Soil status in Poland and sustainable management of soil

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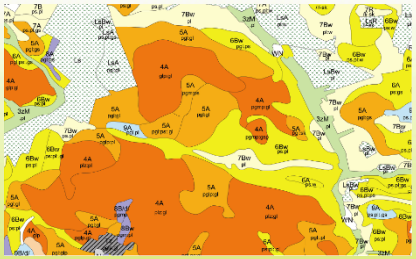
Instytut Uprawy
Nawożenia i Gleboznawstwa

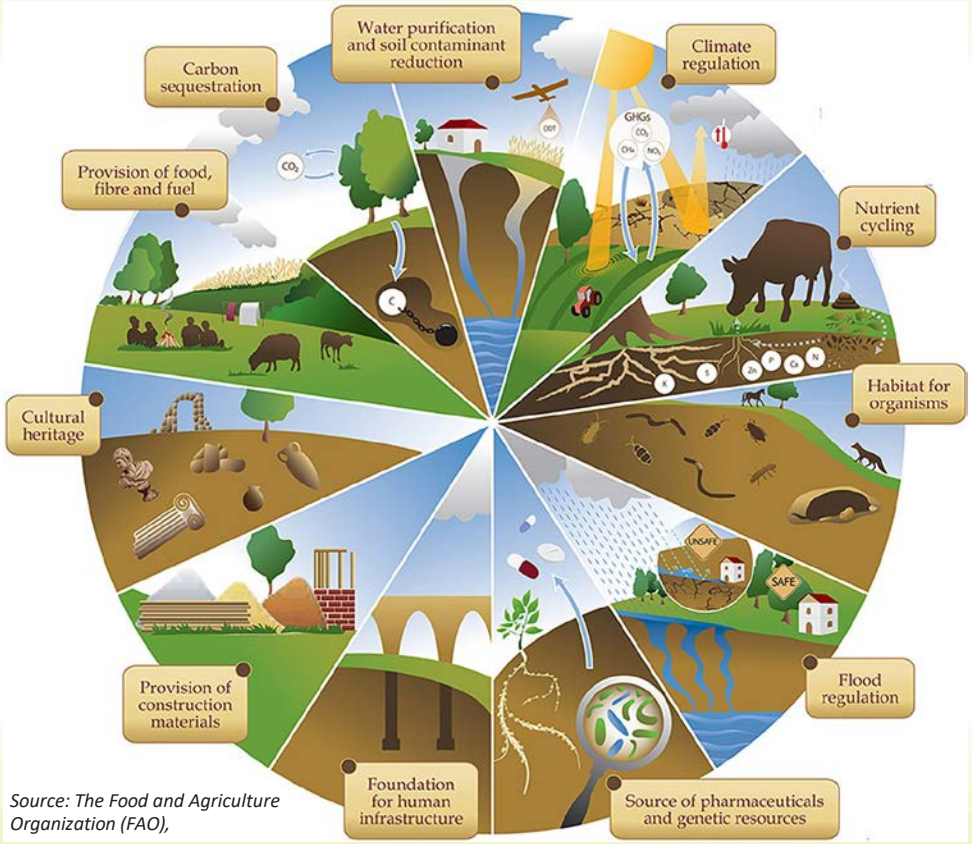
Warszawa, 2019

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**



New momentum for the soil – from a dirt to ecosystem services



Source: The Food and Agriculture Organization (FAO),

Soil vs Sustainable Development Goals

Recent initiatives

- Global Soil Partnership
- Voluntary Guidelines for Soil Sustainable Management
- 4p1000 initiative,
- Soil issues in the Common Agriculture Policy (CAP)
- guidelines on best practice to limit, mitigate or compensate soil sealing
- Soil projects in 7FP and H2020
- European Joint Programming on soil
- Providing support in relation to the implementation of the EU Soil Thematic Strategy- DG ENV (2016-2019)

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COP24·KATOWICE 2018
KONFERENCJA NARODÓW ZJEDNOCZONYCH
W SPRAWIE ZMIAN KLIMATU

Food and Agriculture Organization of the Unit d Nations

Institute of Soil Science and Plant Cultivation State Research Institute

GLOBAL SOIL PARTNERSHIP

World Soil Day

BLACK SOILS INTERNATIONAL NETWORK

Black Soils for food security and climate change adaptation and mitigation

COP 24 side-event | 5th December | 14:00-15:30
Lubelskie Climate Action Room 3 godz.

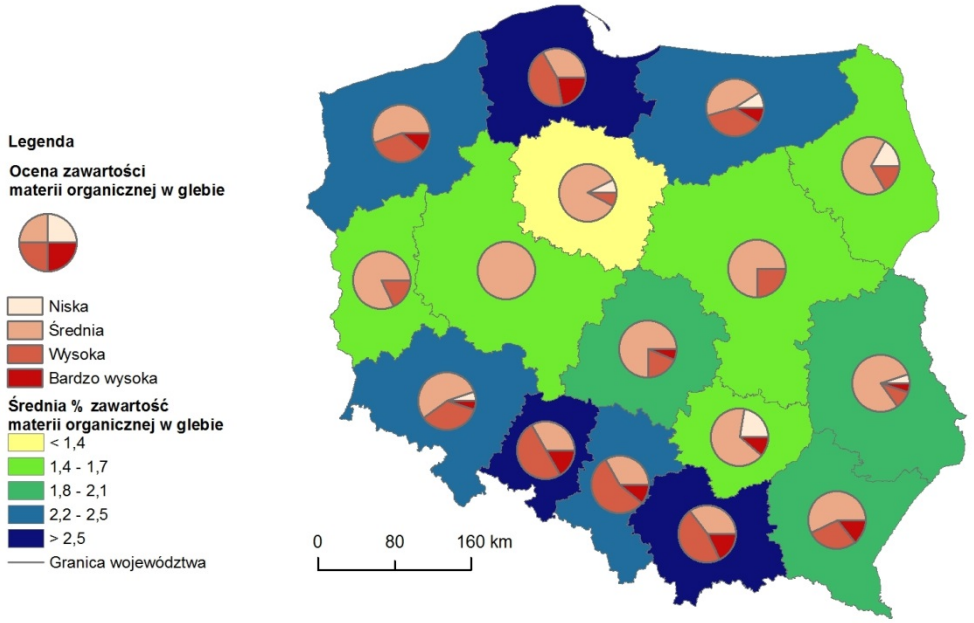
Black Soils are characterized by a thick, dark-colored soil horizon rich in organic matter. Due to their inherent high fertility, these soils remain very sensitive to anthropogenic intervention and are prone to severe degradation. Because of their high soil organic carbon (SOC) content, they are also very sensitive and can be potential large sources of greenhouse gases. Extensively and intensively farmed, they constitute the

