DEVELOPMENT OF A PROTECTION METHOD AGAINST SOIL EROSION AND WATER CONSERVATION IN SZEKSZÁRD

STOCKHOLM JUNIOR WATER PRIZE HUNGARIAN COMPETITION 2022

Balázs Andócsi, Olivér Herceg

Béla I. Grammar School

Supervisor: Barocsai Zoltán

Concent

1. Investigation of soil erosion caused by the wind and rainfalls in the Szekszárd Hills

1.1. Introduction

In our dissertation we investigate the soil erosion effects of wind and rainfalls. With the change of these climate elements their destructive power to the soil becomes even greater, and we have developed a mulching method as a potential solution. Our investigations took place in the Parásztai-Séd's sub-basin in the Szekszárd Hills. Here, the composition of the soil is loess. We have investigated the precipitation trends, the wind, and temperature, whilst noting the change in the occurrence of drought years. With the determination of soil texture and its maximum water holding capacity, we have come to a conclusion regarding the Hills's erosion sensitivity. We have measured the creek's discharges and the carriage of sediment, which runs down through the hill. Our goal was to investigate the erosion effects of extreme rainfalls. After that, we have estimated the average soil erosion using the general soil loss equation. This research's goal was to prove the upcoming change of water management in the area, to show its effects on the environment, and to allow us to provide a potential solution against the given problem.

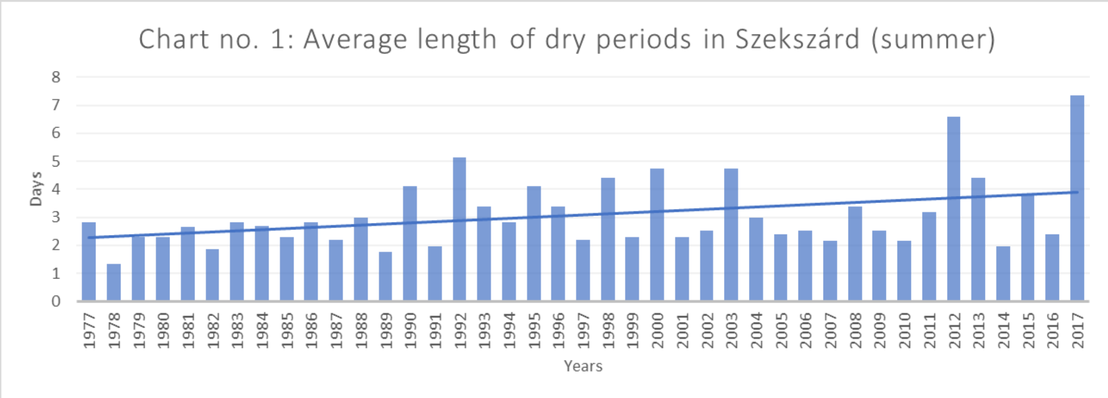
1.2. Investigating the weather's transition to becoming extreme based on data collected from rainfalls, the temperature and the wind

The average temperature of Earth's surface has increased in the last 50 years, partly thanks to the gases that were granted by humanity influencing the planet's greenhouse effect. As an aftermath, we can expect significant environmental, economical, and social changes. According to a report by the EASAC which says that extreme rainfalls will be more frequent in Europe, and frequency of extreme temperature periods will also be higher. In the Central-European region the rainfall patterns could also go extreme. As a follow-up to the climate change, the dry periods during summer could also increase, meaning that there is a higher chance for drought.[1] By that, the accommodation for extreme climate phenomenons becomes even more important to the agriculture, for example, developing soil preserving systems and water saving technologies.

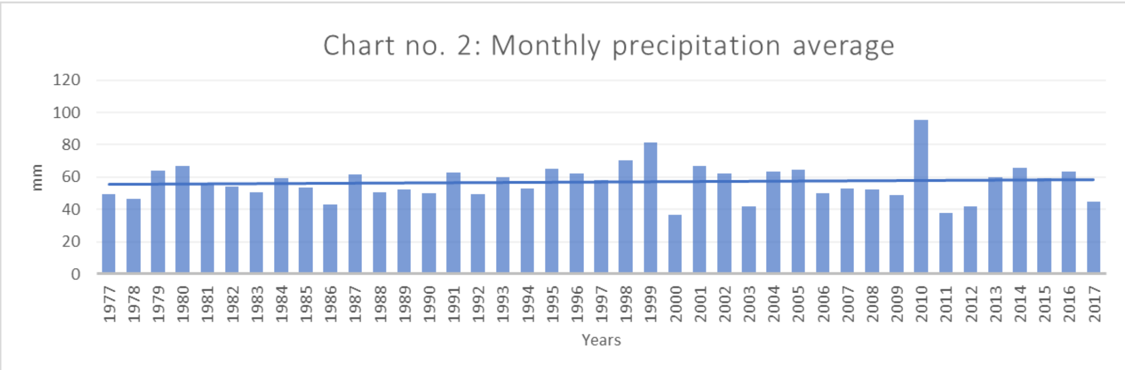
We have analysed the meterological journals of László Kővári and the archives of The Department of Agriculture and Environment of the Tolna County Government Office to learn about the rain patterns becoming extreme, the change of mean temperatures, and the evolution of wind's direction and velocity around Szekszárd.

