

Evaluation of erosion risk with stakeholders using RUSLE methodology and publicly available information in a large olive producing area in Southern Spain



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Objectives

- 1- To explain an example of adaptation of RUSLE technology to erosion appraisal in collaboration with stakeholder.
- 2- To explore possibilities open by information in the public domain.
- 3- To identify weakest points for further research.



Layout

- 1- Introduction.
- 2- Background in olive cultivation and water erosion.
- 3- Materials and methods.
- 4- Results.
- 5- Comments and conclusions.



Overall picture

- 1- Largest soil use in Andalusia (\approx size of Austria), where it covers 18%, 1.5 Mha.
- 2- Mediterranean type of climate, limited rainfall (350-700 mm year⁻¹), long-dry summer.
- 3- Cultivation based on optimizing water use by the tree: low tree density, limited canopy size, bare soil.
- 4- It is an heterogeneous picture evolving since the XVIII century.

Overall picture



ET_o
Rainfall

Olive farm class	Hectares	Surface	Percentage
Traditional rainfed (high slope)	391.487		31 %
Traditional rainfed (moderate slope)	509.598		40 %
Traditional irrigated	282.410		22 %
Modern intensive	94.845		7 %



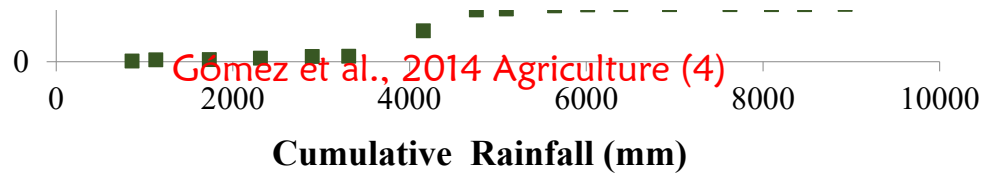
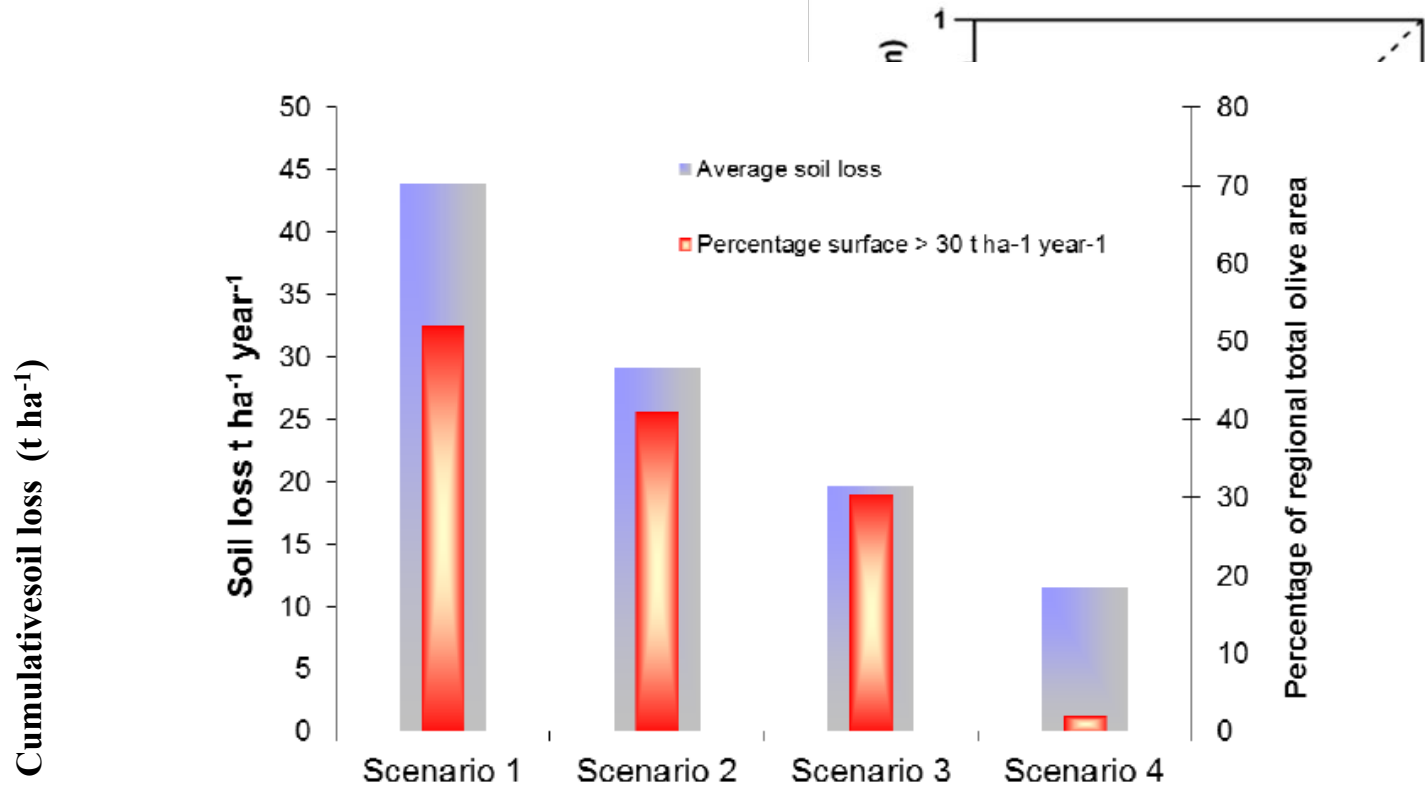
S-2: Background



