Statistical evaluation of Agricultural terraces control on soil erosion

Pascal Breil, Arnaud Cerbelaud, Gwendoline Blanchet, Laure Roupioz, Xavier Briottet

HAL Id: hal-03822040
https://hal.inrae.fr/hal-03822040

Submitted on 20 Oct 2022

Session on Erosion Mitigation & Management Practices

P.Breil; A.Cerbelaud; L.Roupioz; G.Blanchet; X.Briottet
contact : pascal.breil@inrae.fr

#EUsoil

30 september 2021
Storm « Alex »

ONLINE WORKSHOP ON
SOIL EROSION FOR THE EU   20 – 22 JUNE 2022 | JRC Ispra

European Commission
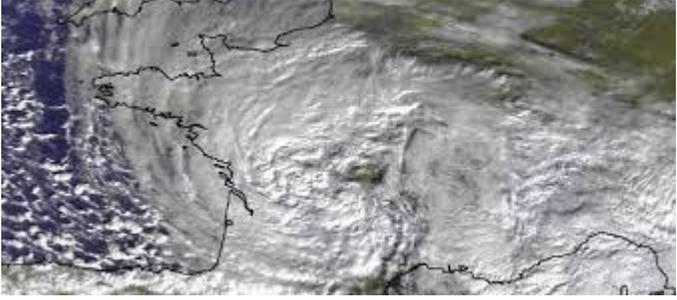
Working hypothesis : Do agricultural terraces have a mitigating role on the erosive effect of heavy runoff?

With terraces

Without terraces

3. Supervised classification methods for automatic damage detection caused by heavy rainfall using multitemporal high resolution optical imagery and auxiliary data

Cerbelaud A. et al, 2021. https://doi.org/10.5194/isprs-archives-XLIII-B3-2021-693-2021.

- Plot-based supervised classification relying on vector components $(RD^k)_\theta$:
  (i) k-NN algorithm; (ii) Multi-Layer Perceptron neural network; (iii) Gaussian process classifier
- Selection of the most reliable and performing combination of indicators

✓ Most satisfying classifications obtained with a Gaussian process classifier
  ➤ 89% OA with less than 13% false discoveries with : $(RD^{NDVI})_{sdev}$ and $(RD^{SAVI})_{mean}$ or $(RD^{NDWI})_{max}$
✓ Processing of the entire 1 150 km^2 area to produce maps displaying probability of damage classification
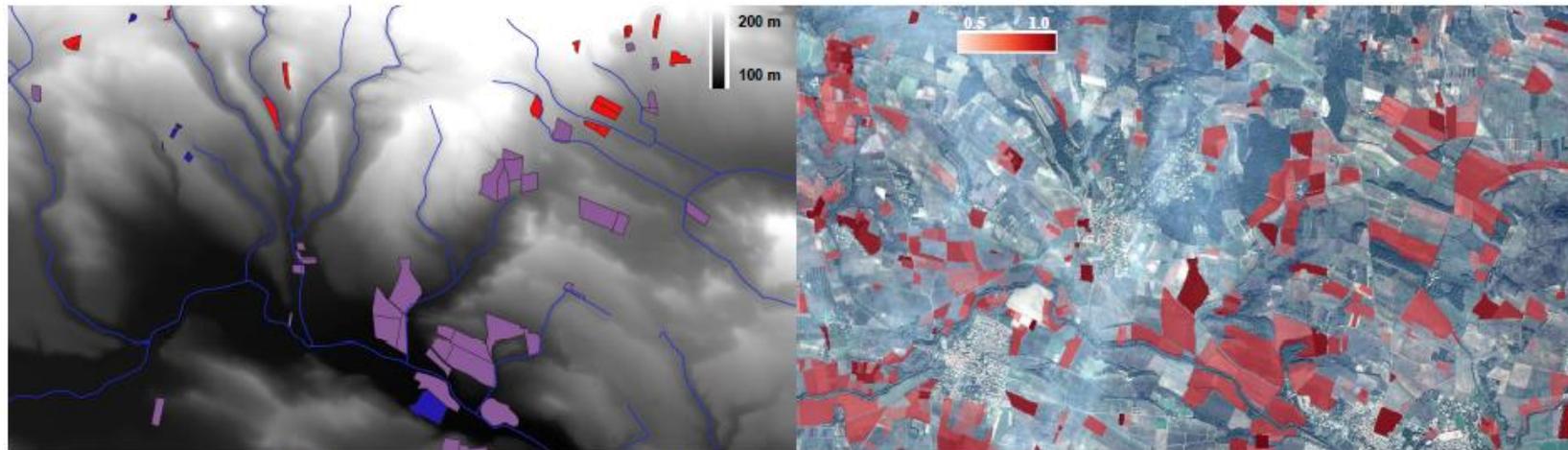
(a) *DGT* training (red), *DPI* validation (purple) and *UDPI* learning and validation (blue) plots over elevation map and stream network

