Explaining agricultural land use changes in Spain (2004 – 2021): Markets, climate and water resources

Gabriel Arbonès Domingo[1,2], Lucia De Stefano[1,3], Alberto Garrido[1,2]

[1]Observatorio del Agua, Fundación Botín

[2]Escuela Técnica Superior de Ingeniería Agronómica, Alimentaria y de Biosistemas, CEIGRAM, Universidad Politécnica de Madrid

[3]Facultad de Ciencias Geológicas, Universidad Complutense de Madrid

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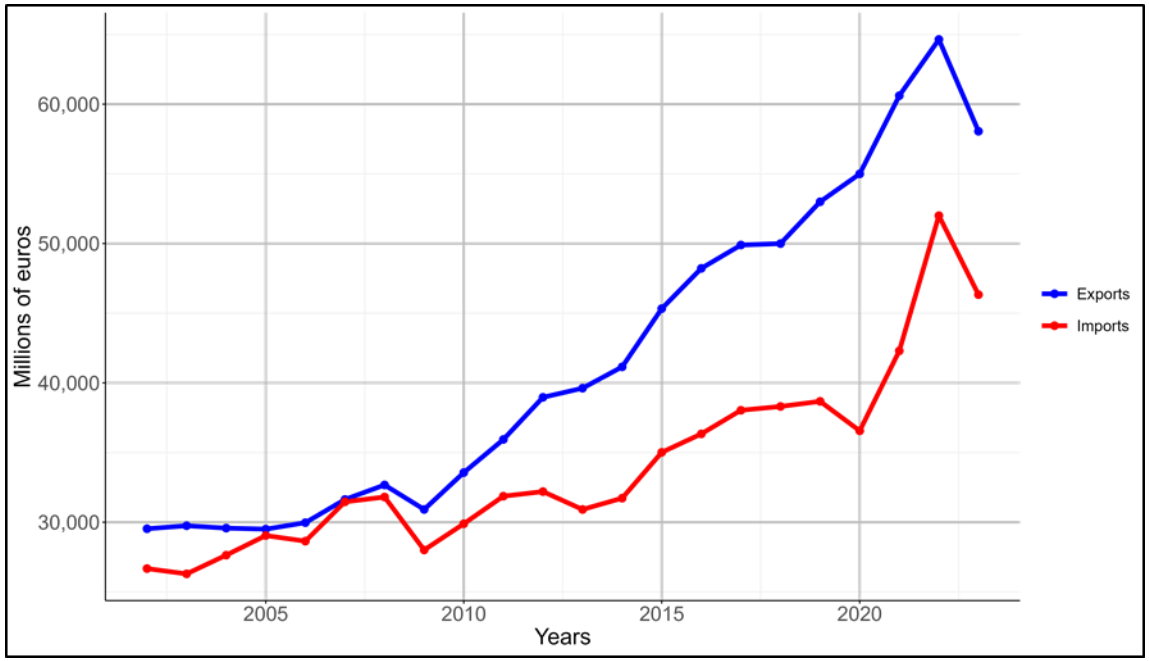
Background

Spain, Europe's market garden

- Spain is the fourth largest agri-food exporter in the European Union and the eighth largest in the world (3.3% market share).
- World leader in olive oil production, 43% of market share
- Spain the largest wine exporter by volume and the third largest economic value
- First fruit and vegetable producer in the European Union
- Between 1980 to 2016, Spanish exports multiplied by 3.5 times, while imports increased by 42%



Evolution of exports and imports of the agri-food sector in real million euros (Base 2021)

Source: DataComex

Is Spanish agriculture sustainable?

ENVIRONMENT • EUROPE

Thousands of illegal wells in Spain worsen water shortage

Illegal drilling, often linked to intensive agriculture, is still being carried out and half the population now lives in areas where water consumption exceeds available resources.

By Isabelle Piquer (Madrid (Spain) correspondent)
Published on August 13, 2022, at 9:00 pm (Paris), updated on August 13, 2022, at 9:00 pm · 3 min. · Lire en français

The only structure that can be seen from space, the greenhouses of Almeria.

20 SEP, 2023 @ 14:30 · ENVIRONMENT·LEAD·MURCIA · 1 MIN READ

REPORT: 456 TONNES OF NITRATES ENDED UP IN THE MAR MENOR IN 2022

BY SIMON HUNTER

Methodology

Research objectives & Methodology

Analysis of land use change in Spain at provincial level (2004 – 2023)

Land use evolution analysis → Analysis of irrigated area → Crop change analysis →

