



Summary Report

The Bugs Matter Citizen Science Survey: counting insect ‘splats’ on vehicle number plates reveals a 58.5% reduction in the abundance of actively flying insects in the UK between 2004 and 2021.

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A citizen-science survey, led by Kent Wildlife Trust and Buglife, has found that over the last 17 years the abundance of flying insects in the countryside that get hit by cars has plummeted by almost 60%.

Background

There is a growing amount of evidence of widespread insect population decline. These declines could have catastrophic impacts on the earth’s natural environment and our ability to survive on the planet. However, there has not been enough data to draw robust conclusions about trends in insect populations in the UK, because standardised surveys are not used for all insect groups or at a national scale. Our study demonstrates the use of an innovative method for widespread monitoring of insect ‘splat rate’, to investigate changes in insect populations in the UK over a 17 year timeframe.

The Bugs Matter survey was undertaken in the summer of 2021, and compared results with a similar survey in 2004. The survey took place across the UK and found that overall, the number of insects recorded had reduced by 58.5%. There were differences between each country. England suffered the greatest decline with 65.0% fewer insects recorded in 2021 than in 2004, Wales had 55.0% fewer, and Scotland 27.9% fewer.

Without the help of hundreds of citizen scientists Bugs Matter would not be possible, and we thank everyone who has taken part.

What is the Bugs Matter survey?

Bugs Matter enlists the help of volunteer citizen scientists to monitor the health of the UK’s insect populations by recording the numbers of insects that become accidentally squashed on vehicle number plates during a journey. Insects were counted using a ‘splatometer’ – a standard-sized grid, to ensure counts were made consistently (Figure 1), and number plates are cleaned prior to the journey starting to make sure counts don’t include insects from previous journeys. Data about journeys, vehicle types and numbers of insects are collected using the specially designed Bugs Matter smartphone app.:

- [Bugs Matter – Apps on Google Play](#)
- [Bugs Matter on the App Store \(apple.com\)](#)

The Bugs Matter survey takes place from the start of June to the end of August. It was first run by the RSPB in 2004, repeated by Kent Wildlife Trust in Kent in 2019, and then repeated again nationally by Kent Wildlife Trust and Buglife in 2021.

- In 2004, 196,448 insects were sampled over 14,466 journeys comprising 867,595 miles, a splat rate of 0.238 splats per mile.
- In 2019, 1,063 insects were sampled over 599 journeys comprising 9,960 miles, a splat rate of 0.098 splats per mile.
- In 2021, 11,712 insects were sampled over 3,348 journeys comprising 121,641 miles, a splat rate of 0.104 splats per mile.

Using a statistical model, we compared the number of insects sampled by vehicles in 2019 and 2021 with the data collected by the RSPB in 2004.

Why count squashed insects?

Bugs Matter is based on the ‘windscreen phenomenon’, a name for the observation that people tend to find fewer insects on car windscreens now compared to several decades ago. Taking the ‘windscreen phenomenon’ as inspiration, we can use cars as a sampling tool. Cars are useful, as they are used by lots of people, travel around the country, and as they do so, they ‘sample’ insects. And, if we use cars as our sampling tool, we can turn the ‘windscreen phenomenon’ observation or anecdote, into useful data. By using a simple and easily repeatable method, we can compare ‘splat rate’ between years, and over time build a better understanding of any trends in insect populations. It is therefore essential that the survey is repeated regularly so that a trend can be established.

Insects are critical to a healthy functioning environment. They pollinate most of the world’s crops, provide natural pest control, decompose organic matter and recycle nutrients into the soil. Without them we could not grow onions, cabbages, broccoli, chillies, tomatoes, coffee, cocoa, most fruits, sunflowers, and rapeseed, and demand for synthetic fibres would surge because bees pollinate cotton and flax. Insects underpin food chains, providing food for larger animals including birds, bats, reptiles, amphibians, fish and terrestrial mammals. Almost all birds eat insects - many of those that eat seeds and other food as adults must feed insects to their young – it is thought to take 200,000 insects to raise a single swallow chick. Quite simply, without insects, life on earth would collapse.

