_pglb_gf
583	32	pglb	jarocin	jarocinski	4	A	pglb		gf	pgm			4A_pglb_gf_pgm
890	33	gs	skubice	skubicki	8	F	gs		gc	pl			8F_gs_gc_pl
891	34	pgl	skubice	skubicki	4	A	pgl						4A_pgl
755	35	pgl	skubice	skubicki	6	Bw	pgl		pl	gf			6Bw_pgl_pl_gf
755	36	pgl	skubice	skubicki	5	Bw	pgl			gf			5Bw_pgl_gf
815	37	n	skubice	skubicki	2z	T	n						2zT_n
815	38	pgl	skubice	skubicki	5	Bw	pgl			gf			5Bw_pgl_gf
816	39	pgl	skubice	skubicki	4	A	pgl		gf				4A_pgl_gf
816	40	pgl	skubice	skubicki	4	A	pgl			gf			4A_pgl_gf
816	41	pgm	skubice	skubicki	4	A	pgm		gf				4A_pgm_gf
816	42	pgm	skubice	skubicki	2	B	pgm		gf				2B_pgm_gf
817	43	ps	skubice	skubicki	6	Bw	ps			pl			6Bw_ps_pl
817	44	ps	skubice	skubicki	7	Bw	ps			pl			7Bw_ps_pl
817	45	pgl	skubice	skubicki	5	Bw	pgl			pl	gf		5Bw_pgl_pl_gf

koord. (0 wybrany(x)ych) z *6100 Opcje



Yellow regions – we have done comparative measurements after 3-50 years

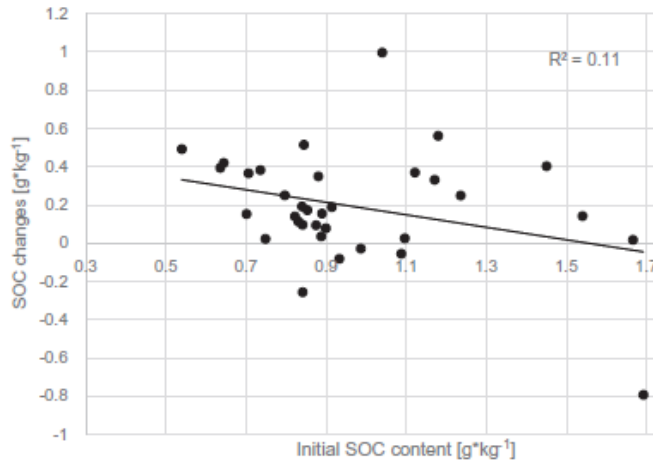


Fig. 6. Relationship between initial SOC content and SOC change in soil profile 1960–2010 period.

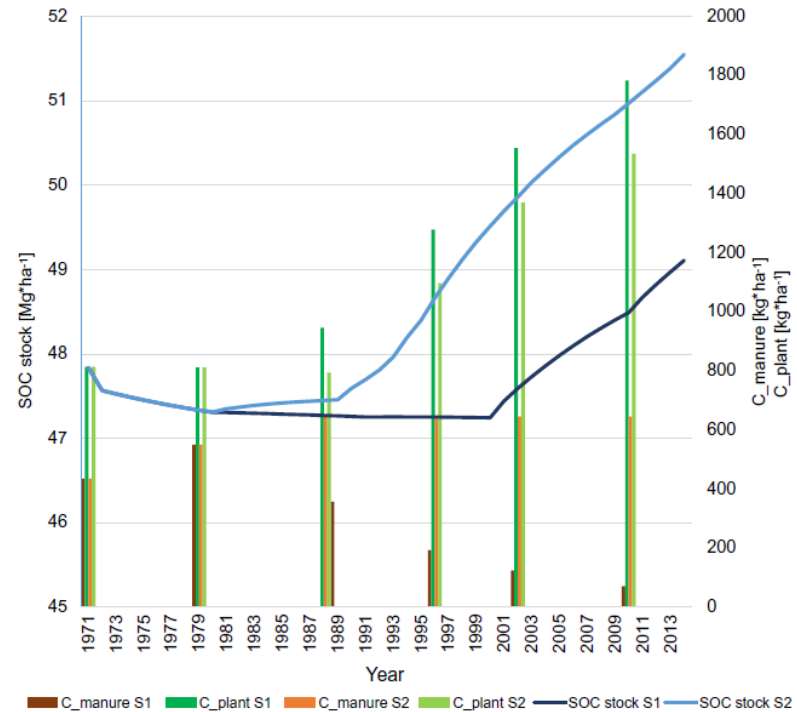


Fig. 9. Comparison of SOC stock trends for scenarios S-1 (as was) and S-2 (MFS). Bars mean average manure and plant inputs of C in years of national agricultural census for the considered scenarios.

