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Combining MODIS data and tower based measurements to estimate net ecosystem carbon exchange for the Republic of Ireland

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A number of previous studies have employed Fluxnet data in developing models to upscale localised eddy covariance (EC) footprints in order to determine net ecosystem carbon exchange (NEE) over regional or national scales. This study combined measured EC flux data (from three EC stations in Ireland over the period 2002-2007) with data from the Moderate Resolution Imaging Spectrometer (MODIS) onboard the Terra (EOS-AM) Satellite, and land cover maps (Corine Land Cover for 2006) to develop predictive NEE models using an adapted regression tree method allowing upscaling to wider areas with MODIS products. Separate models were developed for the four main ecosystem types found in the Republic of Ireland: grassland, peatland, forestry and cropland. The NEE models showed promising correlations with the EC measurements of NEE for training and predictive data sets. Excluding urban and water areas, the results indicate that Ireland’s terrestrial ecosystems are a sink for CO_2 of -1.3Mg C-CO_2 ha-1 y-1 giving a national estimate of -9.3 Tg C-CO_2 y-1. This uptake compares to the national inventory estimate for emissions from agriculture of 5.03 Tg C-CO_2 eq y-1. The models also captured well the spatiotemporal variations over the Republic of Ireland relative to the measured NEE in different ecosystem types over different seasons. The method shows potential in accounting for carbon fluxes over large areas.