

Agricultural land abandonment and regulation ecosystem services balance in the Mediterranean area of Spain

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INTRODUCTION

- **Agricultural land abandonment in Spain**
from 20 M a 17 M ha. (1990-2018)
- **Citrus fields in the Valencian Community**
-5,5% in the last 5 years > 9000 ha)

CONSEQUENCES

Social and economic: rural exodus, economic lost,...

Environmental

CONCEPTUAL FRAMEWORK



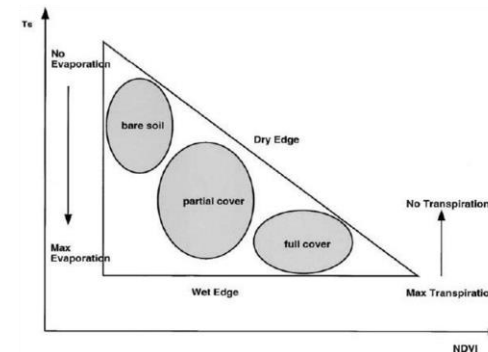
Remote Sensing

- Optimal method for remote environmental assessment
- In this work:
 - TVDI: selection of the study area
 - Direct use of remote sensing products to measure ecosystem services

TVDI – Temperature Vegetation Dryness Index (Sandholt et al, 2002)

$$TVDI = \frac{LST_i + LST_{min}}{a + b \cdot NDVI} - LST_{min}$$

$$TVDI = \frac{LST_i + LST_{min}}{a + b \cdot EVI} - LST_{min}$$



Simplified LST/NDVI space, adapted from Lambin & Ehrlich, (1996)



Land use classification

- Soil classification based on its current and on its potential modification characteristics

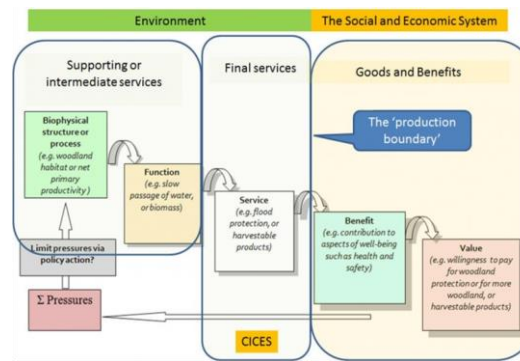


CORINE LAND COVER. 2018



Ecosystem Services

- Classifications: CICES V5.1
- Service types:
 - Provision
 - Regulation
 - Cultural



CICES Guidance Report V5.1

HYPOTHESES AND OBJECTIVES

Hypotheses

The abandonment of the citrus farming activity produces a decrease in the ecosystem services of regulation and maintenance.

Objectives

Primary

- Identify areas of agricultural abandonment based on the use of soil classifications and high values of hydric stress indices.
- Evaluate three regulating ecosystem services in a citrus area that has been abandoned to identify potential losses.

Secondary

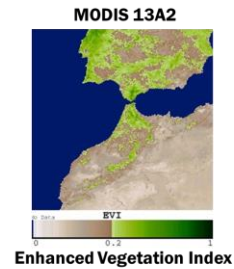
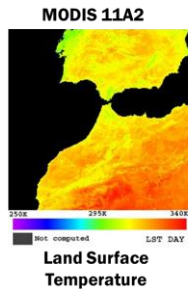
- Identify areas with high water stress in the geographical context of the Valencian Community using remote sensing techniques, using the 2012-2018 period as a base.
- Know the behavior of ecosystem services throughout the study period (losses-recoveries-gains).
- Relate the behavior of ecosystem services with changes in land use in the study area.