[1] MTA, 2014

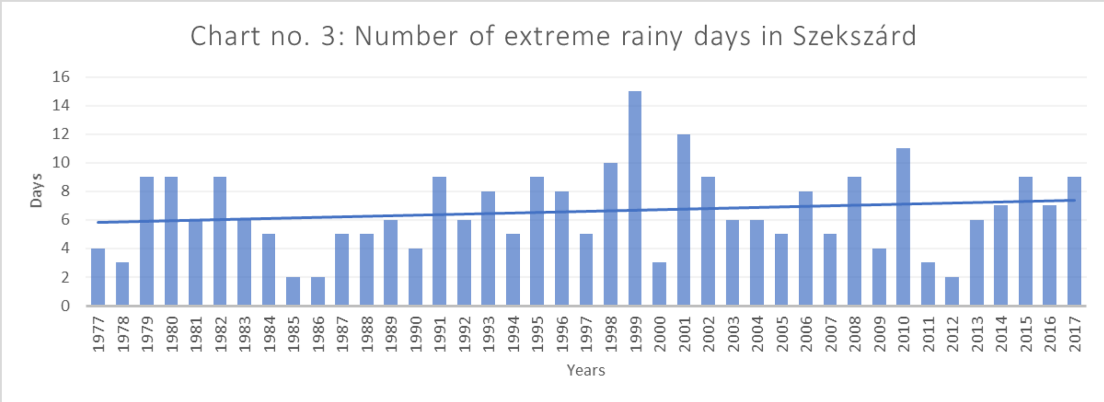
Firstly, we have investigated the average length of dry periods. In the last 40 years the length of dry periods have slightly increased, and we can also see the differences between the extreme periods in the last 20 years. We also have calculated the average length of summer dry periods, using data from summer.



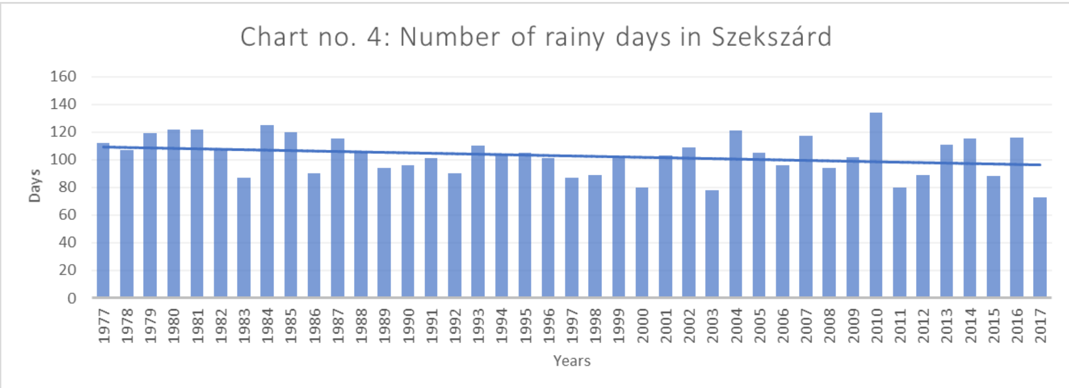
The chart shows that the average length of summer dry periods have increased from 2 to 4, meaning that during this 40 years its length have doubled up. The first third part of the term shows that these periods are more balanced between through the years, whilst in the second third part this balance sways, and in the last part we can clearly see the transition of the climate becoming extreme (chart no. 1). Our next step was to calculate the average monthly rainfall, from which we can conclude that the amount of rainfall have slightly changed, but the difference between the years are becoming more extreme (chart no. 2).



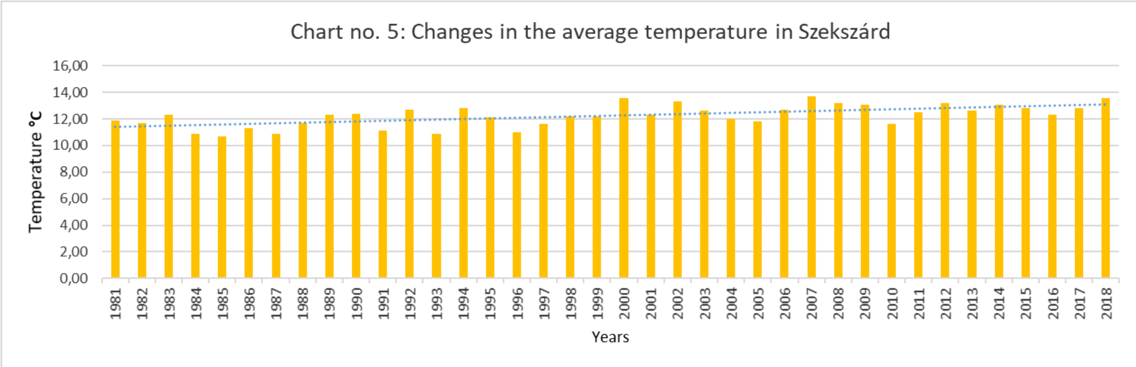
We investigated the number of days that had extreme rainfalls. By extreme rainfall we mean those rainfalls which's rainfall depth was greater than 20mm on the given day. The chart's trend line shows that the rainfalls which had a depth of 20mm or greater have increased (by around 30%) in the last 40 years (chart no. 3).



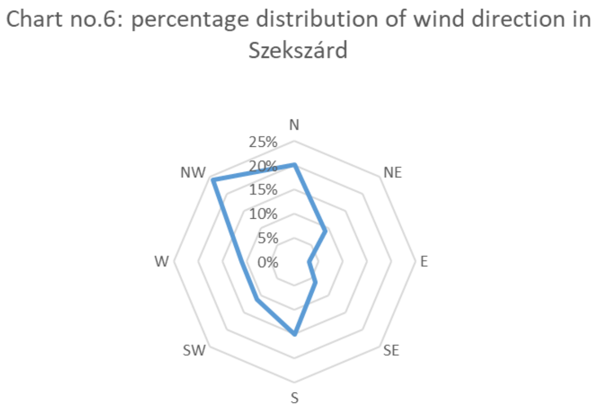
The 4th chart illustrates that the days of occurring rainfalls show decreasing tendency. We can see a 10% drop in the last forty years' average, and the maximum (2010) and minimum (2017) have happened in the last 10 years (Chart no. 4).



This shows a connection with the average monthly rainfall. These two chart proves that the amount of rain has not changed significantly, instead the rainfalls' distribution differ from the rains of 1977.



