Peatlands

8

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Abstract

Peatlands form part of the iconic landscape of Ireland and account for nearly a quarter of the land area. Raised bogs, blanket bogs and fens are Ireland's last great area of wilderness, hovering between land and water, providing unusual habitats for its unique and specialist flora and fauna. At the same time, the peat itself is a significant carbon store (C) and a repository of treasures as well as critical information to understand past climates and land uses. Historically, all natural peatlands have been impacted by humans through our efforts to 'utilise' this land, through draining, burning, afforestation, grazing and other 'improvements'. Nowadays, peatlands are found mainly drained either for agriculture, forestry or peat extraction or utilised for wind farms or recreational purposes. All of these land uses dry the bog and result in a loss of biodiversity at all levels; genetic, species, habitats and landscapes; a loss of water and mineral storage capacity leading to increased flooding and water pollution. Also, a loss of C sequestration capacity and the loss of stored C to the atmosphere and waterways, as well as an increased risk of bog burst and fires and the spread of invasive species can result. There is now a growing national and global interest in peatland restoration and in ending non-sustainable uses of peat by bringing back the 'sustainable' services and benefits that peatlands provide to society as a whole.

Keywords

Peatland • Organic soil • Raised bog • Blanket bog Fen • Sustainable management • Greenhouse gas emissions

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8.1 Introduction

Peatlands have been in the Irish landscape since the last Ice Age and, together with a remnant of primaeval forests, they form our oldest natural heritage. Irish peatlands are the country's last great area of wilderness, hovering between land and water, providing unusual habitats for its unique and specialist flora and fauna. Peatlands cover a large area of the land surface, occurring as raised bogs, blanket bogs or fens and forming cultural landscape icons in many parts of the country (e.g. Connemara, Ox Mountains and Slieve Bloom). Peatlands have accumulated peat over millennia, creating an important economic raw material, on which the livelihoods of certain rural populations have critically depended. This accumulated peat mass makes peatlands a fascinating historical archive of past environmental and cultural change. More importantly in view of recent climate change, peatlands store very large amounts of carbon (C) that would be released to the atmosphere should the peatland degrade, for instance, when a peatland is drained. Peatlands are the most space-effective C stores of all terrestrial ecosystems (Dise 2009). Over centuries, peatlands slowly remove and store more C than they release and, therefore, they exert a net cooling effect on the global climate (Frolking et al. 2006). Once degraded, this process is reversed. Despite the many benefits provided by peatlands, these ecosystem services have generally remained unnoticed. This has resulted in a lack of appreciation of the need for cautious management to maintain this precious resource.

Peatlands and Irish people have been closely connected by a long history of cultural and economic development. In the distant past, peat landscapes were both feared and respected as wilderness areas and often linked to traditional culture, rituals and worship (Feehan et al. 2008). In modern times, peatlands have been afforested, cutover by domestic turf-cutting, cutaway by industrial peat extraction, eroded by overgrazing and agricultural reclamation, damaged by infrastructural developments and invaded by alien

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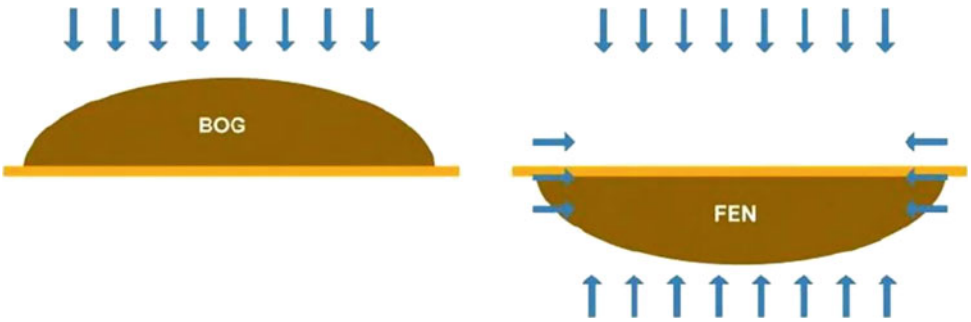

Fig. 8.1 Schematic representation and classical different between 'bog' and 'fen'. Brown = peat; arrow = water flow. Adapted from Joosten (2008)

non-native species. Moreover, climate change poses a further threat to the survival of these natural ecosystems (Belyea and Malmer 2004; Jones et al. 2006).

