Subject: Pasture conditions in northern Europe, update as at 31 July 2018

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Objectives

Following a request from DG AGRI G4 to provide an overview of pasture conditions in Europe, with a particular focus on central and northern EU countries that are experiencing a dry spell, the Monitoring Agricultural Resources (MARS) team of the JRC Food Security Unit has analysed several anomaly indicators based on the fAPAR (fraction of absorbed photosynthetically active radiation by vegetation) observed from the remote sensing of pasture areas. The two main objectives of this analysis are:

- To provide an overview of the pasture conditions throughout the 2018 growing season, identifying those regions where pasture productivity has been negatively impacted by the effect of water stress;

- To provide a qualitative assessment of the damage caused by water stress in the countries affected, in terms of severity and exceptionality in a recent historical perspective, and highlighting those areas where the effects are most severe.

Methodology

Pasture productivity was monitored through two different anomaly indicators: The pasture productivity index (PPI) and the absolute fAPAR differences. Both indicators are complementary. The PPI indicates how exceptional an anomaly in fAPAR is for a given region (e.g. how close it is to the historical minimum of that region, on average, etc.). The absolute difference of fAPAR, by contrast, indicates the magnitude of the anomaly. The absolute difference helps distinguish regions where the photosynthetic activity of pastures decreases sharply from regions where the anomalies are less pronounced.

The period of analysis considered was from 1 May (when grassland cutting usually starts in most of the countries considered) until 31 July (latest data available).

In addition, we provide graphs that rank the average fAPAR (from 1 May to 31 July) for all seasons since 1999 (the first year of the observations) and we provide graphs that include the course of fAPAR for the current 2017-2018 season, the long-term average (LTA), and a season from the past that, given the evolution

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1 The relative index of pasture productivity or the pasture productivity index is an indicator of biomass formation based on the integration of the fAPAR remote sensing product over pasture areas at regional level over a period of interest. The index shows the relative status of the current season compared to the historical series from 1999 to 2017, and its values range approximately from -3 to 3. A value of 0 indicates that biomass production in the current season is similar to that of the long-term average. Values greater than 2 and less than -2 indicate that biomass production in the current season is close to, respectively, the historical maximum and minimum of the period 1999-2017, for the period considered in the analysis.

2 fAPAR, the fraction of absorbed photosynthetically active radiation, ranges between 0 and 1, and expresses the proportion of incoming PAR radiation (from 400 to 700 nanometres) absorbed by vegetation for photosynthesis.
of fAPAR and the agro-meteorological conditions experienced, we consider to be most similar to the current season. Both types of graphs allow us to establish a reference from recent history that can help to understand and put in perspective the severity of the dry events experienced this year.

First, we present an overview of the pasture conditions in the northern EU based on the information provided by the maps, and then we analyse in detail the situation for groups of countries with similar conditions.

Results of the analysis

*EU-28 pasture productivity and fAPAR anomalies*

Dry and hot conditions persist in northern DE, the Benelux, DK, southern SE, UK and IE. These are the EU countries in which pasture conditions have been most affected, as highlighted by both the PPI and the fAPAR anomalies map. The average fAPAR between May and July 2018 for all of these countries is the lowest on the historical archive (1999-2017), as will be explained in the sections below. North-western DE (Sachsen Anhalt, Schleswig-Holstein, Weser-Ems), DK, and the Benelux are the most severely affected regions.

Pasture productivity is below average in north-eastern FR and central CZ, but the effects of the dry conditions are less severe than in the countries mentioned in the previous paragraph. A few seasons in the period 1999-2017 showed even lower pasture productivity levels due to dry conditions.

Similarly, in the Baltic countries (EE, LV, LT), FI and eastern PL, pasture conditions from May to July are close to or below the average. The exceptionality and the magnitude of fAPAR anomalies in this region is lower than in north-central and north-western countries because of rainfall since the second half of June. Nevertheless, as will be explained below, in the past 20 years there are few growing seasons in which dry
conditions have had a greater impact on pasture productivity. In more recent years (2011-2017) pasture productivity was predominantly above average in this region, providing a sharp contrast with the current season.

