

Scottish Natural Heritage

Commissioned Report 313

Literature review of the history of grassland management
in Scotland





COMMISSIONED REPORT

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Summary

Literature review of the history of grassland management in Scotland

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BACKGROUND

The biodiversity of semi-natural grasslands (also known as unimproved grasslands) is a product of their past low-intensity agricultural management. Current knowledge of appropriate management for these species-rich pastures and meadows is often based on assumptions of the types of management in the past that created and maintained them. This project provides evidence from historical records to support SNH's advice on the status and management of unimproved lowland grasslands. It describes the typical grassland management regimes of the past three centuries, looking at hay production and grazings, and at past methods of improvement and fertilisation. It shows which types of grassland were valued and which were considered undesirable, and thus how past grassland management has shaped the modern resource.

MAIN FINDINGS

- Grasslands across Europe have been improved by artificial irrigation from the thirteenth century onwards. However, the introduction of 'bed-work' meadows to England around 1600 led to the mass conversion of unimproved grassland into artificially irrigated meadows. The technology of bed-work meadows appeared in Scotland by the eighteenth century.
- Sown grass seed for hay was first introduced to Scotland by the earl of Haddington in the early eighteenth century. Its use had spread to Islay by 1761 and to Sutherland by the 1770s. Rye grass and clover were sown from the eighteenth century onwards.
- Rough pasture was considered 'barbarous' and unreliable while hay from artificially sown grass was considered reliable and civilised. These modernising attitudes amongst landowners contributed to the improvement of grazings by the sowing of rye-grass and clover during the eighteenth and nineteenth centuries.
- Although hay could be made from flying bent (*Molinia caerulea*) on Rum, heather on Shetland and bogs in Dumfriesshire, the species recommended as making good hay and pasture tended to be those that are now typical of mesotrophic grasslands such as NVC communities MG5, MG6 and MG9. Approved species included Yorkshire-fog (*Holcus lanatus*), rough meadow-grass (*Poa trivialis*), crested dog's-tail (*Cynosurus cristatus*), sweet vernal-grass (*Anthoxanthum odoratum*), bent grasses (*Agrostis* spp.), tufted hair-grass (*Deschampsia cespitosa*), ribwort plantain (*Plantago lanceolata*) and bird's-foot-trefoil (*Lotus corniculatus*).
- Animal dung was originally used to manure meadows. By the early eighteenth century, other materials including lime, mould, ashes and composts were being used. A text from 1716 recommends: ashes of wood, peat, turf, sea-coal, dung of pigeons or other fowl, lime, chalk or marle and blue clay called Urry dug out of coal mines. Chemical fertilisers were used from the mid-nineteenth century. A 19th century text, from England, recommended dung, bone dust, guano, superphosphate and gypsum.
- The shieling system of seasonal grazing on upland pastures appears to have become redundant in the nineteenth century due to the introduction of sown grasses and improved cropping techniques.

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INTRODUCTION AND METHODS

Meadows and grazings in Scotland have left a lengthy historical footprint. For example, the Pictish (pre-900) word that designated a water meadow was **dul/*dol* (later Scottish Gaelic *dal-*), meaning 'haugh-land or water-meadow' (Watson, 1926). Some of the tenants in the shire of Stirling during the reign of King Alexander I (1107-24) were described as *gresmanni* (gresmen) and, at a slightly later date during the early thirteenth century, it is known that *grescan* (a grazing cáin or tax) was paid to a thane of Inverkeilor (Barrow, 1973).

Given this lengthy history it is perhaps surprising that little work on the historical aspects of the management of 'low-maintenance' or 'unimproved' grasslands, hereafter defined as meadows (cut annually), grazings and shielings, has been undertaken in Scotland. While it is true that one monograph on shieling systems in parts of central Perthshire, together with a few individual case studies have been published, the latter have generally been completed as an adjunct to a different line of research. Undoubtedly, this is because historical investigation into estate management in Scotland has tended to focus on the political and social developments rather than the actual general practices of land management. This paucity of investigation stands in stark contrast to other European countries.

Partly as a consequence of this lack of knowledge, SNH has relied heavily on statistics relating to grassland decline in England on the assumption that agricultural management in lowland Scotland is likely to have been similar to that in England. While this could prove to be correct, it is unlikely that a similar case could be made for the extensive upland grassland areas of Scotland, due to differences in climatic conditions.

It is the intention of this report to begin to rectify this situation, primarily via a survey of secondary literature on 'unimproved' grassland management across Britain. In addition, a small amount of desk-based research on targeted family archives which are available for consultation in the National Archives of Scotland will be undertaken. Unfortunately, at present it is not known just how much material relating to the management of unimproved grasslands still survives in the primary source records for Scotland and it would be impossible to undertake a complete survey within the timescale of this project.

One of the first questions to address is what is meant by the phrase, 'unimproved grassland'? One obvious definition would be that it means post-agricultural-improvement grasslands (ie. post-1700), after which new agricultural regimes of rotation, sowing, and soil enrichment, together with different breeds of animal, were imposed onto pre-existing agricultural and pastoral landscapes by improving Scottish landowners like the marquis of Breadalbane, Lord Kames, or Sir James Grant of Freuchie.

Of course, this assumes that pre-1700 Scots did nothing substantial to either enrich or improve the different types of grasslands (meadows, grazings and shielings) available to them and that they indulged in low-intensity management of these resources. This hypothesis remains to be tested against the primary source evidence, however, and by uncritically adopting such assumptions, we may be doing pre-1700 landlords and tenants a grave disservice. This is mainly because grassland management in Scotland has a long history and references to meadows, grazings and shielings can regularly be found in the earliest surviving twelfth-century historical records. The fact that such references appear at all may be due in part to the way in

which the Scottish landscape was divided into different units of assessment from an early date.

This report begins with a literature review of material relating to unimproved grasslands in both Britain and Europe, highlighting any inconsistencies in the Scottish material. The second section places unimproved Scottish grasslands in their historical context, and includes an overview of the history of land division and assessment. This is followed by an attempt to categorise different types of unimproved grasslands in Scotland as they appear in the historical record. The final section of the report summarises the findings and makes recommendations for further research.

LITERATURE REVIEW

In Britain, people have been writing specifically about meadows since at least c.1600 and the main stimulus behind this seems to have been a scientific advancement in the management of 'unimproved' grasslands: namely, the development and introduction of a new type of human-controlled irrigation (bed-works) on meadows in south-western England. This was a very important development in the history of meadow management and it is worth discussing in some detail here for two reasons. First, it had turned into a European-wide phenomenon by the early nineteenth century. Second, its practice seems to have effectively involved the mass conversion of hitherto 'unimproved' meadows in parts of Britain into artificially irrigated meadows.

The introduction of artificial downward floated water meadows (bed-work meadows)

The person traditionally given credit for the introduction of this important new technique in England is Rowland Vaughan who took 20 years to construct his new irrigation system of sluices and canals. In 1610 he wrote:

But in his drownings, he makes lands arise, in grace and goodnesse to the highest pitch; and meads and pastures price he multiples; [...] infuseth in the woombe of sterile lands, the liquid seede that makes them plenty bring [...]

According to Vaughan, who lived in Herefordshire, he had become concerned with the condition of an old 30 acre meadow on his lands which he describes as being 'over-worn with age and heavily laden with moss, cowslips and other imperfect grasses.' Therefore, he decided to improve his exhausted meadows by introducing artificial irrigation to improve the grasses and he made a number of recommendations to anyone copying his techniques. Firstly, the soil type of the meadow in question should be checked as not all soils were the same. In addition, the landowner should ensure that all the water was gone by March and that all flooding of the land should be done at night so as to avoid scorching the grass during the heat of the day (Vaughan, 1610).

It has, however, recently been argued that Vaughan was not the inventor of this process, and that what he had in fact constructed was a catch-work meadow, a type which had already been in common use across Europe by the thirteenth century. This was where channels were cut along the contours of a valley side so the water simply flowed down the natural slope via a series of ditches. According to the authors of this article, the origins of the bed-work meadow may instead lie in Wessex in the sixteenth century. Bed-work meadows required a greater financial commitment because they lay on valley floors where the water could not easily flow naturally without the aid of an intricate system of carrier channels, sluices and drains (Taylor *et al*, 2006). In fact, such meadows seem to have been created in England for two reasons: to provide an abundant and reliable hay crop and to sustain flocks and herds of animals during the winter months (Bettey, 1999). This technical innovation was not quickly introduced throughout England, nor did it work successfully wherever it was introduced. It has been argued that outwith Wessex and elsewhere in south-western England either the topography or the climate, or both factors, worked against the long-term success of such schemes (Martins and Williamson, 1994).

Whatever the case, it has been claimed that it was the eighteenth century before the science that underpinned the creation of bed-work meadows was printed and the technology appeared in Scotland (Bettey, 1999). For example, during the late

eighteenth and early nineteenth centuries George Boswell produced at least four editions of his book *A Treatise on Watering Meadows* which seems to have been widely read in Britain. This is an important text because he does not just advocate turning 'unimproved' meadows into artificially irrigated meadows but also higher pastures and moor-land. He further explained that after such lands had been converted to irrigated meadow and the hay cut, the aftermath was extremely beneficial to milk and butter beasts (Boswell, 1801). Such techniques were introduced to Scotland before 1800 and the reports concerning them were full of praise because the creation process had killed off all the low value plants including rushes and heather (Johnston, 1794b).