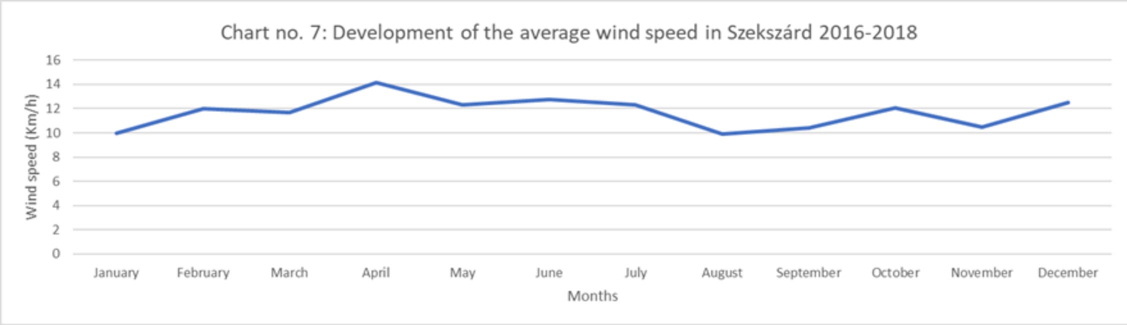
On the chart which illustrates Szekszárd's mean temperature datas of the last 37 years (Chart no. 5) the trend line shows that the yearly mean temperature around Szekszárd indicates an increasing tendency. We also have investigated these years' seasonal mean temperature. The charts shows really well, that the difference not only can be seen on a yearly, but also on a seasonal basis. According to the trend line the highest mean temperature rise can be shown in the spring- and summer periods. The typical wind direction was determined using 730 data from 2018.



The typical direction of wind of the Dunántúl is north-west directed. In the temperate zone and also in Hungary the wind's relative direction only sways between 15-35 percent.[2] This phenomenon can be experienced in the Szekszárd Hills because the most typical wind direction only makes up 24 percent.

According to these datas, the one-sided defence methods cannot be used, because the wind is not blowing in one direction through the year. That is why we need to develop more complex and well thought out methods if we want to defend against the soil erosion effects (Chart no. 6). We could only investigate the last three years' evolution of wind velocity using data from around Szekszárd. The chart illustrates that the highest wind velocity was during springs, and summers. In conclusion, we can say that the biggest amount of soil is being eroded during these periods, because the ground cover plants are not developed that well at the start and the middle part of spring, but there is already that high temperature that can dry out the soil (Chart no. 7).

[2] Dr. Péczely, 2002

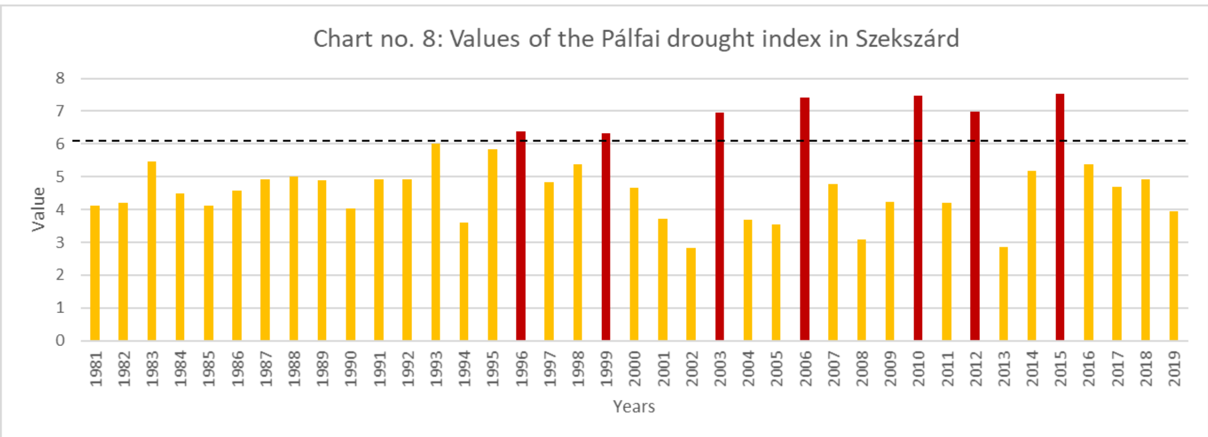


The increase of mean temperature could lead to further droughts, also, because the rainfalls are going extreme the drying periods could also become longer. And by that, the soil could dry out not just on a bigger scale, but also on a longer term. The amount of rain is not changing, but the rainfalls are less frequent, and the amount of days that had extreme rainfall will also increase. From this comes that the surfaces that could hold longer against drying out, the suddenly pouring down high amount of rain mean significant harm to them. These phenomenons mostly could occur during summer, and spring. The peak of soil erosion could also happen in these periods. The varied wind direction makes it harder to defend against erosion, because the method used in defence must not concentrate on a given direction.

1.3. Investigating periods of drought

Drought is a period, where the amount of rainfall is significantly less than the average. Or where the total amount of rain reaches the ordinary amount, but the evaporation loss of the soil greatly increases because of high temperature. As an aftermath, a drier period, drought will be present for a longer time. The ground cover plants will also stop developing because of the lack of water. This process can result in the perishing of plants.[3]

These changes are increasing the extent of soil erosion on the Hills, because the wind can carry the dried out particles of the soil much easier. This can be meant for rainfalls too. To determine



