University of Southampton

Faculty of Arts and Humanities

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Settlement and Land Use in the Tiber Delta and its Environs 3000 BC – AD 300

By

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Abstract

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The delta and lower valley of the Tiber in central Italy represents a wetland landscape and its environs indicating complexity in its geomorphological formation and pattern of settlement. However, the nature of the area, and the diverse origins of data for the archaeological record of the landscape, means that a comprehensive heuristic study of the pattern of settlement and land use has not been undertaken. This work aims to explore the spatial organisation and change in the pattern of settlement and resource use for the Tiber delta and lower Tiber valley by modelling the landscape of the area and developing a methodology of data integration. Its primary aim is to reassess the patterns and dynamics of settlement continuity and change and the interaction between human activity and the changing landscape from 3000 BC to AD 300, with an emphasis on broader trends in the pattern of settlement and land use for the area. This is acheived by developing a methodology for modelling the past landscape using an integration of different approaches from archaeological and geomorphological methods.

The broad chronological approach represented here provides an opportunity to analyse broad environmental changes and the human interaction and contribution to a landscape of varied and changing resources. The methodology draws on published and archive site datasets, together with published survey and excavation reports, and combines these with geological, land cover and drainage coverages, ASTER and LiDAR toographic datasets, and borehole evidence to model the past topography, land use and settlement pattern for the study area. To these datasets are added the results of geophysical survey, air photographs and satellite imagery to provide greater detail in coverage of parts of the central delta.

This research presents results of the landscape model and the analysis of the settlement pattern for the area, and demonstrates the continuity and change in human settlement and exploitation of resources for the different periods between 3000 BC and AD 300. These results set out the changes in the delta environment and the human interaction and settlement in the wetland area and beyond, and establish an overview of the documented changes to subsistence and forms of agriculture from sites in the study area. These results are compared with evidence from other sites and landscapes in central Italy.

An assessment of the integrated methodology is presented, outlining the contribution of the study, and the areas of the methodology that were successfully applied, or were used with limited success. Possible themes and future directions for research in the study area are also presented.

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Chapter 1 : Aims and Objectives

1.1 Introduction

The following study aims to explore the spatial organisation and change in the pattern of settlement and resource use for the Tiber delta and lower Tiber valley (Figure 1.1). Its principal objective is to model the landscape of the area, including the changes to the coastline and delta, the distribution of settlement and the pattern of potential resources from 3000 BC to AD 300, from the relative stabilisation of the delta environment and its habitation in the Late Neolithic and Eneolithic, through to the establishing of the Roman port of Portus in the 1st century AD and its expansion in the 2nd century AD. It is intended as a heuristic approach to advance the investigation of the archaeology associated with the lower reaches of the Tiber river system and reassess the pattern of settlement and land use for the landscape.

The primary aim is to reassess the patterns and dynamics of settlement continuity and change and the interaction between human activity and the changing landscape from 3000 BC to AD 300, with an emphasis on broader trends in the pattern of settlement and land use for the area. The secondary aim is to develop and provide a methodology for modelling the past landscape using an integration of different approaches from archaeological and geomorphological methods, harnessing results from field survey techniques, archives of remotely sensed data, and archaeological records to look at this archaeologically significant area over a broad period of time.

To fulfil these objectives the work focuses on the following questions:

- How has the changing natural and anthropogenic environment affected the nature and presence of archaeological evidence for settlement and land use in the zone between the mouth of the Tiber and Rome?

- How and why has the pattern of settlement and land use changed or continued as a response to the changing environment of the lower Tiber valley?

Three outcomes were achieved for the study. Firstly, the creation of a spatial dataset for the area, incorporating varying forms of archaeological data. Secondly the production of new insights into the spatial pattern and distribution of archaeological sites for different key periods, and thirdly production of an indication of the human ecology of the landscape.

The idea for this research stemmed from work undertaken for the Portus Project by the author from 1998 to 2006. This project focused on the survey of the Roman site of Portus with the specific objective of mapping the buried and extant remains of the site. However, while undertaking fieldwork and writing up components of the research for Portus, an idea took hold with the author that the broader significance and human exploitation of the Tiber delta was a subject that had not received attention in terms of a landscape approach, either through the drawing together of all the archaeological data and analysis of the distribution of sites, or in terms of an approach investigating the human ecology of the area, and that analysing the broad settlement pattern and resource use for the delta zone before and during the formation of the Roman port would provide a clearer notion of the development of human activity in the area.

The archaeological significance of the landscape between Rome and the Tyrrhenian coast is considerable. Archaeological records for the area demonstrate continuous human activity in the region from the Lower Palaeolithic until the present day (Amendolea 2004). Several major and important urban centres from the Neolithic, Eneolithic, Bronze Age, (Bietti Sestieri 1984) Archaic and Roman periods are located along the course of the Tiber and its tributaries, including the Bronze Age and Archaic site of Ficana (Fischer Hansen 1990; Brandt 1996), the Roman *castrum* and city of Ostia Antica (Meiggs 1973) and the Roman port complex at Portus (Testaguzza 1970). Several important sites are also located on the coastal plain of the Tiber and the small tributaries and torrents running from the *Lago di Bracciano* and the *Monti Sabbatini*. These include the supposed location of the ancient city of Elsium (modern day Palo) and a series of maritime villas. The prominence of these sites belies the presence of extensive archaeological material associated with the prehistoric, Archaic and early Roman occupation of the lower Tiber, including the delta and surrounding hillslopes, representing the settlement, and human interaction with, the river valley and floodplain in the Late Holocene.

Figure 1.1 Location map showing the Italian peninsula, Rome and the River Tiber in relation to principal sites in the lower Tiber and Tiber delta

Despite a number of archaeological studies of landscapes in central Italy, no comprehensive study has been conducted on the region along the river Tiber below Rome drawing on both archaeological and geomorphological evidence for the development of the landscape. Intensive archaeological studies have been made of the Tiber valley above Rome (Jones 1962; 1963; Potter 1976; 1979; Ward Perkins 1962). Settlement patterns and environmental change have formed the focus of several other studies, including research on the Pontine plain and slopes of the Apennines (Attema 1993; Attema et al. 1999). There has, however, been a focus on the historically important urban centres and high status Roman villa sites (Franceschini 2005) along the lower reaches of the Tiber and around the river delta over the past 200 years, with scant investigation into the formation and habitation of the surrounding landscape.

Work at the site of Ostia Antica, particularly through the excavation campaigns of Calza (1925; 1928; 1940) followed a tradition of antiquarian and archaeological research commenced by the popes in the 17th century[1], and can trace its line through to recent academic research on the foundation of the town (Zevi 2001; 2001a) and the urban plan of Ostia (Claridge and Gallina Zevi 1996). Similar studies have been conducted at Portus to the north of the Tiber, commencing with the work of Lanciani (1868) through to the research of Testaguzza (1970) and more recent fieldwork conducted at the site (Keay *et al.* 2005). It is apparent from the material published on the area that there is a lacuna in our understanding of the relationship between the process of formation of the landscape of the Tiber valley below Rome, and the pattern of settlement and land use in the lower valley and delta.

- There is a need to develop a model of the pattern or nature of settlement for the zone or an understanding of exploitation of resources and how and why the area was inhabited.

- There are some preconceived ideas that dominate research of the zone as a marginal region of delta and floodplain, regularly inundated by floodwaters from the river and, apart from the creation of the port of Portus in the Imperial Roman period, of little economic importance in its own right.

- The area is principally seen as a zone of interconnectivity, a link from the Roman ports to Rome, rather than as a settled landscape where a population was sustained.

[1] Papal interest in the site in fact started early, with pope Sixtus IV using marble from Ostia Antica for the cathedral at Pisa (Ashby 1912, 160)

- There has been an invariable focus on urban centres and high status archaeological sites over landscape analysis.

- A significant development since the early 1990s in the developing of land, particularly on the Tiber floodplain from Rome down to Fiumicino means that the archaeological resource is under threat. Rescue excavation and survey has, however, provided new publications and archive material for study.

- No consistent integration has taken place of the archaeological record with the geomorphological and environmental evidence for the region.

- Studies in the area have invariably focused either on environmental and geomorphological concerns, or archaeological questions without any form of integrated analysis.

There is a tendency to envisage the course of the river and the delta as a marginal area which, up until the major drainage work of the *Bonifica* in the late 19th and early 20th centuries (Genala 1884; Chapter 4, Figs 4.37-4.41; Manfredini 2002, 20) was an uninhabited zone of marshland and coastal lagoon. Wetlands in the Mediterranean have always been considered marginal areas within the Mediterranean environment (Horden & Purcell 2000, 186). However, the historical record and archaeology of such areas suggests that the wetland is a significant resource within the ancient landscape. The great expanses of wetland on rivers such as the Po, Ebro, and Nile (Amorosi and Milli 2001; Amorosi *et al.* 2004; Hooke 2006; Pennington 2017; Pennington *et al.* 2017) provide large-scale examples of such environments. However, it is the smaller more localized forms of wetland that provide a greater repertoire of environments over a smaller geographical area (Horden & Purcell 2000, 187).

According to Horden & Purcell (2000) coastal wetland provides four resources that are exploited; firstly, it is the perfect environment for hunter-gathering activity, based on the natural plant and animal species[2]. Secondly it provides the conditions for occasional agricultural practices on the fringes of the wetland, particularly in the dry season. Thirdly wetland provides a guaranteed zone of perennial humidity crucial for pastoral and some forms of arable cultivation (Chapter 4, Figs 4.15-4.25). Finally, the location of wetland between land and sea makes it an ideal interface of communication both through natural manmade harbours, along river channels and also along coastal seaboards (Horden & Purcell 2000, 188). In addition, there is the potential for other exploitation of resources, for instance creation of saltpans (Chapter 4, Fig. 4.8). These different forms of exploitation underlie varying activities practiced in such environments, including settlement, and the different levels of adaptation and intensity of resource exploitation. These assertions are explored and examined in this thesis.

The zone of wetland to the west of Rome provides an example similar to wetlands elsewhere in the Mediterranean. An area that for thousands of years provided seasonal marshland and resources for both settled and transhumant populations in the region, was finally changed irrevocably at the end of the nineteenth century CE through the system of *Bonificazione* initiated under the reign of Vittorio Emmanuelle and continued in the 1920s and 1930s (Genala 1884; Bellotti 1998). The areas of the Maccarese Plain, Fiumicino, Ostia Antica and the zone around the *Stagno Ostiense* are the focus of systematic development through projects designed to expand the urban area of Rome along the line of the Tiber in the river floodplain and delta.

It is noticeable from landscape studies elsewhere in the Italian peninsula (Ward-Perkins *et al.* 1986; Attema et al. 1999; Amorosi *et al.* 2013) that wetlands and areas prone to sporadic flooding form an integral part of the landscape being settled and exploited by humans throughout the Holocene. In any case such a limited understanding of the region of the lower Tiber neglects to take into consideration the environmental and geomorphological changes occurring over the course of millennia in the region.

Secondly there is a tendency for the region to be recognised purely in terms of the city of Rome and its satellite towns and ports, without its own distinct identity delineated by

[2] Purcell and Horden (2000) make the point that the environmental conditions on wetland, for instance on the Ebro, are ideal for supporting large populations of insects and amphibious animals which in turn support populations of migrating birds and fish.

the considerable river delta and changing environmental conditions found in the area. It is a region highlighted for its importance for the supply of salt to Rome (Morelli et al. 2004), or for the location of the Republican and Imperial ports of Rome. Studies of other significant river environments with deltaic formations demonstrate that such zones are important in their own right (Mercuri et al. 2012; Stefani et al. 2005; Ward Perkins 1986). It is the period in the millennia prior to the hegemony of Rome and the development of the area for the port of Rome that is arguably of greater interest, as this facilitates an analysis of the pattern of settlement and the use of resources in the delta and the lower part of the river floodplain prior to the establishment of Portus, and of the changes to that pattern during and after the creation of the port.

The existing studies of the Tiber and the river delta suggest a lack of consistent integration, particularly between geomorphological and archaeological research. In part this is a reflection on the nature of methodological approaches used for different forms of study, where the temporal and spatial scales utilised for environmental analysis may differ from those applied at the level of the archaeological site (Walsh 1999, 5). The study of this landscape is especially prescient because of the large-scale development of the region as a whole, and particularly along the river plain to the north of the Tiber between Rome and Fiumicino. The construction of massive residential and industrial centres along the *autostrada* to *Ponte Galeria* means that the landscape is changing irrevocably, and large amounts of new data are coming to light as part of the mitigation strategies for such developments. Just as the building of the airport at Fiumicino in the 1960s has obscured some of the finer morphological evidence for the formation of the Tiber delta, and the location and extent of archaeological remains associated with the harbour at Portus, current developments will mean that evidence of the archaeological landscape in the region will be lost.

1.2 The Study Area

The study area is located on the Tyrrhenian coast of Italy (Figure 1.2) comprising the coastal plain and hills to the west and south of Rome. For the purposes of data collection, the limits of the study area were delimited by the UTM grid coordinate system zone UTM 33N, using the European 1950 datum. The north-west corner of the area located at 258700E, 4648000N, and the south-east corner located at 301960E, 4606230N, comprising an area of 1,477,957,680 m² (147796 hectares). Datasets were later transformed to the WGS84 datum to facilitate overlay of sites and other layers with the ArcGIS basemap orthorectified images.

A number of arguments are generally expressed for the definition of boundaries for the study of an area of landscape (Binford, 1964). The focus of the present study requires a broad study area centred on the lower course of the Tiber. However, it would be impossible to restrict the geographical area to the river floodplain and to ignore the wider landscape. This includes the Pleistocene hillslopes on either side of the floodplain, the lower reaches of the *Monti Sabatini* and the *Colli Albani* overlooking the Tiber delta and the coastal littoral to the north and south of the river mouth, that was so crucial to the formation of the lagoons and dune ridges at the mouth of the river (Figures 1.2 and 1.3). The nature of the study area is dealt with in greater depth in Chapter 5. However, the sites used for settlement analysis were derived from a geographical area that excluded the area around Rome (Fig. 1.5). The number and variability of sites in the vicinity of Rome, removed from the immediate vicinity of the lower river valley and the delta, were deemed to have less relevance for the study. In addition, the quantity of sites in the record, in the immediate vicinity of Italy's capital, would have provided too much data for classification and analysis for the scope of this work.

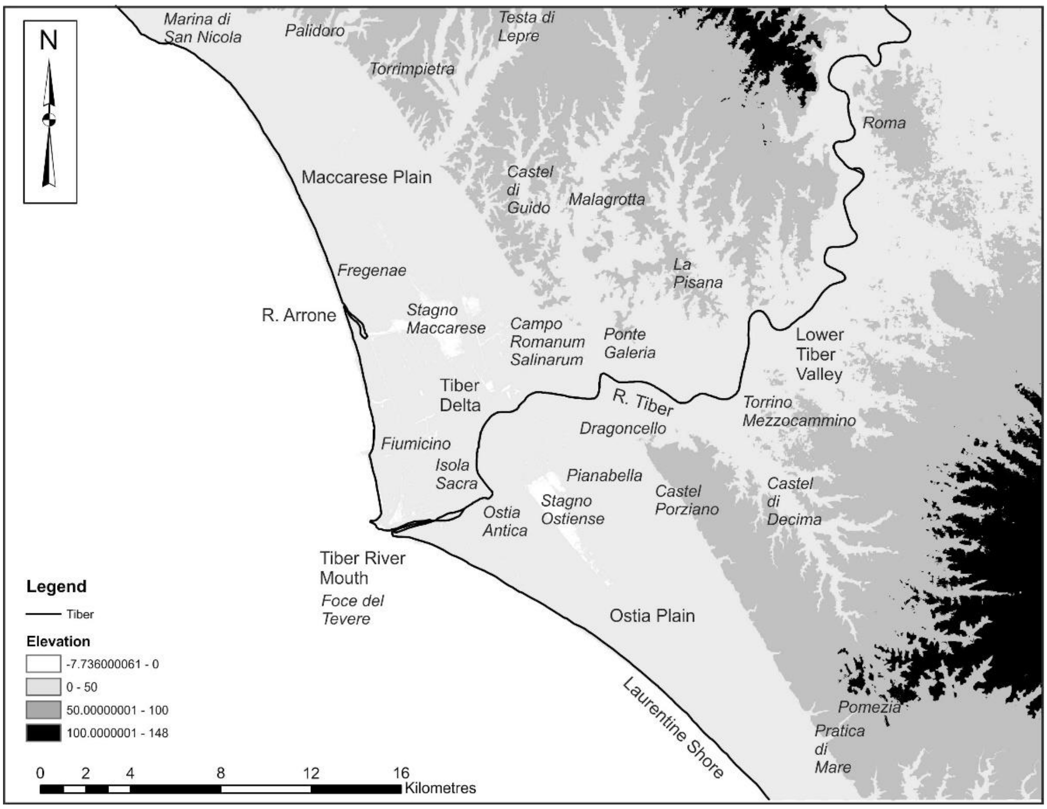

Figure 1.2 Map of the study area showing principal areas mentioned in the text (Elevation based on ASTER data. ASTER GDEM is a product of METI and NASA)

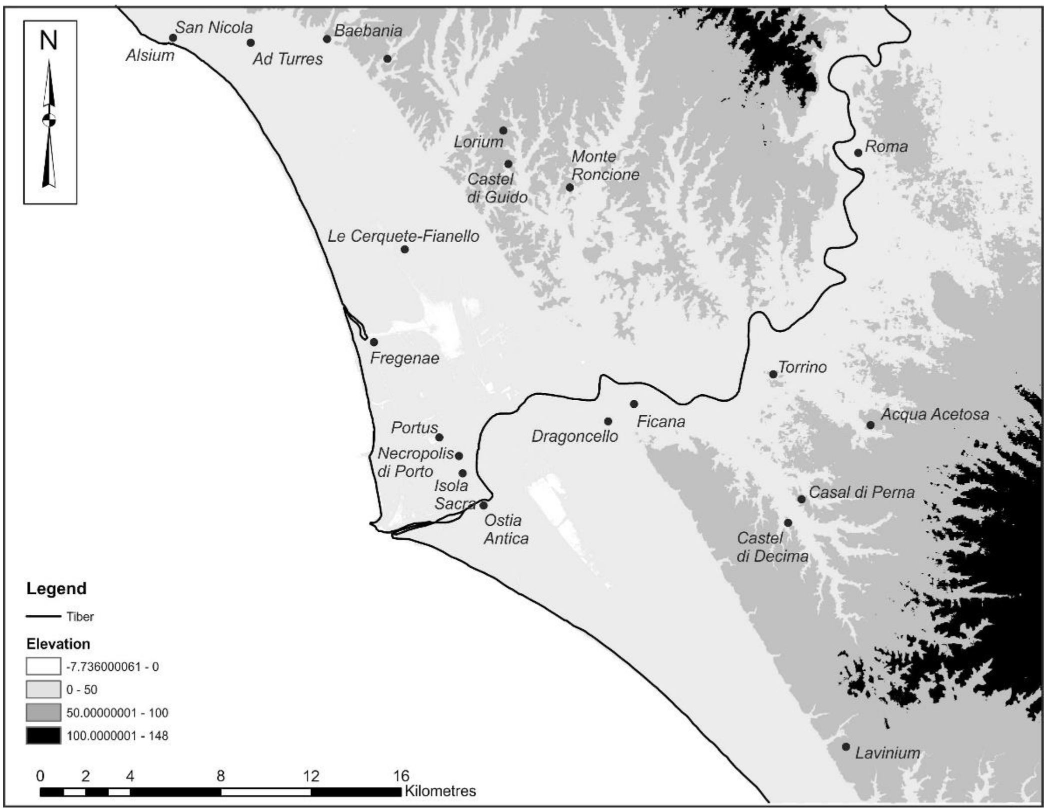

Figure 1.3 Map of the study area showing principal sites mentioned in the text (Elevation based on ASTER data. ASTER GDEM is a product of METI and NASA)

In order to include the hillslopes close to the Tiber, use of the watershed of the Tiber Valley has proven useful. However, a watershed model of the river excludes some of the key smaller tributaries of the Tiber, and altogether excludes the broader coastal area of the Tiber delta, an important zone for the purposes of this study, but an area more closely connected in terms of sedimentary deposition to the streams flowing from the *Monti Sabatini* (in the case of the Maccarese Plain) and the *Colli Albani* (in the case of the *Pianabella* and the plain to the south of *Ostia Antica*). The study area thus is confined to north and south by the full extent of the Tiber delta and floodplain, taking into account the area of the watershed of the Tiber and the surrounding hillslopes to the south of Rome. The area used to select the extent of archaeological sites covers some 801046933 m^2 (80105 hectares).

1.3 Chronological Focus

It is the changing nature of the river system and floodplain in relation to human settlement and land use that forms the focus of this work. As such the chronological range of the study concentrates on the period from the stabilisation of the early delta and the presence of late Neolithic and Eneolithic settlement in the area (Di Rita et al. 2009) up to the period of construction of Portus in the 1st century AD, bringing the period up to AD 300 to include the development of the maritime zone under Trajan, the greatest extent of the port network in the first part of the second century AD, and the period of expansion of villa sites and rural settlement during the Imperial period. The date of 3000 BC marks a point at which the Tiber delta had stabilised in terms of the eustatic and isostatic curves (Lambeck *et al.* 2011, 251), with the rise in relative sea level slowing and the standplain and dune cordons of the delta being established by around 3,500 BC. While changes still occurred in terms of relative sea level and variations in the deltaic environment (Marra *et al*. 2013) the date marks a point at which both lagoons of the delta had formed, and their connection to the sea was reduced significantly (Milli *et al.* 2013, 175).

There is a tendency with the archaeological record, particularly in terms of Roman archaeology, to focus on events represented in the historical record rather than on the *longue durée* and the changing dynamics of settlement and exploitation of resources (Lucas 2012). The chronological range used for this study attempts to address this, looking at a long period of time covering over 3000 years (Table 1.1).

Phase	Date Range
Mesolithic	To 5800 BC
Neolithic	5800-3500 BC
Eneolithic	3500-2000 BC
Bronze Age	2000-900 BC
Iron Age	900-700 BC
Orientalizing	700-580 BC
Archaic	580-480 BC
Classical	480-350 BC
Protohistoric	900-350 BC (see discussion below and Chapter 7)
Roman Republic	509 BC-27 BC
Imperial Roman	27 BC-AD 375

Table 1.1 Basic periods used in Italian prehistory and protohistory. The sub-divisions mark the basic periods, with more complex and overlapping sub-divisions related in Chapter 3

The chronological range from the Eneolithic to the 3rd century AD crosses periods with a number of changes in landscape dynamics that are tangible in the archaeological record. Evidence for the end of the Neolithic, the Eneolithic, and the early Bronze Age suggests a more mobile population exploiting resources in the delta (Manfredini *et al.* 1995). By the Late Bronze Age and the start of the Iron Age, the formation of nucleated settlement is more prevalent. With the Archaic and Republican periods, a pattern of rural settlement and agrarian land use emerges that declines in the 1st century BC, before commencing a resurgence in the 1st century AD. On the macro-scale the geomorphological development of the Tiber and the delta and the exploitation of the nascent wetland and surrounding landscape provide a synergy in terms of later prehistoric exploitation of coastal resources. With the start of urbanisation and population of settlement nuclei from the late Bronze Age through to the Archaic period the dynamics of settlement and exploitation of the delta and river valley change, in terms of the nature of the resources being exploited and the modes by which such resources are used. This relates closely to the evolving nature of the river and the delta environments. It must be noted that, the period of transition from the early Iron Age, through the Archaic, Orientalizing and Classical periods (Table 1.1) presents an issue in terms of terminology and usage in the various datasets from the study area.

Survey in the area to the north of the Tiber tends to refer to pre-Roman settlement as Etruscan, with some instances of Orientalizing settlement. The terms Iron Age and Archaic are used in survey terminology to the south of the Tiber. For the combining of Iron Age settlement for the study area, therefore, the term Protohistoric is used to define sites from approximately 900 BC to 350 BC, to ensure consistency in representing settlement from the pre-Roman 1st millennium BC (see Chapter 7).

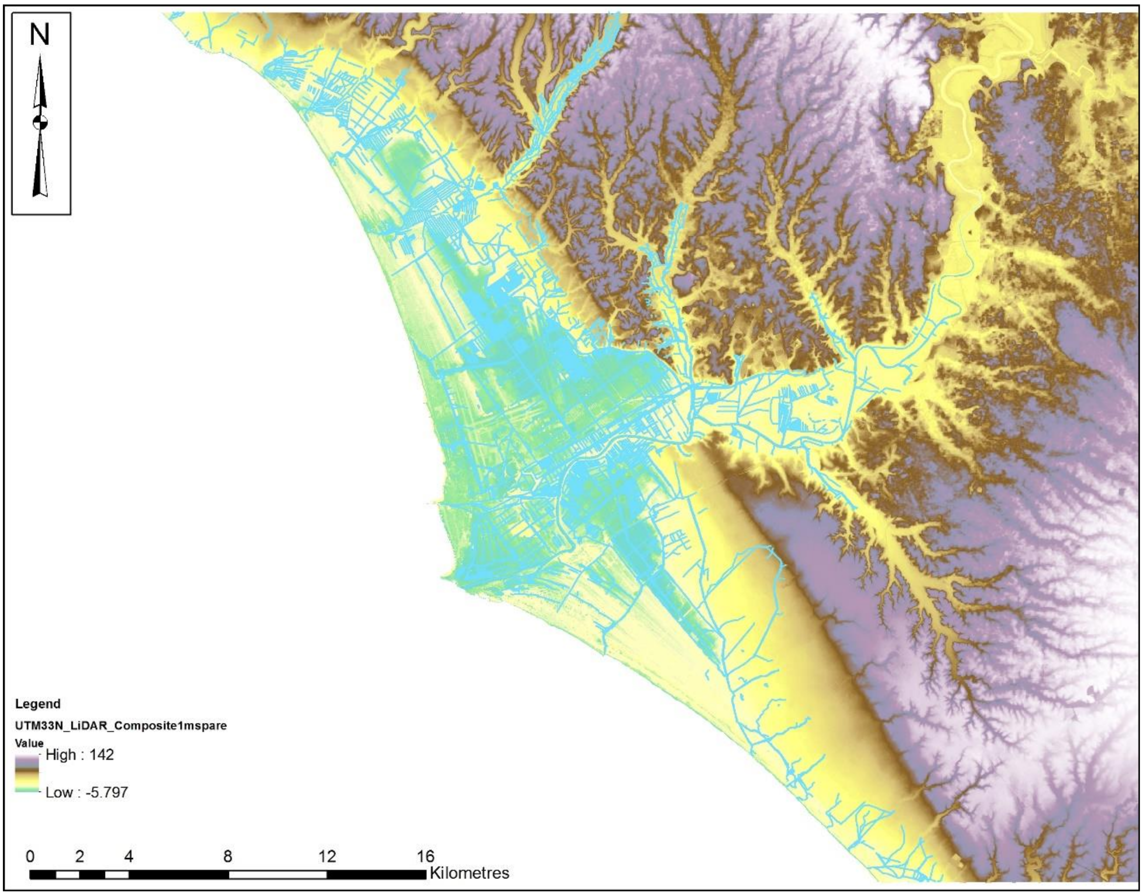

Figure 1.4 Map of the study area showing the course of the River Tiber and the principal tributaries, together with the bonifica drainage system of the Tiber delta (Elevation based on ASTER data. ASTER GDEM is a product of METI and NASA)

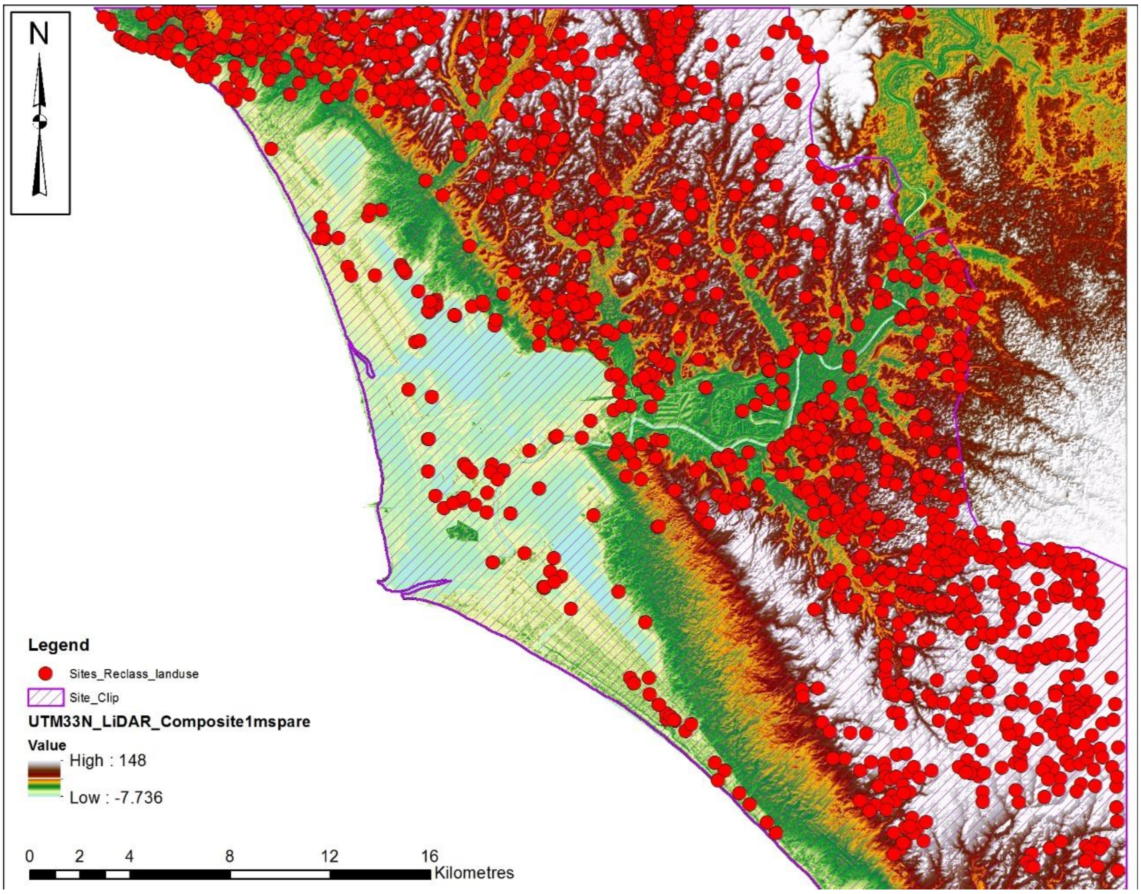

Figure 1.5 Map of the study area showing the area of the polygon used to define the sites used in the analysis.

A third interesting period of changing settlement and land use dynamics occurs with the increasing hegemony of Roman power and the system of rural settlement and agriculture on the fringes of the delta, and the use of the delta and lower river course for salt production, again potentially tied to the evolution of the river system and the increasing progradation of the delta and development of the floodplain. Thus, a large chronological span is considered for this research, allowing comparison of varied settlement and landscape dynamics over the *longue durée*.

The spatial and temporal constraints established above provide the definitive study area here. However, development of two factors influence the pattern of settlement and use of resources in this area in the 1st millennium BC. Firstly, the formation of large nucleated settlements prior to and during the Etruscan period occurs immediately to the north of the study area (including Veii, Cerveteri, Tarquinia, Pyrgi and others). Secondly, from around the 8th century BC the expansion of the nucleated settlement in the area of Rome becomes a more dominant factor, and the city of Rome by the 4th century BC gains hegemony ove the Tiber delta. Representing these very influential socio-economic changes is impossible through direct analysis of the settlement data, as the area chosen for analysis does not include the Etruscan settlements to the north, and the present study does not include the archaeological sites in the vicinity of Rome (see above). Thus, the most expendient way of including these factors, and the formation of large-scale settlements beyond the constraints of this research is to highlight their presence and influence when interpreting the factors affecting the establishing of settlements, the pattern of these settlements, and the exploitation of resources in the Tiber delta area.

1.4 Research Methodology

In order to investigate the changing nature of the study area, the archaeological and geoarchaeological components of the landscape were studied through an integrated analysis of existing archive material (Chapter 7), ethnographic and cartographic evidence (Chapter 4) and new survey data (Chapters 5 and 8). A major part of the work is formed by an analysis of the methods and approaches used in the study area. Existing documentary evidence was also analysed in the form of existing archive records and published reports on excavation and survey work in the area (De Rossi *et al.* 1968; Tartara *et al.* 1999; Amendolea, 2004), including data held by the *Soprintendenza Speciale per i Beni Culturali* *di Roma*[3],and the *Soprintendenza per i Beni Archeologici del Lazio*. This work was carried out between December 2006 and March 2019. Outside of academic sources, much of the data included within this study comes from requests to a number of institutions and organisations in Italy, including the Provincia di Roma, the Istituto Centrale per il Catologo e la Documentazione (ICCD), the Soprintendenza Archeologica di Roma and the British School at Rome amongst others. Geophysical survey data included in the study derives principally from fieldwork conducted by the author with different teams of surveyors during multiple phases of archaeological survey in the vicinity of Ostia Antica, Portus and the Isola Sacra. Grey literature and published sources for this data are cited in the text, however, the main publications for these surveys comprise Keay *et al.* (2005), Germoni et al. (2011) and Keay *et al.* (forthcoming). The computer-based analysis, interpretation and write-up of this thesis were conducted at the University of Southampton.

An analysis was made as part of this on the extent and availability of archive materials recently produced in the extensive development of the Tiber floodplain between EUR and Fiumicino (Morelli *et al.* 2004). In addition, new data was collated using non-intrusive methods of investigation. Continued programmes of fieldwork have resulted in collection of geophysical and topographic survey data (Keay *et al.*, 2005; Germoni *et al.*, 2011; Keay, Millett and Strutt, 2014; 2014a), borehole data (Goiran *et al.*, 2009; J.-P. Goiran *et al.*, 2010a) and fieldwalking evidence for the study area. The relatively new datasets compiled as part of the Sistema Informativo Territoriale Archeologico di Roma (ArchaeoSITARProject: http://www.archeositarproject.it/) also provided key information on the archaeology of the Tiber floodplain within the Comune di Roma. The compilation of datasets forms the basis of the archaeological model of the changing pattern of settlement over time.

In addition, this research incorporates study of remotely sensed data, including historical air photographic archives and analysis of multispectral satellite imagery for the central delta area (Keay et al. 2014; 2014a). All of this material was integrated into a GIS and related database of the study area, allowing the different strands of data to be geo-referenced and collated in an accessible format. The interrogation of these sets of data

[3] These were previously organised as the *Soprintendenza Archeologica di Roma* and the *Soprintendenza Archeologica di Ostia*. The area of Portus and Ostia are now overseen by the *Parco Archeologico di Ostia Antica.*

produced the analysis of patterns of continuity and change in the archaeological landscape of the lower Tiber and delta presented here.

1.5 The Contribution of this Study

Based on the preceding methodology, the contribution of this study is to the analysis of the pattern of settlement and the human ecology of the study area over a broad chronological span of time and integrate a diverse range of datasets to explore the nature of the landscape. It provides an overall picture of human settlement in the landscape of the Tiber valley that has not been attempted before across the entire area, drawing on extant datasets and the results of published works and new survey data. It presents an integrated strategy for modelling and assessing the landscape, and a measure of the benefits and limitations of the methodology used. Finally, the broad and overarching nature of this work means that a number of themes are developed and suggested for further study, and this provides a framework for deepening analysis in a number of areas, including research into aspects of the archaeology, focus on advancing the GIS aspects of the modelling and analysis of site distribution, and scope for further applications of survey and remote sensing techniques.

1.6 Outline of the Chapters

The research presented here has been organized into ten chapters including the introduction. Chapter 2 provides a synthesis of the geomorphological formation of the Tiber and the coastal plain during the Pleistocene and Holocene, and highlights the issues relating to the existing theories of its evolution. Chapter 3 relates the archaeological context of the lower Tiber valley, providing a general synthesis of the recorded excavations and work undertaken in the area, and relating this to a review of archaeological theory in Italy, including its origins and the classical approaches to archaeology, and defines the approach of the current study to the wetland and the area surrounding the Tiber delta. It highlights the lacunae in the evidence for the study area and defines the approach of the current research.

Chapter 4 assesses the nature of photographic and cartographic evidence relating to the lower Tiber area, with emphasis on its significance for settlement and land use in the wetland environment and providing nuance to the human element of life and subsistence in the area. This also elaborates on the limitations of the evidence in relating documentary evidence to the study area and timeframe of this research.

Chapter 5 establishes the archaeological research methodology, including the sources, processing and analysis of data, the relevance of different types of data and the contribution of different datasets and the methods of analysis.

Chapter 6 elaborates on the modelling of the geology, topography and land use for the study area, based on GIS datasets, and the geomorphological evidence covered in Chapter 2.

Chapter 7 sets out the archaeological record for the study area from published evidence, comprising sources of archaeological evidence, historic documentation, excavation and survey, and the results of recent survey. It discusses the validation and reclassification of the site database and outlines the classifications of site and rural settlement used for the GIS analysis of the study area.

Chapter 8 presents the site-based GIS analysis of the study area, and then uses this to elaborate on the settlement pattern and land use of two case study areas in the central part of the Tiber delta. This analysis utilises the site database, GIS coverages, plus air photographic evidence, satellite imagery and geophysical survey results, to compare published extensive data with the more intensive results of field survey.

Chapter 9 returns to the research questions, assessing the settlement pattern and land use for the period 3000 BC to AD 300, and comparing the results with evidence from other surveys in central Italy. It also provides an evaluation of the methodology, establishing the strengths and weaknesses of the approach.

Conclusions and proposals for future work are given in Chapter 10.

Chapter 2 : The Geology and Geomorphology of the Tiber and the River Delta

2.1 Introduction

The pattern of settlement and changing land use along the lower course of the Tiber and in the Tiber delta is influenced by the geological formations and landscape of the region and the anthropogenic interaction with the river and the surrounding landscape. This is not based on an environmentally deterministic framework, rather the natural changes and anthropogenic adaptation and interaction with the landscape that have influenced the 'environmental possibilism' of the wetland zone (Butzer 1982; Fekadu 2014). It is therefore key to the current research to understand the development of the area in terms of its geology and geomorphology, and the principal causes of the changes that have altered the environment.

This chapter establishes the basic modern topographic setting of the River Tiber (Section 2.2), its source and seasonality, its watershed and zone of influence. Section 2.3 then gives a framework of the broad geological formation of this area of Central Italy for the Late Pleistocene and Holocene geomorphological processes. Section 2.4 provides a basic summary of the development of the lower Tiber in the Holocene. Section 2.5 gives an account of the environment from the later Iron Age to the Roman period for the geomorphology. Section 2.6 outlines the nature of flooding and inundation of the lower Tiber. Section 2.7 provides a brief summary of the formations along the coastal littoral of the Tiber delta, principally the dune formations either side of the Tiber mouth. Finally, section 2.8 summarises the main issues affecting the pattern of settlement and land use in the study area, noting the key changes represented in the evidence that may have affected human activity between the wetland of the lower Tiber and delta from the Eneolithic to the Imperial Period (3000 BC – AD 300).

2.2 The River and its Setting

The River Tiber runs from its source in the Appennines of Umbria (Fig. 2.1) in a north-west to south-east direction. North of Rome it runs between the Sabini and Cornicolani (left bank) mountains and Monte Soracte, through the Tiber Graben (Borzi *et al.* 1998). The modern course of the river then runs between two distinct zones of volcanic activity formed by the Sabatini and Colli Albani volcanic districts (Marra *et al.* 1998) passing via Ponte Galeria and the alluvial floodplain to the Tiber delta, located on the edge of the Tyrrhenian basin (Amorosi and Milli 2001), where the river discharges into the Tyrrhenian sea. From source to the sea the river runs for a distance of 403km, from the foot of Monte Fumaiolo to the coast (Le Gall 1953, 6). The basin of the Tiber covers an area of 17,156km^2 (Fig. 2.2).

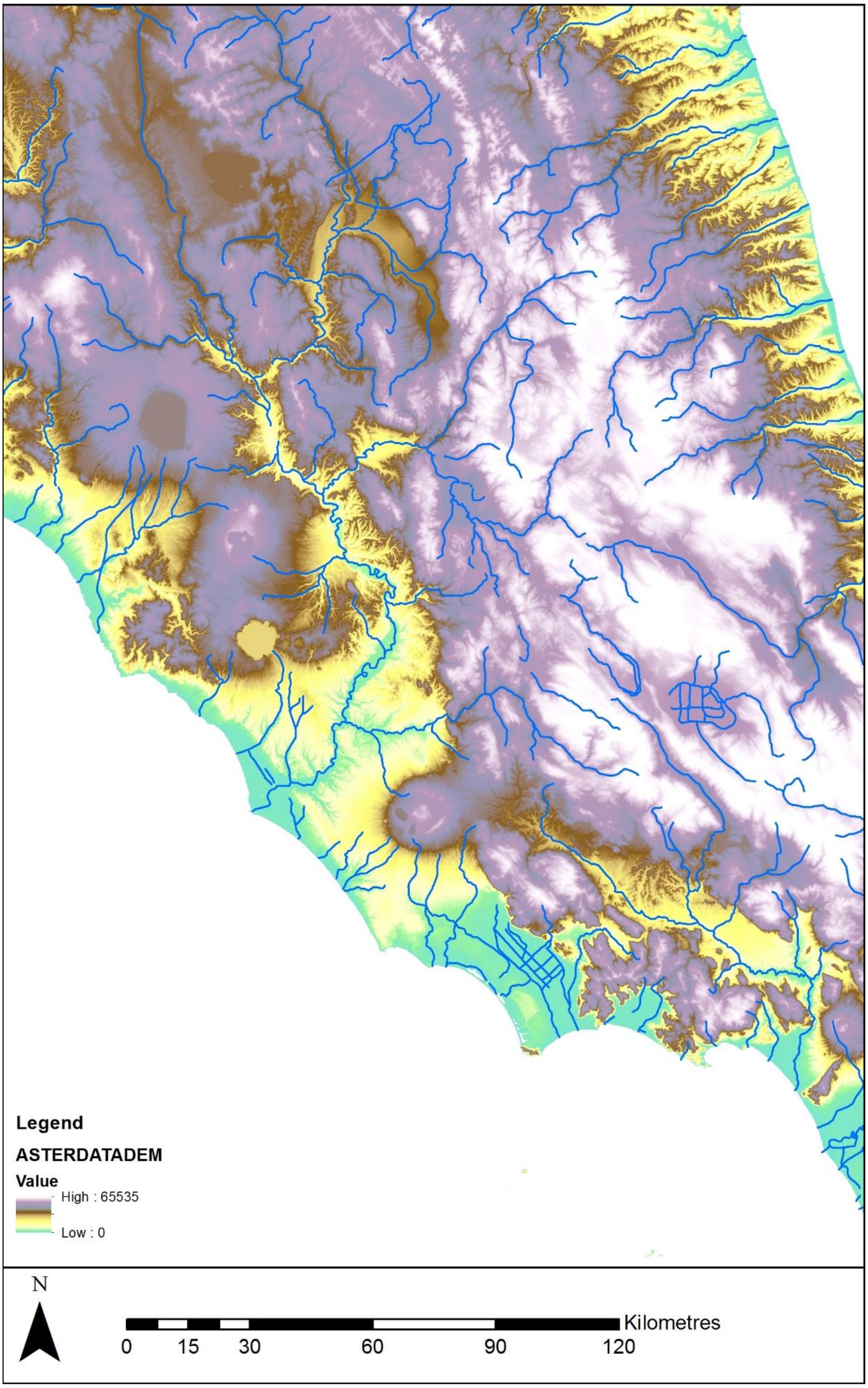

Figure 2.1The course of the River Tiber in relation to the modern topography (Elevation based on ASTER data. ASTER GDEM is a product of METI and NASA)

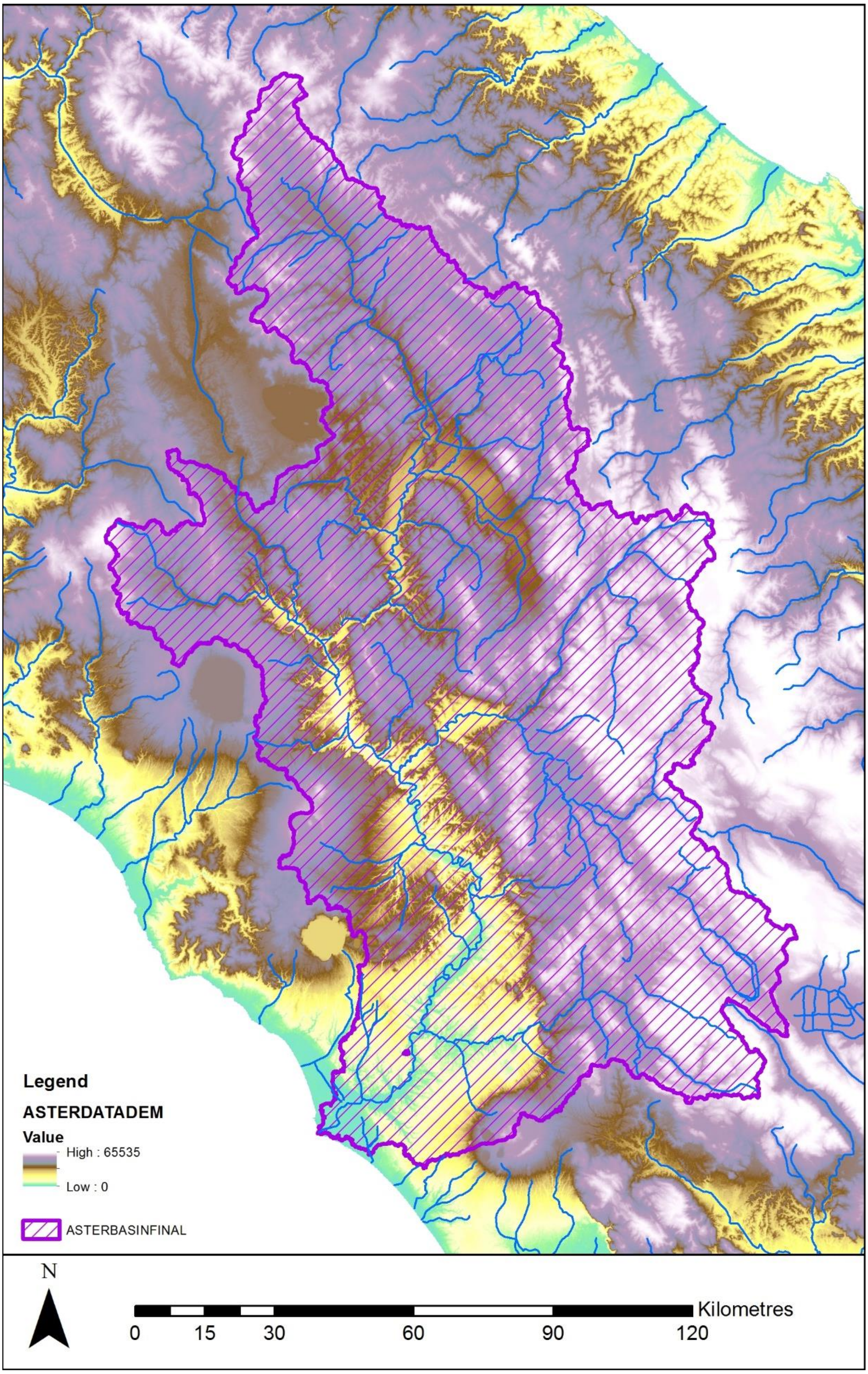

Figure 2.2 Watershed of the River Tiber (Elevation and Basin calculation by author based on ASTER data. ASTER GDEM is a product of METI and NASA)

2.3 Geological Development of the Tiber Valley

The geology of the upper part of the River Tiber is dominated by the Appennine mountain chain (Fig. 2.3), from which the river finds its source, and which lines the northern and eastern course of its upper reaches (Le Gall 1953, 8). The upper Tiber basin corresponds to topography which finds its origins in tectonic and volcanic activity at the end of the Pliocene (2.58 million years ago), and the formation of a series of lakes in the region. The upper basin corresponds with the location of one of these lakes, covering the valley of Clitunno and the area between Todi and Narni (Le Gall 1953, 8). The course of the ancient river in the area of the lakes flowed immediately out into the Tyrrhenian Sea. The later volcanic activity from the Alban and Sabatini areas was fundamental in the formation of the middle and lower reaches of the river (Le Gall, 1953).

The palaeomorphology of the region of Lazio is complex, comprising a variety of volcanic and sedimentary materials deposited between the Pliocene and Pleistocene. The formation of the area was marked by plate tectonics and eustatic fluctuation (Di Bella *et al.*, 2005). In most areas a stratigraphic gap is present which separates the Late–Pliocene and Pleistocene. In the area from Rome to the coast *Arctica Islandica* molluscs are found in sandy intervals or biocalcarenites (Di Bella *et al.*, 2005) occurring some metres above the base of the Pleistocene sequence. Peculiar conditions existed in the area of Rome suggesting scarce influence from kinetic phenomena caused by the morphology of the palaeo-coast (Di Bella *et al.*, 2005).

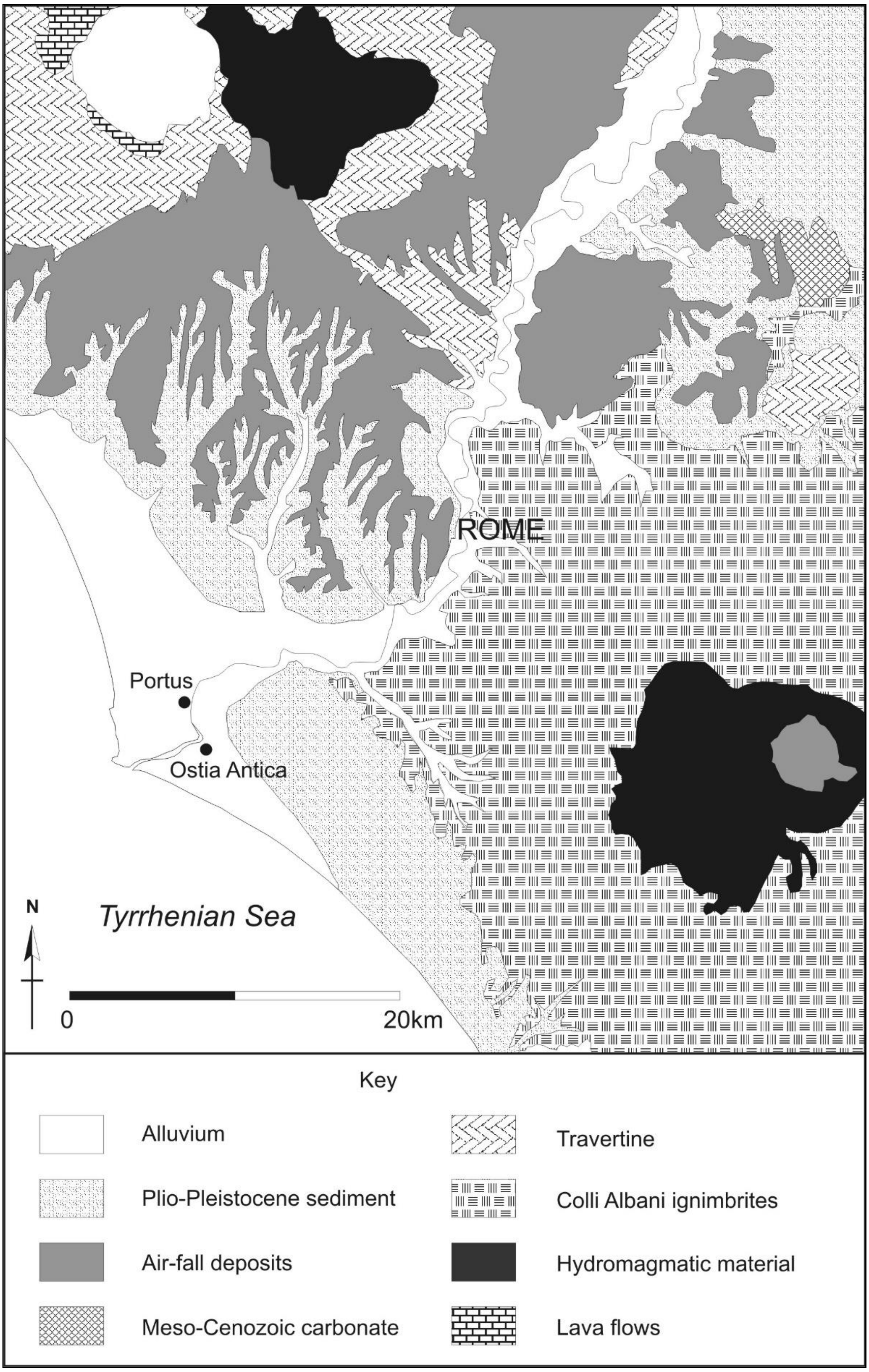

Figure 2.3 Base geological map of Latium and South Etruria (based on Borzi et al. 1998)

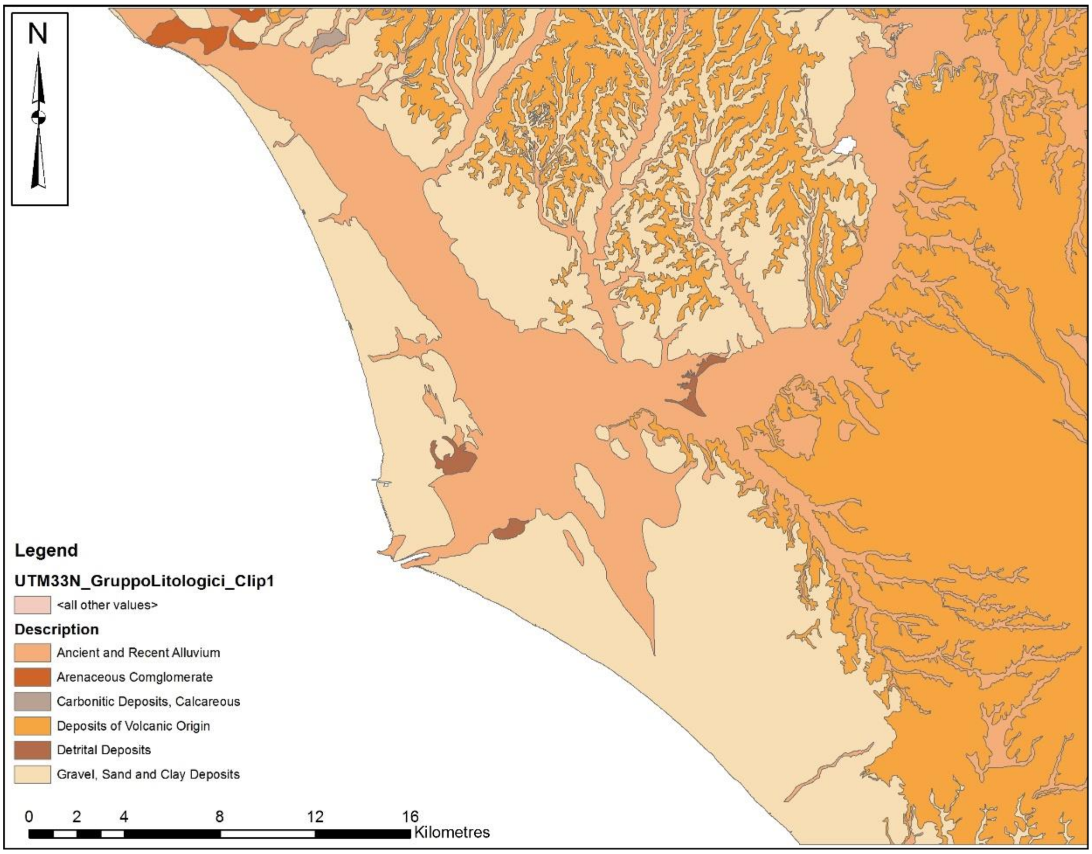

Figure 2.4 Geological map of the study area (based on data from the Provincia di Roma)

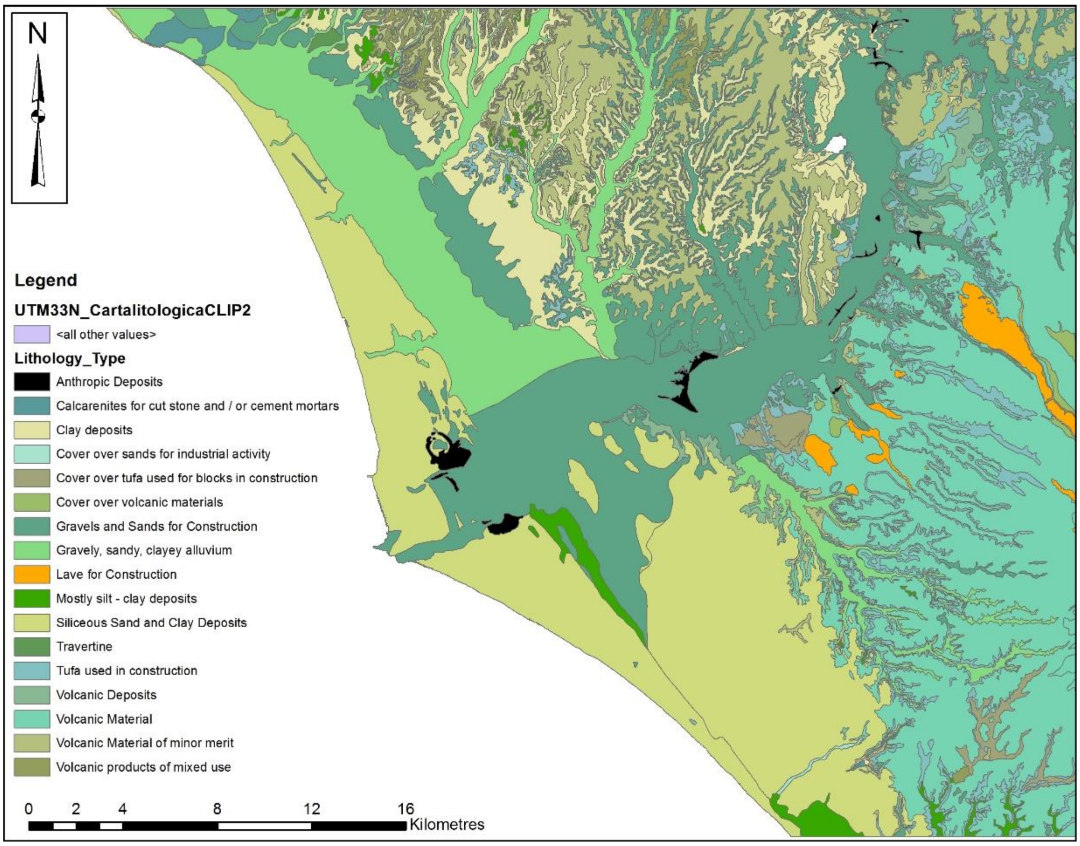

Figure 2.5 Lithological map of the study area (based on data from the Provincia di Roma)

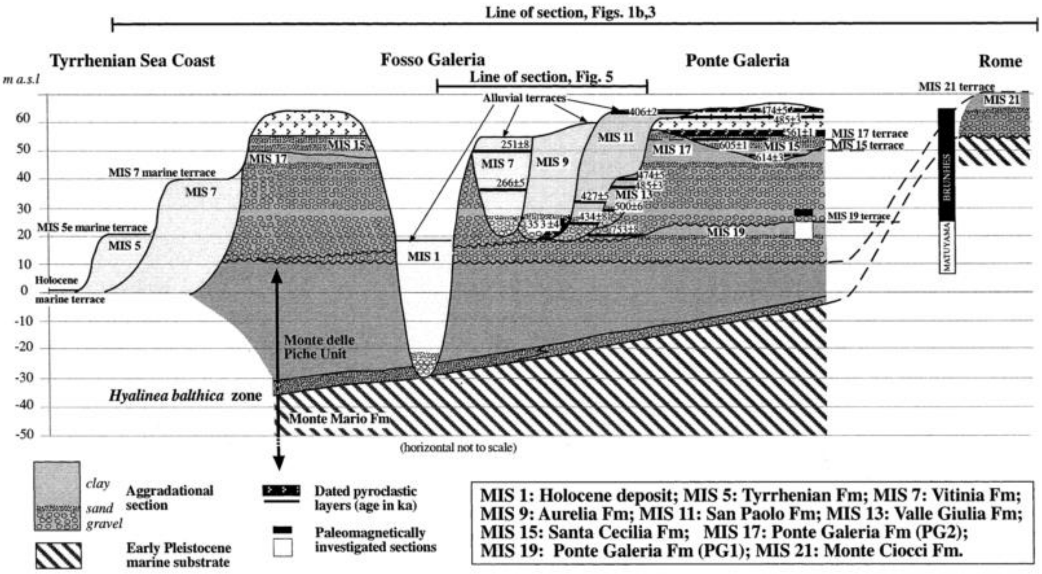

Figure 2.6 Composite aggradational sections for the lower Tiber river and delta, and tributaries, correlated with marine isotopic stages (Karner et al. 2001, 137)

The stratigraphic sequence of Pleistocene deposits that form the hills to the north of the Tiber floodplain (Figs 2.4, 2.5 and 2.6) have been analysed in the vicinity of Ponte Galeria. Deposits represent two depositional sequences, one of river pebbles and conglomerates, and the second of Eolian salmon sands (Conato *et al.* 1980; Marra *et al.* 1998, 51). According to Marra *et al.* (1998) the lower part of the Ponte Galeria sequence shows the transition from a continental to a deltaic-marine environment, prior to a regression with renewed continental deposits. A second unit then indicates a shift from a limno-brackish to a littoral environment (Marra *et al.* 1998). The second sequence is formed from a deltaic-marine deposit, overlain by a littoral-to-lagoonal deposit and Eolian sands. Both sequences correspond to the course of an ancient river, called the Palaeotiber (Marra *et al.* 1998, 54; Fig. 2.7).

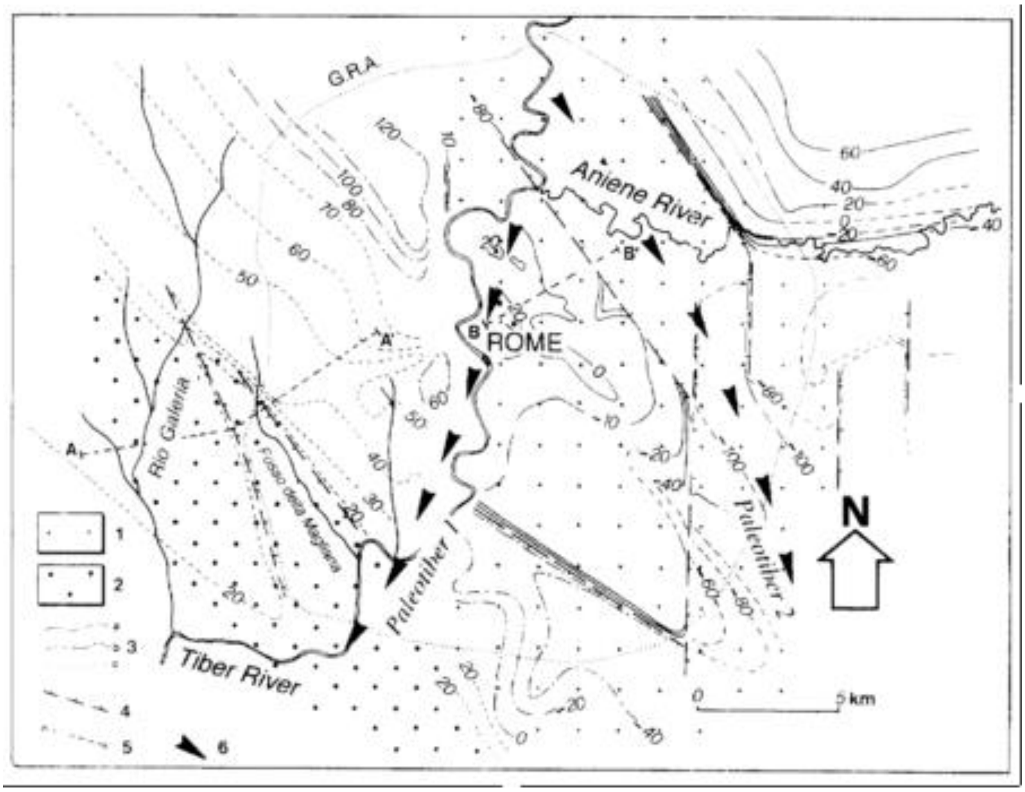

Figure 2.7 Location of the Palaeotiber (Marra et al., 1998)

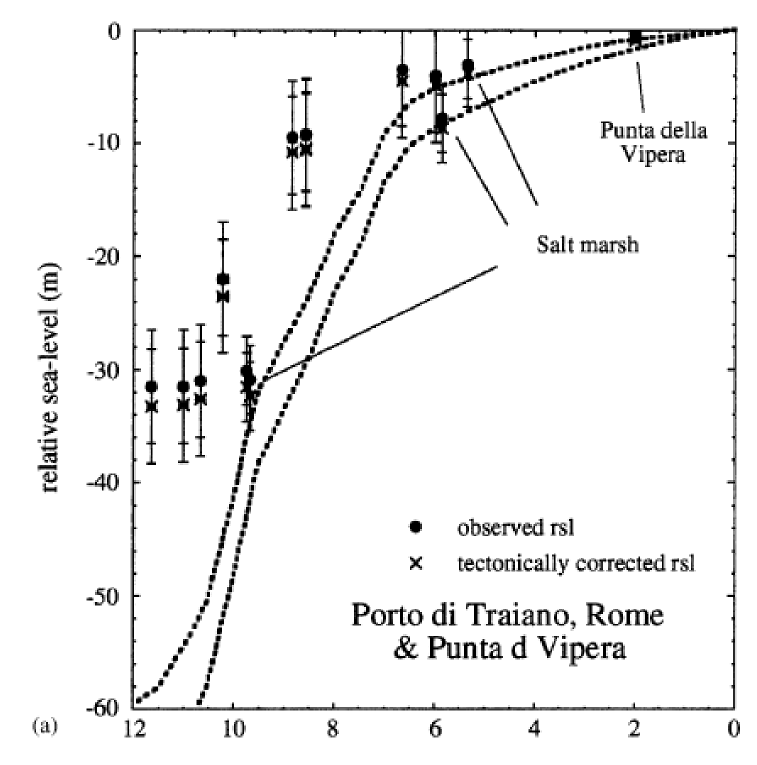

Figure 2.8 RSC curve for the Porto di Traiano, Tiber floodplain (Lambeck 2004, 1586)

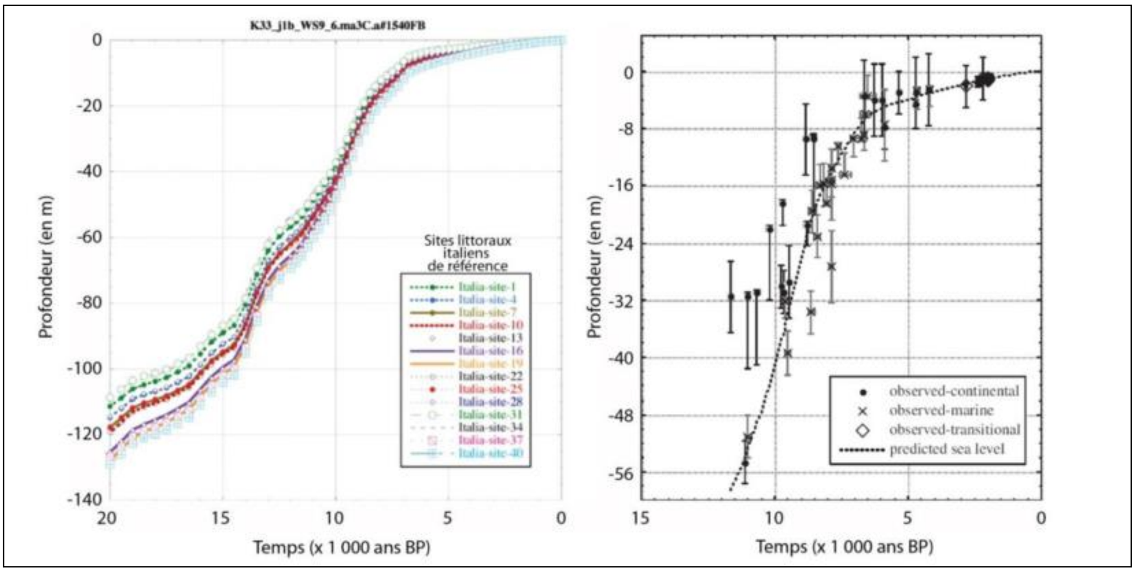

Figure 2.9 Graph of eustatic sea level change for sites in Italy (left) and for the Tiber delta (right) (Bellotti et al., 1995; K Lambeck et al., 2004; Salomon, 2013)

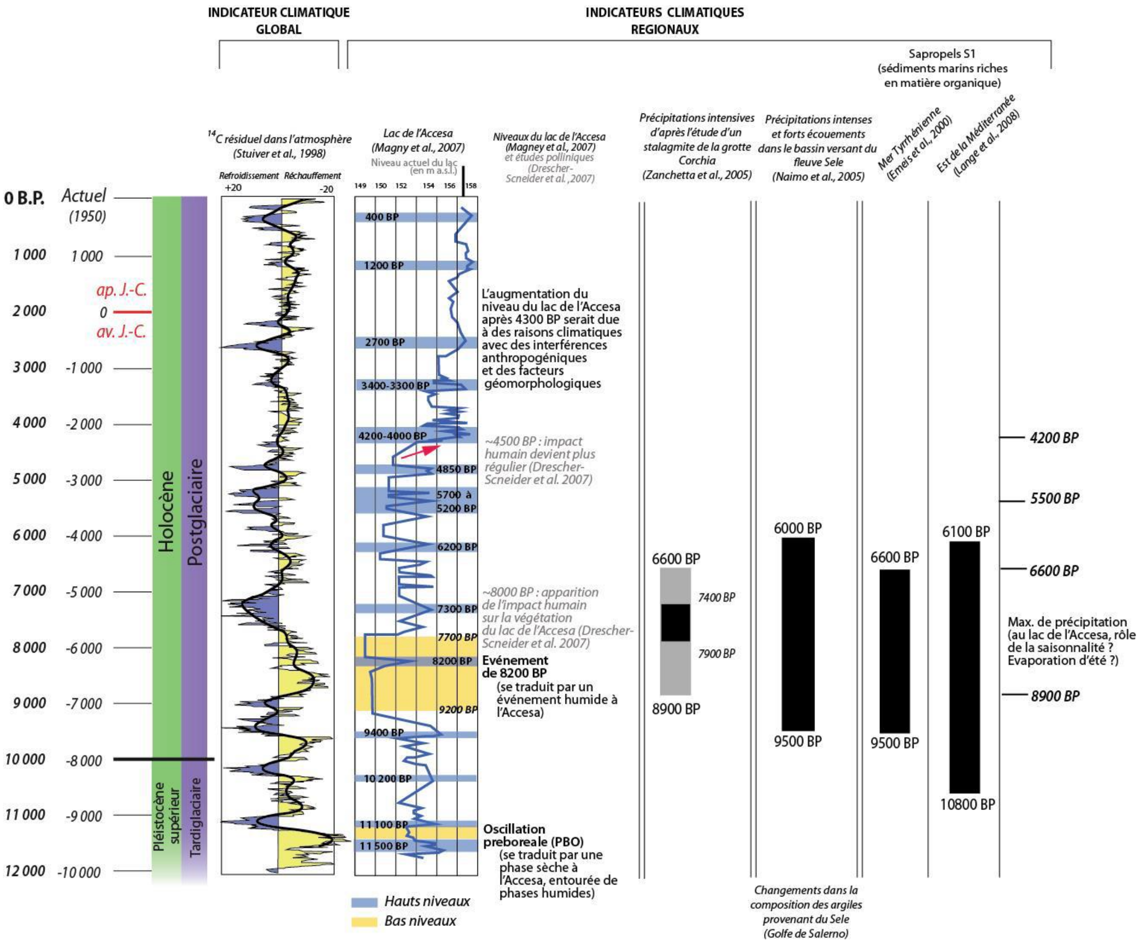

Figure 2.10 Climatic indicators for the earth, and for central Italy (Salomon 2013)

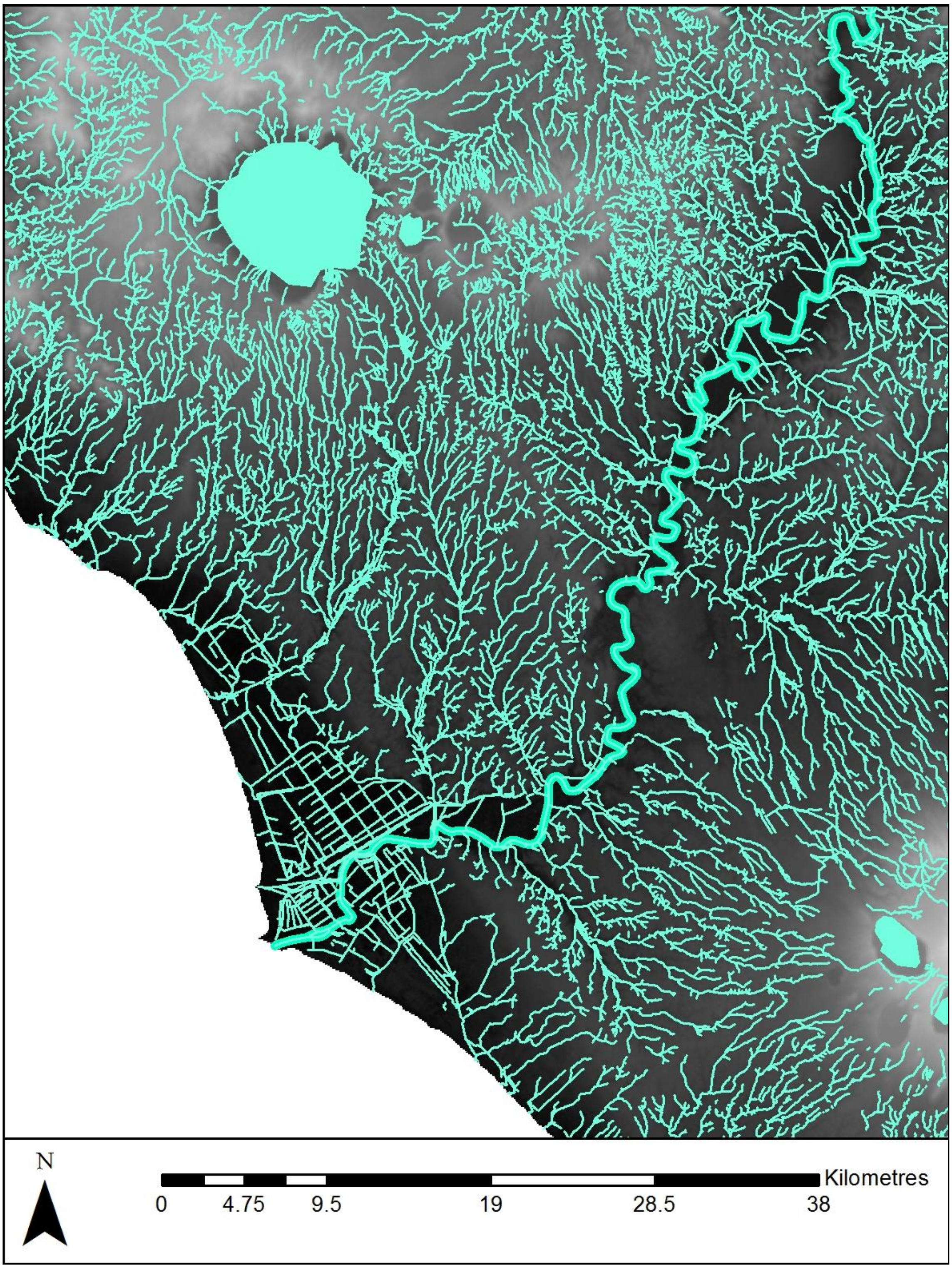

Figure 2.11 Drainage for the middle and lower Tiber Valley (Elevation based on ASTER data. ASTER GDEM is a product of METI and NASA)

2.4 The Holocene and the Geomorphology of the Lower Tiber River and Delta

The development of the lower Tiber valley in the Holocene has been dominated by patterns of erosion in the upper reaches of the valley and deposition along the lower part of the Tiber, the progradation of the river delta (Bellotti 1998; Giraudi *et al.* 2006; Giraudi *et al.* 2007; Bicket *et al.* 2010), and the eustatic sea level rise for the Mediterranean (Figs 2.8 and 2.9). The floodplain of the valley above Ponte Galeria is constrained by Pliocene and Pleistocene deposits along the left and right banks of the river. To the west around Rome its course is limited by the Monte Mario ridge, running from north to south parallel with the river, and the 'Argille Azzurre' of the Monte Vaticano unit.