This chapter will review how Irish peatlands are a significant element in Irish nature and a valuable ecological resource before assessing their past and current utilisation from a land management and environmental perspective.

8.2 Peatlands, Peat Soils and Peat

Peatlands are wetland ecosystems that are characterised by the accumulation of organic matter called peat which derives from dead and decaying plant material under high water saturation conditions. Peat accumulates where the production of plant material exceeds decay. Water is the most important factor limiting decay. Irish peatlands were formed in the last 10,000 years (since the last ice age) and have developed under climatic conditions whereby precipitation exceeded evapotranspiration or in areas of impeded drainage. In natural (those with little human impact) peatlands, peat accumulates at a rate of about 0.5–1 cm per year (or 5–10 m over 10,000 years) with strong local and temporal variations (Clymo 1992, Charman 2002). Peat is defined as material that has passively accumulated consisting of at least 30% (dry mass) of dead organic material. A peat soil contains organic material (peat) over a depth of at least 40 cm (30 cm if undrained); the depth requirement does not apply in the event that the peat layer is directly over bedrock (Renou-Wilson et al. 2011a, b; Simo et al. 2014). A peatland is further defined as a geographical area (with or without vegetation) where peat soil occurs naturally (i.e. all classes of peat-covered terrain). For mapping purposes, a peatland should cover a minimum spatial extent of 1 ha. The properties of Irish peat soils vary widely due the range of peat type encountered throughout the island and their associated anthropogenic disturbances. Surface peats have been found to have a pH as low as 3.3 and bulk density as low as 0.05 g cm^3 (Hammond 1981, Renou-Wilson et al. 2018a). However basal fen peat found at the bottom of raised bog, above a layer of marl [1] can reach pH above 6.

There are different types of peatlands depending on geographic region, terrain and vegetation type. In Ireland, the major distinction is between bogs and fens. Bogs only receive nutrients from precipitation and thus are nutrient-poor whereas fens (which receive nutrients from the surface or groundwater as well as precipitation and tend to be more calcium and nutrient rich, although poor fens also exist). The difference between a bog and a fen is represented in Fig. 8.1. The key characteristics of a peatland include waterlogged conditions, development of specific vegetation and the consequent formation and storage of peat (defined below). The interconnection and interdependencies between water, plants and peat is critical to the survival of the peatland and, therefore, make them vulnerable to a wide range of disturbances.

8.3 Extent and Profiles of Fens, Raised Bogs and Blanket Bogs

While Hammond (1981) estimated that peatlands covered a total area of 1.17 million ha or 17% of the area of the Republic of Ireland, a multi-source data map of peat soils (i.e. which may or may not have the original peat vegetation cover) estimated the national cover at 1.46 million ha or 20.6%. This map excluded small areas (<7 ha) and fens and, therefore, is still likely to be an underestimate (Connolly and Holden 2009) and is being constantly refined as new remote sensing platforms become available. More recent estimates based upon the Irish Soil Information Systems indicate that peatlands occupy as much as 1.7 million ha, roughly 25% of the area (SIS 2014). There have been several different schemes proposed for the classification of peatlands in Ireland. The accepted one is Hammond (1981), in which three types are distinguished: fens, raised bogs and blanket bogs (Fig. 8.2). Blanket bogs can be further subdivided into two categories: Atlantic blanket bogs and mountain blanket bogs.

[1]Marl: a calcareous limnic deposit formed in fresh water lakes by Charophyceae (Stone-worts) permeated by variable quantities of shells of fresh water molluscs; found, beneath the raised bogs in the Irish Midlands.

Fig. 8.2 The common frog (*Rana temporaria*) on a raised bog in the Irish Midlands with the carnivorous sundew (*Drosera rotundifolia*), bog asphodel (*Narthecium ossifragum*), bog cranberry (*Vaccinium oxycoccos*) and ling heather (*Calluna vulgaris*)

The Irish habitat classification (Fossitt 2000) includes an additional type identified as 'cutover bogs' and used in situations where part of the original mass of peat has been removed through turf-cutting or other forms of peat extraction. Cutover bogs can be associated with all peat-forming systems, including fen peats, raised bogs and blanket bogs. However, the terms 'peatland' and 'bog' are not interchangeable.

