**UK POST-WORKSHOP VOTING QUESTIONNAIRE**

**Developing Core Common Outcomes for Peatland Research and Monitoring**

**Important information before you start – please print or sign**

Information you should know before deciding if you will sign below to indicate that you consent to proceed with the survey:

* This research is funded by NERC (via their Valuing Nature Programme) and ESRC, in collaboration with IUCN, Defra and the United Nations
* The research is being led by Prof Mark Reed in collaboration with Dr Dylan Young and Dr Gav Stewart from Newcastle University and the VNP Peatland Tipping Points project. For more information, visit: https://www.peatlandtippingpoints.com/. Prof Reed is Research Lead for IUCN UK Peatland Programme and CEO of Fast Track Impact Ltd.
* The research has is covered under ethics permission from the Newcastle University granted to the Peatland Tipping Points project
* Your participation in this research is voluntary and have the right to withdraw from the research at any point, and to ask for your data to be destroyed.
* We will not store personal information about you, in line with GDPR, and will not ask for your name, so the data you provide will remain fully confidential
* Data will be stored long-term in the UK Data Archive. For full data management plan contact mark.reed@newcastle.ac.uk
* Analysed data will be used in a manuscript that will be submitted to *Conservation Biology* in 2020, led by Dr Stewart

I have read and understood the information above and consent to the data I provide being used in these ways (please either type your name here, use an electronic signature or sign and scan this page):

Signature/PRINT NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Name (if signed): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Thanks in advance for your help and time!

Mark Reed

Professor of Socio-Technical Innovation, Newcastle University

**Background**

**The challenge.** The restoration of damaged peatlands has been identified as a key option for reaching net zero emissions by 2050 by the Committee on Climate Change, but debate continues to rage over the effects of restoration and management decisions, such as whether or not to allow managed burning. However, despite a growing research base, decisions in peatland policy and practice are often constrained by a lack of evidence, as it is difficult to combine insights from different studies about the same issue when studies measure different outcomes in different ways, and do not fully or consistently report the data.

**The goal.** To address this challenge, we are facilitating a consensus building process to identify a core list of outcome measures that could be used to study and monitor restoration outcomes. This is of relevance to Defra’s forthcoming England Peat Strategy and the identification of indicators to monitor their 25 year environment plan, and to each of the Devolved Administrations as they seek to evaluate the effects of policies that have funded peatland restoration in Scotland, Wales and Northern Ireland. Publication of the work in collaboration with Newcastle University and the UN’s Global Peatland Initiative, will lead to an increase in the amount of synthesisable data, enabling systematic reviews and meta-analyses to underpin future evidence-based policy and practice in the UK and internationally.

**The approach.** A number of variables, or “outcome measures”, have been identified and grouped into outcome sets: climate mitigation, biodiversity and hydrology outcomes, and contextual variables that are necessary to interpret these outcomes. This was done via a survey and expert workshop in Newcastle in March 2019. The purpose of this survey is to reach consensus across the wider peatland research, policy and practitioner community on the most important outcomes that should be measured by research and monitoring initiatives.

**How to complete this questionnaire**

1. **Rate your expertise to choose which outcome set(s) to rate:** The first section of the questionnaire helps us understand who you are, and the nature of your expertise. Please rate your expertise in each of the three areas, and only then rate outcome variables in your areas of expertise (e.g. if you rated your expertise as C, D or E in biodiversity, you would skip the biodiversity outcome measures, and if you rated your expertise as A or B for hydrology, you would rate the hydrology outcome measures). At any point, if you do not understand or feel qualified to rate an outcome measure, please leave it blank.
2. **Rank outcomes:** For the outcome set(s) in which you have expertise (biodiversity, hydrology or climate change), rate each outcome in turn, using the scale below, as **low** **(write 1, 2 or 3), medium (4, 5 or 6) or high (7, 8 or 9)** priority.

Ranking scale:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **LOW** | | | **MEDIUM** | | | **HIGH** | | |
| Not important | | | Not important but optional | | | Important | | |

For each outcome measure:

* 1. Consider first if you agree that this **outcome measure (e.g. peak flow)** is important or not (a low/medium/high priority) for monitoring policies or practices that aim to deliver outcomes in the **core area** you are evaluating (e.g. protecting or restoring peatland **hydrology**).
  2. Then consider if it should be a priority to measure this outcome (in this example, peak flow again) for policies and practices that seek to deliver outcomes in the **other two core areas** (in this example, you are asking if it is important to measure peak flow to determine the success of policies/practices to mitigate climate change or biodiversity). In the worked example over the page, the respondent suggests that “peak flow” is “high” (9) priority for monitoring policies and practices targeting hydrology, “medium” (5) for biodiversity policies and practices and “low” (2) for climate mitigation policies and practices.
  3. For each core area, there is an identical list of **contextual variables**. For these you only need to decide if these are high, medium or low priority for measuring alongside the outcome measures listed in that core area, to aid the analysis and interpretation of biodiversity, hydrology or climatic data. There is an identical list of contextual variables in each core area – please rate these variables for each core area in which you have rated your expertise as high (A or B in question 3), considering their relative importance for analysing and interpreting data in that specific set. In the worked example over the page, the respondent considers that “altitude” is an important piece of contextual data to have alongside any hydrological outcome measures
  4. **If you are not sure** what any of the outcome measures or contextual variable mean, please leave the row blank

**Worked example**

**Core area: Hydrology**

|  |  |  |  |
| --- | --- | --- | --- |
| **Outcome measures:** | How important is it to collect data on each outcome measure if we want to evaluate policies and practices that aim to deliver: | | |
| **Water quality and/or flood risk mitigation** (1-9) | **Biodiversity**  (1-9) | **Climate change mitigation** (1-9) |
| Outcome set: Surface water |  |  |  |
| Peak flow | 9 | 5 | 2 |

|  |  |
| --- | --- |
| **Contextual variable** | How important is it to measure these variables alongside **hydrological** data collection?(1-9) |
| Altitude | 8 |

**Part 1: Your expertise**

1. What organisation do you work for or are you affiliated with?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What is your job title or role?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. How would you rate your expertise in UK peatlands (including any type of peatland that occurs in the country)?

**Hydrology** (please circle):

My experience and/or expertise in this area:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| None | A little | Some | Extensive | Expert |

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|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| I have no working knowledge of this topic | I work on related areas but I am relatively inexperienced and possess a basic understanding of the topic | I have some experience in this field, but my knowledge of the topic is limited. I would not be comfortable in providing advice and guidance about the topic | I regularly work in this field and have a very good working knowledge of the topic. I have contributed to field guides or the research literature about this topic | I work extensively in this field and have a full working knowledge of the topic. I actively contribute to the research literature about this topic |

**Biodiversity** (please circle):

My experience and/or expertise in this area:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| None | A little | Some | Extensive | Expert |

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|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| I have no working knowledge of this topic | I work on related areas but I am relatively inexperienced and possess a basic understanding of the topic | I have some experience in this field, but my knowledge of the topic is limited. I would not be comfortable in providing advice and guidance about the topic | I regularly work in this field and have a very good working knowledge of the topic. I have contributed to field guides or the research literature about this topic | I work extensively in this field and have a full working knowledge of the topic. I actively contribute to the research literature about this topic |

**Climate change** (please circle):

My experience and/or expertise in this area:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| None | A little | Some | Extensive | Expert |

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|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| I have no working knowledge of this topic | I work on related areas but I am relatively inexperienced and possess a basic understanding of the topic | I have some experience in this field, but my knowledge of the topic is limited. I would not be comfortable in providing advice and guidance about the topic | I regularly work in this field and have a very good working knowledge of the topic. I have contributed to field guides or the research literature about this topic | I work extensively in this field and have a full working knowledge of the topic. I actively contribute to the research literature about this topic |

**Next step: please read**

Based on your answer to question 3 (whether or not you ticked any of the indicators of expertise in question 4), please now proceed to the sections (hydrology, biodiversity or climate change) in which you rated your expertise as A or B, ignoring sections where you rated your expertise C, D or E:

* I rated my expertise A or B for **hydrology** in question 3: **please proceed to section 2**
* I rated my expertise A or B for **biodiversity** in question 3: **please (also) proceed to section 3**
* I rated my expertise A or B for **climate change** in question 3: **please (also) proceed to section 4**
* I rated my expertise C, D or E in all categories: please proceed no further – thank you for your help!

**Part 2: Hydrology core area**

Rate each outcome in turn as **low** **(write 1, 2 or 3), medium (4, 5 or 6) or high (7, 8 or 9)** priority. Note: please only write numbers (1-9) in the questionnaire.