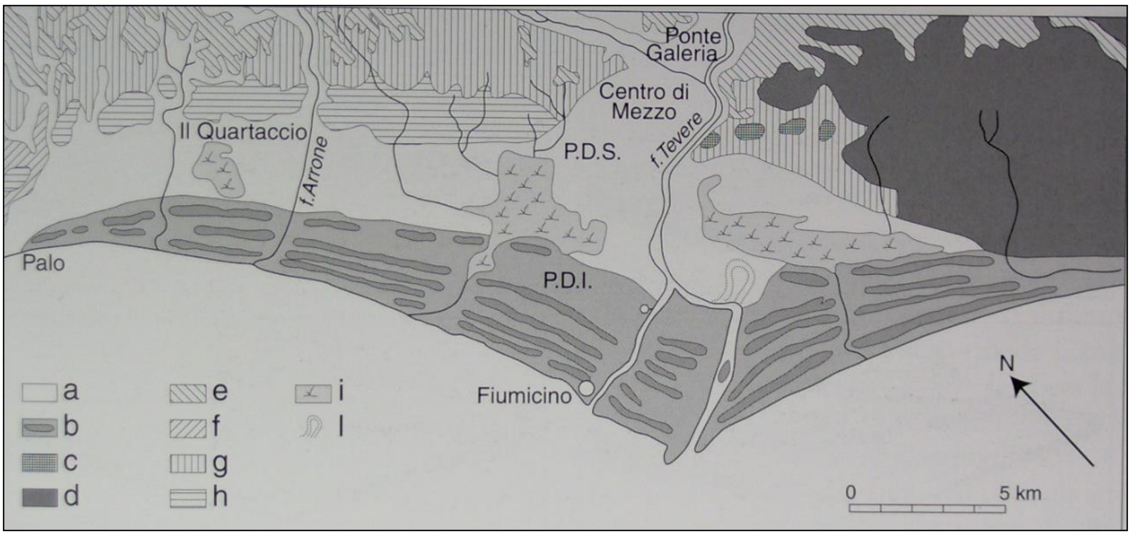

Figure 2.12 Geomorphology of the Tiber delta from (Bellotti *et al.* 1989) showing a-recent alluvium, b-recent dune and inter-dune sediments, c- ancient alluvium, d-reddish sands of ancient dunes, e-Pleistocene pyroclastic material, f-travertine, g clays and sandy clays with pebble lenses and malacofauna, h-gravels and sandy gravels, i-ancient lagoon, l-fossilised fluvial channels

The river is fed by a series of tributaries in the area of Rome (Fig. 2.11), with the right bank streams transporting sands, silts and gravels, and the left bank transporting silty-clayey sediments derived from the Alban Hills area of Lazio (Campolunghi *et al.* 2007, 31). The variation in transported material from the left and right banks of the Tiber is also visible from analysis of streams from the lower reaches of the valley, including at Vallerano and the Fosso di Malafede. Analysis indicates that areas most susceptible to subsidence are located outside of the historic centre of the city of Rome to the north, or around and to the south of the Caffarella water stream, along the Tiber floodplain and across the river delta (Campolunghi et al. 2007, 34), due to the fact that many of the deposits in the historic centre of Rome have completed their consolidation process.

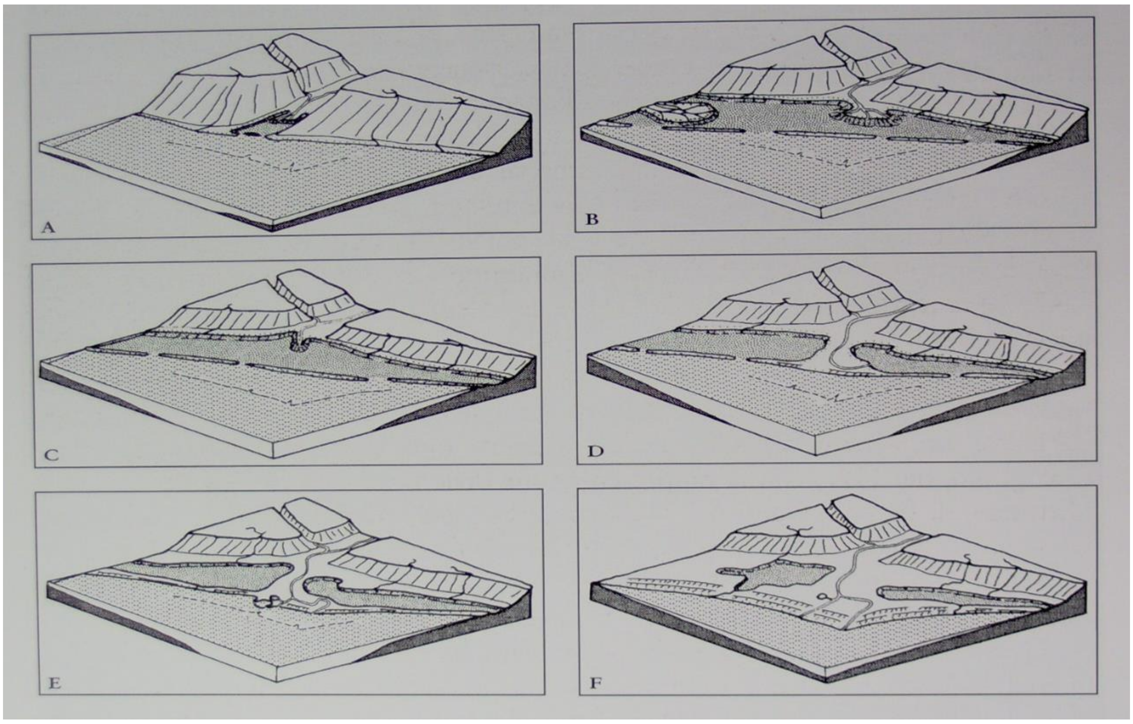

Figure 2.13 Isometric diagram taken from (Bellotti, 1998) showing the Tiber delta at A- c.14,000 BP, B- c. 9,000 BP, C- c. 5,000 BP, D- c.3,000 BP, E- 2nd century AD and E- Before the bonifica at the end of the 19th century

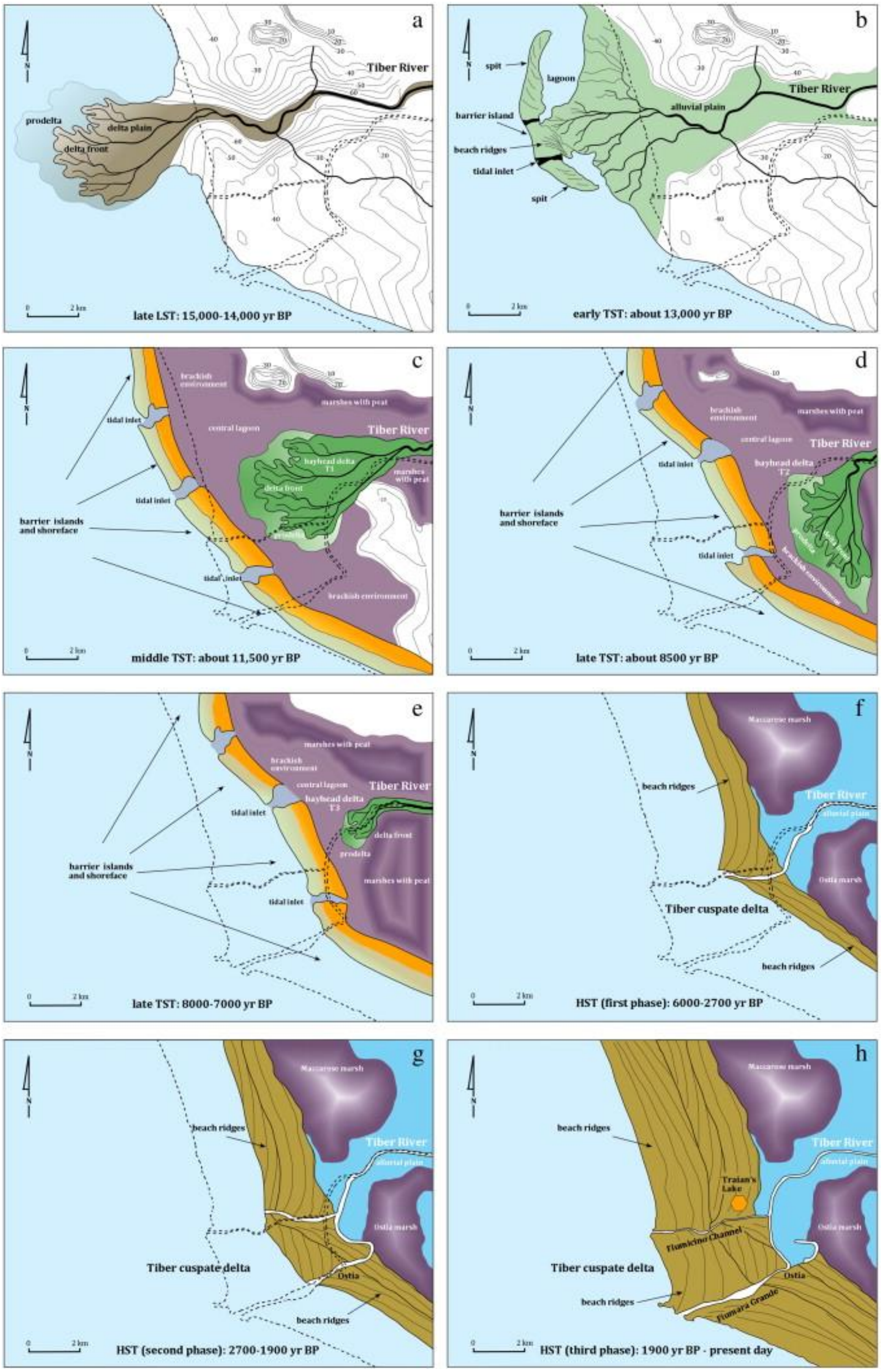

Figure 2.14 Proposed palaeogeographical model for the lower Tiber and delta (from Milli *et al*. 2013, 172)

The area to the north of the river Tiber, known as the Agro Portuense, consists of marine, dune, lacustrine and alluvial deposits (Arnoldus-Huyzendveld *et al.* 2005) dating to the Holocene period. This area is situated between two volcanic complexes dating to the middle Pleistocene (600,000 to 200,000 years BP), the Vulcano Laziale to the southeast and the Vulcano Sabatino to the north-west (De Rita et al. 1988; Arnoldus-Huyzendveld *et al*. 2005). The Tiber around Rome runs in the depression between these two areas, overlying sandy and clay delta deposits of the lower and middle Pleistocene, which in turn overlie Plio-Pleistocene marine clays (Marra and Rosa, 1995). The current landscape is therefore the product of volcanic deposits, fluvial incision, tectonic shift and sea-level change. The undulating landscape of the hills around Rome is separated from the coastal plain by several Pleistocene coastal terraces (Hearty and Dai Pra 1986; Arnoldus huyzendveld *et al.* 1993; Arnoldus-Huyzendveld *et al.*, 2005).

The deposits of the present coastal plain (Figs 2.12, 2.13 and 2.14) date to the Versilian Holocene transgression phase that occurred between 17,000 and 5,000 BP (Arnoldus-Huyzendveld *et al.* 2005). The river delta is subdivided into two parts; the inner delta comprises alluvial and marshy deposits while the outer delta consists of dune and beach ridges (Bellotti *et al.* 1995, 618). The development of the palaeo-environment of the lower Tiber in the later Holocene is linked to anthropic change to the environment of the Tiber valley and delta. This includes deforestation in the mountains and lakes of central Italy (Salomon 2013, 74) and, by 1200 BP, an increase in erosion from the denuded valley slopes, similar to erosion in the Biferno Valley, and along river courses in the region of Basilicata (Salomon 2013; Figs 2.13 and 2.14). It is the prograding nature of the Tiber delta, and the increased discharge rate and alluvial overburden along the floodplain and in the delta area that affects the visibility and depth of archaeological deposits within the aggradation area of the river.

2.5 The Tiber Valley in Historical Times (600BC – Present)

The lower Tiber Valley in historical times saw the accretion of many parts of the river valley floor and a migration of the river course. Arnoldus-Huyzendveld (2005) describes the Tiber as a self-organising system, in which the meander of a single curve in the river is not an isolated phenomenon, but an expression of the whole dynamic of the watercourse (Brown 1997). A number of instances exist for evidence of the course of the river in Imperial times; evidence for a river floor about 1m below the present level was encountered near Magliana. Evidence for a Roman bridge and dam were found (Catalli *et al.* 1993), with the dam constructed in the middle of the 1st century AD. Near the bridge a 700m long depression filled with gley was located, crossed by the bridge at a right angle (Arnoldus-Huyzendveld *et al.* 2005, 16). The dam was built to protect the Campo Merlo from flooding. Natural layers also showed evidence of at least two major floods in AD 15 and 36 (Le Gall 1953; Arnoldus-Huyzendveld *et al.* 2005). At Ponte Galeria investigations close to the Fosso Galeria tributary revealed the Roman valley floor below over 1m of fluvial sediment (Petriaggi *et al.* 1995; Arnoldus-Huyzendveld *et al.* 2005). A length of the Portus acqueduct was also located at the boundary of the well-drained soils to the north and the less well-drained soils to the south (Arnoldus-Huyzendveld et al. 2005, 18). Near the Fosso Galeria tributary an alluvial fan was distinguishable from the alluvial sediment. The distal part of the fan was buried below recent Tiber sediments, with ancient drainage ditches excavated into the alluvial fan area – a prime location for settlement. The inundation of the Tiber floodplain, a regular occurrence at Rome and below the city, was one of the dominant factors in shaping and affecting use of the delta in the historical period.

The most prominent change to the course of the Tiber in the medieval and post-medieval period occurred at Ostia in 1557 (Bellotti 1998; Keay *et al*. 2013, 341), when the river flooded and breached a bend in the river, changing its course (Arnoldus-Huyzendveld and Paroli 1995; Arnoldus-Huyzendveld *et al.* 1997). During excavation at this point on the line of the Tiber, three phases of lateral meander displacement were noted; one Roman from the 1st century AD, and two from the late medieval period, in 1530 and 1557 (Arnoldus-Huyzendveld et al. 2005, 19). These were correlated with a list of known floods (Di Martino & Belati 1980, 19).

In terms of the coastal environment, a number of factors need to be considered, including Neotectonic movement (Arnoldus-Huyzendveld 2005, 19). Evidence for the coast of Lazio suggests a lift of 20mm per century since 125,000 BP (Leoni and Dai Pra 1997, 94) for the Civitavacchia area. Real sea level change has had a greater effect (Leoni and Dai Pra, 1997; Antonioli and Leoni, 1998) with data from the coast of Lazio showing an average sea level rise in the Republican period of 3.9mm per year, and in the Imperial period of 1.2mm per year (Arnoldus-Huyzendveld et al. 2005, 19), with minor changes in the medieval period.

The variation in sea level in the central Mediterranean is the product of three factors; the eustatic lift in this part of the globe, the glacio-hydro-isostatic change and the tectonic variations. Records of change for these governing factors is most present and reliable for the period after the last glacial, covering the Holocene (Lambeck *et al.* 2004, 1567). The measurement of sea-level change along the Tyrhennian coastline on the grand scale is reliant on evidence from different sea level markers, with analysis of deposits containing varying species of bivalves, gastropod and lagoonal species, assessment of raised beaches and beach rock, and observed sea-level change all playing a part in establishing and refining the record of sea-level change. Data for the Tiber delta based on borehole samples relies on the dating of peat, marsh and wood fragments (Belluomini *et al.* 1986; Lambeck *et al.* 2004). The tectonic action in the area has been interpreted as showing signs of a slow rate of uplift (0.15 ± 0.05mm yr^{-1}) in the Late Holocene, although recent study (Marra *et al*. 2013) suggests a drop in sea level between 3000 and 2000 BC (see modelling of the delta in Chapter 6).

The shoreline at the mouth of the Tiber (Figs 2.13 and 2.14) has migrated seawards by 4-5km in the past 2000 years, and the Claudian and Trajanic harbours silted up in the early medieval and medieval periods (Arnoldus-Huyzendveld *et al.* 2005, 19). Arnoldus huyzendveld and Pellegrino (2000) suggest an enlargement of the delta formation linked to an increase in the sediment load of the Tiber, caused by a change in land use. The effects of these changes were recognised certainly from the 14th century onwards (Arnoldus-Huyzendveld et al. 2005, 20). Changes may also be linked to climate variations in the Middle Ages, and the decay of water and soil conservation measures in later antiquity, leading to the development of younger valley fills (Vita Finzi 1969, 101). This all led to an increase of fluvial sedimentation, an increase in the rate of the extension of the coastline, and an increase in the meander amplitude of the Tiber.

Opinions of authors diverge in relation to the earlier coastal formations of the Tiber delta and its position in the 1st century AD. On two occasions in 1999 the Roman beach was located in the area of Isola Sacra in about the same location as seen on the Carta dell'Agro (Arnoldus-Huyzendveld *et al.* 2005; Comune di Roma 1987). The absolute level of the beach was +0.60m, but this does fit in with the sea level changes hypothesised by Leoni & Dai Pra (1997) as this would have conceivably been the back shore of the coast (Reinbeck & Singh 1980, 345). Debate is more intense in relation to the shoreline to the north of the Claudian harbour (Arnoldus-Huyzendveld et al. 2005, 21). Arnoldus-Huyzendveld summarises the various avenues of thought on the subject. Castagnoli (1963) hypothesises the line of the coast alongside the right Claudian mole (Arnoldus-Huyzendveld et al. 2005, Fig. 2.5). Both the Servizio Geologico D'Italia (1967) and Testaguzza (1970) give different locations for the coastline, as does the Carta dell'Agro (Comune di Roma 1987).

Some discussions suggest a lateral movement of the course of the Tiber in the Holocene, with a progression of the river course towards the south in the meander belt of the valley (Giraudi *et al.* 2007) in particular for the second half of the Holocene. According to Giraudi the Tiber discharged into the Mediterranean from two mouths from the 8th to 3rd century BC (Giraudi *et al.* 2007, 1). His work was designed to inform about the palaeo-geography of the centre of the Tiber delta in the period before the construction of the ports of Claudius and Trajan, comparing diverse hypotheses along the way. Most work of the 19th and 20th centuries for this area has been based on sedimentary analysis and tying in of data with documentary and historical evidence, however, the radiocarbon dating of sediments of less than 5000 years old has not allowed an adequate reconstruction of the late Holocene period. Utilising geomorphological data has shown that the pattern of change was more complicated than originally thought (Giraudi *et al.* 2007, 2). At least until the 9th and 8th centuries BC the mouth of the Tiber was situated to the south west of the port of Claudius close to the present course of the Fiumicino, and it was only at some time from the 4th century BC that the course changed, moving closer to its modern line.

Two studies have been performed in the area recently, one (Arnoldus-Huyzendveld *et al.*, 2005) concentrating on the geological formations of the zone, and the second (Morelli *et al.* 2004) looking more at the archaeological material. One interesting find was located some 1000 to 1700m to the north of the port of Claudius; an ancient beach with remains of amphorae of unknown date behind dunes dated to the 1st century AD. On the basis that the beach and port were roughly rectilinear in shape, it is hypothesised that the beach would have been located some 300-400m from the eastern extremity of the northern mole of the port of Claudius (Arnoldus-Huyzendveld *et al.* 2005; Giraudi *et al.* 2006). Arnoldus-Huyzendveld suggests in fact that the northern mole would have therefore been attached to the mainland along its eastern length. The fieldwork in 2001 and 2002 encountered the Roman coastline in three locations, showing the level of the beach to be +0.75m above sea level, close to the altitude of the Isola Sacra sites based on a core taken to the south of the Fossa Traiana.

Important data have also been retrieved from the collection of dunes and bodies of fresh and saline water to the north of the Porto di Claudio (Morelli *et al.* 2004; Giraudi *et al.* 2007). These suggest the presence of a lagoon of freshwater situated between dune cordons. The ceramic material was datable to the 2nd and 1st centuries BC. At sites 5 and 6 faunal remains from salt water were found. Arnoldus-Huyzendveld *et al.* (2005) suggests that the deposits seawards of the 1st century beach are evidence for post-Roman coastline advancement (Arnoldus-Huyzendveld *et al.* 2005, 21). Also, excavation of sediments in the dune area suggest that the Holocene dunes must have been a zone where groundwater was close to or even at the surface – groundwater now being 0.2-0.5m below sea level, with its level controlled artificially (Arnoldus-Huyzendveld *et al.* 2005, 26). This is all evidence for freshwater springs, such as those present at Ostia Antica (Ricciardi & Scrinari 1996, 14) and in the Pianabella area. The pre-Roman age of these dunes is also pointed at by the well-developed soil type (Arnoldus-Huyzendveld et al. 2005, 26) with Bradford (1957) recognising the chain of Pleistocene 'islands' from Portus to Castel Fusano. The Republican settlement at Ostia was, in essence, founded on a firm and stable shoreline (Bradford, 1957, 243).

Arnoldus-Huyzendveld *et al.* (2005) state in conclusion that the landscape is essentially pre-Roman, part of the glacio-eustatic sea-level rise around 5,000 BP, when the external rim of the lagoon was stabilised. The sea level would never have reached the area of the Holocene dunes, although it may have reached a temporary position on the seaward side. It is also stated that a large inlet on the shoreline at the place indicated on geological maps, suggesting that by the 1st century AD a new environmental equilibrium was reached in the Tiber catchment, maybe of anthropogenic origin. Bellotti *et al.* (1989) suggest that the only connection between the sea and the Maccarese lagoon was located at the Foce dello Stagno, 4km to the north west of the Claudian harbour. All of the data seems to suggest that the inner margin of the Claudian harbour was cut into the Holocene dunes, although towards the north this corresponded with an interdunal lagoon.

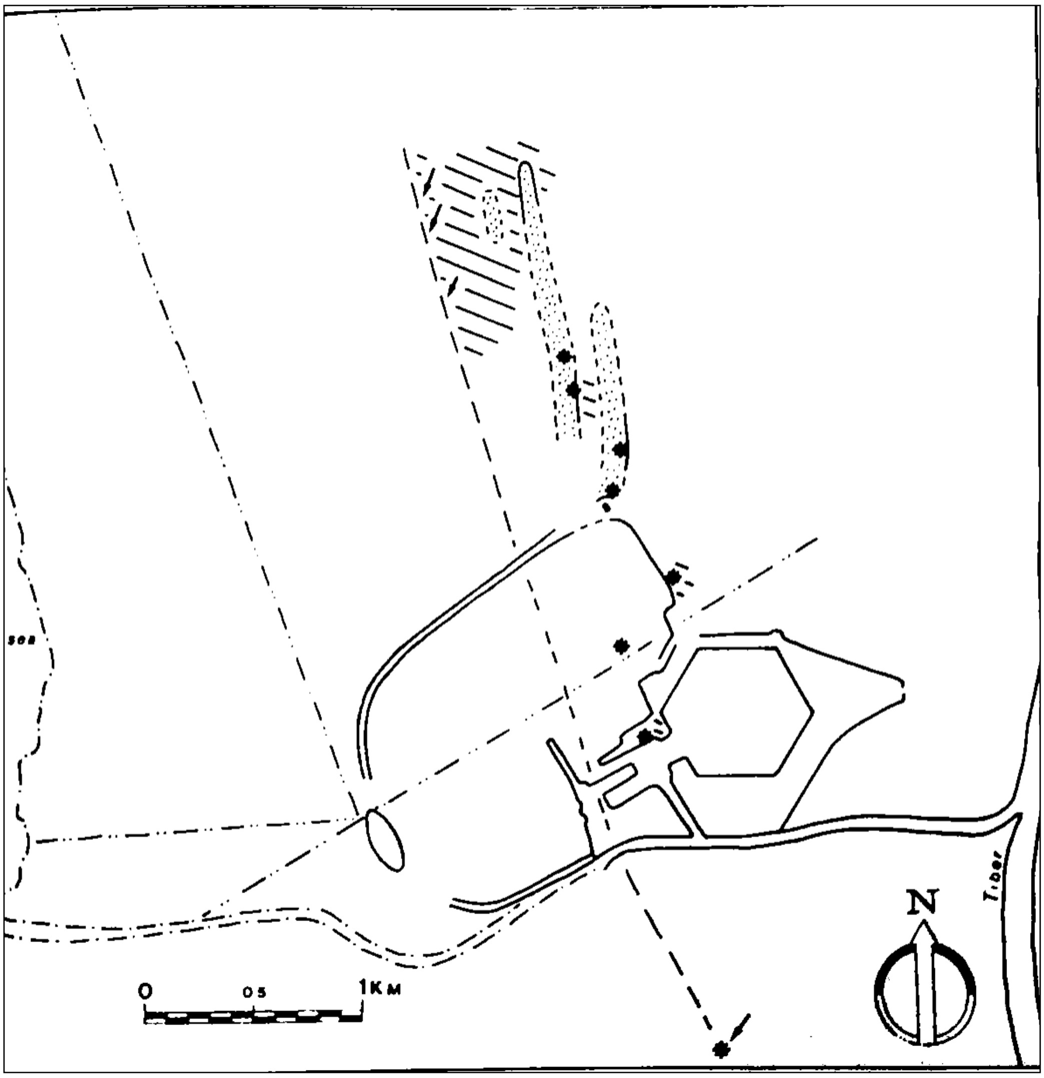

Figure 2.15 Schematic diagram of the dune systems and inter-dunal lagoons cut by the mole of the Claudian harbour (Arnoldus-Huyzendveld *et al.*, 2005)

The data tie in to the hypothesis of the presence of a northern entrance to the Porto di Claudio. Despite these assertions, work that has been produced across the delta while these reports were in press suggest other elements in the development of the zone (Giraudi *et al.* 2007, 3). In the north-west area of the Porto di Claudio there are remains of littoral cordons of deposits related to a depression outside of the northern side of the port (Fig. 2.15). Giraudi's criticism of the work by Arnoldus-Huyzendveld and Morelli is that their work has not been given sufficient contextualisation in relation to the geomorphology of the river for it to be sound. Giraudi instead has based his analysis on air photographic evidence from the 1950s, and then carried out fieldwork to ask particular questions of the data. He states that the recent studies over-simplify the development of the coastal littoral (Giraudi *et al.* 2007, 4). It is therefore possible that in the area 1km to the north of the port no sign of coastal erosion is actually located, and that it does not follow that the exact location of the 1st century AD beach has been found by fieldwork, an idea that has been advanced without proper chronological evidence being established.

In the area to the north and north east of Monte Giulio there are sediments showing the location of saline water and ceramics from 1st to 4th centuries AD, together with a depression in the topography that previously was attributed to a northern entrance to the port linking the Claudian basin with the sea. This cut some of the littoral cordons, but was then blocked by the development of further lines of deposits. This pattern is visible in the modern terrain and in the map of Amenduni (Genala 1884). The presence of faunal remains associated with saline water indicates that this must represent the remains of a lagoon linked to the sea or a break in the coast allowing the passage of salt water (Giraudi *et al.* 2007). Excavation has not allowed any idea of the age or depth of deposits for this area, although the presence of a 1st century AD tomb below the level of some deposits suggests the presence of the saltwater here and an increase in the level of the water in this period (fitting with some hypotheses about a 1m rise in sea level between the 4th and 1st centuries BC, and a 0.2m rise in the 1st and 2nd centuries AD, then 0.3m thereafter). A further site noted by Giraudi *et al.* (2007) indicates an area of freshwater, marked by a sub-circular depression measuring 50-60m in diameter. This was excavated into the dunes and is older than the 1st century AD. This forms part of a pattern of six depressions of homogenous dimensions visible from air photographs. The overarching picture for the outer Tiber delta is of a landscape dominated by archaeological remains from 4th century BC onwards, with 3rd and 2nd century BC deposits located to the north of Portus, and at the settlement of Ostia, indicating that a stable land surface was present by this time. Most of the archaeological deposits date from the 1st century AD onwards, and formation of the port complex.

2.6 Inundations of the Tiber and the Alluvial Deposition in the Floodplain and Delta

The river regime of the Tiber is affected by the levels of precipitation in the river basin, with the highest precipitation falling in the months of October to April, and with higher levels of precipitation in the mountains around Rieti, and lower levels for the area around Rome and Fiumicino (Salomon 2013, 23).

The nature of possible settlement in the floodplain and delta is dealt with tangentally in a number of classical sources. Livy (4.49.2-3) notes devastation of fields and farmhouses due to the Tiber overflowing its banks (Aldrete 2007, 16), and Cassius Dio (37.58.3-4) noted that a great number of boats at the mouth of the Tiber were sunk (Aldrete 2007, 19).

Average rainfall for the period 1921 to 1990 has been measured by 40 stations in the Tiber basin (Aldrete 2007, 58; Fig. 2.16) indicating higher levels in November and December. The river discharge as measured at Ripetta in Rome (Aldrete 2007, 59) indicates the highest river discharge in the months from December to March (Fig. 2.17), although annual discharge when plotted across the 20th century shows significant variation year by year (Salomon 2013, 26).

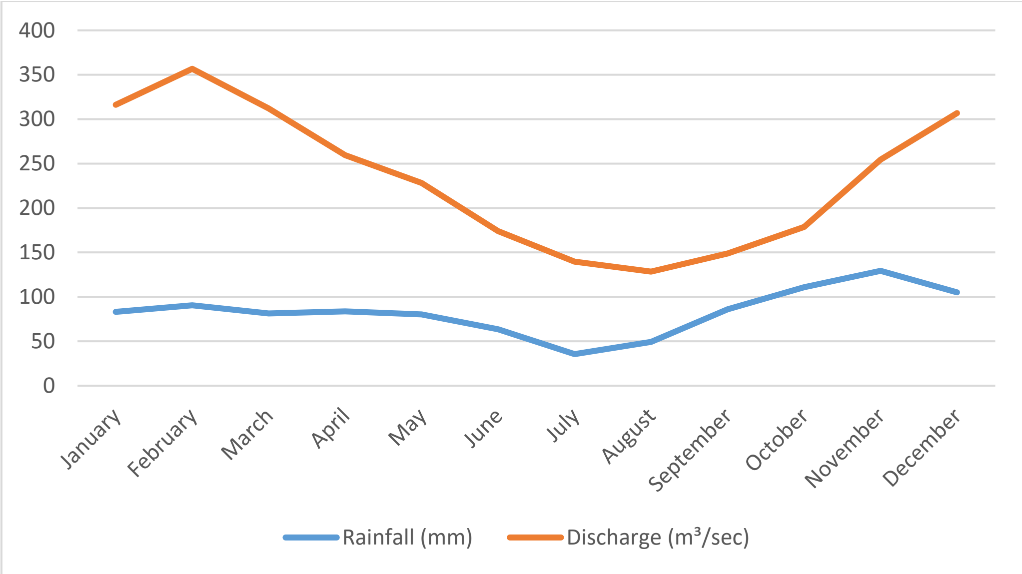

Figure 2.16 Average rainfall in the Tiber Basin 1921 – 1990, and discharge for the same period (after Aldrete 2007)

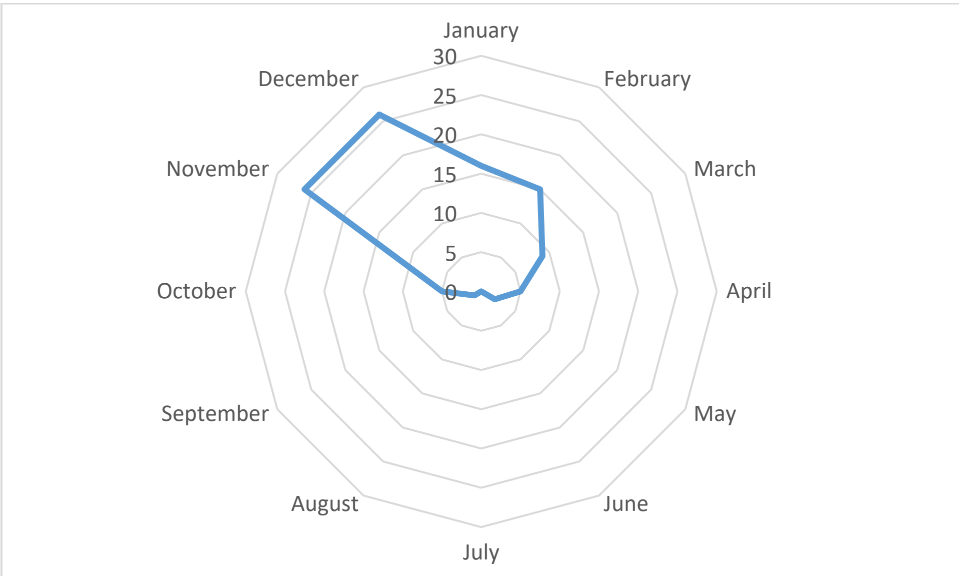

Figure 2.17 Radar chart showing the number of recorded flood episodes by month from available records starting in AD 791 (after Aldrete 2007)

Run-off in the Tiber Basin is augmented by the steep slopes and impermeable nature of the geology (Le Gall 1957, 12), although sedimentary run-off varies across the basin (Salomon 2013, 32).

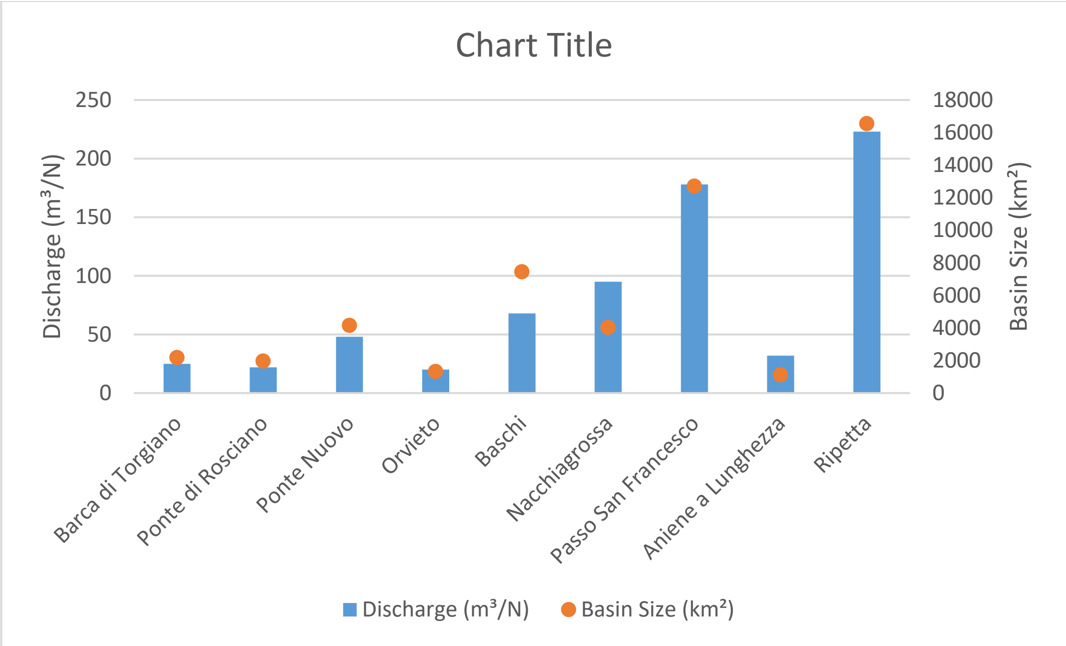

Figure 2.18 Average discharge at key locations in the Tiber Basin and the basin size of the principle areas (after Le Gall 1957, 13)

It is the velocity of the run-off and discharge from the basin that dictates the strength and level of flooding along the course of the lower Tiber (Le Gall 1957, 20). Prior to the modern development of the embankments of the Tiber at Rome and further downstream along the course of the river, to prevent flooding of the delta and river floodplain, regular flooding of the river is recorded from 5th century BC onwards, with flooding recorded in photography in the early part of the 20th century in Rome and in the Tiber delta (see Chapter 4; Figs 4.10 to 4.12), and a column erected in 1704 on the stairs of the Porto di Ripetta (Funiciello *et al.* 2006, 89) with the flood levels of preceding flood evets recorded on the stone. The quantity of discharge and the amount of sediment carried down the Tiber increased during and after the classical period, due in part to deforestation in the upper and middle Tiber Valley (Le Gall 1953, 29). The deposition of the sediment as alluvium led both to the increased progradation of the Tiber delta at the river's mouth, and the increase in depth of alluvium overlying parts of the delta, principally those in the river floodplain and in the zone to the north of Portus and across the *Campus Salinarum Romanum*. The discharge of sediment into the Tyrrhenian Sea can be seen in the discolouration of the water around the mouth of the Tiber (Le Gall 1957, 29).

The tributaries of the Tiber give indication as to the variable run-off feeding the main Tiber. While their discharge correlates with their different basin sizes (Fig. 2.18), some of the tributaries, including the River Aniene, give limited levels of discharge. The average level of discharge is, however, strongest at Ripetta in the main Tiber channel.

In terms of the regularity of flooding of the Tiber valley, the recorded events commence in 414 BC with the accounts of Livy (Aldrete 2007, 14; Bersani 2004, 26; Le Gall 1953, 35), with classical authors presenting varied levels of detail in their accounts.[4] The first marker presenting an approximate elevation for the height of flooding dates to AD 1230, and accounts for markers of the elevation of flood episodes continue from this date. From 1702 flood measurements were taken from the station at Ripetta (Aldrete 2007, 241). The frequency chart (Fig. 2.19) shows that the recorded events increased in the 19th and 20th centuries due to the more consistent systems of recording. Across the records the flood events that reach over 18m are few (Fig. 2.20) and as might be expected the more extreme the flood event, the rarer the occurrence.

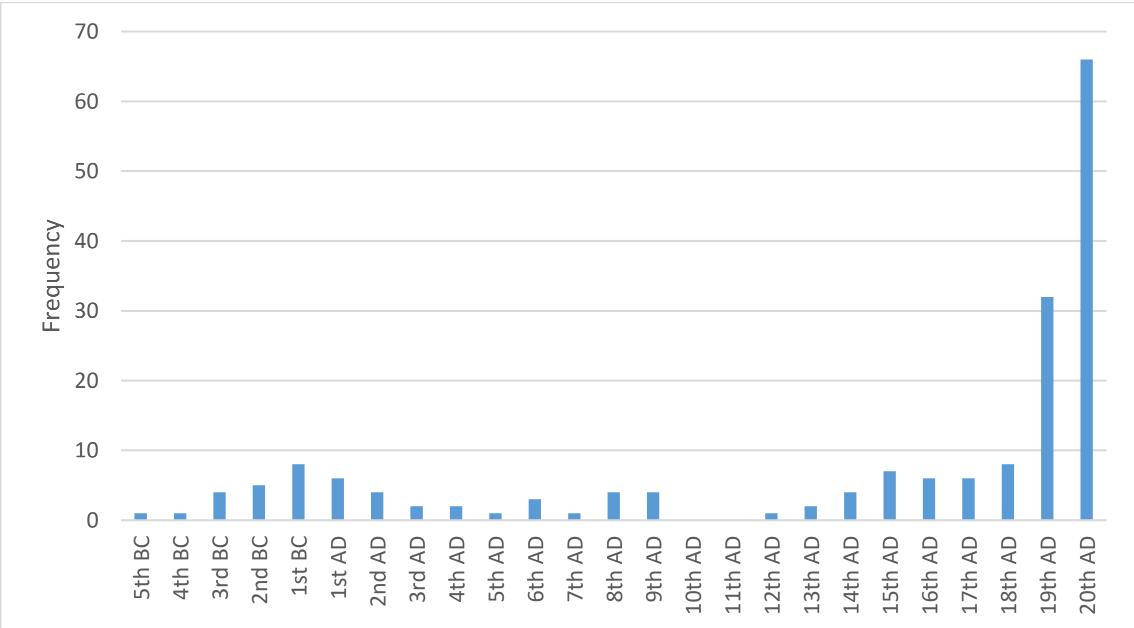

Figure 2.19 Frequency of recorded flood events by century (after Aldrete 2007, Appendix 1)

[4] A full account of the different sources is given in Aldrete (2007) with some coverage of early floods in Le Gall (1953). Data is used in this chapter, however, there is insufficient space to give a full account of the different records. It must be noted that different authors do not always agree on the dates and flood events on the Tiber (Aldrete 2007, 242).

The events, when plotted chronologically provide some indication of the frequency of occurences, with the 18-19m extreme flood events occurring infrequently (Fig. 2.20), but also clustering to some degree around certain periods of time (Fig. 2.21). Several events occur between the mid-16th century and and mid-17th century. Several slightly less extreme inundations, up to 16m in height, occurred in the first decades of 20th century.

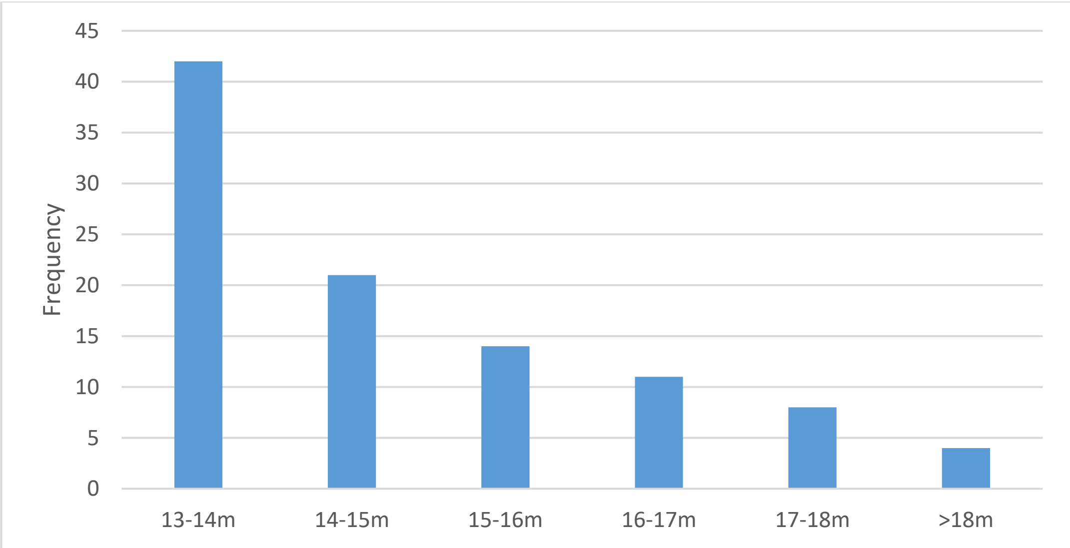

Figure 2.20 Frequency of recorded floods of different levels (after Aldrete 2007, Appendix 1)

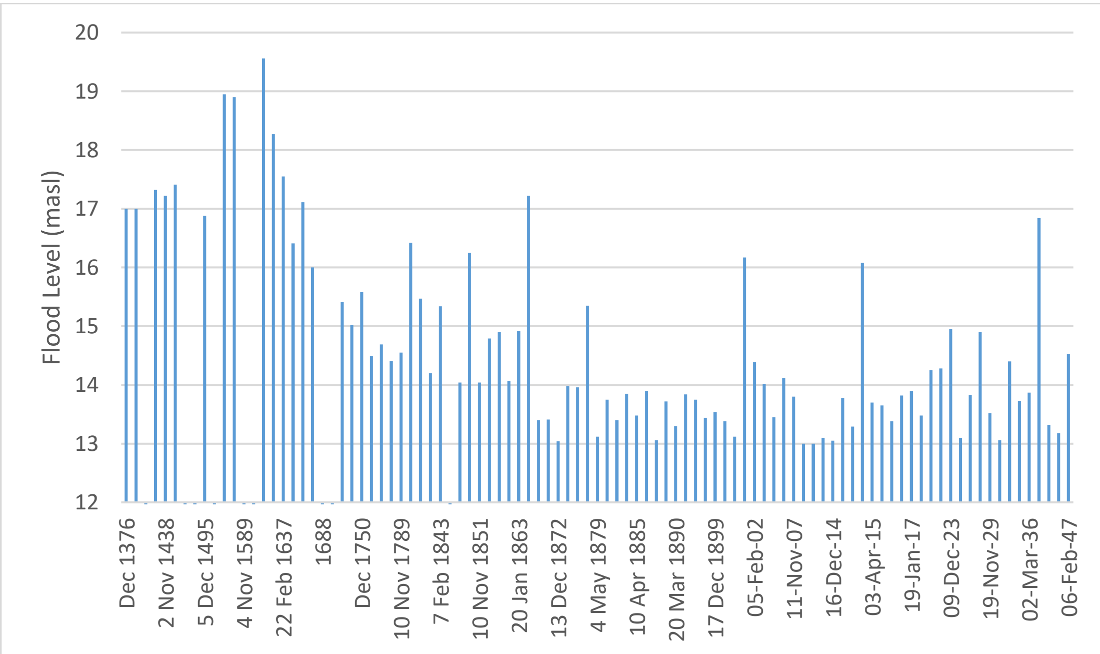

Figure 2.21 Measurements of the level of inundation from different sources for the medieval and post-medieval period to 1947 (after Aldrete 2007, Appendix 1)

The hydrological analysis of data in ArcGIS indicates that the areas of greatest alluvial infilling are influenced by the sediment run-off of the Tiber valley. However, the areas of the lagoons on the Maccarese and Ostia plains are also influenced by the surrounding hydrology, with run-off along the River Arrone and the watershed below Ardea respectively. The alluvial sediment was fundamental in the formation of the bay-head of the Tiber mouth, the progradation of the delta and the formation of alluvial deposits behind the standplain of the delta, particularly after the relative stabilisation of the delta and sea level in the Neolithic. However, the process of alluvial deposition, caused principally by the steepening of valley sides and climatic variation including frost weathering, is what contributed to the formation of the Older Fill along the Tiber Valley (Vita Finzi, 1969, 96). After c. 10,000BC it is not until the Classical period that stream aggradation resumes, relating to erosion upstream in the Tiber Valley and its tributaries, again associated with the climate and deforestation in the area (Vita Finzi, 1969, 101). The network of streams in Etruria are prone to erosion, migration and aggradation (Potter 1976, 114; Vita-Finzi 1969, 72).

A basic modelling of flood levels for the lower Tiber (Fig. 2.22) provides some indication of the inundations of the valley and floodplain. Aldrete (2007, 62) provides parameters for the Tiber flood classification, with elevated river levels being 7-10masl, flood from 10-13masl, extraordinary flood from 13-16masl and exceptional levels being above 16masl. Modelling of these levels indicates localised flooding and infilling of drainage features in the delta area (Fig. 2.23), with greater area coverage for 14m and 18m flood levels.

With the levels of flooding and alluviation there is the potential for hydrosedimentary crises caused by natural climatic episodes, or by anthropic change. One such crisis is noted for the final Bronze Age (Salomon 2013, 74) between 1300-1200 BC, with intensification of human activity and woodland clearance, noted especially in the Biferno Valley and other areas in the south of Italy (Salomon 2013, 74). A further hydrosedimentary crisis dominated the 9th to 6th centuries with the expansion of agriculture in the Iron Age economies of central Italy, including the Etruscans (Salomon 2013, 74). These crises are followed by evidence for increased alluviation in the 3rd century BC and 1st century AD, a pattern represented in other Italian valleys (Potter 1976, 209), with alluviation persisting until the medieval period.

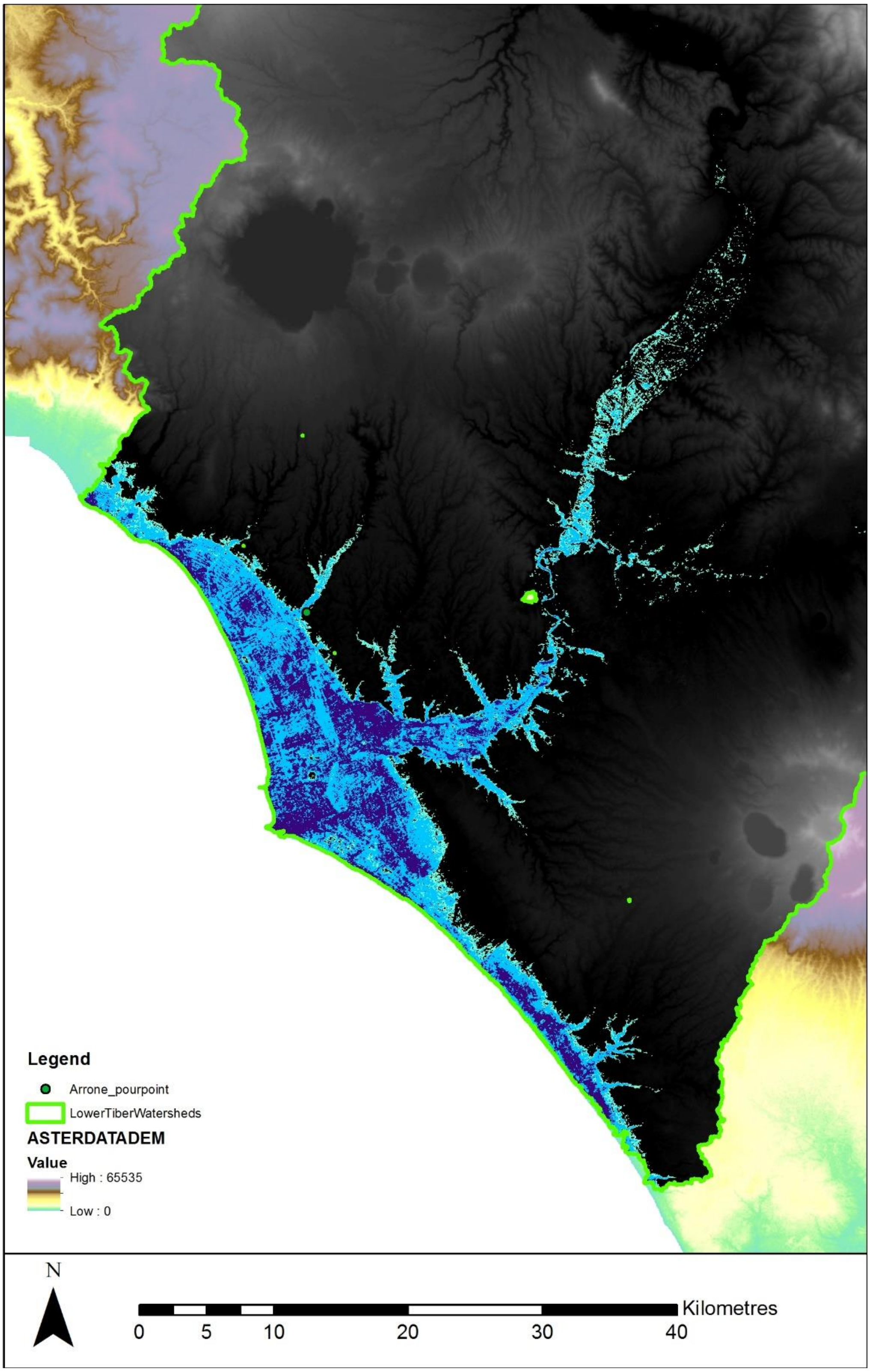

Figure 2.22 Combined area of watersheds draining into the study areacoastline, with different levels of flooding modelled using a planar method, showing 7m (dark blue), 14m (mid blue) and 18m (light blue) flood events (Data from Aldrete 2007, 62)

These periods of inundation carrying sediment into the lower Tiber area, where it is deposited, means that archaeological record from the Neolithic through to the Roman period can, in some instances, be located several metres below the modern ground surface. With Final Bronze Age deposits in the vicinity of Ostia located 3-5m below ground level (Conti 1982, 29), and Roman deposits upwards of 3-4m below ground level in other parts of the delta (Bellotti *et al.* 1108; Table I; Bellotti *et al.* 2007; see Chapter 6). These deposits affect the general visibility of archaeological remains in the floodplain and delta area and underscore the nature and seasonal or temporary nature of activities falling within the alluvial floodplain.

2.7 The Coastal Littoral

Evidence of the later progradation of the Tiber delta presents the issue of defining the different littoral structures relating to the geomorphology of the river and the present dune formations along the coast. Many of the sedimentary bands present in the air photographic images and representing cordons in the geomorphological studies (Salomon 2013, 166) represent littoral rather than dune cordons, caused by the deposition of sediments from the main River Tiber and, to a lesser extent, the Fiumicino channel. The increase in sediment load during hydrosedimentaery crises in the Final Bronze Age, the Iron Age and then in the Republican and Imperial periods (Salomon 2013, 74) led to an increased rate of progradation of the delta, represented in the bands of cordons in air photographic evidence.

2.8 The Macro-Environment and Roman Climate Optimum

While the preceding sections of this chapter focus on the local stabilisation of the study area in terms of the river regime and delta of the Tiber, and sea level rise, it is important to note the overarching nature and effects of the changes in the macro-environment for the period 3000 BC to AD 300. Harper (2017) underscores the contribution of broad climatic and environmental factors and their influence on local climatic phases. These factors include global climate mechanisms such as orbital forcing (Harper 2017, 41) and solar irradiance, but also volcanic eruptions (Harper 2017, 44) which have a cooling effect on the climate. Temperature variation indices indicate a period of warmer climate in the late Neolithic, lowering at around 2250 BC (Harper 2017, 41; Zhang and Feng 2018, 865) with cooler summers in the northern hemisphere. The Roman Warm Period or Roman Climate Optimum in the last two centuries BC and the first centuries AD (Harper 2017, 15; 40) meant a persistent warmer, wetter and stable climate, favouring the increase in agriculture and demographic intensity. From the 6th century, however, and possibly associated with a concentration of large volcanic eruptions, the climate then cooled (Büntgen et al. 2016, 1). This warm period, linked to increased agriculture and population may well have been instrumental in the peak in recorded flooding for the Tiber in the 1st century BC and 1st century AD (Harper 2017, 48; Figure 2.19 above), and the seasonal difference of Spring and Summer, as opposed to Winter, flooding (Harper 2017, 49). This changed with the advent of the Late Antique Little Ice Age (Büntgen et al. 2016), potentially precipitated by a series of volcanic eruptions in the mid-6th century, and more broadly associated with declining conditionsin the Mediterranean and Central Europe, and a possible catalyst for the incursion of Slavic-speaking groups into Europe (Büntgen et al. 2016, 5). These broader changes, in addition to local conditions, may have been partly responsible for the increase in rural settlements and villa sites within the study area from 3rd century BC, and certainly between the 1st century BC and 2nd century AD.

2.9 The Relevance of the Geomorphology

The considerable body of work and evidence for the development of the lower reaches of the Tiber and the delta provide a substantial backdrop for the pattern of settlement and land use for the zone from prehistory into the Roman period. Although the data is comprehensive and, in the last few years at least, has provided excellent comparative data on the environment and vegetation of the wetland zone, a number of key issues still remain with regard to details of the geomorphology and environment of the lower Tiber and delta. Firstly, the need for a more comprehensive understanding of the river within its meander belt is needed. A change in the course or a meander of the river would not happen in isolation (Arnoldus-Huyzendveld et al. 2005, 16) and the river system needs to be seen holistically as a self-organising system. Thus, changes in the course of the Tiber within its valley in the Holocene influence the nature of the wetland environment. This has particular implications for the location of sites such as Ficana and the farmsteads and villas located on streams running down to the Tiber. In addition, the complexity of the marine and freshwater deposits in the interface between the inner and outer delta is considerable. It is feasible that there is a mixing of the fresh- and sea-water lagoons and channels between dune cordons. It is possible that the salinity of the outer delta changes throughout the year, depending on the level of the river water and water table. This would affect the seasonal habitation and exploitation of the wetland at a small scale, but not the broad changes from freshwater to saline lagoons in the delta (see Chapter 6 and the modelling of the environment).

The overview of the geology and geomorphology presented here emphasises the importance of the alluvial erosion and deposition in the Tiber river regime, particularly in relation to changes in climate, environment and removal of vegetation and deforestation in areas of the watershed (Potter 1976; Salomon 2013). The periodic inundation of the floodplain and delta of the river is a powerful natural and, from the Classical period, man-made event, destructive in the short term but instrumental in the deposition of fertile sediment from further upstream and influencing the environment of the lower river course and delta. It is of interest to note that, while the Tiber delta had stabilised by c. 3,500 BC in terms of the sea level change, the area became more influenced by the fluvial regime with the progradation of the delta and the building up of the dune cordons. Vita-Finzi's (1969, 100) note on erosion and deposition being influenced by climate and steepness of valley sides is relevant, and the increase in discharge and of sediment load and deposition in the Classical period in spite of the limited changes to sea level underscores the relevance of human activity along the course of the Tiber and its effect on the lower river environment. This more stable delta environment was, then, periodically more unstable and the subject of inundations and deposition of alluvium.

This geomorphological background provides the foundation for analysis and interpretation of the archaeological record. Reflecting on the affect of the erosion and deposition and periodic flood episodes provides an explanation not only of the environment in which human activity was taking place in the lower Tiber valley and delta, but an indication of potential areas where the alluvium limits the visibility of the archaeological record. The fluvial regime governing the Tiber delta thus needs to be included to improve our interpretation of the nature of the archaeological record and assist in our interpretation of the pattern of settlement. The nature of this environment is also key to developing an assessment of the types and forms of land use in the floodplain and delta, and the limits and extents of the different ecological zones that were fundamental to subsistence in the study area. The methodology utilised for this study provides some degree of scope for evaluating these factors. Extensively the use of GIS coverages including drainage, geology and land use provide the opportunity to model the landscape and its variability. Evidence of changes in the river morphology can be mapped through analysis of LiDAR and multispectral satellite imagery. The nature of varying deposits across the delta can be analysed through lithological data and published borehole data. Finally, the use of geophysical survey and air photographic evidence with archived and published archaeological data provides evidence of human settlement and potential land use within these areas. This chapter has provided the geomorphological framework within which the pattern of settlement and land use interacts. Chapter 3 establishes the nature of the archaeological record, the theoretical framework that has led to the modern record, and the broad chronology of human habitation and subsistence in the region from the Neolithic to the Roman period.

Chapter 3 : Archaeological Approaches in Italy and the Archaeology of the Lower Tiber Valley and Delta

3.1 Introduction

This chapter presents a literature review of the theoretical approaches to archaeology of the study area, and a broad chronological synthesis of archaeology in the region and study area from the Neolithic to the Roman period. This is designed to build a broad and selective picture of the nature of the published archaeological evidence, and the potential lacunae in the visible material. In order to grasp the nature of the archaeological record in the lower Tiber valley it is important to form a critical understanding of the development of archaeological theory, and the schools of thought that have influenced archaeological research in the study area. This is also essential to provide a part of the methodological framework for this research, in terms of the archaeological evidence and formulating an approach using a human ecology model.

Archaeological study in Italy has been influenced by diverse outlooks, from papal interventions in the 16th century (Ramage 1992, 661) to excavation programmes associated with nationalistic ideologies in the late 19th century and early part of the 20th century (Manacorda 1982; Nelis 2007). Frequently antiquarian studies focused on extant remains of pre-Roman and Roman materials, and extrapolation of remains based on rigorous topographic and architectural schools of thought, for instance Lanciani (1868; 1903). Landscape approaches to archaeology have been influenced by the significance of toponyms for understanding past landscapes particularly in the *Campagna Romana* (Nibby 1849). The overall focus of archaeological research in the study area has been placed on Archaic and Roman archaeology through classical schools of thought, and the ideal of *Romanità* in the early 20th century, although palaeo-ethnological approaches to material culture have also been espoused, both through the natural sciences and through post-war archaeological theory. The issue of the visibility of these schools of thought is perhaps reflected in the dominance of classical archaeology at an institutional level during the fascist and post-war periods in Italy (Iacono 2014, 3). This imbalance clearly affects the latter half of the time period examined in this work. It is apparent that the lower Tiber

Valley is nearly always omitted from discussions of later prehistory, certainly in the context of landscape archaeology (although not in detailed accounts of excavations for sites such as Ficana. See Brandt 1996; Fischer Hansen 1990), and the present study has the potential to address this imbalance.

This chapter is organised into different sections, starting with a synthesis of the development of archaeological approaches in Italy (Section 3.2) that relate to the study area. A synopsis of the archaeology of the region and study area is then given by period (Section 3.3), highlighting the broader trends in material culture and subsistence patterns for the area up to the start of the Imperial Roman period. Section 3.4 summarises the state of the environmental evidence in the study area through palynological data and examples of faunal remains. Section 3.5 focuses on the specific trends in patterns of settlement and land use for the chronological period considered for this research. The final section (3.6) establishes the rationale and theoretical basis of the current work, pulling out any analytical insights relating to the aims of this study, suggesting an approach to the analysis of settlement and land use patterns for the Lower Tiber and Delta based on the changing economic and environmental distribution across the study area.

3.2 The Development of Archaeological Theory in Italy

The systems and synergies of archaeological thought are crucial to an understanding of the development of archaeological research in the Tiber valley, and the areas upon which efforts have been focused in the last 150 years. Archaeological work preceding this was very much based on antiquarian activity by landowners and interested parties, principally for the area around Rome, firstly by the popes, as the most prominent and wealthy exponents of philanthropy in the area of the Campagna Romana. The frescoes in the Vatican library attest to the notions of representing the remains of Roman structures and reconstructing the feats of engineering and construction (see Chapter 4). With the political unification of Italy in 1871 and the use of Rome as the new nation's capital, efforts focused on the national identity and the state, supported a number of archaeological endeavours. This was superseded by the *Ventennio* and the formation of a fascist, and above all Roman, sense of identity, reflected in the archaeological projects of the time. Post-war developments focused on a slow break away from the established norms, particularly with prehistoric archaeology, and the adoption of landscape approaches to research (Barker, 1996; Guidi, 1998). These different areas of archaeological research have led to separate schools of study and thought, but have also produced some nuanced work, coloured by the impact of past theoretical objectives on the archaeological record, and more recent approaches to the evidence.

3.2.1 Patronage and the Natural Sciences

Interest in archaeological sites and artefacts in 16th, 17th and 18th century Italy derived from two sources (Fig. 3.1). Primarily the interests of elite parties in the different regions of Italy led to the excavation and collection of archaeological sites and artefacts, from the excavations at Pompeii and Herculaneum by the Bourbon monarchs in the 18th century (Ramage 1992), and the interests of the popes in and around Rome. Papal involvement in past cultures went beyond a passing interest. In 1461 pope Pius II visited the ruins of Portus and proposed the idea of dredging the area and re-establishing the port (Nibby 1827; Pepe *et al.* 2013, 75). The fascination with mapping and representing Rome's past is reflected in Danti's frescoes in the Vatican, commissioned by pope Gregory XIII (Chapter 4, Figs 4.31 and 4.32), showing both the 16th century view of the ruins of Portus and Ostia, but also the harbours of Portus reconstructed. The affinity of the papal authorities with the collection of archaeological artefacts, including the search for material for wealthy private patrons, continued into the 18th century, with popes such as Clement XIV involved in the collecting of antiquities (Ramage 1992, 661). The work of such patrons was not without criticism, with the writing of Goethe, Winckelmann and Hamilton expressing contempt for some of the methods used (Ramage 1992, 654).

Beyond the examples of private or wealthy patronage, the earliest scholarship relating to archaeology derived from the spread of the natural sciences in Europe. The first scientific studies or at least recognition of archaeological materials occurred in the 16th century. While notes associated with prehistoric materials are present in the 16th century[5],

[5] Michele Mercato at the court of Pope Clement VIII understood the human origin of retouched flints and Pleistocene faunal remains of elephants were displayed by Virgilio Romano in his private museum in Rome (Segre 2001).

some of the first descriptive work attempting to identify artefacts and faunal remains occurred in the 17th century, particularly in the identification of Lower Palaeolithic remains such as the elephant bone classified by Ciampino from north-west Latium (Segre 2001, 76). Although some degree of study can be attributed to this period, the purely systematic classification of Palaeolithic artefacts and deposits did not occur until the 19th century.

3.2.2 Topography and Palaeo-ethnography in the 19th Century

It is in the 19th century that systematic archaeological work started in the area of the Campagna Romana, with the mapping by Nibby and Gell in the early to mid-19th century (Gell 1834; Nibby 1849) and publication of a study of placenames by Nibby (1849). The 19th century also saw the development of a more scientific approach to the study of archaeological materials with the development of the paleo-ethnological school of prehistoric studies by Pigorini (Malone 2003). Pigorini applied a theory of cultural uniformitarianism to the study of prehistory (Desittere 1991, 568). The ideas of logical positivism and Darwinism came to Italy from England (Desittere 1991, 568), whereas the natural historical approach of scholars such as Pigorini were of French and Swiss origin.

The progress of archaeology and palaeo-ethnology in Italy was linked to the emergence of a unified Italian state and the organization of a new discipline after 1860 (Guidi 1988, 25). At the start and in the middle of the nineteenth century a number of excavations were conducted as a result of the discovery of archaeological sites during development of land for agriculture. Alessandro Visconti (1816-17) excavated a number of tombs at Castel Gandolfo, attributing the site to the ancient inhabitants of Alba Longa. Other field observations and excavation took place in the north and centre of Italy; in 1853 in the area around Bologna by Giovanni Gozzadini (Desittere 1991, 569), and elsewhere. While marking early approaches to the archaeology, the research by individuals in this period contributed the essentially topographic approach seen in the archaeological maps of sites such as Portus and the *Campus Salinarum Romanum* of Lanciani (1868; 1903) that are influential to landscape approaches to the area, inviting comparison between these early maps and the results of more recent research.