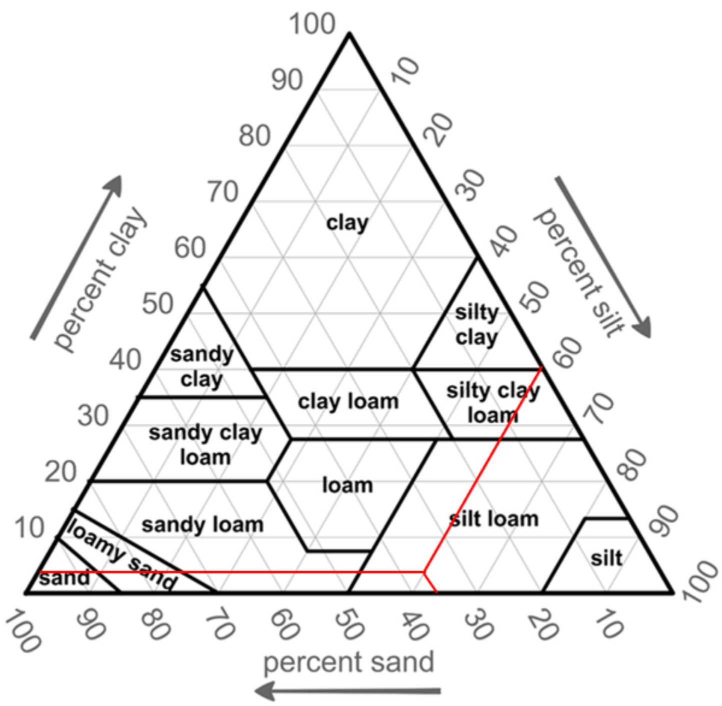
[3] Köles, 2011

the extent of drought we have used Pálfai's drought index. The extent of drought on the Szekszárd Hills have not gone beyond 8, (Chart no. 8) which means that the typical drought in the area is moderate. Analysing the past 40 years' information, we can see that the occurrence of drought periods are increasing. This is the cause of rainfall patterns becoming extreme, and of the rise of yearly mean temperature. Because the rainfalls are occurring less frequently, the temperature is rising, meaning that the occurrence of drought years will likely increase.

1.4. Definition of soil texture and the water collector's storage amount

During the sampling of soil we have used methods according to the Regulation VII. 18. of 90/2008 by the Department of the Agriculture. Our average samples were taken from vine plantations, and from forested areas. We took these samples to our school's lab where we have placed them on drying trays. After two weeks of drying we have checked their condition. We have separated the particles of the dried out soil using a mortar, and after that we have grouped the particles by their size using methods by the USDA.[4] During the investigation of particle composition we were using Köhn's pipette method. We have also examined the maximum moisture absorption capacity of the soil. To have a base of compare, we have compared the results from the valley's soil with potting soil.

The examined soil's type is muddy adobe by particle composition (1st picture).

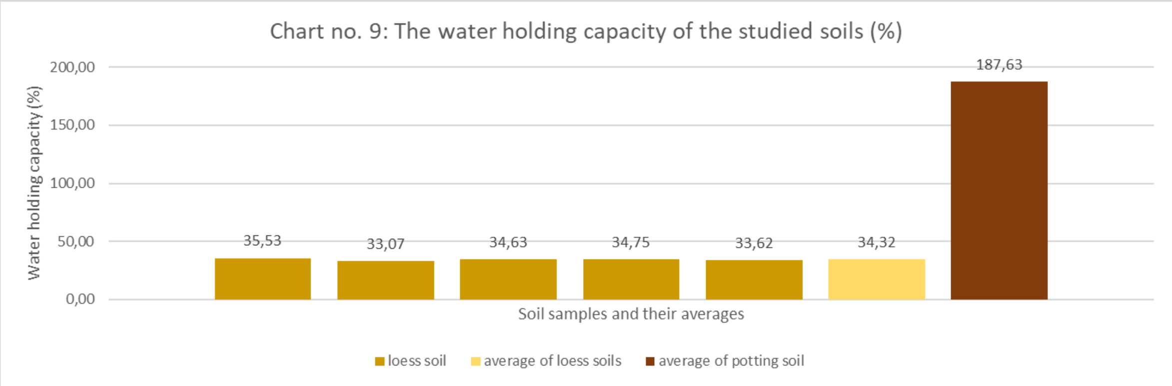


1th picture: Determination of soil texture

This type of soil is built up by several fractions. It is built up by mainly mud, but it has some sand fractions, and adobe mix in its composition. The mixed composition increases the cohesion between the particles and the resistance against soil erosion, and because of the small particle size, it is capable of keeping the water inside for a longer time, letting it through slowly.

[4] Filep Stefanovics, Füleky, 1999

The water holding capacity of this soil is low, around 34% (the holding capacity of the potting soil is 180%), which indicates the future water management used on the soil, which provides a supply for the plants (Chart no. 9).



The chart shows that the dispersion between the values are low. Accord to this, the valley's soil cannot take in precipitation of large amount. For this soil type, it is typical that the influence of wind- and water erosion on this sloping surface colour are both significant.[5] Due to the low water holding capacity, the soil is drying out easier in drought or in high temperatures. This favours soil erosion caused by wind or water. Slope rinsing is the typical erosion type during large-scale rainfalls.

1.5. Soil erosion estimation

By erosion, we mean the desolation of the surface due to water, wind, or ice. We speak of soil erosion, when the erosion makes an effect on the surface layer usable by Humanity.[6] We have estimated the erosion of a forested area, and an area under viticulture using the general soil loss equation. On the forested area the scale of soil erosion was 1.36 ton/hectare/year, and on the vineyards it was 17.56 ton/hectare/year. (1st spreadsheet).

