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Impact of Land Requisition for Military Training during World War II on Farming and the South Downs Landscape, England

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ABSTRACT

The impact of World War II on the physical landscape of British towns and cities as a result of airborne assault is well known. However, less newsworthy but arguably no less significant is the impact of the war on agriculture and the countryside, especially in South-East England. This paper outlines the building of an historical Geographical Information System (GIS) from different data sources including the National Farm Survey (NFS), Luftwaffe and Royal Air Force (RAF) aerial photographs and basic topographic mapping for the South Downs in East and West Sussex. It explores the impact and legacy of World War II on the agricultural landscape of this area through both the 'plough-up' campaigns aimed at increasing agricultural production and the occupation of farm land for military training purposes. Farms surrounding an area where extensive tracts of land were taken over for military training and defensive purposes on the Downs close to Brighton and the county town of Lewes in East Sussex are the focus of attention illuminating the beneficial and disruptive impacts of the government's drive to increase food output by bringing land into more productive use by means of a 'plough-up' campaign and using formerly agricultural land for military training. These changes contributed to the transformation of the region into "an arable monoculture" and the virtual disappearance of traditional sheep rearing in the post-war decades.

KEYWORDS

Agricultural restructuring; World War II farming; historical GIS; military land requisition; statistical method

Abbreviations

1LUS	First Land Utilisation Survey
CWAEC	County War Agricultural Executive Committee
LULC	Land Use/Land Cover
NFS	National Farm Survey
RAF	Royal Air Force

1 Introduction

The political, economic and social impact of military conflict has been at the forefront of human consciousness in countries and regions where it has occurred throughout recorded history. Deaths



of people, civilian and military, the destruction of buildings and the suffering of people caught up in the conflict are the obvious impact of warfare with a legacy lasting long after the conflict on the battlefield has ceased. Such memories are often sustained in the national collective conscious by memorial structures, charitable organisations and annual commemorations. However, with the passage of time, historical reflection may focus not only on these immediate consequences [1], but also on the less obvious and more subtle effects of conflict. Nevertheless, the notion that militaristic action might also impact on the physical environment and landscape has only come to be widely recognised and gained increased traction in the last 50 years despite Pearson's [2] argument that "the links between war and the environment stretch back to at least the Persian–Scythian War of 512 BCE." Perhaps increasing evidence of the damaging effect of human activity on the environment in other spheres since the 1960s, notably highlighted at the time by publication of Carson's [3] *Silent Spring* and the Club of Rome's *Limits to Growth* [4], may have contributed to a sense of outrage at the decimation of Vietnamese jungle during the Vietnam War at a similar period in history (1954–1975). Military action may not only impact on the visual landscape and surface features arising from the passage of troops and vehicles but also bring about geomorphic disturbance [5].

Examination of historical documents, oral histories and other materials through the lens of archaeology, historical geography and more recently geospatial analysis have now resulted in a number of studies examining the impact of World War I (WWI) and World War II (WWII) in different European countries as well as across other theatres of war [6]. Previous research has tended to focus on landscapes in countries where military action took place, notably the battlefields of Europe including The Netherlands [7,8], the forests of northern France [9], Normandy-Maine [10,11] and Belgium [12]. The physical and environmental impact of warfare on countries engaged in an international conflict, but which remained unoccupied by opposition forces, such as the United Kingdom in WWII, has tended to focus on the bombing of cities and towns where the intention was to destroy infrastructure and disrupt the daily lives of citizens. Less well researched is the effect of warfare on rural areas and landscapes in the countryside and the lives of people including farmers who were continuing to produce food for the nation. Nunn's [13] recent study of the impact of WWII on Norfolk's rural landscape constitutes one notable exception. Areas in the countryside have long been used for military training in peace time on account of their distance from centres of population [14], although there has been growing awareness of its impact on the landscape [15–19]. The restoration of land use after conflict or when used for routine training purposes has also been the focus for some researchers [20,21]. This article focuses on the combined impact of military training on land requisitioned for this purpose during WWII and the construction of defensive works on an area of South-East England, part of the South Downs. It also aims to explore the longer-term impact of such measures on farming and agricultural land use/land cover (LULC) in the same study area. The specific objectives are:

- to quantify and visualise change in agricultural LULC on farms with fields in and/or adjacent to the land requisitioned for military training;
- to identify and locate 'military disturbance' features (points, lines and areas) and the types of agricultural LULC previously at those locations;
- to examine the potentially disruptive consequences of 'military disturbance' features on farming operations and farm layout as a whole;
- to identify whether the 'plough-up' campaigns contributed to agricultural LULC change during the post-war decades.

This article has been structured as follows: [Section 2](#) explores the contextual background in which farming and the landscape of the study area was impacted by WWII as well as other work concerned

with the changing landscape; [Section 3](#) outlines the data sources and methods used; [Section 4](#) presents the analysis and findings within four subsections corresponding to the objectives; [Section 5](#) discusses the implications of the findings and [Section 6](#) reaches conclusions.

2 Related Works

This section briefly discusses trends in British agriculture before WWII and other sources of information about the incidence of military activity on the South Downs, including some that have provided a starting point for part of the analysis described subsequently. Government intervention to stimulate agricultural production during the First World War (WWI) [22] was largely nullified by a decline in British agriculture during the interwar years, when farmers allowed marginal land in upland and lowland areas to fall out of production, although some have argued that in arable areas after 1932 “farming showed signs of recovery” [23]. County War Agricultural Executive Committees (CWAECs), which had been established during WWI, were reinvigorated in the late 1930s in anticipation of a second conflict. Legislation passed in April 1939 offered a subsidy to farmers who ploughed-up land for re-sowing/re-planting to specified crops and the CWAECs were tasked with identifying suitable land that amounted to some “10 per cent of the area of permanent grass” [24]. CWAEC surveyors identified land for plough-up in three waves for harvest in 1940, 1941 or 1942 [25]. Some land on the South Downs was included in these plough-up campaigns, especially marginal land that been neglected or gone out of production.

