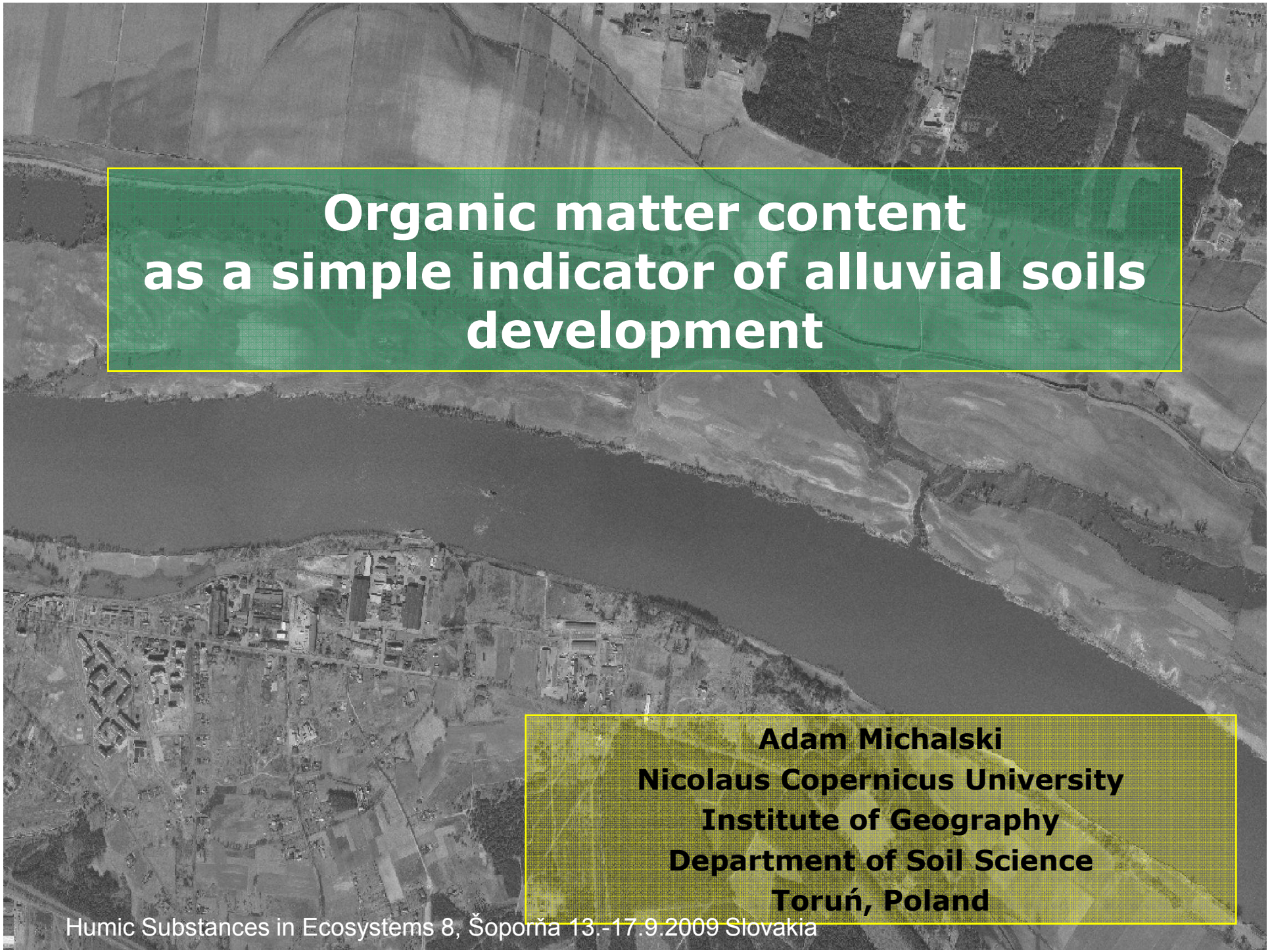

Organic matter content as a simple indicator of alluvial soils development

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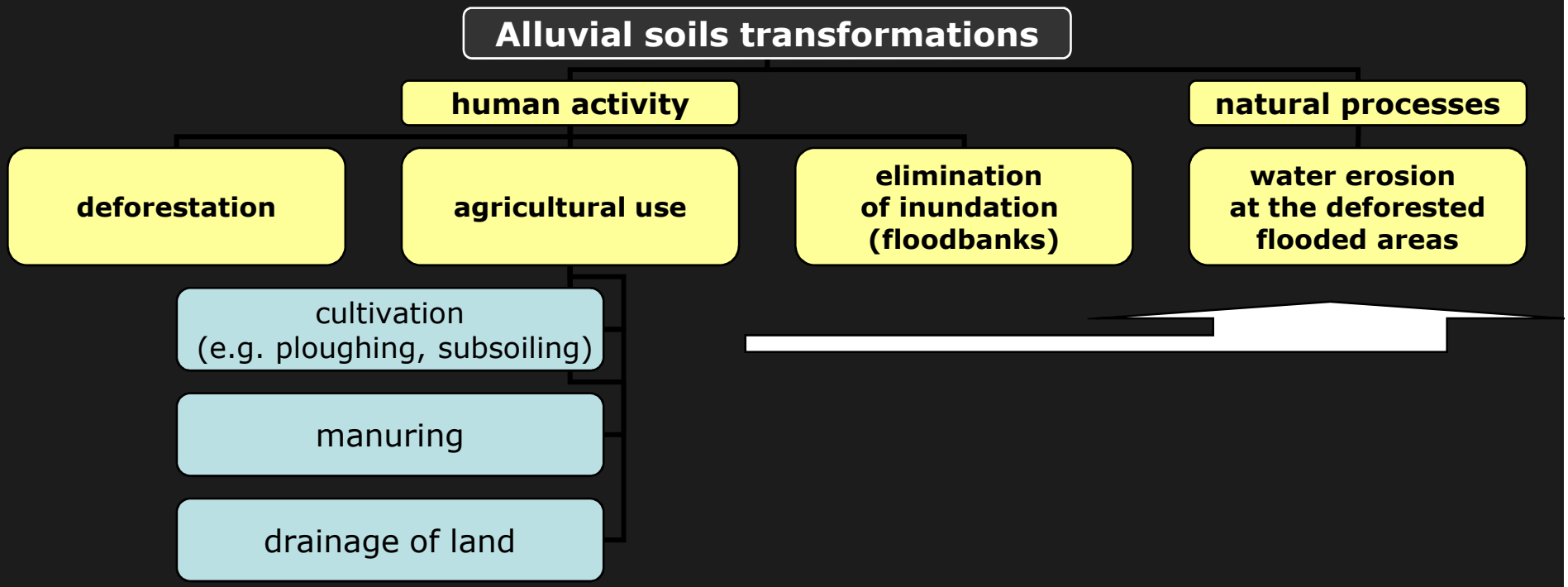
The aim of the study

