Simulating the performance of tree crops under RCP 8.5 climate scenario

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Introduction

- We used the gridded COSMO-CLM climate simulations over the Iberian Peninsula produced by the University of Kassel (RCP 8.5). The dataset was restricted to the study site area (Cordoba province) and then bias-corrected against long series of measured data recorded by national and regional meteorological stations networks.

- The study site area was divided into clusters at the layer of municipalities (77 clusters). The simulations for all the crops were run individually in all clustered municipalities.

- All the simulations spanned from 2001 to 2070. The pathway evolution of the climate and CO2 followed the RCP 8.5 scenario.

Córdoba province – 13771 km²
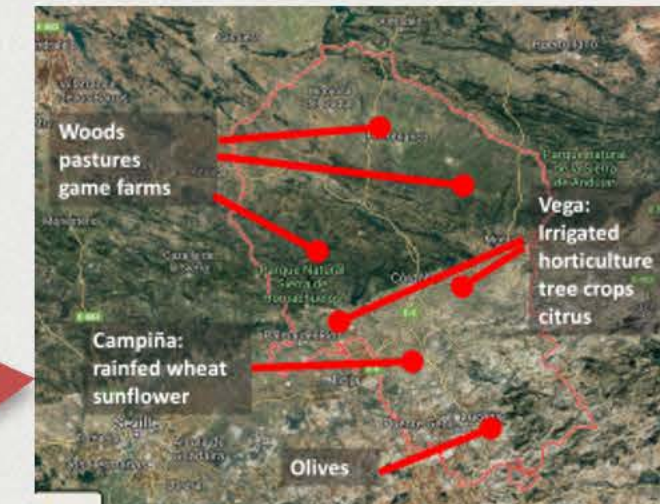
Geographical distribution of the more frequent land use categories in the Study Area

Materials and methods

- Fruit crops: the simulations of almond (cv. Guara) and peach (cv. Babygold 9) were carried out with the model **FruitCan** (in preparation), specifically developed for this project AXIS ERA-NET "MAPPY".

- Olive: the simulations of olive groves were conducted with the model **OliveCan** (Lopez-Bernal et al., 2018), developed by the University of Córdoba and IAS-CSIC.
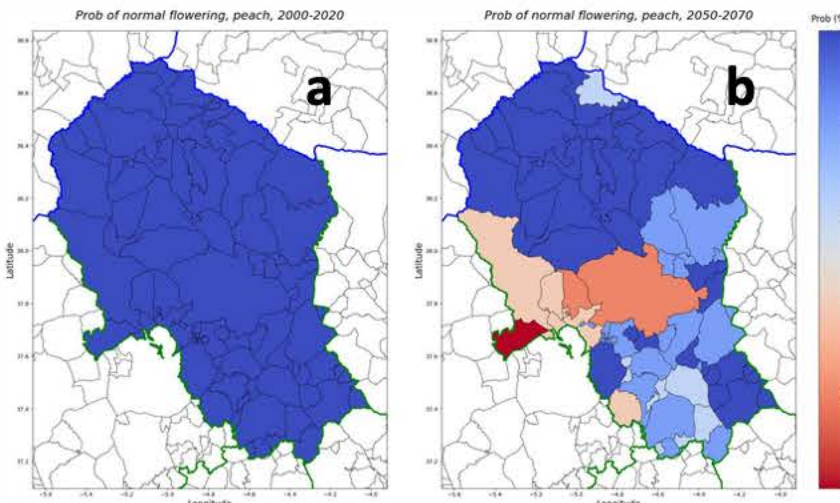
Average monthly climatic variables for the study site in the period 1970-2010
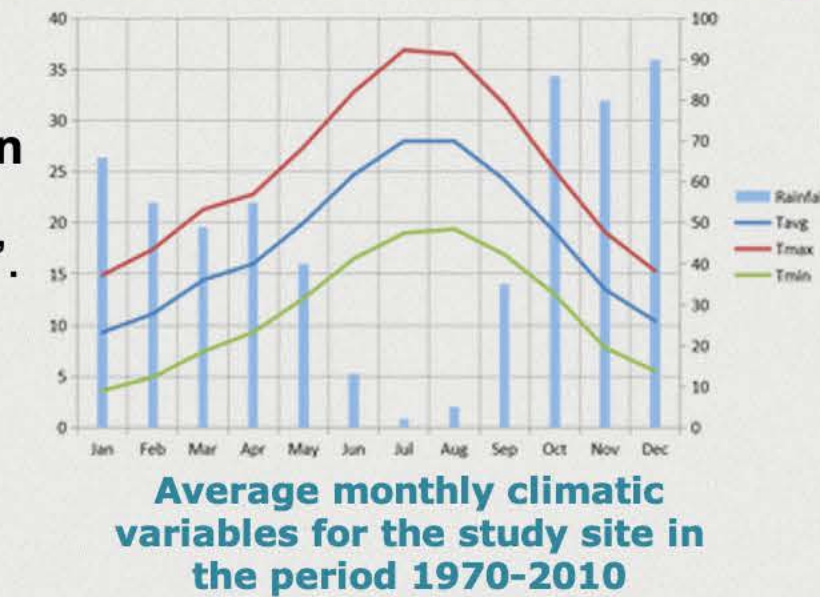
Results

