REVIVING RESILIENCE:
PEATLAND RESTORATION IN THE CAIRNGORMS UPLANDS

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The Cairngorms, a sprawling expanse of rugged terrain and untamed beauty, is home to some of the most iconic landscapes in Scotland. Nestled within this vast wilderness lies an ecological treasure – the peatlands. These ancient landscapes, with their unique flora and fauna, have long been an integral component in the Cairngorms' ecosystems. However, the resilience of these peatlands has been compromised by various factors, necessitating a concerted effort in peatland restoration. This article explores the role of peatland restoration in enhancing habitat resilience in the uplands of the Cairngorms.

Before delving into the restoration efforts, it is essential to understand a bit more about these peatlands and why they are a vital part of the Cairngorms ecosystem. Peatlands are not mere expanses of waterlogged ground; they are living entities that play a multifaceted role in supporting biodiversity, regulating water flow, and sequestering carbon.

For example, they soak up rainwater, and gradually release it into streams and rivers, thereby regulating water flow. This natural filtration process also helps maintain water quality, benefiting both wildlife and downstream communities. Additionally, peatlands store vast amounts of carbon, making them crucial in the fight against climate change. The unique vegetation that thrives in peatlands, contributes to the overall biodiversity of the region.

Peatland formation in the Cairngorms:

During the glacial periods of the Quaternary, ice sheets covered large portions of the Cairngorms. Glacial activity, such as the carving of valleys and extensive deposition of glacial till shaped this landscape. From the end of the last ice age c.11,700 years ago and through the current Holocene epoch the climate warmed and vegetation began to colonise these exposed landscapes.

Plant communities in the Cairngorms evolved in response to the climatic and environmental conditions with peat-forming vegetation, including sphagnum mosses, sedges, cotton grasses and specialist heath species, dominating in waterlogged areas. These species tolerate nutrient poor waterlogged conditions and help sustain a highly acidic soil profile. All these factors help to create an ecological niche that excludes other upland species and supports communities unique to our peatlands.

The annual biomass of this specialist plant growth falls onto a bog surface that is almost permanently saturated, and this anoxic environment mummifies the organic matter by preventing microbial and chemical decay. As the years pass older material is compressed and transformed into the dark fibrous matter that we know as peat, typically accumulating depth at a rate of c 0.1mm per year.

The Cairngorms, like other regions, has experienced fluctuations in temperature and precipitation over the centuries, with many significant and sustained periods giving rise to notable changes in the habitat dynamics. For example, the Medieval Climatic Optimum or Warm Period (c. 900AD to 1400AD) may well have dried our peatlands, reducing acidity and leading to oxidisation of organic material and release of locked-in nutrients, as well as shrinking and cracking the peat. This may have started or exacerbated erosion processes and supported surface colonisation by trees such as Scots Pine, Birch and Willow, then the following Little Ice Age (c.1600-1850AD) may have led to the reversal of much of this change. This is a possible explanation for some of the preserved stumps that can be seen buried mid-way down the peat profile.

Changes in climate over longer periods significantly influence water balance and vegetation production and hence the rate of peat accumulation. In the Cairngorms this rate of accumulation may be even slower as a result of poorer annual productivity at altitude and more extreme weathering effects, so where we measure peat depths of 4m (which is not uncommon) we may be looking at 8000+ years of peat accumulation.

It's sobering to think that habitat dynamics have been stable enough for this length of accumulation, and that much of the degradation in these habitats has probably occurred in the last 500 years as anthropogenic influences on these habitats have increased.

The challenges facing our peatlands:

Despite their importance, the Cairngorm's peatlands currently still face numerous challenges that compromise their integrity and take their toll on these fragile ecosystems.

Most of the lower and middle altitude peatlands in the Cairngorms have been drained for agricultural or sporting purposes, disrupting the natural hydrology and leading to the degradation of peat layers. Drainage can lead to a transition from more robust bog vegetation towards a lichen dominated sward with poor structure that is not very resilient to weathering or other pressures, a similar effect can occur when peatland is subject to regular muirburn. In the uplands where exposure is a key factor there is a similar effect

but here overuse by herbivores often exacerbates the issue, as trampling and grazing reduce the vegetation cover and open bare patches across the fragile peat surface which can be more easily eroded. Often these factors compound.

