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A REVIEW ON SHEET EROSION MEASUREMENTS IN HUNGARY

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Abstract: Soil erosion has a significant role in ecology, economy and in environmental protection therefore its quantification and prediction are very important, particularly on a national level. Although some details can be described using physical equations, the entire soil erosion process is rather complicated and can be determined only empirically, which requires large measured datasets. Because plot measurement is the most convenient and therefore the most popular way of capturing erosion data, we used plot measurement to understand erosion in Hungary. The northern and the western parts of the country are endangered by sheet erosion, which is why the plots were carried out in those areas. Most of the plots were constructed to determine the "K" factor of the USLE (Universal Soil Loss Equation) under permanently tilled soils without vegetation cover. Additionally the soil protection effect of various field crops and the additional land use types (forest, pasture) was measured in the plots. Furthermore descriptive investigations, rainfall simulations and soil tracer detections were also used to quantify sheet erosion at different environmental conditions and scales. Despite the large amount of measured data collected, only a few of them have since been published. Due to a lack of available data, national erosion research, erosion prediction, and model calibration are less precise and effective Scaling problems among the measured levels also emphasized a definite need for a larger and more accessible national database. Finally, without the financial base of additional plot measurements, the publication of the previously gathered data is absolutely necessary to continue soil erosion studies in Hungary.

Introduction

Soil erosion is a global problem that affects—with varying intensity—most of the cultivated areas of the world. The pressures of an increasing population have led both to food that is produced intensively on existing farmland and to the involvement of new areas into intensive tillage operations (RHODES 2014). Consequently, since soil is a conditionally renewable resource, soil erosion hazards can be a ticking time bomb for a country's security.

The success of avoiding and remediating soil erosion depends on the detailed knowledge of the sub-processes involved in erosion. Useful models are accessible only when large amounts of measured results are available.

Since soil erosion is a rather complex phenomena contingent on the temporary interactions of various environmental parameters, even the basic processes vary within a particular area. To apply a general and adequate soil erosion model in the landscape and to gain the best results, it must be calibrated and validated with local data first. Accordingly the very best soil erosion model can present inadequate results because of the lack of previous calibration and validation. Therefore each country has almost a responsibility to gather as much and as high quality place-specific erosion data as it is possible.

The case of Hungary is very unique from this point of view because two thirds of the country is used agriculturally and widespread loose sediment parent material makes the soils especially prone to erosion. Although the area of the country (ca. 93,000 km^2) is smaller than the average traditionally agricultural country in the EU, a wide range of erosion processes can be found and often parallel to each other. The flatter, continental parts of Hungary are often afflicted by wind erosion and even by "berm erosion" on salt affected alkali flats (TÓTH et al. 2015), while the hilly parts are eroded by both sheet and gully erosion. The varying landscape and climate results in a rather complex mosaic pattern of soil erosion processes with very high spatial diversity (CENTERI 2002c, KERTÉSZ and CENTERI 2006). This spatial diversity makes the up- and downscaling of the measured data considerably difficult both over time (DE VENTE and POESEN 2005) and among scales (STROOSNIJDER 2005).

The aim of this paper is to review the efforts of soil erosion measurements in Hungary and compare the published results. To do so, the focus is solely on sheet erosion, even though gully (JAKAB et al. 2009, KERTÉSZ and JAKAB 2011), wind (NÉGYESI et al. 2014) and fluvial (SZALAI et al. 2013) erosion also have a very important impact on recent landscape development of Hungary.

Measuring soil erosion

Most of Hungary's soil erosion history has occurred from natural phenomena and is of limited interest to this study. However anthropogenic soil erosion events and processes have increased in the last century due to intensive farming practices (SZILASSI et al. 2006). Therefore soil loss as a potential danger, rising in the 20th century, directed attention to erosion processes. From a theoretical standpoint the history of soil erosion research was divided to three main groups by the authors described below: (1) descriptive studies, (2) process oriented studies, (3) complex studies. This classification is subjective reflecting the progressive attitude of man to the nature over time.

Descriptive studies

In the first part of the 20th century soil erosion was considered more of a cause of recent landscape morphology rather than a process, which detaches soil particles and moves them elsewhere. Because of this common consideration, a detailed survey of the current status of soil erosion in Hungary seemed to be more prescient than investigations of the processes of its present soil erosion. Results of the survey were soil erosion maps constructed and produced at various scales from national (DUCK 1960, STEFANOVITS 1964) to larger scales (DUCK 1966, ÁDÁM 1967). Additionally, case studies were carried out in order to measure nutrient distributions along different slopes due to sheet erosion on various soil types (MATTYASOVSZKY and DUCK 1954).

At that time, soil erosion was considered as an effect, which mitigated soil fertility hence caused economical damages. Its role as an environmental hazard had not yet been recognized. On the other hand the role of human activity was identified as the main purpose of accelerated erosion increase. Consequently significant efforts were made for erosion prevention and soil protection theories and practices (FEKETE 1953).

Although process oriented investigations have become more popular since the 70s, descriptive studies were still popular. In that time KERÉNYI (1984a) introduced a new way of soil erosion surveying and mapping in which he took rill and gully erosion into account in order to determine the real rate of accumulated soil loss. Since this type of survey needed significantly more effort it did not become widespread.

Process oriented studies

While descriptive investigations increased a need arose to understand the processes involved in generating soil erosion. This led to increasing attention being paid to monitoring and modelling studies. Soil erosion monitoring was carried out with the construction of measuring equipment that could quantify runoff and soil loss values due to natural precipitation events. These techniques aimed at measuring soil losses at different spatial scales since it became evident right away that the results of different scales are hardly comparable to each other (STROOSNIJDER 2005).

The small-scale investigations were based on monitoring sediment traps at catchment outlets (SZŰCS 2012), creeks or rivers (DEZSÉNY and LENDVAI 1986). In the 80s the water quality of Lake Balaton—because the lake was a very popular destination—decreased dramatically, becoming a major problem. Although water pollution was partly due to the lack of sewerage, attention was focused on the erosion processes in the Balaton watershed (DEZSÉNY and LENDVAI 1986). At this point in time measurements were concentrated on the surface water quality of the streams in the catchment in which phosphate received the primary interest (MÁTÉ 1987).

In the early 90s, a country wide catena scale monitoring program was designed and partly constructed by the National Soil Monitoring Network (TIM) (VÁRALLYAY 1994). In this study metal sheets of 1 m^2 were placed into the soil at exactly 60 cm from the surface parallel to various geomorphological positions—mainly on ridges, footslopes and midslopes. The changes of soil depth above the metal sheet referred the dynamics of erosion or deposition processes (NOVÁKY 2001). Although in this study the construction took the main part of the budget—maintenance being nearly negligible—monitoring stopped because of financial difficulties. Moreover there are very limited data published from the short monitoring period (18 stations, 3 slope positions and 3 recording times). These data partly reflect the obscurity of the first year results manifested in a few cm changes in both directions at the same place (NOVÁKY 2001).