Given their prominence in the literature it looks as though the creation of new bed-work meadows in Scotland was largely the work of one family, Charles Stephens and his two sons who had learned the irrigation trade in England. One possible problem with this claim is that it appeared in a book written by one of the two sons, George Stephens, who was an author as well as a professional irrigator so he could have been trying to boost the family business with his writings. In any event, Stephens related that he had worked in both Britain and Scandinavia after he had been employed in 1806 by the Nerican Agricultural Society of Sweden to introduce a specific mode of draining to that country. In his book Stephens persuasively argued that deposition of sediment during flooding upon grasses greatly enriched the soil through some unknown chemical process. He also stated that water levels were critical, that good drainage was necessary, and that catch-work irrigation should be avoided at all costs. He further recommended that the grass seeds generally used for laying down land to water meadow should be vernal grass, crested dogtail, soft meadow grass, rough-stalked meadow grass, foxtail, and *Agrostis stolonifera*, which last, according to Stephens, was one of the prevailing grasses in all good meadows (Stephens, 1829).

In fact, Stephens wholly credited his father Charles with the introduction of artificially irrigated meadows into Scotland after he had been engaged by the Highland Society in 1792 to travel around Scotland and produce a report on the best places to introduce them. According to Stephens, after the report was completed his father then began to introduce artificially irrigated meadows across Scotland in areas like Caithness, Clackmannanshire, Aberdeenshire, Galloway, Dumfriesshire, Peeblesshire, and Perthshire (the list was not exhaustive) and, in many of these trials, existing traditional 'unimproved' meadows underwent the conversion process to artificial irrigation. Unfortunately, Stephens did not provide a great deal of detail about the programme of conversion undertaken by his father and one of the few facts he recorded was that Kirkhouse meadow, of nine Scots acres (one Scots acre equalled 1.26 English acres) in the parish of Traquhair was the first scientifically-formed irrigated water meadow in Scotland.

It should be noted, however, that Stephens was not the only person with a strong interest in artificially irrigated meadows in Scotland at this time as a scientific treatise on the subject was published by the *Highland Society of Scotland* in 1807, though this mostly concentrated on catch-work meadows. The author also reported on the best seeds to sow on such meadows and the best times for watering (Singers, 1807b). The same writer also produced a report on various artificially watered meadows in southern Scotland, particularly those upon the estates of the duke of Buccleuch who employed a flooder, Mr. Charles Stevens (despite the difference in spelling probably the father of George Stephens). The survey covered a total of 20 meadows alongside the Esk, Ewes, Tiviot, Etterick, and Yarrow rivers but also listed a grand total of 37 meadows, totalling 362 acres, laid out by Stevens on the Buccleuch estates between 1797 and 1804. At that time a further five meadows

were under construction and when they were finished it was estimated that there would be a total of 415 English acres of artificially irrigated water meadow on the Buccleuch estates (Singers, 1807c).

Clearly, the duke of Buccleuch had embarked upon an extensive programme of artificially irrigated meadow expansion and, although the figures of 42 meadows totalling 415 acres looks impressive they are somewhat dwarfed by the size of a single meadow near Fintry in Stirlingshire that was reckoned to be around 500 acres in extent (<http://stat-acc-scot.edina.ac.uk/link/1791-99/Stirling/Fintry/11/372/>). This must surely have been created to cater for cattle markets in the area.

George Stephens was, however, more forthcoming on his own programme of conversion after he had returned to Scotland from Sweden in 1822 and, like his father, he seems to have worked across Scotland for various families in Dumfriesshire and Galloway, for the duke of Atholl at Dunkeld, for the earl of Mansfield at Scone, around Loch Dochart, near Crieff, Rosshire, Sutherland, Lanarkshire, Peeblesshire, Glendevon, and in Aberdeenshire. Some of these new irrigated meadows had previously been bogs or moor-land. The remainder had either been traditional 'unimproved' meadows, either still in use or those that had previously fallen out of use (Stephens, 1829).

While Stephens clearly enjoyed giving the impression that he was the sole provider of irrigation services in Scotland at that time, it is clear from his writings that many landlords were also engaged in converting old meadows and waste into irrigated meadows at the same time, perhaps only using Stephens to officially inspect their handiwork. Accordingly, it can only be presumed that either other professional irrigators were working in Scotland at the same time or those landlords were reading the scientific literature about bed-work and catch-work meadow conversion for themselves. Until further investigation is undertaken either scenario is possible, although it should be noted that the *Highland Society of Scotland* published technical details about artificially irrigated meadows and offered different prizes to tenants in Ross and Cromarty, Sutherland, and Caithness who were willing to conduct water over their pasture grounds to eradicate heath and produce grass (MacKenzie, 1799).

Interestingly, there are a couple of instances in his book when Stephens admits, perhaps inadvertently, that artificially irrigated meadows had been previously introduced to Scotland at a much earlier date. The most important of these admissions relates to the extensive system of effluent-irrigated meadows around Edinburgh that Stephens confessed had already been in use for 100 years (since c.1729) and were now so rich they had to be cut five or six times per annum. Yet another was when Stephens admitted that in Perthshire there were 'many places' where there were traces of water being carried over the ground to water meadows, but there was nobody left alive who could remember them working (Stephens, 1829). In the course of research for this review, evidence was found relating to the creation of an artificially irrigated meadow near Pitfirrane in Fife where the landowner had inserted sluices on a piece of land before sowing it with clover and rye-grass in 1723 (NLS, MS.6456). Further supporting evidence of an earlier date for the introduction of artificially irrigated meadows to Scotland can be found in reports written by earlier authors. For example, before 1793 Robertson noted the extensive remains of old water ducts for watering grazings in Strathearn (Robertson, 1793b). Unfortunately, it is impossible to tell from the source exactly how long these workings had been out of use.

It is also easy to see why so many landlords were keen to either employ or follow Stephens in creating new irrigated meadows. With regard to his irrigating work in

Sweden he claimed that he had converted a bog meadow producing 1150st of hay per annum to an irrigated meadow that produced over 4000st of hay per annum. In Scotland, he also gave various examples of the economics of meadow improvement and claimed that some of his sites had gone from a value of 5s per acre to £7 per acre after irrigation (Traquhair) or from £3 per acre to £19 per acre after irrigation in Dumfriesshire (Stephens, 1829). These figures represented potentially huge economic gains for any landlord in return for a relatively minor investment.

It is tempting to suggest that one of the reasons why the Stephens family were so busy converting bog, moor, and 'traditional' meadow into irrigated meadow during the last decade of the eighteenth century and first two decades of the nineteenth century was because of the huge increase in feed requirements that must have been needed to meet the demand in animal carcasses to supply the British army during the Napoleonic Wars. Such a case was recently advanced, for example, in relation to English artificial water meadows (Martins & Williamson, 1994). However, the Napoleonic Wars ended in 1815 and the cessation of hostilities was quickly followed by a massive depression in the basic prices of all foodstuffs in Britain. This is problematic because if there was ever a link between warfare, increased production of animal feed, and the creation of irrigated water meadows, it cannot be used to explain why Stephens was so busy creating more irrigated meadows in Scotland after his return from Sweden in 1822 during a time of economic depression. In Scotland, we must surely look for another reason to explain the phenomenon of irrigated meadow creation post-1815. Perhaps, like some estates in northern and eastern England (Martins and Williamson, 1994), some artificially irrigated water meadows in Scotland later became deliberately included in designed ornamental landscapes. This hypothesis remains to be tested against further research.

More importantly perhaps, apart from three short regional studies on irrigated meadows in parts of Renfrewshire and Perthshire (Mitchell, 1984; Mitchell, 1997; Fraser, 2001), no historian has yet attempted to ascertain the full extent, scale, and geographic loci of these conversions made both by the members of the Stephens family and various landlords in Scotland. This should probably be undertaken in the near future since it would greatly aid in plotting the rapid demise of some 'unimproved' meadows and other grasslands across many different parts of the country. Six years ago a reference was made to a list of 150 artificially irrigated meadows in parts of eastern Scotland, Lanarkshire, and Galloway that had been compiled by Iain Fraser but this has so far proven difficult to track down and it is not clear whether it has been published (Barber, 2001). Even if it has, the historical evidence consulted for this review indicates that it would be far from exhaustive. Similar but more thorough studies have already been undertaken for many parts of England where both the chronology of building, investigation of the meadow designs, and the mapping of remains have been completed in detail (Martins & Williamson, 1994; Cowan, 2005).

In fact, Stephens's publication appears to be the last book that discusses artificially irrigated meadows in Scotland in any detail. Other nineteenth century publications on this type of meadow just tend to refer to Scottish examples in passing, one exception being a short article arguing that English water meadows were eminently suitable for use in Scotland (Robie, 1876). This trend has carried through to the twentieth century and beyond, as far more research on both catch-work and bed-work meadows have been undertaken in England and Wales. Scotland has nothing to match the depth of research done both at a local level and a national level for England and Wales (Cook & Williamson, 1999), apart from two papers writing up the results of limited irrigation experiments on Scottish hill pasture upon one farm in the Pentland Hills in Midlothian (Heddle & Ogg, 1933; Heddle & Ogg, 1936) and the

restoration of one wet meadow within the Loch Lomond nature reserve (Mitchell, 1984; Mitchell, 1997). For example, one product of this sustained research outwith Scotland means that it can now be estimated that 40,500ha of artificially irrigated water meadows had been constructed in England and Wales by the end of the nineteenth century, 3% of which remain operational today. Their importance as a component of the landscape character and as a wildlife habitat is recognised, and many of these are now SSSIs. The maintenance and restoration of traditional water meadows is also supported under the Environmental Stewardship Scheme. One such example can be found at Sherborne, run by the National Trust (Cutting & Cummings, 1999).

Thanks to this research, it has now been suggested that the severe agricultural depression in the 1870s effectively ushered in the demise of artificially irrigated meadows in England and Wales because it led to a low level of investment in land that lasted until WWII as arable reverted to pasture, more marginal reclaimed lands were abandoned, drainage systems deteriorated, and the active management of water meadows declined (Cook & Williamson, 1999). At least some of the decline of artificially irrigated water meadows in Scotland can be attributed to more prosaic means. As early as the 1820s it was noted that some of the relatively new water meadows on the Buccleuch estates had already been ploughed up and seeded because the price of grain had greatly risen (Stephens, 1829). Here, we would seem to have a good example of artificially irrigated meadows being destroyed for short-term financial gain. More recently, it has been suggested that a number were also destroyed by the construction of new railway lines that favoured flat valley floors (Fraser, 2001). It might also be questioned, for example, how many natural water meadows were destroyed by the construction of the Caledonian Canal which completely altered the pre-existing water table.