- aspect of the main topic *Anthropogenic changes of soil cover on the Vistula river floodplain between Toruń and Bydgoszcz*:
  - transformations of soil organic matter caused by human activity (agricultural use of land),
  - transformations of soil organic matter in floodplain soils influenced to inundation (*flooded area*) and with absence of this process (*non-flooded area*)

Processes causing transformation of floodplain soil cover



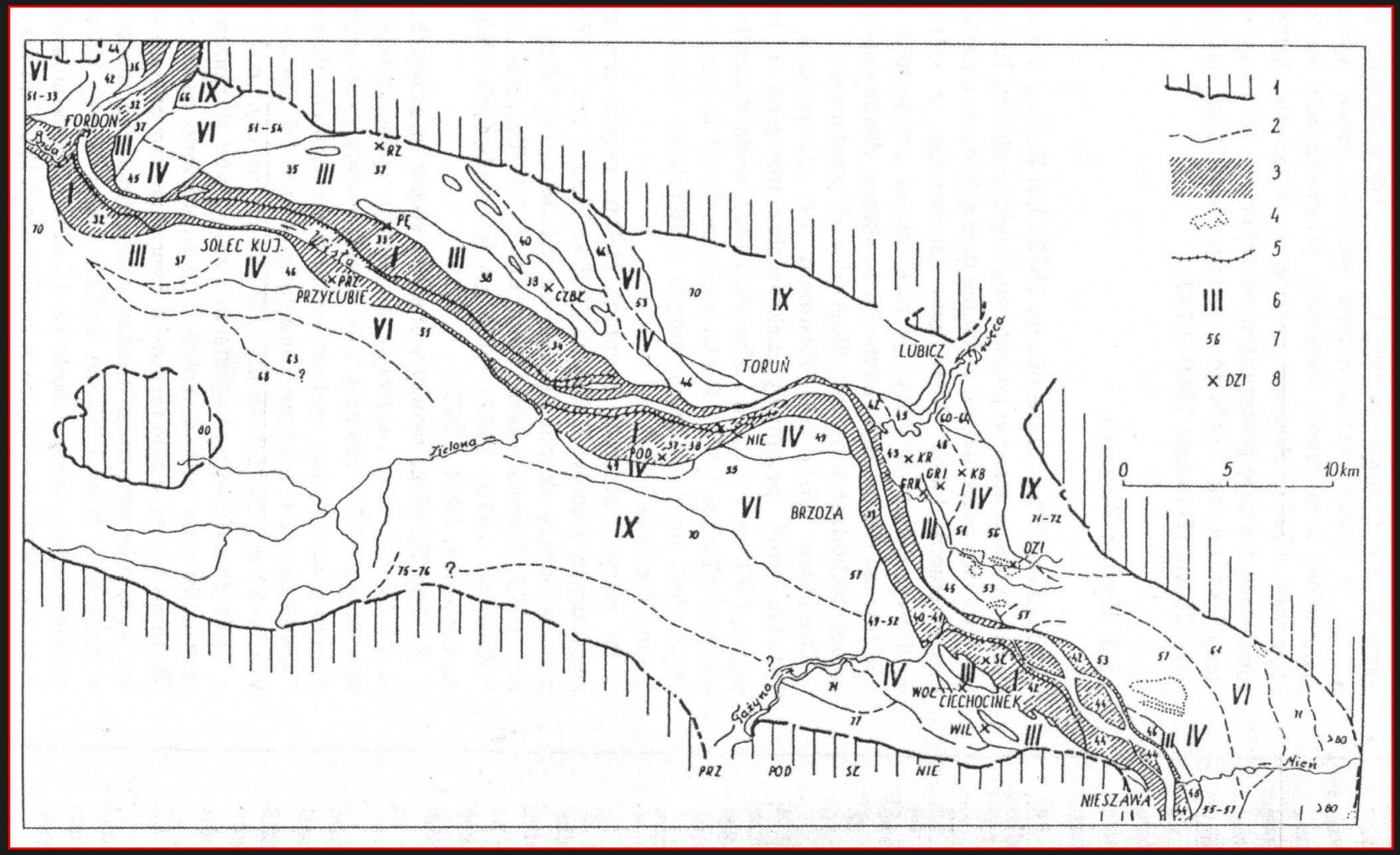


Fig. 1. Terraces in the Toruń Basin (Tomczak 1982)
1- the edge of moraine plateau , **2 –** edges of river terraces, **3 – flooplain (terrace I**), **4 –** melting depressions, **5 –** floodbanks, **6 –** terraces numbers, **7 –** altitude (m a.s.l.), **8 –** dated sites:
DZI – Dzikowo, KB – Kopańskie Bagno, GR I i GR II – Grabowiec I i II, CZBŁ- Czarne Błota, RZ – Rzęczkowo, WOŁ – Wołuszewo, WIL – Wilkowyje, KR – Krusz, PE – Pędzewo, PRZ – Przyłubie, POD – Podgórz, SL – Sicmsk, NIE - Nieszawa

