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ASSESSMENT OF THE CURRENT SOIL EROSION IN PIRANGA RIVER BASIN, MINAS GERAIS STATE

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INTRODUCTION

Soil erosion is the main environmental impact that affects the state of Minas Gerais, with degradation and impoverishment of soils with reduction of surface water quality in basins. A quick and quite accurate manner to qualitatively assess the erosive potential in a particular region is given by the application of predictive soil loss models, which consider the assets and liabilities of the erosion factors.

The aim of this work was to evaluate the current soil erosion through the integration of RUSLE/GIS using map algebra in the Piranga River Basin (PRB), Zona da Mata region of Minas Gerais state.

MATERIAL AND METHODS

The Piranga River Basin (PRB) is located in Zona da Mata region of Minas Gerais state (Figure 1) with a drainage area of 4,254 km^2.

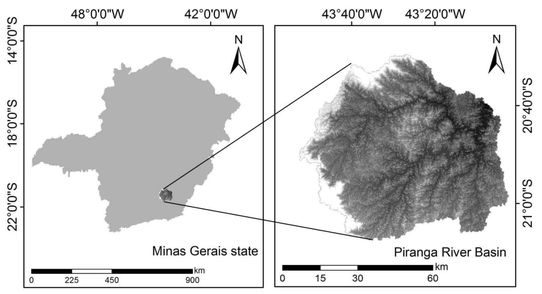

Figure 1. Location and the Digital Elevation Model (DEM) of the PRB in the Minas Gerais state.

Revised Universal Soil Loss Equation

$$A = R \times K \times LS \times C \times P$$

where:

A: soil loss (Mg ha^{-1} yr^{-1});
R: rainfall erosivity (MJ mm ha^{-1} h^{-1} yr^{-1});
K: soil erodibility (t h MJ^{-1} mm^{-1});
LS: topographic factor (dimensionless);
C: soil use and management factor (dimensionless);
P: soil conservation practice factor (dimensionless).

Rainfall erosivity (R)

The model for estimating the mean annual R value for Southeastern Brazil , proposed by Mello et al. (2013), is given by:

$$R = -399433 + 420.49 \times A - 78296 \times LA - 0.01784 \times A^2 - 1594.04 \times LA^2 + 195.84 \times LO^2 + 17.77 \times LO \times A - 1716.27 \times LA \times LO + 0.1851 \times LO^2 \times A + 0.00001002 \times LO \times A^2 + 1.389 \times LO^2 \times LA^2 + 0.01364 \times LA^2 \times LO^3$$

where:

A: altitude (m)
LA and LO: latitude and longitude (decimal degrees)

Topografic factor (LS)

The topographic factor (LS), adapted to RUSLE, can be estimated by (Engel, 2003)

$$LS = \left(\frac{[\text{Flow accumulation}].[\text{Cell size}]}{22.13}\right)^{0.4} \left(\frac{[\sin(\text{Slope})]}{0.0896}\right)^{1.3}$$

Soil erodibility (K)

Soil type	K (t h MJ^{-1} mm^{-1})	Authors
Argisol	0.033	Sá et al. (2004)
Cambisol	0.0508	Araújo et al. (2011)
Oxisol (Latosol)	0.01913	Mannigel et al. (2002)

Soil use, management and conservation (CP)

Land use	C	Author
Agriculture	0.29	Beskow et al. (2009)
Pasture	0.09	Ozsoy et al. (2012)
Forest	0.01	Beskow et al. (2009)
Eucalyptus	0.3	Martins et al. (2010)
Water	0	
Urbanization	0	
Bare soil	1	

The P factor was considered to be equal to 1

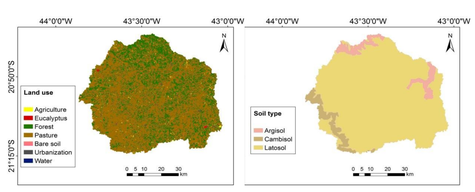

Figure 2. Land use and soil type maps of the PRB

RESULTS

The maps of the RUSLE factors (R, K, LS and CP) are presented in Figure 3.

