

Abstracts and Speaker Biographies

Water from peatlands – an industry perspective

Andrew Walker, Yorkshire Water

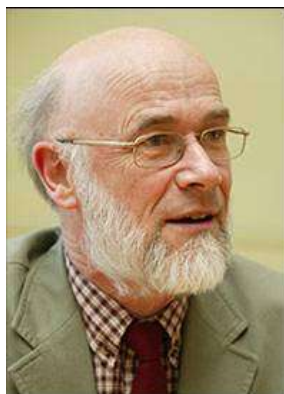
After graduating from Sunderland Polytechnic in 1988 with a BSc. in Environmental Studies, I did what any dedicated Environmentalist would do, and went to Austria to be a Ski Instructor. Various injuries later, I returned to the UK, and started work at Yorkshire Water in 1991. I have worked in many areas of the company, from monitoring reservoirs for movement to emergency planning. In 1998 I became Water Conservation Manager, and had a job convincing customers that water was a finite resource after the floods struck in 2000. I completed an MSc in Public Health Engineering at Leeds, but decided a PhD was a step too far when working full time.



For the last 7 years, I have managed various R&D initiatives, looking at what activities impact on water quality, most notably colour. I have also worked extensively on YWS land-holding to support our tenants' businesses, whilst minimising the impact of pesticides on water. I believe that the UK is too small for exclusive use of land for one purpose, and that a considered compromise which balances everybody's needs is the right thing to do. I'm now trying to convince Moorland Owners they might like to work with us to address colour in the longer term.

Living With Environmental Change: linking science, policy and practice

Andrew Watkinson, LWECC



Society faces a range of challenges from climate change through to biodiversity conservation. In making the transition to a low carbon economy and adapting to environmental change it is essential that we find a way to protect and enhance carbon stocks, while managing ecosystems and ecosystem services for the benefits of human well-being and protecting the natural environment. In this paper consideration will be given to how we can best link science, policy and practice to promote the evidence base for effective policy frameworks that will enable action to enhance the ecosystem services provided by peatlands.

Andrew Watkinson is Director of Living With Environmental Change and former Director of The Tyndall Centre for Climate Change Research. Andrew trained as an ecologist and has published widely from corals to geese and from China to the Caribbean. In his current position he is keen to promote innovative research that will address the environmental challenges that we currently face. Hence his support for the Peatland Programme.

IUCN review 6 - Peatlands and the Historic Environment Assessing the resource, Planning for the Future

Ben Gearey, University of Birmingham

The peatlands of the United Kingdom preserve a rich and varied archaeological resource. This paper will assess the current state of knowledge of the character and distribution of such historic environment assets in upland and lowland contexts, outline gaps in understanding and consider both the potential of, and challenges facing, future study. It will stress the importance of taking an holistic approach to peatland systems in terms of their value for palaeoenvironmental research, which can provide information regarding long term patterns of environmental change, such as climate change and the impact of human activity. It will discuss current and future threats to the resource and outline the need for continued dialogue and collaboration in the areas of management and policy to ensure the effective conservation of the historic environment resource of peatlands.



Ben Gearey is Research Fellow in the Institute of Archaeology, University of Birmingham. His current research interests include the environmental archaeology of wetlands with a particular focus on lowland mire systems.

The Peatlands and the Historic Environment Review Team is lead by Dr Ben Gearey, University of Birmingham, supported by Dr Norá Bermingham, University of Birmingham; Dr Dan Charman, University of Exeter; Dr Robert Van de Noort, University of Exeter; William Fletcher, English Heritage; Dr Ralph Fyfe, University of Plymouth; Dr Henry Chapman, University of Birmingham; Jamie Quartermaine, Oxford Archaeology North; Elizabeth Huckerby, Oxford Archaeology North.

Peatland restoration in the Pennines

Chris Dean, Paul Leadbitter, Tim Thom,

The Pennines contain most of England's upland peat, ranging from near pristine condition at Moor House, to heavily gripped peat in the North Pennines and Yorkshire Dales to significantly damaged and eroding peat in the Peak District. This range of peatland conditions and the techniques of restoration, monitoring and research represent a significant opportunity for peatland restoration practitioners to coordinate and cooperate over a large scale.

The Moors for the Future Partnership, the North Pennines AONB Partnership and the Yorkshire Peat Partnership cover the majority of the Pennine peatland areas. These three partnerships have significant peatland restoration programmes to tackle their different peatland restoration issues and needs. Over the past few years the Pennine Peat Network has been developed by these partnerships in the spirit of cooperation with the intent of sharing restoration methods, coordinating on research projects, increasing restoration contractor capacity and learning from each others successes and challenges.

The Dark Peak and South Pennines had for 150 years devastating atmospheric pollution at a level unimaginable today, the catalyst of summer wildfires has then left vast areas of very acidic degraded peat which the Moors for the Future partnership are having great success at restoring. Starting with 33 km² of degraded ground in 2002, 7 km² of the worst of this has now been stabilised with another 5 km² included in the EU funded Life+ project which is just starting.

The North Pennines AONB Partnership's Peatscapes project aims to conserve and enhance the internationally important peatland resource within the Area of Outstanding Natural Beauty and to promote peatland conservation at the local, national and international level. The North Pennines AONB contains 9,500 km of grips cut into the peat over the past 50 years. With over 900 km² of peatlands in the North Pennines AONB, Peatscapes has been working proactively to restore these peatlands, develop a sound scientific programme to inform restoration and policy, celebrate the importance of peatlands and promote best practice land management on peatlands.

Filling the gap between the North Pennines AONB Partnership's Peatscapes project and Moors for the Future the Yorkshire Peat Partnership is using many of the techniques developed by Moors for the Future and the North Pennines AONB Partnership to restore around 280 km² of damaged blanket bog in the Yorkshire Dales & North York Moors National Parks, Nidderdale AONB and the industrial South Pennines

in Yorkshire by blocking 2500km of gullies, restoring 850 km of eroding gullies and re-vegetating 170 ha of bare peat by 2013. This represents about 50% of the restoration work needed in the region.

