

**Waste-management and Peri-urban Agriculture in the Early Modern Scottish
Burgh**

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Abstract

The deepening of soil for agriculture is a widely-recognised northern European phenomenon. In Scotland, geoarchaeological investigation has identified such anthropogenically deepened soils in urban and rural contexts and interprets them in terms of this northern European tradition, but has not explored the processes behind their formation or the longevity of the practice. While it is well known that Scotland's medieval town-dwellers grew their dietary staples, their agricultural practices and impact on peri-urban fields has lacked detailed investigation. This paper reviews the geoarchaeological evidence and analyses documentary records from seventeen Scottish burghs, together illustrating a central component of burgh agriculture, the management of urban waste for use as manure. Burgh regulations reveal changing cultural attitudes towards waste as a valued commodity occurring in the seventeenth and eighteenth centuries as fewer townsmen engaged directly in cultivation, but urban waste nevertheless remained in demand as fertilizer in the hinterland of many Scottish towns into the later nineteenth century.

From the time of their first formal establishment in the twelfth century, Scotland's burghs were integrated closely with the countryside around them. Not only did the burgesses (that is, those who had full membership of and representation in the burgh community, as opposed to those simply designated as 'indwellers', who had no rights in the common resources of the burgh) enjoy a monopoly over the trade of an extensive prescribed hinterland but a substantial tranche of territory immediately

adjacent to the towns themselves was controlled directly by them in common and from which they received an equal share of arable ground, pasture and fuel-cutting rights.¹ As a result, whilst the burgesses were primarily craftsmen and traders, they were also cultivators who produced the bulk of their dietary staples on their share of the burgh's common lands but who supplemented that production with purchases in the burgh market. In the larger Scottish burghs – Edinburgh and Dundee particularly – by the fifteenth century rising population relative to the available common-land resources had reduced the level of direct involvement in cultivation and increased dependence on market supplies, but even in these few truly substantial communities there was still no sharp separation of 'urban' from 'rural' activities and many leading burgesses remained active as cultivators.

The sixteenth century witnessed a widening separation of a rising percentage of the Scottish urban population from direct involvement in growing its own bulk food-supplies. This trend resulted in the progressive disconnection through the Early Modern period of most Scottish town-dwellers from the process of primary food-production, a disconnection which was considered by social theorists, such as the Edinburgh-based philosopher Adam Ferguson, to be an essential component in the social evolution from chaotic tribal primitivism to order and civility which he explored in his 1767 *Essay on the History of Civil Society*; it represented a decisive cultural shift towards the 'polite' urban society of the nation in the late eighteenth and nineteenth centuries.² Growth in population numbers in many Scottish towns played a significant part in this severance of the direct link between food production and consumption, but the break occurred at different times and to varying extents around the country depending on the rate of physical expansion and economic development

in a given community. Down to the sixteenth century, most of Scotland's urban centres had been very small in scale compared with those in England and mainland Europe, with only Edinburgh's population exceeding an estimated twelve thousand by the 1500s and with its nearest competitor, Dundee, standing at around half that figure.³ Indeed, as the engravings of the Dutch military engineer Johannes Slezzer illustrate, the majority of Scotland's burghs remained small in scale at the end of the seventeenth century, often with populations below two thousand and with some only in the high hundreds.⁴ As late as *c.*1750, fewer than nine per cent of Scots lived in urban centres but within a century that percentage had nearly quadrupled.⁵

As the rate of urbanisation in Scotland accelerated in the sixteenth century and continued to rise subsequently, and the percentage of 'indwellers' – mainly landless, waged employees - in the urban populations grew, the numbers of town-dwellers directly involved in the growth of their dietary staples declined sharply. This social trend had many consequences for Scottish burgh life, but one of the least considered is the fundamental shift which occurred in public attitudes towards waste and refuse of all types, with materials previously conserved by their producers for use as agricultural or horticultural manures losing its value to them and becoming simply a nuisance to be disposed of as rapidly as possible. Such a shift in attitude towards the problem of waste disposal has been the subject of detailed study for the post-Chadwickian era of public health and sanitary reform in the later nineteenth century, principally with regard to major British, European and North American cities such as Glasgow, Manchester, London, Paris, Milwaukee and Chicago, albeit with a primary focus on the process of removal of waste from within the urban area rather than on the means and effects of its final disposal.⁶ This transition, however, was more than a

simple switch from perception of a public ‘good’ to a public ‘ill’, for historical records reveal a striking ambivalence in attitude towards materials which were at one and the same time a valued resource and an object of disgust.

The inconvenience caused by accumulation of domestic waste in public thoroughfares was already a well-recognised cause of neighbourly disputes and official anxiety by the late Middle Ages, but despite repeated efforts to regulate the malodorous midden-heaps on the private forelands between house-fronts and the public highway, they remained a widely perceived ill that exercised Scottish urban governments into the mid nineteenth century. The regular repetition from the sixteenth century onwards of burgh legislation concerning private dung-hills and middens, however, reveals also the economic value attached by many Scottish town-dwellers to their household waste and the anxiety to ensure that the wealth it represented was expended to the benefit of the individual or community.⁷ By the late eighteenth century, however, what had previously been a commodity garnered and guarded for its value as fertilizer by its producers, tolerated or even treasured despite its often foul odour and unsightly form, came to be perceived by most observers as simply inconvenient, noisome ‘waste’ but by the 1840s was viewed by social reformers like Edwin Chadwick as a hazard to public health.⁸ Nevertheless, although a growing number of townsfolk simply wished to be freed from dealing with their own refuse and waste, the material remained in demand by agriculturalists as manure and continued to be attributed significant economic value. This paper explores that dichotomy through discussion of the geoarchaeological evidence from the anthrosols (‘soils that have been modified profoundly through human activities’)⁹ created by manuring processes from the late

medieval period to the nineteenth century, and the historical evidence for the socio-economic context of that manuring practice.

Except for passionate composters who recycle their organic domestic refuse to enrich their vegetable gardens, the insulation of most modern city-dwellers from the physical processes of primary food-production and waste-management has removed awareness of what for their ancestors would have been inextricably linked activities. Disposal of the by-products and wastes of community living has been a problem which has confronted humans since the earliest communal settlements in the Neolithic Middle East and evidence from around the world indicates that one common response to that problem was to use refuse as agricultural fertilizer.¹⁰ It is widely acknowledged that all types of waste associated with human settlement form one of the principal agents in modification of soils in urban and peri-urban contexts and five main mechanisms for production of the waste have been identified; human habitation, stalled animals, use of fires and hearths, metalworking, and other processing activities.¹¹ The human habitation contribution can be further broken down into enrichment through inputs of faeces and urine, re-deposition of cesspit contents, domestic food-processing waste and household rubbish, spoiled store products, and the debris of the inhabited structures themselves. Modern Western cultural aversion to the use of much of these types of material – especially human bodily waste - as fertilizer in the cultivation of foodstuffs arose principally from later nineteenth-century developments in medical science which linked such waste with disease-spread and other health issues, principally the consequences of ingestion of concentrations of heavy metals from food grown in soil modified by significant inputs of organic waste.¹² This aversion has perhaps limited past discussion of pre-modern urban waste disposal in Britain, and

has helped to embed deep in the public consciousness a vision of our ancestors wallowing in their own filth. As evidence from both past societies and current practice in much of Asia demonstrates, however, such waste was until recently – and in some cultures still is – seen as a valuable source of soil enrichment for agriculture.¹³

Until at least the late 1600s, and in many smaller Scottish provincial burghs until well into the nineteenth century, agriculture was as much a part of the socio-economic life of the community as crafts and trade.¹⁴ It was not just vegetable gardens and orchards in the backlands of the tenements that were being cultivated, burgesses had a share in the surrounding arable and pasture land. On these fields, burgesses produced the bulk of their dietary staples, principally barley, oats and pulses, and grazed their livestock. While many burgesses may not have personally dirtied their hands in cultivating their portion of the common fields, most retained their share – and in some cases actively sought to expand their access to arable and pasture beyond the burgh lands – but some chose either to lease it out or employ labourers to cultivate it on their behalf.¹⁵ Consequently, burgesses had an interest in maintaining the fertility of peri-urban land and, amongst other resources, employed the most readily-available form of natural fertilizer for use on garden plots or for replenishing soil nutrients in the burgh fields: their own waste in all its forms.

