Game & Wildlife Conservation Trust written evidence submitted to Defra's England Peat Strategy (via Online survey, completed 31st July 2020)

[This pdf of our online response has the references detailed for information]

Q4. Are our targets realistic and achievable to ensure peatland is functioning healthily for the needs of wildlife, people and the planet by 2050? If not, what needs to be changed?

Whilst we discuss specific considerations below we wish to emphasise at the outset a number of key points:

1. There are considerable knowledge gaps in the science in relation to the impact of vegetation burning on upland peat (a point recognised by Natural England in its Wildfire Evidence Review (July 2020)), and some previously relied upon science needs reviewing before safe policy decisions can be made; "Old truths" need to be replaced by the new evidence.
2. Without such a comprehensive review there is a certainty that the policy objective of healthily functioning peatlands will not be achieved.
3. That changed understanding of methane emission/warming impacts need to be taken into account.
4. That controlled 'cool' burns of heather on peatlands in the prescribed burning season (1 October to 15 April in upland areas) have an important role to play in restorative management and mitigation of wildfire; this management tool must be used to achieve the best outcome and not be lost from the vegetation management toolkit.
5. That plans to restore peatland should be a process of co-creation with farmers and other land managers using an adaptive management strategy and making use of experiential evidence; recent experience with Farmer Clusters, as an example, shows this can work well.
6. That the definition of what constitutes blanket bog needs to be improved; simply applying a depth of peat is indicative of conditions many thousands of years ago, not necessarily what can be achieved now and risks dangerous unintended outcomes. This would aid the individual assessment of each site and remove the inappropriate and potentially damaging "one size fits all approach" to restoration.
7. We believe it is valid, on current evidence, to take the view that rewetting will not prevent wildfire ignition or the significant damage which occurs because of the increased likelihood of extended dry periods brought about by climate change; evidence from other fire-prone ecosystems suggests this will require reduction in fuel loads (GWCT peatland report p.11, 6.7). A simple rule of thumb is that doubling the fuel load, doubles the rate of spread and quadruples the fire intensity, with catastrophic consequences.
8. Should the decision be made to ban prescribed 'cool' burns on peatlands, Government will need to establish an alternative vegetation management strategy and fund this annual activity. Alternative management strategies come at a cost and the effectiveness of these is uncertain in different landscapes.

9. The indicators of favourable condition in Common Standards Monitoring should be reviewed in the light of new evidence on impact of management interventions.
10. Land managers should be encouraged to work with Natural England to review peatland condition on their holdings.
11. Lowland peat restoration strategies are faced with the significant requirement to balance food production and restoration. Consequently, extensive re-wetting that undermines current commercial farming activities is not in our view sustainable.
12. Lowland peat preservation needs to focus on sustainability through adapting crop rotations and farming practices to those that support soil health and structure.

A significant starting point for the development of any policy and its deliverability is sufficient supporting evidence. Consequently in considering whether the targets set are realistic and achievable we question whether there is appropriate data to make definite policy decisions and set targets. Indeed considerable knowledge gaps exist e.g. data covering varying timescales as well as geographic scales, at different peat depths and classifications and in relation to historic and current management regimes. In addition, and significantly "*Conclusions from previous science are now out of date and not safe to be used in policy-making*."[1] Our concern is that unless policy thinking migrates to be in line with the weight of current scientific understanding (and adapts as that changes) unintended consequences will result.

Scientific understanding continues to evolve in all aspects of our global ecosystem. Relevant to this strategy, are, for example:

1. Short-lived climate pollutants - the changed understanding of the impacts of methane on GWP and the view that it is warming potential not emissions that should now be considered;
2. Low-severity fires and restorative management - controlled 'cool' burns of heather on peatlands in the burning season have a role to play in restorative management and mitigation of wildfire. The genetic composition of the flora has adapted to centuries of this form of management allowing rapid regeneration to occur. Abandoning this management approach and not replacing it with a viable alternative, if indeed one exists, allows surface fuel load increases resulting in uncontrolled wildfires that the peatland adapted flora cannot recover from, or the incinerated peat beneath it;
3. Low-severity fires slow decomposition in peatlands – recent research by Flanagan *et al* (2020) has demonstrated that soil microbial activity is inhibited by 'cool' burns which slows the rate of decomposition of surface organic matter increasing sequestration levels after 1 -3 years (see below); and
4. Trees on peatlands do not improve C sequestration – research has shown that tree planting as an alternative land use on peatlands to address the carbon agenda risks "*..jeopardizing soil (and ecosystem) C stocks on the extensive heather moorlands and heathlands with organic horizons of <50 cm depth*" (

[1] Peatland Protection – the science: four key reports. The Uplands Partnership. July 2020.
[2] Friggens NL, Hester AJ, Mitchell RJ, Parker TC, Subke J-A, Wookey PA. Tree planting in organic soils does not result in net

Friggens *et al* (2020))[2]. Friggens *et al* demonstrated that planting native tree species onto heather moorland with podzolic and peaty podzolic soils in Scotland, did not lead to an increase in net ecosystem C stock 12 or 39 years after planting.

