The Heather Trust

Sustainable, Resilient Moorland

Where is moorland management going?

Expert views

PLUS

Heather beetle and pheromones
an attractive idea

Wildfire
mitigating the risk

Moorland best practice
on your smartphone

Annual Review 2021

www.heathertrust.co.uk

Contents

The Heather Trust
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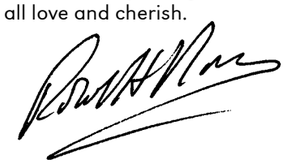
Rob Marrs, President

Rob Marrs

Last year I remarked in the President's piece that it had been an interesting year. What changes? Ditto for this year. Even so, last year, at this time, the vaccine was an aspiration and lockdowns imminent for Christmas. I remarked that last year was boring, with limited travel, but this year I have managed to do some field work (way hey). Three days measuring bracken in the Peak District (boring for some but I loved it), two days cutting down trees and weighing them (why would anyone want to – it was to measure carbon accumulation) and two days walking over the Moor House Estate in the North Pennines. A major highlight for me this year, was the acceptance of the Moor House grassland sheep exclosure experiments within the Ecological Continuity Trust's (ECT) register of long-term experiments. Long-term experiments are essential to show how different drivers alter the vegetation through time and the ECT's mission is to ensure they survive. My two days at Moor House, although tiring, was to provide some photographs of the experiments. So, I am happier now that I am back in the field, life seems to be improving. Another highlight was the day I spent "doing consultancy" in Caithness, as my contribution to the Heather Trust's annual auction. We had a brilliant day wandering over the Berriedale Estate where their restoration work and deer culling work looked superb. I am sure I get more out of these trips than the Estate staff. So "things" are improving for us, in that they are getting back more to near-normal. Let's hope that this continues into 2022 and beyond.

But what of the Heather Trust? It has committed, throughout the various lockdowns, to try and bring people together remotely to provide better management of our uplands. In October we ran a face-to-face conference on Bolton Abbey Estate with the theme of "Where is moorland management going?" and it seems to me we are at a pivotal point in determining the future direction of moorlands in the component parts of the UK. In the future, will we be managing our upland moors for the current aims for sheep and grouse? Or will we be concentrating on carbon acquisition, biodiversity targets or even forestry? All of these are possible. Not all are desirable in all locations, but decisions need to be made. Nothing in upland management is easy. It is never black and white. This is where the Heather Trust comes in. It aspires to be an honest broker, considering all sides of conflicting arguments, and trying to reach consensus where possible. This is the key to the Heather Trust's success; dedicated to improving the management of the uplands we all love and cherish.



Antony Braithwaite, Outgoing Chair of Trustees

Antony Braithwaite

Our charity was born 37 years ago from philanthropists (Sir Joseph Nickerson and others) recognising the difficulty of balancing competing interests on open moorland and the uplands of Britain.

In those days, the headline riddle was the number of sheep balanced against the requirements of grouse shooting. Today the concept of the charity is the same, with perhaps more riddles to test us – trees, carbon sequestration, flood management with climate change etc.

The Heather Trust has always been a think tank, with active demonstrations of their ideas, wherever possible.

Replies to our 'Covid appeal' this year produced all sorts of fond memories. John Phillips, our first renowned Director, ran demonstration moors and I received memories and photographs of the famous Misty Law experiment in North Ayrshire (which was owned by the charity). Simon Thorp, his successor and no less renowned, has just produced the final report from a 7-year project that promoted grazing management, at Molland Moor on Exmoor, and this marks the end of another phase of work at Molland where our involvement started in 2002.

Our present management of Scotland's Moorland Forum is a perfect example of the Think Tank concept – the Forum is very influential in opinion forming in Scotland.

Another reply to our appeal contained a copy of John Phillip's book, 'Moorland Management', which documents his great practical experience. We have just entertained at Bolton Abbey Ian Coghill, author of 'Moorland Matters', which describes his experience and insights into the current riddles, and, on that occasion, one of our benefactors reminded us of the book that started the moorland think tank process – 'The Grouse in Health and in Disease' (1911). All three represent the practical and technical experience of experts on moorland management over more than a century and are vital reading for understanding the competing interests of today.

The Heather Trust Board Report 2021

Last year's report started with the observation of how good the Heather Trust is at getting people together on a moor, discussing topical moorland matters and sharing differences of opinion. Early this October we were delighted to have a proper AGM, in the flesh and to share an excellent morning with 30 guests out on the Bolton Abbey estate.

I was going to write, 'with likeminded people' and that would be true in the sense that I expect that all have a love of moorland landscapes and wildlife. What they would not agree on is exactly how that landscape and wildlife should be managed, and to that I should add the soil beneath their feet, especially if it has over 40cm of peat! However, whether your main interest was shooting grouse, managing for grouse, wildlife, soil and water conservation or implementing Government policy, the Board were pleased that guests felt able to share their expertise and opinions in an open and constructive manner in what all would agree to be a captivating moorland environment.

The afternoon continued in that vein with four excellent speakers covering licensing heather burning on deep peat, continued research on plant/soil relationships under heather burning, non-burning and cutting regimes, the fate of breeding wader populations on moorlands if grouse moor management was to change and the economic potential of moorland natural capital. I believe that an excellent day was had by all, in no small part due to preparation and hard work of the staff of Bolton Abbey estate and our own support staff who made the day run like clockwork.

Trustees' efforts to ensure The Heather Trust remains a modern, relevant land use and environmental charity have continued throughout 2021. In many ways the pause that Covid 19 forced on all of us during 2020 and that our Director, Anne Gray, needed to take some time away from the Trust to deal with health issues, served to give us time to evaluate workloads and working arrangements.

Now having returned in good health, we realise that we get best value from Anne when we allow her to play to her strengths and focus on Scottish Policy and Projects. We are therefore aiming to move to a model whereby we will seek to fund a Director for Scotland, a Director for England and Wales, and a Business Manager post to create a senior management team that can work effectively together to deliver our charitable purposes.

Maintaining existing funding streams and attracting new funds is key to making this happen and the Board has been busy with the development of a new funding strategy. Much of our Director and Trustee time is spent representing the Trust on several different committees and stakeholder groups. We could not do this without the financial support of our members, income from our country marketing sale and generous donations from individuals.

You may note that our accounts from the last financial year showed an unrestricted deficit of nearly £23,000 which we were able to meet from our reserves. The situation this year is looking much healthier. We expect to make a surplus of over £25,000 due mostly to the very generous donations from our supporters, charitable trusts and other bodies that are aligned with our main aim of developing and maintaining sustainable, resilient moorlands which throughout Great Britain for the benefit of everyone. Very recently, Antony Braithwaite, our Chairman for the past eight years, has decided to stand down from the Board. We wish to express our thanks for his support and generosity to the Trust during his tenure.

We have also moved our administrative office this year into the heart of Dumfries. Our correspondence address is now The Heather Trust, The Hub, 24-26 Friars Vennel, Dumfries, DG1 2RL. The Hub is a social enterprise that provides flexible workspace for organisations. It allows the Trust to fully embrace the new flexible work practices that are becoming prevalent, and it means we can share the cost of Wi-Fi, printing and other standard office costs.

The theme of this year's AGM and part of this year's Review is 'Where is moorland management going?' Agricultural support mechanisms are changing, greater emphasis is being put on carbon capture and storage in our uplands and pressure grows for rewilding, however it is defined. In these times of change it is vital that the Heather Trusts remains a strong presence in the debate and, as ever, seeks to facilitate and offer impartial guidance on the ways forward for the benefit of all. We could not do this without the continuing support of our members, donors and the hard work and dedication of our administrative staff. We thank you all and look forward to the year ahead.

Ian Condliffe

Office Bearers

President
Professor Rob Marrs
Rob is the Emeritus Bulley Professor of Applied Plant Biology in the School of Environmental Sciences at the University of Liverpool and has a particular focus on vegetation dynamics in the uplands.

Outgoing Chairman
Antony Braithwaite
Antony is a landowner based in Northumberland with a keen interest in grouse and fisheries. He stepped down from the Board in October 2021.

Vice President
Mervyn Browne MBE
Mervyn was a founding member of The Heather Trust over 30 years ago and specialised in bracken control work, particularly in Ireland.

Vice President
Malcolm Hay
Malcolm's estate at Edinglassie near Huntly in Aberdeenshire has become an important site for peatland restoration work.

Board

Dr Colin Shedden
Colin is Scottish Director of the British Association for Shooting and Conservation and lives near Dunkeld.

Ian Condliffe
Ian lives in Ilkley and was Defra's national principal technical advisor for upland environmental research and development.

Robert Benson
Robert was formerly the Chairman of the Moorland Association and is an experienced sporting manager based in Cumbria with extensive links across upland management communities.

Colin Matheson
Colin was a chartered surveyor and land agent for over 45 years and former Director of the College Valley Estate in North Northumberland.

Roger Burton
Roger has recently retired after 26 years with Scottish Natural Heritage and has a strong insight into the public benefits that well-managed moorland can deliver.

Viscount Devonport
Viscount Devonport has been a moorland owner since 1972. He was part of a 15-year demonstration farms and moors project with the Countryside Commission and participated in the Otterburn Project.

Hamish Waugh
Hamish Waugh is a traditional hill farmer in the Scottish Borders farming over extensive unfenced moorland with heather on the highest areas and on North facing slopes. Hamish uses traditional farming practices which promote biodiversity and encourage a wide array of both plant and bird life.

Meet the Team

Director Scotland
Having worked as Director from 2018 to 2021, Anne Gray will now be leading Scottish Policy and Projects for the Trust.

Director's Assistant
Anne Stoddart has been with the Trust since 2011 and supports the Director in all the Trust's activities. She also provides administrative support to Scotland's Moorland Forum and Working for Waders.

Membership and Finance Officer
Clara Jackson started working for the Trust in 2010 and manages memberships, finance and sponsorship.

Events and Business Support
Eppie Sprung joined the Trust in 2017 and co-ordinates our annual Country Market and Sporting Sale and our communication channels. In addition, Eppie provides general business and governance support to the Trust.

Consultant
Simon Thorp (previous Director) provides input to the Trust running the Bracken Control Group, representative on the Uplands Stakeholder forum, Chairing the Uplands Management Group, and England & Wales Wildfire Forum.

Dr Oliver Moore was Moorland Management Best Practice Guidance Officer (until July 2021)

2020 ANNUAL ACCOUNTS - HEADLINES

As presented at our AGM on 13th October 2021

TOTAL INCOME
£147,354

UNRESTRICTED
£99,661

DONATIONS AND LEGACIES
£38,732

INCOME FOR CHARITABLE ACTIVITIES
£57,654

INVESTMENT INCOME
£3,275

RESTRICTED
£47,693

DONATIONS AND LEGACIES
£47,693

TOTAL EXPENDITURE
£188,050

UNRESTRICTED
£122,529

RAISING FUNDS
£7,724

CHARITABLE ACTIVITIES
£114,805

RESTRICTED
£65,521

CHARITABLE ACTIVITIES
£65,521

DEFICIT IN 2020
£40,696*

RESERVES
(AT DECEMBER 2021)
£120,000

*Our total deficit in 2020 was £40,696. This was made up of a deficit in our unrestricted funds of £22,868. This is the Trust's true deficit for the year. We also showed a deficit in our restricted funds of £17,828. We receive restricted funds from various sources which are to be paid out again in grants to other organisations, and a deficit in these funds is merely a quirk of timing over the year end period.

