CREE

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Introduction

The saltmarshes of the Cree estuary (see Figure 10.1 for general location) demonstrate well the geomorphological features of fringing estuarine saltmarsh. The creek system is dendritic, especially in the north close to the Cree exit, although the creeks in the south have been artificially straightened. Saltpans are distributed over all marsh levels, particularly on the marshes adjacent to the Cree exit. Parts of the saltmarsh have developed very recently and independently of the complex of saltmarshes in the inner Solway Firth. For example, the marsh at the Baldoon Sands on the west side of the estuary has mainly developed since 1847 (Figure 10.18). In spite of this recent development, estuarine sedimentation has prevailed in the Cree estuary over most of the Holocene Epoch because all of the present saltmarshes are backed by extensive areas of emerged estuarine flats known in Scotland as ‘carse'.

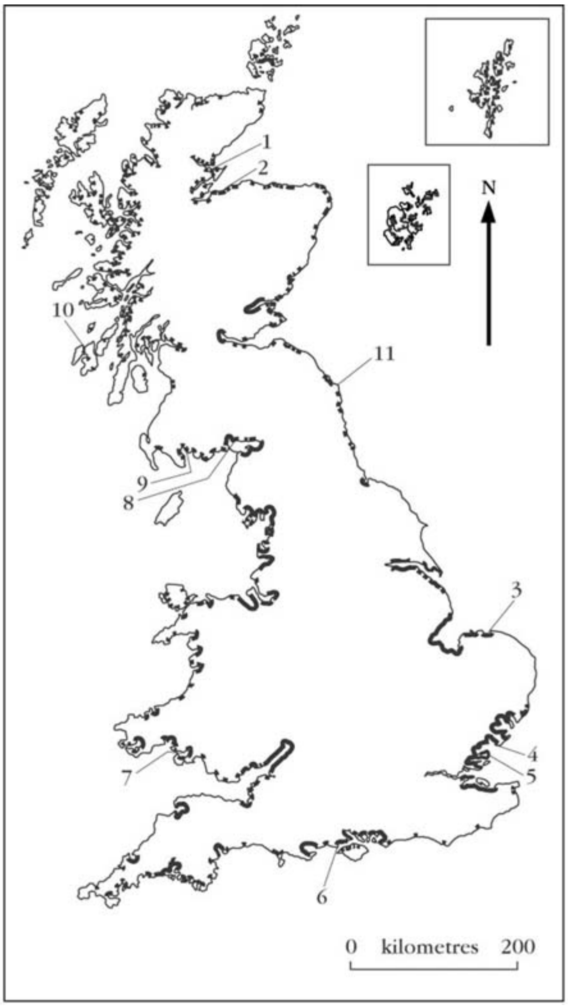

Figure 10.1: The generalized distribution of active saltmarshes in Great Britain. Key to GCR sites described in the present chapter or Chapter 11 (coastal assemblage GCR sites): 1. Morrich More; 2. Culbin; 3. North Norfolk Coast; 4. St Osyth Marsh; 5. Dengie Marsh; 6. Keyhaven Marsh, Hurst Castle; 7. Burry 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.)

