

Soil carbon stocks in UK grasslands A brief summary of the literature, 2018

Soils hold the largest pool of terrestrial carbon in the UK (Ostle *et al.*, 2009). The amount of carbon accumulated in soils is mainly dependent on the rate of input from plant photosynthate balanced by losses from decomposition, leaching and erosion. The type of vegetation, management and climate will affect these inputs, while soil moisture, soil temperature and available oxygen are key factors controlling decomposition and the loss of carbon.

It is difficult to determine the soil-carbon stock under different land uses as all the major studies use different land use categories and do not always differentiate between types of grassland and woodland. They also report over different soil depths and in different units. However, **woodland, grassland and wetland habitats all have large stocks of carbon in their soil** (Bradley *et al.*, 2005; Chamberlain *et al.*, 2010; Alonso *et al.*, 2012; Ward *et al.*, 2016.).

Grassland is often perceived as storing little carbon, but stocks are considerable and those within neutral grassland soils were shown to be well above that for improved grassland, arable and horticultural soils (UK NEA technical report, 2011). Janssens *et al* (2005) produced figures suggesting that UK grasslands sequester large amounts of carbon at a rate of $242 \pm 1,990$ kg/ha/yr, which is higher than that of more slowly growing forests (106 ± 40 kg/ha/yr) and contrasts with a net loss from arable land (-137 ± 103 kg/ha/yr).

Within floodplains, the stock of soil carbon in the top 15 cm for each land use type was estimated using data from the Countryside Survey (Carey *et al*, 2008). Carbon density ($t\ ha^{-1}$) was estimated considering the extent of the broad habitats within floodplains - carbon density is much lower in arable and improved grassland soils, but their total carbon stock is higher due to their much larger extent. Mean carbon density was calculated at North Meadow Cricklade within the top 10 cm to be in the order of $10.94 (\pm 0.44)$ kg C m^{-2} ($109.4\ t\ ha^{-1}$) (Lawson & Gowing, unpublished data, n = 15). These values are much higher than values reported for the broader habitat of neutral grassland (Table 1), and extensively managed grasslands in a survey of grassland soil carbon (Ward *et al.* 2016).

Table 1. The topsoil (0-15 cm) carbon density ($t\ C\ ha^{-1}$) and total carbon stock (Tg C).

Broad Habitat	Mean C density ($t\ ha^{-1}$)¹⁾	Area of land use with Floodplain (000 ha)*	Carbon Stock in Floodplains (Tg C)
Arable & horticultural	47.3	248.5	117.5
Improved grassland	67.2	285.5	191.9
Neutral grassland	68.7	22	15.1
Broadleaved, mixed and yew woodland	73.0	58.5	42.7
Coniferous woodland	89.8	4.2	3.8
Fen, marsh & swamp	82.8	4.5	3.7

(Mean carbon density data from the Countryside Survey 2007 reported in Chamberlain *et al.*, 2010).

* Estimated area of England and Wales

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