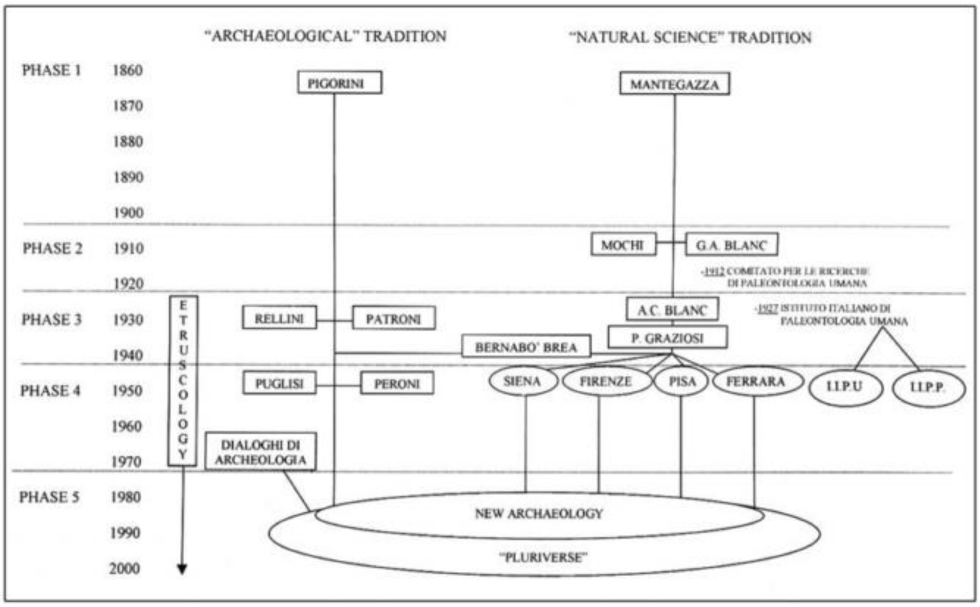

Figure 3.1 Diagram showing the evolution of prehistoric studies (from Guidi 2010, 13)

3.2.3 Early 20th Century Schools of Thought

It would be too easy to relate the history of palaeoethnology in Italy between the wars with a major emphasis given by the fascist regime to classical archaeology used to exalt the values of Roman society (Guidi 1988, 78). The 'Great Tradition' of classical archaeology has always dominated study in Italian universities (Barker 1996, 190). In fact more central to the theoretical ideas of the time was the importance or prevalence of the studies of humanism, idealism and anti-evolutionary modes of thought. A trancending concession to this is 'Teoria e Storia della storiografia' written by Croce (1917). Here is manifest the author's aversion to the study of historical thought based only on documentary evidence, or on monuments, emphasising that 'la fertilità dei campi dello spirito non solo [...] sarebbe sminuita ma addirittura rovinata'[6] (Croce 1917, 23). The purpose of archaeologists, readers and archivists as contributing to a variety of universal concepts (culture, civility, progress and liberty) that he saw as being the true subjects of history (Guidi 1988, 78). Croce defined two possible ways of studying prehistory that prefigured with extraordinary clarity the principal aims of palaeoethnology in 1920s Italy: 'Volete intendere la storia vera di un neolitico ligure o siculo? Cercate anzitutto, se vi è

[6] 'The fertility of the fields of the spirit would not only be lessened by even ruined'.

possibile, di rifarvi mentalmente neolitico ligure o siculo; e se non vi è possibile, o non vi importa, contentatevi di descrivere e classificare e disporre in serie i crani, gli utensili e i graffiti che si sono rinvenuti, appartenenti a quei neolitici'[7] (Croce 1917, 119). While Croce's ideas were prescient in terms of the developing schools of thought for the study of prehistory, the idealism of his approach is weakened by the lack of scientific rigour that it proscribes, and the placing in this instance of typologies and systems of classification below the importance of an idealised past.

The influence of philosophical idealism is present in the works of Ugo Alberto Rellini and Giuseppe Patroni[8]. In 1912, the same year as they conducted research together on a Bronze Age habitation at Castelfranco (Castellaro di Vhò di Piadena), Patroni expressed a series of reservations about the theory of study on terrestrial and maritime prehistory and, together with a synthesis of Italian prehistoric culture, he published the two volume manual La Preistoria (1937). Using the format of the Storia Politica d'Italia, the book was filled with rich descriptions of everyday life in prehistory, without main scientific basis (a method of research envisaged by Croce) (Guidi 1988, 79). This system assumed a number of actually unknown things about the life of people in prehistory and the communal system of organisation of society, similar to the Soviet model (Guidi 1988, 79). referring to the Palaeolithic, which he considered as part of the start of the protohistoric period, Patroni, in a polemic on the difficulty of historians in accepting the existence of a period for the starting of written records, referred to people of colour as the residual population from the Palaeolithic, defined with a colonial stereotype as being "parassiti degli sforzi altrui [..] vinti nella corsa"[9] (Patroni 1937, 133).

The considerable input to the study of archaeology around Rome by the various national research academies and institutes in the first part of the 20th century should not

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[7] 'Do you want to understand the true story of a Ligurian or Sicilian Neolithic? Seek first, if you can, a mental image of the Ligurian or Sicilian Neolithic, and if you cannot, or do not mind, be satisfied in describing and classifying and arranging in series the skulls, tools and graffiti that have been found that belong to the Neolithic.'

[8] Patroni was one of the three pioneers of prehistoric archaeology in the area of Rome, together with Pigorini and Rellini. Their work represents and incredibly active period in Italian archaeology in the late 19th and early 20th centuries that formed the basis of the characterization of the Neolithic and Bronze Age in the peninsula until recently (Malone 2003, 235).

[9] '…parasites to the efforts of others who won the race.'

be overlooked. By the end of the 19th century a number of such institutions were present in Rome with researchers conducting excavation and survey in the Italian Peninsula. Of these the particular focus of the first director of the British School at Rome was on the *Campagna Romana*[10]. During his time at the institution Ashby wrote prolifically, covering discoveries at Ostia (Ashby 1912), a resumé of archaeological sites in the *Campagna Romana* (Ashby 1927), and analysis of earlier maps of the area, particularly the Eufrosino della Volpaia map from 1547 (Ashby 1914). Ashby's work, topographical in nature, drew heavily on the work of Gell and Nibby (Gell 1834; Nibby 1827; Nibby 1849) , together with the research of other 19th century scholars including George Dennis (Dennis, 1848), and the formation of a Carta archeologica d'Italia after the unification of Italy (Potter & Stoddart 2001, 6).

3.2.4 Fascist Italy

The political changes that occurred in Italy in the 1920s had an impact on the focus of archaeological work in the peninsula and the way in which archaeological monuments were perceived. The dominating factor of archaeological research in the *Ventennio* was establishing the question of *Romanità* or 'Romanness', concerned with the myth of Rome politically, culturally and in terms of the institutions of the fascist state (Manacorda 1982; Nelis, 2007). The concession made here, that archaeology was akin to the study of classical art, has been perceived as contributing to an impoverishment of archaeological research (Manacorda 1982, 89). A lack of interest in the subject of Late Antique archaeology, exemplified by the destruction of Late Antique contexts, for instance at Ostia (Manacorda 1982, 90), is evident in this period. To a certain degree this elevation of Rome's status could also be seen as pragmatic. With the unification of Italy there was a necessity to develop the resources of the nation's new capital (Nelis 2007, 410), and an economic as well as nationalist vein could be traced from the unification of Italy to the *Ventennio*.

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[10] Thomas Ashby was assistant director of the British School at Rome from 1903-6, and director from 1906-1925. An excellent summary of Ashby's achievements is given in Potter & Stoddart (2001, 6-10) giving a more expansive account of his time and works than can be presented here.

Rome's Imperial past became the model for the new state, with the most impressive remains from this era being deemed of value and being incorporated into the new fabric of the state, in some cases involving mass clearance and destruction of buildings in Rome itself (Nelis 2007) to render the remains of the city's classical past more visible. The case of the Via dell'Impero demonstrates the result of this form of public display (Minor 1999), notwithstanding the colonial ambitions of Italy before the Second World War (Santoro 2003).

The focus of archaeological work in the Roman Campagna similarly reflected these preoccupations, in addition to focuses on Etruscan sites and other monuments associated with Rome's association with other cultural entities in the region. The most prominent archaeological excavations and work outside of Rome were at Ostia Antica (Calza 1925; 1928; 1940; 1953; Baldassare 2001; Zevi 2002), with the excavations of the city, and further excavations on the Imperial Late Antique necropolis on Isola Sacra, with a focus on the Imperial monuments and tombs.

It is perhaps worth noting here the influence that the *Ventennio* had on the landscape of the Tiber delta. It was during this period that the systematic bonificazione of the delta was undertaken, with a complete drainage of the wetland area and reorganization of the resulting farmland into a series of farms or smallholdings, an enterprise matched by similar projects elsewhere in Italy (Samuels, 2010). While this is beyond the scope of the archaeological, linking rather to the modernizing and rational model of fascism for the countryside, the link between the improvement of the zone at the mouth of the Tiber, and the presence of some of the greatest archaeological sites linked with Imperial Rome could not have been lost[11].

3.2.5 Post-War Italy: Amici, Marxist Theory and the Annales Paradigm

The attitude to theoretical debate in Italian archaeology has been summed up eloquently by Guidi (1998) with a statement that 'the problem was in the roots of our

[11] Samuels (2010) study of the heterotopia of landscapes in fascist Italy, and in particular Sicily, is of some interest here. While the heterotopia theory may not be presenting anything new, the underlying rationale for agricultural improvement in this period is of relevance, and the resulting landscapes are reminiscent of some of the now relict buildings and farms located in the Tiber Delta.

(academic) culture, characterized by a programmatic divorce between humanistic and scientific studies and from a substantial lack of interest for the anthropological theories' (Guidi 1998, 678). If this statement can be used to sum up the sentiment for debate for the first half of the 20th century, it was not reflected in the second half. Post-war archaeological thought in Italy was heavily influenced by Marxist theories (Dyson 1993, 200; Guidi 1998, 678), especially from the 1960s onwards. The 1970s and 1980s saw an emergence in discourse of archaeological research and ideas in Italy, framed with archaeological theory. Components of this reflected the theoretical developments occurring in other parts of Europe and in the United States (Bergonzi 1986) with synthesis and discussion of ideas imported into the frame of Italian archaeology (Bergonzi 1986; Cardarelli 1986; Guidi, 1998), including the New Archaeology. These imported ideas were discussed alongside Italian theoretical ideas, on approaches to archaeology and ethnology and debate on facies and the cultural and social aspects of the archaeological record in Italian prehistory (Bietti Sestieri 1985; Bietti 1986; Guidi 1988; De Grossi Mazzorin 1989)[12].

The Annales school of thought also had an influential bearing on the practice of archaeology in Italy, both on the part of Italian scholars and from the viewpoint of archaeologists from Britain and elsewhere. This approach places an emphasis on the long-term historical, ecological and cultural changes that shape human activity, as opposed to the shaping of human existence through single events (Dyson 1993, 201), and finds common ground in historical geography, but also in landscape and settlement archaeology where processes play an important role in understanding the development of the subject (Dyson, 1993; Barker 1999). The adoption of the Annales paradigm was seen as complementary to rather than as contradicting New Archaeology and post-processual forms of theory, but with the potential for addressing lacunae within these other forms of archaeological thought, particularly with regard to the individual in both past and present, historical events in the archaeological record, or notions of subjectivity and objectivity in approaches to scientific data (Bintliff 1991, 4).

[12] Of particular note are the works presented by European, American and Italian scholars in the journal Dialoghi di Archeologia from 1967 onwards. The radical theoretical alignment of the journal made it an excellent conduit for ideas, expressed in papers in Italian, for scholars and students. Iacono (2014) examines Dialoghi di Archeologia, their founders gli Amici, the decline of political content in the journal in the 1990s and the journal's legacy in a recent paper.

The Annales paradigm provides an ambitious construct relating to the duration of time, in terms of short, middle and long-term periods (Fig. 3.2), and the areas of past society to which these pertain. While the theory itself is ambitious and contains vast potential, Braudel's work has been criticised for not answering the historiographical dilemmas that it poses (Bintliff 1991, 8; Harding 2005, 92). Criticism was also directed at the neglect of the short-term life events posited in the model, a point admitted by Braudel, and perhaps an interesting vein of thought when dealing with the temporal constraints of archaeological material and contexts (Braudel 1972, 502). Lucas (2012 179) to some degree addressed the nature of archaeological events, seeing events in historical studies as subordinate to historical processes (Lucas 2012, 180) and the issue of defining events in relation to archaeology[13].

HISTORY OF EVENTS	**SHORT TERM-EVENMENTS**	**Narrative, Political History Events Individuals**
STRUCTURAL HISTORY	**MEDIUM TERM-CONJONCTURES**	**Social, Economic History**
		Economic Agrarian, Demographic Cycles History of Eras, regions, societies Worldviews, ideologies, (Mentalités)
	LONG TERM-STRUCTURES OF THE LONGUE DUREÉ	**Geohistory: 'enabling and constraining' History of Civilizations, peoples Stable technologies, world views (Mentalités)**

Figure 3.2 Braudel's model of historical time based on short, medium and long-term duration (from Bintliff 1991, 6)

[13] Lucas (2012, 181) notes the difficulty of reconciling the two ontologies of events as particular occurrences and structure in terms of recurrent events or practices.

Ultimately the major issue raised with such terminology is representing the presence of 'events' in the archaeological record, and the aggregate nature of the evidence. In spite of this one of the principal contributions of the Annales paradigm is that of Problem History and ascribing to certain trends in historical data an event which characterises the change in the evidence (Bintliff 1991, 14). While the importance of single events in historical or archaeological evidence is apparent, there is a contention about the conditions and evidence in the build-up to such historical points in time. While an individual event may act as a catalyst, the broader historical or archaeological evidence and its implications need to be considered[14].

The Annales School of thought has provided much in the way of analysis of project objectives and interpretation of datasets for research in central Italy. The research conducted by Barker on the Bronze Age of central Italy has proved particularly important in the study of prehistoric models of subsistence (Barker 1986; Barker 1999; Barker & Grant 1991), and with some degree of recognition of the Annales paradigm (Barker, 1991), which lends itself to the methodology and interpretation of the archaeology of landscapes. These issues of temporality and duration provide the potential for analysing the perception of past social groups of particular homogenous areas of landscape over time. This is an approach that has been advocated for wetlands when analysed in terms of human-landscape interaction (O'Sullivan and Van de Noort, 2007) elsewhere in Europe. The notion of cultural biographies of such places, the changing pattern of settlement, land use and the exploitation of resources and procurement of material in such a context is an area of research that has not necessarily been applied in Italy, with some key exceptions (Attema, 1993), and offers a possible view to contemplate for the research presented here (see section 3.6 below). However, while the influence of this theory needs to be recognised, the limitations of the approach need to be considered, and mean that the Annales School approach is of less relevance to this research than the landscape and human ecology approaches detailed below.

[14] A useful case study is presented by Bintliff (1991) using the Boetia Survey in Greece to illustrate the historical perception for the decline in Boeotian fortunes, and its relationship to underlying causes including class conflict, poverty and agricultural decline, and the trending in archaeological and environmental evidence for a severe erosional phase.

3.2.6 Landscape Archaeology

Co-existing with the Post-War developments in Marxist theory in Italy was the increase in landscape-based archaeological projects with their theoretical basis in local and regional perspectives. Some of these are represented by studies by Italian institutions at local, regional or national level, including universities (Barker 1996). Others were initiated and run by different foreign academies based in Rome. The most prominent of these in the Roman Campagna was the South Etruria Survey. Rather than being a response to a particular theoretical outlook, the survey, initiated by Ward-Perkins (Smith 2018) was a response to the urbanisation of the Roman Campagna, particularly in South Etruria, and the shift to modern forms of land use, including practices of arable farming and specifically deep ploughing, which was eroding and destroying the archaeological record of the area (Barker 1996 163). The South Etruria Survey continued from the 1950s until the late 1970s, producing an immense archive of material and cataloguing for hundreds of sites, and a number of syntheses of the material (Ward-Perkins 1961; 1962; Potter 1979) in addition to other smaller scale projects run elsewhere in the Italian Peninsula (Ward-Perkins *et al.* 1986). What many of these regional projects have in common is that they represent solid post-war archaeological field practice, with a rationale based on objective approaches to landscapes and the analysis of the material, or a rescue agenda derived from the prevailing archaeological necessities instigated by rebuilding on a massive scale. Many of the theoretical issues and dilemmas associated with the archives of, say, the South Etruria Survey would not be addressed until a reassessment of the material in the late 1990s and early 2000s (Di Guiseppe 2008; Patterson *et al.* 2000; Witcher 2008). By contrast some of the regional landscape archaeology conducted from the late 1970s onwards was weighted by the developing theoretical considerations of the period, with Marxist thought in some instances (Witcher 2006, 41), and the Annales School with projects such as the Biferno Valley Survey in Molise (Barker 1995).

One other aspect of archaeological approaches from the 1980s and 1990s is that of dealing with the archaeological record associated with ancient settlement and other practices that leave more ephemeral traces on landscapes than sedentary cultures or urban settlement. A variety of different studies have turned to ethnographic and comparative analyses in an effort to populate the ancient landscape with dimensions of social or economic activities that, for reasons of deposited evidence or the survival of material over the millennia, are not well-reflected in the archaeological record. Some of the key economic practices in Italian prehistory, particularly from the Eneolithic and Bronze Age, and into the Iron Age and Republican period, are based on brief habitation at a particular site, and movement through the landscape. Fleming's (1987; 2006) analysis of land use, particularly in the context of British landscapes, provides some relevant material. His study of co-axial field systems provides some useful analysis of geographical and environmental factors associated with different forms of land use (Fleming 1987, 192) together with more theoretical notions of the forms of society behind such systems of land organisation. The mapping of traces of settlement and land division systems for the current study area may provide similar insights into the social hierarchies and modes of land use. Transhumance practice is a crucial part of animal husbandry and pastoral economy found in these periods (Barker and Grant 1991), with similar forms of pastoral economy (Chapter 4, Figs 4.13 and 4.25) and use of livestock (Chapter 4, Figs 4.16 and 4.26) running up to the present day[15]. The ephemeral nature of much of the archaeological record from such practices is evident, and ethnoarchaeological studies in more mountainous regions of Central Italy (Barker and Grant 1991) have proven useful in comparing 20th century modes of practice with the archaeological and textual record for the study area. Moreover, broader studies of the practice and surviving evidence for transhumance during the Roman Republic (Gabba and Pasquinucci 1979) have also reflected the need for inclusion of economic practices that existed on the ancient social and archaeological periphery, even if such modes of survival were fundamental to the structure of these economies. The need to analyse a representative area of landscape in order to understand the social and economic conditions affecting patterns of settlement and land use is apparent, with natural variations in ecology and resources, together with man-made change to environments in a particular region, affecting the sustainability of different types of settlement and modes of subsistence.

[15] Although it represents more of a statement of death and rebirth, the film Le Quattro Volte, written and directed by Michelangelo Frammartino (2010) is framed in the daily life of a village in Calabria, Southern Italy. The practices of pastoral grazing, albeit in an area of landscape surrounding one village, form the subject of the film, and also show other practices of the rural economy such as charcoal burning. An objective ethnographic study it is not, but it does demonstrate the everyday nature of the rural economy in some areas of Italy in the 21st century.

3.2.7 Human Ecology and Human Geography

Theoretical concepts have been developed with regard to human geography and ecology, in particular through the work of Butzer (Butzer 1982; Brown 1999) incorporating geomorphological and archaeological aspects of evidence to elucidate on patterns of settlement and land use, principally for hunter-gatherer communities (Butzer 1982, 234), but also reflecting on models of settlement and subsistence for pastoral and agricultural communities (Butzer 1982, 276). In addition, developments in human geography (Whatmore 2002) have assessed the relationship between what is perceived as the natural and cultural worlds. The subject of nature and its relationship with social theory is of critical relevance to human ecology and the study of past landscapes (Whatmore 2002). The view of nature as separate from the human sphere. In addition, Whatmore (2002) develops the notion of the perception of differences between the natural and cultural worlds, quoting Cronon (1995) that for nature to be natural must be pristine. The notions of what makes landscape, and the cultural versus natural aspects of this, are dealt with at length in terms of archaeological, anthropological and human ecological literature. Whatmore and Hinchliffe (2010) note the influence of an ecological approach, that cultural agency is not the only dynamic to work in the formation of landscapes.

By contrast, Ingold (1993 152) emphasises the importance of time and landscape as topical points of contact between archaeology and anthropology, and in the study of human life as process. In particular Ingold refers to this approach in forming a theoretical concept of 'dwelling perspective', and exploding the notions of opposing naturalistic and culturalistic views of landscape being either a neutral backdrop to human activity, or it being cognitively and ritually ordered (Ingold 1993, 2). While elements of Ingold's thesis are polemical in nature and lacking in objectivity (for instance the definition of landscape; Ingold 1993, 154) the central idea of taskscape bears scrutiny. Where many discourses emphasise the dichotomy between nature and culture, Ingold (1993, 154) does not subscribe to this, insisting that landscape is not identical to nature or culture, although it is the familiar domain of our dwelling. Ingold also draws a distinction between the notions of landscape and space, insisting rather that our perception of landscape is that of a 'journey made', or that the nature of a place owes itself to experiences of those that spend time there (Ingold 1993, 155). Taskscape incorporates the notions of temporality and social involvement, but also needs to include the notion of tasks completed and their relationship to one another, and the complex interweaving of concurrent sequences and cycles (Ingold 1993, 160).

Such theoretical approaches have limited scope in terms of the research presented here. In modelling the pattern of settlement and land use for the lower Tiber, this research is primarily embedded in the quantifiable archaeological evidence for the area, with an emphasis on subsistence and the practicalities of exploitation of resources and the distribution of communities exploiting different ecological areas. While reflection on the evidence in terms of cultural and natural spheres of influence may form an interesting area of study for the future, Ingold's taskscape model, and the eschewing of the tensions between the cultural and natural interpretations of landscape, are perhaps most relevant. The archaeological evidence for the study area in some cases (Di Rita *et al*. 2009) emphasises the interaction between environmental and man-made factors in the landscape and focusing on this rather than presenting a theoretical dichotomy seems more germain to the current research. Similarly, a detailed taskscape perspective, elaborating on 'dwelling perspective' presents an aspect relevant to analysis of the pattern of settlement for the study area, but beyond the focus of this work.

One other possible approach to systems of human ecology is to assess the nature of different regions relating to their environmental and archaeological profiles. The use of biomes and ecotones is widely used in ecological modelling (Butzer, 1982, 15) with biomes representing partly overlapping habitats and ecotones representing the spatial transition two or more different communities. These zones are normally utilised in macro-environmental studies, but can also play a part in modelling human ecosystems (Butzer, 1982, 32). Sites then appear within particular habitats. These are equally things that appear in human ecosystems (Butzer 1982, 32). This approach in a way fits the nature of the geomorphological and archaeological record for the lower Tiber valley, and a perspective that is fundamentally in line with the variability of the land cover and environment of the area. Analysis of the pattern of settlement for different periods with the changing river floodplain and delta, and the possible land use for the area, provides a perspective allowing the modelling of the settlement and land use firmly based in the tangible and quantitative archaeological evidence, and the established coverages for topographic data for the study area.

3.2.8 Modelling of Resources and Settlement

The goal of this approach ultimately is to comprehend and analyse the archaeological record as part of a human ecosystem (Butzer 1982, 211). Several model approaches can be applied to modelling biomes and resources in terms of ecology and human ecosystems. Its relevance to the lower Tiber and delta is that it facilitates the analysis of the quantified archaeological sites and other spatial data in relation to the varying forms of environment across the landscape. In addition, the settlement focus of this approach emphasises the human nature and influence on the environment, rather than underscoring a purely environmental focus in the analysis. The theoretical models presented below outline a number of possible approaches to the analysis of settlements in a landscape, either relating settlements to one another, or facilitating comparison with the surrounding environment.

3.2.8.1 Theissen Polygons and Gravity Models

Theissen polygons facilitate a basic delineation of polygons around a network of point-based sites (Bernhardsen 1992, 204). This represents a rather simplistic tool that does not take into account the size of population centres, or any form of topographic obstruction or variation. However, as a rudimentary method for comparing with other coverages of resources it provides the potential for a basic assessment of resources within a defined constraint. By contrast gravity models are based on the interaction between settlements being related to the size of population of the settlement (Butzer 1982, 215). This form of model has been utilised to demonstrate the importance of land use and resourses associated with distances travelled to exploit the resources in question.

3.2.8.2 von Thünen Model

The Von Thünen model posits that an isolated population in a homogenous environment will create distinct rings of types of land use around the settlement. The closer the ring around the focal point, the more localised the activity, from market gardening and and domestic animals, to local resource exploitation such as lumber and firewood, to crop cultivation and finally pastoral activity involving transhumance or daily animal grazing returning to the settlement at night.

The issue with this model is that it is predicated on a number of assumptions or aspects that may not relate to a particular period, settlement type or pattern of resource exploitation. This includes the use of modern land use categories for exploitation, the assumption that biotic distributions were the same for the modern period and the assumption that technology is an independent variable (Vita Finzi 1978; Butzer 1982, 218). Witcher (2008, 477) moreover highlights the problems of assuming a simple model of distribution with a single urban centre such as Rome, when the social and economic organisation of the hinterland is much more complicated than one particular organisational model. One way of utilising this model is to introduce other complicating factors, such as roads and watercourses (Wilson, 2008,733). Similar issues were found with this model by Goodchild (2007, 34), surrounding in particular the assumption of constrained hinterlands for settlement, a point also illustrated by Horden and Purcell (2000, 116) in relation to the hinterland of cities. If this presents an issue in the modelling of cities, villas and farmsteads in the Mediterranean, then it presents particular problems in the assessment of later prehistoric settlement hinterlands, considering the diverse potential nature of settlement, and the diverse economic and subsistence strategies relied upon. There is also no reason to reject the presence of a level of diverse agricultural and subsistence practices in the Roman period for the study area, including practice of transhumance, and the nature of temporary and permanent settlement in the pattern of settlement, in addition to the presence of a formal complex economy of production in the Roman period.

3.2.8.3 Central-Place Theory

This represents a theory based on the vertical hierarchy of of goods, resources and services of a settlement (Butzer 1982, 219). This is divided into three principles: marketing, trafficking and administrative. The limitation of this model is that is works only with settled agrarian economies, where a hierarchy of settlement is present.

3.2.8.4 Resource Concentration Model

While the preceding models and theories work well in terms of permanent settlement patterns, they present issues where dealing with more mobile nomadic, hunter-gatherer or pastoral communities. One approach in dealing with these is to assume that resources in the landscape are static, and then use resource catchment areas to explain differences in productivity or patterns in relation to sites and their proximity to one another (Butzer 1982, 223; Figs 3.3, 3.4 and 3.5).

This model is also based on a number of assumptions. Models assume a relatively homogenous distribution of resources within a biome, and higher group density within preferred biomes, with the assumption of stepped population inceases between increasingly preferred biomes (Butzer 1982, 223). Patchiness ofresources can be developed through recognising different ecotones, with populations geared towards resource predictability of unpredictability.

All of these approaches to data contain considerations that are pivotal to analysis. These include the scale or hierarchy of sites, in terms of activity from a focal point of one activity to large nucleated settlement, and in terms of time from a single episode leaving tangible remains, to prolonged settlement over centuries or millennia (Butzer 1982, 230). Placing these sites in context involves elaborating on the resources and land use at their disposal. And the hierarchy of these resources, and elaborating on the social, economic and political influences for the sites; their function, position in a hierarchy, and the influences of administration or markets pertaining to their presence.

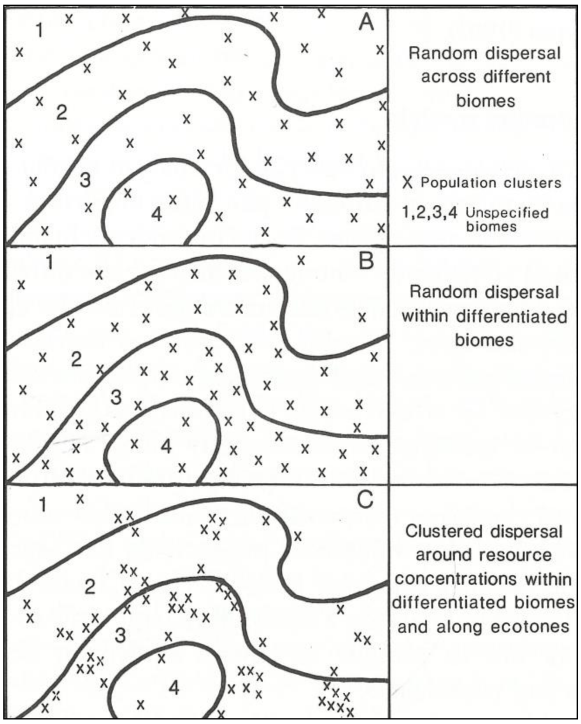

Figure 3.3 Models for large-scale settlement hunter gatherer patterns (after Butzer 1982, 224)

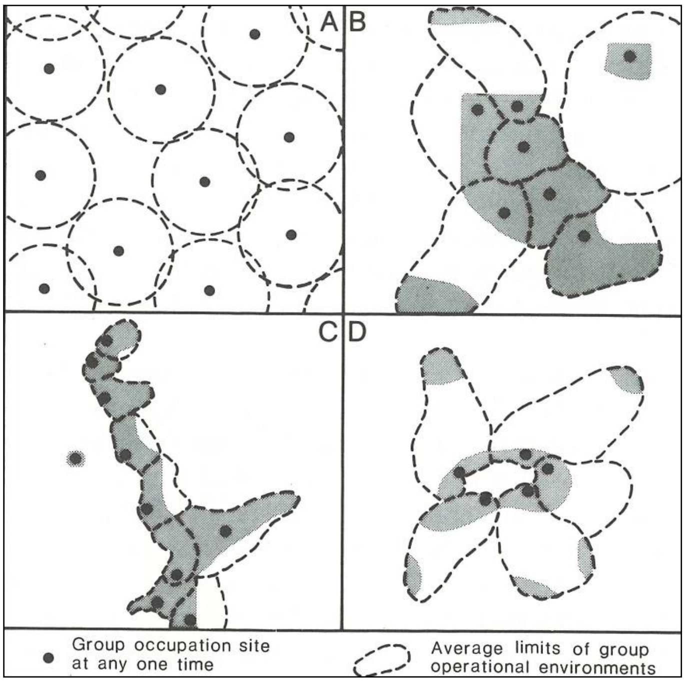

Figure 3.4 Medium scale settlement patterns for hunter gatherers (after Butzer 1982, 226)

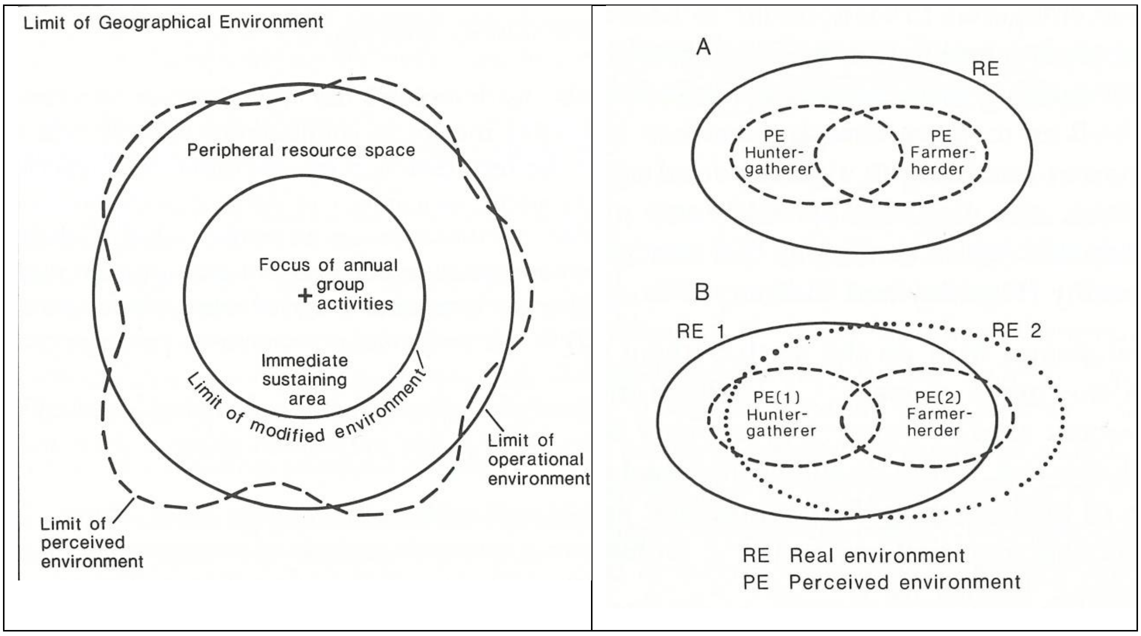

Figure 3.5 Model environment for hunter-gatherer space (left) and perceived environments between hunter-gatherers and farm herders (after Butzer 1982, 255)

Two salient issues present themselves when utilising patterns of site and resource in the current study area. Firstly, an analysis looking at the *longue durée* in terms of patterns of resource use needs to assess the variable nature of human activity, resource exploitation and economy both across different periods, but also in terms of the hierarchy of settlement and resource use in a given period. The archaeological record for Lazio in the final Neolithic/Eneolithic suggests some degree of cereal cultivation in addition to sedentary settlement and animal husbandry, but also transhumance and the movement of livestock and goods over larger distances. This pattern of variable site and settlement status, and different interacting economies within the area continues throughout the periods in question, although the proportions of different practices may change. Patterns change equally over time in terms of climate and environment, and this affects the nature of resources and the potential pattern for exploitation, as represented in the palynological and geomorphological data.

This variable pattern of settlement and use therefore requires some consideration of models and frameworks that draw on the theories adapted for both mobile and sedentary populations. A number of models are proposed for hunter-gatherer communities (see Butzer 1982, 230-240) that contain elements that relate to non-hunter-gatherer communities that are also mobile, but do not necessarily deal with the hierarchies of settlement and resources for the Eneolithic, Bronze Age or protohistoric periods of the study area. Similarly, while villa and rural settlements are represented in the archaeological record for Lazio and the study area, elements of mobile social groups are present in the Republican and Imperial periods across central and southern Italy (Gabba and Pasquinnucci 1979).

Given the nature of the archaeological record for the lower Tiber valley, and the associated coverages for the topography, land cover, drainage and other associated data, analysis of the settlement pattern and resources for this study used a combination of quantitative proximity and overlay analyses, together with a visual analysis of a combination of Theissen polygons, and Euclidean and cost distance analyses to assess the location of settlement in relation to types of ecotone and resource, and the potential extent of resource exploitation for the sites (see Chapter 8, Sections 8.2 and 8.3). For the Protohistoric and Roman periods some basic settlement hierarchy between nucleated settlement or villas, and rural settlement, was also introduced.

3.3 The Archaeological Record for Lazio and the Lower Tiber Valley

This research is primarily interested in the period from the Eneolithic to the Roman Republican period (3000BC – AD 300), and the trends represented in patterns of settlement, land use and subsistence. However, a brief resumé of the Palaeolithic, Mesolithic and Neolithic is given here to add some degree of context for the region and study area. The varied nature of subsistence economies in central Italy from the Neolithic onward, and the prominence of animal husbandry throughout later prehistory and into the Roman period mean that some of the preceding trends in settlement and subsistence are of general relevance. The focus of this synthesis is on the area between Rome and the mouth of the Tiber, taking in the surrounding hillslopes and the river delta. The synthesis does not include Rome, due to the complex and extensive nature of the archaeology of the city and the focus of this work on the Lower Tiber and coastal plain.

3.3.1 Earliest Human Presence to the end of the Mesolithic

The first recorded human presence in the area of the Tiber Valley dates to the last eruptions of the Laziale and Vulture volcanic ranges, at around 830,000 and 811,000 BC for the Vulture and 700,000 BC for the Laziale ranges (Anzidei *et al.* 1985, 17). Up until the Riss-Würm interglacial (Barker 1999, 4; Belluomini et al. 1975, 323), the record is dominated by sites in the open, close to lakes and water courses, with an economy dominated by hunting. In the area of the Tiber a number of sites dated to the Lower Palaeolithic have been recorded, generally associated with the Pleistocene deposits of the region between the Tiber and the Lago di Bracciano, the lower areas of the Monti Sabatini (Di Bella *et al.*, 2005), and all associated with *Homo erectus*. In the vicinity of Rome at Valchetta Cartoni pieces of *selce* were located on sand and clay strata, and bifacial tools and boar teeth were found at Monte Mario, associated with a tuffite strata from one of the ancient eruptions of the Sabatino volcanoes (Anzidei *et al.* 1985, 21). Along the coastal region the most prominent sites are Torre in Pietra (Malatesta 1978; Follieri 1979), Castel di Guido (Mariani-Costantini *et al.* 2001) and Malagrotta (Cassoli *et al.* 1982), ranged above the coastal plain alongside the Arrone and the Tiber.

Middle Palaeolithic activity in Lazio is represented mainly by the Pontine facies[16] associated with the Mousterian period (Anzidei *et al.* 1985, 30). Close to Rome the sites at Monte delle Gioie, Saccopastore and Sedia del Disavolo at Rebibbia-Casal de' Pazzi indicate settlement and human activity from this period (Anzidei *et al.*1984; Anzidei *et al.* 1985, 32). Sites along the southern coast of Lazio at Monte Circeo and Gaeta (Grotta Breuil, Grotta Guattari, Grotta dei Moscerini and Grotta di Sant'Agostino) also provide evidence of remains for the Middle to Upper Paleolithic transition. The sites, close to the modern coastline, and never more than 10km from the coast in the Middle Palaeolithic, contained tools belonging to the Pontine regional group of the Mousterian Culture (Stiner & Kuhn 1992, 310).

The Upper Palaeolithic (30,000 to 10,000 BC) in Italy corresponds to a cold, dry glacial phase with its maximum advance in the Appennines of Italy at about 20,000 BC, with a series of short stadial and glacial periods, culminating in the disappearance of glaciers by the Holocene (Giraudi, C. and Frezzotti, M. 1997, 289). Evidence for exploitation of plant resources, non-existent for the Palaeolithic, is balanced slightly by evidence of the ability of Palaeolithic cultures to process plant remains. The site at Bilancino, from the Gravettian period, has been interpreted as a summer camp corresponding to a cold phase with scarce woodland and plentiful wetland environments. The discovery of a grindstone with evidence of starch grains on its surface, presents evidence of the processing of wild plant grains (Bellini *et al.* 2008).

Mesolithic archaeology is present in the Italian peninsula, particularly at sites found in Liguria, Abruzzo (Anzidei *et al.* 1985, 63) and Puglia, principally along the coastline at sites such as Grotta della Mura and Grotta del Fico (Whitehouse 1968; Whitehouse 2007, 241). Of particular relevance for the area of the Tyrrhenian coastline are the sites along the Campanian coast at Cardium, and sites such as Isola Santa (Lucca) dating to 11200 – 10350 BC with some evidence of gathering activity attested by charred hazelnut remains associated with a hearth (Bellini *et al.*, 2008). The general subsistence economy of

[16] The term 'culture' applied here was the focus of discussion during the upgrade process, due to the loaded nature of the term. The term 'facies' was suggested as a possible replacement. However, in terms of literature on the archaeology of Italy and the area in question, the use of 'culture'' (Gaudo Culture, for instance) seems to be ubiquitous. Thus the author has used 'facies' where possible, although the term 'culture' is sometimes used.

the zone was of gathering of shellfish and other marine resources on the basis of opportunity, to supplement a broader diet from hunting of mammals. Exceptions to this rule do, however, exist (Colonese *et al.* 2009, 1935) with intertidal molluscs forming a substantial part of the subsistence pattern. The principal focus for Mesolithic sites in Lazio is the coastline in the vicinity of Anzio at Riparo Blanc, with deposits dated to c. 7811 to 7474 calBC (8565±80; R-341; University of Rome; calibrated 6,615 BC in Alessio et al. 1968, 358; recabilbrated to 7811 to 7474 calBC using OxCal 4.3), and demonstrating the exploitation of marine resources, especially Trochus molluscs, with middens and tools including pointers (Taschini 1968). Scant evidence exists, however, for Mesolithic sites in the area of the Tiber, between Rome and the coast.

3.3.2 The Neolithic (6000 – 3500 BC)

The transition from the Mesolithic to the Neolithic in Italy, as with elsewhere in Western Europe, rests on the change in subsistence economies from hunter-gathering activity to subsistence farming and more stable forms of settlement (Anzidei *et al.* 1985. 67). In contrast to the Mesolithic, the early Neolithic record provides ample evidence for settlement and modes of subsistence in Central Italy.

In the vicinity of the Lower Tiber, the earliest Neolithic material comes from the site of Palidoro, similar in type to that of Pienza. Fragments of impasto open form vessels were found, decorated with linear impressions made using the edge of a shell, and deeper incised impressions forming motifs. Other valuable information has been derived from the sites of Torre Spacata to the south-east of Rome and Casale di Porta Medaglia to the south of Rome, at Grotta Patrizi di Sasso Furbara, also Tre Erici and Pyrgi to the north of the study area (Malone 2003, 261). In addition, the site of La Marmotta at Anguillara Sabazia on the Lago di Bracciano provides excellent data on habitation of a lake settlement in the Neolithic (Fugazzola Delpino *et al.* 1993; Fugazzola Delpino & Mineo 1995; Malone 2003, 258; Table 3.1).

The archaeological record for the study area demonstrates diverse practices in terms of economy, dependent in part on geographic location and the phases of settlement. The coastal zone is represented by a mixed agrarian economy based on cereal production and animal husbandry, while in the more mountainous areas in the foothills of the Apennines animal husbandry, particularly of bovines and caprines, dominates. In the second half of the 4th millennium specialisation within the products of animal husbandry is witnessed in the record, particularly relating to production of wool and milk (Anzidei *et al.* 1985, 88).

The presence of Late Neolithic deposits in the area to the south and east of Rome suggests a continuation of economic practices from this period into the Eneolithic.

Phase	Date	Cultures
Mesolithic	?-5800 BC	Central Italy
Early Neolithic	5500 – 4400 BC	Sasso-Fiorano
Early Neolithic	5600 – 5200 BC	Guadone Impressed Wares
Middle Neolithic	5000 – 4500 BC	Catignano/Guadone
Late Neolithic	4300 – 3600 BC	Chassey-Lagozza

Table 3.1 Principal Neolithic cultures for Central Italy mentioned in the text (from Malone 2003, 243)

The Neolithic remains in the Faliscan area provide some insight into the development of the economy in this period. At Vannaro a cave dwelling with ceramics of the Sasso type was excavated, indicating early stratigraphy containing ceramic with *ansa a rocchetto*, and later deposits with ceramic material similar to the Ripoli culture. In addition, the deposits indicated a change in economy from animal husbandry in the first instance to hunting of wild goat in the later sequences, a similar pattern to that demonstrated for the same period in the Sabina and at Valle Ottara close to Cittaducale (Rieti) (Anzidei *et al.* 1985, 88).

The Neolithic facies in the study area form a prelude to the main focus of this study. However, the material of the late Neolithic is relevant as a certain degree of continuity exists in the archaeological sites of the area, with late Neolithic material represented at Le Cerquete-Fianello and other sites, in addition to the Eneolithic (Carboni and Salvadei 1993, 57).

3.3.3 The Eneolithic (3500 BC – 2000 BC)

The Eneolithic in Italian archaeology marks the period from the middle centuries of the fourth millennium, and the most ancient period where use of metals is noted (Anzidei *et al*. 1985, 97). The period is characterised by a hiatus in archaeological material in comparison to the Neolithic. The traditional interpretation of social structure for the period is based on funerary deposits, as evidence for settlement and dwellings is scarce, and suggests family groups, with a patriarchal warrior culture.

In the study area (Fig.3.6) recent excavation in the zone to the south of the Tiber has brought to light tombs and settlements associated with the Gaudo culture in the Eneolithic, including a settlement at Tor Pagnotta that includes Gaudo and Laterza material. Gaudo (Anzidei 2008, 309), Laterza and Ortucchio remains are present at Casetta Mistici and the tombs at Torre della Chiesaccia near Laurentina (Anzidei *et al.*, 2011).

In the area around Rome evidence suggests continuity of settlement from the Eneolithic into the Bronze Age, around the end of the 3rd and the start of 2nd millennium (Anzidei *et al.* 1985, 106). This situation is represented in the Tiber plain around the Aniene and the area to the south-east of Rome. The cultural remains at these sites are derived from Andria-Cellino and the San Marco-Laterza cultures, in the locality of Mole di Corcole.

Culture/Period	**Approximate Dates**
Eneolithic	3500-2000 BC
Gaudo	3150-2300 BC
Laterza	2950-2350 BC
Ortucchio	2670-2130 BC

Table 3.2 List of Eneolithic periods and cultures from Central Italy, with approximate date ranges

At Piscina di Tor Spaccata, at the foot of the Colli Albani on a tufa plateau, a settlement of facies type Andria-Laterza was excavated, giving evidence of the form of settlement and type of activities on such a site. The site consisted of a single cultural horizon (Anzidei *et al.* 1985, 108), intensively occupied for a brief period, where abundant ceramic fragments and faunal remains were found. The excavated area could be interpreted as having been organised for work or food production, with contexts including a ditch with ceramics (including a cup) and faunal remains nearby. The ditch also contained fragments of charcoal. A further work area, with ceramics, animal bone and charcoal, was discovered, including a large vessel used probably for food preparation or storage. Two areas of possible hearth floors were also noted with evidence of cooking of meat. In a separate area, evidence of a baked earth floor, with burnt cereals was found (spelt and barley) with little evidence for ceramics of faunal remains (Anzidei *et al.* 1985, 109).

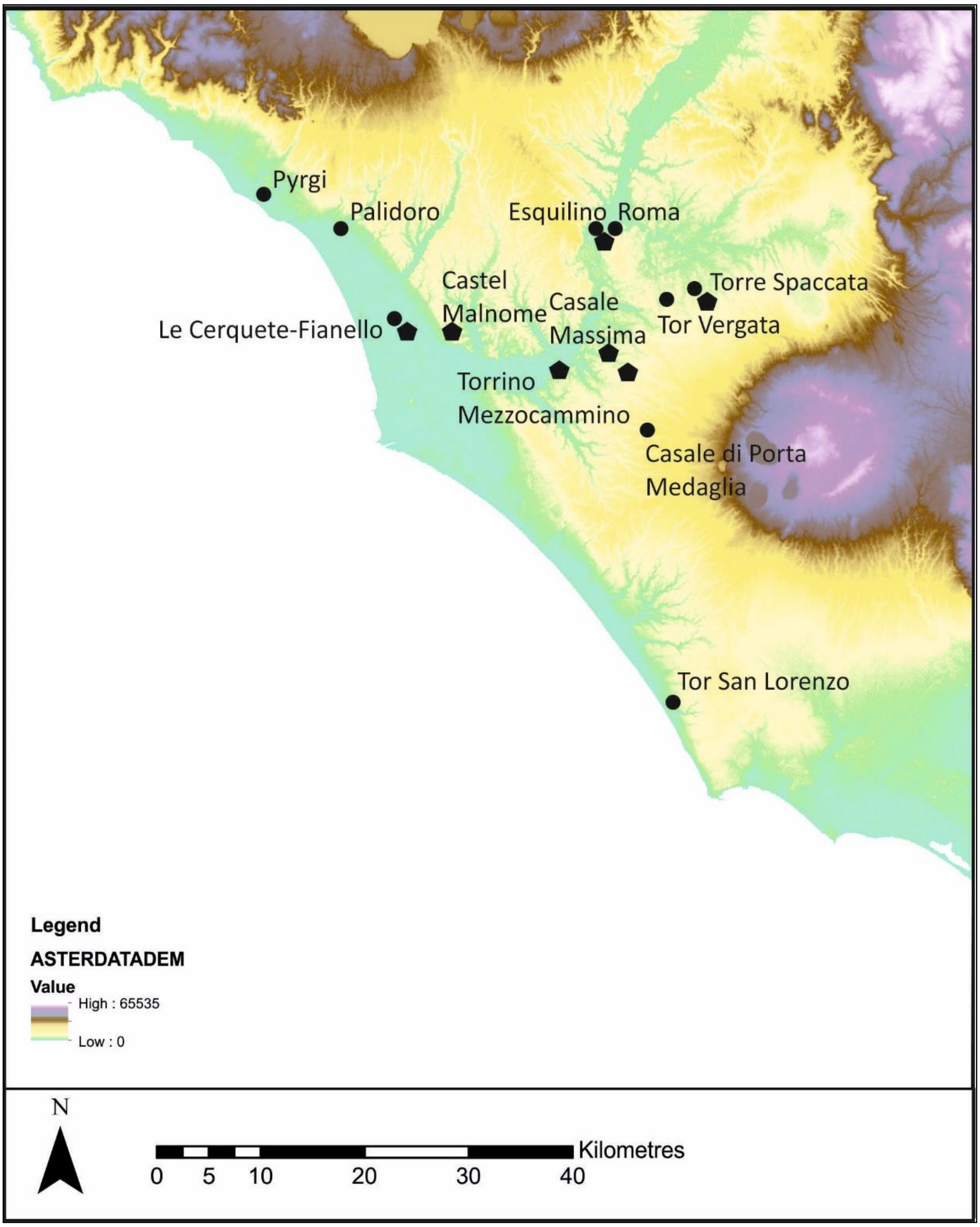

Figure 3.6 Eneolithic sites in the study area mentioned in the text (Elevation based on ASTER data. ASTER GDEM is a product of METI and NASA)

Tombs were also discovered in the settlement, with crouched inhumations spaced c. 10m apart. No evidence for covered structures was found although they were most probably present. The cereal grains found in the excavation together with the faunal remains suggests the practice of mixed agriculture including arable farming, although no evidence for baking of bread was found[17]. Faunal remains included caprines, bovines, swine, dog and deer. Based on the quantification of the remains approximately 80% of the meat in the diet of the inhabitants of Piscina di Tor Spaccata in the Eneolithic would have been beef, a high percentage when compared to contemporary and more recent complexes in the archaeological record.

The ceramics were all made from an impasto rich in lithic inclusions, with a lip at the mouth of the vessel and horizontal decorations attached to the exterior of vessels. These included coned vessels, jugs and amphorae with elbowed handles, also ovoid vases. Finer ceramics were also found with thin walls, burnished with decoration etched or incised into the wall of the vessels. A few bone tools were found including points and spatulas, and flint and obsidian tools also suggesting working of animal skins and leather and hunting activities. Some weights discovered indicate possible fishing, and whorls indicate spinning of wool. The evidence at Tor Spaccata thus indicates a small family group with no full-time or professional division of labour for activities, but rather involvement of the entire community. The presence of similar sites in the area suggest simple mixed agricultural practice and hunting and fishing in an area in the immediate vicinity of the settlement. The importance of natural resources for this form of economy is apparent, with a number of factors requiring consideration in studying the location of sites, their nature and type of materials present therein. The presence of sources of water, streams and lagoons critical to transhumance and animal husbandry, and the varying microclimates and elevation of sites above sea level all provide a series of factors which affect the economic opportunities that could be used (Cazzella 1973, 194).

The most prominent archaeological record for the Eneolithic in the area of the Tiber delta is that on the Maccarese Plain at Le Cerquete-Fianello (Carboni and Salvadei 1993; Manfredini *et al.* 1995; Manfredini *et al.* 2000; Manfredini, 2002). Recutting of canals for the *Bonifica* resulted in the locating of burials and associated deposits, and excavations on a low rise of ground to the east of the ancient lagoon on the Maccarese revealed evidence for a settlement (Manfredini 2002). The remains are dispersed over a

[17] Anzidei *et al.* (1985, 110) note that the grain types found at Tor Spaccata are the same as those found for the Iron Age settlement in the Roman Forum, which is dated one millennium later than the Eneolithic site, suggesting little change in the types of cereals being grown in the 3rd and 2nd millennia BC in the area of Rome.

wide area comprising fourteen different sites, with burials and settlement including ceramics and faunal remains (Figs 3.7, 3.8 and 3.9). Settlement remains at the sites were dated using AMS radiocarbon to a period between 3370 and 2920 BC, with dates from the site represented as 3488-3101 calBC (4555±40; OxA-8107; OxCal 4.3. Calibrated as 3370-3130 BC in Tagliacozzo et al. 2002, 216; Carboni et al. 2002, 257), 3365-3097 calBC (4530±40; OxA-8106; OxCal 4.3. Calibrated as 3350-3100 BC in Tagliacozzo et al. 2002, 216; Carboni et al. 2002, 257), 3368-3091 calBC (4525±45; OxA-8058; OxCal 4.3. Calibrated as 3350-3100 BC in Tagliacozzo et al. 2002, 216; Carboni et al. 2002, 257), 3353-3032 calBC (4495±40; OxA-10803; OxCal 4.3. Calibrated as 3340-3090 BC in Tagliacozzo et al. 2002, 216; Carboni et al. 2002, 257), 3339-2926 calBC (4445± 60; OxA-6212; OxCal 4.3. Calibrated as 3310-2930 BC in Tagliacozzo et al. 2002, 216; Carboni et al. 2002, 257), 3330-2920 calBC (4425±40; OxA-10802; OxCal 4.3. Calibrated as 3270-2920 BC in Tagliacozzo et al. 2002, 216; Carboni et al. 2002, 257), 3363-2764 calBC (4380± 100; OxA-6214; OxCal 4.3. Calibrated as 3300-2910 BC in Tagliacozzo et al. 2002, 216; Carboni et al. 2002, 257) and 3324-2891 calBC (4375± 55; OxA-6213; OxCal 4.3. Calibrated as 3090-2920 in Tagliacozzo et al. 2002, 216; Carboni et al. 2002, 257).

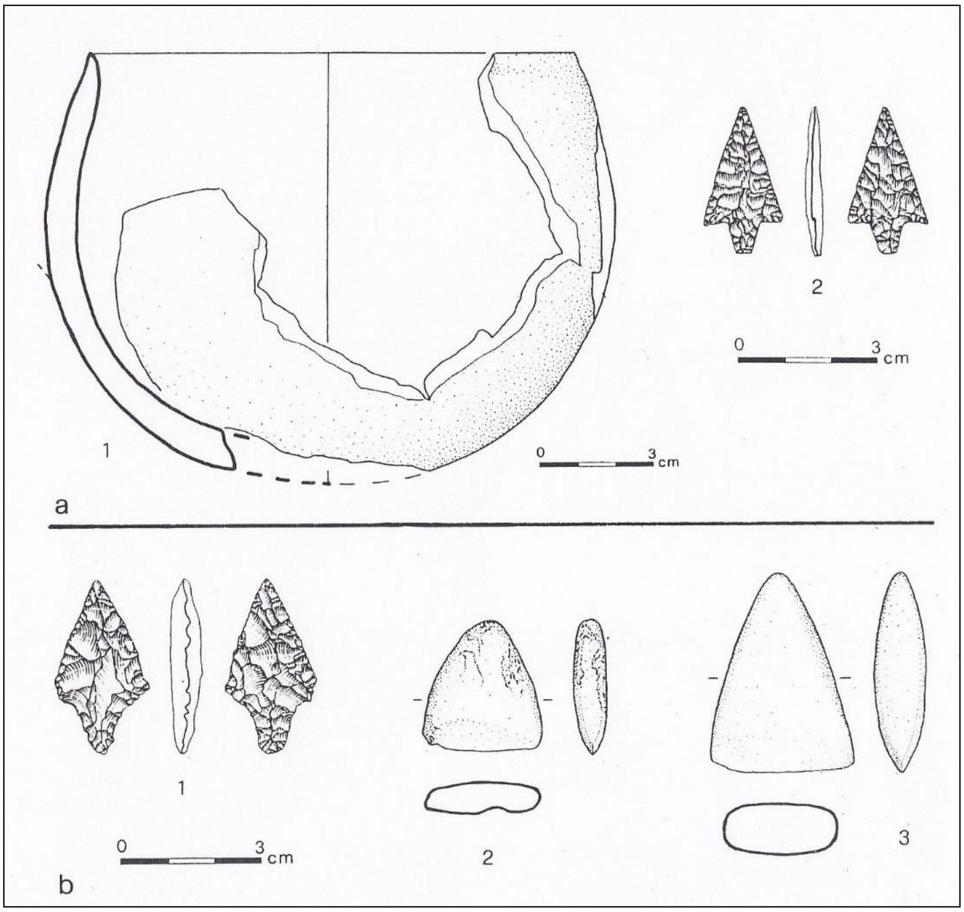

Figure 3.7 Material from tomb at Site D1 on the Maccarese Plain (Carboni & Salvadei 1993, 263)

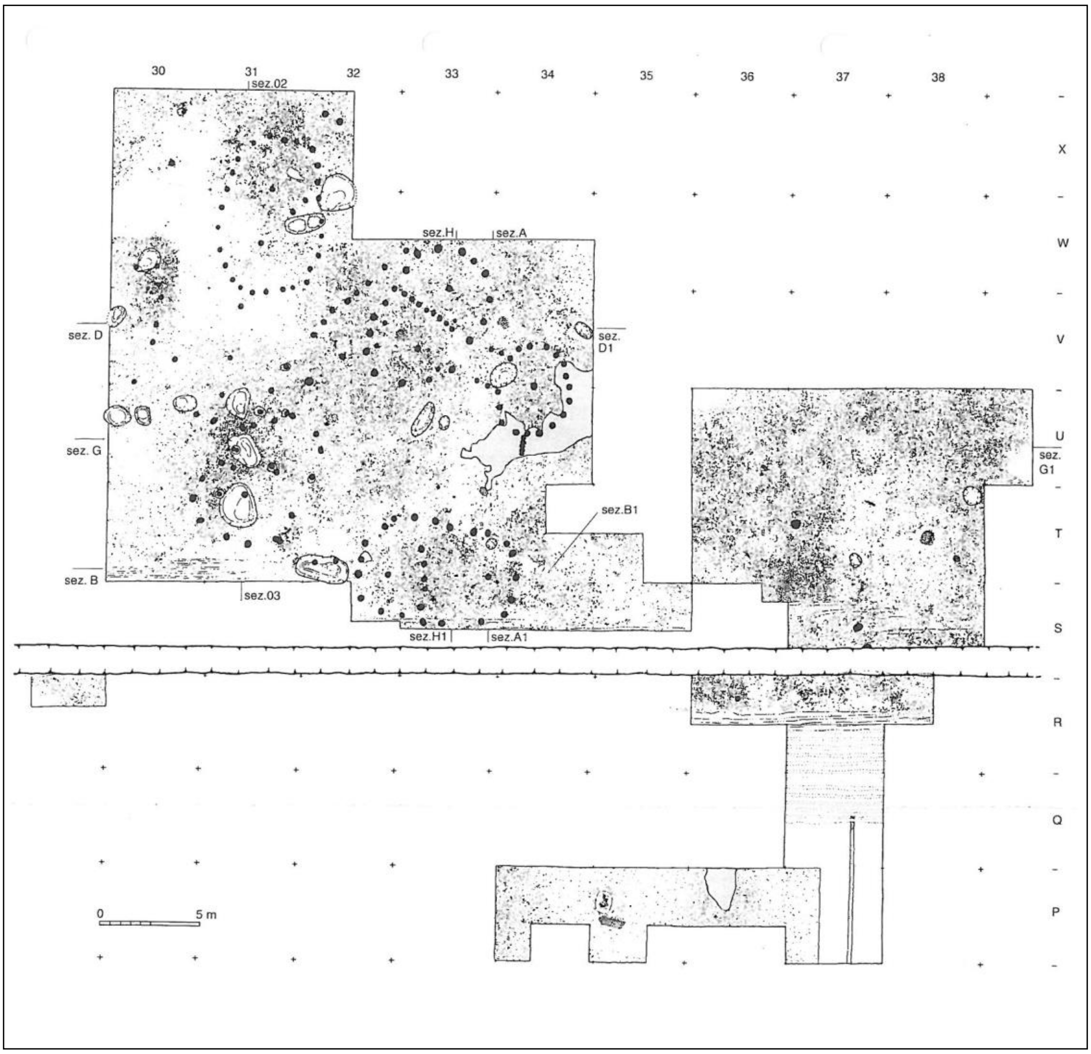

Figure 3.8 Plan of the excavated area of Cerquete Fianello 1992-2000 (from Manfredini, 2002)

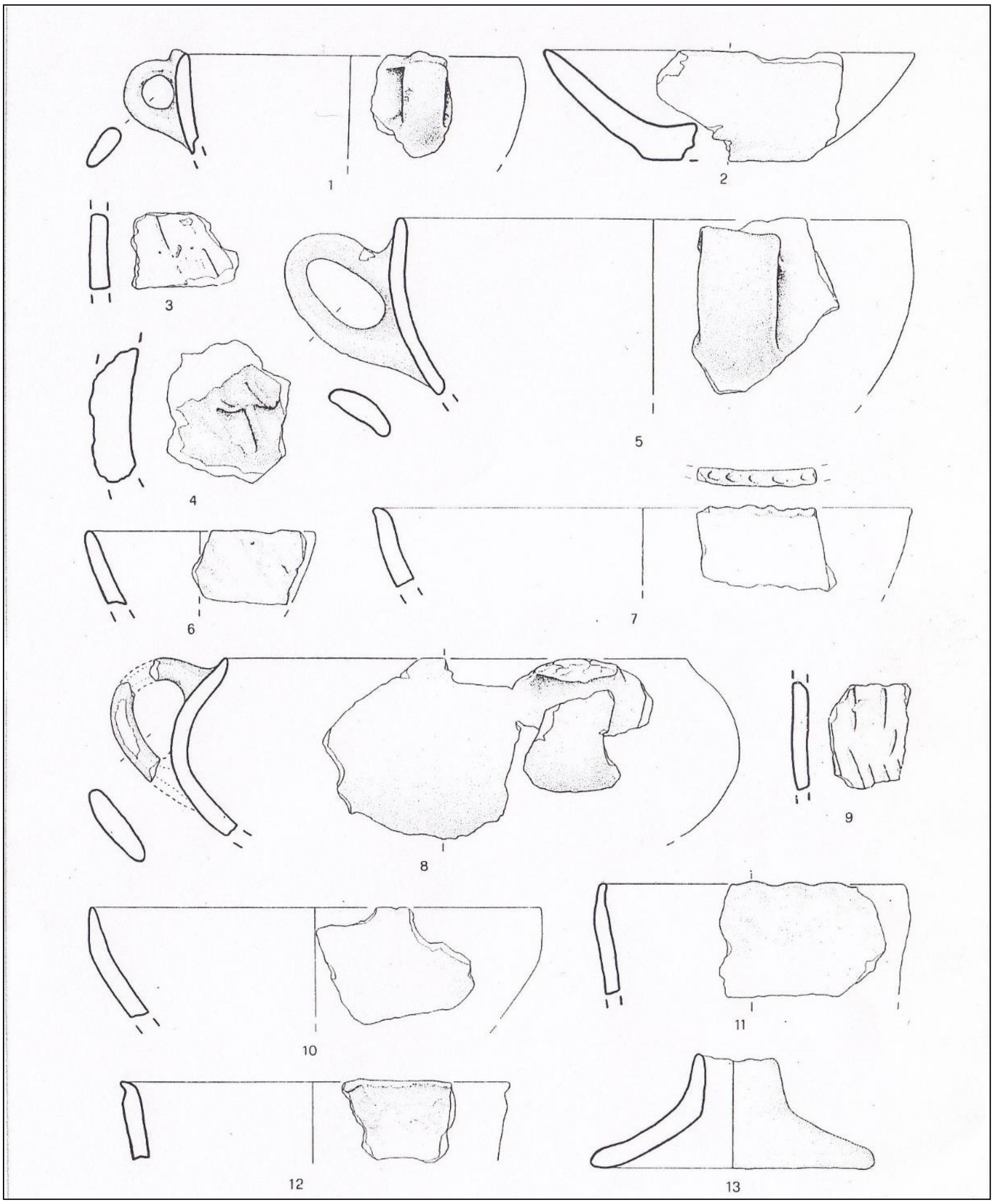

Figure 3.9 Ceramics from site J on the Maccarese Plain (from Carboni & Salvadei 1993, 267)

Site D, in the south of the area, has been heavily damaged through plough activity, but consists of material of the Lagozza cultural facies from the end of the Neolithic (Carboni & Salvadei 1993, 257). The assemblage includes open form vessels, bowls and cups.

At least one fragment of cordoned ware suggests transition into the Eneolithic period. The lithic assemblage includes flint and obsidian, comprising arrowheads, scrapers and points, also burins (Carboni & Salvadei 1993, 259). One blade from the assemblage is different from the Lagozza types of flint and obsidian, suggesting an Eneolithic type of technology. The faunal remains at Le Cerquete-Fianello show that the principal wild animals represented in the record are those of roe deer and wild cat (Tagliacozzo *et al.* 2002, 235). The majority of the assemblage comprised domesticated animals; dog, pig, cattle, sheep and horse.

The most prominent cultural trait in Eneolithic culture, for the study area and central Italy in general, is the use of excavated tombs or grotticelle artificiale, usually ovate in form, with narrow access corridors, and either single, double or triple burials (Anzidei *et al.* 1985). The presence of weaponry is represented in burials from central and northern Italy, including flint arrowheads and blades with evidence of extensive retouching. Stone maces and copper halberds are noted in the metalworking areas of Etruria. The quantity of weaponry in part distinguishes the Eneolithic burials from those of the Neolithic (Anzidei *et al*. 1985, 99).

Tombs of this period also demonstrate close links with Anatolia and the Aegean, with examples of worked copper, for instance at the necropolis at Paestum and Salerno relating to the Gaudo culture (Cazzella 1973, 192), interpreted as indicating groups from the Eastern Mediterranean that settled on the Italian coast[18]. Such hypotheses have received much criticism, with the cultural parallels between Italian Neolithic and Eneolithic materials being stressed. The presence of campaniform beakers in northern and central Italy, showing horizontal incised designs on the walls of the vessel, also indicates the presence of Eneolithic cultures (Anzidei *et al.* 1985, 101).

[18] A hypothesis supported by V. Gordon Childe, based on the notion of metalwork in Italy being initiated by groups of 'prospectors' arriving on its shores, stating that '…the rays of Oriental culture should strike upon the Apennine Peninsula first after Greece.' (Childe 1947, 225).

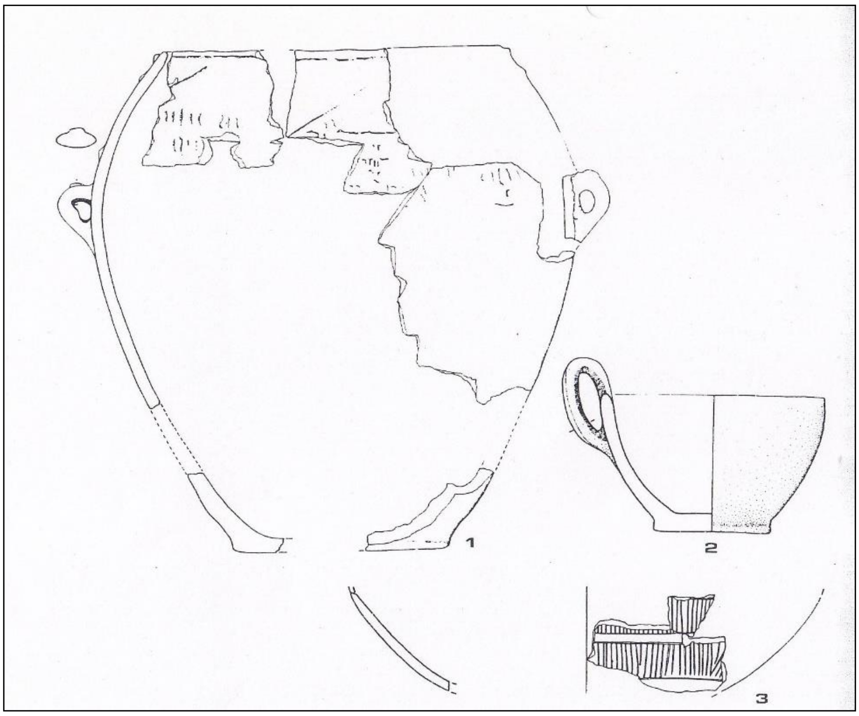

Figure 3.10 Ceramic material from Torre Spaccata of facies type Andrea-Laterza, a storage vessel, cup and bowl (from Anzidei *et al.* 1985, 108)

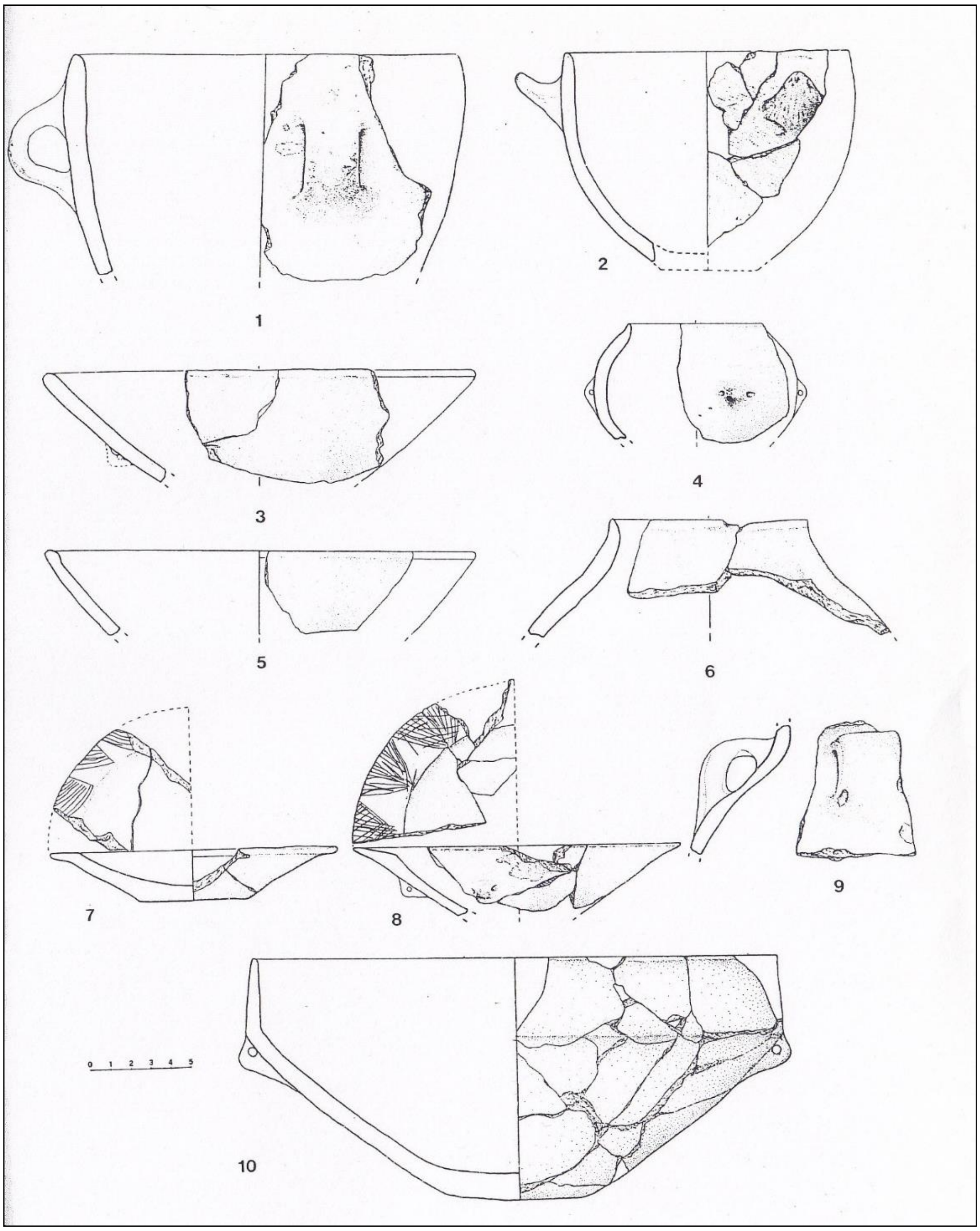

Figure 3.11 Ceramics from Torre Spaccata (Anzidei *et al.* 1985)

3.3.4 The Bronze Age and the Latial Cultural Facies (2000 BC – 900 BC)

Lazio to the south of the Tiber and in the area around Rome is represented by cultural development of a local nature, defining this region from the surrounding areas. The earlier settlements of the Middle Bronze Age are related to the proto-Appennine facies of Southern Italy (Fig. 3.12). The economy is based on deer, freshwater turtle, fish and fox, with small amounts of sheep, cattle and pig (Anzidei *et al.* 1985, 124). Settlements are generally located on valley sides, as well as along the coast at Sperlonga, Gaeta and Lavinio. In Rome material on the slopes of the Campidoglio attest to occupation, together with deposits in the Roman Forum, with Sub-Appennine and Protovillanovan material preceding burials from the latial culture. Close to the Tiber delta to the south of the river, the Sub-Appennine culture also seems to mark the start of settlement at Ardea. The cultures of this period are known, however, principally through burial remains, with material at Cavallo Morto comprising cinerary urns and ornaments, and cremation burials at Campo del Fico, dated to c. 1100 BC, of impasto, similar to material found in Etruria in the territory of Cerveteri. Similar cremation burials of this period were also found in the area of Osteria del Curato to the south-east of Rome.

