

Peatlands and Bogs



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Focus on Climate Action

This talk is carried out in Collaboration with:
Raymond Flynn
Queen's University Belfast

We are Grateful for the use of his Research and expertise on:

Blanket Bog Conservation: Hydrology and Economics

And Towards Quantification of Blanket Bog Ecosystem Services to Water.

Background to Raymond Flynn's research:

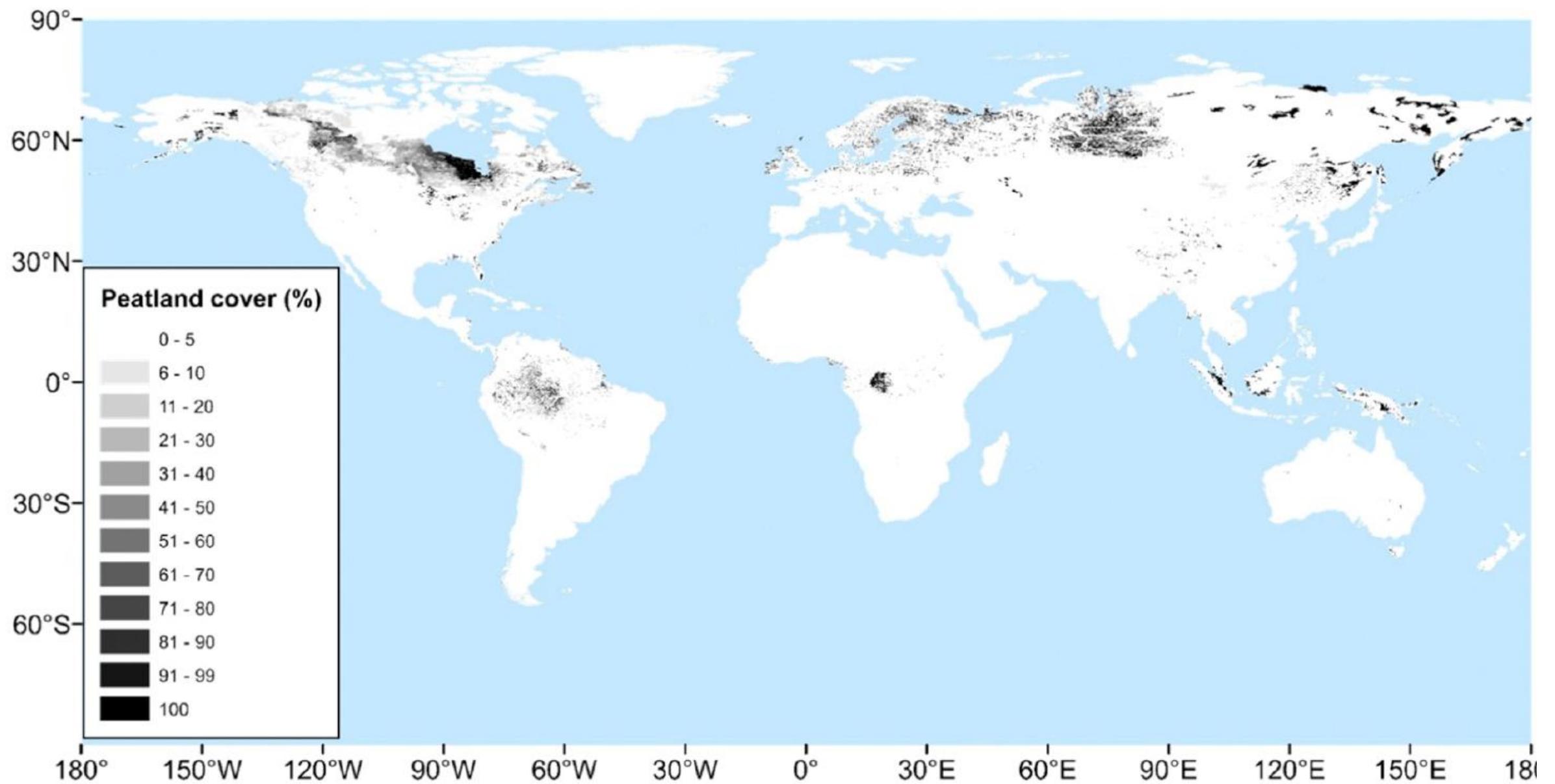
- The EU requires ecosystem services to be mapped and assessed across member states on a national level by 2020 as part of its biodiversity strategy.
- He is carrying out a Four Year EPA-funded multidisciplinary research programme across island of Ireland (2016-2020)
- The research explores if there is an economic basis for blanket bog conservation and/or restoration as this seems to carry more weight for action than environmental or climate arguments.
- A lot of work being carried out on bogs and peatlands, but is underpinned by very limited science.

Peatlands and Bogs

In its simplest definition – **bogs and peatlands are stores of organic carbon formed over long periods of time.**

There are different types of peatlands and they can be found in arctic, boreal, temperate, and tropical regions.

Peatlands cover about 3% of the earth's land surface, holding an estimated maximum of 600 Gigatonne of carbon (C). This is equivalent to about 89% of global terrestrial Carbon biomass.



