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Early historic settlement on the western carselands of the Forth valley: a reappraisal

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ABSTRACT

This paper challenges the view, widespread amongst historians and archaeologists, that prior to the Improvement period the carselands west of Stirling were devoid of settlement due to near-continuous peat mosses. The argument is supported by cartographic evidence of pre-Improvement settlement and by documentary evidence of farming and settlement from the 15th century onward. Settlement was concentrated along the river margins and most of the modern carseland settlements are recorded by the 17th century. Eighteenth-century writers thought that the mosses had always been discontinuous and identified the important relationship between settlement and soil-types across the carse. Fortunately, the scientifically and archaeologically important surviving peat mosses have made the area a focus of palaeo-ecological and geomorphological research in recent decades. The scientific evidence supports the historical conclusion that the mosses were likely to be discontinuous in the pre-Improvement period, providing attractive sites for early settlement along their margins and confirms the correlation between documented early modern settlement and soil types, themselves a reflection of the evolution of the carse in the post-glacial period. The modern landscape is not, in this view, simply a product of moss clearance but also includes land never covered by moss and land only partially reclaimed. The reasons why recorded archaeological evidence for settlement is confined to the margins of the carse are briefly considered, as are some of the wider historical implications (such as movement between the north and south of Scotland).

INTRODUCTION

This paper presents new archival and cartographic data and places them in an environmental context in order to assess the degree to which the western carselands of the Forth Valley were covered in impenetrable peat mosses prior to the Improvement period.

Cadell (1913, 232–3) is the most commonly cited source for the view, often espoused by local people, archaeologists and historians (eg Mitchison 1987, 1; McNeill & MacQueen, 1996, 13; Ellis 2001, 173–4) and geographers (Shipley 1974, 75; Grieve 1993, 34), that prior to the major peat clearances, the carse was a 12-mile long 'dreary expanse of peat moss and heather … with its deep and treacherous pools [forming] an almost impassable morass from one to two miles broad'. It was, Cadell continues, 'known at different places as Flanders, Cardross … or Blairdrummond Moss'. Although Cadell recognized that peat depth varied from place to place (1913, 263, 265) and that bogs had different names, he did not see them as originally separate. Whittington (1968), whilst recognizing that there was moss-free ground in the pre-Improvement period, emphasized its limited extent and 'primitive' character and did

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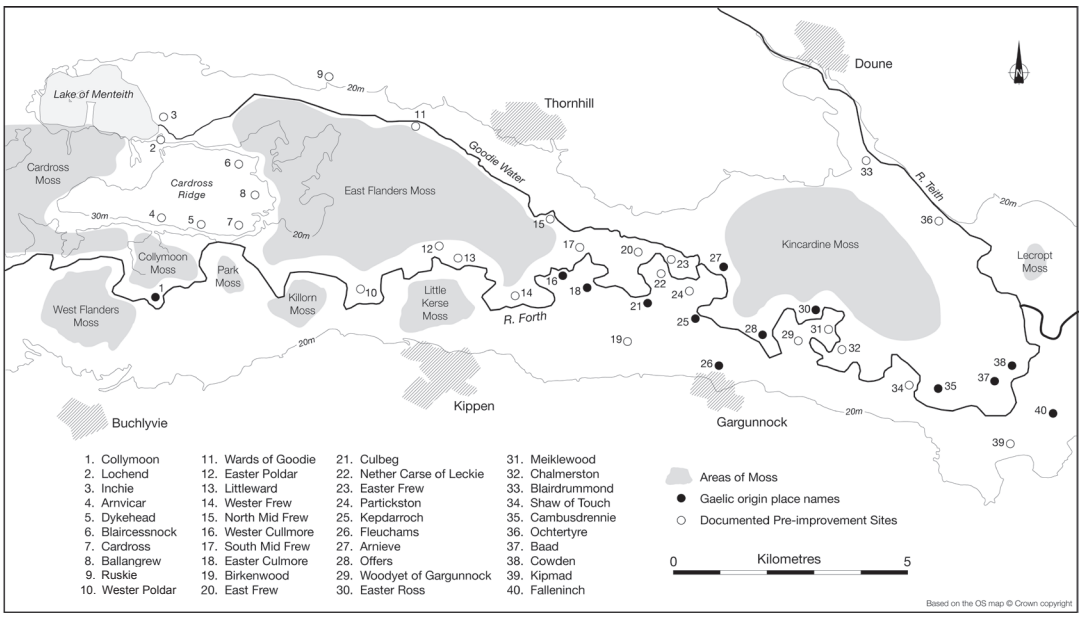