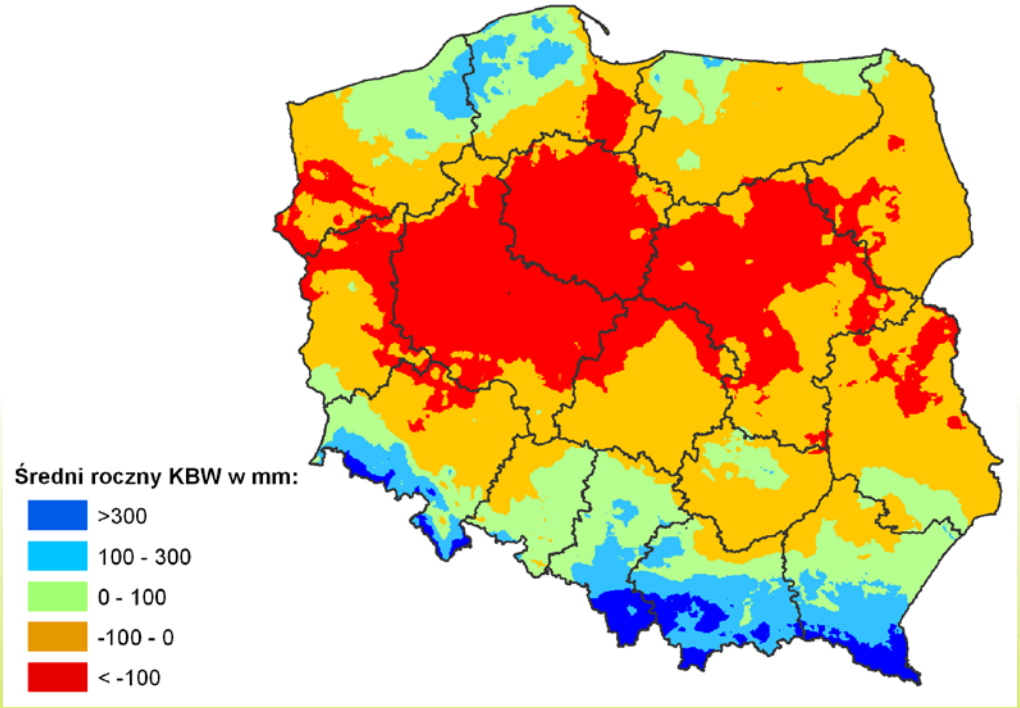
Targets of sustainable soil management

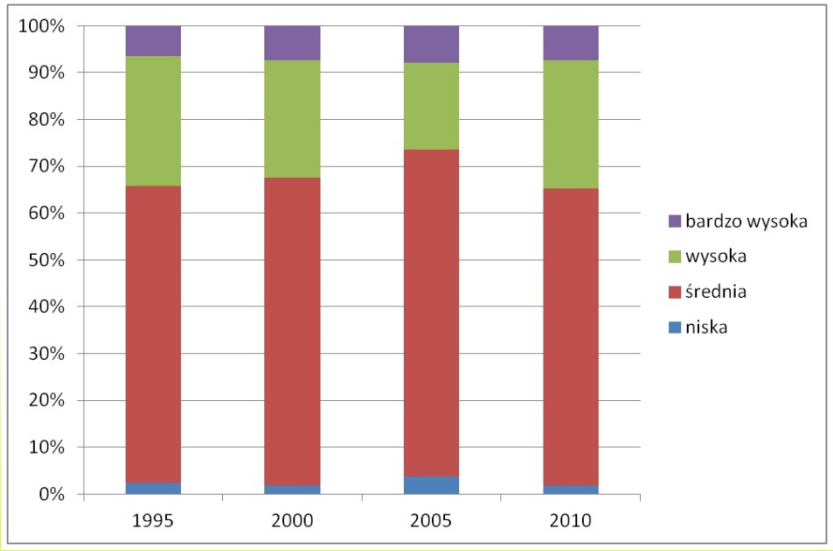
Policy brief 1 – project SOIL4EU

- **Wind and water soil erosion is limited**
- **Contaminant inputs to soil are low and levels are non-toxic to human and animals**
- **Contaminant levels in soil enable the production of healthy crops**
- **Net sealing is reduced and spatial development responsible**
- **Soil carbon in mineral soils remains at a stable level at least**
- **Decline of organic matter in peat soils is reduced**
- **Soil biodiversity sustained to enable biological processes of energy and nutrient cycling**
- **Soil capacity for retaining water in soil is sustained**
- **GHG emissions from soil are low and counteracted by C sequestration**
- **Good soil structure and low compaction**

SOM in Poland

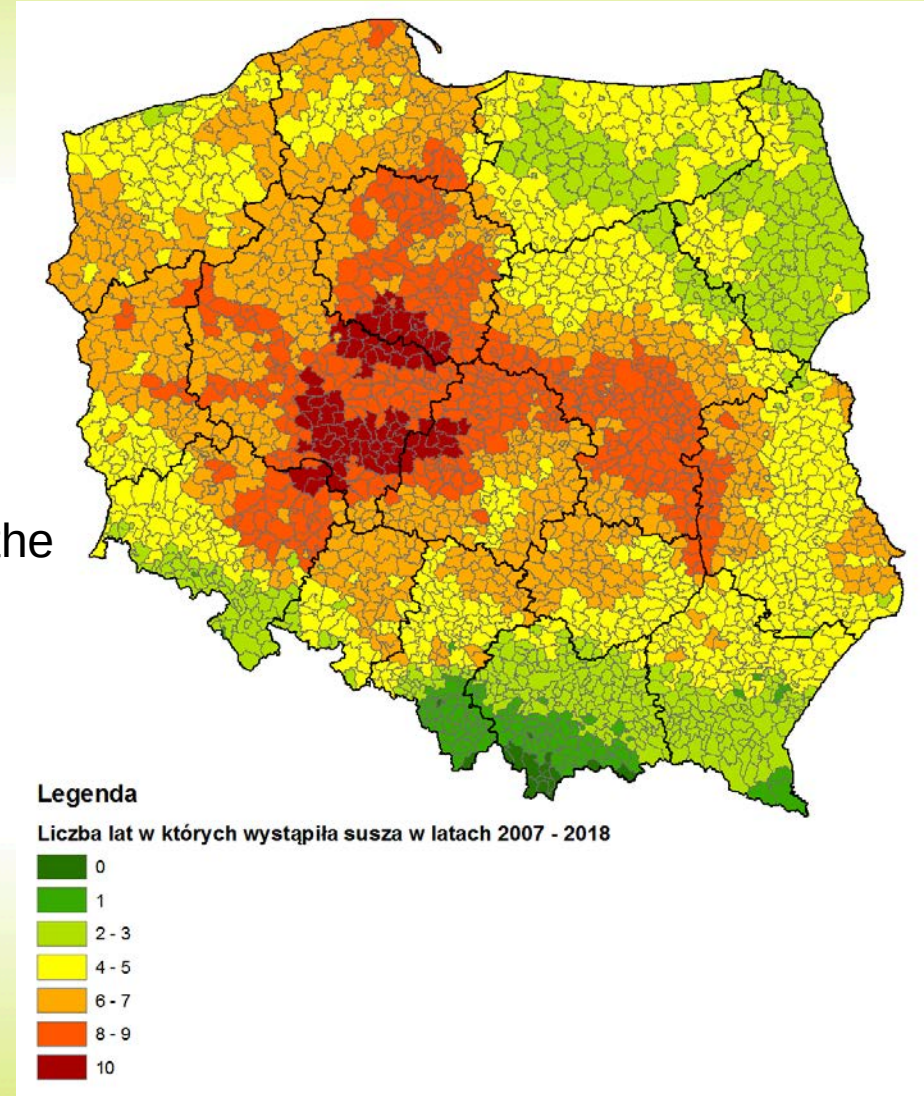






Risk of drought

Number of years with the reported drought



In order to sustain soil functions and soil fertility, soil organic matter **must be kept at a stable level**.

This can be achieved through:

- a positive balance of organic matter in the soil,
- reducing soil disturbance by tillage,
- improving soil structure and enhancing soil biodiversity.

- **Bringing sufficient amounts of plant residues to the soil** is a common measure for sustaining SOM. These practices include growing green manure crops, catch crops, perennial forage and cover crops, and leaving crop residues in the field. The plant residues are ploughed in and slowly decomposed by the soil biota to constitute a source of soil humus.

- **Organic fertilisers** applied to soil can be a significant source of soil carbon. It must be emphasized that **only safe (uncontaminated) organic materials** can be applied to soil. Organic soil amendments might include **animal manure or recycled organic matter**, e.g. compost, composted sludge, food waste, digestate.
- **Conservation tillage** reduces the disturbance of the soil profile, protecting soil structure and enhancing SOM accumulation. Reducing tillage involves **limiting the aeration** of soil and related SOM mineralization. However, reduced or no-till practices result in carbon accumulation only when applied in **long-term**. **Permanent grasslands** are effective for carbon accumulation in mineral soils, especially when grass and legume species are combined.

Is manure neccesary to keep SOM at stable level?