Culture or Period	**Approximate Date**
Bronze Age	2000 – 900 BC
Proto-Appenine	1600-1500 BC
Appenine	1500-1300 BC
Sub-Appenine	1300-1200 BC
Proto-Villanovan	1200-1000 BC

Table 3.3 List of the conditional cultural groups for Central Italy in the Bronze Age

At Ficana a group of burials seem to indicate the transition between the Protovillanovan facies and the first phase of the Latial culture. The presence of contact between Etruria and the coastal zone to the south of Rome in this period is attested by the typology of bronze artefacts (Anzidei *et al.* 1985, 139)[19]. This connection may be a nascent form of the links between *Latium Vetus* and Cerveteri in the first centuries of the Iron Age. Extensive remains of settlement and economy are also present in the Pontine Plain, connected to pottery production and salt production (Attema 1993; Attema and Alessandri, 2012, 288), with ceramics dating this latter to the recent and Final Bronze Age (1400 to 1000 BC; see Attema and Alessandri 2012, 290).

[19] A bronze hoard close to Ardea contains material similar to finds at Tolfetano inland from Cerveteri (Anzidei *et al.* 1985, 139).

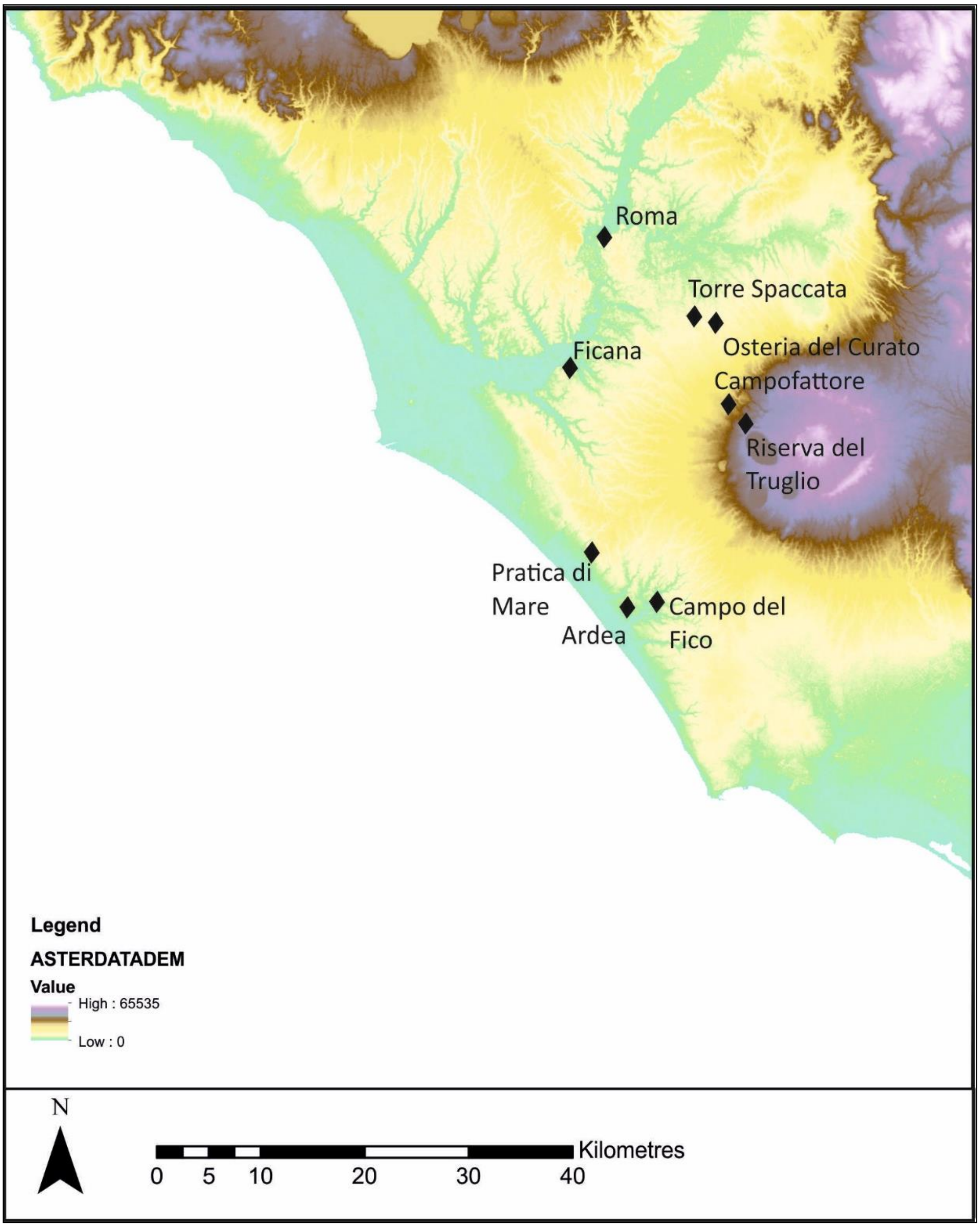

Figure 3.12 Bronze Age sites in the study area mentioned in the text (Elevation based on ASTER data. ASTER GDEM is a product of METI and NASA)

The Appennine culture is well-represented in the Sabina, the Colli Albani, and around Rome, out to Monte Roncione on the Via Aurelia. Important sites in the formation of ancient Lazio such as Rome, Gabii, Lavinio, Ficana and Satricum, are inhabited from this period.

In general, there is no evidence for continuity of settlement activity between the Eneolithic and the Middle Bronze Age in the study area. For example, at Torre Spaccata (Figs 3.13) there is barely any trace of Middle Bronze Age activity, in spite of intensive Neolithic and Late Bronze Age activity (Anzidei *et al.* 1985, 126). In summary the Middle Bronze Age in Lazio is divided between that in Etruria and the areas to the south and east of the Tiber. Southern Lazio seems to be less densely populated, with a poorer economy based on transhumance and pastoral farming, also hunting and a small amount of agriculture. By contrast the same period in Etruria shows more mixed agriculture with arable farming but still a strong reliance on animal husbandry, and a denser population. A number of sites are also distributed along the coast of Etruria to the north of the Arrone that have been dated to this period. They include the Middle and Late Bronze Age sites at Tombolo della Foce, Infernetto di Sotto, Grottino D'Ansedonia, Tombolo della Feniglia and Pertuso among others (Casi, 2000).

In terms of the Late Bronze Age in Lazio, there is a general lack of extensive excavation and material on which to base interpretation (Anzidei *et al.* 1985,137). There seems to be a continuation in the presence and occupation of settlements from the Middle Bronze Age, at Rome, Gabii, Lavinio, Ficana and other sites.

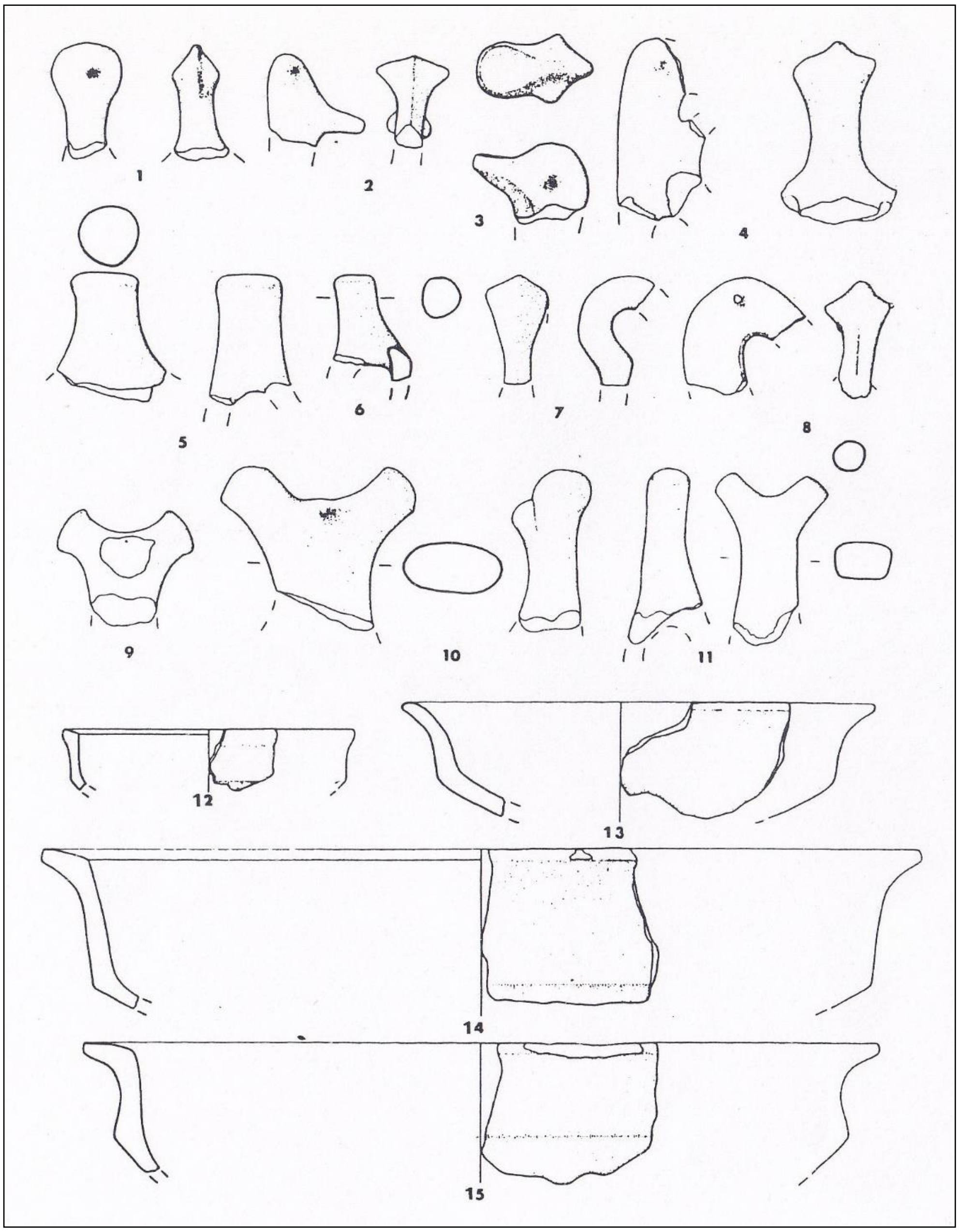

Figure 3.13 Handles and bowls of the Sub-Appennine Culture (Anzidei Bietti Sestieri, A.M., De Santis, A. 1985, 130)

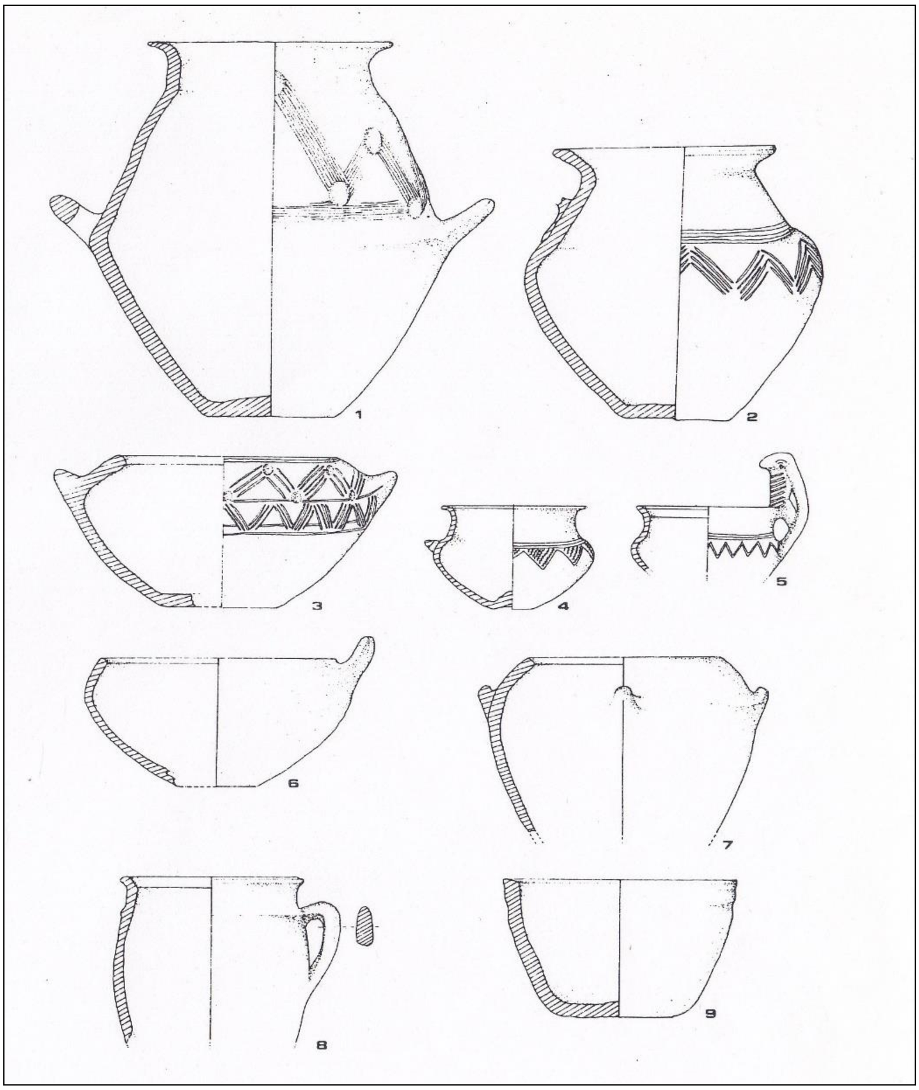

Figure 3.14 Ceramics of the Proto-Villanovan Culture from Southern Etruria (Anzidei *et al.* 1985, 131)

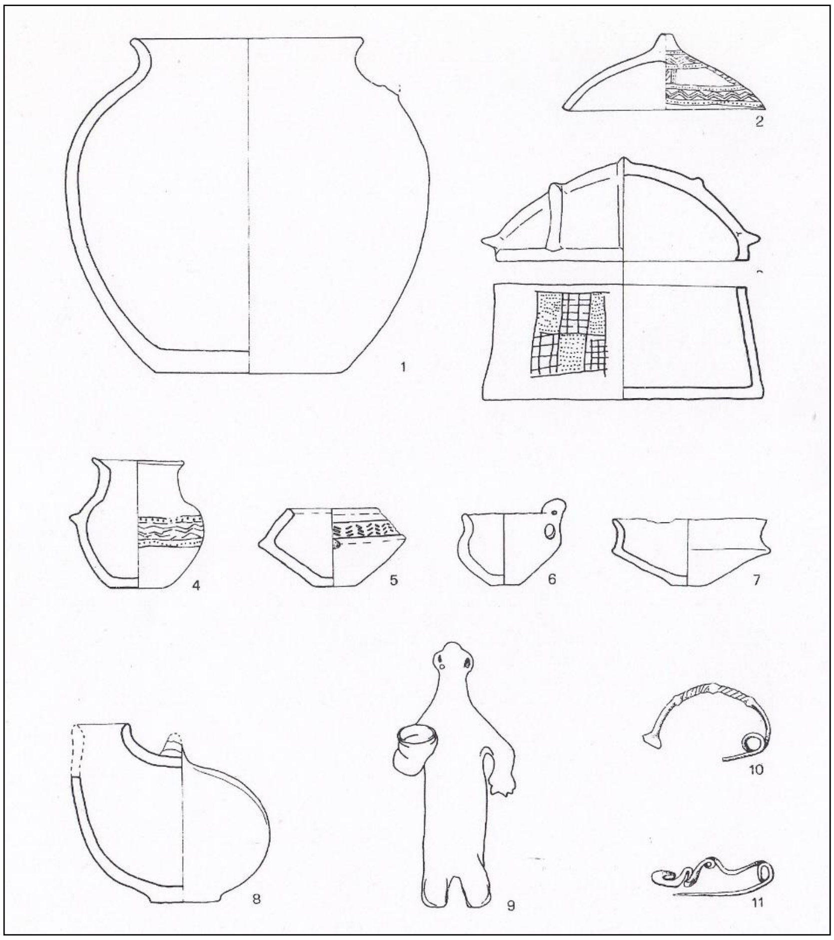

Figure 3.15 Ceramics in the Latial Culture phase I, including urns, cups and bowls

Figure 3.16 Ceramics in the Latial Culture phase I, including urns, cups and bowls

By the Final Bronze Age (c. 1000 BC) it is possible to see the first signs of what could be defined as the Latial Cultural facies in the archaeological record (Figs 3.16 and 3.17). This is represented by scarce, if well-characterized, evidence from the Colli Albani (Campofattore and Riserva del Truglio, Lorenzo Vecchio, Boschetto, Cavalletti and Vigna d'Andrea) and the coastal zone to the south of Rome at Pratica di Mare, also in Rome and the Sabina (Anzidei *et al.* 1985, 140).

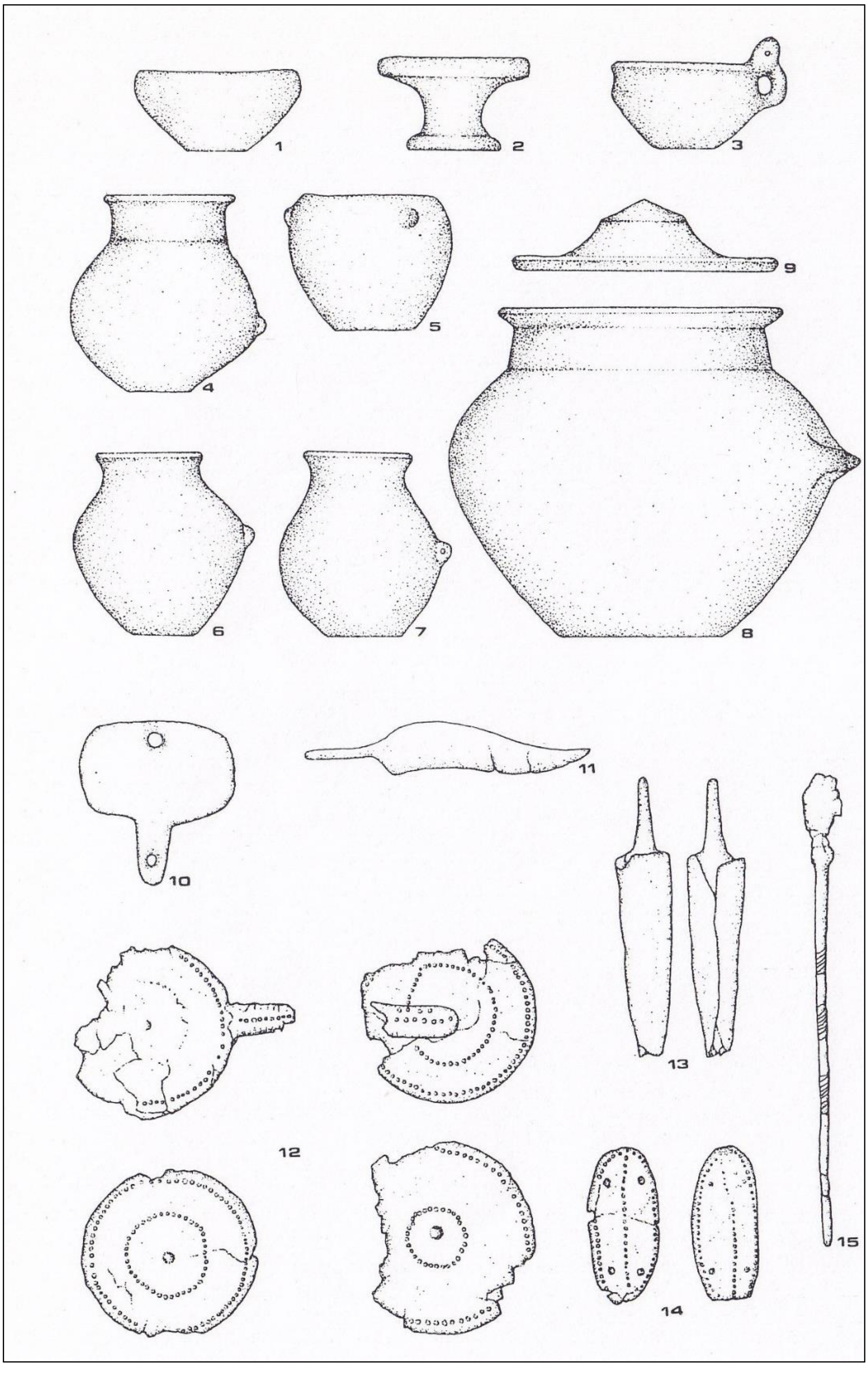

Figure 3.16 Ceramics and metalwork from Pratica di Mare (Lavinium) from 10th century BC of the Latial Culture phase I

In general, there is scarce excavated evidence of settlement. Burials take the form of cremation buried in tombs or ditches, usually protected by urns with a conical cover. On rare occasions the urn may take the form of a capanna. Grave goods can comprise miniaturised vessels, ornaments, weapons and others. Evidence for the basis of economy for this final phase of the Bronze Age is scarce. However, if the preceding and successive periods are an indication then the probability would be an economy based on limited cereal cultivation, collection of wild fruits and plants, hunting and fishing, and animal husbandry based on caprines and pig (Anzidei *et al*. 1985, 146). Settlements were probably located close to transhumance routes, with the similarities in cultures between different areas (Colli Albani and the coast, Rome and the Sabina) being due to the practice of transhumance. Production of pottery is entirely handmade, and probably domestic. Metal objects are scarce and probably the product of external influence from Southern Italy, Umbria and Etruria. As with the preceding phase there seems to be a strong link between the area of Monti del Tolfa and the hinterland of Cerveteri, with movement of metal artefacts and moulds for metalworking, and similar funerary practice in Etruria as with the first latial phase, with miniature grave goods, but without the rigour of the Latial Culture practices. These exchanges seem to occur along a coastal corridor with communication between sites along the coastal littoral, in the study area at Pratica di Mare and Ficana, together with Monti di Tolfa.

The Bronze Age of Italy was traditionally represented in terms of social groups of nomadic and semi-nomadic type surviving through a pastoral economy (Anzidei *et al.* 1985, 113) with animal husbandry based on cattle and caprines, and transhumance across the peninsula[20], linked particularly to the Rinaldone (Anzidei *et al.* 2007) and Gaudo cultures along the Tyrrhenian coast, comprising the second half of the 3rd millennium and the 2nd millennium BC. They are defined as pastoral warriors, in contrast to the economies based on farming and sedentary settlement in the Neolithic. The term created by Puglisi was the Apennine Culture, to describe these communities dependent mainly on sheep and goat (Anzidei *et al.* 1985; Cazzella 1973, 193). Settlement was based on a number of permanent villages (for example Belverde sul Monte Cetona) and temporary settlements elsewhere, usually close to sources of water. Fundamental to the economy was the activity

[20] The main proponent of this theory was Puglisi, who hypothesised a direct linear development of Eneolithic culture into the middle and late Bronze Age (Puglisi 1959). By contrast Östenberg (1967) disputed the mobility of Eneolithic groups, suggesting that weaponry in graves represented ritual artefacts. The hypothesis of Peroni (1971) does not rule out the bellicose relationships between groups, while emphasising the reliance in the period on arable cultivation and animal husbandry. A good synthesis of the arguments can be found in Cazzella (1973, 193).

of transhumance (Anzidei *et al.* 1985, 114) from the Apennines in summer, down to the coastal plain of the Adriatic and Tyrrhenian Sea.

Material of the period reflects (Fig. 3.18) the homogeneity of the cultures across the Italian Peninsula, with handmade vessels of impasto but with a broad variation in forms and decorations, similar across the peninsula, but with slight variations in different regions.

In the study area, for the first time in the archaeological chronology, the cultures of this part of the Italian Peninsula start to demonstrate clear differences in relation to those in the rest of the region (Anzidei *et al.* 1985, 123). The archaeological record shows a difference between the Middle Bronze Age and the previous cultures, with very few examples of uninterrupted settlement between the Eneolithic and the Middle Bronze Age. The reasons for this are not clear, although it may be linked to climate change associated with the Sub-Boreal climatic phase, leading to a drop in temperatures and greater aridity in Europe (Carboni *et al.* 2005; Cremaschi *et al.* 2011).

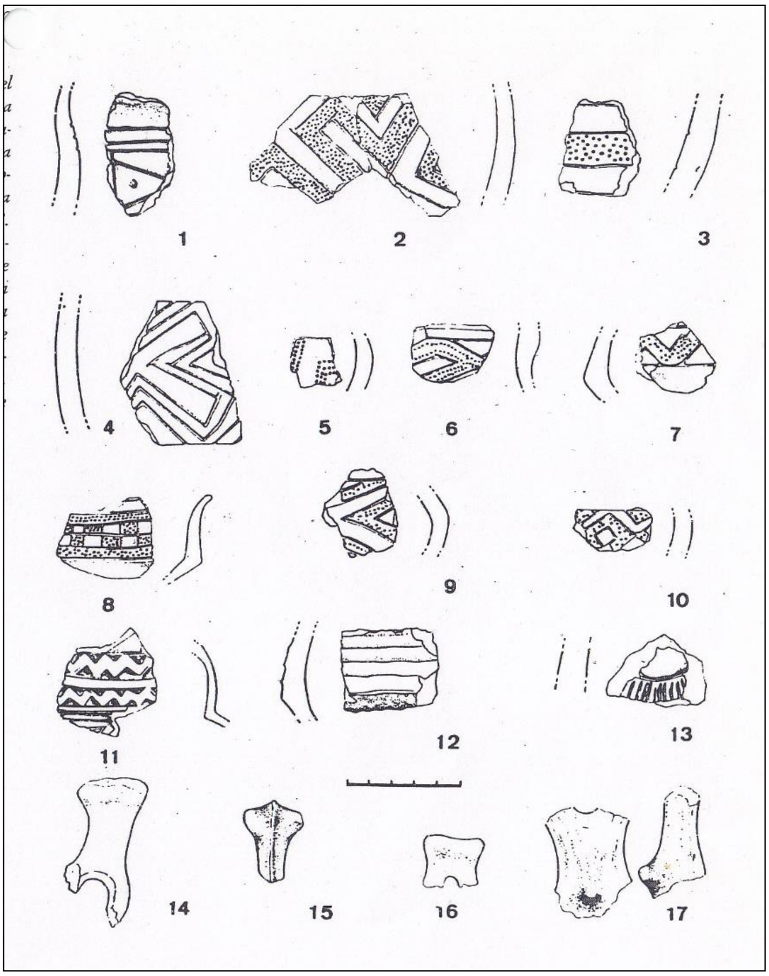

Figure 3.17 Ceramics of the Appennine Culture from the area of Rome (Anzidei *et al.* 1985, 125)

The Middle Bronze Age settlements are generally concentrated around water resources, on the shore of lakes such as Bracciano and Mezzano. These lacustrine deposits provide unparalleled records due to the preservation of organic material. In the coastal zone sites such as Marangone and Torre Chiaruccia indicate activity in the Middle Bronze Age, and other sites on the tufaceous hillslopes along the edge of the coastal floodplain (Anzidei *et al.* 1985, 124). The pattern of settlement across Etruria comprises small sites a short distance from one another, with evidence of an economy based on caprines, cattle and swine. Widespread pastoral economies (Rossenberg *et al.* 2012, 49) and the abundance of trackways in the area leading to the interior of Etruria indicates the practice of transhumance (Barker and Grant 1991). Arable farming does appear in the record suggesting cultivation of wheat. In spite of the presence of mineral resources at Monti della Tolfa, evidence of metalworking is scarce.

A series of cultural facies are recognisable for the different regions of Italy in the Late Bronze Age (1300 – 1000 BC). These eventually form the basis for cultural sub-division for the Iron Age. The two prevalent cultures in the area of the Lower Tiber are those of the Sub-Appennine (Fig. 3.14) and Protovillanovan (Fig. 3.15) culture, attributed to c. 1300-1200 BC and 1200-1000 BC respectively. The Sub-Appennine culture is represented principally by impasto pottery without incised decoration with open form. Habitation in the Sub-Appennine culture is generally represented by open settlement or cave dwellings, with assemblages including bronze objects similar to the Appennine Culture. The Protovillanovan Culture by contrast is more clearly differentiated by region and locality (Anzidei *et al*. 1985, 129) in part through the evidence from burials, most notably cremation burials with vessels. Ceramics are generally handmade, of impasto, with a biconical form, usually of medium or large vessels, with a rich variety of incised decoration including triangles, zig-zags and combed designs.

The principal settlement and necropolis of this period on the Tiber is at Ficana (Quilici Gigli 1971; Bartoloni and Cataldi Dini, 1978; Fischer Hansen, 1990; Brandt, 1996), with some finds of Late Bronze Age ceramics in the vicinity of Ostia to the west at Collettore di Ponente (Conti 1982) and Terme di Nettuno (Bartoloni, 1986; Attema and Alessandri, 2012). To the east further settlement on the course of the Tiber is located at Torrino, and along tributaries of the Tiber to the south at Casal di Perna (Bartoloni, 1986).

3.3.5 The Iron Age (900-730BC)

The conventional start of the Iron Age in Italy is the 9th century BC, with Rome and Lazio representing some of the best documented areas in the peninsula (Anzidei *et al.* 1985, 149). One reason for this representation in the archaeological record is the intensive research that has been conducted in and around Rome, and the study of the urban formation of the city.

The first phases of the period corresponds to phases IIA and IIB dated to between 900 BC and 830 BC, and 830 BC and 770 BC respectively. The most prominent archaeological material for these phase are the tombs and burials in Lazio, and traces of settlement (for instance at Velletri, Lanuvio, Fontana di Papa, Rocca di Papa, Albano, Castelgandolfo and Grottaferrata). Within the area of the Lower Tiber, the deposits in Rome at the Roman Forum, the Campidoglio, Foro Boario and the Palatine are also important, with material ofLatial Period II also found at Osteria dell'Osa (Bietti Sestieri and De Santis 2008, 126). Towards the coast the sites of Lavinium, Anzio, Satricum and others are representative of phases IIA and IIB (Anzidei *et al.* 1985, 150). In many of these sites, continuity from phase I to phase IIA is documented in the archaeological record. Several other centres in the study area appear to have their origins in phase IIB, including Acqua Acetosa and Castel di Decima. Although evidence of Bronze Age settlement and earlier tombs are located in the vicinity of these sites, there was resurgence in the population and habitation at each site. Ficana, on the Tiber, also presents a similar situation, with evidence for Middle Bronze Age settlement and phase I cremation burials. Along the tributaries of the Lower Tiber are a number of Iron Age settlements; Torrino and Castel di Decima to the south of the Tiber and Monte Roncione, Pantan di Grano and Prati Madonna to the north (Bartoloni 1986).

Phase	**Date Range**
Latial Culture I	1000-900 BC
Latial Culture IIA	900-830 BC
Latial Culture IIB	830-700 BC
Latial Culture III	770-730 BC
Latial Culture IVA	730-630 BC
Latial Culture IVB	630-580 BC
Villanovan Culture	900-700 BC
Etruscan	700-300 BC
Late Iron Age	750-730 BC
Orientalizing	680-580 BC
Archaic	580-480 BC
Classical	480-350 BC

Table 3.4 Range of Phases for the Iron Age to Classical periods (after Cascino et al. 2012, 345)

Further north along the coastline the site of La Mattonara near Civitavecchia, excavations between the 1930s and 1970s revealed the presence of a settlement of early Iron Age date (Bastianelli 1988), possibly starting in the last part of the Bronze Age, with presence of Villanovan ceramics (Pascucci 1989). In fact, the archaeological evidence for the area suggests the presence of numerous Early Iron Age settlements along the coastline to the north and south of Civitavecchia (Pascucci 1989, 109). The nature of these sites is suggestive of a complex system of settlement lacking in homogeneity. Those sites that eventually develop as urban centres in the Iron Age normally have evidence for settlement from the end of the Bronze Age onwards. Between 9th and 8th centuries BC it is possible to see some degree of change in the model of settlement, with a differentiation between the inhabited areas and spaces for the dead. Settlements are located on plateaux with a dwelling area of between 2.3 and 10 ha (Anzidei *et al.* 1985, 154) defended on the edges by a ditch. Buildings are almost exclusively *a capanna* with the living floor cut directly into tufa, with oval or occasionally rectangular plan, and a door on the shorter side of the dwelling. The *capanne* usually have a fire in the centre of the dwelling used for cooking, and evidence of domestic pottery including storage vessels, cooking vessels, and vessels used in consuming food. The distribution of dwellings does not seem to follow a particular pattern, although the presence of *a capanna* in the centre of the settlement is usually found to represent a cult house, eventually being replaced by walled temples in the 6th and 5th centuries BC.

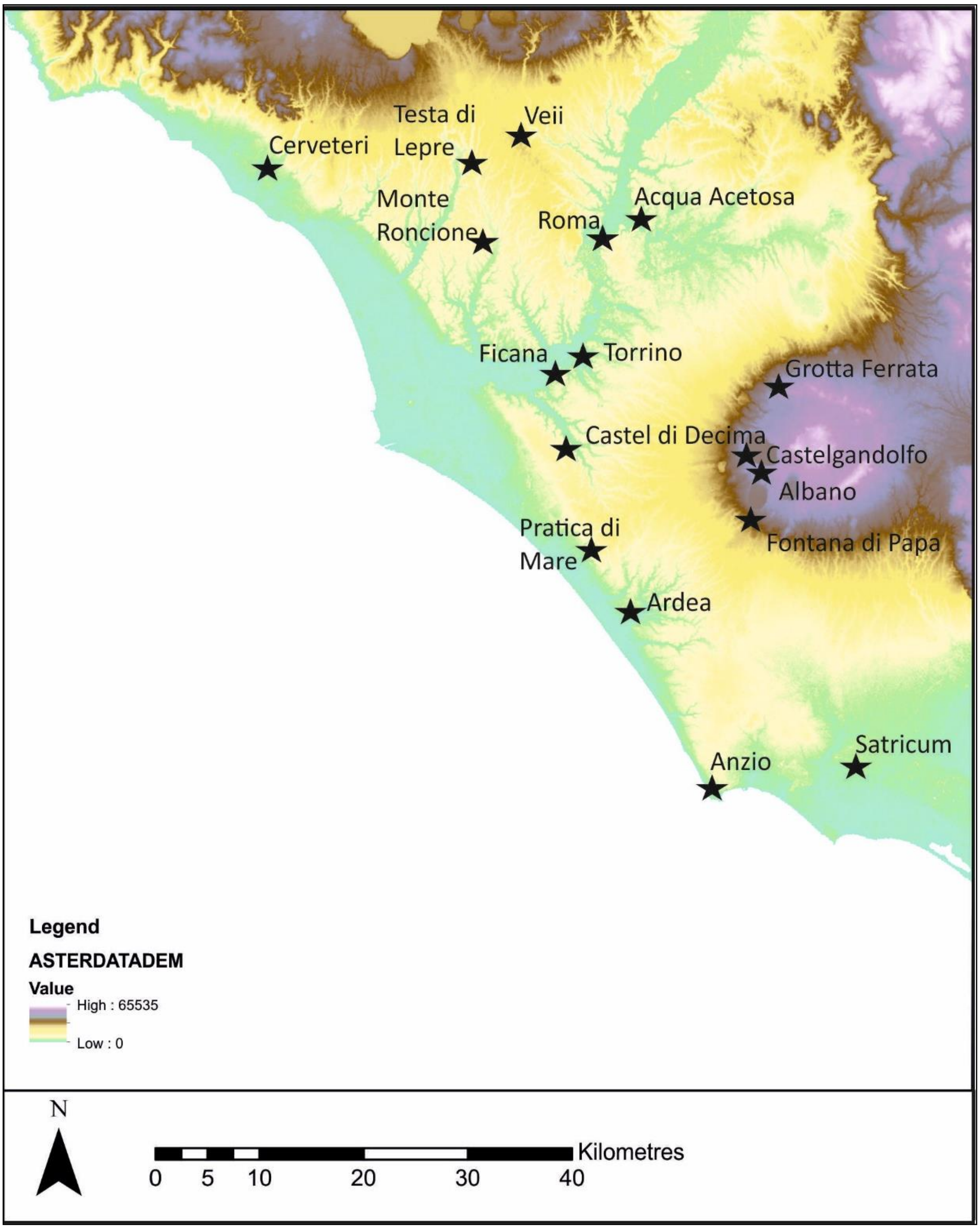

Figure 3.18 Latial III sites in the study area mentioned in the text (Elevation based on ASTER data. ASTER GDEM is a product of METI and NASA)

The distribution of settlement seems to be related to lines of transhumance and the strong connections between different regions of Lazio. Rome is located at a prime point of contact between the Faliscan region, the Sabina, and at the point where the Tiber Valley opens up onto the floodplain and coastal zone of Lazio. A more active role at the start of the Iron Age is that of the settlements along the coast, for instance Lavinio, Ardea, Anzio, and the strong routes of communication with Etruria. This network seems to use the coastal plain as a corridor for passing material and ideas at the start of the Iron Age, circumventing to a certain degree the interior, centred probably on Ficana *en route* to Cerveteri. This model of networking places the central area of the Lower Tiber as central to patterns of movement and subsistence in the earlier part of the Iron Age. The Villanovan facies, well represented around Cerveteri and at the necropolis of Sorbo (Belardelli et al. 2007, 72), is different from that represented at Veii, Tarquinia and Vulci, with a massive presence of artefacts of Latial type.

This system of networking started to change in the second half of the 9th century BC. With the growth of five strong Villanovan centres in Etruria at Caere, Tarquinia, Veii, Volsinii and Vulci (Barker 1999, 20) Cerveteri lost its relative importance certainly with respect to Tarquinia and Veii, and as such contact with Veii and the interior of Etruria became more pronounced, refocusing the route of communication towards Rome. This also coincided with stronger connections with Campania and the Greek colonies to the south (Anzidei *et al.* 1985, 157).

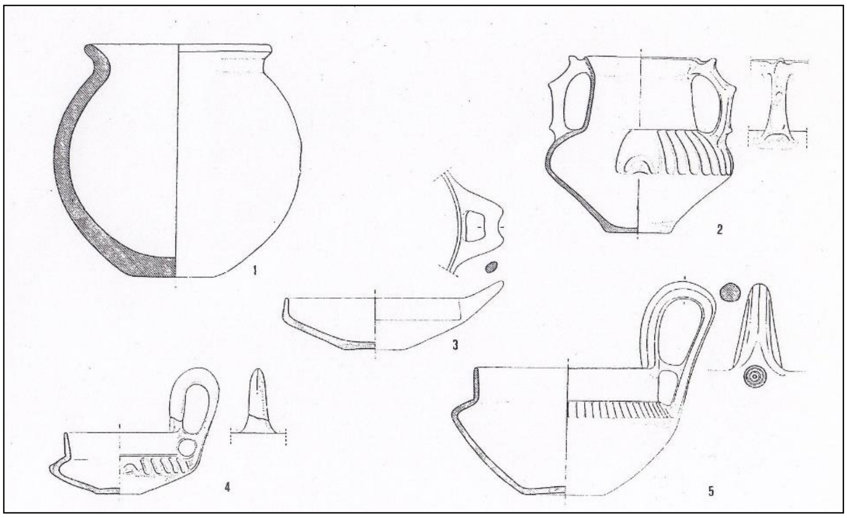

Figure 3.19 Ceramics of the Latial Culture phase III (c. 770-720 BC) including cups of the type found in many of the burials of the period (Anzidei *et al.* 1985, 189)

The growth of sites such as Castel di Decima is probably due to the increased strength of these routes of communication. The economy of the period is based on a number of forms. The area of Southern Lazio, for instance the Colli Albani, was not well adapted to agriculture, Evidence, such as it is, suggests a relatively poor agriculture, with grain based on spelt and barley, and faunal remains comprising pig, caprines, and cattle, and wild animal remains comprising freshwater turtle, fish and wildfowl. The issue with this is that much of the evidence comes from sites such as the tombs of the necropolis of the Roman Forum, close to the temple of Antony and Faustina (Anzidei *et al.* 1985, 173) and the remains are representative of probable ritual activity, with the types of animal used over-representing the contents of the everyday diet. Caprines and pig probably formed the greater part of this diet.

Transhumance routes still played a significant part. In terms of domestic animals, for instance based on the assemblages from Rome, Fidene and Ficana, a large proportion of the faunal assemblages comprise cattle, sheep and pig (De Grossi Mazzorin 1989, 129). Evidence also exists for exploitation of wild animals, principally deer and wild boar, suggesting a mixed woodland environment used for hunting (De Grossi Mazzorin 1989, 140).

Culturally there seems to be, for the first time, evidence of sub-division of tasks, particularly with activities such as weaving (a female activity), represented by spindles and other objects in tombs. Metal goods are still rare in this period, suggesting artisanal woodworking, straw and clay. The increased importance of contact with Greek colonies to the south, in particular from Campania, cannot be underestimated, and an increase in different types of bronze object, including personal decoration and tools.

Phase III of the Iron Age in the 8th century BC (Figs 3.19) shows the influence of Greek colonies in Campania and the Etruscans on the Latial Cultures (Anzidei *et al.* 1986). Little evidence exists for the basis of the economy in this phase, although it is possible to deduce that a concentration and organisation of space of settlements and territories occurred. This includes private land ownership and the formalisation of agricultural land and woodland. This also marks the extension of property ownership and the greater use of arboreal agriculture, including vines and olives, plants well-known to the inhabitants of Lazio from the Bronze Age, but being formally cultivated for the first time from the 8th and 7th centuries BC.

Ceramics do not change extensively in phase III although some changes suggest slight variations in the preparation of food. Metalworking increased, and iron, rare in the 9th century, became the more frequently used material. Much of the production seems linked to Etruria, with Veii and the Agro Falisco. It is interesting to note the continuity of distribution of materials and goods along the coast, with the connection between Lazio and Etruria.

This period also corresponds to the continuing centralisation of large settlement, and the establishing of hierarchical social structures, including those of the Etruscans and Latial cultures. While some discussion of the start of more hierarchical cultures seems to stem from inquiry as to the origins of some cultures, most predominantly the Etruscans, several mtDNA studies indicate that the Etruscan population is of local origin rather than with links to western Anatolia (Vernesi *et al.* 2004; Ghirotto *et al.* 2013; Tassi *et al.* 2013).[21]

3.3.6 The Orientalizing Period (730-580BC)

The Orientalizing Period in Italy corresponds to the period of a little over a century where Greek forms of ceramic and decoration are presented in the archaeological record. The origins derive from the exploitation of new material and forms of decoration in Greek material culture influenced by Assyrian and Syrian art. Orientalizing culture was particularly prevalent in Etruria, due to contacts with Greece and the area of Magna Grecia, which comprised much of the southern part of the Italian Peninsula.

For the study area, and from the faunal remains of sites such as Rome, Ficana and Fidene, the proportions of remains derived from hunting, fishing and gathering in this period are scarce, although wild goat, deer and boar were hunted (De Grossi Mazzorin 1989, 127). Evidence of larger mammals, in particular deer, from Ficana and Fidene suggest that hunting was a conspicuous activity conducted by those with the time and means to do so. Worked antler and horn appears in the archaeological record at a number of sites of this period, including Ficana, Tarquinia and Satricum.

3.3.7 The Archaic Period (580 – 480BC)

The Archaic period of the Tyrrhenian coastal region spans a period of c. 100 years between the Orientalizing period and the Classical Period, incorporating the early Roman

[21] Tassi *et al.* (2013, 16) note that the main separation between the Anatolian and Tuscan mitochondrial pools occurred some 6,500 years ago at least, and thus an Anatolian origin for Etruscan civilization is unlikely based on the genetic evidence.

Republic. The urban centres and economies of Latium and Etruria continued, with no break in the material culture represented by the Iron Age. Archaeological evidence outside of the study area, particularly in the region of Campania around Salerno, suggests the expansion of Etruscan influence along the Tyrrhenian coast from Etruria.

3.3.8 The Roman Republic (509-27 BC) and Classical Period (480-350 BC)

The continuity of settlement and land use in the area of the lower Tiber and delta in the Republican period has received scant attention. As the current study shows there appears to be some degree of continuous settlement in the study area, represented by the presence of Etruscan and early Republican farms and rural settlements in the archaeological record (Amendolea 2004). The level of disturbance and conflict in Lazio, not least between Rome and the Etruscan and Faliscan territories to the north of the Tiber, is considerable. Most important to our understanding of the lower Tiber in this period is the system of colonisation in the Mid-Republican period.

Key to the archaeology of the Lower Tiber and Tiber delta in the period of the Roman Republic is the relationship between Ficana and the newly-formed castrum of Ostia Antica. Although legend relates that Ostia was founded in the 7th century BC the archaeological evidence places the foundation of the city as the 4th century (Santa Maria Scrinari 1984; Brandt 2002; Zevi 2002). More substantiated is the importance of Ficana as a settlement on the Tiber from the Late Bronze Age onwards, with particular evidence of settlement in the Archaic and Early Republican period (Bartoloni and Cataldi Dini 1978; Santa Maria Scrinari 1984; Fischer Hansen 1990; Brandt 1996; Zevi 2002). With the Republican period a series of rural villa sites are represented in the archaeological record in the territory around Ostia and in the zone to the north of the Tiber. To the south of the river villas at Dragoncello, Malafede and Monte Cugno (Pellegrino 2004; Zevi 2004) are present from the 4th century BC onwards through to the 1st century BC, with later structures associated with settlement in the Imperial period. At Fralana (Acilia) an area of ceramic fragments indicates the presence of late 4th century BC settlement close to the location of a later Imperial villa (Pellegrino *et al.* 1995, 419). Similar rural settlements extend along the line of the Tiber to the north from the area of Portus to Ponte Galeria, with evidence of rural settlement from the 4th and 3rd century BC attested at Ponte Galeria

(Petriaggi *et al.* 1995, 364). A series of villas are also situated on the low hillslopes to the north of the Tiber, including that present at Castel di Guido (Rossi 2001) showing possible continuity of settlement from the 3rd century BC to 3rd century AD. The distribution of these sites, and the excavated material, indicate a network of rural settlements based on agrarian practices along the Lower Tiber, with sites located either along the edge of the river floodplain between Ponte Galeria and Ostia Antica, or in the tributary valleys to the north and south of the river. These settlements are related to a system of roads and acqueducts built in the Republican period between Rome and the coast. The Via Aurelia dates to the 3rd century BC and runs along the edge of the Maccarese Plain to the north of the Tiber. The Via Ostiense leading to Ostia Antica, with evidence of the road and associated buildings and infrastructure, including material from 1st century BC at Acilia (Izzi and Pellegrino, 2001) and the Via Portuense dating to the 1st century AD (Petriaggi *et al*. 2001, 144).

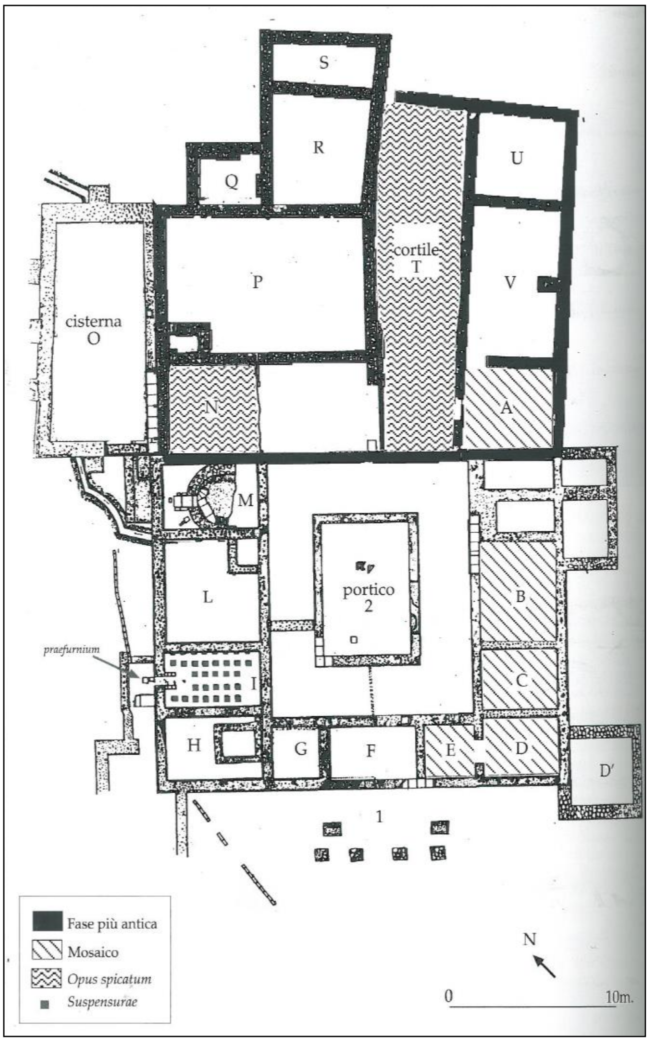

Figure 3.20 Villa of Dragoncello (Site F)(from (De Franceschini, 2005)

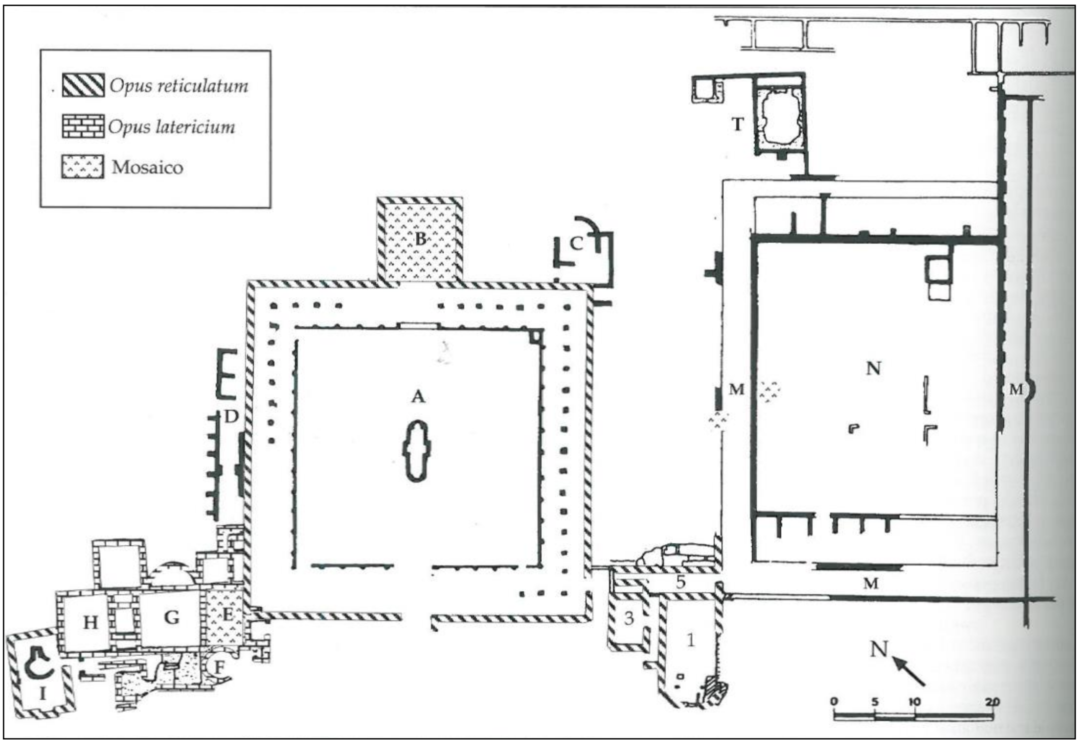

Figure 3.21 Plan of the Villa of Pliny, Castelfusano (from (De Franceschini, 2005)

Key to the location of settlement in the study area in this period is the growth, particularly in the later Republic and Imperial periods, of maritime villas along the coast, particularly along the coast to the south of Ostia Antica, and with other key examples to the north around the area of Palo. These include the Villa di Grotte di Piastra at Castelporziano, built in the 1st century BC, comprising a residential area and baths (De Franceschini 2005, 265). In the Republican period the majority of recorded villa sites, however, exist along the edges of the Tiber floodplain, and in the tributaries of the Tiber, comprising villa rustica, effectively high status farms. These include the Villa del Castel del Guido on the Via Aurelia, the Villa di Via Magliana, the Villa del Torrino on the Via Ostiense, the Villa di Acilia at Fralana, and the villa complex at Dragoncello (Pellegrino 1983; Pellegrino 1984; Pellegrino *et al.* 1995; De Franceschini 2005). These sites share some common features indicating the presence of sites for habitation with extensive resources for the processing of agricultural produce, indicating the presence of mixed agriculture in the area of the Tiber and the edges of the delta. In addition, floodplain and delta area provide evidence for the production of salt certainly from the Republican period. Theories about the foundation of Ostia have speculated that the castrum was originally founded to protect the saltworks in the area (Bellotti *et al.* 2011, 1114), and the presence of Etruscan saltworks on the Maccarese Plain is attested to (Morelli *et al.* 2004). The existing evidence from the study area certainly indicates an economy based on mixed agriculture, industrial practices including saltworking, and possible transhumance practices for the keeping of livestock.

3.3.9 The Imperial Period

Within the Tiber delta, the most significant development in terms of impact to the economy and settlement pattern of the area was the development of Portus during the reign of Claudius in the 1st century AD. The site of Portus lies a few kilometres to the north of Ostia Antica at the ancient mouth of the Tiber (Keay *et al.* 2005). The port was established under the Emperor Claudius and was enlarged under the Emperor Trajan and formed the main port in the movement of commodities between the Mediterranean and Rome from the 1st to the 6th centuries AD.

Due to the prograding nature of the Tiber delta, the site of Portus is now located some 2 km inland and covers some 3.5 km^2. It is subdivided amongst several landowners, principally the Italian state (*the Parco Archeologico di Ostia Antica*), the Comune di Fiumicino and the Duke Sforza Cesarini. Our current understanding is that the port was articulated around the Claudian basin (200 ha), the Trajanic basin (32 ha) and a small basin, the *darsena* (2 ha), which were inter-connected by a series of canals. Much of the internal space was given over to large warehouses, as well as a large temple complex and other kinds of public building. There appears to have been little residential space. The rationale for this massive complex can only be properly understood in terms of its broader context in the Tiber delta, and relationship to Rome and the neighbouring river port at Ostia. A network of canals connected it to the Tiber to the east, Ostia to the south, and the Tyrrhenian Sea to the west.

The broader context and landscape of the port has formed the focus of early cartographic representation including Danti's 1582 fresco of Portus and the surrounding area. Various toponyms in the area were also contained in Nibby's (1849) topographic description of the area around Rome.

The first major topographic study of the site was undertaken by Lanciani (1868). This was followed by a number of archaeological studies, including a summary of excavations and a general account of the complex by Lugli & Filibeck (1935), and an account of the harbour by Testaguzza (1970) based on archaeological discoveries during the construction of the International Airport at Fiumicino in the 1960s. Work was also undertaken by the Soprintendenza per i Beni Archeologici di Ostia (now the Parco Archeologico di Ostia Antica; Mannucci 1992) at Portus, with a number of interventions in the 1990s and 2000s. The overriding focus of work on Imperial Roman archaeology in the Delta, with the exception of Ostia, has been at Portus, and has dealt with the harbour complex. More recent development along the source of the Tiber and into the Delta has, however, revealed more on the nature of the economy of the zone outside of the port complex.

The broader pattern of settlement and land use between Rome and Portus, and across the Tiber delta suggests an intensification of settlement and economic practices with the arrival of the port. Many of the villa sites established in the Republican period continue to be inhabited. The Villa Torrino, the Dragoncello villa complex and the Villa Castel del Guido on the Via Aurelia all continue to be used into the 2nd century AD, with new villa rustica, such as the Villa di Fregene and Villa di Infernaccio, being constructed (De Franceschini 2005). It is the extensive construction of maritime villas that marks the period of the 1st century AD, with the Villa di Castelfusano, or Pliny's Villa (De Franceschini 2005, 260), and a series of maritime villas belonging to the ruling elite being constructed along the Laurentine shore to the south of Ostia Antica (Rendell *et al.* 2007). While these complexes indicate high status ownership, the presence of some potentially industrial features, for instance a possible tank for preparation of fish at Pliny's Villa (De Franceschini 2005, 261) indicate an economic use of these sites. The discovery of a mole along the western side of the Laguna di Ostia in 2007[22] may indicate the organisation of the area for different possible uses, including trade of commodities in the Imperial period.

[22] The discovery was reported widely in the press, including Il Messaggero (16.12.2007) and Corriere della Sera (16.12.2007).

Figure 3.22 Area of excavation between the line of the Via Portuense and the River Tiber in 2006 (photo: K. Strutt)

Continued development of salt workings is noted for the early Imperial period (Bellotti et al. 2011, 1115), particularly in the form of the *Campus Salinarum Romanarum* (Di Rita *et al.*, 2009) to the north of the Tiber. In addition, the palynological evidence for the area suggests increased woodland in the area, including oak. It is difficult to link such increases with woodland plantations, however, wood found in the form of posts in Imperial Roman contexts have been linked to local species of oak at Lingua D'Oca, using chloroplast DNA sampling (Di Rita et al. 2010, 63). The increased stands of arboreal woodland in the study area, and particularly in the coastal zone, from 2000 BP indicates both increased terrain for woodland through the changing environment of the delta, but potentially demonstrates the management and use of woodland in the area.

Figure 3.23 Imperial period tombs alongside the Via RediPuglia, Isola Sacra. Part of the Necropolis di Porto (photo: K. Strutt)

3.4 The Environmental Conditions

In addition to the broad archaeological range for central Italy and the Tiber valley from survey and excavation, evidence from a number of sites and interventions provides comparative evidence for the environment of the study area, predominantly through palynological samples and faunal remains from different excavations.

3.4.1 The Palynological Evidence

Recent coring and analysis of deposits has provided a continuous record of the changes in vegetation and associated resource exploitation (Fig. 2.16) for the Tiber delta (Di Rita *et al.* 2009, 61). The results of this analysis indicate the both environmental change and the effects of geomorphological process, and the influence of anthropogenic factors, changed the environment of the Tiber delta from the Middle Holocene onwards.

The interleaving of the river system and the marine estuary of the Tiber make it a periodically unstable environment, in spite of the settling of sea levels by c. 6000 BP. This is highlighted by the evidence from pollen and macrofossil analysis, indicating the varying environment of the zone for the last 7,000 years. From 8,300 - 5400BP (6300-3400 BC) dense mixed deciduous and evergreen forests dominated the area, surrounded by a eutrophic freshwater basin. Around 5,400BP (3400 BC) a change occurred to a marshy environment caused by a lowering of the water table. An increase in seeds from cereals is also visible in the record, in this phase, possibly related to subsistence at Eneolithic settlements such as Le Cerquete-Fianello in the area. Between 5,100 - 2900 BP (3,100-900 BC) expansion of coverage by riparian trees occurs with a rise in the water table, while between 2,900-2,000 BP (900 - 0BC) development of new marshlands occurs with a lowering of the lagoon level. After 2000BP an expansion of arboreal vegetation occurs, with evergreen and deciduous oak forests, and evidence of saltworks (Di Rita, *et al*. 2009). The data indicates that from 6300 to 3400 BC, in the Neolithic and Eneolithic periods, the Stagno di Maccarese was a eutrophic freshwater basin, surrounded by a forested landscape of mixed deciduous woodland.[23]

[23] Di Rita et al. 2009 provides details of radiocarbon dates from Lingua d'Ocaon which these periods are based. Laboratory codes are LTL 1494A, LTL1495A, LTL2075A and LTL2076A (University of Lecce).

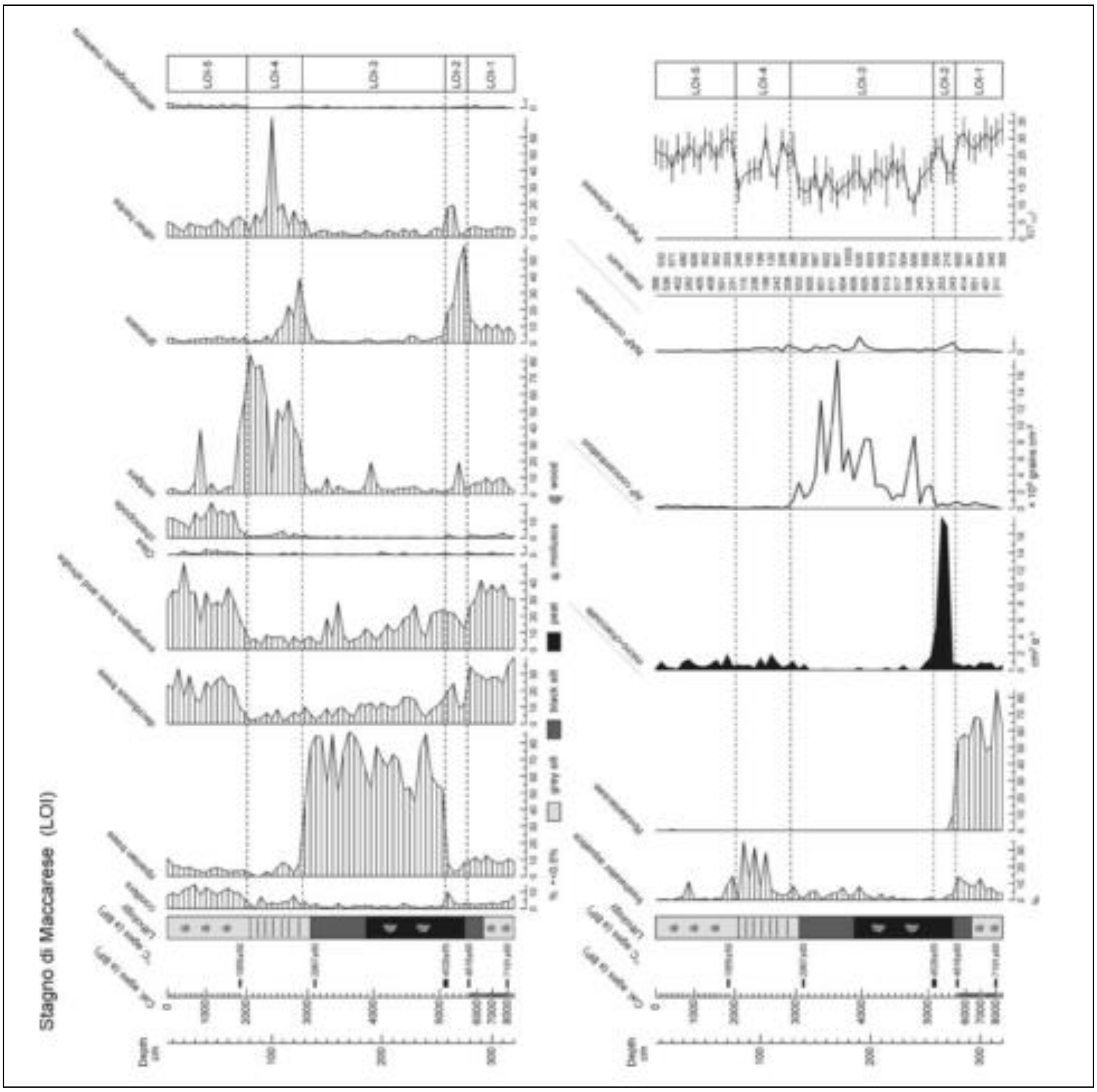

Figure 3.24 Pollen diagram for the Stagno Maccarese (Di Rita et al. 2009, 57)

Towards the end of the Eneolithic and in the Early Bronze Age extensive marshlands developed, potentially affecting the agrarian practices that could be achieved in the area, and a process similar to those found in other coastal sites of the Tyrrhenian Sea. From 3,100 to 0 BC/AD, throughout the Bronze Age and the early Iron Age an extensive alder carr characterized the coastal landscape, possibly triggered by increased water influx. Between 900 BC and AD 300 an unstable marshy environment characterised the area, formed by ponds, wetlands, fens and salt soils, induced by a lowering of the water level (Di Rita et al. 2010, 67).

A slightly varied pattern of geomorphological process and environmental change occurred in the zone of the coastal lagoon close to Ostia Antica (Bellotti *et al.* 2011), although analysed for a shorter time period. From the palynological and macrofossil evidence in and around the Ostia lagoon the area was characterised by marshland and sedge vegetation from 1900 to 600 BC, with species suggesting that the lagoon was freshwater and mixed deciduous woodland in the immediate area. The extent of the woodland increased from around 1000 BC, with evidence of a temporary drying of the marshland around 1100 BC, and scarce settled human activity around this time. Around 600 BC intrusion of water through the dune cordons led to the lagoon becoming brackish. Around 450 BC there is an increased presence of cultivated and anthropochore plants in the pollen record including olive and grape vine. The area was still dominated from 600 BC to 600 AD by mixed deciduous woodland (Bellotti *et al.* 2011, 1112).

The palynological data presents some interesting comparisions with the broader geomorphological analyses of the south Tiber delta around Ostia. By 640 BC, the Tiber river mouth had just migrated, and the beach-barrier separating the Ostia marsh from the sea was too unstable with the risk of storms and high seas for permanent human occupation. In addition, the area inland was mostly marshy and would not have provided an adequate zone for permanent settlement. From c.600 BC pollen and mollusc data indicate that the marsh became brackish. By 450 BC, once the deltaic cusp had migrated further west, the available land would have been safe for the establishing of a castrum alongside the Tiber, where Ostia Antica is now located (Bellotti *et al.* 2011). This lends credence to the archaeological evidence that Ostia was probably founded in the early Republic in the 4th century BC (Zevi 2001; 2002; Brandt, 2002). Further detail and discussion of the environmental evidence is covered in Chapter 6.

3.4.2 Faunal Remains

Evidence from faunal remains comes predominantly from excavated deposits for a range of sites in central Italy and the area of the Tiber valley. While location of sites derived from fieldwalking shows scant faunal remains due to the abraded conditions of many surface finds, a number of key excavations have been undertaken in the study area to furnish the results of faunal remain analysis, providing evidence of the types of animal husbandry, forms of wild fauna being exploited, and the potential nature of different secondary produce for subsistence and storage. These records also provide evidence of the proportions of domesticates being farmed across the different periods.

Some of the earliest excavated remains come from the sites at Cle Cerquete-Fianello (Carboni and Salvadei 1993; Manfredini 2002) showing the predominance of caprines and cattle, as well as domestic pig. Similarly, for the Iron Age evidence from Ficana and other sites indicates the mix of wild and domestic fauna used at the site within certain contexts (Brandt 1996).

Several broader studies of patterns of consumption and types of domestic animal farming are also relevant for the area (Mackinnon 2001; De Grossa Mazzorin 1989; 2001). Brought together these studies provide substantial evidence of the forms of subsistence practices in the study area across the different periods. The evidence, where pertinent, is related in Chapters 8 and 9.

3.5 Trends in Settlement and Subsistence in the Archaeological Record (3000 BC – AD 300)

The synthesis of evidence for the study area indicates a number of trends in the existing evidence for settlement distribution and the types of economy being practiced from the Eneolithic to the Roman Republican and Imperial periods. In some aspects there is continuity in agricultural practice, whereas for other areas key changes occur relating to cultural forms and possible social and economic practices.

Some degree of continuity seems to exist between the Neolithic and the Eneolithic, certainly in terms of the practice of animal husbandry. There appears to be a greater emphasis on arable practice, with the growing of spelt, barley and other forms of wheat in the Neolithic, with a greater reliance on pastoral economy in the Eneolithic. A change in society seems to be suggested by the evidence, with a shift towards a more patriarchal and warrior dominated society in the Eneolithic, a trend that emerges more as the Bronze Age continues.

In the Middle and Later Bronze Age the cultural and economic differences in different parts of the study area start to crystallize, particularly the differences between Southern Etruria and the areas to the south and east of the Tiber. The pattern of settlement also changes through the Bronze Age and into the Iron Age. Certain settlements indicate a break in settlement in the early Bronze Age, and resettlement of Neolithic and Eneolithic sites in the Middle Bronze Age. The use of transhumance practices meanwhile seems, from the archaeological evidence, to continue from the Bronze Age through to the Roman Republic as a principal pastoral practice (Gabba and Pasquinucci 1979). As the Iron Age progresses there is a graduation towards nucleated settlement and the formation of urban centres, particularly in Etruria, but also with sites such as Ficana in Latium. The practice of pastoral farming and growth of some grains does, however, continue and the presence of urban centres provides a separate dynamic between higher status social groups and urban dwellings, and the continuity of subsistence forms of economy.

The events of the 3rd century BC in Etruria with the subjugation of different cities and the translocation of their populations forms a further contrasting point when analysing the continuation of settlement and the rural economy. What patterns of continuity and change are presented in the data in the area of the Lower Tiber, between the river valley and the fringes of the delta, between Etruria and Latium, with the rise of Roman power?

Based on these overall trends it is possible to establish a number of key periods of change derived from overall archaeological interpretations that would require focus for the study area:

- Possible continuity or change in settlement and forms of land use and subsistence in the study area from the end of the Neolithic into the Bronze Age (the Eneolithic).
- What changes to settlement and subsistence occur in the study area, if any, between the Middle and Final Bronze Age with the appearance of Sub-Appennine and Proto-Villanovan Cultures.
- What form of settlement pattern and land use occurs in the study area from the Iron Age with the creation of recognised urban centres.
- What form of continuity or change is represented for the Archaic and Republican periods in terms of settlement and rural economy for the area.
- What trends dominate the later part of the Republican period culminating in the creation of Portus in the 1st century AD.

These points represent broad transitions that may be represented temporally in the changing modes of subsistence across the three millennia under discussion. While the trends noted here are broad, and are represented by the archaeological record, the aim here is to focus completely on the Lower Tiber and Delta, and the patterns of settlement in this area, referring where necessary to the broader changes and implications of the region. To address these issues a number of different patterns in the archaeological and remotely sensed data need to be analysed.

In addition to these broad trends, synthesis of the archaeological record in this chapter also provides useful detail in terms of the nature of settlement, and the potential use of materials, from the a capanna structures of the Eneolithic to the Iron Age, and the permanet villa complexes associated with the Roman period. The synthesis also serves to provide the context of the material culture for these periods. The chronological periods that this study deals with are vibrant, colourful and advanced in terms of the people inhabiting and subsisting in the area of the lower Tiber. With a study focusing on the extensive pattern of settlement and land use it is all too easy to lose sight of the inhabitants and the material culture of the area. The preceding sections serve to illustrate some of the social complexity.