(b) Probability of damage classification on land cadastre plots as detected by the classifier over *Pléiades* image

**Figure 8.** Close-up from the NW of Carcassonne after the 2018 floodings.

Method

Filtering of "agricultural" plots having received more than 47 mm of rain in 1 hour → 1362 plots selected

Rain radar data

% DOMINANT LAND USES

- urban diffuse 6%
- hardwood forest 33%
- coniferous forest 10%
- grassland 51%

Légende

OSO20m_Vesubie
- winter cultivation
- hardwood forest
- coniferous forest
- lawns
- woody moors
- dense urban
- urban diffuse
- ind. & com. zones
- road surfaces
- mineral surfaces
- beaches and dunes
- water
- glaciers or snow
- meadows
- orchards
- vines
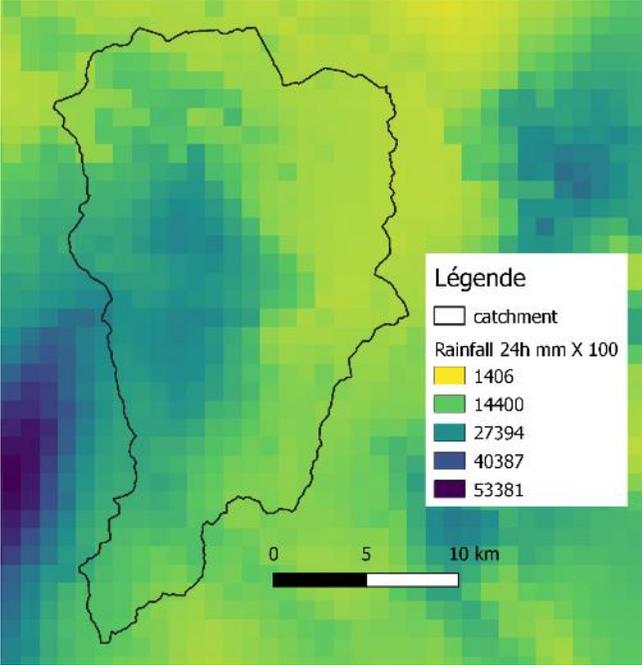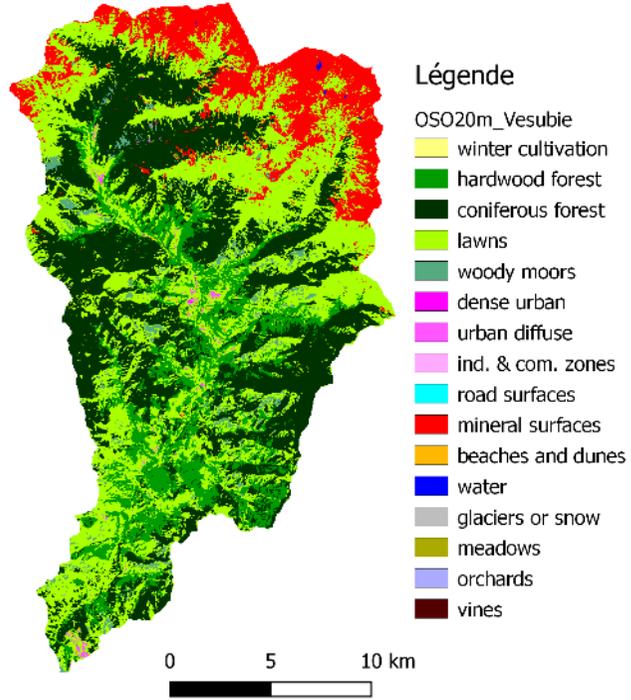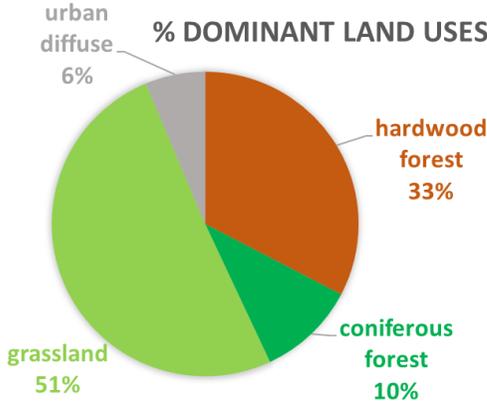
Land use data (Pleiade data – 2017 – OSO)