Methodology: Database ESYRCE plot level georeferenced information

Analysis explanatory variables

Systematic literature review → Explanatory variables analysis

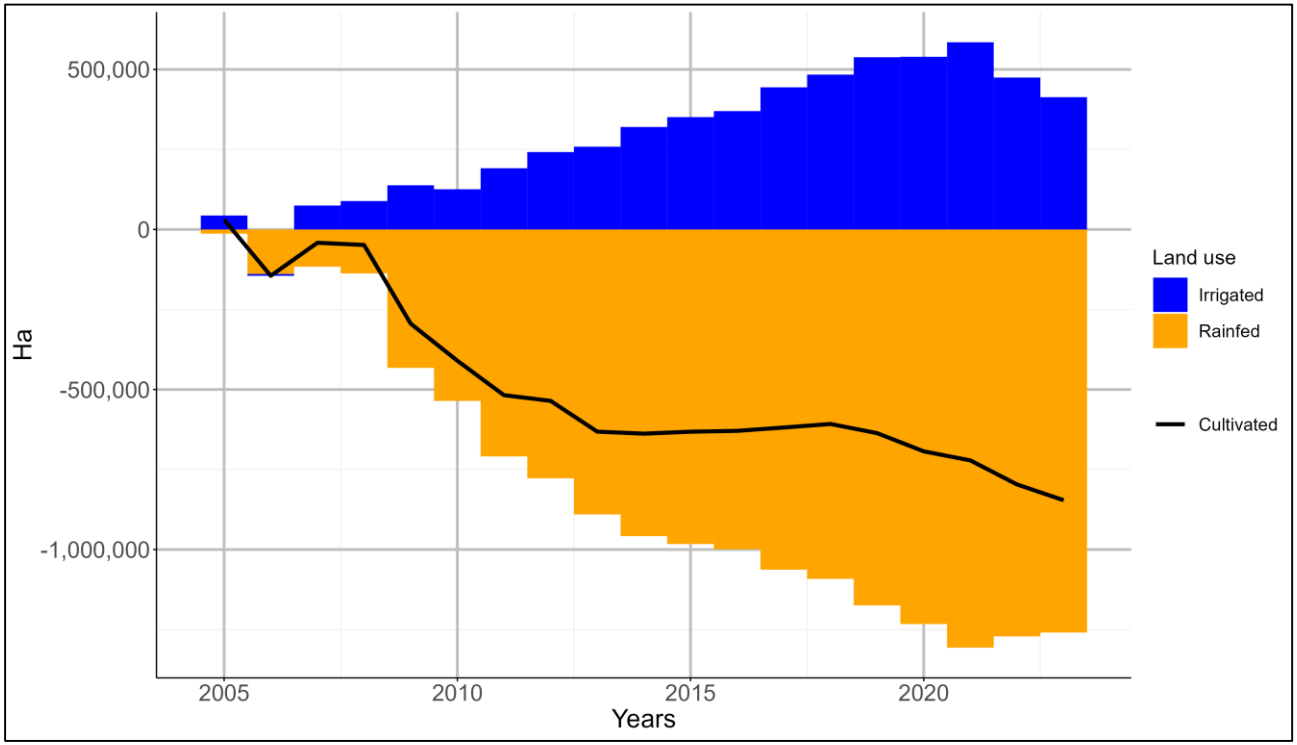
Methodology: Databases climatic factors / hydrology and water policy factors / agricultural market dynamics and other socioeconomic factors / Common Agricultural Policy and other land policies

Land use changes in Spain 2004- 2023

Expansion of irrigation

- Decrease of 1,259,361 hectares (-8.79%) in rainfed crops
- Increase of 413,379 hectares (+12.84%) irrigated crops
- Decrease of 845,982 hectares (-4.82%) in total cultivated area

Absolute accumulated variation of land uses 2004-2023



Source: ESYRCE

Investment in woody crops

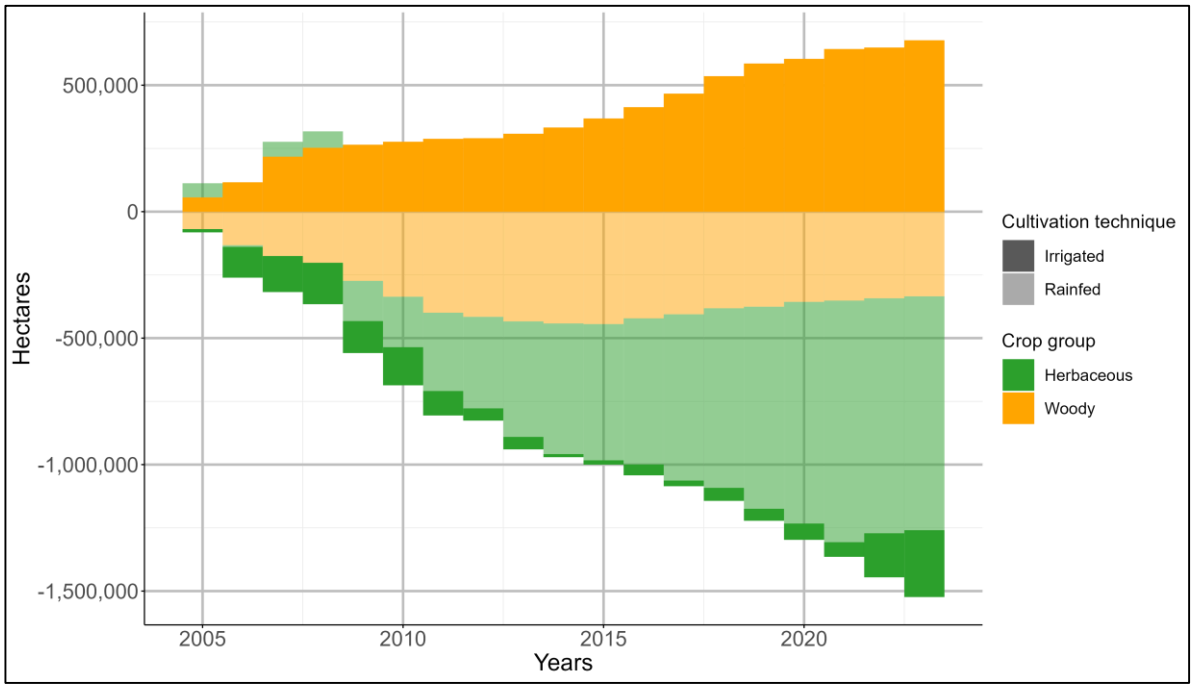
- Conversion of rainfed annual and woody crops to irrigated woody crops
- Areas of rainfed annual crops are left uncultivated
- Reduction of irrigated annual crop area in dry years