**Germany, Benelux, Denmark and Sweden**

Pastures have been most severely affected by dry conditions in north and north-eastern Germany (*Sachsen-Anhalt, Mecklenburg-Vorpommern*). The lack of substantial rainfall and the unusually hot conditions since May produced a sharp decrease in the photosynthetic activity of pastures, as indicated in the time-series. In this region, the most similar year (in terms of fAPAR and weather conditions) is 2003. The decrease in fAPAR in 2018 is more pronounced than in 2003, but in 2003 pasture growth before May was also exceptionally low.

In north-western DE (*Weser-Ems*) and in the Benelux countries, pasture conditions deteriorated only from the second half of June onwards. Since then, the lack of rainfall and the heightened temperatures led to a sharp decrease in pasture productivity. The most similar years are 2010 (see graphs) and 2006, when dry conditions produced a negative fAPAR anomaly from May to July. However, in both years abundant precipitation in August led to the recovery of pasture productivity towards the end of the season.

The situation is also exceptional in DK. The effects of the dry conditions are more severe than in 2008, the most similar season to 2018. In 2008, fAPAR was persistently lower than the average from mid-April to August, due to dry conditions, with a similar amount of precipitation to that of 2018. However, temperatures from May to July in 2018 have been higher than in the same period of 2008. This has resulted in a stronger water deficit and early senescence of pastures, leading to a sharp decrease in pasture productivity from mid-June onwards to below the low levels of 2008.

A similar exceptional situation is found in southern SE (*Sydsverige*) where the only comparable year of the past twenty is 2006. Weather conditions in 2006 from January to July were as dry as in 2018. However, two exceptionally hot periods in 2018 (in May and the second half of July) caused more damage to pasture growth than in 2006.
**UK and Ireland**

Exceptionally dry conditions since June have significantly damaged pasture productivity in the southern UK and IE. Significant rainfall (about 40 mm) was recorded in the last week of July, leading the exceptionally low values of fAPAR observed in mid-July to increase slightly.

The most similar year for both regions is 2006, which presented a negative fAPAR anomaly of the same magnitude as that observed this year. However, in 2006, that anomaly occurred one month later (July-August) than in 2018, as rainfall in May 2006 was very abundant and prevented water stress until July.

**North-eastern France and the Czech Republic**

In north-eastern FR (e.g. Lorraine), the current season is quite similar to two recent years, 2015 and 2017. The most negative season was in 2003, when an intense drought across the country caused major damages to pastures and fodder maize areas. Pasture productivity in the summer of 2018 did not fall to the low levels observed in 2003.

In the centre of the Czech Republic (Stredocesky Kraj), pasture productivity has been significantly affected by dry conditions since mid-May. Similar conditions were experienced in 2003 and 2007, which also presented a sharp decrease in pasture productivity from June onwards due to unusually dry and warm summer conditions.
Baltic countries, Poland and Finland

In the main grassland areas of eastern PL (Mazowieckie, Warmisko-Mazurskie), pasture productivity is currently above the LTA. As shown in the time series, after a dip in the second half of May and the first half of June, fAPAR recovered after the significant rainfall registered in mid-June and (more distinctly) the second half of July. The outlook for August is positive in all of these areas.

Conditions remained drier than usual in LV, LT and EE, but precipitation since the second half of June prevented substantial damage to grasslands. Pasture productivity was below the LTA from June to mid-July, but, as at the end of July, fAPAR values are close to seasonal values. Considering the May to July period as a whole, 2018 is not an extreme year such as 2006, for example, (see graphs below) when exceptionally hot and dry conditions caused greater damage to pastures.

Similarly, precipitation in southern FI (Etelä-Suomi) in July was close to the LTA, and this alleviated the effects of water stress on pasture productivity. The fAPAR at the end of July is now close to seasonal values. The average fAPAR from May to July is below the LTA and well below the levels attained in recent years (since 2011), but 2018 cannot be considered an extreme year within the full dataset analysed.