ILLUS 1 The raised mosses as depicted in the mid-18th century Roy's Military Survey and Gaelic and documented pre-Improvement settlements

not explore its significance for settlement or movement or for subsequent reclamation of the mosses. Finds from the carselands themselves are portable (Ellis 2001, 176) and do not necessarily indicate settlement. The archaeological evidence for prehistoric and medieval settlement fringes the carse margins, concentrating largely on the northern and southern slopes (RCAHMS 2000, 28–30) and most known settlement sites are 'homes of the elite' (RCAHMS 2000, 30; eg Hoffmann & Woolliscroft 2006). According to RCAHMS (2000, 30), 'Extensive colonization of the low ground by the middle of the 18th century is suggested by General Roy's map (Roy, 1747–55) which depicts and names most of the farms that today occupy the valley floor, but it is not yet clear when these settlements were first established.'

Roy's map precedes the major phase of local moss clearances begun about 1766 by Lord Kames. Roy shows the mosses to be discrete, each with its separate name and with extensive settlement around the fringes; bands of moss-free ground fringe the river-banks (illus 1). Is this an accurate representation? If accurate, is it to be explained by pre-18th century peat clearance or does it indicate that our view of this 'impassable morass' is incorrect? What might the mosses have been like before major human impacts? This paper develops two separate but closely inter-related approaches to environmental history. The first part presents new archival evidence that argues for considerably more pre-modern settlement and use of the carselands than is often assumed. The second part reviews the geomorphological evolution of the carselands, drawing on diverse geological sources which in combination suggest that before Improvement this landscape would have been a patchwork of different habitats, not the uniform 'morass' we imagine.

MEDIEVAL AND EARLY MODERN SETTLEMENT: HISTORICAL EVIDENCE

There is place-name evidence and direct documentary evidence for a near-modern settlement pattern on the carselands prior to the Improvement period (illus 1). Gaelic-origin place-names in this area are likely to be of 14th century origin or earlier (Taylor pers comm). Kepdarroch is one of several to be recorded well before the clearance phase; its lands (including the moss) were divided in 1557 when there were rigs of infield and outfield, a byre, barn, stable and peat house as well as a substantial residential house, an orchard and grazing for around 80 sheep or their equivalent (SCA B66/1/4 f. 40 r–v). The most extensive moss-free area depicted by Roy is the south-eastern part of the carse, including sites such as Kipmad (modern Whitehouse Farm), Falleninch, Shaw of Touch, Patrickston, Westwood and Meiklewood, all either of Gaelic origin or recorded early or both. Also extensive is the carse surface above the west bank of the River Teith with the elite site of Ochtertyre, other less prestigious sites and a significant route northward from Stirling to Blairdrummond. Frew, east of East Flanders Moss and bounded by the Goodie and Forth, provides the clearest early documentary evidence, with records of harvesting oats and meadow hay from 1437 and further records of settlement from 1499 and 1521–2 (Burnett 1882, 475, 673; Livingstone 1908, item 495; RMS III 1123); Frew would be included in the moss-free strip recorded by Tait and Gray (below). Grain was being grown at Wards of Goodie by 1542 (RMS III 2851). Records of Poldar (1533) and Littleward (1566) confirm settlement between East Flanders Moss and its associated rivers long before systematic clearance can have begun (NAS GD15/266 Tack of East Poldar, 1533; RMS IV, 1027; NAS GD15/185 to GD15/198). Many of these Gaelic-origin and early documented sites are shown on Roy and the distribution of documented and mapped sites is similar.

A series of testamentary inventories dated between 1599 and 1694 and mainly from the Frew area[1] suggests farms producing substantial quantities of cheese and butter and raising poor quality (mainly black) oats with little other grain produce, but their overall rent levels indicate that they were substantial compared with the smallest farms of the Stirling area (Harrison 1997). Other farms on these western carselands seem to have had a broadly similar pattern of production in the 17th century; most suggest that the grains were worth more than the livestock.