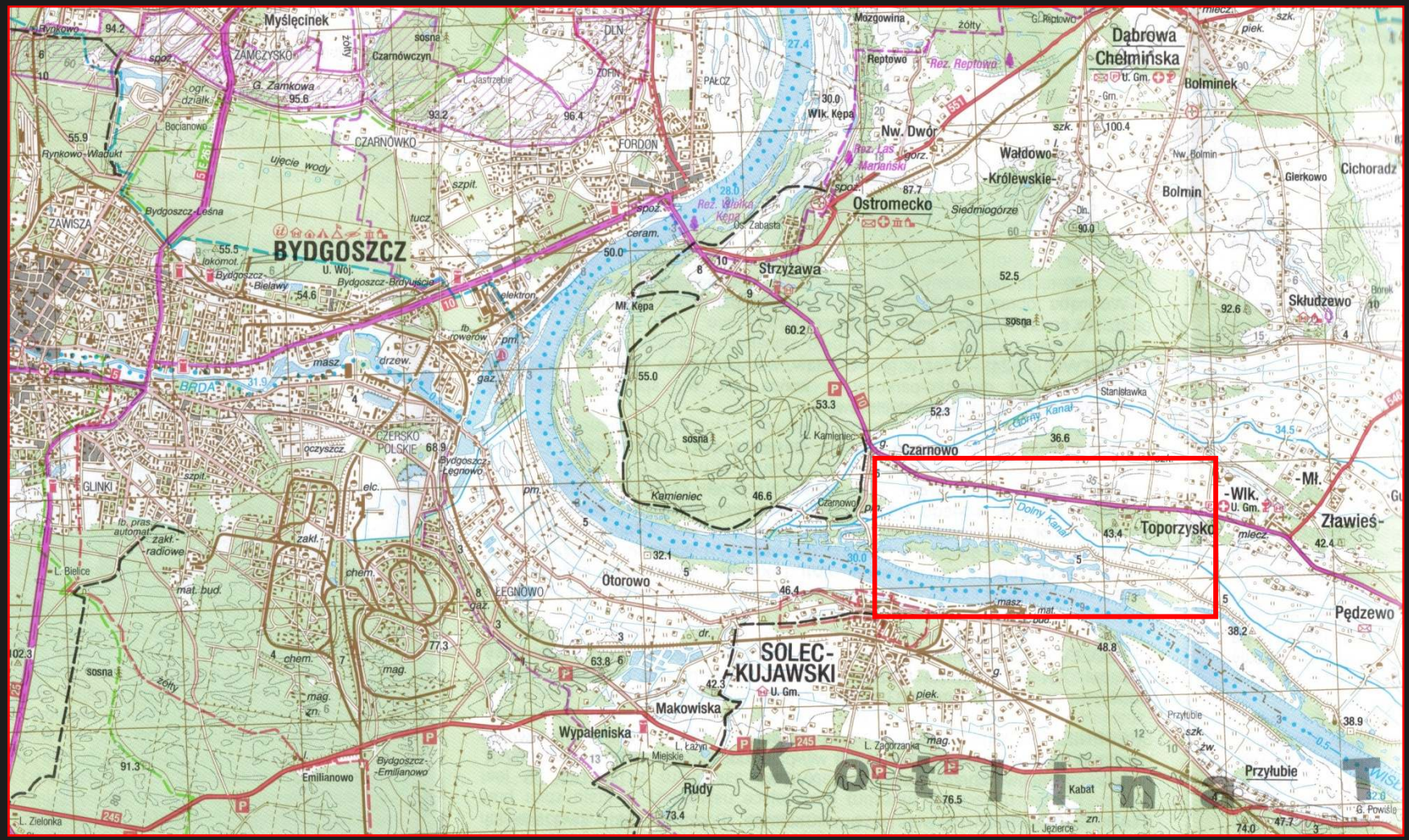


Fig. 2. Location of the study area

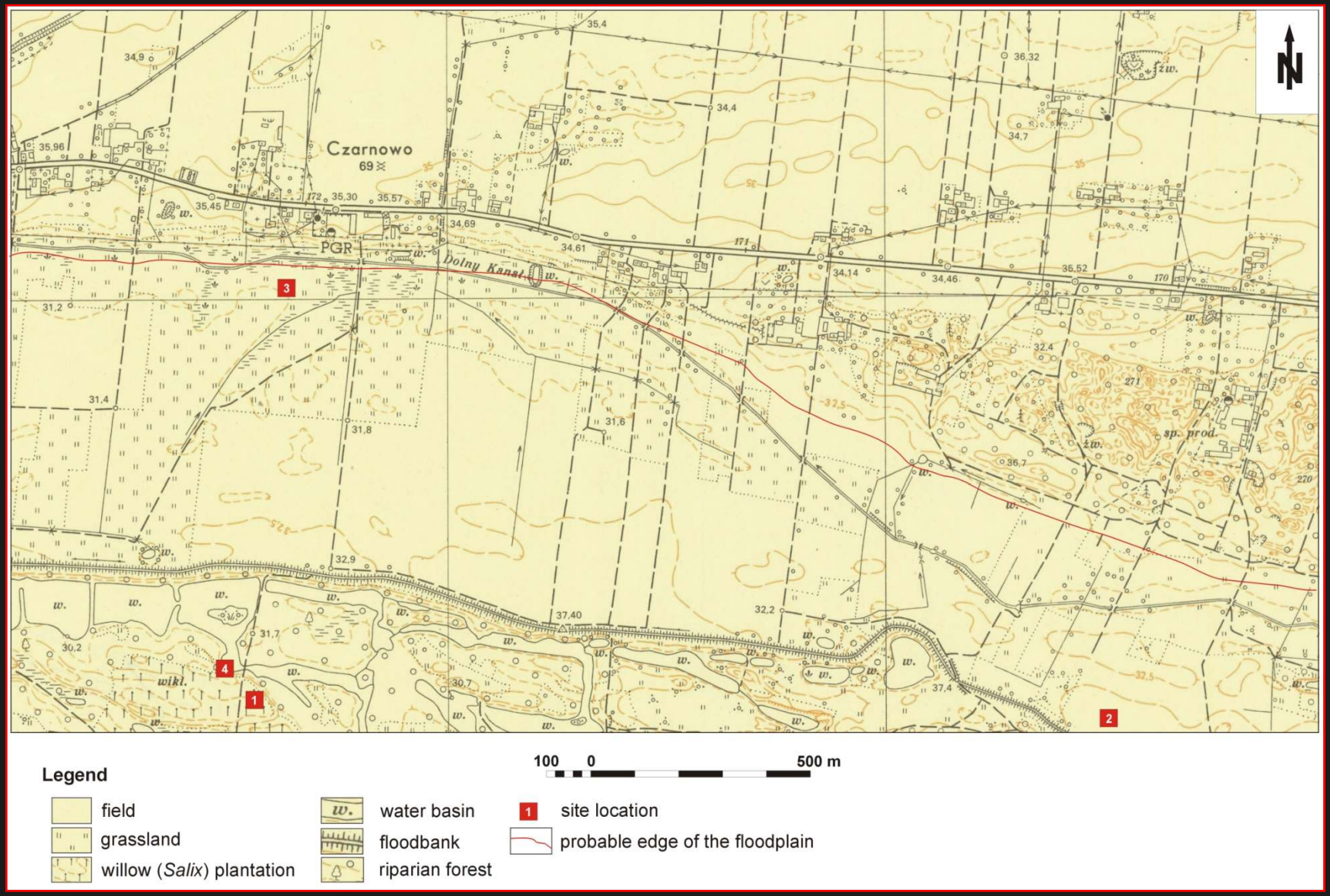


Fig. 3. Location of soil profiles on the map from 70. of XX century

