

Cautionary notes on linking the National Farm Survey with other records for investigating the agrarian history of Second World War Britain*

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Abstract

This paper explores the feasibility of using National Farm Survey (NFS) data in conjunction with a contemporary aerial photograph to reconstruct farm sizes, shapes and land use in the parish of Hamsey, East Sussex. A detailed analysis based on linking these documents demonstrates that there are difficulties with the consistency of the data, with only 12 out of 19 farms having a complete set of NFS forms, and with some ambiguities discovered in the NFS maps. The areas of arable and grassland for each farm were identified from the 1940 aerial photograph and captured in a GIS. The total acreages were then compared with the totals for crops and grass as shown in the June 1941 Agricultural Census. These were found to diverge by more than 20 per cent in over a third of cases. Attempts were made to adjust for the effects of the wartime plough-up campaign in order to improve levels of agreement but these were largely unsuccessful due to the high numbers of 'part' fields. The study yields some useful information at the micro-scale but provides salutary warnings about any attempt to reconstruct farms on a larger geographical scale due to the complex and time-consuming nature of the task.

It has been argued that the period since the early 1930s has had more profound consequences for British agriculture than any other since the agricultural revolution of the eighteenth century.¹ The inter-war years may be characterized as a mixture of decline and regeneration. On the one hand the agricultural area in the United Kingdom fell by some 2.5 million acres to just over 31.5 million acres, of which only 9 million acres were under crops other than grass, and this was coupled with increasing pressure to develop and build over the countryside.² On the other hand, a more scientific approach was being adopted towards farming, and

* We are grateful to Claire Ivison, Kingston University, for drawing Figures 1 to 5, to Evelyn Dodds, University of Sussex, for assistance with the Luftwaffe aerial photograph, and to the anonymous reviewers who commented on an earlier draft of this paper.

¹ J. Martin, *The development of modern agriculture: comparison of the First Land Utilisation Survey field sheets and 1:63,360 scale maps*, *J. Applied Geography* 30 (2010), p. 1.

² K. J. Taylor, N. S. Walford and B. M. Short, 'Assessing the land use of inter-war Britain: a

innovations such as bail milking were adopted by some farmers.³ There was also a growing interest in regional survey work and a broader ‘culture of landscape’ in inter-war Britain as exemplified by the Scouting and Guiding movements, easier access to the countryside and the upsurge in rambling.⁴

Stamp’s Land Utilisation Survey, conducted during the 1930s, was the first attempt to undertake a comprehensive and standardized national survey of land use in Britain. Such surveys comprised a large part of the answer to governmental needs to control from Whitehall, and the 1930s were characterized by a dramatic shift in policy as the free market era of the 1920s gave way to increased state intervention, surveillance and control via a series of agriculture acts and marketing schemes. With the outbreak of war in 1939, the Minister of Agriculture was further empowered under the Defence of the Realm Act to preserve, maintain and control farmland for maximum food production; to terminate tenancies where neglect or poor cultivation was demonstrable; and to destroy vermin and pests.⁵

This paved the way for an extensive state-directed plough-up campaign designed to maximize arable production which, within the space of five years, transformed British agriculture from ‘a predominantly pastoral system of low input, low output farming to a “national farm” dominated by intensive arable farming, heavily dependent on inputs such as fertilizers and machinery acquired from outside the agricultural sector’.⁶ The National Farm Survey (NFS) was undertaken between 1941 and 1943 as a means of assisting with this plough-up campaign, as well as with a view to post-war land use planning and as an historical record of the main features of every farm.

The mid-twentieth century represents a period of transition, not to say revolution, in British agricultural history, and understanding the structure, layout and conditions of a group of individual farms provides a starting point for assessing factors, such as variation in land character and quality, that might have influenced the survivability of farms in the post-war decades. Related research has explored continuity of occupation by families on farms in parishes across the extent of the South Downs.⁷ This paper presents the detailed results of a study undertaken to investigate the feasibility of reconstructing all the farms in a single parish in south-east England in wartime, using the NFS records in conjunction with a 1940 aerial photograph and other contemporary Ministry of Agriculture data. As a methodological paper, it is not designed to present an empirical survey of agriculture at this period, although certain aspects of farming structure and process will be touched upon.

Table 1 identifies the specific data sources employed for this purpose. Superficially, we now

³ P. Brassley, ‘British farming between the wars’, in P. Brassley, J. Burchardt and L. Thompson (eds), *The English countryside between the wars: regeneration or decline?* (2006), p. 198.

⁴ D. Matless, ‘Regional surveys and local knowledges: the geographical imagination in Britain, 1918–39’, *Trans. Inst. British Geographers* 17 (1992), pp. 464–80; P. Brandon, *The discovery of Sussex* (2010).

⁵ J. Martin, ‘The wild rabbit: plague, policies and pestilence in England and Wales, 1931–1955’, *AgHR* 58

(2010), p. 267.

⁶ B. Short, C. Watkins and J. Martin, “‘The front line of freedom’: state-led agricultural revolution in Britain, 1939–45”, in B. Short, C. Watkins and J. Martin (eds), *The front line of freedom: British farming in the Second World War* (2006), p. 1.

⁷ N. Walford, ‘The National Farm Survey and the tracing of post-war farmers’ movements on the South Downs’, in Short *et al.* (eds), *Front line of freedom*, pp. 217–29.

TABLE 1. Primary sources used in the study

<i>Data Source</i>	<i>Location of archive/reference</i>
Second and third County Series 1:10560 Ordnance Survey maps	
NFS forms for Hamsey June–Nov 1942	TNA, MAF 32/101.
NFS maps for Hamsey	TNA, MAF 73/41/40, MAF 73/41/54 and MAF 73/41/53
June 1941 Agricultural Census summary for Hamsey	TNA, MAF 68/3994
Luftwaffe aerial photograph August 1940, no. 40	University of Sussex collection

have an enormous amount of information from which to undertake such work. A project very similar in nature was carried out by Riley and Watkins, who used NFS data and RAF aerial photographs dating from 1946 and 1947 to reconstruct three case-study farms on a field-by-field basis. They concluded that the detailed interpretations provided by these case studies yielded valuable insights on field-by-field data on land use, cropping and farming systems. However, they achieved mixed results and concluded that it was rather difficult to relate the crops and land uses to individual fields.⁸ One aim of the present study is to determine whether the use of a more nearly contemporary aerial photograph, dating from 1940, yields more positive results in terms of reconstructing land use on a field-by-field basis. Furthermore this study extends beyond single case-study farms to consider an entire parish unit, which brings into focus such familiar but potentially knotty issues as land being located in one parish but returned in another, and the fragmented nature of some holdings.