Woody crops
Irrigated: +677,600 ha (+51.59%)
Rainfed: -334,633 ha (-8.96%)

Arable crops
Rainfed: -924,727 ha (-8.76%)
Irrigated: -264,221 ha (-14.47%)

Source: ESYRCE

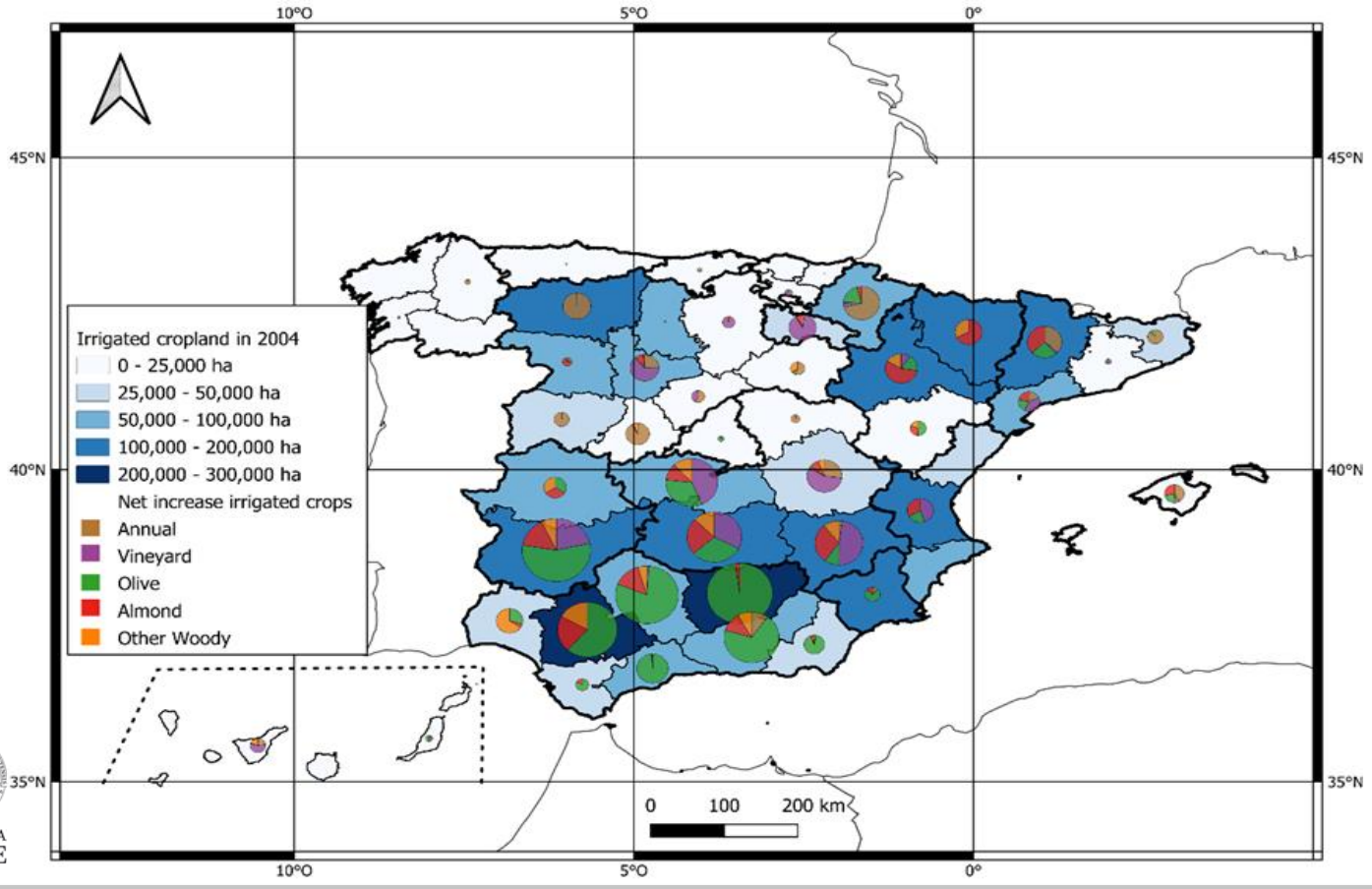
Accumulated variation of the surface of irrigated and rainfed annual and woody crops



Geographical and crop specialization

- Irrigation expansion is concentrated in the south of Spain, an area with water stress
- Irrigation expansion occurs in provinces with extensive irrigated areas
- Irrigated woody crops with the greatest increase: olive groves, vineyards, almond and pistachio (also rainfed)