Therefore, it is imperative that England's Peat Strategy provides a direction of travel without prescriptive measures unless the ***weight*** and clarity of scientific evidence is available, for example as it is for peat cut for horticultural use.

"We will bring all our peatland into **good condition, restoration management or more sustainable management** by 2040". There are numerous types and condition categories for peatland; this complexity indicates a one-size fits all approach would be misguided. The condition of peatland is strongly related to historic and current land use, each with different GHG emissions, exacerbated by historic atmospheric pollution, drainage and climate change. Reducing GHG emissions will potentially involve trade-offs between emissions, biodiversity, risk of wildfire and regulating, cultural and provisioning services. In other words, these factors will affect what constitutes a peatland that is "functioning healthily". Until extensive data is available to make site by site judgements as to the most appropriate management approach it is important that the strategy allows for adaptive management to reflect the influence of each of these factors on different peatland types, land uses and locations. The recent GWCT Peatland report highlighted that "*Data on both carbon fluxes and carbon stocks for peatland are sparse and biased towards a few repeat assessments of the same peatland sites. Data from so few sites need to be interpreted with caution.*" [3]

Furthermore, in the light of new scientific understanding, there is a need to improve the definition of blanket bog and address how the peatland condition score is determined. Blanket bog is not uniform; peat depth can vary significantly within a few metres. Consequently applying a definition based on depth of peat risks dangerous unintended outcomes. Furthermore where the hydrology has changed, there is little chance of re-wetting being possible. Assessment of peatland sites follows the JNCC Common Standards Monitoring for Upland Habitats (July 2009) which "... implicitly assume that fire only has damaging effects on peatlands …. the guidelines …..thus make it more-or-less impossible for burned sites to be classified as being in good condition"[4]. We question whether a previous burn should be a sufficient measure for a site to be classified as unfavourable particularly in the light of current scientific thinking. We think there are better indicators such as wetness, depth of peat or amount of growth and cover of peat-forming vegetation thus taking into account fuel load as a key measure of progress towards favourable condition. We would also encourage Defra to revisit the suggestions made in the The Uplands

[2] Friggens NL, Hester AJ, Mitchell RJ, Parker TC, Subke J-A, Wookey PA. Tree planting in organic soils does not result in net carbon sequestration on decadal timescales. *Glob Change Biol*. 2020;00:1–11. https://doi. org/10.1111/gcb.15229

[3] GWCT Peatland Report 2020:A review of the environmental impacts including carbon sequestration, greenhouse gas emissions and wildfire on peatland in England associated with grouse moor management.

[4] Davies, G.M. et al (2016) The role of fire in UK peatland and moorland management: the need for informed, unbiased debate. Phil. Trans. R. Soc. B 371: 20150342

Management Group's report on Blanket Bog monitoring approaches produced in February 2020 (www uplandsmanagement.co.uk).

The debate on how to achieve peatland net zero is complicated by:

- the significant differences in emissions between upland and 'agricultural' peat;
- the difference in opportunity costs between the two;
- the need to prevent high/uncontrolled emissions from wildfire in the uplands (discussed further in Q10);
- the level of scientific evidence on the impacts of controlled 'cool' burning; and,
- the implications of re-wetting on methane emissions (such as from warm, wet and sedge dominated upland sites) and, more importantly, on lowland sites nitrous oxide emissions potentially negating any beneficial carbon sequestration.