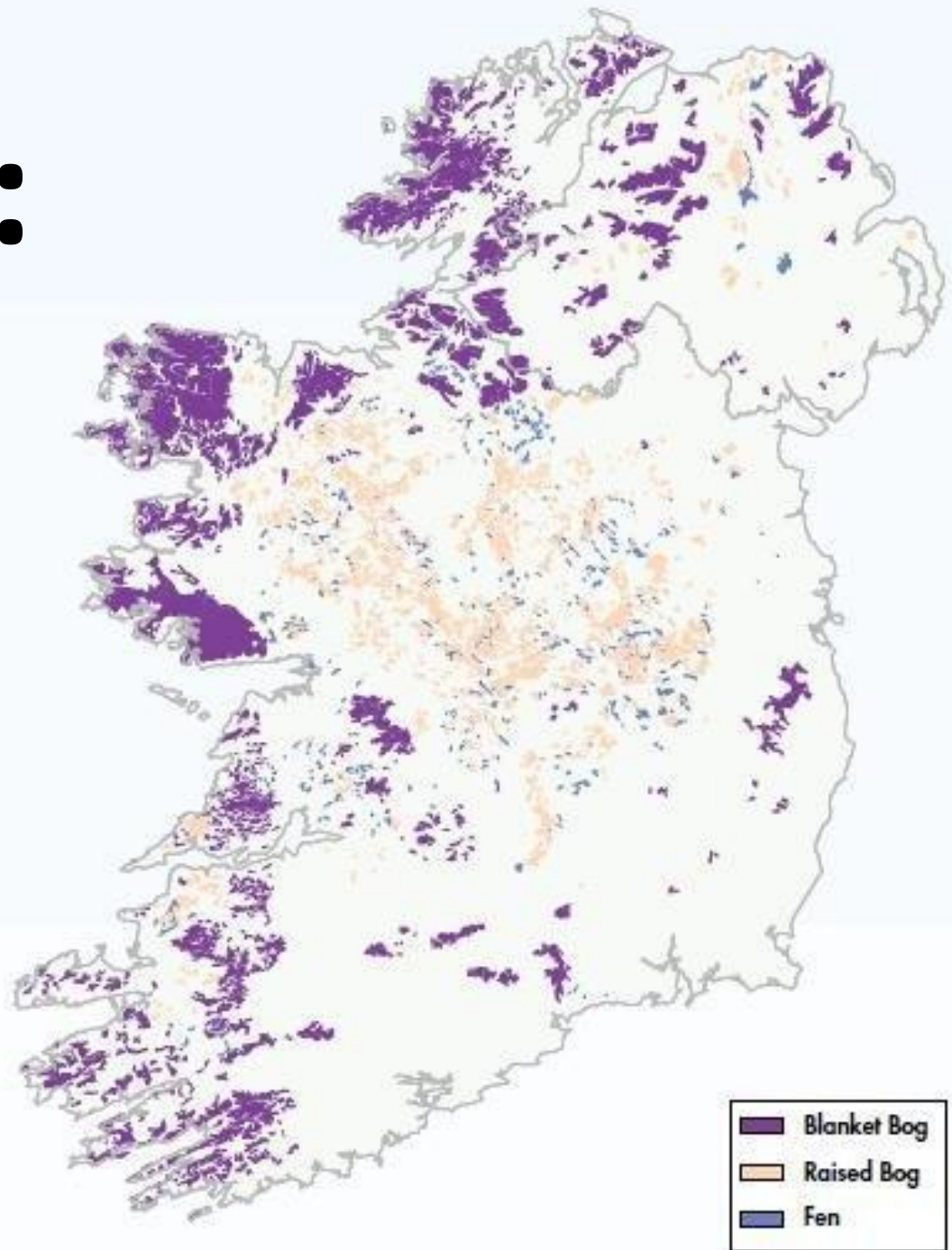
A global estimate of peatland and its distribution along the latitude (map from [Xu et al., 2018](#), creative common).

Ireland's Bogs:

Type and distribution



Image: Coll et al. (2014)



Formation of Fens/Raised Bogs

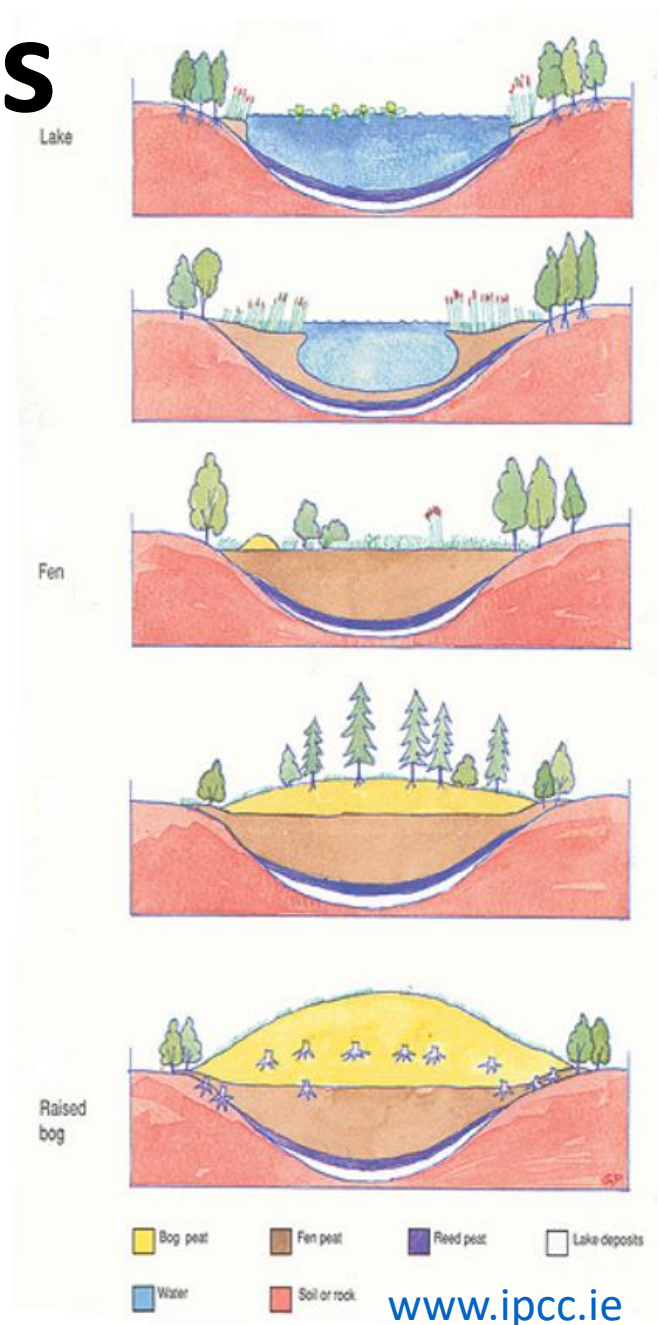
Around 10 000 years ago in Ireland, glaciers melted as the climate became warmer and lakes were formed in low-lying areas. Grasses arrived and trees and forests grew around the edges of the lakes. As they died they sank and accumulated at the bottom. After hundreds of years the dead woodland

vegetation filled the entire lake and transformed it into what is called a **fen**.