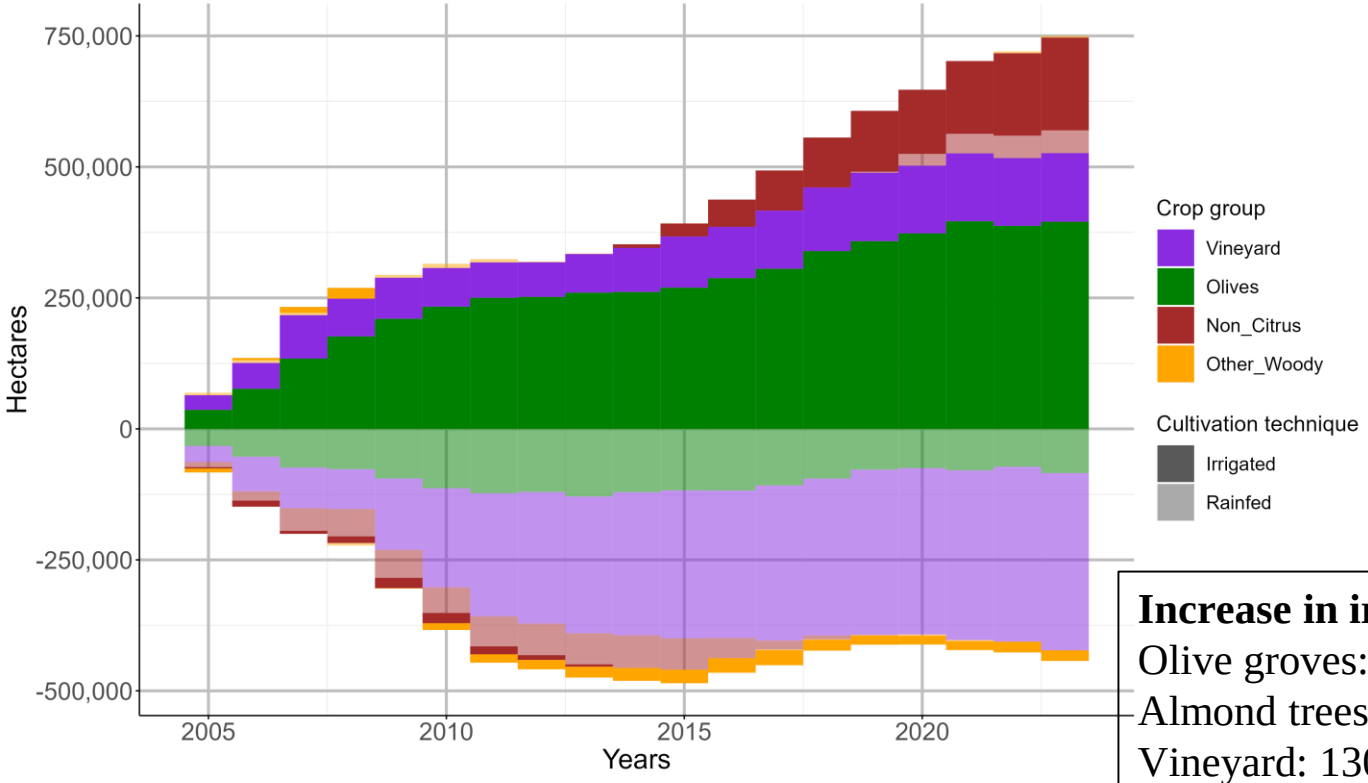
Variation in the area of the main irrigated crops between 2004 and 2022 and irrigated area in 2004



Source: ESYRCE

Geographical and crop specialization

Accumulated variation of the surface of irrigated and rainfed woody crops



Increase in irrigated area
Olive groves: 395,435 ha (+82.53%)
Almond trees: 145,555 ha (+415%)
Vineyard: 130,894 ha (+48.81%)

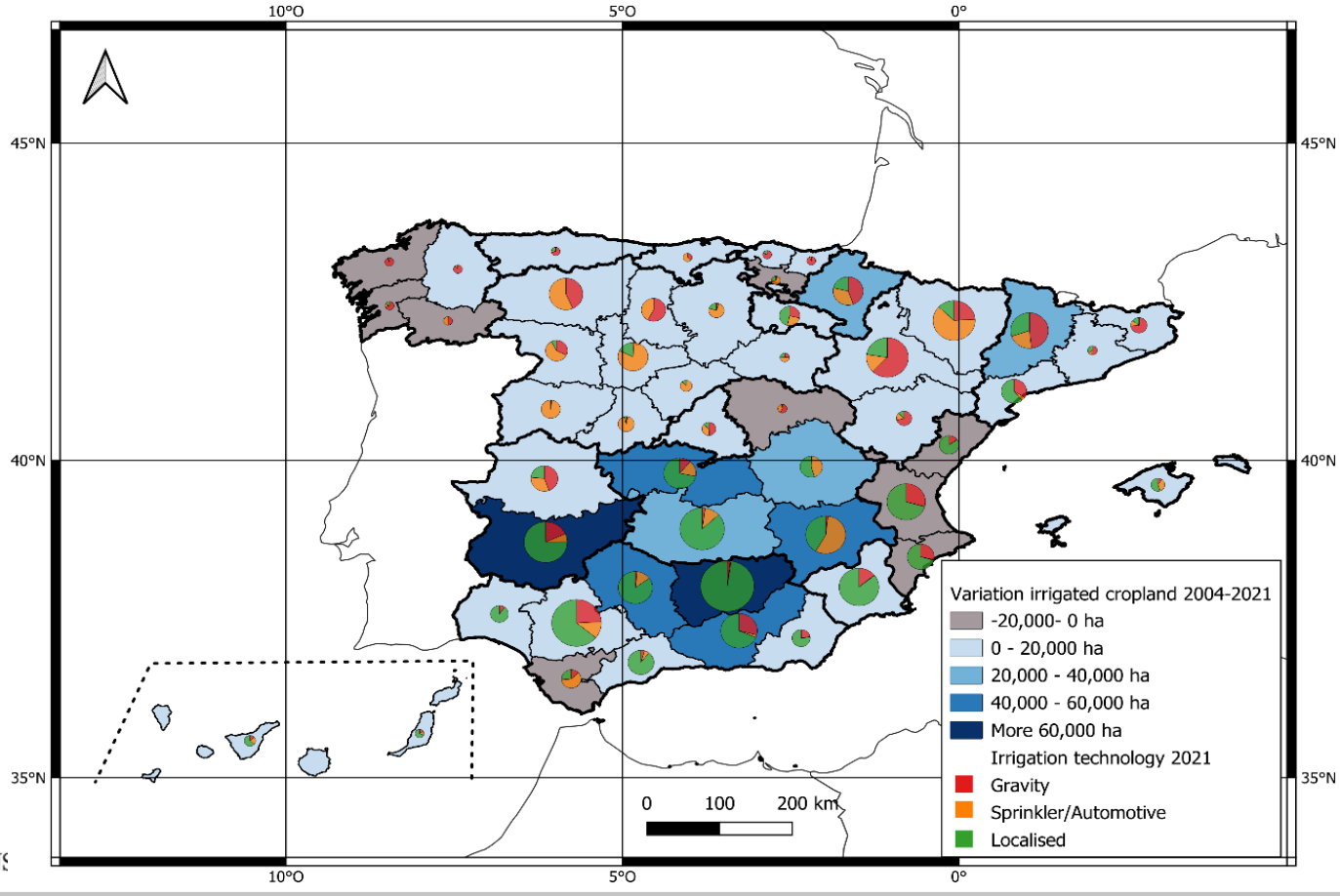
Rainfed pistachio: 43,904 ha (+43,904 ha)
Irrigated pistachio: 34,591 ha (+34,591 ha)