Contents lists available at ScienceDirect

Geoderma

journal homepage: www.elsevier.com/locate/geoderma



Modelling soil carbon trends for agriculture development scenarios at regional level

Radosław Kaczynski^{a,*}, Grzegorz Siebielec^a, Marjoleine C. Hanegraaf^b, Hein Korevaar^c

^a Institute of Soil Science and Plant Cultivation-State Research Institute, Pulawy, Poland

^b Nutrient Management Institute, Wageningen, The Netherlands

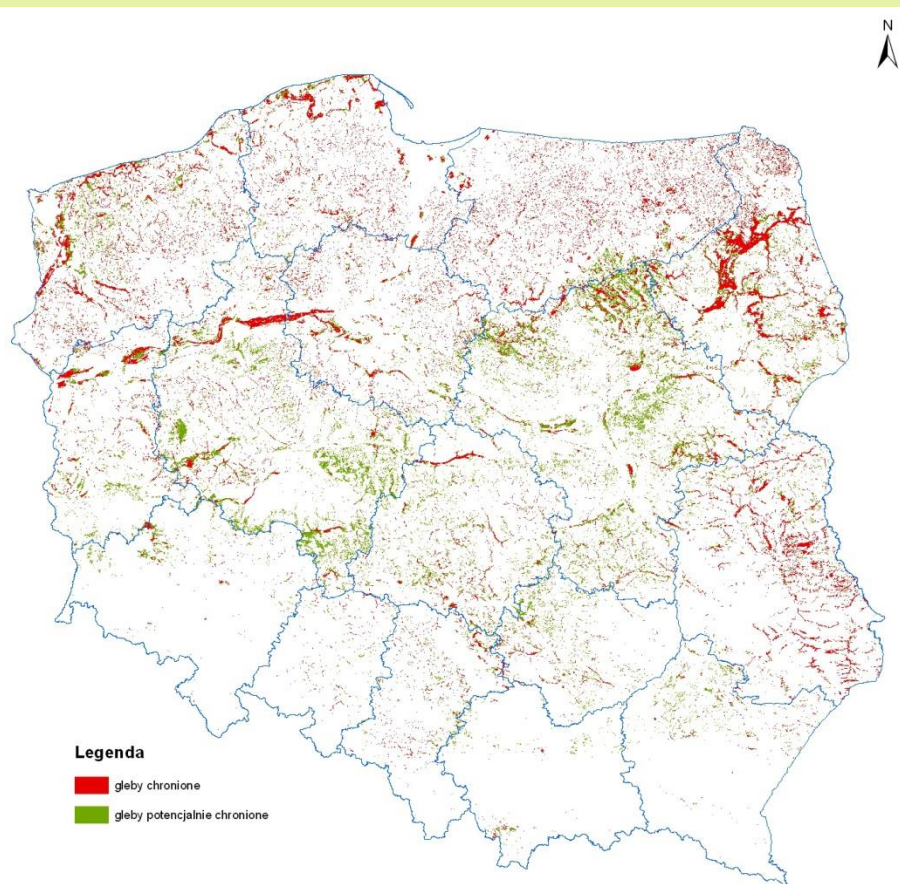
^c Wageningen University & Research, Agrosystems Research, Wageningen, The Netherlands