Chris Dean is the Programme Manager for the Moors for the Future Partnership. Paul Leadbitter is the Project Manager of the North Pennines AONB Partnership's Peatscapes Project. Tim Thom is the Programme Manager for the Yorkshire Peat Partnership.

Water quality regulation by peatlands

Chris Evans, Centre for Ecology & Hydrology

Blanket bogs form the headwaters of many British river systems, and are a major source of drinking water in areas such as the Pennines. Waters draining peatlands are strongly regulated by biogeochemical processes occurring within the peatland, and tend to be naturally acidic, low-nutrient and rich in DOC. Peatland regulatory processes are affected both by management and by external factors such as climate and atmospheric deposition. Intact, accumulating peatlands effectively retain most atmospheric pollutants, including sulphur, nitrogen and heavy metals. While this has reduced pollutant levels in drainage waters, the 'pollution legacy' stored in peatlands is vulnerable to future release due to climate change or inappropriate management.



Loss of vegetation cover and erosion in the South Pennines has resulted in the failure of some aspects of peatland water quality regulation, leading to elevated nitrate and sulphate losses and resulting acidification, as well as greatly increased POC loss. The role of peatlands in relation to DOC is complex; arguably DOC generation by peatlands represents an 'ecosystem disservice'. Recovery from historic acidification of these systems has increased DOC losses, with detrimental consequences for water treatment. The extent to which this can be mitigated through peatland management will be discussed.

Chris is a research scientist working at the Centre for Ecology and Hydrology in Bangor. He started out working on the water quality of lakes and streams affected by acid deposition, then moved upstream to work on biogeochemical processes in peats and other upland soils. Current interests include controls on fluvial carbon fluxes and greenhouse gas emissions from peatlands, and the way that different environmental drivers and processes interact. His enthusiasm for cold, wet places is probably attributable to having grown up on Dartmoor.

MICCI - Moorland Indicators of Climate Change Initiative

Chris Robinson, Peak District National Park

MICCI is a novel schools outreach initiative to promote awareness of the importance of peatlands as carbon stores and for their protection for mitigating climate change. It encourages young people, their schools and local communities to engage with National Parks and peatland research. Since 2008 it has engaged 25 schools across 3 National Parks in England and Wales to take part in 'hands-on' scientific field trips (GCSE and A level) to explore peatland environments.

Linkages with Manchester University and Moors for the Future have encouraged knowledge exchange between science and schools. Active learning was facilitated through dissolved organic carbon tests of water samples, analysis of results, and mini-conferences. Young people from areas of urban and rural deprivation have been targeted as priority beneficiaries. A fieldtrip programme, hand-outs and analysis spreadsheets have been developed by the Peak District National Park Education team, which will be further developed to share with other peatland projects in the future.



For 2010-2012, the Association of National Parks (ANPA) in collaboration with the IUCN UK Peatland Programme plans to extend this initiative on a national scale across all National Parks, grant funding permitting. Links across the UK with university based carbon scientists, National Park ecologists and education teams and schools will foster greater understanding of peatlands and the climate challenge.

Chris Robinson is an Education Officer for the Peak District National Park based at Losehill Hall in Castleton. Chris is a former science teacher and now develops and

organises learning programmes for young people in the National Park. He is particularly interested in involving young people in climate change research and engaging them in the wider debate.

The IUCN UK Peatland Programme

Clifton Bain, IUCN UK Peatland Programme

The IUCN (International Union for the Conservation of Nature) UK Peatland Programme has been established to promote peatland restoration through partnerships, strong science, sound policy and effective practice. Funding for a three year programme of work, which began in June 2009, was given by the Peter De Haan Charitable Trust. A key element of our work is the recognition that peatlands provide valuable ecosystem services and that restoring damaged peatlands can help meet national and international Government obligations on carbon, biodiversity and water. With all this high level strategic activity in favour of peatlands we now need to focus attention on getting the right support for the people who manage the peatlands and who can bring them into a fully functioning state

The Programme has a number of planned initiatives, including a Commission of Inquiry into Peatlands aimed at providing the evidence base to support greater investment in restoration of damaged peatland. It will set out what the partnership aims to achieve and introduce the various strands of our work. The talk will also outline some of the progress being made particularly in relation to peatlands and climate change policy.



Clifton Bain has recently been appointed as Director of the IUCN UK Peatland Programme, which is raising awareness of the multiple benefits of peatlands for climate change, water and biodiversity. Currently on secondment from RSPB, Clifton is a Zoology graduate of Aberdeen University with over 25 years experience in wildlife conservation. He started his career with the RSPB as a researcher studying upland breeding birds and their habitats in north Wales. He then moved into the East Midlands as a conservation officer for the RSPB where he was involved in national campaigning work to conserve peatlands. For the last ten years has been based in the RSPB Scotland headquarters, in Edinburgh, as senior policy officer covering biodiversity and climate change.

Fire on Peatlands

Colin Legg, University of Edinburgh

Most peatland systems in the UK have vegetation that can potentially support a fire. Experience of fire-prone vegetation round the world teaches us that fires cannot be eliminated, but we can do a lot to manage both the probability or frequency of fires occurring and the effects that those fires will have when they do occur. Some of the effects of fire may be seen as beneficial (increased economic return from sheep and grouse; improved habitat for golden plover; reduced wildfire hazard) whilst others are seen as harmful (loss of carbon; reduced diversity of Sphagnum species; visual scars on the landscape).



The challenge for peatland managers is therefore to find the correct balance between the relative costs and benefits of fire that takes into account all the risks associated with each management option, including the risk of severe and damaging wildfire. The challenge for scientists is to provide the quantitative evidence base that enables those calculations to be made. The challenge for policy makers is to find the means to adequately reward those who provide the ecosystem services that the rest of us expect.

