Introduction – citations

Anwar:

One of the most striking features is the significant overall reduction of the flower- ing period and earlier maturity in the future climate (2030, 2060 and 2090) relative to the baseline for all of the five crops across the four locations (Figs. 3 and 4). For example, there is a significant ad- vancement in median flowering date of wheat at Hamilton for 2030, 2060, and 2090 of 10, 18 and 29 days respectively. Likewise, for field peas at Katanning, a similar comparison suggests the median flow- ering date is advanced by 8, 14 and 25 days and at Cunderdin, barley matured earlier by about 5, 11, and 19 days. The advancement in phenological events is likely to be related to projected tempera- ture increases and, to some extent, rainfall changes (see Fig. 5).

Change in climate results in a different response in the growth
and development of each crop species due to interspecies varia- tion in temperature requirement for achieving certain phenological stages

Cook 2013 (pasture lands):

Precipitation is the dominant climate control on inter-annual variability of LAImax in pasture cells,
showing widespread and significant positive correlations, especially in semi-arid regions

Our results are broadly consistent with previous studies that have documented widespread greening
and increased productivity in the biosphere over the last several decades (e.g., [6,7,35,54]). These increases have largely been attributed to increased temperatures and longer growing seasons, especially at high latitudes

In southwestern North America, net primary productivity has been declining [62], possibly due to recent climatic changes. In southeastern Australia, the recent “Millennium Drought” [63] has driven significant vegetation productivity declines [64–66].

Badeck 2004:

Trends in the
timing of plant developmental phases that are brought about by the current anthropogenic global climate change can have major impacts on plant productivity, competition between plant species, and interactions with heterotrophe organisms. In addition to direct effects in the biosphere, these impacts can have consequences for goods and services extracted from ecosystems for human use.

quantification of the effects mentioned so far and attribution of changes in phenology to climatic change are required.

Hence there is ample evidence that the timing of many phenological phases is a function of temperature.

The general expectation in a warming climate is therefore to find time trends in the phenological switches that determine the length of the vegetation period in temperature-limited, cold-deciduous plants. A correlation between the date of onset of the phenophase and antecedent heat sums, mainly temperatures of the preceding months, is to be expected. In water-limited systems where plants enter into dormant stages or die when soil water is depleted, changes in precipitation patterns are expected to modify the annual cycle of plant activity.

Environmental factors other than temperature also modify plant phenology. The second most important trigger of spring phenological phases is photoperiod length. This has been shown in experimental studies (Saxe et al ., 2001).

Observations on changes in the trend, as evident in the
review by Walther et al . (2002), confirm this expectation of an acceleration of spring phenology advancement in the late 20th century. Peñuelas et al . (2002) made the same observa- tion in analysing time series for a mesic Mediterranean site in northern Spain. Scheifinger