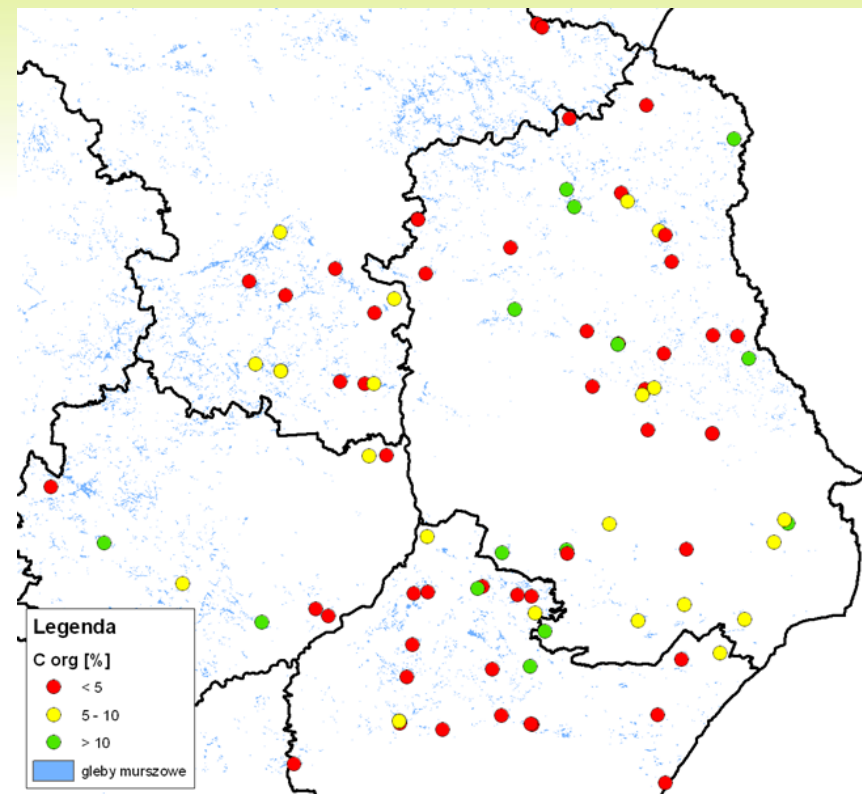
**Work under
7FP Cantogther project**

MONITORING OF PEAT SOILS – SINCE 2016

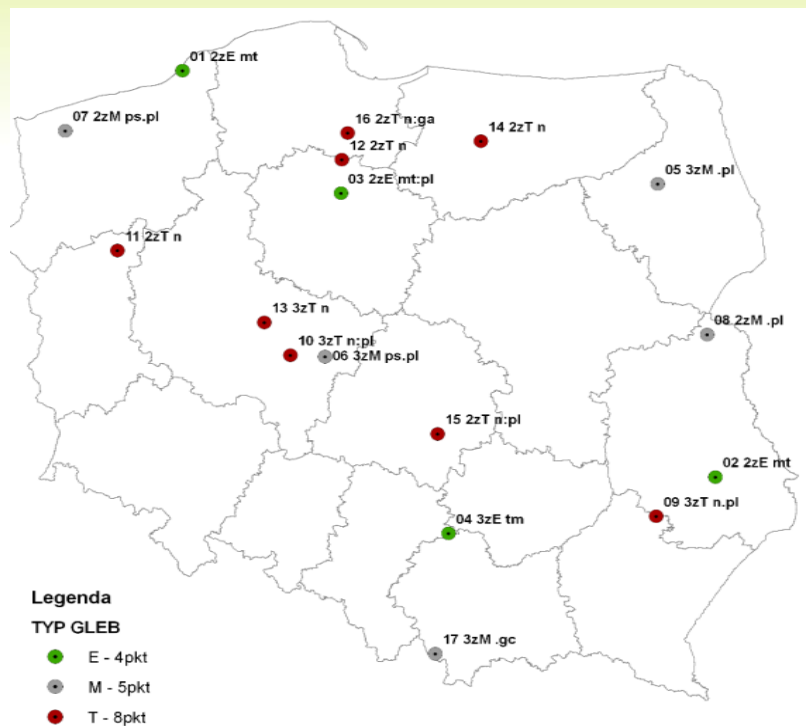
Peat soils – what are the trends?



