

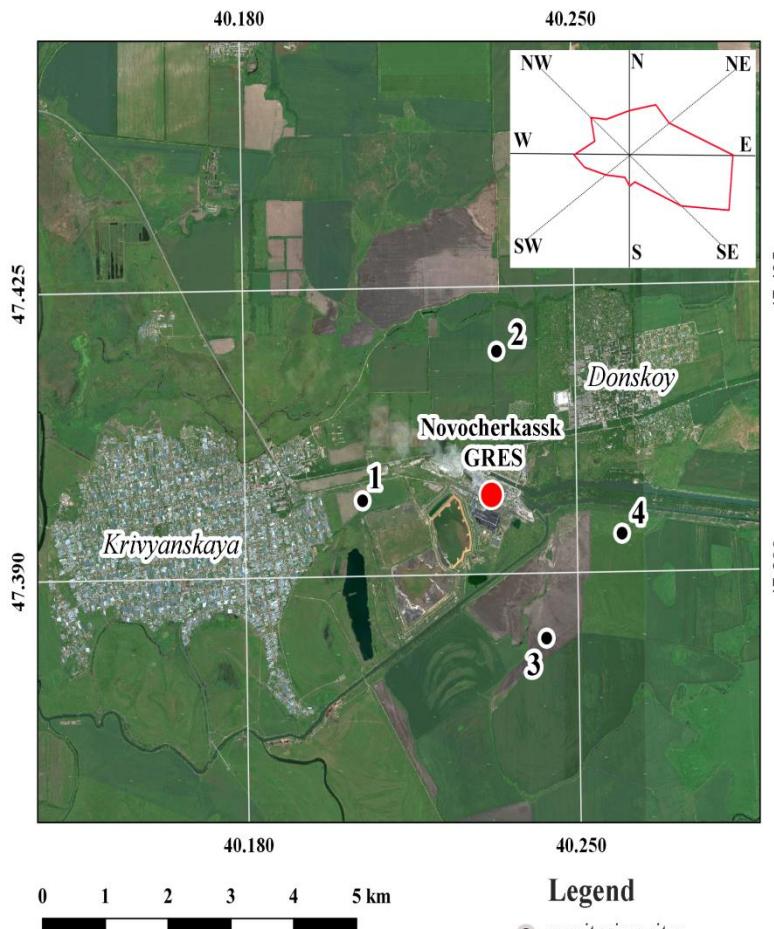


The effect of different level and type of pollution on the heavy metals accumulation and distribution in soil-plant system

Victor Chaplygin, Saglara Mandzhieva, Tatiana Minkina,
Natalia Chernikova, Aleksey Fedorenko, Anatolii Barahov
and Ilia Lobzenko

Southern Federal University, Rostov-on-Don, Russia
chaplygin@sfedu.ru

Object of study



The territory around the Novocherkasskaya power plant in the Lower Don floodplain in Rostov oblast, South of Russia

Object of study



Haplic Chernozem



Poa pratensis L.



Triticum aestivum



Elytrigia repens (L.) Nevski.

The total content and mobile forms of heavy metals in the soil (0-20), mg/kg

The total contents of Cr, Ni, Mn, Cd, Cu, Zn, and Pb in soils were determined by the X-ray fluorescence method. Mobile forms of heavy metals were solubilized by 1 N ammonium acetate buffer solution with pH 4.8 (soil : solution = 1 : 5, extraction time 18 h) capable of solubilizing exchangeable forms of metals, which characterize their actual mobility (Minkina et al. 2018).