Water erosion

- 1- Nice conditions for accelerated erosion.
- 2- Identified in numerous studies field studies, as well as modelling analysis at regional scale.
- 3- Attempted to be addressed through changes in soil management.

Water erosion



Vanwallegem et al. 2011 (Agriculture) Fig 22-2252





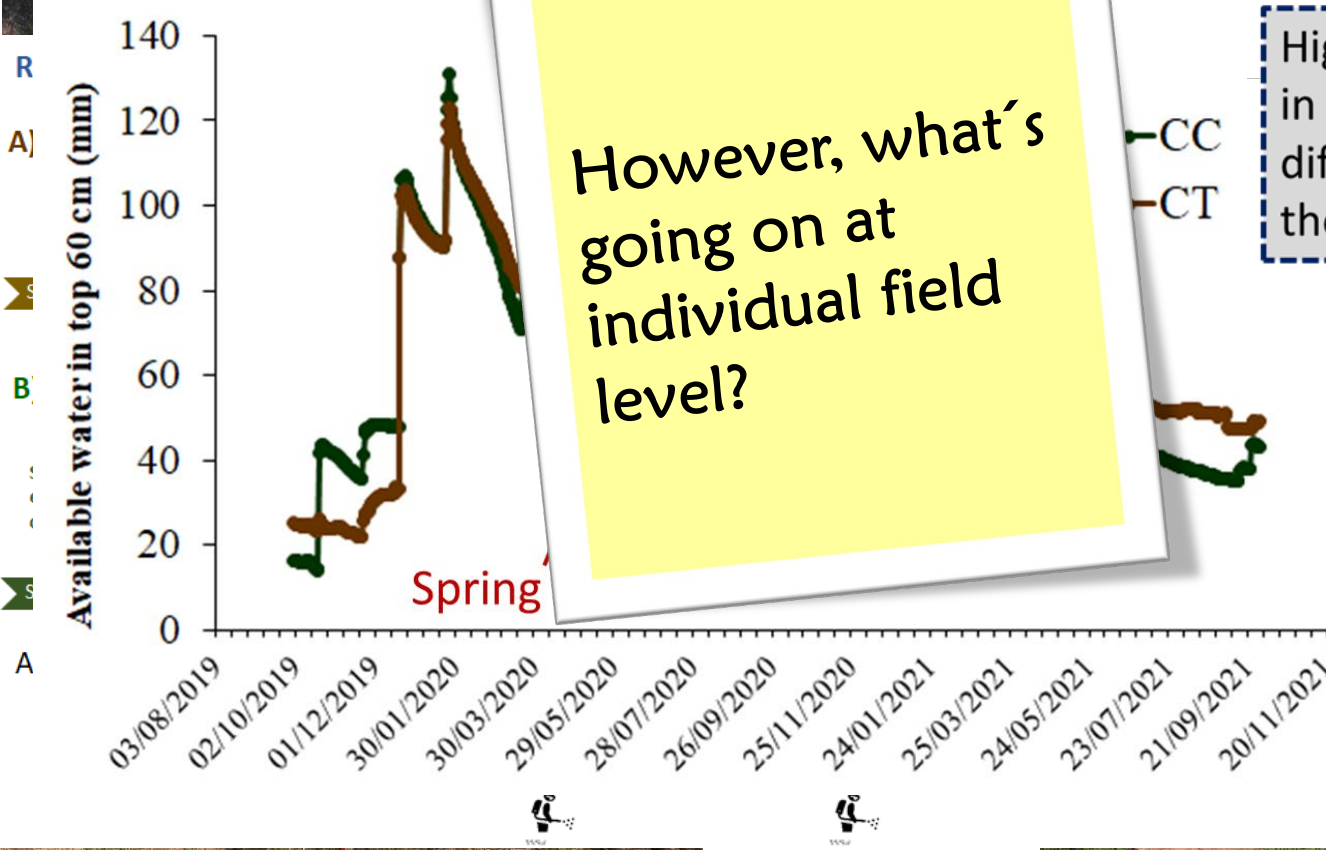
Soil management

- 1- Shift from bare soil management into temporary cover crop (temporary due to prevent competition for soil water).
- 2- Combined with mulch of chopped pruning residues.

Soil management

1- Early fall

