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Sediment input and pollution of floodplains in the Oka River catchment

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Investigations about the influence of flood events on the floodplain pollution are presented. The research activities have been carried out in the Oka-river floodplain area near the city of Ryazan in the frame of international Russian-German cooperation at two experimental sites.

The first one is located within the Oka-river floodplain near settlement Solotcha. This river site crosses grasslands, hay harvests, new-channel bush and small forests. The second river site is situated 13 km downstream. It crosses the floodplain opposite the city of Ryazan and expands through an anthropomorphic agro-landscape (the reclaimed arable lands and meadows). During the six years study (1997-2003) a wide range of spring floods were observed: from anomalous low in 1997 and 2002, up to comparatively high in 1999 (643 cm), when the average high flood was exceeded by about 93 cm.

The investigation included a complex study of landscape components- the soil stratification, configuration and quality; the quality of river and subsurface water; the input and quality of high flood sediments. The sampling of high flood sediments was carried out with artificial lawn sediment traps according to the method of the German partners at the Elbe river.

Table 1 shows the quantity of deposits of the natural and agro-landscapes.

Table 1: Sediment freights on the floodplain landscape area of the Oka-river near the city of Ryazan

Location of observation points	Sediment Freight, g/m ²					
	1998	1999	2000	2001	2002	2003
River site No 1						
Meadow, 4 km from the river channel (Oka)	8	371	26	720	-	28
Drained meadow 2.95 km from the Oka-river channel	4	501	20	114	-	-
The old dry channel, 0.5 km from the Oka-river	1	356	-	-	-	-
River site No 2						
Draining arable land, 3.8 km from the Oka-river	617	-	-	303	-	681
Draining arable land, 2.9 km from the Oka-river	656	1290	790	482	-	729
Drained meadow, 2.5 km from the Oka-river	421	-	359	-	-	-
Grassland, 1.6 km from the Oka-river	-	71	-	-	-	-
Meadow behind the dam, 4.3 km from the Oka-river	-	48	38	-	-	28

Flood sediments showed a pH close to the neutral point and up to 70% clay particles content. The total organic content was between 12% and 52%. The sediments exceed the K content (in 4-12 times) and P content (in 2-3 times) of the zonal soils. Cr, Ni and Cu concentrations exceed available standard concentrations, Zn content is close to ESC. Heavy metals

concentrations in sediments exceed their concentrations in unaffected soil by 20-25%. The alluvial soils are differentiated with irregular distribution of the metal concentration distribution through the soil depth profile. At the unimproved meadows the first maximum of the metal content is met within the humus layer and below it is decreased up to depth 50-60 cm by 10-50%. In the deeper layers the gradual increase of metal content is observed. On the reclaimed arable lands maximum concentrations were marked in the layer 40-50 cm. Maximum Hg concentrations (up to 0.15 mg/kg) were observed in the humus layer of all profiles. It is allowed to consider flood sediments as the major source of floodplain pollution with metals.

Hydrosphere pollution was first time studied for floodplain landscapes with biogen elements on the base of integrated characteristics of quality: soluble organic carbon (DOC) content; adsorbed AOX content, according to European river guidelines. The values for the above mentioned parameters for the different components of agrolandscapes are shown in the Table 2.

Table 2: Organic pollutant content for soluble compounds within floodplain landscapes (r. Oka, Rjazan, flood 2000)

№	Hydrosphere element	Date	DOC, mg/l	AOX, µg/l
1.	Snow 1 site 2 site	22.03.00	2 1.2	5.8 54.5
2.	R.Oka: - before flood - during flood - after flood	22.03.00 5.04.00 12.04.00-29.04.00 5.05.00-22.05.00	5.9 3.0 4.3-9.3 9.5 – 5.9	9,7 17,0 26.0-70.1 61.0 – 30.3
3.	R. Solotcha (after flood)	22.05.00	22.5	52.5
4.	Drainage flow	5.05.00-22.05.00	5.4 – 9.0	51.7 – 80.4
5.	Subsurface water	22.05.00	3.0 – 15.0	40.5 – 70.4
6.	R. Voga (after flood)	12.05.00	29.0	44.3

Data from the Table 2 shows the high level of AOX pollution in Oka river floodplain agrolandscapes. As to compare DOC standard value for the Rhein river is 3.0 mg/l, AOX is the same standard for all river and equal 25µg/l. The comparison of DOC and AOX concentrations in river surface water and in floodplain soil drainage flow indicates the high mobility of analysed organic compounds. The mean values for DOC and AOX concentrations were 7.6 and 0.005 mg/l and in flood flow 7.7 and 0.0053 mg/l in drainage flow, respectively.