Source: ESYRCE

Investment in irrigation technology

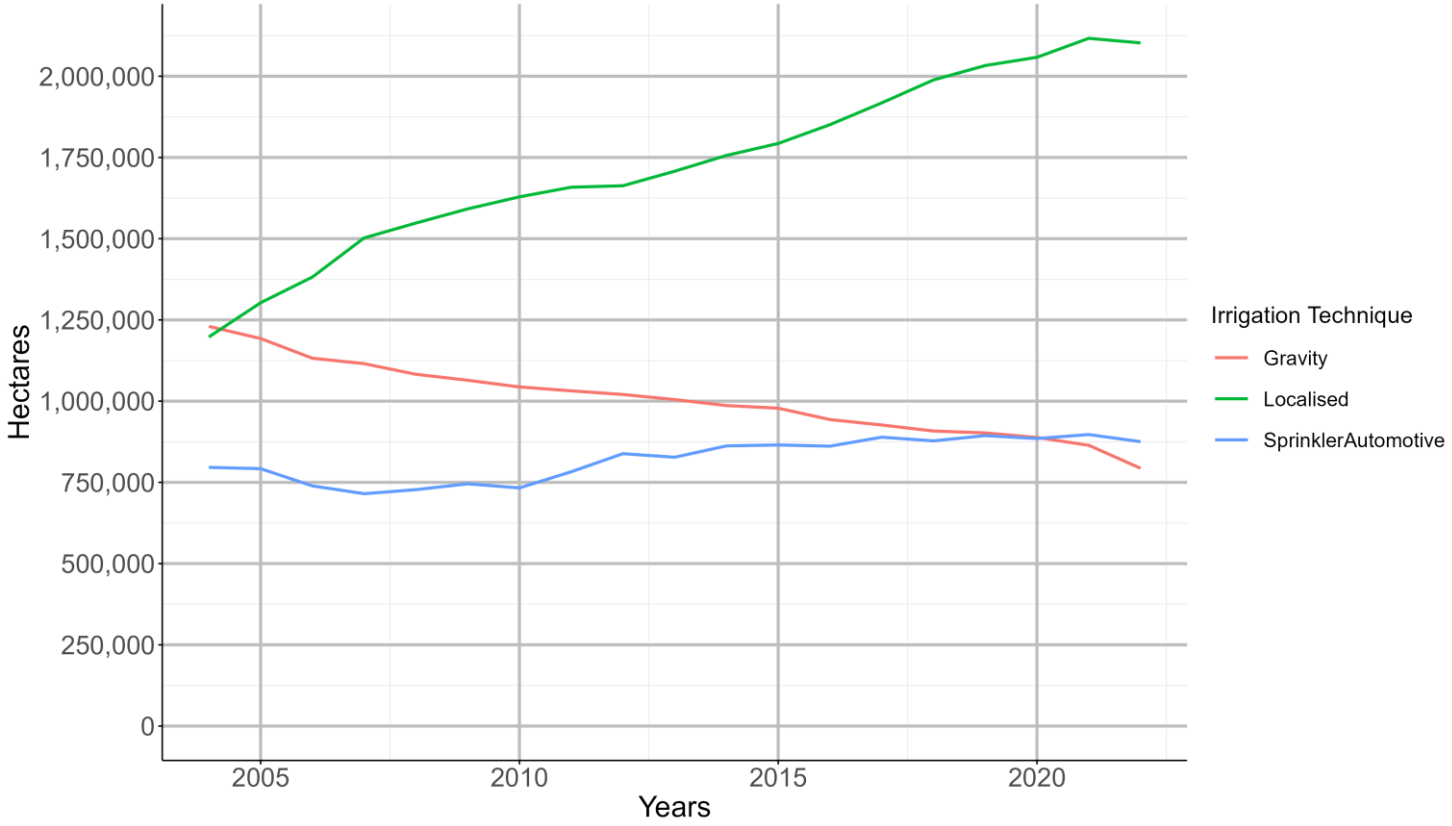
- Increase in localized irrigation by converting to gravity systems and new irrigation
- Localized irrigation is linked to the increase in the area of irrigated woody crops