It is not immediately obvious why there should be this discrepancy in research on artificially irrigated meadows between different parts of Britain. It could be a reflection of the different priorities of bodies like Natural England and Scottish Natural Heritage but the lack of research in Scotland may simply be down to the fact that there is only one permanent post in Scottish environmental history across all of the Scottish universities.

Nevertheless, on the basis of the literature consulted to date, there were once three different types of artificially irrigated meadow in Scotland. These can be broadly classified as water catch-work, water bed-work, and effluent bed-work. The last type seems to be the rarest of the three in Scotland with only two examples uncovered to date: Edinburgh and Crieff. More Scottish examples of this type may appear if further research is undertaken as they seem to have been commoner in England.

'Unimproved' grasslands

Meadows

The statistics quoted in the two preceding paragraphs also relate to other types of meadows in England and Wales, which were traditionally divided into two main types, wet and dry: 'wet meadows occur where the water overflows or drowns or where lands are artificially watered, dry meadows are not flooded or overflown and lie in warm and fertile soil' (Worlidge, 1716). Just over a century later, with increasing scientific investigation, it was argued that there were more classifications of meadow and these were listed as follows: upland pastures with thin soils, meadows on poor stiff soils and hungry clays, meadows on rich deep loams, meadows on the banks of rivers subject to occasional flooding, and irrigated meadows (Buckman, 1858). Neither of these works appears to have considered any evidence from Scotland.

One reason for this may be that up to the mid-point of the nineteenth century very little had been written about 'unimproved' meadows in Scotland and most of what had appeared was contained either in estate surveys, the statistical accounts, traveller's reports or in general agricultural surveys rather than specialist literature. Probably the best known estate survey is that completed for Loch Tay by Farquharson and M^cArthur in 1769. In this, the lands on both side of the loch were measured and assessed, accompanied by a series of maps and drawings, and all the meadows and grazings were measured and mapped in exhaustive detail (M^cArthur, 1936). Unfortunately, this report does not provide grazing figures in sufficient detail for absolute numbers to be estimated for livestock upon meadow and grazings.

There were other estate surveys completed around this time. One of the best known was the survey of Assynt, completed in the 1770s. This provides just as much detail on individual townships as the previous survey but, even though there is next to no mention of meadow land, 'sweet grasses' for hay are referred to on a number of occasions (Adam, 1960). This evidence would suggest that hay was cut on a regular basis in Assynt but perhaps the surveyor just did not see anything he would have recognised as a meadow. The maps that accompany such reports always tend to be informative and they all record meadow if it is relevant to the farm or township under discussion.

Apart from this there is an exceeding large body of material in eighteenth and nineteenth century maps in the national archives. A single search brought up over 180 maps that contain direct references to meadows during the era of improvement and it would undoubtedly be a major advance in our knowledge of meadows and grazings in Scotland if this body of evidence was surveyed and recorded. In addition to this, the details of other meadows, both natural and artificially irrigated appear on the 1st edition Ordnance Survey maps and it would be worthwhile surveying these too. Neither has much use been made of the information pertaining to meadows in the Scottish statistical accounts, other than for small regional studies. For example, the numbers of references to meadows more than doubles between the two main reports of 1791-99 and 1834-45. At present, it is unknown whether this percentage rise can be accounted for by different questions being asked of the informants or if it is an actual reflection of an increase in meadows. Whatever the case, the statistical accounts also occasionally preserve local names for meadows, like the *bawks* of Buchan which seem to have consisted of a series of ditched enclosures where the cattle pastured in summer

[\(http://stat-acc-scot.edina.ac.uk/link/1791-99/Aberdeen/Peterhead/16/570/\)](http://stat-acc-scot.edina.ac.uk/link/1791-99/Aberdeen/Peterhead/16/570/).

Within the third body of evidence, traveller's reports, one of the most famous is that written by John Walker. He visited the Hebrides in 1764 and 1771 where he noticed tremendous differences in the meadows and grazings between islands. In Lewis, for example, he claimed that the making of hay was a new improvement which had recently been introduced. This contrasted slightly with the situation he encountered in the Uists and Benbecula where he found entire fields of ribwort plantain, red and white clover, kidney vetch and especially tufted vetch which made excellent hay. He stated that hay making had been introduced to South Uist in 1756 but did not comment on the other two islands.

In addition, he noted that a field of rye-grass had been cut for hay in Islay on 11 June 1764 (presumably a sown crop), while the inhabitants of Coll had never made hay. Two farms on Tiree made hay and an experiment sowing rye-grass for hay had been made in 1754 but discontinued despite the fine results. Upon visiting Rum he found large areas of flying bent, also called purple moor-grass (*Molinia caerulea*), which he reckoned would make excellent hay but did not state whether this resource was actually being used. Finally, in Skye he calculated that the practice of hay making had been introduced in the 1730s yet the inhabitants had resisted the sowing of clover and rye-grass because there was not enough time for it to dry properly. While there is no pressing reason to doubt any of these descriptions, it should be remembered that Walker was working for the Commissioners of the Annexed Estates, whose job was to 'civilise' the Highlands and Islands post-Jacobitism. In addition, he was anti-Catholic and openly associated the Catholicism he encountered on some of the islands with 'rude and uncultured soils' (McKay, 1980). It has been suggested that some of the islanders traditionally may have had no need of hay but instead used the machair as a reserve of winter feed for grazing animals, even though this would quickly have led to erosion (Dodgshon, 1998).

There were a series of agricultural reports produced in Scotland during the 1790s and early 1800s but, as they were written by different people, there was no standardisation in what they were attempting to record or what they thought important in the landscape. In a typical example of the genre, a minister living in Campbeltown in the 1790s related the fact that he knew of two types of meadow in Scotland. One was dunged on a regular basis. The other was occasionally flooded, after which it produced a tremendous crop of hay. Unfortunately, the author of this work was more concerned with all the advantages of artificially irrigated meadows rather than recording in any detail the 'unimproved' meadows in the landscape around him (Smith, 1792). There are, however, other references to people regularly cutting hay in woods comprising ash, oak, and birch during the eighteenth century in Argyll (Cregeen, 1964). Unfortunately, the same report does not specify whether these were actual managed meadows in the woods or large patches of grass growing under an open canopy.

In Dumfries, for example, the author responsible for that volume described two types of meadow, bog and laich. The bog type of meadow was far more prevalent but only the lay-type was ever manured (Singers, 1812). In contrast, in Aberdeenshire at the same time another author noted only two types of meadow, laich and irrigated. The dunging of meadows there was not mentioned (Anderson, 1794). In the Northern Isles it was calculated that Orkney possessed 30,000 acres of inbye, pasture and meadow. Shetland had 23,000 acres of good pasture and meadow. Both islands also apparently possessed a resource referred to as 'heather hay' (Sinclair, 1795). Presumably, this was cut to supplement the hay feed during the winter months. Finally, in Fife, the author of that volume only described two types of meadow. Although he admitted that 'a little watering' could be found (which presumably is a reference to irrigated meadows of some kind), the main kind of meadow in Fife was

sea-shore grass. This was, apparently, very rich and had been adapted for both hay cutting and for pasture (Beatson, 1794).

What is also quite remarkable about these reports is the rate of change in 'traditional' meadow management that they seem to have been recording. In the Northern Isles, for example, the 'American system' of 'high land' meadow irrigation was about to be introduced, though there was no accompanying explanation of what this involved (Sinclair, 1795). In Angus, the Mearns, and Perthshire, artificial grasses, clover and rye-grass had already been used to replace natural grasses for some time (Donaldson, 1794a). Both rye-grass and clover had been widely introduced into meadows in Sutherland and Ross (Sinclair, 1795). In Selkirkshire it was admitted that nearly all meadow and pasture had been ploughed up and that some fields had been planted with clover and rye-grass for hay (Johnston, 1794c). In Roxburghshire the cultivation of hay had virtually ceased and had been replaced by turnips (Ure, 1794). The inhabitants of Dumfriesshire had planted with rye-grass, rib-grass (probably ribwort plantain), red, white, and yellow clovers. It was noted that the old grass should be spread with Lime before ploughing (Johnston, 1794a). The same processes had also occurred in East and West Lothian (Robertson, 1793; Buchan-Hepburn, 1794), and in Aberdeenshire it was noted that rye-grass was gradually replacing the traditional meadow grasses because it was 'more spectacular' (Anderson, 1794). Interestingly, not everyone agreed with the introduction of these new grasses and clovers although this seems to have been a minority viewpoint at that time (Curtis, 1798).

In fact, only West Lothian, Clydesdale and Dumbartonshire seem to have reported that 'unimproved' meadows were still in operation during the 1790s. For example, in Dumbartonshire it was noted that the 'natural grass on the mountains is in abundance and of the finest grasses including sheep's fescue, sweet vernal, crested dog's tail and fine bent grasses' (Ure, 1794; Naysmith, 1794; Trotter, 1794). Such reports, however, may be misleading. For example, in the 1791 return for Arrochar parish in the Old Statistical Account the minister noted that there had been massive changes in the local landscape since the introduction of large sheep flocks and the virtual disappearance of black cattle. Essentially, much of the heath and moor grazings had disappeared and had been completely replaced by grass. The parish was now much greener (Gillespie, 1791).

All of which would seem to indicate that there had been massive changes in the grass composition of 'unimproved' meadows and grazings at some point during the eighteenth century across Scotland with the introduction of rye-grass and clovers. Perhaps more importantly, if an assessment of the disappearance of 'unimproved' grazings and grasslands in Scotland is to be undertaken then the changes in livestock grazing patterns and the introduction of new breeds during the eighteenth century, at least in some parts of the country, must also be taken into account.