New types of plants such as Sphagnum moss colonised the surface of the fen and their remains sank to the bottom and formed peat. Over thousands of years

the **fen** transformed into a peat **bog**. Trees or vegetation including sphagnum moss began to grow on the bog and died. As the peat accumulated,

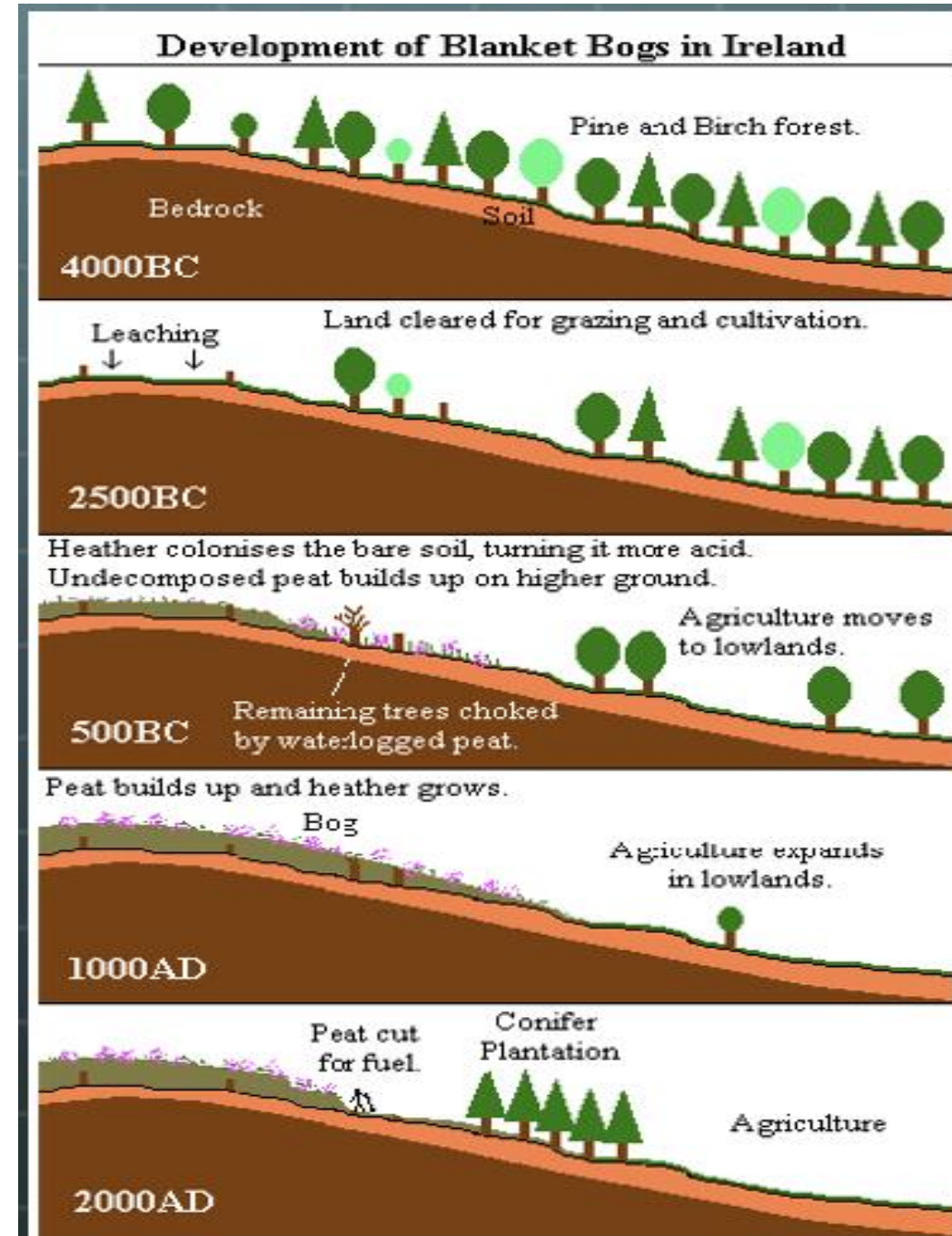
the bog grew higher into a **raised bog** rising between 0.5 and 1mm per year since the last glacial period. The tough sphagnum moss is ideally suited to living in these waterlogged, acidic and nutrient-poor conditions where all nutrients are gotten from rainfall.



Formation of Blanket Bogs

From : All About Irish Bogs: Which Covers 1/6th of Ireland Published by [Kaiya Rumrill](#)

- Blanket bogs began forming when glaciers melt 10,000 years ago.
- The process accelerated 4000 years ago when the climate became wetter and accelerated again when people began deforesting the land in 2500 BC for farming and grazing.
- They cut down trees on the highest ground because they were the thinnest. Once trees were gone, rainwater washed away the nutrients in the soil, Heather started to grow and the soil became acidic.
- Leached iron deposited at a lower depth and created a barrier that prevented water from filtering through. The soil became waterlogged.
- Bog peat started to build up and blanket bogs began to form.



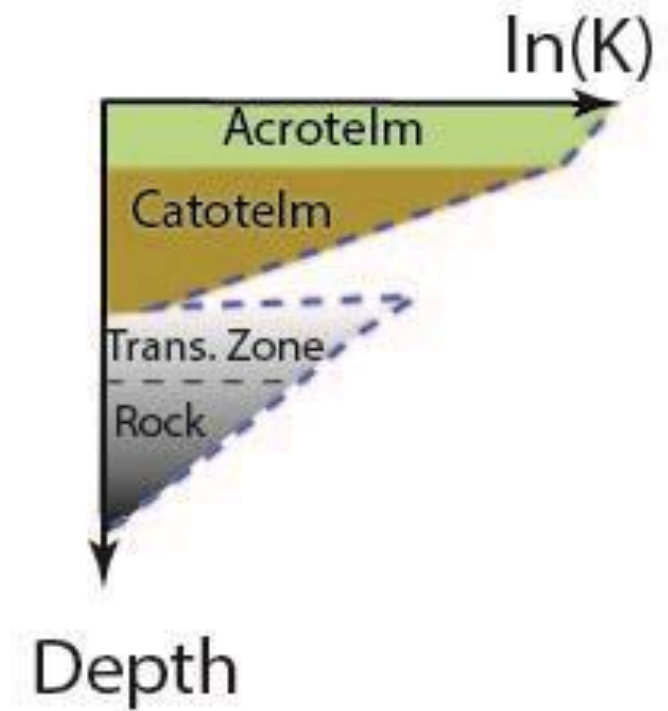
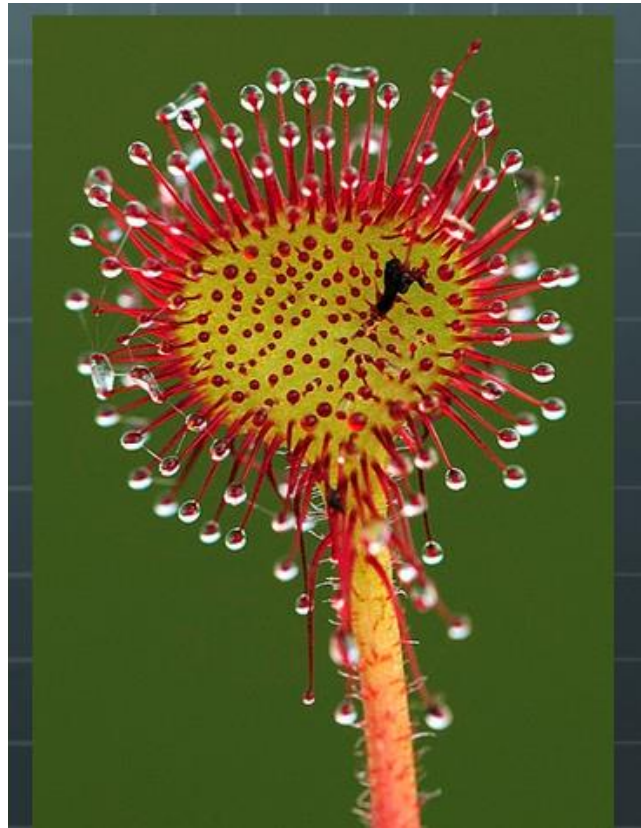
How does the bog ecosystem work?