CHALLENGING UPLAND FUTURES

A conference to celebrate 20 years of the Centre for Mountain Studies, at the University of the Highlands and Islands' Perth College - and to take stock of latest research and the policy debate around the future land uses of the Scottish Uplands

As set out in the programme, 'Challenging Upland Futures' was a public forum with the aim, agreed by a range of diverse stakeholders, to integrate knowledge and understanding on the uplands of Scotland, and to agree priority actions to help ensure that our uplands deliver the widest possible range of benefits.

It was a packed two days (5th and 6th October) of information, discussion, workshops and - at last - a very welcome greeting of friends, colleagues and acquaintances in person.

The speaker list included The Heather Trust talking about our 'What are Britain's Uplands for?' discussion events. It was an excellent opportunity to remind those attending that The Heather Trust is, at its heart, a reconciliation project that aims to bring the different interests in moorland management together to find consensus and shared understanding where possible and to encourage continuing dialogue where it is not. Our presentation was well received and was part of the overall very high standard of contributors that Perth College were able to bring together for an opening day of information gathering. The second day was dedicated to workshops which explored: 1. Addressing climate change and biodiversity in upland initiatives; 2. Good practice community engagement in the uplands; 3. Finding optimum spatial scales to deliver multiple benefits in the uplands and for integrating policy objectives; and 4. Contributions of the uplands to a Just Transition.

The organisers at The Centre for Mountain Studies are collating the workshop outcomes and other discussion points with the aim of pulling together a clear set of 'asks' - or priority actions as the introduction sets out - that the conference will call for and follow up.

Brian & Mary Chugg Conservation Award

2020 WINNERS: GRAZE THE MOOR PROJECT

We were very pleased to learn that the Molland Estate had won this award. The Heather Trust's involvement with Molland Moor started in 2001 when the Trust was awarded a contract by Defra to develop moorland management practices on five English moors that would benefit both wildlife and agriculture.

Graze the Moor is an innovative grazing project based on Molland Moor (681 hecatres) that ended in 2019. The Award is given to the project group as an exemplar of partnership-working between the owner and tenant farmer, Natural England, Exmoor National Park Authority, Environment Agency, expert consultants and academics. The project was set up to seek solutions on a formerly heather-dominated moor that had been encroached, in many areas, by purple moor grass The Project Report shows that, through introducing an experimental moorland system including over-wintering of cattle, there is evidence of over 75ha of heather regeneration, increased breeding birds population and no loss of farm profitability compared with conventional upland beef and sheep farming. However, there was an increase in heather beetle attacks contributing to ongoing heather loss. On behalf of the project group, Christina Williams, landowner, said that it had been an interesting journey and hoped the project could continue. 'Sadly, after eight years, there is no further funding for the research elements of the project but we hope to continue the monitoring for the next few years. With the future of agri-environment schemes unknown at present, we do not know if we will be allowed to continue with our winter grazing. We will keep The Exmoor Society up to date with any developments.'

Members of the project team: Chair: Simon Thorp, Consultant to The Heather Trust; Dr Allan Butler, Royal Agricultural University; Professor Janet Dwyer, Countryside and Community Research Institute; Dr David Boyce, independent ecologist; Mike Pearce, Natural England; Christina Williams, Molland Estate; Steve and Richard Langdon, tenant farmers at Luckworthy Farm, Dave Barrow, Moorkeeper, Julie Tucker, Farm Secretary.

Christina Williams, Molland Estate

THE TRUST AT COP26

The major event of 2021 was the UN Climate Change Convention's 26th Conference of the Parties (CoP26), held in Glasgow only a few weeks ago. For the first time since the process started, the organisers included a Peatland Pavilion as part of the Blue Zone set-up. We also saw peatlands properly recognised for both the contribution they can make to worsening climate change when they are in a state that emits carbon dioxide, and how, when restored to a natural or near natural functional state, they can be part of the solution by sequestering and storing carbon. The Trust's Director Scotland, Anne Gray, was privileged to be asked to participate in discussions.

The Heather Trust took part in two Peatland Pavilion sessions at CoP26 – firstly speaking at a session organised by the Icelandic Government's Soil Conservation Service on Engaging Stakeholders in Peatland Restoration and secondly by hosting the discussion for the Scottish Government's session on Peatland Rights and Cultures.

The main take-away message from my presentation on stakeholder engagement was ***it ain't what you do, it's the way that you do it, and that's what gets results*** [stolen from Bananarama or Ella Fitzgerald, depending on your vintage!]. As someone who has been at the heart of land use and management policy development in Scotland for quite a number of years now, I've seen a lot of attempts at engaging landowners and managers in new schemes and initiatives and I've been asked on countless occasions how it should be done. In all that time I've only seen a couple of very good examples and Scotland's Peatland ACTION program is one of them. That's not to say Peatland ACTION hasn't had its challenges, but, right from the start, it has done engagement with peatland owners and managers really well. The reasons why are not rocket science, but they are worth spelling out.

First of all, the Project got people who represent landowners, farmers, crofters and so on involved at the highest, national level of the Project Steering Board – and not in a tokenistic way but to listen to what we had to say. Then at a local level, they employed Peatland Action Officers to work with landowners and managers to pull together project applications, oversee works and follow up. Basically, if a peatland manager likes the concept of restoration, the leg work is largely done for them. More than this though, Peatland Action Officers are not all employed directly by NatureScot (who run the main project). Many are employed (with funding from NatureScot) within existing local organisations such as the Tweed Forum and Shetland Amenity Trust. Organisations that are already working with landowners and managers on a range of issues through agri-environment and other such schemes. This makes use of local knowledge and builds on existing local linkages and – perhaps crucially – builds on existing 'trust'. As well as this, it enables these local organisations to thrive.

In a similar way, land management consultancies can also do the same type of co-ordination and delivery work on behalf of individual or groups of estates, as has been the case with some deer management groups.

Finally, the project has thought about non-threatening ways to speak to the various communities of interest that rely on peat harvesting, such as the whisky industry and the few crofters that cut peat for domestic fires. So, for example, workshops on how to minimise damage and allow recovery of small areas of cutting have taken place.

There's no magic bullet in terms of cracking successful engagement but there are key aspects such as listening, understanding, facilitating, building trust and evolving practice with those on the ground. It's about respectful communication and discussion all round, and about finding mutually beneficial solutions.

The Heather Trust has been working with Peatland Action on new guidance for land managers on how to manage peatland beyond initial restoration work, as it follows a pathway to functional recovery that might take 20 years or more. Taking the above factors into account, this guidance looks at the role some traditional management practices might play in ensuring good recovery of peatland to a functional state, such as considering when and how much grazing, for example, might be beneficial and when it would be more sensible to reduce livestock or wild herbivore pressure. Muirburn, cutting, grazing, deer management and other issues are covered. We'll be publishing in 2022.

New Grazing Technology to Benefit Black Grouse at RSPB Geltsdale

As we consider 'Where is moorland management going?', Ian Ryeland, the farmland warden at RSPB Geltsdale, describes a novel farm management system designed to improve the habitat for moorland fringe birds, particularly black grouse.

RSPB Geltsdale comprises two large upland farms in the North Pennines with open areas of moorland and acid grassland, grazed extensively by hardy native breed cattle for the benefit of wildlife.

Rewilding isn't a word we use much although it's been happening here for years, perhaps even before the term was coined. A reduction in the numbers of sheep and an increase in cattle is slowly transforming the moorland fringe and lower fells, increasing the diversity of the grass sward and promoting natural regeneration of trees in the valleys. Some areas have had grazing animals removed altogether, others are grazed with Exmoor ponies which are a great natural controller of bracken and help to create great feeding opportunities for ring ouzels.

A particular highlight is the reserve's Bruthwaite woodland (Fig 1); 600 acres of native tree planting spreading across the northern flank of Tindale Fell from Tarn House towards Geltsdale itself where remnants of ancient woodland pasture still exist. This is landscape-scale habitat creation. It's dramatic, stunningly beautiful and at times teeming with wildlife. A thousand years ago it was a hunting forest, then it was plundered for its coal in the industrial revolution and latterly it became one of the largest sheep farms in Cumbria. Since being planted with trees in 2004, the prevailing weather systems, topography and roe deer browsing have all played their part in shaping what has become a very natural-looking scrub woodland. It seems like it's always been here!

Over time we've seen a huge increase in birdlife with willow warblers replacing meadow pipit as the most common species. Whinchats and stonechats are common too and the area is one of the best places around to see and hear cuckoos which come to lay eggs in the plethora of bird nests and gorge themselves on caterpillars. In winter black grouse feed in the hawthorn trees and display on the open ground. Alongside the trees there has been regeneration of plant life including patches of rare northern bilberry, greater woodrush, butterwort and an abundance of wildflowers.

Now the woodland is established we are able to introduce cattle into the area. Cows are great for the woodland ecosystem. They create diversity through their trampling and non-selective grazing, never nibbling down to the ground like sheep will. They are very good at recycling nutrients and distributing seeds via their dung. They clear glades and will promote natural regeneration of the woodland.

Funding from the North Pennines AONB Fellfoot Forward Project has enabled the reserve to purchase an invisible (virtual) fence system called Nofence which eliminates the need for standard livestock fencing which can be lethal for low-flying birds like grouse and short-eared owls. We would rather be removing fences than putting them up! What is an invisible fence? The cow wears a GPS collar unit (Fig. 2) which plays an audible melody as it approaches the fence line and emits an electric pulse to the neck if it attempts to cross the line, thus deterring the cow from crossing the boundary. A grazing area or pasture is digitally created using a mapping App which then communicates with the collar on the cow. When the animal approaches the Nofence boundary, the collar emits the audio melody warning to deter the cow from crossing the line. The signal resembles a scale of tones, starting at a low pitch and rising gradually as the cow approaches the Nofence boundary. The animal quickly recognises this sound and will turn and go back to the Nofence pasture to avoid the electric pulse.

Fig 1. The Bruthwaite woodland pasture from above the RSPB visitor centre

This means we can divide up the large woodland into smaller areas and move the cattle around, focussing the trampling and grazing in some parts whilst avoiding footpaths and sections where trees are still trying to establish. Thus, we can now manage the grazing much more precisely than was previously possible.

We are hoping black grouse will respond well to this mob-grazing management and birds have already been seen feeding in areas where the cattle are present. The population has fluctuated on the reserve with small numbers recorded in the early 2000's, rising to 59 lekking birds in 2015, a direct response to the change in livestock grazing and new tree planting. A succession of wet springs since then has seen the number of male birds drop to 21 but the reserve provides plenty of suitable habitat and year-round feeding opportunities meaning they have a good chance to recover.

Ian Ryding, Farmland Warden, RSPB Geltsdale

Fig. 2. Cows in the woodland wearing their Nofence collars

HDH WILLS
CHARITABLE TRUST

The HDH Wills Charitable Trust provided the Trust with funding to support our small research grants programme between 2018 and 2021. During this time we have used it to: part-fund the final year's work and write-up of our Peak District Heather Beetle study; to enable the University of Liverpool to carry out data-analysis and write-up a paper on "Rewilding the Uplands: the effects of removing sheep on soils and plants"; and to support the University of York to progress the second phase (2019-2022) of a 10-year piece of research into the nutritional value of heather and sedge under three different management regimes; cut, burn and leave (see page 34).

A small grant has also been made to support the work of David Hall with the University of Greenwich, introduced overleaf.

Investigation of Pheromones of Heather Beetle

David Hall is Professor of Chemical Ecology at the Natural Resources Institute, University of Greenwich. He summarises the first part of his research on how heather beetles may find each other that could have implications for their control.

