DIFFERENCE BETWEEN THE SIZE OF WATER EROSION BY ORIGINAL AND MODIFIED METHODOLOGIES (DEMONSTRATION OF CADASTRAL VÍCEMILICE)

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ABSTRACT

The theme of the thesis is Design of erosion control measure in the cadastral Vícemilice. The work includes the calculation of the size of water erosion. The article focuses on this issue.

The base is dividing the territory in to erosion of closed units. With Wischmeier-Smith equation is calculated for each size of water erosion. The values for each factor were identified using the methodology by Janeček. Currently, there are two. Newer contains certain adjustments and recommendations. Therefore, the results equations identified using both methods and the results are compared with each other.

The main finding is that the size according to the current methodology is 2955.28 t*year^{-1} and vice versa using the new methodology 6678.60 t*year^{-1}. The percentage (arable land) of looks like this: the original methodology – 16 % of arable land is threatened by erosion threat level 4 (verbal naming is very strong erosion), 2 % erosion level 3 (strong erosion), 47 % erosion level 2 (medium erosion) and 35 % level 1 (slight erosion); the modified method - 67 % of the risk of erosion level 4, 15 % level 3, 10 % level 2, and only 8 % level 1. Increased erosion is caused primarily by changing in the value of the R factor and changing the calculation of the factor L and S. Also changed the allowable soil loss associated with soil depth. Original permissible soil loss 10 t*ha^{-1}*year^{-1} was preserved, but the new methodology recommended to protect valuable land use permissible soil loss as soils moderately deep (4 t*ha^{-1}*year^{-1}). Therefore, increase the representation of degree of erosion hazard 4. According to the results show that the new method is required to use effective erosion control measures to reduce erosion on erosion hazard level 1. Question remains whether it is not only artificial increase erosion and whether it is really active step to protect soil.

Key words: soil, water erosion, universal equation = Wischmeier-Smith equation = USLE, agriculture

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INTRODUCTION

Water erosion is a global problem. Every year there is a huge wash-out arable land. In addition to problems caused by washes (in particular the reduction of production) has trouble even in the area where the sediment deposited (for example clogging of rivers and reservoirs, pollution of roads), whose removal is too expensive. (Janeček, 2002) Would not it be better to avoid this situation? In addition, we must remember – water erosion still carries a large amount of land, on the earth ever increasing population and today is used virtually all the arable land. Can we really afford to lose topsoil price, if we want all people to have the opportunity to receive quality food?

Czech Republic is threatened by water and wind erosion. Both threaten our most fertile areas (Polabí, south Moravia, and Hana). (Janeček, 2002)

MATERIAL AND METHODS

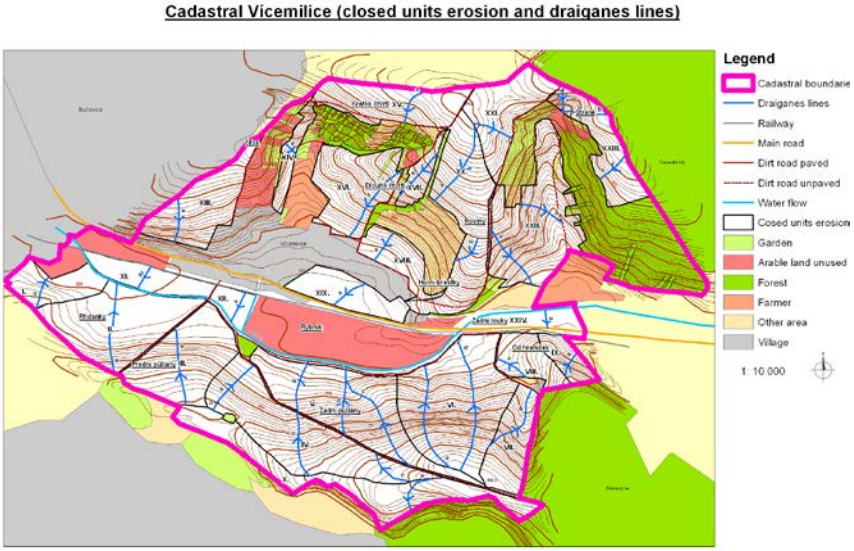
The thesis contains two parts. The first was a review of the scientific literature on erosion water´s, wind´s and anti-erosion measures. The second part includes a description of the cadastral area; calculate the size of water erosion and the design of anti-erosion measures that would sufficiently reduce erosion. Here I only focused on calculation of erosion washes.