Variation in the irrigated area and % irrigated technology over irrigated cropland area at provincial level in 2021



Source: ESYRCE

Investment in irrigation technology



Changes in irrigation technology
Localized: +905,063 ha (+75.5%)
Gravity: -436,671 ha (-35.5%)

Source: ESYRCE

Discussion: explanatory factors

1) What are the reasons behind the expansion of irrigated land, particularly in Southern Spain?

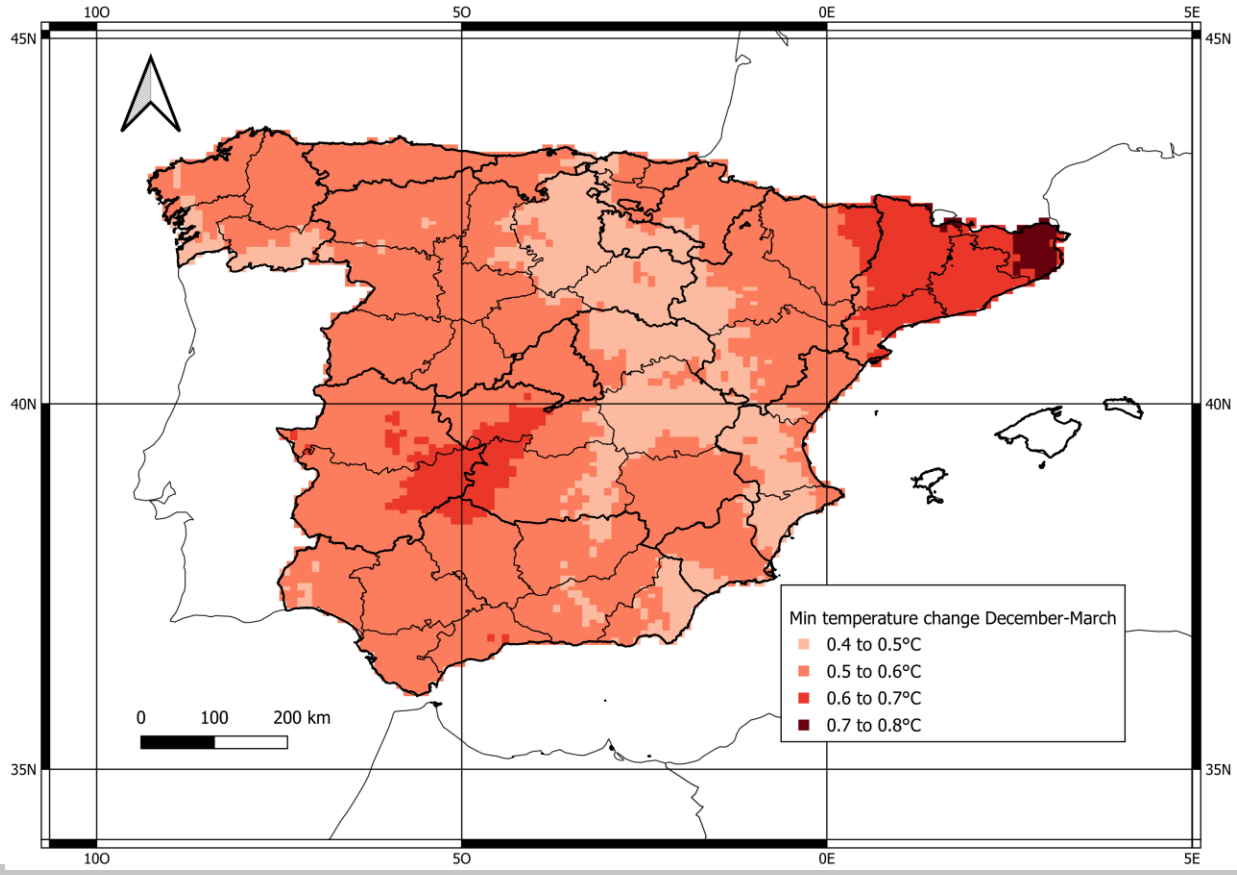
2) In a context of water scarcity, how has the increase in irrigated area been made possible?

3) Why have farmers chosen certain woody crops for irrigation, and why now?

