Open Library of Humanities

Research

Peer Review:

Copyright:

Open Access:

Digital Preservation:

RESEARCH

How did East Sussex Really Appear in 1066? The Cartographic Evidence

Christopher Macdonald Hewitt
University of Western Ontario, CA
chewitt4@uwo.ca

Military history has provided significant insight into the factors determining the outcome of armed conflict through time. At the same time, it often fails to adequately assess variables unrelated to historical accounts per se that may contribute to military outcomes. For example, in 1066, English and Norman forces engaged in a decisive battle near Hastings, U.K. Numerous historical accounts have chronicled this event, using a combination of eyewitness and participant testimony, as well as written records, and art forms. Few, however, have paid significant attention to the role of the local landscape in shaping events. In the case of Hastings, the battlefield itself provides an example of the way in which geography can contribute to our understanding of historical events. By applying environmental sources and a regressive cartographic analysis, this study demonstrates that there is, in fact, considerable evidence to suggest how the landscape appeared back to the time of the battle. This finding is significant, insofar as it opens the door to new research on the Battle of Hastings which may shed additional light on the events that occurred there and the factors that influenced the outcome of this crucial conflict in British history. It also reveals the importance of applying new methodological approaches to traditional disciplines such as history, to deepen and expand existing analysis.

Introduction

For the most part, our understanding of military history relies upon a scholarly assessment of qualitative accounts of participants, eyewitnesses, stories, chronicles and other forms of evidence directly related to the event in question. However, other than broad discussions associated with terrain, academic reconstructions rarely consider the full environmental context of the site in question. By completing a comprehensive environmental context of the battle in question, military researchers would be able to

better assess factors such as the choice of battle sites, the decisions taken by military commanders, and most importantly, military outcomes (Morillo 2013, 3–5).

The 1066 Battle of Hastings—the most famous in British history—provides an interesting case in point. To many historians of the Battle of Hastings, the reconstruction by Williamson is sufficient for our understanding of the region in 1066 (Tetlow 1974, 134–35, J. A. Williamson 1959, 77, Lawson 2016). However, contrary to Tetlow's claims of a "painstaking reconstruction" (1974, 134–35), Williamson, in fact, provides little in the way of environmental sources or methods to back his reconstruction. Instead, he only provides a narrative history of the region (Williamson 1959). This perspective is problematic because we do not know which sources he used or the reliability of those sources. In fact, this seems to represent yet another case of where, in the words of Rackham, historians "confine themselves to the written word or, worse still, to the literary word; they are reluctant … to see … the land itself … At best this shortens perspectives … At worst it manufactures false conclusions" (Rackham 1986, 6). In the specific case of the Norman Conquest, Williamson's approach could lead to errors in the understanding of William's campaign and hence could render many historians' claims about the battlefield environment to be false.[1] In order to 'set the record straight,' it would seem more than appropriate to revisit and as necessary revise current interpretations of the local landscape in 1066.

This study offers just such a corrective. Using the temporal categories in the East Sussex Historic Environmental Record (ESHER) as a reference, it undertakes an evidence-based comprehensive reconstruction of the Hastings landscape, stepping it back to how it likely appeared in 1066 (East Sussex County Council 2013). Temporal categories examined include Present–1946, 1945–1914, 1913–1800, 1799–1600, 1599–1500, and 1499–1066. As will be revealed, only by reconstructing the Hastings area back to the eleventh century in this way, can work subsequently proceed to effectively test historians' interpretations of the choices and decisions made by the English and Norman armies of the time.

---

[1] There have been a number of studies as cited in this article on the environment of East Sussex in the medieval period. Many of these studies are not cited in the literature on the battle (see bibliography of Lawson's book [2016]).

In pursuing this task, this study begins with a brief discussion on the context of the battle followed by a survey of the literature on the British environment back to the medieval period. This is followed by a discussion of the sources to be used in the reconstruction, and of the methodologies that are employed in its execution. Finally, in conclusion, the study will consider the implications of its findings for historical accounts of the Battle of Hastings and more generally the importance of geographic analysis to historical studies.

Historical and Environmental Context

In the year 1066, there was a succession crisis to the English throne. In early January, King Edward of England died and his great nephew Edgar, by then in his early teens, was considered still too young to rule (Lawson 2016, 26). Consequently, in accordance with the wishes of the dying King Edward, Harold II Godwineson was named king of England (Lawson 2016, 31). However, there were two other claimants. One, Harald Hardrada, was king of Norway while the other, William, was duke of Normandy. On September 25, 1066, Harold defeated Harald at the Battle of Stamford Bridge in Yorkshire. On September 28 or 29, William landed at Pevensey. Harold subsequently rushed south to defeat William, thus setting the stage for one of the most epic battles in British history, the Battle of Hastings (Lawson 2016, 36–41).

Historical accounts of the battle are many and varied. Gravett's illustrated popular history offers an excellent starting point for understanding this conflict, providing a productive overall introduction as well as references to critical studies within the literature (1992). Beyond this, Huscroft's interpretation provides a number of key references on the Battle of Hastings (2009, 339). The first and most thorough is Lawson's re-published book entitled *The Battle of Hastings 1066* (published online in 2016, originally published in 2003 in print) followed by Morillo's edited book entitled *The Battle of Hastings: Sources and Interpretations* (1996). Another study by Brown, entitled "The Battle of Hastings", is reproduced from its original publication in Morillo's book (1996) and in another edited collection by Strickland (1992). Three other useful interpretations include Bradbury's *The Battle of Hastings* (1998); Wood's *The Battle of Hastings: The Fall of Anglo-Saxon England* (2009);

and Grehan and Mace's recent *The Battle of Hastings 1066 – The Uncomfortable Truth: Revealing the True Location of England's Most Famous Battle* (2012).

With respect to the historical environment, some general works focusing on the medieval British Isles are in existence (Hoffmann 2014, Aberth 2013, Dark 2000). Some of the more detailed studies include Rackham's *History of the Countryside* (1986) which covers every land use of the period, and his *Ancient Woodland* (1980), which covers woodlands only. Historical fields and how they relate to villages are examined by Taylor in his *Fields in the English Landscape* (2000) and *Village and Farmstead* (1983). Finally, there is Campbell's discussion of the now-famous Domesday Book, William the Conqueror's great survey of people, lands and wealth in 1086 (2000).