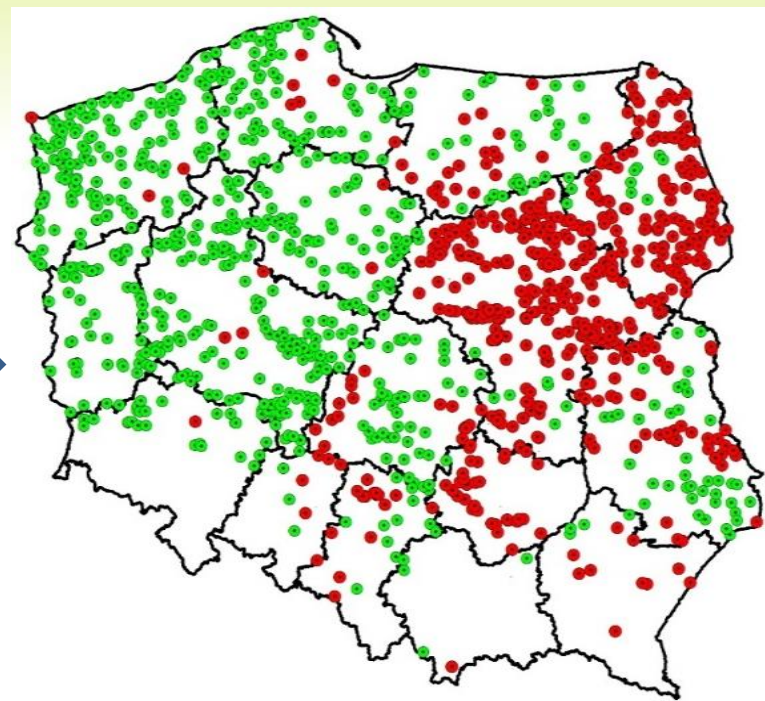
Map of organic soils



Eastern Poland – current C contents in former peat soils

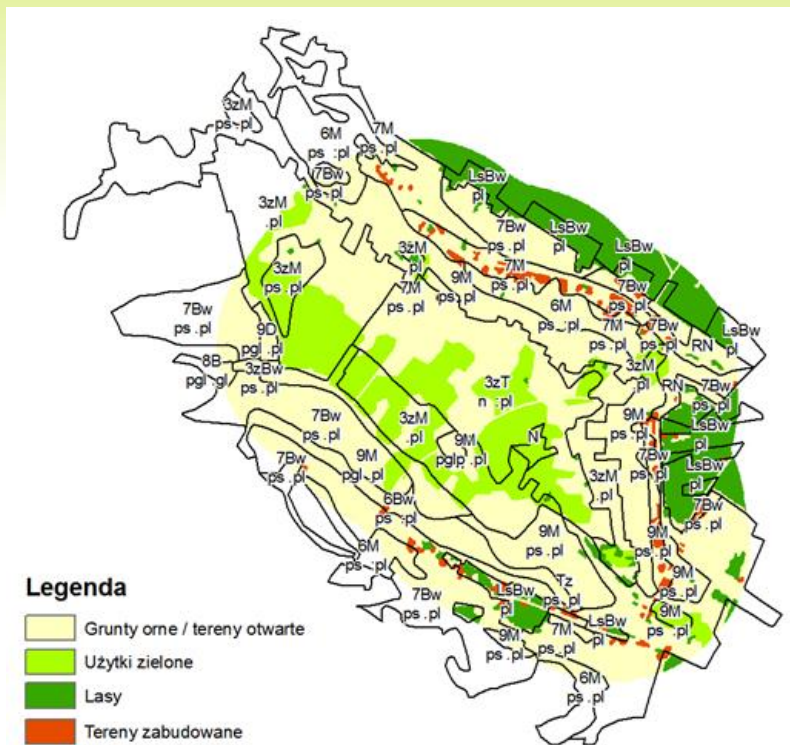


Case studies



Country monitoring of peat soils

Case studies



Land use change analysis

Field assessments and sampling

Financed by Ministry of Agriculture and Rural Development



SOIL MONITORING FOR CAP EVALUATION AND IMPLEMENTATION

Soil parameters	Year – number of sampling locations		
	2014-2015	2016	2017
pH-H ₂ O and pH-KCl	160 228	-	3 200
Corg	-	30 000	14 200
exchangeable P, K, Mg	-	30 000	14 200
CEC	-	-	44 200

Since 2017:

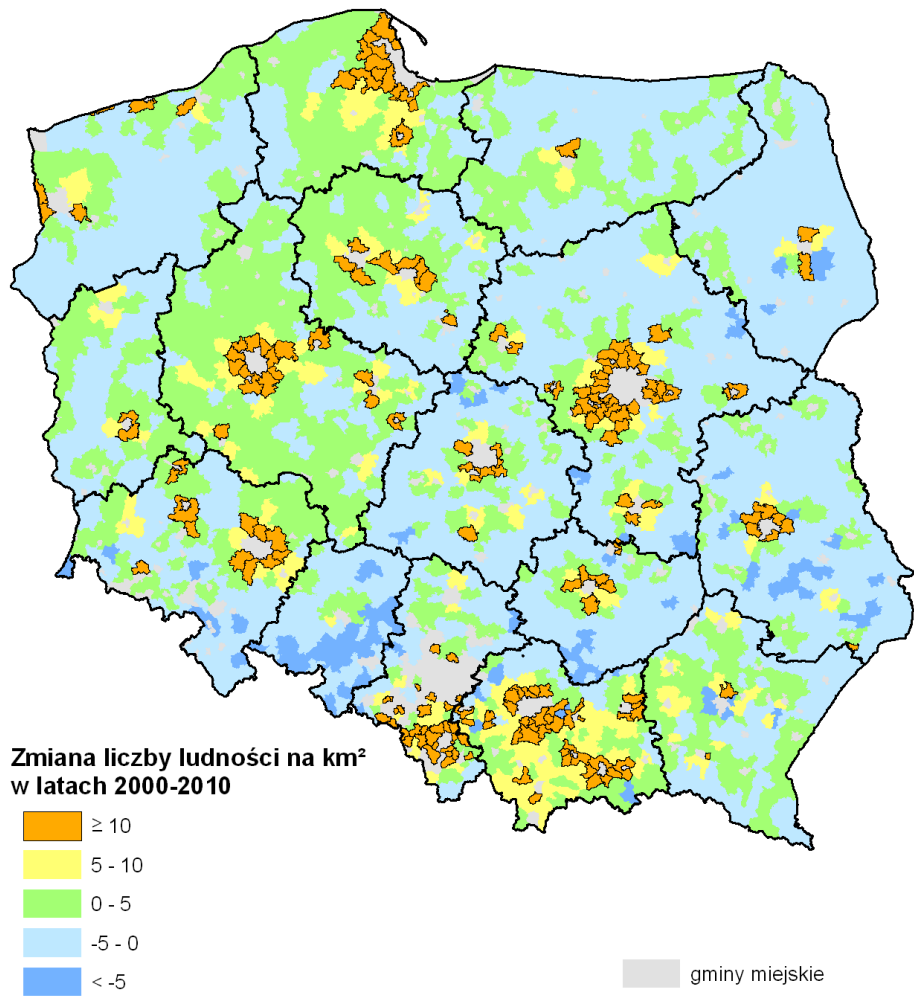
- 600 farms across Poland representing various CAP instruments
- range of chemical and biodiversity parameters
- questionnaires on agricultural data

Collaboration with state Agro-chemical Stations

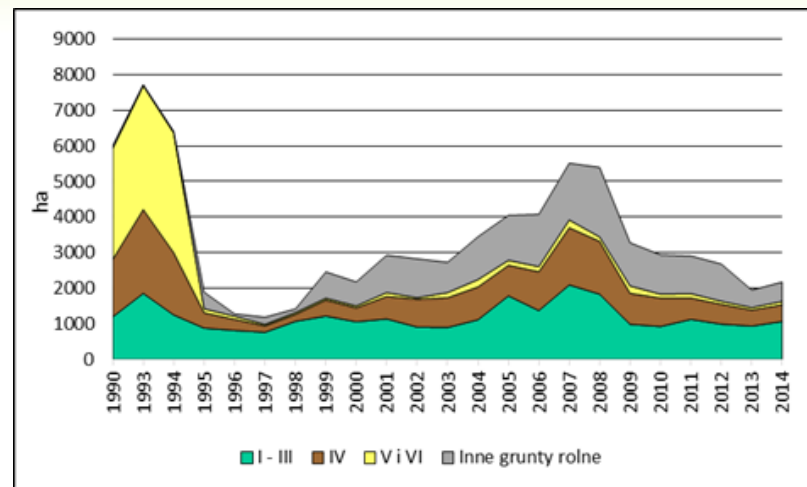
Financed by Ministry of Agriculture and Rural Development



MONITORING LAND TAKE, URBAN SPRAWL, ARTIFICIAL SURFACES, SEALING



Demographic data - migration



Land take vs soil classes (based on GUS data)

URBAN-SMS

Urban Soil Management Strategy

2007 – 2013

Priority 3 Environment

Area of Intervention 3.1

Developing a High Quality

Environment by Managing and

Protecting Natural Resources and

Heritage

www.urban-sms.eu

URBAN-SMS project partners:

City of Stuttgart (Lead Partner)