Contemporary or near-contemporary commentators support this view of extensive use of the carselands. In 1646 Littleward was not moss-covered (Mitchell 1907, 610). In 1724 it was noted that 'by the industry of the inhabitants' parts of the moss had been cleared by cutting, paring and burning (Mitchell 1906, 341); such clearance presupposes the ability to farm the land recovered from the moss. Two 1761 plans of the Cardross estate (NAS RHP 30799 & RHP 35452) confirm settlements and fields, albeit some of them wet or boggy, between the mosses and the Forth and Goodie rivers; some clearance is indicated by field names (Bruntland, Newfoundland) but this is of very limited extent. John Ramsay, a well-informed local landowner of the later 18th century, knew that agriculture on the western carse had been less advanced than along the tidal Forth east of Stirling until about 1700 and comments on the changes in agricultural methods as lime came into regular use thereafter. But he is describing change on existing farms, not the creation of new ones (Allardyce 1888, 193, 196, 197). In the 1790s, the minister of Kippen parish wrote that the infield land of the carse had been laboured 'for time immemorial' (Campbell 1978, 540).

That said, from the late 17th century, those settlements increased in value as lime became more readily available on the western carse.

Moss clearance accelerated as the 18th century progressed and in some cases entire mosses were cleared, thus creating the modern, rectilinear landscape. This was not entirely as a product of moss clearance but an amalgam of drained moss, of land cleared of moss and of land anciently farmed but radically changed during the Improvement period, a series of processes discussed in detail elsewhere (Harrison 2003; Harrison 2006).

Related to the settlements were a number of well-known north–south routes across the carselands. This was most clearly seen when the Jacobite army crossed the carse at Frew, southward in 1745, northward in 1746. A bridge across the Goodie on this route is recorded in 1647 and there was a ford across the Forth. These passages, with their potential for military movements, had been watched for centuries (Bain 1884, 382; ibid 384; NA Privy Seal, C47/22/1/42; RPC third series II, 218; RPC third series XIII, 567; APS IX, 92a 1689; RPC XV, 332). The main difficulties in crossing the carse are likely to have been the danger of spates, rendering the fords impassable, although in the long term these spates created the floodplains, whilst roads on the heavy carse clays would be difficult in wet weather or when frozen. The Frew route was mainly across fields that were harvested in the 15th century (above) and probably for centuries before that. It is probably the Auchmore (Great Ford) mentioned in the Scotichronicon (MacQueen & MacQueen 1993, 191). Another important route followed the Teith river terrace north from Drip via Ochtertyre and Blairdrummond, east of the mosses.

There is, thus, strong historical evidence for settlement in the late medieval and early modern period, well before the main phase of moss clearance. That raised questions about how consistent such an interpretation was with scientific understanding of the development of the carselands and so of how far back in time settlement could extend. Those questions required a different approach.

