

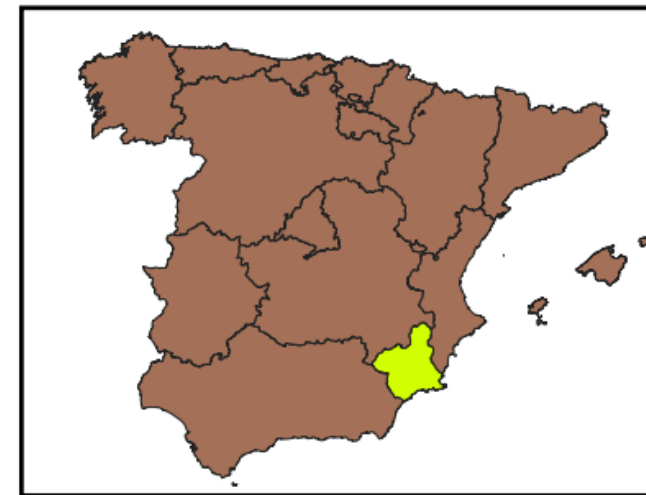
From natural land to irrigated crops: impact of land use change and crop diversification on interrill erosion

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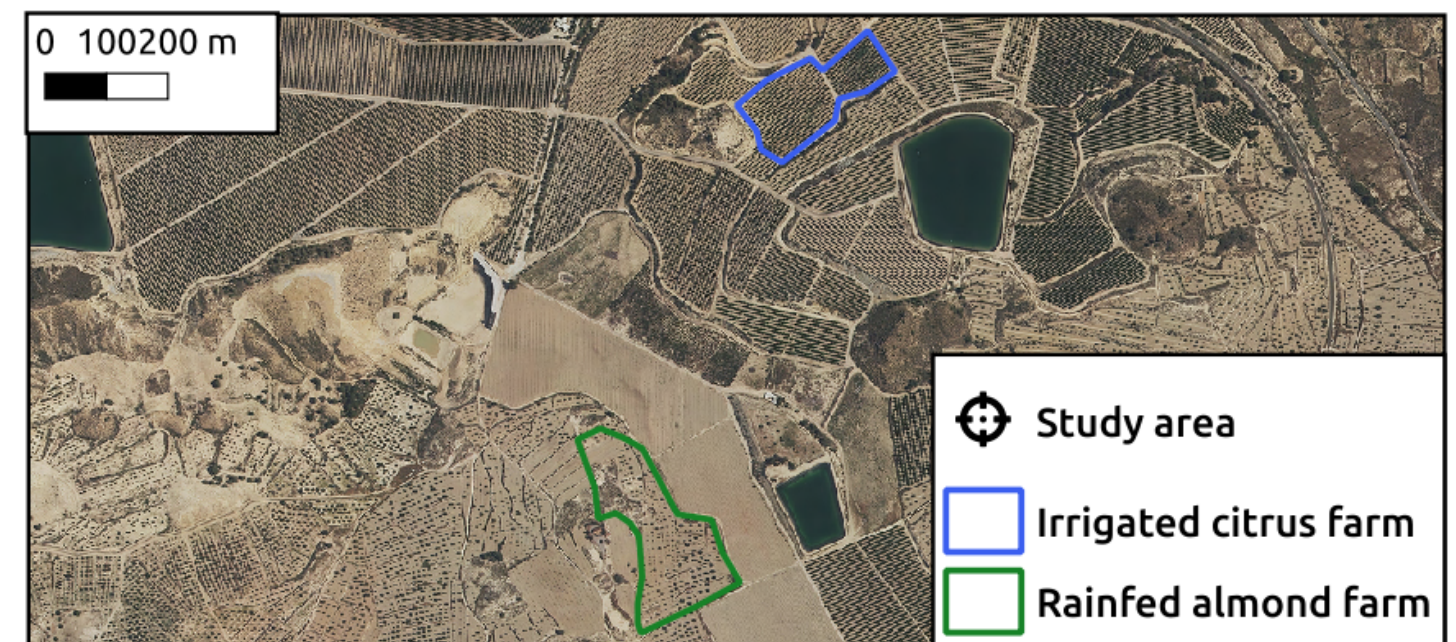
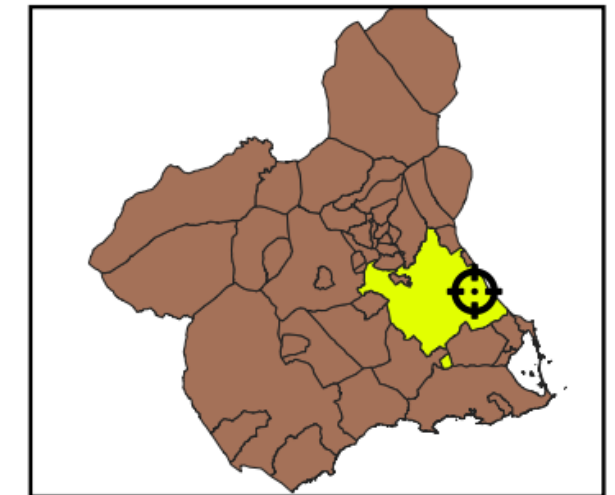
Soil erosion is one of the most important processes of **soil degradation**. Especially vulnerable to soil erosion are many **agricultural systems of SE Spain** which are being **transformed** from a **rainfed to irrigated** agriculture. We hypothesized that **crop diversification** can be an excellent measure to **reduce soil erosion** and to **generate multiple benefits** for ecosystems.