Rating scale:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **LOW** | | | **MEDIUM** | | | **HIGH** | | |
| Not important | | | Not important but optional | | | Important | | |

For each outcome measure below:

* Consider first if you agree that this **outcome measure (e.g. peak flow)** is important or not (a low/medium/high priority) for monitoring policies or practices that aim to deliver outcomes in the **core area** you are evaluating (e.g. protecting or restoring peatland **hydrology**)
* Then consider if it should be a priority to measure this outcome (in this example, peak flow again) for policies and practices that seek to deliver outcomes in the **other two core areas** (in this example, you are asking if it is important to measure peak flow to determine the success of policies/practices to mitigate climate change or biodiversity)

If you are not sure what any of the outcome measures mean, please leave the row blank.

|  |  |  |  |
| --- | --- | --- | --- |
| **Outcome measures:** | How important is it to collect data on each outcome measure if we want to evaluate policies and practices that aim to deliver: | | |
| **Water quality and/or flood risk mitigation** (1-9) | **Biodiversity**  (1-9) | **Climate change mitigation** (1-9) |
| Outcome set: Water table |  |  |  |
| Water-table depth - direct |  |  |  |
| Water-table depth inferred from vegetation composition |  |  |  |
| Rate of change in water-table depth |  |  |  |
| Palaeoecological measures |  |  |  |
| Water-table variation |  |  |  |
| Summer water-table depth |  |  |  |
| Duration at summer water-table depth |  |  |  |
| Annual max/min water-table |  |  |  |
| Outcome set: Groundwater flow |  |  |  |
| Hydraulic conductivity |  |  |  |
| Infiltration rates |  |  |  |
| Water-table height |  |  |  |
| Hydraulic head |  |  |  |
| Hydraulic gradients |  |  |  |
| Peat pipes |  |  |  |
| Pore size |  |  |  |
| Outcome set: Hydrological connectivity |  |  |  |
| Network index |  |  |  |
| Ditch drainage networks |  |  |  |
| Gully drainage networks |  |  |  |
| Streamflow |  |  |  |
| Outcome set: Surface water |  |  |  |
| Change in area of water |  |  |  |
| Overland flow (surface flow) |  |  |  |
| Peak flow |  |  |  |
| Flooded / not flooded |  |  |  |
| Outcome set: Water balance |  |  |  |
| Rainfall |  |  |  |
| Evapotranspiration |  |  |  |
| Water management records |  |  |  |
| Storm intensity |  |  |  |
| Interception losses |  |  |  |
| Discharge from catchments |  |  |  |
| Peatland surface levels change (“bog breathing”) |  |  |  |
| Outcome set: Moisture/water content |  |  |  |
| Canopy vegetation |  |  |  |
| Thickness of moss/litter layer |  |  |  |
| Volumetric water content above water table |  |  |  |
| Specific yield (drainable porosity) |  |  |  |
| Change in vegetation cover (drying stress) |  |  |  |
| Pore-water pressure |  |  |  |
| Outcome set: Topographic survey |  |  |  |
| Peatland shape and extent |  |  |  |
| Location of ditches, gullies and streams |  |  |  |
| Catchment area |  |  |  |
| Topographic indices |  |  |  |
| Surface flow rates related to vegetation |  |  |  |
| Flow attenuation |  |  |  |
| Landform (microtope etc.) |  |  |  |
| Surface roughness |  |  |  |
| Landform (microtope etc.) |  |  |  |

Certain contextual variables need to be collected alongside data for the outcome measures above to aid the analysis and interpretation of results. Please now rank the importance of the following contextual variables, on the basis of how important you think it is to collect these alongside **hydrological** data:

|  |  |
| --- | --- |
| **Contextual variable** | How important is it to measure these variables alongside **hydrological** data collection?(1-9) |
| Atmospheric deposition |  |
| Burning |  |
| Grazing |  |
| Subsidence |  |
| Drainage |  |
| Macrofossil analysis |  |
| Site history including former land use and management practices |  |
| Current land use and management practices |  |
| Depth of acrotelm/catotelm |  |
| Topography |  |
| Aspect |  |
| Altitude |  |
| Site location |  |
| Time/season |  |
| Temperature |  |
| Rainfall |  |
| Humidity |  |
| Evaporation rates |  |
| Evapotranspiration rates |  |

*Note: this table is identical across all three core areas, but you are being asked to rank how important each variable is to collect alongside data in each core area. For example, you may think that topography is more important to measure alongside (to help analyse and interpret) hydrological or biodiversity outcome measures, compared to climate change outcome measures.*

**Next step:** If you rated your expertise as high (A or B in question 3) in biodiversity, please proceed to Part 3 of this questionnaire. If you only rated your expertise as high in hydrology, please ignore the following parts. You have now completed the questionnaire – thank you! **Part 3: Biodiversity core area**

Rate each outcome in turn as **low** **(write 1, 2 or 3), medium (4, 5 or 6) or high (7, 8 or 9)** priority. Note: please only write numbers (1-9) in the questionnaire.