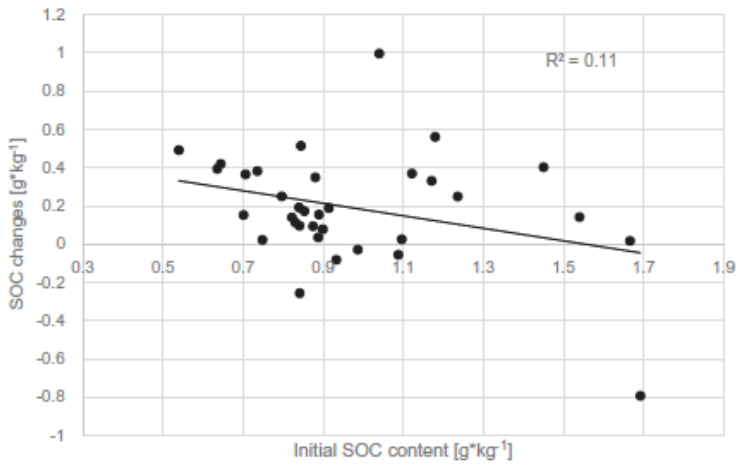


Fig. 6. Relationship between initial SOC content and SOC change in soil profiles within 1960–2010 period.

Year	Yield	Residue C	Manure C
	Mg ha^{-1}		
1960	2.15	0.71	0.34
1969	2.84	0.81	0.44
1979	4.03	0.81	0.55
1989	4.08	0.95	0.36
1996	3.97	1.28	0.19
2002	4.30	1.56	0.12
2010	5.16	1.78	0.07

Contents lists available at ScienceDirect

Geoderma

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

Modelling soil carbon trends for agriculture development scenarios at regional level

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[b] Nutrient Management Institute, Wageningen, The Netherlands
[c] Wageningen University & Research, Agrosystems Research, Wageningen, The Netherlands

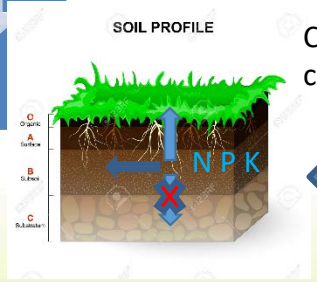
Work under
7FP Cantogether project

How to reduce nutrient and water loss?

Aware fertilisation

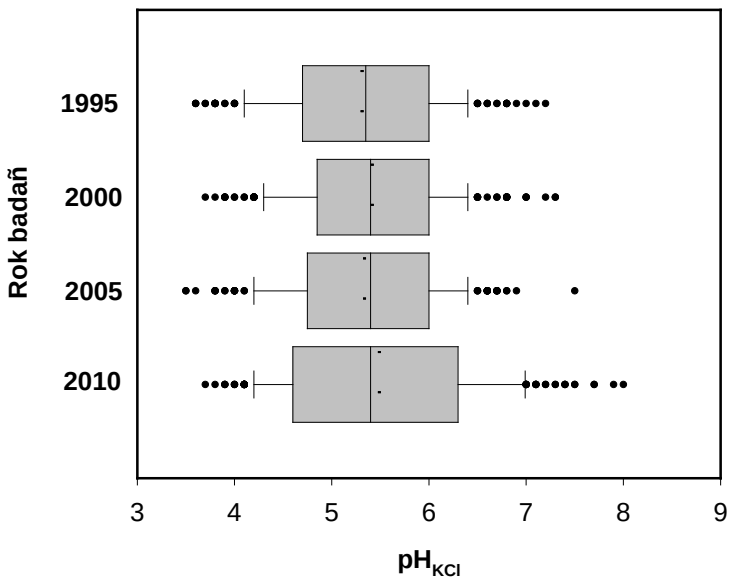
- Soil testing
- Crop selection
- Application rate adjusted
- Time and precision

Soil management

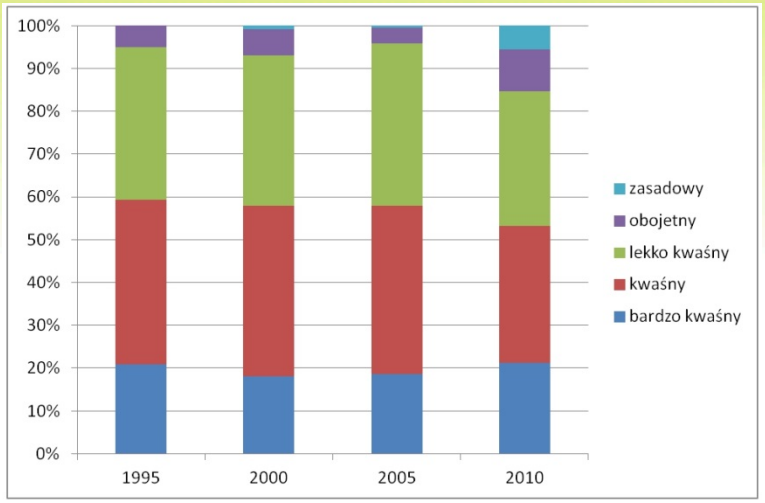


- Erosion prevention
  - mulching
  - Cover crops
  - Tillage direction
  - Crop residues
- SOM
  - Organic fertilisation
  - Cover crops
  - Simplified tillage
  - Liming
- pH regulation
  - N form
  - mulching
- Soil structure
  - Planning time
  - Cover crops
- Limiting compaction
  - Planning time
  - Simplified tillage
  - Limited traffic

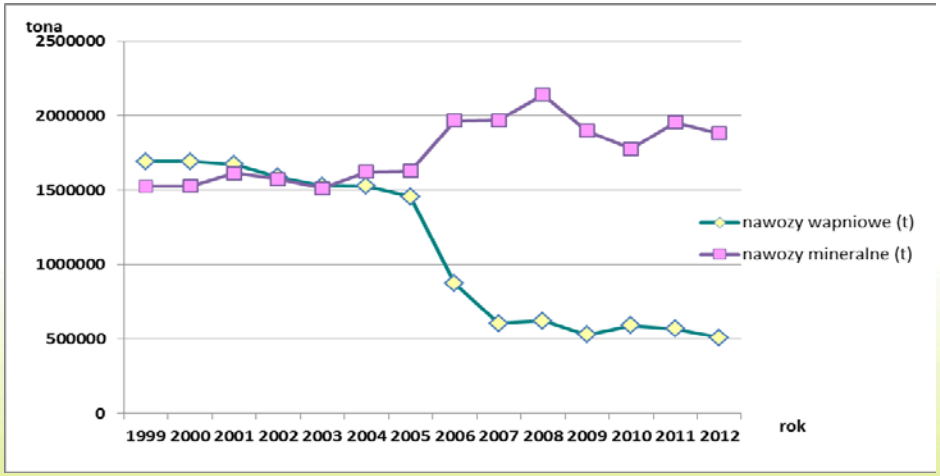
Soil acidity



pH

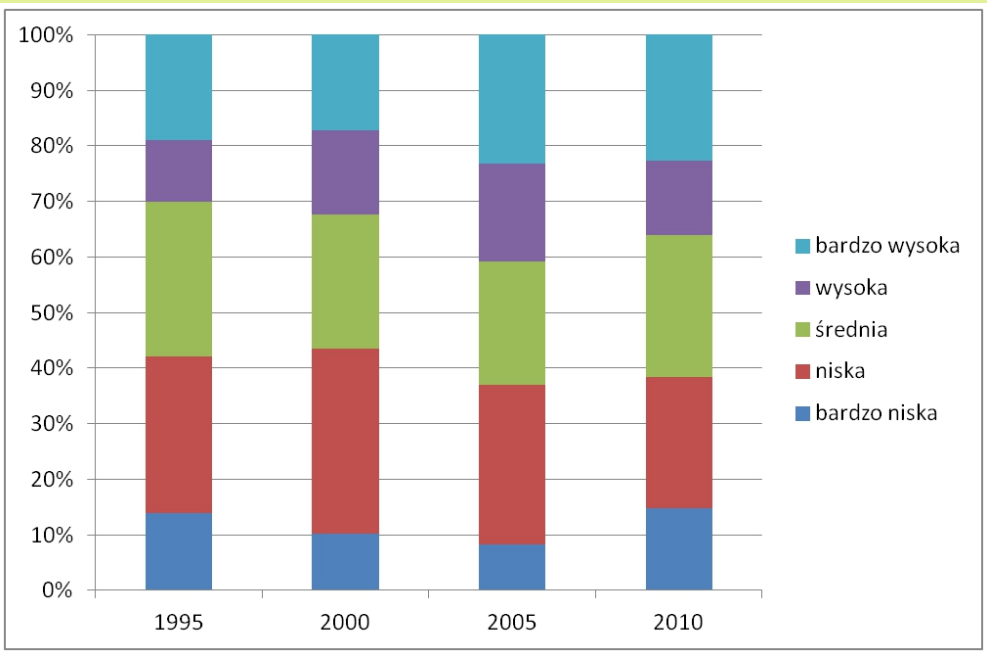


Share of pH classes (from bottom: very acidic, acidic, slightly acidic, neutral, akaline)