Nº plot	Direction and distance from pollution source, km	Mn	Zn	Cr	Cu	Pb	Ni	Cd
1	1.6 NW	942/63	112/17	137/7	72/5	66/7	66/4	1.00/0.17
2	1.5 N	870/32	92/6	132/4	43/1	34/3	56/2	0.60/0.04
3	2.2 SE	1025/99	99/1	115/5	50/1	34/1	62/3	0.54/0.04
4	2.1 E	758/109	132/1	123/3	62/1	45/1	81/3	0.42/0.04
*LSD _{0.95}		58/4	15/1	19/3	11/1	9/1	13/1	0.10/0.01
**MPC		1500/140	-/23	-/6	-/3	32/6	-/4	-/0.05

Total content / mobile forms

*least significant difference

**maximum permissible concentration in soil

The heavy metals content in cultivated and wild herbaceous plants at monitoring plots, mg / kg

№	Direction and distance from pollution source, km	Mn	Zn	Cr	Cu	Pb	Ni	Cd
		Triticum aestivum						
1	1,6 NW	68/56/44	24/36/42	16/14/19	7/7/10	3,1/4,2/ 4,0	6,6 /8,8/ 4,8	0,60 /0,60/ 0,37
2	1,5 N	27/42/40	10/10/38	13/12/9	5/7/9	4,0/6,0/ 5,0	1,9/2,8/ 3,8	0,53 /0,70/ 0,41
3	2,2 SE	45/57/31	5/7/20	4/5/5	2/3/3	1,0/0,6/ 1,1	0,9/1,3/2,4	0,31 /0,44/0,05
4	2,1 E	19/21/27	7/10/23	5/4/5	2/3/5	0,6/0,6/ 1,0	1,6/2,4/ 3,6	0,11/0,09/ 0,12
		Elytrigia repens (L.) Nevski.						
1	1,6 NW	65/63/25	36/33/26	22/24/9	3/5/3	1,9/5,1/2,6	8,3 /13,9/2,0	0,65 /0,62/ 0,39
2	1,5 N	36/52/42	14/14/35	17/16/9	2/4/5	2,4/2,7/0,8	1,7/2,8/ 3,9	0,50 /0,37/ 0,61
3	2,2 SE	43/74/30	11/19/25	17/13/14	4/5/5	1,0/1,3/1,3	0,5/3,2/1,9	0,32 /0,40/ 0,54
4	2,1 E	44/17/19	15/19/21	12/8/4	1/4/4	1,2/2,1/1,7	1,4/3,2/1,0	0,31 /0,43/0,07
		Poa pratensis L.						
1	1,6 NW	16/53/15	7/23/8	5/7/4	14/20/4	1,5/3,1/1,3	0,7/2,7/0,6	0,08/0,13/0,03
2	1,5 N	4/11/9	2/15/4	4/7/3	10/17/2	1,4/3,7/1,6	0,6/2,3/0,9	0,06/0,05/0,05
3	2,2 SE	6/20/14	4/13/8	4/5/4	11/14/1	0,7/1,4/0,9	0,5/1,1/1,2	0,02/0,05/0,03
4	2,1 E	8/30/25	8/26/14	6/6/5	7/8/1	2,2/3,2/0,4	1,0/2,0/2,2	0,08/0,12/0,04
*MPL		-	50	-	30,0	5,0	3,0	0,3
**MPC		-	50	-	10,0	0,5	-	0,1