Plot measurements

Measuring in situ soil erosion this method is currently the most widespread of the world. Many sites can be found in Europe with large amounts of published data (VACCA et al. 2000, JANKAUSKAS and JANKAUSKIENE 2003, CERDAN et al. 2006, GONZÁLEZ-HIDALGO et al. 2007) and many countries neighboring Hungary have well documented monitoring results such as Romania (IONITA et al. 2006), Slovakia (STANKOVIANSKY et al. 2006) and Slovenia (HRVATIN et al. 2006). Theoretically plot measurement can provide data on a wide variety of scales even though data is typically recorded at micro and smaller scaled investigations (STROOSNIJDER 2005).

Hungary is situated on the border of 3 climatic zones therefore the whole country cannot be described as one unit. The SE part (The Great Plain) is continental and has the least amount of precipitation (less than 500mm $year^{-1}$) and a high yearly mean temperature fluctuation (20°C). The Western part is the wettest while the SW has a slight Mediterranean influence (DÖVÉNYI 2010).

The size of the published plots varies from 2 to 1200 m^2 due to different purposes (KAZÓ (1966a) reported about the advantages and disadvantages of in situ measurements on various plot sizes). In accordance with topography and pedology the most endangered spots can be found mainly in the western and the northern parts of the country (KERTÉSZ and CENTERI 2006) (Figure 1). In these areas the soils concerned are Luvisols and Lithosols on the higher parts and Cambisols on the hills. The most investigated land use type is arable land, especially black fallow or continuous seedbed conditions, however, forest cover has also been investigated (BÁNKY 1959b).

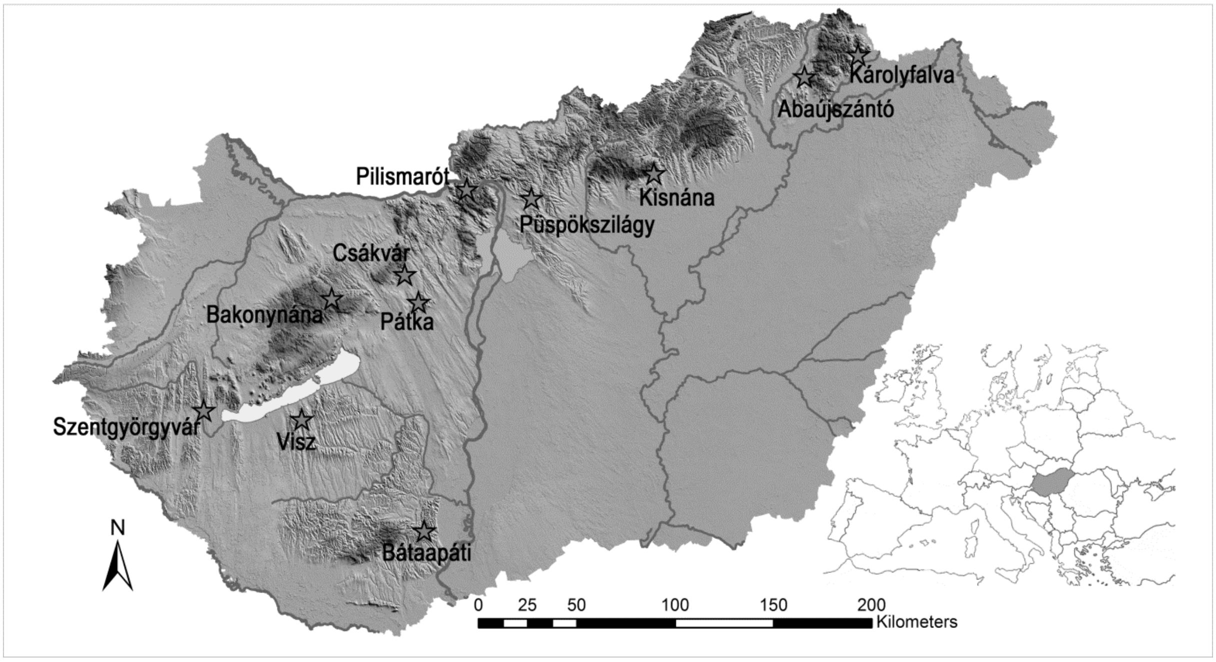


Figure 1. Location of plot measurements in Hungary
1. ábra A parcellás mérések elhelyezkedése hazánkban

The appearance of the USLE concept (WISCHMEIER and SMITH 1978) provided a standard way for sheet erosion measurement. Its high efficiency was associated with easy applicability, which is why the USLE method became widely accepted even in Hungary behind the *iron curtain*. Although considerable more plot measurement data was registered and stored this study focuses on only ten locations on the basis of seventeen publications. Most of the measured data are still unavailable since they manifested only in manuscripts even though some of them contain data that covers long periods of time (more than 10 years continuous monitoring).

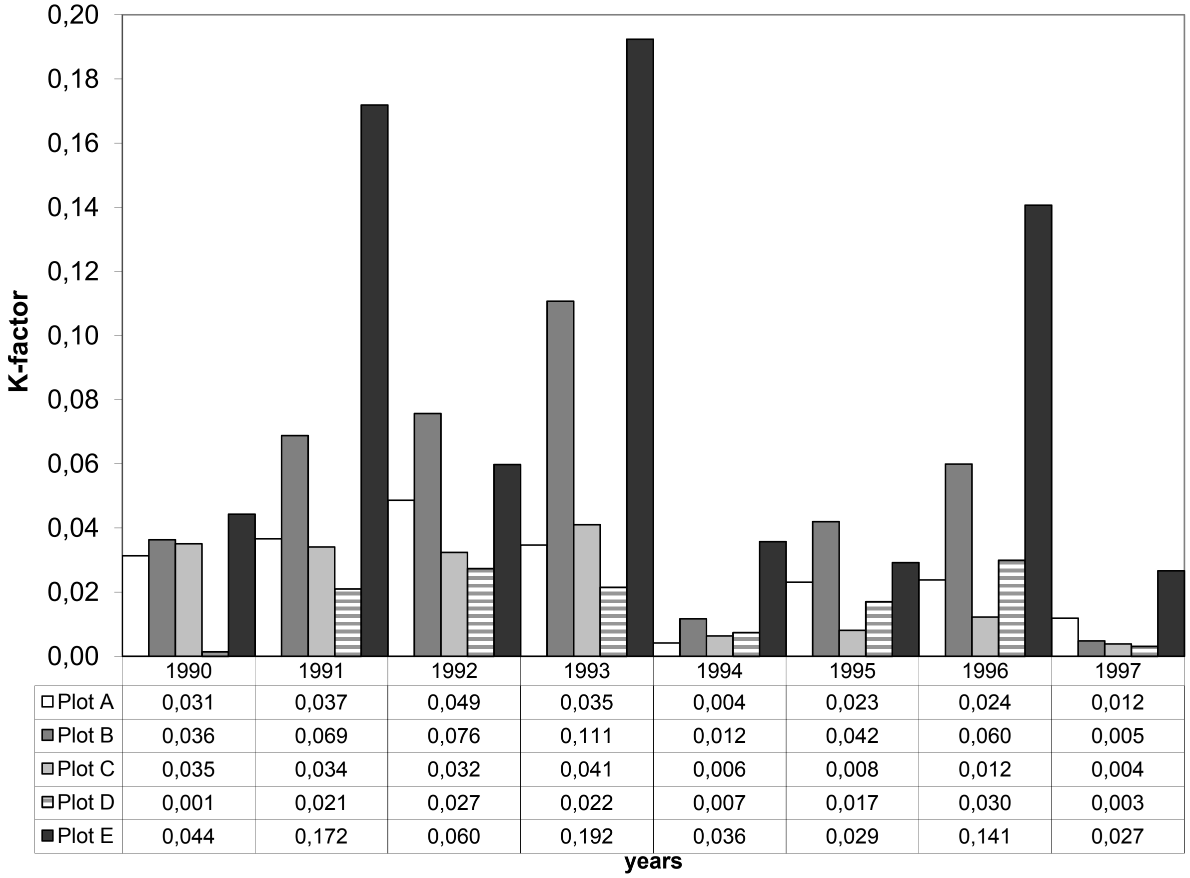
Some of the sources present single precipitation induced runoff and soil loss values, other reveal derived values (e.g. soil erodibility (K) factor from the USLE) (Table 1). A common problem in sources from former times was the exchangeability and comparability of the presented data due to the lack of certain precipitation parameters or soil bulk density. The bulk density of soil loss is generally much less than that of the in situ soil, hence soil loss values presented in bulk units are hardly comparable to those of weight units.