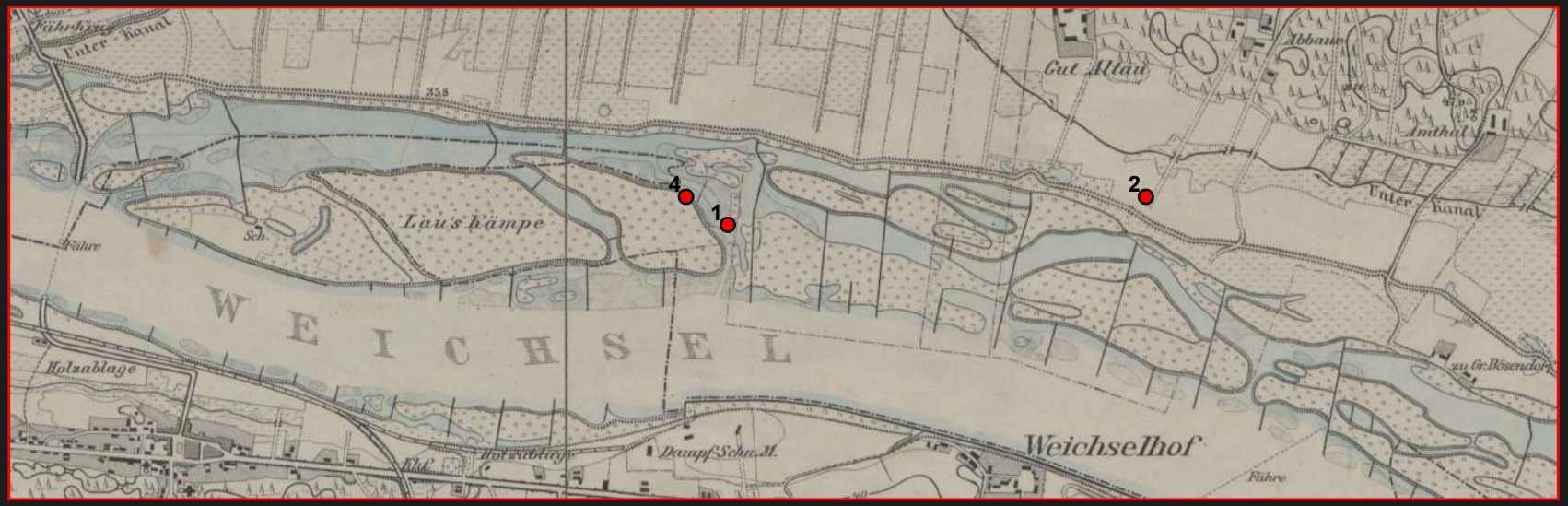


Fig. 4. Location of soil profiles on the map from the 2nd half of XIX century

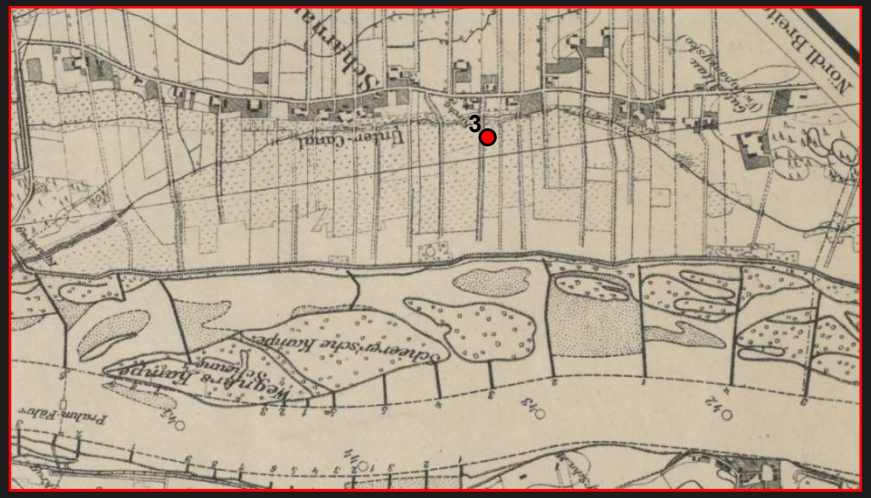
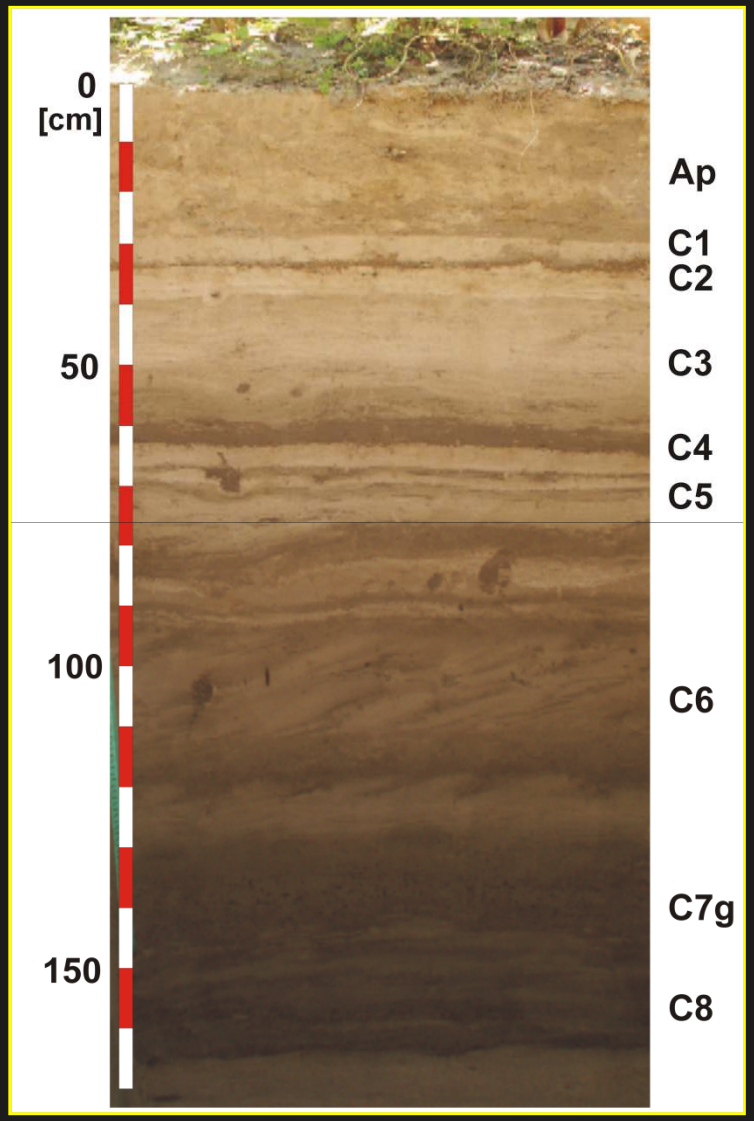