8.3.1 Fens

Fens are peatlands that are formed from vegetation receiving a constant influx of base-rich groundwaters and, therefore, can be described as minerotrophic (fed by groundwater). Fen peats in Ireland usually have a relatively high pH but some remain acidic with a pH ranging from 4.5 to 8.0 (Doyle and Críodáin 2003). Fen peats are mineral-rich with relatively high ash content (10–20%) and a relatively shallow peat depth (*c.* 2 m). The vegetation is generally species rich and largely dominated by sedges (*Carex* species), rushes (*Juncus articulatus* and *J. effusus*) and tall herbs (*Epilobium palustre* and *Galium palustre*) and with brown mosses a feature of the ground layer. *Schoenus nigricans* forms a characteristic sward in one particular type of rich fen still found across the country. There is a notable absence of *Sphagnum* species. In the Irish climate, fen can be seen as a transitional ecosystem *en route* to a raised bog. However, they are rarely seen to progress in this natural direction due to human-induced disturbances, be it reclamation for agriculture, road works or land-filling. Natural fens are rare, as 97% of the country's fens have been drained for agriculture (Foss et al. 2001). While fens of conservation importance still occur right across the country, their current extent is estimated at 20,180 ha only (Foss 2007).

8.3.2 Raised Bogs

Raised bogs are found mainly in the Irish midlands under a rainfall regime of between 750 and 1000 mm per year. The peat surface is strongly acid, but beneath this layer, glacial alkaline soils of limestone origin can be found. Raised bogs are dominated by *Sphagnum* mosses, with heather (*Calluna vulgaris* [L.] Hull), bog cotton (*Eriophorum angustifolium* Honckeny), and several species of sundew (*Drosera* spp.) and orchids (e.g. *Dactylorhiza incarnata*) can also be found. Raised bog development started at the end of the last glacial

period 10,000 years ago, when shallow lakes left by the retreating ice covered much of central Ireland. Nutrient-rich groundwater derived from calcareous glacial drift, fed these lakes (Mitchell and Ryan 1997). Reeds and sedges encroached around the lake edges; their remains fell into the water where they were only partly decomposed, in time forming a thick layer of reed peat. The upward growth of sedges and other plants (brown moss spp. as well *Sphagnum* mosses) and the accumulation of their undecayed remains 'raised' the peat surface above the influence of groundwater, becoming 'rain-fed' and, therefore, ombrotrophic. This gave rise to raised bogs up to 14 m deep (averaging 6–7 m), a feature that made them particularly suitable for peat exploitation. However, Ireland is still home to some of the finest examples of raised bog in Western Europe and its bogs have been recognised as being of national and international conservation importance.

8.3.3 Blanket Bogs

Blanket bogs developed about 4000 years ago; they are found chiefly along the western seaboard and on mountaintops throughout the rest of the country. Most of the blanket bogs were formed through paludification which is a process whereby peat accumulates directly over a formerly dry mineral soil that is now waterlogged. This occurred as a result of changed climatic conditions, and the distribution of blanket bogs is strongly related to climatic factors: they are most widespread in areas where annual rainfall levels are greater than 1200 mm and the number of rain days exceeds 225. These bogs are shallow and form a blanket-like layer averaging 2.5 m in depth over an underlying acidic mineral soil or bedrock. In their natural condition, these areas are dominated by *Eriophorum* species, black bog rush (*Schoenus nigricans* in Atlantic blanket bog), and purple moor-grass (*Molinia caerulea*), lousewort (*Pedicularis sylvatica*), bell heather (*Erica cinerea*) and the bryophytes *Campylopus atrovirens* and *Pleurozia purpurea*.

