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PART IV

Fires on Drained Peat Soils of Russia – Causes and Effects

Background

Unfortunately fires occurring on drained peat soils in the European part of Russia are common facts. The area of peat lands burned range between several hundreds and thousands hectares every year. The year 2002 was an extreme year.

What are the causes of these peat fires? First, the climatic peculiarities of Western Russia are characterized by dry and hot periods during summer that commonly last many weeks and sometimes months. These climate features result in drying of the upper layers of drained peat soils. The second cause concern the peculiarities of drained peat utilization outside the Chernozem zone of the Russian Federation. Almost all peat sites have been drained by channels and the level of the groundwater table was regulated by pump stations. As a result of at last ten years of the difficult economical situation in Russia many of these stations are not maintained and are degrading. The water regime of drained peat soils in this situation is thus depending on climate conditions only.

A third cause for peat fires in Russia is the low level of agricultural cultivation on peat soils. Modern methods of agricultural utilization of peat soils in West Europe and North America are involving a layer of sand under peat soil. This method prevents the spread of fires. Unfortunately until today there are no territories cultivated by this methods in Russia.

Thus, these climatic and economic factors promote the fire occurrence in peat lands in the European part of Russia. The situation is very similar in the other center of peat fires – South East Asia.

Impacts of Peat Fires: Nutrient Losses and Emissions to the Atmosphere

What are the consequences of peat fires in European Russia, and what are distinctions of it in other world regions?

The destruction of soil organic matter is the most striking result of this type degradation (Fig. 1 and 2). In drained agricultural peat soils the content of mineral components is 10-20% only, and the consequences of fire are catastrophically for these soils. After combustion of the peat layer depressions are formed on the surface of the land affected. Depth and area of these depressions are determined by the groundwater layer and the depth of the mineral bottom. A complete combustion of the peat profile down to the mineral layer is the most extreme situation. This occurs quite regularly in European Russia because many drained peat lands have rather shallow organic layers (100 cm or less) (Zaidelman et al. 1999, 2000). This is in contrast to South East Asia where the depth of peat can be 4-6 m and more.