Colin Legg is Senior Lecturer at the University of Edinburgh Centre for the Study of Environmental Change and Sustainability, School of GeoSciences. Teaching interests include plant ecology, vegetation management and conservation, and research methodology. Recent research on management of upland vegetation, in particular relating to vegetation fires: their management and their effects.

Wind Farm and peat carbon payback model

Dali Nayek, University of Aberdeen

Large scale wind farm developments in Scotland have raised concerns about reliability of methods used to calculate carbon emission savings to be achieved in Scotland by replacing power generated from fossil fuels (and other more conventional sources). This is largely due to wind farms being sited on peatlands as opposed to mineral soils. Scottish Government policy is to deliver renewable energy without environmental harm, and to meet biodiversity objectives including the conservation of designated wildlife sites and important habitats such as peatlands. A carbon calculator was developed to calculate potential carbon emission savings associated with a wind farm development on peatland, forestland or afforested peatland. The total carbon emission savings of an individual wind farm are estimated by accounting emissions from the power source that will be replaced by wind power against: loss of carbon due to infrastructure development; loss of carbon due to backup power generation; loss of carbon stored in peat and forest; loss of carbon-fixing potential of peatland and forest; and carbon savings due to habitat improvement. Most of the carbon losses are determined by national infrastructure, but those from peat soil and plants are influenced by site selection and management practices. The extent of drainage around each constructed element of the wind farm is a major factor for greenhouse gas emissions. By selecting a site with a low extent of drainage and using management practices that minimise net carbon losses, emissions from the soil and plants may cancel out as little as < 6% of the potential carbon savings, even on peatland. However, if the soil has a high extent of drainage and management practices that minimise carbon losses are abandoned, greenhouse gas emissions from the soil and plants can amount to 77% of the wind farm's gross carbon savings. Thus, the development of wind farms on peat as opposed to mineral soils incurs a much greater risk that the potential net saving of greenhouse gas emissions will be significantly reduced by site management practice.



Dali Rani Nayak is a Research Fellow at the University of Aberdeen. Dr. Dali did her Ph.D. from Utkal University, India on Carbon Management vis-à-vis Greenhouse Gas Emission from Flooded Soils Planted to Rice. Presently she has been working in the Environmental Modeling group of University of Aberdeen with Prof. Pete Smith and Dr. Jo Smith and her major interest lies in studying both the GHG budgeting of different ecosystems and impact of climate change on the GHG budgeting of those ecosystems.

IUCN review 2 - Peatlands: climate change mitigation and adaptation potential

Fred Worrall, Durham University

Within the terrestrial biosphere the northern peatlands are the most important terrestrial carbon store, and it has been estimated that 20-30% of the global terrestrial carbon is held in 3% of its land area. The northern peatland carbon store is estimated to be approximately 455 Gt C and over the Holocene northern peatlands have accumulated carbon at an average rate of 96 Mt C/yr, making this ecosystem not only a substantial store but also a large potential sink of atmospheric carbon. Traditionally, pristine (undisturbed) peatlands have been considered to act as carbon sinks and, therefore, help to moderate the long-term build up of atmospheric CO₂. However, many northern peatlands have suffered from disturbance, including drainage, agricultural improvement, peat cutting, afforestation, burning, and increased atmospheric nutrient deposition. Such disturbance has altered peatland carbon cycling processes and has led to increased release of the soil carbon stock to the atmosphere and surface waters.

Therefore, protection and restoration of these degraded peatlands is being pursued by national and regional agencies in order to conserve existing carbon stocks and to help mitigate climate change. It is believed that restoration reduces carbon losses both to the atmosphere and the aqueous environment. However, it may lead to an increase in methane (CH₄) emissions, at least in the short term, which is a more potent greenhouse gas than carbon dioxide (CO₂). This review shows a high degree variation between restoration techniques with regard to their potential for climate mitigation but that some techniques can provide upto 60 years of additional resilience against climate change.

The Peatlands: climate change mitigation and adaptation potential Review Team is lead by Dr Fred Worrall, University of Durham, and supported by Dr Rebekka Artz, Macaulay Land Research Institute; Dr Pippa Chapman, University of Leeds; Dr Chris Evans, Centre for Ecology and Hydrology, University of Bangor; Prof Joseph Holden, University of Leeds; Prof Pete Smith, University of Aberdeen.

IUCN review 7 - Impacts of Burning Management on Peatlands

Fred Worrall, Durham University

In the UK upland peat catchments are commonly managed for sheep grazing and/or for breeding of animals for recreational hunting. In England, it has been estimated that 40% of moorland has received some burn management with estimates of as much as 17% of English uplands having been burnt in 4 years. Managed burning may have shown a correlation with improved grazing and improved grouse numbers, but it has also been associated with causing wildfire with its potential for damage to the underlying basis of the peat ecosystem and for causing vegetational change along undesirable trajectories towards degenerate bog and heathland vegetation.

The burning of peatland vegetation promotes the development of grass dominated communities especially on shorter burning rotations; brings improvement in the structural diversity of the ecosystem; and helped preserve a range of rare species. However, the promotion of grasses and heather-dominated vegetation may drive the ecosystem away from peat formation vegetation and into what is often classed as degenerated state. Conversely, the managed burning of peat soils have been shown to lead to increased peat erosion; development of water repellency that limits infiltration; increased runoff; limits carbon storage; and significant changes in water quality from peat soils.

This review brings together information from published reviews and studies with available unpublished information in order to assess the impact of managed burning under the following headings: soil and water quality; biodiversity; socio-economic benefits; and climate change mitigation potential.

The Impacts of Burning Management on Peatlands Review Team is lead by Dr Fred Worrall, Durham University, supported by Dr Gareth Clay, University of Durham; Prof Rob Marrs, University of Liverpool; Dr Mark Reed, University of Aberdeen.

