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CO_2 exchange following peat extraction – a comparison of two paired restored/unrestored peatlands

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Peat extraction is an important industry in parts of Canada and elsewhere globally. The resulting disturbance from drainage and vacuum-harvesting is mitigated through best practices which now incorporate restoration intended to return the peatland's biodiversity and greenhouse gas (GHG) exchange to that resembling the pre-disturbance state. We examine the net ecosystem exchange of CO_2 (NEE) in two sets of paired peatlands. Within each pair, the extraction year was the same and the sites were treated identically post-extraction in terms of management (blocking drains or leveling as applicable). The first pair is located in the vicinity of Rivière-du-Loup, Québec, Canada and were harvested in 1980. The Bois-des-Bel (BDB) site was restored in 1999 following the methods of Quinty and Rochefort (2003). GHG fluxes have been studied at various points since restoration (e.g. Strack and Zuback, 2013) largely using chamber measurements. The site now hosts a thriving bog ecosystem with Sphagnum, Eriophorum and shrub communities. A site 30 km away near Saint-Alexandre de Kamouraska (SAK) was managed post-harvest as BDB with drains blocked but was left unrestored and now has only sparse Eriophorum with invasive species. The second pair of peatlands represents a newly extracted site near Seba Beach, Alberta, Canada. One field was restored (SBR) in autumn 2012 as per the Québec sites but with ditches infilled when the fields were levelled while the other (SBU) was left unrestored. In the summer of 2013, eddy covariance towers were installed at each location and measured NEE continuously at 10Hz throughout the subsequent periods. BDB and SBR remain operational today while SBU was removed in fall 2014 and SAK in fall 2015. In this presentation, we will focus on the coincident years of operation. After 15 years, BDB has measured NEE in the range of that observed at natural peatlands. A summer sink and winter release lead to annual uptake of CO_2. At SAK, the lack of establishment of moss cover has led to the site remaining a source of CO_2 to the atmosphere. SBR follows a trend towards becoming a weak sink for CO_2 as vegetation re-establishes. SBU remained a weak source of CO_2 to the atmosphere. The two restored sites showed more difference between years than did the unrestored sites, presumably caused by vegetation responding to the different environmental conditions within a growing season.