A clear policy objective should be to improve understanding and continually evolve management approaches. In this regard recent research has increased understanding of the role of controlled 'cool' burning in the prescribed season in peatland management/restoration by, for example, emphasising the importance of viewing C fluxes and stocks over different timescales (and not just immediately post burn), the difference between uncontrolled 'hot' wildfires in the summer and controlled 'cool' burns undertaken in the burning season and the contribution of pyrogenic charcoal to carbon sequestration. The Trust has explored this topic extensively its recent peatland report. Of note is that this increased understanding has led to an adapted approach to controlled 'cool' burning. In policy terms periodic burning has become associated with burning on a fixed term of years; a feature of Natural England's previous management plans for grouse moors on upland SSSIs. However greater scientific understanding of the role that burning can play in reducing heather dominance and restoring peat-forming plants has resulted in the concept of blanket bog restoration burning. This is helpful as burning should be for an ecological purpose or outcome and not just by periodic rota, resulting in practitioners assessing and managing the land to benefit a much improved blanket bog assemblage of vegetation and health as well as supporting grouse populations. However we feel that the concept of restoration burning needs defining. We refer to this topic again in Q10 on wildfires.

A paper by Flanagan *et al* (May 2020)[5] has produced data on a hitherto unknown soil process in peatland organic matter conservation. The research published in Global Change Biology shows that when studying carbon dioxide release, sites that had been burnt initially had higher emissions compared to the unburnt peat, but after 15 days, the emissions from burnt samples were less than unburnt samples. The scientists calculated from this that the cumulative amount of carbon dioxide over 1-3 years would be less in the burnt peat samples. Furthermore, the burnt peat soils were less susceptible to changes in temperature, and the heat altered the profile of

[5] Flanagan, NE, Wang, H, Winton, S, Richardson, CJ. Low‐severity fire as a mechanism of organic matter protection in global peatlands: Thermal alteration slows decomposition. Glob Change Biol. 2020; 00: 1-17.

the bacteria, restricting microbial access to the organic matter and therefore reducing decomposition of the peat. This reduction in temperature sensitivity is important for peatland response to climate change. Significantly these results support the idea that low-severity fires can help organic matter in peat survive and better protect the carbon stores from decomposition. Such low-severity fires can stabilise carbon contained in the peat and prevent its loss as carbon dioxide while causing little change overall to the chemistry of the peat. These fires created a coating on the surface of the peat that resists water with minimal structural changes to the soil.

This is important to reduce post-fire evaporation and prevent exposure of the carbon stock. Maintaining the water and preventing loss through evaporation will also help prevent severe fires, which can be caused by dehydration of the peatlands, leading to damage of the carbon stores in the peat. These low-severity fires can increase resistance to water and create an insulating layer.

There is strong evidence that the chemistry of the soil surface is significantly altered by the heat of the fire. This temperature change at the surface reduced the rates of microbial respiration by limiting their access to organic matter. This can reduce the amount of CO2 released, and also make the soil and the microorganisms within it less sensitive to temperature changes – an important possibility when considering climate change. This change may increase the stable carbon found in the layers of peat and increase the proportion of organic matter that persists. This process of low-severity fire is an underestimated, yet potentially important part of the global carbon cycle in peatlands.

The cutting of vegetation is increasingly being promoted as a less-damaging alternative to burning. However, very little is known about the long-term effects on vegetation structure and composition or associated carbon fluxes. Cutting does not remove the fuel load, as the brash is usually left rather than removed, which in turn releases GHG as it decomposes, whilst remaining a risk of uncontrolled ignition prior to this. We do not know the fate of this material in relation to the pyrogenic charcoal created during a controlled 'cool' burn. Furthermore, compression is highlighted as a problem in drained lowland peat which is exacerbated by the passage of machinery through compaction. Whilst the University of York identified that there is little compaction due to machinery movements in the short term this has not been explored over the long term and under continuous passes by large machinery in upland situations where topography and access can present a major challenge.

Further work is needed on the role of seasonal re-wetting of lowland peatland not least the timescales required to ensure that if re-wetting is part of a rotation it is 'wetted' long enough to be a net gain when drained again.

Whilst re-wetting to restore peatland may result in lower C losses, the impact on methane emissions and, more importantly in lowland situations, nitrous oxide needs exploration. Work by Liu[6] suggests that "*Even after rewetting, highly degraded soils*

[6] H Liu *et al* (2019) Soil degradation determines release of nitrous oxide and dissolved organic carbon from peatlands *Environ.*

may exhibit high N_2O release rates." Back in 2010 the Natural England assessment of England's Peatlands (NE257) stated that "*The impact of re-wetting peatland on the nitrous oxide emissions seems to depend strongly on type of peatland and its previous management. Restoration generally reduces the minimal nitrous oxide emissions from drained low nutrient raised and blanket bogs. The picture is less clear with the re-wetting of drained and fertilised agricultural peatlands, where some studies show reductions but others have observed increased N_2O emissions*."