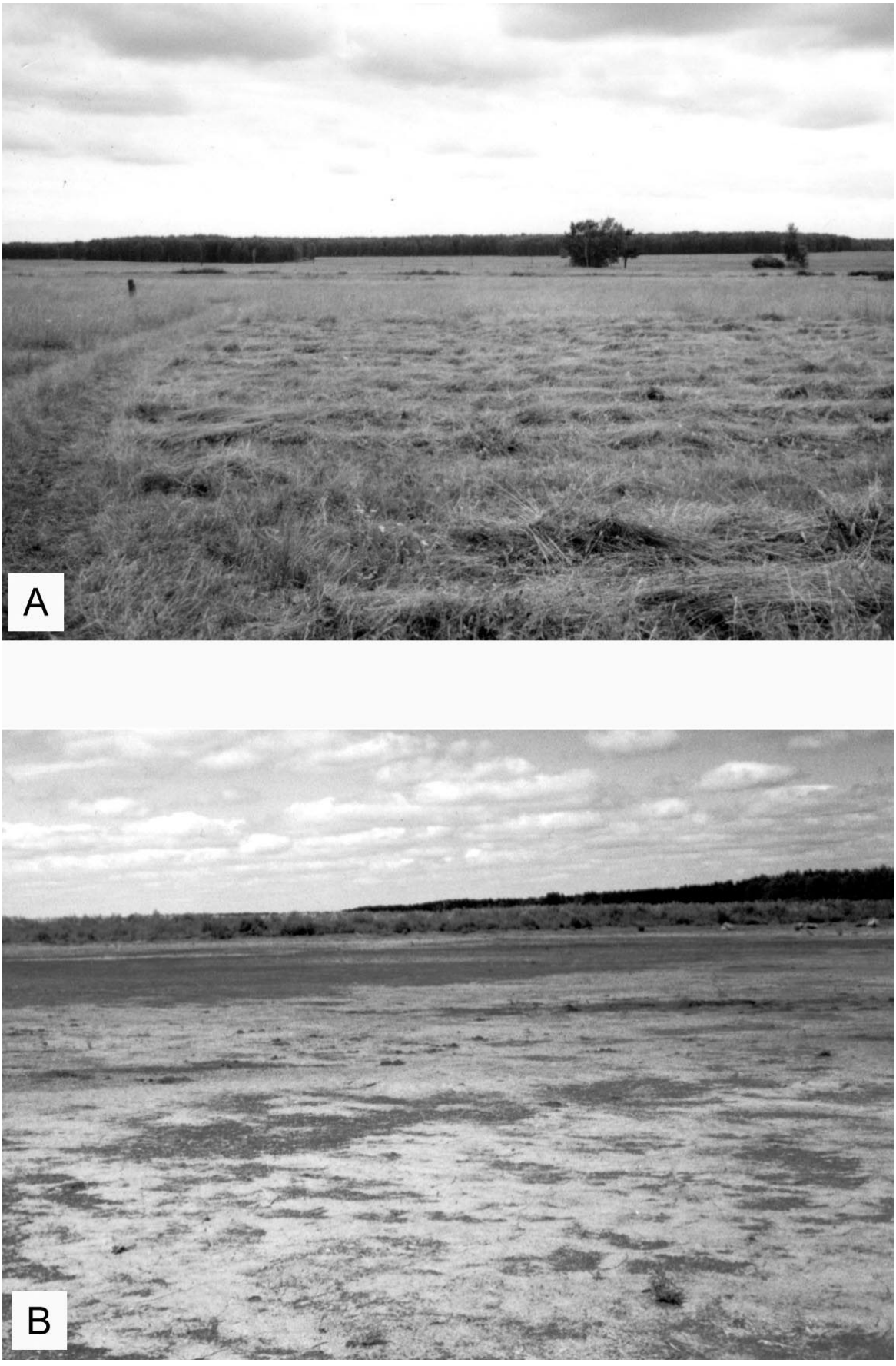

Figure 1. Drained peat land before (A) and after (B) fire in Rjazan region (100 km East of Moscow).