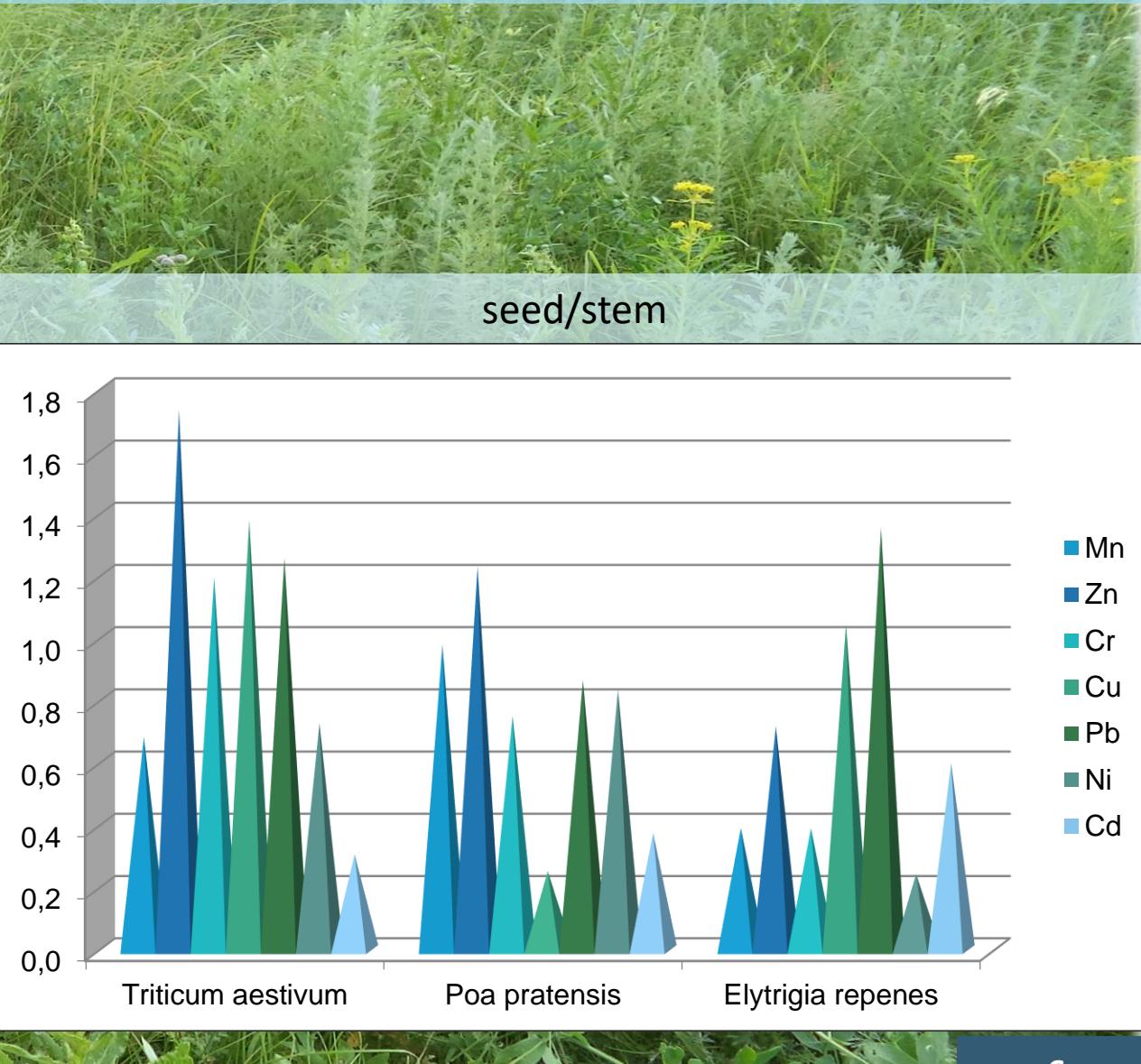