A counter-theory relating to re-wetting lowland peatland is that overall N_2O emissions are lower. Although in general re-wetting soil increases N_2O emissions, in the case of lowland peatlands overall N_2O production reduces, as it's stabilising some of the organic matter and slowing down the release of N ready for volatilisation. Additionally N_2O is quite hard to measure as it is emitted only under certain conditions.

More research is clearly required across different sites, different management sequences and at different stages of restoration. Timescales are important as GHG emissions could spike before reducing due, for example, to an increase in losses of C through DOC directly after re-wetting. Kaduk *et al* in 2018[7] reported that a fen under restoration management was still a small and consistent C source 15 years after agricultural use.

Q5. One of the prime goals of the Nature for Climate Fund is Greenhouse Gas abatement. How could we achieve the right balance between upland and lowland restoration sites, given their relative differences in abatement potential?

The differences are not just in abatement potential. The opportunity costs of lowland restoration are much higher due to the high asset value and value of the agricultural output. The right balance will therefore need to reflect this as well as the abatement potential. The current focus on SSSI condition results in an undue focus on upland peatland sites. Furthermore the favourable condition score for SSSIs, as determined by the Common Standards Monitoring for Upland Habitat referred to above, is a high bar to achieve given the size of grouse moor SSSI units.

The Nature for Climate Fund should support nature-based solutions that deliver more than one objective as this would ensure value for money and provide an appropriate balance between restoration objectives in upland (biodiversity, water quality) and lowland (food production, biodiversity) sites. As has been stated many times before, nature and carbon management are interrelated, and must be managed as such.

The 25YEP has a stated ambition to manage soils sustainably. Given soil losses in lowland peatland and the importance of this area to our food security more focus should be on protecting remaining peatland stocks through designing ELM options

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Res. Lett. **14** 094009

[7] Kaduk *et al* Carbon Loss from Fenland Soils Under Intensive Agricultural Use Compared to Seminatural and Restoration Management. American Geophysical Union, Fall Meeting 2018, abstract #B21A-01

that provide an economic rationale for adoption either through grants that support new cultivation methods, rotational re-wetting or through financial support for adopting less intensive, longer rotations with 'break' crops that create the conditions for minimizing peat soil erosion/loss; (Buschmann *et al* suggested reimbursement for yield losses and investment costs[8]). The key to ensuring take up of funding opportunities to abate GHG emissions on lowland sites will be successful land manager engagement. Buschmann *et al* suggests that "*the most accepted [alternatives] were those in which the water level is kept constant or raised only moderately*". This is likely to preclude extensive re-wetting which implies a higher water table and the cessation of conventional agriculture. Submerged (or controlled) drainage has been used effectively in high productivity areas in the Netherlands. Despite high investment costs, Buschmann *et al* found that this approach had the lowest CO_2 abatement costs as subsidence rates can be halved in this way resulting in emission reductions of up to 50%. The new Lowland Agricultural Peat Taskforce needs to look into ways of sustainably managing our remaining lowland peatlands in the face of the need for continued food production, otherwise there is a risk that environmental degradation will merely be translocated to other locations to satisfy consumer demand.

Q6. How should government use the Nature for Climate Fund to help stimulate the development of a market for private sector investment in ecosystem services and nature-based solutions to climate change?

By appropriately 'valuing' sustainable approaches that deliver multiple ecosystem services (including food production) rather than focusing on individual solutions such as tree planting.

We envisage a blended finance model could work here especially where provisioning services are part of the over-all mix. Engaging the food supply chain companies and farmers who have their own net-zero targets is essential.

If the decision is made to ban prescribed burning on peatlands (i.e. controlled 'cool' burns during the burning season), what would the Government's alternative strategy be for managing vegetation on peatlands to minimise wildfire incidents and protect restored peatlands and how might this 'service' be funded? As we point out in answer to Q5 and Q10, upland land managers currently provide a controlled 'cool' burning service. It will be important for Government to consider the opportunity cost of this private sector service and understand who will be responsible for its design and delivery given the lack of knowledge of the effectiveness of alternative strategies in different landscapes.

Q7. What other actions, if any, could help to transform the level of peatland restoration in England?