Cadastral Vícemilice belong to the city Bučovice (South Moravian Region). The area is characterized by steep slopes. The basic shape of cadastral determines the flow Litava, which runs through the center. The minimum altitude is 220 m above sea level; right bank has a maximum altitude 309 m and links 341 m. Slope gradient on the right bank ranges 0.49 – 15.20 % and the left 0.87 – 20.99 %. The cadastral area of these soils is represented: fluvisol (around watercourse), luvisol, chernozem, and dominated leptosols. Climate is the area to B2 (moderately warm). The natural vegetation is oak-beech and beech. Production includes cadastral between sugar beet production areas. This information was obtained from the literature or specialized websites.

Using local investigation, it was found that all the arable land referred to in the land, so does not use. The total area of cadastral to Land Registry is 514.2576 hectares. It is 419.7825 hectares agricultural land resources. Arable land in it should occupy 395.7982 hectares. Some plots, however, are grassed. In the field were identified and subsequently removed from observation. Water erosion was measured at 342.5612 hectares. This area was divided into 24 units closed erosion. Subsequently, for each closed units erosion values were determined individual factors and substituted into Wischmeier-Smith equation. All length and sizes were determined in ArcGis, where were also created all the maps.

Factor R, K and P is determined according to the methodology. Factor L and S are determined for each drain line, factor C is determined by the representation communicated crop farmers. Because there are currently two methods for the determination of the factors, was used both, and the results were compared. All values and calculations were determined from the methodologies.

Picture 1 Cadastral Vícemilice



RESULT AND DISCUSSION

The result of this work is to determine the size washed off by water erosion and determine the degree of erosion hazard. Under current valid methodology was washed off 2955.28 t*year^{-1}. Under the new methodology, the erosion is 6678.60 t*year^{-1}. The difference was created by increasing the value of the factor R. Moreover adjust calculations factors L and S.

Similarly, it is also at risk of erosion. The new methodology has much more erosion of closed units in the fourth level. It has been met recommendations to the deep soils was acceptable soil loss as soils moderately deep (from 10 t*ha^{-1}*year^{-1} to 4 t*ha^{-1}*year^{-1}). The percentage (arable land) of looks like this: according to the original methodology – 16 % of arable land is threatened by erosion threat level 4, 2 % erosion level 3, 47 % erosion level 2 and 35 % level 1; according to a modified methodology – 67 % the risk of erosion level 4, 15 % level 3, 10 % level 2 and only 8 % of the first level.

Adjusting of some factors has been a major increase washes soil water erosion. Justification author of the new methodology is that it is necessary to protect our valuable arable land. The question remains whether this step leads to greater protection. Currently, the biggest problem is the reluctance of farmers to change farming and lack of money for anti-erosion measures. Increase erosion, however, will result in the design of more effective anti-erosion measures, but will have greater purchase value and will place greater demands on farmers. So it may happen that all soil protection will prevent.