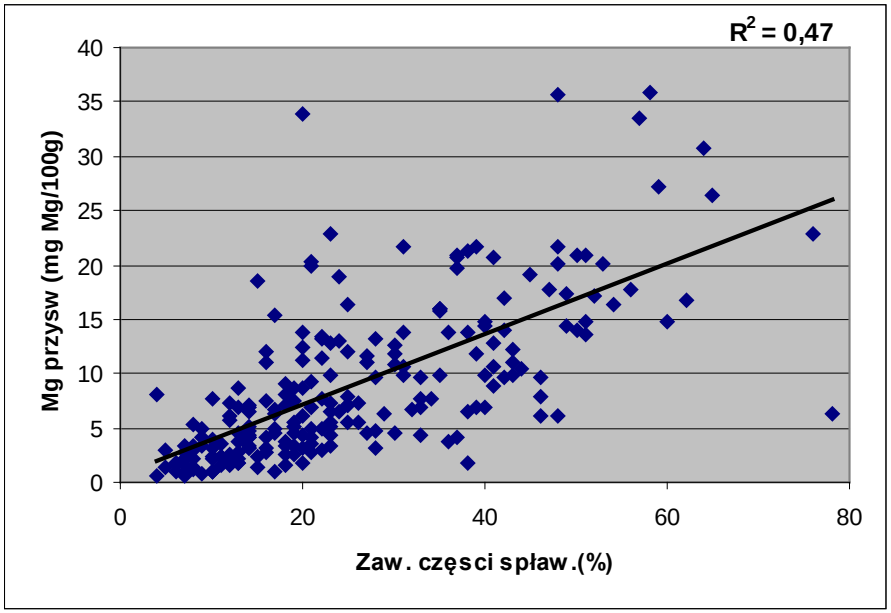
Mineral and Ca-fertilizers utilized in Poland

Nutrients



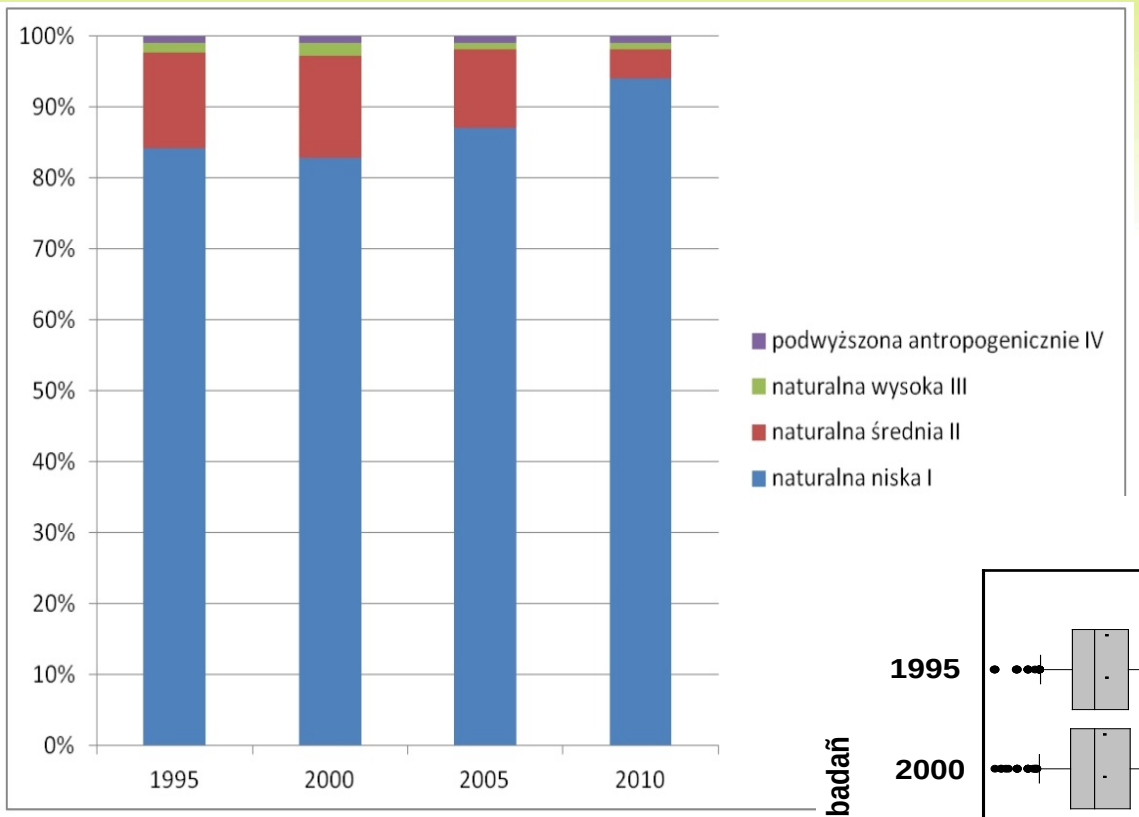
Avail. Phosphorus

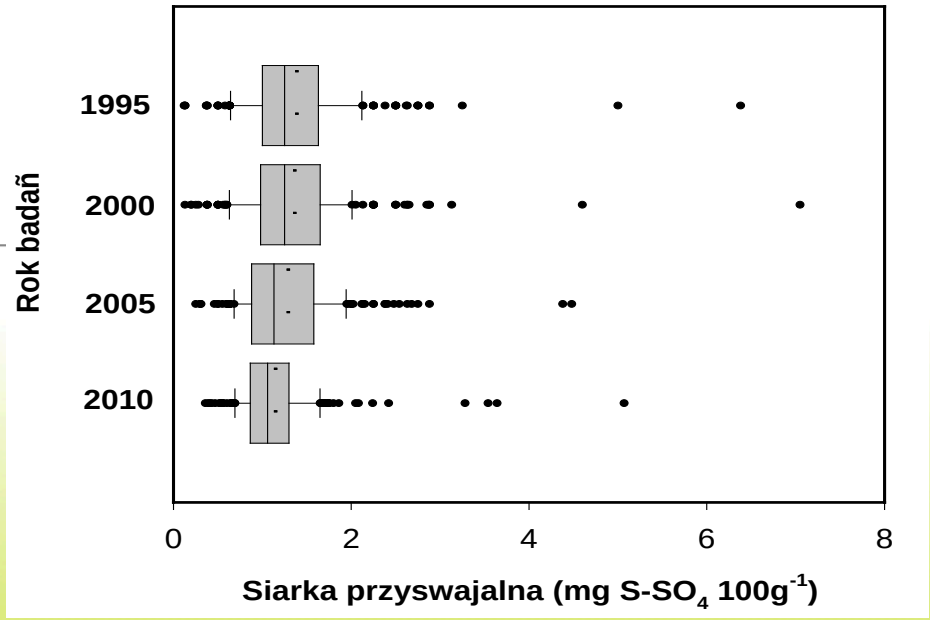
Avail. Mg vs texture



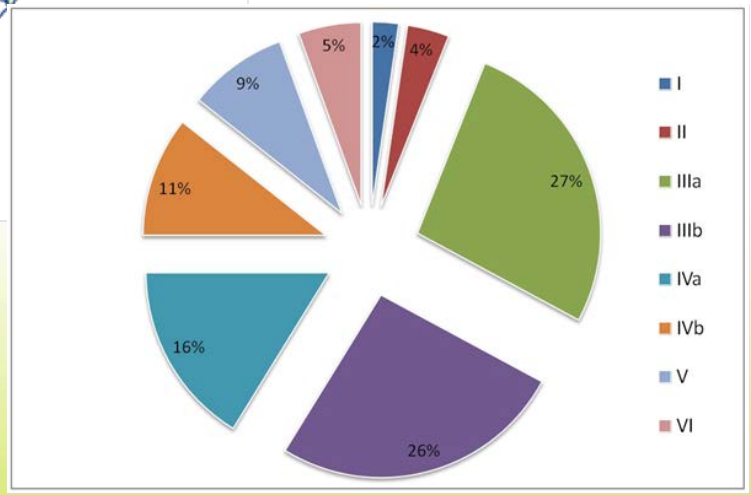
Share of K deficient soils in 2010 - 47%