With respect to East Sussex, a number of studies exist. These include the relevant volumes of the *Victoria History of the Counties of England* series (V. C. H. Sussex IX and V. C. H. Sussex I), a historical atlas (Leslie and Short 1999) and Brandon's overview of the area (1974). Other studies have examined the long-term evolution of the Sussex coast (Long, Waller and Plater 2006, Long, Waller and Stupples 2006, Jennings and Smyth 1987, 1990, Moffat 1986) (Smyth and Jennings 1988, Salzmann 1910, Waller 1994, Rippon 2000). Medieval land use for the time of the Norman Conquest is further discussed by King in his chapter on Domesday Sussex (1962). Agricultural land use, farming, yields and weather patterns are also examined by Brandon (1971a, 1971b, 1972). Brandon has additionally investigated the evolution of woodlands in Sussex in the medieval period (1969). Unfortunately, though, many of these studies are not cited in the literature on the battle. For reference, see the bibliography of Lawson's book (2016).

Nonetheless, these and related sources are beneficial to a broader understanding of the landscape of Britain, and more specifically East Sussex back to the time of the Battle of Hastings. To gain a much more detailed portrait of the land use of the time, however, maps provide a much more detailed and potentially revealing portrait of the local terrain. Moreover, even though none can be traced directly to the Battle, extant cartographic representations through time do exist that can nevertheless provide a firm basis for developing sound evidence of landscape and land use well before the time of their creation. These are explored in the sections below, and then

subsequently analyzed through map regression to provide a credible environmental portrait of Hastings in 1066.

Cartographic Sources

To begin with, there are a series of historical maps from the twentieth to the fourteenth centuries which can prove useful in interpreting the local landscape. For this study, the author searched for historical maps which depicted the south-east of England which could best serve as a basis to develop representations of the landscape back to the eleventh century. Historical maps were selected as the primary framework and source because this study views the landscape "as a source itself and as a means of integrating other evidence" (Rippon 2004, 3) as well as the fact that since the sixteenth century, maps have been the main source on their local environment (Baker and Butlin 1973, 1). Like the environmental literature, many of these maps have been well researched and presented in books or articles but have not been used specifically in interpretations of the battle or its campaign (Hewitt 2018). Brief discussions of the key maps about the battle are included below.

As per Rippon's analytical method (2004, 79), one key source is the environmental record of the Hastings area. This is accessible using a Geographic Information System (GIS) vector-based database as a framework with which to analyze the landscape by stepping it back to the eleventh century. Vector-based data is "[a] representation of spatial data based on coordinate location storage for shape-defining points and associated attribute information" (Bolstad 2005, 513). This database records the land uses and historic periods of features in the landscape. The main columns in this database are the characterization, sub characterization and period. There is also a text column which provides an interpretation of the location. The land use classifications are discussed in Rippon's book through several examples including Cornwall (2004, 101–3) and Lancashire (2004, 106–9). Rippon's book also provides numerous cartographic examples including examples with Domesday data (2004, 129–31). Bannister has developed several documents which provide various interpretations of the Sussex database in the *Sussex Historic Landscape Characterization* (SHLC) series (Bannister, 2014). The database for this project was accessed through the East Sussex Historical Environmental Record (ESHER, 2013).

The Ordnance Survey of Great Britain has produced current digital data which cover the Hastings area in some detail. The digital vector-based dataset is the 1:50,000 scale maps of Great Britain known as the *"Landranger"* series (Perkins and Parry 1996, 61–68, Ordnance Survey 2012). These maps include many different elements such as buildings, infrastructure, place-names, railways, roads, and water bodies (Perkins and Parry 1996, 64–65, Ordnance Survey 2012). All data is disseminated in 100 km² blocks based on the British National Grid coordinate system (Kimerling, et al. 2009, 69, Ordnance Survey 2012). These data will be accessed from the Ordnance Survey website (Ordnance Survey 2012).

There is also a wide range of Ordnance Survey maps from the early twentieth and nineteenth centuries which can be accessed. In this study, the maps from the third and first edition will be reviewed. The third edition was surveyed during the First World War and represents the start of the interwar period between the First and Second World Wars (Brighton & Eastbourne, 1920; Hastings, 1921). The first edition maps were drawn in the early 1800's and revised in the 1880's particularly with the addition of the railroad. The copies in use here were reprinted in the late 1960's with a detailed description accompanying each map (Sheet 73 Sheerness and Dungeness, 1969; Sheet 88 Hastings, 1969). These maps were accessed through the Map Library at the University of Western Ontario and scanned.

A third source is the Yeakell and Gardner map depicting the fields of Sussex in the late eighteenth century at the time of parliamentary enclosure and the beginning of the Industrial Revolution (Yeakell and Gardner 1783, Fontana 2000, Taylor 2000, 139–40). This map is the oldest detailed land use map available and is accessible digitally online. Unlike the 1724 estate map of Battle as discussed by Lawson and presented in his book (Lawson 2016, 48–50 and 219–20), Yeakell and Gardner's map does depict land use and topography. A previous study has indicated that the "boundaries on this map are intended to represent actual field boundaries" (Kingsley 1982, 92). The local hydrologic and road network, as well as the distribution of woodland, are also depicted in detail. Assuming the veracity of Hoskins view that it was an "immeasurably slow process by which the English landscape, down to the nineteenth century, came into being" (Hoskins 1977, 79), this map is relevant in

examining East Sussex land uses back to the Norman Conquest for several reasons. The first relates to its depictions of the road network, given that in fact "[f]ew new roads were created between Saxon times and the turnpike and 'enclosure' roads of the eighteenth century" (Hoskins 1977, 242). These additions to the road network could be considered when developing a local medieval road network. Therefore, the local medieval road or simple track network could be derived from this map. Second are the field boundaries, which may provide clues as to patterns dating back to the eleventh century during the time of the battle.