INTRODUCTION

Many insects communicate with each other by means of volatile chemicals known as pheromones. For example, sex pheromones are produced by one sex and attract the other sex for mating. Aggregation pheromones are also produced by one sex but attract both sexes to sources of food and for mating. Insect pheromones are generally produced by the insects in tiny amounts, typically a few nanograms (10^{-9} gram), and the receiving insect detects them by highly sensitive receptors on their antennae. If we can identify and synthesise these pheromones for an insect pest, we can use them to bait traps to provide a sensitive means of detecting the presence and monitoring the abundance and distribution of the pest. It is also possible to use the synthesised pheromones to control the pest by mass trapping with large numbers of traps, luring the pest to a killing agent such as insecticide or biocontrol agent, or by disrupting mating or aggregation, for example. Pheromones are natural products, they are generally highly specific for the target pest without effects on non-target organisms, and they are generally highly biologically-active so that only relatively small amounts are required to have an effect.

This project aimed to determine whether heather beetle produces pheromones, and, if so, to attempt to identify the chemical structure and synthesise them so that their use in management of heather beetle could be evaluated.

RESULTS

Live heather beetles were collected by Roy Brown and Bruce Giddy and sent to NRI. A method for distinguishing males and females was developed as this has not been reported before. This was based on the different patterns of the end of the abdomen (Fig. 1). This made it possible to collect the volatile chemicals from male and female beetles separately, by drawing clean air over the insects and trapping the volatiles released on a solid adsorbent (Fig. 2). The trapped volatiles could then be removed by washing the adsorbent with an organic solvent. In all, 62 collections were made from individual beetles or groups of up to four.

Fig. 2. Collection of volatile compounds from heather beetle. Air is drawn from left to right through a charcoal filter to purify it, through a glass chamber containing a heather beetle with heather and out through a collection filter which traps the volatile compounds for analysis

The volatile collections were analysed by gas chromatography (GC), a powerful method for separating out the components of mixtures of volatile compounds. The GC was coupled to mass spectrometry (MS) which gives information on the chemical structures of the components. No obvious differences could be detected between the compositions of volatiles collected from male or female beetles. However, closer examination revealed the presence of tiny amounts (picograms, 10^{-12} gram) of a compound with the analytical properties reported for a compound used as a pheromone by related beetles. This was present only in collections from male beetles.

The volatile collections were also analysed by GC coupled to electroantennographic (EAG) recordings from the receptors on the antennae of live heather beetles (Fig. 3). An EAG response was observed to the candidate pheromone compound from antennae of both male and female beetles, although this was very weak, probably due to the small amount present.

Fig. 3. Antenna of heather beetle suspended between electrodes for electroantennogram recording from receptors on antenna

CONCLUSIONS

A compound has been identified as a candidate pheromone component produced by male heather beetles. It is probably an aggregation pheromone, stimulating receptors on the antennae of both male and female beetles, making it of much more potential use in management of the pest. The compound is currently being synthesised at NRI, requiring 14 steps. The synthetic compound will be made available for testing as an attractant for the next generation of heather beetle in 2022.

This work has been funded by the Heather Trust, The Moorland Association and the Moorland Communities Tradition Ltd.

David Hall

Fig. 1. Male (left) and female (right) heather beetles showing different patterns of terminal segments of the abdomen

Burning on Blanket and Other Peats:

Implications of relying on data from Moor House

Ben Clutterbuck

Richard Lindsay

Long-running moorland experimental plots can provide valuable insights into vegetation and soil change. However, care must be taken when trying to interpret possible changes on long term plots.

Ben Clutterbuck, Senior Lecturer in GIS and Remote Sensing, Nottingham Trent University. Richard Lindsay, Head of Environmental and Conservation Research, University of East London

BACKGROUND

The impacts of burning on blanket bog is a topic of continued interest, and discussions around the appropriateness of burning vegetation on blanket and other peats are seemingly ongoing – at least in the eyes of policymakers. A number of conclusions have been drawn by a range of authors over the years about the impacts of burning on vegetation structure, *Sphagnum* growth, water table, and water quality based on evidence from a long-term experiment in the North Pennines at Hard Hill in the Moor House – Upper Teesdale National Nature Reserve (NNR). In this article we summarise an assessment of the experimental design and highlight implications for the data derived from this site (see Clutterbuck et al., 2020 for further detail).

HARD HILL EXPERIMENTAL PLOTS

The Hard Hill experiment was initiated by the Nature Conservancy in 1954. It set out to establish a series of randomised replicated plots to monitor the effects of grazing and rotational burning treatments on blanket bog vegetation and soil fertility (Elliott, 1958). Four blocks (A-D) were established, each comprising six treatment plots measuring approximately 30 m x 30 m (Figure 1). Half of each block was fenced off to exclude grazing, and three rotational burning treatments were subsequently replicated in both halves: burned in 1954 only, burned every 10 years and burned every 20 years.

In order to quantify the impact of experimental burn manipulation on vegetation, it would be expected that vegetation across the area was surveyed prior to the experiment. It might also be expected that any large deformations in the peat surface of the plots (e.g. the presence of erosion gullying), would also be recorded as such features would tend to act as drainage features. Unfortunately, neither of these aspects was surveyed prior to the start of the experiment and this consequent lack of baseline data has significant implications for all subsequent interpretations of data obtained since.

Prior to designation of the NNR in 1952, Moor House had been managed as a grouse moor, with records of shooting dating back to 1842 (Bell, 1843 cited in Taylor & Rawes, 1974). At the initiation of the experiment, the vegetation on Hard Hill was assumed to be of comparable age and reported to have been out of fire management for at least 40 years (Hobbs, 1984). Furthermore, all plots were described as having been burnt at the start of the experiment "to remove all vegetation" but it is not recorded whether this meant that any moss layer was also burnt away – in which case the fire regime employed must have been intense – or whether only the aerial parts of vascular vegetation (e.g. heather and cotton grass) was burnt off. Moreover, examination of an aerial photograph captured in 1953 reveals several burn scars (Figure 1) and shows that the vegetation across the experimental area was not in any case of comparable post-fire age at the start of the experiment. This had a profound impact on vegetation structure because it was still visible in an aerial photograph captured 40 years later (Inset Block B: 1992). This observation indicates not only the long-term impacts of burning on blanket bog vegetation, but that the vegetation within the affected plots is not comparable to other plots within the experiment.

Examination of topographical data highlights a range of slope in terrain across and within the experimental blocks. It is also clear on the ground that several substantial erosion or shrinkage features are present within experimental blocks A and D. All plots were surveyed using terrestrial laser scanning (TLS) and the anomalous features are particularly marked in Block D, where a large erosion or shrinkage gully (potentially associated with a sub-surface peat pipe) runs through both of the plots burned in 1954 only (Inset A). This feature will have enhanced influence on local drainage and demonstrates that at least these two further plots are not comparable to other plots within the experiment. It is perhaps not surprising that a survey conducted in 2019 identified a lower frequency of *Sphagnum* moss in these two plots compared to the other four plots in Block D (Clutterbuck et al., 2020). Without pre-experimental vegetation survey data it is of course not possible to confirm whether this modern result reflects the frequency of *Sphagnum* at the start of the experiment or indeed the influence of burning on *Sphagnum* presence. However, a *Sphagnum* survey was conducted several years after the experiment started (Forrest, 1961) and this showed that the relative cover of *Sphagnum* in Block D was markedly higher in both 10-year treatment plots and in the fenced 20-year plot than in either of the 1954-burn plots.

It is also worth noting that the 20-year grazed plot in Block D has a concentration of *Sphagnum* records towards the southernmost corner of the plot. This can perhaps be explained by the fact that the whole block slopes from NW to SE, so the southernmost corner of the 20-year grazed plot is the natural collecting point for water seeping across the block as a whole – or, given the presence of the marked deformation feature that cuts across the block, a collecting point for at least the lower third of the block.

We have also been assessing the condition of the peat and the microtopography of the surface in the plots as these characteristics provide further information about post-fire recovery. Data for Block D are presented in Clutterbuck et al. (2020), but we have now surveyed all other experimental blocks and other areas outside, including the footprint of the Centre for Ecology and Hydrology (CEH) greenhouse gas (GHG) flux tower approximately 800 m due east. These data will be reported in early 2022.

SUMMARY

The experimental plots at Hard Hill are not comparable either within or between blocks. Furthermore, the starting condition of the various plots is unknown. The assumption that the various plots are replicated and well documented is thus unfounded. Consequently, any research findings to date about the impacts of burning on blanket bog based on these assumptions cannot be relied on. Our survey work provides the first detailed description – in effect a baseline from this point on – of the small-scale morphology of the experimental plots. Such small-scale morphology is at least as important as species composition in characterising the condition of a peat bog surface given the relatively limited range of plant species typical of bog habitats. Indeed, in Tierra del Fuego where entire bogs may be formed by a single *Sphagnum* species, it is the small-scale 'hummock-hollow' morphology of the bog surfaces which provides almost the entire source of habitat and species diversity. If the experimental plots at Hard Hill exist to illustrate the effects of burning and grazing on bog condition, an account of the small-scale morphology of the ground must form a central part of any habitat description – an account which has until now been conspicuously absent from almost all previous literature published about the experiment.

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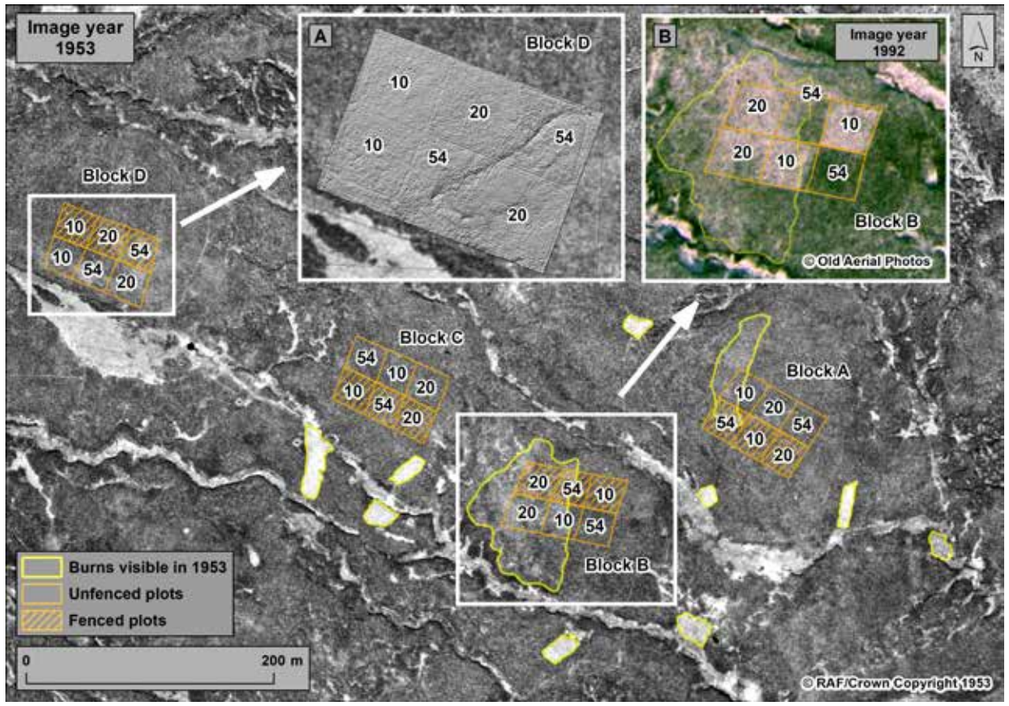


Figure 1. Hard Hill in 1953 showing location of recent burn scars in relation to the future experimental blocks. Inset A: Peat surface underneath vegetation in experimental Block D extracted from TLS survey showing presence of meso-scale erosion gullies; Inset B: Aerial photograph from 1992 showing the long-term impact of pre-experimental burning on vegetation structure 40 years later, particularly evident in the fenced plot burned in 1954 only.

