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Extreme summer heat and drought acts as an environmental veto for fruit production in European beech

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European beech is known to be a masting species, i.e. fruit production does not occur every year. It is thought to be a species which is flowering controlled, i.e. that after successful pollination, fruits and seeds would be produced. In the last two decades, years with high fruit production occurred every two to three years in Middle Europe, which may be indication for an inherent biennial cycle. However, successful fruit production can be hampered by disadvantageous weather conditions, such as frost events, during the pollination season.

In Switzerland, after high beech pollen concentration was measured in spring of 2018, high fruit production was expected. However, during the extremely hot and dry European summer of 2018, beech produced no, or only small amounts of beechnuts in two of three long-term monitoring beech stands in Switzerland, which are part of the Swiss Long-Term Forest Ecosystem Research Programme. We observed that beechnuts were aborted in early summer already. Over the last decades, we found similar examples of mast failure and fruit abortion in years with hot and dry summer conditions. These extreme conditions can thus act as an “environmental veto”, similar to frost events during flowering. In years with fruit abortion, summer mean temperatures were 1.2°C higher, and precipitation sums were 45% lower than the long-term average. Our findings are evidence for a biennial masting cycle in European beech, which can be interrupted by extreme weather conditions such as extreme summer heat and drought or frost during flowering.