Research at the University of Stirling over the last decade, stimulated by Professor Christopher Smout's 1998 question of whether archaeologists or soil scientists could date and explain the processes behind agricultural soil formation in Scotland,¹⁶ has built on earlier studies of the history of soils and field systems.¹⁷ These projects have

explored aspects of the interlinked issue of urban waste and peri-urban agriculture, and have used a range of historical and geoarchaeological techniques. Research has focussed on the processes of waste-management and on identification of the inputs to the fields, principally recognised in the anthrosols, the anthropogenically deepened topsoils which can still be found around some smaller Scottish burghs. What has been revealed is a subtly detailed but hitherto neglected record of one dimension of the large-scale environmental change effected by past human action, and evidence for wider environmental impacts triggered by demand for both more agricultural land and fertilizers. It has, moreover, exposed a further aspect of local political interactions, as burgh administrations sought to balance internal social tensions concerning the accumulation and disposal of waste; manage external pressure on burgh resources; and regulate access to them while still maintaining stable relations with neighbouring landowners. A broad exploration of these issues has required a multi- and interdisciplinary environmental history methodology, bringing together a range of scholars from across the Humanities and Natural Sciences. The result is a richly-textured synthetic overview which extends far beyond what any single discipline could achieve.

First, what are the records? They fall into two broad categories: the anthrosols created through inputs of waste and other materials into the soil of the cultivated areas in and around the burghs; and the documentation which records the various aspects of that process, from descriptions of the waste being produced through to legislation governing its use or disposal. Neither data-set can alone provide all the answers to the mechanisms at work; the anthrosols preserve a record of the constituents of the waste and of some of the processes of its introduction into the soil, the documents generally

provide us with a record of how the waste was produced, gathered and transported to its place of use but rarely provide detail beyond broad labels defining composition and generalised statements regarding where and how it was used. The documentary records, too, reveal some of the implications of other methods employed to deepen and enrich the soil, principally through the digging in of turf stripped from other areas, which resulted in extensive land degradation, the breakdown of the structural integrity of areas of peat-moss which provided the burgh communities with their principal fuel supply, and, in coastal communities, recurrent episodes of severe erosion and wind-blow of dune systems and links. Instances of the latter will be referred to but are tangential to the principal theme of the present discussion; the use of domestic waste in all its forms as fertilizer in agricultural activities.

It is the soil that constitutes our principal record of past manuring practices. The following discussion will use the terms anthropogenic soils and anthrosols to label the distinctive soils created by human induced topsoil changes and which form a potential sub-category of the recently recognised soil classification of *technosols* (soils ‘whose properties and pedogenesis are dominated by their technical origin’).¹⁸ Modification, however, is not solely a consequence of anthropogenic inputs of material, for extractive processes such as stone-clearance and drainage have played an equally significant role in anthrosol formation, enhancing the cultivable properties of soils or affecting Ph levels through accelerating or inhibiting leaching. Such anthrosols have been a recognised geoarchaeological feature in Scotland since at least the early 1980s.¹⁹ In an urban context in Scotland, down to the early 2000s they were discussed mainly with reference to the so-called ‘garden soils’ identified in excavations in St Andrews from the early 1980s onwards, which were themselves

being interpreted in the context of a wider European debate over the formation of 'black' or 'dark earth' in towns.²⁰ These deep, homogenous *hortosols* (soils created through horticultural activity) have been interpreted mainly as the product of material introduced from outside the burgh to provide soils for horticulture. Their widespread occurrence across the footprint of the post-medieval settled area of St Andrews has been interpreted as evidence for a dramatic change in property ownership and land use patterns.²¹ This 'imported garden soil model' is predicated on a breakdown and abandonment of the medieval property divisions, withdrawal from other activities on the former backlands of individual tenements, and the turning over of the whole of the newly open zone to cultivation. A suggested context for such a radical reconfiguration has been a collapse of the economic condition of St Andrews in the post-Reformation period, with the burgh suffering progressive contraction in its inhabited area and general economic stagnation from the mid-sixteenth to early nineteenth centuries.

The 'imported garden soil' model gained general acceptance amongst archaeologists and was regularly advanced to explain the deepened soil layer, but by the later 1990s there was gathering uncertainty over the processes by which it had been formed. In 1997, Peter Clark articulated that uncertainty in his summary discussion of a decade of excavations in St Andrews and pointed to the English examples of Lincoln, London and Worcester, mainly of late Roman and Anglo-Saxon date, as evidence for a number of different deposition processes which could produce similar layers.²² Out of that uncertainty, in 2001 Stephen Carter proposed an alternative model for deepened soils formation which still views them primarily as the consequence of the import of material from outside the burgh. Thin-section micromorphological analysis

(the study at microscopic level of soil composition, structure, form, organisation, colour etc., using fine-ground, slide-mounted slices of resin-impregnated dried soil) of the 'garden soil' from one St Andrews site revealed significant differences between two horizons visible in the deepened layer. Both horizons contained quantities of fuel residues, food debris and building materials, but while in the upper soil layer this amounted to a substantial 20 per cent of the soil profile, in the lower horizon these materials were identified in only insignificant quantities. The bulk of the deposited material was scarcely distinguishable from the *in situ* topsoil, which led him to propose that it was 'most likely to have been introduced simply as turf/topsoil or as a topsoil derived sediment', probably obtained from somewhere on the raised beach area immediately adjacent to the burgh.²³ Carter's conclusion from this was that it was impossible to differentiate between topsoil introduced for cultivation purposes and identical material possibly resulting from the decay of turf used as roofing and walling in the burgh. His interpretation of the two distinct horizons was that lower layer was the disturbed natural topsoil of the burgh area, slightly contaminated with twelfth-century and later debris resulting from the development of the town, while the upper layer was an 'occupation' deposit consisting of some material derived from disposal of refuse of various forms but largely of the residues of 400 to 500 years of turf-, clay- and timber-built structures.²⁴ Rather than being evidence for the creation of a new cultivated zone encompassing the supposedly shrunken remains of a declining burgh, Carter has proposed that the 'garden soils' are evidence instead of a vibrant pre- and post-Reformation community involved in the sediment-generating business of building and rebuilding on intensely exploited urban backlands.

