SHALLOW PEAT METHANE EMISSIONS

How does restoration age, vegetation and water depth impact methane (CH_4) emissions from restored mires within Exmoor National Park?

- Re-establishment of mire vegetation associated with wetter conditions serves as a useful indicator for increased CH_4 emissions, which in turn indicates that restored mires on Exmoor are returning to a more natural state.
- Annual CH_4 emissions from restored sites on Exmoor are low, even after ~7 years post-restoration, suggesting that the timeline for mire restoration to a more natural state is likely to exceed 10 years.

This study[1] investigated the gaseous carbon (C) balance of restored mires in Exmoor National Park using a restoration age sequence of sites (from 6 months to ~7 years post-restoration), as well as unrestored and semi-natural sites.

Increased cover of plants associated with wetter conditions (e.g., *Sphagnum* moss) and higher mean annual water levels were linked to increased methane (CH_4) emissions and site restoration status (Figure 36 and 37). Higher CH_4 fluxes indicate the presence of anaerobic (oxygen deficient) microbial communities where microbial CH_4 generation (methanogenesis) occurs as a biproduct in the breakdown of organic matter. Therefore, CH_4 emissions, and thus methanogenesis, is an indicator that anaerobic conditions are becoming more dominant within the peat soil due to increased water saturation.

Restoration activities on Exmoor seek to increase water saturation levels within the peat soils, and therefore CH_4 emissions can be viewed as a sign of restoration success. Figure 37 shows that vegetation data, particularly percentage cover of mire species associated with wetter habitats, could provide a valuable tool for assessing CH_4 emissions and site conditions of restored mires.

Semi-natural sites (those with little or no impact from drainage and peat cutting) from this study showed similar properties (i.e. gas emission balance, depth profiles of dissolved gases and stable C isotope analysis) to natural peat soils elsewhere in Europe and North America. However, the semi-natural sites from this study are likely still in a state of transition, also supported by vegetation survey data. Recovering peat soils can transition through a stage of higher CH_4 emissions before lowering as the coverage of gas conductive (aerenchymatous) plant species (e.g. cotton grasses (*Eriophorum* spp.)) decreases, and conditions within the peat soil stabilise.

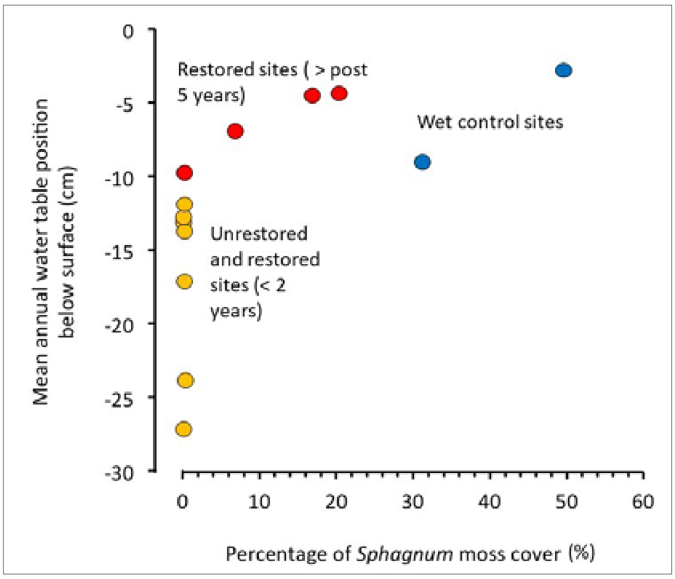

Figure 36 Mean annual water table position and percentage cover of *Sphagnum* moss for study sites ranging from unrestored and newly restored (yellow) through to semi-natural sites/wet controls (blue).

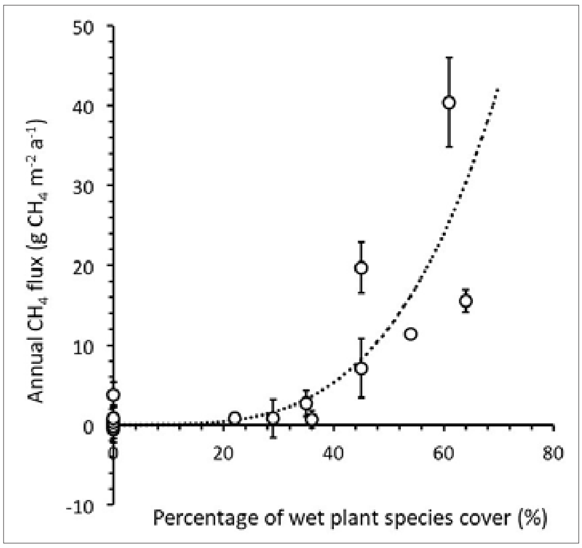

Figure 37 Relationship between annual methane (CH4) flux (g CH4 m^{-2} a^{-1}) and percentage (%) cover of wet mire plant species (e.g. *Sphagnum* moss) at sample sites. Flux estimates are based upon scaled monthly or bimonthly measurements from June 2013 to June 2014.

REFERENCES

The appendices are available to view at **www.exeter.ac.uk/creww/research/casestudies/miresproject**

1. Mcaleer, A. Carbon dioxide and methane exchange from restored mires in Exmoor National Park. (University of Bristol, 2016).