A bog consists of two layers. The upper layer is **Acrotelm, which means “the living layer”. The lower layer is **Catotelm** which is the peaty layer of the bog.**

The living layer includes the Bog Plants:

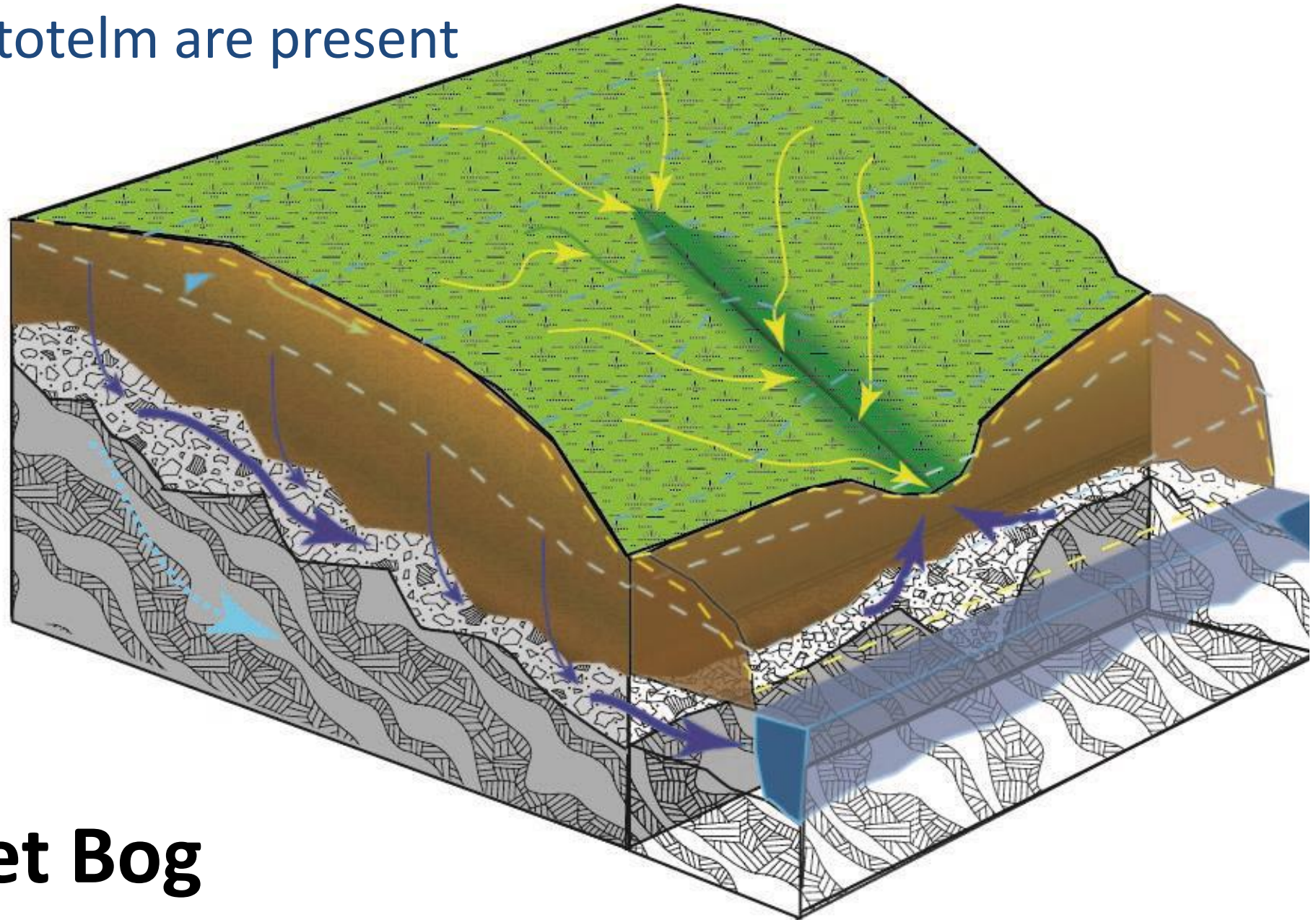
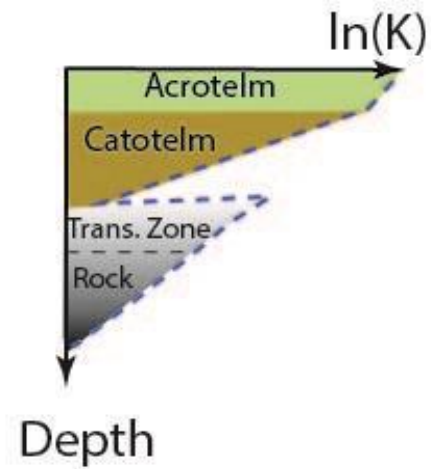
- Bog Cotton
- Ling Heather
- Bog Asphodel
- Tormentil
- Deer Sedge
- Purple Moor Grass
- Sundew
- Cross leaved Heath



And animals:

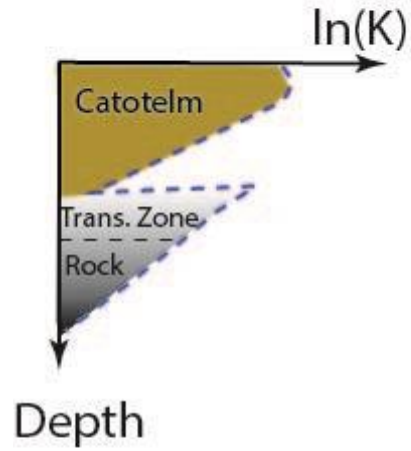
- The hare
- Dragonflies
- Frogs
- Insects
- birds

Acrotelm and Catotelm are present on intact bogs.



