

CURES FROM THE BOG

Degraded and drained, Ireland's peatlands face an uncertain future. But a groundbreaking project to find new medicines, following leads from the country's ancient folklore, may offer salvation

by Lucy Kehoe

The long-leaved sundew (*Drosera anglica*), a carnivorous plant found growing at Lodge Bog in County Kildare



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irouetting through a kissing gate tucked into the corner of a rural County Kildare road, we're met with the bog. It fans out, grass and sedge quivering above a tightly woven vegetative tapestry of russet, maroon and myriad greens. Autumn has crept in: heather is crisped to brown; the poker-like, bog asphodel seed pods are an angry, burnished red. A soft blanket of wet sphagnum moss dances under foot, all orange, brown and energetic green, while up close, we catch occasional flashes of the last lilac blooms. Beneath this tweed-toned vegetal cloak sits three thick metres of moist, black peat.

'Bogs are in the hearts of Irish people,' says Nuala Madigan, CEO of the Irish Peatland Conservation Council (IPCC) and my guide to Lodge Bog (Móin Alúine), a raised bog in County Kildare. 'People are connected to these boglands.' Following her lead, I jump down onto the bog from a boardwalk. She tells me to avoid the patches of moss and aim for the heather to keep my shoes dry, all the while explaining how bogs have provided fuel, sustenance, shelter, medicine and capital for Irish communities through the booms and busts of history.

Between the low-lying blankets of sphagnum – used in the First World War as an antiseptic wound dressing – sit diminutive carnivorous sundew plants, their round leaves covered in up to 200 crimson, pin-shaped hairs. Each one glimmers with a mucilaginous secretion that entraps unsuspecting insects. This gel-like substance – acidic and enzymatic – was once a treatment for warts. I scan for the trifoliate leaves of the bogbean, an innocuous plant with white, star-shaped blooms with wiry-haired petals. Its creeping rootstock extends some



Bog rosemary (*Andromeda polifolia*) thrive in the wet conditions found in Irish peatlands

NUALA MADIGAN



Low-lying bog plants on Lodge Bog, including cross-leaved heather (*Erica tetralix*) and bog asphodel (*Narthecium ossifragum*) seed pods

LUCY KEHOE

ten feet into the peat below. The leaves were once a cure for inflammation, coughs and, in that vague vocabulary often encountered in pre-modern medical practices, used to 'purify the blood'. We're standing on an ancient pharmacy – one that's about to reopen.

PLANT MEDICINE

Gaia Scalabrino is the executive director of Trinity College Dublin's new centre for natural product research: NatPro. She has hands-on experience with the bogbean, having grappled with the plant many times in an attempt to remove it from Irish peatland. 'They're amazing. They have these tiny little leaves, but when you take them out...' Sitting on a bench outside the university, she gestures with her hands to demonstrate the sheer extent of the root system. 'When you see something beautiful and complex like that, you're thinking, "What's hidden behind it?" There must be some power in it. That's what we're looking for – the power within nature.'

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The flowers of the bog bean (*Menyanthes trifoliata*)

NUALA MADIGAN

The bogbean (*Menyanthes trifoliata*) is one of more than 50 species of Irish flora under investigation in a groundbreaking project seeking new treatments for inflammatory, auto-immune and viral diseases. Entitled 'Unlocking Nature's Pharmacy', the project marries ethnopharmacology (the history of the plant species used for medical intent) and modern scientific research to find therapeutically active molecules in native bog plants – that is, components with potential medicinal, cosmetic and/or food industry uses. If found, active ingredients will be harnessed to develop new economic opportunities for the Irish economy.

Crucially, the researchers aren't working from scratch. Hints as to the power hidden in some plants can be found in ancient tales and folk remedies, although it's difficult to pin down certainties and specifics. In Ireland, folklore dances across the rain-dashed hills and through its wild boglands, intermingling with myths, ritual and religion, and attributing healing powers to mosses, bog asphodel blooms and the viviparous lizard (Ireland's lone native reptile). It's a faded knowledge, a little intangible, but one that the Trinity team believes could provide leads.

One source in particular makes the task less onerous. The School's Collection, part of the country's National Folklore Collection, is a survey, conducted between 1937 and 1939, that saw teachers at 5,000 primary schools collate information from students and their communities regarding local customs. Alongside myths, legends, farming rituals and regional songs, a significant

number of the entries referred to useful herbs and 'cures' – ways to alleviate specific ailments and illnesses through magical and religious ritual, as well as botanical supplements. More than 12,000 of the entries in the collection reference folk medicine.

Reading through the digitised records on the online database – *dúchas.ie* – a relationship between community and landscape blooms. Thirteen-year-old Bridie Heffernan, from Feighcullen in Co. Kildare, relays that the slime from 'old bog holes' can be put on burns; 72-year-old Mary Curran from Killygowan in Co. Cavan suggests that bog beans are useful in reducing swelling. An entry from a school in Behy, Co. Donegal, claims a man by the name of William Morrow can make 'a plaster from herbs that can cure cancer'.