With changing climate, these challenges intensify. The trend away from winters with more continuous snow cover leaves degraded peatlands more exposed to the harsh weathering effects. These include more frequent freeze thaw cycles, which give rise to needle ice formation which extrudes bare peat surfaces causing them to exfoliate, wind erosion which scours the surface of layers of poorly bonded peat, or intense rainfall and overland flows which both rapidly erode bare areas. Rain, surface flow and wind erosion effects are also exacerbated by more frequent heavy rain events and increasingly intense rainstorms during the summer months. These factors all increase the need for intervention to re-vegetate bare eroding areas and to improve the hydrology of these systems so that the rate of loss cannot increase.

Facing the challenges:

Recognising the urgent need to safeguard against these challenges most land managers in the Cairngorms are now actively carrying out peatland restoration work, particularly now it is so clear that we are facing both climate and biodiversity crises. There will be many who find irony in the fact that historic land management practices might have contributed to the degraded condition of these habitats, however our understanding of the importance of these habitats has evolved and land management practice is evolving with it. So, it's crucial to put the past aside and look to the future as we strive to repair our peatlands and build increased resilience within this important habitat.

Restoration efforts typically involve blocking drainage ditches and channels, re-vegetating bare areas by translocating vegetation or seedings of resilient native species, alongside employing techniques to encourage natural water retention, and flow management. Restoration projects aim to restore vegetation cover that can protect the fragile peat beneath and to restore the hydrological balance of the peatlands, recreating conditions that allow these ecosystems to thrive and continue to lock up vast amounts of carbon.

The most effective way to do this, where ground conditions and access allow, is using large, low ground pressure excavators, supported by dedicated teams of hand labourers. In some areas where access is limited the work needs to be done entirely by hand labour teams, and materials may need to be moved in by helicopters Some question the role of such carbon intensive processes and machinery in support of an activity that is focused on reducing carbon emissions, however the short-term emissions or impacts arising from

the process are far outweighed by the future emissions savings and habitat improvement that should occur.

Aerial view of work in the Cairngorms Photo credit Matt Watson

Lifting heavy materials into inaccessible spots Photo credit Matt Watson

Monitoring Peatland techniques Photo credit Matt Watson

Increasingly we find that some of the most engaged workers supporting and delivering peatland restoration come from land management backgrounds and
their deep understanding of how the land and habitats work, helps them with delivery of projects. Their inherent love and appreciation for what to many might seem a bleak workspace, coupled with tenacity for working in challenging weather gives them staying power where others would seek kinder workplaces. This will chime with readers of this journal who surely share this same understanding, love and appreciation of this landscape, though some may baulk at spending most of their working days in it.

The environmental benefits:

The environmental benefits of peatland restoration are multifaceted and extend far beyond the immediate rejuvenation of the peatlands themselves.

A primary rationale for Peatland restoration is that it contributes to climate change mitigation. Healthy peatlands sequester carbon, preventing its release into the atmosphere, so by restoring these ecosystems, we play a crucial role in the global effort to combat climate change.

Improved water regulation and quality is another significant advantage. As drainage channels are blocked, flow is slowed and vegetation cover is improved, peatlands increasingly help reduce the risk of flooding downstream

and provide a more sustained source of clean, clear water. Reduced erosion means less acidic material entering river systems which helps ensure these remain within crucial pH margins for successful salmonid reproduction, and less particulate matter in the water helps reduce water colouration and turbidity downstream which enhances freshwater ecology.

The biodiversity benefits:

The Cairngorms are renowned for their diverse and unique ecosystems, and peatlands are no exception. These waterlogged landscapes provide a specialised habitat for a variety of plant and animal species, many of which are uniquely adapted to the challenging conditions of the peatlands.

None is more iconic or visible than the spring flush of cotton grass that blankets swathes of the uplands, but many are more subtle such as the glistening sticky leaved carnivorous Sundews, the glossy red berries of Bog Cranberry, or the pendant yellow flowers of the Bog Asphodel. In the more waterlogged areas, we see rich carpets or hummocks of Sphagnum mosses colouring the surface wine red, apple green and salmon pink and floating in the deeper pools you may find *Sphagnum Cuspidatum* with its likeness to a drowned kitten. Amongst and above these flit the banded and metallic colours of the many Dragonflies and Damselflies that good bog supports as well as iconic upland wading birds like curlew, golden plover and dunlin. Above all soar raptors such as, merlin, hen harrier and short-eared owls.

Peatland restoration projects aim to increase the availability of the conditions that foster the return of this bog-specific vegetation and support the creatures that thrive on it, hence peatland restoration acts as a lifeline for some of the biodiversity that, in part, defines the Cairngorms and this work helps to tackle the biodiversity crises.