Area	R	K	LS	C	P	A (t/ha/yr)
Forest	683,3	0,016	2,77	0,05	0,9	**1,36**
Vineyards	683,3	0,016	3,06	0,75	0,7	**17,56**

1st spreadsheet: Soil erosion estimation

Different national and international professional literature have tried to determine the tempo of soil formation. They have concluded that the process of soil formation can be put between 0.04 ton/hectare/year and 11 ton/hectare/year. A regulation by the Hungarian Standards Board says that maximum tolerable soil erosion is 15 ton/hectare/year. The quantity of soil erosion in the forested

[5] Szatmári, 2013
[6] Szatmári, 2013

areas in the valley of Parásztai-Séd are acceptable. Although the same cannot be said for the vineyards. The amount of eroded soil exceeds the optimal soil formation rate estimate. In conclusion, we need soil retention measures, especially because of the weather elements expected to become extreme in the future.[7]

1.6. The change in the soil moisture content depending on the weather elements

Our goal with the sampling was to examine the change of the soil moisture content during different weather conditions. We have collected the soil samples on a vineyard. In total, we have collected 48 samples in 8 different times. We have marked 2 sampling locations through the vineyards, and we took samples from different depths (0-10; 10-20; 20-30 cm). We have homogenized the samples by mixing them, so we could get an average moisture content. The point of taking samples from different depths was to monitor the vertical movement of moisture content. The sampling times were selected based on the presence of different weather elements. We have collected data after rainfall, and after longer dry periods too. (Chart no. 10-11-12)

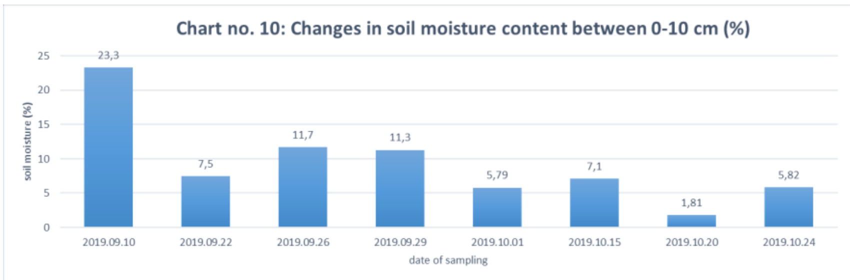


Chart no. 10: Changes in soil moisture content between 0-10 cm (%)

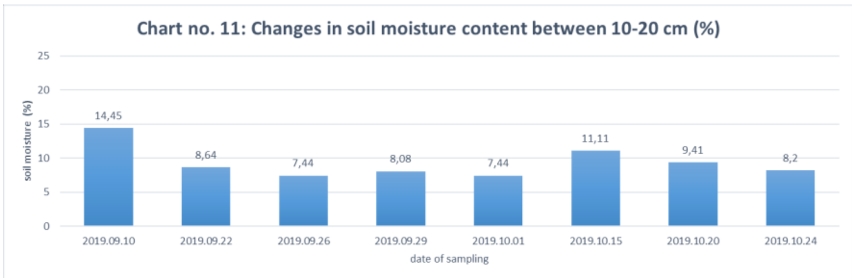


Chart no. 11: Changes in soil moisture content between 10-20 cm (%)

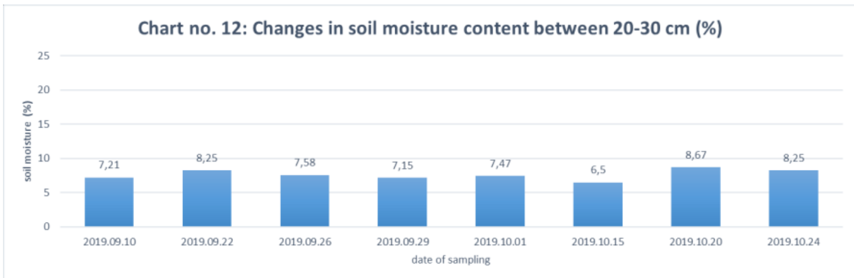


Chart no. 12: Changes in soil moisture content between 20-30 cm (%)

In conclusion we can say that the soil moisture content has a correlation with the change of weather elements. It can be seen very clearly, that following a rainfall the soil moisture content was increasing, and in dry periods it was decreasing. The results are greatly showing the specialty of the soil texture, because the vertical movement of the water has appeared as a slow process, which proves that the erosion caused by rainfalls is significant because it results in slope rinsing, and the surface's drying out favours to the erosion effect caused by the wind.

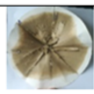
[7] Centeri, 2001

1.7. Examining the sediment transport of watercourses

We have examined the discharge and the amount of sediment transported by the creek in the valley of Parásztai-Séd. The sampling took place in three different times. The first five took place in autumn, the second three in winter during snow break, and the remaining was in spring and summer, after extreme rainfalls.

The largest discharge was in the autumn period, after days that had large amounts of rain. The amount of sediment transported have increased, which means the basic connection can be evincible.

The amount of sediment transported during the snow break was much larger compared to the ones we measured during autumn. The measurement we did on the 29th of January have shown that the average discharge have increased 12 times, and the amount of sediment transported have increased by 10 times.

measurements date	12th May 2019	14th May 2019	15th May 2019	16-28th May 2019	29th May 2019	30th May-16th June 2019	17th June 2019
discharges (l/s)	-	5,89	3,07	-	74,05	-	100<
amount of precipitation: (mm)	20 (thunderstorm)	19,1 (all day rain)	17,6 (rain in the morning)	∑18,4 (high temperature)	16,4 (thunderstorm)	∑8,1 (dog days)	37,9 (evening thunderstorm)
filter paper	-			-		-	
amount of suspended sediment (g/l)	-	3,03	3,18	-	5,51	-	26,93
amount of suspended sediment (g/s)	-	17,85	9,76	-	408,02	-	2693<

2nd spreadsheet: Parásztai-Séd water flow data during extreme precipitation

We have experienced the largest amount of sediment transported, and the largest discharge during the spring-summer periods (2nd spreadsheet). I would like to highlight the period of canicular days that took place from the end of May until the 16th of June. Consequently the soil have dried out on a large scale. On the 17th of June a downpour have occurred which had a depth of 37.9 mm. An accurate value cannot be given due to the inaccuracy of water depth and the size of the channel cross-section, so we instead used estimated values in our calculations. The weight of sediment transported by the creek was around 2693 grams/second. We expected the largest amount of soil carried away during this period, and this was also proven right by our calculations. The data series prove that we need to concentrate the protection against soil erosion for the duration of the summer canicular days, and to the occurrence of sudden thunderstorms, because the erosion effects by rainfalls are doing the highest damage during these times.