Climate change affects agriculture

- Increase minimum temperatures: better conditions for woody crops (almond)
- Increase maximum temperatures: adverse effects, limit some annual crops (maize)
- Increase rain variability, increased evapotranspiration: less profitable rainfed cultivation, more dependence on irrigation

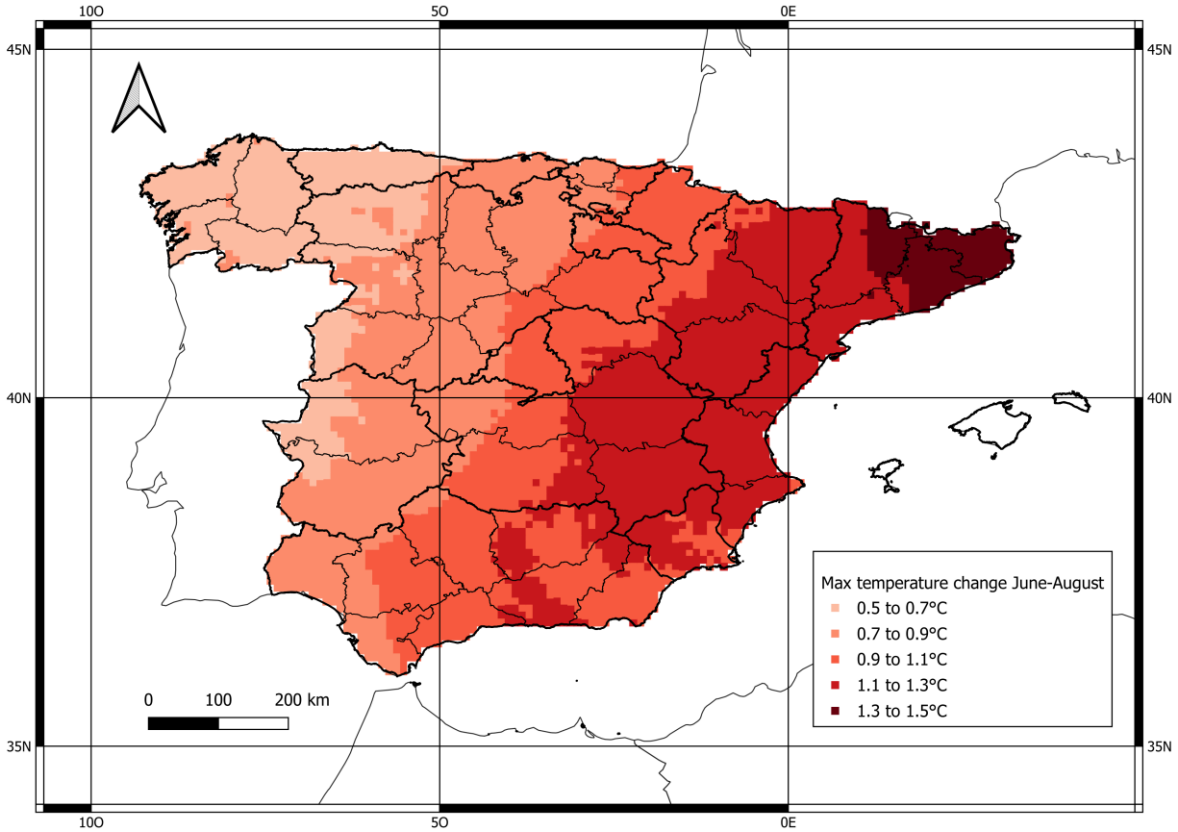
Increase in average annual minimum temperature in degrees Celsius between December and March between the periods 1960-1990 and 1990-2020.



Source: Proyecto CICLES

Climate change affects agriculture

Increase in mean annual maximum temperature in degrees Celsius between June and August between the periods 1960-1990 and 1990-2020