The South Downs has been afforded some protection from development since 1966 when it was designated as an Area of Outstanding Natural Beauty (AONB) under the post-WWII National Parks and Access to the Countryside Act (1949) legislation as it had not met the requirements for full national park status, although the latter was conferred in 2010. There has been growing interest in the legacy arising from use of the South Downs for military training during WWII and of the conflict itself in recent years, although it should not be assumed their impact was necessarily negative. The requisition of land for military training effectively closed off public access and use for agricultural or other civilian purposes ceased, which produced “unexpected benefits” protecting nature according to Doxford et al. [26]. After WWII, it took some time for normality to return and five months after the war ended in Europe Major Beamish, the Conservative Member of Parliament for Lewes in East Sussex asked a question in parliament about when the land would be derequisitioned. The Secretary of State for war answered that “areas will be released as soon as they can be cleared of unexploded missiles” (<https://hansard.parliament.uk/Commons/1945-10-16/debates/5063fd70-1a16-470a-9a49-7a79679a679c/SouthDownsTrainingArea>) (accessed on 29 September 2024), which had resulted from their use for training as well as bombs dropped during enemy raids. The South Downs military training area has also featured in social media (<https://www.youtube.com/watch?v=a9FRGSpL7JU>) (accessed on 29 September 2024) as part of a growing interest in local history. This example refers to the remote Balsdean Farm, the remnant of a medieval deserted village, where the dilapidated buildings were used for target practice and razed to the ground after the area was derequisitioned (<https://www.youtube.com/watch?v=ogBdGmA7IN8>) (accessed on 29 September 2024). A recently published research report, *Changing Chalk: Downs from above Aerial Survey of the South Downs North of Brighton* [27], for Historic England has made use of a range of aerial survey sources including aerial photography and lidar data to carry out archaeological mapping and interpretation of this area of the South Downs. Eighty years on from WWII, the report’s authors conclude that physical evidence of “the many thousands of soldiers who trampled over the hills” and the tank tracks has faded, although “the chalk downland forever changed” with conversion of pasture to arable a permanent feature [27].

The impact of WWII on the South Downs extended beyond the limits of the land requisitioned for military training. A notable example is at Cuckmere Haven, where a river of the same name meanders through its lower valley into the English Channel, which was “a specific assault target under the plans for Operation Sea Lion, being one of the landing beaches of the 6th Division of the German army” (<https://vdocuments.site/defence-area-2-archaeology-data-service-ar-under-the-plans-for-operation-sea-lion.html?page=1>) (accessed on 29 September 2024). Extensive defensive works were constructed, some of which remain to this day. These included “World War II pill boxes in the Cuckmere valley”, which were used to protect the area from invasion and to act as a decoy target distracting German bombers from attacking the nearby port of Newhaven (<https://www.southdowns.gov.uk/lest-we-forget-six-south-downs-places-where-we-remember/>) (accessed on 29 September 2024). It was not only British armed forces but allied troops as well who were involved, for example Piddingworth Farm, which was one of the farms comprising part of the Stanmer Park estate north east of Brighton, was passed over to the Canadian Army (<https://www.geograph.org.uk/photo/2201877>) (accessed on 29 September 2024).

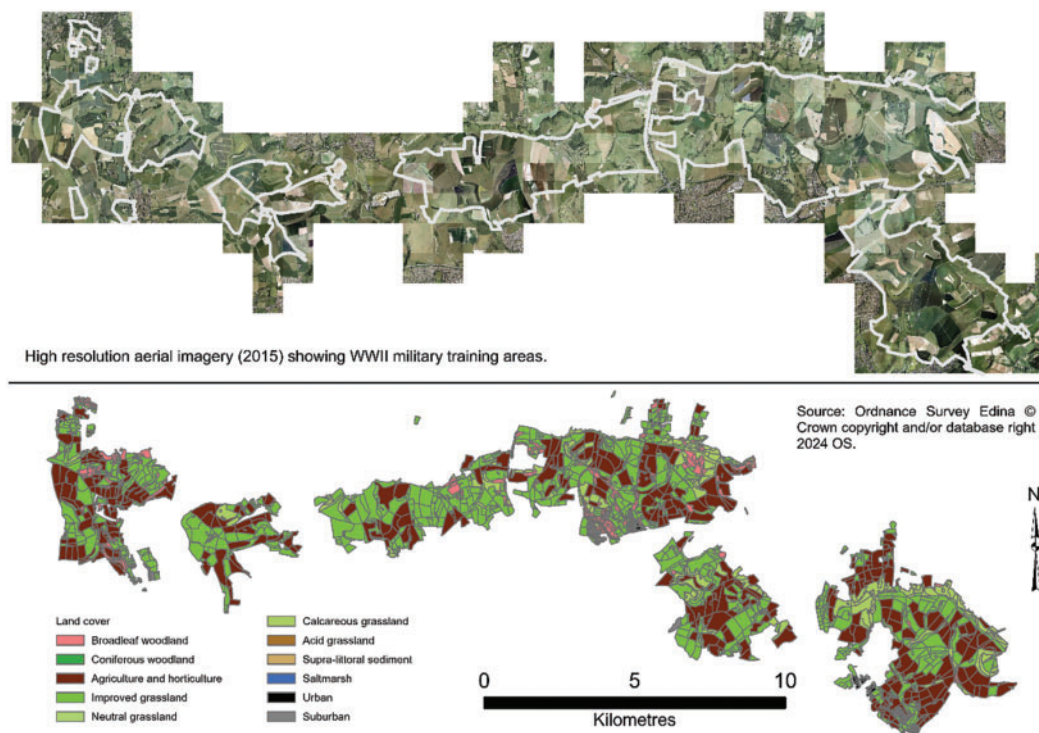


Figure 1: Contemporary aerial image (2015) of the South Downs WWII military training area in comparison with aerial imagery and Land Cover Map (2015) of the area. Sources: High Resolution (25 cm) Vertical Aerial Imagery (2015) (JPG geospatial data), scale 1:500, updated: 25 October 2015, Getmapping, using: EDINA Aerial Digimap Service, <https://digimap.edina.ac.uk> (accessed on 29 September 2024). Land Cover Map 2015 (FileGeoDatabase geospatial data), scale 1:250,000, updated: 26 May 2017, CEH, using: EDINA Environment Digimap Service, <https://digimap.edina.ac.uk> (accessed on 29 September 2024)