2- Fall



Higher water (not much) in some rainy period, differences (CC < CT) after the onset of Spring

May Jun Jul Aug

Mowing cover crop Senescence of cover crop Cleaning of weeds in tree line

May Jun Jul Aug

Cleaning of weeds in tree line

4- Late Spring-Summer

3- Winter

D.O.P. Estepa



<https://www.doestepa.com>

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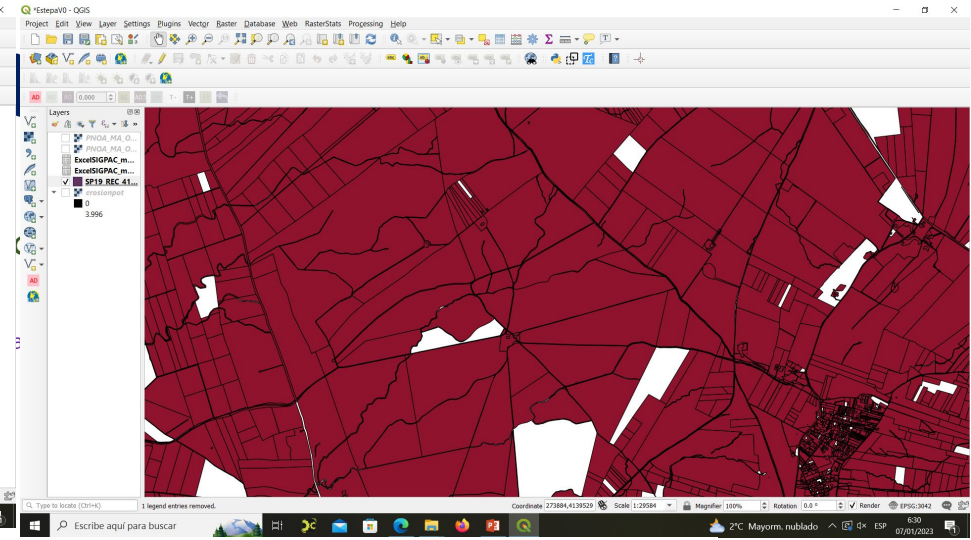
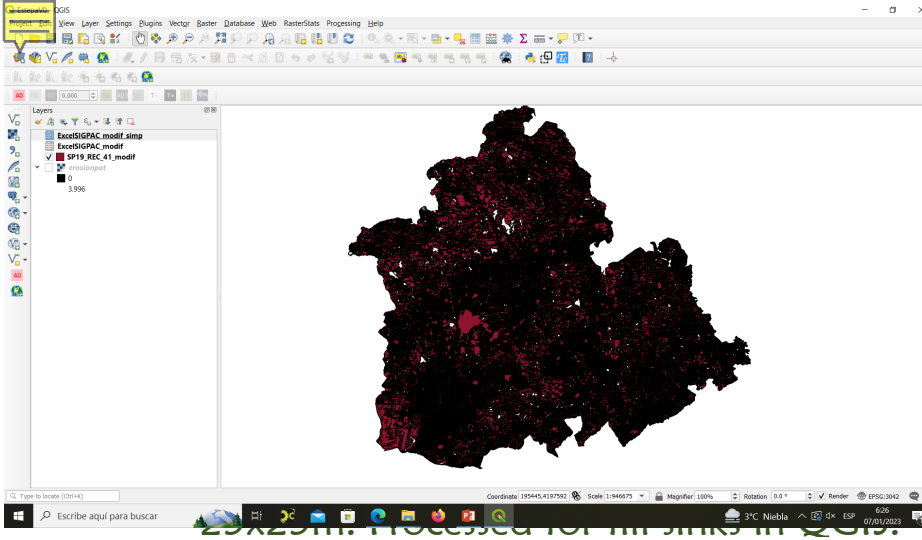
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lquivir River Valley (0.82 Mha).