Environmental Impact Assessment on Peat

Jane MacDonald, SSE Renewables

Environmental Impact Assessments for wind farms proposed on peatlands have evolved in recent years as more knowledge and data from constructed wind farms becomes available. A great deal of emphasis is now placed on assessments of peat stability and carbon impacts in addition to the core ecological and hydrological aspects. There is also now an increased awareness of the interrelationships between all of these related aspects, and that, in assessing the impact and defining construction methods and mitigation measures for each, the positive or negative effects on the peatland / wind farm carbon budgets have also to be taken into account. This increased level of awareness, and ultimately complexity, of an EIA means that the planning authorities and advisory bodies are also required to keep pace with the developments in the EIA process. This requires effective communication of expectations and guidance.

This presentation outlines the approach SSE Renewables currently undertakes in the assessment of peatland impacts for a typical wind farm EIA, and discusses the pitfalls and uncertainties faced during this process by both regulatory agencies and developers alike. The talk will also examine the methods typically employed to ensure that the commitments made in the environmental statement, and confirmed through the conditioned planning consent, are effectively delivered on site during the construction phase.



Jane MacDonald is a graduate in Geology and Applied Geology with a masters in Environmental Studies. Prior to taking up the position of Environmental Manager at SSE Renewables Jane worked in Environmental Consultancy, primarily in soil, water and environmental management related disciplines. Her responsibilities at SSE Renewables extend through all stages of the development process from initial site selection and environmental impact assessment, through to completion of construction. Her primary focus as Environmental Manager is to ensure that all SSE Renewables on-shore wind farm projects are consistently delivered to the highest standards in environmental management, with the intent of continually raising the bar with regards to best practice in this field.

Telling stories: knowledge exchange across science, policy and practice

Jeremy Phillipson, RELU

It is commonly put forward that effective research exploitation must be built upon a foundation of active knowledge exchange and stakeholder engagement during the process of knowledge production. However, what is often lacking is a systematic appreciation of the specific practices of knowledge exchange and their relative merits. The presentation reports on the experience of the UK Research Councils' Rural Economy and Land Use (Relu) Programme. Relu is a major research programme supporting strategic interdisciplinary research on the challenges facing the UK countryside, ranging from the restoration of trust in food chains, to the means of promoting sustainable agriculture and reduced stress on water catchments, to the adaptation of rural living and land use to environmental change. Relu's



mandate to engage stakeholders at all levels of the programme led it to adopt a philosophy of knowledge exchange and a commitment to engaging stakeholders throughout the research process, at all stages. An experimental approach to knowledge exchange was encouraged across its 75 research projects. They adopted varied methodological approaches, such as forms of action research, participatory modelling, the initiation of knowledge co-operatives, joint-knowledge production involving researchers and local communities, and the development of adaptive learning networks.

Jeremy Phillipson is Assistant Director of the UK Research Councils Rural Economy and Land Use Programme where he leads on knowledge exchange. He is based at the Centre for Rural Economy at Newcastle University where his research has focused on knowledge transfer processes and the science and technology needs of rural economies and resource management

Peatland viability in the face of climate change

Joanna Clark, Imperial College London

Upland blanket peatlands are the largest terrestrial carbon store in Great Britain. These rain-fed peatlands have developed on shallow slopes in upland areas because saturated conditions caused by wet and cool climatic conditions slow down organic matter decomposition. Climate change projections for increased temperatures and potential evaporation rates and decreased summer precipitation, have led to concerns about the long-term stability of peatland carbon sinks. To examine the vulnerability to climate change, we developed and applied statistical bioclimatic envelope models (BCEMs) to examine changes in the 'climate space' associated with 1961-90 climatic conditions and the mapped distribution of blanket peat under future climate projections. All BCEMs showed a decrease in blanket peat 'climate space' under UKCIP02 projections, with areas to the east and south of Great Britain the most vulnerable. Comparisons between these simple statistical BCEMs outputs and more complex process-based dynamic peat carbon models were made at four data rich blanket peat field sites. Although the dynamic peat carbon models showed an overall decrease in the net accumulation of carbon over time, responses varied between sites and models. Such variation between dynamic models and BCEMs highlights our incomplete knowledge about processes controlling carbon accumulation and turnover in peatlands; and the need for further field based research to provide the essential data required to develop and apply these models.



Joanna is currently a Grantham Institute for Climate Change Fellow based in the Department of Civil and Environmental Engineering, Imperial College London. She works primarily on carbon cycling in organic soils, particularly on understanding how carbon cycling could be affected by climate change and acid deposition. Work presented today is a summary of the key findings from a recent knowledge exchange project on 'Climate Change and the British Uplands' funded by the Environment Agency and NERC QUEST research programme. This work was carried out in collaboration with a wide multi-partner network from the research and policy community.

Managing peatlands for biodiversity

Jonny Hughes, Scottish Wildlife Trust

The workshop will focus on how we can better manage the peatland resource specifically for biodiversity interests. Is carbon and water management of the resource always compatible with biodiversity management? What are the rare and threatened species and habitat sub types within the UK's peatland resource which need special consideration? The workshop will discuss these and other questions and attempt to identify the most important priorities for action, and conflicts for resolution.



Jonny Hughes is a professional ecologist who is currently Director of Conservation at the Scottish Wildlife Trust and Vice Chair of IUCN UK Peatland Programme. Jonny surveyed over a third of all the raised bogs in Scotland during a LIFE funded programme in the 1990s run by SWT. During this time he developed a real passion for bogs of all kinds and continues to campaign for their protection. SWT are currently resurveying some of these sites with a view to making an assessment of the current state of the raised bog resource in Scotland, and how it has changed over the past 15 years or so.

Defra peatland greenhouse gas overview

Judith Stuart, Defra



In order to fully understand the potential of peatland restoration in mitigating climate change we need a better understanding of the total greenhouse gas budgets of peatlands and the impact of restoration on greenhouse gas fluxes. Defra has been funding research to fill these knowledge gaps.