Fig. 1 offers an impression of the area on the South Downs covered by military training zones during WWII. It includes a mosaic of high-resolution aerial imagery from 2015 of the landscape

together with a land cover map. The 2015 Land Cover Map (LCM) was produced by the United Kingdom Centre for Ecology and Hydrology (UKCEH) (Information products | UK Centre for Ecology & Hydrology (ceh.ac.uk)) (accessed on 29 September 2024). Overall, the landscape is now a mixture of agricultural and open space low intensity recreational use. The aerial imagery reveals a mixture of grass and cropland the latter predominantly cereals and oilseed rape. Improved grassland forms the major land cover (43.5%) followed by agriculture and horticulture (38.0%). Despite the area's proximity to sizeable population centres along the south coast, planning restrictions covering the area, especially those arising from its designation as an AONB in 1966 (see above), have to a large extent prevented urban sprawl onto the more elevated parts of the South Downs where the military training zones were located. Only 3.8 per cent of the former training area was suburban or urban land in 2015. The northward expansion of Brighton and Hove and other settlements has generally been restricted to the south-facing dry valleys up to the point where the development is not visible on the skyline. Calcareous grassland, which might reasonably be considered comparable with the heath and rough grazing of earlier surveys (see below) was the only other substantial land cover in 2015 comprising 10.9 per cent of the formerly militarized area.

3 Materials and Methods

The methods used for classifying LULC have changed considerably since the time when data analysed here were first collected. Although aerial photography was well developed by the 1930s, coverage was comparatively limited and access to imagery was restricted to those, often military, organisations involved with its collection. Even during more recent decades since satellite remote sensing became normalised as the means of collecting source data for classifying LULC, the methods employed have evolved from image processing and ground-truthing to now involve machine learning [28–31]. Some of the LULC classification produced by these methods have been consolidated into publicly accessible geodatabases such as the Coordinate Information on the Environment (CORINE) and Google Maps [32]. These tend to concentrate on contemporary rather than historic LULC, although the Vision of Britain is one notable exception [33]. This article accepts the classification employed by those undertaking field surveys in the 1930s and early 1940s in conjunction with aerial photographic imagery that only recently became accessible to researchers. It applies quantitative statistical methods to examine the LULC changes associated with military activities in the study area during WWII and links with Swetnam's 'stability mapping' approach [34].

The impact of emergency measures introduced in Britain during WWII on farming and the rural landscape on part of the South Downs has been explored by combining a group of three types geospatial data source. Table 1 provides a summary of the various data sources. The first geospatial data source is the published maps from the First Land Utilisation Survey (LUS1), which was coordinated during the 1930s, by Dudley Stamp, Professor of Geography at King's College, London [35,36]. This survey, considered as "the first and perhaps pre-eminent geographically comprehensive survey of land utilisation in Britain" [37], has been the subject of extensive discussion and use since its results were published [38,39]. The survey used 1:10,560 scale maps (6 inches to the mile) as field sheets, which were subsequently manually reduced to 1:63,360 scale for publication. It took some years for the complete set of maps to be published, although the sheets for East and West Sussex (133 and 134) appeared in 1936 following field survey in the early 1930s. The maps showed seven land use classes with overprinting used to denote some sub-categories (e.g., deciduous, coniferous, mixed and new plantation woodland) and transport routes (major/minor roads and railways). Only the digitised polygons for five uses were included in the present analysis as they relate to the focus on farming and agricultural landscape: arable including temporary (ley) grass; meadowland and permanent grass;

forest and woodland; heath and rough land; and horticulture, orchards, large gardens, etc. The polygons for individual land parcels (fields) were captured by means of heads-up digitising using Ordnance Survey (OS) topographic mapping as a background from Digimap (<https://digimap.edina.ac.uk/>) (accessed on 29 September 2024) in order to achieve consistency in georeferencing from mosaiced images of scanned maps across the whole study area. The land use information provided by the LUS1 has been used as the means for determining the agricultural and rural land use across the area used for military training and the NFS farms (second data source).

Table 1: Summary data sources and times periods when land use/land covered was mapped

Dataset	Time collected	Contribution to present analysis	Where used
Royal air force (RAF) aerial photographs	03 April 1945; 17 May 1945; 29 July 1945; 19 April 1946	Evidence of physical impact of military training activity on the landscape at discrete locations	Figs. 2 and 4
First Land Utilisation Survey	1930–1938 (East and West Sussex maps published 1936)	Land use/cover polygons manually digitized from 1:63,360 scale scanned maps	Fig. 3
Luftwaffe aerial photographs	August 1940	Evidence of physical impact of military training activity on the landscape over an extensive area centred on Lewes	Fig. 4
Ordnance survey	2022	20 m contour lines	Fig. 4
Ordnance survey	County series 1:2500 2nd revision (1906–1939)	Used as underlay base topographic maps when heads-up digitising the First Land Utilisation Survey polygons	Not applicable
National farm survey	1941–43 (74% of farms in study area surveyed in 1942)	Farm boundaries and fields annotated on 1:10,560 scale topographic OS maps; recording of fields and approved cropping of plough-up land; delineation of land requisitioned for military training	Figs. 5 and 6

The second main data source comprised the historical records of the National Farm Survey (NFS), which were released for public consultation and research in the mid-1990s [40,41]. Farms were surveyed during the early years of WWII (1941–1943) with the intention of assessing the condition of the agricultural industry and identifying poorly managed farms and underproductive farmland that could be resown with crops to boost output. Each farm with a minimum of 5 acres (2.03 ha) was surveyed, which produced the Primary Record (PR) completed by CWAEC surveyors in the field between 1940 and 1943. The second set of documents in the NFS collection are the completed schedules from the

Agricultural Census (AC) (including the Horticultural and Occupation returns) for 04 June 1941. This is the only occasion the annual Agricultural Census documents have been released to researchers. The majority (92%) of farms in the study area were surveyed between July 1941 and December 1942, and 74 per cent of these were during the calendar year 1942. Apart from ownership and occupier details, the surveyors assessed farms in terms of availability of utilities (water and electricity), fertiliser use, weed and pest infestation and managerial ability. For the present analysis the details in Section F were most relevant. It could include a list of fields identified by their OS field number that were suitable for resowing with crops in the ‘plough-up’ campaign [25], thus not only increasing food production during WWII but also potentially stimulating continued cropping of the land after the war. The whole or parts of fields could be specified for ‘ploughing-up’, usually to a single crop, although in some cases multiple crops were listed.