MOOR Flavour

Heather Trust Country Market & Sporting Sale

SAVE THE DATE: 6TH MAY 2022

Eppie Sprung, our Events and Business Officer, shares her thoughts on our 2021 Country Market and Sporting Sale and looks forward to 2022.

2021 was a strange year for our Country Market and Sporting Sale. Late 2020 / early 2021, we really all felt that we were coming out the other side of Covid-19 but, of course, restrictions (of varying degrees) have remained much longer than any of us could have predicted.

This saw our 2021 Sale impacted, just as the 2020 Sale had been.

With fewer shoots available, it was our Arts and Books and Country Living categories that stood out this year.

Particularly popular Lots included Moorland Matters by Ian Coghill (who we were then delighted to have speaking at our AGM and conference in October), heather seed from Mill Farm and oven-ready grouse from Wellhope Moor. As you can see, staying closer to home was definitely a theme of our 2021 Sale!

We feel incredibly lucky that we managed to raise a whopping £29,406, from a combination of cash donations and Lot purchases.

This fundraising achievement is only possible thanks to the ongoing support of our cash and Lot donors and the enthusiasm of our bidders. Our heartfelt thanks go out to each and every one of you.

The Sale is our largest fundraiser each year and, without it, our charitable activities would be severely curtailed.

Over the coming months, I will undoubtedly be in touch with each and every one of you to ask you to consider making a Lot donation to the 2022 Sale. However, please don't feel you need to wait to hear from me to make a donation. If you have an idea for a Lot donation, under any of our categories, please send me an e-mail on: **events@heathertrust.co.uk**.

2022 Categories will include:

- SHOOTING
- STALKING
- BESPOKE MACNABS
- FISHING
- COUNTRY LIVING
- TICKETS AND DAYS OUT
- ART AND BOOKS
- ACCOMMODATION

General Donation Appeal

In addition to our Country Market and Sporting Sale, we also conducted a general appeal for donations during 2021 that raised a total of almost £25,000. This contribution from our members and supporters demonstrates the significant level of support for both our vision and activities and will enable us to continue delivering towards this vision through 2022 and beyond.

VISIONS FOR OUR MOORLANDS

The theme of our AGM this year was, "Where is moorland management going?" We all probably have a vision about what we would like our moorlands to look like and deliver, and maybe that vision is changing as government policies for the environment evolve and the growing power of social media influences how people think.

We asked our AGM speakers and other friends of the Heather Trust to outline their vision for us.

Ian Condliffe

The Heather Trust

At the end of this year, I will be stepping down after 14 years as a Heather Trust trustee. So, from where I sit in England, what is my personal vision for moorlands and has it changed over those years? At the start of my tenure, I wrote about maintaining the balance; of moorland biodiversity, livestock grazing and field sports. Things have moved on since then and the Heather Trust's vision of sustainable, resilient moorlands for the benefit of everyone sums up the changes in people's perceptions of moorland since.

I see demand growing for moorlands to improve the quality of the public goods and services that they have always provided. Hopefully this will be through incentive payments from government rather than increased regulation. Aided by social media, the public perception of driven grouse shooting – the burning of heather and the legal and sadly illegal control of predators will put increasing pressure on some landowners and government to further discourage or even ban burning and maybe driven grouse shooting. I therefore see a reduction in the number of moors managed for the sport. Those remaining will be cutting rather than burning heather. Changes in agricultural support payments will put financial pressures on moorland owners and graziers, challenging the economic sustainability of our uplands. Owners will need to respond to this by promoting and creating a market for the natural capital the uplands can provide.

Rewilding? I'm not sure if I have seen any true examples of this. There are certainly some moorlands being far less intensively and intrusively managed, usually funded by philanthropic landowners or government grants. They will change the landscape and wildlife balance. My vision, therefore, is for a more variable upland landscape, looking less managed than we see today.

WHERE IS MOORLAND MANAGEMENT GOING?

Richard May

High Moor and Piggford Moor in the South West Peak

Rewilding is in vogue. Thoreau and Muir anguished about wilderness too, those 'wild, uninhabited, uncultivated regions'. But all fake, a chimera, to quote renowned conservationist Aldo Leopold: 'every head of wildlife still alive is artificialized by economic forces'. He could have added 'civilisations, urbanisation, species introductions'. Leopold opined that wilding was 'good taste but poor insight' since wildlife's future lay not in curbing human occupancy but in understanding its influence and creating a new ethic for its governance.

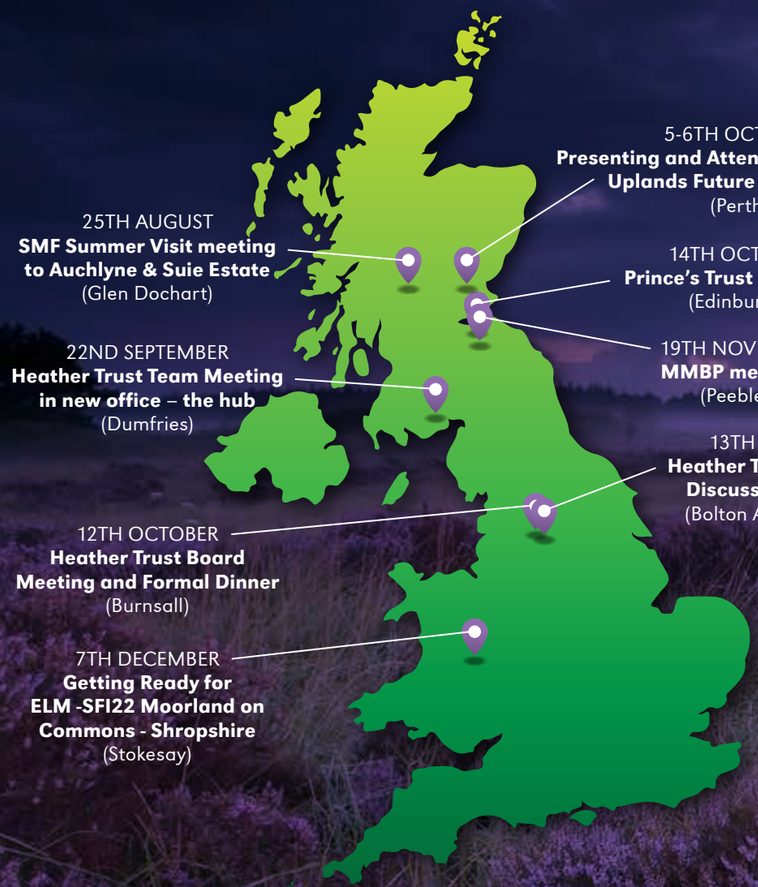
In 1990 High Moor, a mere 400 Cheshire acres , was an island of Molinia grass. After trespass sheep grazing, the nearest heather plant was in Macclesfield Garden Centre. Left to re-wild it was barren, apart from alien conifers colonising from adjacent forestry. After a wild, but ultimately successful, attempt to regenerate heather, John Phillips remarked 'Your problem will be managing heather, not growing it'. Prescient words because the rampantly growing heather became a monoculture, beautifully purple, but long, dark, dank, inedible, little more biodiverse than the Molinia grass it replaced.

20 pairs of Red Grouse were released in 2002, with self-sustaining numbers rising this year to 30 pairs. High Moor has also become Cheshire's hotspot for breeding curlew and lapwing. Based on the 'governing ethic' that heather over 6 inches high isn't eaten by grouse, nor by sheep, is too high for chicks, waders don't nest in it and is a fire risk, it's removed on a 6 year cycle over 80% of the moor. Cutting or burning, whichever is easiest, doesn't really matter.

It concerns me that those who seek to influence and advise moor owners on conservation matters have become too deskbound and too hands off. The real skill, envisaged by Leopold, is to be a living, working part of a biodiversity equilibrium and thus ensure its long-term sustainability, which may require, Leopold again, using, 'the tractor, chain-saw, rifle or flame-thrower'. Grouse moor managers have known this for decades and that is why their moors have been given SPA and SSSI status.

SMF = Scotland's Moorland Forum
WfW = Working for Waders

CALENDAR OF ACTIVITIES



25TH AUGUST
SMF Summer Visit meeting to Auchlyne & Suie Estate
(Glen Dochart)

22ND SEPTEMBER
Heather Trust Team Meeting in new office – the hub
(Dumfries)

12TH OCTOBER
Heather Trust Board Meeting and Formal Dinner
(Burnsall)

7TH DECEMBER
Getting Ready for ELM -SFI22 Moorland on Commons - Shropshire
(Stokesay)

5-6TH OCTOBER
Presenting and Attending Challenging Uplands Future Conference
(Perth)

14TH OCTOBER
Prince's Trust Reception
(Edinburgh)

19TH NOVEMBER
MMBP meetings
(Peebles)

13TH OCTOBER
Heather Trust AGM and Discussion meeting
(Bolton Abbey Estate)

ZOOM MEETINGS AND DISCUSSIONS

WfW Small Grant Fund Meeting
5th Jan

WfW Communications Meeting
27th Jan

Scottish Wildfire Forum Meeting
4th Feb

SMF Chairman's Working Group Meeting
10th Feb

Heather Trust Natural Capital Event
17th Feb

Holistic Moorland Management Meeting
24th February

WfW Facilitation Group Meeting
22nd Feb

WfW Communications Group Meeting
1st March

Moorland Management Best Practice Group Meeting
8th March

Heather Trust Natural Capital Event
10th March

Heather Trust Board Meeting
17th March

Uplands Stakeholder Forum Meeting
23rd March

Uplands Alliance Steering Group Meeting
30th March

WfW 2021/22 Budget Meeting
31st March

Defra-ELM Testing and Trials Landscape Recovery Call Information Session
1st April

SMF = Scotland's Moorland Forum
WfW = Working for Waders

Scottish Forum on Natural Capital Land Management Group Meeting
20th April

Heather & Grass Burning Regulations 2021 General Discussion
21st April

WfW Communications Group Meeting
21st April

Peatlands ES UK Project Advisory Group Meeting
22nd April

Muirburn Code Working Group Meeting
23rd April

Uplands Management Group Meeting
27th April

England and Wales Wildfire Forum Meeting
4th May

Peatland ACTION Board Meeting
5th May

Scottish Wildfire Forum Meeting
12th May

Heather Trust Board Meeting
13th May

WfW Facilitation Group Meeting
31st May

Uplands Stakeholder Forum Meeting
22nd June

WfW Communications Group Meeting
1st July

Heather Trust Board Meeting
5th August

Peatland ACTION Board Meeting
10th August

Scottish Wildfire Forum Meeting
18th August

Royal Geographical Society Event
7th September

Muirburn Code Working Group Meeting
8th September

WfW Small Grants Fund Assessment Meeting
10th September

Uplands Stakeholder Forum Meeting
14th September

WfW Small Grants Fund Meeting
15th September

SMF Full Forum Meeting
16th September

Uplands Alliance Steering Group Meeting
21st September

Green Finance for Landowners Workshop
30th September

Bracken Control Webinar – Review of the Future of Chemical Control
1st October

Uplands Alliance Steering Group Meeting
18th October

Sustainable Land Management Group Meeting
21st October

Centre for Carbon Innovation, University of Edinburgh Research Meeting
21st October