Going back earlier, there are multiple maps from the seventeenth century and late sixteenth century that depict the Sussex area around the time of the Spanish Armada (1588). Robert Morden was one of some map dealers who "relied on a great deal of 'recycling': the copying and reissuing of…others' maps" (Delano-Smith and Kain 1999, 104). His late seventeenth-century map indicates generalized land uses at the time and also coastal characteristics. For example, he notes that some areas, such as Rye, were open to the sea, while the Pevensey area (Pevensey Marsh and Pevensey) consisted of fluvial channels running inland (Hewitt 2018). Earlier in the seventeenth century, Speed produced a map from 1610 with the unusually long name of "Sussex Described and divided into Rapes with the situation of Chichester the cheife citie thereof. And the armes of such Nobles as have bene dignified with the title of Earles since the conquest and other accidents therein observed." (*Sussex County Record Society*, PM118). This map at first glance is very similar to Morden's map. However, there are some noteworthy differences. For example, some places are named on Morden's map with the modern spelling differing from those used by Speed. Speed's map was in fact based on the work of John Norden who revised Christopher Saxton's maps by including a legend, administrative boundaries, town plan and grid marks for reference (Delano-Smith and Kain 1999, 73). Saxton's map dates to 1576 and is entitled: "CANTII, Southsexiae, Surriae et Middlesexiae comitat" British Library (2016). Saxton was a surveyor who was the first to map the counties of England and Wales in detail (Delano-Smith and Kain 1999, 68). His map offers a survey of generalized land use that includes existing woodlands in the area around Battle (*Battell*).

The oldest map sourced is the Gough Map King's College London (2011). The Gough map is "the earliest surviving map of Britain that shows the island in a geographically recognizable form" (Lloyd and Lilley 2009, 29, Lilley, Lloyd and Campbell 2009). It is believed to have been developed in the fourteenth century, but some authors place its date in the late thirteenth century (Lloyd and Lilley 2009, 29, Lilley, Lloyd and Campbell 2009). The Gough map is useful insofar as it specifically depicts the area of East Sussex where the Norman Conquest began in 1066 with a reasonable degree of accuracy (Lloyd and Lilley 2009, 41–44).[2]

Analytical Methods

For this study, analysis of these cartographic sources was undertaken using "map regression". According to Rippon (2004, 79), map regression is an analytical technique, where the researcher begins with a modern map of a location and then proceeds back in time to progressively analyze older maps of the same location. This process typically involves a sequence where one begins with "Ordnance Survey maps [regressed to] … the Tithe Map [and then] … any earlier estate maps" (Rippon 2004, 79). In this way, the researcher can observe "how the countryside changed over the last couple of centuries" (Rippon 2004, 79). According to Rippon, the best example of this technique is by Williamson on fields in East Anglia (Rippon 2004, 79, T. Williamson 1987). Another example is the analysis by Kraft in his studies on Ancient Troy (Kraft, Kayan and Erol 1980, Kraft, Rapp, et al. 2003).

Results

Based on these historical maps, historical land uses stepping back to 1066 were developed. The first step in developing and graphically presenting the historical land uses was to georeference the large-scale historical maps. These maps were geo-referenced through the affine transformation to the 2012 Ordnance Survey data. These geo-rectifications typically went through several iterations with points being added or removed until an acceptable Root Mean Square Error (RMSE) was achieved. For most of this study, the RMSE was between 10 and 20, but some were much lower

---

[2] Accuracy is indicated by an R2 value of at least 0.75 for a geographically weighted regression model as depicted in Figure 12 in Lloyd and Lilley's paper (2009, 41–44).

(the geo-rectifications where the RMSE was under 10 were maps with only a small area to be referenced). These values were considered acceptable because the maps were historical (accuracy may vary) and in some areas, there were significant changes to the landscape since the maps were developed, such as in the case of urban Hastings. There were also potential errors in the surveying when the maps were initially drawn. This type of geo-referencing was applied to the maps from 1920 – 1921, 1884 and 1778–1783. For the older maps, their evidence was considered in conjunction with the detailed land use maps and the data in the ESHER database.

Once the historical maps were geo-referenced, the areas in the ESHER database were classified into the various land uses by a period as defined in the ESHER. **Table 1** defines the land uses depicted in the figures. This classification was based upon the maps or database respectively and was conducted through several methods. The first was to associate each period with the land uses which were classified as being from that period. For example, woodland classified as early medieval (410–1065) was assumed to be woodland through the entire study period. This assumption provided a rough starting point for the land uses in each period. From here the unclassified areas in between the classified ones had to be interpreted. The classification was estimated by overlaying the ESHER map over the geo-referenced historical maps, as discussed above, and setting the ESHER as transparent. This process enabled the historical maps to be seen beneath the ESHER map. Then the land use for each area was re-determined based upon the interpretation of the historical maps. For example, if the historical map indicated woodland, then the corresponding ESHER area was classified as woodland. The interpretation text in the ESHER database was used for the periods before the eighteenth century insofar as no detailed map existed before that point in time.

Once all of the land use maps were complete, the Hastings area data was generalized to a resolution of 250 m by 250 m. This resolution was selected because a finer resolution in particular with the historical reconstructions "could lead one to the conclusion that we know more than we really do" (Heinen 1998, 189). The generalization was calculated as a vector to raster transformation where the vector-based data were converted into a raster surface. A raster surface is "[a] regular "grid cell" approach to defining space" (Bolstad 2005, 511). The technique assigned a land

Table 1: ESHER Land Use Definitions.

ESHER	Definition
Coastal	Land that is along the coast and could be flooded at high tide.
Communications	Forms of communication typically from the nineteenth century onward.
Cropland	Areas which are used for crops.
Designed Landscapes	Areas which were planned such as urban and rural parks.
Fieldscapes	Land which is employed for farming or pasture but are unsure which is most correct.
Horticulture	Areas designated for growing such as orchards or greenhouses.
Industry	Sites currently or formerly employed to extract or process minerals.
Military	Defensive structures such as castles.
Pasture	Areas for pasture.
Reclaimed Marshland	Areas which were formerly marshland – either tidal or freshwater.
Recreation	Locations of sporting events such as race tracks or marinas.
Settlement	Areas employed for human habitation originating with historical cores.
Unimproved/Unenclosed	Open areas such as common lands.
Water	Areas with open water.
Woodland	Areas covered by trees.

Sources: (Bannister, SHLC – V, 2010, pp. 32–44).

use value to each raster cell based on the land use at the center of the cell. For the cells which had to be determined manually, the dominant land use in the cell was applied (Bolstad 2005, 48–49). Once complete the land uses were mapped as follows.