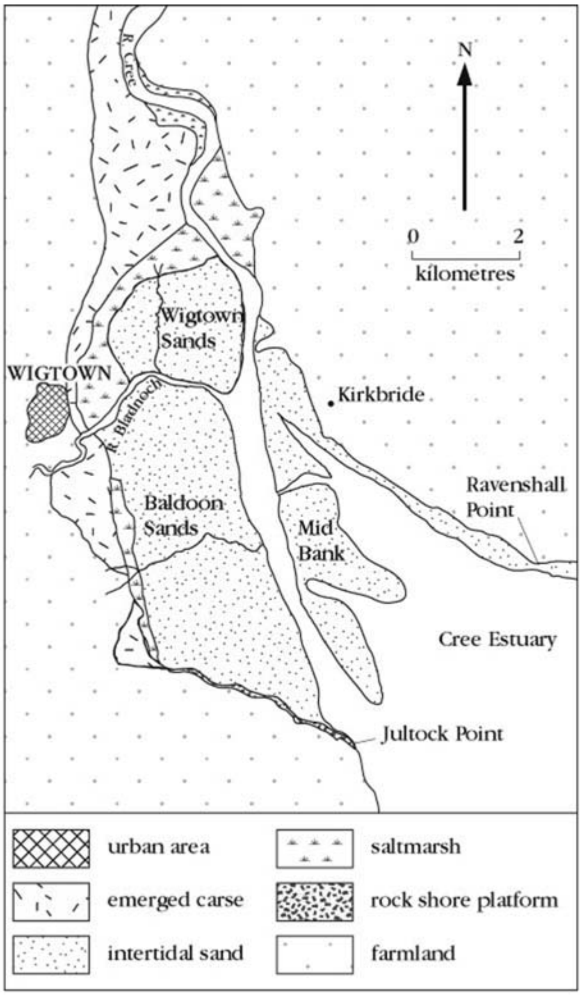

Figure 10.18: Saltmarshes and emerged carse surfaces in the Cree estuary, Wigtown Bay. The estuary is shallow and extensive sandflats are exposed at MLWS. Muddier sediments are restricted to the tidal reaches of the Cree River itself in the north where small saltmarshes fringe its course, particularly on the inside of meander loops.

Description

The total extent of saltmarsh in Wigtown Bay amounts to 553 ha (Burd, 1989), 108 ha of which lie on the western shore of the Cree estuary (Rowe, 1978), extending for over 10 km northwards from near Jultock Point to the tidal limit of the River Cree itself to the south of the town of Newton Stewart. On the eastern shore of the Cree, north of Ravenshall Point, saltmarsh occurs only within a small area north of Wigtown Sands (Figure10.18) and small, partly enclosed, areas farther upstream. The saltmarsh communities are mostly dominated by a common saltmarsh-grass–fescue (*Puccinellia–Festuca)* sward (Burd, 1989). Much of the shoreline within Wigtown Bay is characterized by extensive sandflats that are succeeded landwards by saltmarshes, brackish reedswamps and emerged Holocene carse deposits (Figure 10.19). Within the smaller bays, more-restricted areas of saltmarsh are present. However, in spite of the wealth of information gained on Holocene sea-level changes in this area and the wide variety of features present, few studies have been undertaken to assess the evolution and processes of the modern sandflats and saltmarshes.

Figure 10.19: A view looking south over the meanders of the Cree estuary towards Jultock Point in the distance on the right (west) side. Extensive sandflats are visible to the south of the forest in the middle distance. Emerged carse surfaces (old saltmarsh deposits) dominate the foreground, separated from the present saltmarsh by small cliffs that can be seen in places along the main river channel. (Photo: P. and A. Macdonald/SNH.)

North of Jultock Point (Figure 10.18) the flats of Baldoon Sands extend to 3.75 km wide and are backed by saltmarshes that widen from 50 m in the south to 1 km in the north adjacent to Wigtown Sands and the mouth of the River Bladnoch. The marshes are dissected by large and generally linear channels, and extensive saltpan systems occur in places. For example, at Baldoon the saltmarsh reaches 300 m wide and is traversed by several linear creeks that have been artificially deepened and straightened to facilitate more rapid drainage from the grazed marsh surface (Figure 10.20). There is only a very restricted amount of low marsh supporting primary colonizing vegetation. In places the marsh edge is marked by a small terrace but more often there occurs a low-angled ramp of partly-vegetated sand, which merges imperceptibly to the sandflat surface. The flora of the marsh surface is typical of a grazed Solway saltmarsh, being dominated by a fescue–common saltmarsh-grass *(Festuca– ?Puccinellia)* sward with abundant thrift *Armeria maritima* and sea milkwort *Glaux maritima*. At Crook of Baldoon, the marsh is backed by a rubble embankment that is used for flood protection and access and has been extended southwards recently, parallel to the fence-line, to enclose the rear of the high saltmarsh surface.