Steps

- 1- Appraisal of soil management by interviews.
- 2- Build GIS for RUSLE implementation for public information and free GIS software.
- 3- Evaluation of management based on Sentinel images.
- 4- Appraisal of erosion at parcel level.
- 5- Discussion with stakeholders.



SP19_REC_41_modif :: Features Total: 519769, Filtered: 492813, Selected: 0

ID_RECINTO	CD_PROV	CD_MUN	CD_POL	CD_PARCELA	CD_RECINTO	CD_USO	NU_AREA	PC_PASTOS	COEF_REG	PDTE_MEDIA	INCIDENCIA	REGION	GC	VER
1	30666889	41	1	1	12	4 FY	723.48		0	1.6886	207,678	2001	TCR	SP19_1
2	30666893	41	1	1	13	4 ED	57.36		0	1.5935	207,678			SP19_1
3	30666897	41	1	1	14	2 IM	2126.12		0	1.4331	207,678			SP19_1
4	30665981	41	1	1	15	1 PS	79.17	0.00	0	2.4478	207	0203	PT	SP19_1
5	30666898	41	1	1	16	1 FY	3480.48		100	1.1561	207,678	1802	CP	SP19_1
6	30666900	41	1	1	16	3 TH	12306.26		100	2.5035	12,207	2001	TCR	SP19_1
7	30666662	41	1	1	19	1 IM	706.87		0	3.1389	207,678			SP19_1
8	32394772	41	1	1	4	2 OV	10026.94		100	7.5387	207,1005	1802	CP	SP19_1
9	30667168	41	1	1	10	3 OV	5023.47		0	6.0560	207,678	1802	CP	SP19_1
10	30667169	41	1	1	10	4 OV	658.95		0	0.9187	207,678	1802	CP	SP19_1
11	33718557	41	1	1	5	1 IM	1848.14		0	1.5299	207,678			SP19_1
12	33718558	41	1	1	5	2 OV	4281.52		0	1.4047	207,678	1802	CP	SP19_1
13	33718559	41	1	1	13	2 OV	2601.89		0	1.6643	207,678	1802	CP	SP19_1
14	33718560	41	1	1	13	3 IM	1766.94		0	1.8404	207,678			SP19_1
15	33718561	41	1	1	13	6 TA	203.64		0	1.5966	207,678	1101	TCS	SP19_1
16	33718562	41	1	1	13	7 OV	395.54		0	2.1664	207,678	1802	CP	SP19_1
17	30666660	41	1	1	16	2 IM	1753.17		0	1.5953	207,678			SP19_1
18	30666658	41	1	1	18	2 FY	3106.66		0	0.9700	207	1802	CP	SP19_1
19	30666661	41	1	1	18	4 IM	3202.46		0	1.8804	207,678			SP19_1
20	30666602	41	1	1	17	1 TA	29065.59		0	2.4626	12,207	1101	TCS	SP19_1
21	30665979	41	1	1	1	1 TA	2410.36		0	7.7657	11,207	1101	TCS	SP19_1
22	30666830	41	1	1	2	1 IM	2361.61		0	8.2813	207,678			SP19_1
23	30666832	41	1	1	2	2 TA	11681.72		0	6.3521	11,12,207,678	1101	TCS	SP19_1
24	30666828	41	1	1	2	3 OV	3782.92		100	13.9858	207,678	1101	TCS	SP19_1

LS → Raster based

Soils: Soil regio raste

<https://p.geodiv>

K → From so et al. (1997) (2004).

R → Annual, regional reposi



Red de Información Ambiental de Andalucía - Portal Ambiental de Andalucía (www.ambiental.org)

S-3: Methods

<https://view.genial.ly/62a62befd0647f0018eba865/guide-qgis>





Soil cover and Management

- 1- Interviews provided an overall analysis.
- 2- We calibrated a C values based on orchard and features of each management.
- 3- We identified if bare soil or temporary cover crop was used from Sentinel-2 L2 images based on differences in EVI between summer and winter, with threshold calibrated locally.