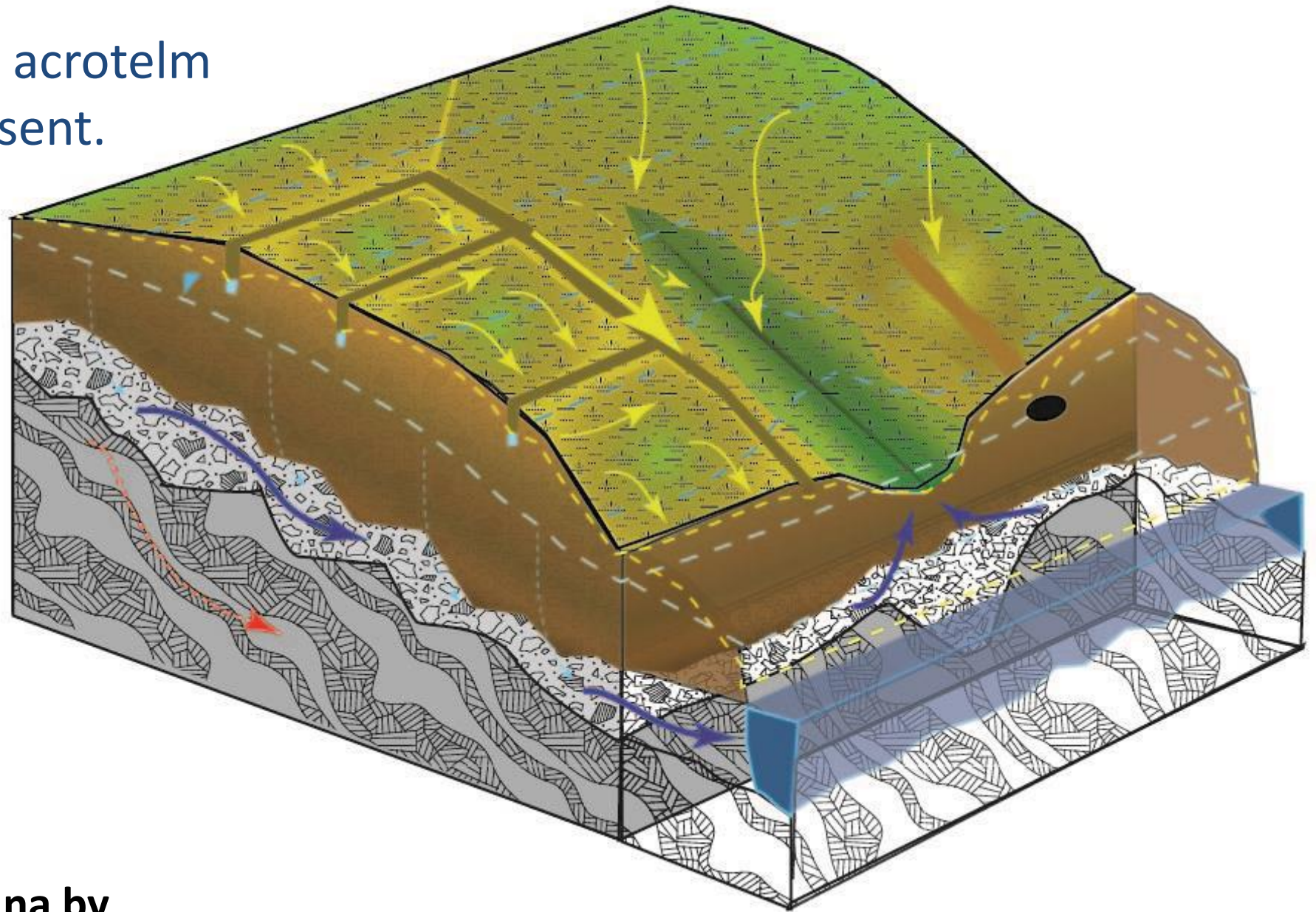
Active Blanket Bog

On damaged bogs the acrotelm may be reduced or absent.



Slightly Degrading Blanket Bog

Removal of Flora and Fauna by
Drainage, Planting Conifer Forests, Over Grazing by Sheep, Turf Cutting and Burning



The State of Ireland's Bogs

With the founding of Bord Na Mona in the 1950's the raised bogs were industrially exploited to such an extent that today the official figure for active bog, that is where the peat is still accumulating, is **0.6% of its original extent.**



The planting of conifer plantations on peat soils, typically in the uplands, along with overgrazing by sheep, turf cutting and wildfires have left **only 20% of Atlantic Bog habitats**, synonymous with uplands in the west of Ireland, **worthy of conservation.**

(Padraic Fogarty Irish Wildlife Trust – MacGills
Summer School 2019)

- At least 14 billion tonnes* of Carbon are stored in Irish Bogs, taken from atmosphere over past 8,000-10,000 years.
- Most bogs are now decomposing and contributing to national CO2 emissions.
- The Carbon is being lost:
 - 1 To the atmosphere as gases (CH4 methane, CO2 carbon dioxide)
 - 2 As Solids (erosion and cutting)
 - 3 To water through decomposition (as dissolved organic carbon) – which is enhanced by drainage.
- Current hydrological and geological setting at many sites makes bogs suitable for reversal of this trend to make them carbon sinks again.

The Value of Bogs – the Ecosystem Services they Provide

- **What is an Ecosystem Service?**

Ecosystem services are the many and varied benefits that humans gain freely from the natural environment and from properly-functioning ecosystems. (Wikipedia)

It is important to note, that if the natural environment is degraded or destroyed through extractive use (non-sustainable) or the ecosystem is no longer able to function properly, these free benefits will no longer be available.

FACT:

Up to now, the Irish State has chosen to use bogs in a manner that degrades or damages them.

- In a nutshell, as we can see from the state of our bogs, we have extracted what we need from them to the point that they are depleted or in a state where they are no longer properly-functioning ecosystems. By choosing one set of 'products' we have also destroyed or reduced the value of another set of 'products'.

Now, we as a nation, have to choose which is more important.

