

England Biodiversity Indicators 2021

This document supports
18. Spring Index

**Technical background document:
Advice on the calculation of the Spring Index**

For further information on the England Biodiversity Indicators visit
<https://www.gov.uk/government/statistics/england-biodiversity-indicators>

Calculation of the Spring Index

The England Spring Index is calculated from the annual mean observation date of the following 4 biological events: first flowering of hawthorn (*Crataegus monogyna*), first flowering of horse chestnut (*Aesculus hippocastanum*), first appearance of orange tip butterfly (*Anthocharis cardamines*) and first sighting of a swallow (*Hirundo rustica*).

For data collected up to and including 2018, the overall index was compiled by calculating an annual mean across all sites where all 4 biological events were recorded. As there was no missing data the England Spring Index could be calculated in 2 ways: the average of the four events or the average of the locations (the same value will be returned). After the England spring index was calculated, the raw data was not used in the calculation again.

In order to include more data in the calculation the method was changed in 2019 and the overall index was compiled by calculating an annual mean for each species using all available data, and averaging these 4 means. This new method of calculation (see “Background and Further Information” section, below), has been applied to all previous years retrospectively and has been submitted for external review.

The number of locations will vary from year to year. The England Spring Index varies year to year mostly because of differences in the temperature.

The average date of these events is now (1998 to 2020) about 8.9 days in advance of the average for the period 1891 to 1947. The England Spring Index shows a very significant relationship with mean March to April Central England Temperature, which appears to be stronger when mean temperatures exceed 7°C. For the England Spring Index, the relationship in years with mean March to April temperatures below 7°C was:

England Spring Index = 148.36 minus 3.43 x Temperature, $R^2 = 37.10\%$, $p < 0.001$

The equivalent for years when mean March to April temperatures equalled or exceeded 7 °C was:

England Spring Index = 175.36 minus to 7.43 x Temperature, $R^2 = 78.46\%$, $p < 0.001$

Data for the 1891 to 1947 period comes from the phenological network of the Royal Meteorological Society as published in the Quarterly Journal of the Royal Meteorological Society. This was a voluntary network of recorders that submitted their phenological observations to a central coordinator. All these data have now been digitised and loaded into the Nature’s Calendar database. The UK Phenology Network/Nature’s Calendar project runs along broadly similar lines. As a citizen science project it also involves volunteers contributing their observations and is run and coordinated by the Woodland Trust. Here we use their data from 1998 onwards. The number of records varies from year to year, but the current scheme is substantially bigger than the earlier one.

Since locations reflect the distribution of volunteer recorders they are not evenly spread across the country, but rather reflect the density of human population, with a greater number of recorders in the South to East and fewer in the North.

The reliability of the data is dependent on the frequent and timely observations of the natural world by the volunteer recorders. The data show such a strong relationship with temperature that we have confidence in their reliability.

Background and Further Information.

- Previously, the spring index was calculated using only data from locations for which **all four** spring index species have been recorded. Recorders gave a postcode and could record anywhere within 10 km of that postcode.
- However, in 2017 (when Nature Calendar's website was launched), recording location changed to plotting records on a map and each recording location is now the area of a circle with only a 20 metre radius.
- This change means that it is much less likely that a single recorder can record **all four** spring index species in a single location.
- The new method (as applied to data utilised in the 2020 and 2021 publications) takes into account all the individual sightings submitted.
- Consequently, the new method increases the amount of data that can be used in the calculation. It also allows an additional year of data (i.e. 1998) to be included in the dataset.