In our age of scientific reason, folklore remedies are often dismissed, yet the contents of many bottles in our medicine cabinets can be traced back to them. Aspirin's active ingredient was isolated from willow bark; plant-derived opioids have treated a variety of ailments for six millennia; digoxin, used to control irregular heart rhythm, was isolated from foxgloves in 1930.

'Old science is not bad science,' says Helen Sheridan, the academic director of NatPro and an associate professor of pharmacy and pharmaceutical sciences at Trinity College. 'It's just science we can build on.' Her team isn't alone in trying to unlock new medicines from traditional knowledge. Earlier this year, researchers showed that Northern Irish soil, long used in Irish folk medicine, contains antibiotic-producing bacteria that could help in the fight against antimicrobial resistance. Further afield, studies into the scientific underpinnings of traditional cures from communities in China, the Amazon and the Arctic are leading to tentative investigations into treatments for diseases including cancer and Parkinson's.

For the Unlocking Nature's Pharmacy team, initial research may take place in the archives, but once a plant has been identified as 'of interest', a scientifically rigorous process gets underway. Plant samples are obtained, dried and broken down to allow for exploration of their bioactivity and chemical footprints. Then, the sample is extracted and separated into its constituent parts to understand if and how its bioactivity alters when the context in which a molecule exists is changed. Sometimes, a molecule only acts a certain way when engaged with the rest of the plant; other times, one part may act alone.

It's early days, but initial research has shown anti-inflammatory and immunomodulatory (modulation of the immune system) activity associated with some of the species. The relevant plants will now need to go through a much more complex process of dereplication, in-vitro cellular screening, enzymic screening and antimicrobial screening to determine whether continued investigation is worth pursuing. The entire process, from initial investigation to creation of a commercially viable product, can take anywhere up to 15 years for drug discovery, although it takes less time for supplements, food products and cosmetic ingredients.

A DEGRADING LANDSCAPE

There's another side to this project that goes beyond commercial and medical success. Standing on the wet sphagnum crust of Lodge Bog, Nuala Madigan describes



Common cottongrass (*Eriophorum angustifolium*), also known as bog cotton

CATHERINE O'CONNELL

the complex and somewhat paradoxical relationship between Irish people and this landscape. It all comes down to peat – the accumulation of partially decayed vegetation or other organic matter in thick layers beneath bogland. Peat provides the conditions for Ireland's unique and special biodiversity to thrive, but it has also been used and abused for the past 1,000 years as a natural resource.

As part of the project, efforts are being made to ignite cultural ownership over boglands and renew understanding of the potential value hidden within them – value that extends beyond the black stuff. 'We want to revitalise the traditional Irish knowledge,' says Scalabrino. 'We want to reintroduce it into the community. Then, we can bring novel solutions to people

THE MAKING OF A BOG

- Ireland's raised peatlands developed 10,000 years ago in a post-glacial environment. As ice melted and retreated, lakes filled the spaces left over. Reeds encroaching into the lakes formed fens, and as the remains of aquatic plants and animals fell to the bottom, reedswamp peat formed. Today's acid bog peat built up when pine forests at the edge of the fen habitat fell and sphagnum moss began to spread.

In contrast, the blanket bogs found in the west of Ireland formed around 4,000–7,000 years ago. Tree clearance by humans, coupled with high rainfall, caused minerals to wash into lower layers of soil, producing an 'iron pan' – an impermeable layer. This caused waterlogging that encouraged peat formation. The average peat depth in blanket bogs is up to three metres, whereas raised bogs can have peat formations up to 12 metres deep.

Low-lying bog plants in the summer months, including yellow-flowered bog asphodel and cross-leaved heather



GAIA SCALABRINO

and say, "Actually, you can use your land to create this." It's a bold ambition – one that has been formulated just as Ireland grapples with an uncertain future for its peatlands.

Peat became a cheap and accessible fuel during the 19th century, essential for a newly formed country where 20 per cent of the environment is blanketed by bog. In the past 70 years, peat harvesting, or turf cutting, has provided a significant contribution to the Irish economy. 'Everybody has a family member who cut turf,' says Madigan. She doesn't condemn the historical commercial activity, but notes that it may be time for change. 'It's a habitat that has long been important to the Irish people, but now we need to give something back to the bogs.'

The 35-hectare Lodge Bog site is home to more than 388 plant and animal species, but it's actually an uncut remnant of the much larger, now-depleted Bog of Allen. This vast predecessor – part of an ancient bog system that once covered 1.17 million hectares – has been stripped away. Look at Lodge Bog on a satellite image and the surrounding landscape is scarred with eerily tidy strips of dark, bare soil. The image is repeated across the Irish midlands: the International Panel on Climate

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Change estimates that just 25 per cent of Irish peatlands are 'relatively intact', with the remainder 'deteriorating in quality due to on-going threats and the slow pace of restoration'. The organisation has labelled Irish peatlands 'the most threatened peatland in Western Europe'.