Community engagement and education:

An integral aspect of successful peatland restoration is community engagement and education. Local communities, including land managers, landowners, and residents, play a pivotal role in the success of these projects. Understanding the importance of peatlands and the role they play in maintaining a healthy ecosystem encourages a sense of shared responsibility for the environment.

Educational programs, workshops, and guided walks led by experts, outdoor leaders and ranger services provide valuable insights into the significance of peatlands and the ongoing restoration efforts. By fostering a connection between the community and the land, these initiatives help create

more passionate stewards for these important environments, and this in turn helps ensure the long-term success of the projects.

Challenges and Solutions in Peatland Restoration:

While the benefits of peatland restoration are evident, the process is not without its challenges.

One of the primary hurdles is securing funding for large-scale restoration projects. Since 2012 most of this funding in Scotland has come through a restoration fund provided by the Scottish Government, through its PeatlandACTION fund, which has a substantial commitment to fund this work through to the early 2030's, but this will fall far short of the sums needed to restore all the country's degraded peatlands. In recognition of this it is hoped that capital funding for future work may be partly or wholly supported by a carbon credit scheme that will provide land managers with a long-term income stream to fund and manage their peatlands. This may be further complemented by a biodiversity credit scheme in the future.

In addition to financial challenges, the restoration process itself requires careful planning, drawing on the peatland specialists, ecologists, geomorphologists and hydrologists to optimise restoration plans. These then rely on the availability of specialist contracting firms who can implement the plans with care and consideration for the fragile habitats they are working in.

Peatland restoration is still a relatively new area of work so there is still much trial-and-error involved in developing solutions to the challenges. This is particularly the case in the higher mountainous areas of Scotland such as the Cairngorms where solutions that have been found to be effective in other parts of the country will simply not work. This is because the environment is so much more challenging, the growing season much shorter and the window for delivering the work is limited.

When developing restoration approaches for sites in the Cairngorms we try to strike a tricky balance between scope, scale and expense, aiming to do just enough work to change the trajectory and stimulate a process of natural recovery, so that time and nature can do the rest of the work.

Examining previous peatland restoration projects in the Cairngorms area provides valuable insights into effective strategies and outcomes. For instance, they have readily demonstrated the positive impact of blocking drainage ditches and translocating re-vegetation onto bare areas. Monitoring efforts have shown improvements in water retention, increased biodiversity, and increased numbers of iconic bird species. Similarly, projects delivered over the past 8 years in the Cairngorms area highlight the importance of collaboration

between stakeholder organisations, landowners, local communities and interest groups. Working together these collaborations have successfully restored around 4000ha of the degraded peatlands with the Cairngorms National Park, with plans to deliver c.2000ha per annum in the near future.

Looking to the Future: Sustaining the Cairngorms Peatlands:

As we navigate the challenges of the 21st century, the restoration and conservation of Cairngorms peatlands stand as a beacon of hope. Through concerted efforts, these vital ecosystems can be preserved and improved, helping to ensure the Cairngorms remain a haven for biodiversity and a stronghold against climate change.

The Cairngorms land managers and advisors continue to lead the way in peatland restoration. By sharing knowledge, engaging in sustainable land management practices, and fostering a sense of responsibility among all stakeholders, they collectively contribute to the resilience of the Cairngorms uplands by helping to restore and sustain a delicate balance that has endured for centuries. The peatlands, with their moss-covered expanses, bobbing cotton heads and crystal-clear pools, are not just a testament to the past but a promise for the future.

Through peatland restoration, we are acting as stewards and ambassadors for a critical component of this majestic landscape, we are healing scars from the past and forging a path toward a more resilient future.

As individuals we can all help in this effort by limiting the need to store carbon, by helping raise awareness of the importance of these areas, by limiting passage damage on newly restored areas and for those of you that like to be up to your elbows in muck, by volunteering to help with the work.

About the author

Matt Watson is an ecologist who lives and works in the Cairngorms. He is currently Peatland Programme Manager for the Cairngorms National Park Authority. He has had a lifelong passion for the outdoors and upland wilderness areas and has built a career around surveying and understanding these habitats. He has been involved in research into Peatland dynamics and restoration since the early 2000's and in this time has been instrumental in the development of many of the key restoration techniques used today. Recreationally he spends much of his spare time amongst the hills and peaks of the Cairngorm massif, walking, climbing, skiing the mountains and floating down the rivers and lochs that flow from them.