Rating scale:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **LOW** | | | **MEDIUM** | | | **HIGH** | | |
| Not important | | | Not important but optional | | | Important | | |

For each outcome measure below:

* Consider first if you agree that this **outcome measure (e.g. abundance of key bird species)** is important or not (a low/medium/high priority) for monitoring policies or practices that aim to deliver outcomes in the **core area** you are evaluating (e.g. protecting or restoring peatland **biodiversity**)
* Then consider if it should be a priority to measure this outcome (in this example, peak flow again) for policies and practices that seek to deliver outcomes in the **other two core areas** (in this example, you are asking if it is important to measure peak flow to determine the success of policies/practices to mitigate climate change or biodiversity)

If you are not sure what any of the outcome measures mean, please leave the row blank.

**Note:** the order of the last three columns is different to the previous core area.

|  |  |  |  |
| --- | --- | --- | --- |
| **Outcome measures:** | How important is it to collect data on each outcome measure if we want to evaluate policies and practices that aim to deliver: | | |
| **Biodiversity**  (1-9) | **Water quality and/or flood risk mitigation** (1-9) | **Climate change mitigation** (1-9) |
| Outcome set: Birds (key species) |  |  |  |
| Abundance |  |  |  |
| Composition |  |  |  |
| Presence / absence |  |  |  |
| Distribution |  |  |  |
| Breeding success |  |  |  |
| Red list status |  |  |  |
| Outcome set: Vegetation (key species) |  |  |  |
| Abundance |  |  |  |
| Composition |  |  |  |
| Presence / absence |  |  |  |
| Distribution |  |  |  |
| Productivity |  |  |  |
| Cover |  |  |  |
| Structure |  |  |  |
| Outcome set: Invertebrates (key species) |  |  |  |
| Abundance |  |  |  |
| Composition |  |  |  |
| Presence / absence |  |  |  |
| Distribution |  |  |  |
| Biomass |  |  |  |
| Outcome set: Habitat |  |  |  |
| Tope |  |  |  |
| Habitat directive priority |  |  |  |
| Structure |  |  |  |
| Species distribution |  |  |  |
| Extent |  |  |  |
| Alpha diversity |  |  |  |
| Beta diversity |  |  |  |
| Functional diversity |  |  |  |
| Species richness |  |  |  |

Certain contextual variables need to be collected alongside data for the outcome measures above to aid the analysis and interpretation of results. Please now rank the importance of the following contextual variables, on the basis of how important you think it is to collect these alongside **biodiversity** data:

|  |  |
| --- | --- |
| **Contextual variable** | How important is it to measure these variables alongside **biodiversity** data collection?(1-9) |
| Atmospheric deposition |  |
| Burning |  |
| Grazing |  |
| Subsidence |  |
| Drainage |  |
| Macrofossil analysis |  |
| Site history including former land use and management practices |  |
| Current land use and management practices |  |
| Depth of acrotelm/catotelm |  |
| Topography |  |
| Aspect |  |
| Altitude |  |
| Site location |  |
| Time/season |  |
| Temperature |  |
| Rainfall |  |
| Humidity |  |
| Evaporation rates |  |
| Evapotranspiration rates |  |

**Note:** this table is identical across all three core areas, but you are being asked to rank how important each variable is to collect alongside data in each core area. For example, you may think that topography is more important to measure alongside (to help analyse and interpret) hydrological or biodiversity outcome measures, compared to climate change outcome measures.

**Next step:** If you rated your expertise as high (A or B in question 3) in climate change, please proceed to Part 4 of this questionnaire. If you only rated your expertise as high in biodiversity, please ignore the remaining part. You have now completed the questionnaire – thank you! **Part 4: Climate change core area**

Rate each outcome in turn as **low** **(write 1, 2 or 3), medium (4, 5 or 6) or high (7, 8 or 9)** priority. Note: please only write numbers (1-9) in the questionnaire.

Rating scale:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **LOW** | | | **MEDIUM** | | | **HIGH** | | |
| Not important | | | Not important but optional | | | Important | | |

For each outcome measure below:

* Consider first if you agree that this **outcome measure (e.g. rate of peat accumulation)** is important or not (a low/medium/high priority) for monitoring policies or practices that aim to deliver outcomes in the **core area** you are evaluating (e.g. protecting or restoring peatland **climate change**)
* Then consider if it should be a priority to measure this outcome (in this example, peak flow again) for policies and practices that seek to deliver outcomes in the **other two core areas** (in this example, you are asking if it is important to measure peak flow to determine the success of policies/practices to mitigate climate change or biodiversity)

If you are not sure what any of the outcome measures mean, please leave the row blank.