Counting insects not only gives an estimate of the abundance of insect life in our towns and countryside, but also a measure of the health of our environment. When insect numbers fall this is an indication that nature is in trouble. Insect numbers can also show where wildlife is recovering, and so Bugs Matter can be used to measure how the work of conservation organisations and others is helping nature’s recovery.

What did we find out?

Our results show that the number of insects sampled on vehicle number plates in the UK decreased by 58.5% between 2004 and 2021 (34.4%/decade), and that this difference was statistically significant. The greatest decreases in splat rate occurred in England (65% between 2004 and 2021 or 38.2%/decade), whilst journeys in Scotland recorded a comparably smaller decrease in splat rate (27.9% between 2004 and 2021 or 16.4%/decade), and splat rates in Wales were intermediate (55% between 2004 and 2021 or 32.3%/decade). Unfortunately there were too few surveys in Northern Ireland to draw conclusions. Figure 2 shows the journeys made by citizen scientists, Figure 3 shows the change in ‘splat rate’ each year, and Figure 4 shows a heat map of splat rate of insects on car number plates for each UK country.



Figure 1. Photograph showing the splatometer positioned over a number plate.

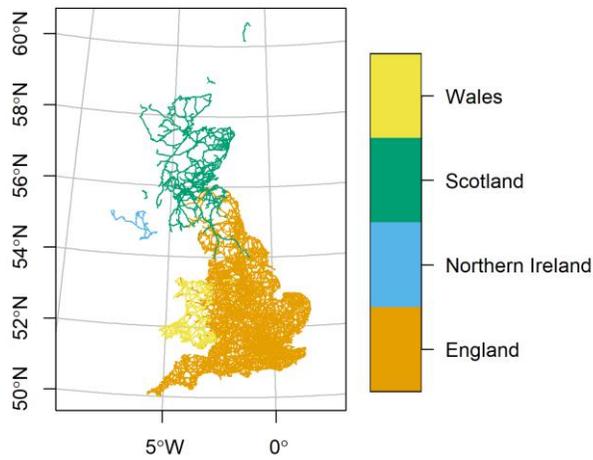


Figure 2. A map showing the distribution and extent of journeys in 2004, 2019 and 2021 included in this

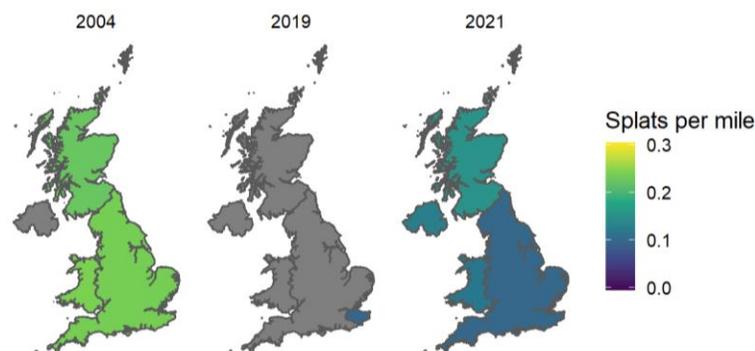


Figure 4. Heat map of the UK showing splat rate of insects on car number plates from the Bugs Matter survey in the UK in each of the survey years, 2004, 2019 and 2021.

analysis of Bugs Matter survey data on insect numbers sampled by vehicle number plates in the UK.