3.6 Approaching the Tiber Delta, Archaeologies of Economy and Ecotones

To address the issues of settlement and land use within the study area interpretation of the published archaeological data and narrative are not enough. To understand the role of the Lower Tiber Valley and Delta for past settlement and subsistence it is necessary to analyse the relationship between the wetland and the surrounding landscape, and how past societies exploited its resources, settled it and traversed what is a vast area of the landscape. A large quantity of data exists for the area outside of the results of published excavation, and while such information is crucial to the present analysis, a wide variety of other data is central to the research. The approach to such data also has a significant bearing on the outcomes of the analysis, and the meaning that will be placed on the data.

The development of archaeological theory in Italy was summarised earlier in this chapter, in particular the Annales Paradigm. While a number of weaknesses exist with this approach, it has a certain relevancy to the current research. The aims of this thesis require an analysis of the broad trends in settlement pattern and land use related to the economy of the study area. While events do have an impact on these trends, and therefore the archaeological record, it is the social, environmental and economic pressures that build over the medium to long term that are most readily definable in the archaeological record. Thus, the underlying approach for this study will be based on models encompassing settlement and land use patterns in the broader context of the changing environment in the study area and the resources that, through either natural or anthropogenic influence, changed the patterns of settlement and subsistence over time.

While not wishing to espouse an environmentally deterministic approach to the study area, the use of ecotones in understanding the distribution of settlement, as discussed by Butzer (1982, 224) in relation to patterns of hunter-gatherer sites, has some advantages. Butzer's approach related to Palaeolithic and hunter-gather economies, rather than sedentary settlement. Its usefulness here is in aiding an interpretation of a varied economy and pattern of settlement, which throughout the period in question relied on both sedentary and nomadic modes of subsistence and their relationship. The pastoral economy in Central Italy and in the area of the Lower Tiber is a key facet of the subsistence of societies throughout the last three millennia BC (see above; Barker 1999). Therefore, an approach is required that draws on archaeological data, and associated environmental data for the area in question. These methods need to be able to cope with strategies for the location of both permanent and temporary settlement, patterns of mobility and factors influencing a variety of social groups from pastoral nomads to permanent landowners and farmers, and settlements linked to gathering of natural resources (Butzer 1982, 223).

The environmental data, together with the geomorphological data present from a number of research projects in the region, provides a substantial body of evidence for modelling the changing environment of the Tiber Valley and delta area and the surrounding hillslopes to provide context to the research, in terms of the 'Environmental Possibilism' of the zone[24]. This notion derives strongly from theories of cultural geography, stating that, while environmental conditions may set certain constraints or limitations on human action that humans through action over time can mitigate completely overcome

[24] The theory of 'Environmental Possibilism' advanced the notion that, while physical geography and ecology have an effect on the ability of humans to survive or subsist in certain environments, human patterns of subsistence are based on the choices, actions and responses of a population (Fekadu, 2014).

some constraints (Butzer, 1982). The relationship between the geomorphology of the study area, and the resources associated with the changing pattern of settlement and land use is a key component in understanding settlement and subsistence at a local and regional level, particularly where it relates to notions of agency in the landscape, and the relating of ecotones to the subsistence of communities. As such the following chapter will provide a background analysis of the development and change of the geomorphology and environment of the study area.

The archaeological data for the research is based on the presence of published narratives and survey or excavation results, and on gazetteers of archaeological data collated by different state and research institutions represented by archived reports. This data provides a background of locations and broad inferences of site type and date, giving a foundation of archaeological records to be analysed. In order to deepen and broaden the data, it is proposed that different forms of non-intrusive data will be used in conjunction with the archaeological archive. This will include remotely sensed satellite data, and recent LiDAR topographic data for spatial analysis of the nature and form of sites. Due to the massive scale of development within the study area, this analysis will also rely on air photographic archive data from the 1940s and 1950s to provide comparable datasets of the nature and distribution of archaeological remains. Finally, existing geophysical survey data collated from different surveys and publications involving the author will also be integrated to provide high resolution data on sub-surface remains from certain parts of the study area. A full description of the methods used and an analysis of the strengths and limitations of this approach are given in chapter 5.

In support of the archaeological analysis, the importance of a number of data sources that might be termed ethnographic provide supporting evidence. The interpretation of areas of, say, pastoralism using modern ethnographic examples has been used elsewhere in Central Italy (O'Sullivan and Van de Noort 2007; Barker and Grant 1991). For the lower Tiber and delta there is a surprising body of documentation from the 19th and early 20th century, from painting through to photographic archives (Chapter 4), illustrating the lives of the population of the area before and during the *bonifica*. With the usual caveats attached, these sources will at the least help elaborate the archaeological analysis of the area, and at most provide an essential component in addressing the basic concept of how individuals and communities lived their lives, and how events and processes influenced by environmental factors and human interaction occurred and still represent a tangible part of human interaction with the landscape.

Chapter 4 : The Photographic, Pictorial and Cartographic Evidence for the Tiber Delta

4.1 Introduction

Chapters 2 and 3 have provided a background and synthesis of the geology, geomorphology and archaeology for the Lower Tiber and Tiber delta, and provided some background on the theoretical frameworks used in Italian archaeology, and the proposed use of a human ecological approach to this research. The final section of Chapter 3 also elucidated on the basic environmental changes for the study area based on faunal and palynological records. A further strand in the analysis of the pattern of settlement in the lower Tiber floodplain and delta is the photographic and documentary evidence for the area.

The photographic and pictorial material, in particular the photographs from the late 19th and early 20th century, provide a record of the environment and agricultural practice from before and during the bonificazione or land improvement of the delta. While there are limitations in drawing comparisons between this material and the archaeological evidence for settlement in the area in later prehistory and in the Roman period, some comparisons for the use of the wetland in terms of agriculture and exploitation of resources can be made. The photographs in some instances also provide evidence for the inundations of the Tiber delta, and the land use and environment for the area as a key phase in the transition of the landscape from wetland and marginal resource to improved and drained farmland with a structured modern agricultural system.

Cartographic evidence for the area provides documentary accounts for the topography, settlement, drainage and land use of the lower Tiber and delta from the 16th century onwards (Pannuzi 2013, para 3). While the spatial accuracy of the maps may in many instances be limited, and the agenda associated with the creation of the maps requires consideration, they provide an unparalleled record for nearly half a century of change in the landscape. They demonstrate the use of the wetland through time, including agriculture, industrial activity, and in many cases military activity. Maps from the later 19th century also demonstrate the plans for the improvement and drainage of the area.

Fundamentally these forms of evidence, that may be considered as ethnographic in their essence, provide an analogue for the archaeological and environmental evidence utilised in the later chapters. They shed a light on the lower orders of settlement in a landscape that was marginal in the nature of the resources exploited there, and the propensity for natural flooding of the area. They show that, in spite of the nature of the wetland, it was a fundamental component of the landscape with a resident population, and varying forms of agricultural practice and industry.

4.2 Pictorial and Photographic Evidence for the Wetland

A substantial record of artwork and photography exists to illustrate the environment and land use of the Tiber delta and floodplain in the period before, during and shortly after the 20th century bonificazione of the wetland. Relating documentary evidence to the past exploitation of the lower course of the Tiber and the resources of the delta, forms part of a relevant, if perhaps controversial, component of the research. A number of resources give evidence of the changing landscape of the lower Tiber and the Roman Campagna in general, firstly through traditional ways of representation through artwork and painting, and from the end of the 19th century through photography and film. Photography by Thomas Ashby and others from the British School at Rome in particular provides evidence for this area (Figs 4.10 to 4.13).

This chapter contains artwork and photographs pertinent to the analysis of the Tiber delta, demonstrating the late 19th century land use, settlement in a capanne houses, the dominant pastoral economy of the area in the 19th century, and the changing wetland landscape during and immediately after the bonificazione of the Tiber delta. Several photographs also indicate the extent of the floodwaters during the inundation of the Tiber from Rome down to the mouth of the Tiber. Some of the artwork also presents the use of the floodplain for industrial activity, including the salt pans located in the vicinity of the Borgo di Ostia. While the connection between historical use of the Tiber delta, as represented in these images, and the later prehistoric and Roman Republican presence of settlement and land use cannot be directly made, the scope for presenting the ethnographic record for continued settlement and activity in the area and drawing parallels to changes to the floodplain in the last 150 years is pertinent. Not only do the records show the extent to which the modern wetland was populated and used, it perhaps illustrates the changes to a marginal landscape through large-scale engineering projects over a period of time, and the effects that this had on the form of dwelling and methods of subsistence.

4.2.1 The Environment

The documentary record for the Tiber delta, the floodplain and the surrounding landscape provides a snapshot of the environment and use of the area for a restricted period of time, for the post-medieval period c. 1800 to the early part of the 20th century. This is a key period in the changes which occurred to the wetland area, in terms of systems of subsistence that had continued for centuries, and for the sudden changes that occurred in the 1920s as part of the extensive bonificazzione or land improvement. This led to the formation of the improved agricultural areas of the delta that we know today.

While this provides a point at which drawn and photographic records of the landscape were being produced, this representation of the environment is much removed from the pattern of environmental change which occurred from 3000 BC to AD 300. The last 200 years represent a humid, cooler phase in relation to the climate of the preceding 5000 years of the Holocene, and this needs to be factored in when considering the nature of the environment. That being said, the ethnographic record for the area provides a counterpoint to the archaeological evidence analysed in the preceding chapters and assists our interpretation of the ephemeral or scant archaeological record for the delta and floodplain of the Tiber.

Figure 4.1 Il torrente di Arrone, Maccarese by Roessler Franz (1845-1907)

The overarching theme of many of the painted depictions of the area is that of wetland, taking the form of lagoons, and the rivers that traverse the delta, with reed and wetland vegetation, mixed deciduous woodland and grassland on the eastern side of the delta plain (Fig. 4.1). A number of painted works by Henry Coleman and Roessler Franz (Figs 4.1, 4.2 and 4.3) depict the lagoon areas of the delta and the dune cordons. Within the context of the wetland area, portrayal of cattle grazing is prominent with associated evidence of temporary habitation (Fig. 4.2) and enclosure. There is also evidence of small vessels being used on the lagoon. Some of the watercolours of Roessler Franz (Figs. 4.4 and 4.5) also show human activity, predominantly of figures collecting wood or hunting in the lagoon landscape.

Figure 4.2 Henry Coleman 1877 The Maccarese

Figure 4.3 Roesler Franz Cattle on the Maccarese Plain

Figure 4.4 Watercolour by E. Roesler Franz (1845-1907) Fascinari a Maccarese

Figure 4.5 Watercolour of the Maccarese by Roesler Franz

http://tenutacasteldiguido.blogspot.com/2011/03/le-mani-del-capitale-finanziario.html

Figure 4.6 Coastline near the Tiber by Pietro Barucci (1845-1917)

Figure 4.7 Henry Coleman 1877 The Maccarese

The depiction of the landscape in the coastal area of Maccarese indicates sandy and dune deposits, with wild grasses, sparse deciduous and coniferous trees, similar in general to the dunes and beaches alongside the Macccarese in the 21st century (Figs 4.6 and 4.7) Some early representations of the Tiber floodplain do exist, with the watercolour by Locatelli showing the salt pans near Ostia being one example (Fig. 4.8). The work, as with many of the other paintings of the period, creates a romanticised portrayal of the lower Tiber. However, the painting does depict the inundation of the lower reaches of the river before the improvement of the delta for farmland, and prior to the construction of the bund along the lower reaches of the Tiber.

Figure 4.8 Locatelli 1833 Salt pans near Ostia (source: http://www.digiter.it/georarcheologia/georarcheologia/locatelli-ostia-salt-pans/)

Figure 4.9 Agricultural works, architectural and land reclamation in Italy during the fascist period: a view of the countryside Maccarese before rehabilitation (source: Archivi Alinari, Firenze, CDP-A-MAL053-0029)

Figure 4.10 Flooding of the Tiber at Ponte Galeria 1915 (source: The British School at Rome)

Perhaps a more reliable record of the lower Tiber in recent history comes from the photographs of Peter Paul Mackay (1890-1910) and Thomas Ashby (1892-1926)[25]. Both recorded the landscapes of the Campagna Romana in this period, and both visited the area of the lower Tiber from Ponte Galeria to the coast. Of these photographs those demonstrating the inundation of the Tiber provide an impressive record of the changes to the lower reaches of the river which occurred regularly, and were recorded, from the Roman period onwards (Aldrete 2006, 241). The photographs of the flooding of the Tiber, taken from Ponte Galeria in 1915, indicate the extent of one of these episodes (Figs. 4.10-4.12).

Figure 4.11 Flooding of the Tiber seen from Ponte Galeria 1915 (source: The British School at Rome)

[25] The catalogue of archived photographs, including those of Mackay and Ashby, can be viewed on the British School at Rome website's digital collections (http://www.bsr.ac.uk/library/digital-collections) .

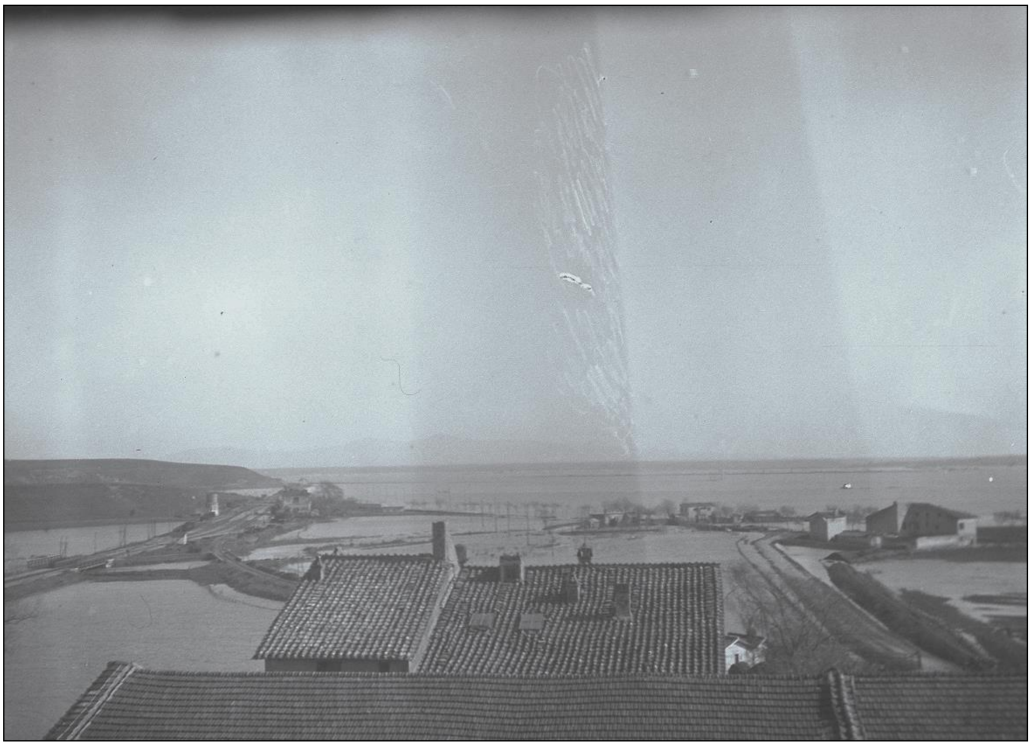

Figure 4.12 Flooding of the Tiber from Ponte Galeria 1915 (source: The British School at Rome)

Figure 4.13 Landscape near Via Aurelia overlooking Tiber Delta 1915 (source: The British School at Rome)

Figure 4.14 The Trajanic Basin at Portus pre-bonifica (Stagno di Porto 1895), (source: The British School at Rome, ppm-0718)

4.2.2 Settlement, People and Land Use

The photographic and artistic record for the area of the Tiber delta provides one theme for developing our comprehension of the environment. There is also a record of daily life, including human interaction and the forms of industries and agricultural practices that dominated the delta in the late 19th and early 20th century. This record includes photography by Thomas Ashby and Peter Paul Mackay, but also some images from other sources. As with the depictions of the environment and inundations of the Tiber, the evidence provides a unique reflection on the period of time when more ancient animal husbandry and resource exploitation were either dying out or, more rationally, changing and adapting to practices adopted with the improvement of agriculture and the terrain associated with the landscape of the Tiber delta. The images collected here provide a sample of the evidence recording the use of more ancient technology and practices (Barker 1995, 16). However, an extensive archive is present on the British School at Rome website (http://www.bsr.ac.uk/library/digital-collections) and the Alinari Archives (https://www.alinari.it/) showing the changes to the Stagno Maccarese, the creation of the *bonifica*, and the change from unimproved wetland to cultivation of crops including rice, grapes and the creation of model farms with the construction of *casali* and dairy buildings as part of the improvement.[26]

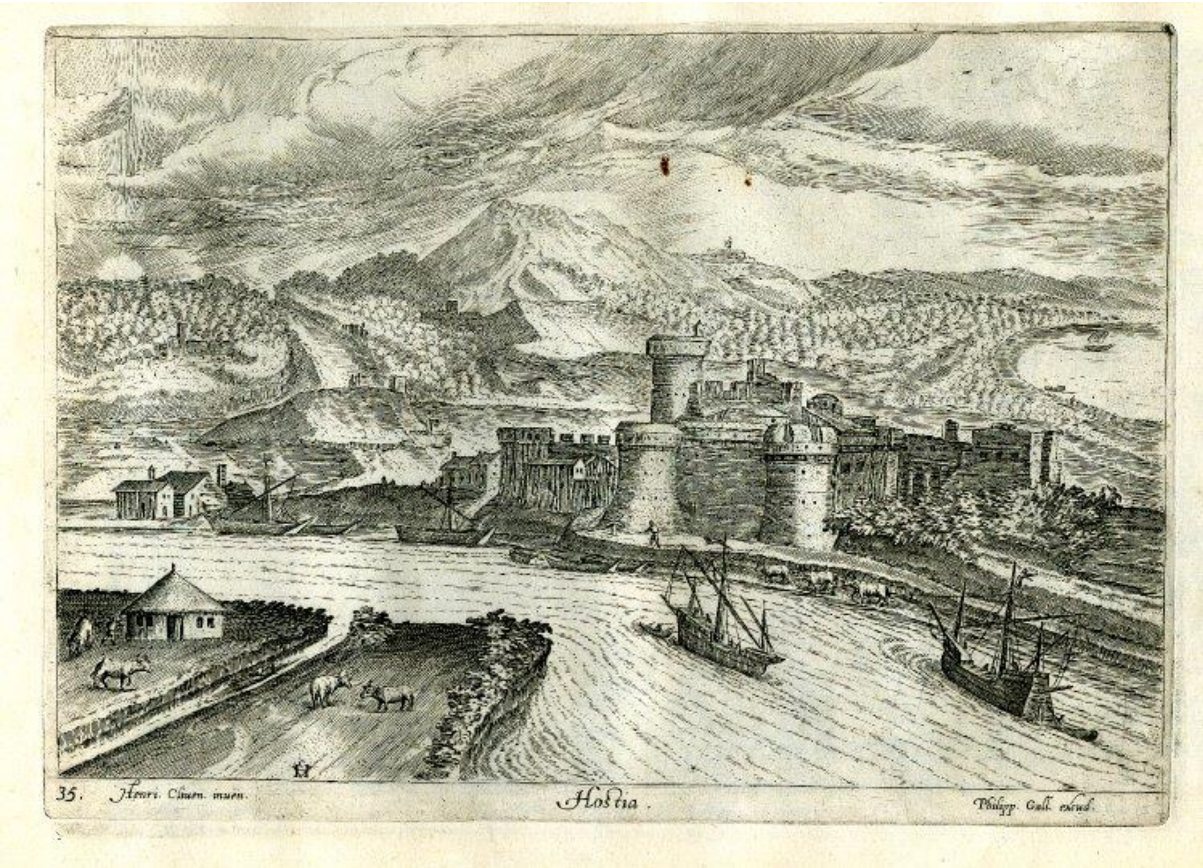

Figure 4.15 View of the ancient harbour city Ostia, the Tiber with some ships in the foreground, a mountainous landscape in the distance; Hendrick van Cleef (source: The British Museum, no. 1950,0306.2.34.)

[26] Barker (1995, 15-16) summarises the background to the farming population, predominantly in the Mezzogiorno, and the records of Carlo Levi in Cristo si è fermato ad Eboli in particular. While images of the period are easy to romanticise, the photography from the late 19th and early 20th century does touch on the daily life of the lower social orders of the period, and relates to the population of an area of landscape whose mark and traces on the archaeological record are, at best, ephemeral.

Figure 4.16 Capanne on the Tiber floodplain (Via Aurelia and neighbourhood, Maccarese, mandria of buffaloes 1890-1905 (source: The British School at Rome, ppm-0189)

Figure 4.17 Capanne in the area between Maccarese and Ostia (from Vicini 1989, after Manfredini 2002, 77)

The photography and other images depicting settlement on the floodplain and delta is pertinent. In addition to the watercolour by Henry Coleman (Fig. 4.2) photography from the delta shows multiple instances of reed and pole-built dwellings, a capanna. These can be associated with evidence of animal husbandry, agriculture and enclosure (Fig. 4.16), or more general evidence for concentrated settlement (Fig. 4.17). Some photographs also include evidence of tools, outbuildings, or stages and platforms constructed as part of dwelling areas (Fig. 4.18) for storage of tools associated with animal husbandry, processing of milk and other produce.

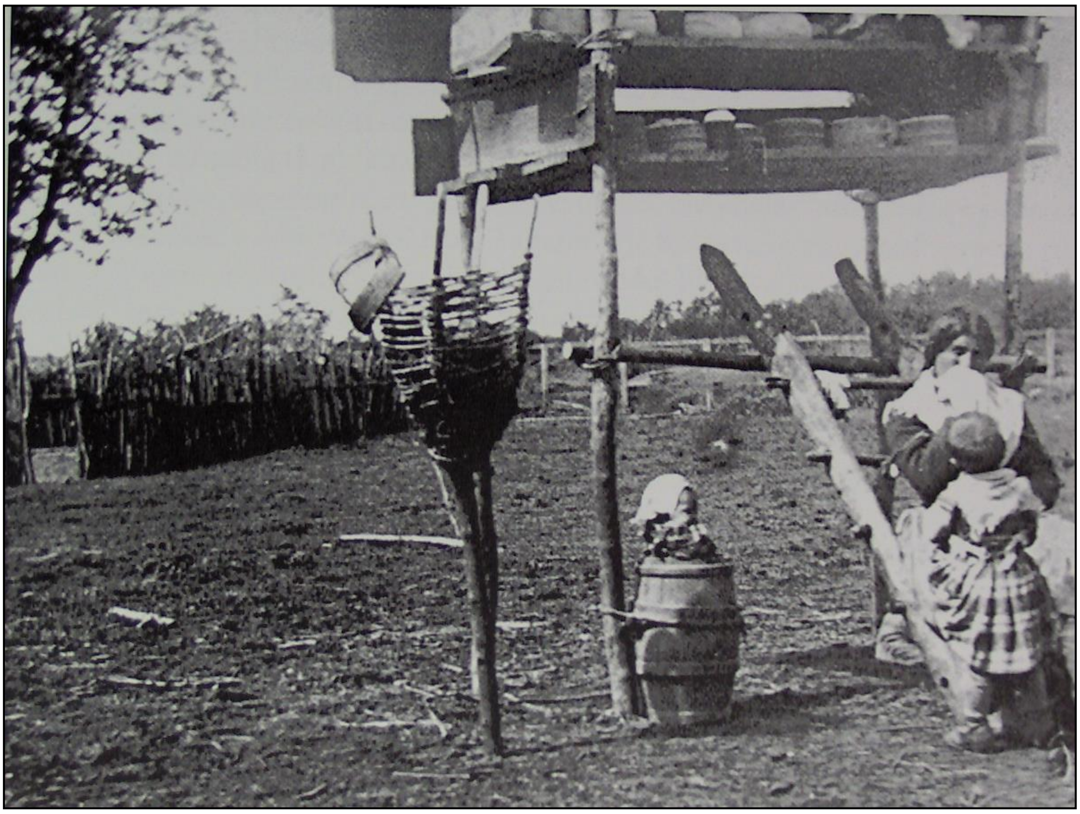

Figure 4.18 Raised structure containing food and vessels (from Guidoni 1980, after Manfredini 2002, 91)

The majority of constructions are based on a standard a capanna structure, usually circular in plan, with staves forming the main structure, and reed used as thatch. Other examples show a more rectilinear plan, with a roof beam, and long and short sides to the structure (Fig. 4.16). While many structures are relatively small in terms of dimensions, a number are depicted for the Tiber delta as being far larger, including a capanne in the vicinity of the Casale di San Sebastiano (Shepherd 2006, 32; Fig. 4.19). The dimensions and nature of these structures is an aspect in realising the nature of the dispersed or concentrated settlement, and the outbuildings associated with dwelling and agricultural practice. While some, especially the smaller structures, represent dwellings either temporary or more permanent in nature, others seem to indicate barns, storage buildings, or similar constructions (Shepherd 2006, 33).[27]

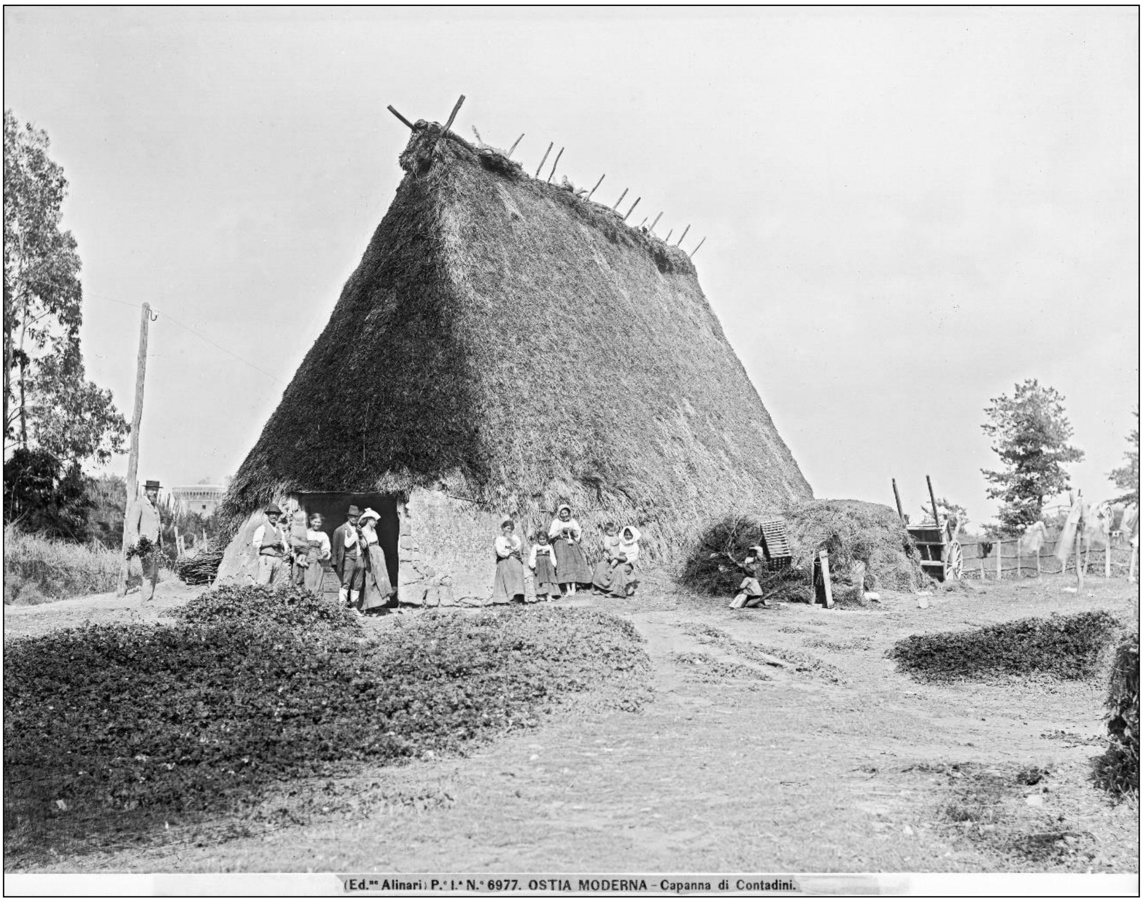

Figure 4.19 Peasant hut at Ancient Ostia, Rome (source: Archivi Alinari, Firenze, c. 1885, ACA-F-006977-0000)

In addition to individual examples of this form of construction from the late 19th and early 20th century, several photographs of the general landscape of Ostia and the Tiber show dispersal of structures in the landscape (Figs 4.20 and 4.21). These indicate structures on the floodplain of the Tiber in the area of the Isola Sacra. The pattern of

[27] Shepherd (2006, 32) also relates the account in Gualdi's (1986) Pane e Lavoro of the destruction of capanne at Ostia prior to commencement of the excavations. Shepherd (2006, 33) also considers many of the capanne to be temporary dwellings assoviated with trackways and routes in the landscape, and access to the banks of the Tiber and the ferry crossing of the Tiber (La Scafa).

settlement and the network of routes used to traverse the floodplain around Ostia is discussed by Shepherd (2006, 31). Shepherd (2006) cites Cervasato (1910) and his description from the start of the 20th century indicating many dwellings ‘a capanna’ in the vicinity of castles and other nucleated settlement. The ‘Rilievo Topofotografico di Osta dal Pallone’ indicates a number of a ccapanna structures, and multiple trails between settlements across the floodplain, in addition to permanent structures and the Via Ostiense (Shepherd 2006, 16)[28].

Figure 4.20 Ostia Antica showing capanna structures or hayricks in the distance (source: The British School at Rome ta-0051)

[28] Shepherd (2006) cautions against an interpretation of dwelling or settlement for all of these objects in the photographs, as some may indicate haystacks rather than capanne (Shepherd 2006, 33)

Figure 4.21 The horrea along the Tiber at Ostia, with capanna structures dotted across the Isola Sacra in the distance (from Manucci 1992)

Figure 4.22 ‘Bonifica dell’Isola Sacra: rush gathering (source: Luce Institute/Alinari Archive Management, Florence, FCL-S-000012-0022)

Representations of individuals in the wetland landscape of the Tiber delta indicate a number of subsistence activities being undertaken. These include harvesting of rushes (Fig. 4.22) and the hand cultivation of farmland on the plain (Figs 4.23 and 4.24). Grazing of cattle and their movement across the delta and floodplain is also attested in the photography (Fig. 4.25), with their use for cultivation on the Maccarese Plain evident (Fig. 4.26). Exploitation and processing of other materials in the area are also demonstrated, including cutting, seasoning and storage of wood (Fig. 4.27) and hunting on the lagoons (Fig. 4.28).

Figure 4.23 Farmland in the Campagna Romana and Pontina (source: Maurizio Delladio; www.delladio.it)

Figure 4.24 Farmland in the Campagna Romana and Pontina (source: Maurizio Delladio; www.delladio.it)

Figure 4.25 Agricultural works, architectural and land reclamation in Italy during the fascist period: herd of cattle crossing a canal in the country Maccarese before rehabilitation (source: Istituto Luce / Archivi Alinari, Firenze CDP-A-MAL053-0030

Figure 4.26 Cultivation in the Campagna Romana and Pontina (source: Maurizio Delladio; www.delladio.it)

Figure 4.27 Cutting timber in the Campagna Romana and Pontina (source: Maurizio Delladio; www.delladio.it)

Figure 4.28 Punt on the marshland of the Campagna Romana and Pontina (source: Maurizio Delladio; www.delladio.it)

4.3 The Ethnographic Record and Its Significance

The significance of this form of ethnographic evidence in relation to the Tiber delta and the period under scrutiny is, in part, tenuous. At play in the form of evidence are a number of juxtaposed notions and sentiments. The artwork can, in many instances, represent an idealised or romanticised representation of the past, and the topography, buildings and landscapes need to be interpreted in an objective fashion. For the photography there is the potential for a similar romanticised nature in the composition and making of the image. In addition, the images represent a period of time far removed from the period 3000 BC to AD300. Differences exist in terms of environment, climate and land use, and while similarities may remain in terms of the general nature of the wetland prior to its improvement in the 20th century, the temporal distance between the ancient landscape and the recent past needs to be remembered.

While these caveats are important, the archive material provides useful evidence on the habitation and exploitation of the wetland and the surrounding landscape. While some of the images presented here may be from either Ostia or the Roman Campagna and the Pontine Plain (for example Figs 4.22 and 4.23) all of the remaining images are from, or of, the Tiber floodplain and delta, and thus all represent the geographical area of this study[29].

Notwithstanding the issues, these images indicate a number of themes in terms of the habitation of the space of a wetland. Recalling Ingold's (1993) idea of 'dwelling perspective' the photographs provide a human face to the more methodologically rigorous analysis of the archaeological evidence. This includes representation of the presence and absence of temporary or permanent settlement, use of the immediate terrain around a settlement, use of the more extensive area around settlement, the resources exploited and trades practised, the nature of the agriculture used, and the exploitation of natural resources in terms of hunting and gathering, not all of which leave a tangible mark on the archaeological record. It also sheds light on the nature and extent of settlement and subsistence prior to modern improvement of the wetland, of a form that has almost disappeared completely. The images show a diverse pattern of settlement and land use for

[29] A significant number of examples exist in the British School at Rome digital archive and elsewhere for the Roman Campagna. These are not reproduced here, but show in some cases very large *a capanna* structures, and round *a capanna* surrounded by fencing or hedging to protect the habitation from livestock.

the areas, comprising use of natural resources. This includes hunting and gathering of raw materials including wood, and conceivably would include felling of timber and the seasoning and preparation of materials. It also includes gathering of reeds, and the use of staves and thatch for the building of dwellings, which in turn indicate coppicing of woodland and other practices. The agriculture in the photographs is of mixed cultivation and animal husbandry, dependent on hand cultivating of the floodplain, also the husbandry of cattle and sheep or goat, with production of dairy products.

Finally, the archives provide an indication of the extent but also the ephemeral nature of much of settlement on the floodplain and delta. The images provide an accessible representation of a disappearing landscape, and show some of the variation of settlement type, from isolated temporary habitation to more concentrated settlement. The nature of much of the material presented in these images is, however, temporary. The wooden structures represented are constructed from biodegradable materials. Many of the outbuildings and platforms or supporting structures are also wooden and thus leave no or limited traces in the archaeological record (for one example see De Castro *et al*. 2018). In addition, the tools and belongings of some of the families also make use of reeds, pliable wooden material, and other wooden or fibrous goods. Much of the extensive settlement, goods and materials present in these images are invisible in the archaeological record. This provides useful comparison with the extant archaeological record for sites such as Le Cerquete – Fianello, with the survival of postholes, faunal remains and ceramics and lithic. A modern equivalent might be the survival of similar post-holes, bone and ceramics, and the iron components of farm tools. The broad parallels between settlement and subsistence on the floodplain in prehistory, in the Roman period, and in the modern period are pertinent. This is a landscape that has always been populated, if only sparsely, and the resources have always been exploited. The lack of visibility in the archaeological record is something that persists not because the area was devoid of habitation, but because of the status and nature of the population. It is difficult to establish the exact nature of this settlement, although the use of scatters of ceramic or flint material coupled with the modelling of potential resources for the landscape, goes some way towards addressing the imbalance in the archaeological record. These artworks and images serve to emphasise the ephemeral nature of some of the types of settlement in the study area, and to demonstrate that, in spite of the lack of visibility the wetland was inhabited and was the origin of important resources for the settlements in the area.

4.4 Cartographic Evidence for the Tiber Delta

A prodigious number of map sources exist for the Campagna Romana, dating principally from the 16th century onwards. As with most maps their purpose and the methodology used in their creation can have a significant effect on their application in an archaeological study. Many of the sources presented here give a clear indication of the topography and layout of the study area, and the changes in the environment in the last five hundred years (Pannuzi 2013). While some maps show a certain degree of licence in their design, and varying degrees of scale and accuracy in their topology, the features represented in the documents do relate to the modern topography of the study area as mapped and projected.

In addition, some of the details included in the maps can help us to elucidate on the presence of archaeological remains witnessed during the survey of the area. Some of the features also provide information on the contemporary use of the wetland of the Tiber delta and the lower course of the river, giving an ethno-historical aspect to some of the material. It must be noted, however, that caveats exist in terms of the potential for map documents to help in the interpretation of the study area, including issues with the scale of different maps, their spatial accuracy, and the original purpose or scope of these documents, where features not within the purview of the cartographers may have been omitted.

A number of sources, especially those relating to the salines and salt production in the Tiber delta, are elaborated on by Pannuzi (2013), in particular Torriani's watercolour 'Tenuta di Porto del Capitolo di S. Pietro', showing possible warehouses for salt storage. Other maps indicate the topography of the Tiber delta from the middle of the 16th century. While some of the later maps, especially those produced in the mid-late 19th century onwards, are accurately surveyed, many of the earlier maps are either at small scale, representing modern settlement and ancient remains in the area, or at larger scale represent an artist's view of archaeological remains and the topography of the area (for instance Danti's 1582 frescoes of the area of Portus; Figs 4.31 and 4.32). Preliminary attempts to georeferenced early maps to the modern topography of the study area revealed the limitations of the topographic precision of many of the sources and was of limited use in analysing the contribution of the documents. Thus, a selection of historic maps are considered here in relation to the nature of the topography in the 16th to 19th centuries. These sources also indicate potential agricultural and industrial practices in the area of the Tiber floodplain and delta and provide a counterpoint to the photographic evidence in the preceding section in the assessment of the scope and extent of human activity in the study area.

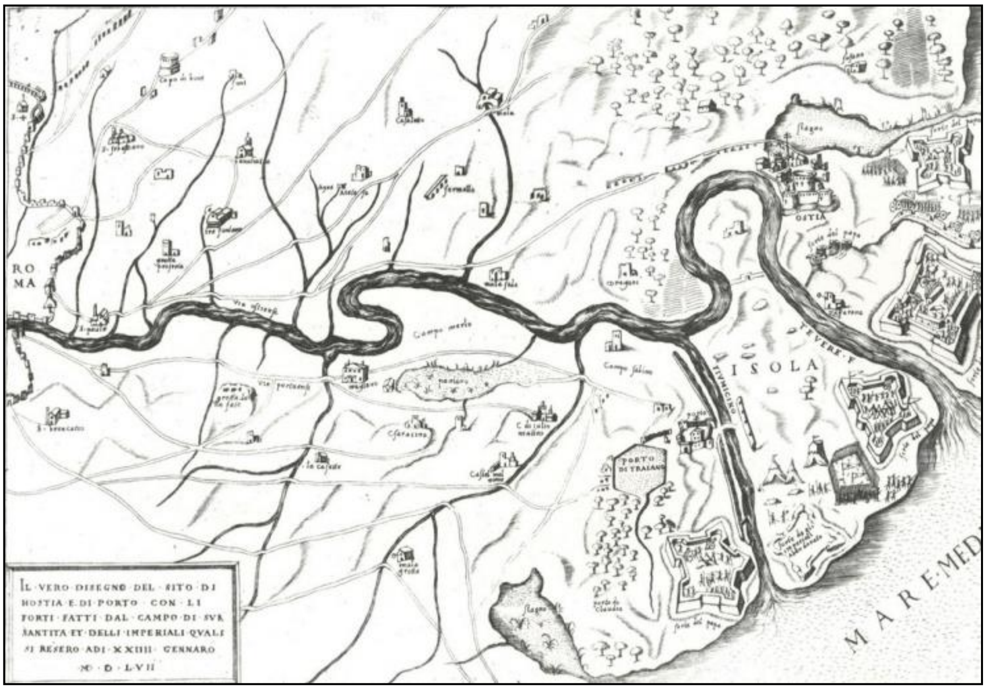

Figure 4.29 Anonymous map 1557. Il vero disegno del sito di Hostia e di Porto

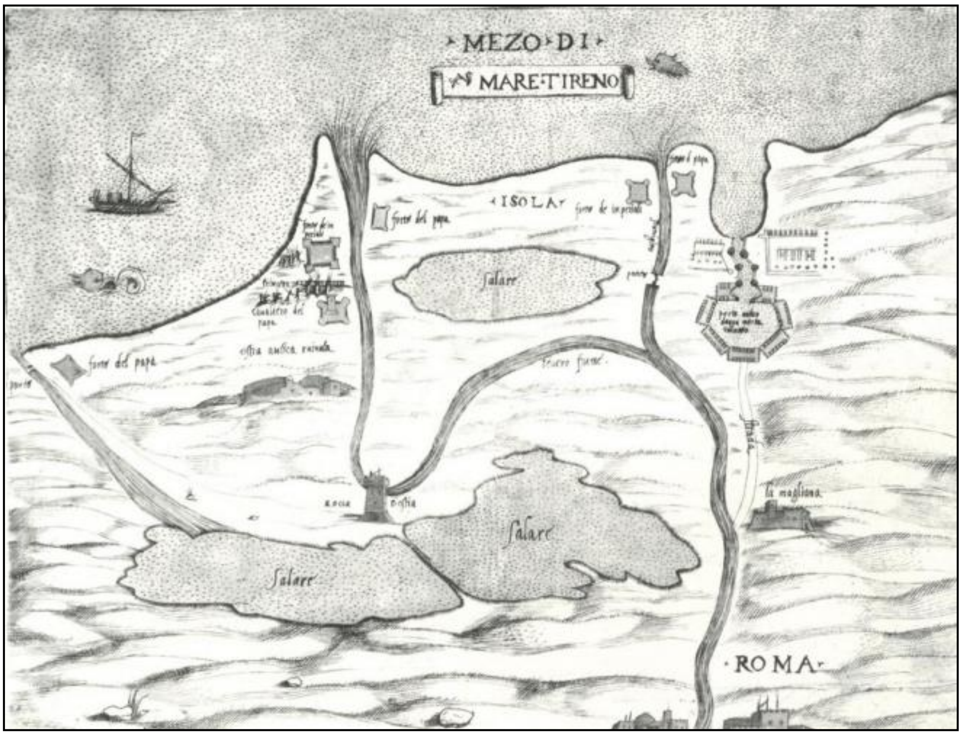

Figure 4.30 Anonymous map c.1557 I forti papali ed imperiali di Ostia (source: http://www.codadellacometa.it/studi/cartografie/storica/storica.html)

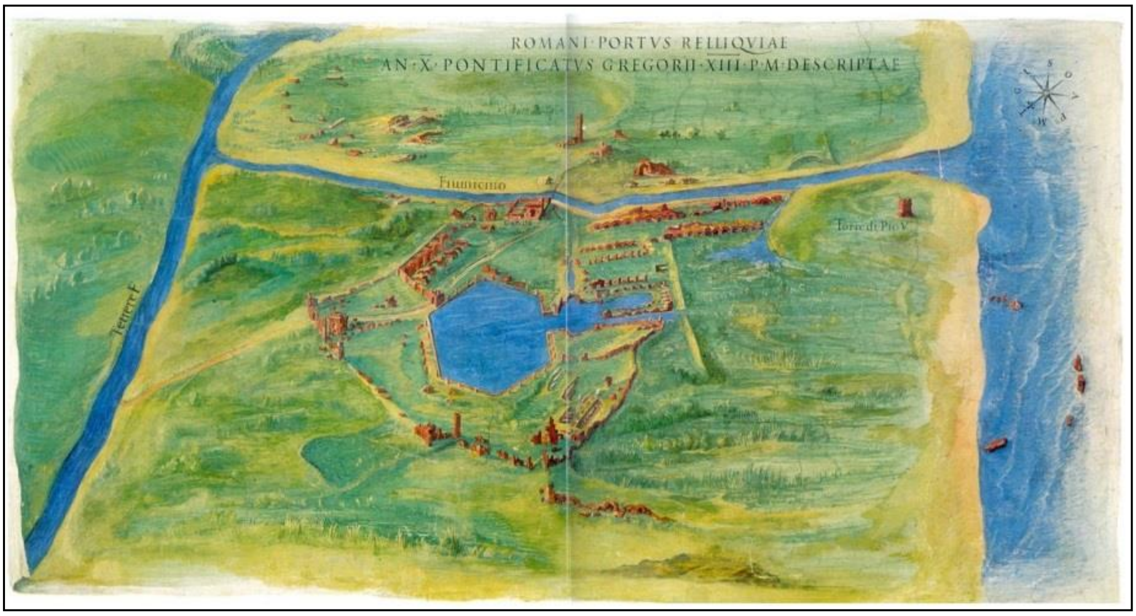

Figure 4.31 Map of Ignazio Danti 1582.Veduta delle Rovine di Porto. Fresco. (source: http://www.codadellacometa.it/studi/cartografie/storica/storica.html)

Figure 4.32 Map of Ignazio Danti 1582.Ricostruzione delle rovine di Portus. Fresco. (source: http://www.codadellacometa.it/studi/cartografie/storica/storica.html)

Two of the earliest maps of the area, dating to 1557 (Figs 4.29 and 4.30) indicate the general topography of the lower reaches of the Tiber and the area around Ostia respectively. The former shows the prograding nature of the delta, and the location of contemporary fort defences on the coast. The remains of the casueway of the Via Ostiense is represented, together with the remains of Portus and the Campus Salinarum. The stagni of Maccarese and Ostia are also shown, together with a marshy area to the north of the Via Portuense. The second map indicates the remains of Portus and Ostia Antica and the 16th century salines for saltworking around Ostia.

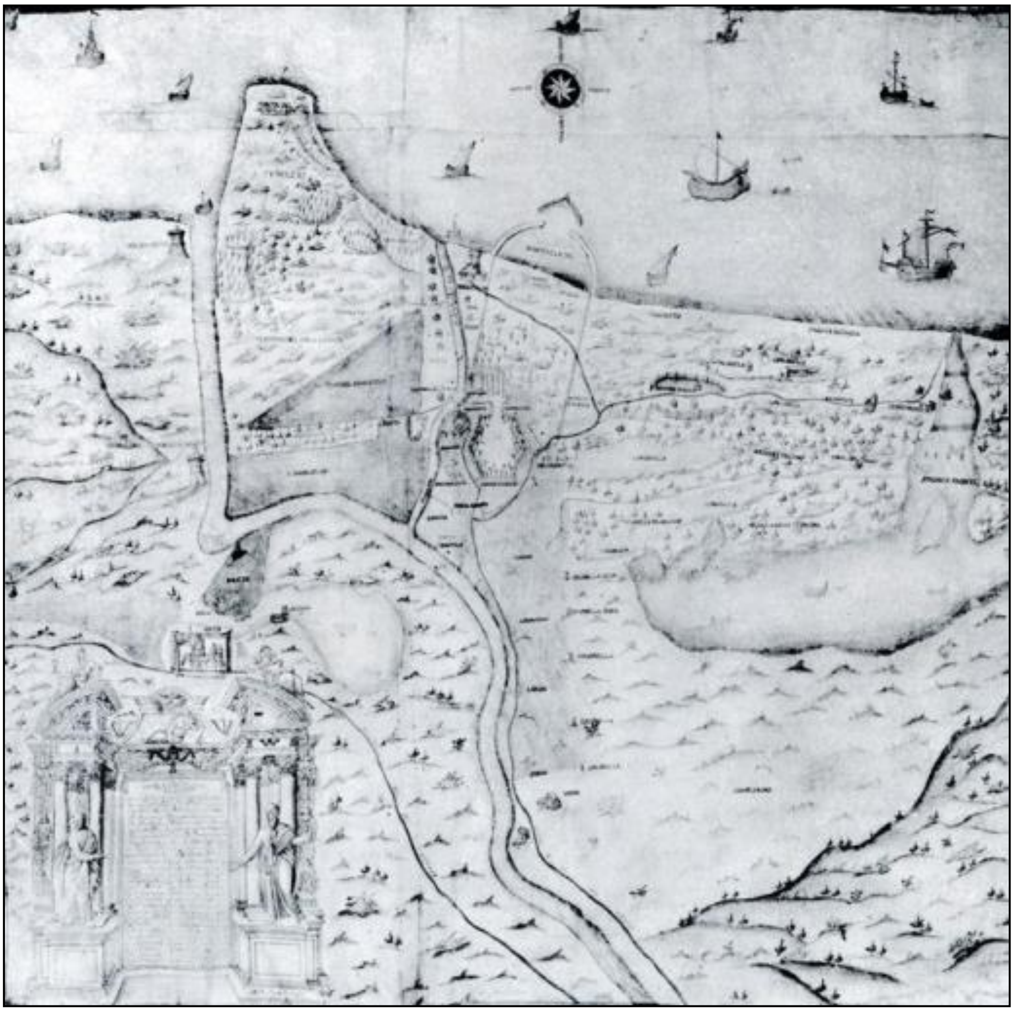

Figure 4.33 Orazio Torriani Map of Acquerello 1603. Tenuta di Porto del Capitolo di S. Pietro (source: http://www.codadellacometa.it/studi/cartografie/storica/storica.html)

Figure 4.30 is comparable to the Torriani watercolour (Fig. 4.33) although this latter marks the Isola Sacra and the possible line of the Via Flavia. The Ostia salines are presented, together with the Stagno Maccarese, and an indication of the mixed woodland and vegetation on the Maccarese plain. A more definite representation of the Stagno Ostiense and the saltworking at Ostia are given in Verani's map of 1804 (Fig. 4.34). These are located to the east of the Borgo di Ostia, and perhaps compare to the Locatelli watercolour of 1833 (Fig. 4.8) in representing the saltworking on this side of the Tiber. The remains of Ostia Antica are also presented, together with 19th century enclosure and possible settlement around the Borgo di Ostia. The saltworking is also indicated in Canina's 1829 map (Fig. 4.35), together with the Isola Sacra, evidence of the Roman road network including the Via Flavia and Via Severiana, the remains of the harbours of Portus, and the Fiume Morto.

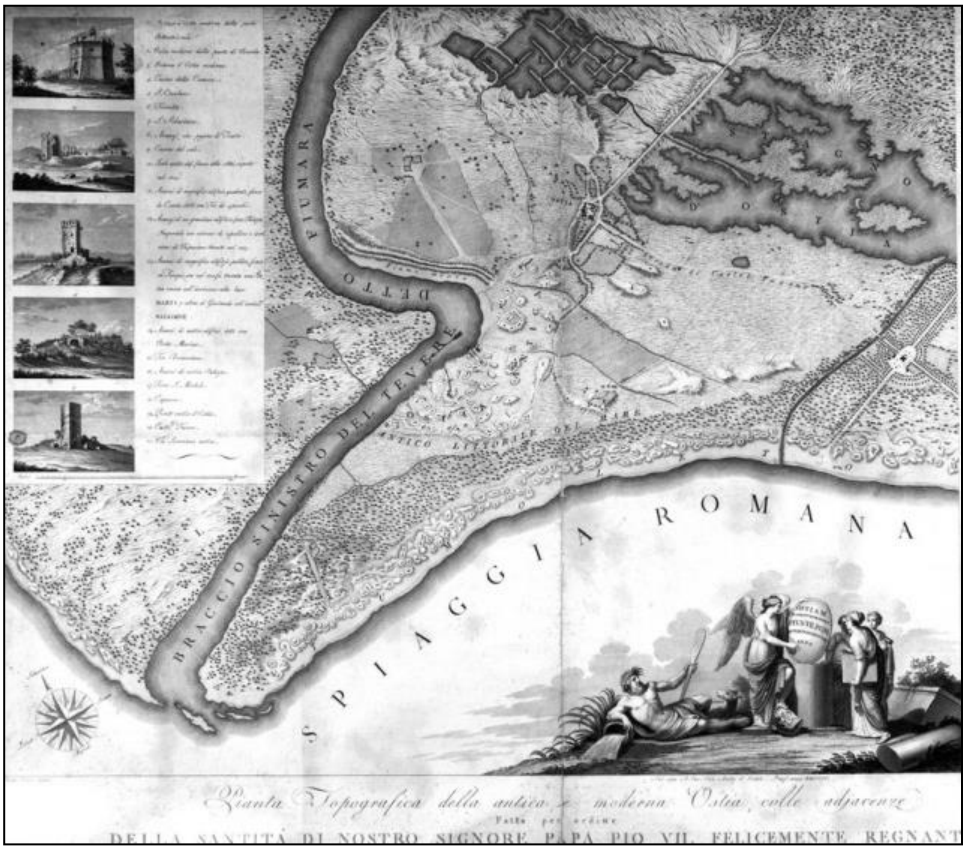

Figure 4.34 1804. Giuseppe Verani – Vincenzo Feoli. Cartatopografica della antica e moderna Ostia, colle adiacenze (source: http://www.codadellacometa.it/studi/cartografie/storica/storica.html)

Figure 4.35 1829. Luigi Canina. Pianta della zona di Ostia e di Porto con evidenziate le zone archeologiche (source: http://www.codadellacometa.it/studi/cartografie/storica/storica.html)

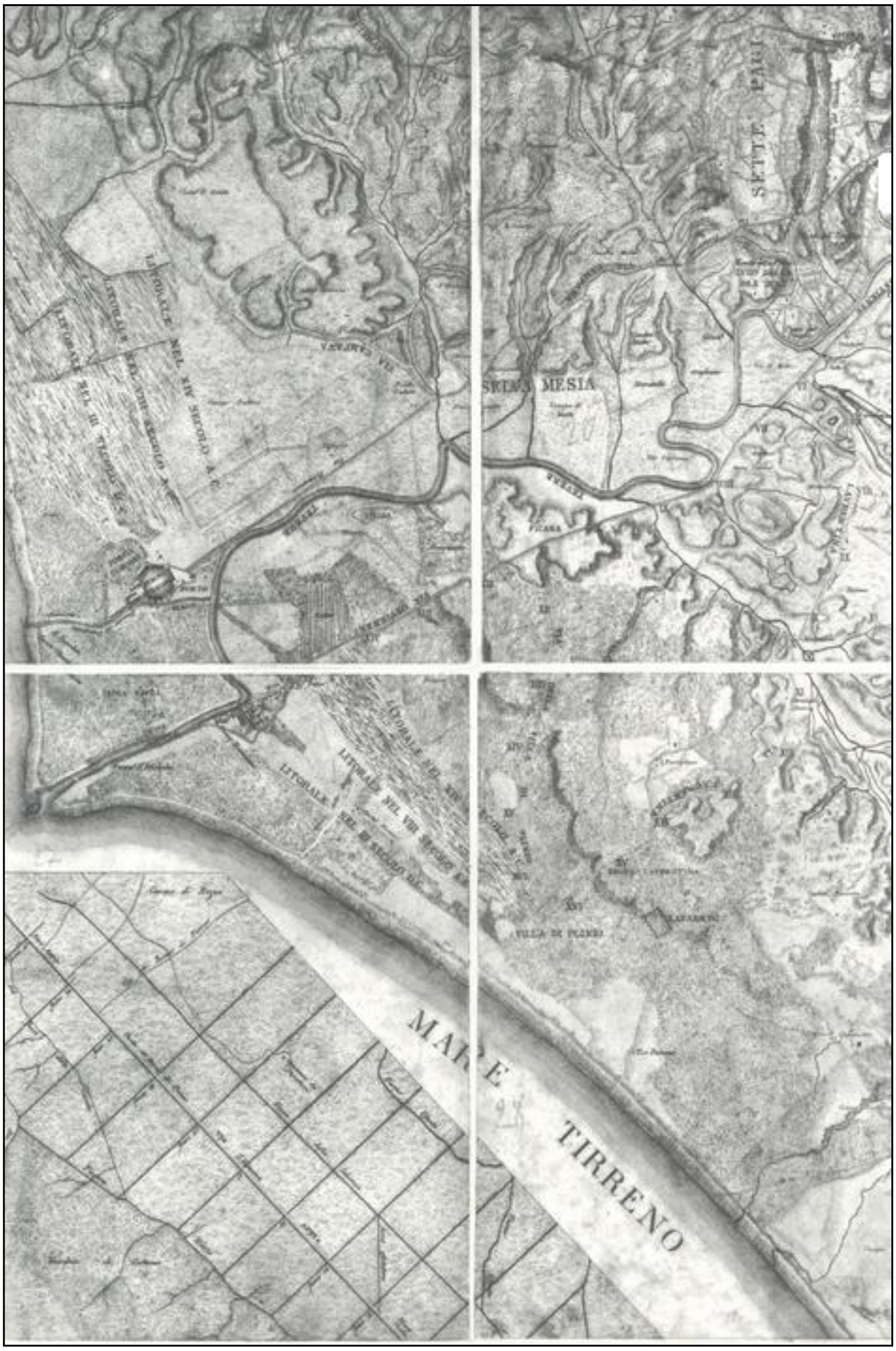

Figure 4.36 1845. Luigi Canina. Zona: Sette Pagi-Ostia-Laurento - Particolare dell'Agro Pontino (source: http://www.codadellacometa.it/studi/cartografie/storica/storica.html)

Canina’s 1845 map (Fig. 4.36) illustrates the broader topography of the lower Tiber, including the prograding coastal littoral for the 14th and 8th centuries BC, and the 3rd century AD.

The locations of Ficana, Ostia, Portus and other salient ancient sites are shown, together with the Roman road network (Via Campana, Via Ostiense, Via Portuense and Via Aurelia).

Figures 4.37-4.41 show the maps of the Tiber delta undertaken by Genala (1884) as part of the proposed bonificazione of the wetland zone. The first indicates a schematic plan of the proposed drainage overlaying the Maccarese and Ostia lagoons. Figures 4.38-4.40 indicate the levels of the topography at 250m intervals across the delta, with the proposed drainage system superimposed. Figure 4.41 indicates the vegetation across the zone, including areas of macchia and woodland, dunes and pasture, both dry and that which might be considered wetland. This map serves to show the diversity of the vegetation of the wetland zone, including pasture, woodland and lagoonal wetland.

Of interest in terms of the archaeological remains are the maps of Lanciani for the area (Figs 4.42 and 4.43). These provide a full interpretation of the archaeological remains for the lower Tiber and delta, Portus, Ostia Antica, the Roman roads and all other structural remains noted by Lanciani.

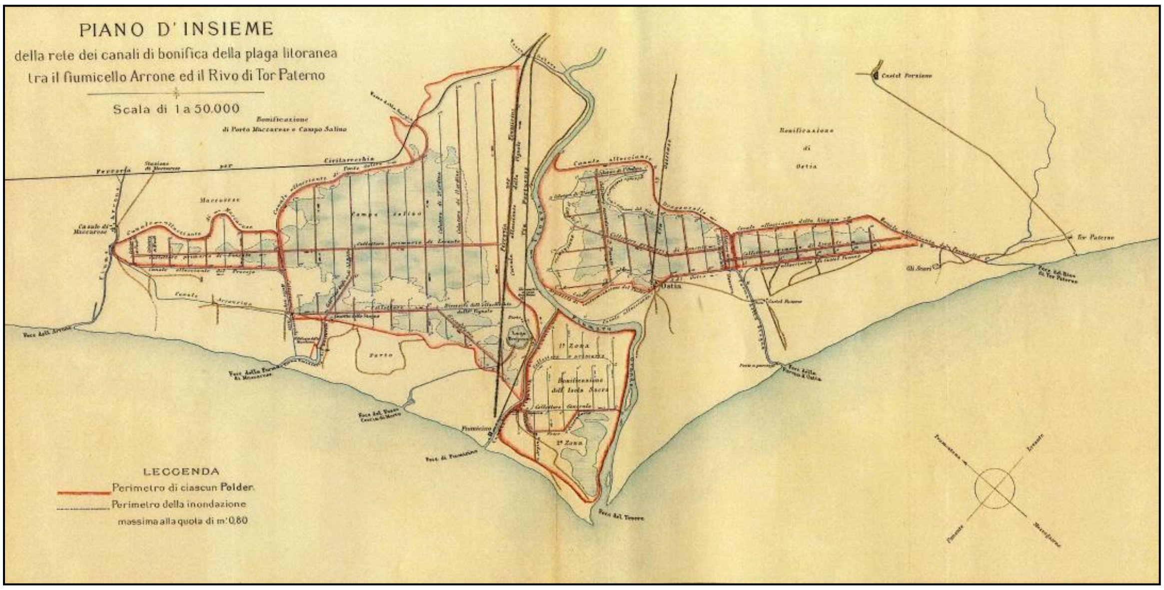

Figure 4.37 Table IV from Genala (1884) showing plan of canal network for the bonifica between the Arrone and Tor Paterno (source: Genala, 1884)

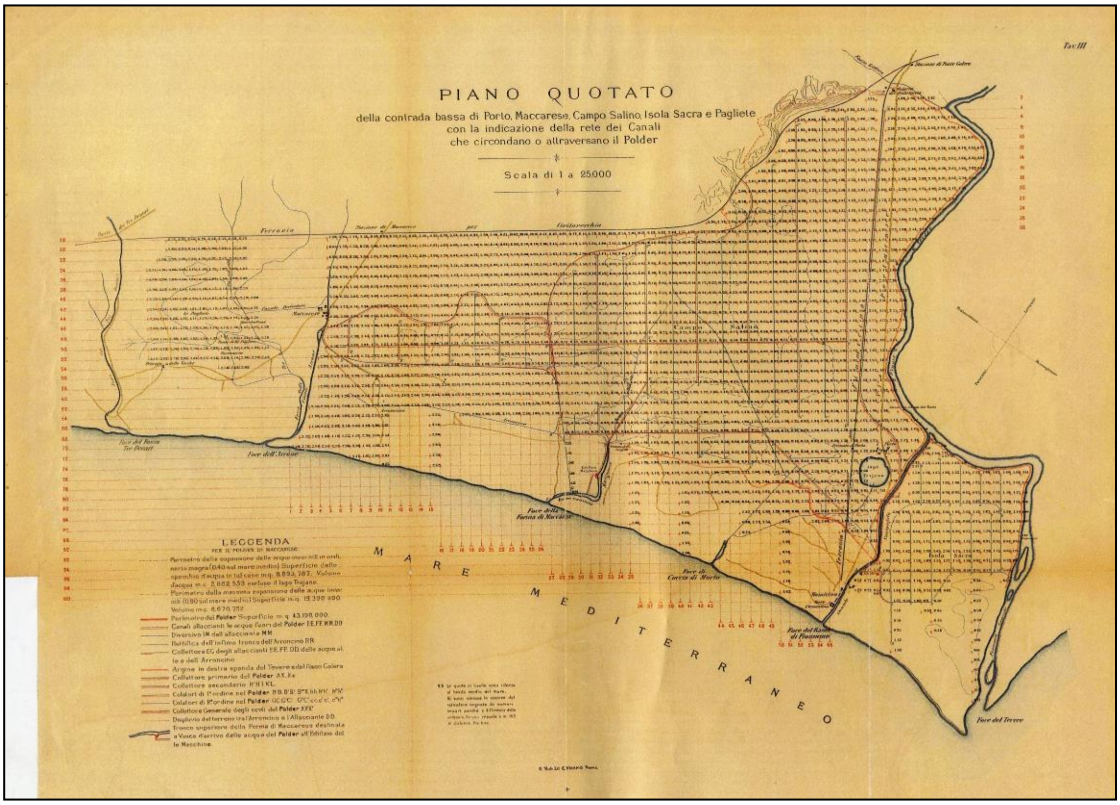

Figure 4.38 Table III from Genala (1884) showing elevations for Porto, Maccarese, Camposalino, Isola Sacra and Pagliete with an indication of canal locations (source: Genala, 1884)

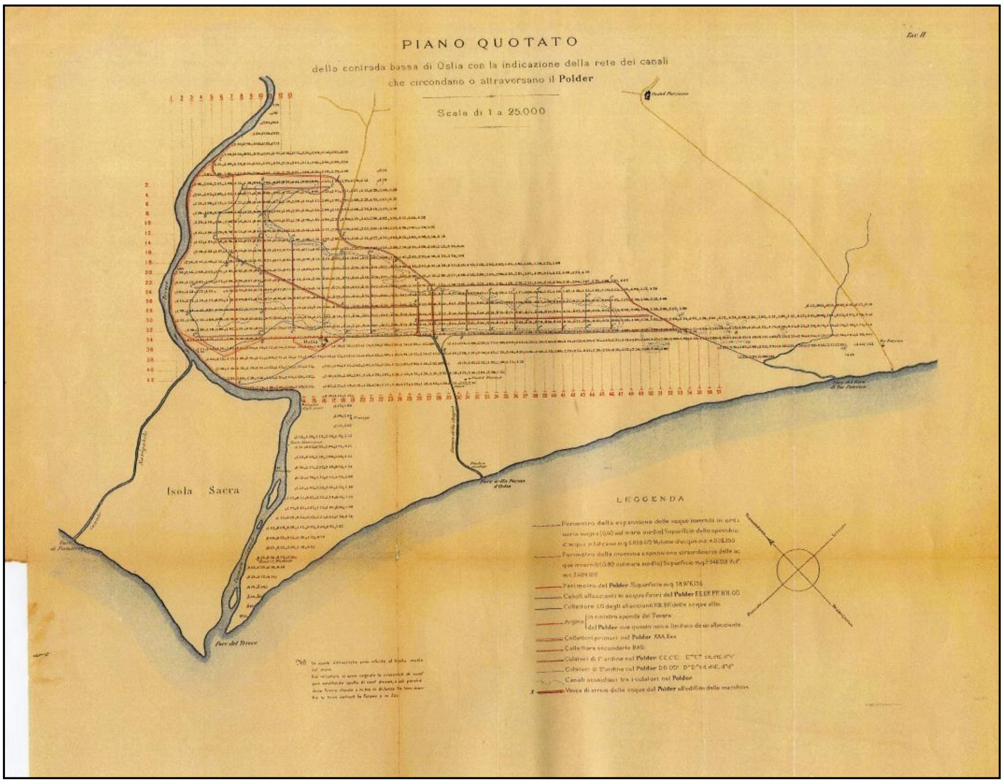

Figure 4.39 Table II from Genala (1884) showing elevations for Ostia with an indication of canal locations (source: Genala, 1884)

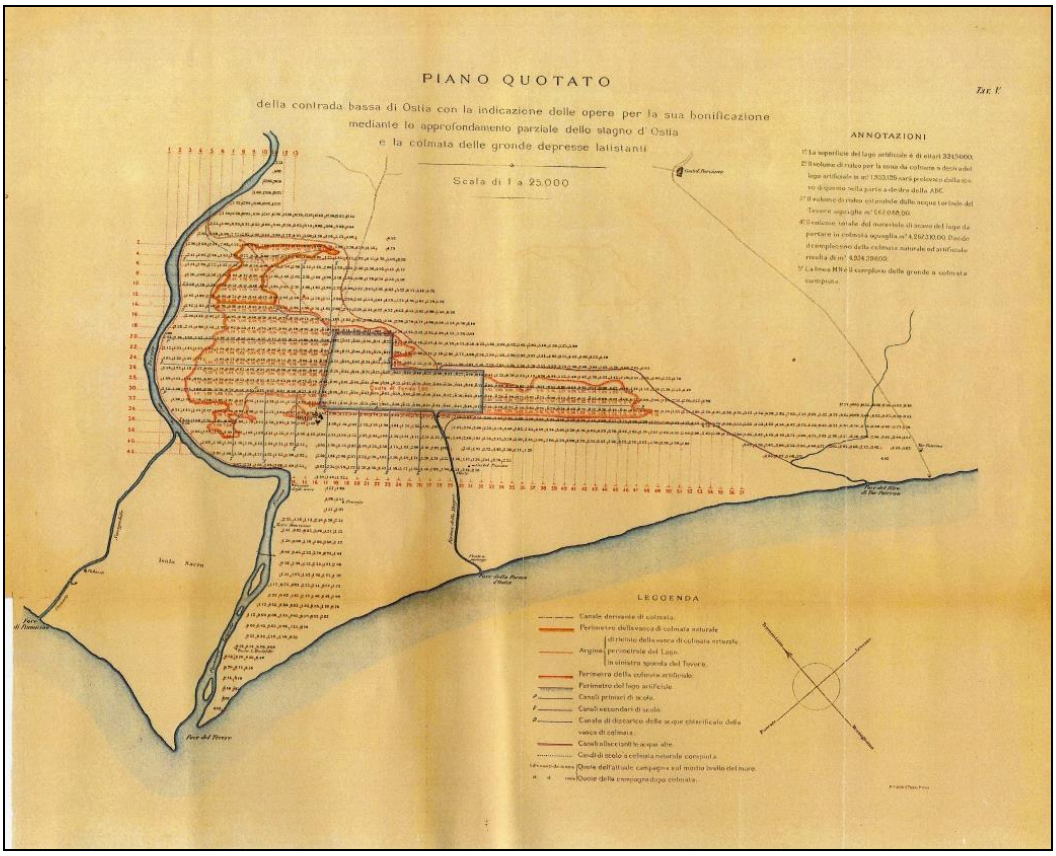

Figure 4.40 Table V from Genala (1884) showing elevations for Ostia with canals and the proposed working and deepening of the stagno (source: Genala, 1884)

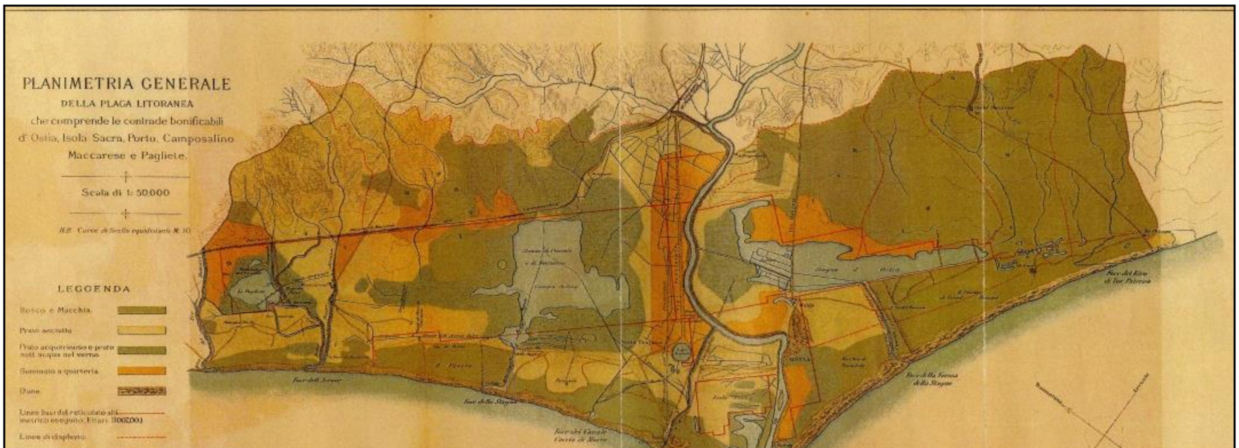

Figure 4.41 Table I from Genala (1884) showing a general plan of the area of the proposed bonifica at Ostia, Isola Sacra, Porto, Camposalino, Maccarese and Pagliete (source: Genala, 1884)

Figure 4.42 Lanciani's map of the Tiber delta

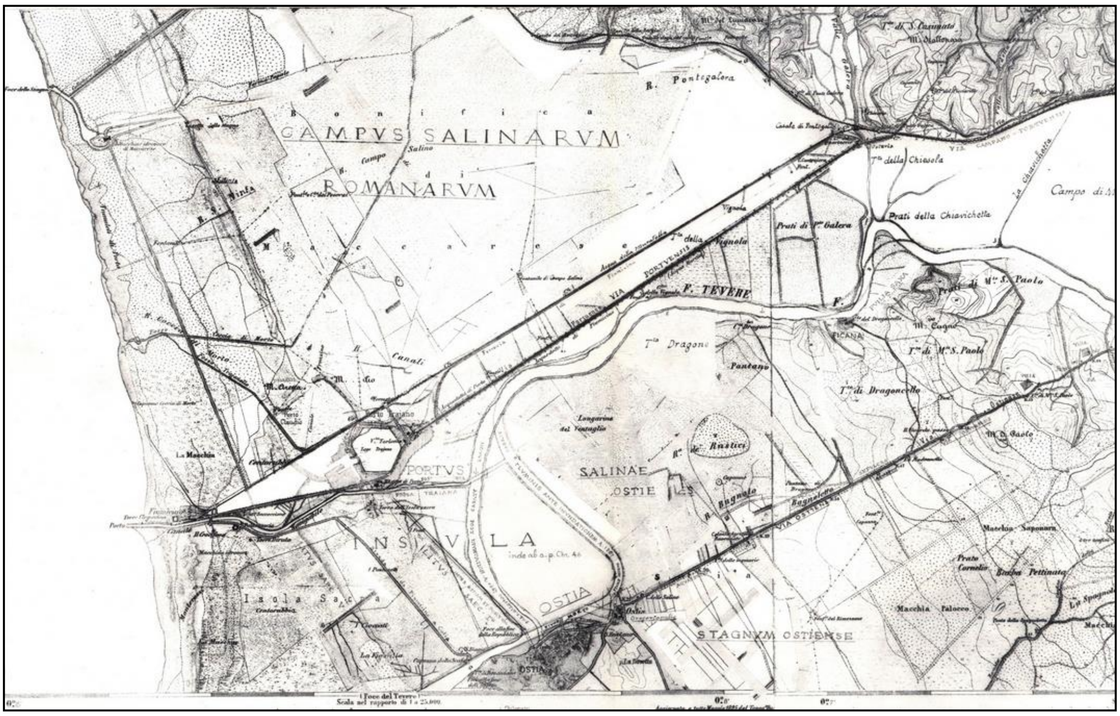

Figure 4.43 Lanciani's map of the *Campus Salinarum Romanum*

4.5 The Map Data and Its Significance

The selection of sources presented in the previous section mark a sondage of the available cartographic material, serving to highlight the use and the issues of historic map data and its use for interpreting the landscape of the study area. While recognisable trends and features appear in the documents that can be compared with the modern topography, there are significant limitations with using cartographic sources as a basis for interpreting layout of the ancient landscape. The prograding nature of the Tiber delta means that parts of the landscape have changed massively since the periods being studied here, together with the cultural and geo-political context for many of the sources. The cartographic evidence is perhaps best viewed as a body of material similar in tone and comparable with the photographic evidence in the previous sections, to be treated as historical documents that can shed some inference on the extent, nature and diversity of land use and settlement in the floodplain and delta of the Tiber.

