The Sustainable Carbon Management of Moorlands: spatial distribution and accumulation of carbon on Dartmoor, southwest England

Submitted by Lauren Elizabeth Parry to the University of Exeter

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I certify that all material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University.

Signature: ……..

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Abstract

Peatlands are unique habitats that have absorbed large amounts of carbon dioxide and locked it away as carbon buried in peat for millennia. In the UK, blanket peatlands form one of the largest terrestrial stores of carbon (Milne and Brown, 1997). Recent research suggests that the carbon sequestering potential and carbon stores of UK blanket peatlands are at risk from changes in land use practices and climate. Although, to date, little research has considered blanket peatland at a landscape scale and a comprehensive understanding of land use and degradation impact upon carbon sequestration has not been gained.

This thesis presents a study of Dartmoor, a blanket peatland in south west England vulnerable to climate change (Clark *et al*, 2010). A landscape scale carbon inventory, using a methodology designed for blanket peatlands is presented. Nearly 1000 peat depths and 30 cores were taken using stratified sampling across Dartmoor's landscape. Functional relationships between peat depth, bulk density and carbon content and topographic parameters were found. In *arc* GIS 9.3 these were used to model landscape scale carbon, this estimates that Dartmoor contained 9.7 (-2.91 + 2.97) Mt of carbon, a value similar to that of the national inventory (Bradley *et al,* 2005).

The thesis then considers the impact of drainage and degradation on carbon accumulation. Fifteen cores were dated from a drained, degraded site with a history of burning and control site using Spheroidal Carbonaceous Particles (SCPs) and radionuclide techniques. Previous studies have raised concern surrounding accuracy dating recent peats. Results indicate that although dating was largely successful, some discrepancies existed related to poor calibration of SCPs and mobility of radionuclides. To avoid error in dating, it was concluded that multiple dates should be used per core. With consideration of this, carbon accumulation was found to be active but significantly lower in the degraded site and unchanged in the drained site. Further analysis suggested that this outcome may vary with changing management and topographic situations. Future carbon accumulation at a landscape scale was calculated under different scenarios. This found degradation could potentially reduce carbon sequestration on Dartmoor by up to 32%. Economic valuation of accumulation values was used to demonstrate how this data could be used to inform management.

This thesis provides an insight into the carbon storage and threats to Dartmoor, an under investigated, yet threatened blanket peatland environment. This helps broaden the spatial understanding of the response and value carbon stored in UK blanket peatlands.

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