MINT Project

Research protocol

German-Polish Exchange



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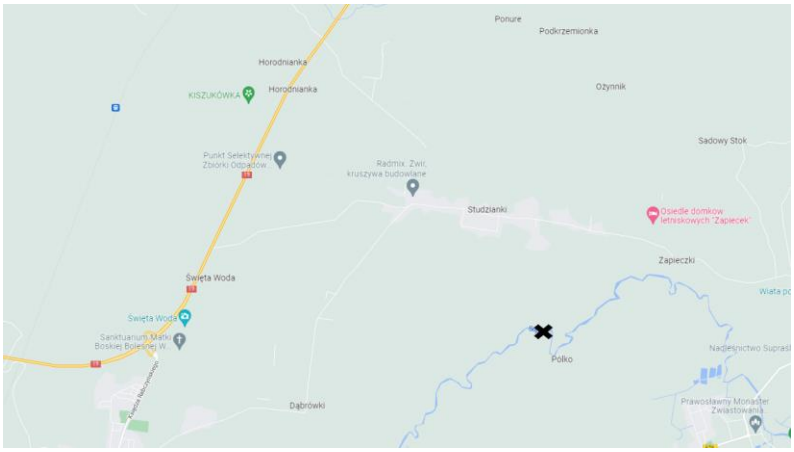
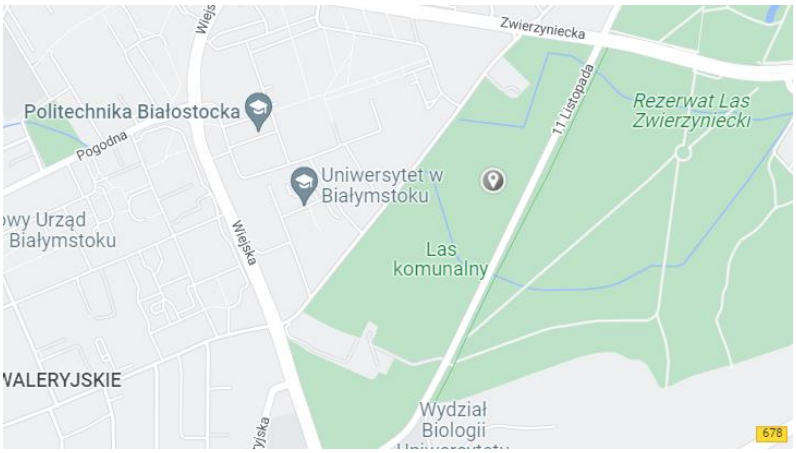
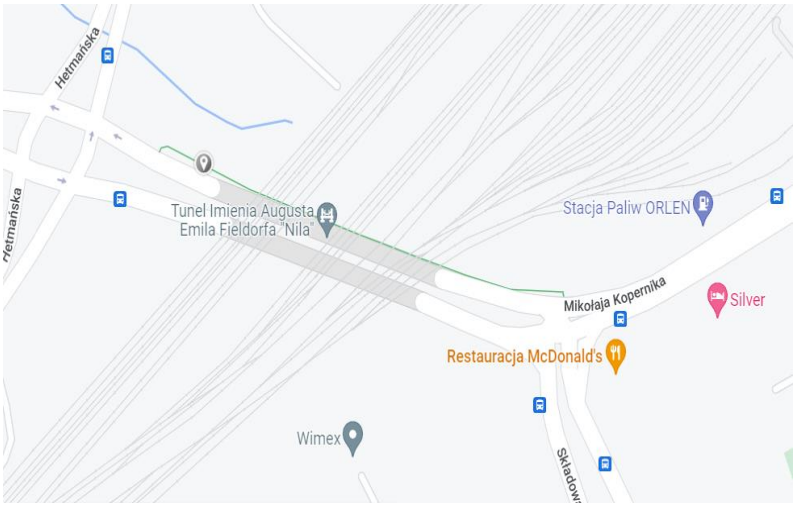
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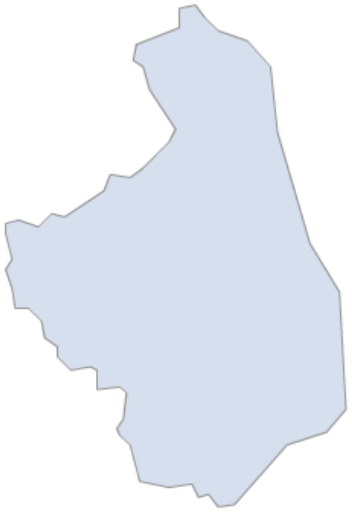
Sampling locations:

No.	Location	Map
1.	Forest soil	
2.	Bottom sediment (Biebrza River in the Biebrza National Park)	
3	Cultivated field (near Dolistowo Stare village)	

4.	Bottom sediment (inflow of the Biała River into the Supraśl River)	
5.	Forest soil (Zwierzyniecki Forest)	
6.	Main Street in Bialystok (Tunnel Fieldorf Nil)	

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Aiming to have the most reliable results showing the influence of environment on the content of cations and anions, we decided to test soil from 6 different locations. We chose these locations because of their remoteness from each other and the various environmental and ambient influences on the tested samples.



Content of cations and anions in soil

Equipment & Reagents

- 500ml polyethylene bottles
- Analytical scale
- Rotary stirrer
- Ion Chromatograph
- Set of colorimetric texts
- Demineralised water
- pH-meter
- Cation and anion patterns
- Laboratory dryer
- Tissue paper filters
- Funnels

Procedure of the experiment

20 grams of fresh soil was weighed on an analytical scale and transferred to a polyethylene bottle and poured with 100ml of demineralised water. The bottles were placed on a rotary stirrer extraction of analytes from soil was carried out for one hour. The extracts obtained were analyzed using ion chromatograph and colorimetric tests.