Parallels with mainland European practices have been seen in the rural agricultural phenomenon referred to as 'plaggen' soil. The anthropogenic character of these soils has long been recognised and the mechanisms behind their formation have been the subject of detailed research in, for example, Germany and the Netherlands.²⁵ 'Plaggen' is a label for a specific type of anthrosol formed by the long-term digging in of high volumes of organically rich material, principally turf, peat, animal dung and midden material, but including also coarser materials like sand or crushed brick, resulting in a deep and highly enriched topsoil layer.²⁶ It is a technique that has been employed in parts of north-western Europe for over 3000 years, but its main period of formation in parts of Germany and the Netherlands dates from the seventh to thirteenth centuries AD. In Shetland, study of the best-known example of anthropogenic soil-deepening on the island of Papa Stour, where the turf and peat of the western two-thirds of the island was systematically stripped to form enriched, deepened topsoil in the townlands on the eastern third, has shown that it was a practice of the post-1200 period.²⁷ Most mainland Scottish studies of the phenomenon have been on rural sites, mainly in the Highlands and Islands, but deepened soil has also been identified recently at the deserted medieval village of Eldbottle in East Lothian, suggesting that it was a practice with currency throughout the country.²⁸ Similar organically-rich, deepened topsoil has long been known to exist around Scotland's post-twelfth-century burghs, and it was suggested that it is a Scottish manifestation of some form of plaggen-forming practice.²⁹ This possibility was one consideration explored through a programme of joint historical and geoarchaeological investigation at a number of Scottish burghs.

Given the loss of most areas of medieval and early modern peri-urban cultivated land below sprawling modern suburbs, research has focussed on smaller communities where significant areas of un-built-up tenement backlands and portions of former burgh fields survive. Trials for topsoil depth determination were made using auguring, permitting the production of depth-gradient maps at several burghs. Investigations at Nairn, Pittenweem, Lauder and Wigtown revealed that while the deepest anthrosols were, as suspected, in the backlands of properties in the historic burgh cores, significantly deepened or anthropogenically enriched soils extended beyond the built-up area into former town fields. Samples were obtained using either test-pitting or coring on selected sites in the backlands (the long strips of garden ground behind street-front properties) and fields then subjected to a range of analytical laboratory tests to determine soil structures and content.³⁰ In these four burghs, the deepened soils from both tenement backlands and peri-urban fields were found to have been significantly enhanced by addition of various materials. As at St Andrews, much of this material appears to be the result of the digging in of turf or peat and the disposal of waste, while inputs of seaweed are known to have continued into the twentieth century at Pittenweem, but both backland and field samples also contained substantial quantities of material probably obtained from dung-heaps and middens. These included fuel residues/hearth-sweepings, pot-sherds, shell material, animal bones and significant traces of lipids, which indicate that human excrement and slaughterhouse waste was added to the mixture. One project focussed on the former common fields to the south-west of Nairn has revealed evidence for the artificial deepening and enriching of the soils there through the input of midden material from the burgh as well as turf and divot brought from the lower ground around the River Nairn. Raised phosphorus levels supported the proposal that the

burgh's waste had been used to enrich these fields, while finer material in the deepened soil horizon was attributed to the mineral components of sand and ashes used to soak up cattle urine and semi-liquid faeces in byres, and of turf.³¹ The presence of substantial quantities of material derived from decayed turf could indicate the transporting from the burgh of debris from building demolition or repair – and substantial turf construction remained a local tradition well into the 1800s³² – which would support Carter's thesis for accumulation of the 'garden soils' at St Andrews, but documentary evidence from Nairn and several other burghs suggests that turf was also cut and transported specifically for use in soil-deepening operations (discussed below).³³

Marked variation in soil depths over relatively short distances within the backlands of the medieval and early modern burghs at Nairn, Pittenweem and Lauder was noted.³⁴ This, it has been argued, was probably a consequence of individual owners pursuing different manuring strategies and, perhaps, making inputs of varying volumes and types of material. Marked differences in soil colour was also noted between the backlands and land adjacent to the old burgh core, further emphasising the degree of modification of *in situ* topsoil. This colour difference, it is argued, signified the high level of organic material from domestic refuse within the backland garden soils and, along with the depth of homogenous soils, underscored the scale of the inputs and the length of time over which they had been added.³⁵

At Nairn, Pittenweem and Lauder, similar areas of deepened soils were also identified in the former burgh fields. These, it is proposed, resulted from identical soil-enhancement strategies and, as already discussed, the Nairn anthrosols have been

shown to contain significant quantities of domestic refuse, hearth waste, lipids, and mineral remains of decayed turf. While no comparable sampling has yet been undertaken at Elgin, field-walking in a surviving area of undeveloped former common field west of the medieval burgh core has produced strong circumstantial evidence for the transporting of household refuse and street-sweepings to the cultivated ground in the form of substantial quantities of medieval pottery, coins and other artefacts.³⁶ A similar practice may account for the random scatters of medieval coins and small items of non-ferrous metalwork found by metal-detectorists in areas of former burgh fields round several Scottish towns.³⁷

Together, these geoarchaeological studies indicate the complexity of the formation of these deepened soils, revealing the use of domestic refuse and, probably, trade waste in the form of shambles refuse (the portions of animal carcasses from slaughtering activity which have no use in any craft process) and also the digging in of significant volumes of organically rich soil materials. At Nairn, this process has been described as ‘an early form of urban composting’, the legacy of which was a general improvement in peri-urban agricultural land soil-quality.³⁸ The scale of the anthropogenic intervention in the peri-urban environment over the best part of a millennium which these analyses indicate is staggering and highlights the inherent fallacy in contemporary belief that landscape-scale environmental change is a product of post-eighteenth-century Improvement agriculture. The modification of soil structures evident in the medieval anthrosols reflects a transformative episode in Scottish landscape history as significant as Neolithic and Bronze Age woodland clearance or the systemic reconfigurations of the eighteenth and nineteenth centuries.

What can the documentary records reveal of the processes by which these deepened soils were created and of the materials being deposited? Embedded within the historical record is a substantial body of incidental data which illustrates aspects of daily life and routine which were too commonplace to merit otherwise documenting. This material provides the historical context for the processes of soil formation identified in the geoarchaeological record. The documentary research has examined the records of sixteen burghs of varying size and wealth in the main survey period, 1450-1850, and distributed widely across the country.³⁹ This wide distribution and cross-section of community size has allowed a national picture to emerge.

In all burghs where detailed records survive, while the accumulation of waste in streets, lanes and against walls was regarded as a public nuisance and general inconvenience, the value of waste material to individuals and to the community was recognised. The processes whereby all household refuse and human waste (referred to as ‘fuilzie’ or ‘failyie’) was garnered into mounds that would be carted when needed to their owners’ cultivated ground were also documented in some detail. Each household maintained its own midden-heap, usually located on the foreland (the space belonging to the property-holder between the public highway and the front wall of the house); essentially this was private property gathered on privately-held ground.⁴⁰ The waste which accumulated in these private midden-heaps had an altogether different status as property from waste dropped or dumped in the public spaces of the community. From at least as early as the 1520s some burgh councils enacted for the regular cleansing of street-waste, the ‘gait syeppens’ (street-oozings/seepings) of horse- and cattle-dung and other materials – such as waste grain, meal or malt – dropped or dumped in the common ways, and of the waste from flesh- and fish-

markets and its disposal as a public resource.⁴¹ Rights to remove and sell on this public waste were then already being 'set' (let by contract to an individual for a stated period for an agreed price). This waste might be gathered into a single midden-heap in a designated location, an arrangement common under licensed waste-collection mechanisms from the later 1600s onwards.⁴² Household refuse including human faeces and urine, however, was private property and the responsibility of the householder. This view of midden waste as private property, with some intrinsic monetary value, led to the emergence of a trade in the commodity. How old that traffic was is unknown, but it surely long predates the surviving records of contracts for delivery of agreed quantities in the 1530s, which reveal an already developed market for midden waste unwanted by some producers but heavily in demand from those with significant agricultural interests. At Haddington, for example, as early as March 1537 the burgh council registers record settlement of breaches of contract for failure to deliver the agreed quantities of 'muck', with cash values assigned per 'lade' (cart-load) to be paid for non-delivery.⁴³