MATERIAL AND METHODS

TVDI

2012-2018

TVDI



**LAND
USE**



**CORINE LAND COVER 2012
CORINE LAND COVER 2018
CORINE LAND COVER 2012-2018**

Imagen de la categoría de frutales cítricos para CORINE 2012 en la zona de estudio. Elaboración propia

**Carbon
Sequestration**

Indicator for the global climate regulation ecosystem service

- Estimation mode: net primary production (NPP) of the study area
- Calculation mode: MODIS 17A3 Remote Sensing product

MODIS/Terra Net Primary Production Yearly L4 Global 500 m SIN Grid Expressed in units of kg C/m²

Soil Losses

Indicator for the ecosystem service of soil regulation and stabilization

- Estimation mode: potential soil losses due to erosion in the study area
- Calculation mode: Universal Soil Loss Equation (USLE) (Wischmeier, W.H. and D.D. Smith. 1978)

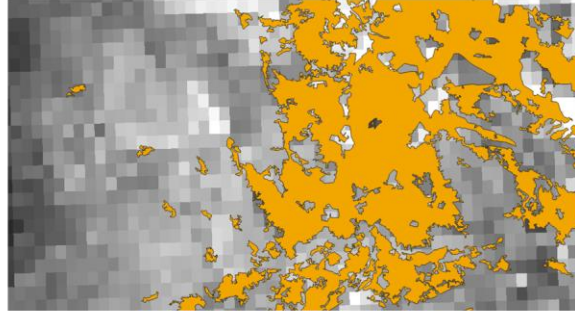
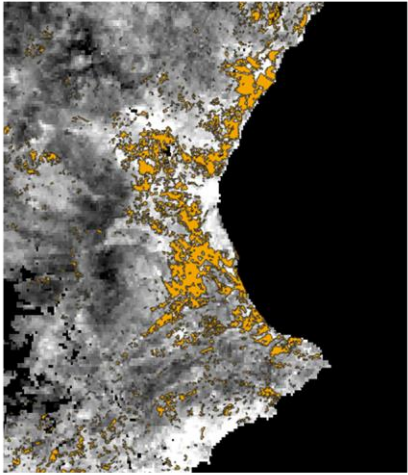
**Pollination
Potential**

Indicator for the ecosystem service regulating pollination and seed dispersal

- Estimation mode: pollination potential of the study area
- Calculation mode: pollination potential estimation equation (Lonsdorf, 2009), based on nesting potential and floral resource

RESULTS

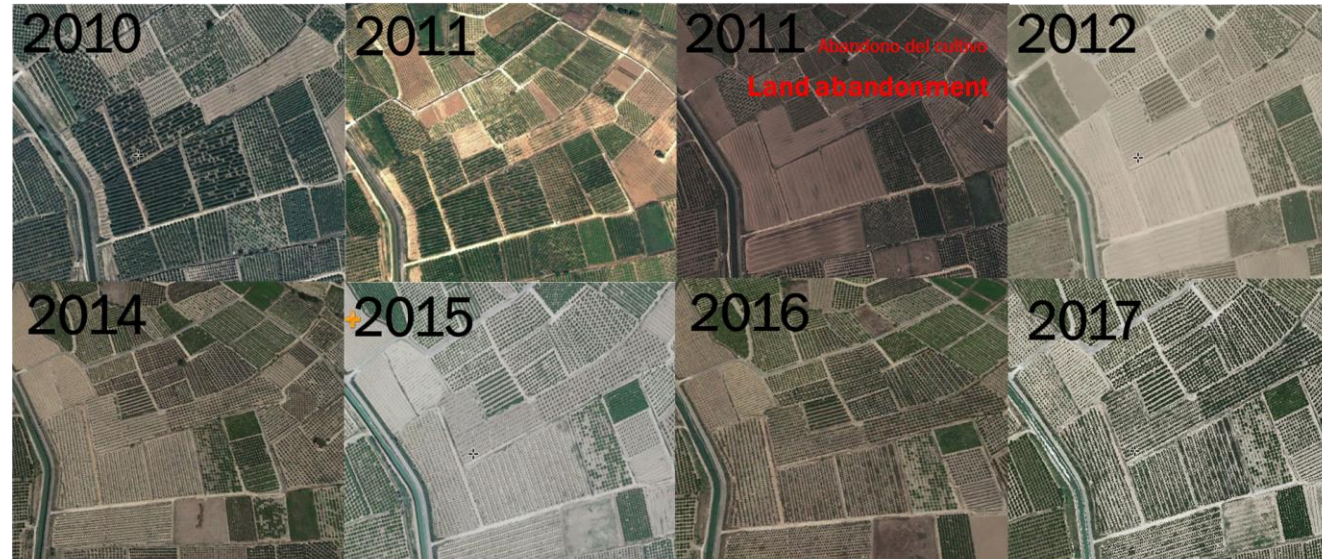
Selection of the study area



TVDI images with CORINE polygons that represent land use areas corresponding to citrus fruit trees