We assessed, during **14 months**, **interrill soil erosion rates** and **processes** along an intensification gradient including three land uses (**natural shrubland, rainfed crops and irrigated crops**), in a **semiarid area of SE Spain (Murcia Region)**. Moreover, in rainfed and irrigated areas, **different crop diversifications** were applied to **evaluate their effects on interrill or sheet erosion**.

Spain



Murcia Region



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Study area

Study area is located in **two farms** near to each other and with the **same characteristics** (lithology, soils, climate, same past land use). One of them is a **rainfed almond crop** (*Prunus dulcis* Mill.) in terraces. The **natural shrubland** in rainfed farm was also included for this study. The other one is a **irrigated citrus crop** (*Citrus reticulata* Blanco) with street-ridge morphology (see pictures below).

Experimental design

The experimental design (see experimental set up in the picture to the right) included **two diversification schemes**. In the **rainfed almond area**: intercropping with **caper** (*Capparis spinosa*) and with **thyme** (*Thymus hyemalis*). While in the **citrus irrigated area** a rotation with **barley** (*Hordeum vulgare*) and **vetch** (*Vicia sativa*) (from February to July) or **faba bean** (*Vicia faba*) (from October to January) were intercropped in the **streets**. Some **ridges** were kept **bare** and another covered with **natural vegetation**.

