STEM for Britain
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MONITORING PEATLAND RESTORATION FOR CARBON SEQUESTRATION USING SATELLITE DATA

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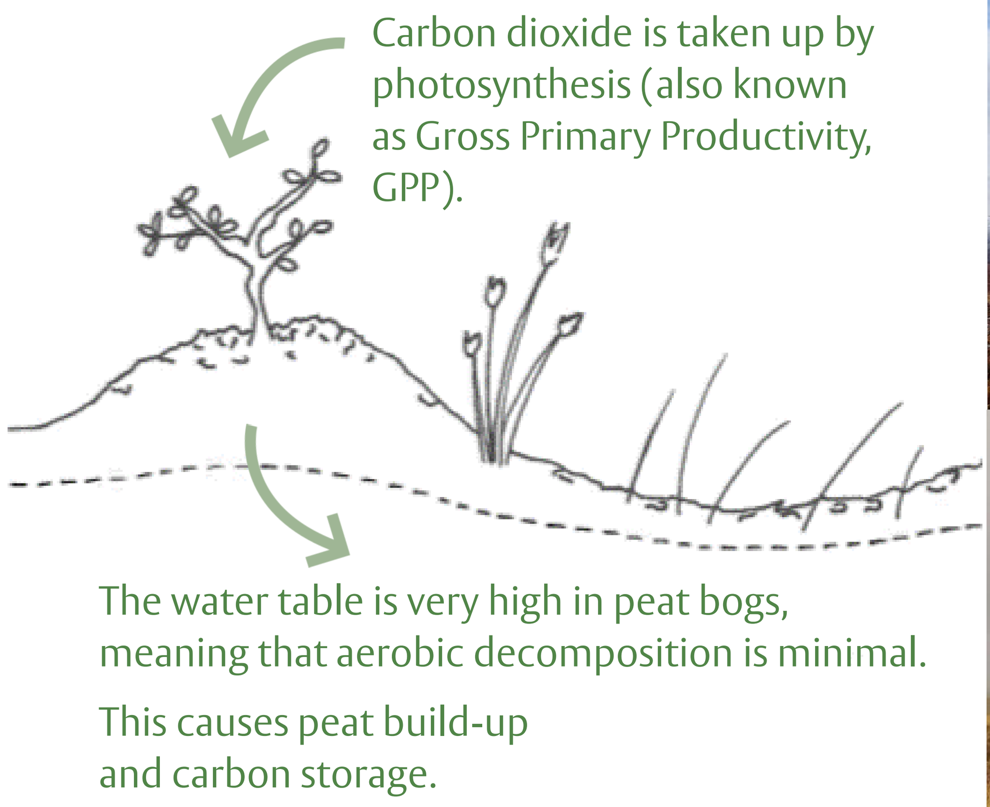
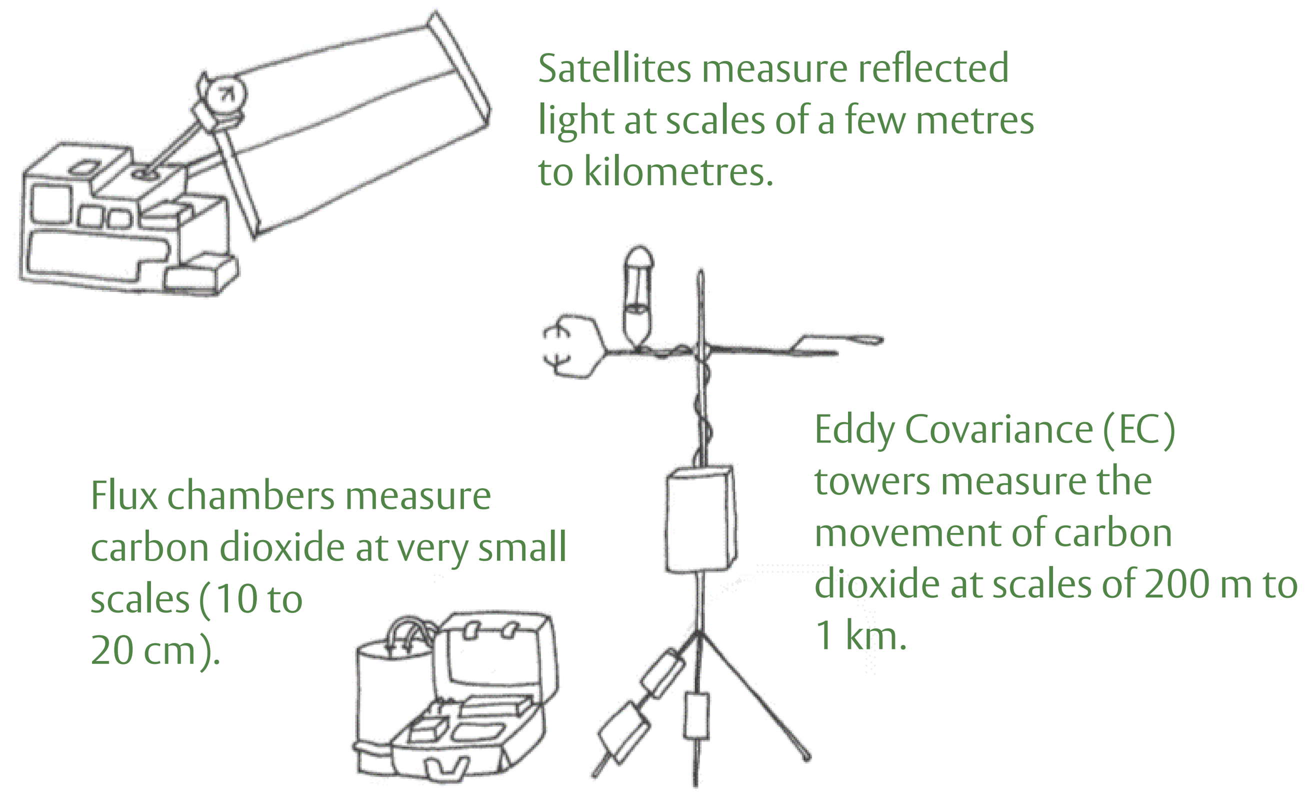


