**Vyrnwy LIFE project – response to UHG for research/monitoring activity.**

## General:

The LIFE project oversaw a wide suite of environmental monitoring research which provides empirical evidence which shows how the restoration work delivered for both project habitat restoration aims, and for wider ecosystem services. The emphasis placed on monitoring at an early stage in the project meant that restoration work was carried out within a scientifically robust structure, and this resulted in a more powerful demonstration of the impacts of habitat restoration than is generally possible.

The results produced from this study have been, or are in the process of being published in the scientific peer reviewed literature. While this, and oral presentations in academic fora have raised a strong academic profile for the project, presentations of the work in mixed scientific/land manager fora has seen the messages from this project spread widely among UK conservation organisations and other similar habitat restoration projects.

## Main findings:

1. The primary aim of the restoration project was to allow the recovery of blanket bog vegetation at the site. We have reported that the condition of vegetation at Lake Vyrnwy, according to the statutory Performance Indicators for the site, has shown signs of recovery, even during the short time frames covered. Wet tolerant plant species are increasing in abundance, while dry tolerant species have died back. Recovery, although greater in the vicinity of blocked drains, is also occurring across the wider landscape, suggesting that broad increases in surface water and the continuing low grazing regime are providing beneficial conditions at the landscape scale.

2. Basic studies of vegetation change following plantation clearance and drain blocking at Penaran provide a limited picture of vegetation recovery but suggest that removal of scattered trees in combination with drain blocking is leading to the recovery of blanket bog species. It also appears that where plantation forestry is removed, recovery is slower and influenced by the state of the initial vegetation community.

3. One of the most fundamental measures of peatland restoration is the reestablishment of shallower near-surface water tables. We demonstrated that a dry zone within about 5 metres of active drains is greatly reduced or removed by the blocking of drains. In addition, water tables became more stable, remaining shallower even during periods without rainfall. Surface water increased considerably in importance after drain blocking, with this increase in surface flow being evident at least 20m from blocked drains.

4. We have provided rare evidence for the much-cited prediction that drain blocking can lead to reduced flood severity in discharge waters. We demonstrate that discharge from both drains and streams becomes much less ‘flashy’ after drain-blocking, with lower and more gradual peak flows, and with greater retention of rainwater within the bog itself.

5. Drain blocking led to strong declines in the amount of colour being released in discharge waters, with colour also shifting to become dominated by lighter, less humified substances. These two aspects will both contribute to improved water quality standards.

6. By monitoring organic carbon losses from drains and streams, this study has been able to present evidence of several key changes after drain blocking: First, a large reduction in the losses of organic carbon from the system; second that peat decomposition from deeper peat layers was reduced; and third that these changes are likely to have a considerable impact on the overall carbon balance of the system.

7. Through a strong programme of farmer engagement and focussed research, this project has provided a highly unusual evidence base suggesting that drain blocking on peatlands is at least a neutral, and potentially a positive, management practice for hill sheep farming. Our studies suggest that drain blocking does not alter the amount of available grazing to sheep, but does provide greater access to wet areas and reduce stock losses in ditches by providing regular drain crossing points.

8. An analysis of RSPB bird and vole survey data suggests that these key fauna are not, at the wider population level, impacted by drain blocking. However, we would expect changes to invertebrate communities and vegetation structure to lead to behavioural changes at the local scale. Thus further, more focussed, monitoring would be warranted to fully investigate the impacts on habitat restoration on SAC designated bird populations on the site.

**Conclusions:**

The monitoring carried out by this study has been highly successful, and has provided an unprecedented body of evidence for the role that habitat restoration can play in delivering for both the primary objective of habitat conservation, and a wider suite of socio-economic benefits. While the value of this research should not be underestimated, we have been able to cover just a few years post-restoration, and this clearly limits the picture that we are able to build. Peatland restoration is a process begun by the engineering work of drain blocking or tree removal, but which continues over decades as peat structures, water tables and vegetation communities continue to gradually change. If we are to fully understand the way that restoration practices influence peatlands, we need landscape scale monitoring, like the work undertaken in this project, to be continued for much longer time periods. Likewise the research presented here has served to highlight the enormous impact that peatland restoration is likely to have on greenhouse gas fluxes, through both hydrological and vegetation community changes. However targeted research is urgently needed if we are to better understand this important issue.