Seasonal demand for fertilizer meant that private dung heaps accumulated over several months and became obstacles to be navigated around in the streets and closes of the burghs. Such long-term build-up of waste in street-side middens did not mean that it was unwanted by its producers. The threat of uncompensated seizure and disposal of the material, in addition to money-fines, used by many burgh councils to force better management and regular clearing of dung-hills, indicates how important this resource was to the burgesses. Despite their economic value to the townsfolk, however, middens were regarded nevertheless as a noisome nuisance where they spilled from forelands into the public way, stimulating measures aimed at

management of a public problem rather than disposal of the private commodity. In some burghs, the authorities waged ultimately losing battles through the sixteenth and seventeenth centuries to control these private midden-heaps. At Nairn, the earliest surviving records of waste-disposal within the burgh in prosecutions for the construction of folds which impeded traffic in the streets dates only from July 1658, but the records refer to legislation extending back into the 1500s forbidding the townsfolk from making middens and dunghills on public roads. Nearly a century later, the councillors were still attempting to enforce this clearly ineffective legislation.⁴⁴

In larger communities, surviving records of burgh council enactments indicate that midden-waste and street-dung were matters of public concern from at least the second quarter of the sixteenth century. Council ordinances concerning the removal of dung and the cleansing of dunghills from the public ways are first recorded in 1529 at Stirling and at Elgin and Haddington from the 1540s onwards, but the late 15th-century poet William Dunbar's tirade against the merchant-burgesses of Edinburgh suggests that it was already an old problem.⁴⁵ The first surviving Elgin council act relating to waste-disposal dates from 1541, when it was ordained that those who had deposited 'gudding' (the generic term for waste used as manure in the fields) at the eastern edge of the burgh were to remove it by an appointed time or anyone would be allowed to take it for their own uses.⁴⁶ An almost contemporary enactment of Haddington burgh council from January 1542 ordained the removal of all middens from the streets within eight days and any remaining after that time were to be 'led away and confiscated to the town's use'.⁴⁷ In 1550, the problem of dunghills being left as obstructions for long periods was tackled by an Elgin ordinance requiring none

to be left in the street for longer than three days, with a fine of 7/- for any breach, and a further stipulation that each burgess had to keep the drainage channels around his property clear of blockages to prevent noisome effluents from spilling into other men's ground.⁴⁸ The accumulation of middens in the back lane between the burgages and the cultivated crofts, providing access to backlands and linking them with the fields around the town, remained an issue. Burgesses were depositing waste in this lane behind their property for ease of carrying it to their land, blocking through access for others. Accordingly, in 1584 the council ordered the clearance of all such middens and fined defaulters.⁴⁹ There was, too, a growing feeling that such public accumulations of refuse were injurious to perceptions of the burgh in the eyes of outsiders and an affront to the local elites who were confronted with reeking middens whenever they visited their town-houses or attended church. At Banff in 1638 it was the 'prejudice of the inhabitantis... and dishonour of the burghe' which were stated imperatives behind a statute requiring the regular cleansing of middens from the main street.⁵⁰

The scale of the trade in street-sweepings and midden material is impressive. As the 1537 court decret and 1542 cleansing ordinance from Haddington referred to earlier reveal, all forms of dung and midden-waste was bought and sold as a marketable commodity and dealers gathered the materials for bulk sale and delivery. The Haddington decret dealt with 40 cartloads of muck, but at Elgin in 1581 one Anthony Cowie was ordered to pay £3 Scots for 200 'leidis of muk' he had promised to deliver to another burgess.⁵¹ In 1647, Jean Bonnyman, a burgess's widow, pursued John Hardie, a member of a prominent Elgin trading and property-owning family, for non-payment to her for 260 loads of dung delivered to his land and a further 53 loads

for which he had made his own carriage arrangements.⁵² Demand for good-quality manure was such that a heap of street-dung and seized midden material gathered in 1685, intended for roup (sale by public auction) by the council, mysteriously vanished overnight, supposedly stolen by a tenant-farmer from outside the burgh.⁵³ Although stolen in this year, from 1685 records show the tack (the lease or tenancy) of this dunghill being obtained by private individuals who either sold its contents on at a profit to cultivators or used it on their own ground.⁵⁴

By the eighteenth century, fewer burgesses were actively cultivating their own ground and their middens were no longer necessary as fertilizer for their own use; dunghills were coming to be regarded as a nuisance. An Elgin statute of 1715 required burgesses to make weekly clearances of middens from outside their doorways and prohibited dumping outside the slaughterhouse or at vennel and wynd heads,⁵⁵ while the council made arrangements for the removal of dung from the streets. To cover the costs of cleansing, the council intended to sell the refuse,⁵⁶ for there was continuing demand for such manure by those who were still cultivating the land and the dung accordingly had a commercial value. In common with other Scottish burghs, Elgin auctioned the right to clear dung and dunghills, not just street-sweepings, which the successful bidder then sold on for profit. Such a method was in use at Perth by 1738, where the successful bidder had to clean all the main streets daily by 10am in winter and 8am in summer, and all back lanes fortnightly, the cleared material being gathered in dumps on the periphery of the town from where it had to be removed weekly, mainly by on-sale to farmers.⁵⁷ Some burgh officials and businessmen clearly saw a commercial opportunity and ran the operation as part of a portfolio of activities, while in other cases it was farmers from neighbouring districts who sought

the tack, intending to use the product on their own fields. Thus, for example, the tack of the street dung and midden material from the closes of the fishing community of Newhaven beside Edinburgh was secured in 1771 by John Cleghorn, a tenant-farmer from nearby Granton.⁵⁸ At Banff in 1764 it was the burgh's provost who secured the contract, while in 1781 at Elgin it was Robert Smith, a lawyer in the burgh, who paid £1.0s.3d for the rights to the dung from the burgh's streets.⁵⁹ Elgin's council attempted to better organise the cleansing operations in 1791, dividing the streets into four lots to be let at 5s each, but no-one bid for any of them.⁶⁰ At Edinburgh, by way of contrast, the public roup of the dung and fuilzie of the city was of huge commercial interest and was managed as a significant contributor to revenues by the council into the nineteenth century.⁶¹

The apparent decline in demand for Elgin's dung coincided with the steady spread of improved agriculture in lowland Moray. While this might be expected to have stimulated demand for fertilizers, and the *Statistical Accounts* and records from other burghs with arable hinterlands - such as Dunbar, Edinburgh, Inverkeithing and Perth⁶² – reveal buoyant demand well into the 1840s, increased numbers of livestock and the keeping of properly maintained dung-heaps on consolidated farms perhaps already provided more convenient sources of material. At Perth, however, farms up to 10 miles away in the Carse of Gowrie still found it profitable to obtain midden-waste from the town, while by the early 1790s farmers in Dumbartonshire were obtaining dung in bulk from Glasgow and Greenock, it being recorded that up to fifty cartloads of town dung could be applied to one acre of land,⁶³ and in Stirlingshire town dung was sought by farmers within a radius of three miles of the main towns.⁶⁴ The rapid expansion of Glasgow met growing demand from improving farmers in eastern