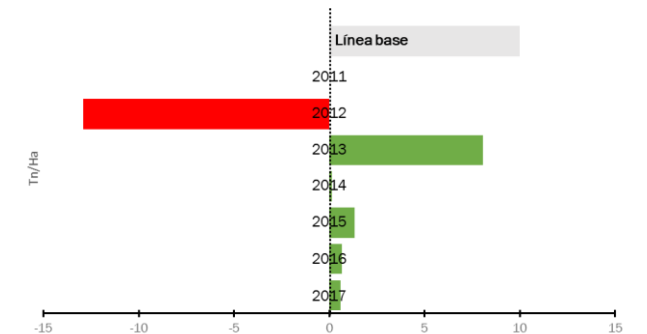
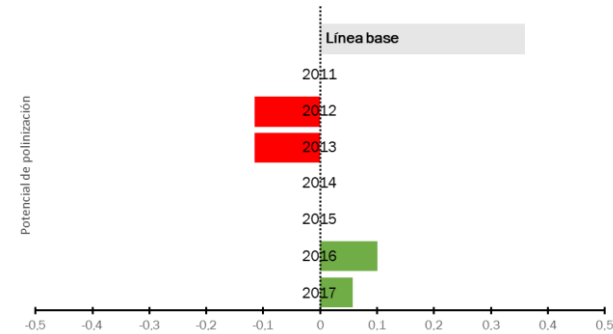
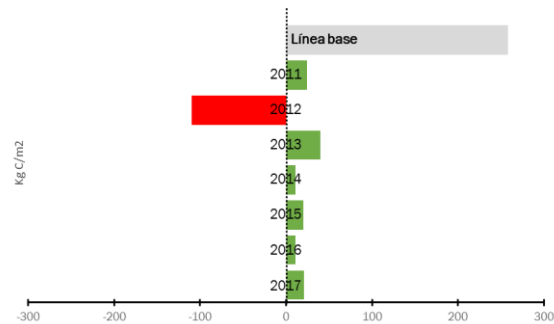
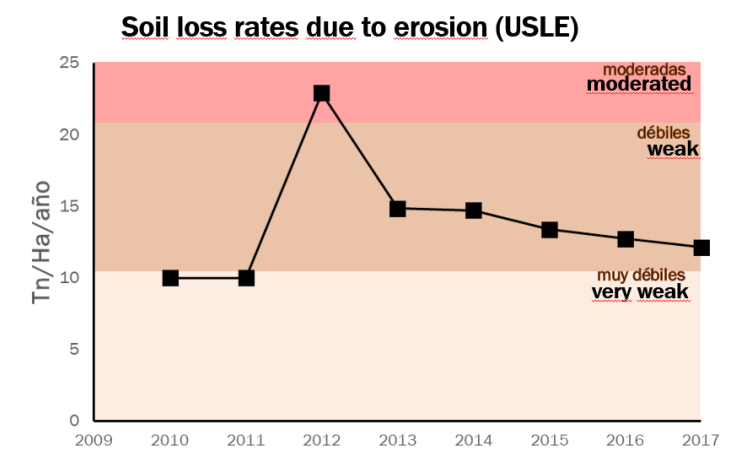
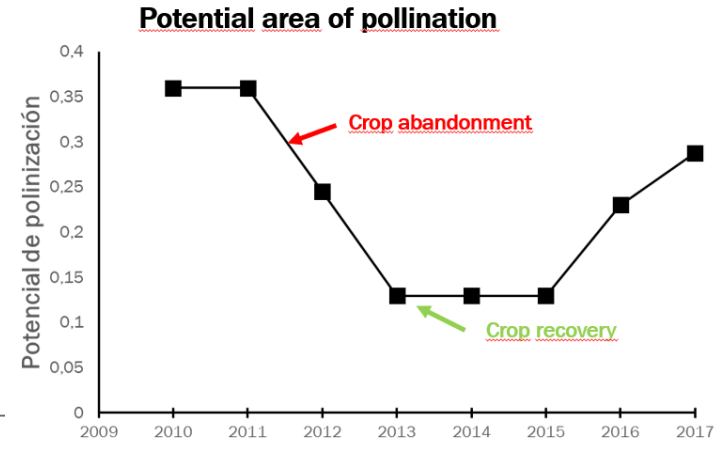
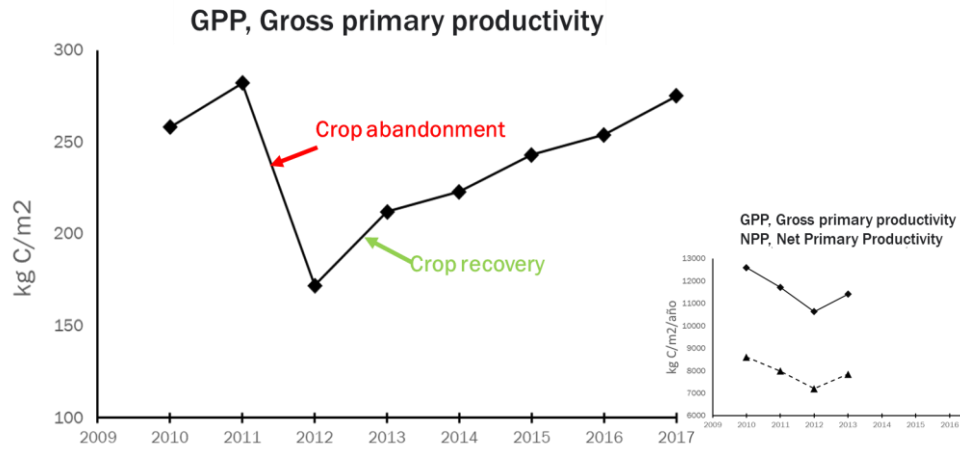
Selection of the study area