Study Box 8.1 Blanket Bog Sub-types

Atlantic blanket bogs are found in low-lying coastal plains and valleys in mountainous areas of western counties, below 200 m ordnance datum (O.D.). They are particularly well developed in counties Donegal, Mayo, Galway, Kerry, Clare and Sligo. Their vegetation is clearly distinct from raised bogs and mountain blanket bogs (White and Doyle 1982). Vegetation is characterised by a grassy appearance due to the occurrence of purple moor grass (*Molinia caerulea*) and black bog rush (*Schoenus nigricans*). Patterned surfaces of pools, hummocks, flats and flushes are important features of these blanket bogs. *Mountain blanket bogs* occur on relatively flat terrain (across mountain plateaux and gentle slopes) in the higher Irish mountains above 200 m O.D. and are distributed more widely than Atlantic blanket bog. The vegetation of these blanket bogs is characterised by the presence of ericoid shrubs and in particular ling heather (*Calluna vulgaris*), crowberry (*Empetrum nigrum*) and bilberry (*Vaccinium myrtillus*). Natural water channels, lakes and flushes are features of mountain blanket bogs.

8.4 Irish Peatlands: A Valuable Ecological Resource

Irish peatlands are mainly open, windswept, wilderness areas virtually devoid of tree cover due to the wet conditions that have prevailed in particular in recent centuries. High precipitation did not favour the spread of trees and a stagnant water table favoured wetland communities over woody shrubs and trees that are typically found in peatland ecosystems elsewhere in the world (Charman 2002). Peatlands are exceptional natural entities. Composed of a unique combination of habitats, they can form a diversity of ecosystems with a unique biodiversity, at species and genetic level. They represent a considerable national biodiversity resource with some species being endemic and rare at a global scale. No less than three bog habitats, two fen habitats and six other habitats associated with peatlands are listed in Annex I of the Habitats Directive (EU Directive on the Conservation of Habitats, Flora and Fauna 92/43/EEC) because they are particularly threatened in Europe. At the species level, peatlands are home to flora and fauna of highly significant conservation value with species new to Ireland

still being discovered (Renou-Wilson et al. 2011a, b), for example an extinct moss refound in a restored raised bog at Clara Bog in Co. Offaly (Smith 2014).

From an ecosystem point of view, natural peatlands act as sinks where peat deposits (and its C) accumulate and the peat, together with water and minerals are stored. Natural peatlands are unique ecosystems because they are generally net sinks for carbon dioxide (CO_2 uptake) and sources of methane (CH_4 emission). Therefore, their climate footprint depends on the magnitude of the land-atmosphere exchange of these two major greenhouse gases (GHG) while nitrous oxide (N_2O) becomes significant only in nutrient-rich fens and when wetlands are drained to agriculture or forested. Peatlands are large C stores globally (Yu 2012), and are estimated to contain between 53 and 75% of total soil organic C stocks in Ireland (Tomlinson 2005; Renou-Wilson et al. 2011a, b). The accumulation of these vast quantities of C occurs over many thousands of years and results from the slow accumulation of partly decomposed plant remains (C-rich organic material) under the water-saturated, oxygen-depleted conditions that prevail in natural peatlands. While the net annual GHG budget of natural peatlands is spatially and temporally variable (Koehler et al. 2011; Wilson et al. 2016), it is sensitive to natural and anthropogenic perturbations. Peat extraction, drainage and cultivation for agricultural and forestry purposes have changed nearly 90% of the original peat soils in Ireland from C sinks to sources (Wilson et al. 2013).