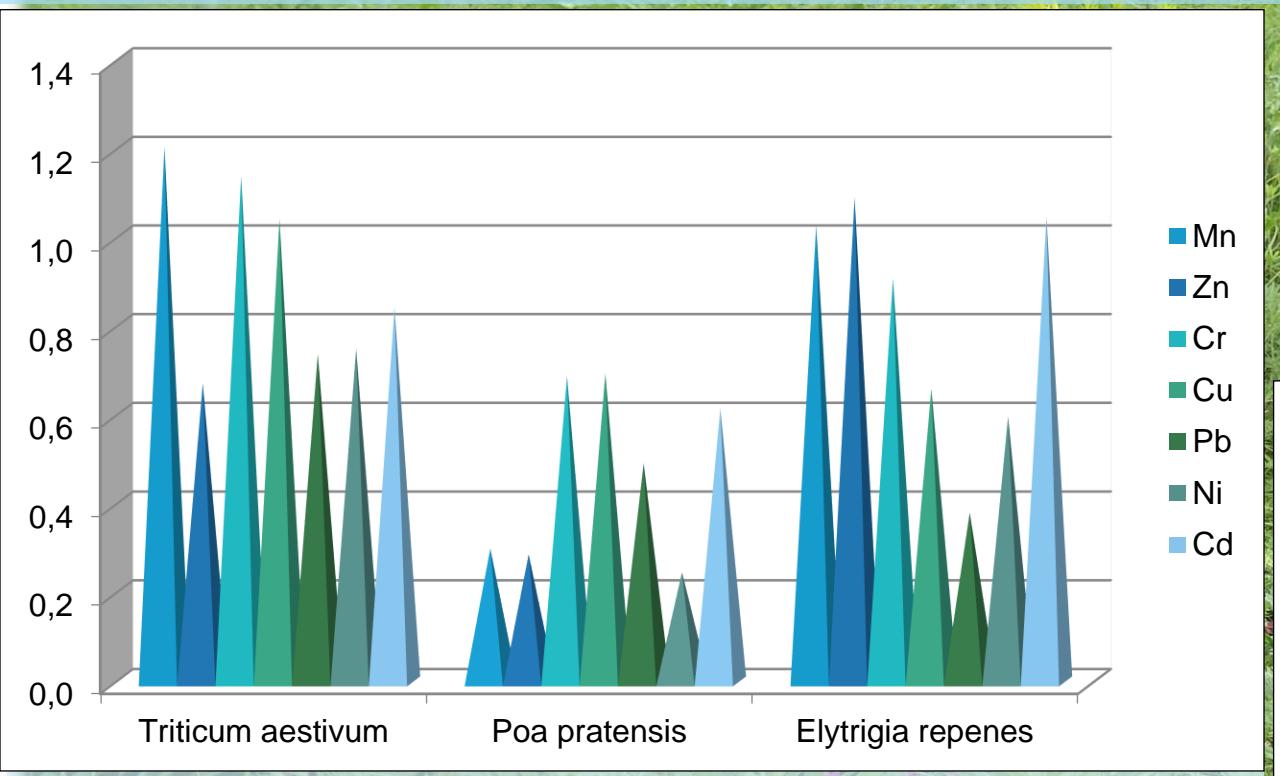
stem/root/seed