The third part of the NFS comprises a set of OS topographic maps, mostly at a scale of 1:10,560 (6 inches to a mile), also held at The National Archives (reference number MAF 73/ followed by a county number, 41 and 42 in the case of East and West Sussex). These maps were annotated by the CWAEC surveyors with farm boundaries and they were individually colour washed to distinguish different farms in some counties. Importantly for the present investigation, the maps also showed extensive tracts of land on the South Downs labelled as “Military Training Area”, which signified that prior agricultural or other land use/land cover had been replaced by military operations and defensive works. The boundaries of NFS farms and their fields adjoining and intersecting the military training areas as well as the militarised areas themselves were heads-up digitised using a clean set of scanned OS topographic maps at 1:10,560 scale [42] obtained from Digimap (<https://digimap.edina.ac.uk/>) (accessed on 29 September 2024) as a backcloth. The digitised polygons for the fields identified in the ‘plough-up’ campaigns of 1940 and 1941 were held as a separate dataset together with details of the crops with which they were to be resown.

The third geospatial dataset comprised aerial photographs. These came from two sources. First, those taken by the Luftwaffe in August 1940 covering an area on the South Downs partially coincident with the eastern section of the military training zone, which were obtained for the present analysis courtesy of the University of Sussex Archive. These were orthorectified and geo-referenced as a mosaic raster image from which details of features such as slip trenches and areas disturbed by military manoeuvres and encampments on the South Downs eastwards and westwards of the Lewes were digitised. The second source of aerial photographs were those taken by the Royal Air Force (RAF) during and after WWII available from Historic England (<https://historicengland.org.uk/images-books/archive/collections/aerial-photos/>) (accessed on 29 September 2024). Unfortunately, these were not available across the rest of the military training area (the part not covered by the Luftwaffe image) but were present for discrete locations towards the west of the area for dates before or shortly after the end of WWII (see Fig. 2 for indicative location of aerial images and data flown). A selection of aerial photographs from Historic England’s archive for this period have been viewed to extend coverage of militarily disturbed areas westwards from the area covered in Carpenter et al.’s report [27]. From 1946 and through the 1950s, the RAF undertook a series of aerial photography campaigns, but in respect of the study area these also omit some of the previously militarised land or were flown up to 15 years after the end of the conflict when visual evidence of military activity is likely to have disappeared. Furthermore, they do not offer a single year to which the post-war land use/land cover could be connected, thus inhibiting a consistent post-war assessment of LULC across the entire area.

Fig. 2 establishes the geographical context for the results presented in the following section by situating the study area in South-East England and the South Downs National Park. There were

These LULC classes are also tabulated in Table 2: meadow and permanent grass account for 59.0 per cent of the land area with an average parcel area of 10.6 ha; heath and moorland (rough grazing) parcels were larger (12.7 ha) making up 28.8 per cent of the area; and of the remaining classes arable was the most important (9.0 per cent and 7.2 ha). Applying the Kruskal-Wallis test confirmed there was a statistically significant difference in the mean areas of these LULC classes ($H = 222.417$, $p < 0.001$). Disregarding the LULC classes, the land parcels within the military training areas were three times the average size of those outside the boundary and those on identified NFS farms were just under half the average area of parcels not thus located. The Mann-Whitney test results in both cases were significant at 0.05 level with $p < 0.001$ (see Table 3). These results suggest that the land selected for requisition generally had lower agricultural productivity within only a small quantity of arable land included.

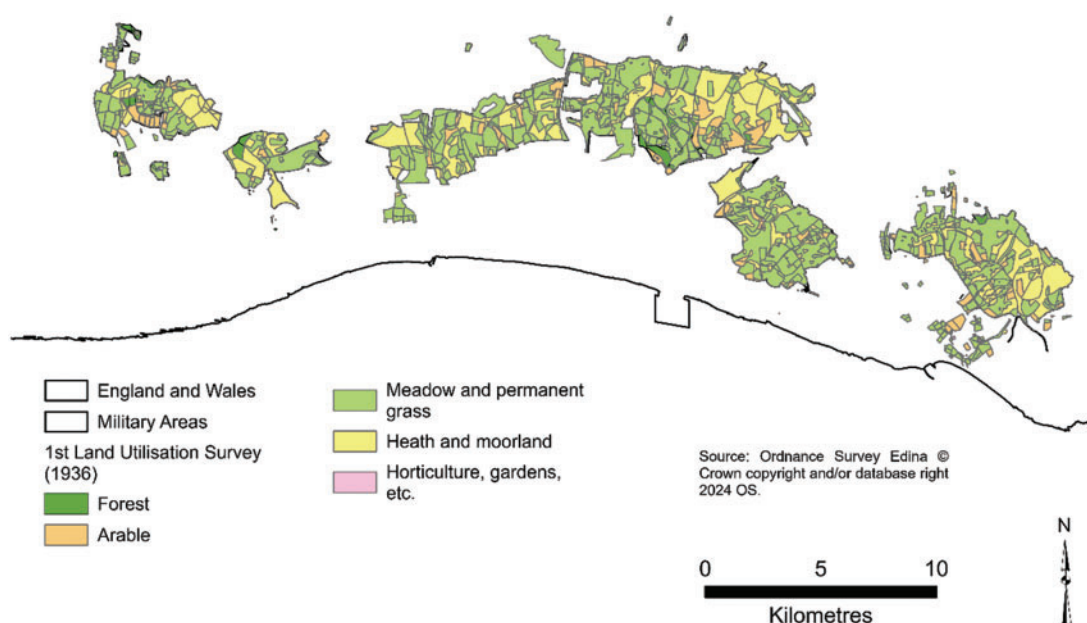


Figure 3: Selected classes of land cover/land use from 1st Land Utilisation Survey on land parcels within the South Downs military training areas and external parcels on National Farm Survey farms having land in these areas. Note: LULC digitised from map sheets published in 1936. Source: 1:2500, County Series 2nd Revision (TIFF geospatial data), scale 1:2500, updated: 30 November 2010, Historic, using: EDINA Historic Digimap Service, <https://digimap.edina.ac.uk> (accessed on 29 September 2024)