[8] Buschmann *et al* Perspectives on agriculturally used drained peat soils: Comparison of the socioeconomic and ecological business environments of six European regions. Land Use Policy 90 (2020) https://doi.org/10.1016/j.landusepol.2019.104181

We believe management practices, such as sustainable grouse moor management, can protect this vital ecosystem from more intensive management practices, wildfire and contribute to improving biodiversity and economic resilience. Grouse moor managers will wish to play their part in contributing to reduced emissions; for instance grouse moor managers have been pivotal in the Yorkshire Peat Partnership, Moors for the Future and Lancashire Peat Partnership projects (see also answer to Q8 below).

Better understanding of how local emissions can be managed and reduced is needed; much of this better understanding could be generated 'on site' suggesting an adaptive (learn by doing) approach could be successful. This is discussed further below.

Q8. Where are the strategic locations where partnerships can work together on large-scale peatland restoration projects, as a contribution to the Nature Recovery Network?

Both Government and grouse moor managers have a vested interest in sustainable environmental and biodiversity outcomes. The GWCT's Peatland Report 2020 highlighted that all grouse moors are located on peatland (either dry heath or bog) and are important strongholds for upland waders as evidenced by research undertaken by the GWCT at Otterburn[9] and Langholm[10]; consequently most are designated.

Grouse moor management is a key economic and social driver underpinning the human effort needed to deliver key environmental and biodiversity outcomes in line with Government policy objectives. For example, grouse moors have the capacity to contribute significantly to the delivery of Government biodiversity outcomes, in particular upland wader populations, as well as contributing to the restoration of blanket bog and the reduction of carbon emissions.

Much of the restoration work undertaken has seen investment by grouse moor owners supplementing Government funded schemes thereby supporting the delivery of a wide range of public benefits. The manpower employed by grouse moors is important in helping to fight wildfires as well as implementing peat bog restoration over large areas of England's uplands. The Moorland Association report that grouse moor managers have been actively blocking up drainage ditches for 15 years or more and have been pivotal in the world leading peatland restoration efforts made in England. It is a misconception that grouse moors are drained to improved habitat for grouse – it is to improve grazing for ruminants.

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9 Fletcher, K.L., Aebischer, N.J., Baines, D., Foster, R., & Hoodless, A.N. (2010). Changes in breeding success and abundance of ground-nesting moorland birds in relation to the experimental deployment of legal predator control. Journal of Applied Ecology, 47: 263-272.

[10] Ludwig SC, Roos S, Baines D (2019) Responses of breeding waders to restoration of grouse management on a moor in South-West Scotland. Journal of Ornithology 160: 789–797.

We therefore believe there is a shared desire to protect peat, enhance biodiversity and maintain living, working landscapes. We believe grouse moor managers should be given the opportunity to set out their 'environmental offer' for the future and work together to make a difference at scale. This approach would support the concept of 'Nature Recovery Network(s)... (to help achieve) landscape-scale recovery for peatland'.

Grouse moors should be encouraged to work together at the landscape-scale on a similar basis to the Farmer Cluster model. These farmer-led groups grew out of Defra's Nature Improvement Areas and have been shown to provide a high level of engagement with, and delivery of, conservation and environmental outcomes. Moors for the Future in the Peak District has also been a successful partnership.

On lowland peatlands encouraging the creation of Fenland farmer clusters allows for a combined net zero/multi-ecosystem services approach across a number of farms so that those with less productive land support those with the greatest focus on food production. Farmer Clusters (farmer-led conservation groups) is a concept, developed by the GWCT, which has proven valuable in linking different farmer's ambitions across a landscape. Farmer's work together voluntarily at the landscape scale to improve biodiversity, soil quality and the environment on their farms. Land manager/farmer motivation is an important facet of conservation success and so it is vital that the Peatland Strategy promotes such approaches.

If Fenland rotational re-wetting is found to be effective in reducing shrinkage and oxidation of peat, and not contribute to other GHG emissions then it will require a co-ordinated action with the Drainage Boards and the farming community. If pumps are switched off and water table levels allowed to rise this will affect all those who own and farmland in the drainage catchment. There is also an increased risk of flooding which will require management as the buffering capacity of the soil to absorb sudden and sustained rainfall events will be diminished.

Q9. What actions are best used in these places to recover and conserve peatland wildlife?

The best actions are those that have been scientifically proven to support peatland biodiversity. We covered this topic in our recent GWCT Peatland Report (section 6 – Biodiversity and grouse moor management) but for ease we reiterate some of the points we made here.