ONLINE WORKSHOP ON

SOIL EROSION FOR THE EU   20 – 22 JUNE 2022 | JRC Ispra

European Commission

# Extraction of "terrace walls" and combination with the probability of damage in agricultural plots.
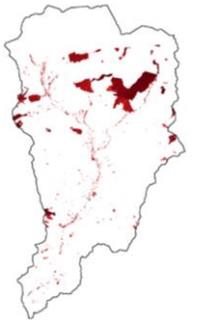
A repeatable change detection approach to map extreme storm-related damages caused by intense surface runoff based on optical and SAR remote sensing: Evidence from three case studies in the South of France

Arnaud Cerbelaud [a, b, c] ⌂ ✉, Laure Roupioz [a], Gwendoline Blanchet [b], Pascal Breil [c], Xavier Briottet [a]
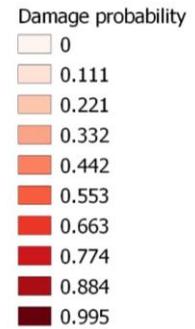
DEM map

Damage probability map

Damage probability
- 0
- 0.111
- 0.221
- 0.332
- 0.442
- 0.553
- 0.663
- 0.774
- 0.884
- 0.995

ONLINE WORKSHOP ON
SOIL EROSION FOR THE EU   20 – 22 JUNE 2022 | JRC Ispra

European Commission

Do agricultural terraces have a mitigating role on the erosive effect of heavy runoff?

ONLINE WORKSHOP ON

SOIL EROSION FOR THE EU   20 – 22 JUNE 2022 | JRC Ispra

European Commission
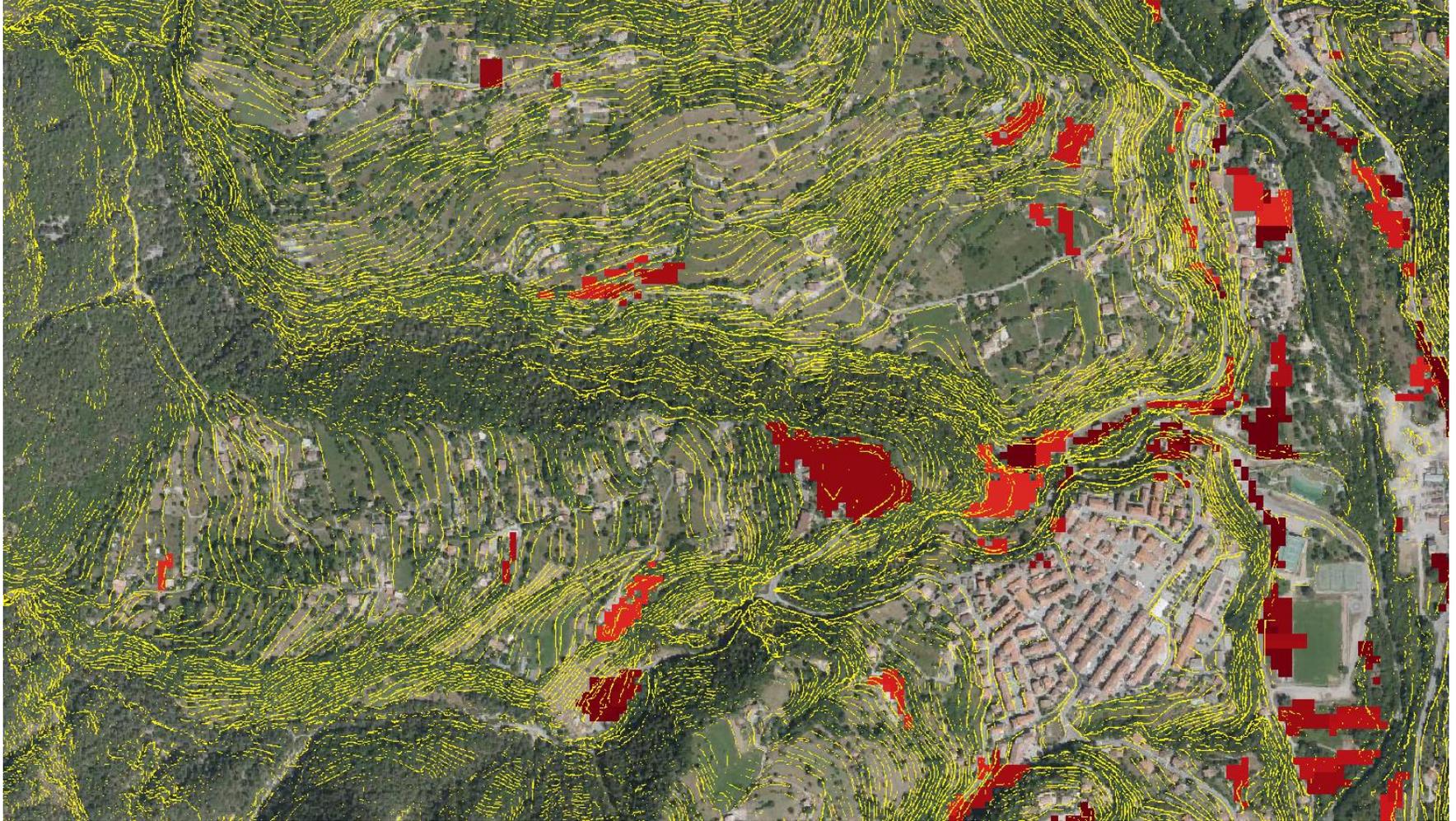
Do agricultural terraces have a mitigating role on the erosive effect of heavy runoff? … First results