Table 2: Classes of land use/land cover in military training areas plus those areas of farms with land in these zones according to First Land Utilisation Survey in 1930s

LULC class	Mean ha (% of total ha)	Standard deviation	N
Arable	7.2 (9.0%)	7.5	147
Heath and moorland (rough grazing)	12.7 (28.8%)	29.7	266
Horticulture, gardens, etc.	0.4 (0.2%)	0.3	63
Meadow and permanent grass	10.6 (59.0%)	21.4	652

(Continued)

Table 2 (continued)

LULC class	Mean ha (% of total ha)	Standard deviation	N
Woodland	1.5 (3.0%)	3.8	231
Total	8.6 (100.0%)		1359

Note: Kruskal-Wallis test: $H = 222.41$, $df = 4$ and $p < 0.001$.

Table 3: Areas of land parcels differentiated by whether they were inside/outside military training and whether shown/not shown on NFS maps

	Mean ha (% of total ha)	Standard deviation	N
Inside military training area	10.5 (87.4%)	23.1	978
Outside military training area	3.9 (12.6%)	9.8	371
Shown on an NFS mapped farm	11.1 (62.7%)	24.2	665
Not shown on an NFS mapped farm	6.3 (37.3%)	15.7	694
Total	8.6 (100.0%)		1359

Note: Mann-Whitney test: inside/outside military area $U = 120,477.5$, $p < 0.001$; shown on NFS farm/not shown on NFS farm $U = 177,507.0$, $p < 0.001$.

4.2 Features in the Militarised Landscape

The evidence of disturbance to the landscape has been interpreted from the aerial photographic imagery and classified into three types based on geometry and physical extent: point features such as gun emplacements or defensive pill boxes; linear features, exclusively slip trenches used for troop training or as anti-glider landing deterrents; and areas, notably Truleigh Hill radar station, troop encampments, tank and other vehicle movement zones, which might also have shown linear tracks, although these were not separately digitised. Fig. 4 shows that the locations of these various types of features across the study area were mostly within the requisitioned land, although there was one encampment outside this zone near Shoreham dating back to World War I and some slip trenches near Brighton race course just outside the training area. Twenty metre contour lines for a region extending beyond the limits of the military training areas are also shown in Fig. 4. They reveal that the requisitioned land avoided the two main river valleys through the chalk downland, the River Adur entering the English Channel between Worthing and Brighton at Shoreham and the River Ouse passing through Lewes and reaching the coast at the port of Newhaven (see earlier reference to emplacement works for defending this port). The smaller River Cuckmere valley lies towards the eastern edge of Fig. 4. The majority of the slip trenches were located above the scarp slope on the downs either side of Lewes. The ground surface areas disturbed by troop and vehicle movements were distributed quite widely and it is likely there were other such areas at locations not covered by the wartime aerial photographic imagery which are not shown in Fig. 4. There was a group of gun sites just outside the training area below the scarp slope close to a rifle range that had been “established during the latter half of the nineteenth century” at Wolstonbury Hill [27].

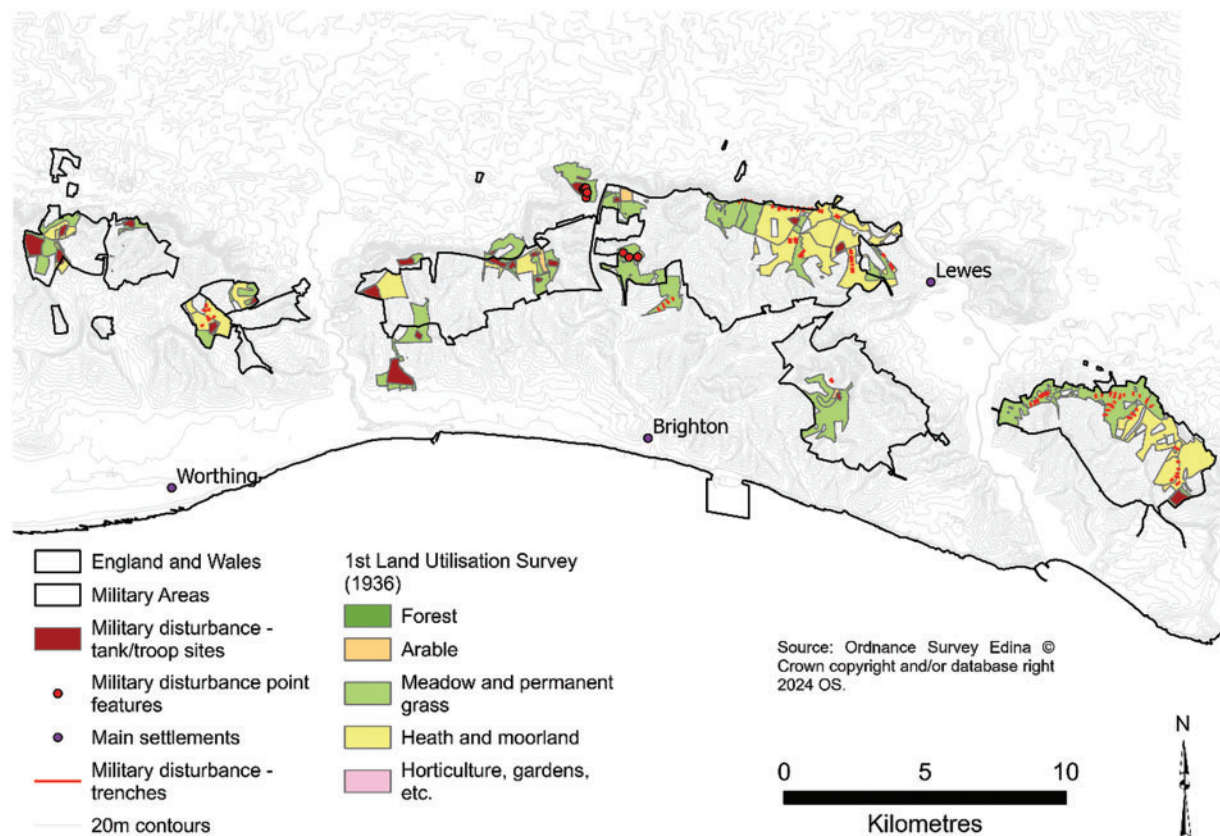


Figure 4: Sites disturbed by military activity within and adjacent to the South Downs military training areas. Note: Horticulture, gardens, etc., in 1936 included low density buildings such as farm houses, barns and cottages in villages. Sources: digitised from RAF and Luftwaffe aerial photographic imagery; OS Terrain 50 (SHAPE geospatial data), scale 1:50,000; updated: 23 May 2023, Ordnance Survey (GB), using: EDINA Digimap Ordnance Survey Service, <https://digimap.edina.ac.uk> (accessed on 29 September 2024)

