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# Effects of extreme weather, climate and pesticides on farmland invertebrates

**Cereal fields provide a staple food**, but are also home to a wide array of invertebrates. This study analysed over 40 years of data to investigate the effects of extreme weather, climate and pesticide use on invertebrates in cereal fields in southern England. As pesticide use had a greater effect on abundance than temperature or rainfall, the authors also recommend reducing pesticide use.

**Invertebrates in arable farmland provide vital ecosystem services**, including pollination, pest control and nutrient recycling. They are also an important link in the food chain that supports farmland animals, and an important source of biodiversity in their own right.

However these invertebrates are under threat from climate change, which is increasing the frequency and severity of extreme weather events. They are also facing the challenges of agricultural intensification, especially increasing pesticide use.

Very few studies have investigated the effects of changes in weather and agricultural intensification together. It is important to understand how arable invertebrates respond to these combined challenges in order to devise mitigation measures.

In this study, researchers determined the impact of extreme weather events, as well as long-term trends in weather and agricultural practices, on arable invertebrates. The study was based on a section of farmland on the Sussex Downs, in southern England. The Game & Wildlife Conservation Trust has collected data on the invertebrates, plants and birds of this cereal ecosystem, as well as its crop management practices, since 1970. Information on the abundance of invertebrates was obtained by sampling 100 cereal fields every year from 1970–2011. The 26 most commonly identified taxa were selected for analysis.

Weather conditions were also assessed. As droughts and temperature anomalies are most commonly associated with changes in invertebrate abundance, the researchers focused on monthly mean temperature and total monthly precipitation in their analysis. Extreme weather events were identified using data obtained from the UK Met Office and grouped into two categories: cold/wet and hot/dry.

Of the 26 invertebrate groups studied, 11 were found to be sensitive to extreme weather events. However, the invertebrates were also remarkably resilient — only two took longer than a year to recover.

Some long-term trends in invertebrate abundance correlated with temperature and rainfall data, suggesting that invertebrates are affected by climate change. However, by far the most important factor in explaining the trends in abundance was pesticide use.

The researchers went on to investigate whether different habitats could encourage resilience to extreme events. Only habitat position influenced sensitivity to extreme weather events. During cold/wet events, abundance generally increased from the previous year on west-facing slopes, while it decreased on other slopes, suggesting that west-facing slopes may act as refuges. There were no other clear links between habitat and resilience, suggesting that habitat manipulation is unlikely to offset the effects of extreme weather on invertebrates.

In the long-term, climate change will cause increases in certain groups of organisms, some of which will contain cereal pests. In turn, this will increase the use of insecticides, having an adverse effect on invertebrate populations. The authors say this is the most likely long-term negative impact of climate change on arable invertebrate numbers.

The researchers say using conservation headlands alongside beetle banks, which also protect farmland birds, may help to conserve invertebrates in cereal fields.

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