Soil cover and Management

Introduction

Basic instructions

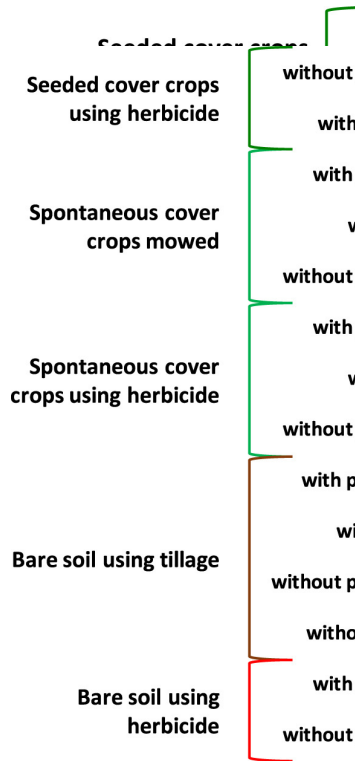
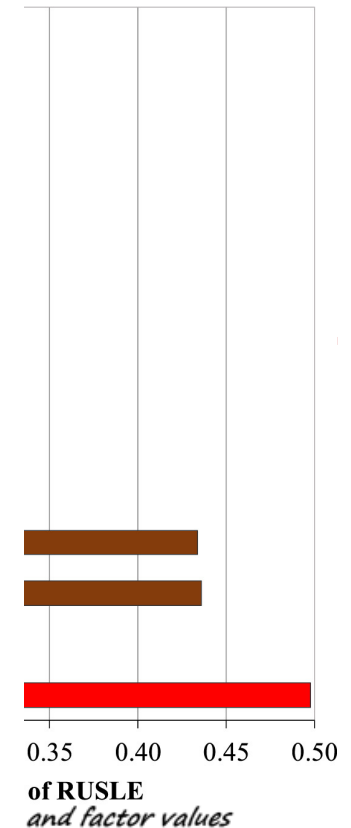


Table 4

Comparison of differences in the vegetation index in winter minus the same index in summer using a Kruskal-Wallis for the calibration exercise with images from 21-II-2019 (winter) vs. 18-VII-2018 (summer): (a) Considering three kinds of lane cover; (b) Considering two kinds of lane cover. *NDVI* is normalized difference vegetation index. *GCI* is green chlorophyll index. *EVI* is enhanced vegetation index.

(a)		Index	Management	Average rank	H	P
NDVI	without		Bare soil	12.67	11.290	0.004
	with		Partial cover crop	16.25		
	with		Total cover crop	26.58		
GCI	without		Bare soil	13.58	6.146	0.046
	with		Partial cover crop	17.75		
	with		Total cover crop	24.17		
EVI	without p		Bare soil	9.08	21.632	0.000
	with		Partial cover crop	17.42		
	with		Total cover crop	29.00		
(b)						
NDVI	with		Bare soil	22.83	3.050	0.081
	without		Cover crop	16.33		
GCI	with		Bare soil	23.33	1.155	0.283
	without		Cover crop	16.08		
EVI	with		Bare soil	21.17	3.794	0.051
	without		Cover crop	17.17		

