

PEAT SOILS

Introduction



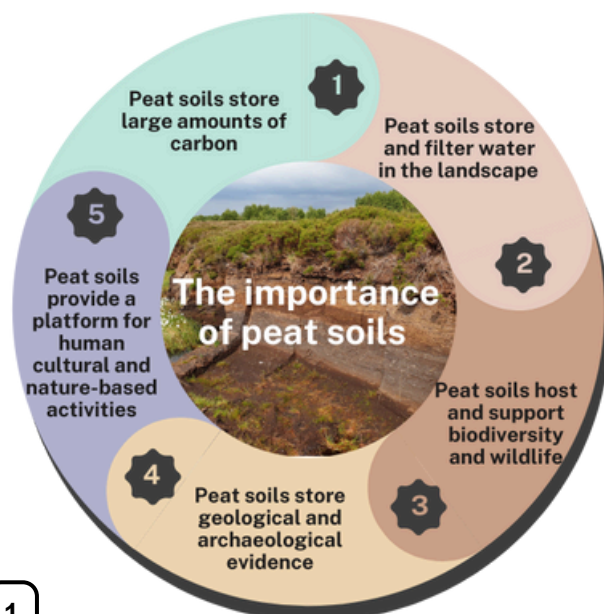
Shallow peat soil reclaimed for agriculture

Peat consists of partly decomposed plant remains that have accumulated where they have been produced (in situ). More precisely, peat is defined as: sedentarily accumulated material consisting of at least 30% (dry mass) of dead organic material. Peat belongs to the larger family of ‘**organic soils**’ or ‘**histic soils**’, which includes a wider range of managed soils containing at least 20% organic matter. However Irish peat soils typically contain on average more than 90% organic matter content, with lower content found in peat soils under grassland (733).

According to the **Global Peatland Assessment Report**, land with any thickness of in-situ peat is a peatland (872). However, for mapping and statistical purposes, each country has its own definition involving a minimal peat depth. In Ireland, a group of experts from various institutions met during the BOGLAND project (732) and defined peat soil as: “soil that contains peat over a depth of at least 30 cm deep; the depth requirement does not apply in the event that the peat layer is directly over bedrock”. Wet peat soils are defined as soils with a water table between 0 and 30 cm below the soil surface. Internationally, wet soils are not defined by the water table but as soils (mineral or organic) that are saturated by water for all or part of the year to the extent that the soil biota have adapted to anaerobic conditions. For the purpose of reporting greenhouse gas emissions (e.g. National Inventory Report), EPA Ireland use the depth strictu-sensu and if the peat layer is less than 30 cm then the soil is classified as organo-mineral (or peaty-mineral).

Estimates of the area of peat soils vary depending on the depth but with the above definition, peat soils cover 1,466,469 ha, or 20.6%, of the national land area (158). Because of the high organic matter content and their depth, peat soils store a huge amount of carbon. Irish peat soils typically contain more than 50% carbon and 2% nitrogen (733).

Irish peatland soils store approximately 2216 Million tonnes of carbon. Preservation of this store is critical to help Ireland meet its targets to reduce greenhouse gas emissions. Healthy peat soils also help to improve water quality and provide a habitat for a range of species. Peat soils are also important repositories of historical and archaeological evidence and provide a platform for many human activities.



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Trends

Peat soils are currently under threat from unsustainable practices and anthropogenic disturbances (land use change) but also natural erosion (268). This significantly impacts on their functioning and the ecosystem services that they provide (268, 421, 739). While they have stored large amounts of carbon and nitrogen over millennia, disturbances to peat soils over short timescales have triggered **losses of peat and release of carbon**, as well as nutrient losses to water and leaching of pollutants such as arsenic, lead and sulphate.

Key Research Findings

Peat composition

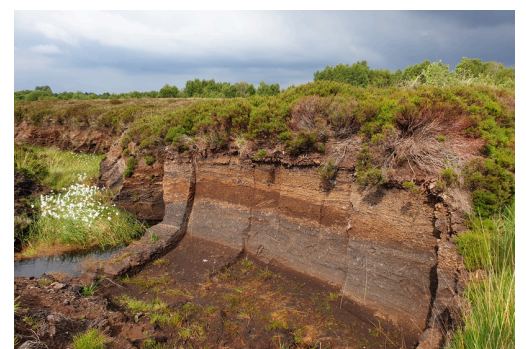
- Peat soils display a large **variety of soil properties** between and within sites, even over short distances (733).
- **Latest estimates put the total carbon stock of Irish peatlands at 2216 Mt**, representing 2/3 of total national soil carbon stock. Approximately 42% is stored in raised bogs, c. 42% in lowland blanket bogs and c.15% in mountain blanket bogs. Land use impacts are often detrimental to the physical and chemical conditions of peat and therefore affect carbon and nitrogen storage in peatlands (733).
- **Peat soils have low amounts of available nutrients, which makes them 'poor' soils**; this is because most of the nitrogen is bound to the organic matter. Still, the total nitrogen stock in Irish peatlands in Ireland has been estimated at 73 Mt (892). But unlike mineral soils, peat soils have no or little phosphorus sorption or storage capacities, and hence applied fertiliser phosphorus is highly mobile and at high risk of incidental losses.
- **Land use impacts are often detrimental** for the physical and chemical conditions of the peat and therefore affect carbon and nitrogen storage (892). Despite representing only 35% of the peatland area, natural and cutover peatlands together contain just under half of the national peatland carbon stock (733).