2. Determination of soil humic content

2.1. Introduction

After examining the soil erosion caused by wind and precipitation, we wanted to prove our results in practice, so we examined the changes in the humus content of the soil depending on the individual spatial factors. Our aim is to be able to prove that the effect of erosion is stronger in vineyards where the conditions are unfavorable, such as no cover vegetation, taking into account the spatial factors, so the humus content will be lower in these areas.

2.2. Collection of soil samples for determination of humus content

To measure the humus content of the soil, we first collected soil samples from different areas of the Parásztai Valley of the Szekszárd Hills. Soil sampling was taken on 04.12.2020. at which time all soils were exposed to the same weather. Soil samples were collected from 13 different areas almost exclusively from vineyards. Thus, 26 samples come from the Szekszárd hills, but we collected several soil samples from different parts of the country, for example: Mecsek, Bükk, Villány Mountains, Balaton Uplands, Tokaj foothills. These were necessary in order to be able to compare local soils with soils with other spatial features. We took samples from the upper 0-30 cm and lower 30-60 cm layers of the soil according to the 21 470 regulation by the Hungarian Standards Board. The acquisition from the two layers was necessary to examine the difference between the upper and lower organic matter content of the soil, respectively. Thus, a total of 62 soil samples were examined!

2.3 Determination of soil humic content

The soil samples were allowed to dry for 2 weeks, and then their humus content was tested in the laboratory of the University of Pécs (2nd picture). The determination was performed by the chromic acid method, which is as follows: 1 g of soil sample was weighed into a test tube and 10 ml of 5% $K_2Cr_2O_7$ solution was added to it. After 10 minutes of shaking and resting, 20 ml of H_2SO_4 was added to the samples. After cooling, the samples were made up to 100 ml with distilled water and allowed to stand for 16 hours. Subsequently, the determination of the humic substance was performed by spectrophotometry using a Biochrom Libra S12 spectrophotometer. To use the instrument, a standard must first be set using glucose solution. All soil samples were placed in the machine, which gave the organic matter content of the soils based on color. Due to the standard, the machine only measured up to 4%, but since our samples were taken from a forested area, this was outside the range, so we were able to calculate the humus content of such soils using an equation:

$$Humic\ content = \frac{\mathrm{X}}{0{,}0951}$$

Where: X is the data given by the spectrophotometer

When taking each soil sample, we examined an area based on the given criteria: Slope slope, slope exposure, slope length, vegetation cover, slope shape, and whether the vineyards are perpendicular or vertical to the slope.

2nd picture: Determination of soil humic content

Slope and slope length were calculated using Google Earth Pro. The slope length was obtained with the route planner in the program, which gave the distance between two selected points A and B. Point A was always placed at the highest point in the area and point B at the lowest point. With the latter method, we obtained not only the slope length but also the slope height, with which we were able to calculate the slope angle using the following formula:

$$\frac{(Aheight - Bheight) * 60}{ABtt}$$

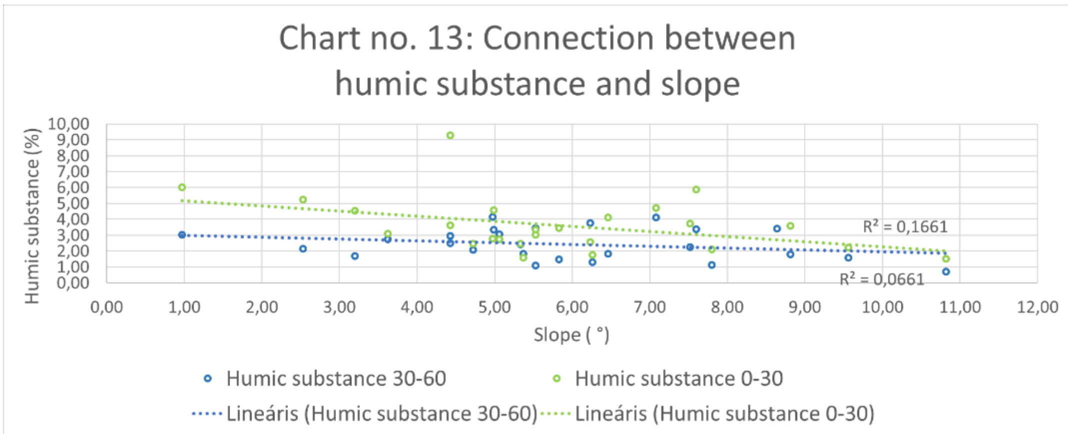
Where: “A” is the top of the slope

"B" is the bottom of the slope

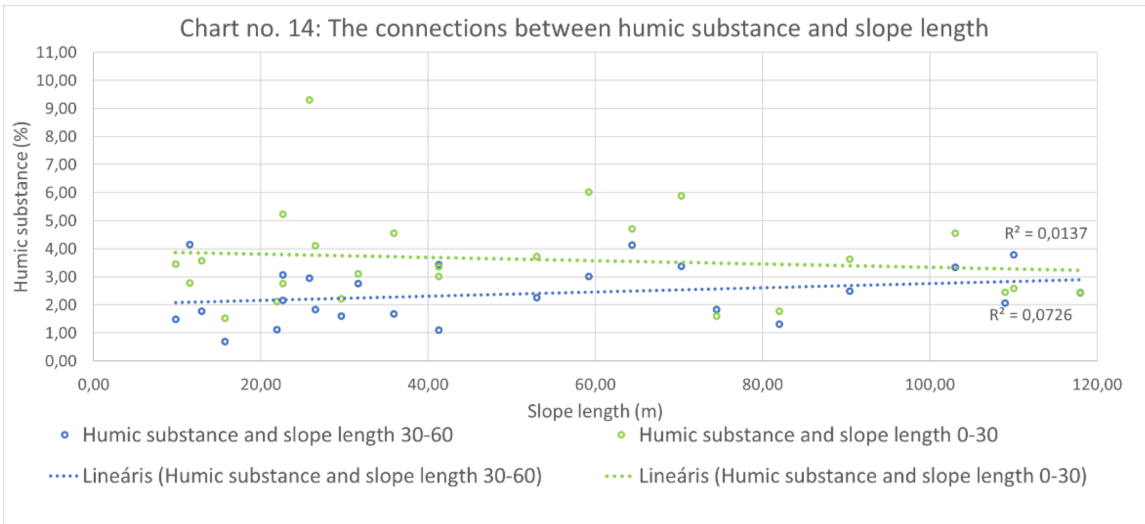
"tt" is the distance between the two points

The calculated data were uploaded to an Excel spreadsheet, where we could compare the similarities and differences of the areas and then examine the effect of each factor on the development of the humus content of the soil.