The physical features representing disturbance by military activity in the study area were overlain on the LULC polygons digitised from the First Land Utilisation Survey maps. Linear and point features, respectively represented by slit trenches and training weapon pits invariably occupied a relatively small area of a polygon, whereas area features such as camps, a radar station and land enclosed by barbed wire accounted for larger physical spaces. At least one military disturbance feature occurred in 89 (6.5%) of the total LULC polygons. Nevertheless, the impact of all types of features is likely to have extended beyond the immediate vicinity of their physical location, for example as tanks were driven over open ground and practice firing was aimed at distant targets. While acknowledging this potentially diffuse unrecorded military disturbance, it is evident that two categories of 1936 LULC (Heath and moorland (rough grazing) and Meadow and permanent grass) accounted for 3496.9 ha (98.6%) the area of the polygons in which the physical features were located. Table 4 shows the mean and standard deviation of these polygons differentiated by their LULC and there was a statistically significant between the categories according to the Kruskal-Wallis H test.

Table 4: Classes of land use/land cover in military training areas plus those areas of farms with land in these zones according to First Land Utilisation Survey in 1930s

LULC class	Mean ha (% of total ha)	Standard deviation	N
Arable	10.6 (9.0%)	7.9	4
Heath and moorland (rough grazing)	57.7 (28.8%)	65.1	27
Horticulture, gardens, etc.	0.2 (0.2%)	0.3	63
Meadow and permanent grass	38.0 (59.0%)	58.9	51
Woodland	1.2 (3.0%)	1.3	2
Total	39.8 (100.0%)		89

Note: Horticulture, gardens, etc., in 1936 included low density buildings such as farm houses, barns and cottages in villages. Kruskal-Wallis test: $H = 20.32$, $df = 4$ and $p < 0.001$.

4.3 Effect on Farm Layout and Operations

The landscape of the South Downs before WWII, as it is now, was dominated by agriculture, forestry and other extensive forms of land cover interspersed with relatively isolated farmsteads, villages and hamlets. The first stage of examining the impact of military training on this landscape focused on the National Farm Survey farms that were either adjacent to or intersected with the military training areas. These are shown in Fig. 5, which distinguishes those farms that intersected the militarized areas (i.e., included land within these zones) and those lying adjacent to such areas. Differences in the NFS surveyors' annotation of farm boundaries on the OS topographic bases maps resulted in some of the farms in the military training areas being omitted from cartographic part of the NFS records. Overall, 7523.6 ha (72.3%) of the training areas do not show any farm boundaries. This omission has been taken into account in Fig. 5 by including the point locations of the farmsteads whose boundaries were not shown on the annotated NFS maps. Information about the existence of these farms was obtained from other parts of the NFS records, notably the Primary Record and Agricultural Census Return, which referred to these named farms as being a constituent part of a whole farm enterprise. For example, Poynings Place Farm in the military training area north of Brighton was part of a farm business with four holdings, which had its 'headquarters' at Manor Farm. There were 26 farms recorded on the NFS maps as having land in the training areas that had a total of 6310.2 ha of which 45.7 per cent was within these areas. Apart from the consequences of closing the military training areas to civilians (including farmers and their workers) several of the adjacent and intersecting farms had separate parcels of land and access to them is likely to have been disrupted in comparison with pre-war farming activity and practice. For example, longer journeys to separate parts of a farm would have been necessary because the tracks crossing the military areas formerly used by farm workers were closed to civilians and the grazing of livestock (cattle and sheep) on the formerly open semi-natural grassland would have no longer been possible.