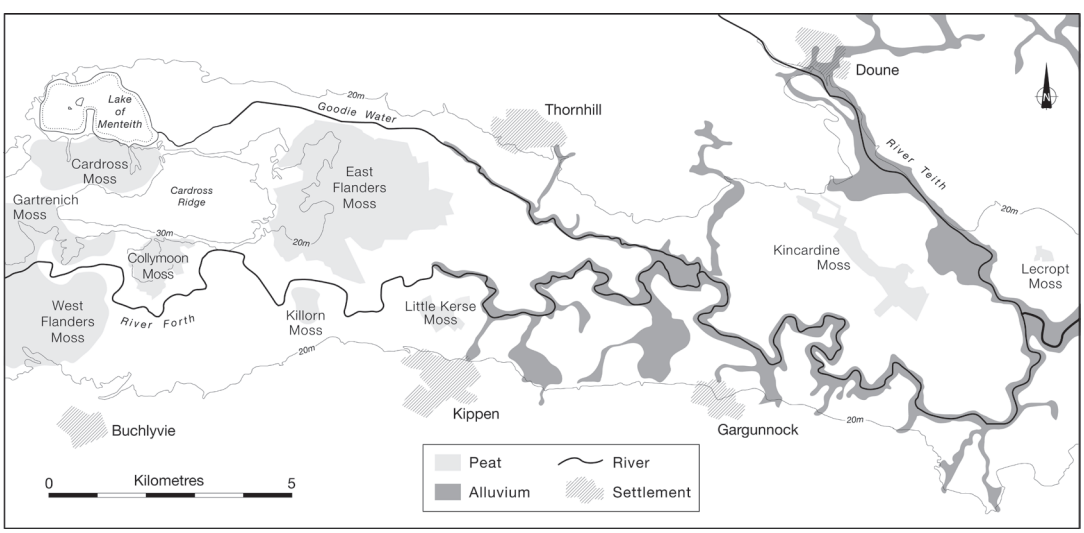
A RECONSIDERATION OF CARSELAND GEOMORPHOLOGY

The reconstruction described above needs to be assessed in the context of the physical landscape of the western carselands. Though the early development of this valley is well understood (eg Sissons & Smith 1965; Sissons 1976; Robinson 1993; Smith 1993; Hansom & Evans 2000; Smith & Holloway 2000; Holloway 2002; Holloway & Smith 2003), surprisingly little is known of the development of the valley floor in the last 7000 years. Two issues are important: the natural extent of the raised mosses, and the behaviour of the rivers flowing across the carse.

The flat surface of the western Forth valley is the product of a relatively high sea level stand in the middle of the Holocene period, around 7800–7600 cal years ago (Holloway & Smith 2003, 49). Estuarine sands and silts fill the valley to altitudes of 14–15m OD and these poorly permeable sediments form the carse. It is on this surface that the raised mosses formed; the estimate by the RCAHMS (2000, 28) that land up to 30m OD was affected by peat growth is a substantial over-estimate. Peat began to spread over the carse surface from 'islands' (Sissons & Smith 1965) and new areas of peat formed. A number of radiocarbon ages have been obtained on single cores from several raised mosses in the western Forth valley, away from localities possibly affected by the Blairdrummond Shoreline, which together suggest peat inception between 7250 and 5300 cal BP (Godwin & Willis 1962, 66–7; Holloway 2002, table A.7; Sissons & Brooks 1971, 126; Ellis 2001, 175–6). Interesting though these data are, they cannot define how fast the newly-established peat surface spread laterally. This has been examined only for West Flanders Moss where Robinson (1993, 32–7) obtained a series of radiocarbon assays and found, on samples which were considered to be reliable, that peat at points separated by 2–3km formed broadly contemporaneously on the carse surface between 7800 and 7300 cal BP.

The data cannot show that peat became laterally continuous. This has never been tested on the carseland and most evidence will have been destroyed during peat clearance, but some reconstructions can be used to indicate that the raised mosses that developed 7800–5300 cal years ago would always have been isolated. The peat bodies developed on the carse began as fens and ponds, and only subsequently became raised mosses. This transition has not been studied in the western Forth valley but from comparisons elsewhere is likely to have occurred very early on in their development (Korhola 1994; Hughes et al 2000). Such mosses are raised into mounds through retaining water delivered by rainfall, and the sizes and shapes of raised mosses can be precisely defined (Ingram 1987). The domes of the different mounds will not have moved through time. Raised mosses maintain surprisingly steep slopes from the centre to their edge. Raised mosses do not spread laterally in the way that blanket peat can, although they do grow, which might favour an interpretation of the Forth valley raised mosses as discrete. Because the shapes of raised mosses in the Forth valley have been modified by artificial drainage as well as cutting, their present shapes cannot be used to predict how large they might naturally have become. A difficulty with viewing the raised mosses as always discrete is that they can coalesce but how many raised mosses reached this stage is not known.

Reconstructions which presume coalescence might make much of the exceptional uniformity of the carse surface, which allows unimpeded growth. However, it is wrong to think that the western Forth valley is totally uniform because, of course, rivers run through it. Rivers will have represented major barriers to peat expansion. Although the Forth valley is a very ancient feature (George 1974) rivers would have been superimposed on the level carse surface following mid-Holocene relative sea level fall. Their courses should be traced from spreads of alluvium deposited on the carse surface. Illus 2 depicts the areas of alluvium defined by soil survey (Soil Survey of Scotland 1968 and unpublished). This is considered to define areas of alluvium better than the equivalent geological survey (Institute of Geological Sciences 1974).