Judith is Soils Policy Specialist and Policy Lead on Peat at the Department for Environment, Food and Rural Affairs. She has been working on soils at Defra for the last 10 years, with a particular focus on soil carbon and peat for the last 3-4 years.

IUCN review 8 - Policy measures for sustainable management of UK peatlands

Mark Reed, University of Aberdeen

This technical review considers policy options that could sustain the future provision of important ecosystem services from peatlands in a rapidly changing world. It combines literature review with insights from peatland stakeholders collected through three workshops in the Peak District, Yorkshire Dales and Dumfries & Galloway. It considers how the wide range of ecosystem services currently provided by peatlands might be affected by a number of current and future biophysical, socio-cultural and policy drivers. It contemplates what the priority policy objectives might be for both lowland and upland peats, and then explores a range of options for achieving these objectives. Options for creating markets to facilitate sustainable peatland management are explored by reviewing literature and experience with Payments for Ecosystem services from around the world, and proposing an approach tailored to UK peatlands. The review considers alternative policy options for sustainable peatland management based on information provision, capacity building, market Incentives, classic regulation (including planning) and state control.



Mark Reed is an interdisciplinary environmental researcher, co-leading RELU's Sustainable Upland project. He is a Senior Lecturer in the School of Geosciences and Deputy Director of the Aberdeen Centre for Environmental Sustainability at the University of Aberdeen.

The Policy Measures Review Team is lead by Dr Mark Reed, University of Aberdeen, supported by Dr Ros Bryce, University of Aberdeen; Sarah Buckmaster, University of Leeds; Dr Mike Christie, Aberystwyth University; Dr Ioan Fazey, University of St Andrews; Jayne Glass, Perth College UHI; Dr Klaus Hubacek, University of Leeds; Clunie Keenleyside, Kleenyside Consulting; Prof Philip Lowe, University of Newcastle; Dr Andrew Moxey, Pareto Consulting; Dr Claire Quinn, University of

Leeds; Dr Alister Scott, Birmingham City University; Prof Bill Slee, Macaulay Land Research Institute; Dr Lindsay Stringer, University of Leeds; Prof Ken Thompson, University of Aberdeen; Simon Thorp, Heather Trust.

Burning as a management tool - A landowner perspective

Martin Gillibrand, Moorland Association

Centuries of moorland burning for sheep grazing, coupled with 150 years burning by gamekeepers for grouse has produced a habitat of considerable importance in both the United Kingdom and Europe and has led to the designation of some 70% of heather moorland in England and Wales as SSSI, SAC and SPA. It is important that this habitat is maintained and extended to secure the features for which it has been designated.

Burning is the most effective way to rejuvenate and regenerate heather and other moorland shrubs. It is necessary to provide food for grouse and sheep, whilst creating the mosaic pattern that benefit grouse and other ground-nesting birds. It is also important to prevent encroachment by scrub and trees.

Properly and regularly carried out a burning programme should lead to rapid regeneration of heather, minimizing the risk of leaving bare peat and erosion and facilitating carbon lock up.

Managed burning during the winter months helps restore the damage caused by summer wildfires, by reducing the bio-mass available to fuel wildfires and limiting the likelihood of burning into the peat layer. A cut in heather may produce similar benefits but is restricted by the nature of the ground, cost and the area that can in practice be cut in any year.

Martin Gillibrand is the Secretary of the Moorland Association and has been since it was formed 25 years ago. He is a solicitor in private practice in Lancaster specializing in work relating to agriculture and estates, particularly Upland Estates. In the course of 40 years carrying out this work he has gained considerable experience in advising on moorland management.

Martyn Howat, Conference Co-chair

Martyn Howat is an independent Environmental Consultant with 37 years experience relating to Environmental land management in the UK.

He worked as a Director for Natural England until the end of 2009, previously having worked for English Nature and its predecessor The Nature Conservancy Council.



As Director for Uplands with Natural England he led the development of NE's Upland policy and work launching their Upland vision at the end of last year. He has an extensive knowledge of the UK's Uplands and has led on a range of projects such as the review of the Grass and Heather burning regulations, the Hen Harrier recovery project, Upland tracks, Landscape matters and work related to provision of Eco-system services etc.

Martyn has strong networks with government, national and regional organisations and individuals who are involved in Upland matters and has a particular interest in sustainable rural communities in the Uplands.

He is a national board member for The Rivers Trust, a Director of the Tyne Rivers Trust and a recently appointed member of the governing Council of the British Association of Shooting and Conservation.

Much of his spare time is taken up walking extensively in the Uplands of the UK.

LCN review 1 - The State of UK Peatlands

Matthew Shepherd, Natural England

Peatlands are landscapes dominated by soils with peaty surface layers. Definitions of peaty soils differ depending on the soil classification system used, but all UK classifications base their definition on the depth of the surface peat material. Deep peaty layers form in waterlogged conditions under blanket bog, raised bog, or fen vegetation, while shallower peaty deposits are associated with periodically waterlogged

habitats such as wet grassland and wet heath. Peatland extent in the UK has been mapped both by soil surveys, which often reflect soil and vegetation information, and geological surveys recording superficial deposits. Peatlands have been put to many different uses (e.g. grazing, afforestation, game management, intensive agriculture, peat extraction) which often involve drainage, as well as experiencing a range of environmental pressures (e.g. pollution, wildfire, climate). These produce a variety of land covers (e.g. heathland, grassland, forest, bare peat) and affect the condition of the peat itself (e.g. erosion, wastage). This presentation outlines our understanding of peatland location and peat depth, and their state with regard to its management, environmental pressures, land covers, and peat condition across the UK. An overview of current peatland status is presented, with a review of the priorities for improving our knowledge of the state of UK peatlands.