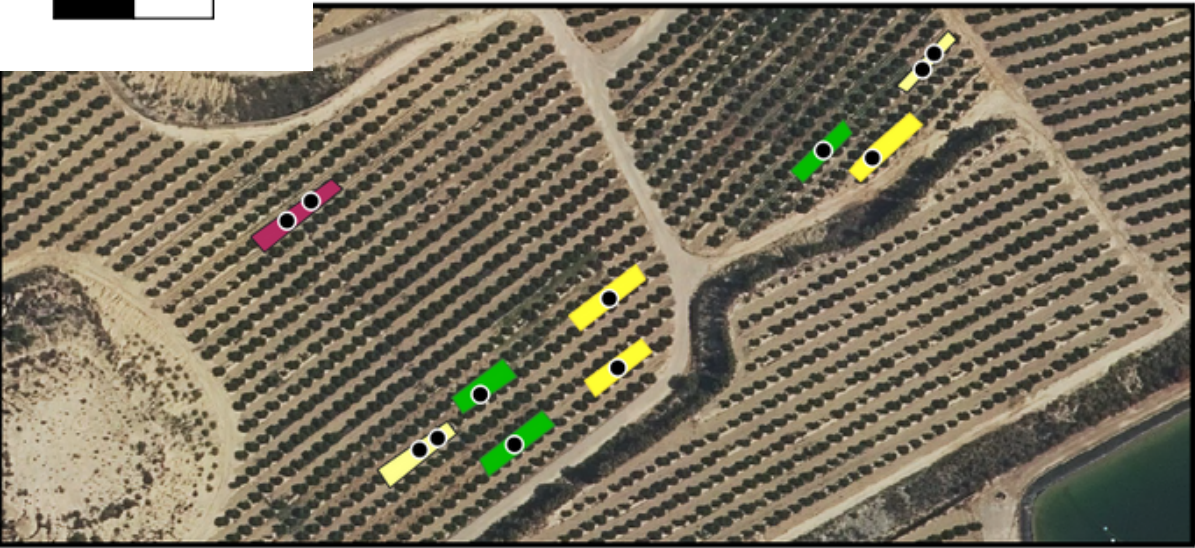
To **measure erosion**, **pins plots** of 1 m2, with **9 erosion pins each**, were **set up**. In the **rainfed farm 23 pins plots (207 pins)** and in the **irrigated area 12 pins plots (108 pins)** were set up (see the picture above right). Pins were measured after **each erosion event** and/or **each month**, identifying **detachment** (positive values) and **sedimentation** (negative values), **by comparing posterior** and **initial height** of each pin.

Pin plot (click on image to see better)