Our on-going work suggests that grouse moor management produces suitable habitat for a range of upland birds, especially waders (dunlin, golden plover and curlew). The UK holds an estimated 27% of the global population of curlew, which is in steep decline. Significantly curlew and golden plover prefer the shorter vegetation provided by cotton-grass, moss and recently burned heather. Previous GWCT research shows that the abundance of waders (main species combined) was on average six-fold higher on moors with either high levels of managed burning or higher levels of sheep grazing than on two large moors with no burning and where

sheep were virtually absent. Consequently cessation of managed burning on peatlands, when combined with the reduced sheep grazing that has occurred over the last two decades, is predicted to have negative repercussions for already declining upland waders.

Although data on the effect of burning on many invertebrates associated with peatland management are limited, the main management objective to encourage invertebrate species is habitat and structural diversity, according to Natural England; similar to the aims of grouse moor managers in providing habitat for red grouse. Natural England states 'For invertebrate conservation on moorland, the main management objective is to maintain or increase the habitat diversity and the structural diversity of the vegetation, which will assist in increasing the diversity of invertebrate species.' Whilst they go onto state very intensive grazing, burning or cutting causes breaks in the continuity and the condition of habitats, we are of the opinion that the small size of prescribed burns is not likely to create a problem for most invertebrates. Invertebrate populations are important to upland managers as they provide a major food source for red grouse as well as other upland waders such as dunlin and golden plover.

The point of these examples is that if land management policy were to change and result in longer vegetation and lack of structural diversity, populations of some of the important upland species (including red listed species) may be put at risk.

It will also be important to know what individual sites hold and what is missing; this can help chart the best approach to recovering and conserving wildlife on peatlands.

Q10. How should the government determine the right balance between more sustainable management and restoration of lowland agricultural peatlands?

Long term food security is at risk as our highly productive Fenlands are experiencing ongoing soil/fertility loss. Wastage varies from 10 to 25mm per year, depending on drainage and other factors, but these are not recent estimates. Self sufficiency in indigenous foods has dropped from over 80% in the 1980's to 53% today and is still falling. The wholesale abandonment of food production from drained peatland soil is not realistic from an economic or sustainability perspective, without considering the impacts on land elsewhere on the planet and the food miles and emissions generated by their transportation. We do not feel that it realistic to consider large-scale restoration (and paludiculture) with these soils – they are more suited to reduced management and protection measures. We welcome the establishment of a task force to look at how this might be best achieved.

This view is supported by research undertaken by Graves & Morris[11] who go on to suggest that climate change will increase annual lowland carbon losses over time resulting in higher annual degradation costs and lower agricultural net margins. This

[11] Graves, A.R. and Morris, J. 2013. Restoration of Fenland Peatland under Climate Change. Report to the Adaptation Sub-Committee of the Committee on Climate Change. Cranfield University, Bedford.

means that restoration benefit:cost ratios do turn positive in the longer-run. This work is cited in a recent CCC report[12] which states "*This indicates that at some point lowland restoration will become worthwhile, and therefore that a longer time-horizon than that considered by land managers needs to be adopted. However, by the time this is more demonstrably and publicly apparent, it may be too late to instigate restoration since the damage may be irreparable*." It is clear action is needed now but adaptive not prescriptive.

Maps of peatland soils are more than 30 years old and up-to-date information on the extent and depth of the peat is badly needed. We need to develop better maps defining where peatland soils are located and a better understanding of the sub-soil processes where peat is not the predominant soil surface component. Many drained soils on silt/skirt land have substantial deposits of under-lying peat which will be oxidizing and shrinking invisibly.

Q11. What other land uses or management practices could we include in the "Reduce" category?

Restorative rotations – sustainable rotations are those which balance the return of soil carbon with the depletion which inevitably occurs when land is drained and farmed, particularly for arable cropping. Although many arable crops do return organic matter to the soil the loss generally exceeds the gain on peatland soils. To counteract this restorative crop phases are required and should be supported under a future Environmental Land Management Scheme. In addition consideration should be given to the use of cover crops over–winter to improve soil structure. Research on low-lying agricultural peat soils found that decomposition and pedogenic alterations lead to the loss of structural pores resulting in the degradation of the soil structure and a reduction in the soil capacity to store, retain and transmit water[13].

Opportunities such as these should be explored so that the integrity of the remaining lowland productive peat resources is maintained.

Q12. How should government ensure that a successful horticultural industry can operate without peat?

Not answered as not our area of expertise.

Q13. How can we ensure a better balance between tree-planting, peatland restoration and nature recovery?