*maximum permissible level in animal feed

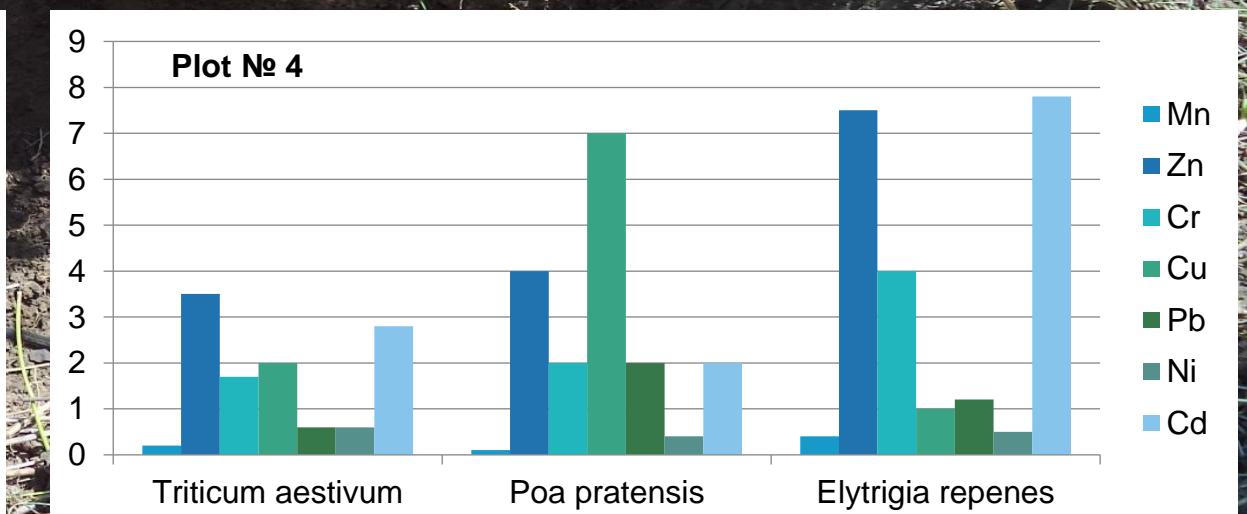
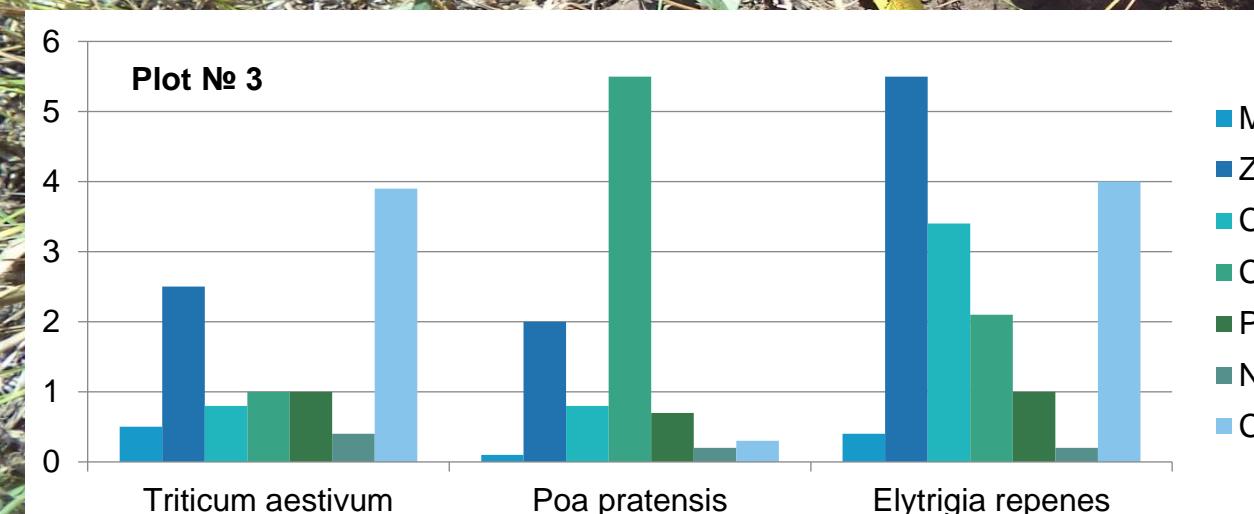
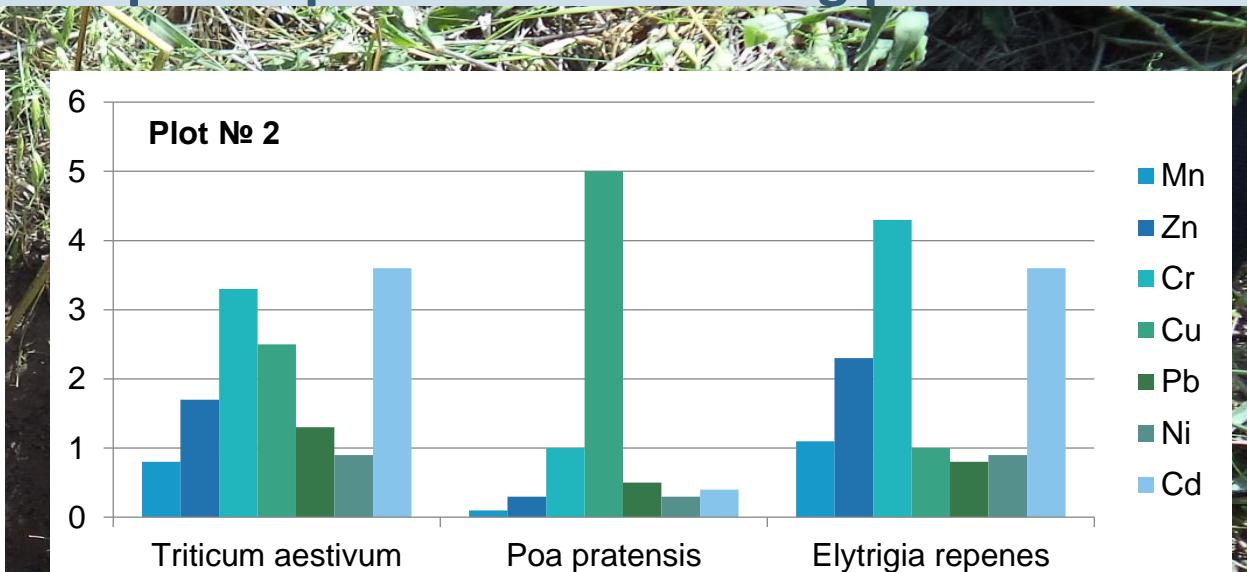
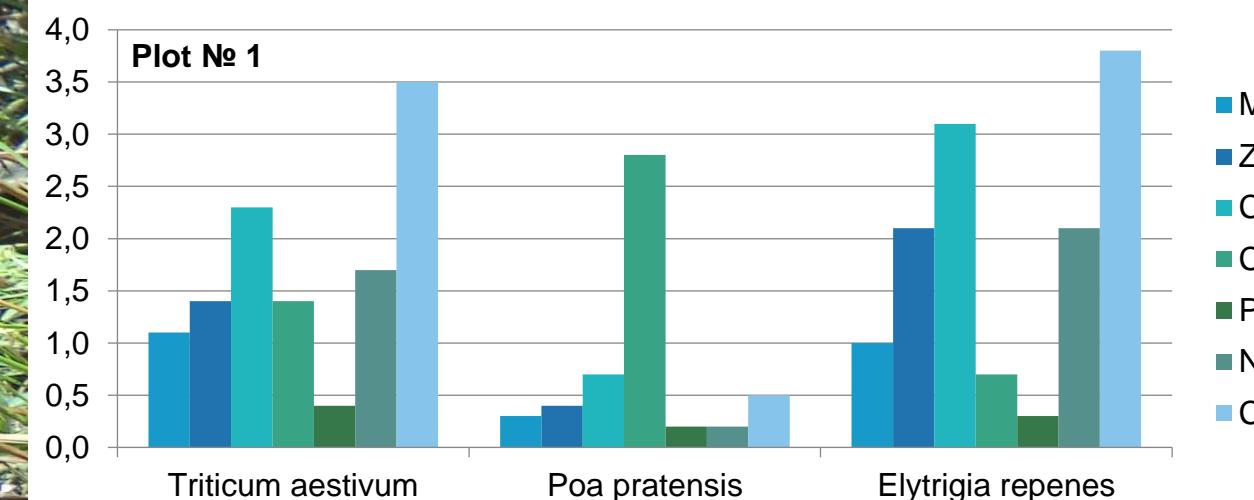
**maximum permissible concentration in medicinal raw materials

Distribution coefficient (DC) of different herbaceous plants under anthropogenic load (1.6 km northwest)

DC – this is the ratio of the HM content in roots to the HM in the aboveground part of plants



Accumulation coefficient (AC) of heavy metals in the stems and leaves of different plant species at monitoring plots



AC – this is the ratio of the HM content in aboveground part of plants to the mobile forms of HM in soil

CONCLUSION

- Contamination of agricultural and wild-growing herbaceous plants with such heavy metals as Pb, Ni, and Cd was revealed.
- Crops are more exposed to heavy metal pollution impact than wild plants.
- Despite the species-specific nature of the accumulation and distribution of elements, agricultural and wild-growing herbaceous plants of the Poaceae family have a general tendency to predominant Pb, Ni, and Cd accumulation in the root system.
- In the aggregate of Distribution coefficient and Accumulation coefficient, *Poa pratensis* is the most resistant to technogenic pollution by heavy metals than *Elytrigia repens* and *Triticum aestivum*.