Rainfed farm

- pins plot
- Natural shrubland
- Control
- Caper
- Thyme



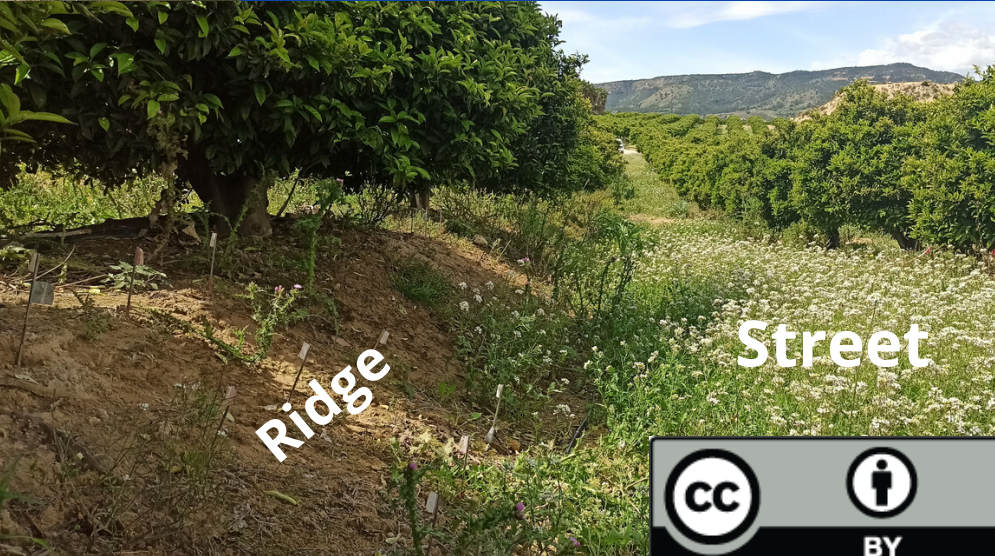
Irrigated farm

- pins plot
- Bare ridge
- Covered ridge
- Bare street
- Covered street

Rainfed farm



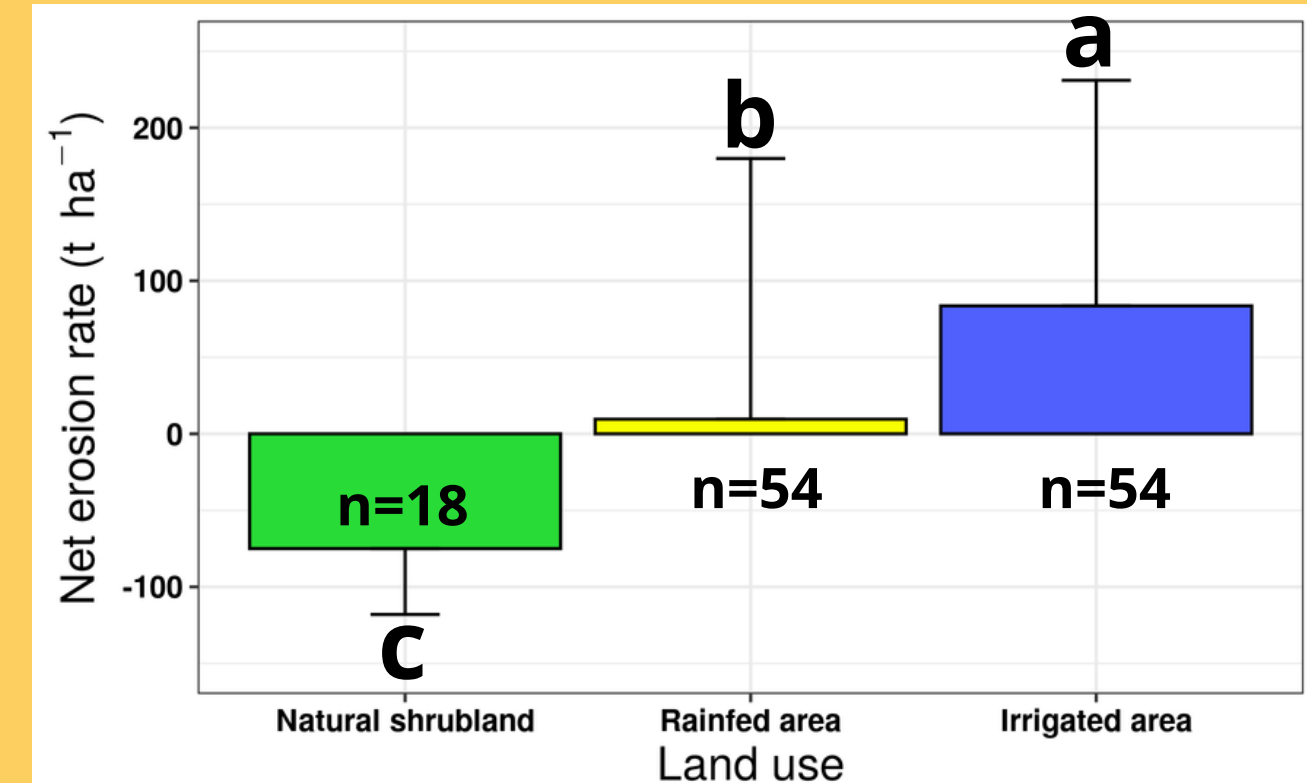
Irrigated farm



LAND USE, RAINFED INTERCROPPING AND NET EROSION RATE

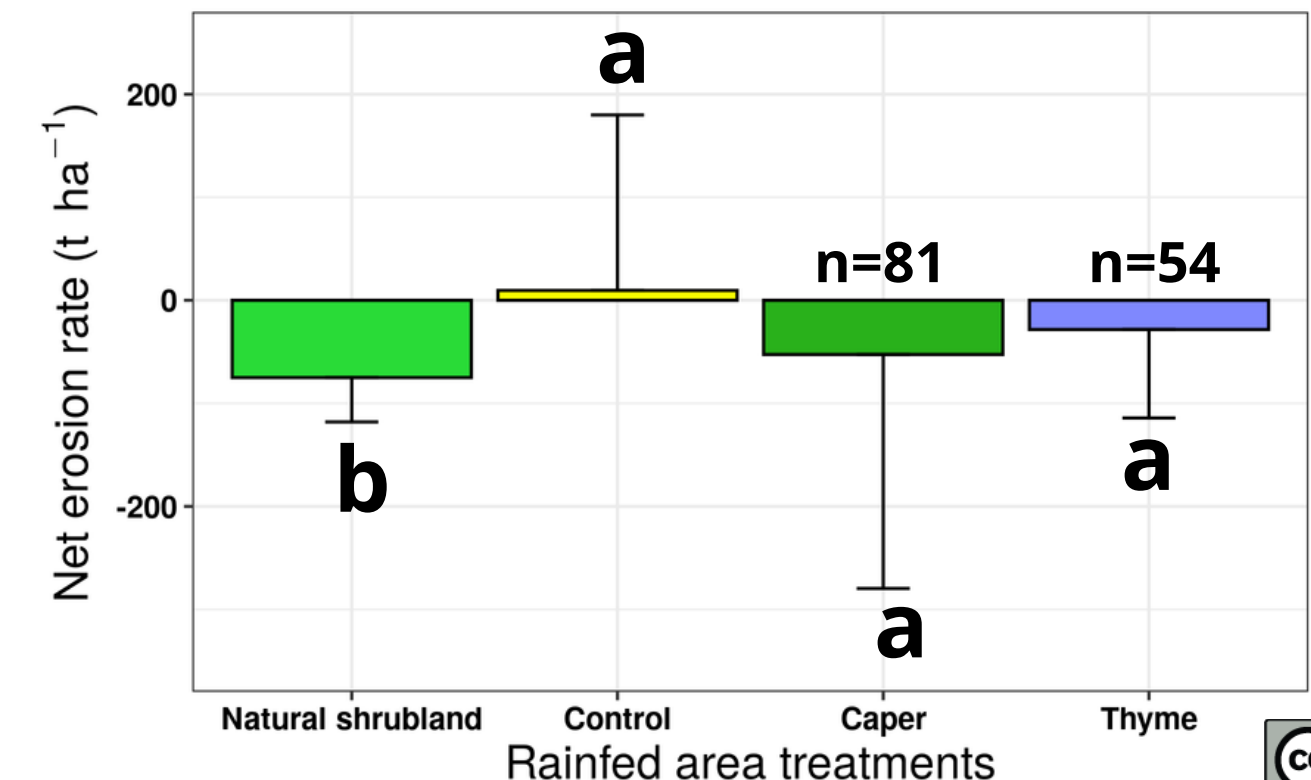
The shrubland area acts as a sediment sink, due to this we found negative net erosion rates ($-74,97 \pm 43,08 \text{ t ha}^{-1}$). Those were statistically different from the net erosion rates in the rainfed almond ($9,59 \pm 170,34 \text{ t ha}^{-1}$) where erosion processes were dominant (see right graph).

Land use conversion from rainfed to irrigated area increased significantly net erosion rates ($83,6 \pm 147,4 \text{ t ha}^{-1}$) (see right graph).