The most accepted calculation methods concern an annual period even though often a few precipitation events result almost in the total amount of annual soil loss. This phenomenon is typical for semiarid regions such as the Mediterranean but due to climate change it is becoming even more frequent even in Hungary. Accordingly the same sediment gathering infrastructure has to collect and store sediment and soil loss of various orders of magnitude. This is why there is no completely accepted and widespread sediment collector equipment in Hungary—even the most up to date devices can not handle extreme events, which often causes data loss.

Table 1. Plot measurement properties in Hungary The presented values are means. (K: soil erodibility factor of the USLE; R: rain erosivity factor of the USLE; A: soil loss; RR: runoff rate; question mark refers to ambiguous data)
1. táblázat Magyarországi parcellás erózióméréseк A pulikált eredmények átlagok. (K: USLE erodálhatósági tényező; R: USLE esőenergia tényező; A: talajveszteség; RR: lefolyási ráta; a kérdőjel kétes adatot jelöl)

Location	Purpose	Plot size (m)	No of plots	Soil	Land use	Monitoring period	Slope steepness (%)	Published results	Source
Csákvár	USLE K factor	1×8	10	Regosols Leptosols	Black fallow	1990-1997	14	K values for five soils	Kertész and Richter 1997; Kertész et al. 2004,
Visz	USLE K, C factors	2×22	4	Cambisol	Black fallow Pasture	1999	9	K=0.034	Tóth et al. 2001.
Kisnána	Erodibility	various	6?	Luvisol	Forest	1958-2009	?	Results of single events	Bánky 1959a
Szent-györgyvár	Tillage comparison	24×50	4	Luvisol	Arable land	2003-2009	9	Annual runoff and soil loss values	Bádonyi et al. 2008; Kertész et al. 2007 Kertész et al. 2010 Madarász et al. 2011
Püspök-szilágy	USLE K factor	2×22	4	Cambisol & Luvisol	Black fallow	2000	9	Results of single events	Balogh et al. 2003
Bátaapáti	USLE K factor	2×22	2	Leptosol	Black fallow	2006	9	K=0.2, A=30 t ha^{-1}, R=140 kJ m^{-2} mm h^{-1}	Balogh et al. 2008
Pilismarót	Erodibility	various	6	Luvisol	Arable land	1982-1985	14-23	RR=0.04; A= 10.2 g m^{-2}	Góczán & Kertész 1988, 1990; Kertész 1987
Bakonynána	Erodibility	various	6	Luvisol	Arable land	1976-1984	18-29	RR=5.6	Kertész and Góczán 1990; Góczán and Kertész 1988
Abaújszántó	Geotextil effect	2×10	16	Cambisols	Vineyard Orchard	2007-2008	10-20	K= 0.002; 0.004; 0.035	Kertész et al. 2007b,c
Károlyfalva	Erodibility	0.8×2.5	4	Cambisol	Black fallow	1986	18	Results of single events	Kerényi 1991, 2006
Pátka	Model calibration	2×20 1.8×60	3	Cambisol Chernozem	Arable field Vineyard Orchard	1999-2002	4-13	Results of single events	Barta 2004

The most adequate database among the investigated sources is based on the Csákvár experimental station (Figure 2). The K factor for five representative soils of the Lake Balaton catchment was determined over several years. Four soil types were transported to the station in order to equalize climatic conditions. Each investigated soil was originally shallow, therefore after the settlement of the replaced soil the circumstances were the same as in the in situ locations (KERTÉSZ and RICHTER 1997). Eight years of measurement was calculated into eight separate K factor values for each of the five investigated soils (KERTÉSZ et al. 2004).



	1990	1991	1992	1993	1994	1995	1996	1997
□Plot A	0,031	0,037	0,049	0,035	0,004	0,023	0,024	0,012
■Plot B	0,036	0,069	0,076	0,111	0,012	0,042	0,060	0,005
□Plot C	0,035	0,034	0,032	0,041	0,006	0,008	0,012	0,004
▤Plot D	0,001	0,021	0,027	0,022	0,007	0,017	0,030	0,003
■Plot E	0,044	0,172	0,060	0,192	0,036	0,029	0,141	0,027

Figure 2. Measured K values on Csákvár station (A: Lithosol, sandy silt; B: Cambisol, silty sand; C: Cambisol silty clay; D: Rendzina silty clay; E: Cambisol silty clay) After KERTÉSZ et al. (2004)

2. ábra Mért K értékek a Csákvári Állomásról (A: Köves sziklás váztalaj, homokos vályog; B: Váztalaj homok; C: Földes kopár agyag; D: Lejtőhordalék agyag; E: Rendzina silty clay) KERTÉSZ et al. (2004)

Presumably the database measured at the Kisnána station contains the highest amount of data, however it has yet to be published. On the basis of the available data here, no valuable calculations or comparisons can be made.

Some parts of the data measured at Szentgyörgyvár are published both in a detailed rough format and in a summarized format (Table 2), hence they are not particularly applicable for further calculations or comparisons (BÁDONYI et al. 2008, KERTÉSZ et al. 2007, KERTÉSZ et al. 2010). Moreover the main parts of the database are still unavailable for the scientific community.

Table 2. Main measured parameters on the Szentgyörgyvár site. (R: USLE erosivity factor; Dep: deposited soil loss; Susp: suspended soil loss) After Bádonyi et al. 2008 and Madarász et al. 2011

2. táblázat Szentgyörgyvári Állomás által mért főbb adatok . (R: USLE esőenergia tényező; Dep: ülepedő talajveszteség; Susp: lebegtetett talajveszteség) Bádonyi et al. 2008 és Madarász et al. 2011 alapján

Year	**R**	**Tillage**	**Runoff**	**Runoff rate**	**Dep.**	**Susp.**	**Total Soil loss**
	kJ m^{-2} mm h^{-1}		m^3 ha^{-1}		kg ha^{-1}	kg ha^{-1}	kg ha^{-1}
2004	51.34	Conventional	15.458	0.010	57	9	67
		Minimum	2.708	0.002	3	2	5
		M/C %	17.5	17.5	5.3	20.9	7.5
2005	173.35	Conventional	892.127	0.290	4542	264	4806
		Minimum	342.531	0.111	101	74	175
		M/C %	38.4	38.4	2.2	28	3.6
2006	40.24	Conventional	448.631	0.015	7331	591	7922
		Minimum	110.44	0.005	1.1	64	165
		M/C %	24.6	35.9	1.4	10.8	2.1
Mean for 2007-2009	n.a.	Conventional	26.2	0.04	n.a.	n.a.	1540
		Minimum	9.4	0.014	n.a.	n.a.	580
		M/C %	35.9	35	n.a.	n.a.	37.7

The published parts of the erosion measurements carried out at Bátaapáti and Püspökszilágy are short-term case studies. Since the data issued are separated and point scale, both in time and space, the usage of these measurements are limited.