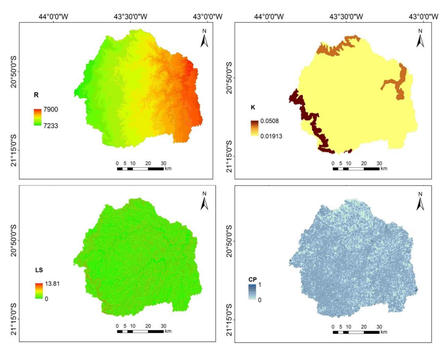

Figure 3. Maps of the factors of RUSLE (R, K, LS and CP)

The spatial distribution of the current soil erosion is presented in Figure 4, adapting the classification proposed by Beskow et al. (2009).

In general, the predominant classes of current soil erosion in the PRB were “slight” and “slight to moderate”. These results can be explained by the interaction of the soil type (Latosols) and the land use (forest) in the basin.

On the other hand, high soil loss values was observed in areas with presence of Cambisols covered with extensive pasture, but only represented 1.69% of the soil loss in the PRB.

Soil loss (Mg ha^{-1} yr^{-1})	Current soil erosion	Area (%)
0 - 2.5	Slight	77.94
2.5 - 5	Slight to Moderate	9.55
5 a 10	Moderate	8.46
10 a 15	Moderate to High	2.36
15 - 25	High	1.15
25 - 100	Very High	0.53
> 100	Extremely High	0.01

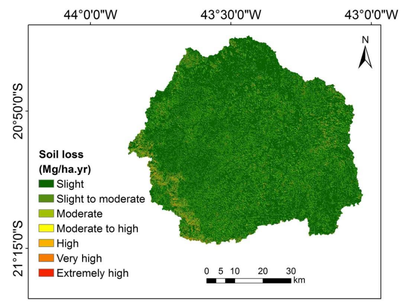

Figure 4. Spatial distribution of the current soil erosion in PRB

These results show that although there is predominance (65% of the area) of extensive pasture (i.e. high CP factor value) the PRB presented low soil loss values, mainly due to the presence of Latosols in these areas.

CONCLUSIONS

The use of RUSLE/GIS showed to be an appropriate tool for assessing the current soil erosion in Piranga River Basin and facilitate sustainable land management through conservation planning.

In general terms, the PRB can be classified as “slight” current soil erosion, which represents 77.94% of the basin area.

Only 1.69% of the PRB area presented high soil loss rates, which occurred in areas with the combination of Cambisols covered by pastures.

REFERENCES

Araújo, F. S., Salviano, A. A. C. and Neto, M. R. H. 2011.Estimativa da Erodibilidade de Latossolos do Piauí. *Scientia Plena*. 7(10): 1-6.

Beskow, S., Mello, C.R. and Norton, L. D. 2009. Soil erosion prediction in the Grande River Basin, Brazil using distributed modeling. Catena. 79(1): 49-59.

Engel, B. 2003. Estimating soil erosion using RUSLE - using Arcview., Indianapolis: Purdue University.

Mannigel, A. R., Carvalho, M. P., Moreti, D.and Medeiros, L. R. 2002. Fator erodibilidade e tolerância de perda dos solos do Estado de São Paulo. *Acta Scient*. 24(5): 1335-1340.

Mello, C. R., Viola, M. R., Beskow, S.and Norton, L. D. 2013. Multivariate models for annual rainfall erosivity in Brazil. *Geoderma*. 202-203: 88-102.

Ozsoy, G., Aksoy, E., Dirim, M. S.and Tumsavas, Z. 2012. Determination of soil erosion risk in the Mustafakemalpasa River Basin, Turkey, using the Revised Universal Soil Loss Equation, Geographic Information System, and Remote Sensing. *Environm. Manag*. 50(4): 679-694.