8.5 Historical Review of Peatland Utilisation and Stakeholders

Peat has been a source of fuel in Ireland since prehistoric times. Seventh- and eighth-century law-texts contain references to turf-cutting although these are few and ambiguous. The clearest is in the text on mill races: here the ditch of a turf-bog (clad fótbaig móna) is included among the seven ditches exempt from liability in the case of accidental drowning (Binchy 1955). Reading between the lines, one can assume that the ditch was made during the cutting of turf for use as fuel. The first explicit mention of turf as fuel is in the early twelfth-century tale Aislinge Meic Con Glinne (Jackson 1990) where it is mentioned that the miserable hospitality of the monastery of Cork included two sparks of fire in the middle of a wisp or oat-chaff and two sods of wet turf (dá fót do úr-mónaid). Before the Anglo-Normans arrived, wetlands were not only drained for turf-cutting but they may also have been used as a source of reeds for thatching, basket-making etc. (Kelly 2000). From these mediaeval sources (e.g. Calendar of Ormond Deeds), it is understood that some raised bogs around Dublin seem to have been cut-away as early the thirteenth century. Despite traditional hand-cutting, Irish peatlands remained largely untouched up to modern times. In the nineteenth century, peat was the main fuel available to a population that had expanded to more than 8.2 million (Feehan et al. 2008). According to Mitchell (1976), the disappearance of peatlands in the eastern part of Ireland is related to this period of intense peat-cutting due to high population density. Furthermore, peatlands were extensively used for the summer grazing of animals and the cultivation of crops. Of the different peatland types, fens suffered most from agricultural reclamation. Cole (1984) reviewed the history of agricultural development on peatland in Ireland, which intensified in the 1950s at the same time as peat extraction became an industry with the establishment of Bord na Móna, the main producer of peat energy and supplier of peat products in Ireland (Fig. 8.3). Mechanisation of the process and utilisation of adapted vehicles has allowed for more peat to be extracted over a wider area of bog, in less accessible terrain and also on a semi-commercial basis (for domestic use). This was not solely confined to raised bogs in the Midlands, as Conoghan (2000) reported the dramatic rise in the use of the excavator method and hopper method of peat extraction on blanket bogs since the mid-1980s. Since the 1990s with the increasing demand for horticultural peat, peat extraction for horticultural products has particularly impacted smaller raised bogs, which had been so far spared from industrial peat extraction for energy use.

At the same time as industrial cutaway peatlands appeared for the first time in the Irish landscape, considerable areas of bogs were being afforested with coniferous species, such as Sitka spruce (*Picea sitchensis*), lodgepole pine (*Pinus contorta*) and Norway spruce (*Picea abies*) (Fig. 8.3). Most planting was carried out on lowland and

Fig. 8.3 Examples of natural mountain blanket bog (Glenveagh National Park, Co. Donegal), Atlanticblanket bog (Owenirragh, Co. Mayo) and fen (Scragh, Co. Westmeath). *Photos* F. Renou-Wilson

montane blanket bogs, with some financial and technical difficulties (waterlogging, nutrient-poor soil, exposure to name but a few) and more significantly unsustainable outlooks (Renou and Farrell 2005; Renou-Wilson and Byrne 2015). Although the afforestation of blanket bogs is officially declining, private afforestation may continue to occur on non-designated blanket bogs.

Agriculture is the oldest land use of peat soils, and reclamation and drainage of organic soils were intensified in the last two centuries as a result population pressures. In addition, several Acts and schemes, including the 1945 Arterial Drainage Act, the Farm Improvement Programme and the Programme for Western Development have supported the reclamation and drainage of organic soils for agricultural purposes. In the 1980s and early 1990s, the European Union (EU) Headage grant scheme intensified grazing patterns with an upsurge in sheep numbers. In recent years, the threat from overgrazing has somewhat receded with the introduction of agri-environmental schemes (Green Low Carbon Agri-environment Scheme (GLAS), formerly the Rural Environmental Protection Scheme (REPS)) and the decoupling of Common Agricultural Policy subsidies from production (translated into the National Farm Plan Scheme and Commonage Plans).

More recently, due to the fact that peatlands are generally uninhabited, they have become attractive for a wide variety of new land use options including urban, industrial and infrastructural development as well as dumping of waste. Fens have been mostly subject to dumping or landfill because of their low-lying nature. Fens have often been filled in so as to create drier ground conditions and to make a site more suitable for subsequent developments such as housing (Foss 2007). Other industrial developments: quarries, industrial infrastructure or road constructions have impacted peatlands in a very limited way (thousands of hectares), but at an increasing number of sites. The Irish climate is ideally suited for both peatlands and wind farms and the vast majority of wind farms are located on upland and cutaway peatland areas (Renou-Wilson and Farrell 2009). Peatlands have also provided space for recreation, tourism and even military exercises. In the last decades, the number of tourists interested in outdoor activities has increased and with it, the impact of trampling on blanket bogs, which was until recently confined to National Parks (Wicklow, Glenveagh and Connemara), and has started to spread onto other peatland areas of conservation importance. Upland blanket bogs, some designated, have been unacceptably degraded, with the impact likened to overgrazing (MacGowan and Doyle 1997).