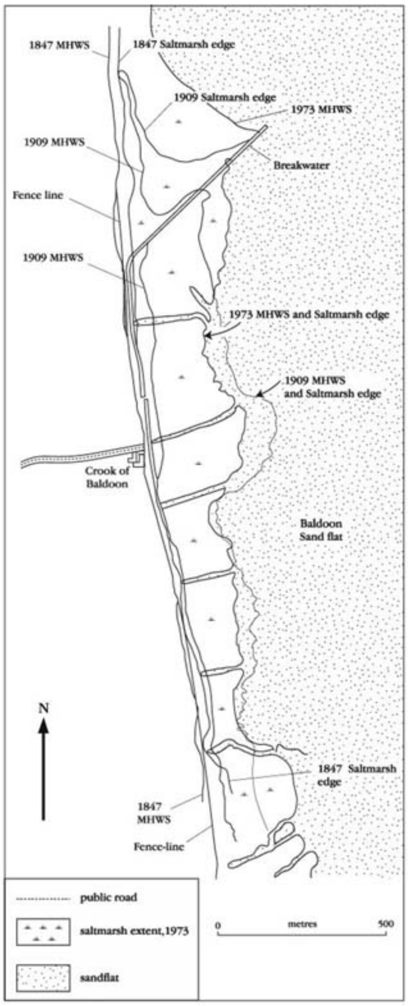

Figure 10.20: The linear saltmarshes at the Crook of Baldoon, on the western side of the Cree estuary appear to have undergone rapid accretion since the edge was mapped in 1847 but have mainly undergone edge retreat since 1973. Landward embankments along much of the Cree testify to land-claim for agricultural purposes in the past. Linear creeks at Baldoon have been artificially straightened and deepened.

North of Wigtown, the sandflats give way to muddier sediments and marshes up to 1 km wide are located on the eastern side of the River Cree as well as on the west. North of Wigtown Sands towards Newton Stewart, the river channel is deeply incised and its muddy banks are characterized by failure and toppling of saltmarsh sediment and vegetation into the channel below. The estuary becomes increasingly restricted between either artificial earth embankments, boulder groynes or low cliffs cut into emerged Holocene estuarine deposits, but a range of high-marsh vegetation with occasional reedbed occurs (Figure10.19). Minor depositional areas occurring on the inside loops of the meandering tidal channel are characterized by narrow and steeply sloping banks of silt and clay but strong river and tidal streams along much of this section have resulted in an incised channel and limited deposition (Figure 10.19).

South of the Cree exit, the foreshore is characterized by sand and gravels and no saltmarsh occurs until inside Fleet Bay, on the south-eastern side of Wigtown Bay, but outside the GCR site boundary. Here 1 km-wide mudflats with flanking saltmarshes occur between Skyreburn Bridge and The Canal. Low-marsh vegetation grades gradually landwards into high-marsh species and creek and saltpan development is limited, with little evidence of erosion. The Canal is an artificial and embanked boulder-lined channel that is deeply incised at its landward end into emerged Holocene estuarine deposits.

Throughout the area of the Solway, there are large sections of the present shore backed by emerged Holocene marine features, good examples of which occur at the heads of the Cree and Fleet estuaries. In these areas the emerged estuarine silts and clays of the carselands attain altitudes of between 7–10 m OD. Within the Cree estuary carseland, sediments extend as far inland to the north as Newton Stewart and to within 2 km of Jultock Point in the south on the western shore. The carse deposits reach 3.5 km wide north of Wigtown, where they partially overlie and partially abut large peat beds at Moss of Cree, Carsegown Moss and Borrow Moss. The carselands in the Fleet estuary are more restricted, forming terraces up to 500 m wide.