- Continue to orientate farmers and industry to extract and drain for 'productive' agricultural and commercial purposes which will incur substantial costs in fines (renewable energy, biodiversity, water framework directive etc) and which will continue to destroy other ecosystem services / products.

Note: Farmers are currently penalised through their land being made ineligible for payment where land is too wet or habitat is unsuitable for grazing (heather, gorse, willow, scrub etc) thus forcing actions such as drainage or burning.

Or

- Restoring and regenerating bogs where possible to deliver ecosystem services we have traditionally undervalued. Following this course of action will see a loss of jobs in the extractive industries but it will offer the potential to retrain and re-orientate workers towards the new approach.
- Livestock grazing can continue as part of this eco-system; however, the livestock is adapted to the eco-system not the eco-system to the livestock. In simpler terms, the right cow or sheep in the right place. Buying local communities into local energy initiatives should replace the need for turf as a fuel source.

To make an informed choice, let's look at the different ecosystem services bogs provide and their values.

What **Ecosystem Services** do Bogs Provide?

Despite covering only 3% of the earth's land surface, bogs and peatlands provide many ecosystem services including:

Current / traditional uses

- **Biomass production** for agricultural use including horticulture, dairy, and forestry. This includes **potting compost** and **peat bedding** for animals.
Extractive use
- **An energy source**. Peat has been extracted and used domestically and industrially as an energy source or fuel.
Extractive use
- **Grazing areas created through drainage** for agricultural production of sheep and cattle.
Extractive use
- **Areas for Industrial monoculture forests** of predominantly non-native conifers
Extractive use

Or Carbon Storage and Climate Action Services

- **Carbon storage.** Peat is one of the largest Carbon stores per unit area. It is vital these Carbon stores remain locked in the ground.
- **Carbon sequestration (sinks)** – an active bog sequesters or locks carbon from the atmosphere into the ground. Although it does not sequester as much as growing trees, what it does sequester is locked and stored for thousands of years unlike trees which release the carbon through burning or rotting.
- **Climate regulation.** As one of the largest terrestrial Carbon components, peat influences the direction and magnitude of carbon cycle-climate feedbacks.

The Science: Sinks and Sources of Carbon

Under natural conditions, peatlands are carbon sink ecosystems (the place and process whereby carbon is locked away). Billions of tonnes of carbon is stored in bogs and peatlands. High water levels keeps oxygen from getting at the carbon stores and bonding with the carbon to form Carbon dioxide (CO₂) which is released into the atmosphere. The lesson here - to keep the stores of carbon from releasing CO₂ into the atmosphere, the carbon (peat) must be kept saturated.

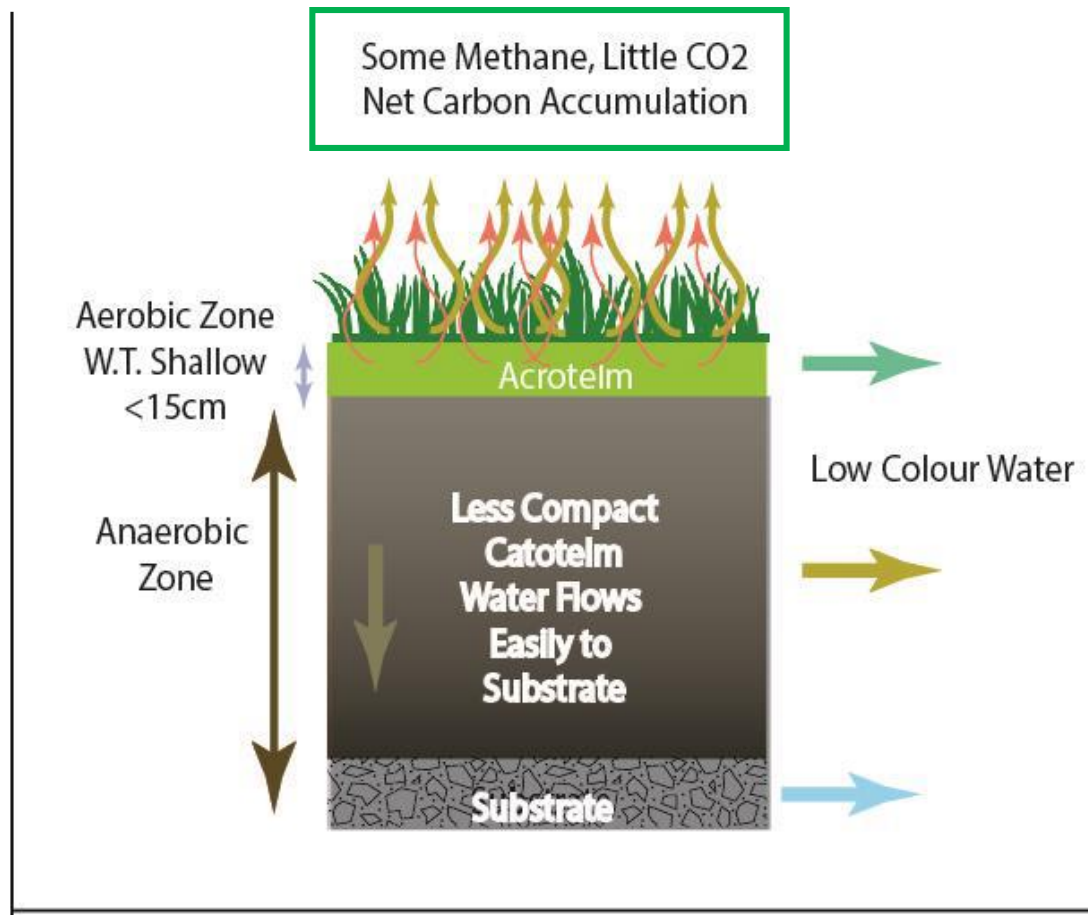
For over 1 000 years, peatlands have been mined for fuel and fertilizer, and used for grazing and agriculture.

Agricultural use requires draining the peat, which causes it to compact. These practices release the carbon stored in peat and add it to atmospheric carbon dioxide (CO₂).