ILLUS 2 The western carselands and the current extent of raised mosses, alluvial deposits and carse below 20m OD (from Soil Survey of Scotland (1968) *Stirling – Sheet 31*) and settlements and other features around the carselands

Large valley-side spreads such as at Boquhan, Gargunnock, Redhall and Touch to the south and Thornhill, Coldoch and Blairdrummond to the north are Devensian alluvial fans (illus 2), generated during deglaciation (eg Smith, Thompson & Kemp 1978, 104–5) though still active in the Holocene period. Within the carse are more-or-less continuous ribbons of alluvium. These are usually restricted to spreads only tens of metres wide and there is no evidence that when superimposed on the carse, rivers wandered freely over its surface. Relative sea level fall led to rivers cutting down (incising) into the carse surface (Smith et al 1978, 106) and becoming to some extent confined (Lewin & Brindle 1977), restricting lateral movement. Such confinement would have allowed peat inception, and initially rivers will not have impacted on the spatial pattern of peat growth.

Two properties of rivers would have restricted lateral peat growth. The first is that peat will not form where rivers flow, but peat can still become established to the river banks – as it has west of our area where the River Forth flows in a narrow channel between West Flanders and Gartrenich Mosses. More importantly, rivers were transformed by lateral erosion from thin channels to wide floodplains after the middle of the Holocene period (Brown & Keough 1992; Brown 1997; Macklin 1999) and floodplain creation by the accumulation of flat-lying flood sediments will have created peat-free corridors across the carse. Increased river discharges through changes in climate or land use, most notably in farming landscapes, accelerated the lateral erosion of rivers, widening their valley floors. Increased sediment loads from eroding streambanks and surrounding soils, transferred along alluvial fans on valley sides, supplied floodplains with sediment. Such fluvial transformations are widely recorded in the UK (Lewin, Macklin & Johnstone 2005) though very little data are available for central Scotland (Tipping & Tisdall 2006, 446–7). Riverine deposits are not associated with the mid-postglacial marine transgression that created the carse surface: existing surfaces were modified but terrestrial sediment supply was seemingly low (Smith et al 1978, 106). Holloway (2002) reported the deposition of probably fluvial silty sands after *c* 4000 cal BP in a small tributary of the Goodie Water near the Lake of Menteith, and this may represent Bronze Age alluviation.

The spatial pattern of floodplains in illus 2 suggests that alluviation affected the eastern part of the carse most. For example, no alluvial deposits separate Gartrenich and West Flanders Mosses (above), no such sediments were recorded in the peat sequence excavated at Parks of Garden (Ellis et al 2002) and estuarine sediments were recorded to the ground surface at Easter Poldar by Smith (1993, 462–3). From this point east floodplains are continuous. This might suggest that localized sediment supply via alluvial fans from valley sides was important in their creation, but this might also reflect the ponding of fluvial sediment when sea level rose again in the formation of the Blairdrummond Shoreline. River courses, particularly around Frew, created a dense network of floodplains of mineral soil and frequent inundation by floods probably maintained these natural, comparatively free-draining and nutrient-rich routeways across the carse.

Local farmers still recognize differences in the soils across the superficially homogeneous carse. The soil in the Frew area, close to the confluence of the Forth and Goodie, is sandier and freer than that elsewhere; on modern carse farms, the best land is that closest to the rivers (More pers comm; Carrick pers comm). Older writers distinguish the soils of the river margins from those of the rest of the carselands (Robertson 1794, 18). Campbell, in the 1790s mentions the strip of haugh beside the rivers, 'which is very fertile … adapted to tillage or pasture' (1978, 518) whilst Tait (1793, 266, 268) describes a strip of moss-free land, two and a half miles wide, stretching right across the valley between East Flanders and Kincardine mosses. Gray (1845, 1273) says that it was the 'general opinion' that this strip had never been covered

by moss. The arguments developed above, based on an appreciation of natural processes and landforms, need to be tested on the carse. However, we would suggest that the depictions given by these writers were more accurate than Cadell's account.