HSE Drone Stakeholder Group attended by Bracken Control Group Coordinator
25th October

Annual Bracken Control Group Meeting of Sector Representatives to approve draft of Asulam Emergency Authorisation Application
26th October

Scottish Parliament Cross Party Group on Uplands Management
28th October

Moorland Management Best Practice Group Meeting
28th October

Loch Lomond and the Trossachs National Park Authority Future Nature Route Map Meeting
1st November

Heather Trust Board Meeting
2nd November

England & Wales Wildfire Forum Management Meeting
4th November

SMF Discussion Format Group Meeting
5th November

Wildfire Webinar – Hosted by Northern Ireland Environment Agency
10th November

COP26 Engaging Stakeholders in Restoration Presentation and Chairing Peatland Rights and Cultures Sessions, Glasgow
12th November

England and Wales Wildfire Forum Meeting
16th November

WfW Nest Camera Meeting
17th November

WfW Facilitation Group Meeting
22nd November

Heather Trust Board Meeting
23rd November

University of Derby Public Engagement Research Project Group Meeting
23rd November

Uplands Management Group Meeting
23rd November

SMF Full Forum Rewilding Discussion Meeting
24th November

Review Workshop on Scottish Fire Danger Rating System lead by James Hutton Institute
9th December

Review Workshop on Indirect Drivers of Biodiversity Loss in Scotland lead by James Hutton Institute
9th December

Uplands Stakeholder Forum Meeting
14th December

SMF Discussion Format Group Meeting
17th December

Hugh Raven

Chairman, Scotland's Moorland Forum

Ecological restoration, building natural capital, habitat creation, rewilding: call it what you will, the story in this year of the biodiversity convention is recognition that restoring species and habitats, alongside working for an equable climate, is indispensable to planetary health. Scotland's moorland has a huge role to play.

Following the Scottish general election in the spring, for moorland managers there is plenty of action to come. Regulating muirburn, controls on gamebird medication, licensing grouse-moor management, tighter controls on hunting foxes, legislation on culling of deer – on these and many other areas we'll be busy with the Scottish Government putting across the priorities of our members. This is going to be a parliament that really highlights the importance of moorland. Moorland Forum has never been more important.

Ian Coghill

Chairman of the Co-ordinated Uplands Partnership

It is my personal opinion that the ultimate survival of heather moorland cannot be taken for granted. It exists in its current state, and to its current extent, largely because grouse shooting has prevented its conversion to forestry or farm land, and because the application of traditional landscape management techniques associated with grouse shooting have prevented encroachment by scrub, bracken, sedges or trees and have guarded it against catastrophic wildfire events.

The conservation industry appears determined to make grouse shooting impracticable, an aim, in my view, not unassociated with the financial feeding frenzy around the dubious prospectus of carbon capture via abandoning all forms of management or by simply planting trees.

If heather moorland is to survive, those who own these precious landscapes must take the initiative. They must combine their estates into landscape-scale bodies and demonstrate to government that they are the only people who can deliver at scale the nation's ambitions, and that they can only do so if they are allowed to manage in a way that facilitates their own legitimate ambition to ensure the survival of the habitat and its wildlife, using the tools which created these wonderful places in the first place.

WHERE IS MOORLAND MANAGEMENT GOING?

Christina Williams

Molland Estate

My hopes for the future of Moorland Management are that we can improve the nature and the carbon storage with urgency and rapid success, whilst still being proud of what we have at the moment. I am also acutely aware that what inspires everyone is the moorland landscape and our emotional response to a sense of openness and wildness, so rare in England.

My fear is that the future of Moorland Management is one of argument, controversy and bad science aired in the media and in sound bites. My experience is that managing nature is very complex, very site specific and the risk of bad, unintended consequences quite high. I naively think that, after a long time observing and experimenting, I could draw up a management plan for Molland Moor that would work to increase biodiversity and protect the soil. I feel supported by my Natural England officer and the officers at Exmoor National Park, who trust me.

However, much of fashionable talk of the moment: anti-grazing, anti- swaling, anti -farmer, anti- field sports, pro the extreme end of re-wilding and land abandonment by those who have little practical experience and no knowledge of specific sites is counterproductive to making correct decisions. Sound bites like "sheep wrecked" and "wildlife desert" are bandied about. This generalised and polarised debate gets in the way of good science and understanding of historical practice and local knowledge.

We know what we need to do, the how is mired in controversy, which will do nothing for Nature.

Professor David Hill

The Environment Bank Ltd

The way we manage land is changing. The climate and biodiversity emergencies have to be tackled very quickly if we are to have any hope of averting their most significant impacts on us. How we manage moorland in the future will be critical. For so long, land management has either been to maximise production (almost at any cost) or to see the environment as a charity case. For the first time we are realising that we have to make nature economically visible - over the past 250 years we have sacrificed our natural capital in order to generate short-term economic capital. We therefore do not have a choice but to restore biodiversity - and moorland management has a special role to play.

I am advocating that we mainstream the value of nature into corporate accounts so that, through disclosure of impacts on natural capital, there will be a reduction in its consumption and over-use by corporate business. Those corporates who disclose, reduce and then offset their residual impacts, by investing into land-based management interventions that restore nature, will be those that secure their own investment into their companies. Laggards who fail to do so will collapse. This will generate a new income stream for the ecosystem services that moorland and uplands provide including: biodiversity, water quality and quantity management, flood risk mitigation, carbon storage and even landscape for quiet recreation, woodland, river and stream restoration.

Bracken Control Update

Simon Thorp coordinates the activity of the Bracken Control Group (BCG) and this includes liaising with the authorities to obtain an Emergency Authorisation to allow Asulam, the main chemical control agent, to be available to control bracken.

In the past 12 months, the Bracken Control Group (BCG) has continued to coordinate the views of all those with an interest in the control of bracken throughout the UK. It is a broad church, both in terms of the range of different sectors represented by the Group, but also in the geographical spread.

It is important that bracken control is seen as not just a one-trick pony. There are many ways of controlling the plant. Techniques used range from the humble to the high tech; from hand-pulling of individual plants, to the use of helicopters that can spray hillsides quickly. Different techniques are appropriate for different locations with different levels of resource and capabilities.

To provide an indication of how the area of bracken control carried out in recent years has changed, Figure 1 shows the area of sprayed by helicopter by UK region in the period 2011-2020. These data come from the official Pesticide Usage Survey report provided for Defra by Fera.

At the end of October, the Group submitted the application for the 11th successive annual Emergency Authorisation (EA), which, if successful, will permit the continued availability of Asulam for bracken control in 2022. It is hoped that this application will be considered at the meeting of the Expert Committee on Pesticides that will be held on 25th January 2022, and that a response to the application with be issued soon after.

For pesticide control, a big change in the last year has been the shift from EU to UK regulations. As all the EU legislation has been adopted by the UK, there have been no overnight changes, but we are beginning to see a shift in emphasis.

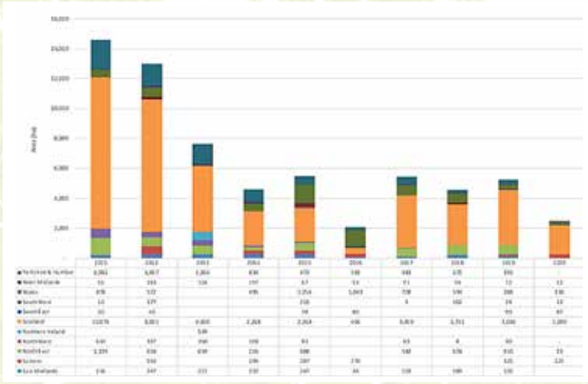


Figure 1. Area of Bracken Controlled by Aerial Spray

The Group will be testing this with the details included in the latest EA application. The sections below highlight the key issues that have been included in this application. For more detail see Annex D of the application, available on the BCG's website[1].

AERIAL SPRAYING BUFFER ZONE

- In the EA approval for the 2020 season, the width of the buffer zone against surface water bodies was increased from 50m to 90m. This restricted the ability of the helicopter contractors to control bracken, especially on wetter hillsides on the west side of the country, and reduced the willingness of land managers to continue or start bracken control programmes.
- The BCG has supported a series of drift trials to provide evidence about the required width of a buffer zone. This will allow spraying to take place safely.
- The evidence has been submitted to the authorities and the result of their assessment is awaited. A significant reduction in the width of the buffer zone is hoped for.

LIVESTOCK EXCLUSION

- A requirement to exclude livestock from the treated area has been in place for many years to minimise the risk of Asulam entering the human food chain.
- Recently, greater emphasis has been placed on this requirement, and it has been highlighted that this requirement is very difficult to achieve, especially on areas where grazing is shared, such as on large upland commons in England and Wales, or common grazings in Scotland.
- To challenge this restriction by providing evidence of the residues in livestock that have grazed on treated areas would be expensive and take a long time. This approach is not viable while there is uncertainty around the use of pesticides.
- A management solution is proposed. The BCG proposes to establish a risk assessment process that will review the options available on each bracken area to be treated with a pesticide. The aim will be to establish a management regime that will provide an adequate level of risk reduction.
- This may involve some extra form filling, but if this is the case, it will be suggested that this is a reasonable price to pay for the continued availability of pesticide.

GROUND-BASED APPLICATION – REMOVAL OF RESTRICTIONS

- Recent approvals for the use of Asulam have only allowed its use on Sites (Areas in NI) of Special Scientific Interest or as part of agri-environment schemes where agreements include a requirement to carry out bracken control using Asulam.
- Ground-based application is important to provide a targeted method to provide follow-up control after primary pesticide treatment. This technique is also important to carry out bracken control in small-scale areas, and areas in forestry, which cannot be controlled by other means.

[1] www.brackencontrol.co.uk/asulam

BRACKEN CONTROL

EMERGENCY AUTHORISATION APPROVAL – A MORE STRATEGIC APPROACH

- The assessment of an Emergency Authorisation application involves a large amount of work, both for the authorities and for the BCG to prepare the application.
- The fact that this is the 11th application serves to indicate that this is not an unforeseen problem, and this latest application has included a suggestion that a longer-term approval be granted.
- UPL Europe Ltd are the authorisation holders for Asulam and the company is preparing the application for full regulatory approval. As is the way with such things, this is not a quick process, and it is likely that the data dossier will not be ready for submission for somewhere between two and five years.
- This makes an annual approval look like a bit of a waste of time and effort. Preparation of the next application starts soon after the previous approval is granted.
- It has been suggested that an annual approval is granted within a longer-term framework. This will allow a check to be carried out each year that none of the assumptions made in granting a longer-term framework has changed and an annual confirmatory application will also provide an opportunity to present additional information formally.
- This appears to be common sense, at least to the drafter of the annual submission, but it remains to be seen if this will attract support from the authorities. There is a chance that this may provide an opportunity for the authorities to demonstrate that common sense can be applied more readily under UK regulations than under EU regulations.

INTEGRATED PEST MANAGEMENT

- To counter a concern that a call to a helicopter or spray contractor is the first port of call when bracken control options are being considered, it is proposed to establish a decision-tree process to guide land managers in their choice of control technique.
- This may be something that develops into a formal process with a paper trail, as a means to be able to demonstrate that all alternative control techniques have been considered, before a decision is made to apply pesticides.
- This concept may be criticised as more bureaucracy, but it may be justified as an appropriate step to justify the use of pesticides.