The humic substance of the soil can be influenced by many factors, including the type of tillage, vegetation cover, slope exposure, slope length, slope shape. By examining the former factors in a complex way, we looked for a correlation with the change in the humus content of the soil. Data on the percentage of humus content in the collected soil samples were uploaded to an Excel spreadsheet, along with data characterizing the sampling sites. In the case of the factors of plant cover, slope shape, type of tillage, the data were numerically classified in order to be shown on a diagram. In this way we were able to better understand the possible connections and differences between the areas. While analyzing the charts, we examined the outliers in each case to see what might affect its variance.



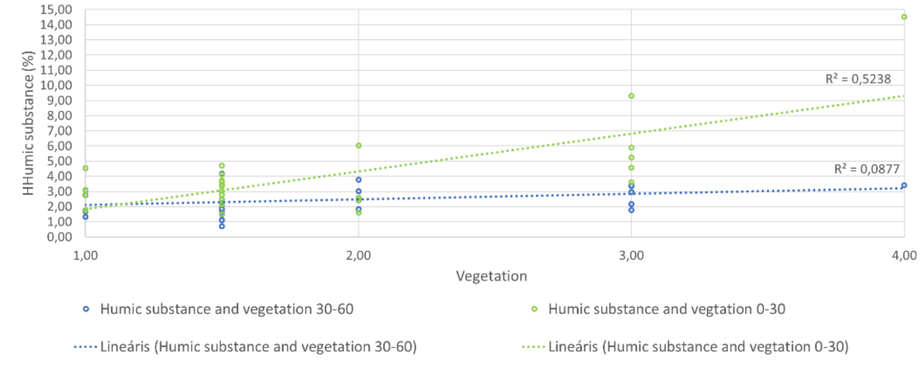
The first aspect on the basis of which the areas were examined was the relationship between humus content and slope slope (Chart no. 13). In the diagram, the trend line shows well that the humus content of the soil decreases with increasing slope. This can be observed in both the upper and lower layers. The rate of decrease in the upper layer is higher due to the fact that this layer is exposed to erosion effects. In the non-Szekszárd areas, the values increase with the slope. This is due to the natural vegetation of the areas.



The next aspect was the humus content of the soil and the slope length of the areas (Chart no. 14). The longer a slope, the greater the degree of erosion, the higher the speed of the water going down the slope, causing more destruction. This can also be observed in the diagram, as the trend line of the upper layer shows a decreasing humus content with increasing the length of the slope, while the humic content increases with the slope length in the lower layer. That's why I couldn't figure it out. The same can be observed with the data of the non-Szekszárd vineyards, where the natural vegetation is also high, the slope does not affect the organic matter content.

The quality of the soil in an area is greatly influenced by the absence or presence of cover vegetation (Chart no. 15). For this factor, I quantified the data to observe the effect of each vegetation cover on organic matter content. A value of 1 was given for areas that did not have cover vegetation, and a value of 1.5 was given for areas that did not have cover vegetation planted only in the absence of cultivation. Areas with alternating row cover vegetation were numbered 2, areas with row cover vegetation were numbered 3, and areas with forest and natural vegetation cover were given number 4. It can be seen from the diagram that the organic matter content is higher the more we move towards higher plant cover. This proves that the vegetation protects the areas not only from quantitative but also from qualitative destruction and also justifies the role of vegetation in the formation of soil humic matter.

Chart no. 15: Connection between humic substance and vegetation



The next aspect was to examine the relationship between the humus content of the soil and tillage Here, too, we provided the area-specific data with a numerical value. The area where the vineyards are planted parallel to the slope was given number 1. 2 are the areas where the installation is diagonal or cannot be clearly identified, 3 are the areas where the installation is perpendicular, 4 are the terraced area, 5 are the wooded area and 6 are on the hilltop. In the diagram, the trend line does not show much difference in the way of tillage. Considering the collected samples, this does not significantly affect the humus content of the soil. The expected result was that in areas where the vineyards are perpendicular to the slope, the humus content will be higher, as this factor also plays a major role in soil erosion. No significant difference is observed between the slope shape and the humus content. As with the previous two data, numbering was required to evaluate the data. The area where the slope was concave was rated 1, the area where it was convex, 3 where it was flat, and the terraced area was rated 4. In this case, the diagram does not show a significant difference between the data taken from Szekszárd. Thus, it can be concluded that this spatial characteristic does not significantly affect the extent of the soil organic matter content either.

3. Protect against soil erosion and improve water conservation

3.1. Design of an automated stormwater catchment

The rainwater collector we designed is an electronically automated device made of recycled materials that would combat the effects of rain and wind on soil erosion and help preserve the quality of arable land by collecting rainwater, which is later returned to the soil by drip irrigation.