The examination of the land uses begins with the modern land use, as presented in **Figure 1** depicting East Sussex and **Figure 2** depicting the town of Battle itself. **Figure 1** reflects the large urban centers from west to east of Eastbourne and Pevensey, Bexhill, Hastings and Rye (inland settlement) on the map. These settlement areas reflect the growth of communities and industry since the end of the Second
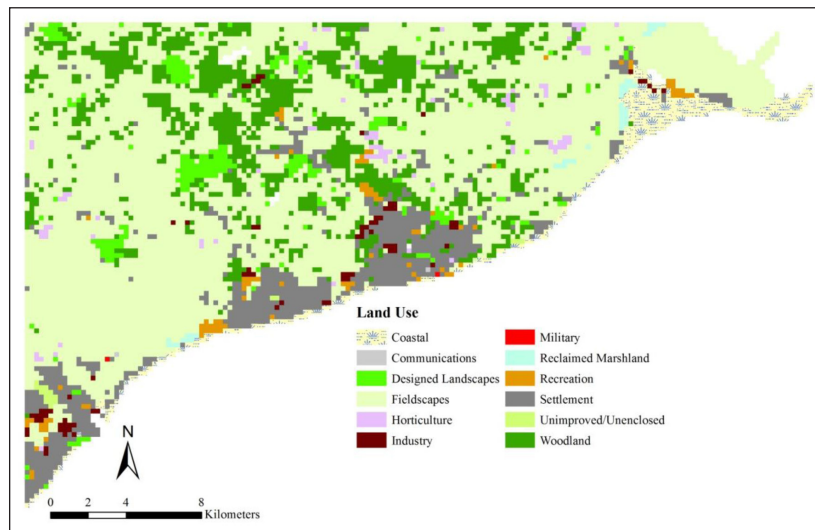
Figure 1: Hastings Area Land Uses Present – 1946.[3]

World War. There are also notable sites of horticulture, recreation and water bodies such as reservoirs.

Figure **3A** and **B** represent the land uses in the period between the two world wars of the twentieth century. Compared to the post-war period (**Figures 1** and **2**), the main change is in the urban coverage. Development of these maps was based on the evidence in the ESHER as well as the Ordnance Survey (OS) maps from the 1920's (Brighton & Eastbourne 1920, Hastings 1921, ESHER 2013).

Figure **3C** and **D** represent the period back from the eve of the First World War to approximately 1800. These maps demonstrate two essential changes from the twentieth century. First is the relatively smaller size of the towns along the coast. Secondly, it was during this period as well, that recreation, and transportation (such as trains) became important. This map was developed from the ESHER as well as two OS maps from the 1880's which were republished in 1969 (ESHER 2013, Sheet 73 Sheerness and Dungeness 1969, Sheet 88 Hastings 1969).

Representing the period from 1799 – 1600 are **Figure 3E** and **F** which represent the earliest land uses for which there are detailed historical maps. Aside from a lack

---

[3] This map is based on the ESHER (2013).

Figure 2: Battle Area Land Uses Present – 1946.[4]

of features in both figures associated with the advent of the modern era, **Figure 3E**
demonstrates a greater buildup of silt around Rye and Winchelsea and land by
Eastbourne (Robinson and Williams 1983, 58). These maps were developed from the
ESHER, Morden (1695) and Speed (1610) maps as well as Yeakell and Gardiner's map
of 1783 (ESHER 2013, Yeakell and Gardner 1783, Fontana 2000). Interpretations in a
historical atlas on Sussex were also considered during this section (Leslie and Short
1999, 54–69).

Figure 3G and **H** for the Hastings and Battle areas respectively, offer a less
detailed but useful portrait of land uses in the sixteenth century. **Figure 3G** indicates
the area surrounding Rye is not land at this time but open water. There also existed
extensive areas of reclaimed marshland (Robinson and Williams 1983, 58–9). A late
sixteenth-century map by Thomas Stonham in the V. C. H. further helps to confirm
this interpretation (V. C. H. Sussex IX, 34–39). In **Figure 3H**, the size of Battle appears

---

[4] This map is based on the ESHER (2013). The urban survey of Battle was also consulted (Harris 2009).
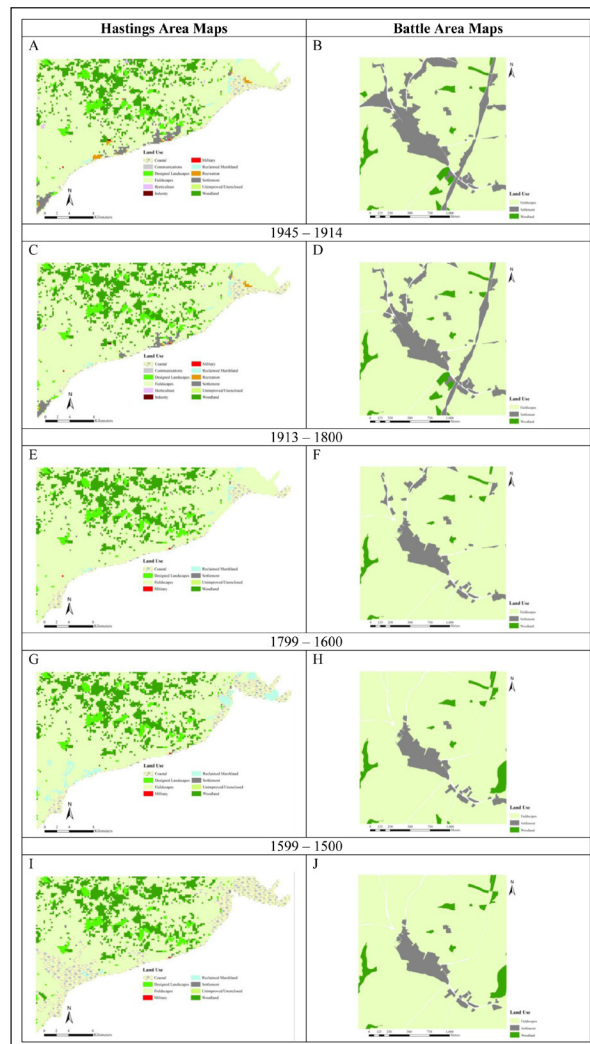
Figure 3: Land Uses 1945 – 1066.[5]

smaller than in the previous periods. These maps were developed from the ESHER
(2013) and Saxton map (1576), as well as consideration from the Yeakell and Gardner
(1783), Morden (1695) and Speed (1610) maps. Findings in the historical atlas on
Sussex were considered as well (Leslie and Short 1999, 50–54).