Plot measurements taken place next to Abaújszántó were aimed to quantify the role of organic geotextiles in soil protection (Jakab et al. 2012), moisture conservation (Kertész et al. 2011) and erosion control (Table 3).

Table 3. Main result of biological geotextiles covered plot measurements at Abaújszántó 2006-2008

3. táblázat Geotextillel fedett parcellák mért értékei Abaújszántón 2006-2008

	Orchard		**Espalier vineyard**				**Traditional vineyard**	
	Jute	**Un-covered**	**Jute**	**Borassus**	**Buriti**	**Un-covered**	**Jute**	**Un-covered**
Soil loss (t ha^{-1} $year^{-1}$)	0.56	2.63	5.29	2.83	6.67	24.83	0.12	0.13
K (t h MJ^{-1} mm^{-1})	n.a.	0.0045	n.a.	n.a.	n.a.	0.0427	n.a.	0.0002
P	0.21	n.a.	0.21	0.11	0.27	n.a.	0.98	n.a.
Runoff mm $year^{-1}$	7.1	9.5	13.7	17.2	11.2	29.0	7.5	6.3
Runoff rate	0.013	0.017	0.025	0.036	0.023	0.053	0.014	0.011

Some of data measured next to Pilismarót and Bakonynána are published in a single storm resolution, however the database seems to be incomplete in terms of the lengths of the measuring period. The presented values are often difficult to compare due to the lack or insufficiency of certain parameters such as surface coverage. The annual summaries have not yet been calculated and because of the length of the elapsed time it is unlikely they will ever be. Although runoff and soil loss results measured at Pátka were of high quality, even for soil erosion prediction model building (Barta 2004), they were not available for further calculations. Similarly the database built at Károlyfalva seems to contain very useful data but neither the literature, the rough database or the calculated values are available.

Rainfall simulation studies

Plot measurement results hardly depend on recent climatic conditions. In the absence or abundance of some certain types of precipitation that occurred under a special soil condition, the measured annual values can differ remarkably from each other. Hence the gained results are comparable only with limitations. To ensure the possibility of a better comparison artificial precipitation forming devices were needed. Reflecting this need the first rainfall simulator was designed and constructed parallel to the global trend and the first plot constructions in Hungary by Mattyasovszky (1953) in the 50s and Kazó (1967) in the 60s.

Table 4. Rainfall simulator studies in Hungary
4. táblázat Eső-szimulátoros vizsálatok Magyarországon

Type of simulator	**Plot size**	**Purpose of using a rainfall simulator**	**Source**
Rotating Drop former, field	0.25 m^2	Infiltration, water management	Kazó 1966b
Rotating Drop former, field	0.25 m^2	Soil erodibility	Kazó 1967
Rotating Drop former, lab	0.25 m^2	Splash erosion	Kerényi 1982, 1984b, 1986
Individual drop former, field	8 m^2	Soil erodibility	Kertész and Richter 1997
Alternating Nozzle type, field	12 m^2	Soil erodibility	Csepinszky et al. 1998
Alternating Nozzle type, field	12 m^2	Soil erodibility, infiltration	Csepinszky et al. 1999a-b
Alternating Nozzle type, field	12 m^2	Soil erodibility, infiltration	Csepinszky and Jakab 1999
Alternating Nozzle type, field	12 m^2	Soil erodibility	Centeri et al. 2001
Alternating Nozzle type, field	12 m^2	Soil erodibility, soil loss prediction	Centeri 2002a
Alternating Nozzle type, field	12 m^2	Soil erodibility, crop rotation	Centeri 2002b
Alternating Nozzle type, field	12 m^2	Soil erodibility	Centeri 2002c
Alternating Nozzle type, field	12 m^2	Soil erodibility	Centeri et al. 2002
Alternating Nozzle type, field	12 m^2	Soil erodibility, crusting impact	Kertész et al. 2002
Fix Nozzle type, field	10 m^2	Phosphorus loss, erodibility	Azazoglu et al. 2003a,b
Alternating Nozzle type, field	12 m^2	Soil erodibility	Centeri 2003
Alternating Nozzle type, field	12 m^2	Soil erodibility	Centeri and Pataki 2003
Alternating Nozzle type, field	12 m^2	Soil erodibility, infiltration	Schweitzer et al. 2003
Alternating Nozzle type, field	12 m^2	Model comparison	Centeri et al. 2004
Alternating Nozzle type, field	12 m^2	Soil erodibility, infiltration	Jakab 2004
Fix Nozzle type, field	10 m^2	Phosphorus loss, comparison of simulators	Sisák et al. 2004a,b
Alternating Nozzle type, field	12 m^2	Soil erodibility	Centeri et al. 2005
Alternating Nozzle type, field	12 m^2	Soil erodibility, infiltration	Jakab and Szalai 2005
Alternating Nozzle type, field	12 m^2	Soil erodibility, Canopy effect	Szűcs et al. 2006
Individual drop former, lab.	0.5 m^2	Karst corrosion	Zámbó and Weidinger 2006
Fix Nozzle type, field	0.25 m^2	Soil erodibility, tillage effect	Kertész et al. 2007
Fix Nozzle type, field	10 m^2	Phosphorus loss	Strauss et al. 2007.
Alternating Nozzle type, field	12 m^2	Soil erosion, canopy effect	Balogh et al. 2008
Alternating Nozzle type, field	12 m^2	Model comparison	Centeri et al. 2009
Fix Nozzle type, field	10 m^2	Rill initiation	Hausner and Sisák 2009a,b
Fix Nozzle type, field	10 m^2	Model calibration	Hausner 2010
Alternating Nozzle type, field	12 m^2	Crusting, SOC erosion	Jakab et al. 2013
Fix Nozzle type, lab.	0.5 m^2	Aggregate erosion, crusting	Szabó et al. 2015

Artificial rainfall simulation has many advantages. It makes the investigations cost-effective, thus theoretically any type of rainfall characteristic can be applied at any time and any place. The purpose of usage also widely varies. In addition to soil loss, runoff and infiltration studies, the device is also perfect for measurements on splash erosion, nutrient movements, contamination leaching, sealing, crusting, organic carbon degradation, and karst corrosion (Table 4). Rainfall simulation studies in Hungary were reviewed in detail by CENTERI et al. (2010).

Descriptive investigations for process estimations

A detailed survey of an area can provide much more information than simply the degree of soil erosion at various spots. The spatial distribution can be compared to other databases such as (1) to other areas comparing the missing or deposited soil values at definite geomorphologic sites; or (2) to the same area from another time. Additionally, if they are well documented, spatial comparisons can be done by applying individual studies from a wide range of published investigations. On the other hand, for temporal comparisons, repeated surveys or standardized estimated initial conditions are needed on the same location, which are generally created by the same research staff.