Quantile distribution of terraces according to the probability of damage.
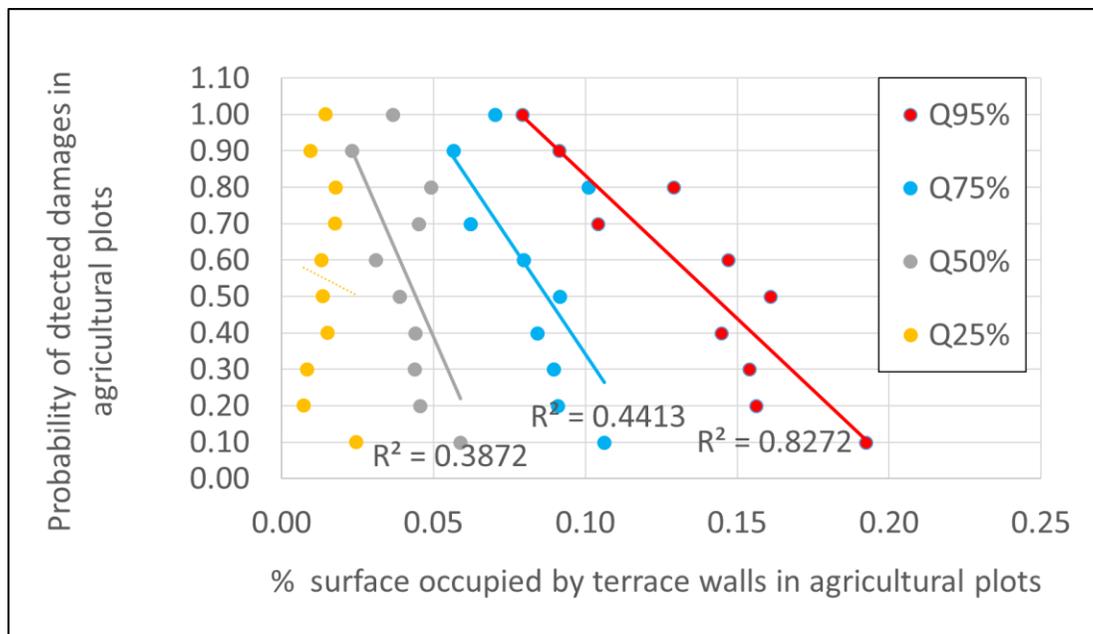
		% terrace wall	
		<= 0.1	> 0.1
% prob.	<= 0.5		
Damages	> 0.5		

Confusion matrix Khi2 test

Observed distribution				Theorical distribution				Relative difference		
	<= 0.1	> 0.1			<= 0.1	> 0.1			<= 0.1	> 0.1
<= 0.5	920	261	1181	<= 0.5	934	247	1181	<= 0.5	-0.01	0.06
> 0.5	157	24	181	> 0.5	143	38	181	> 0.5	0.10	-0.37
	1077	285	1362		1077	285				
P{KHI2} =	0.006									

Do agricultural terraces have a mitigating role on the erosive effect of heavy runoff?

contact : pascal.breil@inrae.fr

In our case, this effect was statistically confirmed.

Example of hilly farmland without terraces - erosion marks can be seen

ONLINE WORKSHOP ON

SOIL EROSION FOR THE EU   20 – 22 JUNE 2022 | JRC Ispra

European Commission