---

[5] These maps are derived from the ESHER, two historical OS maps from the 1920's (Brighton &
Eastbourne 1920, Hastings 1921, ESHER 2013), The Yeakell and Gardner map (1783), seventeenth to
sixteenth century maps, and the Gough map.

The next two maps as presented as **Figure 3I** and **J**, reflect the medieval land use from 1499 until 1066 and are based on the ESHER, written comments in the database, all the previous maps from the Yeakell and Gardner map (1783) to the Gough Map (ESHER 2013, Lilley, Lloyd and Campbell 2009, Yeakell and Gardner 1783) as well as all of the local studies cited previously. The medieval section in Leslie and Short's atlas on Sussex was consulted for further information as well (1999, 36–51). Given the available data for this period, these figures represent an approximation of the land use in the late medieval period. **Figure 3J** represents the land uses for the Battle area for the same time period. As it is difficult to assess where the agricultural land, meadow, and pasture were specifically, the land use "fieldscapes" was applied across the entire area.

Figure 3I indicates that a large portion of the area was woodland in this period with intermixed agriculture (P. F. Brandon 1969, 1972). Small settlements had developed on the landscape as well as a small number of castles such as Hastings and Pevensey (Bradbury 1998, 87 and 122–23). **Figure 3I** also reveals the expanse of the arable land in the middle ages, reflecting the population increase in the early part of this period. Some of this land represented woodland clearances known as assarts which were transformed into arable or pasture (Hoskins 1977, 86–7, Rackham 1980, 134). However, following droughts and disease, especially the Black Death in the mid-fourteenth century, the population declined and the areas of arable land decreased (Bennett and Hollister 2006, 326–30, Leslie and Short 1999, 48–49).

The final two maps as presented in **Figures 4** and **5** reflect probable land use in and around the year 1066. As this landscape is the final step in the analysis, more detail is provided. In its natural state, the Hastings area has been described as "typical undulating wealden country, dense woods, predominantly oak, and great open stretches of grass-land diversified by clumps of trees" (V. C. H. Sussex IX, 126). To estimate this landscape, **Figure 3I** was revised based on the estimated changes to the landscape between 1499 and 1066 (Harvey, 1985).

Specifically, it can generally be assumed that approximately 80 percent of the 1086 acreage was still considered arable land in 1914 (Cantor 1982, 17).[6] This knowledge provides us with a starting point from which the 1066 land use can be

---

[6] It was also indicated that this value varied throughout England for example; the proportions of arable were higher in the Sussex plains but lower in the Weald (Cantor 1982, 17).
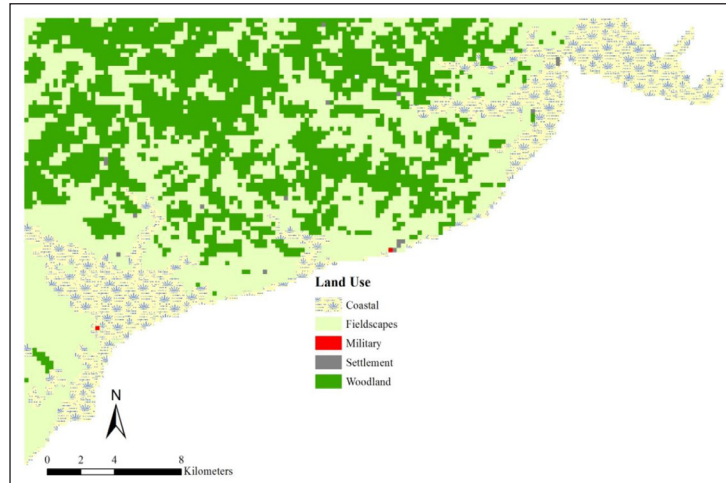
Figure 4: Estimated Hastings Area Land Use in c. 1066.[7]

deduced. This, however, represents only an approximation, as the actual ratio of arable land from 1086 to 1914 would have varied throughout the region with the value lower in the wooded area north of Battle, known as the Weald.

To estimate crop land coverage, two estimates were deduced from a selection of local Domesday sites. These methods, utilized by Lennard and Maitland produced estimates based upon the number of plough-teams (100 acres) and lands (120 acres) per manor (Lennard 1959, 393, Maitland 1987, 435). As the study area included 374.5 plough-lands or 474.875 plough-teams then the rough extent of arable was between 44940 and 47487.5 acres (Campbell 2000, 386–87, Darby 1977, 129–31). Based on **Figure 4**, this study, by contrast, estimates the size of the arable land at just under 58000 acres. Considering there were several Domesday sites just beyond the border of the map which were not considered in the analysis, it is expected these excluded sites would have contributed to the 58000 acres. Thus, the difference in values between the map and Domesday is reasonable. Furthermore, not all of the fieldscapes would have been agricultural, pastoral or left to fallow (i.e., natural unused grassland with some trees) and thus the reported figure can only approximate the values from Domesday. Regardless of the estimate used, however, the amount of arable land was probably considerable.

_____

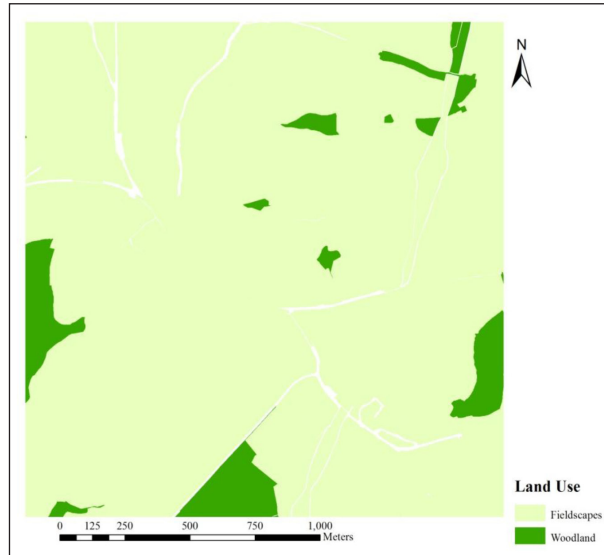[7] This map is primarily derived from the ESHER (2013).

Figure 5: Estimated Battle Area Land Use in c. 1066.[8]

In terms of woodland, the largest change in land use presented in **Figure 3I** and that of 1066 would have been in the extent of coverage of woodland as a result of deforestation. According to the authors of the V. C. H., the woodland would have stretched along a piece of land known as the "Forest Ridge" from northeast of Hastings to the far side of the county. Several existing forests are considered the last vestiges of the original forest (V. C. H. Sussex I, 49–50). Regarding academic studies, Brandon covers this topic extensively in an article on the subject (1969).

