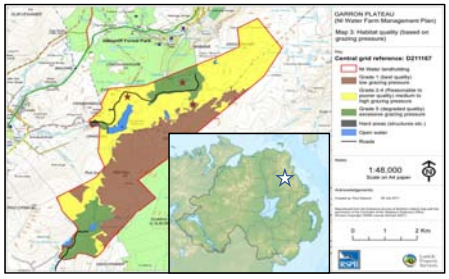
Multi-disciplinary approaches to monitoring and understanding mechanisms at active, degraded and restored blanket bog locations.

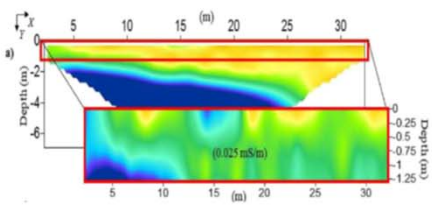
Multi-disciplinary approaches to monitoring and understanding mechanisms at active, degraded and restored blanket bog locations

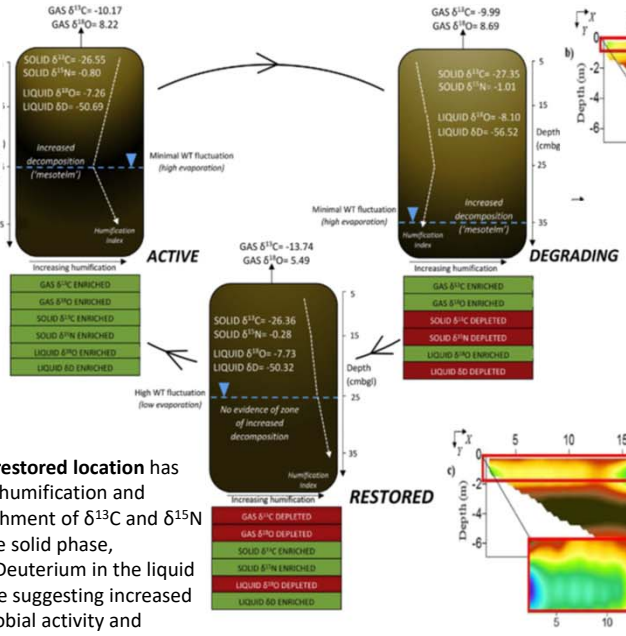
Rory Doherty[1], Laura McAnallen[2], Panagiotis Kirmizakis[1] & Neil Ogle[1]
School of Natural & Built Environment, Queen's University of Belfast
RPS Consulting Engineers, Boucher Road Belfast

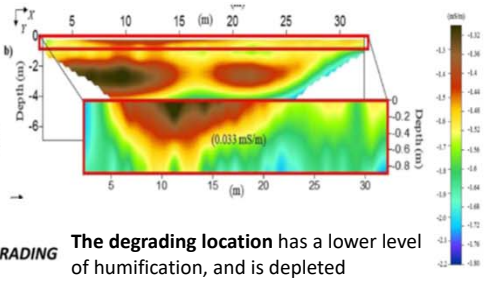
The Garron Plateau (4,628ha), which acts as the catchment for Dungonnell reservoir, is one of the best examples of blanket bog in Northern Ireland. Work undertaken by NIEA found that 38.8% of the peatlands are in unfavourable condition.



Solid peat samples were taken for FTIR and Stable Isotope Analysis following British Geological Survey G-BASE sampling protocol. This involved using a 20m× 20m square grid and taking a peat sample from each corner and also the centre of the grid (giving 5 sample points) from each of the three areas (Degrading (D) 1–5, active (A) 1–5 and restored (R) 1–5)



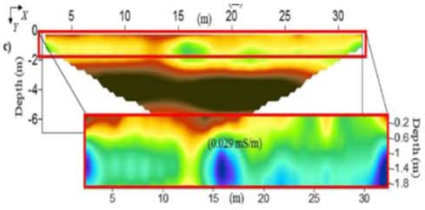




The active peat has shown a high level of humification (low decomposition) . Stable isotope analysis in the solid, liquid and gas phases show the active location is enriched in $\delta^{13}C$ in the solid and gas phases, $\delta^{15}N$ in the solid phase, $\delta^{18}O$ in the liquid and gas phases and δD in the liquid phase, suggesting a closed system with limited isotopic fractionation and thus limited water movement and decomposition.