The parish of Hamsey in East Sussex (Figure 1) lies at the foot of the South Downs, just to the north-west of the county town, Lewes, and stretches onto the clay of the Low Weald to the north, whilst the south-west corner of the parish is chalk downland. The parish therefore includes a variety of landscape types. According to the NFS Primary Return the majority of the farmers were tenants with just two farms part-owned and part-tenanted, and one owned outright by Lady Monkbretton. The June 1941 agricultural census shows that around 1200 acres of the parish were given over to permanent grass with a further 183.5 acres of rough grazing. Livestock consisted mainly of cattle and calves, with just 26 sheep and lambs recorded for the parish, although significant numbers of poultry were also kept, including 1,105 fowls at Conyborough Poultry Farm. The main arable crop was barley with 308 acres recorded in 1941. There were also 122 acres of oats together with 62 acres of mixed corn and 72 acres of temporary grass. Small acreages of other miscellaneous crops such as beans, peas, potatoes and so on complete the picture.

Short *et al.*, in conducting an extensive assessment of the NFS material, included a national sample of some 3,000 farms and two regional samples. Their Sussex sample included 1,200 holdings covering large areas of the South Downs and parts of the Sussex Weald and they found the NFS records to be reasonably complete and the maps to be in good or very good

⁸ M. Riley and C. Watkins, 'The value of the National Farm Survey and contemporary aerial photographs for environmental history', in Short *et al.* (eds), *Front line of freedom*, p. 215.

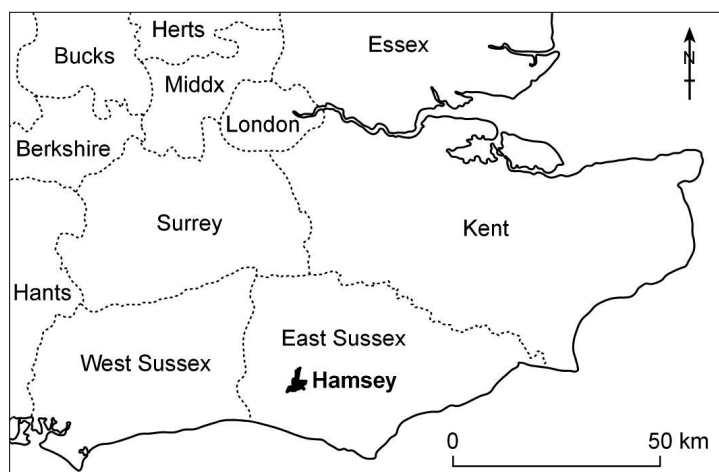


FIGURE 1. Location of the parish of Hamsey, East Sussex

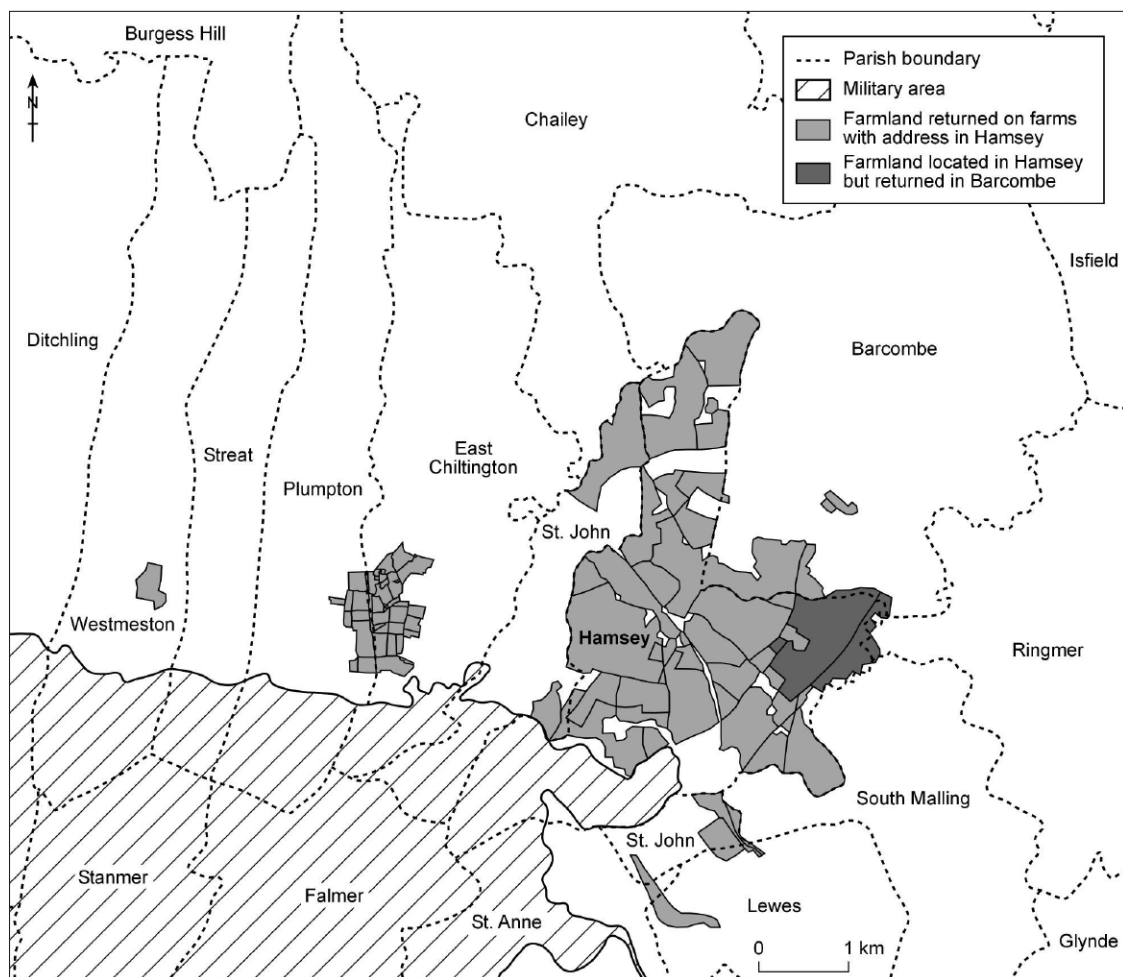


FIGURE 2. Farms in the parish of Hamsey in 1941

condition.⁹ Importantly, the Luftwaffe aerial photograph, which was used here in conjunction with the NFS material, provided complete coverage of the parish of Hamsey, which was vital for the purposes of interpreting its land use on a field-by-field basis.

