**RRES Press Release 24/3/2021 Grasslands stopped fighting climate change over a century ago**

*World’s oldest ecology experiment shows ‘hypersensitive’ grasses unable to absorb any more carbon dioxide*

An investigation into why the world’s 50 million square kilometres of grasslands aren’t soaking up more CO2 from the atmosphere has shown many such habitats reached their peak over a hundred years ago.

Based on UK grown samples, the study also shows that grasses are physiologically constrained from taking up further CO2 – even when nitrogen fertilisers are added to encourage their growth.

In fact, grasslands that have received high levels of nitrogen fertiliser are today yielding less than they were a century ago.

This latest analysis of samples from the world’s longest running ecological experiment, Park Grass, shows that some of the planet’s most productive grasslands may have reached carbon saturation sometime near the beginning of the twentieth century or earlier when the concentration of atmospheric CO2 was only two thirds of its current level.

Grasslands make up about 40% of the earth’s land area – excluding Antarctica and Greenland – and are primarily grazed by large mammals, both wild and domesticated.

The report’s authors say the common practice of adding nitrogen fertiliser to grazing land to encourage greater grass growth – and hence greater CO2 uptake – is not only fruitless from a climate point of view, but also counterproductive.

Dr Andy Macdonald, Rothamsted Research said: “These findings indicate that increasing nitrogen fertilizer supply to temperate grasslands may not be an effective climate change mitigation strategy because it promotes the expansion of grasses at the expense of the more CO2 responsive plants such as forbs and legumes, and it may enhance greenhouse gas emissions.

“In fact, this study shows that heavily fertilised grassland has yielded less under a century of climate change.”

The reason why grassed have reached their limit with regards carbon storage stems from the tiny pores, called stomata, that plants use to exchange carbon dioxide and water vapour between their leaves and the surrounding air.

Carbon dioxide is absorbed through open stomata and used by leaves to make sugars in the process known as photosynthesis.

However, as plants also lose water vapour from their leaves when these stomata are open, they have also evolved the ability to close them - resulting in a delicate balancing act between carbon-in and water-out.

The researchers found that, going as far back as 1917, there has been a decline in the amount of time grasses have had their stomata open – which has meant they have not absorbed as much carbon dioxide from the air.

A further impact of this is that the grasses take up less nitrogen from the soil, which further constrains their growth.

Of all the plant species looked at in the study, grasses seem to be the most sensitive to CO2 levels, say the team which was led by the Technical University of Munich.

The samples the researchers looked at came from the Park Grass experiment, [the oldest ecological experiment in the world](http://news.bbc.co.uk/1/hi/sci/tech/4766081.stm) which is located at Rothamsted Research in Hertfordshire

It was started in 1856 on 3 hectares of old grassland and its original purpose was to investigate the effect of fertilizers and organic manures on hay yields of permanent grassland.

The experiment comprises 20 main plots with different fertilizer inputs, with representative hay samples from each harvest stored in the Rothamsted Sample Archive.

Using new analyses of oxygen and carbon isotope composition, nitrogen and phosphorus in biomass, and yield and climate data, the research team analysed the physiological effects on these samples of increased atmospheric CO2 concentration.

Lead author, Professor Hans Schnyder from theTechnical University of Munich, said: “Sometimes we seem to know more about the future than the past. This is especially true for the projected impacts of future elevated CO2 and climate change on the natural cycles of carbon, water and nitrogen in grassland, that have been intensively studied in controlled environments and field experiments.

“This new investigation of the Park Grass Experiment shows for the first time that key predictions for those future effects have already materialised in the last century or earlier. These results are important for informing earth-systems-modelling and global change management policies for grassland.

“In particular, they also raise questions concerning the sustainability of elevated nitrogen fertilizer use in permanent seminatural grassland.”

Publication

Baca Cabrera, J.C., Hirl, R.T., Schäufele, R. *et al.* Stomatal conductance limited the CO2 response of grassland in the last century. *BMC Biol* **19,**50 (2021). <https://doi.org/10.1186/s12915-021-00988-4>