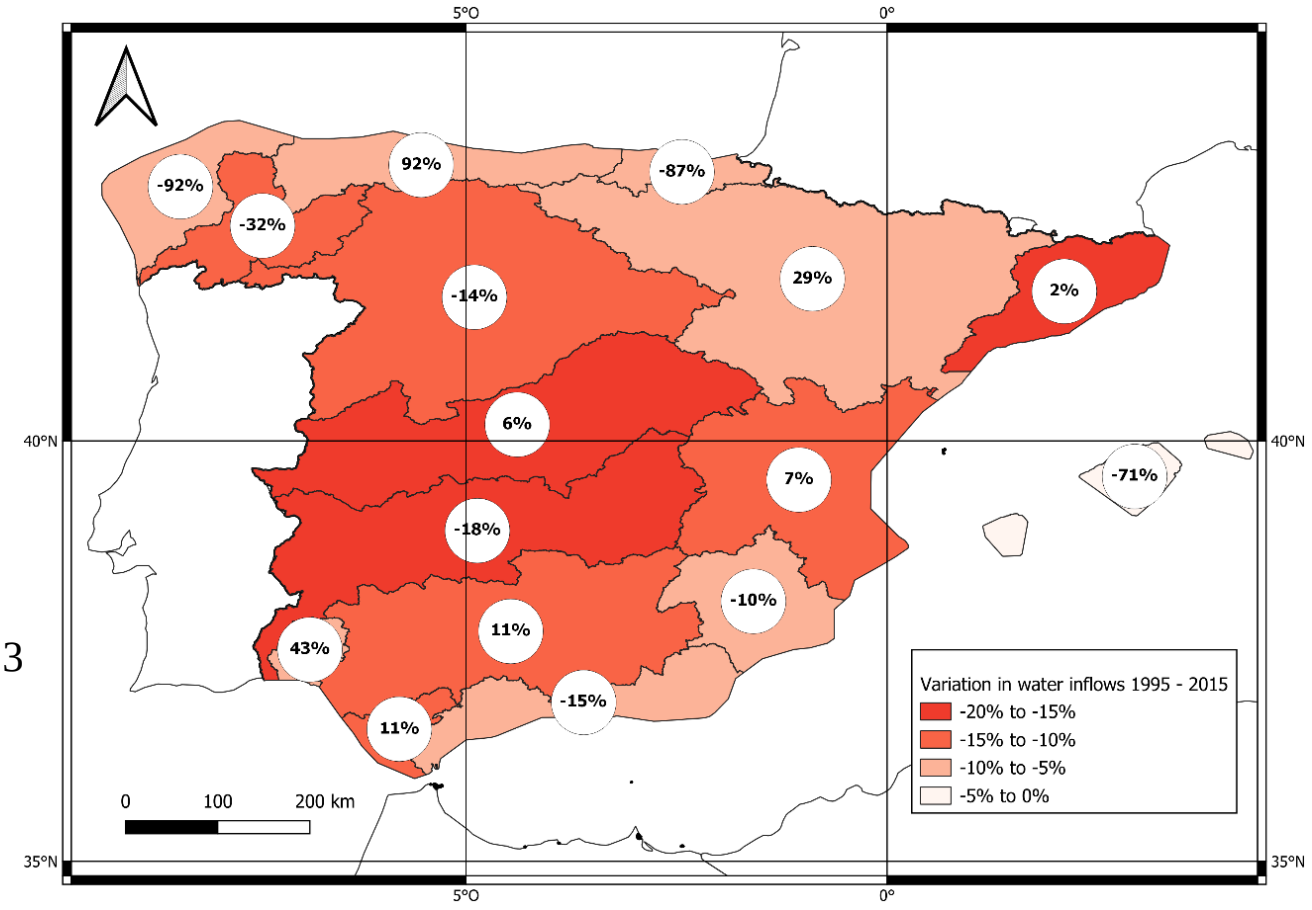


Source: Proyecto CICLES

Technology and policies overcome reduced water availability

- Surface runoff has been reduced by 11.8%.
- Irrigation technology: localized irrigation allows Regulated Deficit Irrigation
- Water administration faces difficulties in containing irrigation expansion

Variation in river runoff in percentage between 1995 and 2015 and within the circles the variation in agricultural water demand between 1995 and 2021

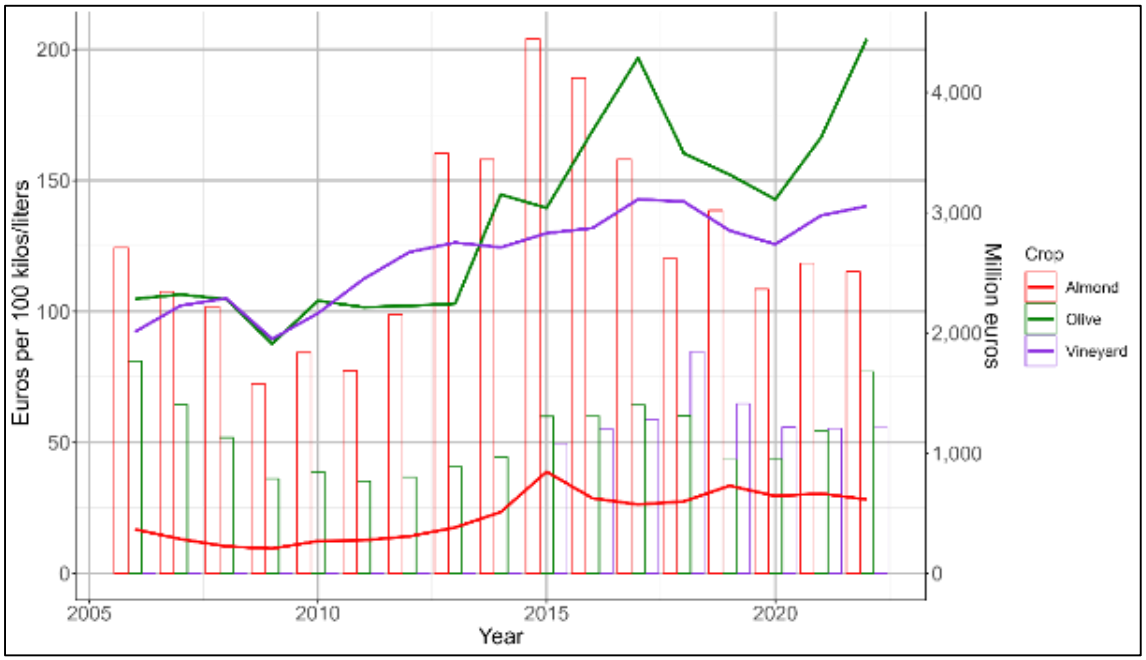


Source: Garrido & Garrote, 2023

Farmers seek to increase their value (land and production)

- Specialization in a few products in which Spain has a competitive advantage
- Increased world demand for Mediterranean products
- Importation of water-intensive and less profitable products (cereals for intensive livestock farming)
- Decoupling of CAP subsidies from agricultural production
- Increase in the value of land (water rights and agricultural investments)

Annual variations in exported volume (million euros) (right y-axis, represented in lines) and their annual variations of price expressed in euros per 100 kilos/liters (left y-axis, represented in bars) in Spain from 2006 to 2021



Source:DataComex

Conclusions

Conclusions.

- The ESYRCE database reflects an intensification of Spanish agriculture characterized by three factors (irrigation, woody crops and irrigation technology)

- The intensification of Spanish agriculture is explained by changes in climate, as well as market incentives for farmers and facilitated by public policies

- Analysis of the impact of agricultural intensification on net water consumption

- Determine whether the adoption of emerging crops such as almond and pistachio is cyclical or indicates a fundamental transformation of the Spanish agricultural model, compared to California

Thank you very much for your attention

Contact: gabriel.arbones@upm.es