Tab. 1 Water erosion on cadastral Vícemilice – original methodology

Units closed erosion (UCE) num.	Drain lines	Area [ha]	R	K [t.ha^{-1}.year^{-1}]	L	S	LS	C	P	G [t.ha^{-1}.year^{-1}]	Diameter UCE G [t.ha^{-1}.year^{-1}]	G_p [t.ha^{-1}.year^{-1}]	Erosion level	Erosion summary
I	a	7.924	17.70	0.49	2.71	0.69	1.87	0.23	1	3.73	3.73	10	1	29.56
II	a	21.3181	17.70	0.41	3.47	0.32	1.11	0.23	1	1.85	1.85	10	1	39.50
III	a	18.0545	17.70	0.42	4.27	0.98	4.18	0.23	1	7.15	7.15	10	1	129.04
IV	a	27.8142	17.70	0.50	3.81	0.92	3.52	0.23	1	7.16	5.49	10	1	152.67
	b				4.02	0.76	3.05			6.21				
	c				2.8	0.57	1.62			3.09				
V	a	27.7915	17,0	0.51	3.38	0.75	2.52	0.23	1	5.23	10.51	10	2	292.16
	b				4.76	1.17	5.59			11.61				
	c				6.11	1.16	7.08			14.70				
VI	a	31.8169	17.70	0.49	6.69	1.60	10.70	0.23	1	21.34	18.39	10	2	585.18
	b				6.61	1.17	7.74			15.44				
VII	a	13.6843	17.70	0.49	5.24	1.33	6.97	0.23	1	13.90	13.90	10	2	190.26
VIII	a	7.624	17.70	0.41	2.26	0.53	1.20	0.23	1	2.00	2.00	10	1	15.27
IX	a	4.3031	17.70	0.32	4.47	2.02	9.04	0.23	1	11.78	11.78	4	3	50.68
X	a	20.7028	17.70	0.39	3.16	0.82	2.61	0.23	1	4.13	4.14	4	2	85.79
XI	a	7.9406	17.70	0.42	1.21	0.10	0.12	0.23	1	0.21	0.21	10	1	1.63
XII	a	3.492	17.70	0.42	1.19	0.08	0.10	0.23	1	0.17	0.17	10	1	0.60
XIII	a	14.6134	17.70	0.44	4.23	1.56	6.62	0.23	1	11.86	11.86	10	2	173.29
XIV	a	3.9399	17.70	0.31	1.94	0.88	1.71	0.23	1	2.16	2.16	4	1	8.50
XV	a	14.2761	17.70	0.31	3.43	1.03	3.54	0.23	1	4.47	4.47	4	2	63.78
XVI	a	16.1728	17.70	0.41	5.54	1.52	8.45	0.23	1	14.10	14.10	4	4	228.10
XVII	a	3.6247	17.70	0.32	4.7	1.86	8.72	0.23	1	11.36	11.36	4	3	41.18
XVIII	a	8.1958	17.70	0.49	2.81	0.80	2.25	0.23	1	4.49	4.49	10	1	36.79
XIX	a	9.2232	17.70	0.52	1.39	0.14	0.19	0.23	1	0.40	0.40	10	1	3.71
XX	a	22.7219	17.70	0.33	4.92	1.01	4.99	0.23	1	6.70	6.84	4	2	155.52
	b				3.33	1.56	5.20			6.99				
XXI	a	14.7633	17.70	0.36	3.20	1.22	3.91	0.23	1	5.73	5.73	4	2	84.60
XXII	a	25.6292	17.70	0.28	8.72	2.18	19.04	0.23	1	21.70	17.14	4	4	439.38
	b				5.53	2.00	11.04			12.58				
XXIII	a	11.6453	17.70	0.30	4.78	2.95	14.10	0.23	1	17.22	12.62	4	4	146.92
	b				5.25	2.44	12.82			15.66				
	c				3.19	1.28	4.07			4.97				
XXIV	a	5.2896	17.70	0.37	1.24	0.12	0.16	0.23	1	0.23	0.23	10	1	1.20
										TOTAL SOIL LOSS OF CADASTRAL [t.year^{-1}]				2955.56