The June Agricultural Census, taken annually in England since 1866 and normally available as parish summaries, was also inspected for Hamsey. Uniquely, the NFS records include the original returns for each farm in the parish for this one year, 1941, from which its parish summary was aggregated. According to the 4 June 1941 return, there were 16 holdings of over five acres in Hamsey, ranging in size from 9 to 329.5 acres.¹⁰ Until 1948 the farmer's place of residence was used to determine in which parish his or her farmland was allocated.¹¹ This meant that a farm could be recorded in one parish although the bulk of its land was in another, and thus Hamsey also includes just over 260 acres of land belonging to farms recorded in the neighbouring parish of Barcombe (Figure 2). It is also the case that some land recorded in Hamsey lies in still other parishes, such as the field on the west side of Figure 2, which falls within the neighbouring parish of Plumpton. Farm XE 218/109/13 is included on the same NFS Primary Return as two farms returned in Hamsey (discussed in more detail below), and so this is also shown in Figure 2 although it actually lies outside the parish boundary. Finally, there was a large military training area, precluding normal farming operations, which covered much of the central South Downs, and this also impinged on the southern part of the parish of Hamsey.

I

The methods employed in this investigation were based upon a combination of Second and Third Series Ordnance Survey maps as a base from which to digitize a polygon layer representing the parish of Hamsey. The NFS maps were photographed and imported into the GIS and displayed as a backdrop to allow information such as the NFS farm reference number, OS parcel number and acreage (as given on the maps) to be transcribed into an associated attribute table. The aim was to reconstruct Hamsey's farms, and so each farm extent was also captured in a separate layer where this was possible. This will also be discussed in more detail below.

The aerial photograph used in conjunction with the NFS material was taken by the Luftwaffe on 12 August 1940 from around 20,000 feet and is centred on Lewes.¹² The Luftwaffe had been secretly compiling images of towns and cities in Britain taken from German civilian and military aircraft in the pre-war period, and these were supplemented by images taken by photo-reconnaissance flights during the war itself. Aircrew carried these images on subsequent bombing raids on towns, cities, ports, airfields and similar strategic targets.¹³ There is therefore

⁹ B. Short, C. Watkins, W. Foot and P. Kinsman, *The National Farm Survey, 1941–43: state surveillance and the countryside in England and Wales in the Second World War* (2000), pp. 145.

¹⁰ TNA, MAF 32/1008/101. The June Returns, available for other war years, are catalogued under MAF 68.

¹¹ G. Clark, *The Agricultural Census – United*

Kingdom and United States (1982), p. 18.

¹² UK Aerial photos, *Historic UK aerial photography*. <http://www.ukaerialphotos.com/historic-aerial-photos.asp> [accessed 15 Jan. 2008].

¹³ <http://germaninvasion.co.uk/luftwaffe/aboutluftwaffe.htm> [accessed 27 Sept. 2011]

little coverage of more rural areas. Riley and Watkins found that the aerial photograph most nearly contemporary to the NFS for their own study area dated from 11 July 1946.¹⁴

The aerial photograph was geo-corrected and orthorectified to correct differences in scale across the image and to enable it to be displayed with the other data layers, and the photograph was then also imported into the GIS. This allowed each polygon to be examined and classified on a field-by-field basis. Seven broad land use categories were identified, based on those used in Stamp's Land Utilisation Survey. These categories were: Forest and Woodland; Meadowland and Permanent Grass; Arable including Temporary Grass; Heath and Rough Grazing; Gardens, Allotments, Orchards etc.; Water; and Land Agriculturally Unproductive. This paper concentrates on the two key and crucial wartime categories of Arable and Meadowland and Permanent Grass (hereafter referred to as Grassland).

The NFS forms include a Primary Return completed by surveyors from the East Sussex County War Agricultural Executive Committee (CWAEC) who visited each holding over five acres and recorded information on tenure; the conditions of the farm; water and electricity supplies; the management of the farm, together with some general comments (Section E) and information on the plough-up campaigns conducted so far on each farm in 1940 and 1941. The individual Census records for each farm were also used to provide information on the acreage of arable and grassland on each holding. The published 1941 parish summary of the Agricultural Census data for Hamsey was also used in an attempt to reconstruct missing information and additionally as a double check on the individual forms.

The results of the study are presented in three sections. First, the quality and internal consistency of the NFS data, including the 4 June 1941 Census material, is assessed. These data are then compared with the information captured in the GIS from the NFS maps. Finally the attempts to reconstruct the land use of individual farms, and especially to identify and quantify areas of arable and grassland, are considered.

II

Some issues have previously been identified with the quality and internal consistency of the NFS records and so an important early step in the course of the data processing was to carry out a series of checks on the NFS data themselves in order to assess their suitability as a basis for this reconstruction.¹⁵ In this instance the data proved to be somewhat patchy, with some forms missing and some returns being amalgamated where several holdings were being run together as one business unit, and this is summarized in Table 2. Farm XE 218/109/013, as noted above, is not located in the parish of Hamsey but rather has the bulk of its land in Plumpton, hence the different parish number (109). However this farm has been included on an amalgamated NFS Primary Return with farms XE 218/101/003 and 020 and was therefore presumably run as one unit with them, hence its inclusion here. It is clearly a

¹⁴ Riley and Watkins, 'The value of the National Farm Survey', In Short *et al.* (eds), *Front line of freedom*, p. 207.

¹⁵ Short *et al.*, *National Farm Survey*, pp. 113–60;

K. J. Taylor, 'A GIS-based approach to reconstructing mid-twentieth century agricultural land use around Lewes, East Sussex' (unpubl. PhD thesis, Kingston University, 2009).

TABLE 2. Summary of data availability for farms in Hamsey

<i>Farm no</i>	<i>Individual Primary Return Form</i>	<i>Amalgamated Primary Return Form</i>	<i>Individual 4 June Census form</i>	<i>Individual farm identifiable on NFS map</i>	<i>Amalgamated farm identifiable on NFS map</i>
XE 218/101/001	Yes		Yes	Yes	
XE 218/101/002	No	Yes	Yes	Query – numbered as 2 but may include 10	Query – appears to include farm 10 but unnumbered on map
XE 218/101/003	No	Yes	Yes	No	Query – incomplete outlining on map
XE 218/101/004	No	Yes	Yes	No	Yes
XE 218/101/005	Yes		Yes	Yes	
XE 218/101/006	Yes		Yes	Yes	
XE 218/101/007	No	Yes	Yes	No	Query – appears to be included with 04 and 08 but unnumbered on map
XE 218/101/008	Yes		Yes	Yes	
XE 218/101/009	Yes		Yes	Yes	
XE 218/101/011	Yes		Yes	Yes	
XE 218/101/010	No	Yes	Yes	No	Query – appears to be included with 02 but unnumbered on map
XE 218/101/012	Yes		Yes	Yes	
XE 218/101/013	Yes		Yes	Yes	
XE 218/101/015	Yes		Yes	Yes	
XE 218/101/016	Yes		No	Yes	
XE 218/101/017	Yes		Yes	Yes	
XE 218/101/018	No	Yes	No	No	Yes
XE 218/101/020	No	Yes	Yes		Query – incomplete outlining on map
XE 218/109/013	Yes	Yes	Yes	Query – incorrectly numbered on NFS map?	Query – due to incomplete outlining of farm 03

Source: TNA, MAF 32/101; 73/41/40; 73/41/54 and 73/41/53.

prerequisite of any such analysis as the present one to establish from the outset the precise farm holdings to be included, since the overlap of farm and parish boundaries obviate any neat solution.