DISCUSSION

To understand the early historic settlement pattern on the western carselands requires both archival and scientific analyses in order to develop a more holistic environmental history. These have shown that both the form and development of raised mosses and processes of accelerated fluvial sedimentation would have militated against a continuous expanse of peat across the carse west of Stirling. Some parts of the river banks were (indeed, on the Goodie, still are) marshy, but the mosses themselves probably did not reach the river banks. A strip of fertile land between the mosses and the rivers probably existed, giving access to fuel, hunting and grazing on the one hand and transport and fishing on the other.

The historical evidence is overwhelming that the carselands have been settled and farmed for centuries: the geomorphological evidence suggests that settlement could have stretched back over millennia. The pattern of mosses and settlement shown on Roy is broadly reliable. The 'continuous morass' was essentially a creation of Cadell's description of 1913 (or at least was derived from it).

Settlers in the carse itself during the 16th and 17th centuries were either tenants or, in some cases, proprietors of small estates such as Kepdarroch or Easter and Wester Poldar. The elites (the landlords and superiors of these settlements) did not live on the carse proper but at sites on the carse fringes or the river terraces, including Blairdrummond, Ochtertyre and Cardross. This may well reflect earlier patterns and be related to the limited size and productivity of holdings constrained between moss and riverbank – sites also hampered by restricted communications, rendering them unsuited to a controlling role. The lack of archaeological remains of the documented vernacular settlements may be attributable to continued settlement at many of the older sites; perhaps, too, archaeologists accepting the 'mythic morass' view, have not looked exhaustively. The documented use of impermanent materials, such as clay and turf, for building must also be taken into account; during the peak of the clearances some sites seem to be almost evanescent as units were divided or amalgamated. It would be an interesting exercise to try to locate documented and mapped sites, known to have existed in the 18th and 19th centuries but with no obvious surface remains.

The implications of this revised view of the western carselands cannot be considered here in full. For example, it poses questions about the ancient division of Scotland into zones north and south of the Forth (APS Ass Will c 3 I, 372; Barrow 1960, 40) and about the military role of Stirling as controlling a unique nodal point of Scotland's geography. Inhabitants of the pre-clearance carse, with its isolated settlements sandwiched between the mosses and the rivers, were familiar with working the carse soils and with the earlier methods of moss clearance; many would participate in the Improvement phase of clearance too and profoundly influence its course. Indeed, without a settled landscape, many of the more labour intensive methods of moss clearance could not have been applied.

There is ample evidence of small boats operating both along and across the upper river (Harrison, 2005). The main, ancient north–south routes (via Drip and Frew) crossed the best-drained soils of the carselands. True, spates and difficult going might present problems for armies with baggage trains, guns and equipment; but for most of the time, the western carse presented no insuperable barrier to movement for individuals or small groups who were used to poor roads and occasional diversions to avoid temporary problems.

ENDNOTES

1 All were located in NAS Dunblane Commissary Court Register of Testaments:

	Name	*Location*	*Date*
CC6/5/3	Wm Taylor	Frew	10/4/1599
CC6/5/3	James Taylor	Mid Frew	7/3/1604
CC6/5/4	Janet Harvie	E Frew	21/9/1617
CC6/5/5	Elspeth Robertson	Mid Frew	20/4/1620
CC6/5/5	Barbara Don	Mid Frew	9/9/1620
CC6/5/5	Euphan Galbraith	W Frew	20/12/1622
CC6/5/6	Janet Robertson	Mid Frew	23/2/1630
CC6/5/8	James Graham	Calziemuck	13/5/1663
CC6/5/8	Grissell Leckie	Mid Frew	13/8/1663
CC6/5/8	Agnes Don	Frew	15/6/1665
CC6/5/8	Jonet Monteith	Calziemuck	2/11/1665
CC6/5/10	Janet Robertson	Frew	29/7/1669
CC6/5/12	John Harvie	Mid Frew	22/3/1677
CC6/5/12	James Harvie	Mid Frew	12/7/1677
CC6/5/16	Archibald Paterson	E Frew	5/7/1694

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REFERENCES

Allardyce, A (ed) 1888 *Scotland and Scotsmen in the Eighteenth Century – from the manuscripts of John Ramsay, Esq of Ochtertyre*. London.

