



FIG WORKING WEEK 2012

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Rome, Italy



Assessment Of Soil Erosion Based On The Method USLE; Çorum Province Example

Presenter

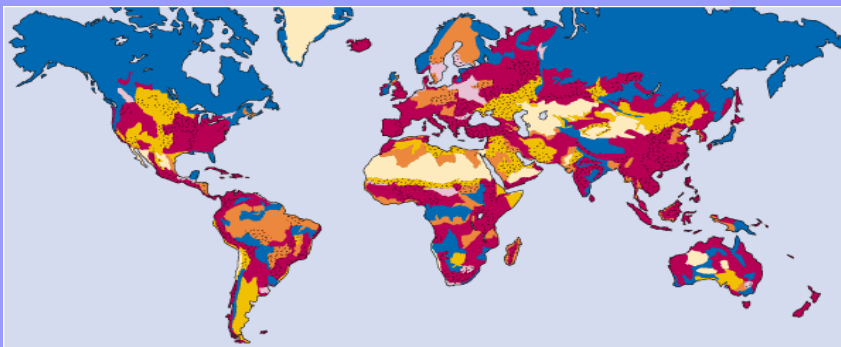
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TS 05E – Technical Aspects of Spatial Information II, 5848

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INTRODUCTION

Erosion is one of the biggest ecological problems which threaten our national reserves for our country as well as whole world.



Soil degradation types		Other symbols	
Water erosion	Physical deterioration	Stable terrain	Non-used wasteland
Wind erosion	Severe degradation	Water bodies	
Chemical deterioration			

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- Turkey is located in Southern West/ Middle Asia-North Africa zone, where is under high erosion effect and mostly become desert.
- Due to erosion the amount of earth moved to sea, dams and lakes is detected about 500 millions tons according to sediment measurement which applied in 26 basins in our country (ÖZEL, M.).

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- Turkey's first, only erosion map was prepared by TOPRAKSU by benefiting the land survey carried out between 1966–1971 and aerial photographs.
- Some developed countries in the world produce various soil erosion models by taking the specifications of their own area into consideration.

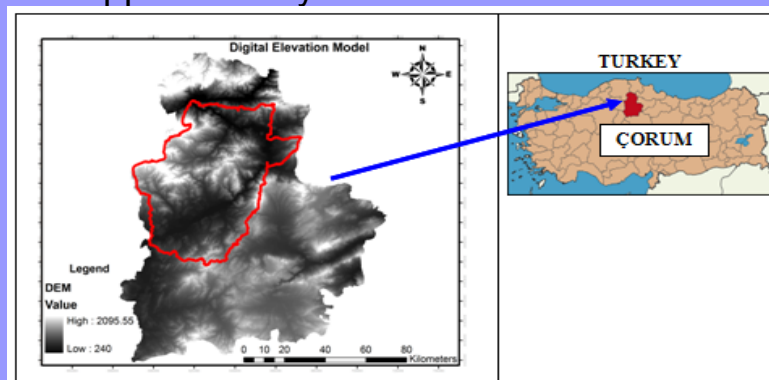
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- The most common of these models are USLE, CORINE, ICONA...etc.
- In this study it is aimed to determine and evaluate the soil loss in the west region of Çorum with the help of commonly used Geographic Information Systems according to USLE model.

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STUDY AREA

- The city of Çorum is situated in the area where the Black Sea Region joins Central Anatolia. It's area approximately 13000 km² .



- The selected study area is approximately 4000 hectares.

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METHOD

The Universal Soil Loss Equation (USLE) is designed to predict long term average annual soil loss in runoff from specified land units in specified cropping and management systems. It was originally developed in the United States of America (US) for areas east of the Rocky Mountains. It is based on data from more than 10000 years of erosion plot studies in the US.

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Equation is,

$$A = R * K * LS * C P$$

Erosion = f (climate, soil, topography, landuse)

