Cyfoeth Naturiol Cymru
Natural Resources Wales

Information note

# Peatland: How carbon sinks can turn into carbon emitters

## Carbon capture

Peat is a type of carbon rich soil made up of the partially decomposed remains of plants and animals.

Peatlands store vast amounts of carbon and act as a natural carbon sink making them ideal for helping to tackle climate change. They help to reduce carbon emissions globally and store approximately double the amount of carbon that is stored in all the world's forests, making them a vital tool in helping to regulate the climate. How? The carbon the living peatland plants capture from the air through photosynthesis becomes trapped due to the waterlogged, anaerobic or oxygen lacking conditions, and becomes essentially, stored in perpetuity unless someone disturbs it. Peat layers are built up over time as new plants grow on the peat surface before dying and becoming part of the peat soil.

The main factors that slow decomposition are waterlogged, cold and acidic conditions. Different combinations of these conditions slow decomposition rates by different amounts and because the conditions behind the process of slowing decomposition can vary, so do peatland types, locations and, importantly, the biodiversity they support. 50% of all Welsh peatlands are designated as Sites of Special Scientific Interest.

## Carbon emissions from peat

Any disturbances to the peatland that changes the conditions controlling decomposition will influence whether they are absorbing or emitting carbon. If the changes in condition change the balance between carbon uptake through photosynthesis and the carbon being released through decomposition, peatlands can switch from ecosystems that absorb carbon to ecosystems that emit not only recent carbon, but carbon absorbed over the last 12,000 years.

When peatlands are drained or burned, the peat water table is lowered, and the compressed organic matter is disturbed. Air penetrates deeper into the peat causing it to dry out and it begins to decay, turning long-submerged carbon into carbon dioxide. By increasing the amount of greenhouse gases in our atmosphere they go from being a carbon sink to a carbon emitter, releasing into the atmosphere centuries worth of stored carbon. The balance of whether a peatland is a carbon store or emitting carbon depends on the peatland's condition. Unless action is taken, the combined pressure of human actions and climate change could cause these important carbon storing ecosystems to become a global source of carbon emissions.

## Carbon footprint

A carbon footprint is a measurement of the total amount of greenhouse gas emissions that an individual, organisation, product or event produces. When we use fossil fuels, like gas to keep our house warm or petrol to run our family car, carbon dioxide ($CO_2$), is created increasing our carbon footprint. Greenhouse gas (GHG) emissions including carbon dioxide, methane and nitrous oxide are causing significant changes to our climate. A big carbon footprint means we are producing a lot of $CO_2$ and are having a greater effect on climate change.

We can use peatlands to help visualise a carbon footprint, although the average carbon footprint is likely to equate to a significant depth of peat, more than likely, deeper than your local peatland!