Tab. 2 Water erosion on cadastral Vícemilice – modified methodology

Units closed erosion (UCE) num.	Drain lines	Area [ha]	R	K [t.ha^{-1}.year^{-1}]	L	S	LS	C	P	G [t.ha^{-1}.year^{-1}]	Diameter UCE G [t.ha^{-1}.year^{-1}]	G_p [t.ha^{-1}.year^{-1}]	Erosion level	Erosion summary
I	a	7.9240	40.00	0.49	2.71	0.69	1.87	0.23	1	8.43	8.43	4	3	66.80
II	a	21.3181	40.00	0.41	3.47	0.32	1.11	0.23	1	4.19	4.19	4	2	89.26
III	a	18.0545	40.00	0.42	4.27	0.98	4.18	0.23	1	16.15	16.15	4	4	291.61
IV	a	27.8142	40.00	0.50	3.81	0.92	3.52	0.23	1	16.19	12.04	4	4	345.03
	b				4.02	0.76	3.05			14.03				
	c				2.68	0.57	1.52			6.99				
V	a	27.7915	40.00	0.51	3.38	0.75	2.52	0.23	1	11.82	23.76	4	4	660.25
	b				4.76	1.17	5.59			26.23				
	c				6.11	1.16	7.08			33.22				
VI	a	31.8169	40.00	0.49	6.69	1.6	10.70	0.23	1	48.24	41.56	4	4	13.43
	b				6.61	1.17	7.74			34.89				
VII	a	13.6843	40.00	0.49	5.24	1.33	6.97	0.23	1	31.42	31.42	4	4	429.97
VIII	a	7.624	40.00	0.41	2.26	0.53	1.2	0.23	1	4.53	4.53	4	2	34.51
IX	a	4.3031	40.00	0.32	4.47	2.02	9.04	0.23	1	26.61	26.61	4	4	114.52
X	a	20.7028	40.00	0.39	3.16	0.82	2.61	0.23	1	9.36	9.36	4	3	193.88
XI	a	7.9406	40.00	0.42	1.21	0.1	0.12	0.23	1	0.46	0.46	4	1	3.68
XII	a	3.492	40.00	0.42	1.19	0.08	0.10	0.23	1	0.39	0.39	4	1	1.35
XIII	a	14.6134	40.00	0.44	4.23	1.56	6.62	0.23	1	26.80	26.80	4	4	391.61
XIV	a	3.9399	40.00	0.31	1.94	0.88	1.71	0.23	1	4.88	4.88	4	2	19.21
XV	a	14.2761	40.00	0.31	3.43	1.03	3.54	0.23	1	10.10	10.10	4	3	144.13
XVI	a	16.1728	40.00	0.41	5.54	1.52	8.45	0.23	1	31.87	31.87	4	4	515.48
XVII	a	3.6247	40.00	0.32	4.7	1.86	8.72	0.23	1	25.67	25.67	4	4	93.05
XVIII	a	8.1958	40.00	0.49	2.81	0.8	2.25	0.23	1	10.14	10.14	4	3	83.13
XIX	a	9.2232	40.00	0.52	1.39	0.14	0.19	0.23	1	0.91	0.91	4	1	8.38
XX	a	22.7219	40.00	0.33	4.92	1.01	4.99	0.23	1	15.15	15.47	4	4	351.47
	b				3.33	1.56	5.20			15.79				
XXI	a	14.7633	40.00	0.36	3.20	1.22	3.91	0.23	1	12.95	12.95	4	4	191.18
XXII	a	25.6292	40.00	0.28	8.72	2.18	19.04	0.23	1	49.05	38.74	4	4	992.95
	b				5.53	2.00	11.04			28.44				
XXIII	a	11.6453	40.00	0.30	4.78	2.95	14.10	0.23	1	38.92	28.51	4	4	332.02
	b				5.25	2.44	12.82			35.38				
	c				3.19	1.28	4.07			11.23				
XXIV	a	5.2896	40.00	0.37	1.24	0.12	0.16	0.23	1	0.51	0.51	4	1	2.70
										TOTAL SOIL LOSS OF CADASTRAL [t.year^{-1}]				6687.60

Fig. 1 Degree of erosion – original methodology

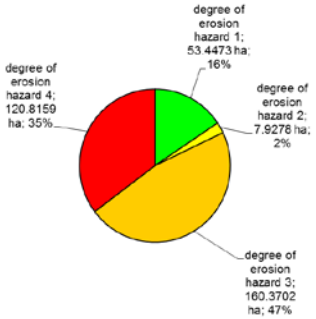
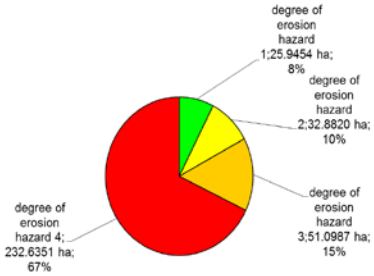


Fig. 2 Degree of erosion – modified methodology



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