Some of these same reports also provide details of how meadows were managed at that time. In the Hebrides, for example, it was noted that the meadows were composed of coarse grasses, were not enclosed, but they had been cleared of stones (Heron, 1794). Presumably, herds were employed to keep the stock out. In contrast, in the central Highlands, Marshall described meadows in very different terms. According to him they were small patches that lay in and around the arable that was too wet, woody or stony to be ploughed (Marshall, 1794). Further east, in Angus and the Mearns, the system of meadow management in use in the 1790s consisted of a rotational system of six years in grass followed by three years in oats, then back to grass again (Roger, 1794).

In Aberdeenshire, the laich meadows were under a three year rotational system: three year under grass followed by three years under oats then back to grass again. It was further noted that these meadows were never dunged and were ploughed up as soon as the hay had been cut. After ploughing, either winter greens or turnips were planted. Here, it looks as though a conscious decision had been made to stop animals from grazing on the aftermath, presumably because it had been felt they would derive more good from eating turnips (Anderson, 1794). In other parts of Britain there also seems to have been a school of thought during the eighteenth century that controlled burning before the ploughing of meadows destroyed all slugs and other pests (Headrick, 1801). Other practices relating to the management of meadows changed around this period and it was noted that although animal dung had formerly been used to manure meadows, by the second decade of the eighteenth century other materials including lime, mould, ashes, composts, or 'top dressing' were now regularly applied to meadows in parts of Scotland (Singers, 1812).

This rate of change may have been partly fostered by a number of scientific papers published by the *Highland Society of Scotland* in 1807. Here, investigations were made about which species were best suited for the purposes of hay and pasture and fifteen were deemed suitable: *Trifolium* (white clover), *Lolium* (rye-grass), *Holcus lanatus* (Yorkshire-fog), *Poa trivialis* (rough meadow-grass), *Cynosurus cristatus* (crested dog's-tail), *Anthoxanthum odoratum* (sweet vernal-grass), *Plantago lanceolata* (ribwort plantain), *Achillea millefolium* (yarrow), *Agrostis* (bent), *Juncus articulatus* (jointed rush), *Aira* (*flexuosa* and *cespitosa*) (wavy hair-grass and tufted hair-grass), *Festuca* (*F. fluitans*, *F. ovina*, and *F. pratensis*) (floating sweet-grass, sheep's-fescue and meadow fescue, *Vicia sativa* (common vetch), *Bellis perennis* (daisy), and *Lotus corniculatus* (bird's-foot-trefoil). The author then continued to suggest the best combinations of plants for both hay grounds and pastures with different soils (Singers, 1807a).

The same also applied to England, but from a much earlier date. At the beginning of the eighteenth century the best methods of fertilising meadows were described in the following way:

[...] dry meadows are the only ones where you may lay dung or other manure to the best advantage and the best time for this is winter about January or February; ashes of wood, peat, turf, sea-coal is very proper to be laid upon dry meadows of cold, spewey, rushy and mossie land, dung of pigeons or other fowl also good; lime, chalk or marle also very good to dry, sandy and hot soils; I have seen much of the blue clay called Urry dug out of the coal mines laid on meadow and pasture lands to a considerable advantage (Worlidge, 1716).

By the nineteenth century, however, some of these manures had disappeared and been replaced with cheaper foreign or chemical fertilisers. In a report on the cultivation of meadow land in England farmers were told that the best manures for their meadows were dung, bone dust, guano, superphosphate and gypsum (Hunt, 1860).

Scientific curiosity about meadows continued into the nineteenth century but there was a noticeable drop in the volume of literature. It might be questioned if this was a reflection of the cessation of interest in actively managing meadows in Britain before WWII (Cook & Williamson, 1999). Throughout Britain there seems to have been a continuing though limited fascination with artificially irrigated meadows as evidenced by experiments on a farm in the Pentland Hills (Heddle & Ogg, 1933; Heddle & Ogg,

1936) and a comparative study of grazed and mown meadows bordering the River Thames in England (Baker, 1937).

In the former paper it was discovered that irrigation had the effect of raising the pH of the soil and that it played an important part in modifying the vegetation by either encouraging or discouraging the growth of different species (Hedde & Ogg, 1936). In the latter paper, the meadows on the chosen site could be traced back to the Domesday Book. Differences in pH were also noticed at this site and it was argued that the relative water content of the alluvial soil accounted for the minor differences. However, because some of the meadows had been exclusively grazed, while others had been consistently cut for hay, the investigator was able to determine that the presence or absence of grazing was a determining factor in floristic composition (Baker, 1937).

During the same period there was also some historical research carried out on English meadows, particularly in relation to lot-meadow customs. Essentially, this involved the annual casting of lots among the people who held mowing rights in order to assign them specific strips of the meadow for cutting. This research discovered that each meadow was divided into thirteen strips and that there were also half- and quarter-rights assigned to each strip. Each lot also carried the right to graze the aftermath of that particular strip and, the author argued that this custom of lotting had its origins in the medieval period (Gretton, 1912). While evidence for such a system of lotting can be found in Scotland in relation to the apportionment of run-rig from 1205 (Barrow, 1971), there seems to be much less evidence for the practice in relation to the division of meadows. In Orkney, during the seventeenth century it appears that meadow ground was sometimes shared on an annual rotation called *meadow skift* and a similar case has been made for Shetland. Evidence of a similar practice has also been found in the Western Isles but only with regard to the islands of Luing and Seil (Clouston, 1914; Shaw, 1980). It is not yet clear whether these examples involved lotting. On the mainland, there are a number of references to various people being the tenants of one part of a particular meadow but the process of how this might have arisen is not clear (for example, NAS, GD112/2/141/36).

In the period between the end of WWII and the 1980s much of the literature published about meadows tended to be general rather than specialist, particularly in Scotland. The exception to this was the *West Highland Survey*. In this, the author compiled extensive statistics relating to the production of hay in western Scotland between 1911 and 1947 and concluded that since livestock numbers had decreased in combination with an increase in hay production, it meant that husbandry skills were declining. He concluded that the grassland economy of that time was not productive (Darling, 1956).

An altogether more general approach to the subject was made in *Scottish Country Life*. Here, the author argued that the introduction of sown grass seed to Scotland for hay had been first made by the earl of Haddington in the early eighteenth century. Thereafter, its use had spread to Islay by 1761 and to Sutherland in the 1770s and this assertion still appears to fit the available historical evidence. Like earlier commentators, though, the author argued that Lowland farmers historically paid little attention to hay making and in the Highlands hay was scarcely made at all (Fenton, 1976). Broadly similar texts were also published in relation to the English countryside, though with a much greater chronological depth which undoubtedly reflects the greater abundance of historical material for both England and Wales in relation to meadows (Rackham, 1986).

The mid-1970s also saw the publication of a valuable statistical text, based upon figures gleaned from the main agricultural censuses of 1870, 1938 and 1965. This provides details on subjects like the amount of rough pasture and common grazing as a percentage of agricultural land, as well as the differing percentages of hay and silage over time (Coppock, 1976). While this type of information can certainly provide some valuable data in regard to meadows, hay making and 'unimproved' pasture over a short period of time, the data is flawed. For example, not all of the agricultural questionnaires asked the same questions across time. Furthermore, the censuses were completed on a more regular basis so the statistics presented in this book may actually hide more than they reveal.

In Britain, during the post-WWII period, it has been argued that there was a further massive decline in all types of meadows. Though most of this decline occurred between the 1930s and the 1980s a survey completed in 2000 demonstrated that further losses had occurred, particularly in Northern Ireland and Scotland, so that now less than 20,000ha of meadow remains in Britain (English Nature, 2002). Part of the reason for this decline has been blamed on the British government who, after 1941, chose to try and increase rural prosperity by increasing productivity. This was done by supporting the agricultural economy through productivity grants and subsidies. As a result, many traditional hay meadows were either reseeded or experienced increased fertiliser use and/or spraying with herbicides and it has been demonstrated that the addition of such artificial fertilisers has resulted in changes to the species composition of meadows (Smith, 1985). Matters were further worsened, apparently, by the fact that the British water authorities possessed the right to drain any piece of land as they saw fit (Feltwell, 1992).

Britain was not the only European country to experience such losses. Recent research undertaken in Czechoslovakia has demonstrated that three types of meadow once accounted for approximately 28% of agricultural land but this figure has fallen by a third since 1980. These three types were: a) semi-natural unmanaged ecosystems of extensive unexploited sub-montane meadows and pastures which had developed spontaneously; b) productive semi-natural meadows originating from type a) through regular management and, c) man-made permanent grass stands of ploughed and re-sown natural meadows. Two reasons were provided to explain the decline in meadows. These were human ignorance and a political desire to achieve national independence in cereal production. In an attempt to ameliorate these changes, and to try to understand how their meadows worked, experiments have been conducted over a 12 year period in the Bohemian-Moravian Highlands to estimate biomass production and the proportions of individual grass species in each class of meadow (Rychnovská, 1993).

On the whole, the Czechoslovakian government seems to have reacted faster to the problem of disappearing meadows than the British government. In fact, it was not until 1991 that positive legislative and monetary steps were taken by the British government and grants were offered to land managers to re-create some of the most attractive English landscapes, paying £50 per ha for restoration of traditional pastures and hay meadows (Feltwell, 1992). In Scotland, the then Scottish Office Agriculture, Environment & Fisheries Department (SOAEFD) introduced the Habitat Scheme in 1994 as part of the Scottish Agri-Environment Programme. This scheme paid farmers to set aside land for 10 or 20 years for the establishment of specific habitats of conservation value, including species-rich lowland grassland.