It is also worthwhile noting that the farm numbers for Hamsey parish do not form a complete sequence – there are some missing, such as XE 218/101/014 and XE 218/101/019. It is possible that these may be holdings of less than five acres – the 1941 Census summary for Hamsey shows three holdings of less than five acres and as such would have been excluded from the NFS. Alternatively they may have been purchased by another farm and have been incorporated into its acreage and thus be lost as an individual holding. Walford comments that ‘In some parishes the sequence of farm numbers is discontinuous, which implies that the NFS record was lost, never collected because of small size, or because the holding had ceased to exist as a separate unit, since the CPH [County/Parish/Holding] numbers are not reassigned’.¹⁶ The farms will hereafter be referred to simply by the last two digits of the number, which denotes their number within the parish.

The internal consistency of the 4 June Census records was checked by examining the forms for each individual farm in Hamsey and comparing these to the totals shown in the Parish Summary. Since no individual forms were available for holdings of less than five acres, this left 16 farms of over five acres listed in the Parish Summary which also had individual Census forms available, and the frequency distribution of the acreages for these farms agreed exactly with the parish summary. But two farms with Primary Return forms, 16 and 18, had no individual Census forms. As the total number of farms was correct without farms 16 and 18, this suggests that these two holdings could already have ceased to exist as separate units, and this is borne out by a note on the Primary Return for farm 16 to the effect that it was ‘all let off to a neighbouring farmer – so no 4 June returns’. The general comments, to be found in Section E of the Primary Return for farm 16 also note that ‘15 acres of good pasture formerly used for grazing one cow and horses is now let off on grazing tenancy to a neighbouring farmer.’ The immediately adjoining farm, 101/20, does not appear to have any grazing rights or to occupy any other land according to the Primary Return, so it is unclear which neighbouring farm is being referred to, since it could lie within another parish.

The total acreage shown in the 4 June 1941 Parish Summary is 2,008.5, although the total of the summary entries for questions 1–32 is actually 2,007.25.¹⁷ If the individual forms included with the NFS are then totalled, this gives a figure of 2,002.35 acres using the totals given by the farmer, but 2,004.6 using the actual figures, as two of the forms are also added up incorrectly. These figures are remarkably comparable and the individual forms for Hamsey in general are completed with a considerable degree of precision, and with three-quarters of the farmers’ returns including fractions of an acre. However, the Parish Summary sheet has been heavily corrected, which may be grounds for some lack of confidence in the totals shown therein. Furthermore, Short *et al.* note that the completion of the June 1941 Census was nationally particularly difficult with, at one stage, an estimated half a million errors to correct, although

¹⁶ Walford, ‘National Farm Survey’ in Short *et al.* (eds), *Front line of freedom*, p.222.

¹⁷ TNA, MAF 68/3994.

TABLE 3. Level of agreement between the acreage shown on the Primary Return and 4 June Census

	<i>Farms in Hamsey</i>		<i>Short et al. Sussex Sample</i>	<i>Short et al. National Sample</i>
	<i>Number</i>	<i>%</i>	<i>%</i>	<i>%</i>
Holdings with a Primary return form (either individual or amalgamated)	14 out of 19			
Holdings with a 4 June Census Return	17 out of 19			
Holdings with both a 4 June Return and a Primary Return	12 out of 19	63.2	91.6	90.8
Holdings where Primary Return and 4 June Census acreage agrees	3 out of 12	25.0	30.2	33.9
Holdings where Census acreage is within 10% of Primary Return acreage	11 out of 12	91.7	56.0	60.2
Holdings where Census acreage is within 20% of Primary Return acreage	12 out of 12	100.0	67.5	71.0

Source: TNA, MAF 32/101; 68/3994.

this could be attributed to the addition of an unfamiliar Supplementary Return asking extra questions specifically for NFS purposes.¹⁸

Secondly the acreages shown on the 4 June Census returns at question 33 (total acreage of Crops and Grass), as completed by the farmer, were checked against those shown on the NFS Primary Return Form, completed by an external surveyor, in this case normally J. Halliday but in one case G. Wibberley (later Principal of Wye College and a noted agricultural commentator), to see how far these agreed. Where farms had no individual forms but amalgamated Primary Returns were available, these were included in the analysis and compared with the sum of the relevant Census forms. Farm 109/13 was also included in this analysis as it was included on an amalgamated form with farms from Hamsey. Where this exercise has been attempted before some significant discrepancies have been found, as in Westmorland by Crowe; and the levels of agreement were also compared with those found by Short *et al.* in their Sussex and National samples as shown in Table 3.¹⁹

Hamsey had poorer data availability compared with both the National and Sussex samples, but where the forms were available, the levels of agreement at 10 and 20 per cent were better than had been found by Short *et al.* To some extent the agreement can be related to farm size (Figure 3). Farms of under 100 acres generally appear to have the smallest difference in acreage between the two forms. However in farms above 100 acres the differences in acreage appear to be more randomly distributed.

¹⁸ Short *et al.*, *National Farm Survey*, p. 95.

¹⁹ H. Crowe, 'Farming the margins: upland agriculture in Westmorland, 1910–1947' (unpubl. DPhil thesis,

University of Sussex, 2010), p. 39; Short *et al.*, *National Farm Survey*, p. 172.

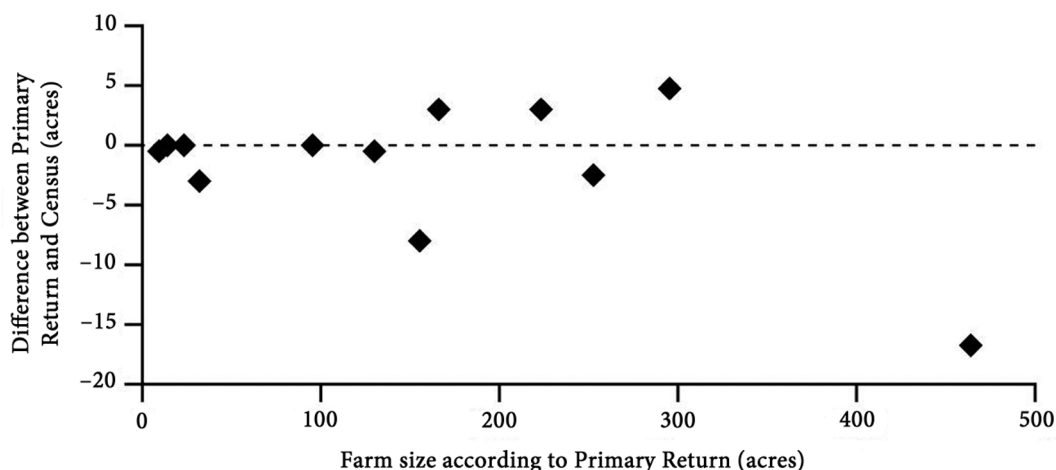


FIGURE 3. Farm size related to difference between Primary Return and Census acreages