Fig. 5. Location of profile 3 on the map from the 2nd half of XIX century

Profile 1



Land use category

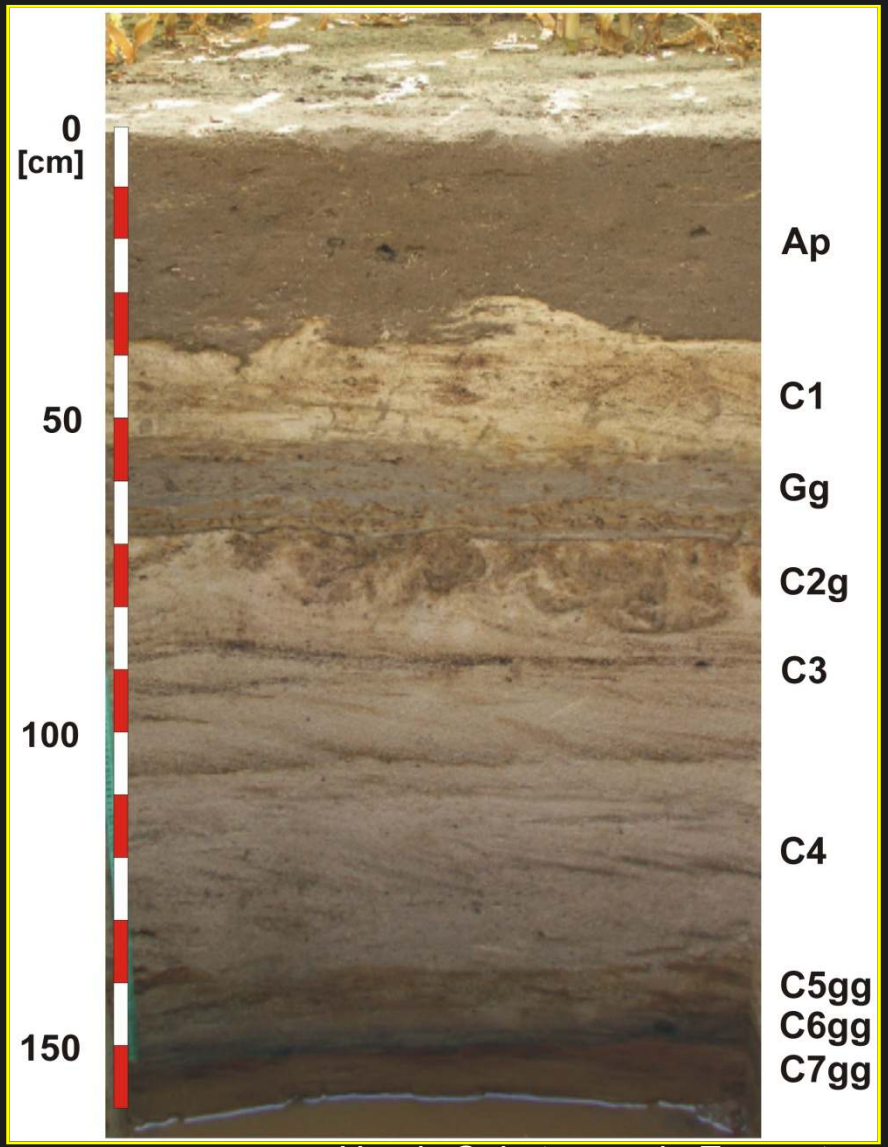
- in the past: **probably willow riparian forest, than plantation of willow (human activity),**
- nowadays: **agricultural use:** corn field (last 20–30 years)

Classification

PSSS (1989): ***mada rzeczna właściwa (proper alluvial soil)***

WRB (2006): ***Haplic Fluvisol (Siltic, Hypogleyic)***

Profile 2



Land use category

- in the past: **agricultural use for about 120 years**

(data from old German maps)

