Solway Firth saltmarshes

[NX 829 492]–[NY 125 560]

J.D. Hansom

The saltmarshes ('merses') of the Solway Firth are an extensive group, comprising all those located to the east and upstream of Balcary Point [NX 829 492] and Skinbumess [NY 125 560], on both the north (Scottish) and south (English) shores of the inner Solway Firth (See (Figure 10.1) for general location and (Figure 10.12)). Defined in this way, the Solway Firth supports 3618 ha of saltmarsh (Pye and French, 1993), of which the GCR sites, Upper Solway Flats and Marshes on the south shore and the Solway Firth (North Shore), account for 2842 ha (76%). In addition, the saltmarshes at the Cree estuary in Wigtown Bay in the outer Solway Firth cover a further 553 ha. The Solway saltmarshes together account for almost 8% of British saltmarshes and although they display some different characteristics ((Table 10.2)), their common location, together with similarities, warrant their treatment within a combined section. The saltmarshcs arc, in the main, of the estuarine fringing type, being developed along the shores of the main Firth and its tributaries, although showing varying degrees of transition into open coast marsh at Caerlaverock on the Scottish shore. In addition, the saltmarsh at Moricambe Bay on the English shore shows many of the characteristics of a more enclosed embayment marsh ((Table 10.2)). The following text therefore describes the general topographic and hydrodynamic situation of the sites, and then seeks to describe and interpret the south shore group, the north shore group, and the Cree saltmarshes in turn.

The Solway Firth reaches almost 60 km wide between Burrow Head on the Scottish coast and St Bees Head on the English coast and extends over 130 km eastwards to the exits of the rivers Esk and Eden. With the exception of the Cree saltmarshes, the Solway saltmarshes are all located within the inner (eastern) Firth (Figure 10.12). The Firth is macrotidal; mean tidal range at Silloth on the Cumbrian coast reaches 8.4 m at springs and 4.8 m at neaps. On the northern coast the mean tidal range at Heston Islet in Auchencairn Bay is 7.4 m at springs and 3.9 m at neaps (Pye and French, 1993). The tidal streams generated can be significant especially at the mouths of tributary streams, at headlands and promontories and within channels between sandbanks. For example, the tidal stream in and out of the River Cree reaches 2.5 m s^{-1} at springs and similar velocities occur offshore of Southerness Point (Ramsay and Brampton, 2000). The general situation is that the ebb tide runs for longer and flows at lower velocities than the flood tide. The extensive area of sandbanks retards the flood peak at successive locations upstream and contributes to a marked tidal asymmetry. This differential tidal flow accentuates the net deposition of sediment within the estuary as slower ebb currents are less able to transport sediment than the stronger flood (Comber *et al.,* 1994).

The Solway Firth is exposed to waves from the south-west, although fetch lengths are rarely more than 250 km. As a result, most waves reach the shore as wind-waves generated in the Irish Sea or the Firth itself or as refracted Atlantic swell (Ramsay and Brampton, 2000). The net effect of what amounts to a unidirectional wave climate is that the Solway Firth, and in particular the inner Firth, is a sediment trap with sediment accreting on the extensive intertidal sandbanks. Thus there is a net buildup of sediment within the Solway, with little sediment escaping seawards (Perkins and Williams, 1966). One result of the predominantly eastward movement of sediment is that the Solway Firth saltmarshes are dominated by sandy sediments that are mainly marine in provenance.

(Table 10.2) Characteristic geomorphological features of some of the main Solway Firth saltmarshes.