III

Next, the farm acreages as calculated from the extents captured in the GIS were compared with the acreage shown on the Primary Return for each farm (Figure 4). Again there is some evidence that the smallest farms appear to have a lower difference in acreage than larger farms. However, the differences for larger farms are, again, fairly randomly distributed. The OS parcel numbers and acreages were transcribed onto 6-inch map sheets by the East Sussex War Agricultural Executive Committee staff from 25-inch base maps. But some sheets reveal that this transcription was less than perfect, with acreages illegible or even missing altogether, leading to fewer farms and smaller areas when the parcels making up a farm are added together, in comparison with the digitized farm areas. The results of comparing these figures with the Primary Return acreage are shown in Table 4. Whilst the Primary Return and GIS acreages showed a reasonably good level of agreement, adding up the acreages of the parcels as annotated on the Ordnance Survey sheets proved less satisfactory and so these were not used for further analysis.

It has already been noted that the GIS polygon layer was created by digitizing over a base layer comprising Ordnance Survey County Series maps. This process has been found to be a 'dominant source of error creation in digital data sets', and it was therefore possible that some of the differences between the GIS and Primary Return acreages had arisen due to errors in digitizing.²⁰ This was checked by selecting a random 20 per cent of all polygons (63 polygons) classed as arable or grassland and falling within a farm boundary. These were redigitized twice, being referred to as checks 1 and 2, and the acreage totals compared with the original captured acreage. For check 1, the mean percentage difference was 0.48 per cent and for check 2 this had increased slightly to 0.57. The largest difference was 0.81 acres and the mean difference was

²⁰ J. C. Walsby, 'The causes and effects of manual digitizing on error creation in data input to GIS', in P. F. Fisher (ed.), *Innovations in GIS 2: selected papers from the Second National Conference on GIS Research UK* (1995), p. 113.

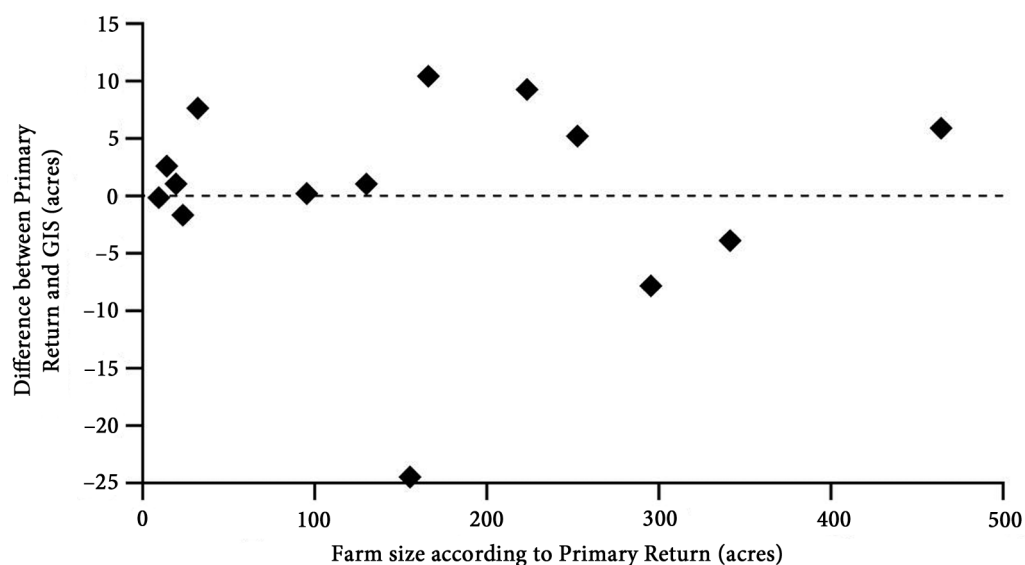


FIGURE 4. Farm size related to difference between Primary Return and GIS acreages

TABLE 4. Level of agreement between the Primary Return acreage, the GIS acreage and the total of OS parcels (per cent)

	<i>Primary Return and GIS</i>	<i>Primary Return and OS parcels</i>
Within 10 per cent	78.6 (11 farms)	60.0 (6 farms)
Within 20 per cent	100.0 (14 farms)	90.0 (10 farms)
Over 20 per cent difference	0	10.0 (1 farm)
No data available	3 farms	6 farms

Source: TNA, MAF 32/101; Second and Third County Series 1:10560 Ordnance Survey maps.

0.08 acres for both Check 1 and Check 2. The polygon with the largest acreage difference was an area of over 40 acres with a partially curved boundary. Curved lines tended to cause more problems in digitizing than straight lines, which arise because of operator choice over where the direction of a curved line changes and no two operators digitizing such a boundary would ever digitize exactly the same points to describe it.²¹ In Check 1, there were 28 polygons that were smaller than the original, two were identical and 33 were larger. For Check 2, 24 polygons were found to be smaller, four identical and 35 larger than the original. It seems therefore that the differences did not lie in any particular direction, and the original digitized dataset can be regarded as reasonably reliable and accurate.

²¹ I. N. Gregory, *A place in history: a guide to using GIS in historical research* (sec. edn, 2005), p. 37.

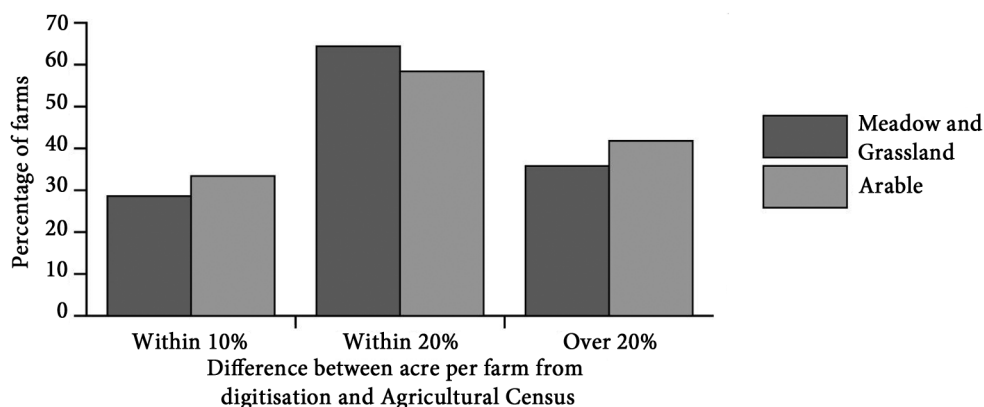


FIGURE 5. Percentage agreement between acreage totals for grassland and arable

IV

Once the accuracy of the farm extents had been assessed, the next step was to evaluate the success of reconstructing individual farms. The land use for each polygon had been classified from the aerial photograph and also through referring to the Primary Return form for information relating to the fields scheduled to be ploughed up and the general comments in Section E. The acreage totals for the two categories of grassland (meadowland and permanent grass) and arable were now compared with the totals for these two classes from the 4 June Census returns. Although it might be imagined that the Census was an accurate survey of agricultural land use, other commentators have acknowledged some of its shortcomings, such as the habit of some farmers in carrying forward figures written on the schedule from one year to the next and to round figures to an unspecified level (e.g. 1, 5 or even 10 acres).²² The results of this comparison are shown in Figure 5.

