Increased severity and frequency of fodder production deficits under future climate conditions in Ireland

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1. Grassland Agriculture in Ireland

Irish agriculture is heavily reliant on dairy and livestock farming, with the vast majority of agricultural land used for grass production or rough grazing. 58.4% of the land area was classified as grassland in 2018 (CSO, 2022). Animals spend most of the year outdoors grazing and grass silage is widely used as fodder while animals are housed.

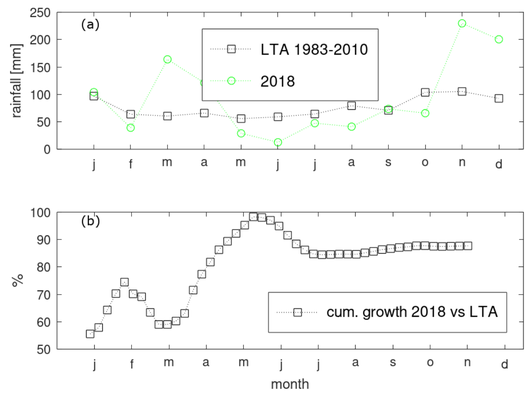

Figure 1. 2018 fodder crisis development: (a) monthly rainfalls LTA & 2018; (b) cumulative grass growth as percentage of LTA (based on national PastureBase data via O'Donovan et al., 2022)

2. Multifactorial 'Fodder Crisis' Events

In recent years, several 'fodder crises' have been widely reported in the media, when fodder supplies ran low resulting in threats to farms' productivity and to animal health and severe economic losses. Fodder crises are multifactorial in nature, but weather conditions at the seasonal or multi-annual scale are a significant driver.

3. The 2018 Fodder Crisis

In 2018 a long and severe drought led to a collapse in grass growth (O'Donovan et al., 2022) and severe shortages of fodder across most of the country, particularly in the south and southeast (Fig. 1). After a cool, wet Spring, conditions between May and mid-July were much warmer and drier than average (Fig. 2). Events similar to that of 2018 may increase in frequency and severity by the mid-21st century due to seasonal shifts in precipitation patterns as predicted by the climate modelling study of Nolan & Flanagan (2020).

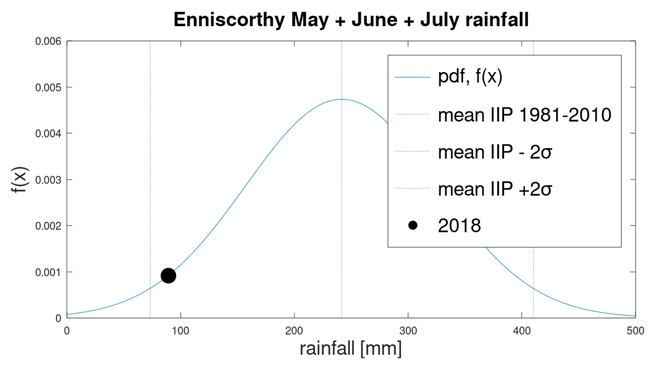

Fig. 2. SE Ireland (Enniscorthy) May+June+July historic rainfall distribution (IIP, 1981–2010; Noone et al., 2016) and 2018 May+June+July rainfall

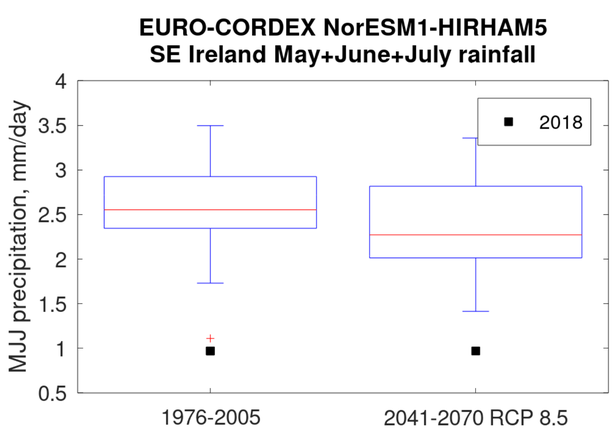

Fig. 3. Distributions of SE Ireland historic (1976–2005) and 2041–2070 May–June–July rainfall from EURO-CORDEX NorESM1-HIRHAM5 (RCP 8.5)
Red = median; blue box = quartiles; black square = 2018 MJJ magnitude.

4. Climate Change & Modelling

Monthly precipitation for southeast Ireland (land area between 52.5 – 53.0 °N, 6.5–7.0° E) for historic and RCP8.5 climate change scenarios was extracted from (1) from the NorESM1-M GCM (CMIP5, KNMI), and (2) downscaled EURO-CORDEX NorESM1-M HIRHAM5 runs. Ensemble means were used to compare the occurrence of the low May–June–July rainfall conditions which contributed to the 2018 event under historic (1981–2010) and mid-21st century (2041–2070) climate (Fig. 3). 1976–2005 was used as the historic period for the EURO-CORDEX runs.

5. Mid-Century Fodder Crises

2041–2070 May–June–July rainfalls under the RCP 8.5 scenario from EURO-CORDEX are lower than for 1981–2010 (Fig. 3). May–June–July rainfall similar to that of 2018 is approximately **3.7 times as likely** to occur in this future climate than in 1981–2010.Work is ongoing to couple grass production models (e.g. Jouven et al., 2006) with climate change data to simulate grass growth rates under future climatic conditions (Fig. 4).

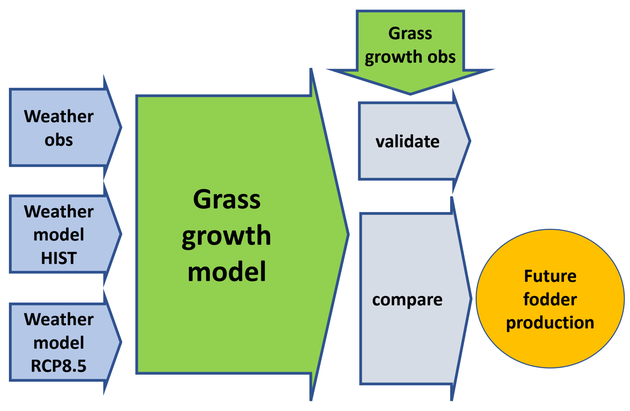

Fig. 4. ClimAg modelling approach for future fodder production under climate change scenarios

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