Salt marshes

From the period immediately before this government initiative a new wave of specialist meadow investigation has begun in England. One of the first important pieces of work was undertaken on the surviving meadows in Greater London that had been left undamaged by agricultural intensification. The remainder of the traditionally managed meadows and pastures had been replaced by agriculturally improved grassland because of cost-effectiveness in a time of increasing economic demands on farmland. These changes were made through the application of fertilisers and changes in management to the production of silage. Other meadows had undergone deep ploughing, which makes it harder for grassland to recover. The Thames grazing marshes had been reclaimed from salt marshes and were of particular importance. Unfortunately, research demonstrated that over 60% of this type of grazing in the greater London area had been lost since 1935, mostly to building schemes (Hare, 1988).

The locations of the European Annex I habitat 1330 Atlantic salt meadows, which includes most Scottish salt marsh, are shown at: http://www.jncc.gov.uk/publications/JNCC312/habitat_comparison.asp?FeatureIntCode=H1330. In contrast to both London and other areas of England, none of the available references to historic salt meadows in Scotland ever seems to have been collated and published. In Scotland, the *slyk* (muds) surrounding them seem to have been almost as important as the sward itself:

There was a bank of sleek and sand in the water of Forth called the Lagerbed, lying opposite to the lands of Bandeath and Balgownie's lands of Throsk, which bank, about 80 years ago [in 1650] came to sward so as to be use for pasture and meadow [...] (NAS, GD75/125)

Some salt meadows were not well looked after:

[...] All and haill that piece of meadow or saltgrass [called the Ballock] with the slyks belonging to it lying at the west end of the panns at Craigtoun pow which pow belongs to David Bruce of Kennet and q[ui]ch peece of meadow or grass at the west end y[ai]rof p[er]tains to the said Noble Earle and was formerly possessed by William Cowstown at the Ferry newk and is bounded betuix the saidis panns at Craigtoun pow on the east and the Water of Forth on the south And the arable land now p[er]taining to that quarter of the said Earle's room of Ferritoun [...] Upon the q[ui]ch piece of meadow or salt grass the said Sir Henry has already built ane saltpann q[ui]lk the said Noble Earle ratifies and approves [...] and gives full power and liberty to the said Sir Henry and his fairsaidis to build als many salt panns y[ai]ron as he shall think fitting and to bring pan wood y[ai]rto through the common way that leadis frae Clackmannan [...] as also the haill coallis that is within the ground of these eleven score riggs of land belonging to the said Earle upon the east syd of the watter of Litle Dovan which runs by the said Earle's his milne called the Parkmilne [...] with power to the said Sir Henry to sett down sinks upon the ground and riggs and to do every othyr thing neccessar for willing of the said coal [...] as also for makeing and inputting of peallis of timber to festin the towes of such shippis & vesuellis as cometh to his pow of Clackmannan on the west syd of Dovan [...] (NAS, GD124/1771)

As far as this example is concerned, it can be suggested that conversion into salt-pans might have been the fate of many similar salt meadows in the Forth estuary

over time as they were deliberately destroyed to take advantage of an economic activity that potentially carried much greater financial rewards.

Recent research in England

In England, research has recently been undertaken on Annex I habitat 6510 Lowland hay meadows. In the UK, this habitat corresponds to NVC type MG4, *Alopecurus pratensis-Sanguisorba officinalis*, grassland. The habitat does not occur in Scotland (<http://www.jncc.gov.uk/publications/JNCC312/habitat.asp?FeatureIntCode=H6510>). These investigations found that MG4 meadows were heavily dependent upon river management, particularly in terms of water quality and quantity. In addition, it was discovered that most MG4 grasses were intolerant of anoxic soils so efficient drainage systems were required to prevent the retention of water. Quite subtle changes in the water regime and nutrient availability were discovered to have a significant influence on grass species composition. Typically, though, an MG4 meadow community can contain up to 18 grass species in a single site and perhaps the most notable feature is the prominence of dicotyledonous herbs in midsummer, particularly great burnet and meadowsweet (Gowing, 2002).

A review was undertaken of the effects of farmyard manure on semi-natural meadows in England. Farmyard manure is applied to grassland to avoid nutrient depletion by crop removal which reduces potential hay yields. However, adding too much farmyard manure leads to a reduction in species richness and diversity. It was argued that sheep dung provided the most concentrated source of nutrients, with the exception of poultry muck which was just too concentrated. Slurry and poultry manures are considered to reduce the species-richness of semi-natural meadows (Simpson and Jefferson, 1996).

Recent research in Scotland

There has been much less specialist literature produced in relation to 'unimproved' meadows in Scotland. During the 1990s a report was commissioned on the historical management of Morenish meadow, situated on the north side of Loch Tay, which was described as one of the largest areas of unimproved lowland grassland in southern Scotland and is designated as an SSSI (<http://www.snh.org.uk/pdfs/publications/corporate/factsandfigures/0304/designatedAreas1.pdf>). This was an innovative attempt to investigate the depth of historical evidence in relation to a single site though the author (a geographer) was clearly reliant on the post-1700-1900 material written in English to form the bulk of the report. A reasonable amount of general material relating to the township and district of Morenish was discovered but, in an admittedly complex archive, the author was clearly unable to find any surviving specific statistical information relating to the use of the meadow itself, other than cartographic evidence (Bil, 1994).

A quite different specialist report was produced in relation to the current management of meadows in the northern isles. At the Loft and Hill of White Hamars grazing project it was noted that an absence of management meant that marsh and wet meadows could become much less suitable for breeding wading birds and lose plant diversity. However, careful grazing by either cattle or sheep could maintain these wetlands as rich habitats for birds and flowers as well as providing valuable pasture. It was observed that the addition of fertilisers promoted more vigorous growth but simultaneously reduced the diversity and abundance of other plants. Supplementary feeding of animals had a similar effect because of local enrichment by dung and urine, and feeding stations tended to concentrate trampling pressures and cause deep poaching and physical damage to the turf. Over the period of investigation it

was noted that marsh-marigold, northern marsh-orchid, and yellow rattle showed the most dramatic and rapid increases, and yellow iris, cuckoo flower, ragged-Robin, meadowsweet, tufted vetch, oval sedge, and jointed rush had also markedly increased. Indeed, reductions in the dominant grasses meant that large heath butterflies and orb web spinning spiders became more numerous (Harris and Jones, 1998).

The most recent historical literature that discusses both meadows and grazings in Scotland has attempted to examine the ecological basis of traditional Highland farming. In this, the author argued that traditional Highland farming was valley-based and orientated towards crop production with only limited use being made of hill ground. A case was also made that although the use of hay as a winter feed was established in the mainland Highlands, its supply was probably not sufficient to maintain all the livestock. As with some of his other work, however, the author bases much of his argument on the relationship between souming levels and meadow acreage (Dodgshon, 2004a). The basic theoretical flaw in this approach, specifically in relation to his use of historical souming figures, has recently been discussed (Ross, 2006b).

Shielings and souming

The 'unimproved' grazings of Scotland are a subject that has hitherto attracted a lot less attention than meadows. The first papers on the subject began to appear in the nineteenth century but it was not really until the 1950s and 1960s that academic interest in the subject increased. At this time investigations into 'unimproved' grazings were really driven by one man, Victor Gaffney, who, in a series of important papers and a book, highlighted some of the evidence relating to hill grazings across the Cairngorm range of mountains. One of his aims seems to have been to highlight the importance of transhumance and the shieling system to the economy of the Highlands over time and he argued that it was the loss of the shielings, either to agriculture or to hunting forest, that initiated the economic decline of the Highlands in the nineteenth century (Gaffney, 1959; Gaffney, 1960; Gaffney, 1969).

Following Gaffney, more articles on shieling systems in other parts of Scotland began to appear, some of which were remarkable in their detail. For example, transhumance activity in north Skye was mapped for the first time, demonstrating exactly how the settlements and their associated shielings could be recorded in some depth (MacSween, 1959). In some instances old shieling sites were also excavated and detailed plans of their various structures were recorded (MacSween and Gailey, 1961). This sudden burst of interest in shielings had been brought to a close by 1970, by which time it had been argued that the contemporary stocking patterns in the Highlands were continuing to ruin what was left of the traditional grasses found at old shieling sites. The only solution, it was suggested, was to completely alter the land-use patterns though it was thought that this was unlikely to happen within the framework of traditional crofting systems and sporting estates (Miller, 1967).

Ten years later this charge of the alleged deterioration of hill grazings was firmly refuted by reference to trends in lambing performance. Here, it was argued that a decreasing lambing percentage in the west of Scotland did not prove that hill grazings had deteriorated *per se* but was in accordance with the hypothesis of such a deterioration (Mather, 1978). The same year, it was argued that while the shieling system in Scotland was of undoubted antiquity, it was likely that it had been re-organised after the arrival of Benedictine and Cistercian monks in Scotland. No direct evidence was mustered to support this assertion though it was stated that the custom of going to the hills in the summer disappeared early from the Borders. The

shieling system appears to have become redundant with the introduction of sown grasses and improved cropping techniques. Only on the island of Lewis did the shieling system survive into the twentieth century, although there seemed to be no particular reason to account for this (Fenton, 1976).

Much of the earlier work on shielings (with the exception of Gaffney) concentrated on the western Highlands and Islands. In order to counter this regional bias Bil chose to look at the historical evidence relating to shieling sites and grazings in central Perthshire where he could be assured of good sources of archival material in the Breadalbane and Atholl muniments (Bil, 1990).

There is little doubt that this book was a major step forward in the study of shielings and their associated grazings and all aspects of shieling life, including construction techniques, was discussed in exhaustive detail. In addition, the author identified the arrival of new breeds of sheep and depopulation as the most important reasons that contributed to the destruction of the central Perthshire shieling system by the 1840s. However, Bil did not consult any of the medieval material relating to central Perthshire which would have enabled him to establish patterns of continuity from that period through to 1600 and beyond. Yet another problem is that this excellent regional study may not apply on a national basis.