As much as one third of the grassland totals and over 40 per cent of the arable totals are widely divergent. One potential difficulty is that the category for gardens etc., which has not been discussed in detail here, includes allotments, orchards and nurseries, broadly based on the classifications used in Stamp's Land Utilisation Survey.²³ These could be interpreted as arable from the aerial photograph, and equally some arable land could be mis-classified as gardens etc. However there is a further difficulty with using the land use classes as interpreted from the aerial photograph. This was taken in August 1940, whereas the Census forms were submitted in June 1941 and the Primary Return forms were not completed for Hamsey parish until 1942. Whilst the aerial photograph could be expected to show land that had been ploughed up in early 1940, it would obviously not show land which was the subject of ploughing orders later than this. Of the twelve farms represented in Figure 2, two had no land ploughed up in 1941

²² Clark, *Agricultural Census*.

(third edn, 1964), p. 22.

²³ L. D. Stamp, *The land of Britain: its use and misuse*

TABLE 5. Paired sample t-tests comparing digitized and documentary area measurement for Hamsey farms.

	<i>Average difference</i>	<i>Standard Deviation</i>	<i>t statistic</i>	<i>P</i>
Total area (digitized versus Primary Return data)	0.37	8.77	0.17	0.88
Total area (digitized versus Agricultural Census data)	1.80	8.06	0.81	0.44
Grassland area (digitized versus Agricultural Census data)	5.25	25.34	0.75	0.47
Arable area (digitized versus Agricultural Census data)	-12.72	20.73	-2.30	0.04

Source: Authors' analysis.

according to the Primary Return. Of the remaining ten, four had clearly identifiable fields designated for ploughing whereas the other six included 'part' fields with no indication as to the exact location of the designated ploughing or the acreage in question. For the four farms with identifiable land designated for plough-up in 1941, an attempt was made to adjust the figures to include these, to see whether this improved the levels of agreement.

A statistical analysis has been carried out on the pairs of area measurements obtained for the 14 farms. These were the figures obtained by digitizing over the NFS maps and those obtained from the Primary Return and Agricultural Census schedule in the case of total farm area, and between the areas for grassland and arable as derived from an interpretation of the aerial photograph in relation to the digitized area and the Agricultural Census. The four pairs of measurements not surprisingly show a very strong and statistically significant positive correlation at the 0.001 level. In addition paired sample t-tests carried out on the data clearly indicate that the differences between the pairs of measures are not statistically significant, except in the case of arable land, where the digitized total is an average 12.7 acres less per farm than that obtained from the Agricultural Census (see Table 5). These results suggest that the interpretation of arable land on the aerial photograph was more challenging than grassland, but that overall the figures obtained from the two sources are virtually identical. Closer examination of the individual differences in the arable areas reveals that these were notably large on three particular farms (02/10, 09 and 13).

For farms 01 and 06, adjusting for the plough-up improved the grassland and arable agreement to within 10 per cent in both cases. However this proved more problematic for farms 08 and 15, which therefore merit closer attention. Winterlands Farm (08) is a 95-acre holding according to the Primary Return, with good agreement (within 10 per cent) between the 1941 Census and Primary Return acreage, and also with the GIS acreage. Section E of the Primary Return characterizes the farm as 'Dairy farm. A well managed holding. About 35% of arable'. The Census return shows 63.25 acres of grassland and 31.75 of arable, whereas the totals classified from the 1940 aerial photograph are 57.21 and 36.89 acres giving within 10 per cent and within 20 per cent agreement respectively. The Primary Return (Section F) shows field



FIGURE 6. Field 322 classed as arable

Source: University of Sussex Map collections

322 as ploughed up for the 1941 harvest. This has an area of 5.65 acres and, if used to adjust the grassland and arable figures, would serve to improve the agreement in both categories. However, on rechecking the aerial photograph, field 322 has already been classified as arable and there appear to be good grounds for this, as shown in Figure 6, where field 322 is outlined in black. The field appears very bright and striped, suggesting arable cropping.

Conyborough Poultry Farm (15) comprises 23 acres according to the Primary Return, and, again, there is good (within 10 per cent) agreement between the Census, Primary Return and GIS acreages. The farm basically consists of two fields and a small area of woodland as shown in Figure 7. The smaller of the two fields (no. 337) is 8 acres and classed as arable from the aerial photograph, giving good agreement with the Census total which is also shown as 8 acres. The larger field (no. 340a) is classed as grassland. The acreage of the field as captured in the GIS is only 12.19 acres and the Ordnance Survey parcel area transcribed onto the map is given as 12.275. However the Census return shows a total of 15 acres of grassland, divided into 12 acres of permanent grass for mowing this season and 3 acres of permanent grass not for mowing. The 12 acres for mowing this season accords well with the larger field but suggests there are 3 acres 'missing'. The patch of woodland in the middle of the larger field is only 1 acre

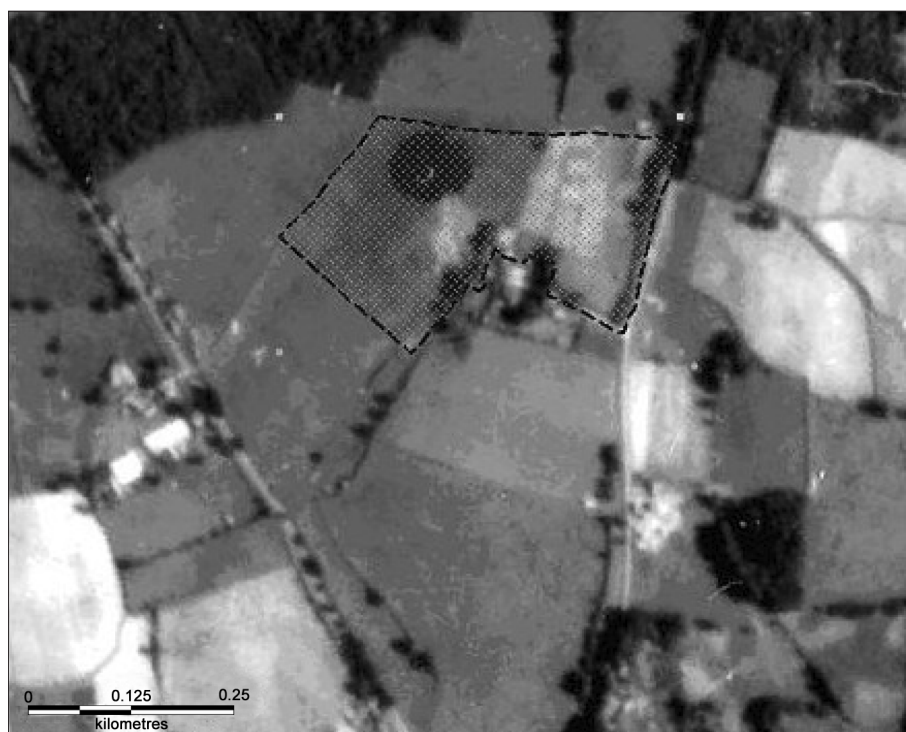


FIGURE 7. Farm 15 from the 1940 aerial photograph and NFS map

Source: University of Sussex map collections; TNA, MAF 73/41/40; 73/41/54 and 73/41/53