The degradation sits uncomfortably with a growing awareness of the importance of peatland in tackling the climate crisis. The Irish government's National Peatlands Strategy 2015 estimated that the country's peatlands (not including fens) store 1.6 billion tonnes of carbon, around 64 per cent of the total organic carbon stored in Irish soil. While pristine peatlands are a significant

carbon sink – taking in up to 1.04 tonnes of carbon per hectare, per year – damaged, drained landscapes with bare peat release carbon dioxide. Drained bogs are estimated to release as much CO₂ each year as Ireland's transportation sector.

In January 2021, the Irish government banned harvesting peat for horticultural products. Meanwhile, Bord na Móna, formerly the largest industrial semi-state peat company in the country, announced an end to all peat harvesting on its lands, with a plan to invest €115 million into restoring degraded peatlands within its ownership. Across the country, commercial harvesting by private peat companies is winding up.

Nevertheless, Ireland remains the third-highest greenhouse gas emitter in Europe per capita, belching out 13 tonnes per person each year. According to Madigan, delays in the designation of protected peatland sites are causing disputes as to who bears responsibility for protecting them. At present, there are 192 special areas of conservation and 148 natural heritage areas designated in the country – but by the IPCC's estimations, more than 1,000 sites of conservation importance exist within Ireland.

PRESERVING THE PHARMACY

The cost of restoring and preserving bogland weighs heavy. In a 2020 publication, Ireland's National Parks and Wildlife Service suggested that completely restoring the country's peatlands would cost €1 billion. In 2020, the government announced a budget of €5 million for peatland restoration. At that funding level, complete renewal would take a minimum of 200 years. 'But that's too late,' says Madigan. 'The bogs won't be here then. We need ten-fold investment – €50 million a year.'

Encouraging community support for restoration is one way to push government action – the IPCC engages with communities that want to preserve and protect their local boglands, providing advice, examples and support. But the future of bogs remains a difficult subject for peatland communities: a decision in 2019 to close a peat-burning electricity station led to the loss of hundreds of jobs in the Shannonbridge community.

That's where Trinity's pharmacy project steps in. Sheridan believes that reintroducing people to the cultural heritage of the landscapes, and revealing the economic value held in bogland biodiversity, will encourage public support for preservation. 'At the moment, people aren't seeing the biodiversity of the

bogs,' says Sheridan. 'They're not seeing them as the Irish rainforest. I don't mean in the glamour of toucans or anything, but in its potential to offer molecules that can affect health, or can be insecticides or nutraceuticals.'

At research sites across the country, including in Waterford, Sligo and Mayo, her team is engaging in community outreach, organising regular meetings with rural communities and spearheading an education programme. 'Bog walks' are offered to support learning, as well as introductions to the heritage hidden in the School's Collection. The start of this school year also saw ten Irish schools introduce a trial module that explores boglands and their biodiversity. 'It's about creating knowledge and making it available to people,' says Scalabrino. 'It's communicating the value of the bogs. We want to validate the science, transfer the knowledge and create those opportunities.'

Sheridan is keen to stress that the project isn't about exploiting boglands: samples, where taken, are small

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and unobtrusive. Any discoveries will eventually lead to synthesised products or, in some circumstances, to agricultural farming on badly degraded landscapes. Many fully extracted peatlands, stripped of flora and unsuitable for restoration, could feasibly be used for farming. 'A living bog is very different to a bog from which turf has been harvested,' says Sheridan. 'A living bog is a vibrant, thriving organism and we don't want to change that.'

Future restoration could offer economic benefit to communities, too; much of the necessary groundwork needed to re-wet and restore bogs, namely blocking old drains to sustain water levels, requires skilled workers and a specific set of bog-friendly tools. As peat harvesting winds down, the industry is releasing those workers into the job market, alongside a fleet of peatland machinery. 'While we have those people, we need to hire them,' says Madigan. She, like Sheridan, sees the integration of the community in future plans – whether restoration or scientific investigation – as integral to both restoration success and the future of rural communities. Provide communities with knowledge and understanding of the importance of bogs and they will strive to save the landscape, as well as its potentially life-saving biodiversity.

On the bench outside Trinity, winding up our conversation, Sheridan admits that the pharmacy project's endpoint is still unknown. They don't know what they'll find. In a way, those discoveries aren't their most pressing objective. 'It's an odyssey,' she says. 'We don't know what's round the corner, or what side door we're going to shoot down.' Her words bring to mind the humble bog bean and its meandering root system spreading out into the unknown possibilities of the black, wet peat. ●

PEATLANDS, WETLANDS AND BOGS

- All peatland and bogs are wetlands – but not all wetlands are bogs or peatland. Wetlands are defined as landscapes in which the ground is saturated and the water table is at or near the surface. Peatlands are a type of wetland where the rich, organic soil – peat – has built up over time, a result of plant matter not fully decomposing due to the watery conditions. In Ireland, a landscape must have a layer of peat at least 30cm thick to be designated a peatland. A bog exists when a peatland's only source of water is rainfall. This makes the bog very low in nutrients, creating a unique and difficult environment for plants.