**Note:** the order of the last three columns is different to the previous core area.

|  |  |  |  |
| --- | --- | --- | --- |
| **Outcome measures:** | How important is it to collect data on each outcome measure if we want to evaluate policies and practices that aim to deliver: | | |
| **Climate change mitigation** (1-9) | **Water quality and/or flood risk mitigation** (1-9) | **Biodiversity**  (1-9) |
| Outcome set: Accumulation/loss |  |  |  |
| Rate of peat accumulation |  |  |  |
| Peat build up behind dams |  |  |  |
| Peatland extent |  |  |  |
| Peat decomposition |  |  |  |
| Dust losses |  |  |  |
| Biomass removal |  |  |  |
| Carbon content of the peat |  |  |  |
| Litter decay rates |  |  |  |
| Peat decay rates |  |  |  |
| Bare peat extent |  |  |  |
| Area or recently burnt peat |  |  |  |
| Net Primary Productivity (NPP) |  |  |  |
| Above ground carbon stock |  |  |  |
| Net Ecosystem Production (NEP) |  |  |  |
| Net Ecosystem Biomass Production (NEBP) |  |  |  |
| Outcome set: GHG flux |  |  |  |
| Dissolved Organic Carbon |  |  |  |
| CO2 |  |  |  |
| CH4 |  |  |  |
| N2O |  |  |  |
| Vegetation – as a proxy for GHG flux |  |  |  |
| Water table – as a proxy for GHG flux |  |  |  |
| Net Ecosystem Exchange |  |  |  |
| Microbial communities |  |  |  |
| Ebullition of GHGs |  |  |  |
| Gross Primary Productivity |  |  |  |
| Ecosystem respiration |  |  |  |
| Particulate Organic Carbon |  |  |  |
| Dissolved Inorganic Carbon |  |  |  |
| Net C flux |  |  |  |
| Methane age |  |  |  |
| Outcome set: water quality |  |  |  |
| Dissolved Organic Carbon |  |  |  |
| Water colour |  |  |  |
| Particulate Organic Carbon |  |  |  |
| Nutrient content – direct (N and P) |  |  |  |
| pH |  |  |  |
| Elemental concentrations |  |  |  |
| Outcome set: peatland condition |  |  |  |
| Bulk density |  |  |  |
| Carbon content |  |  |  |
| Vegetation cover |  |  |  |
| Degree of humification |  |  |  |
| Floristic composition |  |  |  |
| Peatland shape and extent |  |  |  |
| Bare peat extent |  |  |  |
| Extent of rewetting |  |  |  |
| Water repellancy |  |  |  |
| Peat decomposition rates |  |  |  |
| Peatland surface oscillation |  |  |  |
| Outcome set: fire damage |  |  |  |
| Times since burning |  |  |  |
| Fire extent |  |  |  |
| Air pollution |  |  |  |
| Vegetation/peat loss |  |  |  |
| Depth of burn |  |  |  |
| Fire intensity |  |  |  |
| Outcome set: erosion |  |  |  |
| Rates of erosion |  |  |  |
| Amount of erosion |  |  |  |
| Sediment |  |  |  |
| Peat surface oscillation |  |  |  |
| Bare peat area |  |  |  |

Certain contextual variables need to be collected alongside data for the outcome measures above to aid the analysis and interpretation of results. Please now rank the importance of the following contextual variables, on the basis of how important you think it is to collect these alongside **climate change** data:

|  |  |
| --- | --- |
| **Contextual variable** | How important is it to measure these variables alongside **climate change** data collection?(1-9) |
| Atmospheric deposition |  |
| Burning |  |
| Grazing |  |
| Subsidence |  |
| Drainage |  |
| Macrofossil analysis |  |
| Site history including former land use and management practices |  |
| Current land use and management practices |  |
| Depth of acrotelm/catotelm |  |
| Topography |  |
| Aspect |  |
| Altitude |  |
| Site location |  |
| Time/season |  |
| Temperature |  |
| Rainfall |  |
| Humidity |  |
| Evaporation rates |  |
| Evapotranspiration rates |  |

**Note:** this table is identical across all three core areas, but you are being asked to rank how important each variable is to collect alongside data in each core area. For example, you may think that topography is more important to measure alongside (to help analyse and interpret) hydrological or biodiversity outcome measures, compared to climate change outcome measures.

You have now completed the questionnaire – thank you!

Please email it to Dr Dylan Young: D.M.Young@leeds.ac.uk