Based on these data, in developing **Figure 4**, from **Figure 3I**, several techniques were considered to estimate the extent of woodland in this period. One method examined areas classified as parks. These areas were labeled as designed landscapes in the ESHER although a review of the entries in the V. C. H. Sussex I and IX was required before labeling them woodland. An additional method of classifying woodland was through ESHER areas classified as assarts (2013). An assart is a Middle English word, defined as forest cleared for agriculture (Field 1972, 267). In the ESHER database, around 86 percent of the assarts were dated to the medieval period (1066 to 1499) with none dated before 1066 (P. F. Brandon 1969). Therefore, they were begun after

---

[8] This map is derived from the ESHER (2013) and the urban survey of Battle (Harris 2009).

1066. Thus, by including areas designated as assart, in addition to the areas already classified as woodland, we can get a sense from **Figure 4** of how extensive the woodland might have been when William arrived in the Hastings area.

With regard to characterization of the Battle area (**Figure 5**), fortunately much has been written about Battle Abbey in the medieval period to assist in the regression from **Figure 3J**. For example, Searle has characterized the Battle environment as without "strips because there were no common fields. There was only the vill, and beyond it, the leuga, divided into the wists characteristic of the weald: single arable farmsteads enclosed by the forest" (1974, p. 82).

Another author suggests that the woodland tended to be on the marginal sections of the landscape such as the small valleys or on the steeper slopes and the remainder of the landscape was fieldscapes (Baker 1973, 423–24). A historian of the battle has indicated that the original hill would have been covered in local grasses (Bradbury 1998, 142). Thus, based upon these characterizations, **Figure 5** presents what is in all probability, the landscape the English and Norman combatants would have seen when they arrived in 1066.

Discussion and Conclusion

This study has improved on the Williamson limited interpretation (1959) by comprehensively regressing, through cartographic and descriptive historical sources, East Sussex land uses back to the mid-eleventh century. This reconstruction effectively offers researchers of the period two things: 1) a better sense of the land itself back to the period; and 2) an enhanced ability to interpret and analyze several elements relating to the battle or its environment. Specifically, with these land use maps, researchers would be able to do a number of things that have not been undertaken extensively to this point.

First off, by better understanding the local terrain at the time, historians would be in a much better position to test existent theories as to the precise location of the battle and to assess the environmental factors that may have affected its outcome. To some extent, this work has already begun. Based upon the time-based regression presented here, Hewitt's (2016) research using a multi-criteria decision analysis has cast doubt on Battle Abbey as the location of the battle. Secondly, the analysis

undertaken here provides for a detailed analysis of nature and extent to which the terrain has been affected by erosion, perhaps providing clues as to where valuable physical evidence of the conflict may be buried. To date, in fact, no artifacts from the battle have been located (Porter 2012, 15–16).

Thirdly, the analysis would facilitate a much more comprehensive assessment of the local resources available to the English and Norman armies at the time, and how this, in turn, may have affected their battle-readiness. As another often-neglected area in the study of military history, this would force a great focus on the resources required to maintain an army in a battle-ready state, not to mention how the local economy and society may be affected by the presence of large fighting forces.

In terms of methodology, this research would have been more labor and time intensive without the benefit of digital resources. Specifically, had the ESHER and the extensive research behind it not been available, a significant portion of this project would have been devoted to data input and management. This requirement would have increased project costs and required the expertise of a data analyst to manage the data. With respect to the historical maps, before their digital appearance online, researchers would have had to search through lists of manuscripts in archives and visited their locations to see if the map was relevant to the project. Now a simple internet search was all that was required to locate many of these maps. Thus, these digital resources have increased the efficiency of the research process and increased access to sources while reducing time spent searching and project costs.

More broadly, this study clearly reveals the importance of maps and cartographic analysis in both broadening and deepening understanding of military history per se. As a research framework, maps bring an environmental focus to a topic and center it on the environment. While accounts and chronicles are extremely important in scholarly analysis, a fuller understanding of the environmental context through environmental sources such as maps can provide a much more comprehensive reconstruction of a historical environment. With the reconstruction historians are thus able to provide an interpretation of a historical military event which is grounded in the environment it occurred in or as close as we can get to that environment. Thus,

this perspective can provide a pathway to a much more sophisticated understanding of the factors affecting the context and consequences of armed conflict.

Overall, this study underscores the importance of applying up-to-date methodological techniques as a means to test, further explore, and expand upon existing disciplinary methods. This is particularly relevant to history, which through time has relied almost exclusively on written accounts and qualitative analysis. This study opens the door much wider to the application of novel approaches that not only push the boundaries of traditional thinking but provide a much more sophisticated—and potentially more accurate—window on past events.

Competing Interests

The author has no competing interests to declare.

References

Aberth, John. 2013. *An Environmental History of the Middle Ages: The Crucible of Nature*. New York: Routledge.

Baker, Alan R. H. 1973. "Field Systems of Southeast England." In *Studies of Field Systems in the British Isles*, by Alan R. H. Baker and R. A. Butlin, 377–429. Cambridge: Cambridge University Press.

Baker, A. R. H., and **R. A. Butlin.** 1973. "Introduction: Materials and Methods." In *Studies of Field Systems in the British Isles*, by A. R. H. Baker and R. A. Butlin, 1–40. Cambridge: Cambridge University Press. DOI: https://doi.org/10.1017/CBO9780511554872.004

Bannister, Nicola. 2010. Sussex Historic Landscape Characterisation – Appendices (Vol. V) (SHLC – V). West Sussex County Council; East Sussex County Council; Brighton & Hove Unitary Authority; English Heritage.

Bannister, Nicola. 2014. "Sussex Historic Landscape Characterisation (HLC)." Accessed July 11, 2018. http://archaeologydataservice.ac.uk/archives/view/sussex_hlc_2014/downloads.cfm.

Bennett, Judith M., and **C. Warren Hollister.** 2006. *Medieval Europe: A Short History*. 10th. New York: McGraw-Hill Higher Education.

Bolstad, Paul. 2005. *GIS Fundamentals: A First Text on Geographic Information Systems*. White Bear Lake, MN: Elder Press.