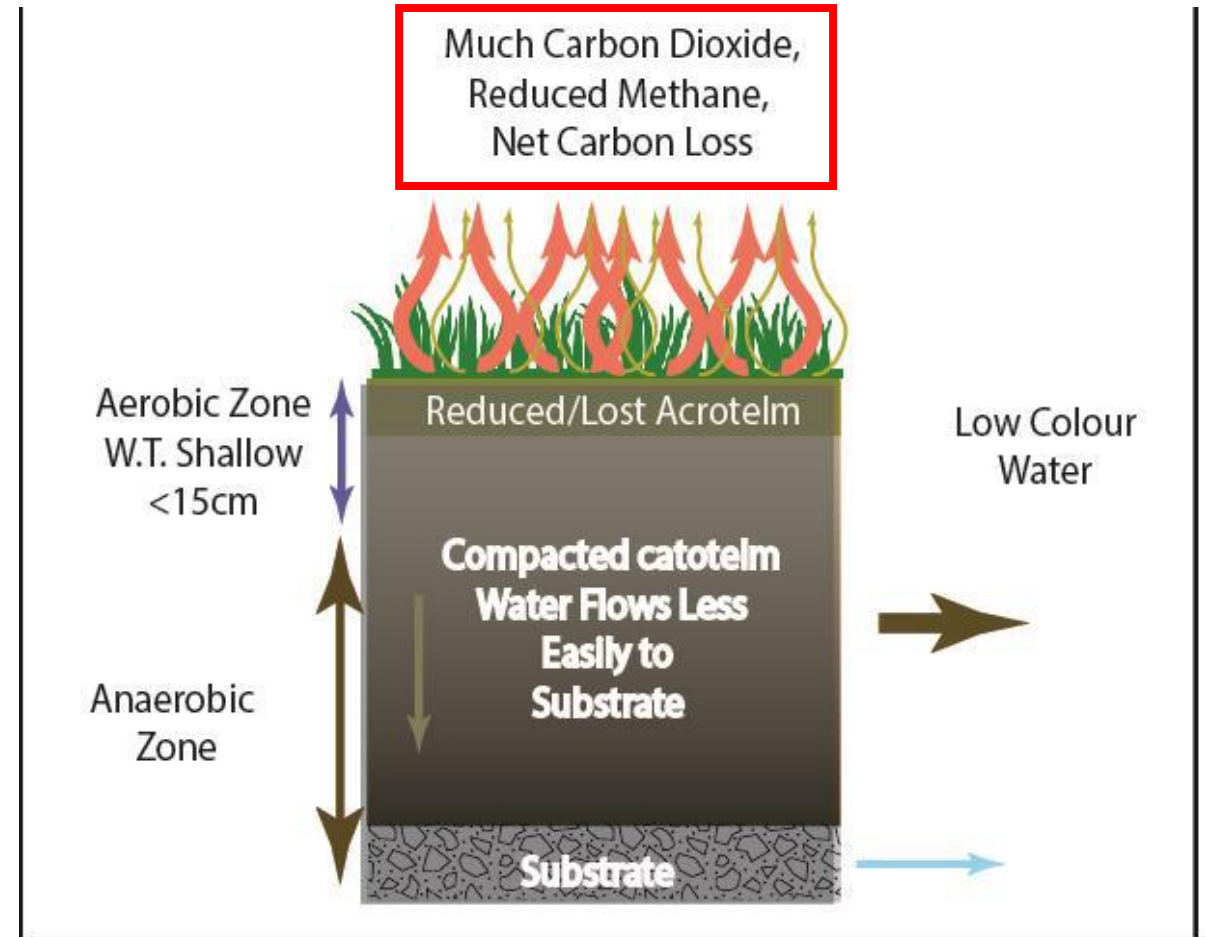
Agricultural use and peat mining along with climate change and rapid land use change (especially the planting of peatlands with industrial monoculture coniferous forests) **have turned peatlands into carbon source ecosystems and adversely affected water quality.**