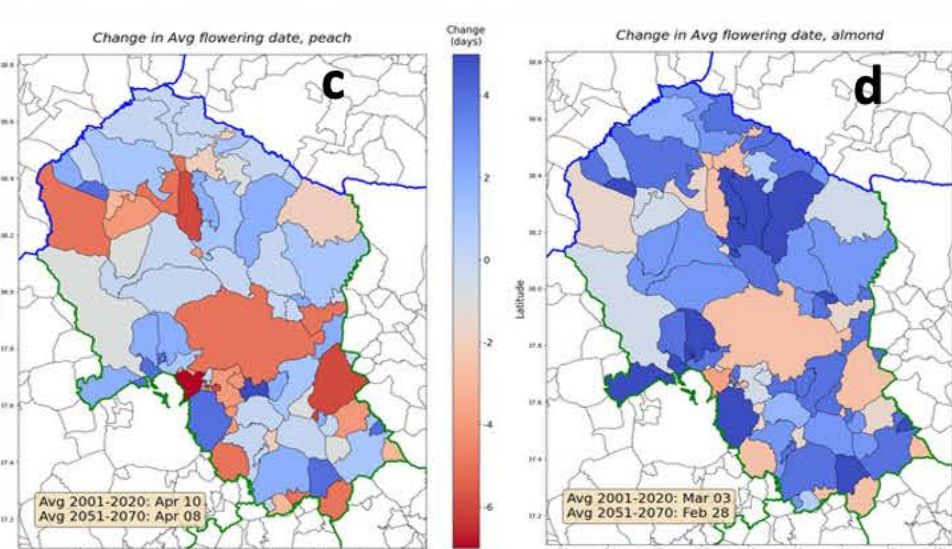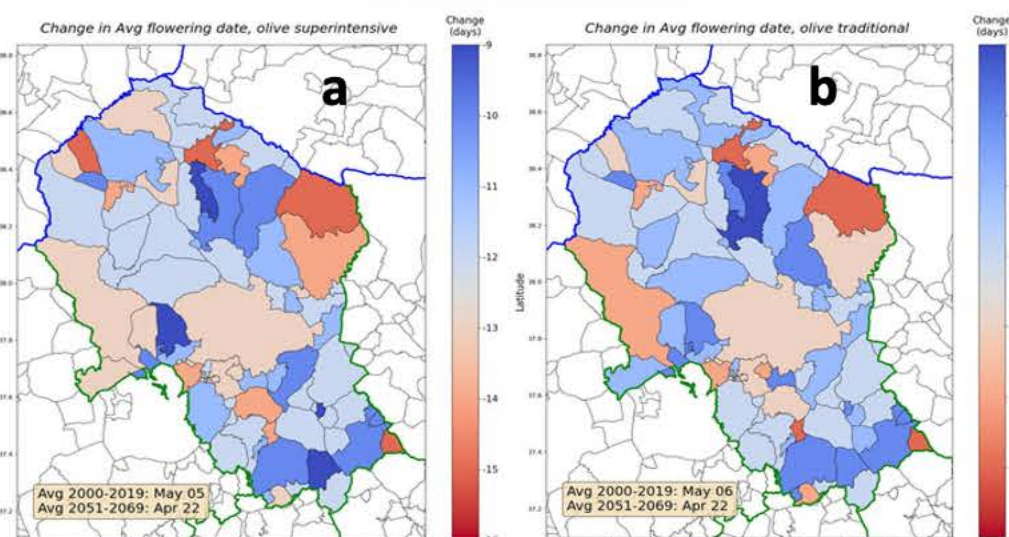### Probability of frost in flowering
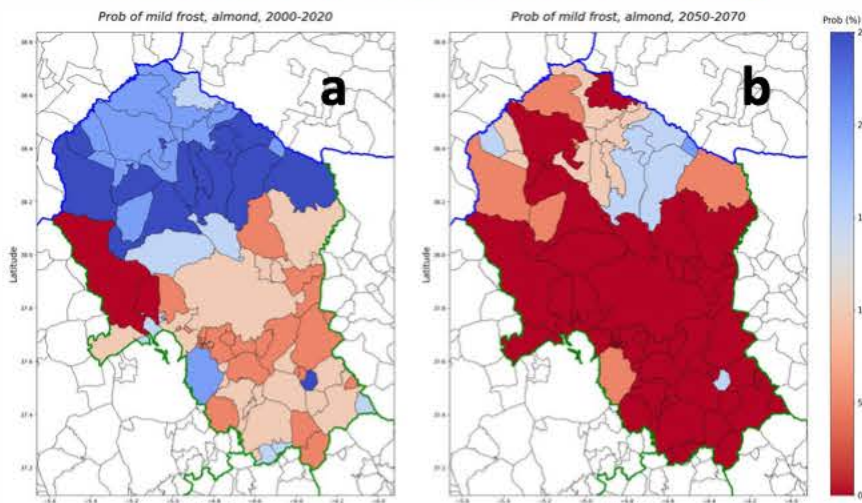
Almond: Probability of mild frost (minimum air T below -2.5 °C) during the flowering period 2000-2020 (a), and 2050-2070 (b)
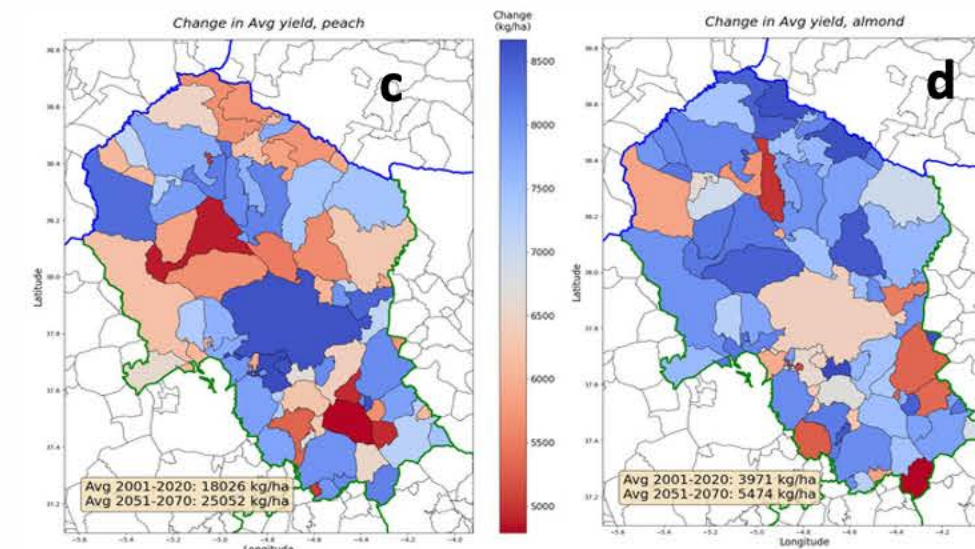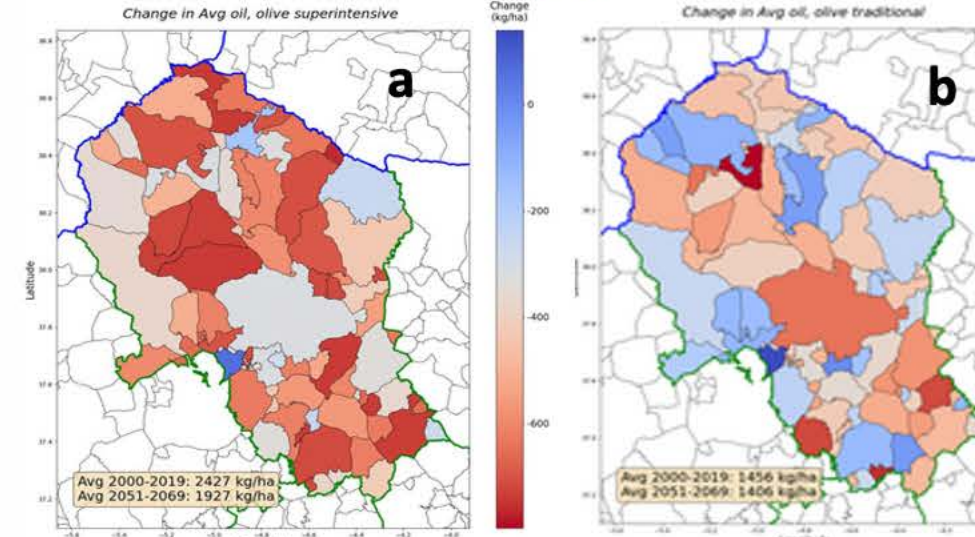
Probability of normal flowering