To that end, the cartographic evidence provides some evidence for the mixed industries and land use of the area from the 16th to 19th centuries. It also documents to planned changes to the entire wetland zone in the late 19th century, culminating in the bonifica and the complete re-adjustment of the landscape into the low-lying agricultural and settled zone that is present today. The cartography indicates the variable nature of the wetland, with pasture, inundated areas, and mixed woodland all providing coherent ecological areas for exploitation. The presence of extensive saltworking in the delta, especially around the Borgo di Ostia (Pannuzi 2013, para 17) is also shown. Finally, the salient archaeological remains within the study area are represented, comprising the major Roman settlements and ports, the ancient road network, and other remains. The evidence requires careful consideration, as archaeological thought on the location and nature of some remains has changed in the intervening period, for instance the location of the settlement of Ficana.

Both photographic and cartographic evidence ultimately serve to illustrate the full diverse potential of settlement and land use on the wetland, including pastoral activities, agriculture, foraging and the exploitation and management of woodland resources, in addition to intensive saltworking.While a like for like comparison cannot be made between post-medieval and modern practice and the explotation of the wetland in the prehistoric and Roman periods, the evidence serves as a comparison for the archaeological evidence of such exploitation from the Neolithic onwards. It aids in our assessment of what was feasible and provides a comparison of the balance of economic activity and settlement in the area.

Chapter 5 : The Archaeological Research Methodology

5.1 Introduction

This chapter sets out the archaeological methodology applied to fulfil the objectives of the research. The aim of the work was to model the pattern and dynamics of settlement and the interaction between human activity and the changing landscape from 3000 BC to AD 300, with an emphasis on broader trends in the pattern of settlement and land use for the area. This required the development of an integrated research methodology, and thus a second aim was to develop and provide a methodology for modelling the past landscape using an integration of different archaeological methods. In order to achieve these aims it was necessary to study material from a number of different sources, including those associated with the geomorphology of the study area, and those determining the nature and distribution of archaeological sites and deposits. It was therefore necessary to draw on both traditional records and archives of archaeological excavation, field recording and geological interventions for the area and to apply analysis of more advanced datasets including historical and more recent results of remote sensing and geophysical survey. The overall methodology is based on a landscape approach, utilising the coverage of data and results from field methods to analyse the patterns and dynamics of settlement and land use for the period in question. To this was added basic analysis of the pattern of settlement using a GIS to quantify the proximity of sites to types of topography, drainage and other resources, and assess the extent of resource exploitation from different settlements.

Some of the methods applied to the research facilitate the analysis of data for mapping the changing geomorphology of the landscape in relation to human settlement patterns, such as satellite imagery and LiDAR. Others provide evidence of lithology (borehole data, deep geophysical methods) or the presence of human interaction with the environment or of settlement (the archaeological record and shallow geophysical survey, also analysis of air photographic records).

The number of different data sources and methods applied for this research requires presenting a complex array of techniques, their modes of operation, development, and both general and archaeological application, together with their associated advantages and limitations to the field of research. To that end different methods of data collection and their application are divided into sections. These comprise data relating to the geomorphological study of the landscape (section 5.2) including radiocarbon dates and coring and borehole evidence, then sources of documentary archaeological evidence (section 5.3) comprising records of archaeological sites from publications and grey literature and other sources of historical information such as maps and photographs. The chapter then relates the different forms of non-intrusive data and survey methods either applied or analysed for the research, comprising sections on air photographic evidence (section 5.4) satellite remote sensing (section 5.5), airborne laser scanning (section 5.6) and geophysical prospecting (section 5.7). A section containing further detail is located in the appendices (Appendix 3). Many of the techniques discussed here have a degree of cross-over in terms of methodological approach, modes of data analysis and interpretation, and these will be made apparent in the text. More critically the integration of these different datasets in the study of the Tiber delta landscape requires discussion, and the final part (section 5.8) of the chapter discusses the integrated methodology used in analysing and interpreting the datasets relating to the study area.

5.2 Geomorphological Evidence

A primary consideration of the research is to map and characterize evidence for the development of the Tiber river system and the prograding delta in terms of spatial evidence. In addition, the building of a chronology from published and archive evidence is needed. Much of the spatial data was derived from remotely sensed and geophysical data, however, evidence for sediment types and depths, and a chronology for the deposition and change in the geoarchaeology came from a number of sources of published and archived geoarchaeological assessment. The combined geomorphological datasets (Chapter 6, Section 6.6) provide the context for the archaeological analysis of the study area, indicating basic time-depth sequences for different parts of the Tiber floodplain and delta. This is critical in evaluating the visibility and nature of the archaeological remains, and the effects of the formation and changes of parts of the river system on the presence of archaeological material.

5.2.1 Radiocarbon Dates

The data is drawn from databases of radiocarbon readings published by different laboratories over the last 60 years, principally represented in the journal Radiocarbon (see Ferrara et al. 1959; 1961, and Alessio and Bella 1965 for examples). In addition, dating from the study area, published in a number of research papers focusing on the geoarchaeology of the Tiber delta (Bellotti 1998; Bellotti *et al.* 2011; Di Rita *et al.* 2009; Marra *et al*. 2013), are referred to, especially where dating of sedimentary sequences are concerned. Many of the former were located in the journal Radiocarbon presenting descriptions and calibrated dates for samples sent to a variety of laboratories, including those from the Roman boats located at Portus (Testaguzza, 1970) and the dates from the excavations of the Eneolithic settlement at Cerquete-Fianello (Hedges et al. 1998, 448).

Where detailed information is given on the uncalibrated readings, the laboratory code ad uncalibrated date is given in parentheses. As part of the analysis for this work radiocarbon dates were also recalibrated using OxCal 4.3 (https://c14.arch.ox.ac.uk/oxcal/OxCal.html) using IntCal 13and the table results to give an updated calibrated date. In some instances, such as Marra *et al.* (2013), no laboratory codes are given, and here the uncalibrated dates and the recalibrated dates are given.[30]

5.2.2 Borehole and Coring Data

The most extensive programme of borehole survey conducted in the Tiber delta is represented by the work of Bellotti and colleagues, spanning a period from the late 1970s to the present day (Bellotti and De Luca 1979; Bellotti *et al.* 1994; 1995; Bellotti 1998; Bellotti *et al.* 1996). Results of the different seasons of data collection are extensively published and formed the bulk of data entered into the database for comparison with air photographic, satellite and geophysical survey data.

More recent campaigns of borehole survey have been conducted both independently and under the aegis of the Portus Project by colleagues from the University

[30] Recalibration of dates was carried out using OxCal 4.3. The recalibration was conducted on 14th August 2019.

of Lyon[31]. Much of the work has focused on expanding the understanding of the development of the Roman port at Portus, and its relationship to the Tiber. However, the data collected in this area (Goiran *et al.* 2009; J.-P. Goiran *et al.*, 2010a; Salomon 2013) provides a substantial body of data relating to the pre-port delta and facilitates a better understanding of the deposits which formed the foundation of the Roman port.

These datasets provide evidence for the time-depth of alluvial and other deposits across the Tiber floodplain and delta. In particular the data from the river floodplain (Marra *et al.* 2013), and from the Maccarese and Ostia delta plains (Giraudi *et al.* 2007; Bellotti *et al.* 2011; Giraudi 2012) provides evidence of the depth of deposits associated with the deposition of alluvium from the Tiber watershed, with Neolithic and Eneolithic deposits in some instances being located at depths of 10-15m below the modern floodplain. This data forms the basis of a model for the historic landscapes of the study area for the range of periods in question. This is essential in relating the ancient topography to the spatial distribution and elevation of the archaeological sites in the study.

5.3 Archaeological Data

5.3.1 Published Evidence

A number of sources of published evidence are noted for the study area. Many relate to monographs for specific excavations and surveys in the area, from the Eneolithic settlements of the Maccarese Plain (Manfredini 2002) and excavation of the Bronze Age and Archaic contexts at Ficana (Brandt 1996). Collections of prehistoric material from fieldwalking data for the Campagna Romana are also represented (Bietti Sestieri 1984). Published accounts of excavation and survey work is also present for the Roman sites in the area, including Portus (Keay *et al.*, 2005), and recent work at Ostia Antica (Claridge and Gallina Zevi 1996). In addition, a series of themed monographs present data from the area, including a gazetteer of villa sites (De Franceschini 2005). It is the substantial collections

[31] The work of Jean-Philippe Goiran and Ferreol Salomon, of the Centre National de la Recerche Scientifique (CNRS) at Lyon and Strasbourg, provided much of the data for the time-depth analysis, in addition to the work of Bellotti.

from journals and bulletins that provides a substantial dataset from published literature, including Archeologia Laziale, Bolletino Comunale Archeologico di Roma and others. The broad published data indicates the distribution and presence of archaeological sites for the study area (see Chapter 7, Section 7.2). The indication of sites by type and period facilitates calculation on site location, aspect and proximity to other settlements and natural resources, and provide evidence of the rationale behind settlement distribution and location.

5.3.2 Grey Literature

Much of the existing archaeological evidence for the region is based on previous syntheses of sites and areas recorded by the *Soprintendenza* and other archaeologists, stemming from sustained antiquarian records through to more recent efforts of fieldwork. Synthesis of existing archaeological records for the study area relied on three principal sources to provide extensive coverage of the landscape. In the first instance sites recorded in the *Carta dell'Agro* for Lazio were catalogued, from previous published versions of the *Carta* and from the digital *Carta dell'Agro* provided by the Provincia di Roma (Comune di Roma, 1987). The relatively low resolution of data and information provided by the Carta dell'Agro[32] was supplemented by more recent sources of material.

[32] The Carta dell'Agro represents a management document showing the location of important archaeological sites. The resulting document is very much biased in favour of extant archaeological remains and architectural features, from Roman villas, early medieval churches, to more recent casali constructed as part of the Bonifica. Some evidence for ceramic scatters of pottery and architectural fragments are recorded, together with some important prehistoric sites. However, the document is very much weighted towards monuments from the historical period. The chronological sub-division of sites also reflects this, with a three period system of grouping comprising Palaeolithic up until 5th century AD, 5th century to 16th century AD, and 16th century to the present.

Figure 5.1 Example of data from Amendolea (2004) for the Palidoro 1:10 000 mapsheet, showing archaeological sites in red, with numbering associated with the gazeteer entries. Entries can relate to any form of material, from scatters of ceramic fragments to standing remains

The Provincia di Roma Carta Bibliografica (Amendolea 2004; Fig. 5.1) provided a consistent record of archaeological sites within the confines of the Provincia di Roma, excluding the Comune di Roma, with sites recorded on copies of the 1:10 000 CTR maps of the Regione di Lazio. In addition, the Comune di Roma Carta per la Qualità (Comune di Roma 2002; Fig. 5.2) provides a detailed record of archaeological sites at a scale of 1:10 000, based principally on the Carta dell'Agro with other material.

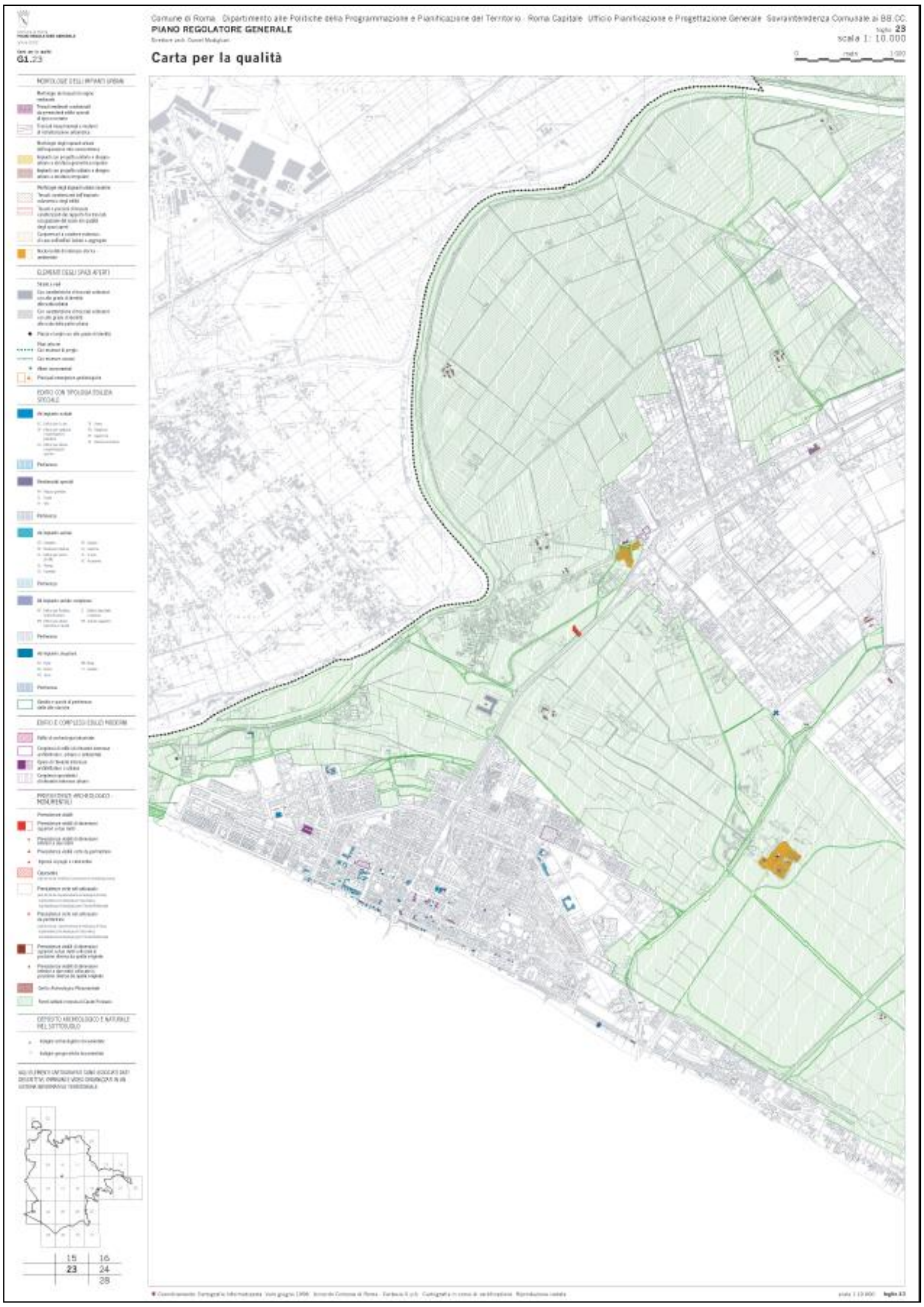

Figure 5.2 Example of data from the Carta per la Qualità (Comune di Roma, 2002) for the G1.23 mapsheet of Ostia

Three other important published works formed the basis of research into documented sites. The *Forma Italiae* publication (Tartara *et al*. 1999) of archaeological sites for the area of Torrimpietra includes a significant number of scatters of archaeological material. The synthesis of sites between Rome and Civitavecchia (De Rossi *et al.* 1968) also provided other examples of material in the area of the Via Aurelia, and sites for the Apiolae area around Pomezia (De Rossi 1970). In addition to these syntheses of archaeological material, a full bibliographical search was conducted with records being entered into the site database. Prominent amongst resources were the interim reports of excavations published in Archeologia Laziale, and short lists of sites presented in Alessandri (2007) and on the Sistema Informativo Territoriale Archeologico (SITAR) website[33].

The synthesis of the published data forms the basis of the dataset of sites for the area (Chapter 7, Section 7.3) which was combined, reclassified to ensure consistency and revalidated to ensure no duplicates appeared in the final database.

5.4 Air Photographic Evidence

Aerial photography has played a significant role in the development of remote sensing in archaeology, particularly in Northern Europe (Scollar et al. 1990, 26). The principal that viewing an archaeological site from above facilitates the classification and interpretation of the remains is well-established (Crawford 1928; Crawford and Keiller 1928) and forms the basis of air photographic interpretation[34].

The development of air photographic techniques and analysis is closely related to military technology and development of data analysis during the First World War and prior to and during the Second World War. The flights undertaken in Britain and elsewhere in this period (Crawford and Keiller 1928) are matched by similar developments in Continental technology and application, including the work of Sara Nistri in Italy. For the purposes of archaeological survey, the reconnaissance photography undertaken in the Mediterrannean before and during the Second World War by the Luftwaffe, RAF and USAAF, and the post-war coverage by state military flights, has proven invaluable in terms of remotely photographed studies of archaeological landscapes (Boemi and Travaglini, 2006; Mazzanti, 2006). The case of Italy is no exception, with first Luftwaffe and then Allied reconnaissance campaigns being run during the Italian campaign (Ceraudo and Shepherd 2010). Both RAF (Shepherd *et al.* 2013) and USAAF (Shepherd *et al.* 2013a)

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[33] The phases of the SITAR project are outlined at http://www.provincia.roma.it/percorsitematici/cultura/servizi-al-cittadino/4163, with the online data resource available at http://sitar.archeoroma.beniculturali.it/.

[34] Crawford used the analogy of viewing a patterned carpet to describe how the viewpoint of low flying aircraft, together with the knowledge gained through the study of site morphology, could allow the interpretation of an archaeological site (Crawford and Keiller, 1928).

photographic archives were deposited in Italy, the former with the British School at Rome, and the latter at the ICCD. Post-war technological development of air photography followed a pattern of both commercial and state projects, with Volo Base flights in Italy conducted by the Aeronautica Militare and specific flights and projects run by private companies such as Sara Nistri and Esacta (Guaitoli 2003).

5.4.1 Air Photography in the Tiber Valley

There is a strong tradition of the use of aerial photography (Fig. 5.3) in the zone between Rome and the coast at the mouth of the River Tiber (Boemi and Travaglini 2006; Bradford 1957, 237; Meiggs1973, Plates II and V). The most significant event in the area of the Tiber delta occurred in 1911 with the aerial reconnaissance carried out over Ostia from a balloon (Shepherd 2006). This flight, together with work conducted by Cesare Tardivo around Rome and Pompeii (Tardivo 1911, 90) demonstrated the potential for this technique when applied to the remains of substantial urban centres.

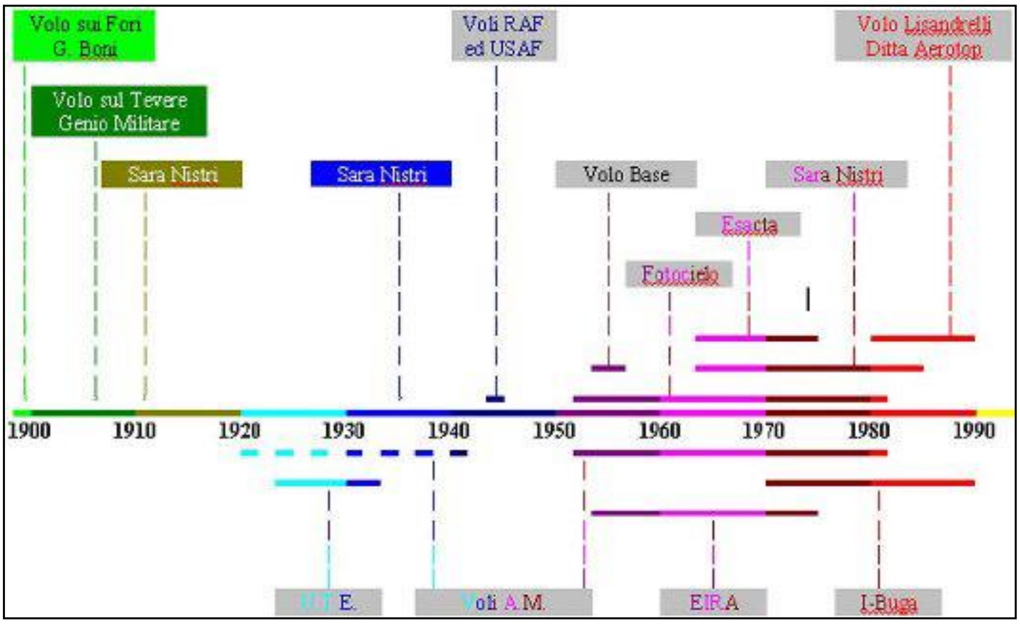

Figure 5.3 Timeline illustrating the phases of different air photographic reconnaissance in Italy. One of the earliest applications of the technique were carried out by the Genio Militare on the River Tiber in the 1910s (source: ICCD; Guaitoli 2003, 31)

Air photographs were produced by Sara Nistra throughout the 1920s and 1930s. However, a substantial proportion of the air photographic archive for the coastal zone and area around Rome is represented by the RAF and USAAF reconnaissance photographs from the Second World War (Mazzanti 2006; Ceraudo and Shepherd 2010). Photographs were collected for the purposes of military reconnaissance, and all are vertical images taken from either 50,000ft or 10,000ft (representing scales of approximately 1:51,000 and 1:11,000 respectively). The flight paths were dictated to by the concerns of the allied military prior to and during the invasion of the Italian peninsula, however the air photographic coverage of the zone between Ostia and Rome is comprehensive for both high and lower altitude photographs. While the high altitude of the flights makes the images less conducive to the mapping of minute detail from specific archaeological sites, the ground coverage of the photographs is massive, providing a resource of photographs that covers most of the landscape between Rome and the sea, and providing critical evidence for the geomorphology and archaeology of the region. The principal advantage of this archive over later air photographic coverage of the area is the lack of urban development along the course of the River Tiber and across the delta compared with the present day.

5.4.2 The Air Photographic Archive and RAF Images

The air photographs utilised for the study are held by the *Istituto Centrale per il Catalogo e la Documentazione* (ICCD)[35]. The RAF photographs in the collection consist principally of images originally held by the library of the British School at Rome (BSR) which were given to the Institute in the 1990s (Shepherd *et al.* 2013). A large part of the archived material has been digitised and placed into a GIS by the ICCD, although some of the flight paths still have not been digitised. Two scales of image were utilised for the air photographic analysis; the 1:51,000 high altitude vertical photos and the 1:11,000 lower altitude photos. The former provided a clear overview of the geology and geomorphology of the lower Tiber valley and the coastal littoral, with the latter allowing a higher

[35] The ICCD provides an online catalogue of photographic and air photographic images for reasearchers at www.iccd.beniculturali.it. The author wishes to thank the director of the air photographic collection Dr Elizabeth J. Shepherd for advice and assistance in perusing the archive and for permission to use air photographic images for researching the lower Tiber region. The technical assistance of Giuseppe di Gennaro at the ICCD is also gratefully acknowledged.

resolution focus on the region to relate geomorphological features to potential archaeological remains.

5.4.3 Georectification of the Photographs

A number of different factors influence the form of air photographs and can present problems relating to the rectification and georegistering of images to base maps. The effect of such factors has more recently been assessed, particularly in relation to the plotting and interpretation of geomorphological features associated with lateral channel movement (Hughes et al. 2006, 2). Although all of the photos used for the air photographic analysis of the study area are vertical, the datasets still require georeferencing to the base map data. A number of issues affected the georeferencing of the material. Many of the images had been georeferenced and projected in the geographical coordinate system European Datum 1950. They were supplied with World coordinates in the form of .tfw files, however the accuracy of the georeferencing was not always sufficient for these files to be used. The issues with accuracy stemmed in part from the effects of distortion around the edges of the photographs (Scollar *et al*. 1990, 79), but greater error occurred through the effect of variations in topography across each photograph and the associated area in the map data (Hughes *et al.* 2006). As a result, all images were assessed visually for discrepancies between the georeferenced photographs and the base map data, and where errors were seen to be present the images were georeferenced accordingly (Fig. 5.4).

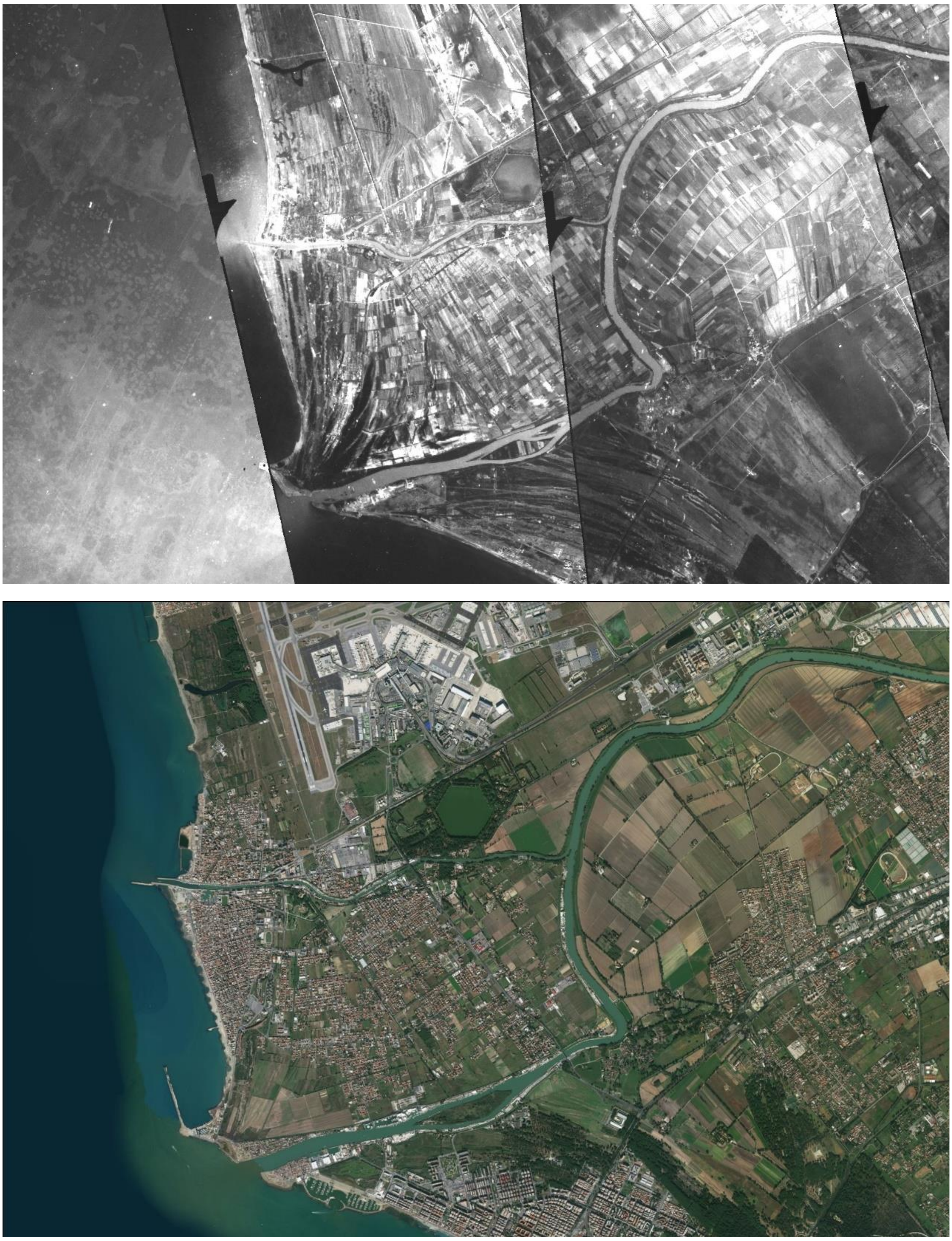

Figure 5.4 Example of georeferenced and mosaiced air photographic material from the 1943 RAF archives, with modern orthorectified photography superimposed on the lower image. The extent of modern development that has occurred since 1943 is clearly visible

5.5 Satellite Imagery

The scope of satellite data for recognising and characterizing archaeological sites and features is well-established (see Appendix 3). Depending on the conditions at the time of data being collected, and the resolution of the satellite data, buried archaeological material can be located. Similarly, the extent and form of geoarchaeological features can also be mapped.

Remotely sensed imagery from satellites has been used for a variety of areas of research, including environmental, geological, agricultural and archaeological research (Campbell 1996).

5.5.1 Application of Remote Sensing in Archaeology

Several different modes of data analysis are used for archaeological applications of satellite data. At its most intuitive this includes the mapping of archaeological features recognised through crop marks, parch marks and earthworks, similar to analysis of air photographic data (see above). Infrared spectral data can also be applied to identify variations in vegetation cover where potential archaeological sites are located, or to locate variations in vegetation caused by the presence of geomorphological features, including palaeocoastlines and palaeochannels (Niemi and Finke 1988).

Ideally imagery for identification and interpretation of settlement distribution and interaction would provide data demonstrating the location and distribution of archaeological sites in an area, including the settlement dimensions, evidence of enclosure, and the development and change of particular settlements, together with proxy soil and land-use distributions. Evidence from this form of interpretation would require verification from other methods of survey and evidence of a ground-based nature, including densities of surface ceramics and extant architectural remains.

5.5.2 Image Interpretation

Regardless of the nature of the images in question, a process of interpretation should be followed. Classification of different objects and features, including digitising of features in imagery, based on form, strength of signal and other parameters is required.

Listing and enumeration of objects should be carried out, together with measurement of particular dimensions and delineation of correlations or distribution in regions of the data. Finally, any noted elements of image tone, texture or associations should be considered (Campbell 1996, 125). For archaeological applications, many of these criteria need to align with archaeological principles of feature identification, including similar morphological interpretation based on known archaeological sites. However, the spectral aspects of the data analysis provide a useful, more objective aspect, of the data analysis that can be combined with the morphological interpretation of the datasets. The grades of data interpretation are noted by Campbell (1996, 121) and relate as much to the archaeological methodology as they do to other areas of research. They include aspects of direct recognition based on skill, experience or judgement, inference based on existing correlations in the data, deterministic interpretation based on quantatively expressed and collateral or ancillary information based on non-image data. Bearing in mind the nature of archaeological evidence and the subjective nature of archaeological analysis, the latter form of interpretation provides a critical area for the analysis, considering in particular the integrated methodological nature of the current study.

5.5.3 Satellite Data for the Tiber Valley

A number of different sources of satellite data are available for the Tiber valley area. This includes elevation data, and various forms of imagery. Low resolution elevation data (90m) is available in the form of global DEM datasets, although this has now been superceded by ASTER 30m resolution digital elevation data. LandSat 7 and 8 data, and earlier low resolution declassified data is also available from the USGS EarthExplorer website (http://earthexplorer.usgs.gov/).

In terms of commercial high resolution satellite imagery for the study area, Quickbird (0.6m panchromatic and 2.4m 4 band multispectral) and GeoEye (0.4m panchromatic and 1.6m multispectral) datasets are available, together with WorldView (0.46m panchromatic and 1.8m multispectral) data.

5.5.4 Data Analysis

For the study of the Tiber delta WorldView 2 data was used for an area incorporating the central delta, Portus, Ostia and the Isola Sacra. Panchromatic and 8 band multispectral imagery were provided for analysis[36].The imagery was collected on 20th August 2012 for an area of 41 sq km.

5.6 Airborne Laser Scanning Data (LiDAR)

Airborne Light Detection and Ranging (LiDAR) data has been collected by Italian authorities, as with many countries in Europe, focusing on areas where the environmental impact of global warming and rising sea levels will potentially have the greatest effect. It is therefore no surprise that LiDAR data has been collected for the Tiber Valley and the Tiber delta, under the aegis of the Ministero dell' Ambiente[37].

The application of LiDAR data to archaeological assessment of landscapes has developed since the start of the 21st century (Crutchley, 2010). LiDAR has applications relating to the creation of terrain models for archaeological sites and landscapes, for assessing small-scale variations in topography relating to earthworks and extant archaeological features and providing high resolution topographic data for use in geoarchaeological studies and surface modelling. The advantages of the technique and the resulting data for archaeological study are widespread (Devereux *et al*. 2008; Hesse 2010; Davis, 2012). While such data has even been valuable in the study of topography in wooded or heavily forested areas (Jones 2010) not all landscapes lend themselves to analysis of LiDAR, and encroaching urbanisation and large-scale disturbance of topsoil or deposition of overburden can seriously limit the effectiveness of the results of LiDAR.

5.6.1 Methods of Data Collection

LiDAR is a remote sensing technique where data can be collected using either ground-based or airborne methods (Jones 2010, 3). Despite the vast array of different

[36] Data was provided by Apollo Mapping in the USA as GeoTiffs with metadata and shapefiles of the overall area of coverage.
[37] For a catalogue of remotely sensed resources for Italy, and for regional coverage of LiDAR see the Ministero website and online viewer at http://www.pcn.minambiente.it/viewer/.

carriages for laser survey, most data used for analysis of archaeological landscapes is provided through airborne data collection (Jones 2010, 4). For airborne LiDAR data collection an active laser beam is transmitted in pulses from an aircraft, with the exact location of measurements being recorded through use of GPS and an Inertial Measurement Unit (IMU) on the aircraft, to an accuracy of 150mm. Most LiDAR systems use light in the near-infrared spectrum (Jones 2010, 5; Challis & Howard 2006, 236). While the use of light spectrum prevents the measurement of terrain below dense tree canopy, in some instances gaps in the canopy may facilitate the recording of some measurements below tree canopy (Fig. 5.5).

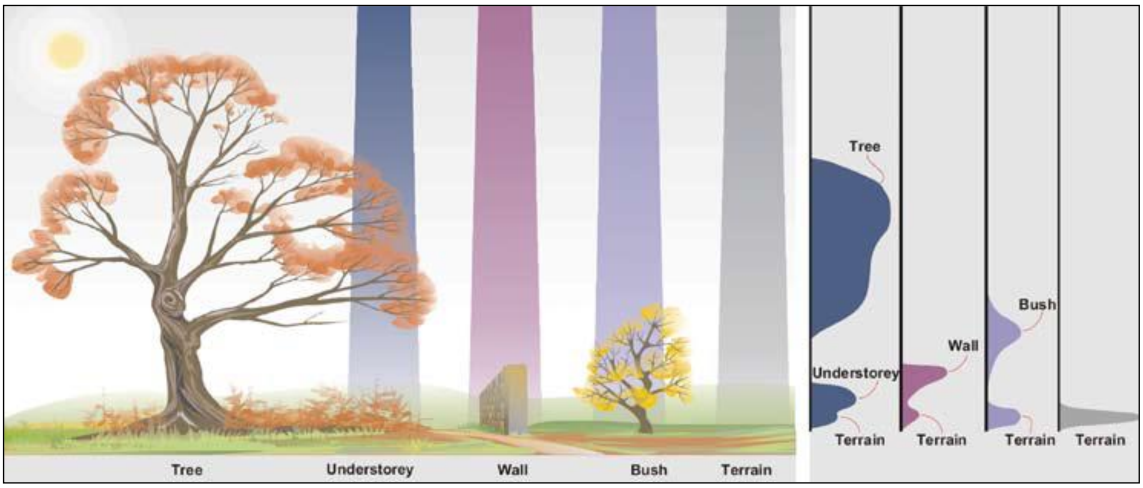

Figure 5.5 Diagram indicating the propagation of the laser pulse through a variety of different terrain including tree canopy, understorey and open ground (Jones 2010, 6)

For the purposes of the current study the most critical data from the LiDAR survey are the first and last returns, the first forming a Digital Surface Model (DSM) of the area and the second presenting the means for calculating a Digital Terrain Model (DTM). LiDAR data collected in the Tiber delta features both first and last responses, and the intensity data for the LiDAR data, which can be used to measure reflectivity of the surface being surveyed (Jones, 2010; Challis *et al.* 2011).

Comparable studies of air photographic data used in combination with LiDAR data exist for a number of environmental and archaeological applications in Italy. Prominent work has been undertaken by the Consiglio Nazionale delle Ricerche (CNR) on a number of sites and landscapes in the south of Italy (Lasaponara *et al.* 2010; Lasaponara *et al.* 2011) at Yrsum to detail microrelief of the site, and at Monteserico for interpretation of geomorphological features. In addition, assessment of coastal environments has been conducted for the mouth of the River Arno (Lupino *et al*. 2005; Pranzini 2007), a study of particular relevance to the Tiber delta with similar examples of pro-grading delta deposits and dune cordons formed along the coastline.

5.6.2 LiDAR Coverage in the Study Area

Airborne laser scanning data has been collected in Italy by the Ministero dell'Ambiente. Coverage in the Regione di Lazio and in the area of the lower Tiber (Fig. 5.6) in particular covering the coastal zone from Castelporziano in the south up the coast to Civitavecchia, and along the valley of the Tiber and the Aniene north of Rome and east beyond Tivoli. The data comprises first and last return data and intensity data at a resolution of 1m, which by current standards is not as high resolution as some datasets, but more than adequate for the current aims of this research in terms of modelling the landscape and assessing archaeological potential based on topographic variations, combined with other remotely sensed datasets.

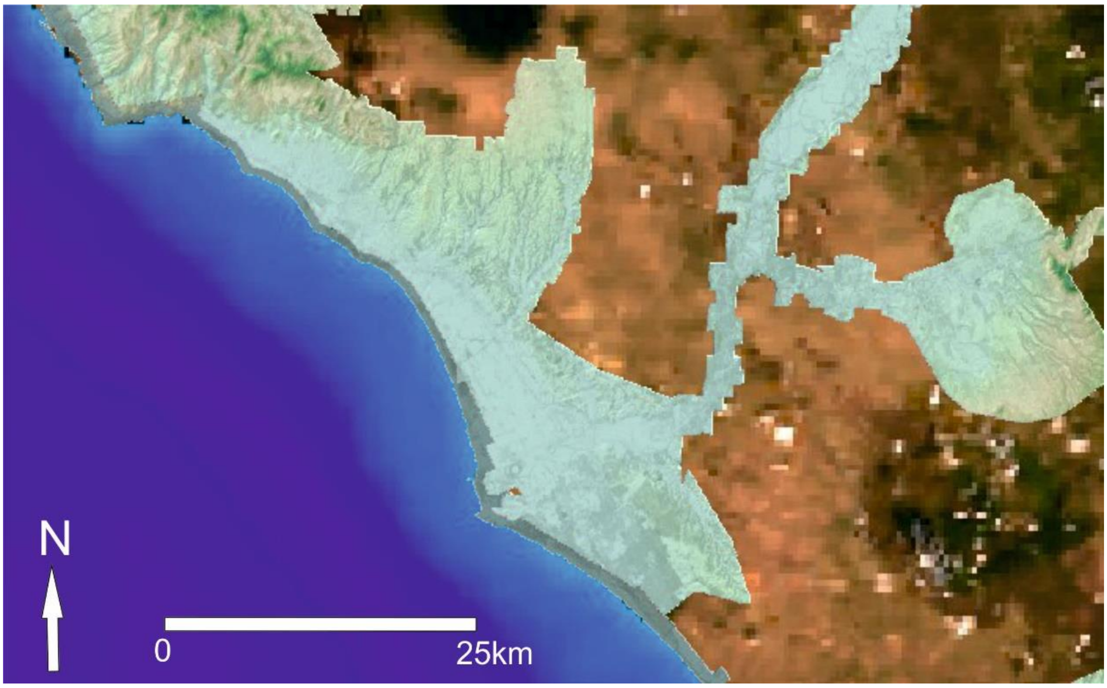

Figure 5.6 Area of coverage for LiDAR data from the Ministero dell'Ambiente (Source: Geoportale Nazionale)

5.6.3 Process Used for Data Conversion and Analysis

The LiDAR data for the study areas derived from a series of ascii files or grid squares 830m by 1100m in size. Data was supplied as Digital Terrain Model (DTM) and first and last return Digital Surface Model (DSM) data. In addition, a series of intensity Tiff files were also supplied.

The DTM dataset was imported into ArcCatalogue and mosaiced using the standard procedure (Davis 2012, 6) with the other grid tiles loaded into the first imported tile. The Mosaic Operator was set to 'Mean' and the Mosaic Colourmap Mode was set to 'Match'. This formed the basis for a topographic dataset incorporating ASTER and LiDAR DTM data, for the topographical analysis undertaken in ArcMAP.

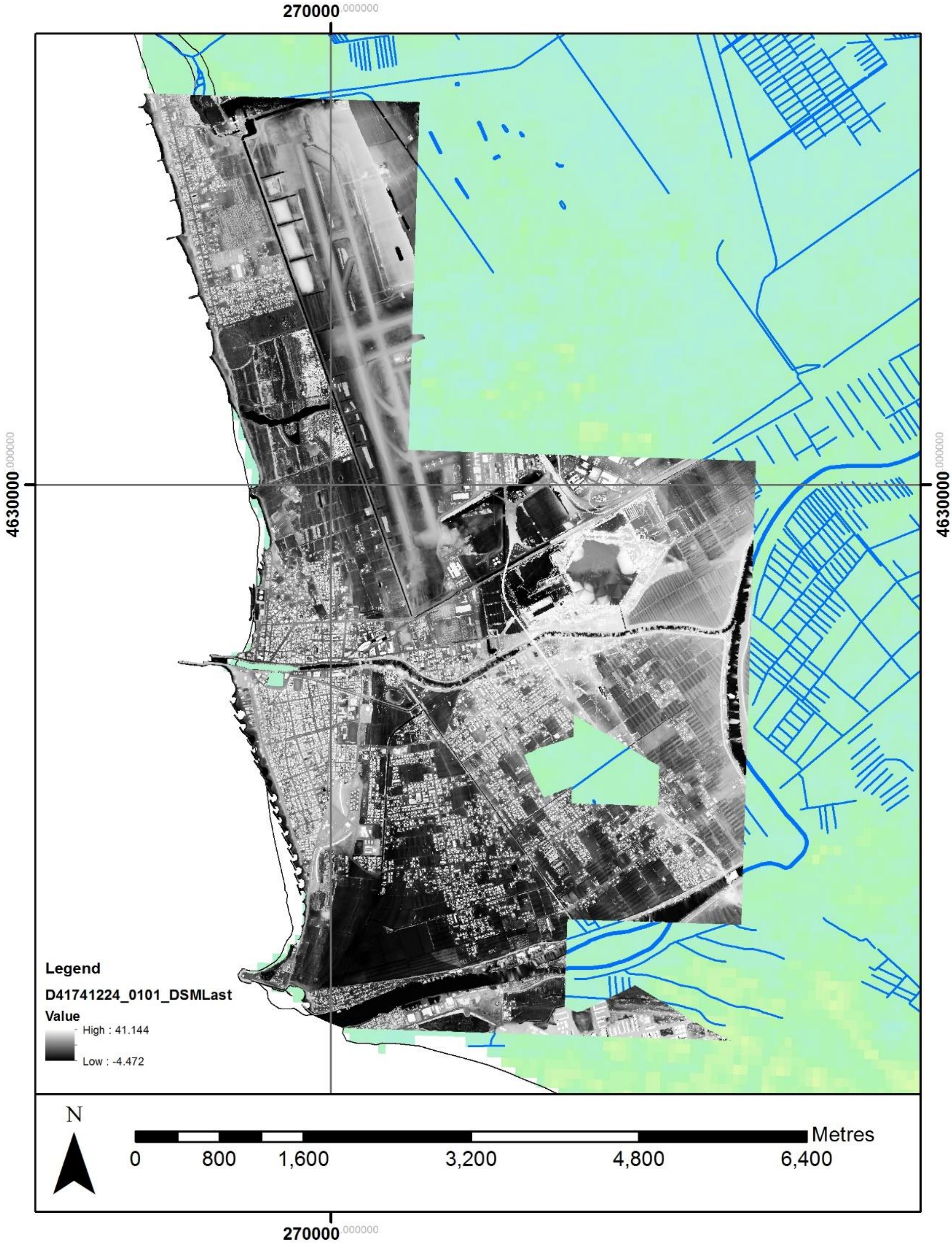

Figure 5.7 DSM LiDAR dataset for the area around Fiumicino

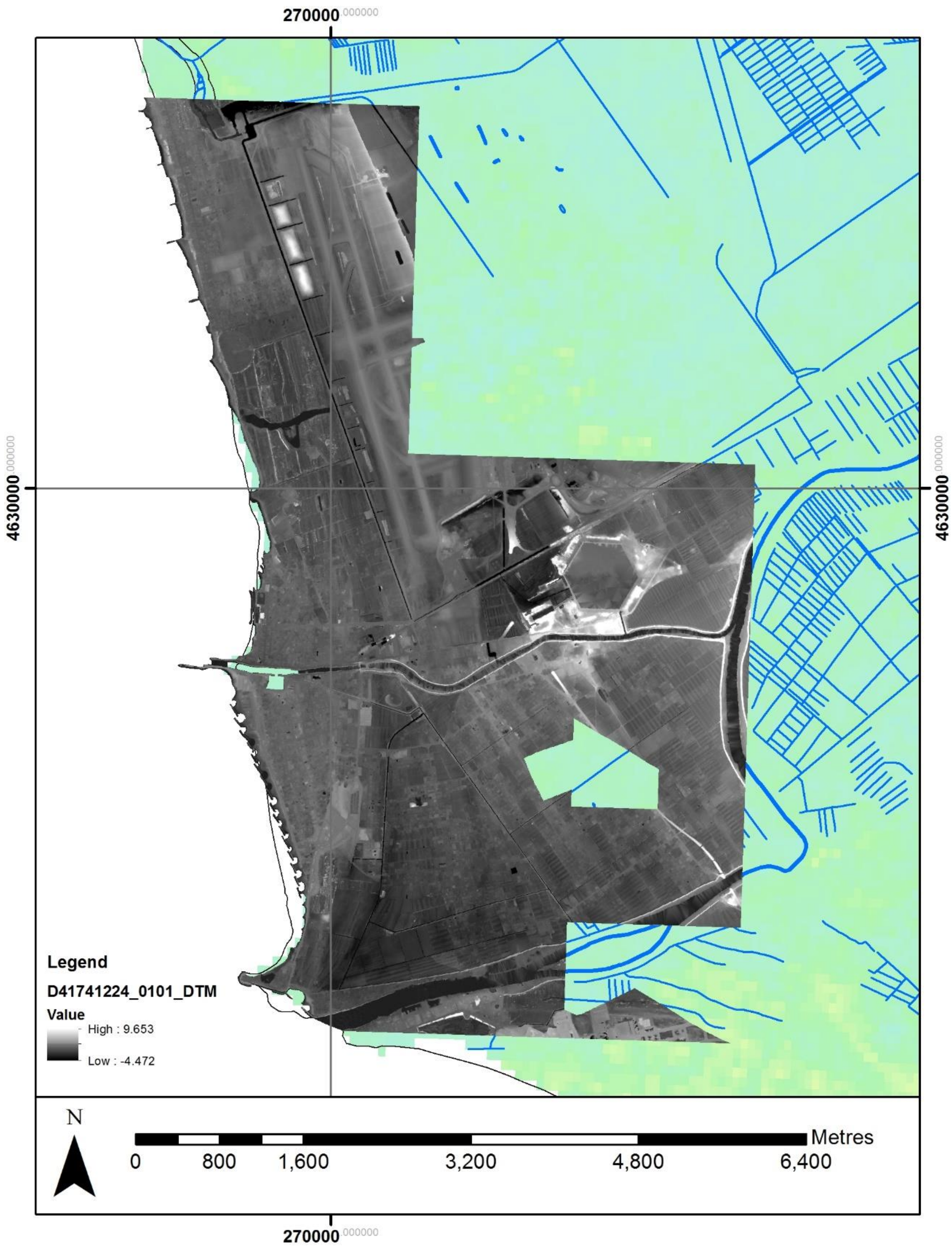

Figure 5.8 DTM LiDAR dataset for the area around Fiumicino

As part of the data processing and analysis, a hillshade model and slope model of the data was created for scrutiny. A local relief model was also created using the methodology prescribed by Hesse (2010) and presented in the CADW LiDAR guide (Davis 2012).

5.6.4 Application and Limitations of the Data

A number of uses for the LiDAR data were highlighted through the use of the above methodology for the study area. The DSM dataset provided unimpeded coverage or the open arable and pasture areas of the delta, and the beaches and dune cordons. However, areas under tree canopy and modern development were of limited use in the overall dataset. By contrast the DTM dataset provided some bare earth topographic data for wooded areas. Undisturbed areas of topography, particularly associated with the modern coastline, parklands and archaeological areas indicated topographic change in both datasets that could be interpreted in terms of possible archaeological features.

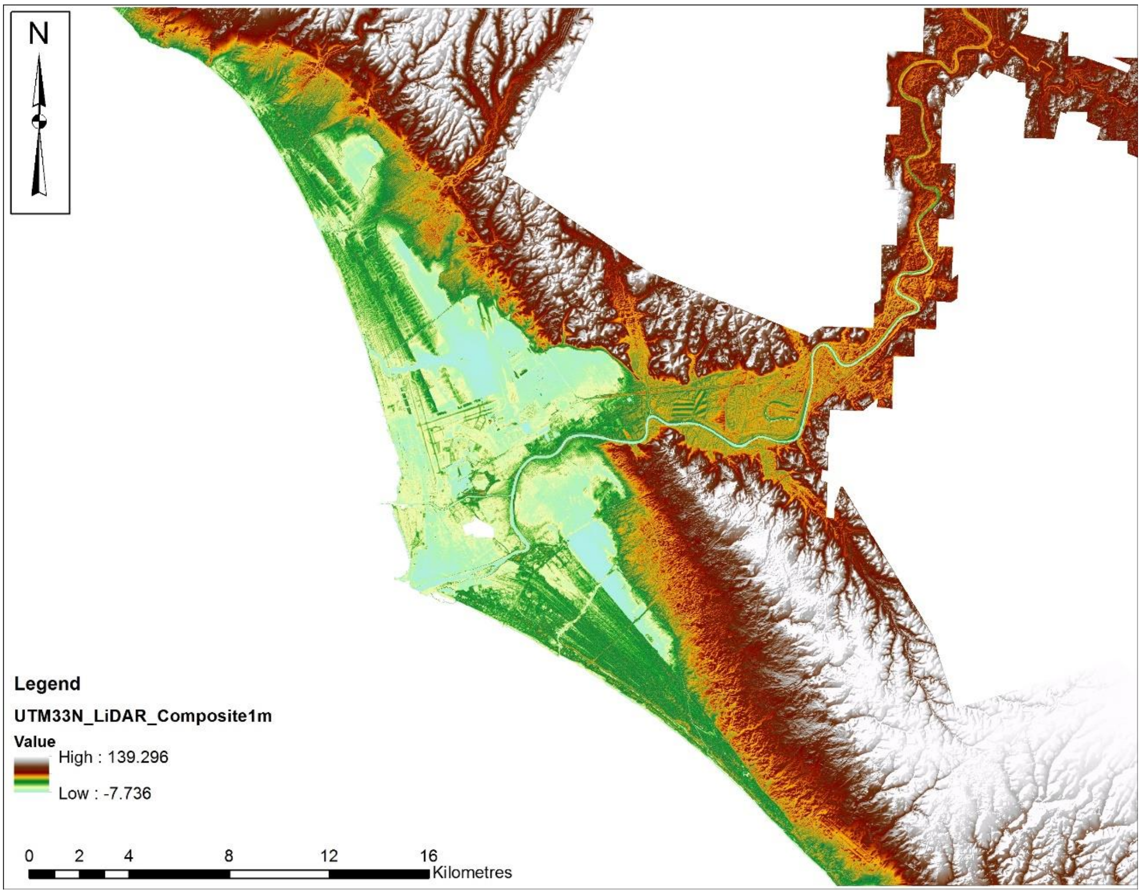

Figure 5.9 Combined 2m by 2m and 1m by 1m DTM LiDAR for the study area

The nature of the modern terrain over areas where the Bonifica had affected the ground is of limited use (Figs 5.7-5.9), however. The creation of massive ridges of ploughsoil in the fields associated with the modern Bonifica and canalisation of the landscape removed any form of subtle earthwork or topographic feature relating to the archaeology. Thus, the usefulness of the LiDAR dataset in the study area was variable throughout the coverage. To a great degree the limitations of the LiDAR in these areas is mitigated by the other non-intrusive data sources applied across the study area, with buried archaeological features showing in both air photographic data and geophysical survey data.

5.7 Geophysical Survey

Ground-based survey within the study area has focused on the application of archaeological geophysics over extensive areas of the Tiber floodplain. Much of the survey work was conducted during the Portus Project between 1998 and 2006 (Millett *et al*. 2004; Keay *et al.* 2005) and the survey of the hinterland of Portus to the south of the Fossa Traiana across the Isola Sacra between 2008 and 2012 (Strutt and Keay 2008; Keay *et al.* 2013; Keay *et al*. 2014; 2014a).

5.7.1 Application of Geophysical Survey in the Study Area

Use of geophysical survey techniques in the Tiber valley has a long tradition (Strutt 2001a) with use of techniques by institutions such as the British School at Rome noted as early as the 1960s (Ward-Perkins 1961, 88) and work by the Fondazione Lerici (Bonghi Jovino & Chiaramonte Treré 1997, 1). Individual research projects in the lower Tiber Valley have also utilised different geophysical survey methods as part of programmes of mapping and survey, inevitably prior to excavation or in the course of a broader study of urban sites in the area. The most notable application of techniques has been at Ostia Antica (Heinzelmann *et al.*, 1997; Heinzelmann, 1998, 2000; Bauer and Heinzelmann 1999; K Strutt, 2001; Strutt 2002; Strutt, 2005) where use of both caesium vapour magnetometers and fluxgate gradiometer aided in the mapping of the plan of the buried city and associated features[38].

[38] The project was directed by Michael Heizelmann, with field seasons running from 1997 until 2002. Helmut Becker conducted caesium vapour surveys in different areas of the city, and the author carried out a season of fluxgate gradiometry in 2002. The sensitivity of the caesium instruments meant that, while near-surface deposits masked some of the deeper features, with

Large-scale geophysical survey was conducted in the area of the Tiber delta as part of the Tiber Valley Project (Patterson *et al.* 2000), with fieldwork directed by Prof. Simon Keay and Prof. Martin Millett as part of the overall project. A number of geophysical surveys were conducted in the middle Tiber valley at prominent Faliscan, Etruscan and Roman sites as part of the project, including surveys of Falerii Novi (Keay *et al.* 2000; Hay *et al.* 2010), Falerii Veteres (Carlucci *et al.* 2007) and Capena (Keay *et al.* 2006) and at the Roman towns of Ocriculum (Hay *et al*. 2013), Baccanae, Castellum Amerinum and Forum Cassii (Johnson *et al.* 2004). The project also involved an extensive archaeological survey of the Roman port of Portus and its immediate hinterland[39], and as part of this survey geophysics was conducted over an area of approximately 260 hectares (Millett *et al.* 2004; Keay *et al.* 2005; Keay *et al.* 2008).

The results of these surveys demonstrated the application of geophysical survey techniques at a variety of sites, over varied types of geology, and in association with different forms of archaeological deposit. The overall emphasis of the work highlighted the application for ancient urban centres (Millett 2013), however, the use of techniques for large-scale coverage, and the integrated approach to survey in order to elucidate on forms of geomorphology and varied archaeological deposits both urban and associated with smaller settlement and land use, was not lost on the researchers. In particular, the survey of Portus revealed significant patterns of deposits relating to the geomorphological development of the Tiber delta, and the different phases of settlement and land use associated with the delta before, and contemporary with, the establishment of the Roman port at Portus. The contribution of the geophysical survey to the project was invaluable and meant that further geophysical survey could be conducted in the area of the Tiber delta to further understand the port and its relationship with other sites in the area. The

processing the results of the caesium vapour magnetometer survey gave a clearer indication of buried structures and walls than the fluxgate gradiometer surveys.

[39] The work was funded by the AHRC and ran from 1998 until 2006. A large team of surveyors was employed during the project, with seasons of work conducted in 1998 in the gardens of the Sforza-Cesarini family (Robinson and Kay, 1998), and in 1999 on arable land to the south of the Via Portuense (Strutt 2000). In 2000 and 2001 four seasons of survey were conducted in the archaeological park at Portus, and completing the survey to the south of the Via Portuense (K. Strutt, 2001b; 2001c; 2001a). The area to the east of the Trajanic Basin to the north of the Via Portuense was surveyed in 2004 (Strutt 2004), with the work being completed in the easternmost part of the area in 2006 (Strutt 2006).

Portus Project[40], following on from the surveys conducted for the Tiber Valley Project, focused mainly on excavation of features associated with the main areas of the Claudian and Trajanic harbour. However, one of the project aims was to further study the hinterland of Portus, particularly the area between the port and *Ostia Antica*, across the Isola Sacra (Germoni *et al.* 2011).

The results of the geophysical surveys from 1998 to 2012 cover an area of some 400 hectares. While many of the surveys provide more information about the structures and phasing of the Roman port, the magnetometry over the port and its hinterland provided a large dataset that could be utilised in conjunction with remotely sensed data, to study the pattern of settlement and land use over the delta. The emphasis of the work, due to the nature of deposits in the central delta area, and the research focus of the project, was the Roman period, although the nature of geophysical survey meant that the palimpsest of archaeological deposits over the survey area was recorded in the data, from geomorphological sediments to modern structures.

In addition to the geophysical survey programmes conducted as part of the Tiber Valley and Portus projects, a number of other geophysical surveys were conducted by the author in the study area. Some of these relate to the Portus Project such as the work undertaken at the *Terme di Matidia* in 2005 (Strutt 2005a) with other work within Ostia Antica (K Strutt, 2001; Strutt, 2002, 2005). In terms of data associated with the broader Tiber delta, a survey was also conducted at Acilia providing evidence for the relationships between the lagoons to the south and east of Ostia and the tufa formations along the edge of the floodplain (Strutt 2007). More recent survey work was also conducted for the *Parco Archeologico di Ostia Antica* at the *Fiume Morto* to the east of Ostia Antica, revealing structures and deposits associated with the ancient course of the Tiber (Strutt 2011).

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[40] The Portus Project, directed by Prof. Simon Keay (also its Principal Investigator), and co-directed by Prof. Martin Millett and Prof. Graeme Earl, was funded by the AHRC and commenced in 2007 with survey and excavations at the Imperial Palace within the archaeological park. Electrical Resistivity Tomography (ERT) survey was applied together with GPR and hand augering (De Gaetano and Strutt 2007) to assess the depth and nature of structures already located in the magnetometer survey from 2000. Over the course of the project a significant amount of ERT and GPR survey was conducted in this pivotal area of the site (Davies *et al*. 2009). In addition further extensive magnetometer survey of the Isola Sacra was carried out between 2008 and 2012 (Strutt *et al*. 2008; Strutt 2009).

The data collected during these surveys thus provides the opportunity for comparison with data from the other methods and data sources utilised for this research. The data presented in the grey literature reports and publications was produced in a particular way for specific publication, and the data was interpreted with particular types and forms of archaeology in mind. The way in which the data was collected is still, however, relevant to the current research, as is the methodology and metadata associated with other third-party data sources used here. In addition to the collection strategies used, the processing and manipulation of the data for this study is also relevant and worth establishing.

5.7.2 Geophysical Survey Methodology

For the surveys in the Tiber valley area, a grid system was established using a Leica Viva Real Time Kinetic (RTK) GPS (Fig. 5.10) utilising the UTM 33N WGS84 coordinate system. Wooden survey pegs and spray markers were set out at 30m by 30m intervals, and the grids for all areas were georeferenced to the surrounding field boundaries and fencelines.

Figure 5.10 Use of RTK GPS in the field to the east of Ostia Antica (photo: K. Strutt)

The magnetometer surveys were conducted using different instruments and methods at different times (Figs 5.11 and 5.12). For the earlier surveys at Portus, Geoscan Research FM36 fluxgate gradiometers were used, with measurements being taken along parallel traverses at 0.5m intervals. From 2008 Bartington Instruments Grad 601 dual sensor fluxgate gradiometers were used (Figs 5.12 and 5.13). Measurements were taken at 0.25m intervals on 0.5m traverses, with data collected in zig-zag fashion.

All survey data was processed using Geoplot 3.0 software. The processing of data was necessary to remove any effects produced by broad variations in geology, or small-scale localised changes in magnetism of material close to the present ground surface. Magnetometer data were despiked to remove any extreme magnetic values caused by metallic objects. A zero mean traverse function was then applied to remove any drift caused by changes in the magnetic field. A low pass filter was then applied to remove any high frequency readings, and results were then interpolated to 0.5m resolution across the traverses.

Figure 5.11 Magnetometry being conducted at Portus in 1998 using a Geoscan Research FM36 fluxgate gradiometer (photo: K. Strutt)

Figure 5.12 Magnetometer survey on the Isola Sacra, close to the modern course of the Tiber, using Bartington Grad 601 fluxgate gradiometers (photo: K. Strutt)

Figure 5.13 Magnetometer survey being conducted with a Bartington Instruments Grad 601 fluxgate gradiometer (photo: K. Strutt)

GPR survey in the study area was also conducted using a GSSI instrument with SIR 3000 console and 400Mhz antenna (Fig. 5.14). Data were collected along traverses spaced

0.25m apart along the x direction of each survey grid across target areas of the sites in the northern, central and southern areas of the survey.

Figure 5.14 Ground Penetrating Radar (GPR) survey being conducted close to the Episcopio at Portus, using a GSSI 400MHz antenna with SIR-3000 console and cart (photo: K. Strutt)

Data were processed using GPR Slice software. The different survey profiles were presented in their relative positions, and all profiles were then processed to remove background noise. A bandpass filter was applied to each profile to remove all high and low frequency readings. The presence of hyperbola in the data were utilised to produce an estimation of signal velocity through the deposits at each site, facilitating a calculation of the depth of different features across each site. Profiles were then converted into grid data and were sliced horizontally to produce a series of timeslices through each survey area. The sedimentary nature of the delta deposits meant that much of the GPR survey conducted in the area was of limited use. Two exceptions to the rule were a small survey conducted across the line of the Via Flavia on the Isola Sacra, and a survey to the east of the later Roman structures of the Episcopio at Portus.

The data from all surveys were exported as a series of bitmaps, and were imported into and georeferenced in a GIS, relating directly to other salient spatial information such as AutoCAD maps of the site and relevant air photographic imagery. An interpretation layer of archaeological and modern features was digitized deriving the nature of different anomalies in the survey data from their form, extent, size and other appropriate information. As no direct chronological information can be derived from the geophysical survey data, much of this had to be inferred from the morphology of anomalies, and the relationships between different features.

5.8 An Integrated Approach to the Methodology

The varied nature of the different datasets and methods, in terms of technique and coverage, requires use of complementary data to understand the basic pattern of evidence across the study area. In terms of published material and grey literature unequal rates of data survival presented gaps in the coverage for the study area (see Chapter 7). Similarly, the location and coverage of swaths of air photographic data limited coverage in some areas. Application of different methods and the relevance of different datasets related heavily to the presence of varying topography and deposits across the Tiber delta (see Chapter 6). In establishing the pattern of settlement for a given period, and its relationship to the changing formations of the delta it is necessary to compare different data types with a high level of spatial accuracy (Keay et al. 2014a), for instance evidence of river morphology relating to published data or survey data showing the development or change in the location of settlements.

The integration of datasets for this research was carried out primarily using GIS applications, together with tabulation in databases of data associated with sites, radiocarbon dates, and other salient evidence for the chronology and distribution of archaeological remains. An account of the integration of the datasets and the issues encountered in analysing the material, is given in Chapter 7.

Chapter 6 : Modelling the Tiber Valley and Delta

6.1 Introduction

Chapter 2 established the geology and geomorphology of the river Tiber and its delta, in relation to the literature and recent fieldwork conducted by a number of projects (Bellotti *et al.* 1989; Bellotti *et al.* 1994; 2007; 2011; J. P. Goiran *et al.* 2010; Salomon *et al.* 2018). The focus of this study, however, is on the distribution and pattern of settlement, and the possible application of models of human ecology on analysing the archaeology of the lower Tiber and its delta. Based on the geomorphological background of the study area it is therefore important to model the landscape for the key periods covered in the research.

In drawing together the archaeological resources for the area five temporal ranges seem to best represent the variations in settlement pattern and use of resources. The Eneolithic through to c. 2000 BC; the Bronze Age from c. 2000 to 1000 BC, The Iron Age at c. 1000 BC, and the Roman period represented by the point at c. 400BC when the castrum of Ostia is supposedly founded, and at c. 300AD when both Claudian and Trajanic basins of the harbour at Portus were present.

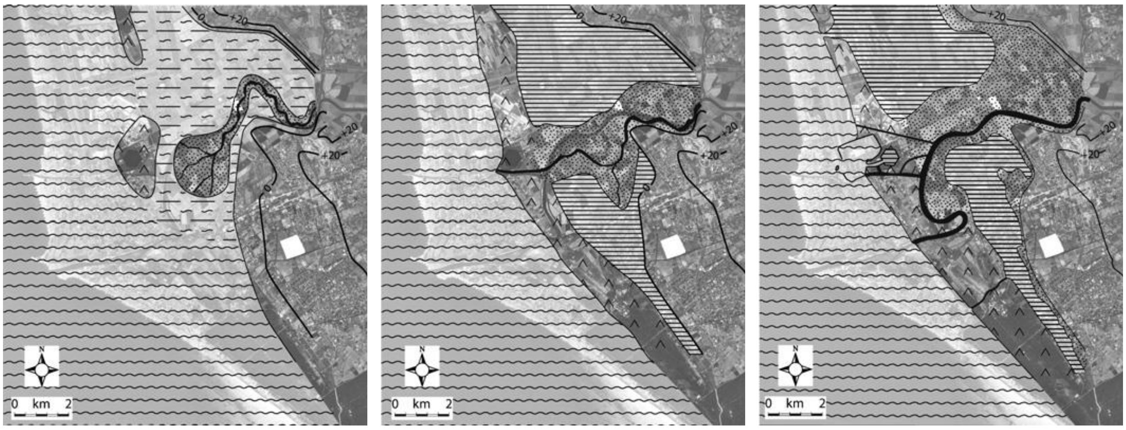


Figure 6.1 Three stages in the development of the lower Tiber and delta from Bellotti *et al.* (2007, 527) showing, left, the delta at c. 7,000 BP (c. 5,000 BC), centre) the area at c. 4,000 BP (c. 2000 BC) and, right, the area at 2nd century AD

For developing the mapping of the landscape for these periods, the changes to the Tiber delta and river are crucial. Over this 3300 year period a number of changes occur in the delta. These include a drop in the mean sea level, the formation and expansion of dune cordons along the coast, and the progradation of the delta (See Chapter 2; Fig. 6.1).

This period does, however, commence after the rapid increase in sea level in the early and middle Holocene (K Lambeck *et al.* 2004) and the formation of the first phase of the coastal standplain (Giraudi, 2004). The geomorphological processes from the Neolithic period demonstrate a complex coastal and fluvial system for the Tiber river and delta, and the depth of deposits for different phases and periods vary significantly across the study area. Most difficult to represent is the bay head and prograding mouth of the Tiber, which at 5000 BC was feeding into a wave –dominated estuary prior to the formation of the coastal standplain or dune cordons (Fig. 6.1).

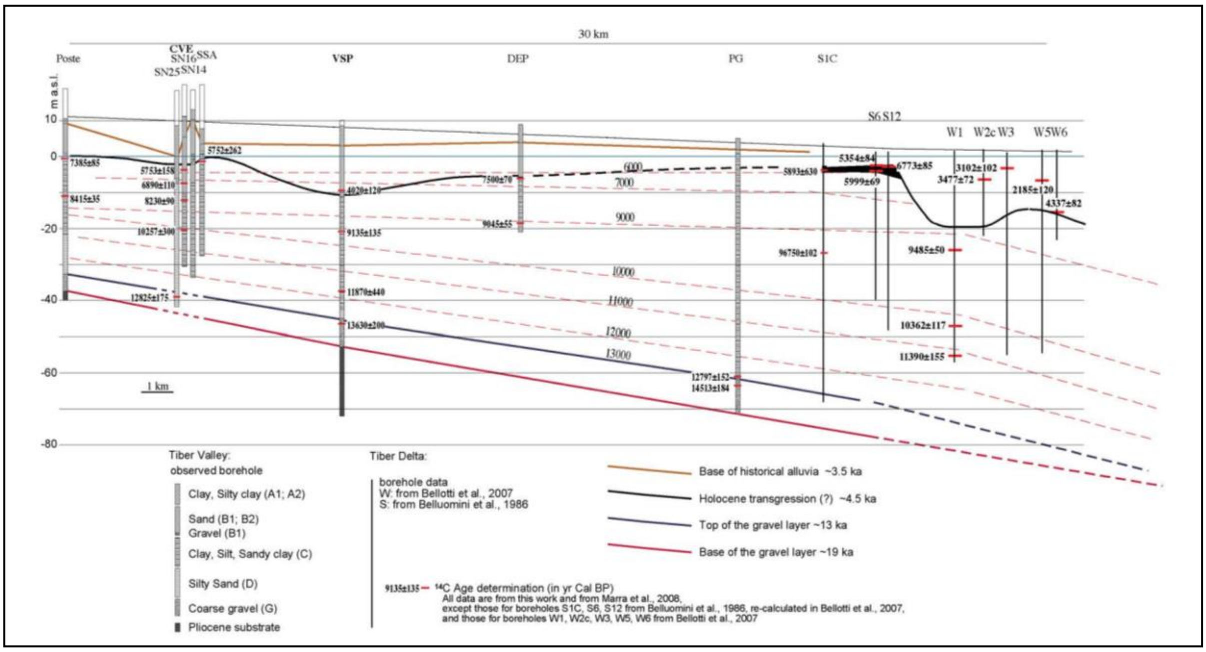


Figure 6.2 Cross section of the Tiber Valley from Rome to the coast, showing major cores and radiocarbon dates (Marra, Bozzano and Cinti, 2013)

Marra *et al*. (2013) summarise evidence from a number of coring campaigns and indicate the changes in depth for deposits in the Tiber valley from the Pleistocene. The depth of deposits in the Neolithic and Eneolithic are also calculated (Fig. 6.2). Most relevant to this study, however, is their evidence for a change in the sea level slightly different to the overall Italian sea level solution (see Chapter 2; also Lambeck *et al.* 2004) indicating sea levels at 3000 BC a little below the modern sea level, but then a decrease in sea level to -3m below the modern level at 2000 BC (Marra *et al.* 2013, 168). This solution indicates a sea level of -1.35m in the Roman period, rising to its current level by the 20th century. Thus our comprehension of the topography and environment of the Tiber Valley and the river delta needs to relate to these broad changes in sea level to the nature of the topography for the main periods of the development of the landscape. To create a summary of the changes across the study area a synthesis of all boreholes was conducted, and the boreholes with pertinent sediments and radiocarbon or OSL dates was compiled, and these formed the basis of the construction of four profiles (Fig. 6.3); three from south-west to north-east across the Maccarese and Ostia Plains, and the central delta (Table 6.1; Figs 6.4 – 6.6) and a fourth profile from north-west to south-east across the delta and the lagoons (Table 6.2; Fig. 6.7). These schematic diagrams utilise the existing and published data. However, there are lacunae in the dataset where depths and changes in sediment have been interpolated. For instance, the elevation of the standplain and dunes is difficult to ascertain. Similarly, the area of Portus, due to the nature of the archaeology and sediments, makes reconstruction of the Bronze Age and Iron Age deposits difficult. In these instances, a best fit of depths or elevations has been provided. The diagrams break down the ancient topography into four basic layers; 3000 BC, 2000 BC, 1000 BC and 400 BC. There is patently more resolution and granularity provided from the data in the text, especially relating to particular phases in the development of the course of the Tiber and changes in the palynology and environment, due to changes in sea level. Thus, more detail of the changes to the environment is given in each profile diagram.