Available sulphur

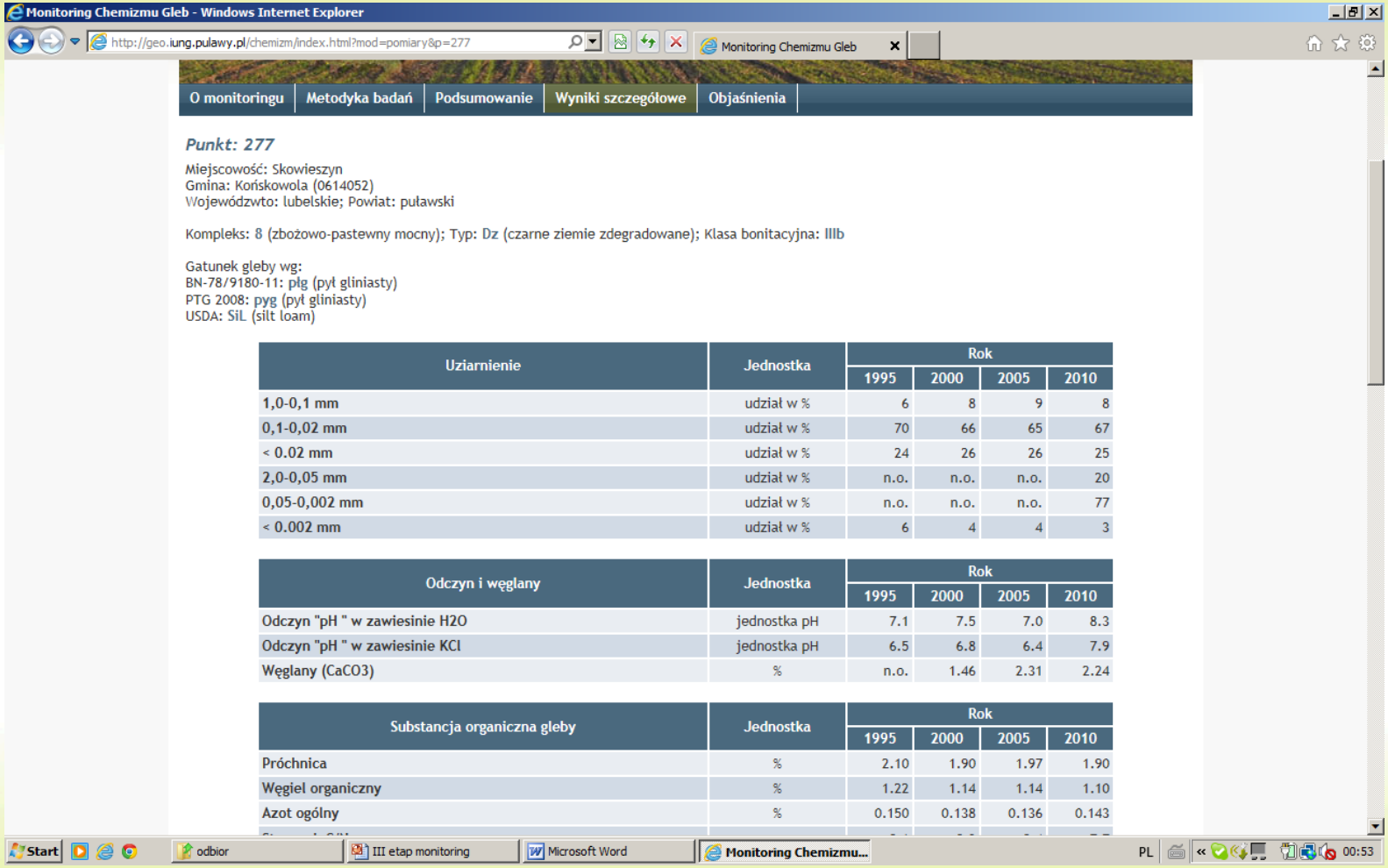




PERMANENT NATIONAL MONITORING 1995-2015; 216 LOCATIONS



Monitoring data – available for public



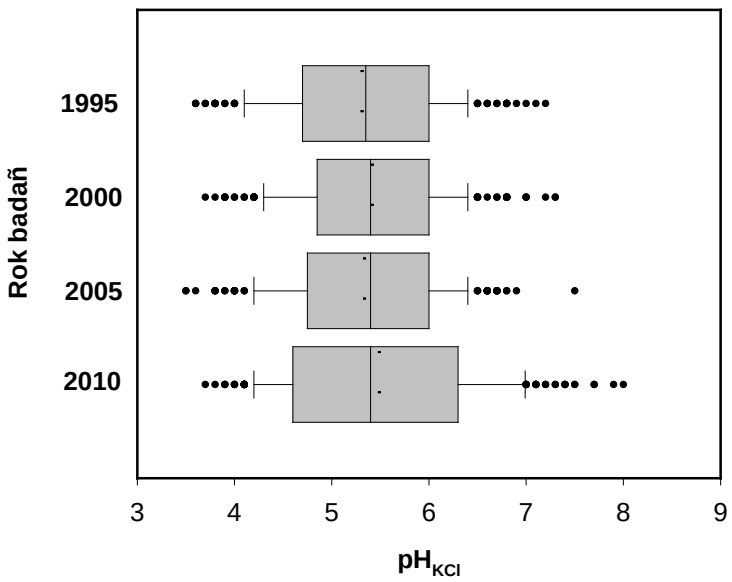
Uziarnienie	Jednostka	Rok			
		1995	2000	2005	2010
1,0-0,1 mm	udział w %	6	8	9	8
0,1-0,02 mm	udział w %	70	66	65	67
< 0.02 mm	udział w %	24	26	26	25
2,0-0,05 mm	udział w %	n.o.	n.o.	n.o.	20
0,05-0,002 mm	udział w %	n.o.	n.o.	n.o.	77
< 0.002 mm	udział w %	6	4	4	3

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

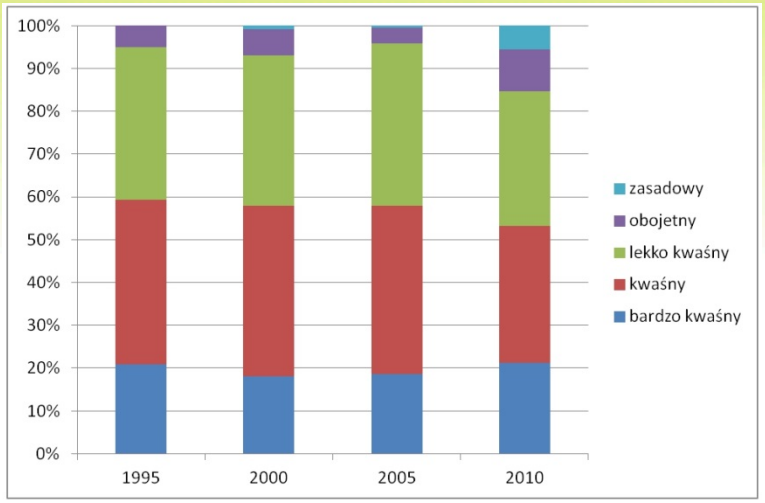
Substancja organiczna gleby	Jednostka	Rok			
		1995	2000	2005	2010
Próchnica	%	2.10	1.90	1.97	1.90
Węgiel organiczny	%	1.22	1.14	1.14	1.10
Azot ogólny	%	0.150	0.138	0.136	0.143