In England, there is a longer recorded history of 'unimproved' grazings, mainly because pasture is mentioned in the Domesday Book, though only in the south-western counties. It has been argued that this does not necessarily mean that other parts of England did not also possess pasture at that time. By the thirteenth century, however, it looks as though 'unimproved' grassland in England had decreased in percentage terms, possibly because of conversion to meadow (Rackham, 1986).

As far as upland 'unimproved' grazing is concerned, however, it has been suggested that much of the uplands of northern England were covered by moor-land hunting forests. Within these, the lords sold grazing rights to peasants. It has been further suggested that these upland forests should be divided into two broad groups. First, where the creation of demesne stock farms and grants to religious houses were paramount. Second, those open to new settlement by peasant communities. As far as the former class is concerned, many appear to have been leased and sub-divided by the monasteries to tenants as time progressed, again eventually leading to the foundation of new hamlets. With regard to the latter class, it seems that over time new settlements were created, as the population recovered and expanded after the Black Death. These progressed further up the valleys, some of which would have been former shieling grounds. In turn, this resulted in more enclosure and gradual loss of forest (Winchester, 2000).

The history of the souming of 'unimproved' grazings has also come to the fore across Europe in recent years, probably due in part to the revitalisation in the history of shielings, but there is now a growing recognition amongst academics that a large proportion of the upland environment in north-west Europe had been apportioned into relatively small areas of pasture from an early date, all of which were highly regulated with imposed limits on the numbers of livestock that could be grazed. These restrictions took two main forms: 'stinting' and 'levency and couchancy'. Stinting was the maximum amount of livestock that a household could graze and permitted managers to control the usage of pasture according to local conditions. Alternatively, levency and couchancy dictated that people could only graze the numbers of livestock that their pasture would sustain during the winter months: it gave more freedom to the individual who could adjust the limits of their exploitation by increasing

or decreasing the size of their holdings according to their own economic plans. (Moor *et al*, 2002).

In Scotland, the research of livestock density is made particularly difficult by the paucity of the surviving evidence before the fifteenth century as many earlier crown and family papers were deliberately destroyed in times of conflict. This contrasts strongly with other European countries which possess much fuller records for the earlier periods. Despite these difficulties, in Scotland some fifteenth-century documents refer to the stinting of pasture into souns, which can be defined as an imposed unit of pasture that supported a finite number of livestock at different times over the course of a year. At its most basic level, a soum was commonly calculated to be the equivalent of the grass requirements of one cow. This could be converted into other livestock units: for example, a soum could pasture anywhere between four to ten sheep instead of a cow and a horse was frequently reckoned to be the equivalent of two souns (Ross, 2006b).

Probably the most prolific writer on the importance of livestock densities and souming in Scotland, and particularly the Scottish Highlands and Islands post-1600, has been Robert Dodgshon. He has used both souns and stocking figures from a wide variety of historical sources to construct a number of theories that focus on the environmental history of the Highlands. Dodgshon has recognised that there are problems with translating souming figures into actual livestock numbers. First, because souns only record mature stock, no ostensible official allowance was calculated for immature animals like calves, foals, lambs and kids. Second, often the soum represented the wishes of the estate, not the tenant. Nevertheless, since souns could also be used to calculate rent, Dodgshon expected tenants to have maintained actual stocking levels that closely matched the figures recorded in the actual soum. In addition, Dodgshon has used souming and stocking figures from the Breadalbane estate in particular to argue that there was a pre-clearance shift towards sheep production in the southern Highlands, although he also concluded that it was the 1860s before sheep numbers rose dramatically overall (Dodgshon, 1998).

Dodgshon's work begins at around 1600 but there are records relating to souming in Scotland that go back to the medieval period. While there seems to be no direct Latin equivalent of the word 'soum' in early Scottish sources, the documentary evidence does contain plenty of examples of people being granted the right to graze animals. For example, between 1193 and 1195 King William I granted the monks of Melrose the right to pasture 200 ewes, 16 oxen and four cows on the grazings that belonged to the lands of Hassendean. Sometime between 1208 and 1215 Lady Muriel of Rothes and her husband Walter Murdach granted the monks of Kinloss the right to pasture 12 cows, one bull, 16 oxen, four rams and 100 sheep on part of the river meadow of the davoch of Dundurcus beside the river Spey. Similarly, in 1282 the monks of Arbroath were granted the right to pasture 100 sheep, four horses, 10 oxen, 20 cows and a bull on a bovat of land in the Garioch (Barrow, 1971; *NLS*, Adv.MS.29.4.2[x]; Innes, 1848). All of these grants relate to the church. Similar types of grant to secular parties before c.1350 are much rarer though this is probably a feature of the surviving evidence in Scotland which is heavily biased towards ecclesiastic records before that date. More importantly, it is very unlikely that these types and numbers of animals were randomly chosen.

There are also early records of disagreements between landlord and tenant over livestock numbers. One such example was the new arrangement, 1188x1204 (dating between 1188 and 1204), between the monks of Melrose and Patrick I, earl of March, concerning lands in Lothian where the monks had previously been allowed to keep three flocks of sheep on common pasture. In this agreement the earl granted

the monks an additional five acres of land in the southern part of *Mosiburnerig* and the monks were to enclose this land with a ditch to make a sheepfold. This would ensure that in future there would be no controversy between the monks and their landlords over sheep numbers. From this date, the three flocks were to contain a maximum of 500 animals, 1500 wedders in total (Innes, 1837). This document suggests that the earl of Dunbar, and probably also the other tenants of the common pasturage, were concerned about the over-stocking of an economic resource.

As the majority of these examples also involve sub-tenancies, which would have required close control by a superior lord, it is perhaps unlikely that they are examples of leveny and couchancy. Instead, since these documents assign precise numbers of different animals to set areas of land, and since there were also disagreements over the actual numbers of animals pastured in particular areas, logically these could be considered as reasonably early examples of different proportions of a soumed landscape, even though the different groupings of animals are not expressly called souns.

When Scots started to replace Latin in some documentation towards the end of the fourteenth century the word 'soun/sowm' began to appear and it occurs with increasing frequency throughout the fifteenth and sixteenth centuries, almost always in connection to individual farms or townships throughout Scotland (NAS AD1/37; NAS GD122/1/15; NAS GD148/246). In contrast, soumings relating to entire estates are comparatively rare until the seventeenth century and then occur with increasing frequency, helped in part by the surveys completed for the Commissioners of the Forfeited Estates after the Jacobite rising ended in 1746, and also by estate surveys as various landlords took an increasing interest in maximising the economic potential of their lands. At present, there is no way of telling whether the survival of entire estate souns after c.1600 is just an accident of survival, or whether it indicates something more significant like changing economic or political circumstances, or increasing concern about pastoral resources.

Dodshon assumes the souns associated with 'unimproved' grasslands can be compared across time and that they were calculated in the same way across Scotland. In fact, it has recently been demonstrated that neither is the case. Souns were calculated in different ways across time and in different ways across Scotland. For example, while the amount of available grass may have been used to calculate the souming rate of 'unimproved' grazings in Argyll, in Mar it was the available water that was the determining factor (Ross, 2006b). All of which indicates that regional studies are the way forward in any further research on the souming of 'unimproved' grazings in Scotland and how they changed over time. More importantly perhaps, since the pioneering work done by archaeologists in the 1960s in Scotland, little has been done to expand our knowledge of excavated shieling and grazing sites. This stands in contrast to all of the excellent work undertaken in Scandinavia (Emanuelsson and Segerström, 1998). Until such work is undertaken in Scotland, the evidence is just too varied to build up a truly national picture and this is further complicated by the lack of research into the medieval Scottish landscape, specifically, how it was first divided up and apportioned out.

The search for order in the historical landscape of Scotland

One noticeable aspect of all of the above historical discussions relating to meadows and grazings in Scotland is the lack of historical depth since none of the contributors to the debate have strayed much before c.1600. In an attempt to begin to resolve this discrepancy the next section of this review discusses the literature on early forms of land division and assessment in Scotland and the need for further research.

Any search is complicated by the fact that the medieval kingdom of the Scots was created out of at least three earlier kingdoms, each of which probably had their own systems of land division and assessment. Accordingly, Scottish historical records list a wide number of different terms in relation to land division and assessment, depending on which part of the country is being researched. These include terms like merkland, unciate/ounceland, pennyland, husbandland, carucate, (Scottish) ploughgate, soum, oxgang, arachor and davoch. This maze of different terms continues to baffle modern scholars looking for order in the landscape. In marked contrast, kings of Scots and their governments never seem to have had a problem in dealing with all these different systems in practical terms since, as far as we know, no attempt was ever made to standardize them and introduce a truly common 'Scottish' system of land division and assessment before the union of the crowns in 1707. This would indicate that all of the different established systems worked well in practice for the whole of society from the crown down to the sub-tenant level. Modern puzzlement about these terms and what they represented may in part result from the fact that much of society nowadays has lost any intimate connection with the land.

During the last three decades some of these terms of assessment have been studied at a doctoral level, with davochs, merklands, and pennylands coming under particular scrutiny (Easson, 1986; Williams, 1996). However, of these three units it is the davoch that has attracted most attention, probably for two reasons. First, because it can be commonly found across much of Scotland north of the Forth and its distribution also reaches from coastal Aberdeenshire to the western Hebrides. Second, because it is frequently argued that it was Pictish in origin.

Since the late-eighteenth century both antiquarians and historians have devoted many pages to the davoch. In the nineteenth century various theories about the davoch were developed by Robertson, Skene, and Innes and these were further refined by the likes of Elder-Levie, McKerral, Megaw, and Barrow, among others, before 1970. Many of these debates centred exclusively about the amount of arable land in each davoch and, depending on which contributor was consulted, this varied to between two and four ploughgates. A general consensus was eventually achieved so that by 1972 Kenneth Jackson, in his discussion of the evidence relating to davochs in *The Book of Deer*, was able to state that:

The original meaning of the term is 'a large vat'; the application to land is not found at all in Ireland, however, but only in Scotland. Just how a word meaning a vat should come to be used of land is not quite clear, but this could have arisen if the term was applied to that amount of land necessary to produce, or to require for sowing it, a fixed amount of grain, enough to fill a large vat of fixed size; this being perhaps not the total yield of grain but only the proportion of it due as a fixed render of tax. This would explain the fact that when it can be checked, in later times, the actual acreage is seen to vary considerably in various parts of the country, exactly as in the

case of the mediaeval bovat and ploughgate, and for the same reason. If it was originally purely a measure of arable land, it had ceased to mean this later, and applied to pastoral land and rough mountain grazing as well. [...] possibly it is, once again, an aspect of the Pictish socio-economic system adopted by the incoming Gaels? (Jackson, 1972).