Peach: Probability of normal flowering 2000-2020 (a) and 2050-2070 (b) - cv BabyGold 9
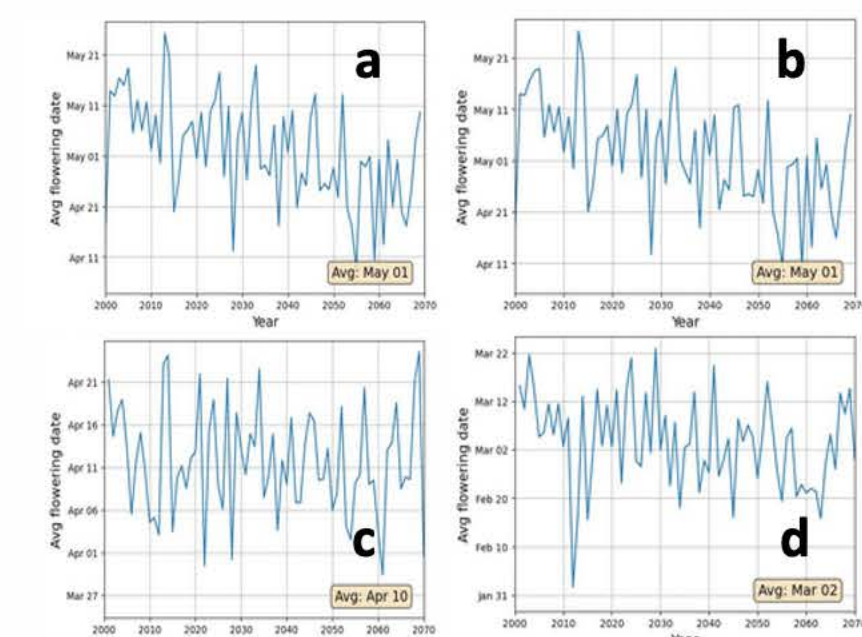
Flowering date