Dumbarntonshire in the early 1800s, although tolls and carriage costs were driving up prices.⁶⁵ Further west, Greenock and Port Glasgow were key suppliers. Fish-market waste had been in high demand as a component of manure from at least the early 1500s, as recorded at Haddington, but the rapid growth of the commercial fisheries around the Clyde estuary after 1750 saw great expansion in the availability of processing waste at a time when demand for organic fertilizers for agricultural improvement was growing with equal rapidity. The dung of the Clyde fishing-ports had been considered superior to other town dungs, its quality being described as greatly improved on account of the waste materials from the herring gutting yards, listed as ‘refuse salt, putrid fish, blood, and other animal substances’.⁶⁶ The same consideration explains the demand for waste from Newhaven on the Forth in the 1770s, mentioned earlier. At the Clyde ports, demand declined in the early nineteenth century when the fishery contracted, it being commented that the quantity of animal matter in the dung had declined in proportion to the ‘earthy sweepings of the streets’.⁶⁷

In Nairn and Inverness, and probably other small burghs in the north of Scotland, the un-aesthetic appearance and health hazards of dunghills and middens continued to cause disquiet amongst the emerging middle classes and health professionals into the mid-nineteenth century. It was recognised, however, that middens provided the poorer inhabitants of the burghs with a source of fertilizer for their potato patches; George Anderson in Inverness reported in the early 1840s that ‘the drainage [in the poorer housing areas], naturally bad enough, is often purposely obstructed by the people, for the purpose of adding to their dunghill heaps of middens, which, as manure for their potatoe-grounds, form the chief treasures of the poorer cottagers and

labourers'.⁶⁸ Anderson also commented that the back courts of the labourers' accommodation could be used as small vegetable patches, 'but their principal value is as stances for pig-houses and dunghills'. This continuation of ancient practice, however, was a mere shadow of the former importance of midden material to Scotland's townspeople and, as fewer and fewer townsfolk pursued any active involvement in agriculture, the input of their waste to neighbouring fields had declined sharply by the mid 1800s and in most cases ceased before the end of the nineteenth century.

One further issue which sheds light on the process of soil deepening and enrichment around Scotland's post-medieval burghs is highlighted in the rearguard defence fought from the sixteenth century by the council of Elgin to protect its common peat mosses from which the burgesses obtained their main supply of domestic fuel. Their action was a reflection of a crisis in the fuel supply for many burghs away from the coal-rich region around the Firth of Forth, which was exacerbated by inroads made by agriculturalists in search of materials to enrich their topsoil.⁶⁹ Legislation in 1580 and 1581 restricting casting of fuel to only a licensed group of burgesses, also ordained that no one was to cast '*faill* (turf used for building), fuel or divot', or '*hoik*' (dig out) or '*fla*' (take off the grass layer) of the moss.⁷⁰ At the same date at Aberdeen, the council prohibited further removal of turf from the coastal links, where the burgesses' actions had resulted in episodes of sand-blow and shortages of materials for other uses, especially building of dykes and for roofing. The prohibition on 'hoik'-ing and 'fla'-ing reveals a further concern; that the removal of turf to deepen cultivated topsoil was exposing the underlying peat to erosion, further depleting fuel reserves. The use of turf and peat in this manner was a north-eastern Scottish tradition, illustrated in

1685 when the Scottish Parliament passed an Act directed specifically at Aberdeenshire, prohibiting the ‘Custom of Delving teiling and casting up great quantities of Corn ground, meadow ground and Suarded ground which they lay in heaps to rott, for making fuilzie or maner to their Land...’,⁷¹ but by the late eighteenth century the practice was widespread in sub-Highland Scotland. Legislative efforts were in vain, however, as a series of court actions at Elgin in 1762 reveal. There, individuals charged with illegal cutting of peat confessed to removing moss-earth and turf to mix with material from their dunghills to form a richer soil for cultivation.⁷² In following decades, it was the mosses themselves which were being taken into cultivation, not materials being removed from them for use elsewhere. That issue introduces another factor: conflicting pressures on land-use for fuel or for agricultural development, but that lies beyond the scope of this paper.⁷³

In conclusion, the processes revealed by these geoarchaeological and historical records illuminate the techniques by which agricultural soil around many Scottish burghs was deepened and improved. More importantly, they provide insights on human actions evident in the geoarchaeological record. At Nairn, for example, references to the use of byre refuse, midden waste, shambles waste and turf and divot cut specifically for the purpose illustrate how the phosphorus, mineral traces, lipids and other distinctive signatures were introduced into garden and field soils.⁷⁴ The sources of material used for manuring and the fact that it was delivered from the urban area to the adjoining fields is recorded at almost every burgh where accounts were examined. Other than in small burghs where there has been little physical expansion until recently, however, the soil evidence to match the documentary record is currently lacking. In larger towns, further geoarchaeological research is needed to

locate areas of surviving anthrosols. Overall, much remains to be done to determine the composition of the materials being introduced, from which it may be possible to identify local or regional diversity of practice. What is also clear is that all organic refuse was valued as fertilizer and some types were hugely in demand on account of perceptions of particular richness. This point raises the question of the growth of the trade in urban waste and how supplies of especially favoured materials were procured. Further research on the individuals controlling the waste-disposal operations in the burghs is also needed, especially to identify any networks of landed and agricultural interests of which they were part. The record sources also provide some indication of the volumes of material being introduced to the fields, and here future geoarchaeological analysis may enable determination of rates of accumulation. The long, steady process of accumulation which the historical record illustrates appears to fit Carter's hypothesis of soil deepening being largely the result of the long-term deposition of organic debris of all forms but principally derived from buildings of turf, timber, clay and divot. However, the north-east Scottish sources reveal that the turf- and divot-derived component of the deepened soils, which he argued was the result of the steady dissolution over centuries of structures built largely from those materials, were also the result of the deliberate introduction of those materials with the intention of improving the soil quality.

Documentary and geoarchaeological records demonstrate the significance of the input of urban midden material into surrounding agricultural land. They reveal also the longevity of the practice and provide insight on the factors which had contributed to its decline in the century before the formal parliamentary legislation controlling the disposal of household waste of all forms. Even after the nineteenth-century Public

Health Acts the direct application of untreated human waste and other midden material to agricultural land continued, and not only at small communities which lacked the resources to introduce piped water-borne sewerage systems and regular street scavenging operations; at Edinburgh, the home of the eighteenth-century essayist Adam Ferguson whose views on civil society were so influential in shaping attitudes towards sanitation and in framing the philosophy of modern civic life, it was only in 1922 that the disposal of much of the city's sewage via the uncovered Craigentenny Burn and its use as fertilizer on the notorious Craigentenny Meadows was discontinued.⁷⁵ To members of 'polite society' in late eighteenth-century Edinburgh, urbane, refined and scholarly, who had little involvement in agriculture – and indeed for the populations of most Scottish towns and cities which continued to discharge their waste direct into rivers and landfill sites into the early 2000s – for what they regarded as noisome matter of no use and much inconvenience to them, out of sight was very much out of mind.

¹ For discussion of burgh foundation and burgess rights, see R D Oram, *Domination and Lordship: Scotland 1070-1230* (forthcoming, Edinburgh, 2011), chapter 8.