www.gios.gov.pl/chemizm_gleb/

National monitoring - Analysis of trends



pH



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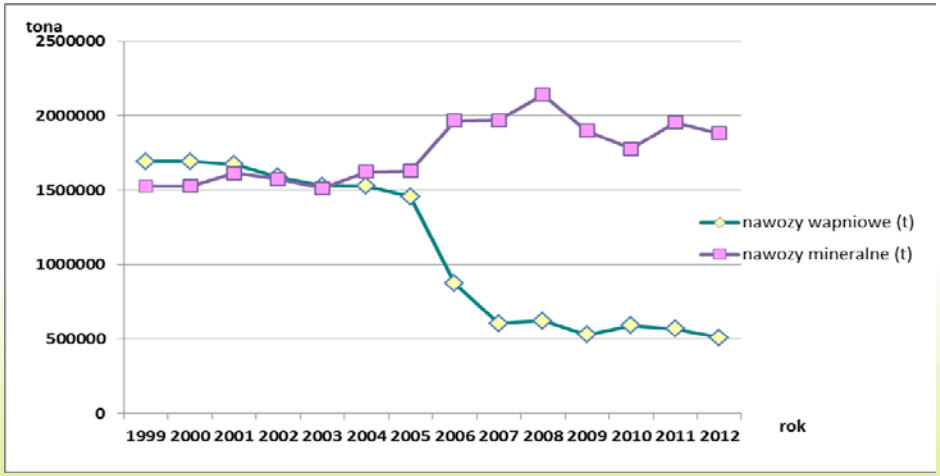
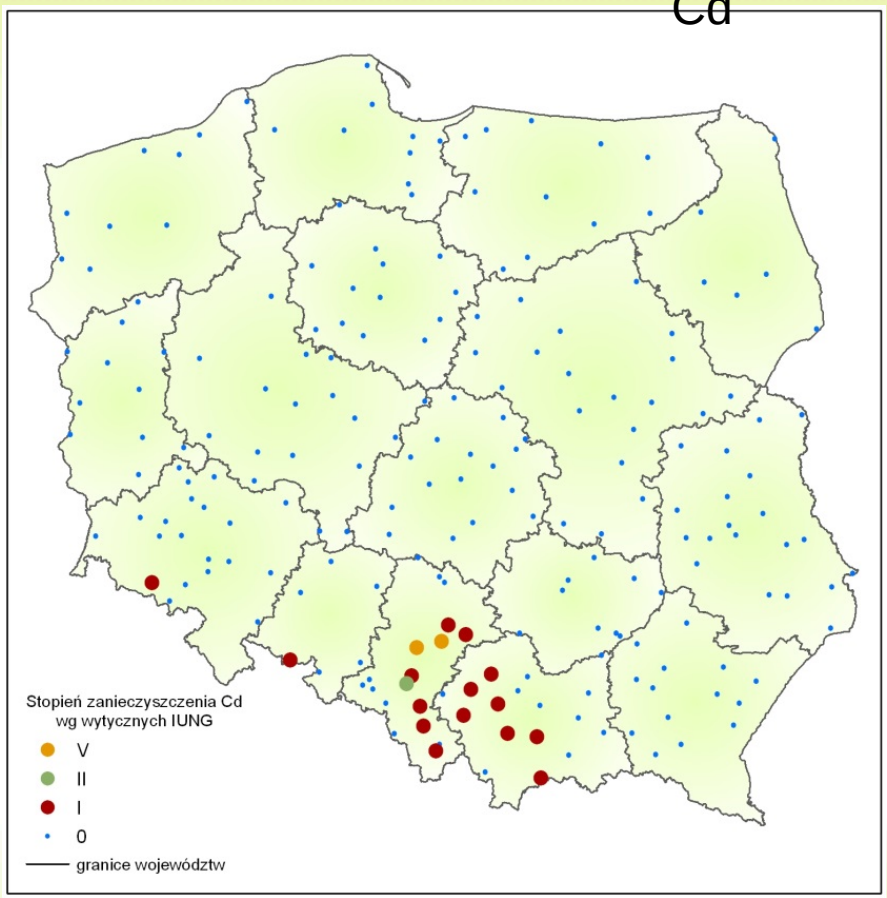