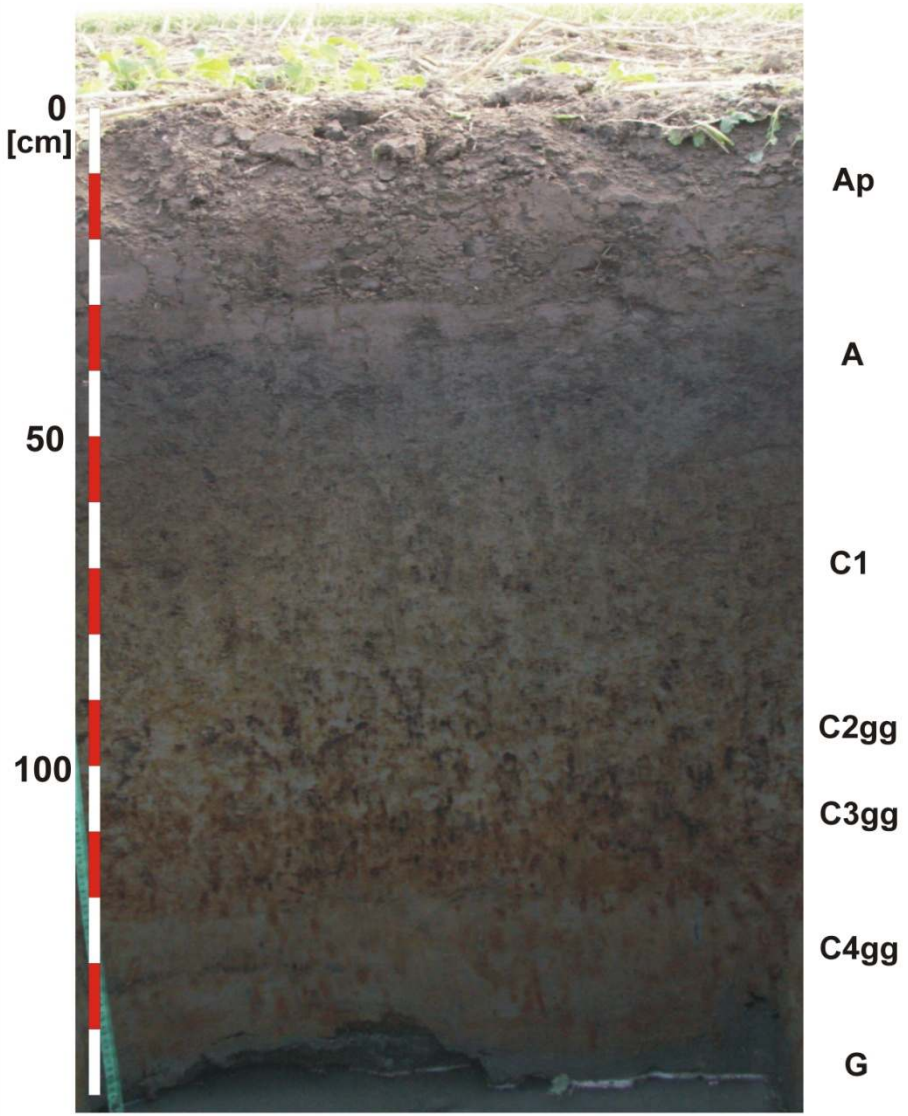
- nowadays: **agricultural use: corn field**

Classification

PSSS (1989): ***mada rzeczna właściwa (proper alluvial soil)***

WRB (2006): ***Umbric Fluvisol (Arenic, Endogleyic)***

Profile 3



Land use category

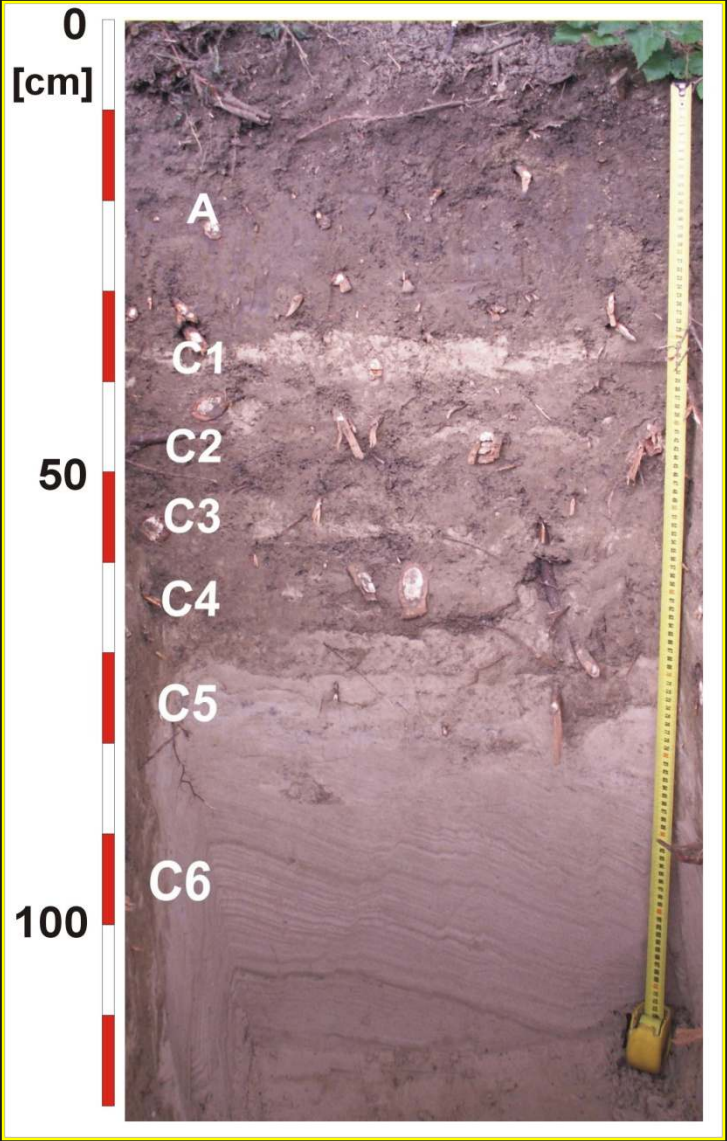
- in the past: **grassland**
- nowadays: **agricultural use (colza field) for 30 years**

Classification

PSSS (1989): ***mada rzeczna próchniczna (humic alluvial soil)***

WRB (2006): ***Gleyic Fluvisol (Humic, Siltic)***

Profile 4



Land use category

- in the past: **probably elm-ash riparian forest,**
- nowadays: **remains of forest („cluster" of trees) enclosed by corn field**

Classification

PSSS (1989): ***mada rzeczna próchniczna (humic alluvial soil)***
WRB (2006): ***Mollic Fluvisol***