² For the emergence of ‘polite’ ideas, see D Allan, *Scotland in the Eighteenth Century* (Harlow, 2002), 130-2, 146-7. For Ferguson’s social vision and philosophy, see A Ferguson, *Essay on the History of Civil Society*, ed. F Oz-Salzberger (Cambridge, 1995); A Broadie, *A History of Scottish Philosophy* (Edinburgh, 2009), 286-7.

³ For a general overview of urban development in 16th- and 17th-century Scotland, see M Lynch, ‘Introduction: Scottish Towns 1500-1700’ in M Lynch (ed), *The Early Modern Town in Scotland* (London, 1987), 1-35, and the particular case of Edinburgh by W Makey, ‘Edinburgh in the Mid-Seventeenth Century’ in the same, 192-218.

⁴ J Slezer, *Theatrum Scotiae: Containing the prospects of their Majesties castles and palaces: together with those of the most considerable towns and colleges; the ruins of many ancient abbeys, churches, monasteries and convents, within the said kingdom. All curiously engraven on copper plates. With a short description of each place* (London, 1693). See especially the ‘prospects’ of Fortrose (Chanonry), Inverness, Elgin, Aberdeen, Arbroath, Brechin, Dundee, St Andrews, Dunfermline, Perth, Dunblane, Stirling, Edinburgh, Glasgow, Paisley and Ayr.

⁵ The changing occupational structure of populations in Scotland’s larger late medieval and early renaissance burghs is explored in M Lynch, ‘The Social and Economic Structure of the Larger Scottish Towns, 1450-1600’, in M Lynch, M Spearman and G Stell (eds), *The Scottish Medieval Town* (Edinburgh, 1988), 261-86. For an overview of urbanisation in the eighteenth and nineteenth centuries, see T. Devine, *The Scottish Nation 1700-2000*, London, 1999, chapter 8.

⁶ For late nineteenth-century attitudes and technological responses, see E C S Moore, *Sanitary Engineering* (London, 1898); J H Maxwell, *The Removal and Disposal of Town Refuse* (London, 1898); W F Goodrich, *The Economic Disposal of Town’s Refuse* (London, 1901). For modern discussion of case studies, see for example, L P Cain, ‘Unfouling the Public’s Nest: Chicago’s Sanitary Diversion of Lake Michigan Water’, *Technology and Culture*, 15 (1974), 594-613; J A Tarr, ‘From City to Farm: Urban Wastes and the American Farmer’, *Agricultural History*, 49 (1975), 598-612; *ibid.*, ‘Out of Sight, Out of Mind: A Brief History of Sewage Disposal in the United States’, *American History Illustrated*, 10 (1976), 40-7; W Cronon, *Nature’s Metropolis: Chicago and the Great West*

(London, 1991); J Sheail, 'Town wastes, agricultural sustainability and Victorian sewage', *Urban History*, 23 (1996), 189-209; B Luckin, 'Pollution in the city', in M Daunton (ed), *The Cambridge Urban History of Britain*, iii, 1840-1950 (Cambridge, 2000), 207-228; I Douglas, R Hodgson and N Lawson, 'Industry, environment and health through 200 years in Manchester', *Ecological Economics*, 41 (2002), 235-55; S Barles, 'A metabolic approach to the city: nineteenth- and twentieth-century Paris', in D Schott, B Luckin and G Massard-Gilbaud (eds), *Resources of the City: Contributions to an Environmental History of Modern Europe* (Aldershot, 2005), 28-47; J F M Clark, "'The incineration of refuse is beautiful": Torquay and the introduction of municipal refuse incinerators', *Urban History*, 34.2 (2007), 255-77.

⁷ See, for example, Anon (ed), *Extracts from the Records of the Royal Burgh of Stirling AD 1519-1666* (Glasgow, 1887), 130, ordinance prohibiting the sale of 'muck or failyie' to anyone other than indwellers of the burgh; or Haddington Burgh Records, B30/13/3, f.60r, 3/3/1609, prohibiting sale of 'muk & fuilyie' to men dwelling to landward.

⁸ The background to mid-nineteenth-century sanitary reform is discussed in E Chadwick, *Report on the Sanitary Condition of the Labouring Population of Gt. Britain*, ed. M W Flinn (Edinburgh, 1965), 3-26.

⁹ *World reference base for soil resources 2006: A framework for international classification, correlation and communication* (Food and Agriculture Organisation of the United Nations: Rome, 2006), 71.

¹⁰ T Hardy-Smith and P C Edwards, 'The Garbage Crisis in prehistory: artefact discard patterns at the Early Natufian site of Wadi Hammeh 27 and the origins of household refuse disposal strategies', *Journal of Anthropological Archaeology* 23 pt 3 (2004), 253-289; I D Bull, P P Betancourt and R P Evershed, 'An Organic Geochemical Investigation of the Practices of Manuring at a Minoan Site on Pseira Island, Crete', *Geoarchaeology* 16 (2001), 223-242; C E Wells, R E Terry, J J Parnell, P J Hardin, M W Jackson and S D Houston, 'Chemical Analysis of Ancient Anthrosols in Residential Areas at Piedras Negras, Guatemala', *Journal of Archaeological Science*, 27 (2001), 449-462; K A Golding and D A Davidson, 'The effect of past waste disposal on soils near to Scottish burghs', *SEESOIL* 16 (2005), 28-36.

¹¹ Golding and Davidson, 'Effect of past waste disposal'.

¹² See, for example, A S Manta, M Angelone, A Bellanca, R Neri and M Sprovieri, 'Heavy metals in urban soils: a case study from the City of Palermo (Sicily) Italy', *The Science of the Total Environment*,

300 (2002), 229-243; X Li, S I Lee, S C Wong, W Shi and I Thornton, 'The study of metal contamination of urban soils of Hong Kong using a GIS-based approach', *Environmental Pollution*, 192 (2004), 113-24. Public Health and Sanitary Reform in Britain aroused considerable debate from the 1840s and the intensity sharpened after the 1875 Public Health Act in England and Wales, with much of the argument revolving around the economic costs of waste-water disposal as opposed to the use of sewage in agriculture. See, for example, N Goddard, '19th-century recycling: the Victorians and the Agricultural utilization of sewage', *History Today*, 31 (1981), 32-6; *ibid.*, "'A mine of wealth"? The Victorians and the agricultural value of sewage', *Journal of Historical Geography*, 22 (1996), 274-90; Sheail, 'Town wastes'.

¹³ P Montague, 'Excrement happens', *The Ecologist*, 29:4 (1999); M Strauss, *Wastewater and excreta use in India* (Dübendorf, International Centre for Waste Disposal, 1986); P Cross, *Health aspects of nightsoil and sludge use in agriculture and aquaculture. Part I: Existing practices and beliefs in the utilisation of human excreta* (Dübendorf, International Centre for Waste Disposal, 1985); C Polprasert, P Edwards, C Pacharaprakiti, V S Rajput and S Suthirawut, *Recycling rural and urban nightsoil in Thailand* (Bangkok, 1982); *China: recycling of organic wastes in agriculture*. Food and Agriculture Organisation of the United Nations, Soils Bulletin no.40 (Rome, 1977).

¹⁴ E Ewan, *Townlife in Fourteenth-Century Scotland* (Edinburgh, 1990), 108-110, 118-9.