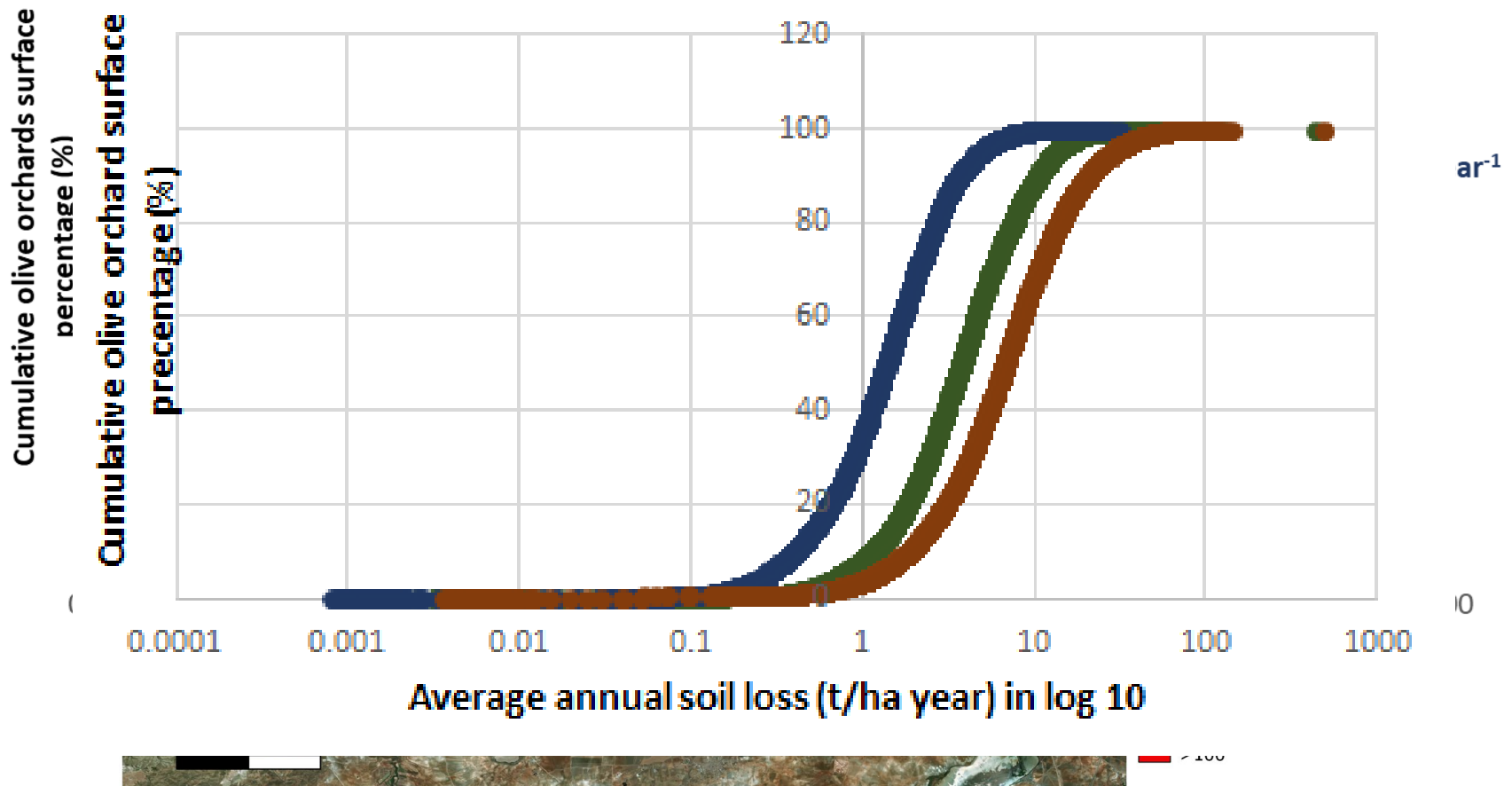


Gómez et al. 2021. Ir

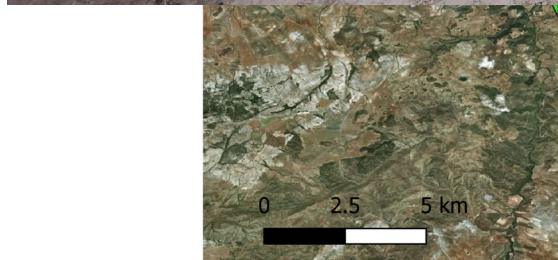
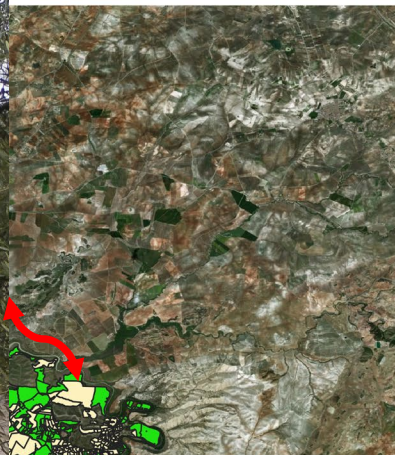
Gómez et al. 2021. Int. Soil and Water Cont. Res. (5)

Guzmán et al. 2022. Land Use Policy (116)

Erosion appraisal at plot level



level



S-4: Results



Main ideas

- 1- It is relatively straightforward to build a geospatial database for RUSLE based erosion appraisal (and other uses) for/by stakeholders across EU countries.
- 2- Identification of soil cover and management is a key element only partially solved using remote sensing.
- 3- In its current form proven useful to stakeholders.
- 4- Major obstacle for erosion control implementation of cover crops on difficult conditions (climate, degraded soils, rabbit pressure, ...).



On-going actions

- 1- Validation at field scale using a standardized methodology based on erosion symptoms.
- 2- Incorporation of different algorithms for LS determination.
- 3- Development of an app for visualization and updating field information (not only for erosion) by technicians.
- 4- Exploratory analysis of new generation satellite images (0.3 m res, with 3D capabilities) for best appraising orchard characteristics and management.



Thanks for your attention! 😊