Change (2000-2020 to 2050-2070) in average flowering date of olive superintensive (a), olive traditional (b), peach (c), and almond (d)
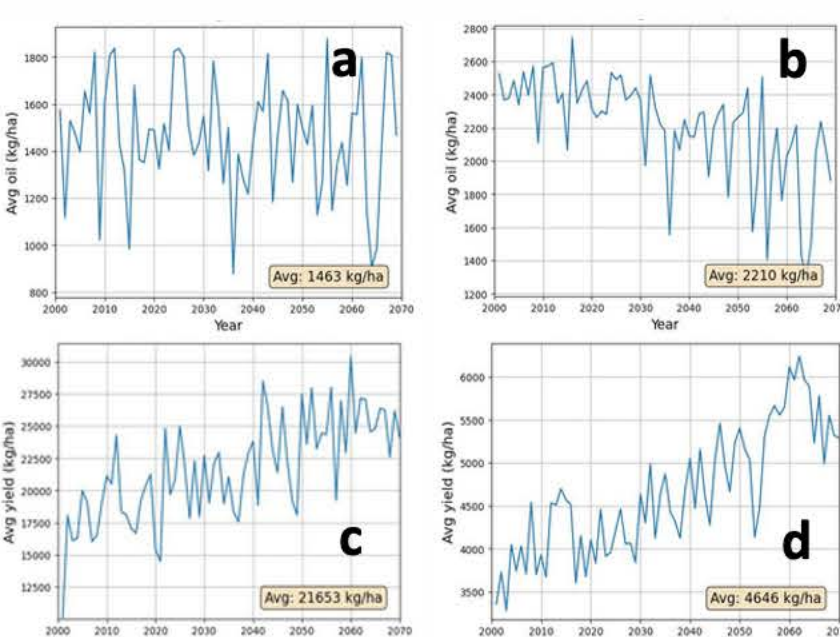
Yield

Change (2000-2020 to 2050-2070) in average yield of olive superintensive (a), olive traditional (b), peach (c), and almond (d)

Flowering date over time

Time Course of average flowering date of olive superintensive (a), olive traditional (b), peach (c), and almond (d)

Yield over time

Time Course of average yield of olive superintensive (a), olive traditional (b), peach (c), and almond (d)

Conclusions

- **Almond and peach** simulations show an increase in terms of yields towards the end of the simulated climatic scenario in the study area, which is due to the increased photosynthesis rate at the expected high concentration of atmospheric CO2 implied by the RCP 8.5 scenario in the next decades.

- **Superintensive olive groves** seem to face a decrease in yield over the study area in these simulations. Olive groves are more deficit-irrigated than almond and peach and worse affected by warming during the summer period, which implies a large increase in crop respiration and more water stress.

- **In almond "Guara"** the risk of moderate frosts generating damage to the majority of flowers seems to disappear from the region in the future.

- **Peach "Babygold 9"**, has no flowering problems in the present climate. Nevertheless, the simulations indicate that the area with the higher concentration of farms dedicated to peach production (western Guadalquivir valley) will experience flowering failure in 1 out of every 4 years, under the simulated climate scenario.