Interpretation

The abundance of well-developed emerged landforms on the north coast of the Solway, and the Cree area in particular, has stimulated interest in the Holocene sea-level history, mainly by Jardine (1975, 1977, 1978) but also by Bishop and Coope (1977) and Haggart (1989). More recent work in the late 1990s by Wells, and reviewed byFirth *et al*. (2000), forms the basis of the following account. Recent stratigraphical evidence from cores taken from the emerged carselands flanking the Cree estuary has established the existence of a buried layer of at least 9 m of fine-grained sediments capped, at between –2 m and 0 m OD, by a thin layer of buried peat. At Carsewalloch Flow, the buried peat is itself buried by up to 9 m of emerged estuarine sediments deposited by the Main Postglacial Transgression at about 6500 years BP (Firth *et al*., 2000), and that now form the carse surface. Estuarine microfossils from the basal sediments indicate that marine influences were dominant prior to 9600 years BP, but radiocarbon dating of the peat that caps these sediments shows sea level had fallen and had abandoned the area by at least 8300 years BP. However, radiocarbon dating of the uppermost part of the thin layer of peat indicates a transgression of the sea by 8000 years BP, followed by a rise to the Main Postglacial Shoreline at between 7–10 m OD by 6500 years BP. The subsequent fall of relative sea level from the uppermost carse surface to its present level was not uniform, because small areas of younger peats are found in the carse sediments at 5700 years BP, and evidence of a shoreline produced by a still-stand or transgression at 2000 years BP is also found. Over the past 2000 years the relative sea level in the Cree estuary and in the rest of the northern Solway Firth fell more or less smoothly to present levels. Such dating evidence produces a sea-level curve for the Cree that is broadly in agreement with elsewhere in Scotland (Haggart, 1989).

On the basis of sea-level curves, it is possible to determine the rate of crustal uplift in Scotland (Shennan, 1989; Firth *et al*., 2000). Over the last few thousand years, the evidence from the Solway suggests a mean rate of crustal uplift of 1.0 mm a^{-1}. Since recent eustatic changes in sea level produce a rise of 1.0–2.4 mm a^{-1} (Trupin and Wahr, 1990), then the present relative sea-level trend on the north coast of the Solway is either stable or, more probably, slightly rising.

Set within this sea-level context, the saltmarshes of the Cree have developed on the fringes of an estuary where they, and their emerged couterparts, have benefited from the shelter provided by Burrow Head to the south and by a north-west–south-east orientation along the length of the inlet. The eastern shore of the Cree estuary is also indented by Fleet Bay, a major NNE–SSW-aligned embayment. Shelter within the Cree has been unchanged over thousands of years and has produced a largely unidirectional wave climate producing a sediment sink that has encouraged sediment influx but little removal. It appears that this system still operates, since many of the sandflat and saltmarsh systems of the Cree are accreting, although the relative contribution of the sediments of different provenance is more difficult to determine. The extensive sandbanks in the Cree and Water of Fleet estuaries suggest that most of the material passes landwards up the tidal channels and the presence of Sellafield-derived radionuclides attached to the sediment confirms the outer Solway as a major source (Harvey and Allan, 1998). Within the Cree mouth itself, increasing amounts of mud suggest a fluvial source augmented by active reworking of emerged Holocene sediments from the carse deposits.

The position of the main channel of the Cree is likely to have a major influence on the local erosion or accretion regime of the sandflat and saltmarsh. For much of its route south from Newton Stewart, the present channel is now guided by embankments designed to allow land-claim of the saltmarsh behind, but which also serve to contain and train the river along a relatively inflexible course, especially on the outer bends of meander loops. At the exit of the Cree to the north of Wigtown Sands, the river has been further deflected to the east by a series of boulder groynes, which, by protecting the northern extent of Wigtown Sands, its saltmarsh and claimed land, serves to direct the main channel of the river onto the eastern shore. As a result the eastern shore to the south of Creetown is scoured by stronger currents that limit the deposition of fine-grained sediments and so is mainly developed in sands and gravels with little or no saltmarsh. The land-claim embankments and the training breakwaters of the River Bladnoch at Wigtown on the west shore also serve to encourage depositional conditions on the west shore by deflecting the main channel of the Cree towards the east.

