Soil erosion as a consequence of climate change

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Abstract
The climate change and relevant negative impacts are currently widely discussed topic. The agricultural soil erosion represent the risks generated also by agricultural activities reflected in soil quality. Rapid climate change can cause the instability of most agricultural and forest ecosystems. Climate change is expected to affect the conditions under which agricultural production is done in many ways. In Slovakia, agricultural soils are potentially at risk of water erosion of varying intensity. Wind erosion is not a serious problem in Slovakia in recent years. Despite the fact that soil erosion level shows in Slovakia in recent period a slight decline however the adoption of soil conservation practices are necessary for future sustainability.
Keywords: Climate Change, Agricultural Soil, Water Erosion, Wind Erosion

1. Introduction

The key to understanding climate change is the definition of climate change. Simply put, to understand these changes, it is necessary to determine the sensitivity of our climate to both anthropogenic and natural factors (Karl and Trenberth, 2003). The main factor is human activity, which increases the content of greenhouse gases such as carbon dioxide, methane or nitrous oxide. As these active gases grow, the greenhouse gas effect is amplified, which is natural and decisive for the preservation of life on earth, but human activity intensifies its effect, thereby global warming of the earth. Human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels, with a likely range of 0.8°C to 1.2°C. Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate. (IPCC, 2018)

Ač, Matejovič, Pecho (2015) draw attention to the problem of climate change with a particularly negative impact on our agricultural conditions. Slovakia can expect a similar fate as a drought plagued California, where farmers fight for every liter of water and leave their devastated farms to survive in large numbers. Slovakia can thus very quickly become one of the countries where water will also be a scarce resource and will become more expensive and inaccessible during this century.

2. Results

According to global climatologic classifications the Slovak Republic is located in a mild climate zone with mean monthly precipitation totals equally distributed over the whole year. During the period 1881 – 2017 a significant increase of annual air temperature by 2.0°C and insignificant trend of annual precipitation totals by about 1% on average were recorded in the Slovak Republic. Annual precipitation totals increased up to 3% in the north and also decreased more than 10% in the south of the country.

Due to improper farming agricultural land erosion may occur. In Slovakia, agricultural soils are potentially at risk of water erosion of varying intensity. Wind erosion is not a serious problem in Slovakia, lighter more granulated soils are mostly endangered with this type of erosion. The intensification and specialization processes of agriculture contribute significantly to the acceleration of environmental problems. Although farmers are aware of the need for good environmental quality for healthy and efficient crop production and successful animal breeding, agriculture has also a negative impact on the deterioration of environment quality. Soil is also degraded by incorrect system of farming.

Table 1. Percentage of Potential Wind Erosion Categories

Year	Extreme [%]	Middle [%]	High [%]	None or low [%]
2015	1.6	2.9	2.4	93.1
2016	1.6	2.8	2.3	93.3
2017	1.6	2.8	2.3	93.3

Source: National Agricultural and Food Centre, Soil Science and Conservation Research Institute

The biggest problem is water erosion. Thus, the fertile soil is washed away in heavy rains, snow and floods. However, irresponsible and unreasonable access to land accelerates erosion. We can state that erosion is the biggest degradation phenomenon in Slovakia, which causes millions of damage to the land fund. There are several possibilities how to face mainly water erosion: anti-erosion of cultures and crops, size and arrangement of land, contour agro-technology, tilth-free technology, mulching. The agricultural soil erosion represent the

risks generated by agricultural activities reflected in soil quality. The incidence of sudden, intense storms combined with longer periods of drought greatly affects erosion.

Table 2. Percentage of Potential Water Erosion Categories

Year	Extreme [%]	Middle [%]	High [%]	None or low [%]
2015	13.6	10.4	14.8	61.2
2016	13.5	10.4	14.8	61.3
2017	13.4	10.4	14.8	61.4

Source: National Agricultural and Food Centre, Soil Science and Conservation Research Institute

The long-term intense impact of erosion processes on the soil can lead to the complete removal of the fine textured soil, which ultimately means the disappearance of the soil itself. In Slovakia dominates water erosion of various intensity. It was potential in 2017 threatened by water erosion, 38.6% (770,423 ha) of agricultural land. Wind erosion is not a serious problem compared to water erosion and in the year 2017 has been potentially endangered 6.7% (137,117 ha) of agricultural land. Agricultural land threatened by high and extreme potential water erosion is found mainly on the sharp slopes of mountain and foothill areas.

Table 3. Categories of Potential Water and Wind Erosion in Slovak Republic in 2017

Categories of Eroded Soil (Soil Deprivation)	Water Erosion		Wind Erosion	
	Area (hectare)	Share on Agricultural Land [%]	Area (hectare)	Share on Agricultural Land [%]
None or low (0-4 t/ha/year)	1 211 875	61,4	1 841 869	93,3
Middle (4-10 t/ha/year)	205 142	10,4	55 455	2,8
High (10-30 t/ha/year)	291 472	14,8	45 390	2,3
Extreme (>30 t/ha/year)	265 012	13,4	30 787	1,5
Total	1 973 501	100,0	1 973 501	100,0

Source: National Agricultural and Food Centre, Soil Science and Conservation Research Institute

We are increasingly confronted with the danger of extreme rainfall in Slovakia, whose short-term intensity (e.g. in 15-30 minutes) often exceeds the physical possibilities of effective absorption of the Earth's surface to hold large volumes of water. For example, in the last two to three decades, the Slovak Hydrometeorological Institute has registered a more frequent occurrence of extreme rainfall. Not only the frequency of their occurrence increase, but the absolute records of maximum of daily or hourly precipitation increases. An even bigger problem is the increasing intensity of short-term rainfall, which is reflected in the fact that precipitation is steeper. In particular, the intensities of 5 to 180 minutes of rain increase significantly. In Slovakia, daily rainfall totals of more than 50 mm are already having a negative impact, whereas quite often the cause of flooding is a series of such days, the number of which can reach 2 to 3 or more. Sometimes such a sequences can be repeated in a short time.

3. Conclusion

Agriculture reacts very sensitively to climate variability and weather extremes like droughts, storms, heavy rainfall and floods. Soil quality affect the quality of plant and animal production within the food chain. Crop production may benefit from a warmer climate but the occurrence of weather extremes and the increase in their intensity will cause other problems. Climate change and the global increase in average annual temperatures will affect the livestock welfare. Agriculture and farming is impacted by climate conditions directly and indirectly. The direct impact is represented by the agro-climate factors which determine and influence production potential of agricultural soils. Future soil degradation and its impact on agricultural production is uncertain and we can state that soil erosion could be a serious threat for worldwide agriculture in future.

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