in area and insufficient to account for this. However there is an area just to the south of Well House, circled in white on Figure 7, which has not been included in the farm extent by the NFS surveyor and comprises 2.965 acres according to the Ordnance Survey parcel area. It is possible that these could constitute the 'missing' 3 acres. Alternatively, field 927 just to the east of the circled area could have been incorrectly assigned to farm 101/02, which is also outlined in yellow and lies immediately south of 101/15. However, whilst the Census acreage for 101/02 is 2.85 acres less than the area captured in the GIS, the area shown on the Primary Return is 3.9 acres more than the GIS area and so no clear conclusions can be drawn. However, there is a further problem. Field 340a is shown on the Primary Return as directed to be ploughed up for the 1941 harvest. If this is used to adjust the GIS figures, the totals become 20.23 acres of arable and no grassland, which clearly conflicts with the figures given in the June 1941 Census.

Therefore, although the plough-up totals shown on the NFS forms should, in theory, provide a useful source of information regarding changes in land use over this period, in reality they are difficult to interpret and, in some cases, appear to be at odds with the information given on the June 1941 Census forms. It therefore becomes clear that by connecting the data from different sources in this way, and at this micro-scale level, a cautionary note must be offered to any too-ready, simplistic interpretation of wartime land use change using these sources.

V

The aim of this exercise had been to reconstruct all the farms within Hamsey parish using a combination of three sources: the NFS, the 4 June Census data, and a 1940 aerial photograph. As part of this process, the consistency and reliability of the various datasets were examined, and it was these that caused the most difficulties for the project as a whole. In theory, the use of the 4 June 1941 Census, including the Parish Summary, should have been an advantage. However, three of the individual 4 June Census returns were originally added up incorrectly, as was the Parish Summary, and at least one return appeared to be missing altogether. The 4 June Return and Primary Return acreages were all within 20 per cent of each other, but few agreed exactly. The difficulties of comparison were further compounded by the fact that some farms were amalgamated together for the NFS but shown separately for the 4 June Return. It was therefore difficult to establish even the basic farm size in a consistent and reliable manner, although the areas recorded by the NFS surveyors on the Primary Returns were effectively the result of carrying out a check on the acreages given on the 4 June Returns through a conversation with the farmers themselves. Therefore, any discrepancy existing between farm areas as digitised from the NFS maps and the Primary Return gives more cause for concern than between the digitised data and the 4 June Census.

This may be further illustrated with reference to the case of farms 101/03, 101/20 and 109/13. These are returned together on an amalgamated Primary Return form, although farm 109/13 also has its own Primary Return. On the NFS maps, the outlining for farm 101/20 was found to be incomplete and no farms numbered as 109/13 could be located. The Primary Return indicated that farm 109/13 should be called 'Novington' and be located in the parish of Plumpton. It should also include a field no. 34, part of which was ploughed up in 1940 and again in 1941. Using this information it was possible to locate Novington Farm on the

map where it was numbered as 97/10 and included in a farm extent comprising two separate sections with a total acreage of 220 as captured in the GIS. However the Primary Return for farm 97/10 shows the area as only 49 acres. This led to the conclusion that the larger section of the farm was actually the 'missing' farm 109/13. This was therefore captured and added to the known extent of farms 101/03 and 101/20. Further deduction was then employed to attempt a reconstruction of the other fields likely to belong to farm 101/20, given the incomplete outlining on the map. The final result was a digitized acreage within 10 per cent of the Primary Return and Census acreage and good agreement in the arable category.

At this point it is apposite to recall that Harvey and Riley interviewed a number of individuals in Devon who were working on the land during the period of the Second World War, focussing on the plough-up campaign and the NFS in detail. They cited a similar example where a farmer, whose family had occupied the same farm for over a century, identified two places where the farm boundary was outlined incorrectly on the NFS map: 'First, there is one area ... that belonged to another farm. Secondly, there is an area that never belonged to the farm.' They conclude that:

The reliance on, and acceptance of, the factual veracity of certain archival sources, particularly those of an 'official', statistical or 'factual' nature is, surprisingly, still often uncontested ... The farmer's oral testimony here shows us an example of how the 'official' NFS is simply wrong. The farmer knows about the detailed field-by-field boundaries, and his family's biographical history (of his father buying land from a nearby estate) intersects with and re-enforces his understanding.²⁴

Moving on to consider the attempt to recreate land use on a field-by-field basis, it must be accepted that this met with limited success, with only a third of arable totals and less than 30 per cent of grassland totals showing good agreement (within ten per cent). There are a number of factors that could have affected the outcome of this part of the exercise. One of the reasons for the discrepancies could be difficulties in the interpretation of the 1940 aerial photograph, which is necessarily, as described above, often a somewhat subjective process although in many cases the colour, pattern and texture are enough to give a fairly good idea of land use. However, Fuller notes that:

The temporary nature of crops and cropping practices may ... lead to problems in interpretation. A crop changes appearance markedly within the growing season. For example, barley passes from being a low-growing green grass, to a crop with a green, vertical, flowering spike or ear, which in turn yellows with ripening and bows over. It is then, of course, harvested. The crop's appearance has changed four times in a matter of weeks.²⁵

Given the August 1940 date for the aerial photograph, it would generally be expected that harvest of wheat, barley and oats would have been in progress, with some already cut and others still standing, and there is evidence for this in the striped appearance of some fields,

²⁴ D. Harvey and M. Riley, "Fighting from the fields": developing the British "National Farm" in the Second World War, *J. Historical Geography*, 35 (2009), pp. 504–6.