Tracer detections

Tracers are very useful tools for soil redistribution investigations. Most of the materials can act as a tracer in soil replacement detection, however some artificial materials are more suitable than others. Since Hungary is located close to the Ukraine fallout from the nuclear accident at Chernobyl nearly contaminated the whole territory of the country as much. Cs-137 detection in soil redistribution therefore can provide soil loss and landscape evolution data both in hillslope (CSEPINSZKY et al. 1999c) and catchment scale (DEZSŐ et al. 2004; KERTÉSZ and JAKAB 2011). Results demonstrated that soil loss of an ordinary transdanubian catchment of 100 km^2 originated partly from subsoil due to gully erosion (~50%) and partly from topsoil due to sheet erosion (50%) (JAKAB et al. 2009).

Retrospective estimates of deposition processes show that many chemical soil parameters can be used such as high phosphate content (CENTERI 2010), mineralogical composition (NAGY et al. 2012), $CaCO_3$ or soil organic matter (JAKAB et al. 2014). These studies report a relatively high deposition rate at the footslope position (generally more than two meters), however the exact volume of soil loss along the investigated hillslope could only be estimated.

For detailed analytical investigations the in situ, real time artificial contamination methods are more applicable than the retrospective ones. For tracers rear earth oxides are used to determine the effects of erosion and tillage. This technique is not widespread in Hungary, however TÓTH (2015) presented preliminary results from rear earth oxide distribution results due to erosion under various tillage systems in Zala county.

Remote sensing

The use of aerial photographs for surveying soil erosion in Hungary dates back to 1966. MIKE (1966) tried to emphasize the advantages of this method compared to the traditional field survey, however, she focused mainly on gully erosion. As the calculation capacity of computers increased, remote sensing image interpretations became generally available even for sheet erosion surveys. VERŐNÉ WOJTASZEK (1996) compared calculated USLE soil loss categories to those interpreted from landsat images for a tilled sample field of 200 ha. The highest differences (37% both) were found in the soil loss categories of 5-10 t ha^{-1} and 15< t ha^{-1}, while the ratio of the area classified to the same category was only 11%. The difficulties mentioned were the disturbing influence of differences in plant coverage. A few years later VERŐNÉ

WOJTASZEK and BALÁZSIK (2008) published soil erosion map results derived from remote sensing images for a whole catchment (~ 120 km^2). These results were validated using field samples. The authors reported that changes in soil quality were detected even under vegetation coverage. Nevertheless this method cannot be automatized as the identification of learning areas is valid for only one image, hence changes in soil moisture content, soil status or vegetation cover can change soil radiation dramatically.

Complex studies

In complex studies the descriptive investigation is generally completed with analytical and/or historical data describing the complex process that formed the present landscape. SZILASSI et al. (2006) investigated the role of land use change in the fluctuating intensity of soil erosion at a small catchment in the Balaton region and concluded that land use patterns have a unique importance in soil loss values.

Conclusions

Sheet erosion measuring methods used in Hungary have always been in accordance with the methods used by the rest of the world. The level of the designed experiments and equipment in Hungary has also increased with international standards. The country spent significant resources to construct and maintain their erosion measuring facilities that resulted in valuable databases at several locations. The most notable weakness of these efforts has been the poor publicity of these results due to the majority of the cases data stored in paper-based raw format without having gone through analysis.

Presently almost all the monitoring activities have been halted mainly due to financial problems. The existing raw data are unavailable for the scientific community, however with minimal additional investment they would become important resources for model calibrations and other soil science purpose. This course of action would be much more inexpensive than beginning new monitoring activities.

Conversely, some may say that it would be sufficient to use the erosion data measured by neighboring countries and there is no need to spend additional money for such costly business. Moreover, the existing correlations are losing their relevance due to the increasingly acute influences of climate change. However, Hungary has very diverse patterns of soil types, land use, climatic conditions and parent rock material that makes the expansion of the results difficult. Additionally the question of up- and downscaling among scales proves problematic without measured data.

Regardless, soil erosion is a rather serious problem—also in Hungary—that requires action. According to the opinion of the authors the increasing quantity of available data on soil erosion provides a higher level of security for the country.

References

ÁDÁM L. 1967: Soil erosion on the Szekszárd hills. Földrajzi értesítő 16: 451–469. In Hungarian

AZAZOGLU E., STRAUSS P., SISÁK I., KLAGHOFER E., BLUM W. 2003a: Effect of reapeted rainfall on phosphorus transport on surface runoff. Diffuse input of chemicals into soil and groundwater - Assesment and management. Dresden, Conference Proceedings 265–268.

AZAZOGLU E., STRAUSS P., SISÁK I., KLAGHOFER E., BLUM W. 2003b: The effect of water quality and successive rainfall on infiltration, runoff and soil loss. COST action 623 "Soil erosion and global change" Final meeting and conference. Book of abstract and field guide 54–55.

BÁDONYI K., MADARÁSZ B., KERTÉSZ Á. CSEPINSZKY B. 2008: Study of the relationship between tillage methods and soil erosion on an experimental site in Zala County. Földrajzi Értesítő 57(1-2): 147–167. In Hungarian with English abstract

BALOGH J., JAKAB G., SZALAI Z. 2008: Erosion mesurements on runoff plots. In: SCHWEITZER F., BÉRCI K., BALOGH J. (eds.) A Bátaapátiban épülő nemzeti radioaktívhulladék-tároló környezetföldrajzi vizsgálata. 2008. MTA Földrajztudományi Kutatóintézet, Budapest, pp. 105–115. In Hungarian

BALOGH J., BALOGHNÉ DI GLÉRIA M., JAKAB G., SZALAI Z. 2008: Soil erosion research applying artificial rain. In SCHWEITZER F., BÉRCI K., BALOGH J. (Eds). A Bátaapátiban épülő nemzeti radioaktívhulladék-tároló környezetföldrajzi vizsgálata. MTA Földrajztudományi Kutatóintézet, Budapest, Hungary 2008; pp. 90–104. In Hungarian

BÁNKY GY. 1959a: Soil erosion and protection in Heves County, Hungary. Az erdő 94(7): 245–250. In Hungarian

BÁNKY GY. 1959b: Three-years results of the soil erosion gauging station in Kisnána. Erdészeti Kutatások 6(3): 139–160. In Hungarian

BARTA K. 2004: Building soil erosion model based on EUROSEM. PhD thesis, Dept. of Physical Geography and Geoinformatics, University of Szeged, Hungary, p. 84. In Hungarian

CENTERI CS. 2002a: Importance of local soil erodibility measurements in soil loss prediction. Acta Agronomica Hungarica 50(1): 43–51.

CENTERI CS. 2002b: Measuring soil erodibility in the field and its effects on soil-protecting crop rotation. Növenytermelés 51(2): 211–222.

CENTERI CS. 2002c: The role of vegetation cover in the control of soil erosion on the Tihany Peninsula. Acta Botanica Hungarica 44(3–4): 285–295.

CENTERI CS., BARTA K., JAKAB G., BÍRÓ ZS., CSÁSZÁR A. 2004: Comparison of the results of soil loss prediction with WEPP and EUROSEM models based on 'in situ' soil loss measurements. In: KERTÉSZ Á., KOVÁCS A., CSUTÁK M., JAKAB G., MADARÁSZ B. (eds.) 4th International Congress of the ESSC: 25–29 May 2004, Budapest - Hungary, proceedings volume. 357 p. Budapest: Geographical Research Institute Hungarian Academy of Sciences, pp. 355–357.