Dr Matthew Shepherd is a Senior Specialist in Soil Science for Natural England. He led Natural England's involvement in the Partnership Peat Project and co-authored a recent report on England's Peatlands, Carbon Storage and Greenhouse Gases. His eight years experience in upland ecology and soil science with Natural England and its founding bodies follows four years' research and survey work on the impact of land management on upland soils, and three years of experience in ecological survey, conservation management and environmental education.

The LCN State of the UK Peatlands Review Team is lead by Dr Matthew Shepherd, with Dr Patricia Bruneau, Scottish Natural Heritage; Andrew Coupar, Scottish Natural Heritage; Sally Johnson, Scottish Natural Heritage; Dr Peter Jones, Countryside Council for Wales; R Weyl, Northern Ireland Environment Agency – yet to confirm; A Higgins, Northern Ireland Agri-food and Biosciences Institute – yet to confirm.

Effective Communication in Practice

The hummocks and hollows of communication: the Flow Country

Norrie Russell, RSPB Scotland

With a history steeped in the 'forestry versus bogs, birds versus jobs' controversy of the 1980's, RSPB's purchase of the 7,000ha Forsinard sporting estate in 1995 and subsequent large scale forestry removal and hill drain damming could easily have become a public relations nightmare. With no history of land management within a hundred miles, a headquarters 800 miles away and previous active campaign against afforestation targeted at the national media and policy makers, communication at a local and regional level was a challenge. Forsinard Flows has however grown to become RSPB's largest nature reserve at 19,500ha including 2,000ha of forest to bog restoration and 10,000 hill dams installed, and we are all still talking.



Needless to say, it has not all gone as well as it could, and we have only properly engaged with some audiences such as the research community very recently. There is however still no detailed mapped forest to bog restoration strategy or plan in place and thousands of hectares of forest on key sites remain 15 years later, so still lots of communicating to do. I plan to cover key audiences and approaches from the acquisition appeal to membership, early promotion, stakeholder consultations, visitor facility development, joint management with sporting interests, schools and community working.

Norrie Russell has managed RSPB's peatland reserves in the Flows of North Scotland as Site Manager since the first acquisition in 1995 and manage a small but hardy team of staff based at Forsinard. In what now seems an age ago I worked as an Area Officer for NCC and later SNH in Argyll following on from interpretive work with NTS and local authorities and a brief stint with the Forestry Commission. When not driving the kids for 80 miles to their friends house, I enjoy trying to improve my wildlife photography.

IUCN review 4 - Impacts of Peatland Restoration, Rewetting, revegetation and vegetation management

Paul Lunt, Plymouth University

The focus of this review is peatland restoration, in particular the policies, present drivers and examples of best practice within the UK. We to review opportunities and constraints to peatland restoration and make recommendations which could be used to inform future policy.

Peatlands restoration has two main aims, vegetation and water management. Vegetation management occurs on a continuum from the re-vegetation of bare peat, to restoration of plant community composition. Considerable restoration gains in UK peatlands has been made over large areas by reduction in grazing animal stock densities, removal of burning management and rewetting by blocking of 1000's of kilometres of drainage ditches. In upland and lowland peatlands successful restoration following tree removal has been achieved where it has been possible to return the hydrological dynamics to the pre-plantation state. However in many afforested, drained and burnt over sites oxidation and compression of surface peat layers has resulted in changes in hydrological function, increasing the risk of invasion from undesirable plant species.

A major problem limiting what we know about the success of peatland restoration is the absence of long-term monitoring data. Post restoration monitoring shows that recovery of water levels is possible in a relatively short time frame (2-5 years). Many restoration projects show short term negative impacts on surface water quality and methane generation but where data exists, positive responses in the medium to long term. Restoration of target bog vegetation in response to management may take several decades to achieve and in established purple moor grass and heather dominated swards may not be feasible. Restoring appropriate *Sphagnum* species and cotton grass is vital to restoring peat forming processes and securing UK peatlands as future carbon sinks.

In addition to the literature, this review draws upon information gathered from the Peat Compendium and workshops involving expert consultees, which were carried out as part of the review. During workshops there was a great deal of consensus on what could and could not be achieved using existing restoration techniques. Also presented within the paper are a series of knowledge gaps and uncertainties. An important point of agreement was that the most convincing argument for the funding of future restoration projects could be made using the multiple objectives of carbon sequestration, water management and biodiversity gain. However a significant future challenge is to understand how various climate scenarios, such as increased temperatures, summer droughts and higher intensity rainfall events are likely to affect peatlands. In particular it was agreed that the lowering of mean water tables and oxidation of peat is likely to result in increased growth and competition from vascular plants which in marginal climatic zones for peat formation could make restoration to blanket or raised bog unachievable. A further significant point of agreement was the need to establish a baseline for monitoring restoration targets and of considering the consequence of no intervention given the potential for future deterioration of the baseline condition in UK peatlands.



Dr Paul Lunt is a lecturer in Environmental Science at Plymouth University. He has a PhD, specializing in mine site restoration from Aberystwyth University. His research interests include vegetation restoration, including lowland and upland bog restoration. Whilst employed as a principal ecological consultant at Penny Anderson Associates he advised on upland management of SSSI's for water utility companies and managed monitoring projects for Moors for the Future. His present research projects include the monitoring of the impacts of blanket bog restoration on peat mineralization rates in Dartmoor National Park. He has been an academic for 13 years, has developed a Masters programmes in

Environmental Consultancy at Plymouth University and previously led a Habitat Creation and Management Masters at Staffordshire University.

The Impacts of Restoration Review Team is lead by Dr Paul Lunt, Plymouth University, supported by Dr Timothy Allott, University of Manchester; Penny Anderson, Penny Anderson Associates; Matt Buckler, Moors for the Future; Andrew Coupar, Scottish Natural Heritage; Dr Peter Jones, Countryside Council for Wales; Dr Jillian Labadz, Nottingham Trent University; Peter Worall, Penny Anderson Associates.