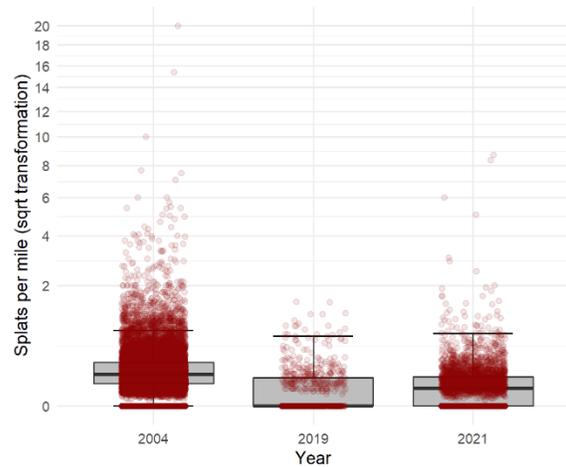


Figure 3. Box and whisker plot showing insect splat rate (splats per mile) in each year. The boxes indicate the central 50% of the data, either side of the median splat rate which is shown by the horizontal line inside the box. The vertical lines extend to 1.5 times the central 50% of the data and the data points 'jittered' so they do not overlap. The thick line at $y = 0$ for each year are data points for journeys with a count of zero splats per mile.

What do the results mean?

Our results are consistent with declining trends in insect populations reported by many other scientific studies from around the world which have found declines in populations of many different types of insect. In particular, the apparent national rate of decline in flying insect abundance of 34.4%/decade in our data is comparable to similar data from Denmark, showing 38.0% and 46.0%/decade declines, and are slightly higher than the 28.0% decadal decline in the biomass of flying insects observed in a widely reported German study.

There were also significantly different changes in splat rates between 2004 and 2021 for the different countries of the UK. The splat rate was 27.9% lower in Scotland in 2021, but had reduced by 65.0% in England. Annual counts of moths have previously recorded a reduction of 22.0% in northern Britain compared with 39.0% in southern Britain between 1968 and 2017. Our data therefore reinforces concerns that the factors responsible for insect declines are acting more strongly on populations in England or Southern Britain than in Scotland or Northern Britain.

However, our data only represent snapshots of insect populations from years at widely spaced intervals over a 17-year period. Furthermore, insect populations and activity fluctuate from year to year for many reasons such as the weather, so we must treat our results with some caution. There is not yet enough data from the Bugs Matter survey to establish a long-term trend, however, our analysis adds weight to concerns that populations of flying insects are disappearing at an alarming rate. The data collected was investigated using a model that included real world data on other landscape, weather, vehicle type and time variables that can affect insect numbers, and has shown that Bugs Matter is a robust data collection methodology that can be used to generate new data and to establish a long-term flying insect monitoring metric.

What needs to happen?

It is increasingly clear that our planet's ecological balance is breaking and there is an urgent need for an intense and global effort to avert these trends. Allowing insect declines to continue is not a rational option for anyone. Insects make up over half the species on Earth, our planet's health depends on them, so their disappearance is intensely concerning. The rate of loss of insects is much faster than that of higher profile wildlife like birds and mammals; local extinction rate for insects is eight times higher!

There are many causes, and they all need to be addressed, but the evidence is clear, we will not avert the crisis without urgently reversing habitat loss and degradation, preventing and mitigating climate change, reconnecting flower-rich habitats, cleaning-up polluted waters, and replacing pesticide dependency with sustainable farming methods.

We can restore nature, and we can reverse the declines in our insects, but we must all work together, we must work at scale, and we must work with urgency. And, we need to continue to monitor the health of our insect populations – Bugs Matter will continue in 2022, we hope that those who took part in 2021 will be joined by hundreds more citizen scientists this year! A particular effort will be made to increase the number of journeys in Northern Ireland.

To draw robust conclusions about long-term trends in insect abundance in the UK, scientists require data from many years, over long time periods, and over large areas – the Bugs Matter citizen science survey will continue to generate such data.

The full technical report for the 2021 Bugs Matter survey containing detailed analysis and references to other studies mentioned here is available here <https://www.kentwildlifetrust.org.uk/get-involved/our-projects/bugs-matter> and enquiries can be directed to info@bugsmatter.app.