3th picture: Model of automated water collector system

The rainwater collection structure consists of a platform, four tarpaulin bars, a molded tarpaulin, a pipe for draining the collected rainwater and electronics for automation. Another part of the eco-farm model is the water reservoir, the drip irrigation system. The tarpaulin of the catchment structure is located inside a pipe. The structure would replace some of the wooden support piles on the vineyard. If the precipitation sensor signals a potential rain, the platform at the bottom of the tube will rise, to which the tarpaulin bars are also attached, and gravity will open the tarpaulin structure, then after the sensor no longer signals the structure, the platform will lower and hide the tarpaulin structure inside the tube. We also needed this solution so as not to reduce the number of hours of sunshine for plants by shading. The rainwater catchment itself (if more is placed) captures the rainfall on the surface of the farmland as a solution, reducing the erosion potential of the rainfall, so there is less chance that the quality of the farmland will deteriorate during the rains. The water collected in this way is sent to a surface or groundwater reservoir around the farmland, from where it would be recycled by drip irrigation to protect the soil from the effects of wind and precipitation erosion and to nourish the vegetation, which is increasingly dry. In the case of a wet soil surface, the cohesion of the soil particles is higher, which prevents the wind from picking up the smallest fractions. In addition, greater intergranular adhesion during precipitation can inhibit erosion processes. If the area is covered with vegetation (eg grassland), the water used plays a role in feeding the vegetation, thus fixing the soil particles, thus protecting them from the effects of erosion (3th picture).

3.2. Improving mulching as a more effective method of protection

Due to the high cost of the automated stormwater collector, we wanted to find and develop a solution and control method that is accessible and easy to implement for all farmers. The essence of our control method is to protect against erosion by using the mulch generated during the pruning of the vineyards. The mulch generated during regular pruning is not left scattered or burned on the ground, but is buried in the vineyards where linear erosion occurs, thus preventing its re-formation and helping to conserve water.

To test the method, permission was sought from a local winemaker to use the post-pruning vein for testing. We then searched the area for lines showing line erosion. We looked at which part of the slope it was forming, we wanted to put our first soil trap here, because this way we prevent linear erosion at the very beginning of the formation. We collected enough vignettes to form the method, then dug a 1 m long, 0.5 m wide and 0.5 m deep pit into which the mulch was inserted and then covered with a layer of earth. The sudden precipitation starting on the slope cannot exert its erosive effect, as the run-off water seeps into the soil at the site of the soil trap, which is due to the mulch, as it leaves enough space between the soil particles to allow the water to seep out, helping the soil to wet keeping.

The operation was repeated every 10-15 meters to continuously reduce the erosion potential of the runoff water and to prevent the water from accelerating and the decomposition of mulch placed in the soil helps to improve or maintain the organic matter content of the soil.

The effectiveness of the method was tested several times after precipitation events, and control measurements showed no re-erosion. Based on the observations, our control method is effective, we did not see the formation of erosion even after repeated precipitation. The design has taken into account the cost and simplicity that all farmers can use in their area to control erosion (4th picture).


line erosion


water retention with mulching


after precipitation events

4th picture: The design of mulching method

4. Global applicability of the solution

Viticulture appears as a monoculture on every continent. According to 2020 data, there are 7.84 million hectares of grapes cultivated in the world. As climate change is becoming a global problem due to climate change, the above-mentioned innovation techniques could be applied to agricultural and monocultural agricultural areas in other continents for soil conservation and water retention. In order to implement the mulching method, which is simpler and cheaper, we can use the biomass generated in the given agricultural crop for this purpose.

5. Introduciton

Olivér Herceg: I am a 12th grade student of the Béla I. Grammar School in Szekszárd. The natural sciences are mostly in my nails. I have been doing research on the effects of water and soil for more than four years. With my research I managed to win the Sajó Elemér award twice, and I won many first places in various Hungarian competitions. I would like to continue my studies at the University of Szeged, majoring in Mechanical Engineering in the Agricultural and Food Industry.

Balázs Andócsi: I am a 9th grade student of the Béla I. Grammar School in Szekszárd. Nails of interest extend to the arts, mostly folk music and folk dance, but also the natural sciences. Most of my family graduated from a water college, mostly in Baja. I plan to stifle my studies at the College of Folk Music.

6. Short summary

The main topic of our research is the examination of the interaction between water and soil, which we did specifically in our environment. We collected a lot of samples for our research, which were analyzed in the science laboratory of our grammar school. Then we developed a cheap and effective method of defense, which promotes protection and water conservation in areas used by agriculture. Our research was helped by our teacher Mr Barocsai.

7. Long summary

The aim of our research is to examine the impact of extreme rainfall distribution caused by climate change on the extent of soil erosion and to develop a proposal to make water management more efficient and to reduce soil erosion processes.

Our research was carried out in the northern part of Szekszárd in the Parásztai-Séd valley, where the typical agricultural activity is viticulture. We began our studies by analyzing precipitation data for the last forty years in the city. Soil samples were collected, soil texture determination and soil erosion estimation were performed. The runoff of Parásztai-Séd and the amount of suspended solids carried by water were measured, and then the water management of the soil was examined.

Our studies have proofed that the distribution of precipitation is becoming more and more extreme. The soil type of the valley is sensitive to erosion, which is already exceeding the rate of soil formation in the vineyards. The highest displacement is typical during times of extreme precipitation. The water management of the top of the soil is sensitive to drought periods and for the slow vertical water flow. Overall, water conservation and soil erosion prevention measures are needed in the valley. In addition to the traditional solutions, the Ecotany model we developed could also be applied. Part of the project was the design of a rainwater harvesting device that, thanks to its automated operation, would not only reduce the impact of rainfall on soil erosion, but also prevent the development of plants by shading during the rainless period. Thirdly, the gradual return of the collected water to the production area would also reduce the effects of wind erosion and feed the vegetation covering the ground.

The installation of the eco-farm model and the associated stormwater collector comes at a high cost, which not all farmers can afford, so we wanted to develop a new cheaper and also efficient solution. Mulching has long been a technique used to prevent erosion in vineyards, and we wanted to improve its efficiency. m dug. This is to prevent the water flowing down the hill from accelerating because the soil trap absorbs the water thanks to the layered mulch. The soil traps were re-done every 10-15 meters so that if one of the traps was full of water, the water could not accelerate again. The method was subjected to a control measurement several times after rain, where we could prove our theory, the method works. With this inexpensive and proven effective method of control, every farmer can protect themselves against erosion caused by extreme weather events.

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