Bain, J (ed) 1884 *Calendar of Documents Relating to Scotland, vol II, 1272–1307*. Edinburgh.

Barrow, G W S (ed) 1960 *Regesta Regum Scottorum I; The Acts of Malcolm IV 1153–1155*. Edinburgh.

Brown, A G 1997 *Alluvial Geoarchaeology*. Cambridge.

Brown, A G & Keough, M 1992 'Holocene floodplain metamorphosis in the Midlands, United Kingdom', *Geomorphology* 4, 433–45.

Burnett, G (ed) 1882 *The Exchequer Rolls of Scotland, 1437–1454*. Edinburgh.

Cadell, H M 1913 *The Story of the Forth*. Glasgow.

Campbell, J 1978 'The Parish of Kippen', *in* Withrington, D J & Grant, I R (eds) *Old Statistical Account, Stirlingshire*, 317–57. Wakefield.

Ellis, C 2001 'Realizing the archaeological potential of the Scottish peatlands: recent work in the Carse of Stirling, Scotland', *in* Purdy, B A (ed) *Enduring Records. The Environmental and Cultural Heritage of Wetlands*, 172–82. Oxbow Books, Oxford.

Ellis, C, Crone, A, Reilly, E & Hughes, P 2002 'Excavation of a neolithic wooden platform', *Proc Prehist Soc* 68, 247–56.

George, T N 1974 'The geology of the Stirling region', *in* Timms, D (ed) *The Stirling Region*, 529. Stirling.

Godwin, H & Willis, E H 1962 'Cambridge University natural radiocarbon measurements VI', *Radiocarbon* 4, 52–70.

Graham, P 1812 *A General View of the Agriculture of Stirlingshire*. Edinburgh.

Graham (Col of Meiklewood) 1832 'Account of the Improvement of One Hundred and Thirty Acres of Land, covered with Peat to the Depth of Ten Feet', *Highland Soc Trans* 9, 223–8.

Gray, A 1845 'Kincardine in Monteith', *New Statistical Account of Scotland* 10, 1242–87.

Grieve, I C 1993. 'Soils', *in* Corbett, L et al (eds) *Central Scotland: Land, Wildlife, People*, 32–42. Forth Naturalist & Historian, Stirling.

Hansom, J D & Evans, D J A 2000 'The Carse of Stirling', *Scott Geogr J* 116, 71–8.

Harrison, J G 1997 'Between Carron and Avon: The Grangemouth Area since 1600', *Forth Nat Hist* 20, 71–91.

Harrison, J G 2003 *Historical Background of Flanders Moss*. Scottish Natural Heritage Commissioned Report 002 (http://www.snh.org.uk/pdfs/publications/commissioned_reports/f021g22.pdf)

Harrison, J G 2005 'Water-borne transport on the Upper Forth and its Tributaries', *Forth Nat Hist* 28, 105–9.

Harrison, J G 2006 'Improving the roads and bridges of the Stirling area *c* 1660–1706', *Proc Soc Antiq Scot* 135, 287–308.

Hoffmann, B & Woolliscroft, D 2006 'Trading with the empire', *Current Archaeology* 206, 18–21.

Holloway, L K 2002 *Sedimentary Environments in the Western Forth Valley during the Late Devensian and early Holocene*. Unpublished PhD Thesis, Coventry University.

Holloway, L K & Smith, D E 2003 'Late Quaternary sea level change and raised marine deposits in the Forth Valley', *in* Evans, D J A (ed) *The Quaternary of the Western Highland Boundary: Field Guide*, 42–9. London.

Hughes, P D M, Mauquoy, D, Barber, K E & Langdon, P G 2000 'Mire-development pathways and palaeoclimatic records from a full Holocene peat archive at Walton Moss, Cumbria, England', *The Holocene* 10, 465–79.

Ingram, H A P 1982 'Size and shape in raised mire ecosystems: a geophysical approach', *Nature* 297, 300–3.

Institute of Geological Sciences 1974 *Stirling – Sheet 39W (Drift Edition)*. Edinburgh.