- Parcel set of 3,1 ha
- Municipal area of Alberic
- $39^{\circ} 8'10.41''N$, $0^{\circ} 32'25.35''O$



Comparison of the study area throughout the 2010-2017 period with orthophotos from the National Plan for Aerial Orthophotography.

RESULTS



CONCLUSIONS

- ❑ TVDI is a tool that, based on remote sensing products, allows the identification of abandoned agricultural areas.
- ❑ Agricultural abandonment produces a decrease in the ecosystem services of global climate regulation, soil stabilization and pollination.
- ❑ The recovery of the previous use, allows the recovery of these services.
- ❑ The carbon sequestration capacity is intensely reduced at the time of abandonment, but its recovery is rapid, probably due to soil-atmosphere interactions and the entry of spontaneous herbaceous plants into the abandoned territory.
- ❑ The potential for soil loss, even at the time of agricultural abandonment, remains moderate and its recovery is rapid. There is a strong link between this potential and agricultural uses and management.
- ❑ Considering this work as an approximation, the evaluation procedures and methods used should be subject to validation for their standardized use.

CONCLUSIONS

- ❑ The pollination potential has a different behavior, since both the nesting capacity and the floral resources are highly dependent on the structure of the vegetation. The pollination service is the only one of those measured in which the loss of service not only affects in situ, but also ex situ due to the dependence of citrus on surrounding pollination.
- ❑ The results of the work are in line with what the IPCC establishes in its latest report “Climate Change and Land” (2019)
- ❑ Considering this work as an approximation, the evaluation procedures and methods used should be subject to validation for their standardized use.
- ❑ Next steps are oriented to use this methodology to evaluate Ecosystem Services gains and losses all over abandoned land in Mediterranean area.