City of Vienna

Federal Environment Agency, Austria

City of Milan

University of Torino

City of Celje

Agricultural Institute of Slovenia

Institute of Soil Science and Plant Cultivation, Pulawy

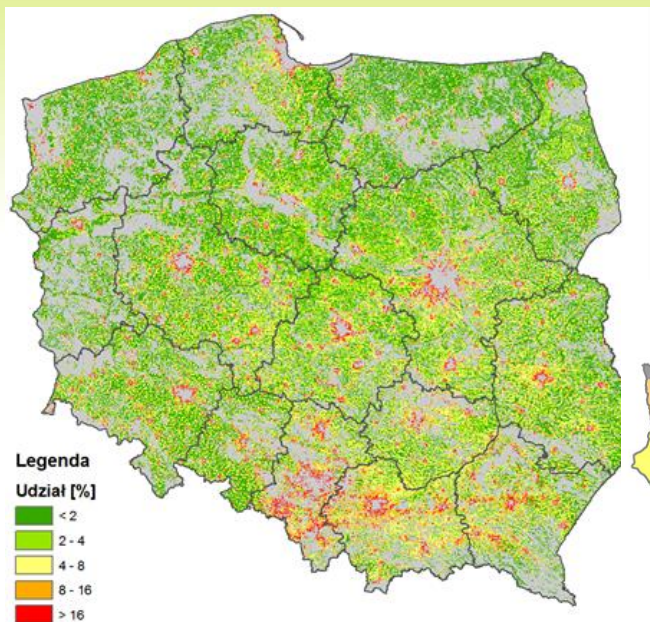
Czech University of Life Sciences Prague

**Soil Science and Conservation Research Institute,
Bratislava**

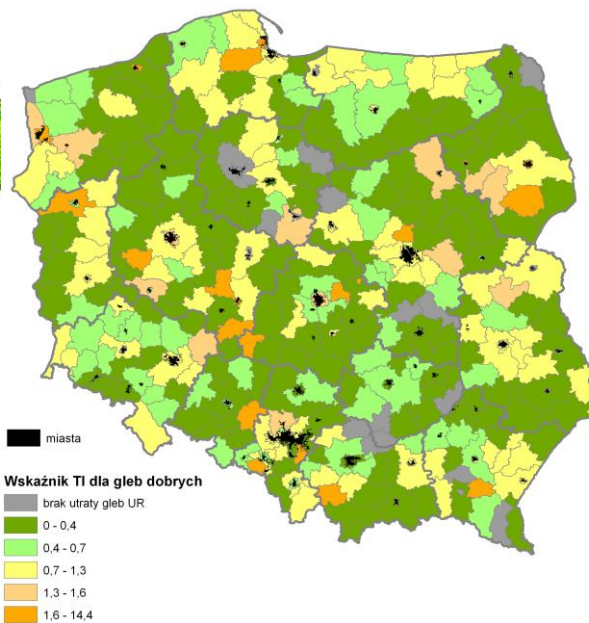
District Authority Stuttgart



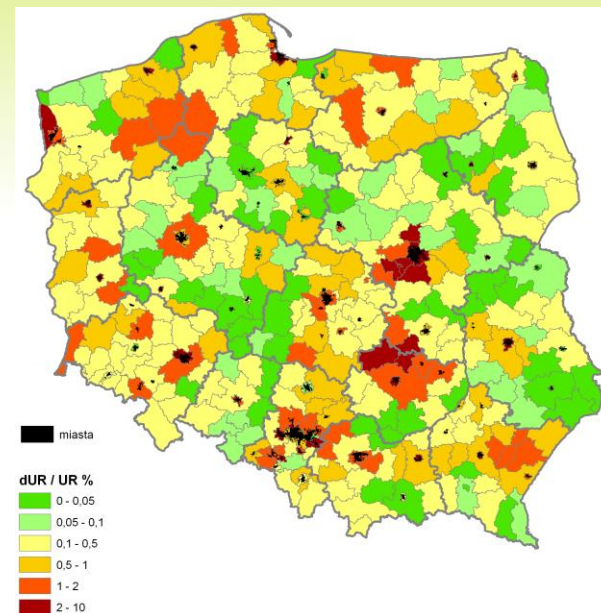
NATIONAL MONITORING OF LAND TAKE – COUNTRY LEVEL



Density of artificial surfaces in rural areas



Transition indexes for best soils 2006-2012



% loss of AA 2006-2012

Financed by Ministry of Agriculture and Rural Development



***Thank you
for the
attention***