IUCN review 5 - Peatland Biodiversity

Penny Anderson, Penny Anderson Associates

Peatlands are a significant biodiversity resource with unique values. They are often typified by species-poor assemblages but have a high level of adaptation of associated species. Intricate patterns in soils, moisture and vegetation structure can produce highly specialized plant and insect assemblages whilst UK peatlands in particular are especially valued for their assemblages of ground-nesting migratory birds and for Red Grouse.

Peatland biodiversity is subject to a number of external drivers. This review considers factors such as forestry, drainage and reversion to farmland which can cause long-term habitat loss and lead to habitat fragmentation. It also considers pollution (including N-deposition and former SO₂ impacts) and over-grazing which can lead to degradation of remaining habitat with associated reduction in function and impacts on key species.

Recent years have seen an increase in peatland management programs aimed at promoting biodiversity interests. We will be in a better position to learn lessons from the findings of flagship projects, which should help to inform wider policy directions. However the review also identifies where remaining knowledge or information gaps may hinder progress and highlights priorities for future monitoring and research.



Penny is Managing Director of a leading Ecological Consultancy and has developed a particular expertise in moorlands, having worked in this environment for over 30 years. She has undertaken research into effective restoration techniques, evaluated the issues on moorland in terms of management needs and prepared costed management plans for many thousands of hectares of moorlands throughout England (especially) plus some in Wales and Scotland. Although principally a botanist, Penny has a sound knowledge of the wider biodiversity interests on the moors and understands the management issues related to grazing animals, grouse production, landscape and amenity, recreation and wildfire.

The Peatland Biodiversity Review Team is lead by Dr Nick Littlewood, Macaulay Land Research Institute, supported by Penny Anderson, Penny Anderson Associates; Dr Rebekka Artz, Macaulay Land Research Institute; Dr Olivia Bragg, University of Dundee; Dr Paul Lunt, University of Plymouth; Prof Rob Marrs, University of Liverpool.

Peatlands and the climate challenge in the UK

Pete Smith, University of Aberdeen

Peatlands in the UK contain over half of the entire UK stock of soil organic carbon and far more carbon than all of the vegetation in the UK. Small changes in carbon losses from peatlands could therefore have a very significant impact on land sector greenhouse gas emissions from the UK and northern peatlands have global significance in the planetary carbon cycle. I will present an overview of peatlands in the carbon cycle, globally and in the UK, examine some of the potential threats to peatlands from climate



change, and examine the management practices that a) reduce greenhouse gas carbon loss and emissions to the atmosphere (climate mitigation) and b) reduce the vulnerability of peatlands to the impacts of future climate change. The talk will serve as an appetizer for talks that will follow later in the day, reporting on the JNCC review on climate change and peatlands (Fred Worrall et al.) and the talks in the session on peatlands and climate change (Judith Stuart; Jo Clark et al.).

Pete Smith is Royal Society-Wolfson Professor of Soils & Global Change at the University of Aberdeen. He has served as Convening Lead Author, Lead Author and Author for the Intergovernmental Panel on Climate Change (IPCC), which was awarded the Nobel Peace Prize in 2007. He has coordinated and participated in many national and international projects on soils, peatlands, agriculture, greenhouse gases, climate change, mitigation and impacts, and ecosystem modelling. He is a Fellow of the Society of Biology, a Rotahmsted Research Fellow, a Research Fellow of the Royal Society (London), and a Fellow of the Royal Society of Edinburgh.

Living Peatlands

Richard Lindsay, University of East London

Most soils are the products of weathering and erosion of parent rock. Peat soils are different. The soil of a peatland – or at least of a peat bog – is derived entirely from the growth of living plant material. The blanket of peat soil actually protects the sub-surface mineral landscape from erosion in some of the highest rainfall areas in the UK. This protective blanket of peat, which covers whole landscapes, has been largely generated by one of our smallest plants – the *Sphagnum* bog moss. One of the most unusual properties of peatlands is that they preserve a record of their development within the peat, and from this we can see that the majority of our peat bogs were created by this small moss. *Sphagnum* achieves this by growing *en mass*, as a continuous carpet of different *Sphagnum* species. Each species has a characteristic growth-form. Some grow as hummocks, others occupy hollow or pools. This simple characteristic produces a remarkably sophisticated system of water control which means that a habitat which has a higher water content than milk can form on mountain ridges and valley sides, has demonstrably adapted to dramatic changes in climate during the last 8,000 years, provides a remarkably



biodiverse habitat, and can store more soil carbon for longer than any other habitat in the UK. Unfortunately much of what is most remarkable about our peat bogs has now been lost. Around 90% of our peat bogs are no longer living peatlands. They no longer have the vital *Sphagnum* carpet which makes them living peatlands. The majority of our bogs are now like an Amazonian rainforest which stands, defoliated and decaying. No more than 10% of our peat bogs are considered to be 'active' living peatlands – and we are all now paying the price for this.

Richard Lindsay is a Principal Lecturer and part of the Environmental Research Group at the University of East London

UK climate targets and context for mitigation and adaptation

Samuel Fankhauser, London School of Economics

This presentation will introduce the legal and policy context for climate change mitigation and adaptation in the UK, as set out in the Climate Change Act of 2008. The presentation will start with Britain's statutory carbon budgets for the period 2008-2022 and ask whether the country is on track to meet its 34% emission reduction target for 2020. It will highlight the main areas where emission reductions will have to occur and discuss the likely contribution of agriculture and land-use change. The presentation will then move on to adaptation. It will introduce Britain's statutory requirement for a country-wide Climate Change Risk Assessment (CCRA) and discuss the level of preparedness in Britain to deal with a changing climate.



Dr Samuel Fankhauser is a Principal Fellow at the Grantham Research Institute on Climate Change at the London School of Economics. He is also a member of the Committee on Climate Change and its Adaptation Sub-Committee. Sam serves as Chief Economist of Globe International, the international legislator forum, and is a Director at Vivid Economics. He has been involved in climate change issues since the early 1990s and served on the 1995, 2001 and 2007 assessments of the Intergovernmental Panel on Climate Change (IPCC).