¹⁵ W Coutts, 'Provincial Merchants and Society: A Study of Dumfries Based on the Registers of Testaments 1600-1665', in Lynch (ed), *Early Modern Town*, 147-66 at 148-50; I D Whyte, 'The Occupation Structure of Scottish Burghs in the Late Seventeenth Century', in *ibid.*, 219-44 at 228-9 (for seasonal employment as harvest labourers and for unskilled labourers); Lynch, 'Introduction: Scottish Towns 1500-1700', 23.

¹⁶ T C Smout, 'Thinking about the environmental history of Scotland and Denmark since 1600', in G Fellows-Jensen (ed), *Denmark and Scotland: the cultural and environmental resources of small nations* (Copenhagen, 2001), 139-512 at 140-142; D A Davidson, 'Soils as cultural resources' in *ibid.*, 171-80.

¹⁷ See, for example, S Foster and T C Smout (eds), *The History of Soils and Field Systems* (Aberdeen, 1994).

¹⁸ *Ibid.*, 95. This classification is formulated around modified soils created in contemporary urban/industrial environments.

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- ¹⁹ J.W. Barber, 'Excavations on Iona, 1979', *PSAS*, 111 (1981), 282-380 [discussion at at 359-60]; D.A. Davidson and I.A. Simpson, 'The formation of deep topsoils in Orkney', *Earth Surface Processes and Landforms*, 9 (1984), 75-81; D A Davidson, G Dercon, M Stewart and F Watson, 'The legacy of past urban waste disposal on local soils', *Journal of Archaeological Science* 33 (2006), 778-783.
- ²⁰ M.J.Rains and D.W. Hall (eds), *Excavations in St Andrews 1980-89* (Glenrothes, 1997), 21, 25-6, 28, 30, 33, 142; S. Carter, 'A reassessment of the origins of the St Andrews "garden soil"', *Tayside and Fife Archaeological Journal*, 7 (2001), 87-92. For the 'black' or 'dark earth' debate see P Norman and F W Reader, 'Further discoveries relating to Roman London, 1906-1912', *Archaeologia*, lxxiii (1912), 257-344; A Gebhardt, 'Dark Earth: Some Results in Rescue Archaeological Contexts in France', in R Macphail (ed), *Bulletin 1 of Archaeological soil micromorphology working group* (1997) at <http://www.gre.ac.uk/~at05/micro/soil-main/papers/paer13.htm> ; E J Siddell, 'Dark earth and obscured stratigraphy', in P J Huntley (ed), *Taphonomy and Interpretation* (Oxford, 2000), 35-42; R I Macphail, H Galinié and F Verhaege, 'A future for Dark Earth?', *Antiquity*, 77 (2003), 349-358; J Heimdahl, *Urbanised Nature in the Past: Site Formation and Environmental Development in Two Swedish Towns, AD 1200-1800*. Thesis in Quaternary Geology No 5 (University of Stockholm, 2005), 16-18.
- ²¹ Carter, 'St Andrews "garden soil"', 87.
- ²² P.R.Clark, 'Discussion', in Rains and Hall (eds), *Excavations in St Andrews*, 142. M A Courty, P Goldberg and R Macphail, *Soils and Micromorphology in Archaeology* (Cambridge, 1989); B Yule, 'The "dark earth" and late Roman London', *Antiquity*, 64 (1990), 620-28; R I Macphail, *Soil report on the Deansway Archaeology Project Worcester*, English Heritage Ancient Monuments Laboratory report 82/91 (1991); H Dalwood, 'The use of soil micromorphology for investigating site formation processes', in K Steane (ed), *Interpretation of stratigraphy: a review of the art*, City of Lincoln Archaeological Report 31, 3-6 (1992).
- ²³ Carter, 'St Andrews "garden soil"', 89.
- ²⁴ *Ibid.*, 91, 92.
- ²⁵ H-P Blume, 'History and Landscape Impact of Plaggen Soils in Europe', at <http://natres.psu.ac.th/Link/SoilCongress/bdd/symp45/64-r.pdf> contains extensive bibliography of past, largely German research on this topic; H-P Blume and P Leinweber, 'Plaggen soils: landscape history, properties and classification', *Journal of Plant Nutrition and Soil Science*, 167, issue 3 (2004), 319-27;

C C Bakels, 'The beginnings of manuring in western Europe', *Antiquity*, 71 (1997), 442–445; D Elwert and J Finner, 'Landschaften und Böden Nordfrieslands', *Mitteilungen der Deutschen Bodenkundlichen Gesellschaft*, 70 (1993), 127-50; W van der Westeringhe, 'Man-made soils in the Netherlands, especially in sandy areas ('plaggen soils')', in W Groenman-van Waateringe and M Robinson (eds), *Man-Made Soils* (Oxford, 1988), 5-20; H de Bakker, *Major Soils and Soil Regions in the Netherlands* (Wageningen, 1979); M J Conry, 'Plaggen soils. A review of man-made raised soils', *Soil and Fertilisers*, 37 (1974), 319-26; J C Pape, 'Plaggen soils in the Netherlands', *Geoderma*, 4 (1970), 229-55; F de Coninck, 'Formation of deep humiferous soils in the Antwerp Campine', *Pédologie*, 7 (1957), 102-106.

²⁶ Davidson, 'Soils as cultural resources', 175-8.

²⁷ D A Davidson and I A Simpson, 'Soils and Landscape History: case studies from the Northern Isles of Scotland', in Foster and Smout (eds), *History of Soils and Field Systems*, 66-74; D A Davidson and S P Carter, 'Micromorphological evidence of past agricultural practices in cultivated soils: the impact of traditional systems on soils in Papa Stour, Shetland', *Journal of Archaeological Science*, 25 (1998), 827-838.

²⁸ E Hindmarch, *Renaissance Golf Club at Archerfield, Evaluation and Excavation Data Structure Report*. Unpublished report by AOC Archaeology Group (Edinburgh, 2006).

²⁹ Davidson, Dercon, Stewart and Watson, 'Legacy of past urban waste disposal on local soils', 778.

³⁰ The principal tests were: Loss on Ignition, Phosphorus mg/Kg, Magnetic Susceptibility, and Frequency Dependent Magnetic Susceptibility.

³¹ Davidson, Dercon, Stewart and Watson, 'Legacy of past urban waste disposal on local soils', 779; <http://www.cehp.stir.ac.uk/proj-2.html> ; <http://www.cehp.stir.ac.uk/proj-2.html> G Dercon, D A Davidson, K Dalsgaard, I Simpson, T Spek and J Thomas, 'Formation of sandy anthropogenic soils in NW Europe: identification of inputs based on particle size distribution', *Catena* 59:3 (2005), 341-356; Davidson and Simpson, 'Soils and Landscape History', 68.

³² For photograph and description of turf-built house at Howfordbridge, Nairnshire, c.1870, see <http://www.scran.ac.uk/database/record.php?usi=000-000-137-526-C&scache=6ymj61mh34&searchdb=scran> Turf-built houses remained common in rural parts of Nairnshire in the 1840s, e.g. in Ardclach parish, see H McBean, 'Parish of Ardclach', *New Statistical Account of Scotland*, 27-43 at 37-8 see <http://stat-acc-scot.edina.ac.uk/link/1834->

[45/Elgin/Ardclach/13/26/](#) The tradition is discussed in B Walker, 'The vernacular buildings of north east Scotland: an exploration', *Scottish Geographical Journal*, 95 (1979), 45-60, especially at 46-50.

