

## Letters to the Editor

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**Length of the growing season**

A set of indicators of climate change and its impacts have been identified, covering climatological, environmental, and socio-economic factors in the UK (Cannell *et al.* 1999). We propose an additional indicator, namely the length of the growing season. This statistic meets the published requirements for an indicator (Cannell *et al.* 1999, pp. 3-4): We propose an additional indicator, namely the length of the growing season. This statistic meets the published requirements for an indicator (Cannell *et al.* 1999, pp. 3-4):

- (i) a long-term record is available;
- (ii) the record shows that the indicator is sensitive to climate;
- (iii) the record is publicly available and routinely updated; and
- (iv) the record is closely related to policy concerns.

The growing season is the period of time each year during which plants can grow; in practice, this is when air and soil temperature are above freezing for most of the time. Using the record of daily mean Central England Temperature (CET - Parker *et al.* 1992), we define the growing season as the longest period within a year that satisfies the twin requirements of:

- (i) beginning at the start of a period when daily mean CET is greater than 5 °C for five consecutive days; and
- (ii) ending on the day prior to the first subsequent period when daily mean CET is less than 5 °C for five consecutive days.

In Fig. 1 we display this record of growing- season length. The longest growing season in the 229-year record occurred in 2000, when it extended for 330 days from 28 January to 22 December. This recent climate record has not, to our knowledge, been noted before. Other

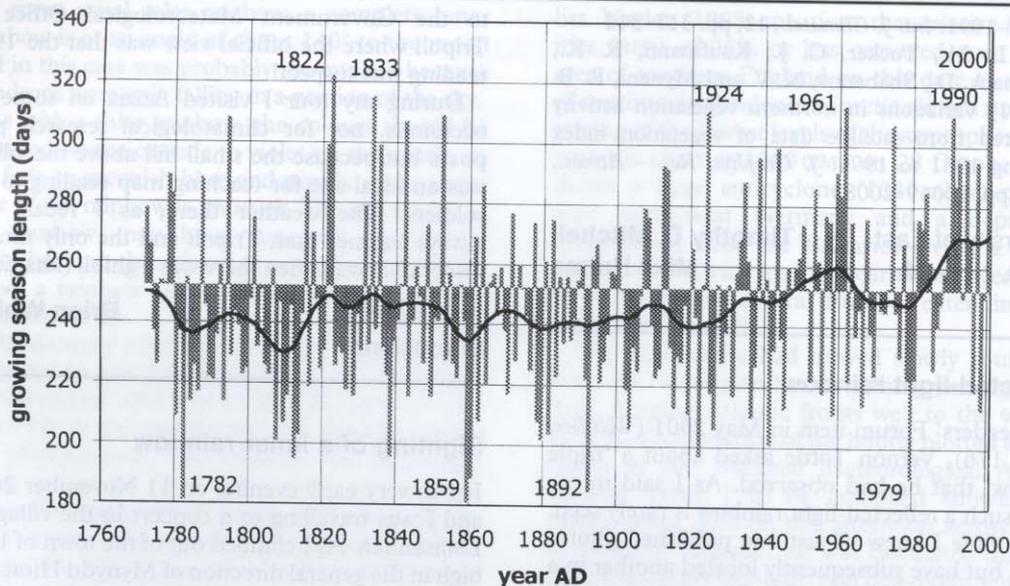


Fig. 1 The length of each year's growing season, 1772–2000, compared with the multi-decadal mean (obtained using a 30-year Gaussian filter) and the mean length for 1961–90 (252 days, 21 March to 28 November)

Table 1 Growing-season extremes, 1772–2000

	Longest (days)	Shortest (days)	Earliest start	Latest start	Earliest end	Latest end
1	330 (2000)	181 (1782)	14 Jan. 1990	6 May 1782	12 Oct. 1843	18 Feb. 1925
2	322 (1822)	181 (1859)	19 Jan. 1822	6 May 1979	15 Oct. 1905	5 Feb. 1834
3	315 (1833)	185 (1892)	19 Jan. 1943	4 May 1945	17 Oct. 1926	21 Jan. 1853
4	313 (1961)	189 (1860)	28 Jan. 2000	28 Apr. 1860	18 Oct. 1896	16 Jan. 1984
5	311 (1924)	190 (1979)	30 Jan. 1787	28 Apr. 1838	20 Oct. 1819	14 Jan. 1975
6	310 (1990)	195 (1812)	3 Feb. 1815	25 Apr. 1812	20 Oct. 1859	4 Jan. 1935

extremes are presented in Table 1. There has been an increase in length over the twentieth century of 28 days; most of the increase took place in two distinct phases, 1920–60 (0.5 days per year) and 1980–2000 (1.1 days per year). Whereas the earlier increase arose equally from an earlier onset of spring and a later onset of winter, all of the recent increase has arisen from an earlier onset of spring. The growing season is now longer than at any time since the start of the record in 1772. If, as is likely, much of the recent rise in CET is the result of anthropogenic climate change, then it is also likely that much of the recent increase in growing-season length is due to human emissions of greenhouse gases.

These results are in harmony with other published work. On the basis of phenological data, Menzel and Fabian (1999) found that the growing season in Europe (including the UK) lengthened by 10.8 days between 1959 and 1993. Myneni *et al.* (1997) used satellite data to suggest that the growing season lengthened between 1981 and

1991, particularly in regions between 45 and 70°N. More recent work has supported these conclusions (Zhou *et al.* 2001; Chmielewski and Rotzer 2001).

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