Communicating peatland management advice

Simon Thorp, Scotland's Moorland Forum

Part of the ongoing work of Scotland's Moorland Forum is a project called Upland Solutions. The aim of this project has been to compare two contrasting study areas in Scotland and to identify what is working well in these areas and what is the cause of any blockages to progress. To provide some additional focus the investigation work has focused on three strands: upland birds, carbon and upland economics.

Many of the responses to questions that the Forum received were in line with expectations. However, we had not expected the complete lack of understanding of the issues associated with peatland management

and carbon, and perhaps more surprisingly no understanding of why carbon should be considered as important.

From this it is clear that those of us involved in the ongoing debates about upland issues may think these are well understood, but we need to make sure that those who own, manage and have an interest in the upland areas are brought and kept up to date with knowledge and developments. Knowledge exchange is not just a buzzword to splash about applications for grant aid; it has to mean something to those who manage the land.



Simon Thorp is well known as the Director of The Heather Trust, but today he represents Scotland's Moorland Forum.

Simon is a Rural Chartered Surveyor who has managed private estates, and he worked as a consultant in the north of England, before taking over as Director of The Heather Trust in 2002. In the same year, The Heather Trust became a founder member of the Moorland Forum, and Simon was appointed as its Secretary in November 2007.

UK National Ecosystem Assessment: recent trends and plausible futures

Steve Albon, Macaulay Land Use Research Institute



More than 200 natural, economic and social scientists have spent the last 12 months synthesising the current status, and trends since WWII, of ecosystem services across eight broad habitats in the UK. The preliminary findings will be described in general, drawing upon specific examples relevant to peatlands as climate warming continues to 2060.

Steve Albon is RERAD Environment – Land Use and Rural Stewardship Programme Coordinator and Co-chair UK National Ecosystem Assessment. Steve studied Environmental Sciences at UEA before beginning his research career studying natural selection in red deer on Rum in the 1970s. In the 1980's his work extended to Soay sheep on St. Kilda and in the 1990's to reindeer on Svalbard. While still passionate about the population dynamics of ungulates, most recently he has been directing more holistic landscape scale ecosystem studies.

Introduction to Inquiry: aims and process

Steve Chapman, Macaulay Land Use Research Institute

I will outline the main the aims of the Inquiry, the timeline and process which has led to the various review topics. The underlying theme is the conservation and restoration of peatlands within Scotland, especially in the context of climate change. I will briefly introduce the review topics and indicate how this body of information will be used both to encourage further investment in peatland research in areas of uncertainty and to influence policy and practice.



Steve is a Senior Researcher at the Macaulay Institute where he has worked as a soil microbiologist for over 25 years. Much of his more recent work has focused on processes in peat and organic soils, looking at the carbon cycle and assessing the peatland carbon stocks within Scotland. He formerly led a European project on peatland restoration (RECIPE) and is currently the Scientific Coordinator for the IUCN UK Peatland Programme Commission of Inquiry on Peatlands.

Fascinating Peatlands

Miner-Farmer landscapes of the North Pennines Area of Outstanding Natural Beauty (AONB): research into extensive lead-mining landscapes, and the threats they face from erosion and climate-change.

Stewart Ainsworth, English Heritage



This 5-Year English Heritage Research department project (started in 2009) integrates research into the archaeological understanding of multi-period lead-mining and agricultural landscapes, the identification of threat and erosion issues specific to these types of landscapes, and development and testing of new methodologies for their recording and analysis. It aims to develop standards and guidelines for recording of similar landscapes elsewhere in British and Europe. Key to the research is the need to understand the relationship between the 'artificial' historic environment fabric of large, lead-mining landscapes and the natural environment within which they reside, and the impact that each may have on the other. The large scale of such landscapes and the

complexity of the remains comprise a complex and wide range of threats, particularly the impact of land-use, peat management and the catchment and dispersal of water from precipitation. The project covers c 300 square kilometres and provides a representative sample of the evolution of a miner-farmer landscape. Within this larger area, a core research area (c 50 square kilometres) will be the subject of intensive fieldwork and testing of remote-sensing technologies and will act as the control sample for the rest of the project area. The project combines a number of traditional and innovative survey approaches including ground-based archaeological, buildings, geophysical, vegetation, and borehole surveys, with analysis of remotely-gathered data from specially commissioned aerial imagery, including digital orthophotography, LiDAR, and high-resolution hyperspectral bandwidth photography, as well as satellite imagery. Partners include the North Pennines AONB, Peatscapes Project, Environment Agency and Natural England. It also includes contributions by external research teams based at Birmingham and Durham Universities.

Stewart is a senior landscape archaeologist within the Research Department of English Heritage. He has over 30 years experience of surveying and analysing archaeological landscapes throughout England, but has specialised mostly on the landscapes of the northern uplands.

Susan Davies, Scottish Natural Heritage, Conference Co-chair

Susan Davies is a graduate of St. Andrews and Aberdeen Universities where she focused on the management of species and habitats in the wider countryside; especially in relation to the need for connectivity between protected areas and advice on agricultural and forestry practices.



On leaving university in 1990, Susan joined the Joint Nature Conservation Committee as an ornithological adviser and subsequently led programmes of work to implement the Birds and Habitats Directive in the UK, and the development of the first UK Biodiversity Action Plan. She joined the Advisory Services Team of Scottish Natural Heritage (SNH) in 2000, leading the implementation of the organisation's research and casework support programmes. She was appointed Director Operations (North) in 2006 and led the delivery of SNH's work in the Highlands, Islands and Grampian - with particular focus on National Nature Reserve management, renewable energy developments and engagement with local authorities through community planning partnerships. Susan has recently taken up

the role of Director of Policy & Advice in SNH where she is responsible for ensuring that SNH's advice is based on a sound evidence base - supported through the commissioned research programme and lessons learnt from project and casework developments.