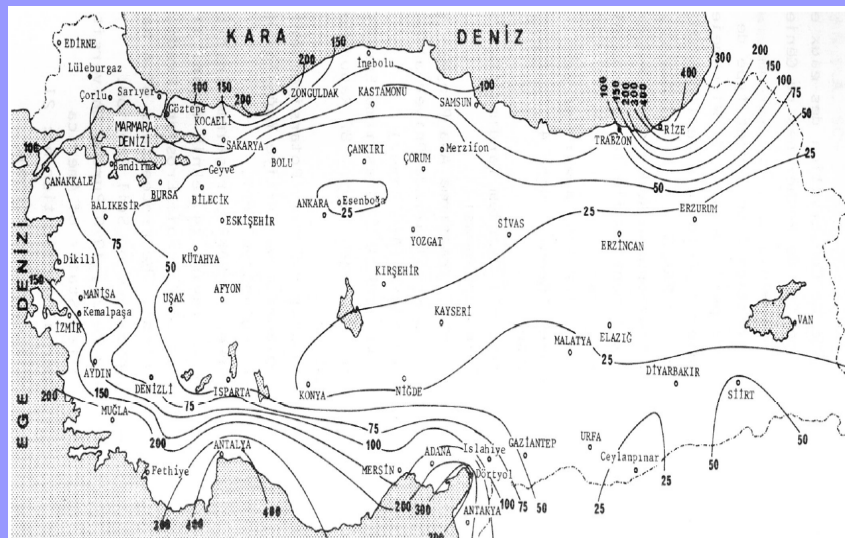
- A = annual soil loss (tons/ha/year)
- R = rainfall-runoff erosivity factor
- K = soil erodibility factor
- LS = topographic factors
(L is slope length, S is slope gradient)
- C = cropping-management factor
- P = soil conservation practice factor

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Rainfall-runoff erosivity factor (R)

- The R factor value quantifies the raindrop impact effect. Rainfall energy is directly related to rain intensity.
- Çorum Meteorology Station R value is calculated by interpolation from the iso-erodent map of Turkey prepared by Doğan (1987).

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Iso-erodent map of Turkey prepared by Doğan (1987)

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R values of unknown elevations were computed by using DEM in ArcGIS and equation ($R_{new} = R_{base} (P_{new}/P_{base})^{1.75}$) by assuming a 50 mm increase of precipitation with each 300 m. increment in altitude.

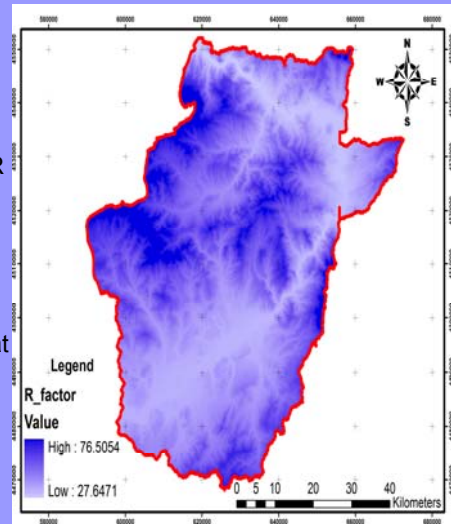
R_{new} = the new value for R at the desired new location

R_{base} = R value at a base location where R is known,

P_{new} = the average annual precipitation at the new location,

P_{base} = the average annual precipitation at the base location

(Toy, T. and Foster G. R., 1998, Ozcan, U., et al., 2008).

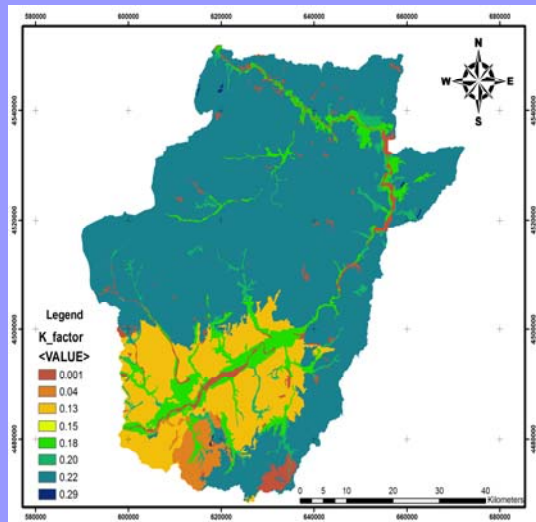


Soil erodibility factor (K)

- The soil erodibility factor (K), represents both susceptibility of soil to erosion and the amount and rate of runoff, as measured under standard plot conditions.
- In this study, information required for the determination of the K factor values was obtained from earlier reports (TURTEM-Turkey Soil Erosion Estimation Model).

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Determined K values based on locally measured soil properties and using soil erodibility factor nomograph for great soil groups in Turkey.



These values were annual averaged corresponding to homogeneous different soil groups.

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Topographic factors (LS)

- The slope length and slope steepness can be used in a single index, which expresses the ratio of soil loss as defined by Wischmeier.

$$LS = (X/22.1)^m (0.065 + 0.045 S + 0.0065 S^2)$$

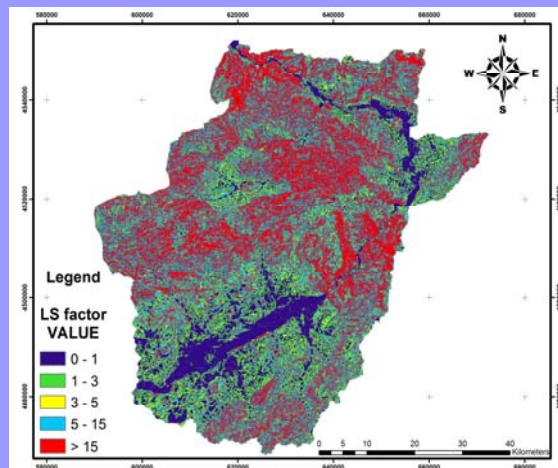
X = slope length (m.) ; S = slope gradient (%)

m value;

