RÉPUBLIQUE FRANÇAISE
Liberté
Égalité
Fraternité

Press release – 05 03 2025

Agricultural biodiversity and climate change: vegetation in the margins of fields has changed in just 10 years

Scientists from INRAE and ANSES have been studying changes in field margin vegetation on 500 agricultural plots in mainland France, to understand how climate change and farming practices are affecting these plants. Their results, published in *Ecology Letters*, show that in 10 years the average temperature in these plots has risen by 1.2°C and soil moisture has fallen by 14%. The work shows that the plant communities in field margins have changed as a result, with more species tolerant to heat and aridity to the detriment of ruderal species (i.e. those able to withstand the disruption associated with farming practices). Climate change mitigation practices, such as plant cover and agroforestry, or reducing the use of agricultural inputs, would help preserve the ability of this biodiversity to adapt.

In France, the biodiversity of agricultural landscapes is playing an increasing role in biodiversity conservation strategies. Field margins occupy an intermediate position between natural environments and cultivated fields. They are of particular interest for studying the effects of both farming practices and climate change on biodiversity. This is because these margins are home to weed species (cleavers, creeping thistle) that are more or less adapted to disruption from farming, as well as grassland species (common sorrel, meadow vetchling) whose conservation is important. These margins also play a vital ecological role as refuge areas and corridors for many species, including beneficial insects and species that repel or regulate pests.

A network of 500 plots to study the biodiversity of field margins

In 2012, under the Ecophyto Plan, the Ministry of Agriculture set up the 500 ENI biovigilance network to monitor the unintended effects of farming practices on biodiversity in field margins. Around 500 plots were chosen to be representative of farming systems in mainland France, 20% of which were organic, and covering three types of crop: arable, vines and market garden produce. Between 2013 and 2021, the scientists analysed botanical data, meteorological data from Météo-France (temperature, soil moisture) and data on farming practices reported by farmers, including the use of fertilisers and herbicides, and the management of vegetation in the margins by mowing.

Pronounced effects of climate change on agricultural plots

Their results showed very pronounced changes in the climate of the 500 plots, with an average temperature rise of 1.2°C and a 14% fall in soil moisture over almost 10 years. At the same time, farming practices on the 500 plots did not change significantly, apart from a slight fall in the frequency of mowing field margins.

Depending on the species and the environment in which they live, plants can adopt three basic strategies:

- stress tolerance, linked to the ability of plants to withstand environmental constraints leading to a lack of resources (aridity, infertile soil, etc.),

- competitiveness, to maximise acquisition of the resources needed for rapid growth in favourable environments,
- and the ruderal strategy, which enables plants to withstand disruption to their environment, due mainly to human activities but also to natural events such as flooding.

Each plant can only adopt one of these strategies at a time. Plant communities therefore reflect the compromises between these different strategies, depending on the environmental constraints affecting them the most. In connection with the pronounced changes in climate on the plots over the study period, the scientists observed changes in the field margin plant communities, with a gradual decline in plant species with competitive and ruderal strategies in favour of species adopting the stress-tolerant strategy.

Communities of plant species selected by rising temperatures and aridity may therefore be poorly adapted to withstand the effects of conventional farming practices. In order to preserve their adaptive potential as much as possible, climate change mitigation practices, such as plant cover and agroforestry, or reducing the use of agricultural inputs, would help preserve the ability of this biodiversity to adapt.

Changes in practices have increased plant diversity in the inter-rows of vines

Scientists from ANSES, working with colleagues from the Institut Agro Montpellier, conducted a study on changes in weed biodiversity in vineyards. Complementing the one conducted with INRAE, it showed the effect of reduced use of plant protection products in a context of climate change. In 2020 and 2021, the scientists carried out research on the same plots, using the same protocols as those from a study carried out in 1978 and 1979.

"*Farming practices in vineyards have become less intensive,*" explains Guillaume Fried, project manager in the Entomology and Botany Unit of ANSES's Plant Health Laboratory. *"The use of herbicides is now limited to beneath the vines, with their use between rows being replaced by mowing or tillage."* In 40 years, the average summer temperature in the plots has risen by 2°C, and the difference between the coldest and hottest temperatures is now 1.2°C greater.

At sites where the thermal amplitude increased the most between 1978 and 2021, the scientists noted an increase in stress-tolerant species, and a decline in ruderal species. This confirms the pattern observed in the study co-led with INRAE. In the vineyards around Montpellier, these changes have also been accompanied by an increase in plant diversity: there is 41% more abundance and 24% more diversity. This can be explained by the simultaneous development of more agroecological practices in vineyards, which offer plant communities better conditions for adapting to climate disruption.

Read the publication *Climate and management changes over 40 years drove more stress-tolerant and less ruderal weed communities in vineyards* to find out more.

Reference

Poinas I., Meynard Ch. N., Fried G. (2025). Plant species better adapted to climate change need agricultural extensification to persist. *Ecology Letters,* doi/10.1111/ele.70030

Scientific contacts:

Isis Poinas – isis.poinas@inrae.fr
Horticultural Crops and Crop Systems Research Unit

Plant Health and Environment (SPE) Scientific Department
INRAE Centre Provence-Alpes-Côte d'Azur

Christine N Meynard – christine.meynard@inrae.fr
Biology Centre for Population Management (INRAE, CIRAD, IRD, Institut Agro, University of Montpellier)
Plant Health and Environment (SPE) Scientific Department
INRAE Centre Occitanie-Montpellier

Guillaume Fried – contact the ANSES press team
Laboratory for Plant Health
ANSES

Press liaison:

INRAE Media and Opinion Department: +33 (0)1 42 75 91 86 – presse@inrae.fr
ANSES press team: +33 (0)1 49 77 13 77 – (0)1 49 77 22 26 – (0)1 49 77 28 20 – presse@anses.fr

---