Peat soils in Ireland have been drained for 100s of years with serious implications for water, carbon loss and biodiversity.



Identifying remains of vegetation (macrofossils) from a peat core (above) and under the microscope (right).



Different peat layers on cutover bog

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Key Research Findings (continued)

Bog Slides

This topic has seen a huge amount of research since a series of damaging events took place in 2003 in Derrybrien, Co. Galway and Pollatomish, County Mayo (506), decreasing during the following decade only to increase again since 2020, mirroring the increase in occurrence of peat slides/bog flows. In 2020 alone, three large bog flows and/or bog slides occurred including at Shass Mountain, Co. Leitrim (165) and this was exceptional given the known annual average of 0.3 such (reported) events over the last 130 years (249).

It is critical to accurately use the terminology associated with peat soil movement to target specific management practices and types of peatlands. A key publication provided definitions to help understand these phenomena and compare studies (258). This is important since it was found, for example, that the recovery of bog burst scars may be more rapid than for peat slide scars (565).



Bog slide in Pollatomish, Co. Mayo, which occurred in Sept 2003.



Source: John Connolly

Bog slide in Shass Mountain, Co Leitrim, which occurred in June 2020.

Definitions

Bog slide: Failure of a blanket bog (i.e. bog peat) involving sliding of intact peat on a shearing surface within the basal peat.

Bog burst: Failure of a raised bog (i.e. bog peat) involving the break-out and evacuation of semi-liquid basal peat. Bog bursts can happen in raised bog with slopes less than 1 degree.

Bogflow (or 'Bog flow'): Failure of a blanket bog (i.e. bog peat) involving the break-out and evacuation of semi-liquid highly humified basal peat from a clearly defined source area.

Peat slide: Failure of a blanket bog involving sliding of intact peat on a shearing surface at the interface between the peat and the mineral substrate material or immediately adjacent to the underlying substrate.

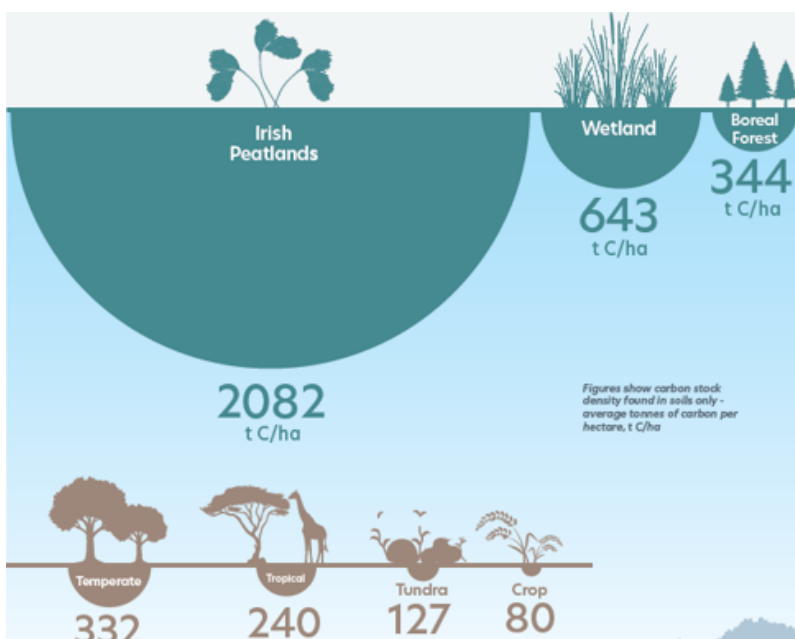
Peaty-debris slide: Shallow translational failure of a hillslope with a mantle of blanket peat in which failure occurs by shearing wholly within the mineral substrate and at a depth below the interface with the base of the peat, such that the peat is only a secondary influence on the failure.

Peat flow: Failure of any other type of peat deposit (fen, transitional mire, basin bog) by any mechanism, including flow failure in any type of peat caused by head-loading.

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How can we effectively address global soil management issues through the sustainable management of Irish peatlands?

- It is critical to learn more about the **properties of the various peat soils** in order to choose environmentally sound and sustainable management practices associated with **land uses** (forestry, agriculture, wind farms).
- The **impact of climate change** on peat soil properties needs to be investigated in long-term experimental settings.
- Peat soils should be a **priority for protection**, not just because of their importance to global carbon stocks but because of their Anthropocene contaminant store (especially arsenic and sulphate).
- The **risk of future bog slides and bog bursts** demands strong links between research (using remote sensing technology) and current developments (Planning permission peat risk assessment studies). These should follow 'living' guidelines that include the characterisation of both the peat (fibre content) and underlying mineral soils and data regarding prevailing groundwater and drainage conditions.
- While the status of **EU soil policy** has seen significant developments in recent years as the European Union has recognised the critical importance of soil health for environmental sustainability, climate change mitigation, biodiversity, water and agriculture, Ireland faces **challenges in implementing current and future soil policies**.



Irish peatlands store 3 times as much carbon per hectare as other international wetland soils with natural raised bogs the carbon store champion! (734).



This factsheet is part of a series produced by Peat Hub Ireland (PHI). The reference numbers in brackets refer to individual publications in the PHI database which link to the original source of evidence. Use the QR codes to access the database or view research projects associated with the themes. All factsheets in the series are available on the PHI website.