Mineral and Ca-fertilizers utilized in Poland

TE exceeding Standard criteria

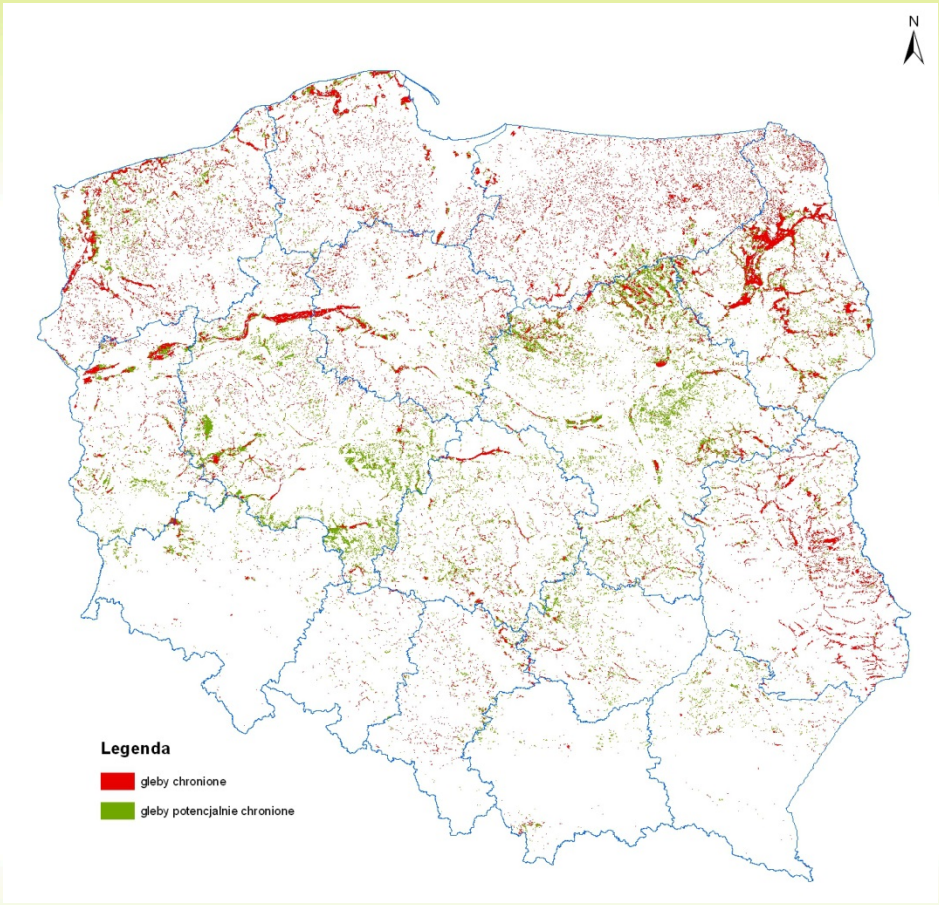
TE content levels – IUNG guidelines

Cd

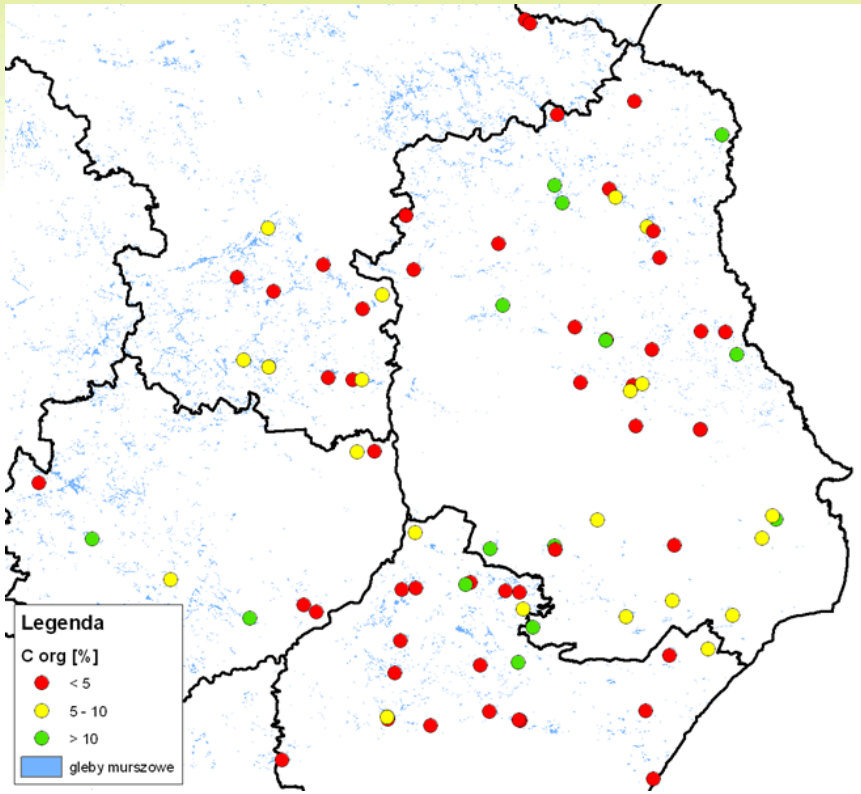


MONITORING OF PEAT SOILS – SINCE 2016

Peat soils – what are the trends?

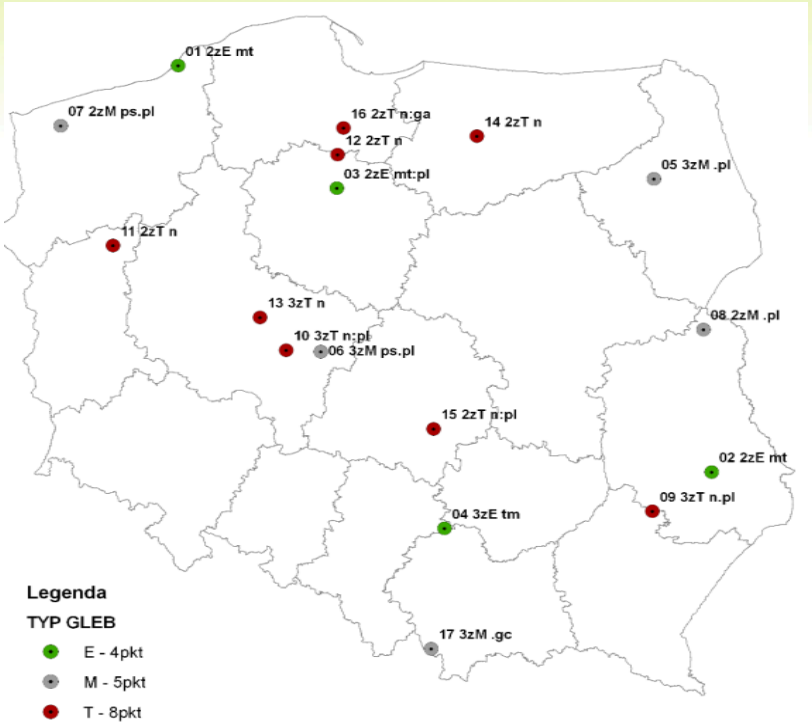


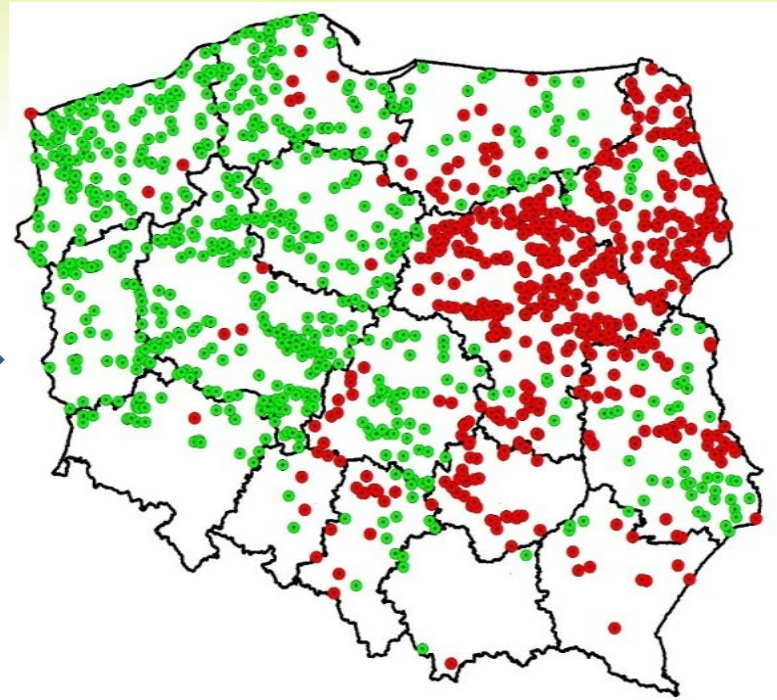
Map of organic soils



Eastern Poland – current C contents in former peat soils

Financed by Ministry of Agriculture and Rural Development



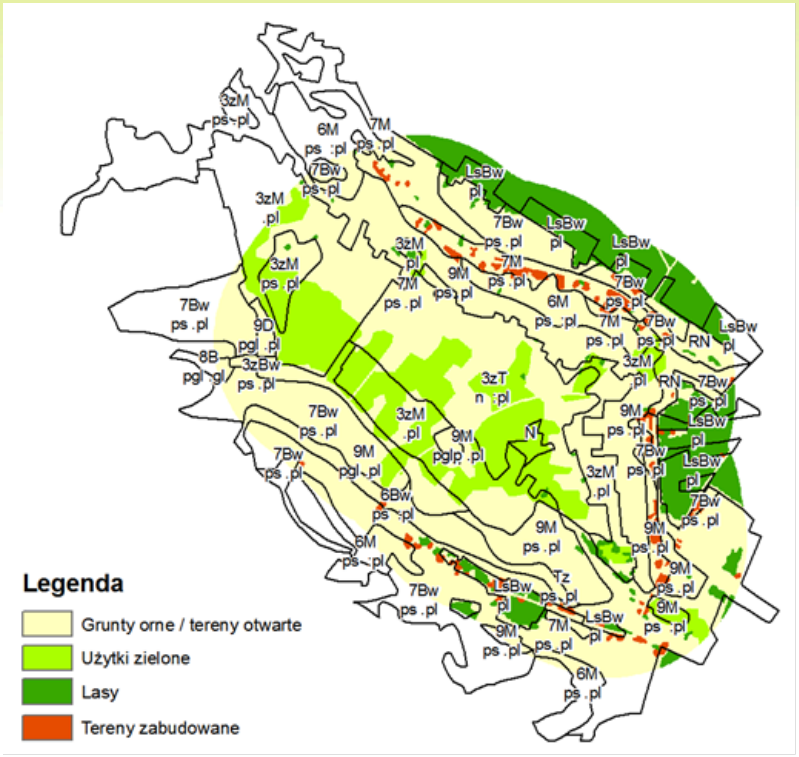


Case studies

Country monitoring of peat soils

Financed by Ministry of Agriculture and Rural Development

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_2O and pH-KCl	160 228	-	3 200
Corg	-	30 000	14 200
exchangeable P, K, Mg	-	30 000	14 200
CEC	-	-	44 200