CENTERI CS., CSEPINSZKY B., JAKAB G., PATAKI R. 2001: Soil erodibility measurements with rainfall simulations in Hungary. In: Land management and soil protection for future generations: IX. Congress of Croatian Society of Soil Science. Brijuni, Horvátország, Croatian Society of Soil Science - International Union of Soil Sciences, p. 123.

CENTERI CS., JAKAB G., BARTA K., SZALAI Z., CSÁSZÁR A. 2005: Comparison of some Soil erosion prediction models applied in Hungary. Talajvédelem 13: 183–192. In Hungarian

CENTERI CS., JAKAB G., SZALAI Z., MADARÁSZ B., SISÁK I., CSEPINSZKY B., BÍRÓ ZS. 2011: Rainfall simulation studies in Hungary In: FOURNIER A. J. (ed.) Soil erosion: causes, processes and effects. 276 p. New York; Basel: Nova Science Publishers, pp. 177–218. (Environmental science, engineering and technology)

CENTERI CS., PATAKI R., BARCZI A. 2002: Soil erosion, soil loss tolerance and sustainability in Hungary. In: Land Degradation: New Trends towards Global Sustainability. The 3rd International Conference on Land Degradations, Rio de Janeiro, Brazília, Embrapa Solos - Ministério da Agricultura, Pecuária e Abastecimento, pp. 1–3.

CENTERI CS., PATAKI R. 2003: Importance of determining Hungarian soil erodibility values in connection with the soil loss tolerance values. Tájökológiai Lapok 1(2): 181–192. In Hungarian with English abstract

CENTERI CS., PENKSZA K., MALATINSZKY Á., PETŐ Á., VONA M. 2010: Potential effects of different land uses on phosphorus loss over the slope in Hungary. 19th World Congress of Soil Science, Soil Solutions for a Changing World, Brisbane, Australia; Published on CD

CENTERI CS., JAKAB G., SZALAI Z., MADARÁSZ B., SISÁK I., CSEPINSZKY B., BÍRÓ ZS. 2011: Rainfall simulation studies in Hungary. In: FOURNIER A. J. (ed.) Soil Erosion: Causes, Processes and Effects. NOVA Publisher, New York pp. 177–218. ISBN: 978-1-61761-186-5

CENTERI CS., BARTA K., JAKAB G., SZALAI Z., BÍRÓ ZS. 2009: Comparison of EUROSEM, WEPP, and MEDRUSH model calculations with measured runoff and soil-loss data from rainfall simulations in Hungary. Journal of plant nutrition and soil science 172: 789–797.

Cerdan O., Poesen J., Govers G., Saby N., Bissonnais Y., Gobin A., Vacca A., Quinton J., Auerswald K., Klik A., Kwaad F., Roxo M.J. 2006: Sheet and rill erosion. In: Boardman J., Poesen J. (eds.) Soil erosion in Europe. Wiley Chichester UK, pp. 501–514.

Csepinszky B., Csiszár B., Jakab G., Józsa S. 1998: Soil erodibility measurements on lake Balaton catchment using rainfall simulation. Unpublished manuscript PATE GMK Keszthely, Hungary. In Hungarian

Csepinszky B., Dezső Z, Jakab G., Józsa S. 1999c: Possibilities of soil erosion measurements using radionuclide fallouts from the atmosphere. In Lelkes J. (ed.) A sugárzástechnika mező- és élelmiszergazdasági alkalmazása, Öntözési Kutató Intézet, Szarvas, Hungary 61–66. In Hungarian with English abstract

Csepinszky B., Jakab G. 1999: Rainfall simulator to study soil erosion. XLI. Georgikon napok, Keszthely Hungary; pp.294–298. In Hungarian with English abstract

Csepinszky B., Jakab G., Józsa S. 1999a: Artificial rain, infiltration and soil loss. XLI. Georgikon napok, Keszthely, Hungary; pp. 424–429. In Hungarian

Csepinszky B., Jakab G., Kisfalusi F. 1999b: Measurement of infiltration and potential charging of initial erosion with rainfall-simulator V. International congress on bioconversion of organic wastes and protection of environment, Ukraine Abstract book; p. 129.

De Vente J., Poesen J. 2005: Predicting soil erosion and sediment yield at the basin scale: Scale issues and semi-quantitave models. Earth-Science Reviews 71: 95–125.

Dezsény Z., Lendvai Z. 1986: Erosion conditions in the watershed area of river Zala and its effect on the quality of surface waters. Agrokémia és Talajtan 35(3–4) 363–382. In Hungarian with English abstract

Dezső Z., Bihari A., Cseszko T. 2004: Investigation of soil erosion in arable land in Hungary using radiotracer technique. ATOMKI Annual Report 18: 57–58.

Dövényi Z. (ed.) 2010: Inventory of microregions in Hungary. MTAFKI, Budapest, Hungary. p. 860. In Hungarian

Duck T. 1960: Survey and evaluation of eroded sites. MTA Agrártudományok Osztályának Közleményei 18: 431–442. In Hungarian with English abstract

Duck T. 1966: The behavior of some brown forest soil types against erosion. Agrokémia és Talajtan 15(2): 263–276. In Hungarian with English abstract

Fekete Z. 1953: Contest against soil erosion on arable lands. Agrártudomány 9: 17–23. In Hungarian

Góczán L., Kertész Á. 1988: Some results of soil erosion monitoring at a large-scale farming experimental station in Hungary. Catena Suppl. 12: 175–184.

González-Hidalgo JC., Pena-Monné JL., Luis M. 2007: A review of daily soil erosion in Western Mediterranean areas. Catena 71: 193–199.

Hausner Cs. 2010: Calibration and parameterization of a model simulating transition between sheet and rill erosion. In: Centeri Cs., Bodnár Á., Jung I., Falusi E. (eds.) TUDOC-2010 Kárpát-Medencei Doktoranduszok Nemzetközi konferenciája. Konferencia Kiadvány SZIE, Gödöllő 90–102. ISBN: 978-963-269-186-2 In Hungarian with English abstract

Hausner Cs., Sisák I. 2009a: Predicting risk of rill initiation in a sub-catchment of lake Balaton, Hungary. EGU General Assembly Wiena, Austria, Proceedings

Hausner Cs., Sisák I. 2009b: Susceptibility of soils to rill erosion in the watershed of lake Balaton, Hungary. Bridging the centuries: 1909–2009 Budapest, Hungary, Book of Abstracts p. 27.

Hrvatin M., Komac B., Perko D., Zorn M. 2006: Slovenia. In: Boardman, J., Poesen J. (eds) 2006: Soil erosion in Europe. Wiley Chichester UK, pp. 155–166.

Ionita I., Radoane M., Mircea S. 2006: Romania. In: Boardman J., Poesen J. (eds.) 2006: Soil erosion in Europe. Wiley Chichester UK, pp. 155–166.