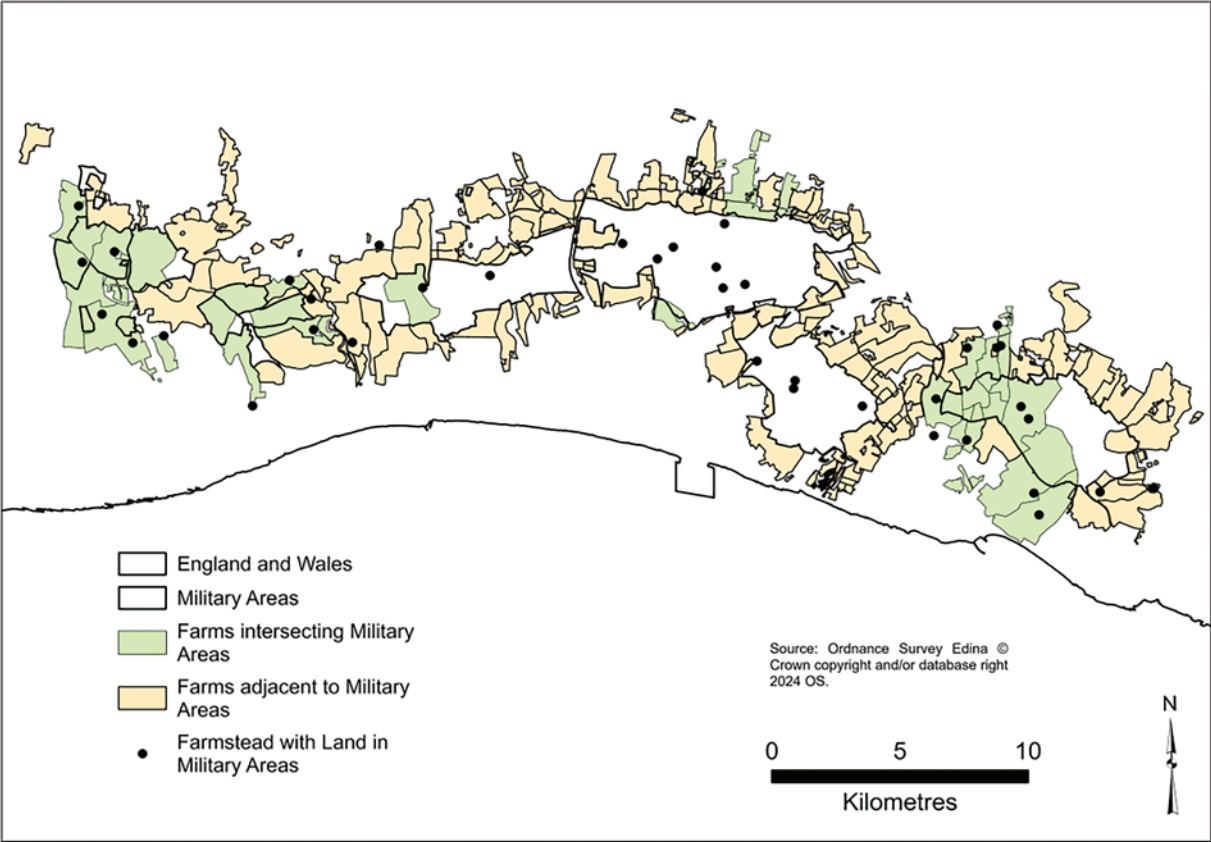


Figure 5: National Farm Survey farms adjacent to and/or with land shown as within the South Downs military training areas. Note: Some farms had separate detached parcels at a distance from the main holding. The National Farm Survey was carried out 1941–1943 and the farm boundaries depicted span this period and until shortly after WWII. Source: 1:2500, County Series 2nd Revision (TIFF geospatial data), scale 1:2500, updated: 30 November 2010, Historic, using: EDINA Historic Digimap Service, <https://digimap.edina.ac.uk> (accessed on 29 September 2024)

4.4 Increasing Food Production by ‘Plough-up’ Campaign

It was noted earlier that one of the main drivers for undertaking the NFS was to identify areas of land on farms that were relatively unproductive and to designate these for re-seeding with approved crops for which there was a shortage of supply in the wartime emergency. Despite the requisitioning of land on the South Downs for military training the NFS surveyors identified a small number of fields that should be ploughed up either as a whole or in part in 1940 and 1941 (17 and 20, respectively). However, the number of fields involved was only 5.2 per cent of the total plough-up fields across the whole South Downs area in East and West Sussex and the average area was 31.9 ha compared with 7.7 ha overall. Although all of the plough-up fields (including parts of fields as identified on OS topographic maps) were destined to be re-sown with arable crops (wheat, oats, beans, peas and linseed), their use according to the First Land Utilisation Survey was spread across arable, meadow and permanent grass and horticulture, etc., in 1940 with additionally heath and moorland (rough

grazing) in 1941 (see Fig. 6), although the difference between the average area of the LULC classes was not significant (see Table 3).

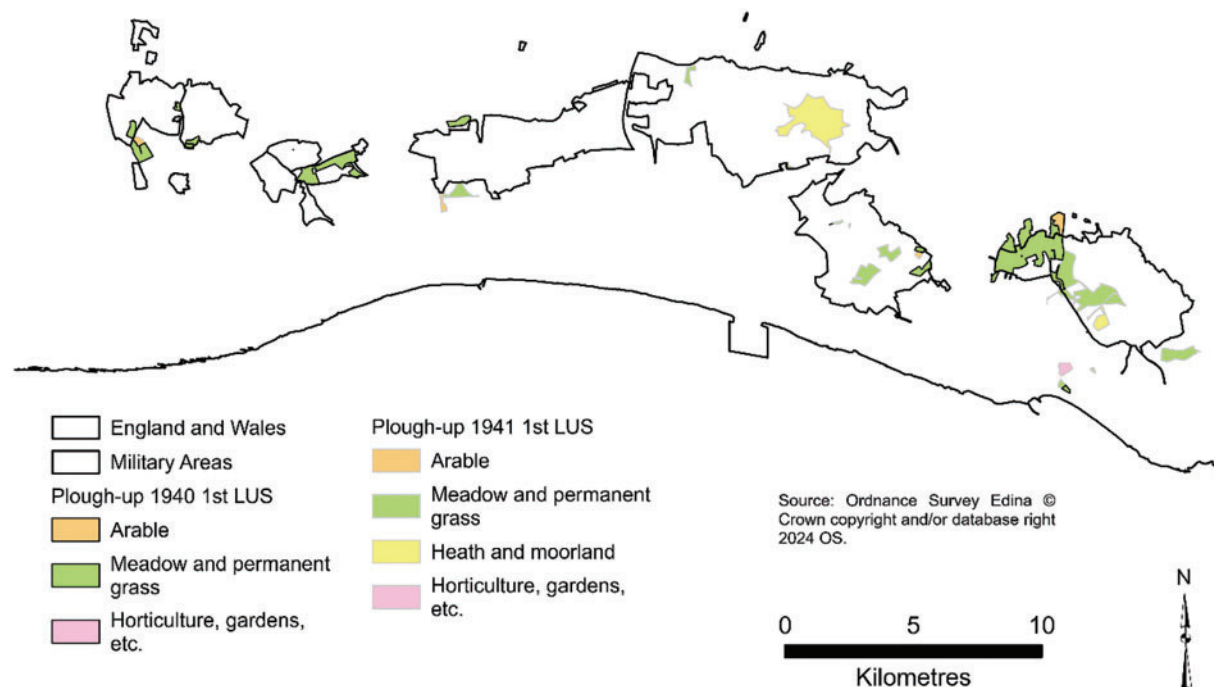


Figure 6: Land parcels within the South Downs military training areas identified for plough-up and re-seeding under 1940 and 1941 plough-up campaigns together with their land cover/land use from 1st Land Utilisation Survey. Note: LULC digitised from map sheets published in 1936; Horticulture, gardens, etc., in 1936 included low density buildings such as farm houses, barns and cottages in villages. Source: 1:2500, County Series 2nd Revision (TIFF geospatial data), scale 1:2500, updated: 30 November 2010, Historic, using: EDINA Historic Digimap Service, <https://digimap.edina.ac.uk> (accessed on 29 September 2024)