6.2 The River and Delta at 3000BC

The Tiber delta at 3000BC would have presented a much different picture to the modern coastline and plain. A reduction in sea level had occurred, influencing the hydrology and environment of the Tiber delta. The sedimentary and palynology for the Stagno Maccarese and Stagno Ostiense provides more detailed evidence for the variable environment and possible human interaction. The formation of littoral sandy deposits started in the 6th millennium BC, and Giraudi (2004) notes that bands of dunes were present at 6000 – 5700 BP (4000-3700 BC) to the north and south of the Tiber mouth. The bayhead delta of the Tiber prograded rapidly between 6000-5000 BP (4000 – 3000 BP) isolating the Maccarese and Ostia lagoons. At 3000 BC, therefore, the Tiber river mouth was marine dominated, with a lagoon to the north with marshy deposits and an open landscape, although there is scant evidence for the types of vegetation for the Ostia lagoon (Bellotti et al .2011). At 2000 BC the area of the Tiber in the present location of Portus indicates fluvial-dominated sterile sands (Goiran *et al.* 2010), with the formation of an Alder Carr on the Maccarese Plain and fenland with a freshwater lake on the Ostia lagoon. This created a dominance of alder, ash and grape, with ivy, cyclamen, comfrey and fern on the Maccarese Plain, and oak dominated deciduous woodland with evergreens on the Ostia Plain (Di Rita *et al*. 2009, 62).

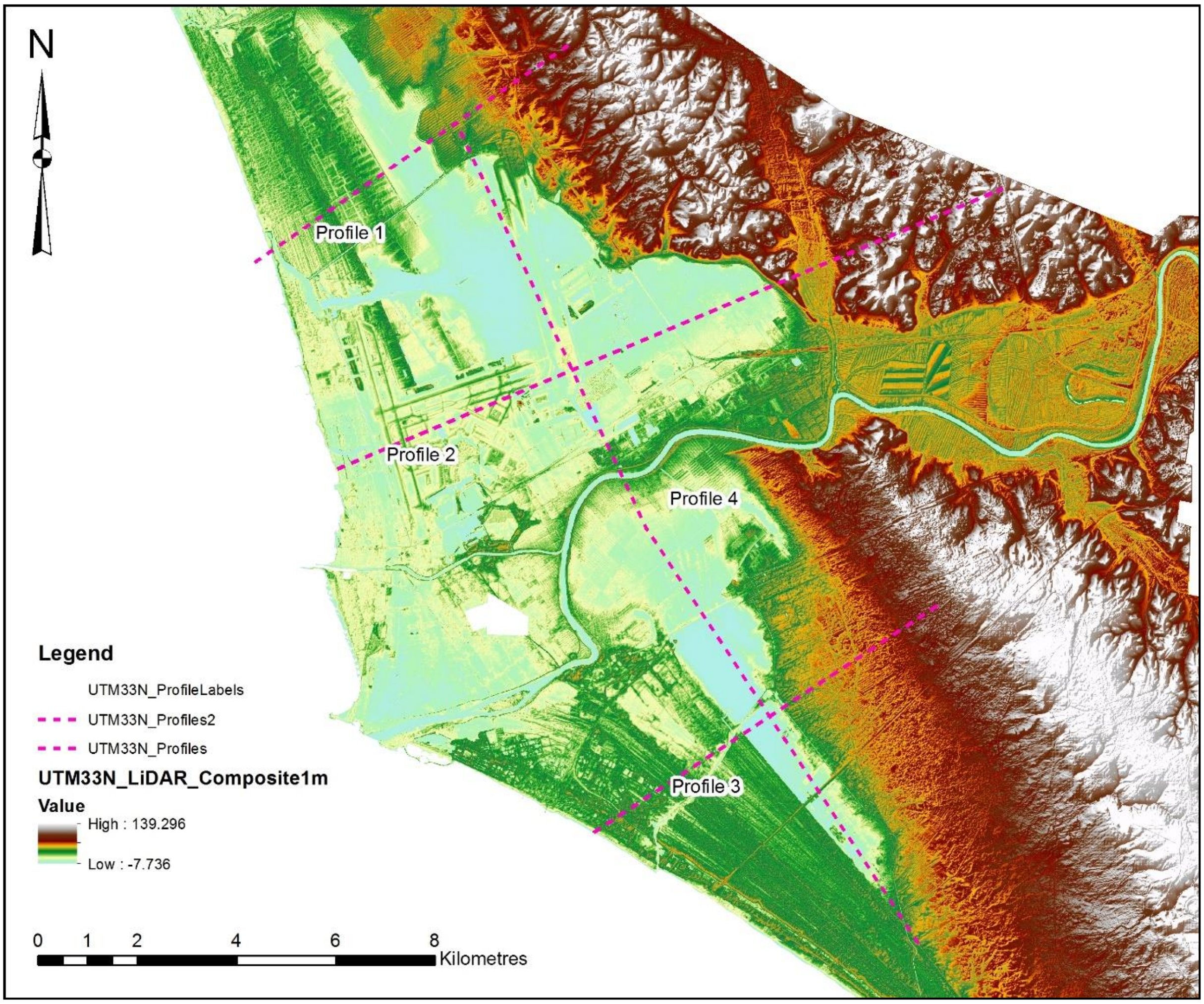


Figure 6.3 Location of the schematic profiles for sea levels and topography 3000 BC to AD 300 (Background data : LiDAR Ministero del Ambiente)

These changes and the period around 3,000 BC fit with the hypothesis of Di Rita et al. (2009, 60) for the opening of the landscape of the Tiber delta from 5400-5100 BP. These changes induced the formation of local reed fens and marshlands (Di Rita et al.

2009, 60), with the environment changing from a river-dominated to a wave-dominated delta and suggesting the formation of coastal ridges.

Synthesis of the data for the environment and pollen record for the Tiber delta indicates a relatively unstable marshland zone with significant variations in the vegetation and potential human interaction in the zone. Evidence for the central delta area in the location of Portus for this period is limited (J.-P. Goiran *et al.*, 2010b; Goiran *et al.*, 2011).

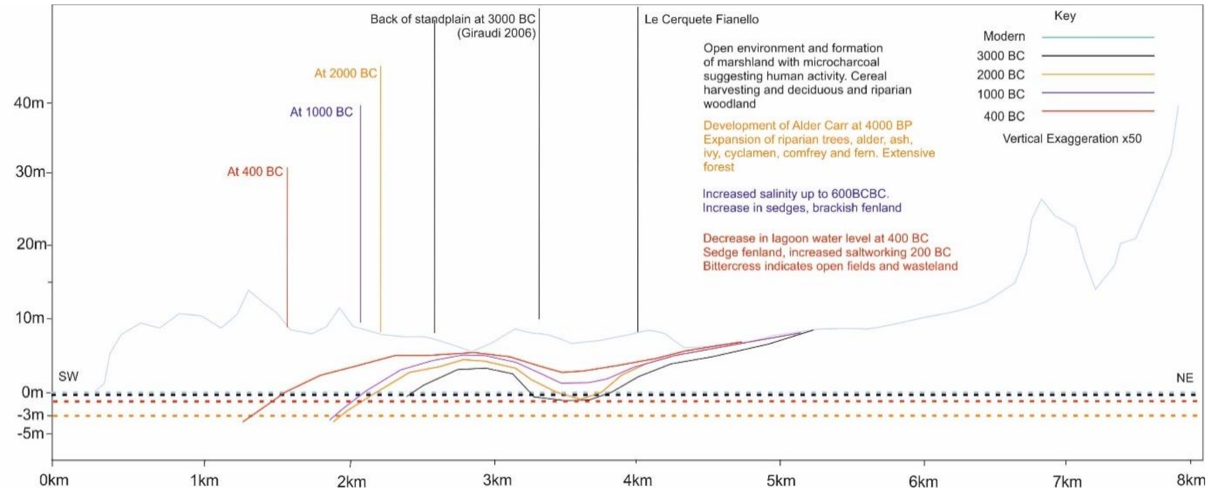


Figure 6.4 Profile 1 across the Maccarese Plain at Le Cerquete Fianello indicating the sea levels and topography at 3000 BC, 2000 BC, 1000 BC and 400 BC (sources: Giraudi *et al.* 2006; Modern topography from LiDAR data Ministero del Ambiente)

6.3 The River and Delta During the Bronze Age

While a sea level similar to that in the 20th century has been inferred by Marra *et al.* (2013) for c. 7,000 BP (c. 5,000 BC), the sediment records and radiocarbon dates suggest a sea level some 3m below the modern level for 4020±120 - 3477±72 cal BP (c. 2000-1500 BC) (Marra *et al.* 2013, 175).[41] The mouth of the Tiber was located in the vicinity of the Fiumicino Canal with marine deposits, and standplain sandy deposits to the north and south, cutting off the lagoons on the Maccarese and Ostia plains. Borehole data from the area of Portus indicates the presence of a fluvial dominated environment from c. 2000 BC (J. P. Goiran *et al.* 2010; Goiran *et al.* 2011). Environmental records for the Maccarese Plain indicate the development of an Alder Carr by 4000 BP (c. 2000 BC), and

[41] Marra et al. (2013) provides a series of radiocarbon dates from boreholes in calibrated form. Thus no information on the uncalibrated dates, the laboratory or software used for the calibration is given, and the author has not recalibrated these using OxCal 4.3.

the fall in sea level may be instrumental in the change to a freshwater environment, leading to the development of woodland on the plain comprising ash, alder and understorey plant including ivy and fern. This corresponds to the development of sedge fenland around a freshwater pond on the Ostia Plain. The Tiber continued to disgorge to the west of the Capo Due Rami, somewhere in the vicinity of the Trajanic Harbour at Portus.

6.4 The River and Delta at 1000 BC

There was a change to wave-dominated deposits at c. 1000 BC for the mouth of the Tiber (J. P. Goiran *et al.*, 2010; Goiran *et al.*, 2011), with the location of the deposits for the mouth of the river further to the west of the Bronze Age location. By 1000 BC the salinity of the Maccarese lagoon had increased, with more dominant sedges on the fenland, and expansion of oak and juniper on the Ostia Plain, culminating in the discharge of the Tiber into the Ostia Lagoon from c. 760 BC.

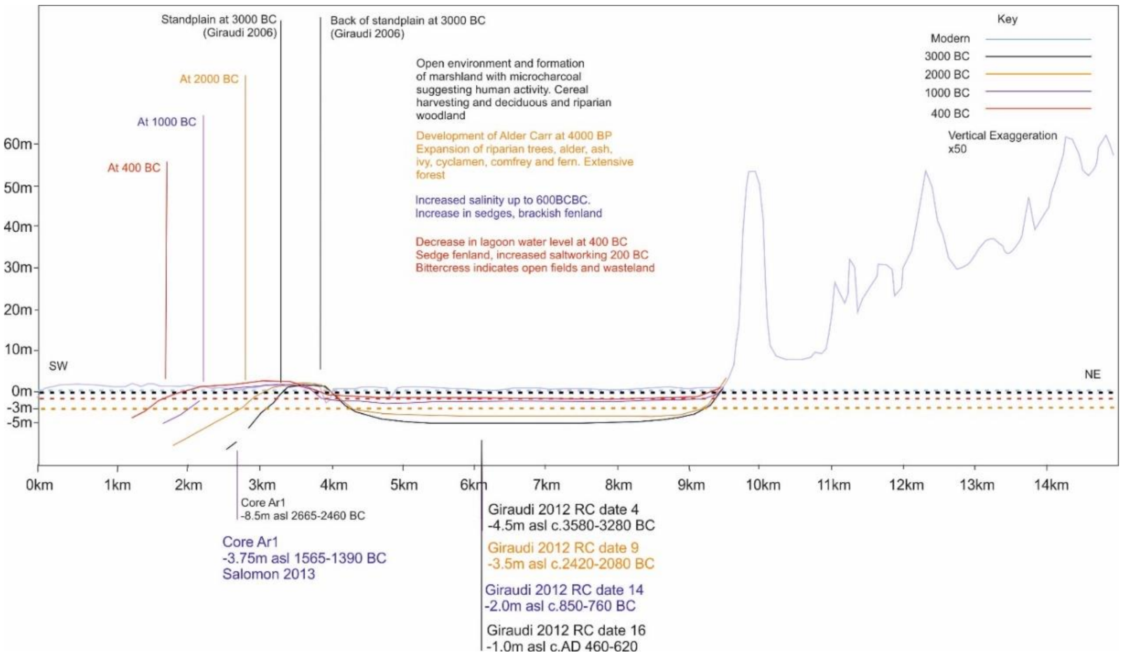


Figure 6.5 Profile 2 across the southern part of the Maccarese Plain, indicating depth of topography and relative sea levels (Modern topography from LiDAR data Ministero del Ambiente)

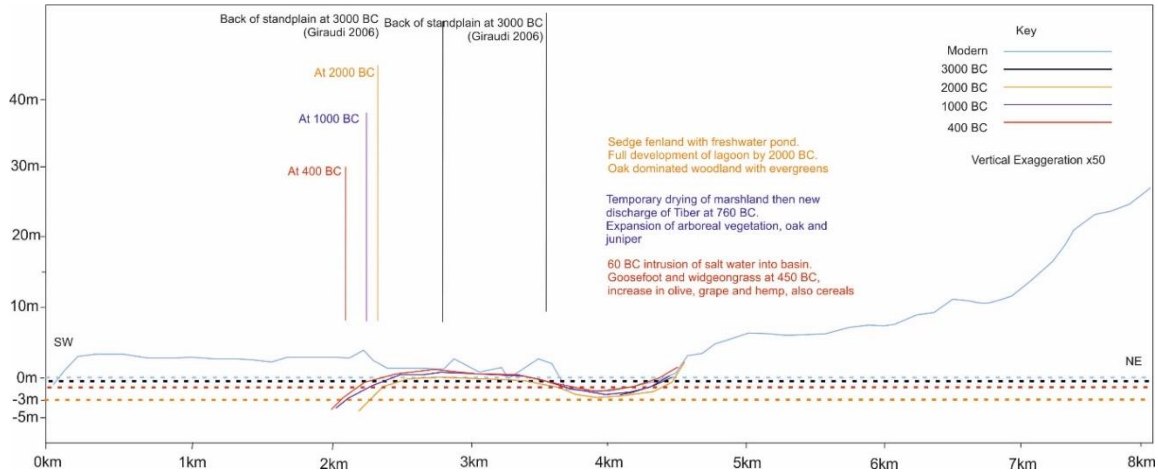


Figure 6.6 Profile 3 across the Ostia Plain indicating relative topography and sea levels (Modern topography from LiDAR data Ministero del Ambiente)

Time at	Stagno Ostiense (Bellotti et al. 2011)		Central Delta (Goiran et al. 2010)		Maccarese Plain (Di Rita et al. 2009)	
	Environment	Flora	Environment	Flora	Environment	Flora
3000 BC					Open environment and formation of marshy deposits due to fall in sea level. Microcharcoal material indicates local fires	Millstone and reaping hook (Manfrdini 2002) indicates cereal harvesting and processing. Deciduous and riparian woodland present
2000 BC	1900-600BC sedge fenland with freshwater pond full development of lagune by 2000 BC.	Oak dominated woodland with evergreens	Fluvial dominated sterile sands		Alder Carr. Development of marshland at 4000 BP.	Expansion of riparian trees. Alder, ash and grapevine. Understorey ivy, cyclamen, comfrey and fern. Dense and extensive forests. Devel

1000 BC	**Drying of the marshland temporarily , then increase in level with discharge of tiber and formation of new break through dunes to the south.**	**Expansion of arboreal vegetation oak and juniper. Commencement of discharge of the Tiber into the lagune at c. 760 BC**	**Sudden opening to the marine dynamics**		**Increased salinity at 2600 BP,**	**Increase in sedges**
400 BC	**60 BC intrusion of saltwater into the basin**	**Appearance of goosefoot, widgeon grass. At 450BC increase in olive, grape and hemp plus cereals, walnut and sweet chestnut**	**Fluvial environment represented by sterile sands. 630BC to AD 75 evidence of open marine environment**		**Decrease in water level at 2400 BP. Sedge fenland. Increased saltwork evidence at 200 BC**	**Bittercress suggests damp open fields, widespread wasteland**

AD 200	Mixed deciduous woodland and evergreen macchia closer to the sea. Goosefoot and similar from 1st century AD showing continued saltworks	Dredging of the area for the creation of the Claudian harbour		Increased salinity, dune formation	Exploitation of the area, walnut and hemp pollen, olive. Increase in evergreen and deciduous forests probably due to the prograding delta. Formation of extensive dunes shown by juniper and pine pollen.

Table 6.1 Summary of geomorphological and environmental information for the Maccarese and Ostia Plains and the central Tiber delta

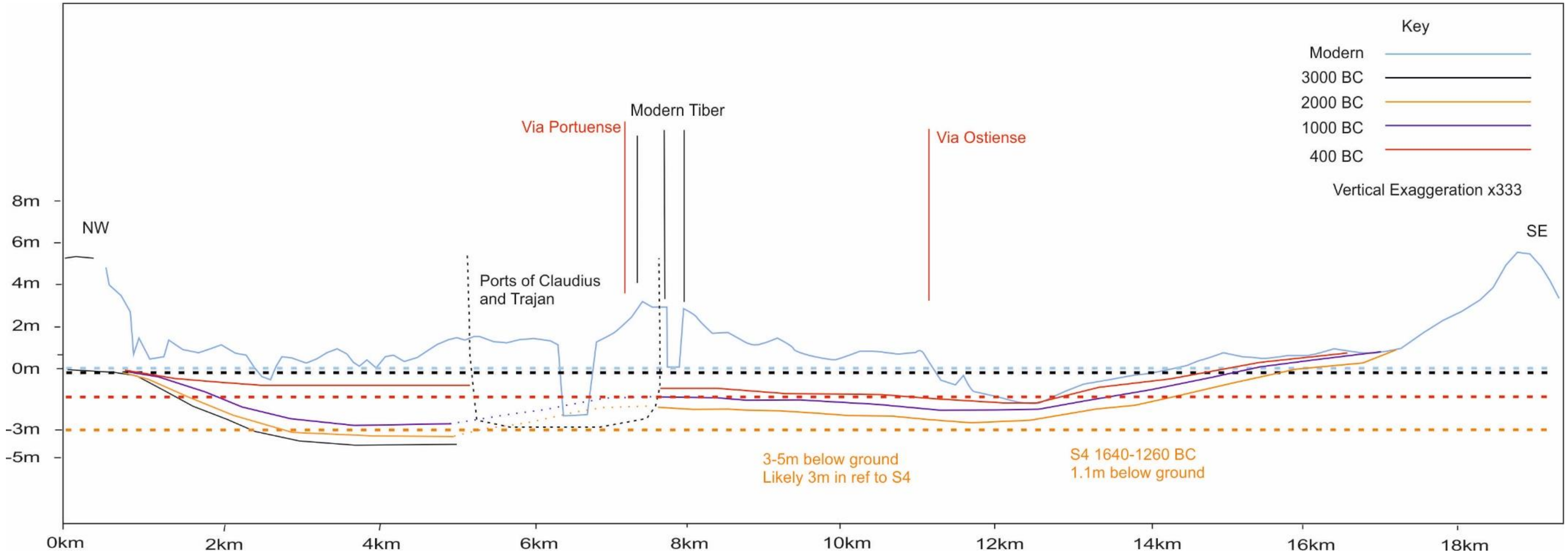


Figure 6.7 Profile 4 running from north-west to south-east across the Maccarese and Ostia plains

Time at	Bayhead Delta of Tiber (Milli et al. 2013)		Ponte Galeria	
	Environment	Flora	Environment	Flora
3000 BC	Progradation of bayhead delta increased due to sediment load up to 5000 BP. Tiber acquires marine mouth. Cuspate delta 6000-5700BP with strandplain.	Mixed oak dominated woodland		
2000 BC				
1000 BC				
400 BC	Migration south of river mouth c. 760 BC			
AD 200				

Table 6.2 Summary of the geomorphology and environment for the Tiber Valley from Portus to Ponte Galeria

The environmental conditions across the delta indicate a drier more brackish environment for the lagoons and plain, with an increase in sedge fenland on the Maccarese Plain and increases in mixed deciduous woodland and juniper to the south of Ostia. These conditions persisted until a rapid change in the course of the Tiber occurred at c. 760 BC. The river ceased to disgorge in the vicinity of the location of Portus, with the course of the river moving to the south and disgorging into the Ostia lagoon. By 450 BC the river course had adopted a river mouth on the line of the modern Tiber course adjacent to Ostia Antica and the Tor Boacciana. An increase in goosefoot and widgeon grass in the palynological record for the Ostia lagoon indicates either freshwater or slightly saline water in the lagoon by this time.

6.5 The Republican and Imperial Changes

At 400 BC the general spatial layout of the Tiber delta bears a number of similarities to the present coastal plain. While the coastline is situated inland at the location of Tor Boacciana, and across the Isola Sacra to the east of the Imperial necropolis several kilometres inland from the modern coastline, the course of the Tiber would have been broadly similar to the modern course. The increased salinity in the lagoon and environment of the Maccarese Plain to the north of the Tiber from c. 1000 BC led to the formation of saltwork areas during the Etruscan period (Giraudi 2011, 2; Giraudi 2012, 1468) and these saltworks seem to have continued and expanded. Increased salinity of the Ostia lagoon also occurred up to c. 60 BC, and the archaeological date for the founding of the Roman *castrum* at Ostia Antica (Zevi 1996) of c.400 BC has been linked to the increased exploitation of the coastal plain and areas for saltworking (Bellotti et al. 2011, 1114)[42]. The palynological record indicates increases in olive, grapevine, hemp, chestnut and walnut, and cereals, all indicative of increases in cultivation in the area of the Ostia

[42] The archaeological evidence for the *castrum* at Ostia indicates the 4th century BC as the earliest phase of settlement here. Bellotti et al. (2011) suggest that the environment of the Ostia lagoon and its increased salinity may fit with the documentary evidence for the founding of Ostia around 640 BC (Bellotti et al. 2011, 1114). However, archaeological evidence directly related to the *castrum* is lacking. This would not preclude the exploitation of the lagoon from the nearby settlement at Ficana, or the presence of temporary settlement pre-dating the *castrum* in the vicinity of the lagoon and on the floodplain.

Lagoon. By contrast the environmental record for the Maccarese Plain indicates a decrease in the water level of the lagoon at c. 400 BC, and increased saltworking by 200 BC, and the presence of open fields and wasteland by this time.

The major change to the sediments and environment of the central portion of the delta comes with the initiation of construction of the Claudian harbour in AD 42 (Keay et al. 2005). Between this date and the 2nd century AD with the construction of the Trajanic Basin, extensive changes occurred to the sandy deposits located in and around the area of the port, The open marine environment is superceded by evidence of a dredging phase as part of the construction of the Roman port (Goiran et al. 2010) represented in core data from Portus indicating a hiatus of dates for the Iron Age and Republican period, and a jump to 1st and 2nd century AD dates at depth in the canal features of the port. This work is covered in detail elsewhere. However, the creation of the port also seems to lead to changes in the habitation and environment of the broader delta and Tiber valley below Ponte Galeria. Saltworking in the area, together with evidence for cultivation continues. Archaeological evidence shows the construction of maritime villas along the coastline south of Ostia, and some on the Maccarese Plain close to Palo. However, no villas are present on the coastal standplain adjacent to the Maccarese lagoon.

6.6 Modelling the Landscape

An assessment of the geomorphology for the river and delta in these periods is necessary to establish the best model of the landscape for the period 3000 BC to AD 300. This study is focused on the pattern of settlement and land use in the lower Tiber rather than the analysis of the geomorphology that has been conducted elsewhere (most recently Bellotti et al. 2011; Salomon et al. 2018). However, the dynamics of this landscape are pertinent to the modelling of the topography and archaeology of the river and delta environments, and the analysis of the distribution of sites and resources that may have formed the basis of subsistence in the area. Thus background mapping for the study area was created, utilising a number of different sources and incorporating the geomorphological evidence for the delta formation to create base topographic mapping for several key points in the formation of the landscape.

6.6.1 Topographic Datasets

The base topography and geology were established using several raster and vector datasets. Topography (Fig. 6.8) for the entire study area was derived primarily through the ASTER DEM dataset available through the United States Geological Survey (USGS) earth explorer web resource (https://earthexplorer.usgs.gov/). This raster dataset provides 30m by 30m pixels with terrain elevation values to the nearest metre and formed the basic topographic coverage for deriving site elevations and modern topographic elevations above sea level.

In addition, higher resolution topographic data was used in the form of Italian Ministero dell'Ambiente Light Detection and Ranging (LiDAR) data. This comprised a coastal area of DTM and DSM data at 2m resolution, and the coastal plain, river valley and topography surrounding the plain at 1m resolution, with elevations above sea level to 0.1m resolution. For the deriving of topographic data, the Digital Surface Model (DSM) dataset was used.

Coastal bathymetry data was also used for comparison with the terrestrial data. This was downloaded as RGB geoTIFF and asci format from http://www.emodnet.eu/bathymetry. The data is low resolution with pixels measuring 200m by 150m in the projected dataset.

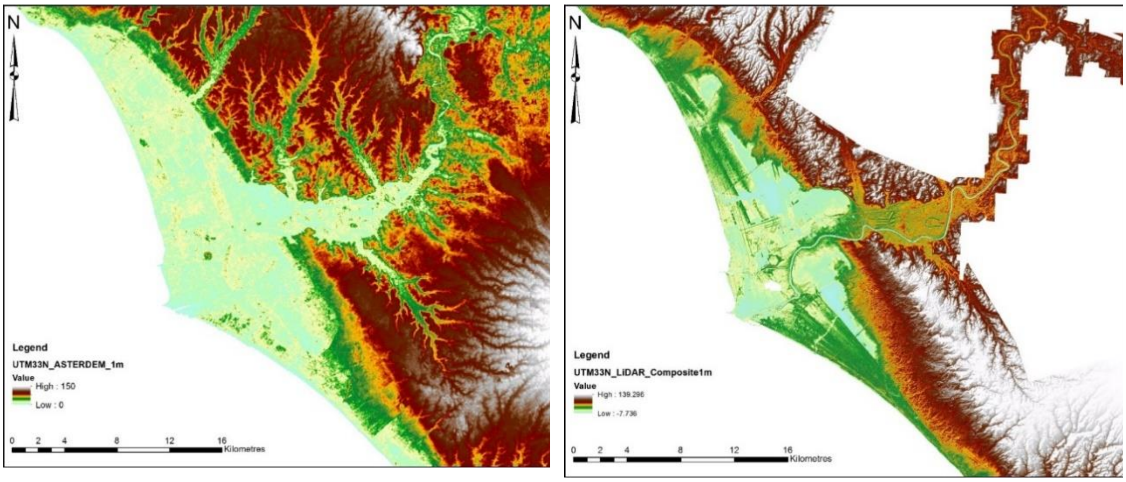


Figure 6.8 The ASTER DEM dataset (left) and LiDAR composite dataset (right)

6.6.2 The Geology, Drainage and Land Use

Geological data was derived from coverages provided by the Provincia di Roma Sistema Informativa Geografico (Fig. 6.9). Coverages were viewed using the Provincia online map interface (http://websit.cittametropolitanaroma.gov.it/Cartografia2D.aspx) and then ordered through their Rome office.

The data coverages comprised four polygon coverages:

- Cartalitologica - Geology
- Gruppolitologici – Geological Groups
- Litostrat regionale - Soils
- Land Use

In addition, a stratigraphic point coverage was provided of all borehole and technical data locations for the study area. The Cartalitologica coverage provides detailed geological data for the area. The lithostratigraphic coverage provides data on soil formations and types, and the lithological group map proves the basic geological groupings of formations and deposits.

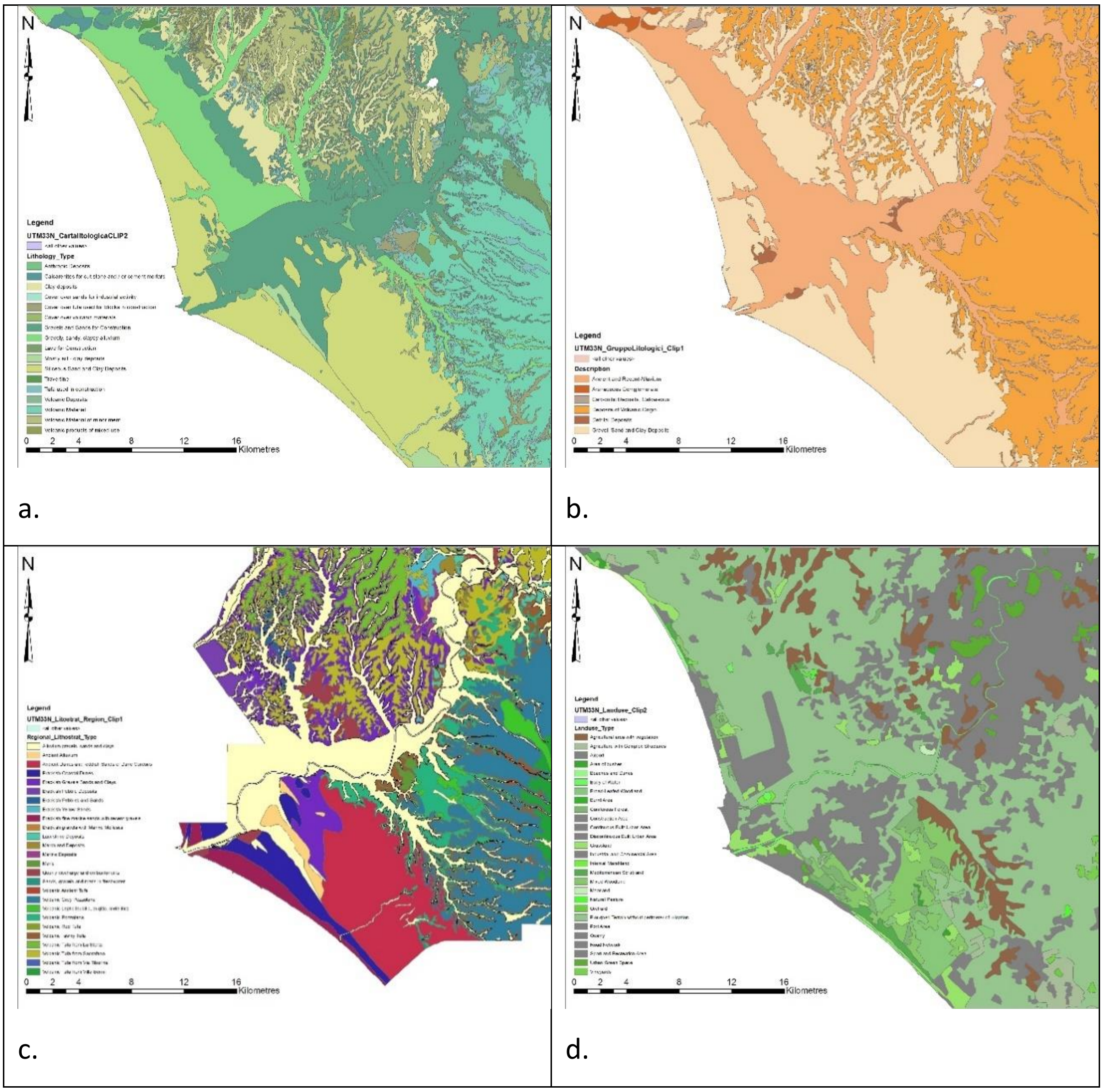


Figure 6.9 Coverages of the (a.) geology, (b.) geological groups, (c.) soils and (d.) land use utilised for the topographic and environmental analysis (source: Provincia di Roma)

In addition, a drainage polyline coverage was provided by the Provincia di Roma in the form of Idrografia_polyline. A rivers polyline coverage was merged with the Idrografia data to create a drainage coverage for the study area (Fig. 6.10).

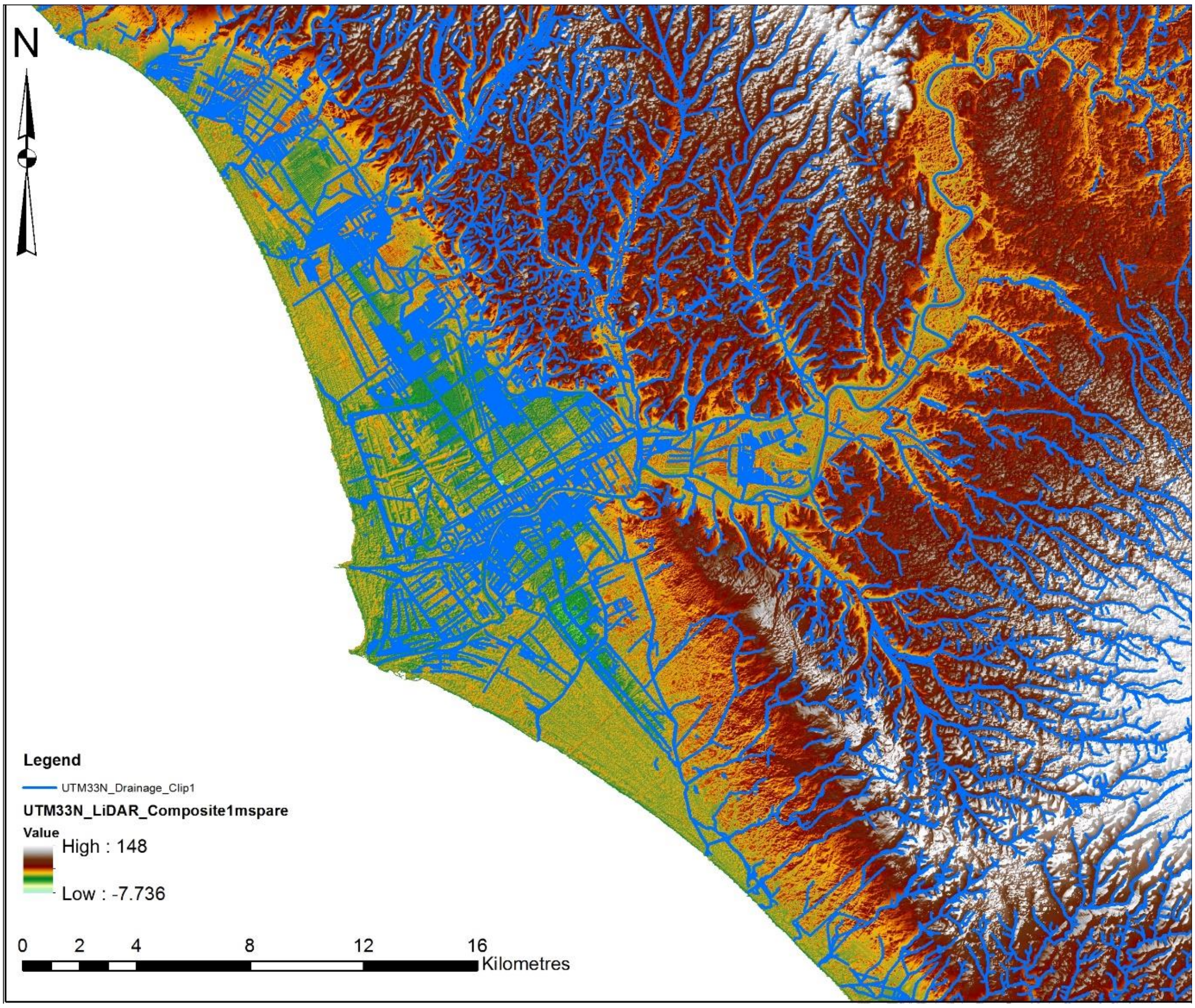


Figure 6.10 Composite drainage coverage derived from the Provincia di Roma dataset

6.6.3 Published Geomorphological Data

Detailed evidence for the nature of deposits and the changing geomorphology came from a number of published sources. Sediment types and depths were derived from several sources, some of low resolution in terms of their location (Bellotti *et al.* 1989; Bellotti *et al.* 1994, 1995, 2007, 2011), and others with more accurate locations (J. P. Goiran *et al.* 2010; Salomon *et al.* 2010, 2018; Salomon, 2013)[43]. These provide the depth of deposits for the lower Tiber and delta, and the depth of OSL and radiocarbon dates for a significant number of the cores, allowing basic models of the nature of sediments and depth-chronological information for the river valley and coastal plain.

[43] The author would like to thank Jean-Philippe Goiran and Ferreol Salomon for providing a dataset of accurate borehole locations for use with the published material.

6.6.4 Modelling the Topography

The extensive literature mapping the cores, chronology and palynology for the Tiber delta provide a comprehensive dataset relating to the geomorphology of the landscape. However, much of the data, represented vertically as cores and palynological diagrams, with extrapolation in the form of fence diagrams and broader descriptions of the environment, is of limited use in this form in terms of reconstructing the broader landscape and ecology of the delta and the surrounding area, and relating this to the archaeological evidence. Thus, a composite topographic surface was required to assist in the modelling of the landscape, and geological and environmental maps were utilised to supplement published data to reconstruct the broader environment of the study area.

For a comprehensive topographic raster dataset, the LiDAR and ASTER data were combined into a single raster DEM using ArcGIS. Firstly, the ASTER data was resampled from 30m to 1m resolution, using the nearest neighbour algorithm, thereby ensuring that elevation values across the dataset represented the source data elevations accurately (Fig. 6.11). The clip function was then used to ensure that both datasets were clipped to the study area perimeter. A no data value of -100 was set during this process, as in previous attempts to combine the datasets the ASTER values had affected the LiDAR values in the areas of the Maccarese and Ostia lagoons, replacing the high resolution LiDAR values with ASTER values. Thus, the changing of the no data values for both datasets ensured that no complications arose from combining the data.

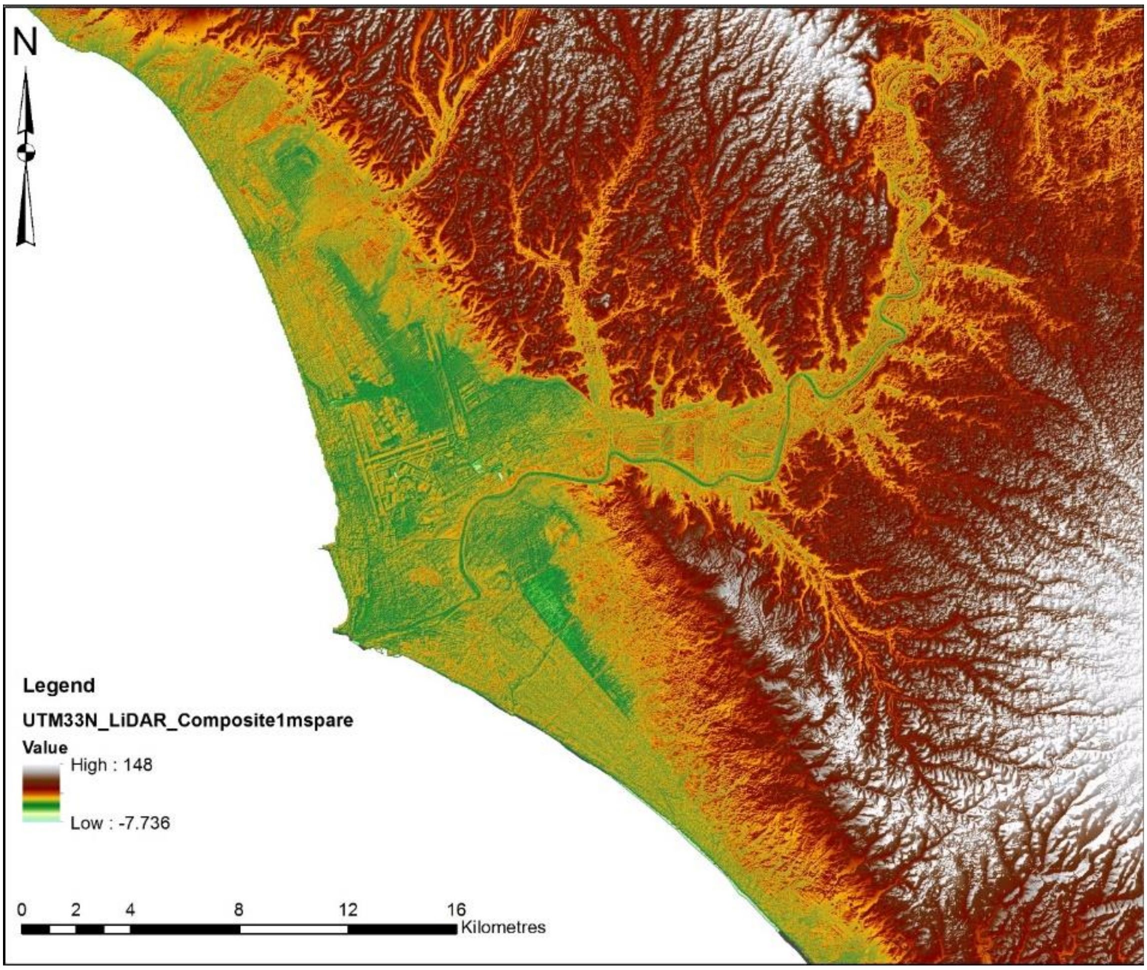


Figure 6.11 The composite digital elevation model derived from the ASTER and LiDAR data. Data cells are at 1m resolution

The coastline for c. AD200 was interpolated using the composite topography and the archaeological datasets (Fig. 6.12; see Chapter 7), most crucially evidence of maritime Roman villas, the archaeology from Portus and the Isola Sacra, and sites located on the Ostia plain, including the foundations of the Tor Boacciana, of supposed Trajanic date. A polygon feature class was digitised utilising the topographic coverage with the evidence of dune cordons, the vector coverages from the archaeological datasets, and the coarse resolution coverage derived from Giraudi's (2006) map of the dune cordons. Simolar polygons were created for points in time deemed relevant for the landscape; for the end of the Eneolithic (3000 BC), the Bronze Age (2000 BC), the early Iron Age (1000 BC) and the Republican period at the point when Rome started to exploit the Tiber delta more extensively (400 BC).

To create a DEM of the pre-modern landscape various modern features in the LiDAR required removal from the dataset. These include modern airports, ports, roads, railway lines (Fig. 6.13), in addition to the modern drainage across the Tiber delta, a series of features originating in the bonificazione or improvement of the wetland for agricultural purposes in the early part of the the 20th century (see Chapter 4).

To remove the modern variations in the topography, a methodology similar to that used in modelling the pre-modern landscape of Charlemagne's Summit Canal was envisaged (Schmidt, Werther and Zielhofer 2018) using vector coverages to assist in the removal of features prior to reinterpolating the topographic dataset. Thus, a coverage of polygon features was created from different sources to enable the removal of modern features. The land use coverage formed the basis of a polygon dataset of urban areas, airports, modern ports and other modern infrastructure.

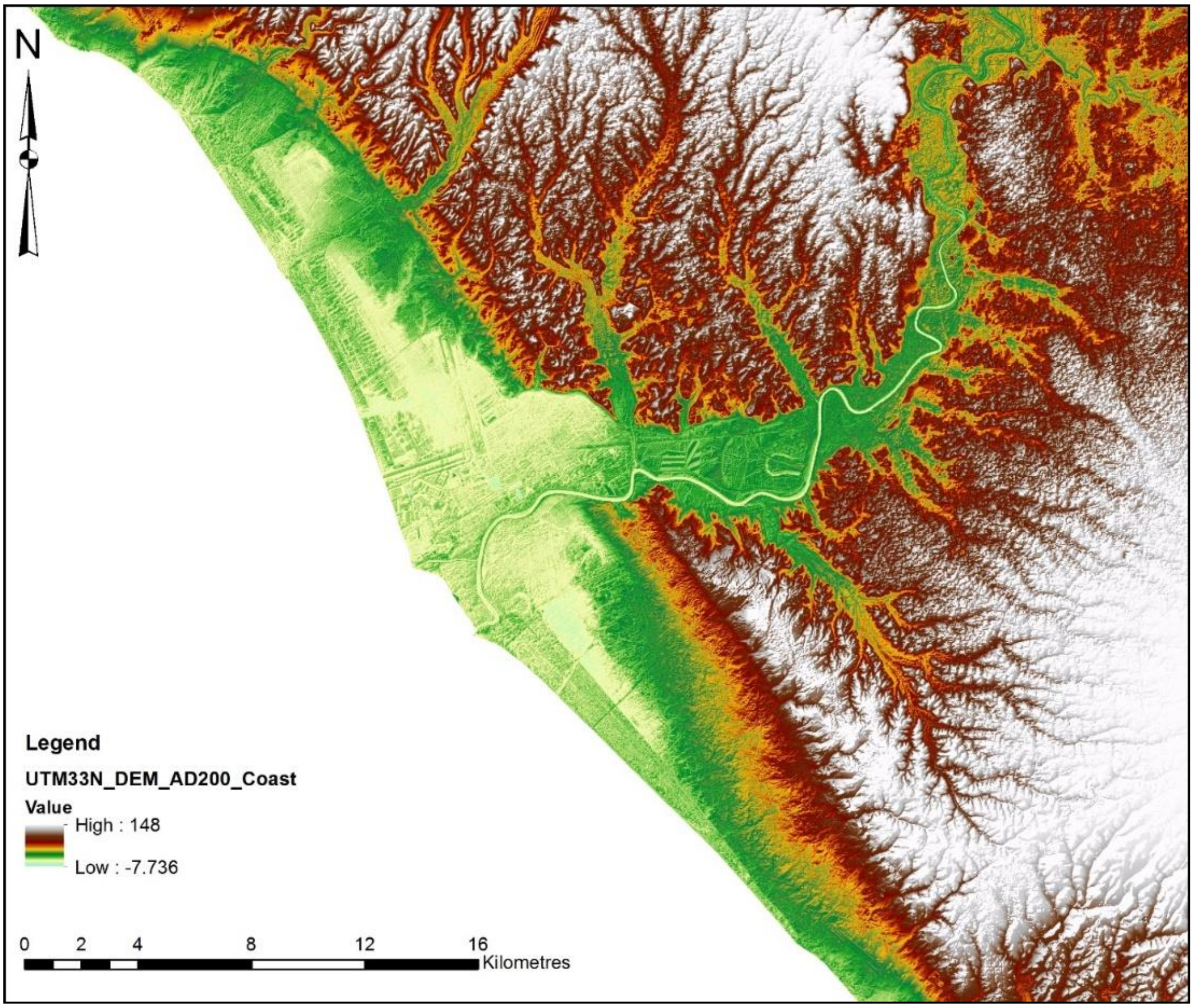


Figure 6.12 Digital elevation model with values clipped to the coastline at c. AD200

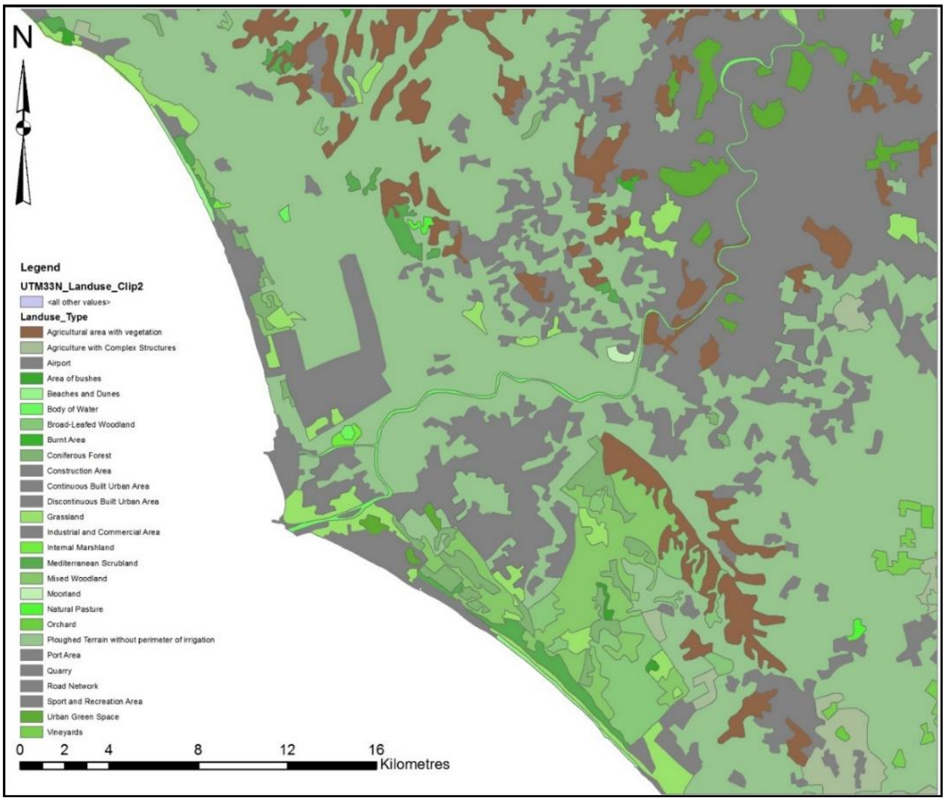


Figure 6.13 Land use dataset, with areas of modern development marked in grey (source: Provincia di Roma)

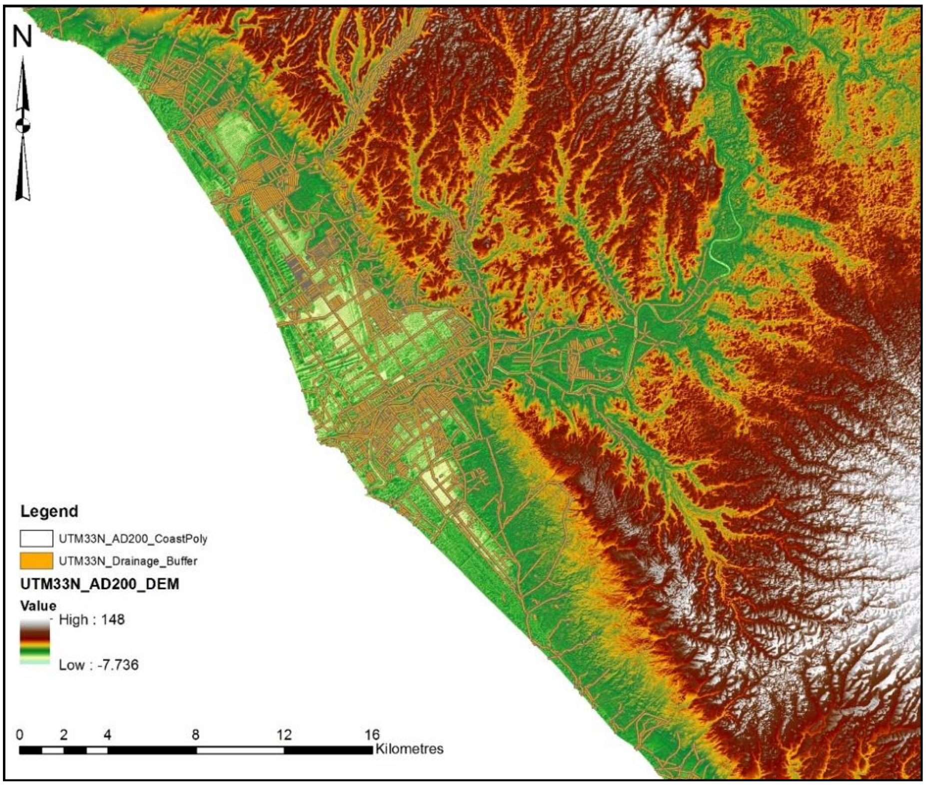


Figure 6.14 Buffer coverage derived from modern drainage features, overlaid on the DEM with coastline for AD 200

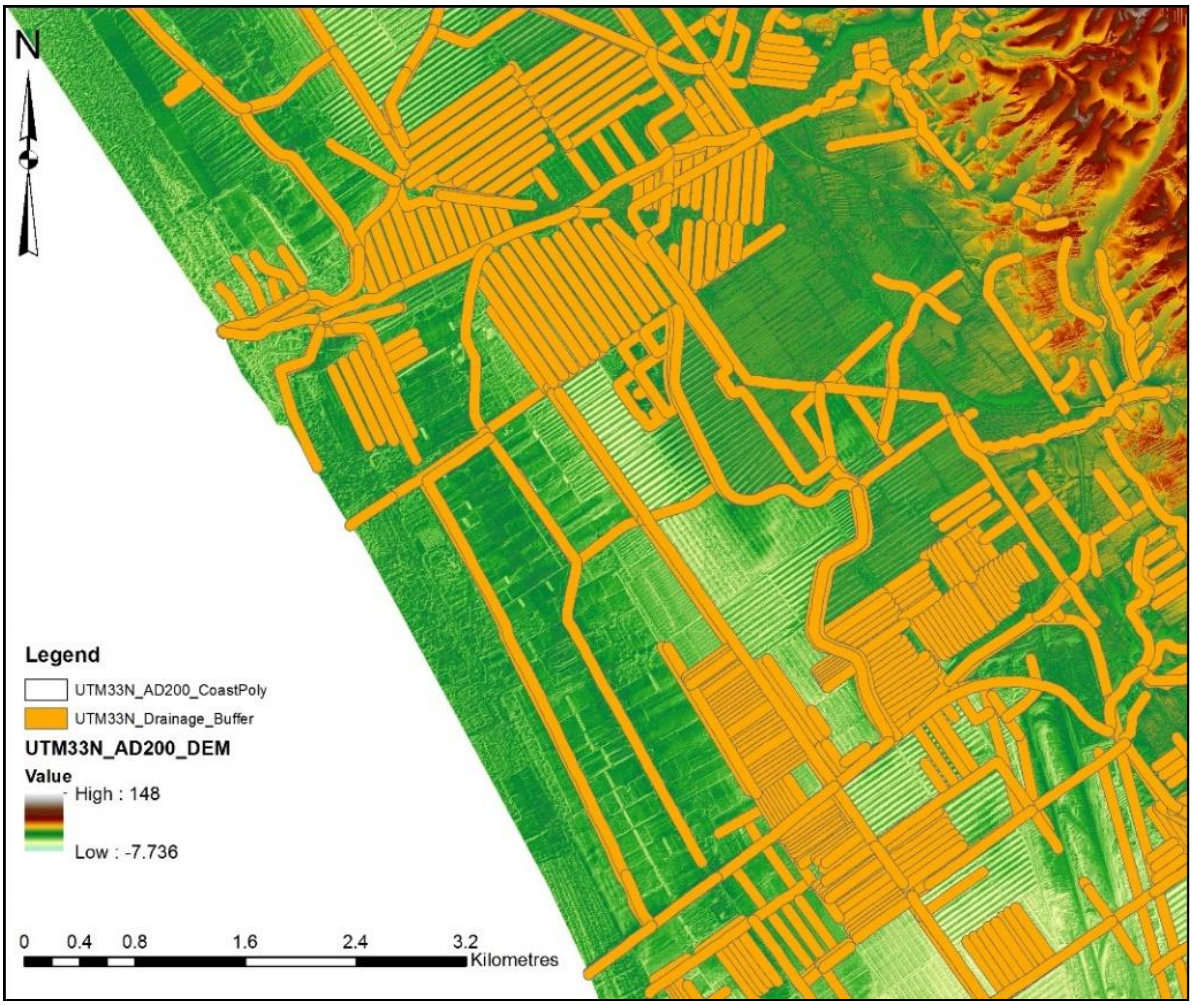


Figure 6.15 Detail of the drainage buffer coverage for the Maccarese Plain. The drainage features in the DEM are blanked out. However, a number of smaller variations in the areas of ploughed fields in the delta are still visible

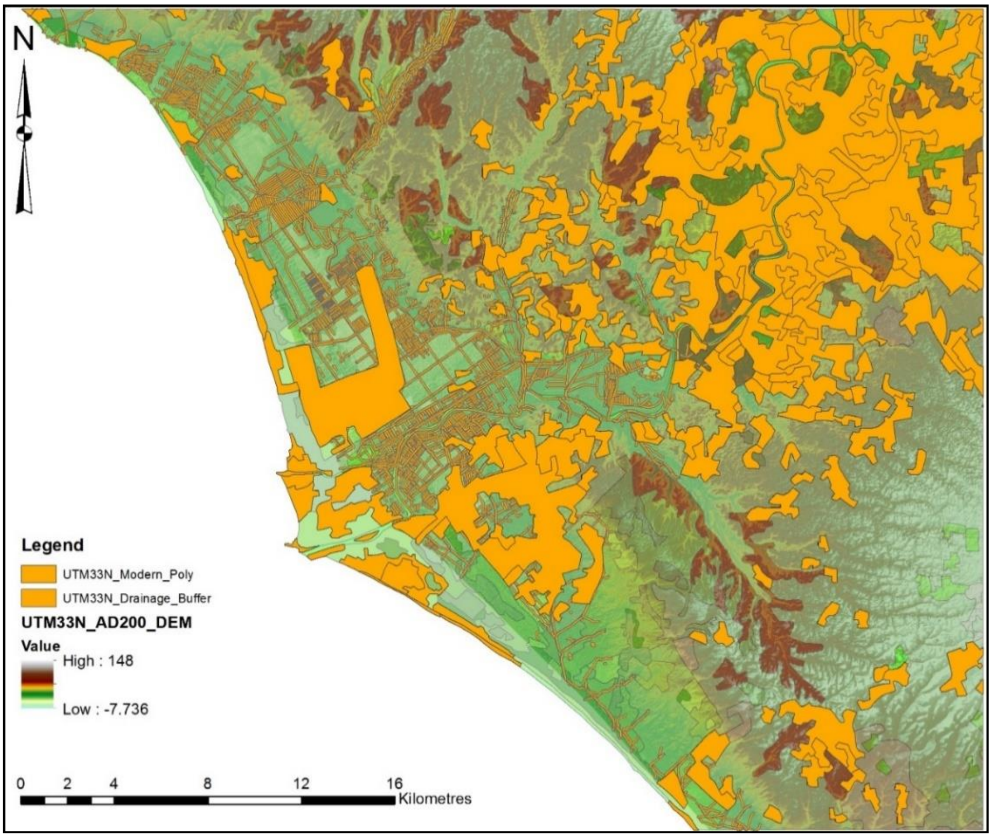


Figure 6.16 Composite dataset of road, rail and drainage buffers and modern infrastructure polygons

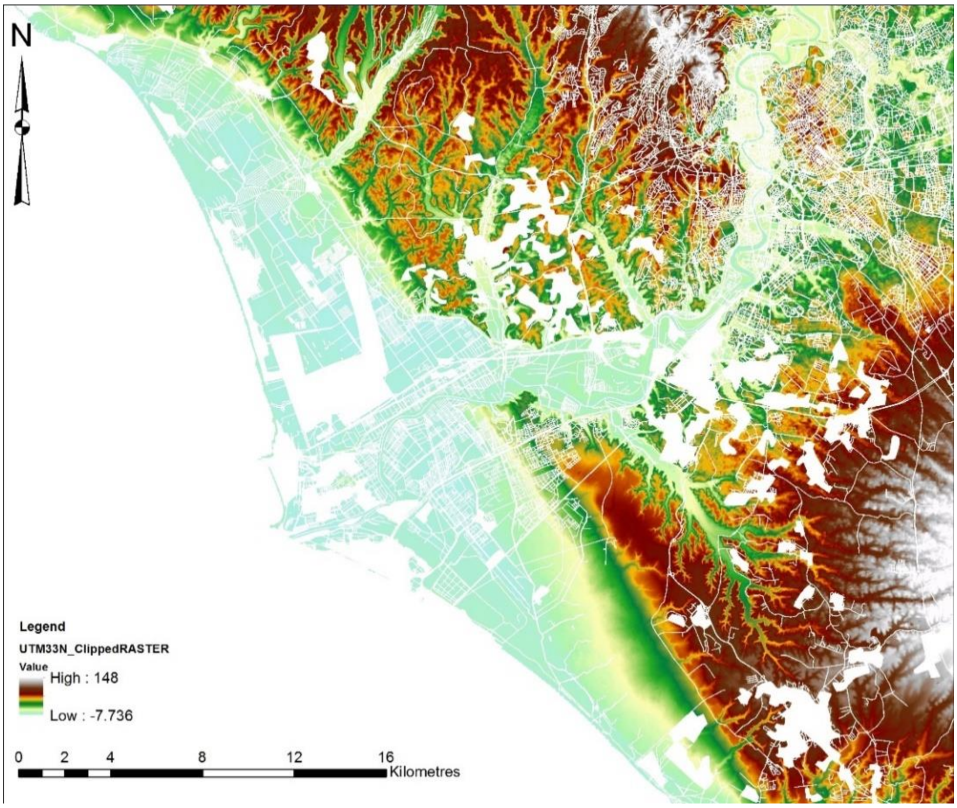
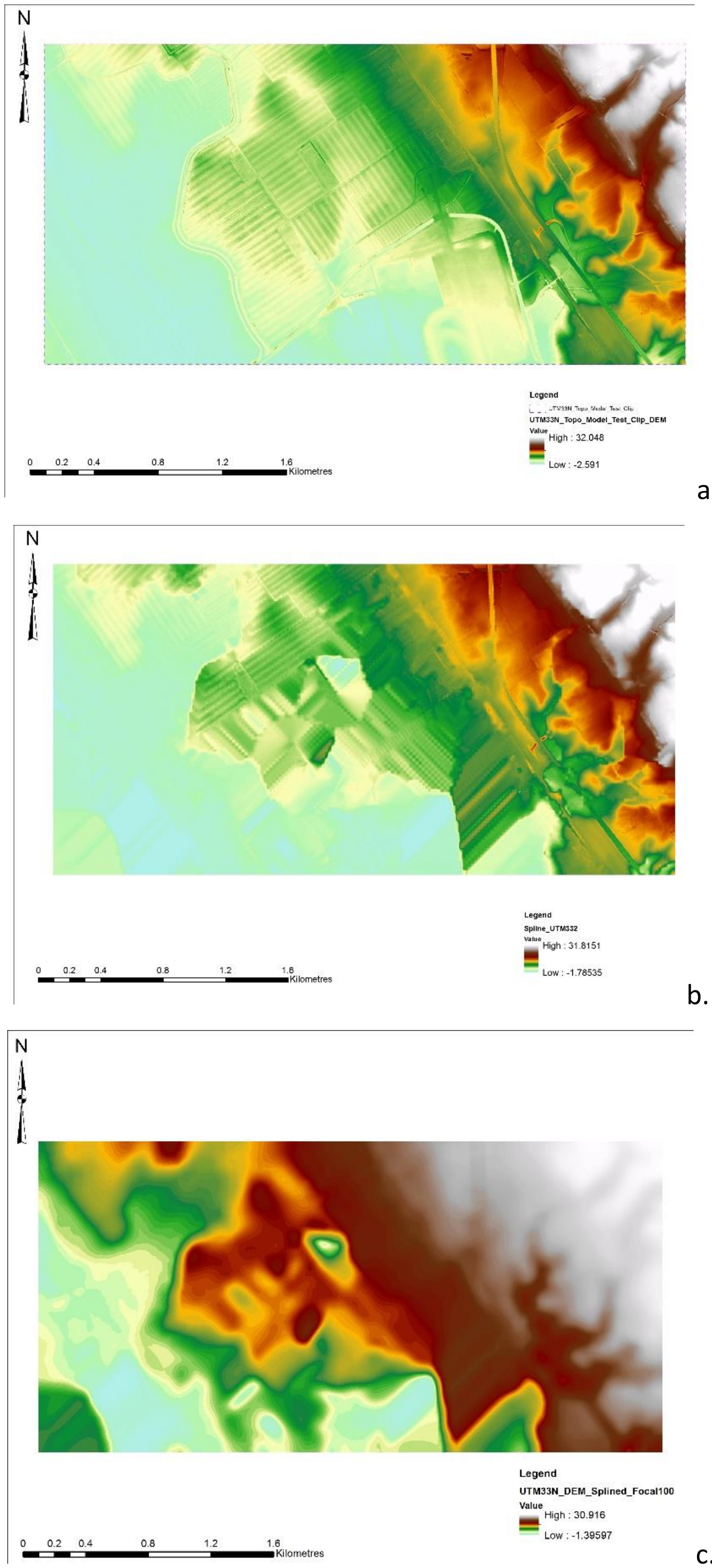


Figure 6.17 Raster dataset with cell values clipped for modern features

The modern drainage of the *bonifica* also creates a series of variations in the topography that bear no relation to the Roman and earlier landscape. The drainage coverage was used with a polygon of the delta area to clip out the course of natural streams and rivers and provide a coverage of the bonifica drainage system (Fig. 6.14). The polylines of this coverage were then processed using the Buffer function to create a series of polygons (Fig. 6.15). The buffer distance was set to 40m, giving a series of polygons 80m across, with rounded ends. The final coverage, overlaid with the DEM (Fig. 6.16), shows that the drainage of the bonifica in the DEM is blanked out by the buffer coverage. Together the urban polygon and drainage buffer coverages cover the variations in the DEM ascribed to modern infrastructure and features. The coverage was then used to remove raster cell values from the DEM underlying the polygons, providing a raster dataset with variations caused by modern material removed (Fig. 6.17).

The overall procedure to create a model of a pre-modern landscape ultimately failed to work for either the overarching study area, or either of the two case areas, with both the processing capacity and time resulting in the failure of the model. A small area for Le Cerquete-Fianello (Fig. 6.18) was successful and gives an impression of how the creation of the model might look. The methodology for this process is laid out as a workflow in Appendix 2. However, the decision was made to eventually use the combined raster dataset of the modern topography.



a.

b.

c.

Figure 6.18 Sample area of modelled pre-modern landscape, showing the initial DTM data (a), the splined data (b), and the final pre-modern landscape surface after focal filtering (c)

6.6.5 Terrain Slope

The slope model for the study area was derived from the ASTER DEM dataset. This dataset was required to test the distribution of sites across the study area, to indicate any preference for terrain on a particular slope or on flat areas. The dataset was derived in ArcGIS using the Raster Surface Slope function.

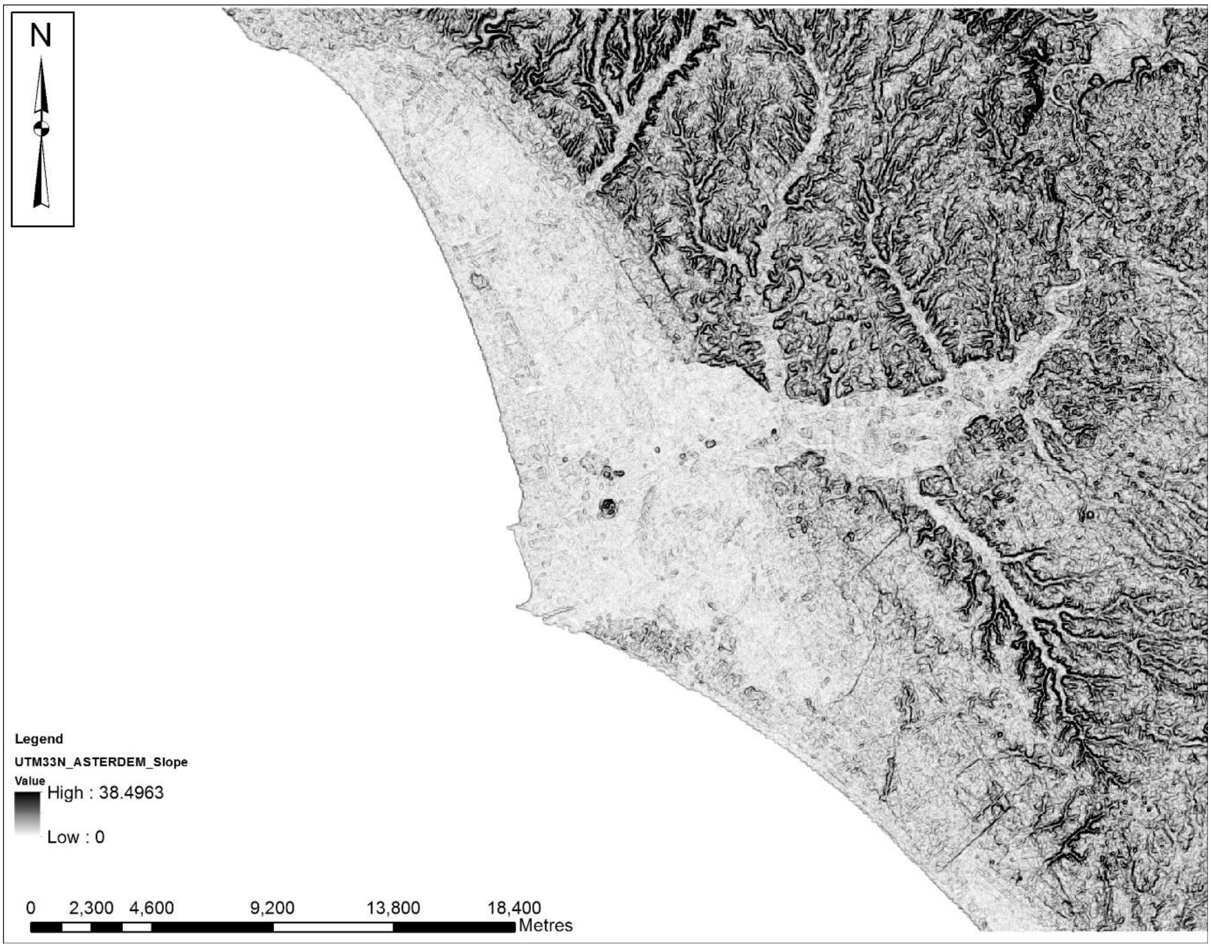


Figure 6.19 Map of gradients of slope in degrees, derived from the modern composite LiDAR and ASTER dataset

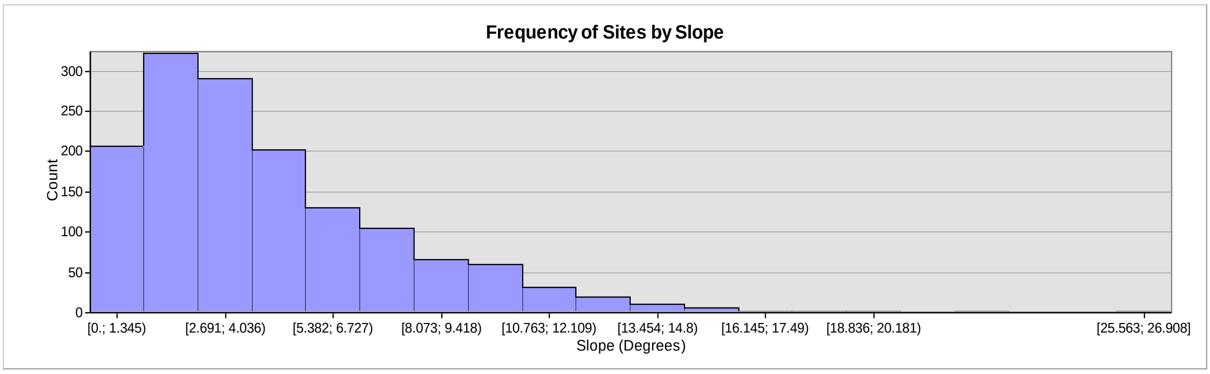


Figure 6.20 Histogram of frequency of sites for gradient of slope (total =1457)

Slope	Cell Count	Hectares
No Data	645333	58079.97
0 to 1.99	409864	36887.76
2 to 3.99	354392	31895.28
4 to 5.99	229442	20649.78
6 to 7.99	132091	11888.19
8 to 9.99	80147	7213.23
10 to 11.99	43735	3936.15
12 to 13.99	24288	2185.92
14 and Over	29388	2644.92
Total	**1948680**	**117301.2**

Table 6.3 Area in hectares of terrain by degree of slope

The slope classification (Fig. 6.19) indicated that the majority of the area is located at under 5°of slope, with a long shallow tail on the histogram indicating the low proportions of greater slope associated with the valley sides to the north and south of the Tiber floodplain.