	Rockcliffe	**Burgh**	**Moricambe Bay**	**Caerlaverock**	**Cree**
Type	Fringing estuary	Fringing estuary	Fringing estuary, bay	Fringing estuary, transitional	Fringing estuary, bay
Marsh-edge morphology	Low cliffs and terraces	Low cliffs and terraces, locally ramped	Low cliffs and terraces, locally ramped	Low cliffs and terraces, rarely ramped	Ramped, locally cliffs and terraces
Creek system	Dendritic	Modified dendritic	Dendritic	Dendritic	Dendritic
Saltpans	Common	Common	Common	Infrequent	Common

Age of active marsh	>200 years	Unknown	Unknown	Pre-mid 19th century	Unknown
Mean sediment type					
Upper marsh	Sandy silt	Sand:fine sand /silt: clay	Sand:fine sand/silt: clay	Sand:silt:clay	Fine sand
Marsh edge	Sandy silt	Sandy silt	Sandy silt	Fine sand	Fine sand
Upper tidal flat silt	Sand to sandy	Sand to silty sand	Silty sand	Fine sand	Sand and gravel

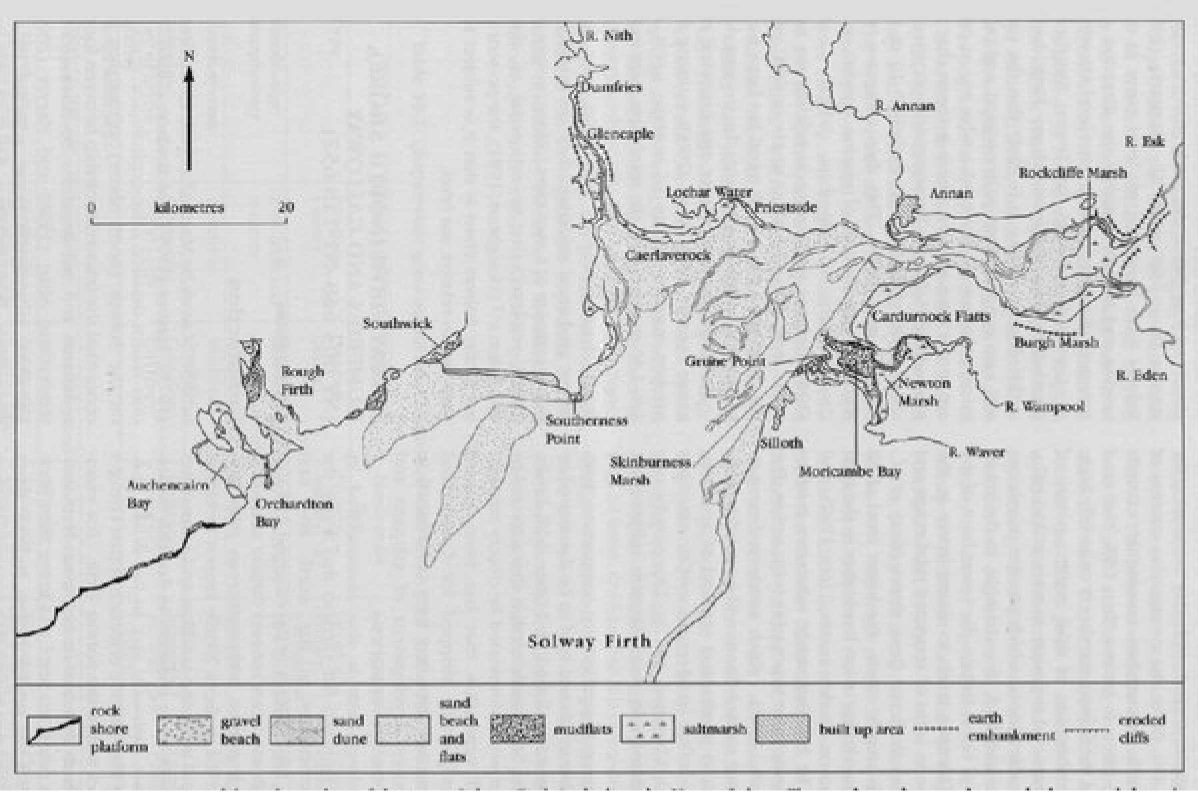
Marshall (1962) showed that the saltmarshes of the Solway are usually composed of more than 90% fine-grained sand, with day accounting for less than 4%. Since the average day content of most British saltmarshes commonly exceeds 30%, and often is greater than 65%, the sand content of the Solway marshes is unusually high.