5 Discussion

Fig. 1 established that agriculture and horticulture, and improved grassland were the two main categories of LULC in 2015 in the former military training area despite continuing efforts to increase biodiversity and restore some areas to traditional calcareous grassland [43–45]. The categories of LULC used in LUS1 in 1936 and the LCM in 2015 are not exactly equivalent. Nevertheless, it is possible to examine the way in which the land in the 1936 LULC categories was distributed into those used in the 2015 LCM. This has been achieved by applying overlay, intersection and reaggregation techniques. Table 5 shows that approximately 60 per cent of land classified as arable or woodland in 1936 according to the LUS1 was in the equivalent category in 2015 (agriculture and horticulture, and woodland, respectively). The large majority of land classed as meadow and permanent grass in 1936 became agriculture and horticulture (35.6%) and improved grassland (45.7%); both of these 2015 LCM classes essentially relate to cultivated farmland. Most of the land assigned to the heath and moorland category in 1936 was also split between the same two LCM classes (30.7% in agriculture and horticulture and 48.6% improved grassland) with only 14.2 per cent

remaining as heath and unimproved grassland. The overall area of land in 2015 classified as heath and moorland was 1465.2 ha representing a reduction of 54.7 per cent, which is substantial even when allowing for differences in the methods of categorisation. Land in the horticulture, gardens, etc. category in 1936, which also included low density buildings (e.g., farms and cottages in villages), had mainly become agriculture and horticulture and improved grassland with 16.3% becoming suburban/urban.

Table 5: Classes of land use/land cover of plough-up fields in 1940 and 1941 in military training areas according to First Land Utilisation Survey in 1930s

First Land Utilisation Survey LULC (1936)	Ha (% of total ha)	Land cover map (UKCEH) LULC (2015)	Ha (% of total ha within 1st LUS class)
Woodland	344.6 (3.0%)	Broadleaf and coniferous woodland	205.2 (59.6%)
		Agriculture and horticulture	40.0 (11.6%)
		Improved grassland	65.4 (19.0%)
		Heath and unimproved grassland	19.5 (5.6%)
		Suburban/urban	14.5 (4.2%)
			344.6 (100.0%)
Arable	977.1 (8.6%)	Broadleaf and coniferous woodland	19.9 (2.0%)
		Agriculture and horticulture	582.9 (59.7%)
		Improved grassland	323.5 (33.2%)
		Heath and unimproved grassland	38.6 (3.9%)
		Suburban/urban	12.2 (1.2%)
			979.1 (100.0%)
Meadow and permanent grass	6717.4 (59.4%)	Broadleaf and coniferous woodland	143.2 (2.1%)
		Agriculture and horticulture	2393.5 (35.6%)
		Improved grassland	3069.2 (45.7%)
		Heath and unimproved grassland	948.7 (14.2%)
		Suburban/urban	162.8 (2.4%)
			6717.4 (100.0%)
Heath and moorland (rough grazing)	3233.3 (28.6%)	Broadleaf and coniferous woodland	207.6 (6.4%)
		Agriculture and horticulture	993.8 (30.7%)
		Improved grassland	1570.6 (48.6%)
		Heath and unimproved grassland	457.9 (14.2%)
		Suburban/urban	3.4 (0.1%)
			3233.3 (100.0%)

(Continued)

Table 5 (continued)

First Land Utilisation Survey LULC (1936)	Ha (% of total ha)	Land cover map (UKCEH) LULC (2015)	Ha (% of total ha within 1st LUS class)
Horticulture, gardens, etc.	42.1 (0.4%)	Broadleaf and coniferous woodland	1.1 (2.6%)
		Agriculture and horticulture	22.4 (53.3%)
		Improved grassland	11.2 (26.4%)
		Heath and unimproved grassland	0.6 (1.4%)
		Suburban/urban	6.8 (16.3%)
			42.1 (100.0%)

Note: Suburban and urban land in military training area land parcels not included; Horticulture, gardens, etc., in 1936 included low density buildings such as farm houses, barns and cottages in villages.

6 Conclusion

The aim of this study was to explore the impact of WWII on farming and the rural landscape of part of an area of South-East England known as the South Downs a substantial part of which was requisitioned for military training or used for defensive structures during WWII. The area used for these purposes reaches an elevation of approximately 300 m and lies north of Brighton, Hove and Worthing on the South coast. The analysis has innovatively combined three main geospatial data sources to establish the LULC distribution across the area before WWII, to locate the physical features arising from military disturbance and to connect these features with the LULC and farms intersecting and/or adjacent to the training area. Fourth, we explored whether the wartime plough-up could have contributed to enduring LULC change during the post-war decades. The three geospatial data sources are: the First Land Utilisation Survey (1936); the National Farm Survey (1941–1943); and aerial photographic imagery (1940 and 1945/46). There were statistically significant differences in the mean area of the LULC classes within the military training area and between the land parcels within and outside the military training area on farms adjacent to and/or intersecting these zones. There is evidence that the changes brought about during WWII stimulated at least some of the future direction of regional scale change in LULC with only a small percentage of former heath and moorland returning to such cover/use by 2015. Overall, the plough-up campaigns of 1940, 1941 and 1942 are estimated to have added 2.79 million hectares of tilled (cultivated) land to crop production [25]. Nationally the ploughing of permanent downland and heathland resulted in a 40 per cent reduction in “the area of unimproved and semi-improved grassland [46] between 1947 and 1981. Similar restoration and re-wilding of formerly militarised landscapes has been recorded elsewhere [47]. Aerial photographic surveys covering the post-war period were spread over a number of years and omitted some of the requisitioned land area, which prevented a complete re-classification of the study area in the aftermath of WWII. Nevertheless, it is clear that even though the physical disturbance produced by troop and vehicle movements as well as structures such as slip trenches, gun emplacements and pill boxes have virtually disappeared, the impact of WWII on the agricultural landscape continued long after the military presence itself had dispersed.

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