Jakab G. 2004: Erodibility measurements using rainfall simulator. Táj, tér, tervezés. Geográfus doktoranduszok VIII. országos konferenciája; Szeged, Hungary, CD kiadvány ISBN 963-482-687-3 In Hungarian

Jakab G., Centeri Cs., Madarász B., Szalai Z., Őrsi A., Kertész Á. 2011: Plot measurements in Hungary. Talajvédelem (különszám) 139–144.

Jakab G., Madarász B., Szalai Z. 2009: Gully or sheet erosion? A case study at catchment scale. Hungarian Geographical Bulletin 58(3): 151–161.

Jakab G., Németh T., Csepinszky B., Madarász B, Szalai Z., Kertész Á. 2013: The influence of short term soil sealing and crusting on hydrology and erosion at Balaton Uplands, Hungary. Carpathian Journal of Earth and Environmental Sciences, 8(1): 147–155.

Jakab G., Szalai Z. 2005: Erodibility measurements in the Tetves catchment using rainfall simulator. Tájökológiai Lapok 3: 177–189. In Hungarian with English abstract

Jakab G., Szalai Z., Kertész Á., Tóth A., Madarász B., Szabó Sz. 2012: Biological geotextiles against soil degradation under subhumid climate - a case study. Carpathian Juornal of Earth and Environmental sciences 7(2): 125–134.

Jankauskas B., Jankauskiene G. 2003: Erosion-preventive crop rotations for landscape ecological stability in upland regions of Lithuania. Agriculture, Ecosystems and Environment 95: 129–142.

KAZÓ B. 1966a: Methods for soil erosion measurements. Agrokémia és Talajtan 15(2): 389–391. In Hungarian with English abstract

KAZÓ B. 1966b: Determination of water regime properties of soils with an artificial rainfall simulatior Agrokémia és Talajtan 15(2): 239–252. In Hungarian with English abstract

KAZÓ B. 1967: A new method for soil erosion mapping using rainfall simulator Földrajzi Értesítő 16: 375–386. In Hungarian with English abstract

KERÉNYI A. 1982: Quantitative study on artificial raindrop impacts on sand in model experiments. Agrokémia és Talajtan 31(1–2): 165–178. In Hungarian

KERÉNYI A. 1984a: A quantitative method supplementing traditional soil erosion mapping. Agrokémia és Talajtan 33(1–2) 458–486. In Hungarian with English abstract

KERÉNYI A. 1984b: The effect of drop impact erosion on the size differentiation of sand particles. Agrokémia és Talajtan 33(1–2): 63–74. In Hungarian with English abstract

KERÉNYI A. 1986: Laboratory simulation study on the initial erosion of sand and soils with well developed structure. Agrokémia és Talajtan 35(1–2): 18–38. In Hungarian with English abstract

KERÉNYI A. 1991: Soil erosion, mapping, laboratory and field experiments. Akadémiai Kiadó. Budapest, Hungary, p. 219. In Hungarian

KERÉNYI A. 2006: Quantitative assessment of sheet and gully erosion on the basis of measurements at Bodrogkeresztúr, Hungary. In: CSORBA P. (ed.) Tiszteletkötet Martonné dr Erdős Katalin 60. születésnapjára, University of Debrecen, Debrecen, Hungary pp. 67–77. In Hungarian

KERTÉSZ A., GÓCZÁN L. 1990: Results of soil loss and runoff volumes measured on the experimental plots of MTA FKI, Bakonynána. Földajzi. Értesítő 39: 47–60. In Hungaian with English abstract

KERTÉSZ A., CENTERI CS. 2006: Hungary In: BOARDMAN J., POESEN J. (Eds.) Soil erosion in Europe, Wiley Chichester UK. pp. 139–153.

KERTÉSZ A., MADARÁSZ B., CSEPINSZKY B., BENKE SZ. 2010: The Role of conservation agriculture in landscape protection. Hungarian Geographical Bulletin 59(2): 167–180.

KERTÉSZ A. 1987: Investigation of soil loss through erosion measurements. Földrajzi Értesítő 36(1–2): 115–142. In Hungarian

KERTÉSZ, Á., HUSZÁR, T., JAKAB, G**.** 2004: The effect of soil physical parameters on soil erosion. Hungarian Geographical Bulletin 53(1–2): 77–84.

KERTÉSZ A., JAKAB G. 2011: Gully erosion in Hungary, review and case study, Procedia - Social and Behavioral Sciences 19: 693–701.

KERTÉSZ A., RICHTER G. 1997: Field work experiments and methods. The Balaton project ESSC newsletter 2–3, 15–17.

KERTÉSZ A., SZALAI Z., JAKAB G., TÓTH A., SZABÓ SZ., MADARÁSZ B., JANKAUSKAS B., GUERRA A., BEZERRA J., PANOMTARANICHAGUL M., CHAU THU D., YI Z. 2011: Biological geotextiles as a tool for soil moisture conservation. Land Degradatin and Development 22: 472–479.

KERTÉSZ A., BÁDONYI K., MADARÁSZ B., CSEPINSZKY B. 2007: Environmental aspects of Conventional and Conservation tillage. In: GODDARD T., ZOEBISCH M., GAN Y., ELLIS W., WATSON A., SOMBATPANIT S. (Eds.) No-till farming systems. Special Publication No. 3; World Association of Soil and Water Conservation, Bangkok; pp. 313–329.

KERTÉSZ A., CSEPINSZKY B., JAKAB G. 2002: The role of surface sealing and crusting in soil erosion. Technology and Method of Soil and Water Conservation Volume III. – Proceedings - 12th International Soil Conservation Organization Conference, May 26 – 31, Beijing, China. Tsinghua University Press, 29–34.

MADARÁSZ B., BÁDONYI K., CSEPINSZKY B., MIKA J., KERTÉSZ A. 2011: Conservation tillage for rational water management and soil conservation. Hungarian Geographical Bulletin 60(2): 117–133.

MÁTÉ F. 1987: Mapping on modern Lake Balaton bottom sediments. Magyar Állami Földtani Intézet jelentése az 1985. évről, pp. 367–379. In Hungarian with English abstract

MATTYASOVSZKY J., DUCK T. 1954: Effect of erosion on nutrients in soils. Agrokémia és Talajtan 3(3): 163–172. In Hungarian with English abstract

MATTYASOVSZKY J. 1953: Investigation of the Permeability of Soils and Application of the Results in Soil Protection. Agrokémia és Talajtan 2: 161–172. In Hungarian with English abstract.

MIKE ZS. 1966: The use of aerial photographs in assessment of soil erosion and in soil conservation plans. Agrokémia és Talajtan 15(2): 353–362. In Hungarian with English abstract

NAGY R., ZSÓFI ZS., PAPP I., FÖLDVÁRI M., KERÉNYI A., SZABÓ SZ. 2012: Evaluation of the relationship between soil erosion and the mineral composition of the soil: a case study from a cool climate wine region of Hungary. Carpathian journal of earth and environmental sciences 7(1): 222–230.

