Abstract:

Human activities exert an ever growing impact on our environment, and this is undoubtedly the responsibility of mankind. In spite of this fact there is almost no process in our environment that can be described exactly in complete detail, and the working of which is known in full extent. Wind erosion is such a process. Although water erosion is mentioned ever more often in scientific circles as a form of erosion, its effect is restricted to a certain region, although it may cause perceptible damage of a greater extent in short time. Wind erosion, apart from the fact that it may have global impact, may play an important role in the warming of our climate according to recent studies. First of all, wind erosion may cause damage far from its origin in human health, nutrition, or in the environment in general. Today several surveys have proved, that erosion caused by wind significantly contributes to the air pollution of cities, the fine dust carried as drift by the wind may cause severe environmental damage in accumulation zones. Microbes, toxic material may attach themselves to the dust carried this way and carried on by the wings of the wind they may cause health issues in humans animals and plants as well. In spite of these facts there are almost no measures against wind erosion employed in arable land, although our ever nearer climate changes and would make these necessary. Reduction of organic matter content presents a great problem in a large part of cultivated land, so the risk of the production of high quality food raises questions of more and more ethical nature. Who is responsible? The fact, that the chemicals used in a growing extent by agriculture may teach many people causing considerable damage to the environment also raises serious ethical questions. More and more people with extreme weather conditions are experienced in Hungary and Europe as the effect of climate change. Drought periods are longer and more frequent. As the intensity of precipitation changes, this also increases the occurrence of floods, and the growing extent of uncovered soil surface shall intensify wind erosion as well accelerating the negative effects described above.

Who will be responsible for this? Who should bear the largest cost of production in agriculture that is caused by the cost of research necessary to uncover the methods of prevention of irreversible damages caused in nature and environment? Because the field of research requires an interdisciplinary approach, research and innovation requires huge funds, the different approaches to the problem in every single field, and different reasoning methods represent a hurdle as well. In search for possible solutions it is necessary that political decisions-makers adopt regulations which have solid scientific fundamentals, and also the cooperation of mankind active in science and economy is crucial.

This is the only way of finding sustainable and long term solutions to the problem.

1. Wind erosion as a natural process:

Wind erosion is basically a natural surface forming geological process. Three basic transportation formats can be discerned such as creep solution and suspension. From these three transportation forms suspension has the greatest effect on the formation of atmospheric dust, which results in atmospheric dust (PM2.5, PM10). Mineral dust aerosols, the micasieve lowering soil particles play an important role in formation of global atmospheric and global hydrological radiation processes. Regarding global and natural scale the majority of atmospheric aerosols enters the atmosphere in the dry and semi dry regions and remain there for a longer time. In these cases we speak of intercontinental transportation (Picture 1.) To in formation basically a dry soil surface, a starting wind speed according to soil type, particle ready to be solated, and sparse vegetation are needed. Mineral dust aerosols may change in diverse ways the climatological relations of affected areas, and they also modify formation precipitation either heightening or lowering its quantites. The temperature and air currents in affected areas are modified by it as well. (G. Alabadi, Chorover et al., 2014.)

Wind erosion not atmospheric dust affects human health and animal health (according to the wind circulation of windborne dust diverse respiratory system complications may occur) visibility, road conditions, and it may also cause extensive damage to infrastructure. (Natalie M. et al., 2014, Joel et al., 2012, P. Williams & M. Young. 1999.)

The extent of the effects and their impact are not entirely clear ever today.

2. Wind erosion on agricultural lands:

Wind erosion in Central Europe affects mostly areas of cultivation, especially in spring months, when the soil surface is free from vegetation or only sparsely covered by it. (Leunaghe G. et al. 2000.) In these areas surface cover may vary in time and spatial dimensions according to cultivation type (Picture 2.) Wind erosion may harm the vegetation, it may change the effect of nutrients and materials used for plant protection (in place, time and efficiency). The nutritive substances existing above the areas of wind erosion, similar to water erosion may cause serious environmental harm such as filling of drainage ditches, and lakes, and eutrophisation. In accumulation zones the concentration of nutrients and possible toxic substances may cause the degradation of yield. (K. Takács & G. Nőcsey 2013, A. Farsang et al. 2011.). During soil cultivation, especially in conventional types of cultivation soil clots and crombs also form, which may deteriorate, the composition of the soil may worsen, resulting in the number of such particles which may be dissolved and moved by wind erosion. (Picture 3.) Wind erosion does not only affect soils of loose consistency or of no consistency, but it may also occur in soils of more bound structure if the cultivation methods are not adequate. During cultivation processes a large quantity of dust may enter the atmosphere, by the means of the so called cultivation erosion. For example in Hungary correlation between the concentration of windborne dust and agricultural cultivation may be clearly demonstrated. (Szemáni J. 2006.) Solution to the problem of erosion and dust resulting from agricultural cultivation may be found in decreasing the level of cultivation and also by the application of techniques and substances increasing the formation of a solid soil crust.

3. The geoethical implications of wind erosion:

Harmed substances to the environment and to human and animal health may exit the soil along with soil particles and drift caused by natural or anthropogenic wind erosion. Today more and more attention is turned to research dealing with the effects of such drifts. In North America the susceptibility of women to dust resulting from the use of agricultural pesticides in agricultural areas was examined, that most of the particulates may come from the water but the quantity accumulated from dust is also significant. To uncover the ways of exposition significantly further research is needed which is necessary because of the complex nature of the exposition. (Desai NC. et al. 2015.) Epidemiological surveys were conducted and the results of these showed, that the concentration of atmospheric dust (PM particles) may help the formation cancer, and respiratory and cardiovascular diseases. According to research the increase in concentration Assist the formation of these illnesses (Tommaso P. et al. 2016.) In the population of young Californian farmworkers investigation was conducted to uncover pulmonary diseases related to inhalation of dust. The researchers found mineral dust small airways disease, pneumononcles (mucous and nodules), and pathologic changes consistent with chronic bronchitis, emphysema, and interstitial (fitness predominated in farmworkers compared with nonfarmworkers. Based on the experiences mineral dust exposure is associated with increased acute airway disease and pneumononcles among these farm workers, but the clincial significance and natural history of these changes remains to be determined. (Schmek B. M. et al. 2009.) The above surveys also show that human and animal health related to the environment, the occurrence and spread of diseases. The wind erosion in cultivated farmlands may transport particules far from the areas of application resulting in serious long term human health issues.

Conclusion:

Summing up the presented surveys:

1. Wind erosion is in essence a natural process, which may affect mostly agricultural areas situated in plains, especially taking into account the effects of climate change. Atmospheric dust resulting from wind erosion may cause an environmental and health risk.

2. Natural climate forming dust storms do not affect areas of single countries but have a range and impact of far greater scale, so they also raise geoethical issues. Who should take countermeasures and how? Who is responsible? Is there anyone responsible for them at all?

3. Dealing with “smaller scale” atmospheric dust originating from agricultural cultivation is clearly the responsibility of the “source” from the standpoint of geoethics. Especially in regard to the nutrient particle and toxic content of it. It would be advisable to take wind erosion into account in daily agricultural practices following the examples present in the US, and also set down the annual maximum level of it as part of the WEPs model.