BLANKET BOG CARBON DYNAMICS - WINTER

(i) Intact Blanket Bog

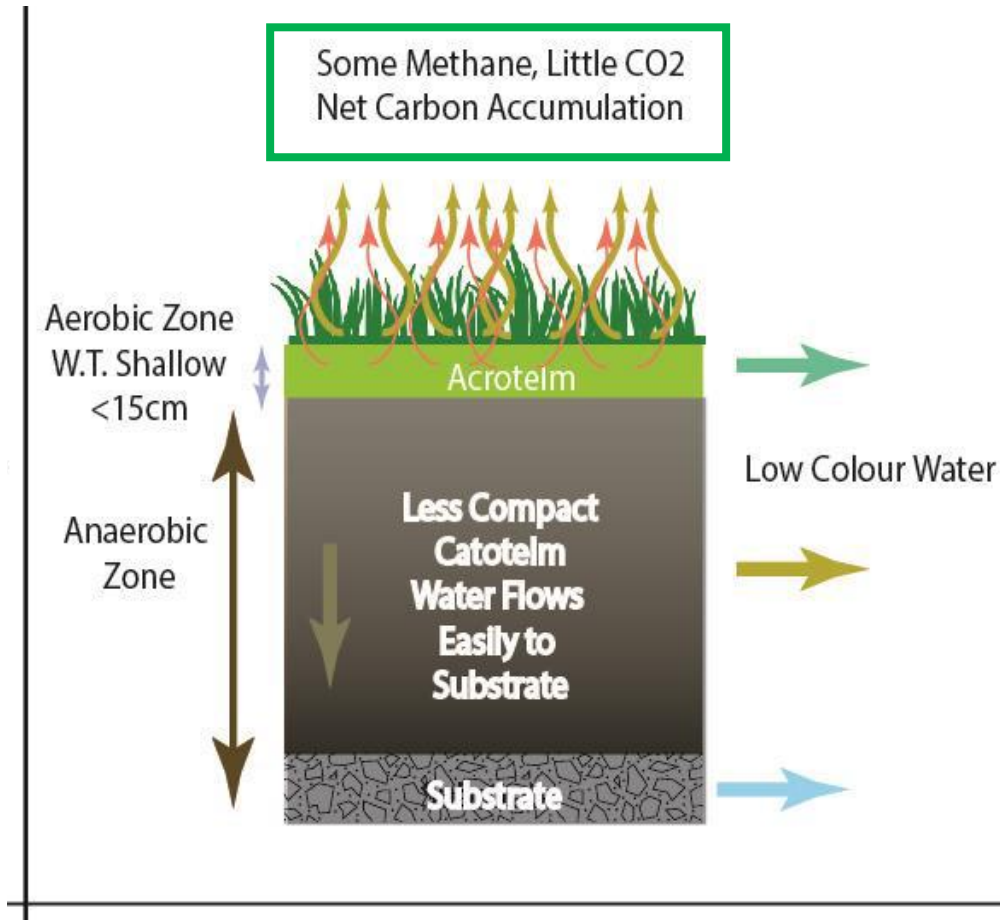


(ii) Damaged Blanket Bog

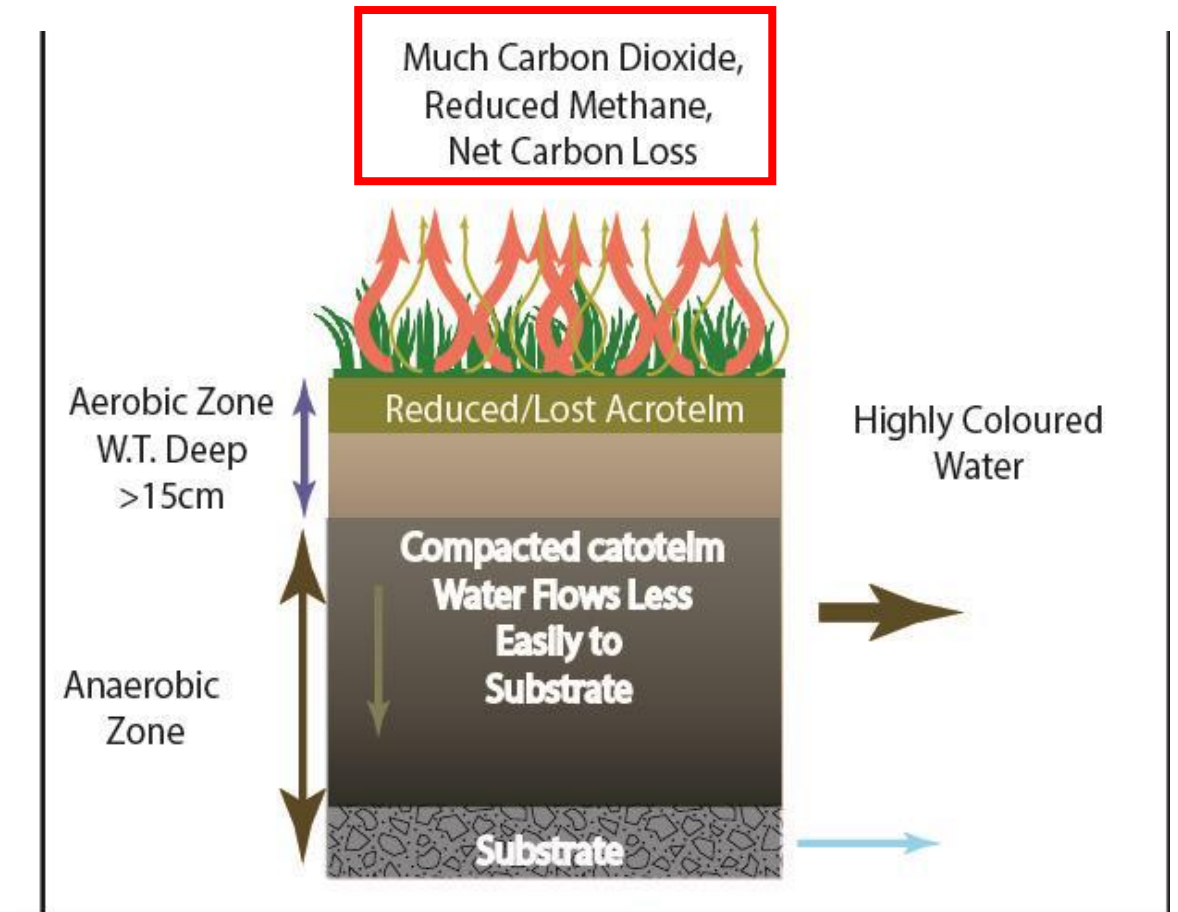


BLANKET BOG CARBON DYNAMICS - SUMMMER

(i) Intact Blanket Bog



(ii) Damaged Blanket Bog



Source: Raymond Flynn Queens University Belfast (2019)

Water Services

- **Water quality.** Blanket Bogs are favoured sources of drinking water due to
 - Abundant volumes of water (high & regular rainfall throughout the year)
 - Low pollution pressures compared to low land catchments.

However:

- The natural levels of colour must be removed.
 - From the previous slides it can be seen that where the bog is degraded this can degrade water quality and colour – leading to increased treatment costs. Thus, bogs in good / active condition naturally filter the water, reducing the costs of treatment.
- **Water regulation.** Bogs serves as a water reservoir and as part of the hydrological cycle which may mitigate flood via water absorption. It maintains baseflow in dry weather.

Water Colour and Bog Condition



Left: Active Blanket Bog, Right: Slightly Degrading Blanket Bog.

Source: Raymond Flynn Queens University Belfast

- Estimated Saving £32/ML or £92,850 /yr for 8 Megalitres/day Treatment Facility –if water contrast above like this every day. (In reality colour levels are cyclical.)
- Contrast is a difference of 13mg/l TOC, giving a loss of 95 tonnes CO₂(eq) /yr.
- Value of 1 tonne CO₂ retained in peat £2450/tonne.

Biodiversity and Research

- **Biodiversity support** including unique habitats for rare and endemic species (aquatic and terrestrial). Maintaining Water Framework Directive status, especially for high status sites. Maintaining/restoring peat accumulating conditions (active blanket bog).
- **Research and education.** Peatland is not currently well understood or documented, offering great scope for research and education.

(Kimmel and Mander, 2010 Flynn, 2019)

Moving From one Use to another

- As can be seen from the carbon, climate action and water services and the values they present to both the state and the landowner, **there is a clear argument towards moving from extractive uses of bog land to restorative / regenerative programmes.** This could not be happening too soon - concerns of elevated greenhouse gas emissions from degraded peatlands have sparked international interest for decades now.
- The EU 2030 climate and energy framework emphasises that forests, agricultural land and wetlands (and thus peatlands), will play a central role in realising the Paris Agreement targets. To that end, the EU requires ecosystem services to be mapped and assessed across member states on a national level by 2020 as part of its biodiversity strategy. Under this framework, from 2021, all EU member states need to report on the emissions and removals of greenhouse gases from wetlands.

- This should be of particular benefit to Hill and High Nature Value sector farmers in making the decision – allowing them to qualify and quantify the services they and their eco-systems deliver under carbon storage, water services, biodiversity etc.
- The state or condition of their bogs and uplands will become very important to the value of the water quality and carbon sink and storage they provide.
- It will also provide them with the data they will need to lobby the Department of Agriculture, Food and the Marine for payment of the eco-system services provided.