NÉGYESI G., LÓKI J., BURÓ B., SZABÓ J., BAKACSI ZS. 2014: The potential wind erosion map of an area covered by sandy and loamy soils – based on wind tunnel measurements. Zeitschrift für Geomorphologie, DOI: 10.1127/0372-8854/2014/0131

NOVÁKY B. 2001: Observation and evaluation of TIM erosion monitoring points. Földrajzi konferencia, Szeged, 2001. 10. 25-27., Szegedi Tudományegyetem TTK Természeti Földrajzi Tanszéke CD pp. 1–14. In Hungarian

RHODES CJ. 2014: Soil erosion, climate change and global food security: challenges and strategies. Science Progress 97(2): DOI: 10.3184/003685014X13994567941465

SISÁK I., CSEPINSZKY B., MÁTÉ F., SZŰCS P., BURUCS Z., STRAUSS P., AZAZOGLU E. 2004b: Comparison of two rainfall simulators. "Soil conservation in a changing Eurpope" 4th congress of the ESSC Budapest, Hungary, Proceedings 39–44.

SISÁK I., MÁTÉ F., STRAUSS P., AZAZOGLU E. 2004a: Particulate and dissolved phosphorus loss from the watershed of Tetves-stream. "Soil conservation in a changing Eurpope" 4th congress of the ESSC Budapest, Hungary, Proceedings 92–96.

STANKOVIANSKY M., FULAJTÁR E., JAMBOR P. 2006: Slovakia. In: BOARDMAN J., POESEN J. (Eds) Soil erosion in Europe. Wiley Chichester UK, pp. 117–138.

STEFANOVITS P. 1964: Soil erosion in Hungary; genetic soil map OMMI genetikus talajtérképek 1, 7. In Hungarian

STRAUSS P., BARBERIS E., SISÁK I., GRIGNANI C., ZAVATTARO L., SACCO D. 2007: Effect of repeated rainfall simulation on soil erosion, runoff and phosphorus transport. 5th Congress of the ESSC, Palermo, Italy, Book of abstracts

STROOSNIJDER L. 2005: Measurement of erosion: Is it possible? Catena 64: 162–173.

SZABÓ J., JAKAB G., SZABÓ B. 2015: Spatial and temporal heterogeneity of runoff and soil loss dynamics under simulated rainfall. Hungarian Geographical Bulletin 64(1): 25–34.

SZALAI Z., BALOGH J., JAKAB G. 2013: Riverbank erosion in Hungary: with an outlook on environmental consequences. Hungarian Geographical Bulletin 62(3): 233–245.

SZILASSI P., JORDÁN GY., VAN ROMPAEY A., CSILLAG G. 2006: Impacts of historical land use changes on erosion and agricultural soil properties in the Kali Basin at Lake Balaton, Hungary. Catena 68: 96–108.

SZŰCS P. 2012: Scale dependence of soil erosion. PhD dissertation, Georgikon Faculty, Pannnon University, Keszthely p. 146. In Hungarian with English theses

SZŰCS P., CSEPINSZKY B., SISÁK I., JAKAB G. 2006:. Rainfall simulation in wheat culture at harvest. Cereal Research Communications 34: 81–84.

TÓTH A. 2015: Laboratory experiment on association of rare earth oxides to different aggregate sizes – preliminary study of a field scale research on sediment redistribution due to erosion. 5th Eugeo Congress on the Geography of Europe: 30 August - 2 September 2015, Budapest, Congress programme and abstracts p. 178.

TÓTH A., JAKAB G., HUSZÁR T., KERTÉSZ Á., SZALAI Z. 2001: Soil erosion measurements in the Tetves Catchment, Hungary. In: JAMBOR, P., SOBOCKÁ, J. (Eds.) Proceedings of the Trilateral Co-operation Meeting on Physical Soil Degradation. Bratislava, Slovakia pp. 13–24.

TÓTH CS., NOVÁK T., RAKONCZAI J. 2015: Hortobágy Puszta: Microtopography of Alkali flats. In: Lóczy D. (Ed.) Landscapes and Landforms of Hungary. (World Geomorphological Landscapes) 294 p. Dordrecht: Springer, pp. 237–156.

VACCA A., LODDO S., OLLESCH G., PUDDU R., SERRA G., TOMASI D., ARU A. 2000: Measurement of runoff and soil erosion in three areas under different land use in Sardinia (Italy). Catena 40: 69–92.

VÁRALLYAY GY. 1994: Soil data-base for long-term field experiments and sustainable land use. Agrokémia és Talajtan 43. 269–290.

VERŐNÉ WOJTASZEK M. 1996: Remote sensing in the estimation of soil erosion on a sample area in Pázmánd. Agrokémia és Talajtan 45(1–2): 31–44. In Hungarian with English abstract

VERŐNÉ WOJTASZEK M., BALÁZSIK V. 2008: Monitoring of soil erosion on the Tetves stream catchment area using satellite images. Agrokémia és Talajtan 57(1): 21–36. In Hungarian with English abstract

WISCHMEIER W.H., SMITH D.D. 1978: Predicting rainfall erosion losses: A guide to conservation planning. USDA Agricultural Handbook 537, US Government Printing Office, Washington D. C.

ZÁMBÓ L., WEIDINGER T. 2006: Investigations of karst corrosional soil effects based on rainfall simulation experiment. In: KISS A., MEZŐSI G., SÜMEGHY Z.. (Eds.) Táj, környezet és társadalom. Ünnepi tanulmányok Keveiné Bárány Ilona professzor asszony tiszteletére. Szeged. 757–765. In Hungarian

LEPELERÓZIÓS VIZSGÁLATOK EREDMÉNYEI MAGYARORSZÁGON

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Kulcsszavak: talajveszteség, léptékfüggés, módszertani különbség, országos adatbázis

Absztrakt: A talajpusztulás Magyarországon mind ökológiai, mind környezetvédelmi és gazdasági értelemben meghatározó szerepet játszik ezért mérése és modellezése elsődleges fontosságú, különösen országos léptékben. Az erózió néhány alapfolyamata jól közelíthető pusztán fizikai összefüggések használatával, azonban a holisztikus megjelenítés - a folyamat meglehetősen összetett volta miatt - csak empirikusan történhet, ami nagymennyiségű mért adat nélkül elképzelhetetlen. A lepelerózió in situ vizsgálatának legalkalmasabb és ezért a leginkább elterjedt módszere a parcellás mérés, következésképp hazánkban is e mérésekből származik a legtöbb adat. Magyarország északi és nyugati területei a leginkább veszélyeztetettek a lepelerózió által, ezért a mérések is e területekre koncentráltak. A legtöbb parcellás mérés a USLE Universal Soil Loss Equation "K" tényezőjének meghatározását célozta ezért növényborítás nélküli, folyamatosan magágy állapotban tartott talajt vizsgált. A későbbiekben aztán egyes szántóföldi növények illetve eltérő területhasználati típusok (erdő, kaszáló) talajvédő hatását is számszerűsítették a mérések során. Ezeken túlmenően eltérő környezeti feltételek és változó lépék mellett a területet leíró vizsgálatok, mesterséges esőztetések és a talajmozgás detektálása egészítette ki a lepeleróziós vizsgálatokat. A nagymennyiségű mért adatnak csak egy részét publikálták ezért jelentős részük nem elérhető a szakemberek számára. A hiányos adatok jelentős csökkenést okoznak a hazai erózióbecslés talajvédelem és modellezés pontosságában és hatékonyságában. Az egyes területi léptékben mért adatok kiterjeszthetősége más léptékekre korlátozott ezért a különböző léptékekben mért adatok megléte és használata nélkülözhetetlen. Az erózióméresre fordítható források szűkülésével, újabb mért adatok hiányában a meglévő értékek közzététele létszükséglet.