By avoiding single topic approaches to climate change. Tree planting has become an easy win/low hanging fruit and is being adopted without context. Policy focus should be on multiple ecosystem service delivery. Blanket planting of trees threatens the ecology of whole landscapes and the livelihoods of the inhabitants. There are

[12] Committee on Climate Change supporting research "Impacts of climate change on meeting Government outcomes in England - Peatlands case study. July 2019

[13] Kechevarzi et al (2010) Physical properties of low-lying agricultural peat soils in England. Geoderma 154(3):196-202

sufficient hedgerows in the UK to accommodate a substantial number of new trees without taking land out of production – enough for around 40 million trees. This would have limited impact on food production and in some areas provide aesthetic and welfare benefits to livestock, although we accept in open landscapes this would be inappropriate and damaging.

Furthermore changing Woodland Grant Scheme rules and ensuring that ELM allows for low density, small scale tree plantings of appropriate tree species in less productive and suitable landscape areas on farmland would increase planting rates. This, coupled with schemes which promote agroforestry, where food production and carbon sequestration can occur concurrently, would be a preferable approach as opposed to blanket tree planting schemes, which in some instances have been shown to cause environmental damage as well as not sequestering carbon as much as thought due to soil carbon losses. Friggens *et al* (2020) demonstrated that "*the decline in SOC cancelled out the increment in C stocks in tree biomass on decadal timescales*" on peatland soils in Scotland.

Recent research suggests that cessation of controlled burning on upland peatland sites may result in those sites having poorer quality habitat and a lower wading bird population, which may lead to further declines amongst an already threatened group of birds.

The strategy should not seek to reduce the ecosystem manager's toolkit. The focus should be on learning how to use the different techniques better to achieve the multiple outcomes desired and to assessing each peatland area individually so that the most important tool(s) that address the outcomes desired can be applied.

Q14. What should be included in our approach to reducing the risk of wildfire?

Climate change is the over-riding threat to peatland restoration, with the threat of wildfire frequency and extent an accompanying risk. Consequently we believe it is valid, on current evidence, to take the view that rewetting will not prevent wildfire ignition because of the increased likelihood of extended dry periods brought about by climate change; this will require reduction in fuel loads (GWCT peatland report p.11, 6.7). This view is supported by research from Canada and Scandinavia quoted in the recent (July 2020) NE Wildfire Evidence Review (NEER014) - "*without the recovery of a* Sphagnum *layer*, *rewetting alone is insufficient to reduce the risk of deep burning unless the water table remains at the peat surface*" (Granath *et al*. 2016[14]).

The role of controlled 'cool' burns undertaken in the burning season in wildfire containment has become embroiled in the debate over grouse moor management, which is unhelpful. We believe that rather than distinguish between burn types (i.e. controlled burns or wildfire), a better indicator would be to use fire severity and to monitor the long-term environmental responses of peatlands to this. Not all burning

[14] Granath, G., Moore, P.A.., Lukenbach, M.C.. & Waddington, J.M. 2016. Mitigating wildfire carbon loss in managed northern peatlands through restoration. *Scientific reports*, 6:28498.

is the same. It is important to distinguish between 'hot' fires, which tend to happen in spring and summer (NEER014) and can burn into the underlying peat, and 'cool' burns designed to burn surface vegetation and which generally only take place within the 'burning season' (1 October-15 April) in the uplands. This distinction is important when considering peatland restoration and wildfire. The new paper published in May 2020 by Flanagan *et al,* which we reviewed in answer to Q1, shows that low-severity fires can increase the pool of stable soil carbon by thermally altering the chemistry of soil organic matter (SOM) and reducing rates of microbial respiration thereby protecting carbon stores from decomposition for thousands of years.

In our recent report we explored this further and commented that *"..in the process of restoring [peatland] sites, careful monitoring of fuel will be needed to avoid a build-up of fuel load during the transition between vegetation communities. Rewetting of peatlands should improve the resilience to wildfires under typical conditions, but these sites are still potentially flammable, particularly under environmental stress (e.g. persistent drought). Water tables typically drop in the summer especially in dry seasons. …wildfire experts also state that on restoration sites 'fuel load build-up' could threaten the success of such schemes if not carefully monitored. In other words, the threat of wildfire remains even on restoration sites …"*

Using controlled 'cool' burns during the burning season akin to those practiced by modern grouse moor managers to remove the vegetation canopy without burning into the peat or moss layer has a role to play alongside re-wetting in wildfire containment. That this management is currently carried out and financed by the private sector is an important consideration; current land managers provide a controlled 'cool' burning service that helps minimize wildfire occurrence. Any move away from 'cool' burns needs to consider the cost of future management and who will bear this cost. Zero management has a low financial cost but a huge environmental cost in the event of wildfire. Alternative management strategies also come at a cost and the effectiveness of these is uncertain in different landscapes.

