

A landscape archaeological approach to estimate the cover-management and conservation practice factors for RUSLE models.

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The HiLSS Project



Collapsing of abandoned terraces systems:

- Lost of archaeological landscape heritage
- Landslide hazard

By considering the different agricultural land-use HLC types in GIS-RUSLE modelling, it will be possible to quantify the effect on soil loss for each HLC type and consequently to devise more environmentally sustainable management for each type.

Environmental sustainability and historic landscape conservation are typically treated as two separate fields, but the HiLSS project will develop a transformative model for interdisciplinary research, proposing a new way to embrace both archaeological and natural values as components of the same landscape management plans.



Synergy between Revised Universal Soil Loss Equation (RUSLE) and Landscape Archaeology



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

$A \rightarrow$ soil loss ($\text{mg ha}^{-1} \text{ year}^{-1}$)



Natural
Factors

R \rightarrow Rainfall erosivity factor = the intensity of precipitation at a particular location

K \rightarrow Soil erodibility factor = measures the susceptible soil types and their particles to detachment and transport by rainfall and runoff.

LS \rightarrow Topographic factor = crucial in the soil erosion modeling for calculating overland flow (surface runoff)

Human
Factors

C \rightarrow Cover management factor = reflects the effect of cropping and other practices on erosion rates

P \rightarrow Support practice factor = indicates the rate of soil loss according to agricultural practice.



Data collection

- Historic Maps
- Historic Orthoimages
- Satellite images
- LU vectorial data



GIS-HCL
mapping



HCL dataset

- Area
- LULC
- Number of Fields
- Boundary Loss



RUSLE
modelling

R **K** **LS**

HLC Models (1950s, 1970s, 2000s, 2010s)

- Regional DEM

- Regional RUSLE factors

- Slope

C

P

Case Scenarios

- **C Factor Values** retrieved in: Panagos, P., Borrelli, P., Meusburger, C., Alewell, C., Lugato, E., Montanarella, L., 2015. Estimating the soil erosion cover-management factor at European scale. *Land Use policy journal*. 48C, 38-50

LULC Categories	C Factor Values
Vineyard	0.352
Sparsely vegetated areas	0.2652
Fruit Trees	0.2188
Non irrigated arable land	0.1232
Agroforestry	0.0881
Grassland	0.0435
Transitional woodland-shrub	0.0219
Mixed Forest	0.0011
Residential area	0.0003
Greenhouse	0.0003
Industrial area	0.0003
Water body	0

- **P Factor:** “The efficiency of conservation measures, regardless of conservation treatments, to reduce runoff and soil loss increases with the increasing of slope”. (Adhikary, P.P., Hombegowda, H.C., Barman, D. et al. Soil erosion control and carbon sequestration in shifting cultivated degraded highlands of eastern India: performance of two contour hedgerow systems. *Agroforest Syst* 91, 757–771 (2017). <https://doi.org/10.1007/s10457-016-9958-3>)

$$\frac{[(A/\text{NoF}) * (A^{-1})]}{\tan(S)}$$



A = HLC type area ; NoF= Number of Fields; S= Slope

Main landscape changes in the past 70 years:

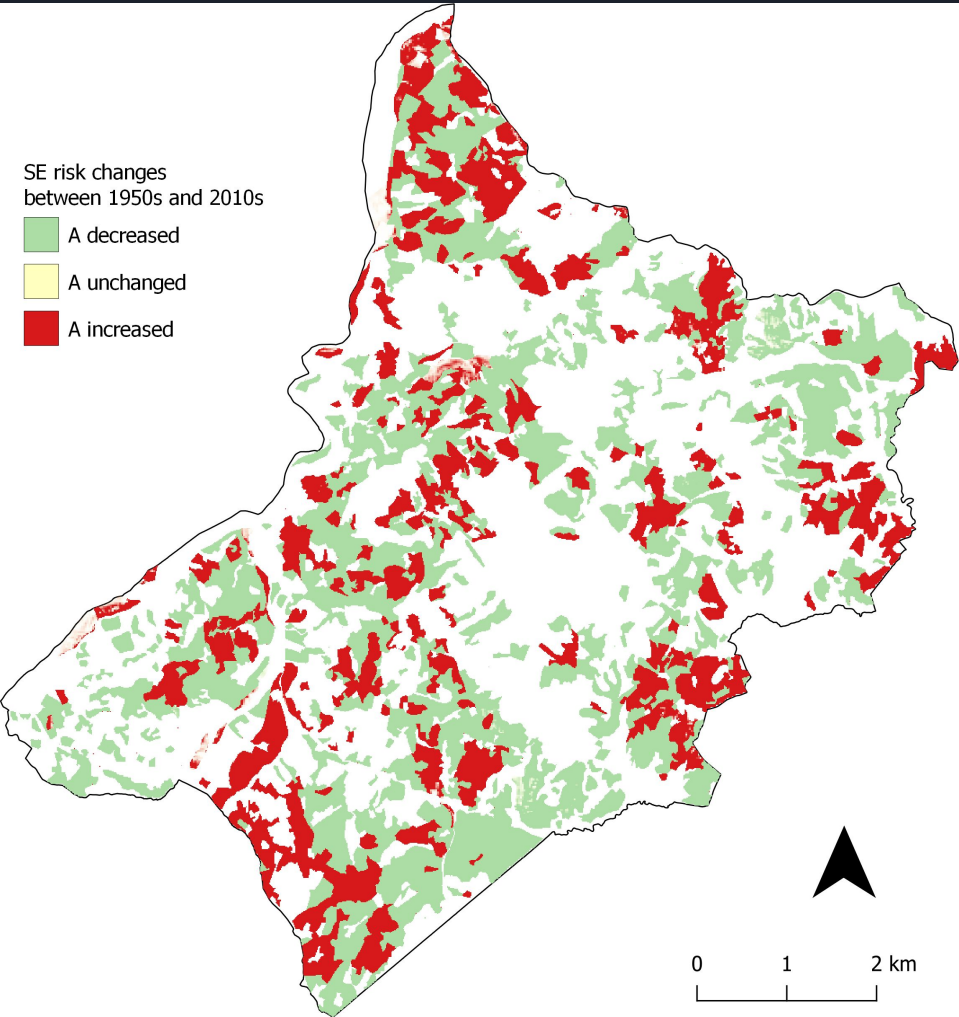
- Replacement of historic Agroforestry with arable farmland.
(+ C factor, + Soil Erosion, - Cultural Values)
- Replacement of historic Agroforestry with grassland or woodland.
(- C factor, - Soil Erosion, - Cultural Values)
- Replacement of small irregular fields with large combined fields.
(+ P Factor, + Soil Erosion, - Cultural Values)

Best 'scenarios':

- Irregular fields / Terraces & grassland
(- C Factor; = P Factor; - Soil Erosion, ≈ Cultural Values)
- Irregular fields / Terraces & Agroforestry
(=C Factor; = P Factor; ≈ Soil Erosion, = Cultural Values)
- Combined fields & grassland
(- C Factor; + P Factor; ≈ Soil Erosion, - Cultural Values)

Worst 'scenario':

- Combined fields & arable land
(+ C factor; + P Factor; + Soil Erosion, - Cultural Values)



HiLSS project team 2021



Thank you for your attention!