Korhola, A A 1994 'Radiocarbon evidence for rates of lateral expansion in raised mires in southern Finland', *Quaternary Research* 42, 299–307.

Lewin, J & Brindle, B J 1977 'Confined meanders', *in* Gregory, K J (ed) *River Channel Changes*, 221–33. Chichester.

Lewin, J, Macklin, M G & Johnstone, E 2005 'Interpreting alluvial archives: Sedimentological factors in the British Holocene fluvial record', *Quat Sci Rev* 24, 1873–89.

Livingstone, M (ed) 1908, *The Register of the Privy Seal of Scotland, vol I, 1488–1529*. Edinburgh.

McNeill, P G B & MacQueen, H L (eds), 1996. *Atlas of Scottish History to 1707*. Edinburgh.

Macklin, M G 1999 'Holocene river environments in prehistoric Britain: human interaction and impact', *J Quat Sci* 14, 521–30.

MacQueen, J & MacQueen, W (eds) 1993 *The Scotichronicon by Walter Bower*. Aberdeen.

Mitchell, A (ed) 1906 *Geographical Collections relating to Scotland Made by Walter Macfarlane vol I*. Edinburgh.

Mitchell, A (ed) 1907 *Geographical Collections relating to Scotland Made by Walter Macfarlane vol II*. Edinburgh.

Mitchison, R 1987 *A History of Scotland*. London.

NSA 1845 *The New Statistical Account of Scotland vol X, Perthshire*. Edinburgh.

Paul, J B & Thomson, J M (eds) 1984 *Register of the Great Seal of Scotland*. Edinburgh.

Register of the Privy Council of Scotland. Third Series, various dates. Edinburgh.

Robertson, J 1794 *General View of the Agriculture in the Southern Districts of the County of Perth*. London.

Robinson, M 1993 'Microfossil analysis and radiocarbon dating of depositional sequences related to Holocene sea-level changes in the Forth Valley, Scotland', *Trans Roy Soc Edinb: Earth Sci* 84, 1–60.

RCAHMS 2000 *The Historic Landscape of Loch Lomond and Trossachs*. Edinburgh.

Shipley, B M 1974 'Soils', *in* Timms, D (ed) *The Stirling Region*, 66–83. Stirling.

Sissons, J B 1976 'The geomorphology of the upper Forth Valley', *Forth Nat Hist* 1, 5–20.

Sissons, J B & Brooks, C L 1971 'Dating of early postglacial land and sea-level changes in the western Forth Valley', *Nature Phys Sci* 234, 124–7.

Sissons, J B & Smith, D E 1965 'Peat bogs in a post-glacial sea and a buried raised beach in the western part of the Carse of Stirling', *Scott J Geol* 1, 247–55.

Smith, D E 1993 'Western Forth Valley,' *in* Gordon, J E & Sutherland, D G (eds) *Quaternary of Scotland*, 456–64. London.

Smith, D E & Holloway, L K 2000 'The geomorphological setting of Flanders Moss', *Forth Nat Hist* 23, 3–20.

Smith, D E, Thompson, K S R & Kemp, D D 1978 'The late Devensian and Flandrian history of the Teith valley, Scotland', *Boreas* 7, 97–107.

Soil Survey of Scotland 1968 *Stirling – Sheet 31*. Aberdeen.

Tait, C 1794 'An Account of the Peat-Mosses of Kincardine and Flanders in Perthshire', *Trans Roy Soc Edinb* 3, 266–79.

Thomson, T & Innes, C (eds) '1814–15', *Acts of the Parliaments of Scotland*. Edinburgh.

Whittington, G 1968 'Landscape Change in the Vale of Menteith', *in* Whittow J B et al (eds) *Essays in Geography for Austin Miller,* 188–206. Reading.

ARCHIVAL SOURCES

National Archives (NA)

C47 Privy Seal Records.

National Archives of Scotland (NAS)

CC6/5 Dunblane Commissary Court Register of Testaments

RHP Register House Plans Series

SC67/49 Stirling Sheriff Court, Register of Deeds

Stirling Council Archives (SCA)

B66/1 Stirling Burgh Protocol Books