ALTERNATIVE PESTICIDES

As a way of giving land managers more choice about how to control bracken, the availability of alternative pesticides to Asulam would be welcome. However, Asulam has the twin benefits of a high degree of selectivity to control bracken plants and an approval for aerial application. Aerial application is often the only viable technique in remote areas or where ground conditions prevent vehicle access.

Amidosulfuron products have approval for application on grassland, which in this context includes bracken. Recent bracken control research has highlighted some concerns about adverse effects associated with the use of amidosulfuron products. The results of the investigation of these products is reported more fully in the EA application. Until further research has clarified the situation, the BCG believes it would be irresponsible to recommend the widespread use of these products. This position is being supported by all the UK conservation agencies.

OTHER ACTIVITY

The above key issues present a busy work programme for the Bracken Control Group but other activity is also taking place.

- There is a busy research programme in progress. Highlights are set out in Annex C of the EA application and some reports are available from the Research page of the website . The research will provide an evidence base that will assist with the development of policy for bracken control and the consideration of the application for the full regulatory approval of Asulam.
- Until the end of 2012, there was a range of hand-held equipment in common use for follow-up treatment and for control of small areas of bracken. As part of the review of the use of Asulam in response to the first EA application, the regulators established that these chemical control techniques were not adequately covered by pesticide safety data. As a result, these techniques have not been authorised in the EA approvals. Further work is proposed to provide the necessary information to allow techniques that use hand-held equipment to be reinstated.
- Drones have the capability for use in bracken control both to provide accurate survey information of the location and extent of bracken beds, and also to carry out pesticide control. The Health & Safety Executive has established a Drone Stakeholder Group recently and the BCG is contributing to this.
- A challenge for the BCG is obtaining accurate data. A fundamental problem is to know the area of bracken cover in the UK. If the area is known, an estimate can be made of how this will change with time if left to its devices. Also, if the total area of bracken controlled each year can be estimated, it would be possible to estimate the net change in the area of bracken each year. The BCG is seeking to improve the quality of information collected each year. Inevitably, this will involve more form filling, but the data collected will support the arguments put forward to continue bracken control.

The BCG continues to bring together people who share an interest in controlling bracken, using any technique. The Group will continue to seek to encourage new approaches to control, based on the best available evidence.
For more details about the activities of the BCG, see the website: **www.brackencontrol.co.uk**

Wildfire

Simon Thorp has been chairman of the England & Wales Wildfire Forum (EWWF), since 2016. He provides his view of current wildfire issues in the UK.

Wildfire is one the world's most visually dramatic, fascinating natural disasters (others being perhaps floods and storms) and therefore press coverage is guaranteed to attract attention. Fortunately, the focus in the last 12 months has been on other parts of the world, but this should not breed complacency. While there have been no large-scale, headline grabbing incidents in the UK, there has been a steady flow of less severe wildfire incidents.

WILDFIRE IN THE UK

Every year, the timing and location of wildfire incidents changes; this demonstrates how any attempt to predict when and where future wildfire incidents will occur is doomed to failure. Figure 1 shows how the area of wildfire incidents and the number of fires in the UK varied in the period 2010-19.

Figures 1: Yearly Burned Area & Number of Fires 2010-2019 (Global Wildfire Information System)

The one fact that everyone agrees on is that the wildfire threat is increasing. We can expect to see more and larger wildfire incidents in the future. We may not reach the scale being experienced in other parts of the world, but the UK's relatively high population density means that even small fires can have a large impact. The COP26 conference took place in November 2021, and the climate change story provides a further incentive, if one were needed, to raise our game and work towards reducing the impact of wildfire, including the associated carbon emissions.

There is great scope to improve the planning and preparation for wildfire that must take place before the smoke starts to rise. This requires land managers to think about wildfire and to develop Wildfire Management Plans, to mitigate the threats identified in a Wildfire Risk Assessment, and, in case all else fails, to draw up a Wildfire Response Plan in conjunction with the local fire and rescue service. The Heather Trust has a role to play here by using its networks to promote this approach with a view to mitigating the effects of wildfire. The guidance documents and templates that are available from the Uplands Management Group's website[1] were developed with input from the England & Wales Wildfire Forum (EWWF).

WILDFIRE FRAMEWORK

In England, the Home Office is the lead government department for wildfire, with support from Defra and the Cabinet Office. The Home Office has responsibility for the 45 fire and rescue services in England; Defra has responsibility for the wildfire fuel, through its links to: agriculture, Natural England (conservation) and Forestry England (woodland); and the Cabinet Office's interest is in resilience planning for communities. Since September 2021, the reformed Department of Levelling Up, Housing and Communities also has some interest in wildfire through its work with communities. This is a loose structure and the EWWF has struggled to identify an outlet at government level. Recently, there has been discussion about the government's role in wildfire and the EWWF has helped to draft a Wildfire Framework. This is a first attempt to develop a coordinated approach by government departments to wildfire and it is very welcome. The Framework is in near final form and, when it is published by the Home Office, a link will be placed on the EWWF's website[2].

WILDFIRE CONFERENCE

The biennial wildfire conferences are developed with the support of the EWWF and the Scottish Wildfire Forum. Following a very successful conference in Cardiff, in November 2019, the next conference was due to be held in November 2021. The Northern Ireland Environment Agency had volunteered to host the conference in Belfast, and a theme of 'The Human Dimension' had been agreed. Due to the travel uncertainties associated with COVID, the conference has been postponed until 9th-10th November 2022. To register interest in attending the conference, send contact details to wildfire21@belfasthills.org. These conferences are an opportunity to share views and knowledge within the UK, but they also allow knowledge exchange to take place with more experienced international delegates.

WILDFIRE AWARENESS TRAINING

The fire and rescue services have expressed concerns about using land managers at wildfire incidents. The Incident Commander is responsible for all safety and needs to know that everyone at the incident knows how to work safely. To address this, with the support of the Moorland Association, the EWWF commissioned the development of an online training module: 'Wildfire Awareness Training for Land Managers'. This is available to everyone from the EWWF's website. There is an externally monitored assessment module that is completed after the training, and a certificate can be provided to anyone who passes the assessment. This training has proved to be popular and effective.

WILDFIRE AND PRESCRIBED BURNING TRAINING

New regulations came into force in February 2021 that require anyone wishing to carry out prescribed burning on deep peat to apply for a licence from Defra. There is more detail about this in the Uplands Management Group article.

Defra wished to provide training modules for anyone who did not have enough experience of prescribed burning to meet the requirements of a burning licence. Defra contracted Forestry England to develop some training and this expanded to cover four training modules: vegetation fire foundation, wildfire management plan, vegetation fire operator, and vegetation fire manager. Some of the modules include a practical training and assessment day.

The modules have been road-tested with representatives of the Moorland Association, the National Gamekeepers Organisation and Natural England and they have been well received. It is recognised that the training provides a way to obtain a recognised burning qualification that will allow land managers to demonstrate that any prescribed burning is planned and carried out in accordance with best practice.

Each module has a separate assessment module and the intention is that these will be accredited by Lantra so that successful completion will be recognised formally. It is not yet known when the training modules will be fully available. Defra is proposing to establish a steering group of some form to provide some stakeholder input to the final development and roll-out of this training.

The development of this training represents an important step forward and a way for land managers to develop professional standards for prescribed burning. While the training will introduce additional bureaucracy, it may prove to be a price worth paying to maintain access to prescribed burning. The proposal to establish a steering group provides an opportunity for stakeholders to exercise considerable control over the way that training for prescribed burning develops. This approach deserves support. The alternative of regulatory control is not a happy prospect.

1 https://www.uplandsmanagement.co.uk/wildfire

2 https://www.northumberland.gov.uk/Fire/Wildfire.aspx

FUTURE PROOFING WITH YOUR PHONE

Ross Macleod, Head of Policy, GWCT Scotland (rmacleod@gwct.org.uk), introduces their new 'Best Practice with Proof' concept.

Until the Covid-19 pandemic interrupted daily life so seriously, game bird management in all its different forms had enjoyed increasing popularity and expansion amongst participants. This growth has not been without problems, as evidenced by recent legal challenges, public debate around habitat impacts, persecution, and other concerns. Equally, when delivered well, we know that gamebird management can be a force for good, generating net biodiversity gain as well as social and economic benefits.

It has become so much more important that the benefits flowing from gamebird management are clear for everyone to see and understand. This also fits alongside more general requirements for land managers, who will increasingly need to show evidence of good practice. Future farm payments will be focused on environmental outcomes, driven by global concern regarding the emerging climate change and biodiversity crises, as well as growing interest in the concept of natural capital. In Scotland, the Werritty Grouse Moor Management Report and Scottish Government's commitment to develop a licensing system will most likely cover all existing elements of moorland management best practice. For estates and keepers, there are likely to be requirements to show presence of key species and sound management of habitats.

Such additional licensing and outcomes monitoring is likely to place a considerable administrative burden on existing resources at NatureScot and other agencies around the UK. At GWCT, we feel this provides an opportunity both for the licensing authorities and land managers to share a common objective around demonstrating net biodiversity gain. It led us to develop the 'Best Practice with Proof' concept. This approach advances guidance using our research knowledge, delivers it using our advisory path and backs it by providing data gathering and interpretation tools.

The recording package we have developed builds on existing training, advice, and reporting. It is aimed at helping estates fulfil due diligence and evidence requirements which may be necessary for licence applications, accreditation, or other general confirmation. Recording is enabled using the 'Epicollect5' app, which offers a flexible and easy-to-use mobile data-gathering option.

GWCT first started using Epicollect to record predator control information at its Scottish Demonstration Farm and this year developed projects for estate keepering and management teams according to their needs. These packages build location, date and time stamps as well as adding pictures, video, and sound clips for further evidence of best practice into records. The current range of projects cover:

- Predator control recording, making it easier for land managers to show legal compliance
- Recording prescribed burning ignition points, linking in with muirburn risk mapping and planning
- Tracking grouse pair/brood counts, grit stations and sheep management
- Wader, raptor, and mountain hare records to assess conservation status
- Deer management recording for a variety of best practice evidence requirements

We now provide reports summarising the data from estate records to help clients gain the most out of their information for efficient, targeted management. These reports also include an objective assessment of due diligence and conservation management.

We envisage the scope to bring biodiversity assessments and management recording together with carbon audits to help place moorland managers in the vanguard of responses to climate and environmental concerns. Assisting the focus on outcomes, we firmly believe that evidence-building through mobile recording offers a positive way forward.

Photography: Graeme Hart / Perthshire Picture Agency

AN UPDATE ON SCOTLAND'S MOORLAND FORUM

by Anne Gray

The Heather Trust runs Scotland's Moorland Forum with funding from NatureScot. The Forum brings together 27 diverse member organisations with an interest in Scotland's moorlands within the wider context of the Scottish Uplands – details can be found at www.moorlandforum.org.uk. Despite the limitations that the Covid situation continued to bring, the Forum maintained a healthy workload during 2021, as well as putting in place new approaches that mean it can continue to be relevant and valued through 2022 and beyond. Below is a snapshot of our work...

Let's talk about...

Regeneration of the Caledonian Pine Wood at Mar Lodge Estate in the Cairngorms featured in our first Discussion Meeting on Moorland and Rewilding.

The Forum ends 2021 with a new beginning, in the shape of a new series of 'leave your baggage at the door' discussions and debates. In line with our objective of bringing a wide and growing spectrum of interests in moorland in Scotland together to air concerns, share thoughts and work towards moving the agenda forward, we are running a series of topic-based discussions both as part of our regular schedule of members' meetings and as online public events.

