Monitoring and Estimating Soil Loss - Case Studies in Chania, Crete

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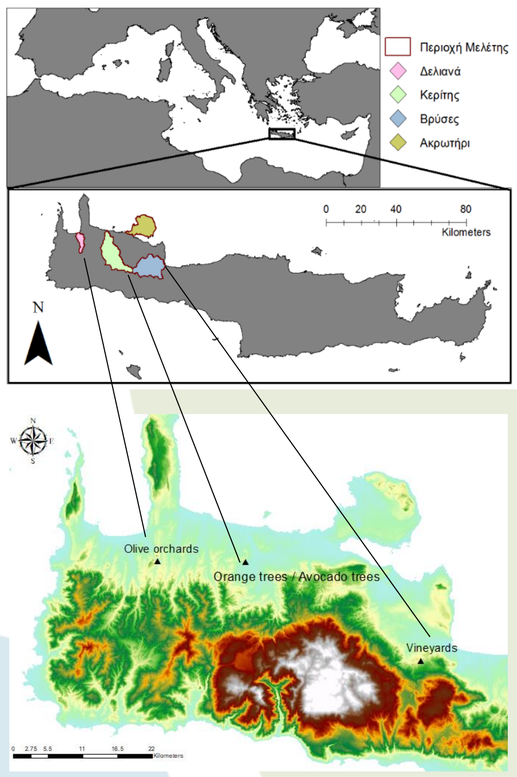
Abstract: The impacts of agricultural practices, land use, and vegetation cover on the erosion processes quantity are assessed in three monitoring study sites: Koufos (Oranges/Avocados), Alikambos (Vines), Astrikas (Olives), in Western Crete. Soil loss (erosion/deposition) amount is identified for the aforementioned study crops by implementing three different methodologies: A. Sediment traps (All sites); B. Cross sections measurement (Alikambos and Astri-kas) and C. Soil deposition reference sticks (Alikambos and Koufos). Therefore, three advanced Soil Improving Cropping System (SICS) treatments are implemented and tested:



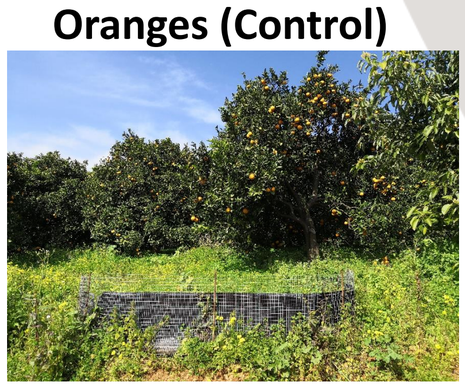
(1) Crop cover treatment (seed with vetch) - Alikambos in vine orchards (Vitis vinifera) in a corporate organic farm of 0.46 ha. Soil erosion rates are compared in the vineyard through Control area (no vetch) and the SICS area, which is tilled and seeded with vetch.

No Vetch (Control)

Vetch (SICS)

(2) Crop switch treatment - Koufos from Orange (Citrus × sinensis -> Persea Americana) (Control) to Avocado orchards (SICS) in a family conventional farm of 0.5 ha. It is a fact that an avocado farm besides financial benefits can also maintain a superior overall soil quality.

Oranges (Control)



Avocados (SICS)

(3) Tilled or non-Tilled treatment - Astrikas in olive orchards (Olea europaea cv. Koroneiki) in an organic farm of 0.29 ha. Soil erosion rates are compared between two 24-year old fields with loam soil, one area no tilled (Control area) and an other twice tilled within SOILCARE project (November 2017 and May 2019) (SICS area).

No Tilled (Control)

Tilled (SICS)

Total soil loss by Erosion–Deposition (ER) equation:

$$ED = \frac{VOL * BD}{TA}$$

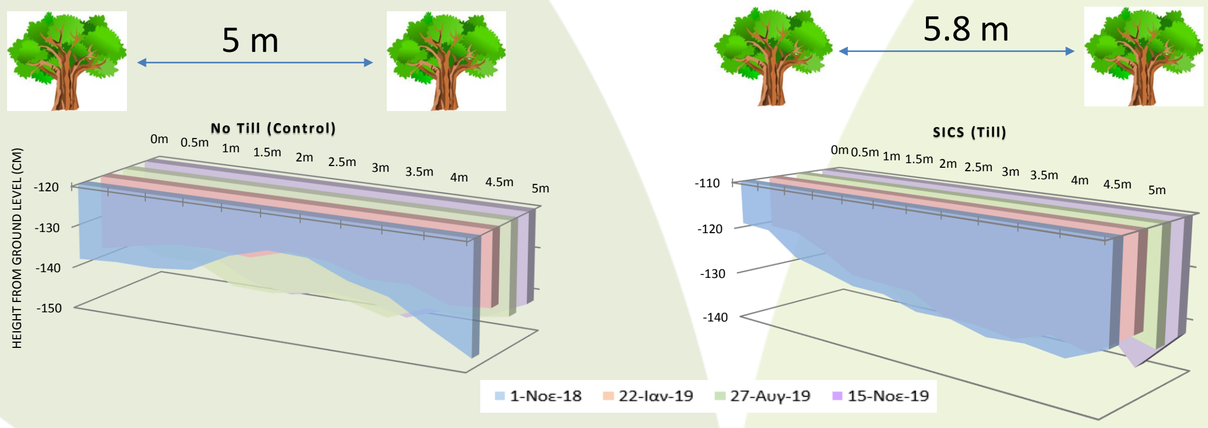
VOL: the volume (m³),
BD: bulk density (kg/m³),
TA: total effective area (ha)

Field estimated bulk densities kg/m³	Control	SICS
Astrikas	1195	1255
Alikambos	900	930
Koufos	1130	710

A. Sediment traps (Koufos) – Extreme rainfall event 26/10/2017 → more than 2 kg of soil within the fences area of 3 m² → ~ **7** tn/ha

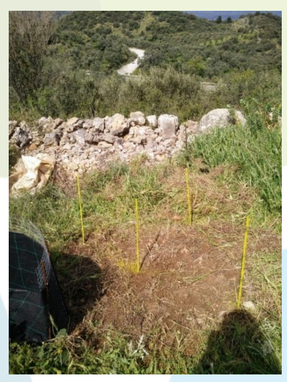
B. Cross Sections Measurements (Astrikas)

Any uncertainty on the soil loss estimates will be faced by performing more dense field campaigns measurements in the future, especially after the appearance of extreme hydro-meteorological events.



C. Soil Sticks (Alikambos)

Soil erosion rate assessment



Alikambos soil rates through Soil Sticks		
Erosion/Deposition (tn/ha)	CONTROL	SICS
16 Jan 19 to 19 Mar 19	3.861	4.447
19 Mar 19 to 30 Aug 19	-3.192	-2.425
30 Aug 19 to 20 Nov 19	2.736	-5.255

Astrikas soil rates through Cross Sections		
Erosion/Deposition (tn/ha)	CONTROL	SICS
01 Nov 18 to 22 Jan 19	-2.209	3.336
22J an 19 to 27 Aug19	15.662	5.884
27 Aug 19 to 15 Nov 19	3.187	-0.425

Conclusions: Accurate estimation of soil erosion rates (tn/ha) have been derived as absolute vales of erosion/deposition as follows: Vineyards (Control) range from 2.68 to 16.41 tn/ha. Vineyards (SICS) range from 1.64 to 13.46 tn/ha. Olives (Control) range from 2.21 to 15.66 tn/ha. Olives (SICS) range from 0.43 to 5.8 tn/ha. Oranges (Control) range from 2.63 to 10.05 tn/ha. Avocado (SICS) range from 2.24 to 8.95 tn/ha.

In all study sites the application of SICS seem to have an alleviating role in soil loss processes. The recommended SICS techniques have been successfully tested for their potential to improve soil quality and mitigate soil loss. It is, therefore, recommended to raise farmers' awareness about the effectiveness of the practices in order to confront the devastating consequences of soil degradation. Emphasis should be given on the yield advantages of crop change into avocado orchards, for which soil erosion has not been yet measured, however, this kind of plantation seems to be a sustainable alternative that preserves soil health too.

The **SOILCARE** project is a 5 year project aimed at identifying and evaluating promising soil improving cropping systems and agronomic techniques increasing profitability and sustainability across scales in Europe.

The SOILCARE project consortium consist of 28 partner institutes from 10 European countries
The SOILCARE project is coordinated by ALTERRA, Wageningen UR, The Netherlands.

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