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The effects of ecological restoration on CO_2 fluxes from a climatically marginal upland blanket bog

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A legacy of gully incision, deposition of industrially-derived aerial pollutants, inappropriate management and wildfire has left large expanses of the topographic Bleaklow Plateau (Peak District National Park, England, UK) bare of vegetation and susceptible to massive erosion of the peat soils. The consequence of such degradation has been to decrease the capacity of the peatland on the plateau to provide important ecosystem services including; loss of net C sink function, discolouration of surface waters, mobilisation to surface waters of stored heavy metals and infilling of upland reservoirs with peat-derived sediment. In response to on-going and worsening degradation a programme of ecological restoration has been undertaken. Restoration methods include: seeding with a lawn grass mix; liming; fertilisation; slope stabilisation; and gully blocking. This talk will present data from a five-year, observational-study of CO_2 fluxes from eight sites, with four sites sampling different restoration treatments and four sampling bare and least disturbed areas. The results of the analysis reveal that sites with revegetation alongside slope stabilisation were most productive and were the largest net (daylight hours) sinks of CO_2. Unrestored, bare sites, while having relatively low gross fluxes of CO_2 were the largest net sources of CO_2. Revegetation without slope stabilisation took longer ($\sim$18 months) to show an impact on CO_2 flux in comparison to the sites with slope stabilisation. Binary logistic regression indicated that a ten centimetre increase in water table depth decreases the odds of observing a net CO_2 sink, on a given site, by up to 30%. Sites with slope stabilisation were between 5-8x more likely to be net CO_2 sinks than the bare sites. Sites without slope stabilisation were only 2-2.3x more likely to be net CO_2 sinks compared to the bare sites. The most important conclusion of this research is that revegetation appears to be effective at increasing the likelihood of net CO_2 behaviour on degraded, climatically marginal blanket peat, with revegetation alongside slope stabilisation having the greatest impact.