In our Peatland Report 2020 we highlight lessons from the USA experience of managing fire-prone ecosystems via fire exclusion. These well-intentioned policies, which stopped managed burning of ground vegetation from the 1930s onwards, have directly led to severe declines in some bird species and the incredibly damaging forest wildfires of today.

Importantly heather and peatland vegetation is adapted to burning with plant populations able to recover well from 'cool' burns. This is not the case with severe wildfires which burn at very high temperatures removing not only the surface vegetation but also burn into the plant roots, remove the seedbank and burn the underlying peat, possibly down tens of centimetres, representing centuries of sequestered carbon. Plants do not recover from such intense burns. Liverpool University (Marrs, pers comm) estimated that Saddleworth moor wildfire in 2018 resulted in seven centimetres of peat being lost; this will take up to 200 years to restore (on the basis of a minimum of 29 years to recreate one cm of surface peat).

In addition it is estimated that the Saddleworth wildfire resulted in the release of 17,798tCO2–26,281tCO2 from soil carbon losses (no calculation of carbon from surface biomass was included) and had a significant negative effect on air quality and biodiversity.

We mentioned at the outset the risk of unintended consequences without sufficient research or ongoing monitoring. Natural England recognized that evidence gaps existed in its recent Wildfire evidence review (NEER014). For example more research is needed into the impact of wider management interventions such as reduced livestock stocking densities on peatlands to minimize impacts on vegetation resulting in longer grass and more fuel load. Wildfires are not unique to peatlands; they occur on lowland heaths and grasslands too.

GWCT ran an All-Party Parliamentary Group (APPG) discussion in Westminster in February 2019 on wildfire and would highlight some of the outcomes identified from that session. In particular:

- there is a need for a UK Fire Danger Rating System.
- within Government the Home Office, Defra and the Cabinet Office are involved in wildfire policy. A more integrated approach is required.
- more funding is required for long term research studies into the effect on wildfire severity of managed (grouse moors) and unmanaged peatland regimes across a range of sites (to allow for regional differences). The evidence produced will be important for developing mitigation strategies and guidance for land managers that are tailored to a given area.
- mitigation is important. There is a need for an informed, cohesive and balanced mitigation policy with appropriate guidance for land managers.
- existing fire groups should be used to help identify risk of wildfire and work with land managers to develop Wildfire Management Plans and Wildfire Response Plans such as the Upland Management Group's Risk Assessment Guidance.

As a general point we would not favour the use of regulation or protection measures as these can limit the ability of land managers to adapt to very localized conditions resulting in unforeseen consequences as well as preventing the development of progressive management approaches. Given appropriate motivation, land manager engagement is the most productive approach to peatland conservation for the reasons given in answer to Q8 which includes wildfire mitigation. The use of long-term management agreements under ELM or conservation covenants or "nature-based solutions" PES-type contracts (as opposed to purely carbon contracts) would be more appropriate.

Q15. What other practices that would be considered damaging, should be reflected under the "Protect" category?

1. *Single year FBTs on peat soils* are in our opinion a particular cause for concern as these short-term contracts are impacting on future productivity through the degradation of soil structure and health. This addresses one of the Government's ambitions stated in the 25YEP, specifically "*Using and managing land sustainably… addressing factors in soil degradation such as erosion, compaction and the decline in organic matter*". In addition currently land let on short term agreements does not meet the eligibility criteria for environmental payments as the applicant does not have management control for the period of the agreement i.e. a minimum of 5 years. This encourages unsustainable, excessively exploitative soil management.

2. *Re-wetting upland wet pasture*. Upland grazed pasture on under-lying peat is a significant source of emissions due to drainage. We are concerned that if this source of emissions is targeted, given low opportunity costs, and these pastures re-wetted there could be unforeseen consequences for stock health (poaching, foot rot), over-wintering (have local farmers got sufficient housing?) and biodiversity (such pastures are favoured by many threatened wader species as well as Black Grouse, meadow flora and invertebrates that are a key food source).

Q16. Would you like to participate in a roundtable in July?

We would very much welcome the opportunity to discuss the points we have raised.

Game & Wildlife Conservation Trust
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