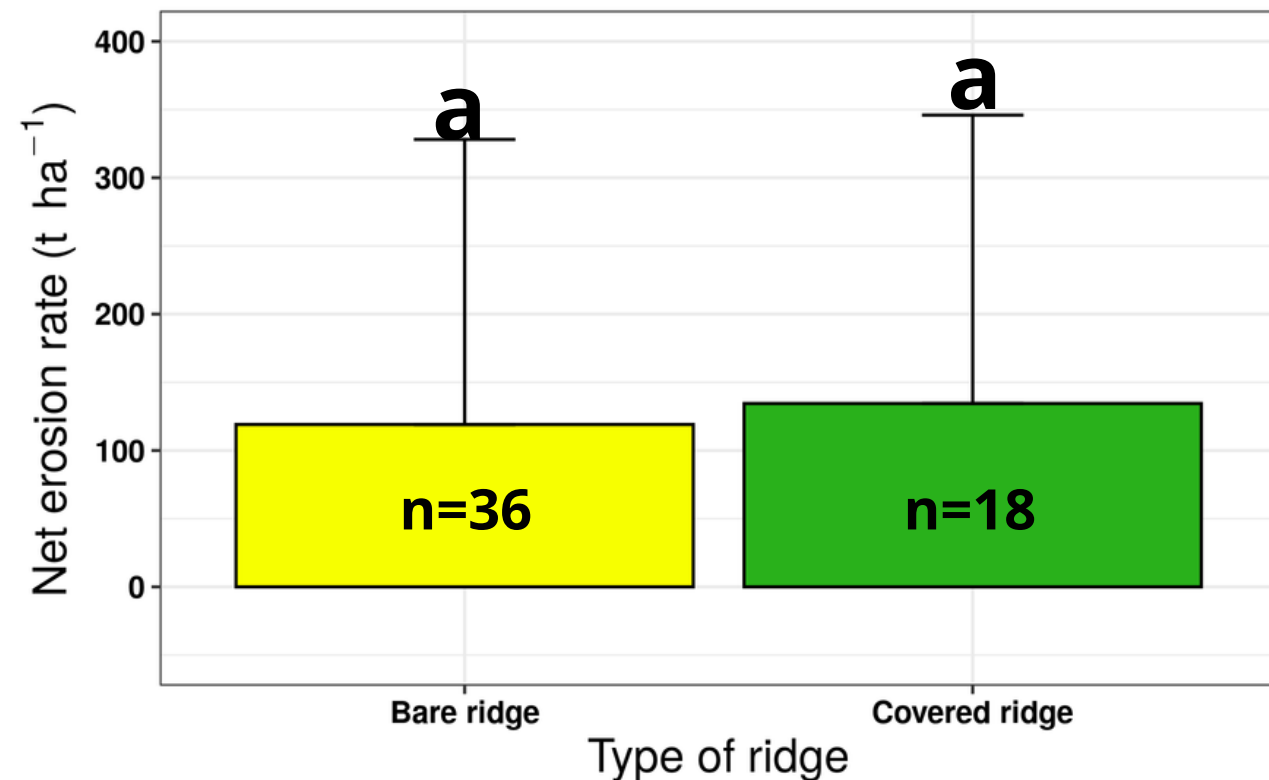


Natural shrubland showed lower net erosion rate than the other treatments (Control, Caper ($-52,56 \pm 227,09 \text{ t ha}^{-1}$) and Thyme ($-28,29 \pm 85,94 \text{ t ha}^{-1}$) (see right graph).

