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Carbon storage in Organic Soils (COrS): Quantifying past variations in carbon accumulation in peatlands of South Wales, UK.

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Globally, peatlands comprise a vital terrestrial carbon sink, currently estimated to be around 500 PgC (Yu et al., 2011, Gorham, 1991). Within the UK, peatlands represent the single most important terrestrial carbon store (IUCN, 2011). In particular, blanket and raised bogs account for around 23,000 square kilometres or 9.5 percent of the UK land area, with current estimates indicating that they store approximately 3.2 PgC (IUCN, 2011). Recent studies suggest that carbon-sequestration rates have been highly variable during the Holocene (Frolking & Roulet, 2007). Reconstructing these past fluctuations is essential to assess how peatlands will respond to future climate change, particularly the possibility that large amounts of respired below-ground carbon will be released as a result of enhanced rates of decomposition, causing positive climate feedback.

Quantitative estimates of past variations in carbon accumulation provide valuable insights into the factors controlling carbon budgets. Recent developments have illustrated how ground-penetrating radar (GPR) can improve constraints on peat thickness (Holden et al., 2002, Warner et al., 1990), facilitating site-specific peat-volume estimates for carbon quantification. We shall present initial results from the COrS project, which brings together a novel combination of geophysical and proxy techniques to reconstruct variations in long-term carbon accumulation in 6 ombrotrophic peat bogs, located across the Brecon Beacons National Park (BBNP), South Wales, UK (51°55'30" N, 3°29'18" W). Detailed GPR surveys are being used to provide comprehensive estimates of total peat extent and thickness at these sites. Combined with surface-elevation data from LiDAR imagery, 3D models are being created, from which total peat-volume estimates will be extracted. Carbon-accumulation rates will be inferred from these bog-volume estimates, coupled with total organic carbon (TOC) measurements and high-resolution radiocarbon dating. In addition, long-term environmental changes are being identified through the use of humification and plant-macrofossil analyses to reconstruct past variations in bog vegetation and surface wetness. This ensemble of techniques will permit direct comparisons to be made between records of carbon accumulation, palaeoclimate and vegetation, and hence will allow the factors influencing long-term carbon storage to be determined.