Bradbury, J. 1998. *The Battle of Hastings*. Stroud, UK: Sutton Publishing Limited.

Brandon, P. F. 1969. "Medieval Clearances in the East Sussex Weald." *Transactions of the Institute of British Geographers* 48: 135–53. DOI: https://doi.org/10.2307/621495

Brandon, P. F. 1971a. "Demesne Arable Farming in Coastal Sussex during the Later Middle Ages." *The Agricultural History Review* 19: 113–34.

Brandon, P. F. 1971b. "Late-Medieval Weather in Sussex and Its Agricultural Significance." *Transactions of the Institute of British Geographers* 54: 1–17. DOI: https://doi.org/10.2307/621358

Brandon, P. F. 1972. "Cereal Yields on the Sussex Estates of Battle Abbey during the Later Middle Ages." *The Economic History Review* 25(3): 403–20. DOI: https://doi.org/10.2307/2593429

Brandon, Peter. 1974. *The Sussex Landscape*. London: Hodder and Stoughton.

British Library. 2016. www.bl.uk.

Brown, R. Allen. 1996. "The Battle of Hastings." In *The Battle of Hastings: Sources and Interpretations*, by Stephen Morillo, 196–218. Woodbridge, UK: The Boydell Press.

Campbell, Bruce M. S. 2000. *English Seigniorial Agriculture, 1250–1450.* Cambridge: Cambridge University Press.

Darby, Henry Clifford. 1977. *Domesday England*. Cambridge, UK: Cambridge University Press. DOI: https://doi.org/10.1017/CBO9780511607981

Dark, Petra. 2000. *The Environment of Britain in the First Millennium AD*. London: Gerald Duckworth & Co. Ltd.

Delano-Smith, Catherine, and **Roger J. P. Kain.** 1999. *English Maps: A History*. London: The British Library.

East Sussex County Council. 2013. "East Sussex Historical Environment Record." Accessed August 22, 2018. https://www.eastsussex.gov.uk/environment/archaeology/her/.

Field, John. 1972. *English Field-Names: A Dictionary*. Newton Abbot, Devon: David & Charles Ltd.

Fontana, Dominic. 2000. "Old Sussex Mapped." Accessed July 12, 2018. http://www. envf.port.ac.uk/geo/research/historical/webmap/sussexmap/sussex.html.

Gravett, Christopher. 1992. *Hastings 1066: The Fall of Saxon England*. Oxford: Osprey Publishing.

Grehan, John, and **Martin Mace.** 2012. *The Battle of Hastings 1066 – The Uncomfortable Truth: Revealing the True Location of England's Most Famous Battle*. Barnsley, UK: Pen & Sword Books Ltd.

Harris, Roland B. 2009. Battle: Historic Character Assessment Report. *Sussex Extensive Urban Survey (EUS)*, Brighton: East Sussex County Council, West Sussex County Council, and Brighton and Hove City Council 2009.

Heinen, Jeffrey. 1998. "Cambridge Illustrated Atlas: Warfare, the Middle Ages, 768–1487 Review." *Speculum* 73(1): 187–9. DOI: https://doi. org/10.2307/2886907

Hewitt, Christopher Macdonald. 2016. "Was the Battle of Hastings really fought on Battle Hill? A GIS Assessment." *Historical Geography* 44: 127–48.

Hewitt, Christopher Macdonald. 2018. Mapping the Pevensey Area back to 1066: The Historical Environmental Evidence. *Cartographica* 53(2): 75–85. DOI: https://doi.org/10.3138/cart.53.2.2017-0001

Hoffmann, Richard C. 2014. *An Environmental History of Medieval Europe*. Cambridge, UK: Cambridge University Press. DOI: https://doi.org/10.1017/CBO9781139050937

Hoskins, W. G. 1977. *The Making of the English Landscape*. London: Hodder and Stoughton Limited.

Huscroft, R. 2009. *The Norman Conquest: A New Introduction*. Harlow, UK: Pearson Education Limited.

Jennings, S., and **C. Smyth.** 1987. "Coastal sedimentation in East Sussex during the Holocene." *Progress in Oceanography* 18: 205–41. DOI: https://doi. org/10.1016/0079-6611(87)90034-6

Jennings, S., and C. Smyth. 1990. "Holocene evolution of the gravel coastline of East
    Sussex." *Proceedings of the Geologists' Association* 101(3): 213–24. DOI: https://
    doi.org/10.1016/S0016-7878(08)80006-5

Kimerling, A. Jon, Aileen R. Buckley, Phillip C. Muehrcke, and Juliana O.
    Muehrcke. 2009. *Map Use: Reading and Analysis.* 6th. Redlands, CA: ESRI Press.

King, S. H. 1962. "Chapter IX Sussex." In *The Domesday Geography of South-East
    England*, by H. C. Darby, and Eila M. J. Campbell 407–82. Cambridge: Cambridge
    University Press.

King's College London. 2011. "Linguistic Geographies: The Gough Map of Great
    Britain." *Bodleian Library.* Accessed July 12, 2018. http://www.goughmap.org/.

Kingsley, David. 1982. *Printed Maps of Sussex, 1575–1900.* 72. Lewes, UK: Sussex
    Record Society.

Kraft, John C., George (Rip) Rapp, Ilhan Kayan, and John V. Luce. 2003.
    "Harbor areas at ancient Troy: Sedimentology and geomorphology complement
    Homer's Iliad." *Geology* 31(2): 163–6. DOI: https://doi.org/10.1130/0091-
    7613(2003)031<0163:HAAATS>2.0.CO;2

Kraft, John C., Ilhan Kayan, and Oğuz Erol. 1980. "Geomorphic Reconstructions
    in the Environs of Ancient Troy." *Science* 209(4458): 776–82. DOI: https://doi.
    org/10.1126/science.209.4458.776

Lawson, M. K. 2016. *The Battle of Hastings 1066.* 3rd. https://archive.org/details/
    LawsonBattleofHastings3rdedn.

Lennard, Reginald. 1959. *Rural England 1086–1135: A Study of Social and Agrarian
    Conditions.* London: Oxford University Press.

Leslie, Kim, and Brian Short. 1999. *A Historical Atlas of Sussex.* Chichester:
    Phillimore & Co Ltd.