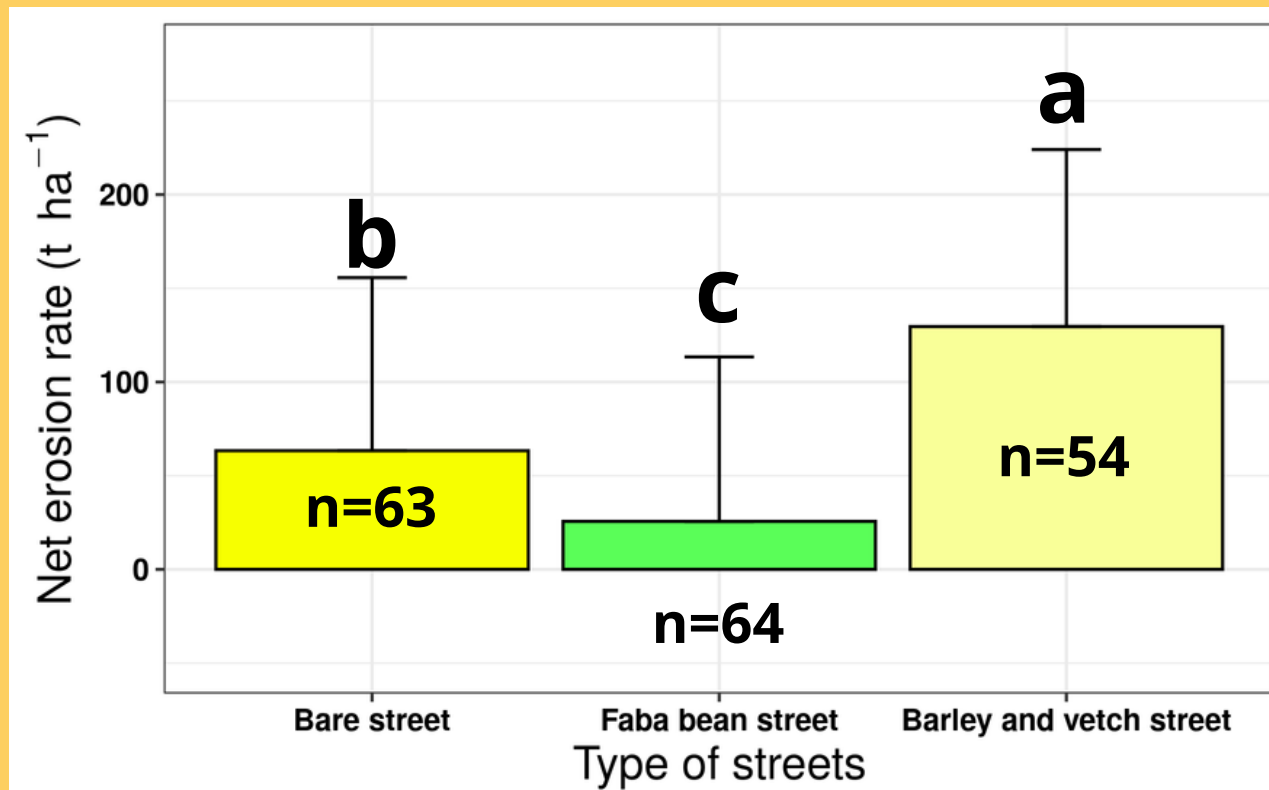
Control, Caper and Thyme intercropping, were not statistically different, but both intercrops showed similar negative mean net erosion rates values, which means sedimentation, in contrast with Control (with a mean positive value) (see right graph).



IRRIGATED INTERCROPPING AND NET EROSION RATE



So far, in the irrigated area with a street-ridge morphology no statistical differences between net erosion rates of bare and covered ridges were observed (119,04 ± 209,05 t ha⁻¹ vs 134,47 ± 211,47 t ha⁻¹, respectively) (see left graph).



On the street areas, bare streets showed higher net erosion rates (63,32 ± 92,35 t ha⁻¹) than streets with faba bean (25,61 ± 87,77 t ha⁻¹), but lower erosion rates than streets with barley and vetch (129,58 ± 94,43 t ha⁻¹) (see left graph).

There was a clear difference between net erosion rate of faba bean streets and barley and vetch streets. In fact, mean net erosion rate in the latter was almost six times higher. More rotation cycles of faba bean and barley and vetch are needed to have a better data representation.

CONCLUSIONS

- 1 Natural shrubland and traditional terraced rainfed crop systems are effective systems for soil conservation.
- 2 The conversion from rainfed to irrigated crops meant a significant increase of erosion rates due to the fact that the latter does not facilitate retention of detached soils.
- 3 Intercropping of Caper and Thyme between rainfed almonds induced sedimentation processes while in control areas (no intercropping) erosion processes were dominant.
- 4 At the irrigated area, maintenance of vegetation cover on ridges has no yet effect over net erosion rate.
- 5 At the irrigated area, streets with faba bean showed lower net erosion rate, while the higher one was observed at the barley and vetch streets.
- 6 A longer experimentation period is needed to determine better the effect of crop diversifications on soil erosion

Acknowledgements. This work has been carried out within the framework of the H2020-RUR-2016-2017 project, Diverfarming 728003. We would like to thank Miguel Martínez from the Escuderos farm and Vicente Valero from the Canteras farm for their support, collaboration and facilitation of the field work.



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