Each year we will explore two topics that have relevance to the future of moorlands. After those discussions, a paper will be developed, which provides an objective synthesis of the opinions gathered. The discussions, and the resulting papers, will be relevant to Scottish ministers, policymakers and stakeholders, and all with an interest in Scotland's moorlands and upland areas.

The process for each topic will be:

- Development of an Introductory Paper to each topic. Produced by the Director with input from other Forum members and appropriate specialists, these papers will ensure an appropriate level of understanding about the topic to be debated and provide stimulus for the discussions themselves.
- Discussion at the Forum. The format for Forum member discussions will be to hear from two or three speakers and then open up to wider discussion. An open, honest, 'leave your baggage at the door' approach is encouraged, and respectful debate is required. There will be no direct attribution in the outputs from these meetings.
- Public online debate. The format will be that of the Chairman (Hugh Raven) in conversation with one or two speakers for c. 30 mins, followed by questions (via the chat facility) from the audience to be put to the speakers. The whole thing will last an hour.
- Both debates will inform a final Think Piece/Open-ended Discussion paper to be issued by the Forum (after approval at a subsequent Forum meeting). This will be sent to relevant Scottish Government ministers, parliamentarians and civil servants, and be available through the Forum's website for any interests that may wish to refer to it.

Our first topic - discussed at our meeting on 24 November - was Rewilding where we looked at issues such as whether moorland can ever be seen as compatible with rewilding ambitions. For example, could moorland be wilder and still produce grouse shooting and farmed livestock, or conceptually is the idea of arresting 'succession' unacceptable to the rewilding community? Could we have rewilding sitting alongside modified landscapes or do they compromise each other? We also talked about how people fit into a rewilded landscape and explored questions about the diminution of the existing industries which are reliant on moorland such as grouse shooting and upland farming (and the supplier businesses that feed into these activities), in favour of newer industries that will come from a rewilded landscape. Issues of wildfire management and changes in species composition (with a particular focus on changes likely to occur to wader populations) were also covered.

Our first public online debate will take place on the evening of 9th February - look out for booking details on the Heather Trust and Moorland Forum websites and social media pages. Summary papers will also be available in due course from Scotland's Moorland Forum website – **www.moorlandforum.org.uk**

Muirburn Code Working Group

The Forum runs the Muirburn Code Working Group. The Group is charged with communicating the Muirburn Code and its messages; exploring opportunities for Muirburn training and best practice; identifying aspects of the supplementary guidance for practitioners that needs to be developed; and making recommendations to Scottish Government on approaches to licensing and compliance monitoring.

This is a very practitioner-based group, with representatives of three sporting estates, the crofting community, a moorland partnership as well as from representative bodies such as Scottish Land & Estates, the Scottish Association of Country Sports and the Scottish Gamekeepers Association, and The Heather Trust, GWCT, NatureScot and Forestry and Land Scotland. The Group is currently exploring some of the practical aspects of a licensing system for muirburn, while a closely aligned subgroup of the Scottish Wildfire Forum is taking forward development of a Lantra-accredited muirburn training module within the National Occupational Standards framework.

Best Practice Moorland Management and Muirburn

As many will know, in response to the Grouse Moor Management Review report (the Werritty report), the Scottish Government is going to introduce licenses for grouse moor management and for muirburn for all management purposes at some point in the current parliamentary term. This is an educated guess, but we might expect to see a draft bill during 2022. There are many aspects to developing the licensing schemes themselves - and the processes and structures that will support them - that Scotland's Moorland Forum can and will contribute to. For example, demonstrating that practitioners are delivering to Best Practice standards will remain central.

That is why the Forum has undertaken an evaluation of existing Moorland Management Best Practice guidance with a range of moorland managers across Scotland. Using a Focus Group approach, the Trust has run the evaluation exercise on behalf of the Forum during December 2021 and will feed back to the Forum in early 2022. We are grateful to the many regional moorland group members, as well as other gamekeepers, moorland farmers and conservation interests for contributing.

This evaluation is part of a larger piece of work that the Moorland Management Best Practice Steering Group is doing to develop a strategic and structured approach for the project. The project started in 2016 with a small, but nevertheless useful budget provided by NatureScot that has helped us develop the guidance we have today - much of which addresses the topics examined in the Werritty report. However, it is recognised that to move forward at pace a long-term strategy and a clear structure need to be set out and resourced. This will ensure effort put in, to date and to come, is properly valued as new legislation and greater regulation come into play.

Moorland Management Best Practice – New Guidance Launched

During 2021 the Forum's guidance on Tick Control was published (**www.moorlandmanagement.org**)

This guidance has been prepared to identify the methods available to moorland managers for reducing the number of ticks (*Ixodes ricinus*) and the associated threat to the economic, environmental and public health status of moorland. Managers of sheep may find this guidance particularly useful so that they can carry out tick control in a safe, responsible and sustainable manner. There is also relevant information for those who manage cattle.

A considerable amount of work also went into developing guidance for the Management and Maintenance of Peatlands beyond initial restoration works. This guidance is in its final stages and will be published during 2022.

Members and guests of Scotland's Moorland Forum enjoy the summer visit to Auchlyne Estate in Glen Dochart

Auchlyne in August

After 18 months of various versions of lockdown and online meetings, Scotland's Moorland Forum members finally enjoyed the freedom of a site visit in late August this year, and we couldn't have picked a better one. We visited Auchlyne Estate in Glen Dochart on a day when temperature got into the high 20°Cs, to hear about the opportunities and challenges of running an upland estate in Highland Scotland.

Discussions included the vital role the Dochart floodplain plays in preventing downstream flooding and a collaborative wader scheme there, as well as the advent of beaver on the river. We also saw and discussed a major peatland restoration scheme on the high ground to the west of the Estate and visited the new deer farming venture that the owner's daughter and our host for the day, Nicola Colquhoun, and her family are developing. Deer management and the operation of the local deer management group was also discussed as was other collaborative management work.

Uplands Management Group

Simon Thorp has been chairman of the Uplands Management Group since its formation in 2015. He reports on latest developments and the interaction with Defra's Uplands Stakeholder Forum.

During the last year, The Uplands Management Group (UMG) has promoted its role as a source of practitioner knowledge and experience in England. The review of the links with Defra's Uplands Stakeholder Forum (USF), mentioned in the article in last year's Annual Review, has taken place, but it is not yet clear if this will lead to a recognition of the Group's full value. The future of the Group remains uncertain.

The UMG was established in 2015, as a successor to the Best Practice Burning Group. Natural England provides the secretariat, but otherwise the Group is independent. It receives no funding and relies on the voluntary support of its members. It is important that the output from the Group is seen to be valued; if it has no impact, members will not be able to justify their involvement. This will bring into question the value of maintaining the Group in its current form.

The Group aims to develop practitioner guidance and reports that reflect a practitioner viewpoint covering a wide range of upland issues, and in the current times of great change, this concept is more relevant than ever. The Group also offers government and its agencies a link to upland practitioners who can 'upland-proof' new policy and regulations with a view to avoiding unintended consequences.

The Group welcomed the approach by Defra about further developments to the Wildfire Risk Assessment guidance. This had been published in 2019 in response to a request from Defra. In February 2021, regulations[1] were published that introduced a requirement for anyone wishing to carry out prescribed burning on deep peat (defined as being over 40cm deep) that is within a designated site to apply for a licence. The regulations include four situations where a licence may be granted, one of which is to reduce the risk of wildfire. In this instance, Defra wants applicants to submit a Wildfire Management Plan (WMP) as part of the application, and an additional version of a WMP was drafted for this purpose[2]. The opportunity was taken to update some of the other wildfire-related documents and everything has been published on the UMG's website[3].

It was convenient for Defra to use the UMG, as the work was carried out quickly and without cost to Defra. This is an example of how the UMG can provide practical assistance to Defra, and more of this sort of exchange will be welcomed.

As in other parts of the UK, massive change is in progress in England to introduce new arrangements for agricultural support including Environmental Land Management. The UMG has offered the knowledge and experience of its members to help with the future developments. As has been demonstrated with the revision of the wildfire guidance, the UMG is uniquely placed to provide cross-sector practitioner input to developments of this nature.

The Heather Trust has its own cross-sector links to organisations in the uplands and, as a result, also has a role to play in providing an independent input into discussions about the future, either on its own behalf, or through the UMG and USF.

1 The Heather and Grass etc. Burning (England) Regulations 2021

2 These regulations have also led to the development of training modules covering wildfire and prescribed burning. See the wildfire article for more detail.

3 https://www.uplandsmanagement.co.uk/wildfire

Working for Waders

Patrick Laurie, Communications Coordinator with the Working for Waders Initiative, provides us with an update on the project's progress in 2021.

The Working for Waders Initiative continued to gather momentum throughout 2021, collaborating with a variety of partners across Scotland to halt the decline of important wading birds like lapwings and curlews. Several projects established in previous years developed and expanded during the spring, particularly the farm wader survey which was designed to capture information about nesting birds during the breeding season. Alongside this (and many other) recurring strands, two major pieces of work were launched to raise awareness of habitat loss and develop stories around the drivers of wader decline.

The first project involved the use of nest cameras. Thanks to a generous donation, the Working for Waders Initiative was able to buy two dozen trail cameras, which were then distributed to partners across Scotland, from Skye to Galloway. With support and guidance, farmers and gamekeepers were encouraged to operate cameras at wader nest sites in order to find out more about the breeding season at a very focussed level.

A mixture of photographs and videos came in from the last week in March to the first days of July, and it is hard to overstate how valuable the results were for a number of different outcomes. Badgers, foxes and stoats were identified as key nest predators, but there was also a significantly harmful contribution from agricultural work including field rolling and slurry spreading. The project did not uncover anything that was not previously known, but it made an important impact because it allowed participants to share their stories and understand the challenges on a field-by-field basis. Most of us know the reality of breeding failures, but seeing it happen in real life provided some valuable lessons for all participants.

Alongside detailed evidence of predation, the project also revealed several successful nesting attempts - although it is obviously much harder to follow the progress of chicks which move around and cannot be caught on camera.

Following the success of the Small Grants Fund in 2020 (administered by The Heather Trust), a second round of funding was launched during the summer, asking for applications for financial support for projects up to a value of £3,000. In response to the Fund, more than forty applications were received from farmers, gamekeepers and land managers across Scotland. Nobody expects small grants like these to singlehandedly reverse the worrying decline of waders in Scotland, but they can be an extremely useful tool to help us all learn more about practical conservation issues. Making wader scrapes or managing rushes to create better breeding habitats might make a big impact at the level of a single farm or field, but the real advantage is in working with a range of partners and understanding how small projects add value to bigger ones.

The move to a £3,000 threshold has allowed several applicants to make proposals to fund projects which include predator control. We all understand that predator control can be a really important part of wader conservation, and 2021's enlarged Small Grants Fund allows us to explore ways to fund this kind of work, which is often hard to measure or quantify in financial terms. We're looking forward to working with the successful applicants to find out more about how this kind of conservation can be funded.

The Working for Waders Initiative is already looking ahead to the 2022 breeding season. If you're working on wader conservation in Scotland, please find out more at **www.WorkingForWaders.com**

Peatland Management Values in the Yorkshire Dales

Kirsten Lees presents the results of the research project she outlined in last year's review. Kirsten is now an early career academic at the University of Derby.

People who live and work in upland peatland landscapes often have very different ideas about how these special places should be managed. There are big differences in viewpoints surrounding issues such as the future of driven grouse shooting, and the necessity of managed burning. Nevertheless, everyone who works in these beautiful landscapes cares deeply about them and wants to manage them well for both the present and the future. People who manage the moorlands in the Yorkshire Dales are proud of the work they are doing in these landscapes, and the beneficial effects for wildlife.