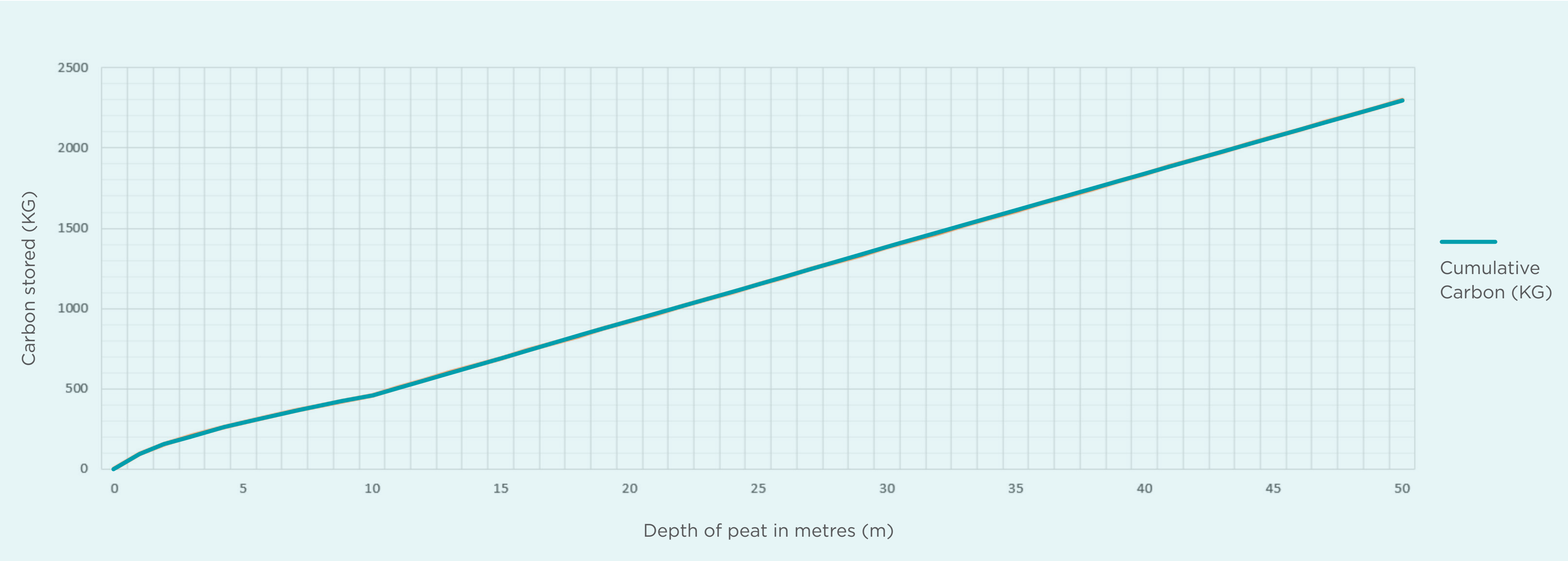
Only 10% of Welsh peatlands are in good condition with emissions from poor condition peatlands estimated to equal 10% of transport emissions, or 550 kilotonnes of $CO_2$ emissions a year. Restoring peatlands will help us reduce GHG emission from peatlands and help us tackle climate change.

## Measuring the carbon content of peat

Information on the surface area, an assessment of a peatland's condition combined with estimates of its peat carbon content, density and depth can help to estimate the total carbon stored in a peatland.

On average, healthy peat has a growth rate of 1mm of peat per year.

### Carbon storing capacity of peat



## Peat composition and growth rates

There are many variables related to peat composition and growth rates. We have based our measurements on the following equations:

**Equation 1** - Carbon content = $10 \times d \times \rho \times f_{om} \times OM_c$ (reference - Lindsay 2010)

where:

| | |
|---|---|
| 10 | = simply a conversion factor to turn g $cm^{-2}$ into kg $m^{-2}$ |
| d | = thickness of peat being considered in cm |
| $\rho$ | = dry bulk density in g $cm^{-3}$ (calculated from equation 2) |
| $f_{om}$ | = fraction of the dry matter which is organic matter (typically 0.94) |
| $OM_c$ | = the proportion of organic matter which is carbon (typically 0.5) |

The conversion factor of 10 means that the units of g $cm^{-3}$ often used for values of bulk density are converted into units where the spatial dimension becomes metres rather than centimetres, but this is convenient if we are ultimately to consider a 'standard cubic metre' of peat.

Bulk density varies with depth so to calculate an overall figure for a given thickness of peat we suggest using the following formula:

**Equation 2** - Bulk density = $0.7005 * \text{peat depth}^{-0.347}$ with peat depth entered in cm (reference - Williamson et al, 2019)

Therefore, for a 5 m thick peat body the carbon content would be:

$10 \times 500 \times 0.081$ [calculated from equation 2] $\times 0.94 \times 0.5 = 190.3$ kg $C/m^2$

## References

Lindsay, R.A, (2010). *Peatbogs and carbon: a critical synthesis to inform policy development in oceanic peat bog conservation and restoration in the context of climate change.* RSPB Scotland. 315 pp.

Williamson, J., Fitch, A. & Evans, C. (2019). *Developing core evidence resources to support the sustainable management of peatland ecosystems in Wales.* NRW Evidence Report, Natural Resources Wales.

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