COMPARISON OF SOIL EROSION DYNAMICS UNDER EXTENSIVE AND INTENSIVE CULTIVATION BASED ON BASIC SOIL PARAMETERS

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Abstract: The conservation of soil and its elemental feature, the soil fertility has not just national and agricultural business interest, since the fertile soil is an elemental part of the material turnover in the environment. The soil erosion can reach huge spatial extensions and starts with the most valuable part: the upper, fertile layer. So, its research is crucial for our future survival. Our studied area can be found in Gerézdpuszta at the Koppány-valley of Hungary, which is a sensitive erosion area. We sampled the upper 30 cm of soil layer in every 10 meters that resulted 32-32 point samples on the arable and on the grassland, respectively. One sample was taken under the forest as reference. We analyzed the basic soil parameters: $CaCO_3$, pH, AL-P_2O_5, AL-K_2O, Kuron's higroscopicity, SOM and the particle size distribution was determined. Besides, we examined the connection between the given results from laboratory soil analyses and the Munsell-type and Google Earth satellite image colors. Our results show the erosion dynamic on our sample slope, and the main differences in basic soil parameters between different intensities. The main indicator of soil erosion dynamic were the $CaCO_3$, the SOM, AL-P_2O_5 and the particle size distribution, where the SOM and $CaCO_3$ were correlate with the Munsell and Google Earth color also.

Keywords: soil erosion processes, dynamic, basic soil parameters, land use type

Introduction

The water erosion is one of the main land degradation processes in the World, which rate is affected by many factors, which are the land use type, soil moisture, water capacity, soil texture, roughness and the crop management. From these factors there are two, what we can influence and modify in order to protect our fertile soils on the way of sustainable land use. In the present study the most important factors of all are the land use type and the crop management. As well known, the less runoff occurs under forests, and the next are the grasslands, where the annual amount of the soil loss is twice of the developing soil loss under forests. Therefore in this respect the land use type has a great importance, which is emphasised in many studies (JORDAN et al., 2005; PODMANICKY et al., 2011; CHEN et al., 2007; ERSKINE et al., 2002; MOHAMMAD et al., 2010; PETŐ et al., 2008; VACCA et al., 2000; PENGA és WANG 2012; KERTÉSZ et al., 2010; KOULOURI et al., 2007; SZILASSI et al., 2006). The best management practice in crop management is important also, because in this way we can reduce the soil erosion and minimize the leaching of nutrients and increase soil productivity. Many study demonstrate that cover crops can improve water infiltration, reduce water runoff, and slow down erosion. (DABNEY, 2001; KERTÉSZ et al., 2001; JAKAB et al., 2013; CSEPINSZKY AND JAKAB, 1999; PARDINI et al., 2003; GARCIA, 2010; NEARING et al., 2005; MADARÁSZ AND KERTÉSZ, 2013; MADARÁSZ et al. 2011, 2014). So the crop management has a great

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importace in the soil erosion processes and its dynamic. Therefore in this study our objective was that we evaluate the soil erosion dynamic based on basic soil parameters under different land use intensities.

Materials and methods

Our studied area can be found in Gerézdpuszta at the Koppány-valley, which is situated in the north-eastern part of the South-Transdanubian Region in Hungary, 30 kms to the South from Lake Balaton. It is a hilly landscape formed by loess deposited on a layer of Pannonian clay and sand sediments, which is characterized by chernozems and brown forest soils. We sampled the upper 30 cm of soil layer in every 10 meters that resulted 32-32 point samples on the arable and on the grassland, respectively. One sample was taken under the forest as reference. We analyzed the basic soil parameters: pH, $CaCO_3$, AL-P_2O_5, AL-K_2O, Kuron's higroscopicity, SOM and the particle size distribution was determined. Besides, we examined the connection between the given results from laboratory soil analyses and the Munsell-type and Google Earth satellite image colors.

Results and discussion

Based on the pH the soil samples were mildly alkaline in case of both area. In case of arable land the distilled water pH was between 7,8–8,2, and the end of the slope the alkaline was increased slightly in case of both area. From the values of pH we can conclude for the dynamic of soil erosion, because we got various values in terms of slope shape. Its clear from the results that the processes are different on the two areas.