8.6 Current Peatland Land Use Categories

While the land area covered by peatlands deemed worthy of conservation has been estimated at 269,270 ha (Malone and O'Connell 2009), it is likely to be an overestimation of the area of natural peatlands in Ireland given that it probably includes areas that have been degraded with some having the potential to be restored. Given the large remaining area of 'managed' peatland (Table 8.1), decisions regarding their management are of critical importance for their future sustainability.

Table 8.1 Distribution of the main land use categories of peatlands

Natural peatlands	269,270[a]
Cutover peatlands (affected by domestic turf-cutting)	612,380[a]
Afforested peatland	301,700[b]
Farmed peatland (grassland and cropland)	295,000[c]
Industrial cutaway peatlands	70,000[d]
Rehabilitated cutaway	18,000

[a]Malone, S, and C O'Connell. 2009. Ireland's Peatland Conservation Action Plan 2020—Halting the Loss of Biodiversity. Irish Peatland Conservation Council, Lullymore

[b]Black, K., O'Brien P., Redmond J., Barett F. & Twomey M. 2008. The extent of recent peatland afforestation in Ireland. Irish Forestry 65 (1&2): 71–81

[c]CRF Table 5.C, National Inventory Report 2007–2009 (Environmental Protection Agency)

[d]57,000 ha (including hard surfaces and fringes) belongs to Bord na Móna and the remainder is an estimate of the area that is cutaway by private companies extracting peat mainly for horticulture

8.6.1 Agriculture

Current agricultural activity on peat soils is largely confined to grassland production and the grazing of cattle or sheep. An estimated 300,000 ha of grassland is on organic based soils (Wilson et al. 2013) with a negligible area used for cropland (Donlan and Byrne 2015). In Ireland, grasslands over organic soils are used for direct livestock (domestic herbivores) grazing with a small area used for forage production (either hay or silage). Some typical grassland over organic soils may be considered unimproved and includes large expanse of blanket bog/heath mosaic with various degree of human-made drainage. Most grasslands, however, have been managed to some degree by grazing, mowing, fertilisation application or intensive drainage. Management of grasslands over organic soils is described in detail by Renou-Wilson et al. (2015). The more nutrient-rich peat soils used for agriculture are hotspots of CO_2 emissions, and the rewetting of agricultural peat soils has been shown to be an important GHG mitigation tool (Renou-Wilson et al. 2016). Land use management related to sheep grazing on the hill and mountain peatlands (and heaths), remains a complex issue that needs further investigation.

8.6.2 Forestry

Peatland forests were not part of the natural assemblage of wild habitats in Ireland. In 2008, 43% or *c.* 301,700 ha of the total forest estate was located on peat soils with the majority located on blanket bog (218,850 ha) and the remainder on raised peat (74,000 ha) and cutaway peatlands (8850 ha) (Black et al. 2008). The twenty-first century has seen the near cessation of the afforestation of natural peatlands but is ongoing on already drained organic soils (cutover and cutaway bogs and some used for agriculture). The main impact of afforestation of peatlands is the drying out of the site which leads to (1) loss of characteristic flora and fauna and (2) direct loss of CO_2 to the atmosphere and indirectly as dissolved organic C losses via hydrological pathways. Cultivation, fertilisation and other management operations also leads to nutrient leaching and degradation of pristine water quality. Nowadays, several controversial challenges, such as more efficient timber production, increased multiple use of forests, mitigation of the effects of climate change, and enhancement of the quality of surface waters, put pressure on the practical forest management of peatlands (Renou-Wilson and Byrne 2015). Specific forest management methods have been developed to account for the specific soil conditions and the interactions between terrestrial and water ecosystems. Coillte, the national state-owned forest company and largest peatland landowner, published a strategy for the 'Future Management of Low Production Forests' detailing a protocol agreed for 43,000 ha of western peatland forests deemed uneconomic and unsustainable (Tiernan 2008). The strategy requires that these areas be replanted with minimal inputs while others will be managed with the aim of restoring a bog ecosystem. Coillte has also been actively involved in the restoration of 2500 ha of afforested blanket bogs and raised bogs through the LIFE programme (Delaney 2008).