Particle size analysis

Genetic horizon	Sampling depth [cm]	Percentage of fraction in diameter [mm]				Textural classes*
			sand	*silt*	*clay*	
		>2,0	2,0 - 0,05	0,05 - 0,002	<0,002	
Profile 1 - Haplic Fluvisol (Siltic, Hypogleyic)						
Ap	0 - 29	0	80	17	3	sandy silt
C1	29 - 33	0	77	19	4	sandy silt
C2	33 - 60	0	93	6	1	silty sand
C3	60 - 65	0	38	51	11	loamy silt
C4	65 - 80 (82)	0	66	25	9	sandy silt
C5	80 (82) - 138	0	69	27	4	sandy silt
C6	138 - 150	0	19	70	11	loamy silt
C7g	150 - 165	0	58	34	8	silt
C8	> 165	1	99	1	0	sand
Profile 2 - Umbric Fluvisol (Arenic, Endogleyic)						
Ap	0 - 38	2	88	10	6	light loam sand
C1	38 - 55	1	99	0	1	sand
Gg	55 - 70 (71)	0	56	33	11	loamy silt
C2g	70 (71) - 86	1	96	2	2	sand
C3	86 - 107	1	100	0	0	sand
C4	107 - 137 (139)	1	100	0	0	sand
C5gg	137 (139) - 146	2	100	0	0	sand
C6gg	146 - 151	0	100	0	0	sand
C7gg	>151	0	100	0	0	sand
Profile 3 - Gleyic Fluvisol (Humic, Siltic)						
Ap	0 - 40	0	21	57	22	heavy loam
A	40 - 54	0	25	51	24	silt heavy loam
C1	54 - 85	0	34	40	26	silt medium loam
C2gg	85 - 106	1	45	39	16	loamy silt
C3gg	106 - 118	0	55	33	12	sandy silt
C4gg	118 - 138 (140)	0	71	21	8	sandy silt
G	>138 (140)	0	68	20	12	silt heavy loam sand

*according to Polish Society of Soil Science (1989)

Chemical and physicochemical properties of soils

Genetic horizon	Sampling depth [cm]	OC [%]	Nt [%]	C/N	$CaCO_3$ [%]	pH	
						H_2O	KCl
Profile 1 - Haplic Fluvisol (Siltic, Hypogleyic)							
Ap	0 - 29	0,41	0,034	12	0,4	7,9	7,4
C1	29 - 33	0,19	0,017	12	0,8	8,4	7,8
C2	33 - 60	0,07	0,006	13	0,6	8,6	8,1
C3	60 - 65	0,49	0,045	11	1,4	8,1	7,5
C4	65 - 80 (82)	0,17	0,015	12	0,8	8,5	7,9
C5	80 (82) - 138	0,27	0,020	13	1,2	8,4	7,7
C6	138 - 150	0,38	0,035	11	1,6	8,4	7,6
C7g	150 - 165	0,25	0,022	11	1,2	8,4	7,7
C8	> 165	n.d	n.d.		0,3	8,4	7,6
Profile 2 - Umbric Fluvisol (Arenic, Endogleyic)							
Ap	0 - 38	0,56	0,054	10	< 0,2	6,7	5,9
C1	38 - 55	n.d.	n.d.		0,0	7,5	6,6
Gg	55 - 70 (71)	0,45	0,043	10	0,0	7,4	6,1
C2g	70 (71) - 86	0,06	0,006	10	0,0	7,6	6,5
C3	86 - 107	n.d.	n.d.		0,0	7,8	7,2
C4	107 - 137 (139)	n.d.	n.d.		0,0	8,0	7,3
C5gg	137 (139) - 146	n.d.	n.d.		0,0	7,9	6,8
C6gg	146 - 151	n.d.	n.d.		0,0	8,1	7,2
C7gg	>151	n.d.	n.d.		0,0	8,0	7,0

n.d. – non determined, OC – organic carbon, Nt – total nitrogen

Chemical and physicochemical properties of soils

Genetic horizon	Sampling depth [cm]	OC [%]	Nt [%]	C/N	$CaCO_3$ [%]	pH	
						H_2O	KCl
Profile 3 - Gleyic Fluvisol (Humic, Siltic)							
Ap	0 - 40	3,03	0,324	9	0,2	7,2	6,4
A	40 - 54	2,12	0,211	10	0,3	8,1	7,1
C1	54 - 85	0,52	0,058	9	0,8	8,1	7,3
C2gg	85 - 106	0,25	0,022	11	2,0	8,2	7,5
C3gg	106 - 118	0,23	0,017	13	0,0	7,9	7,1
C4gg	118 - 138 (140)	0,17	0,016	11	0,0	7,8	6,7
G	>138 (140)	0,23	0,021	11	0,0	7,0	5,9
Profile 4 - Mollic Fluvisol							
A	0 - 33	3,17	0,279	11	3,0	7,5	7,1
C1	33 - 38	0,72	0,075	10	1,5	8,0	7,4
C2	38 - 43	1,38	0,134	10	1,4	8,0	7,2
C3	43 - 58	1,25	0,110	11	1,5	8,1	7,2
C4	58 - 70	0,98	0,098	10	0,9	8,1	7,3
C5	70 - 75	0,11	0,013	8	0,2	8,3	7,5
C6	>75	n. d.	n. d.		0,2	8,2	7,2

