Irrigation of Mediterranean dry farmland impacts weed comunities

Ancha es Castilla (Wide is Castile), a popular saying that perfectly describes the vast landscapes of the land of Don Quixote. Castile, the central plateau of the Iberian Peninsula, is roughly a continuous succession of cereal fields, shaped by humans since pre-Roman periods, that have lasted for centuries almost without change. But change is about to come. According to our results in this paper, the transformation to irrigation designed by new policies in search of higher yields will drastically change the weed community associated to these fields, and other negative impacts may follow.

Agriculture faces the challenge of feeding a growing world population predicted to reach 10 billion by the end of the 21st century. New practices and technologies applied to rise yields in agriculture have greatly increased the productivity of farmland areas across the world. Unfortunately, increasing the production in agriculture is not at no cost. Environmental concerns on e.g. the use of chemicals, water pollution or deforestation have been put forward, and there is a general claim for implementing sustainable agriculture policies to counteract these hazards.

Fig. 1.

In Spain, the transformation into irrigation of a vast area formerly dedicated to extensive dry land farming is one the main ways for increasing the agricultural productivity. Traditional farming devotes large areas to cereal such as wheat or barley, sown in winter and harvested in summer, that rotate with fallow land every few years. Such systems hold a rich weed diversity and provide food and shelter for threatened fauna, resources for pollinators, soil protection and other relevant ecosystem services.

We evaluated the impact of dry land transformation into irrigation in a large Mediterranean area of NW Spain by comparing the weed community within crops in three cultivation systems: dry wheat, irrigated wheat and irrigated maize. Change of crop type, from wheat to maize, turned out to be the main factor explaining a prominent loss in weed species richness and diversity, followed by irrigation. Changes in this community switched the spectra of plant traits into a higher frequency of alien, perennial, broadly distributed and wind-pollinated plants, whilst annual native or restricted and insect-pollinated species decreased.

Not surprisingly, there seems to be a strong effect on the weed community of the large loads of herbicides, fertilizers, watering that define the irrigated farmland and maize cultivation. Eventually, these changes could give rise to new problems in the ecosystem, such as the escape of harmful alien weeds to nearby natural habitats, or the limitations in flower resources for pollinators. Environmental agencies of the regional, national and EU governments should cautiously consider the potential effects of broad changes in agricultural practices and the traditional rural landscapes. Sustainability should be targeted in defining agricultural policies for the near future in Spain and the EU, and it could be barely achievable if the transformation of Spanish Mediterranean cereal steppes into irrigation are implemented.

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