It is evident that there has been change to saltmarsh extents over the historical period. For example, Figure 10.20 shows the movement of the MHWS and saltmarsh extent at Baldoon, on the west side of the estuary. Although embankments enclose a substantial area of former saltmarsh, the relative positions of the 1847 MHWS and 1847 saltmarsh edge show a very narrow and linear saltmarsh, which suggests that the date of enclosure was just prior to 1847. Subsequent to this, accretion, and the construction of a 600 m-long breakwater, resulted in the eastward migration of the MHWS by up to 100 m and eastward migration of the 1909 saltmarsh edge by up to 400 m, presumably at a lower height and characterized by an extensive area of low marsh colonized by pioneer species. By 1973, the edge of the saltmarsh coincided with mean high-water springs and lay on average some 60 m west of the 1909 position and was characterized by an elevated marsh surface at the same altitude as MWHS. Only small patches of low marsh remain, and most of the saltmarsh surface is now regarded as high marsh in vegetational and geomorphological terms.

This process of erosion and steepening of the upper gradient of the saltmarsh continues today, but the main channel of the Cree lies well to the east and is unlikely to be the cause of erosion at Baldoon. More likely is a causal relationship with relative sea-level rise and sediment supply.

Conclusions

Fringing estuarine saltmarshes are greatly influenced by the location of the main channel of the estuary and tend to develop along lines flanking those areas that allow fine-grained sediment to settle. The saltmarshes of the Cree estuary demonstrate this attribute well. Where they have undergone lateral widening, the geomorphological features of dendritic creek systems and numerous saltpans are well developed, especially in the north close to the Cree exit. Parts of the saltmarsh have developed very recently and independently of the complex of saltmarshes in the inner Solway Firth, and substantial areas are less than 200 years old. The Cree estuary saltmarshes are also important because they are associated with extensive areas of emerged estuarine carseland that offers a well-constrained sea-level history and allows more recent sedimentation to be set within a detailed long-term context. Although many of the creeks in the south are artificially straightened and the saltmarshes and rivers of the Cree have not escaped artificial embanking and training to assist agricultural land-claim, enough of the natural features of fringing estuarine saltmarshes remain to make this large area of sandflat and saltmarsh of major conservation importance.

Reference list

Bishop, W.W. and Coope, R. (1977) Stratigraphical and faunal evidence for Lateglacial and early Flandrian environments in south-west Scotland. In Studies in the Scottish Lateglacial Environment (eds J.M. Gray and J.J. Lowe), Pergamon Press, Oxford, pp. 61–88.

Burd, F. (1989) The Saltmarsh Survey of Great Britain: An Inventory of British Saltmarshes, Research and Survey in Nature Conservation, No. **17**, Nature Conservancy Council, Peterborough, 180 pp.

Firth, C.R., Collins, P.E.F. and Smith, D.E. (2000) Focus on Firths: Coastal Landforms, Processes and Management Options. V. The Solway Firth, Scottish Natural Heritage Review, No. **128**, Scottish Natural Heritage, Edinburgh, 120 pp.

Haggart, B.A. (1989) Variations in the pattern and rate of isostatic uplift indicated by a comparison of sea level curves from Scotland. Journal of Quaternary Science,**4**, 67–76.

Harvey, M.M. and Allan, R.L. (1998) The Solway Firth saltmarshes. Scottish Geographical Magazine, **114** (1), 42–5.

Jardine,W.G. (1975) Chronology of Holocene marine transgression and regression in south-western Scotland. Boreas, **4**, 173–96.

Jardine, W.G. (1977) The Quaternary marine record in southwestern Scotland and the Scottish Hebrides. In The Quaternary History of the Irish Sea (eds C. Kidson and M.J. Tooley), Seal House Press, Liverpool, pp. 99–118.

Jardine, W.G. (1978) Holocene coastal sediments and former shorelines of Dumfriesshire and Eastern Galloway. Transactions of the Dumfriesshire and Galloway Natural History and Antiquarian Society, 3rd Series, **55**, 1–59.

Rowe, S.M. (1978) An Investigation of the Erosion and Accretion Regime on the Saltmarshes of the Upper Solway Firth from 1946–1975, Nature Conservancy Council, Peterborough.

Shennan, I. (1989) Holocene crustal movements and sea-level changes in Great Britain. Journal of Quaternary Science, **4**, 77–89.

Trupin, A. and Wahr, J. (1990) Spectroscopic analysis of global tide gauge sea level data. Geophysical Journal International, **100**, 441–53.