The combination of tidal regime, nature of the substrate and exposure to wave action influences the elevation at which pioneer marsh can become established. For example, in the south and west of Great Britain the lower limit of the pioneer *Spartina* tends to occur lower in the tidal frame in areas of restricted tidal range and on marshes sheltered from waves (Gray *et al.,* 1990). On sandy coasts, the lower level of all pioneer marsh vegetation lies higher in the tidal frame than on muddy coasts (Gray, 1992), and this may be because sandy substrates tend to occur in areas more exposed to wave action (Pye and French, 1993). Such sandy sediment is more prone to mobilization than muddy sediment and so mechanical removal of seedlings may occur before an adequate root structure has developed (Chapman, 1977). This may be one of the reasons why most Scottish saltmarshes, including those in the Solway Firth, tend to have little pioneer vegetation in comparison with those farther south and tend to be dominated by the communities found at higher tidal levels. Much of the Solway saltmarsh is characterized by a lawn-like sward dominated by closely cropped graminoid vegetation that has been grazed and/or traditionally stripped for Cumberland turf. These activities may have contributed to the extensive development of saltpans and creeks on the Solway marshes.

The Solway Firth is also characterized by extensive emerged flat surfaces that fringe the Firth, particularly in the north and east (Marshall, 1962). Many of the emerged flats also have a high sand content and display relict den-dritic creek systems with numerous relict saltpans. The flat surfaces, locally known as 'carse', are emerged estuarine sandflats and saltmarshes and although fairly common in Scottish estuaries, they are nationally rare in the British context. They also provide evidence of past changes in sea level within the Solway Firth. For example, peat beds that now lie below sea level indicate times when sea level was lower than present, whereas the emerged carse, indicate times when sea level was higher than present. Haggart (1989) suggests that, over the early part of the Holocene Epoch, sea level rose from about –5 m OD at 10 000 years BP to reach a maximum of about +8.5 m OD at the peak of the transgression at about 6500 years BP Haggart's (1989) Solway Firth Holocene sea-level curve is convincing and broadly matches the direction and timing of changes in relative sea-level elsewhere in Scotland such as in lower Strathearn (Perthshire) and the inner Moray Firth during mid-Holocene times. It is likely that the curve will gain support from palynological and other micro-palaeontological work under way at present in the Cree estuary, where it seems that the peak of the Holocene Transgression occurred at about 6500 years BP and reached 7–10 m OD (Firth *et al.,* 2000). This date compares well with the culmination of marine conditions at Crosscanonby in Cumbria, where Tooley (1985a) places the change in relative sea level sense from rising to falling at about 6800 years BP Since then the overall trend has been mainly of a sea level falling towards the present day.

Based on sea-level curves and historical tide gauge records, Firth *et al*. (2000) estimate that present maximum rates of isostatic uplift are 1.8–1.95 mm a^{-1}, with the minimum rates in the range 0.4–0.56 mm a^{-1}. Since the lower estimates closely compare with uplift rates from recent geological evidence, they are probably a better estimate of actual rates. Since present-day global sea-level rise is estimated at about 1–2.5 mm a^{-1} (Houghton, 1994), the present status of the Solway coast is that it is subject to a slow rise in relative sea level.

(Figure 10.1) The generalized distribution of active saltmarshes in Great Britain. Key to GCR sites described in the present chapter or Chapter 11 (coastal assemblage GCR sites): 1. Morrich More; 2. Culbin; 3. North Norfolk Coast; 4. St Osyth Marsh; 5. Dengie Marsh; 6. Keyhaven Marsh, Hurst Castle; 7. Burly Inlet, Carmarthen Bay; 8. Solway Firth, North and South shores; 9. Solway Firth, Cree Estuary; 10. Loch Gruinart, Islay, 11. Holy Island. (After Pye and French, 1993.)



(Figure 10.12) Location of the saltmarshes of the inner Solway Firth including the Upper Solway Flats and marshes on the south shore and the saltmarshes of the Solway Firth (north shore). The 2842 ha of saltmarsh found at these sites comprises 79% of all the saltmarsh in the Solway and 8% of all British saltmarshes. (After Pye and French, 1993.)

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