8.6.3 Peat Extraction

Peat is currently extracted for (1) electricity generation in condensing power plants, (2) fuel for domestic heating (briquettes and turf), (3) horticultural products and (4) as raw material for chemical products, bedding material, filters and absorbent material. It has been estimated that a total of 100,000 ha of peatland is currently utilised for industrial peat extraction in Ireland; half of which is in active production (Fitzgerald 2006). While the total area of peatlands currently affected by domestic peat extraction (mechanical and hand-cutting) remains unknown, it is estimated that domestic turf-cutting has affected more than half a million hectares (Malone and O'Connell 2009; Wilson et al. 2013).

Thousands of hectares of drained peatlands and organic soils have been 'abandoned' because they have such low productivity for grazing or because turf-cutting is not practiced anymore. The old drainage systems continue to work in many cases while in some cases rewetting may occur naturally. Many peatlands designated as part of the Natura 2000 network (European Union coordinated network of protected areas) include such degraded land where turf-cutting took place on the outskirts of a bog and has not been restored. In the absence of proper management, these sites typically retain an oxic layer that is continually mineralised. These areas remain drier than natural peatlands and are often prone to wildfires.

Industrial cutaway peatlands present a challenging environment in regard to restoration to bring back some of the bog functions and associated benefits (C sequestration, biodiversity etc.). Therefore, rehabilitation or rewetting (drain blocking and damming) has been implemented in most cases with wide range consequences for climate and/or biodiversity benefits depending on the initial degradation status (Renou-Wilson et al. 2018b). Rewetting of bogs used for horticultural peat is even more problematic due to the significant depth of the drains and the type of peat remaining at the surface, which often coincides with a woody fen peat layer that displays high porosity. In addition, Bord na Móna

has rewetted 1175 ha of raised bog (drained but not cut) since 2009 using drain blocking, informed by detailed topographic mapping (Bord na Móna 2016).

8.7 Condition of Irish Peatlands

The human-related impact on peatlands is nothing new and Irish peatlands can be described as deeply humanised landscapes that have evolved, indeed sometimes originated, in close association with land use systems. For example, tree clearance by humans has been implicated in the initiation of peatland growth in the western part of the country (Moore 1993; Molloy and O'Connell 1995; Caulfield 2004). Nevertheless, anthropogenic disturbances of peatlands have been mainly destructive with significant environmental degradation along the way. These disturbances resulted in a loss of biodiversity at all levels; genetic, species, habitats and landscapes. Also, the loss of water and mineral storage capacity leading to increased flooding and water pollution, the loss of C sequestration capacity and the loss of stored C to the atmosphere and waterways, increased risk of bog bursts and fires and the spread of invasive species. Research has shown that past and current management of the majority of Irish peatlands has been unsustainable and Irish peat soils will deteriorate further without intervention (Renou-Wilson et al. 2011a, b). The increasing scale and rate of disturbance that occurred in the twentieth century have clearly contributed to the current situation whereby only a small amount of peatlands remains in a natural or undamaged condition. Of the Holocene extent of fens and bogs in Ireland, only 15% of the original peatland cover is in a near-intact condition reflecting a low level of degradation with an even smaller proportion acting as fully functioning mires, which are active peat-forming ecosystems (Wilson et al. 2013). The area of undisturbed fens is very small as they have long been drained and reclaimed for agricultural use. Similarly, most of the bogs have been affected by peat-cutting, grazing or fire to one extent or another. It was estimated that only 10% of the original raised bog and 28% of the original blanket peatland resource are deemed suitable for conservation (Malone and O'Connell 2009). As the vast majority of peatlands are degraded to various extents, they are critically at risk of future disturbances such as climate change. Predicted climate changes are likely to affect low Atlantic blanket bogs in the west of Ireland the least, while the areas showing greatest changes in precipitation and temperature are the areas containing basin peat in the Midlands.

8.8 Ecosystem Services of Peatlands

Natural peatlands are considered one of the most important ecosystems of the world, because of their key value for biodiversity, water filtration and supply, their role in climate regulation via the sequestration and storage of C from the atmosphere, as an important support for human welfare: for the cultural services associated with the amenity and recreational value of this 'wild land', for providing a source of well-being and knowledge (Fig. 8.4). Therefore, peatlands provide a wide range of ecosystem services to the global society, but these services are often 'hidden' as they are not traded in markets. All of these benefits may be reduced in supply as a result of certain land management interventions, such as drainage for agriculture, afforestation or peat extraction. These uses of bogs produce 'goods' (turf used for energy, domestic heating or horticultural products, livestock, timber production) that have known existing markets. However, these uses are 'unsustainable' as they involve disturbances that are irreversible on any time scale relevant to society (Fig. 8.5).