The degrading location has a lower level of humification, and is depleted in $\delta^{13}C$ in the solid phase due to ingression of vascular plants with increased chargeability due to an increase in polar compounds

The restored location has high humification and enrichment of $\delta^{13}C$ and $\delta^{15}N$ in the solid phase, and Deuterium in the liquid phase suggesting increased microbial activity and reduced evaporation (increased transport?)

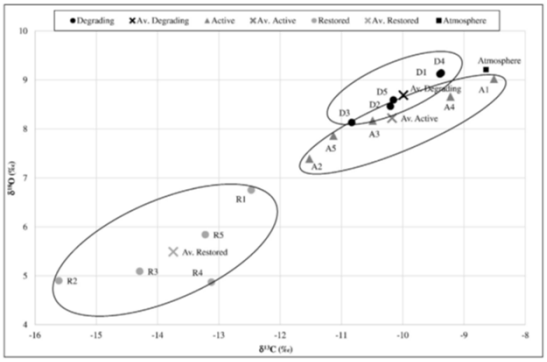


Geophysics: Near-surface resistivity and IP (chargeability) measurements were undertaken using an IRIS SYSCAL Pro. The transect was carried out diagonally on each sample grid using an array of 24 electrodes paced 1.5 m apart, in the dipole-dipole configuration. IP measurements were acquired using a pulse duration of 2000 ms. Modelling of the resistivity and IP data was carried out using the 2D finite difference inversion program RES2DINV. A normalized chargeability (ratio of resistivity and chargeability) profile was compared with organic composition analysis of the solid and liquid phases from active, degrading and restored locations. With the degrading and restored locations, increase the polarity, cation exchange capacity, and the normalized chargeability of the peat. This higher chargeability is not evident in the active peat due to decreased aerobic decomposition and a domination of sphagnum mosses

Porewater chemistry results show that the degrading location is undergoing high rates of decomposition and loss of organic matter into the interstitial water, whereas the opposite is true for the active location. The restored peat is showing low rates of decomposition however has a high concentration of organic material in the porewater, primarily composing long chain aliphatic compounds, sourced from vascular plants.

Analysis of organic fractions and bandings from porewater samples at each location.

Banding	Fractions	Active (mg/l)	Degrading (mg/l)	Restored (mg/l)
C_8—C_{10}	Aliphatic	53.67	39.93	1.67
	Aromatic	0	0	0
C_{10}—C_{12}	Aliphatic	10.85	53.31	0
	Aromatic	321.77	439.18	384.07
C_{12}—C_{16}	Aliphatic	0	0	0
	Aromatic	0	0	0
C_{16}—C_{21}	Aliphatic	0	308.50	0
	Aromatic	0	0	0
C_{21}—C_{35}	Aliphatic	230.10	2302.08	1386.64
	Aromatic	0	131.23	0
C_{35}—C_{44}	Aliphatic	0	0	0
	Aromatic	0	0	98.15
Total	*Aliphatic*	*294.62*	*2703.82*	*1388.31*
	Aromatic	*321.77*	*570.41*	*482.22*
	Aliphatic + Aromatic	***616.39***	***3274.23***	***1870.53***



Stable 13C and 18O isotope analysis of carbon dioxide in soil gas samples taken from the 5 sample locations within the degrading (D), active (A) and restored (R) areas. An atmospheric sample from the Garron Plateau is also shown.

Questions remain around the gas emissions of the restored area

$\delta^{13}C$ and $\delta^{18}O$ in the gas phase and $\delta^{18}O$ in the liquid phase are depleted, as a result of microbial mediated gas production and rewetting.

Understanding the Microbial ecology of restoration is important to ensure that the correct restoration mechanisms are happening

Acknowledgements
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Combined use of geophysical and geochemical methods to assess areas of active, degrading and restored blanket bog McAnallen, L., Doherty, R., Donohue, S., Kirmizakis, P. & Mendonça, C. 01 April 2018 In : Science of The Total Environment. 621, p. 762-771 10

Organic composition and multiphase stable isotope analysis of active, degrading and restored blanket bog. McAnallen, Laura; Doherty, Rory; Ogle, Neil. In: Science of The Total Environment, Vol. 599-600, 01.12.2017, p. 1779-1790