Peatlands are important landscapes because they store approximately a third of the world's soil carbon. Human mismanagement has caused degradation in many UK peatlands, but restoration is now encouraging more natural processes.



Traditional methods of monitoring carbon fluxes are small scale and expensive. Models using satellite data might be a useful alternative, but not many studies have yet been done in peatlands.

$GPP = LSTs \times NDVIs \times m$

$LSTs = \min [(T + Tmin)/(Topt + Tmin) , (Tmax - T)/(Tmax - Topt)]$

$NDVIs = NDVI - 0.1$

The Temperature and Greenness (TG) model is based on Sims et al. (2008). It uses the Normalised Difference Vegetation Index (NDVI) as a measure of plant chlorophyll. Land Surface Temperature (LST) is optimised to the plant functioning of each site.

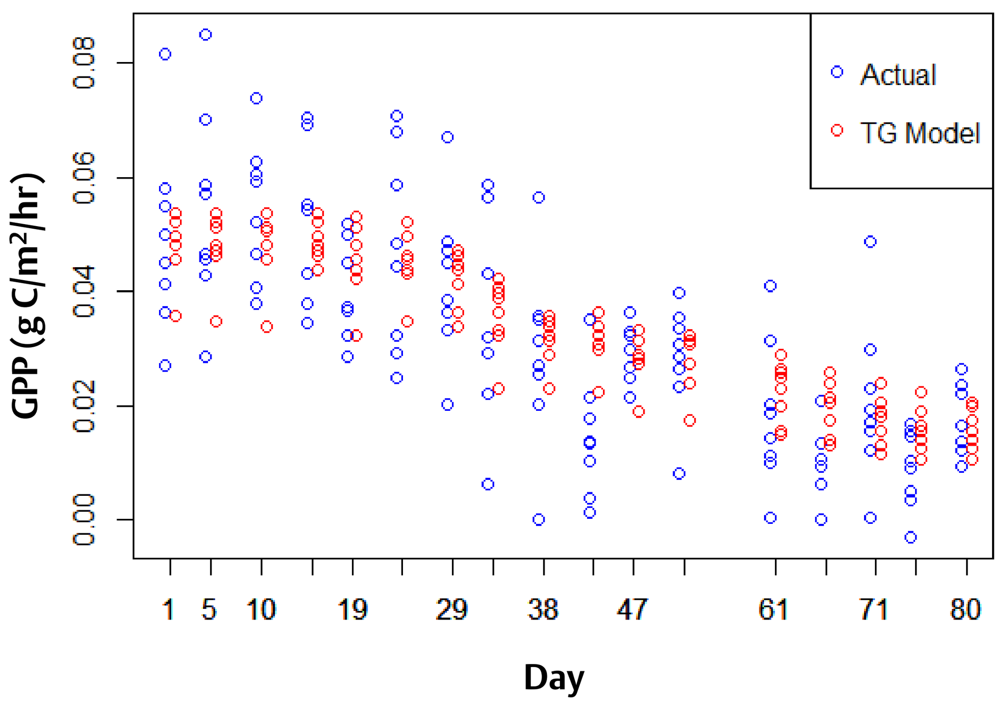
To test the model principles under extreme conditions we subjected *Sphagnum* moss (a key peat-forming species) to 80 days of drought.

The effect of the drought period on carbon fluxes was measured using a flux chamber, and on spectral reflectance using a lab-based spectroradiometer.

To test the model at a small scale in the field we used a handheld spectroradiometer and a flux chamber to measure surface reflectance and carbon fluxes across the growing season.

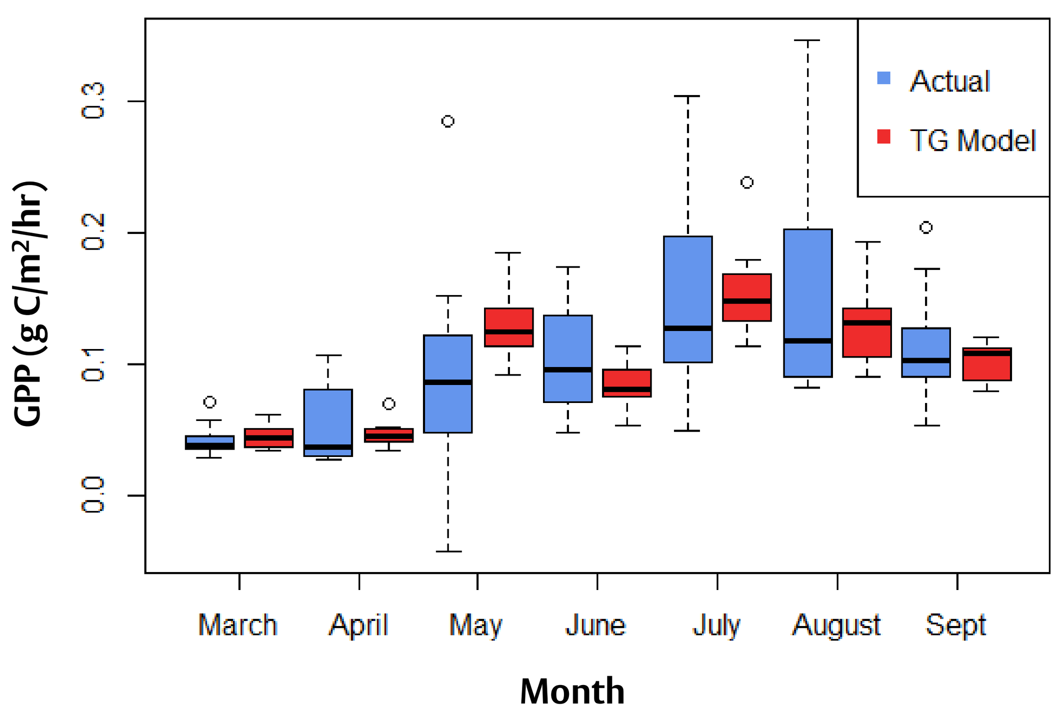
Finally, we tested the model using satellite data from the Moderate Resolution Imaging Spectrometer (MODIS) compared to flux data from and EC tower.