Slope (%)	Slope (%) ≤ 3	3 < Slope (%) < 5	Slope (%) ≥ 5
m - value	0.3	0.4	0.5

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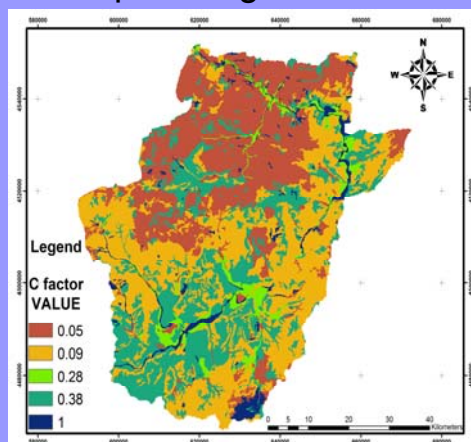
- The values of X and S were derived from DEM. To calculate the X value, Flow Accumulation was derived from the DEM after conducting Fill and Flow Direction processes in Arc Hydro tool.



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Cropping-management factor (C)

- The C factor in the USLE measures the combined effect of all the interrelated cover and crop management variables.



The land use map was used for analyzing the C value.

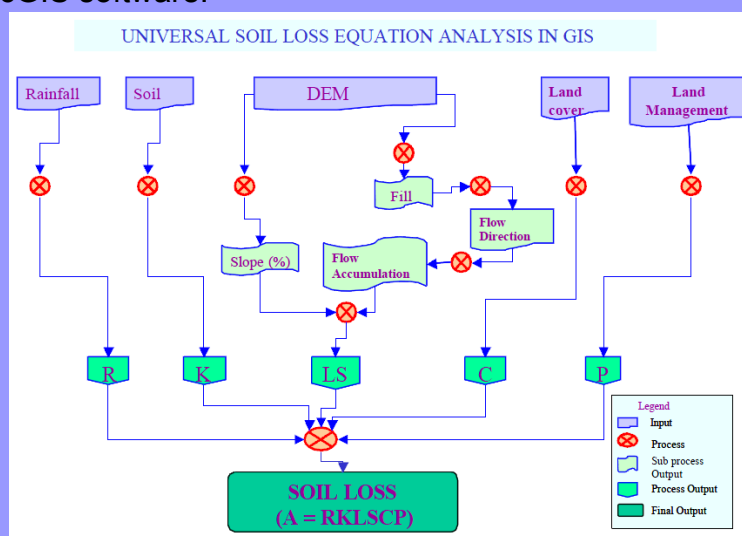
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Conservation practice factor (P)

- By definition, factor P in the USLE is the ratio of soil loss with a specific support practice to the corresponding loss with up and down slope culture.
- Assuming no support practice in the study area, it was not used in calculations (P factor = 1).

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Finally, a map showing potential soil erosion was produced using USLE and integrating layers of R, K, LS, and C with ArcGIS software.



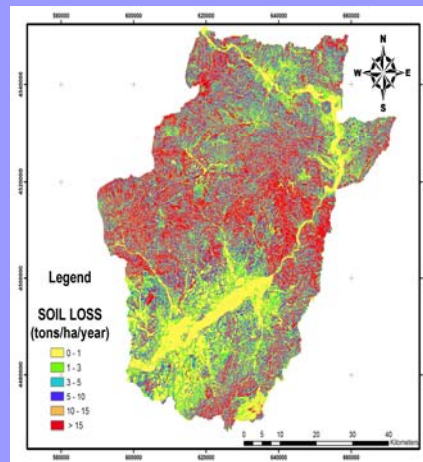
Results

The statistic of the soil loss value in study area as listed in table.

Approximately 29% was predicted to have soil loss between 0 to 1 (ton/ha/ year) .

Serious rate soil loss (greater than 15 ton/ha/year) was obtained approximately 20% of the total soil loss prediction at west region of Çorum.

The mean annual soil loss of the working area is 28.85 ton/ha/year.



Soil Loss Potential (ton/ha/year)	Area (Ha)	% Total Area
0 – 1	1150.59	28.66 %
1 – 3	534.63	13.32 %
3 – 5	419.62	10.45 %
5 – 10	703.40	17.52 %
10 – 15	399.12	9.94 %
>15	807.14	20.11 %
Total	4014.50	100.00 %

Thank you for listening...