// **zdjęcia**

a) Extraction

b) Marking pH

To quantify the pH, a suspension of dry soil and water was prepared at a neutral concentration of 1:5. The suspension was allowed to stand for 2 hours and then the pH was measured.

c) Determination of dry matter and water content

5 grams of soil were weighed into steamers and dried in a laboratory oven at 105°C to a constant weight. After drying, the samples were weighed and the percentage water content was calculated from the difference in masses, the remainder of the sample was treated as dry matter.

Findings

	Cl^-	NO_2^-	NO_3^-	SO_4^{2-}	PO_4^{3-}	NH_4^+	Na^+	Ca^{2+}	Mg^{2+}	K^+	Fe	pH	dry matter	water content
	mg/kg s.m. (ang. mg/kg d.w.)												%	%
Forest soil	52.20	0.23	3.55	41.95	29.09	24.68	27.38	47.50	2.70	19.76	0.73	6.04	81.36	18.64
Bottom sediment (Biebrza River in the Biebrza National Park)	30.36	0.97	9.18	111.47	1.39	18.64	19.87	212.40	10.57	1.94	0.55	7.28	57.69	42.31
Cultivated field (near Dolistowo Stare village)	19.78	1.31	21.81	27.86	29.53	0.77	20.93	177.19	12.39	12.49	1.88	7.29	83.37	16.63
Bottom sediment (inflow of the Biała River into the Supraśl River)	687.04	10.02	141.02	33.68	7.15	-	492.27	164.74	9.59	0.75	1.43	7.24	82.11	17.89
Forest soil (Zwierzyniecki Forest)	21.73	0.84	10.59	19.90	23.30	1.02	18.35	73.40	5.70	11.47	1.75	7.44	81.11	18.89
Main Street in Bialystok (Tunnel Fieldorf Nil)	32.01	1.27	157.05	25.33	1.97	1.36	23.07	114.58	4.82	6.83	5.61	7.17	84.53	15.47

Conclusions

Conclusions from the study of individual elements

Chlorine (Cl)

Among the samples studied, the highest chloride content was found in the sample taken from the estuary of rivers (Suprasl and Biala). Such a high content of chloride ions resulted from an incorrect choice of the sampling site. The soil was taken under the bridge during the winter season, so it was secondarily contaminated with road salt. This conclusion is confirmed by the fact that in the same sample, apart from significant content of chloride ions, large amounts of sodium cations ($Na^+ + Cl \rightarrow NaCl$) were found.

Nitrites (V) (NO^{3-})

Among the samples examined, the sample taken from the estuary (Suprasl and Biala) had the highest nitrate concentration. Elevated nitrate (V) and nitrate (III) contents were probably also related to pollutant inflow from the road.

Nitrates (III) (NO^{2-})

Among the samples analyzed, the highest nitrate (III) content (apart from the sample from the estuary of the Suprasl and Biala rivers) was found in the sample collected near one of the busiest crossroads in Bialystok. This is most probably due to the increased intensity of street traffic in that place and, what follows, to car exhaust fumes.

Sulphates (SO_4^{2-})

Among the samples examined, the highest sulfate content was found in bottom sediment. Bottom sediment is a store of both organic and inorganic compounds precipitating from water, as well as of dead organic matter originating from biochemical transformations in the aquatic environment. It is also a reservoir of dead aquatic organisms, which is also confirmed by the slightly elevated calcium cation content in this sample.

Phosphorus (PO_4^{2-})

Among the samples we examined, samples taken from the farm field and forest land had the highest phosphate content. If we consider the soil from the cultivated field, it is probably due to the use of artificial fertilizers. In the case of forest land, phosphates are formed in the course of biochemical transformations, during the decomposition processes of forest litter by microorganisms.

Ammonia (NH_4)

Among the samples analyzed, the sample taken from the forest and the bottom sediment sample had the highest ammonia content. Ammonium ions are formed in the processes of anaerobic decomposition of green plant biomass. Both in aquatic and forest environments such conditions occur naturally, so the presence of this cation in the presented samples should not be surprising.

Sodium (Na)

Among the analyzed samples, the samples collected from both investigated forests had the lowest content of calcium while the highest content was found in the bottom sediment. The parameters of all the tested samples are within the correct parametric value of soil calcium. Additionally, calcium cations raise the pH of the soil, which is confirmed by the results obtained for this parameter, and they prevent excessive acidification of the soil. Soils are prone to acidification due to the occurrence of acid rain.

Calcium (Ca)

Among the samples studied, the sample taken from the estuary of rivers (Suprasl and Biala) had the highest sodium content. This is due to the pollution caused by the melting snow from sidewalks and streets, contaminated with road salt.

Magnesium (Mg)

The sample collected from an agricultural field in Dolistowo Stare village had the highest magnesium content among the tested samples. The parameters of all the samples studied were within the normal parametric value of magnesium for soil. Magnesium belongs to the macronutrients essential to normal plant growth.

Potassium (K^+)

Out of the tested samples, the samples collected from forest and cultivated field had the highest potassium content. This is due to the high amount of particulate matter and the mineral composition of the soil.

Potassium, like magnesium, also belongs to the group of macronutrients essential for normal plant growth.

Ferrous (Fe)

The sample taken from the proximity of a large intersection in Bialystok had the highest iron content among the samples studied. The excess of this element may be caused by a nearby road from which, due to heavy traffic, metal particles, coming from the abrasion of brake pads, together with dust rise and settle in the soil.