Lilley, Keith D., Christopher D. Lloyd, and Bruce, M. S. Campbell. 2009. "Mapping
    the Realm: A New Look at the Gough Map of Britain (c.1360)." *Imago Mundi*
    61(1): 1–28. DOI: https://doi.org/10.1080/03085690802456228

Lloyd, Christopher D., and Keith D. Lilley. 2009. "Cartographic Veracity in
    Medieval Mapping: Analyzing Geographic Variation in the Gough Map of Great
    Britain." *Annals of the Association of American Geographers*, 27–48. DOI: https://
    doi.org/10.1080/00045600802224638

Long, A. J., M. P. Waller, and **A. J. Plater.** 2006. "Coastal resilience and late Holocene tidal inlet history: The evolution of Dungesness Foreland and the Romney Marsh depositional complex (U.K.)." *Geomorphology* 82: 309–30. DOI: https://doi.org/10.1016/j.geomorph.2006.05.010

Long, A. J., M. P. Waller, and **P. Stupples.** 2006. "Driving mechanisms of coastal change: Peat compaction and the destruction of late Holocene coastal wetlands." *Marine Geology* (225): 63–84. DOI: https://doi.org/10.1016/j.margeo.2005.09.004

Maitland, Frederic William. 1987. *Domesday Book and Beyond: Three Essays in the Early History of England.* 2nd. Cambridge: Cambridge University Press.

Moffat, Brian. 1986. "The environment of Battle Abbey estates (East Sussex) in medieval times; a re-evaluation using analysis of pollen and sediments." *Landscape History*, 77–93.

Morillo, Stephen. 1996. *The Battle of Hastings: Sources and Interpretations.* Woodbridge, UK: The Boydell Press.

Morillo, Stephen. 2013. *What is Military History?* Cambridge, UK: Polity Press.

Ordnance Survey. 1920. "Brighton & Eastbourne." *Sheet 134.* Southampton: Ordnance Survey.

Ordnance Survey. 1921. "Hastings." *Sheet 135.* Southampton: Ordnance Survey.

Ordnance Survey. 1969. *Sheet 73 Sheerness and Dungeness.* Newton Abbot, UK: David and Charles Limited.

Ordnance Survey. 1969. *Sheet 88 Hastings.* Newton Abbot, UK: David and Charles Limited.

Ordnance Survey. 2012. "Maps of Britain from Ordnance Survey." Accessed February 20, 2012. http://www.ordnancesurvey.co.uk/oswebsite/index.html.

Page, William, (ed.) 1905. *The Victoria History of the County of Sussex I.* London: Archibald Constable and Company Limited.

Perkins, C. R., and **R. B. Parry.** 1996. *Mapping the UK: Maps and Spatial Data for the 21st Century.* East Grinstead, UK: Bowker-Saur.

Porter, Roy. 2012. "'On the very spot': In Defence of Battle." *English Heritage Historical Review* 7: 5–17. DOI: https://doi.org/10.1179/1752016913Z.00000000011

Rackham, Oliver. 1980. *Ancient Woodland: Its History, Vegetation and Uses in England*. London: Edward Arnold (Publishers) Ltd.

Rackham, Oliver. 1986. *The History of the Countryside*. London: J. M. Dent & Sons Ltd.

Rippon, Stephen. 2000. *The Transformation of Coastal Wetlands: Exploitation and Management of Marshland Landscapes in North West Europe during the Roman and Medieval Periods*. Oxford, UK: Oxford University Press.

Rippon, Stephen. 2004. *Historic Landscape Analysis: Deciphering the Countryside*. York: Council for British Archaeology.

Robinson, D. A., and **R. G. B. Williams.** 1983. "The Sussex Coast Past and Present." In *Sussex: Environment, Landscape and Society*, by The Geography Editorial Committee, 50–66. Gloucester: Alan Sutton Publishing Limited.

Salzman, L. F. (ed.) 1937. *The Victoria History of the County of Sussex IX*. London: University of London.

Salzmann, L. F. 1910. "The Innings of Pevensey Levels." *Sussex Archaeological Collections* 53: 32–60.

Saxton. 1576. "CANTII, Southsexiae, Surriae et Middlesexiae comitat." *British Library*. Accessed July 12, 2018. http://www.bl.uk/onlinegallery/onlineex/unvbrit/c/001map00000c7c1u00011000.html.

Searle, Eleanor. 1974. *Lordship and Community: Battle Abbey and its Banlieu, 1066–1538*. Toronto: Pontifical Institute of Mediaeval Studies.

Smyth, C., and **S. Jennings.** 1988. "Coastline Changes and Land Management in East Sussex, Southern England." *Ocean & Shoreline Management* 11: 375–94. DOI: https://doi.org/10.1016/0951-8312(88)90015-X

Speed. 1610. "Sussex Described and divided into Rapes with the situation of Chichester the cheife citie thereof. And the armes of such Nobles as have bene dignified with the title of Earles since the conquest and other accidents therein observed." Accessed July 12, 2018. http://www.envf.port.ac.uk/geo/research/historical/webmap/sussexmap/speed.htm.

Strickland, Matthew. 1992. *Anglo-Norman Warfare: Studies in Late Anglo-Saxon and Anglo-Norman Military Organization and Warfare*. Woodbridge, UK: The Boydell Press.

Taylor, Christopher. 1983. *Village and Farmstead: A History of Rural Settlement in England.* London: George Philip.

Taylor, Christopher. 2000. *Fields in the English Landscape.* Stroud: Sutton Publishing Limited.

Tetlow, Edwin. 1974. *The Enigma of Hastings.* New York: St. Martin's Press, Inc.

Waller, M. P. 1994. "Flandrian vegetational history of south-eastern England. Streatigraphy of the Brede valley and pollen data from Brede Bridge." *New Phytologist* 126: 369–92. DOI: https://doi.org/10.1111/j.1469-8137.1994.tb03956.x

Williamson, James A. 1959. *The English Channel: A History.* London: Collins.

Williamson, Tom. 1987. "Early co-axial Field Systems on the East Anglian Boulder Clays." *Proceedings of the Prehistoric Society* 53: 419–31.

Wood, H. H. 2009. *The Battle of Hastings: The Fall of Anglo-Saxon England.* London: Atlantic Books.

Yeakell, Thomas, and **William Gardner.** 1783. "The Fourth Sheet of an Actual Topographical Sheet of the County of Sussex." Accessed July 11, 2018. http://www.envf.port.ac.uk/geo/research/historical/webmap/sussexmap/Yeakell_36.htm.