Recent commentators on the davoch have tended to follow Jackson and explain it as a tub of grain due as render to a superior lord (Dodgshon, 1981). In 2003, a number of key points were established. First, davochs were not confined to low-lying fertile ground nor did they avoid coastlines. Second, davochs were relatively stable units of land that remained in use in the local landscape between c.1000 and c.1930. Third, davoch boundaries were extremely stable as they generally followed landscape features like streams, rivers and ridges. Fourth, each davoch actually contained all of the natural resources that a community required throughout a year like access to fishing, wood, moor-land, arable, pasture (meadows), and high pasture (shielings). Fifth, that there were actually two types of davoch present in the landscape of Moray. The first contained all of these natural economic resources within a finite boundary. The second could not do so and so possessed detached portions of land, perhaps moorland or forest, elsewhere in the landscape (Ross, 2003).

Preliminary research on merklands indicates that they also possessed access to all the same kinds of economic resources within their boundaries and that there were again two different types of merkland, just like the davoch. Much less, however, is known about the husbandland of southern central Scotland and virtually nothing about the arachor in Lennox.

It should not, however, be assumed that just because davochs and merklands were stable features in the landscape, so the shielings, meadows and arable land that collectively comprised them were also stable. In fact, one of the greatest tensions upon 'unimproved' grassland must have occurred over the turf resource as it was needed both for building houses as well as for feeding animals. These competing claims upon an economic resource became particularly problematic in time of natural disaster. For example, there are increasingly desperate tenant petitions regarding the availability of pasture from Strathspey in the 1780s which were the result of cumulative bad weather patterns that had begun back in the early 1770s when both flash and more prolonged flooding were major problems over at least four years. In another example, tacksmen in the lordship of Strathavon, which bordered upon Abernethy, wrote about the time of the 'great flood' of the 1770s that had entirely carried away three oxgates (perhaps as much as seventy-eight acres) of arable land and the entire meadow of the davoch of Delnabo (NAS, GD 248/523/1).

More importantly, in Strathspey itself a number of tenants were fined for cutting turf from 'unimproved' grazings for their buildings at this time as the place where they regularly sourced building turf had been 'under water for some time.' This demonstrates that in Strathspey there was a clear division of the grassland resource between grazings and building purposes. While this seems perfectly logical, it is rare to chance upon evidence describing such an arrangement. In Duthil parish the tenants who possessed lands along the Dulnain River complained that a flood in 1772 had carried away much of the arable land, meadows, and the trees and that another two years of frequent spates had covered the remainder with sand and gravel. In fact, the inhabitants of Cromdale and Abernethy parishes made numerous identical complaints in relation to spates and flooding after 1772, as their 'arable lands and manure were carried off down the Spey.' Although some remedial work was undertaken to strengthen the banks of various rivers that ran into the Spey, it is

clear that some of these, like the River Nethy in the parish of Abernethy, completely changed their courses during this period of prolonged flooding.

Clearly, in Strathspey and Strathavon there was occasionally major destruction of water meadows during the late eighteenth century. Nor was the damage to 'unimproved' grassland confined there. This was precisely the period when local landlords were beginning to think about the improvement of their estates and the following excerpt from a letter by the Grant estate factor gives a good indication of the fate of many 'unimproved' grasslands in parts of Scotland during the eighteenth and nineteenth centuries:

I don't wonder that the present tenants complain of the improvements of the hills — this a new thing to them — they have not so much room for pasture — there present ideas are confined to feeding cattle — But in a few years when they are obliged to till more ground & to till it better less ground will maintain their cattle — Hereafter every part will be improved for corn or pasture & 1 acre in corn is worth more than 20 in pasture. [...] (NAS, GD 248/38/1/20).

Indeed, there is a real sense that many Scots regarded the retention of rough pasture as barbarous at this time, mainly because it could not (according to them) be relied on to feed their stock over the winter (Adam, 1972). Hay from artificially sown grass, however, was both reliable and civilised. If such attitudes were widespread among landowners, it is hardly surprising that so much 'unimproved' grazing was sown with both rye-grass and clover at this time.

Timing of grazings

Far more evidence exists in relation to the timing of grazings in England than in Scotland. In England, for example, some of the meadows were called 'Lammas meadows', mainly because they were closed to livestock between Candlemass (1 February) and Lammas (1 August) (<http://www.wildlifetrust.org.uk/hereford/reserves/luggmeadow.htm>). While it is obvious that these dates are very traditional, there may in fact be some scientific evidence to suggest that some MG4 grasses are actually intolerant of grazing between mid-March and the end of June. There were, however, variations to this general rule in England and some water meadows appear to have been grazed until Lady Day (25 March) rather than Candlemass. Horses and cows were traditionally used for grazing wetter sites during the winter months as sheep are more prone to liver fluke and foot rot (Gowing, 2002; Feltwell, 1992).

Unfortunately, in Scotland many documents supply the bland phrase 'at the usual time' when referring to animals being turned out to pasture, whether it be on meadow aftermath or to shielings. Some detail is, however, available. On the island of South Uist, for example, it is known that the hay was usually cut on 1 July. In contrast, in Ross it was cut between the dates of 20 July and Lammas (McKay, 1980). Upon this slim evidence it looks as though there was some regional variation, just as we might expect.

As far as shieling activity in Scotland was concerned, one of the traditional days for taking stock to the hill pastures was in mid-June though Dodgshon has argued that this changed once commercial sheep farming had been introduced so that stock was taken to the shielings by mid-April and brought back again in mid-August (Dodgshon, 2006). Once again, however, there seems to have been a great deal of regional variation in these dates. For example, in 1663 in Strathspey it was ordained that the oxen, cows and sheep were to be taken to the shielings on 25 May, as soon as the

men had finished sowing the beir, and not returned until midsummer at least when a notice to that effect would be posted in the parish church. The following year, however, the date for going to the shielings was 1 May, again with a midsummer return. Here, it very much looks as though factors like the condition of the grass at the shielings, perhaps even the ambient temperature or lingering snow, may have affected the date when animals went to the shielings. If anyone returned early from the shielings, they were heavily fined (NAS, GD248/76/2/56; GD248/76/2/56). In the forest of Mar, where 1080 soums were set aside for transhumance purposes, it was implied that cattle could arrive there as early as March and as late as June, again depending on the snow cover (NAS, GD127/17/147/1). Finally, in the nineteenth century in Breadlbane, cattle were removed from the shielings in mid-October and were replaced there by stirks until December (NAS, GD112/18/6/7/23).

This evidence ties in with the investigations completed by Coppock for the post-1860 period when he also found a high degree of regional variation throughout Scotland for the start of haymaking, given that the two activities of making hay and grazing were closely linked (Coppock, 1976). It does look as though the introduction of new breeds of animal into Scotland in the eighteenth and nineteenth centuries may not have had so much of an effect on the dates when animals went up to the shielings as argued by Dodgshon.

Recommendations for further investigation

It is clear from this literature review just how little historical work has been undertaken on grassland in Scotland, including both meadows and other grazings. Investigations of the period post-1700 are flawed, either because an artificial time constraint has been used or because they are strongly regional in character.

This reviewer is of the opinion that future work on meadows could be done in three stages. Stage one would be easiest to begin with since it would involve compiling a definitive list of all types of meadow in Scotland with relatively modern material and then work backwards in time. In my opinion, the 1st edition OS maps, in conjunction with the map collections in West Register House and the National Map Library would be the easiest place to start the investigation. Following that, both the first and second statistical accounts, which can provide a lot of information on meadow rotation, together with the reports of the commissioners of the annexed estates, should be investigated in conjunction with other surviving estate surveys. One final source to tackle at this time would be the reports written by members of the Stephens family and any of their contemporaries who were actively engaged in constructing artificial water meadows in the eighteenth and nineteenth centuries. An additional bonus is that many of their publications contain drawings of the different types of bed-work meadows that they were constructing, together with details of the different types of sluices and drains involved. It is also highly likely that there may be aerial photographs that record some of these sites. Put together, these sources will provide a very large database which could form the core of further investigations.

Stage two would also be relatively simple. It would involve a desk-based search of the Latinate and early Scots printed primary cartulary and royal charter sources for all references to historical meadows. Like stage one, this could be done relatively quickly and efficiently, particularly if there was already an existing database product from stage one. An additional bonus of such an arrangement is that it would quickly become obvious whether there were any examples of meadow-longevity in the historical record.

Stage three would be the hardest to complete as it would involve searching the unprinted documentary records for references to meadows between c.1400 and c.1700. It is unlikely that such a huge search would ever be fully funded and it may prove more fruitful to target a smaller number of specific archives that are already known to contain information relating to meadows and then ask active researchers to voluntarily contribute further information from different archives whenever they come across it. Such an arrangement has previously worked successfully within the wider field of Scottish history.

It would, however, be much more difficult to try to begin the same type of project for 'unimproved' grazings and shielings. Although a lot of this work has already been done for Moray, and on a smaller scale for other parts of Scotland, the exact locations of many shieling place-names have now been lost. In Moray, for example, only about 60% of the recovered historical shieling place-names can now be plotted on maps. This is not to say that the work should never be undertaken but the results may be statistically disappointing in comparison to the evidence relating to meadows.