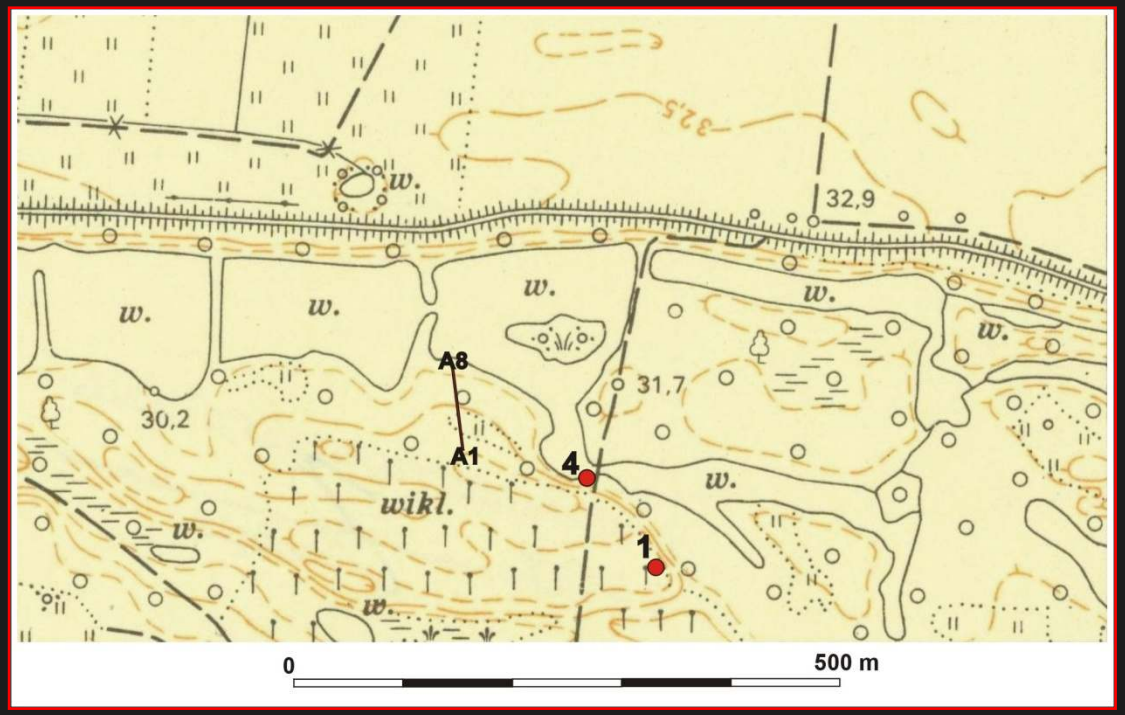


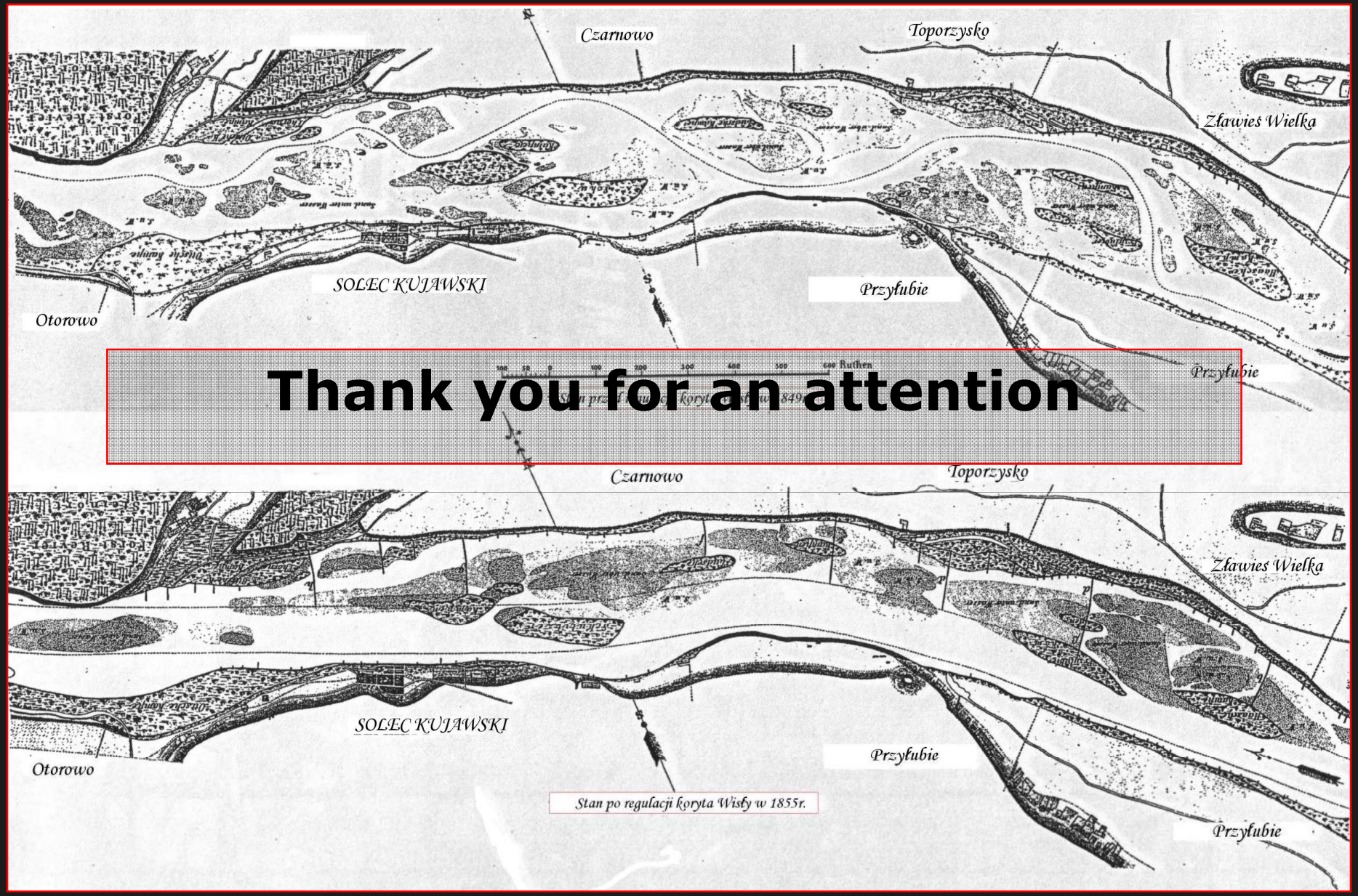
Fig. 6. Location of transect in lower part of flooded area

Point	OC [%]	Nt [%]	C/N	pH	
				H_2O	KCl
A1	8,26	0,573	14	6,9	6,7
A2	4,98	0,431	12	7,3	7,1
A3	4,04	0,365	11	7,5	7,2
A4	5,89	0,466	13	6,9	6,7
A5	2,09	0,198	11	8,0	7,4
A6	2,11	0,203	10	8,1	7,4
A7	2,19	0,203	11	8,0	7,4
A8	3,15	0,256	12	7,9	7,4

Fig. 7. Properties of soil samples from the transect

Conclusions

- Organic matter content can be a simple indicator of the alluvial soils development. It gives informations about the pedogenesis conditions.
- Two generations of alluvial soils can be distinguished in the fllooded area of the floodplain. First one concerns soils which had developed before the Vistula River channel regulations in the 2nd half of XIX century. The second one encompasses soils developed after incorporation of „river islands" to the old part of floodplain (anthropogenic phase).
- Despite of the different time of pedogenesis the alluvial soils of flooded and non-flooded part of the floodplain are characterized by diversifications of organic matter content. It indicates a large influence of other soil forming factors (humidity, flora, human activity).
- Soils of the incorporated „river islands" are characterized by deepen humus horizon (effect of ploughing) and low organic matter content (<0,5% OC). It indicates the need of detailed investigations focused on the trophic potential, position in the flooded area ecosystem and possible soil degradation.



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