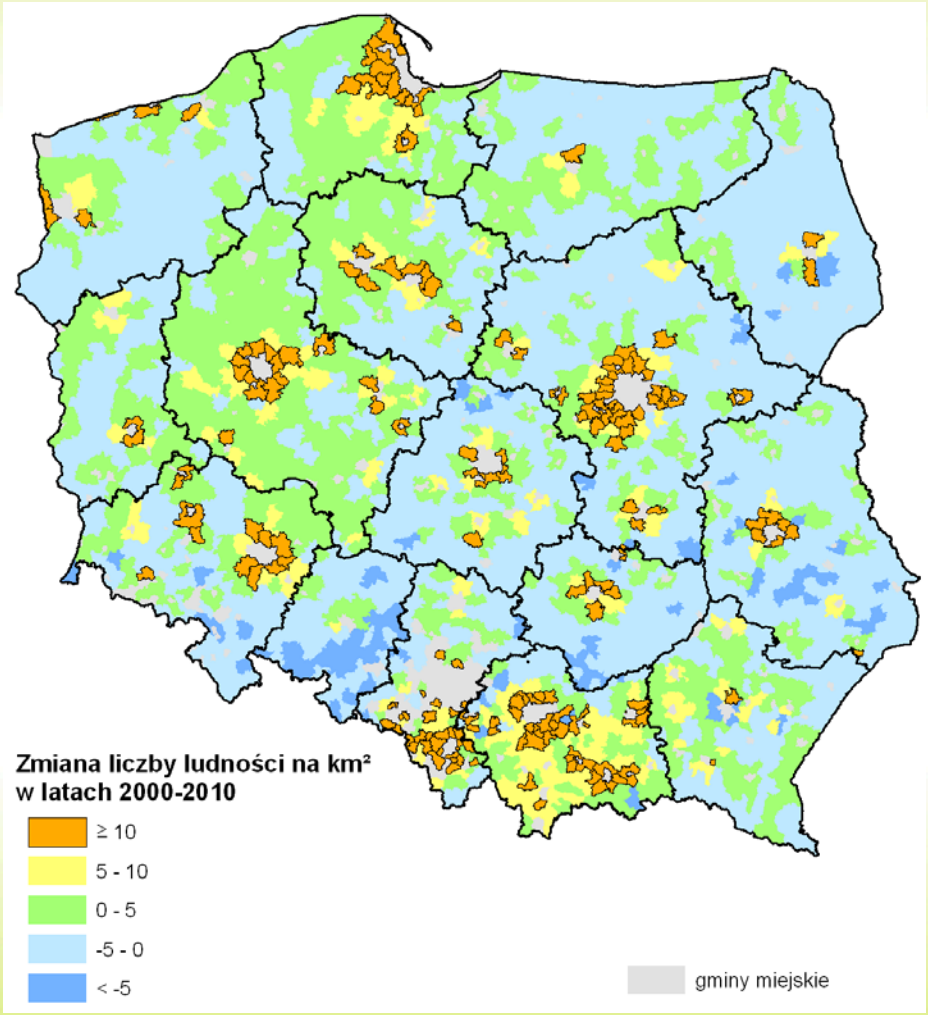
Since 2017:

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

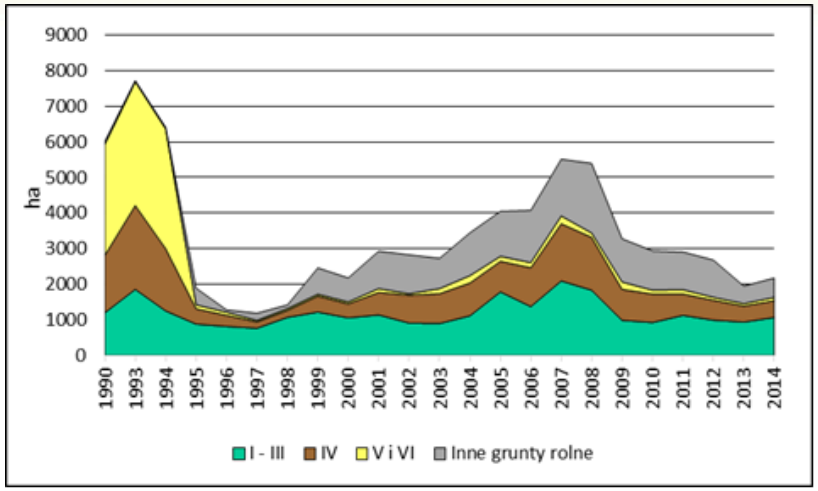
Collaboration with state Agro-chemical Stations

Financed by Ministry of Agriculture and Rural Development

MONITORING LAND TAKE, URBAN SPRAWL, ARTIFICIAL SURFACES, SEALING

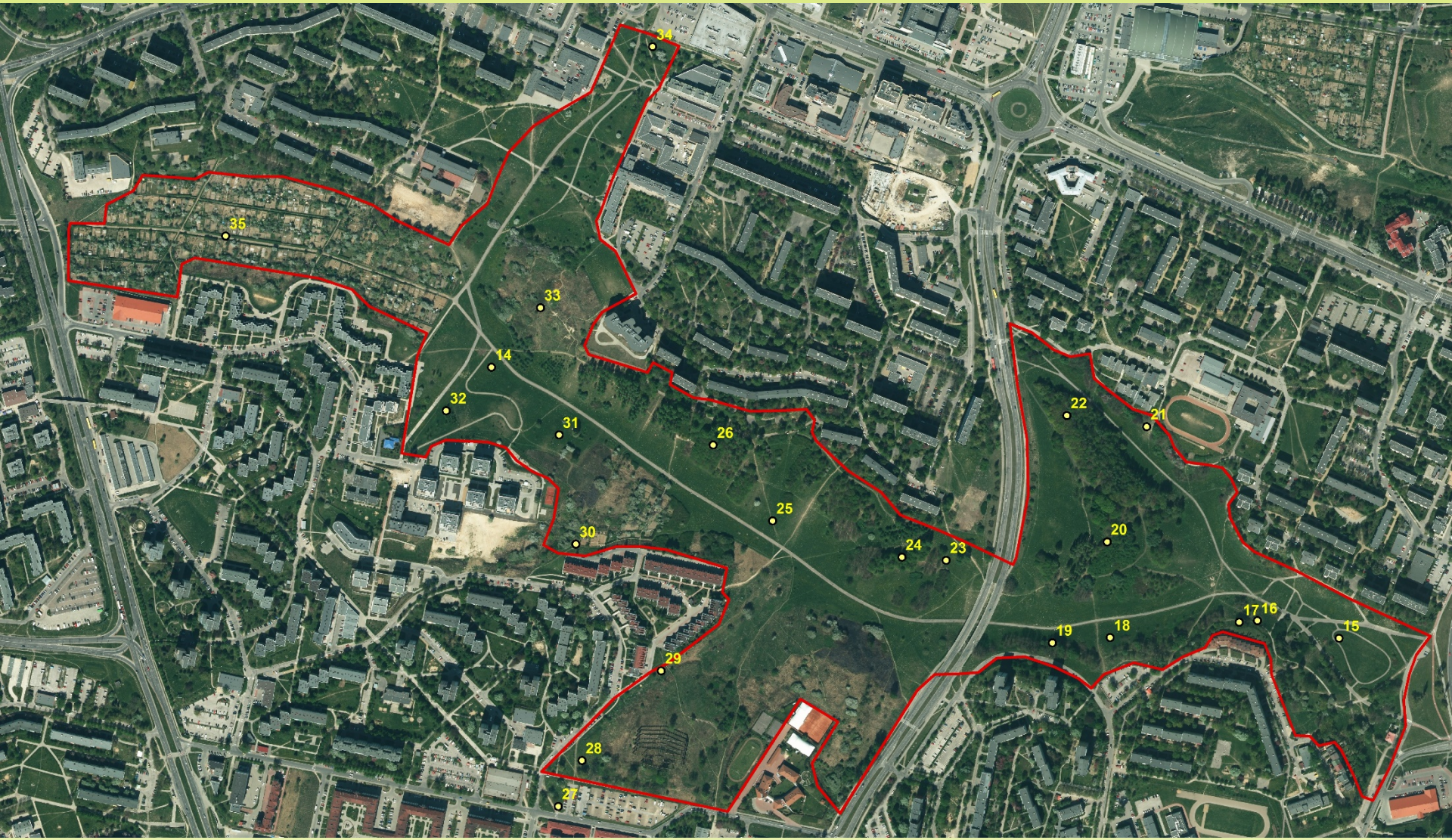


Demographic data - migration



Land take vs soil classes (based on GUS data)

Air temperature measurement points – Lublin (july 2018)



Air temperature at noon

Thank you for the attention