Laboratory work



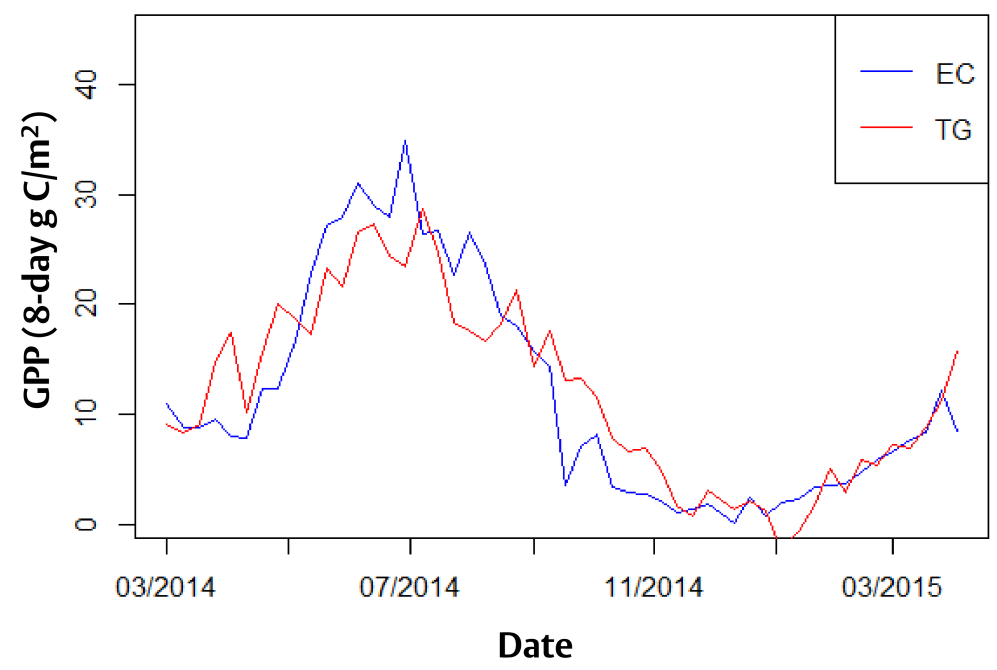
Across the experiment period the drought stress caused the *Sphagnum* to reduce photosynthesis. This is matched by the TG model results.

Field work



Across the growing season the photosynthesis levels changed. The TG model results show this change as well, although the model underestimates higher values.

Satellite data



Across a year of data, the Eddy Covariance tower photosynthesis and the TG results are very well matched, with an R-squared value of 0.81.

Conclusions

Having tested the model principles on different scales, across the growing season, and under extreme conditions, we are now confident that the TG model is a useful addition to methods for monitoring the impact of peatland restoration on peatland carbon dioxide fluxes.

As peatland restoration is now recognised under the Kyoto protocol as a carbon sequestration measure, it is important to have reliable and long-term methods of calculating the progress and success of restoration schemes. We believe the TG model, when applied correctly, can provide useful information in this regard.

References

1. Sims et al (2008) *Remote Sensing of Environment*, 112, 1633–1646

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