Between tha values of humus % in case of sample slopes there is significant difference. The soils, which have under 2% humus content was the arable land as the land use, because of the water erosion has a major negative impact on this field, where the first shifting material is the organic matter. On the arable land the values of humus % don't show considerable fluctuation contrary the grassland. On the grassland against with it, the humus content shows high heterogenity in the mirror of slope-shape and on the whole it has higher humus content values (Figure 2.), because of the smaller disturbance and the continual coverof plants. In this way it is able to preserve the humus content of soil against the soil erosion.

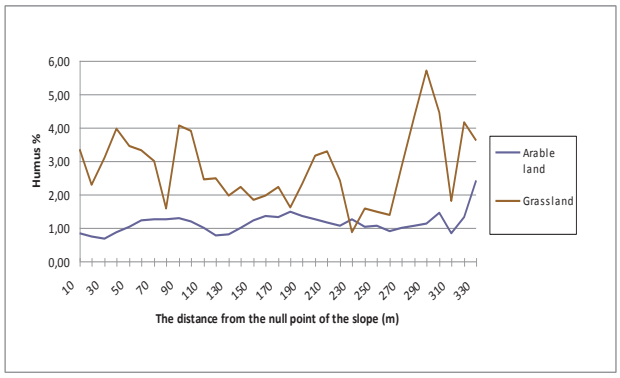

Figure 2. The values of humus% in case of an arable land and a grassland

Owerall we can say that from the humus content is great to characterize the dynamic of erosion, because in case of the arable- and grassland it shows peaks, where the erosion is less intensive and depression, where the erosion is more andvanced. The humus content is increasing at the bottom of slope through the accumulation.

Based on the results we can see that the carbonate content of the arable land is higher at the upper and the lower third of slope a sin case of grassland. The very high carbonate content suggest shallow fertile soil layer and the cumulative parent material (*Figure 3.*).

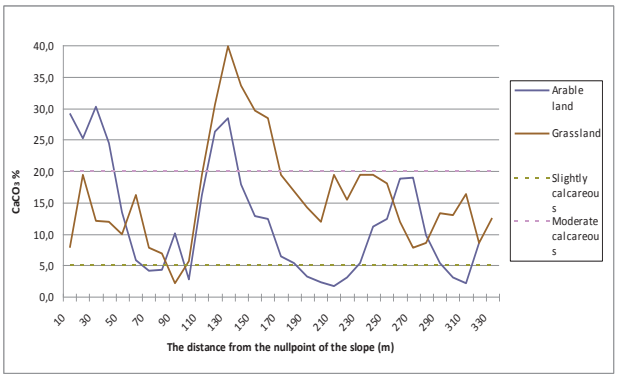

Figure 3. The values of humus% in case of an arable land and a grassland

We can differentiate 3 peaks of the higher carbonate content on the whole slope, which show the parts of the slope, where the working of the soil erosion is more intensive. In thi way we can conclude for the dynamic also. In this case the most eroded part of the upper and the middle part of slope. The amount of nutrients were wery low, but therefore the phosphate and the potassium mostly attache to the organic matter the rate of its show similar image, than the humus % despite of theit low content in our samples. Therefore it is also able to be an indicator of the soil erosion rate and dnyamic. The texture of soil samples on arable- and grassland is silty loam, which is caharacterised by 0-28% clay, silt rate is 50-80%, wile the sand fraction is between 20-50%. The distribution of particles show the similar image, as the other parameters, with 3 peaks and 3 depression in case of arableland, but the rate of the silt and the fine sand follow the rate of other parameters also, but there is not clear is every case.

Based on the measurement of the wet colour determianation, we can say that the samples are yellow base in the 10YR category. At the bottom of the slope the colours were darker as upper parts. The colours of the examined soil samples were correlate with the Google Earth colour also.

Conclusions

On the arable land of Gerézdpuszta there is high level of soil degradation, while on the grassland the degradation was moderate, which fact is confirmed by the field work and the laboratory analyses of soil samples. Based on our results we can conclude that some of the basic physical (grain size) and chemical (CaCO3, the humic %) parameters can be very good indicators of soil erosion processes.

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