Finally, in order to underpin all of this work it should be considered a matter of urgency in historical terms to try and list all the different types of meadows and grazings in Scotland over time and, for example, why *slyk* from salt grass meadows was considered to be so important. Within the course of this short review, which has

barely scratched the surface of the available primary source material, evidence relating to 12 different sub-types of meadow in Scotland has been found:

- effluent artificially-irrigated meadows (both bed- and catch-work)
- water artificially-irrigated meadows (both bed- and catch-work)
- naturally flooded meadows
- salt grass meadows, with their *slyk*
- dry dunged (*laich*) meadows
- seeded meadows
- bog meadows
- *bawk* meadows
- heather meadows
- moor meadows
- ornamental meadows
- wood meadows

There might be many more different types or associated regional variations still awaiting discovery.

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APPENDIX 1: GLOSSARY

Glossary of terms used

- Bawk meadow: a series of ditched enclosures where the cattle pastured in summer
- Bed-work meadow: an artificially irrigated meadow (see effluent bed-work meadow and water bed-work meadow below)
- Beir: an old variety of barley
- Bovate: a unit of land
- Candlemass: 1st February
- Catch-work meadow: see water catch-work meadow below
- Davoch: a unit of land
- Effluent bed-work meadow: meadow irrigated with effluent from nearby towns
- Laich meadow: a dry, dunged meadow
- Lammas: 1st August
- Leveny and couchancy: limiting the numbers of livestock that people could graze to the numbers that their pasture would sustain during the winter months
- Shielings: hill pastures and their associated settlements, used for seasonal grazing of livestock.
- Slyk (or sleek): mud or soil from a salt marsh
- Soum: a unit of pasture that supported a finite number of livestock at different times over the course of a year, usually equivalent to the grass requirements of one cow
- Stinting: dictating the maximum amount of livestock that a household could graze
- Water bed-work meadow: a meadow on the valley floor, irrigated by a system of carrier channels, sluices and drains
- Water catch-work meadow: where channels were cut along the contours of a valley side so that the water flowed down the natural slope via a series of ditches

APPENDIX 2: SUMMARY OF MANAGEMENT TECHNIQUES

The following extracts summarise the management techniques mentioned in the text:

- In Aberdeenshire, the laich meadows were under a three year rotational system: three year under grass followed by three years under oats then back to grass again ...these meadows were never dunged and were ploughed up as soon as the hay had been cut. After ploughing, either winter greens or turnips were planted. Here, it looks as though a conscious decision had been made to stop animals from grazing on the aftermath, presumably because it had been felt they would derive more good from eating turnips (Anderson, 1794).
- The introduction of sown grass seed to Scotland for hay was first made by the earl of Haddington in the early eighteenth century. Thereafter, its use spread to Islay by 1761 and to Sutherland in the 1770s. However, Lowland farmers historically paid little attention to hay making and in the Highlands hay was scarcely made at all (Fenton, 1976).
- There seems to have been a school of thought during the eighteenth century that controlled burning before the ploughing of meadows destroyed all slugs and other pests (Headrick, 1801).
- Although animal dung had formerly been used to manure meadows, by the second decade of the eighteenth century other materials including lime, mould, ashes, composts, or 'top dressing' were now regularly applied to meadows in parts of Scotland (Singers, 1812).
- At the beginning of the eighteenth century the best methods of fertilising meadows were described in the following way:
[...] dry meadows are the only ones where you may lay dung or other manure to the best advantage and the best time for this is winter about January or February; ashes of wood, peat, turf, sea-coal is very proper to be laid upon dry meadows of cold, spewey, rushy and mossie land, dung of pigeons or other fowl also good; lime, chalk or marle also very good to dry, sandy and hot soils; I have seen much of the blue clay called Urry dug out of the coal mines laid on meadow and pasture lands to a considerable advantage (Worlidge, 1716).
- By the nineteenth century, however, some of these manures had disappeared and been replaced with cheaper foreign or chemical fertilisers. In a report on the cultivation of meadow land in England, farmers were told that the best manures for their meadows were dung, bone dust, guano, superphosphate and gypsum (Hunt, 1860).
- It has been suggested that some of the islanders traditionally may have had no need of hay but instead used the machair as a reserve of winter feed for grazing animals, even though this would quickly have led to erosion (Dodgshon, 1998).
- The shieling system appears to have become redundant with the introduction of sown grasses and improved cropping techniques (Fenton, 1976).


APPENDIX 3: SUMMARY OF SPECIES

The following extracts summarise all references to individual species in the text:

- Vaughan, in 1610, described an old meadow on his lands as being 'over-worn with age and heavily laden with moss and cowslips and other imperfect grasses (Vaughan, 1610).
- The reports concerning artificially irrigated meadows were full of praise because the creation process had killed off all the low value plants including rushes and heather (Johnston, 1794b).
- Stephens (1829) recommended that the grass seeds generally used for laying down land to water meadow should be vernal grass, crested dogtail, soft meadow grass, rough-stalked meadow grass, foxtail, and *Agrostis stolonifera*, which last was one of the prevailing grasses in all good meadows.
- The *Highland Society of Scotland* offered prizes to tenants who were willing to conduct water over their pasture grounds to eradicate heath and produce grass (MacKenzie, 1799).
- Evidence was found relating to the creation of an artificially irrigated meadow near Pitfirrane in Fife where the landowner had inserted sluices on a piece of land before sowing it with clover and rye-grass in 1723 (NLS, MS.6456).
- ...Uists and Benbecula, where he found entire fields of ribwort plantain, red and white clover, kidney vetch and especially tufted vetch which made excellent hay (McKay, 1980).
- A field of rye-grass had been cut for hay in Islay on 11 June 1764 (presumably a sown crop) while the inhabitants of Coll had never made hay (McKay, 1980).
- Two farms on Tiree made hay and an experiment sowing rye-grass for hay had been made in 1754 but discontinued despite the fine results (McKay, 1980).
- Upon visiting Rum he found large areas of flying bent, also called purple moor-grass (*Molinia caerulea*), which he reckoned would make excellent hay but did not state whether this resource was actually being used (McKay, 1980).
- In Skye he calculated that the practice of hay making had been introduced in the 1730s yet the inhabitants had resisted the sowing of clover and rye-grass because there was not enough time for it to dry properly (McKay, 1980).
- Orkney and Shetland possessed a resource referred to as 'heather hay' (Sinclair, 1795).
- In Angus, the Mearns, and Perthshire, artificial grasses, clover and rye-grass had already been used to replace natural grasses for some time (Donaldson, 1794a).
- Both rye-grass and clover had been widely introduced into meadows in Sutherland and Ross (Sinclair, 1795).

- In Selkirkshire it was admitted that nearly all meadow and pasture had been ploughed up and that some fields had been planted with clover and rye-grass for hay (Johnston, 1794c).
- The inhabitants of Dumfriesshire had planted with rye-grass, rib-grass (probably ribwort plantain), red, white, and yellow clovers (Johnston, 1794a).
- In Aberdeenshire it was noted that rye-grass was gradually replacing the traditional meadow grasses because it was 'more spectacular' (Anderson, 1794).
- In Dumbartonshire it was noted that the 'natural grass on the mountains is in abundance and of the finest grasses including sheep's fescue, sweet vernal, crested dog's tail and fine bent grasses' (Ure, 1794; Naysmith, 1794; Trotter, 1794).
- In the Old Statistical Account, the minister for Arrochar parish noted that there had been massive changes in the local landscape since the introduction of large sheep flocks and the virtual disappearance of black cattle. Much of the heath and moor grazings had disappeared and had been completely replaced by grass. The parish was much greener (Gillespie, 1791).
- There had been massive changes in the grass composition of 'unimproved' meadows and grazings at some point during the eighteenth century across Scotland with the introduction of rye-grass and clovers.
- Fifteen species were deemed suitable for the purposes of hay and pasture: *Trifolium* (white clover), *Lolium* (rye-grass), *Holcus lanatus* (Yorkshire-fog), *Poa trivialis* (rough meadow-grass), *Cynosurus cristatus* (crested dog's-tail), *Anthoxanthum odoratum* (sweet vernal-grass), *Plantago lanceolata* (ribwort plantain), *Achillea millefolium* (yarrow), *Agrostis* (bent), *Juncus articulatus* (jointed rush), *Aira* (*flexuosa* and *cespitosa*) (wavy hair-grass and tufted hair-grass), *Festuca* (*F. fluitans*, *F. ovina*, and *F. pratensis*) (floating sweet-grass, sheep's-fescue and meadow fescue, *Vicia sativa* (common vetch), *Bellis perennis* (daisy), and *Lotus corniculatus* (bird's-foot-trefoil) (Singers, 1807a).
- Over the period of investigation (of conservation grazing by cattle and sheep on Orkney) it was noted that marsh-marigold, northern marsh-orchid, and yellow rattle showed the most dramatic and rapid increases, and yellow iris, cuckoo flower, ragged-Robin, meadowsweet, tufted vetch, oval sedge, and jointed rush had also markedly increased. Indeed, reductions in the dominant grasses meant that large heath butterflies and orb web spinning spiders became more numerous (Harris and Jones, 1998).
- Many Scots regarded the retention of rough pasture as barbarous, mainly because it could not be relied on to feed their stock over the winter (Adam, 1972). Hay from artificially sown grass, however, was both reliable and civilised. If such attitudes were widespread among landowners, it is hardly surprising that so much 'unimproved' grazing was sown with both rye-grass and clover during the eighteenth and nineteenth centuries.
- The introduction of sown grass seed to Scotland for hay was first made by the earl of Haddington in the early eighteenth century. Thereafter, its use had spread to Islay by 1761 and to Sutherland in the 1770s (Fenton, 1976).

- There are references to people regularly cutting hay in woods comprising ash, oak, and birch during the eighteenth century in Argyll (Cregeen, 1964). Unfortunately, the same report does not specify whether these were actual managed meadows in the woods or large patches of grass growing under an open canopy.



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