8.9 Towards a Sustainable Management of Irish Peatlands

Peatlands are a key part of Ireland's natural heritage and provide many such ecosystem services, including reducing C emissions, assisting with flood regulation, providing a home for our most threatened habitats and species and a place to improve the mind and body. In the first decades of the twenty-first century, the dilemmas facing the peatland resource have been heightened with only a few 'near-intact' or natural peatlands remaining in the Irish landscape and

Fig. 8.4 Examples of peatlands used for turf cutting (Co. Offaly) and industrial peat extraction (Co. Offaly) andafforestation (Co. Sligo). *Photos* F. Renou-Wilson

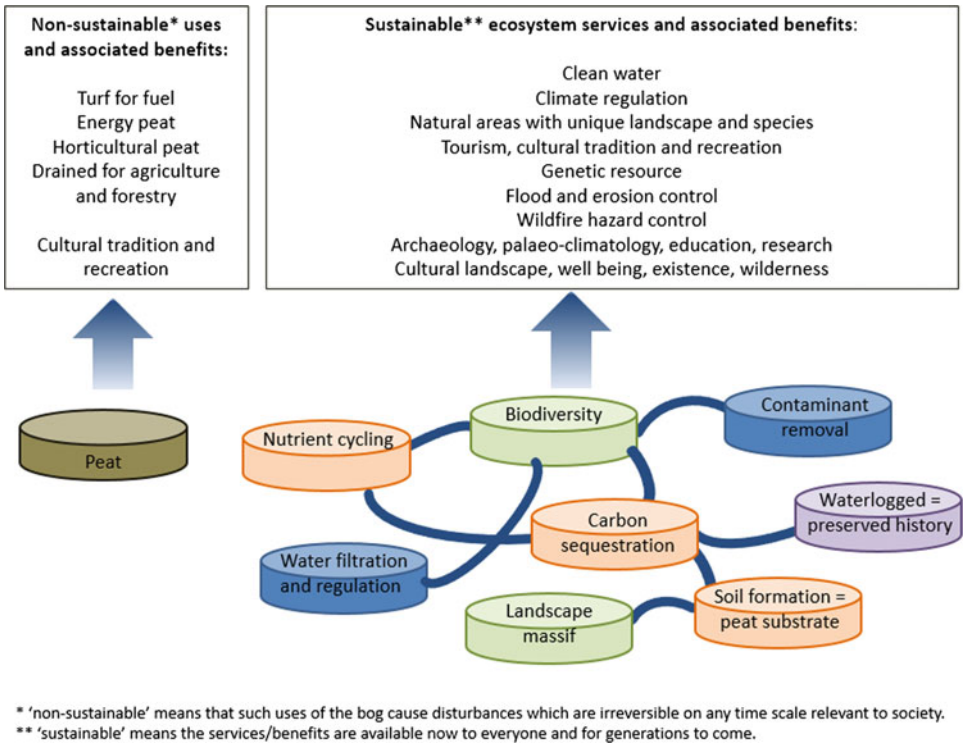

Fig. 8.5 Peatland ecosystem functions, uses, services and associated benefits

which are likely to be further damaged, be it directly by human actions or by global changes.

There is growing national and global interest in peatland restoration and in ending non-sustainable uses of peat by bringing back the 'sustainable' services and benefits that peatlands provide to society as a whole. In Ireland, the first Peatland Strategy was published in 2015 and represents the political will to manage this huge natural resource in a more sustainable way, with the commitment to give direction to Ireland's approach to peatland management and how best to optimise the benefits derived from our vast peatland resource now and for future generations. The main objective of the Peatland Strategy is to guide Government policy in relation to all peatlands across various sectors (agriculture, forestry, energy, environment etc.) but in particular to those nominated as Natura 2000 designated sites. Together with remnants of primaeval forests, these represent the oldest surviving wild landscape on this island, a source of beauty at many levels (aesthetic, cultural, educational), that should be nurtured for future generations.

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