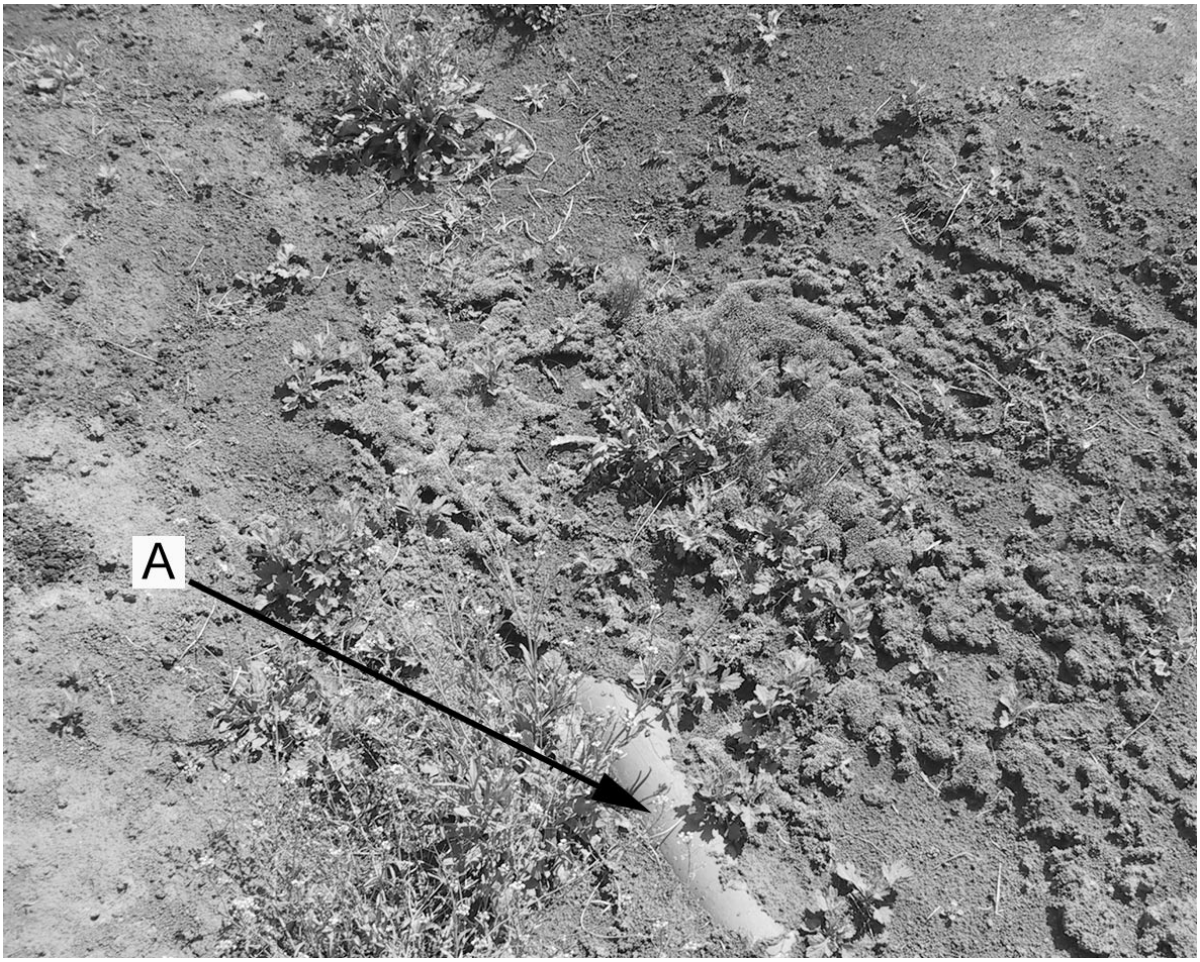

Figure 2. Surface of combusted peat soil. The arrow (A) shows a ceramic drain pipe. In Moscow region draining of peat soils has been done in 80 cm depth.

This depressions result in further drainage of neighbouring, not yet degraded peat soils, resulting in an increase of fire hazard. On the other hand the ground level of burned peat sites are lower than those not affected by fire. As a result, the swamping of the degraded area creates additional problem to recultivation and rehabilitation of this territory. As a result of this the most fertile agricultural lands of Russia are reduced.

The next problem of fire consequences in drained peat lands is the formation of peat ash and its accumulation in large scale. The compounds and properties of ash depend on the characteristics of the burned peat. All peat mineral components are accumulated and concentrated in ash (Table 1). The ash ranges are from light-alkaline to alkaline (pH 8.0-10.0 and higher) whereas peat pH is 3.0-7.00. Studies of water solubility components of ash showed that the ash consists of a mixture of many elements. Their concentrations exceed those of the peat by ten times and more. Ash is transported very easy to the groundwater, rivers, ponds, and neighbouring lands by water and wind.

It is further important to investigate gas emission of gaseous compounds of peat fires, especially the oxides of carbon. The emission of 130-200 m^3 of CO and CO_2 is the result of combusting 1 m^3 only. These gaseous product can be transported over large distances. For examples, the smoke from peat burning Northern Friesland in 1657 went as far as to Krakov (Goldammer 1998). Smoke from peat fires in Moscow region travelled to Sweden and Germany 2002. The contribution of Russian's peat fires to world's CO_2 and CO emissions is not as much as from peat fires in South East Asia. However, the vicinity of these fires to large cities (Moscow, Sankt Peterburg, Vladimir, Rjazan and others) has significant negative influences on human health.

Table 1. Compounds of peat and ash (mg/kg) taken in Rjazan Region.

Elements	**Peat** (mg/kg)	**Ash** (mg/kg)	
		Immediately after fire	**One year after fire**
Al	93802	604061	657920
K	30956	57451	40485
Ca	15810	37648	25574
P	6419	22370	19143
Mg	5527	23528	13041
Fe	3070	121763	101365
Ti	1946	87170	100800
Mn	339	1429	887
B	27	143	119
Ni	11	112 *	89 *
Co	11	31	27
Cd	0.11	0.36	0.30
Cu	9	48 *	47 *
Pb	4	91 *	73 *
Ge	1	4	3

* - content of element for mineral bottom is more than limit danger concentration

Finally it is necessary to note that natural rehabilitation of burned peat land takes much longer than the rehabilitation of burned forests. For example, the rehabilitation of a forest in the European part of Russia needs ca. 50 years. In contrast the formation 50 cm of peat requires about 300 years as minimum.

Unfortunately, taken into account the extensive spreading of drained peat fires in the world and high negative effects on ecological and economic conditions this process is studied very insufficiently. Especially for studies of degraded territories recultivation.

References

Goldammer, J.G. 1998. Environmental history: European regional smog from peat-swamp burning in Germany. Int. Forest Fire News 18, 59-60.

Zaidelman, F.R., M.V. Bannikov, and A.P. Shvarov. 1999. Pyrogenic forms as result of peat soils combustion – properties and fertility. Euroasian Soil Science No.9.

Zaidelman, F.R., M.V. Bannikov, and A.P. Shvarov. 2001. Effects of fire to drained peat soils (Posledstvija pozharov na osushennyh torfjanyh pochvah). Reclamation and Water Management (Melioratsia i vodnoe hoz'aystvo) 2 (4).

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