²⁵ R. M. Fuller, 'Historical aerial photographs as records of land-use changes: a case study of Ancaster and Normanton parishes, Lincolnshire', *East Midland Geographer*, 8 (1985), p. 221.

although the altitude from which the image was taken makes it difficult to pick out fine detail. The weather in August 1940 was particularly dry and sunny with no rain at all being recorded at the Southampton recording station during this month.²⁶

As close in date as the sources are, they still span from August 1940 through to 1942. The aerial photograph was taken in August 1940, the Census in June 1941 and the NFS Primary Returns for Hamsey were completed between June and November 1942. In all cases, except for farm 109/13 (visited by G. Wibberley), the inspection was carried out by J. Halliday, and so the results should not suffer from differences in interpretation between surveyors. The plough-up campaign was at its peak during these years and so considerable land-use changes would be expected to have occurred between 1940 and late 1942. Whilst the Primary Return gives details of the fields ploughed up, in many cases these were shown as 'part' fields and so could not be identified accurately on the GIS. Where complete fields were shown as ploughed up, attempts were made to adjust the figures accordingly and these were successful for two farms. However, as described above, significant differences remained for two other holdings.

VI

It has been claimed that 'the National Farm Survey is unparalleled in the level of detail which it contains about the rural landscape in the mid-twentieth century'.²⁷ In fact the amount of detail available to researchers is so vast that to date only case studies have been attempted. Thus Harvey and Riley argue persuasively for the value of a micro-historical approach which can 'on the one hand, add depth and "fine grain" to the meta-narratives of "big history", while also setting the "myopia" of local studies into a wider context of "big events"'.²⁸ This study has attempted to use the wealth of detail contained within the NFS to build a picture of farming in Hamsey parish, East Sussex, in the early 1940s. This has extended Riley and Watkins's work, which concentrated on single case-study farms, to encompass a larger geographical area and by including an entire parish the summary sheets for the 4 June 1941 Agricultural Census could be used as an additional data source. Although a single parish still covers a relatively small area, it forms part of a larger study area spreading across most of the aerial photograph, where the data from the sources examined here have been combined with data from the mid-1930s and immediate post-war decades.²⁹

Importantly for those wishing to understand more about British farming during the Second World War, reconstructing the individual farms in Hamsey from the NFS maps and forms has proved to be fraught with difficulty. Hamsey parish was chosen for this study as the data appeared to be reasonably clear and complete, and Hamsey itself was in no way an exceptional parish in agricultural terms, and yet significant issues were encountered with the consistency of the NFS and 4 June Census information. As well as the significant differences in acreage for some farms, further difficulties were due to information being returned in varying ways so that, for example, holdings were amalgamated in some cases and not in others. The information

²⁶ <http://www.metoffice.gov.uk/climate/uk/station-data/southamptondata.txt> [accessed 13 Oct. 2011].

²⁷ Riley and Watkins, 'Value of the National Farm

Survey', p. 204.

²⁸ Harvey and Riley, 'Fighting from the fields', p. 502.

²⁹ Taylor, 'GIS-based approach'.

shown on the NFS maps was also found to be suspect and the result of human error in some instances, challenging the notion that a source must be correct just because it is 'official'.

Furthermore, where farm extents were identifiable and were mapped in the GIS, the arbitrariness of the system of allocating farmland to the parish in which the farmer was resident became very apparent, with, for example, over 260 acres of agricultural land situated in Hamsey being recorded in the neighbouring parish of Barcombe. The fragmentation of some holdings was also notable, with farm 09 appearing to include a single field in the parish of Westmeston, almost 2.5 miles from the main farm.

Riley and Watkins had found that 'it was not possible to tie crops and different types of grassland convincingly to individual fields', and this study encountered similar difficulties.³⁰ It had been anticipated that the deployment here of a more nearly contemporary aerial photograph might allow land use to be reconstructed with more certainty, but this proved not to be the case. Unfortunately the aerial photograph pre-dated some of the plough-up campaign and it proved difficult to adjust the data for this given the large number of 'part' fields shown as ploughed up on the Primary Return.

It is, of course, certainly possible to gain much useful information from the NFS and Agricultural Census, particularly when allied to the power of GIS, and it may simply be the case that, in the end, an exceptionally problematic parish was chosen for this study. However some of the difficulties encountered here mirror those experienced by Riley and Watkins and echo the farmer interviews conducted by Harvey and Riley. Of course, the latter's informants themselves might have been potentially suffering from difficulties associated with accurately recalling information after many years, but there is certainly evidence here to suggest that the veracity of the NFS maps may be questionable in some cases. It is extremely likely that the particular issues described here in relation to the Hamsey data may well be more generally applicable.

Gaining a more complete understanding of farm extents and land use in the early 1940s on a micro-scale can help to add detail and 'colour' to our understanding of the bigger picture and to throw into relief important local and regional variations. It remains an open question as to over how large an area researchers should attempt to reconstruct individual farms. An individual parish is quite possibly too small an area given the large amount of land in Hamsey that was farmed by farmers living in other parishes. Clusters of parishes might be a better solution, although those around the edges of such groups are inevitably likely to include some land farmed from the outside. The issue was faced many years ago by Coppock in his study of Chilterns farming, and he advocated the use of parish groups to overcome, to some extent, the 'agricultural versus civil parish' problem.³¹ The availability of the nearly contemporary aerial photograph was beneficial in this study and therefore the choice of area may need to be guided by such pragmatic issues as the data sources available. It may be that the reconstruction of farms is most applicable at a small scale, where sufficient time and attention can be devoted to unravelling the intricacies of each individual farm.

³⁰ Riley and Watkins, 'Value of the National Farm Survey', p.214.

³¹ J. T. Coppock, 'The relationship of farm and parish boundaries: a study in the use of agricultural statistics',

Geographical Stud. 2 (1955), pp. 12–26; id., 'The parish as a geographical/statistical unit', *Tijdschrift voor Economische en Sociale Geografie* 50 (1960), pp. 317–26.

In conclusion, the digitization of the farms from the NFS maps seems to have produced reliable figures for total farm area, although the vagaries of interpreting the aerial photograph mean that the grassland and arable areas may be less sound. However, the accuracy issues associated with the Agricultural Census previously identified by other researchers make it difficult to determine whether land use areas obtained from the combined capture of data from the NFS maps and aerial photograph are more accurate. Further application of the reconstructive technique in other localities where the required combination of data sources are available and where other arable crops (for example, potatoes and field-scale vegetables) and horticultural crops (for instance top and soft fruit) were grown would potentially be worthwhile.

Here the interlinkage of documents provided the source and procedure for the examination of this important period in British agriculture. The NFS itself offers us perhaps the most detailed picture of farming in Britain that has ever been available, and when reading off its data alongside that from aerial photographs, other official sources and oral histories, there is an unparalleled opportunity to drill down from national-level accounts of mid-twentieth century agricultural history to the micro-scale level of the farm, community or parish. The analysis is made that much easier by the use of GIS techniques. But in seizing this opportunity, this paper sets out, necessarily in a detailed and technical manner, the decisions that have to be made, and the discrepancies that may lie in wait to trap the unwary researcher.