We used an innovative social science method to explore a range of different people's opinions and values around changing peatland management to prioritise water and carbon. This method, called Q-method, asks participants to sort and rank statements in response to a question. The project team, which includes representatives from the Heather Trust and Yorkshire Peat Partnership, as well as researchers Dr Rachel Carmenta and Olivia Brightling, developed and tested these statements to represent a wide range of different values and opinions. We ran this method with farmers, estate managers, gamekeepers, and representatives of land-owning organisations, and we also asked the participants to explain why they had rated certain statements highly, and others less so.

Some people felt that traditional moorland management for grouse is still the best way to manage peatland areas. These people said that traditional grouse moor management is, 'the only source of income underpinning safe management of blanket bog' (quote from estate manager) and that removing management 'would be disastrous…in terms of conservation aims' (estate manager). There were also concerns about the loss of income for people who work on these estates, and about the risk of increasing wildfire severity if managed burning is discontinued and fuel loads build up.

Another group of people were more in favour of change and were focused on the desired outcomes from management changes. In some cases, these desired outcomes were associated with an increase in vegetation and species diversity. For example, one participant from a land-owning organisation said, 'we're spending a huge amount of money on *Sphagnum* inoculation'. Sometimes the focus for the participant was carbon and/or water, as one person said, 'we see quite a lot of bare peat and degraded peat…you can see some of it washing away'. In other cases, being able to use the land as a source of income was one of the main concerns.

A third group of people were keen to take care of the land for its own sake rather than with any specific goal in mind. These people were frequently sceptical of top-down schemes, saying things like, '[there's been] huge amounts of public money spent on projects trying to tick as many boxes as possible, not looking into the future' (quote from gamekeeper). People in this group were open to change, saying 'I don't think we should be a working museum' (gamekeeper), whilst recognising that 'in a hundred years people might think differently' to us, the way that in the past digging grips was seen as a good thing to do and now we are filling them in (farmer).

Everyone agreed that the impacts on wild birdlife, and increases in crane flies for birds to eat, were important. There were lots of comments about how much people appreciate the bird life on the moors, saying that they like to see birds like the ring ouzels, hear the curlews etc., that they were 'brought up with' the birds, that seeing them is 'fantastic', and they would be sad if they disappeared.

We recently shared these results at the IUCN UK Peatland Programme conference and will further share what we have found with researchers, conservationists and policy-makers. It is our hope that a greater understanding of the similarities and differences in values between groups of people working in upland peatland landscapes will lead to management schemes that minimise conflict and benefit the landscapes and wildlife that are important to all of us.

SCIENCE OUTCOMES FROM 10 YEARS OF PEATLAND-ES-UK

Evidence on Heather Management

Dr Andreas Heinemeyer is an Associate Professor at the Stockholm Environment Institute (SEI) at the University of York (Department of Environment & Geography). He routinely measures and models how and how fast carbon cycles through terrestrial plant-soil systems, how much carbon is stored and how carbon and water cycles interact. Currently, he is preparing the final report of a 10-year research project on assessing upland peatland heather management impacts on ecosystem services we all rely on, such as carbon storage (climate change mitigation), water storage (providing drinking water) and biodiversity (plants, invertebrates and birds).

Blanket bogs cover much of the UK uplands in vast 'blankets' of peat of about 2m or more, which accumulated over thousands of years and there are now about 100kg of carbon under each step you take! However, all is not well as climate change could cause stored carbon to be decomposed and released back into the atmosphere, together with methane, a greenhouse gas with a much larger warming impact. Importantly, management also impacts bog condition, affecting its functions and resilience to climate change. Crucially, an intact bog provides several ecosystem services to our society, not only carbon storage, but also drinking water and recreation linked to biodiversity in addition to farming economy.

The Peatland-ES-UK project aims to assess key plant-soil processes underpinning ecosystem services and their sensitivity to climate and management. The study compares a previous rotational burn intervention to alternative mowing within paired catchments and additional uncut areas (see Fig. 1) across three sites in Northern England. We are now entering the final 10th year of two funding phases, and although we can report some overall findings we would need another 10 years to capture the complete vegetation regrowth impact. Hopefully we will manage to secure the necessary funding as this study has a unique potential to underpin an evidence and outcomes based approach. Our updated findings so far are summarised below.

Sites: ranging from (wet to dry) least "modified" with high water table and more *Sphagnum* moss cover (Mossdale), to "intermediate" (Whitendale) and more "modified" (Nidderdale) with lower water tables and less *Sphagnum* cover.

Peat surface: whilst mowing did not compact the peat it reduced the micro-topography (i.e. flatter due to cutting off some of the tussocks/hummocks), and burning led to a short-lived increase in bare ground of a few percent.

Water storage: mowing increased the water table depth (wetter) by about 2-3 cm and reduced stream flow rates by about 10-20% compared to burning. However, the water table effect disappeared after 3-5 years and the flow impact was only seen at 2/3 sites. Moreover, uncut (old heather) plots are now the driest.

Water quality: this was assessed for all managed plots in the peat surface (water extracted from the top 10 cm of peat) and in all the burnt and mown catchments' central stream outlets (at the flow weirs). Neither burning, cutting

Figure 1: The three managements: burning, cutting and uncut plots (protected by marker posts as they are located within the mown catchment). Note the heavy cutting machinery (mostly doing a double chop and leaving brash as a fine mulch). Monitoring was done on 5x5 m plots (which also included brash removal plots).

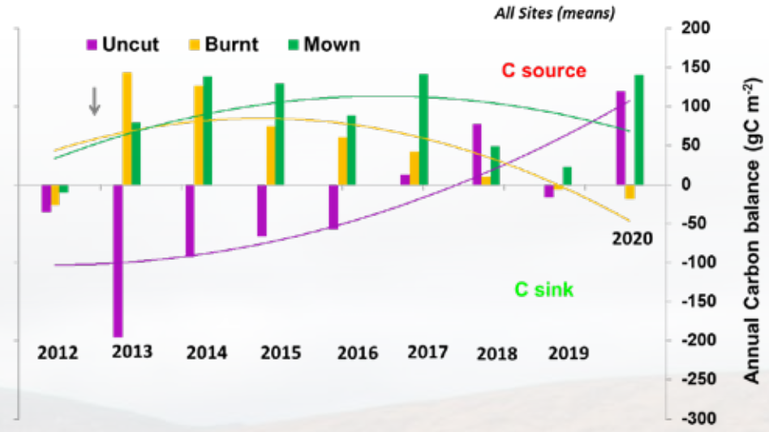


Figure 2: Average modelled annual carbon balance (right) during 2012-2020 for uncut, burnt and mown managements (arrow marks management onset in 2013) based on chamber carbon flux measurements (left). Note the initial higher balance (carbon loss) on burnt plots but subsequently higher losses on mown ones and the overall negative balance (carbon gain) for uncut plots, but becoming increasingly positive (carbon loss), likely due to a less efficient, aging heather (now about 35 years old).

or no management showed a clear effect on the extracted peat water colour (the darker the colour the more carbon it contains), which only related weakly to vegetation type. Over time, flow water increasingly showed higher dissolved organic carbon (DOC) and nutrient concentrations in the mown catchments.

Vegetation impacts: whereas mown areas showed quicker revegetation than burnt plots, especially by *Sphagnum* moss and sedges (cotton grass), 9 years after management the increase in the abundance of *Sphagnum* cover was similar (10%) but sedge cover was still higher on mown plots. Moreover, overall heather regrowth and cover was similar but both managements increased nutrition in heather compared to uncut areas, specifically nitrogen, magnesium, manganese and potassium (all of importance to bird and sheep health).

Carbon balance: based on flux chamber measurements (Fig. 2), over 10 years uncut areas stored on average 267 g of carbon [gC per m^2], whilst burning lost about 402 gC with an additional 447 gC from the initial biomass combustion (together 849 gC), mowing lost 772 gC. However, whereas emissions from mown areas continued to increase over time (long-term brash decomposition), emissions reduced on burnt areas (see Fig. 2) which also include 'locked away' charcoal carbon; in fact, burnt Nidderdale areas (the driest and most modified site) became a C sink after 8 years. Only measuring a further 10 years will reveal the full story.

Greenhouse gas emissions: overall soil methane emissions were highest on uncut, lowest on burnt plots and highest on the wettest site (Mossdale), peaking in warm and wet years and areas, with high sedge cover, which was highest on mown plots. Importantly, the overall net warming potential was slightly negative for uncut (climate cooling), very positive for mown areas but 25% less so on burnt plots.

Soil environment: soil surface temperatures changed only slightly on burnt areas, and did not affect deeper layers, mostly mowing affected maxima and minima in relation to the insulating brash layer.

Decomposition impacts: field measurements and peat incubation studies in the laboratory showed slightly lower peat decomposition after burning (a possible charcoal impact as well as less litter decomposition).

Biodiversity impacts: annual crane fly numbers and emergence, crucial for red grouse and other bird chicks, showed strongly negative summer drought impacts. However, whilst higher peat moisture increases cranefly numbers, too wet conditions decrease them. So wetter but not too wet might be best.

The phrase "a wetter bog is better" is good and clearly, as the environment is changing, we need to adapt management and common perceptions to ensure ecosystem resilience. Adapting to a changing environment requires open discussion around evidence, site context and local experience. Our study indicates that, overall, no one management approach is likely to be the best, and this does not even consider fire risk of no management. It is clearly not a simple story as many aspects are interconnected, mostly via soil processes – hidden from plain view; as any good GP, we need to understand how the entire system works in order to prescribe the best treatment. Our results are a vital contribution to the evidence base around an outcomes based management policy. Notwithstanding current policy changes on burning and financial uncertainties around the future of this project (ending in July 2022), we hope to be able to continue this project together with the Heather Trust and other interested stakeholders (ideally to include Defra) to ensure its future and deliver on its long-term aims set out by Defra and Natural England.

PURPLE PAGES

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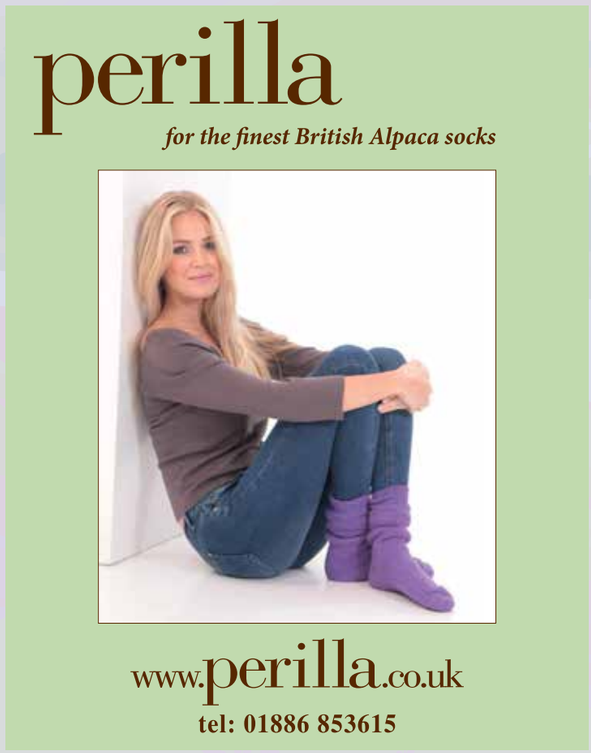

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The Heather Trust
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