³³ Davidson, Dercon, Stewart and Watson, 'Legacy of past urban waste disposal on local soils', 782.

³⁴ Golding and Davidson, 'Effect of past waste disposal on soils', 3. K A Golding, The effect of waste disposal on soils in and around historic small towns. PhD Thesis. University of Stirling (2008).

³⁵ Golding and Davidson, 'Effect of past waste disposal on soils', 3, 5.

³⁶ Pers. Comm. Susan Bennett, former curator of Elgin Museum.

³⁷ J D Bateson and N M McQ Holmes, 'Roman and medieval coins found in Scotland, 1988-95', *Proceedings of the Society of Antiquaries of Scotland*, 127 (1997), 527-61: metal-detector finds on areas of former cultivated land associated with burghs occurred in this period at Aberlady, Cupar, Dornoch, Elgin and Rattray. For discussion of metal finds from medieval cultivated ground at Dornoch, <http://canmore.rcahms.gov.uk/en/site/123446/details/dornoch+meadows+business+park/> or A Cox, R Coleman and C Miller, 'Meadows Business Park, Dornoch (Dornoch parish), medieval occupation and post-medieval finds', *Discovery and Excavation in Scotland* (1997), 46.

³⁸ Davidson, Dercon, Stewart and Watson, 'Legacy of past urban waste disposal on local soils', 782.

³⁹ The burghs are, from north to south, Tain, Nairn, Elgin, Banff, Fraserburgh, Old Aberdeen and Aberdeen, Perth, Pittenweem, Stirling, Edinburgh, Haddington, Lauder, Peebles, Selkirk, Wigtown and Whithorn

⁴⁰ This position contrasts with that in contemporary England, where only waste deposited on the private ground at the rear of a property was secure from removal by town authorities. See, for example, W King, 'How High is Too High? Disposing of Dung in Seventeenth-Century Prescot', *Sixteenth Century Journal*, xxiii/3 (1992), 443-457 at 443-5.

⁴¹ *Stirling Records*, 6, 9 November 1520, the set of the street sweepings to Robert Arnot; Haddington Burgh Registers, Court Book 1530-1555 B30/9/2, 79r burgh court 6 March 1536/7, for the delivery to Cristell Thomson of the muck of the fish-market gathered by John Hume; *ibid.*, 178r 15 Feb 1542/3 for the 'dichting' of the flesh-market, the muck of which had been set (let by contract) to the same John Hume.

⁴² As set out, for example, in the 1738 arrangements in Perth [BS59/25/3/39], where four sites for the temporary gathering of the material removed by the cleansers were designated.

⁴³ Haddington Burgh Registers, Court Book 1530-1555 B30/9/2, 79r burgh court 6 March 1536/7.

⁴⁴ Davidson, Dercon, Stewart and Watson, 'Legacy of past urban waste disposal on urban soils', 779.

⁴⁵ H Harvey-Wood (ed), *William Dunbar: Selected Poems* (London, 2003), 64-6.

⁴⁶ *Stirling Records*, 37-8; *Elgin Records*, i, 65-66.

⁴⁷ Haddington Burgh Registers, Court Book 1530-1555 B30/9/2, 162r 26 Jan 1541/2.

⁴⁸ *Elgin Records*, i, 105.

⁴⁹ *Elgin Records*, i, 173.

⁵⁰ *The Annals of Banff*, ed. W Cramond, *New Spalding Club*, i (Aberdeen, 1891), 82.

⁵¹ *Elgin Records*, i, 159.

⁵² *Elgin Records*, i, 182.

⁵³ *Elgin Records*, i, 338. The 'gutter' referred to in the council minute may be represented by the substantial water-course found in excavations in Lossie Wynd in 1977: Hall and others, 'Archaeology of Elgin', 822.

⁵⁴ *Elgin Records*, i, 338. The first tack, for three years, was to Thomas Watson, a maltman, who paid 33/4 Scots for the period.

⁵⁵ *Elgin Records*, i, 390.

⁵⁶ *Elgin Records*, i, 469.

⁵⁷ B59/25/3/39 (Perth), tack for one year.

⁵⁸ NAS GD265/4/1/13 Tack, inhabitants of Newhaven and John Cleghorn, tenant in Granton, anent lease of street dung (25 Jan 1771).

⁵⁹ *Annals of Banff*, i, 312; *Elgin Records*, i, 205.

⁶⁰ *Elgin Records*, i, 207.

⁶¹ See, for example, NAS JC65/18, articles of public roup of the dung and fuilzie of the Extended Royalty of the City of Edinburgh, 1809.

⁶² NAS B18/32/18 (Dunbar); B34/20/232 (Inverkeithing); B59/25/3/140, B59/25/3/150 (Perth); JC45/29, JC65/18-22 (Edinburgh).

⁶³ D Ure, *General View of the Agriculture in the County of Dumbarton* (London, 1794), 32.

⁶⁴ R Belsches, *General View of the Agriculture in the County of Stirling* (Edinburgh, 1796), 38.

⁶⁵ A Whyte and D Macfarlan, *General View of the Agriculture of the County of Dumbarton* (Glasgow, 1811), 197.

⁶⁶ Whyte and Macfarlan, *Agriculture of Dumbarton*, 197-8.

⁶⁷ Whyte and Macfarlan, *Agriculture of Dumbarton*, 198.

⁶⁸ George Anderson, 'Sanitary Report on the Town of Inverness, North Britain', cited in E. Chadwick, *Report on the Sanitary Condition of the Labouring Population of Great Britain*, ed. M.W. Flinn (Edinburgh, 1965), 115.

⁶⁹ R D Oram, 'Abondance inépuisable ? Crise de l'approvisionnement en combustible et réactions en Ecosse du Nord entre environ 1500 et environ 1800,' in J-M Derex and F Grégoire (eds) *Histoire économique et sociale de la tourbe et des tourbières. Æstuaris* (2009), 31-44.

⁷⁰ *Elgin Records*, i, 158, 163. This prohibition was repeated in 1581 (*Elgin Records*, i, 167).

⁷¹ *APS*, VIII, pp.494-5 (1685).

⁷² Mitchell Library MS.246130, extracts from the records of the burgh of Elgin: 1 September 1762 in court haldin by Provost Brodee, Bailies Laing & Leslie. James Allan procurator fiscal of court complained upon the persons after named for their casting & winning peats & firr in the moss of Mostowie and selling the same through the country, as also for their taking in and improving the land and sole of the said moss and converting the same into corn land, and for their casting and carrying away the moss or turff and/or surface of the said moss and mixing the same with their dunghills or burning of the samyn & craved that as the persons after named had been guilty of the foresaid offences repeated times within these 7 years past [...] each fined £50 Scots; *Elgin Records*, i, 199, 475, 477, 478.

⁷³ Discussed in R D Oram, 'Abondance inépuisable? Crise de l'approvisionnement en combustible et réactions en Écosse du Nord environ 1500 et environ 1800' in J-M Derex and F Grégoire (eds), *Histoire économique et sociale de la tourbe et des tourbières: Actes du deuxième colloque international du Groupe d'histoire des zones humides* (Cordemais, 2009), 31-44.

⁷⁴ Davidson, Dercon, Stewart and Watson, 'Legacy of past urban waste disposal on local soils', 779.

⁷⁵ P J Smith, 'The foul burns of Edinburgh: Public health attitudes and environmental change', *Scottish Geographical Journal*, 91.1 (1975), 25-37.