6.6.6 Terrain Aspect

The terrain aspect model was derived solely from the ASTERDEM topographic dataset. While an attempt was made to utilise the interpolated ASTER and LiDAR data, the function for the aspect model meant that, where pixels in the ASTER data had been converted to 1m by 1mcells of the same elevation, the aspect values for these cells were produced as 'flat' or no overall aspect. Thus, the 30m by 30m ASTER data was used.

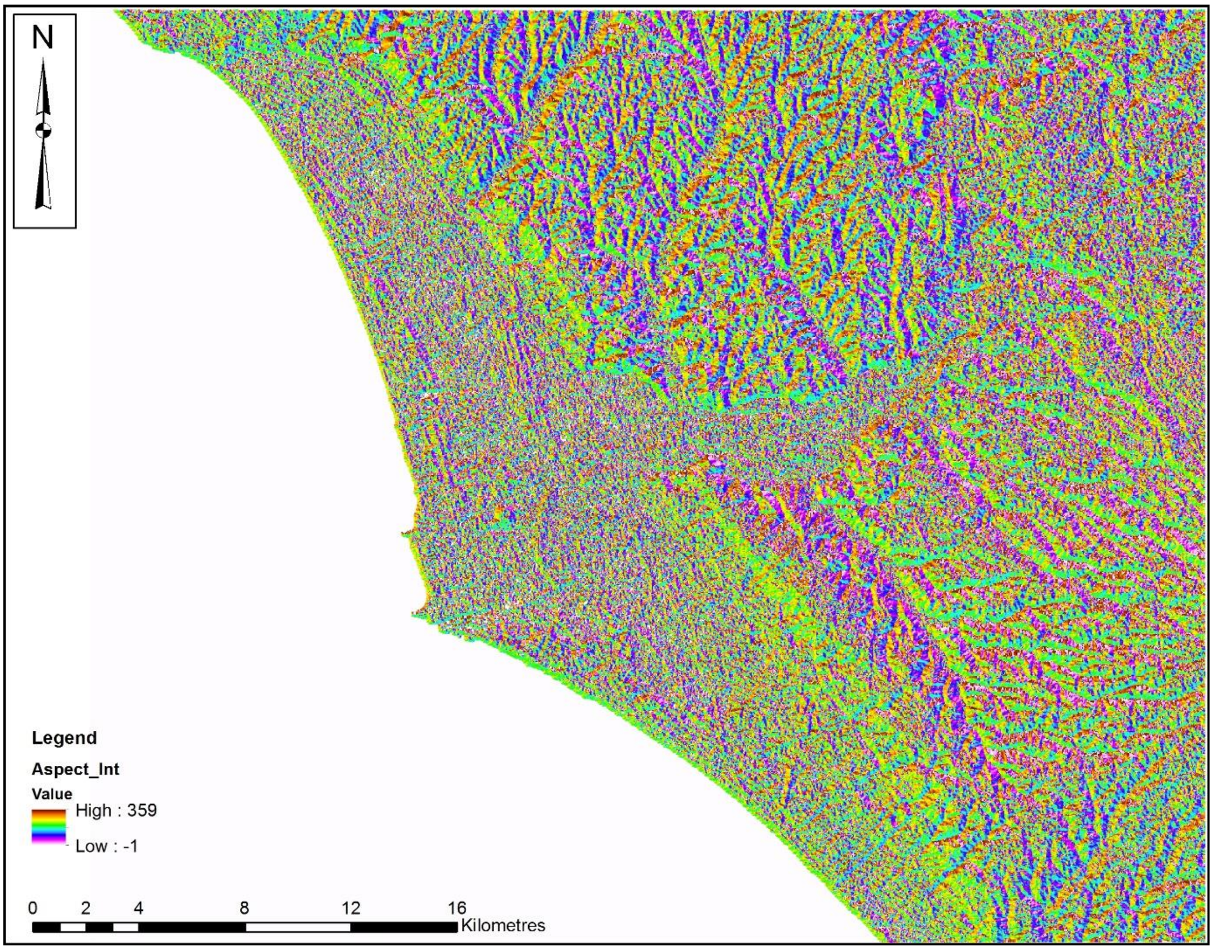


Figure 6.21 Slope aspect map derived from the ASTER 30m resolution data

Aspect	Cell Count	Hectares
No data	645333	58079.97
Flat	7980	718.2
North	152893	13760.37
North East	148071	13326.39
East	153598	13823.82
South East	152798	13751.82
South East	173153	15583.77
South West	181461	16331.49
West	178240	16041.6
North West	155153	13963.77
Total	1948680	117301.2

Table 6.4 Area in hectares for slope aspect

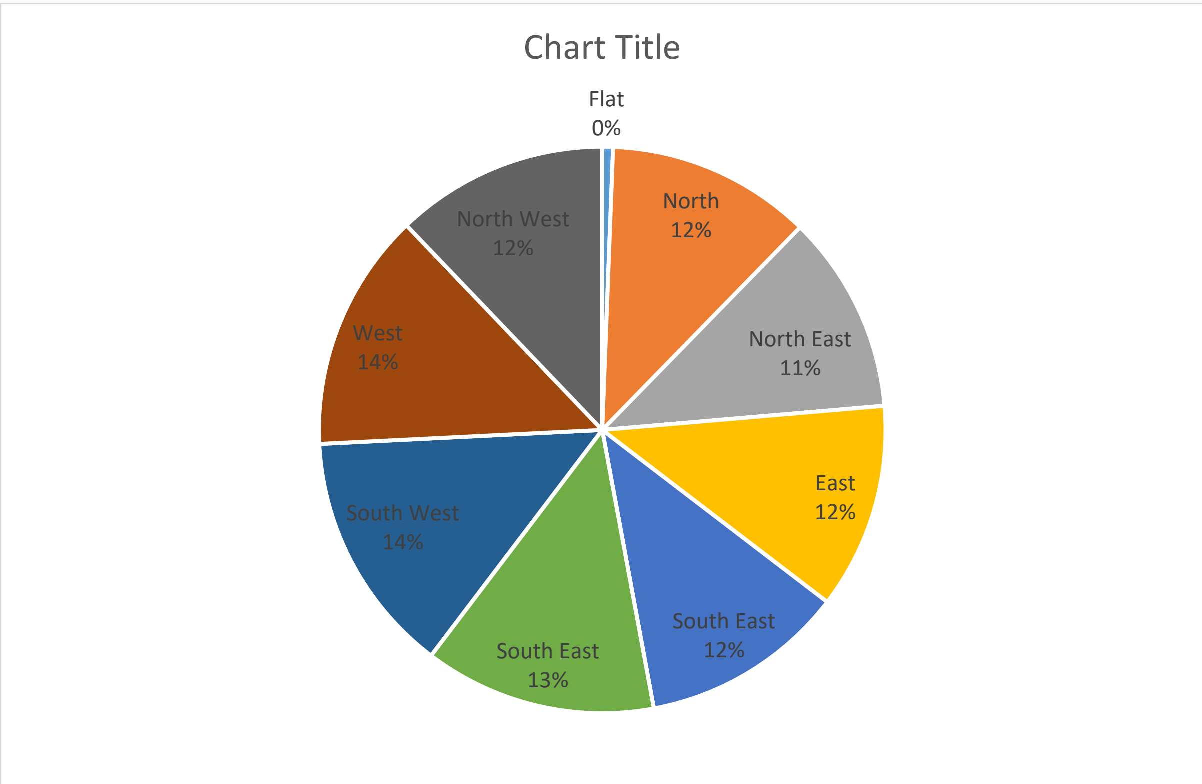


Figure 6.22 Pie chart of percentages of terrain by slope aspect

6.6.7 Modelling the Geology and Environment

The geology (Tables 6.4 and 6.5) and land use data (Table 6.8) provided a counterpoint to the topography, and a basic spatial breakdown of the different soils, bedrock and environment for the study area. The complex breakdown of the drift geology by type, while useful for comparison with the topography, provided too much fine detail for the present work, particularly in terms of modern uses for aggregates and other materials. Values of areas were therefore revalidated and reassigned to a more constrained list of drift geology types (Table 6.7), breaking areas down to basic drift geology of sands and gravels, clays and silts, limestone, volcanic materials and man-made deposits.

Solid Geology		
Type	**Hectares**	**Percent**
Ancient and Recent Alluvium	26165.71	26.53%
Detrital Deposits	349.91	0.35%
Gravel, Sand and Clay Deposits	34699.93	35.18%
Carbonitic Deposits, Calcareous	79.94	0.08%
Deposits of Volcanic Origin	36969.61	37.48%
Arenaceous Comglomerate	363.50	0.37%
Total	**98628.59**	**100.00%**

Table 6.5 Area in hectares of solid geology for the study area

Drift Geology		
Type	**Hectares**	**Percent**
Anthropic Deposits	477.4651929	0.48%
Calcarenites for cut stone and / or cement mortars	394.320985	0.40%
Clay deposits	7464.479469	7.57%
Cover over sands for industrial activity	54.95244052	0.06%
Cover over tufa used for blocks in construction	765.6783544	0.78%
Cover over volcanic materials	280.3437987	0.28%
Gravels and Sands for Construction	22302.18141	22.60%
Gravely	10351.42573	10.49%
Lave for Construction	983.1671992	1.00%
Mostly silt - clay deposits	1317.060361	1.33%
Siliceous Sand and Clay Deposits	18184.69069	18.43%
Travertine	212.0551486	0.21%
Tufa used in construction	4347.824392	4.41%
Volcanic Material	21006.88707	21.29%
Volcanic Material of minor merit	9595.507221	9.72%
Volcanic products of mixed use	931.4033209	0.94%
Total	**98669.44279**	**100.00%**

Table 6.6 Area in hectares for the drift geology

Drift Geology		
Type	**Hectares**	**Percent**
Man-made Deposits	477.47	0.48%
Volcanic Material	32797.31	33.24%
Tufa	5113.50	5.18%
Travertine and Limestone	606.38	0.61%
Clays and Silts	8781.54	8.90%
Gravels and Sands	50893.25	51.58%
Total	**98669.44**	**100.00%**

Table 6.7 Area in hectares for the revalidated drift geology

At this level the most apparent break in the solid geology (Fig. 6.23) is that between the deposits of volcanic origin (38%), gravels, sands and clay deposits (35%) and the ancient and recent alluvium (27%). These split almost exactly three ways between the volcanic geology of Latium to the south of the Tiber, together with the tufas to the north of the river, the sands and gravels to the north, and the alluvium of the Tiber delta and river valley, with more weight given to the bedrock geology of the Pleistocene. Even so, alluvial deposits for the study area account for over a quarter of the geological grouping, and a significant area within the study. This comprises three types of environment in the form of the delta, the main Tiber river valley, and the lower parts of the tributary valleys of the Tiber. The nature of these deposits also provides the greatest possibility for variations of depth in terms of the developing Holocene landscape, making the representing of time-depth crucial in analysing the pattern of archaeology over this area.

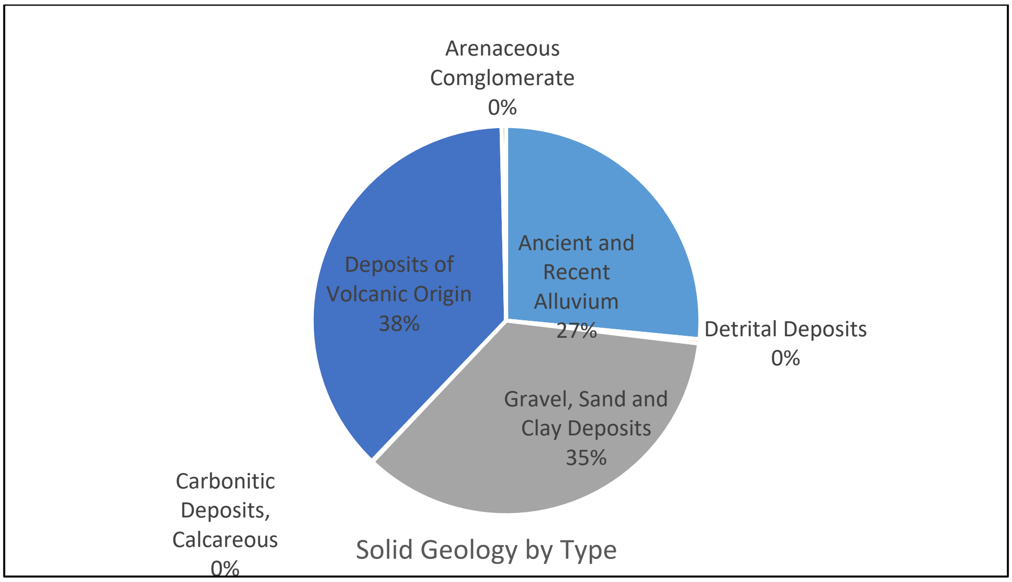


Figure 6.23 Pie chart of the solid geology by type

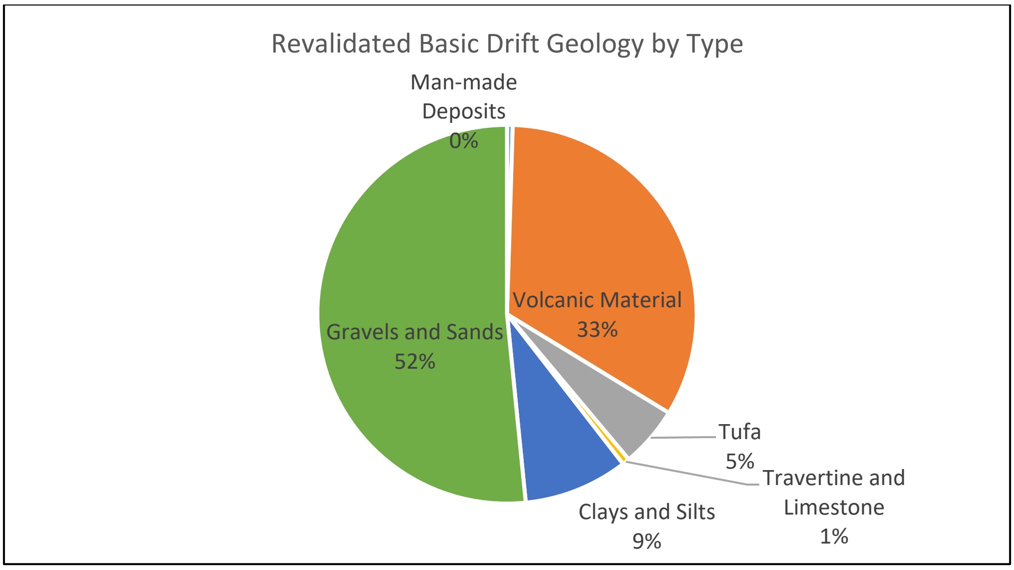


Figure 6.24 Pie chart of the drift geology by type

The revalidated types for the drift geology of the study area show some variation from the solid geology (Fig. 6.24). The largest component of the classifications indicates gravels and sands (52%), and while this is a simplified dataset, with the gravel and sand deposits incorporating the hillsides to the north of the Tiber, and the coastal zone of the delta. Volcanic material generally represents the hard volcanic geology of Latium, and areas of tufa to the north of the Tiber. The remaining clays and silts indicate deposits immediately around the Tiber and the tributary streams and rivers. In many ways the drift geology data provides a less satisfactory dataset than the solid geology, mainly due to the fact that many of the subtypes are related to modern extraction areas, linking volcanic rock, gravels and other deposits to quarrying of material for the purposes of construction. The data does, however, in the original breakdown of types (Fig. 6.9) indicate the sands of the Tiber delta, especially for the coastal plain to the south of Ostia.

The land use data (Table 6.8) provides a useful if limited coverage for the study area. The broad dataset has a number of refined categories including basic agricultural denominations, different types of woodland (mixed, coniferous), grassland, pasture, and areas of Mediterranean scrubland. A number of categories fall under the general heading of 'modern', including ports, airports, roads and quarries. These are mentioned in relation to the topographic modelling (Above), but it is the categories of land use relating to agriculture, wetland, dunes and beaches and forestry that are of interest here. A revalidation of the dataset was undertaken, and different areas were regrouped by a series of broader categories (Table 6.9). These conflated all modern land use into a ‘modern infrastructure’ category and brought all agricultural land into an ‘Agriculture’ category. Other types such as coniferous and mixed woodland were left separate to denote the different types of woodland, and areas of Mediterranean scrub, orchards and other groups were also left in their own categories. These broader groupings (Fig. 6.25) present a dataset dominated by agricultural land (56%) and modern infrastructure (31%) with the remaining 13% taken up by the other categories. This data provided an opportunity in forming the basis of a model of land use, but also a dilemma. The broad categorisation of the land use in the study area indicates the dominance of woodland types to the south of the Tiber in the area of Castelporziano, but also along the coastal dunes of the delta. The broad agricultural areas present a block of terrain easily identifiable until any attempt at recognising the nuances of modern and ancient agricultural type.

Type	Hectares	Percent
Agricultural area with vegetation	7132.57	7.22%
Agriculture with Complex Structures	1530.99	1.55%
Airport	1969.02	1.99%
Area of bushes	96.26	0.10%
Beaches and Dunes	211.51	0.21%
Body of Water	588.68	0.60%
Broad-Leafed Woodland	1771.37	1.79%
Burnt Area	44.74	0.05%
Coniferous Forest	1503.49	1.52%
Construction Area	1387.13	1.40%
Continuous Built Urban Area	8415.64	8.51%
Discontinuous Built Urban Area	14309.80	14.48%
Grassland	2674.58	2.71%
Industrial and Commercial Area	1755.32	1.78%
Internal Marshland	74.92	0.08%
Mediterranean Scrubland	1020.27	1.03%
Mixed Woodland	3198.70	3.24%
Moorland	57.27	0.06%
Natural Pasture	84.78	0.09%

Orchard	76.39	0.08%
Ploughed Terrain without perimeter of irrigation	46269.55	46.81%
Port Area	128.14	0.13%
Quarry	685.95	0.69%
Road Network	468.34	0.47%
Sport and Recreation Area	1560.73	1.58%
Urban Green Space	1485.02	1.50%
Vineyards	353.65	0.36%
Total	**98854.80**	**100.00%**

Table 6.8 Basic categories and hectarage of land use by type

Type	**Hectares**	**Percent**
Modern Infrastructure	30680.06	31.04%
Mixed Woodland	4970.08	5.03%
Coniferous Woodland	1503.49	1.52%
Agricultural	54933.11	55.57%
Bushes and Mediterranean Scrubland	1116.53	1.13%
Marshland and Wetland	663.60	0.67%
Dunes	211.51	0.21%
Grassland	2759.36	2.79%
Orchard and Vineyard	430.04	0.44%
Other	1587.02	1.61%
Total	**98854.80**	**100.00%**

Table 6.9 Revalidated categories of land use by area and type

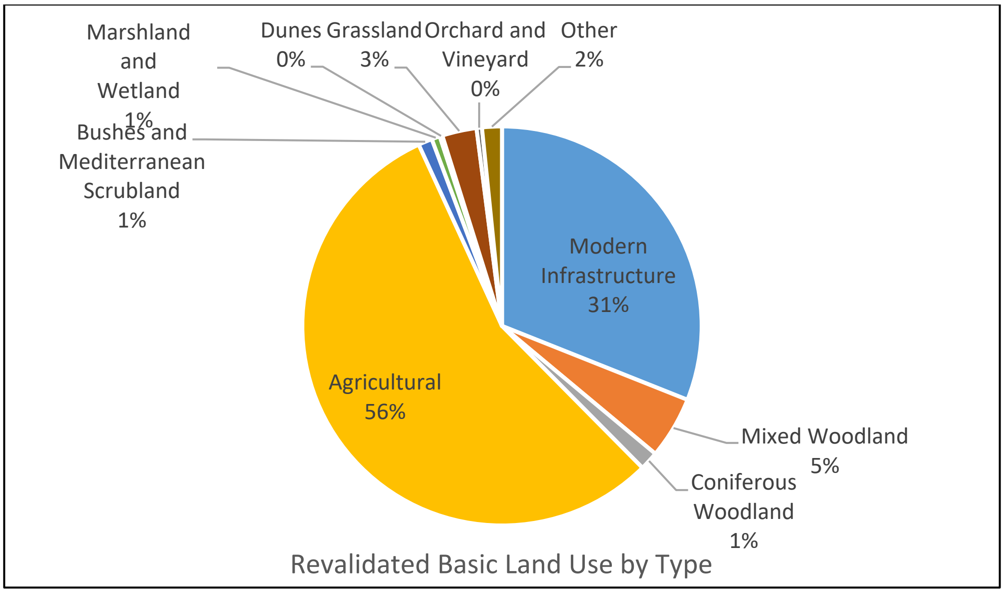
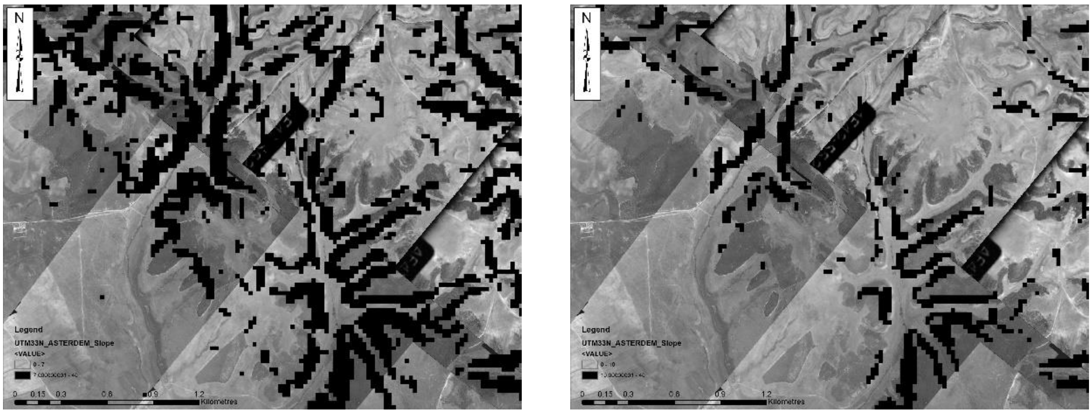


Figure 6.25 Modern land use by type

Finally, the large area of modern infrastructure required redefining to fit in with modelling earlier landscapes and their respective land use. One small proportion of the dataset did provide an interesting pattern in the dataset; the small areas of scrubland, grassland and orchards seemed present on the hillsides to the north of the Tiber, and along the coastal fringes of the delta. Conflation of these areas was undertaken in ArcGIS. Firstly, all polygons of specific types were conflated into single polygons using the Dissolve function (Data management/Generalization/Dissolve). Once the broad definitions were derived the resulting map showed that, apart from a small number of 'modern Infrastructure' polygons, all of these lay within 'Agricultural' areas. Thus, their values were changed to 'Agriculture'. Finally, the three 'Marshland' polygons were also changed to 'Agriculture', as these represented the course of the Tiber, and two small areas on the coastal plain, all adjacent to agricultural areas, and none of them representing the actual extents of the marshland and wetland prior to the Bonifica. The final dissolved land use map provided no definition between agricultural land and any of the small wooded valleys in the tributaries of the Tiber Valley, although the breakdown of grassland, woodland and scrub along the coastal plain and overlooking the Tiber valley to north and south (Fig. 6.26) provided a starting point for the environmental reconstruction.

Figure 6.26 The revalidated and dissolved land use dataset

Reconstruction of the land use was then carried out. Three specific areas were of major concern in terms of re-establishing a model of the ancient land use. Firstly, the possible extent of the floodplain and delta had to be derived, based on a basic flood model for the area. Secondly, the possible extents of mixed woodland for the study area had to be calculated. Finally, these areas had to be added to the coverage of land use to produce a definitive land use coverage. The objective for this coverage was to produce a land use model with a generally high level of confidence in the attributed classifications and areas, based on the modern land cover and the aggradation polygon for the floodplain and delta. While land use models can be formed where sufficient documentary and cartographic evidence exist of the late medieval and post-medieval periods (Poska *et al.* 2008) the limited evidence for the study area suggested that a single broad land use coverage should be generated, that provided a relatively high degree of confidence based on the existing modern data.



a. b.

Figure 6.27 Examples of integer slope raster coverages overlaid with RAF air photographs from 1943/44, for 7 ° (a) and 10 ° (b) slopes

For the refinement of the woodland coverage the slope raster coverage was compared with air photographic evidence from the 1940s, to assess the extent of woodland on the valley slopes, and the best degree of slope with which to calculate woodland coverage for the study area (Fig. 6.27). A polygon coverage was then produced to represent the woodland of the valley sides using an 8° of slope for the study area (Fig. 6.28).

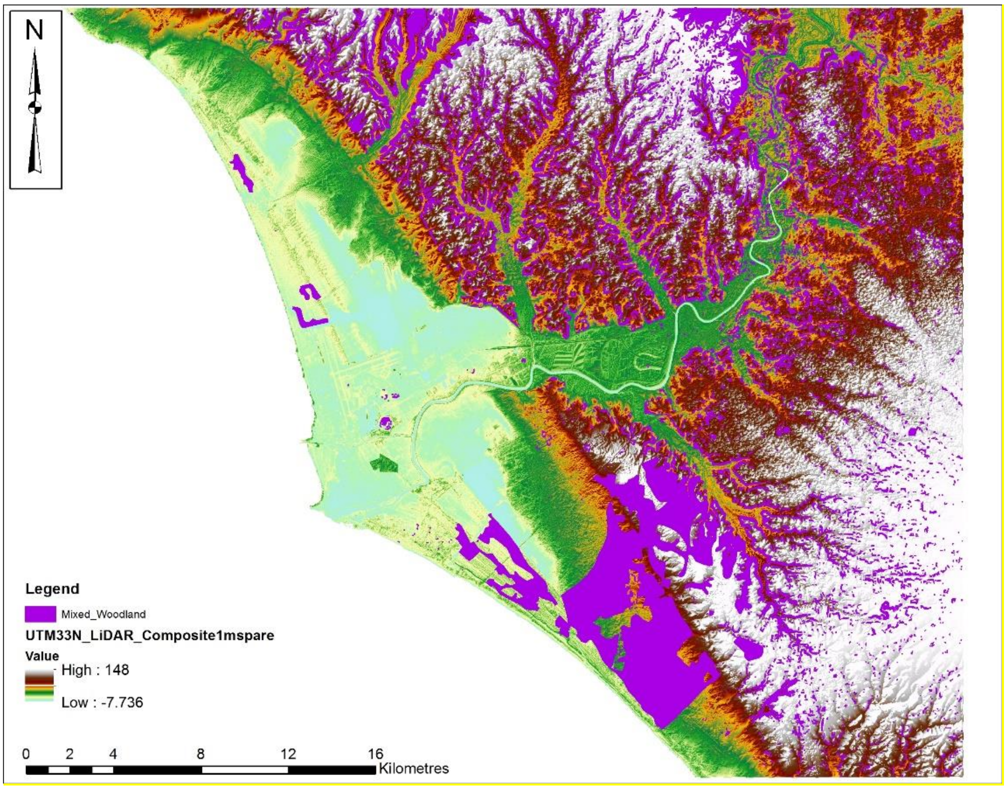


Figure 6.28 Mixed woodland classification derived from existing woodland and slope coverage for the valley sides

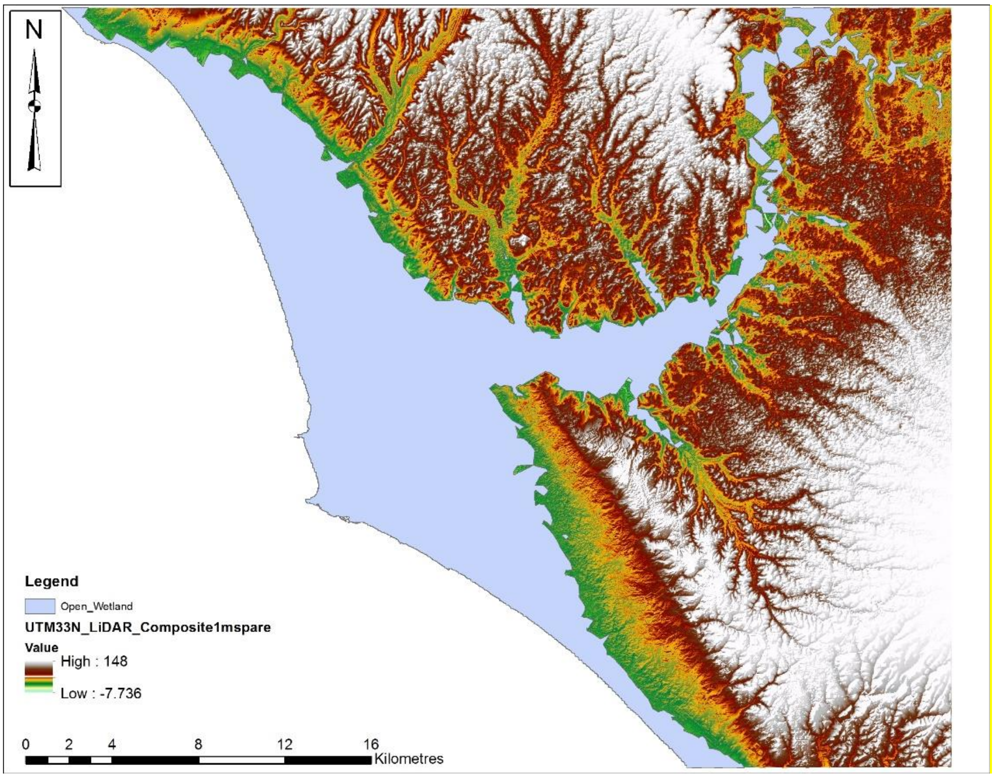


Figure 6.29 Wetland classification derived from topographic flood model with elevation of 15m in the area of Ripetta

The wetland classification for the land use coverage was derived from the aggradation polygon This polygon (Fig. 6.29), derived from a model of flood levels from Ripetta, formed the most efficient way of representing areas of mixed agricultural and vegetational type at any risk of periodic flooding from the Tiber river and other watercourses running to the coastal plain.

These new polygon coverages were merged to ensure that each represented a single entity, and then were added to a final land use coverage (Fig. 6.30) to provide a definitive representation of the land use classifications for the study area. This final coverage indicates a significant proportion (Fig. 6.31) of the land cover as 'Agricultural' (58%), with the wetland zone forming the next largest ecotone by area (24%) followed by mixed woodland (12%).

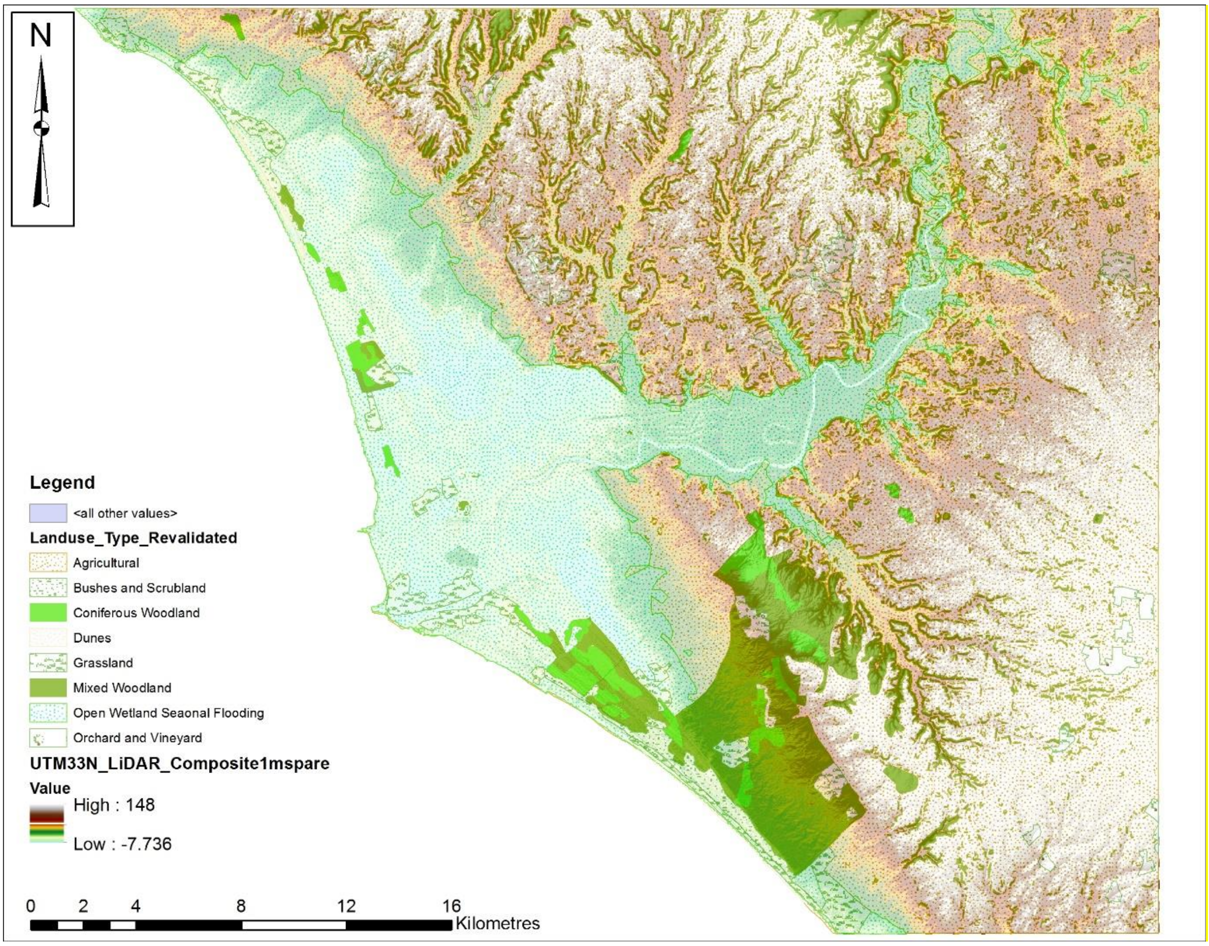


Figure 6.30 Integrated land use model coverage for the study area

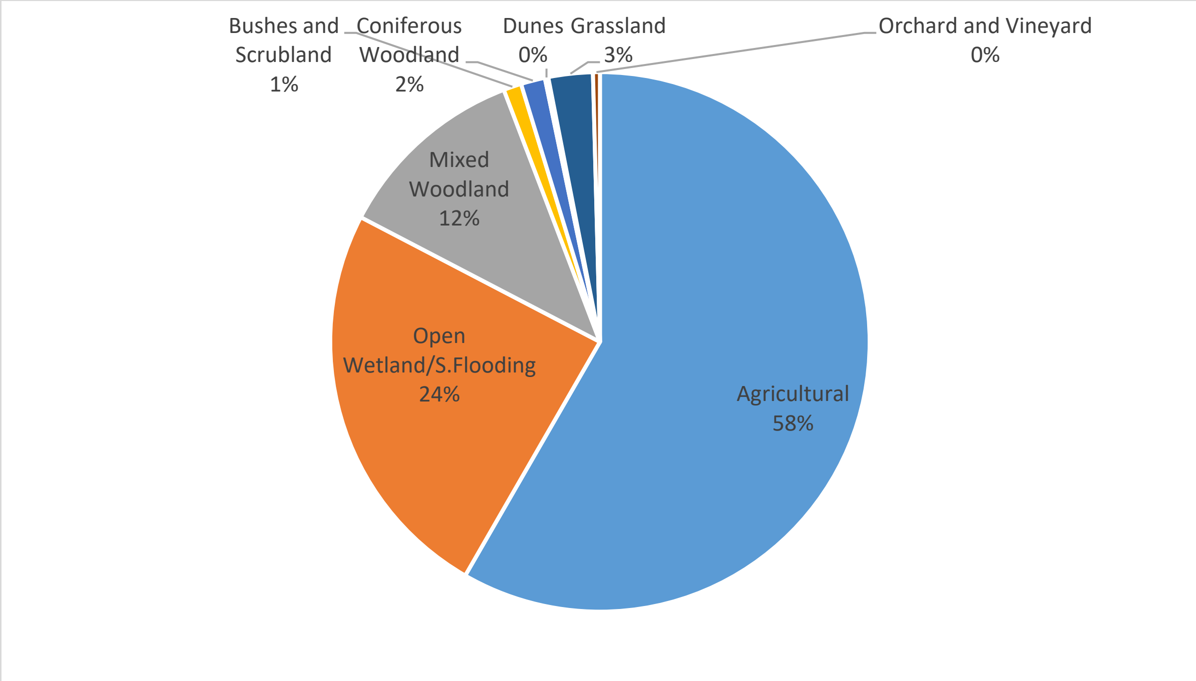


Figure 6.31 Pie chart of percentages of land use by type for the study area

6.7 The Modelled Environment

The coverages produced through the GIS for the topography, drainage, solid and drift geology and the land use for the study area, all contribute a spatial backdrop for the analysis of the pattern of settlement for the study area. Some limitations were presented in the processing of these coverages. Firstly, the effort to create a pre-modern topographic raster failed to produce a coverage for the study area. A working methodology was produced for this that could be used in future. This resulted in the using of the modern topographic raster dataset. Secondly, the nature of the environmental data and land use coverage meant that a very limited land use model could be created for the study area. There is no scope for major variation of this by period. However, the broad classifications used, and the reliability of the original dataset, means that the land use coverage provides data with a high level of confidence in terms of its representation of land use classifrication for the study area.

This combination of models, comprising topography, drainage, geology and land use, form the basis of the environmental model for the study area. These provide the basis for analysis of the proximity and overlay of settlement for different periods for the overall study area, allowing a full analysis of settlement distribution to be conducted. Chapter 7 relates the creation and classification of the database of archaeological sites for the study area.

Chapter 7 : The Archaeology of the Study Area

7.1 Introduction

Chapter 3 outlined the archaeology, sites and material culture for the study area and region from the Neolithic to the Roman Period. The location of the lower Tiber places it in an area of varying significance from the Eneolithic onwards, influenced predominantly by the Gaudo and Ripoli facies in the Eneolithic, the Sub-Appenine facies in the Bronze Age, Proto-Villanovan and Latial cultures, and then Etruscan and Roman (Anzidei *et al.* 1985, 195; Torelli 1981). The archaeology of the area is represented by varying forms of settlement and other sites, for the Eneolithic and Bronze Age representing the dispersed and pastoral forms of economy of the period, with evidence of animal husbandry and cereal production at the end of the Neolithic, followed by pastoral farming, then the development of nucleated settlement by the Iron Age. The area of the Tiber delta and the lower river valley thus provides varied potential for investigation of different periods. Distribution of the different facies, certainly by the Iron Age also seems to indicate that the Tiber formed a barrier between groups, most notably the Etruscan and Latial cultures in the 1st millennium BC (Anzidei *et al.* 1985).

To analyse the pattern and distribution of settlement from 3000 BC to AD 300 required the collating and mapping of the archaeological evidence for the study area. The sources of data and the creation of a database of point-based locations for sites is mentioned briefly in Chapter 5. This drew on a number of data sources of varying quality and levels of resolution, with datasets originally created to address different approaches to the historic environment, from broad distributions of presence of archaeological material, to detailed datasets derived from extensive landscape research. These sources formed the basis of a point-based dataset for the study area, allowing some statistical analysis of location, distribution and relationships to be developed for the area.

In addition, more detailed evidence from survey datasets, remotely sensed data and excavation formed the basis of digitised data for the Tiber delta and floodplain, and the surrounding hillslopes, to provide more granularity in terms of the extent and form of settlement and land use.

7.2 The Archaeological Dataset: Point Data

For the overall study area data from a number of different resources was used (Chapter 5, Section 5.3). The general distribution of sites in the landscape was derived from the Carta Bibliografica, Carta dell'Agro and Carta per la Qualità maps indicating distribution for the comuni of Fiumicino, Ardea, Cerveteri, the Provincia di Roma, and the Comune di Roma respectively (Fig. 7.1). These varied datasets presented a number of issues in terms of their integration, and the detail of the data was dependent on a number of further sources, some cited in these resources, and others less well-represented.

The most detailed information on the archaeology of the area was taken from three volumes of the Formae Italiae, covering the areas of the Via Aurelia, Torrimpietra and Apoliae (G De Rossi 1970; De Rossi *et al*. 1968; Tartara et al. 1999) and displayed with the data from all other map sources. The location of sites from these were presented in the Carta Bibliografica (Amendolea 2004) and this was used as the primary dataset for the sites. In addition, other point-based site data from other projects in the area was incorporated, including the work of Bietti Sestieri (1984) and Rendell et al. (2007) providing further detail for some areas (Fig. 7.1). In addition, the Sistema InformativoTerritoriale Archeologico di Roma (SITAR) online resource provided more detail on sites recently excavated in the Comune di Roma (http://www.archeositarproject.it/).

The data from all sources was entered into an Access databased with a table for each dataset, with coordinates for each point derived from the GIS in WGS84 UTM33N. All tables had common fields of Site_ID, X, Y, Site Type and Source. Additional fields of Site Name were added to the tables. A total of 2266 sites were recorded for the area (Table 7.1).

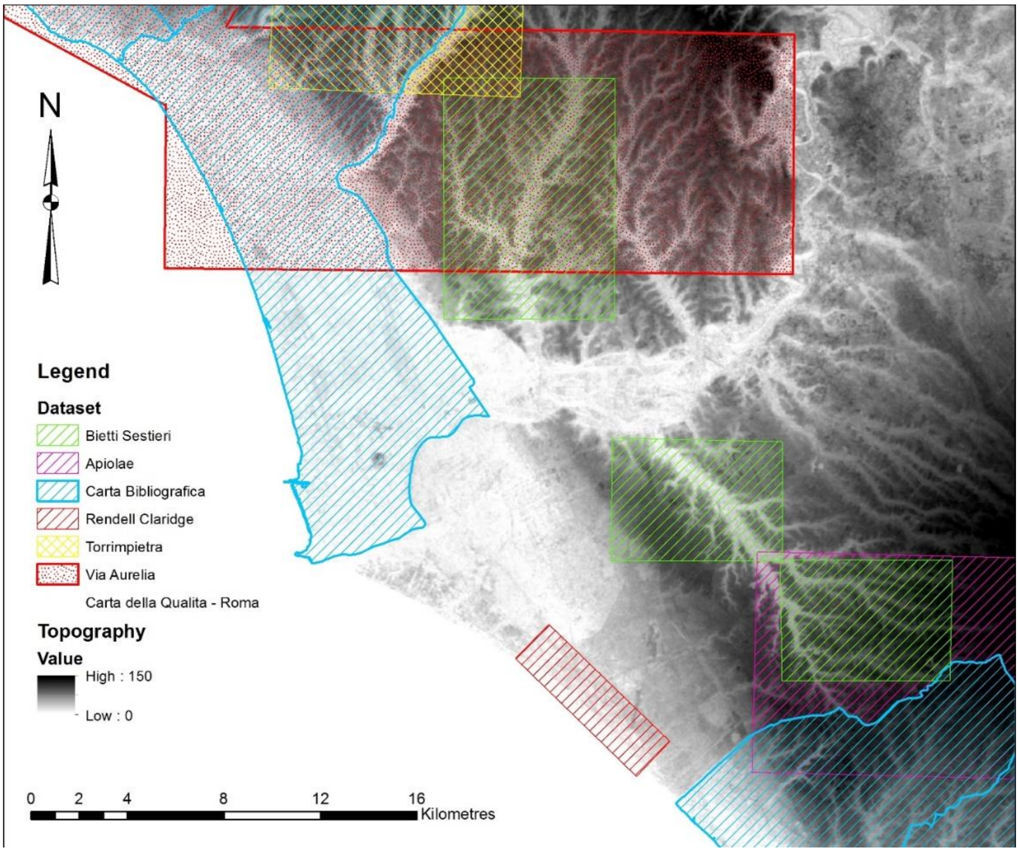


Figure 7.1 Spatial location of the main sources of archaeological data for the study area

Table	**Data Source**	**Sites**
1_Carta_Bibliografica	Carta Bibliografica (Amendolea, 2004)	426
2_CartaperlaQualita	Carta per la Qualità (Comune di Roma, 2002)	239
3_Cartadell'Agro	Carta dell'Agro (Comune di Roma, 1987)	569
4_CartadellAgroPoly	Carta dell'Agro (Comune di Roma, 1987)	832
5_Researched_Sites	Various	87
6_SES_Sites	South Etruria Survey Database	44
7_SITAR	SITAR Database (http://sitar.archeoroma.beniculturali.it/)	69
	Total	**2266**

Table 7.1 Number of records for the different datasets

7.2.1 Site Type

For collating the data, a look-up list of site types was created, based on a review of the overall number of entries and their categorisation in the source material. The list was designed to rationalise the different forms of site across all of the datasets, a process that was constrained by the limits of some of the data. The focus of this study on the distribution of settlement meant that the categories of 'rural settlement' and 'villa' provided the principle data for evaluating this distribution, in addition to the 'nucleated site' category. Several of the remaining categories also provided comparative data for these principal records. For instance, the 'bridge' and 'road' categories facilitated the mapping of potential roads, in addition to the definite and hypothesised lines of roads from some of the sources (for example Tartara *et al.* 1999). In addition, the 'tomb' category of record provided data on burials alongside roads, and related to potential settlement locations, again giving comparative records for the distribution of settlement locations. The revalidation off the look-up categories in fact found few entries that could be conflated or removed. Several entries for sites such as churches were deemed superfluous to a study of sites from 3000 BC to AD 300 and were removed. Similarly, the one entry for a mill suggested that possible locations of such sites were not adequately represented in the dataset and this was removed. The main conflation of categories occurred for the 'castrum' and 'borg' categories, bringing these in line with entries for the few nucleated sites in the dataset. These all represent sites of Iron Age and later date, generally walled settlements.

While entries for 'Flint Scatters' and 'Working Sites' were retained, the details of such entries generally pertained to Middle and Upper Palaeolithic records. These were retained as some related spatially to settlement in the Neolithic to Eneolithic periods. However, the category of 'Rural Settlement' formed the focus of the analysis. This broad definition belies a number of issues relating to the nature of the sites. Many are derived from definitions of scatters of fictile or ceramic material, and this can relate to detailed definition of the ceramic types (South Etruria Survey; Carta Bibliografica (Amendolea 2004) derived from De Rossi *et al.* 1968), or generic scatters of ceramic material. As with other landscape studies these scatters may relate to substantial buried archaeological remains, or potential evidence for more ephemeral remains associated with sites occupied for a short period, possibly of post-built structures, although a lack of intrusive investigation for many of the records makes such identification impossible for many sites (Jeneson 2013, 62). The nature of 'Rural Settlement' sites is also dependent on period. Sites recorded for the Neolithic and Eneolithic period invariably derive from scatters of ceramic and lithic material indicating possible settlement, although the nature of the prehistoric economy in Italy may mean that such sites were occupied for a short period. A number of distributed sites across the delta or, in some instances, along ridges, may also indicate several 'sites' of one extensive population, or short-term occupation over different phases within the same facies. The decision was made to record all such sites as individual 'Rural Settlement' and to consider the issues of dispersal and occupation when comparing and interpreting the data in terms of the topography, land use and other datasets relating to possible patterns of human ecology.

Two periods of settlement provide the possibility of a more hierarchical approach in terms of the nature of settlement: Protohistoric and Roman. With the former the presence of some 'Nucleated Settlement' relating to smaller 'Rural Settlements' provides the possibility of further investigation of the distribution of sites in relation to more intensively settled locations. For the Roman period the presence of 'Nucleated Settlement' and 'Villa' sites also provides such potential.

Site Type	Revalidated Site Type	Notes
Castrum	Nucleated Site	
Mansio	Mansio	All records indicating large roadside stopping places
Villa	Villa	All sites named as villas, mainly Roman or occasionally Archaic sites
Rural Settlement	Rural Settlement	All areas of ceramic fragments indicating the presence of an area of settlement or similar
Tomb	Tomb	All records indicating tombs, tumuli, necropolis

Site Type	Revalidated Site Type	Notes
Road	Road	All noted roads, in addition to digitised roads marked on maps from sources
Findspot	Findspot	General findspot of single objects
Flint Scatter	Flint Scatter	Areas indicating prehistoric flint
Port	Port	Ancient port sites
Working Site	Working Site	Records indicated as working sites
Drainage Feature	Drainage Feature	General drainage features not listed as cuniculi
Tower	Tower	Records appearing as tower. Excludes medieval sites
Bridge	Bridge	Any record indicating bridge or remains of bridge sub-structure
Cave	Cave	Records indicating cave sites
Fountain	Removed	
Gateway	Removed	
Church	Removed	Church records (3) removed
Temple	Temple	Records listed as Temples
Walls	Walls	Any records indicating exposed walls
Nympheum	Nympheum	
Cuniculum	Cuniculum	All records indicting cunuculi
Spring	Spring	
Mill	Removed	Mill record (1) removed
Cippus	Cippus	
Baths	Baths	
Dovecot	Removed	Dovecot entry removed
Sanctuary	Sanctuary	
Casale	Removed	
Borg	Nucleated Site	

Site Type	Revalidated Site Type	Notes
Unknown	Unknown	
Nucleated Site	Nucleated Site	
Cistern	Cistern	
Outpost	Outpost	
Acqueduct	Acqueduct	

Table 7.2 List of the look-up site types, and the revalidation of categories for the database

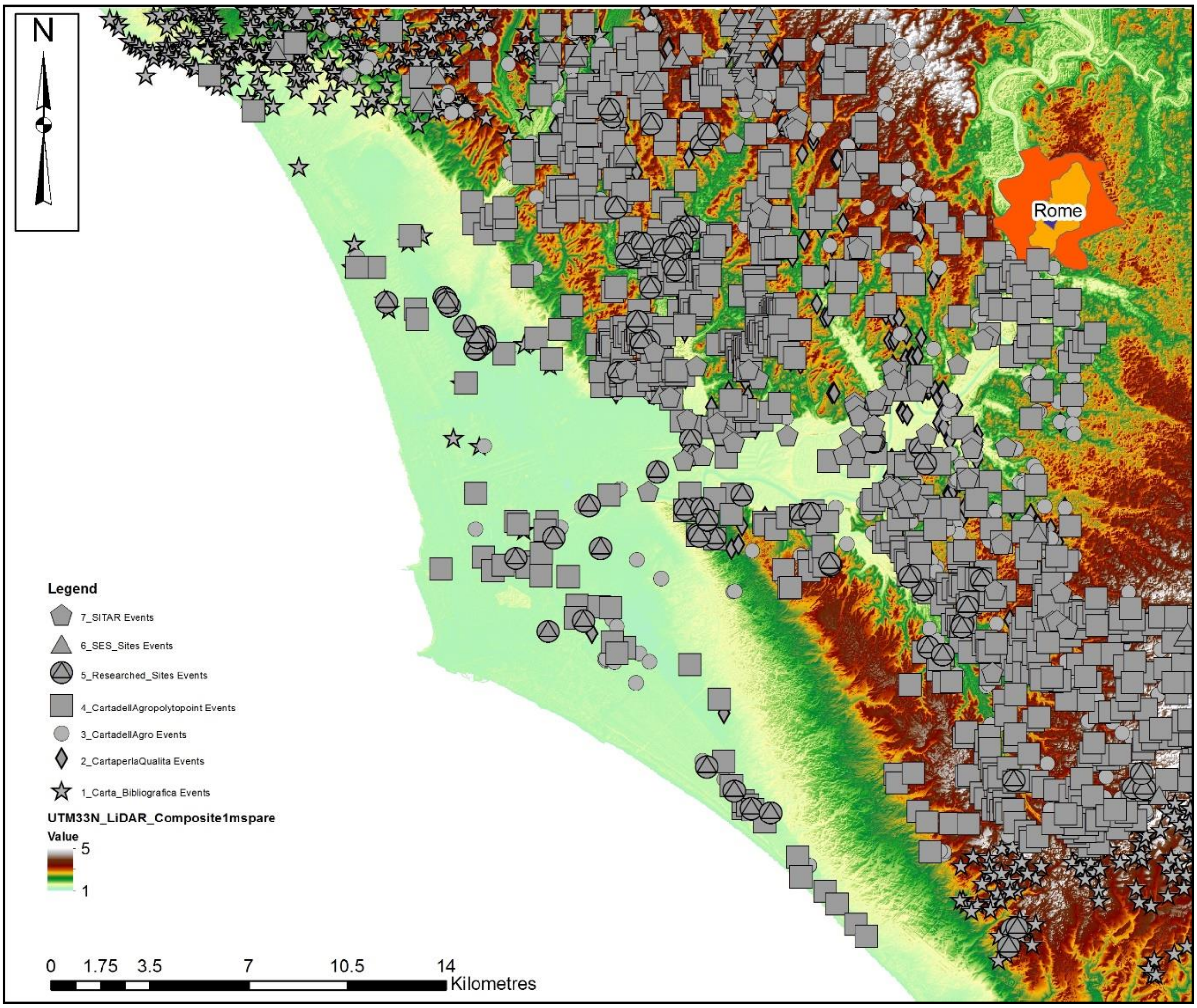


Figure 7.2 Point-based site locations for the overall dataset by resource

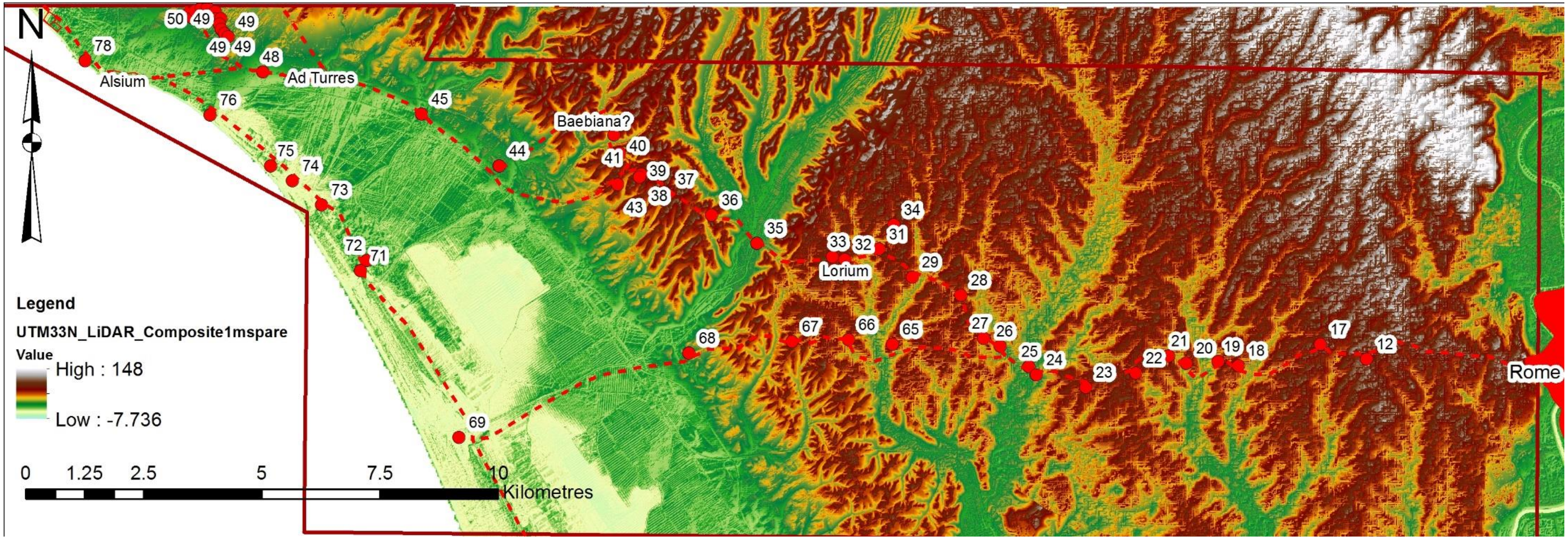


Figure 7.3 Sites and ancient roads noted in (De Rossi *et al.* 1968) for the area along the Via Aurelia to the west of Rome to the edge of the Maccarese Plain

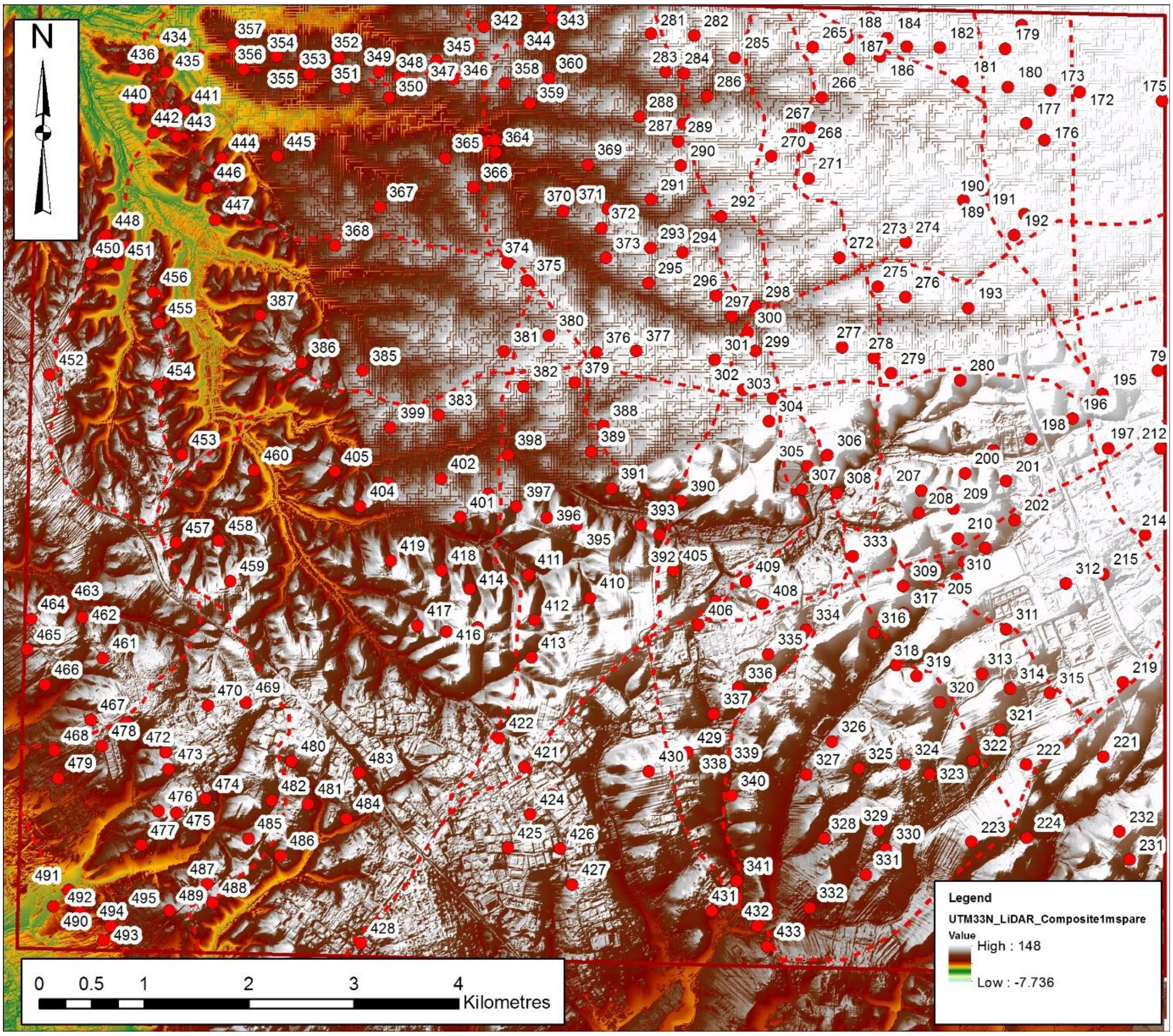


Figure 7.4 Ancient sites and roads noted in De Rossi 1970

Many of the data sources also give indications for diverse forms of site, including tombs, necropolis, road paving, bridges and other material. The point data held in some sources is also augmented by the known or hypothesised lines of roads from the Etruscan and Roman periods, for instance the data derived from De Rossi *et al.* (1968; Fig. 7.3), De Rossi (1970; Fig. 7.4) and Tartara *et al.* (1999; Fig. 7.5). These sites and related data serve in particular to elucidate on the nature of possible settlement, particularly for the Protohistoric and Roman periods for which they invariably relate. Thus, location of villa and rural settlement location may relate to one another, but also may correlate closely to the line of roads and routes of communication in the landscape. Locations of necropolis and tombs are related closely to the presence of villa sites or nucleated settlement. These sites were maintained in the dataset for comparison with the pattern of settlement.

Finally, a number of other related sites were recorded from different data sources, including temples, nymphea, sanctuaries, outposts and towers. These have been retained in the dataset for comparison with the pattern of settlement for different periods, although the number of sites of these types that are represented are so small as to preclude their broader use in the analysis of the dataset.

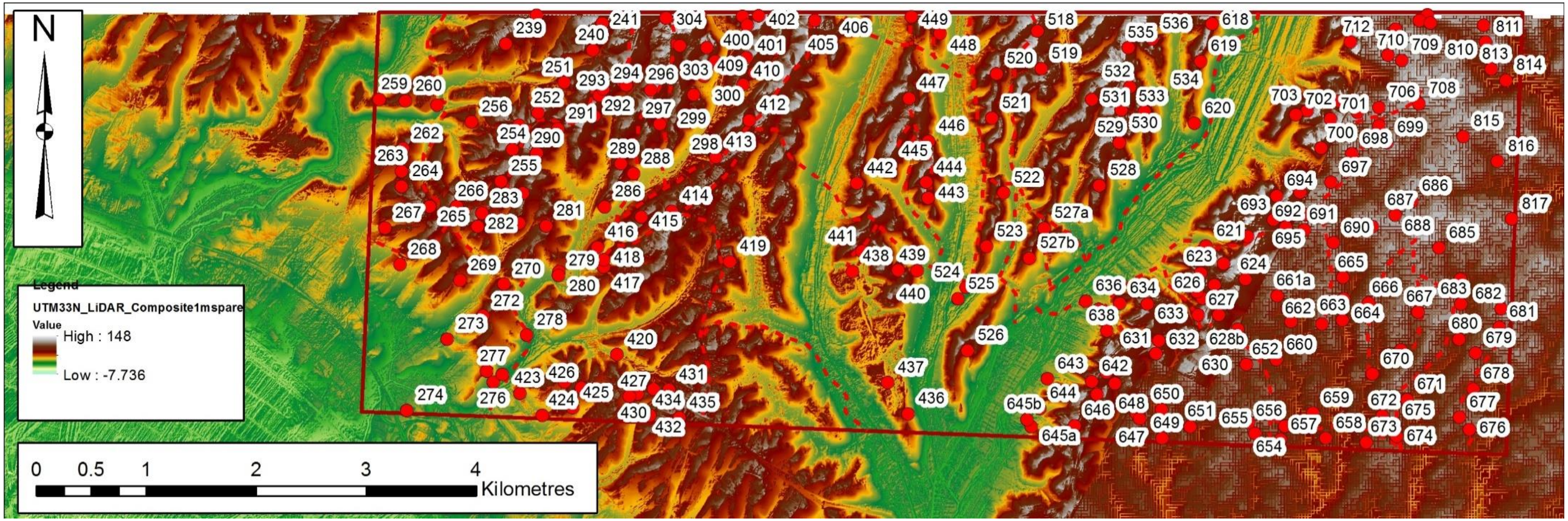


Figure 7.5 Ancient sites and roads from the Torrimpietra volume (Tartara et al. 1999)

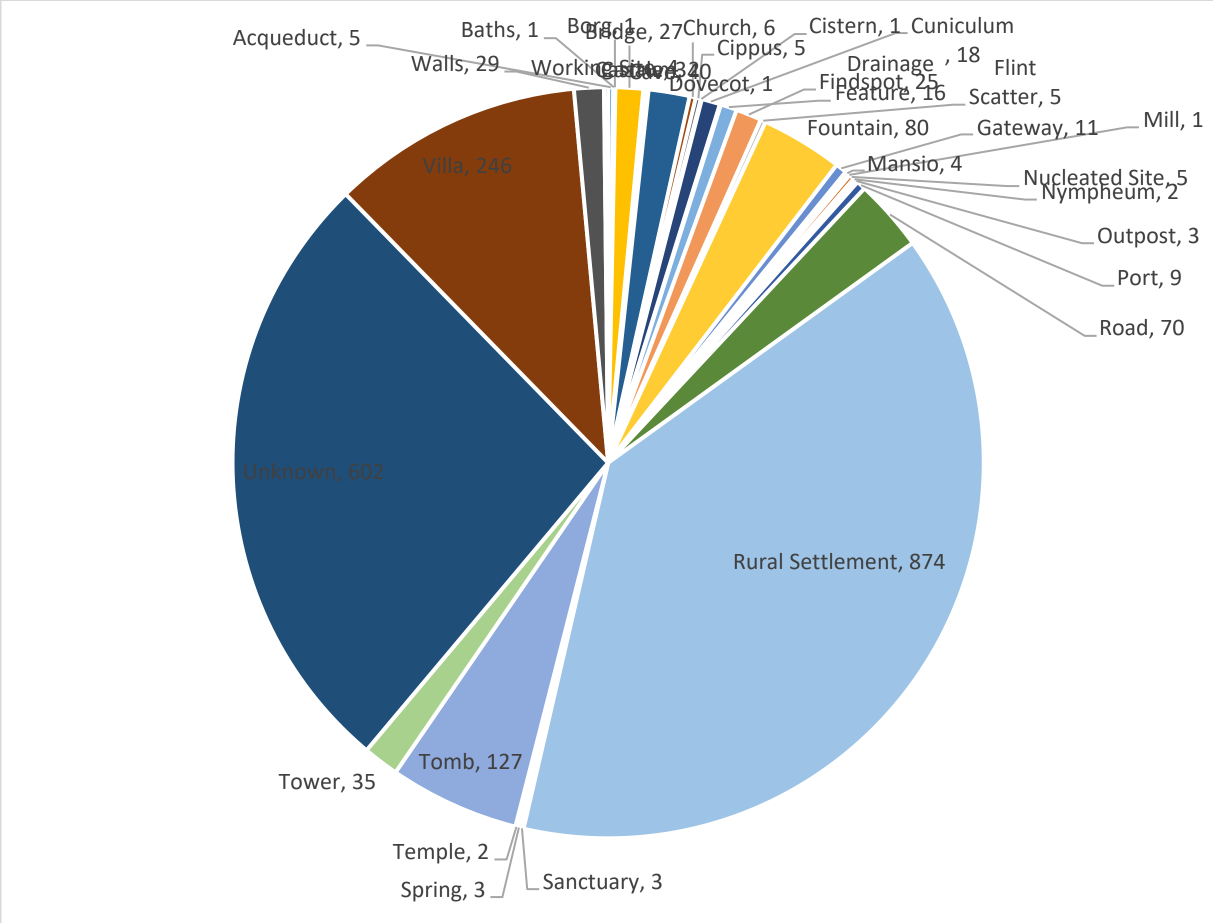


Figure 7.6 Different site classifications for the overall dataset (total=2266)

Of the 2266 entries in the dataset, 602 (26.6%) were recorded as unknown type. Of these a significant number derived from the Carta per la Qualità, with 239 sites. The remaining records of unknown site type derived principally from the Carta dell'Agro, where a numbe of entries were recorded as 'Sito Preistorico' but pertain to Palaeolithic sites. These include Palaeolithic elephant kill sites on the gravel hillsides to the north of the Tiber (Mariani-Costantini *et al.* 2001), together with finds elsewhere in Lazio (La Rosa et al. 1995).

7.2.1 Date Ranges and Temporal Resolution

The temporal detail for the dataset provides a constraint on how the point-based site locations could be used. The broad classifications provided adequate ranges for the data (Table x), with sites invariably labelled in sources as Neolithic, Eneolithic, Bronze Age.

These basic ranges, however, were limited in two ways. Firstly, the early and late Bronze Age periods were in several cases given, but not with a degree of consistency that allowed the further sub-division of the period as a whole. Secondly different resources labelled sites of broadly Iron Age date in different ways. The Carta Bibliografica, with its data derived from De Rossi et al. (1968) along the Via Aurelia invariably labelled sites as Archaic and Etruscan. The data derived from Bietti Sestieri (1984) also labelled a number of sites as Iron Age. Thus, the three broad categories of period were retained. However, an overarching 'Protohistoric Iron Age' category was derived to allow comparison of sites from these overlapping categories to be compared.

Period	**Sub-Period**	**Timeframe**	**Notes**
Neolithic		5500 – 3500 BC	
Eneolithic		3500-2000 BC	
Bronze Age		2000 – 1200 BC	
Iron Age		1200-800 BC	
Archaic		800-500 BC	
Etruscan		800 – 509 BC	
Roman		509 BC-476 AD	
Republican	6th century BC	509 BC – 1 BC	
	5th century BC		
	4th century BC		
	3rd century BC		
	2nd century BC		
	1st century BC		
Imperial	1st century AD	AD1 – AD 476	
	2nd century AD		
	3rd century AD		
Late Antique	4th century AD		
	5th century AD		
	6th century AD		

Table 7.3 Time periods used for the study

Of the 2266 entries in the database evidence of the period of activity was given for 891 (Table 7.4) with others representing unknown time periods. Within this sample, the majority of entries were recorded as Roman (577 or 65%), with smaller numbers recorded for Etruscan, Archaic and Iron Age (195 in total, or 11.7%) and increasingly fewer entries for the Bronze ge, Eneolithic and Neolithic (Fig. 7.7). This in part represents the focus on the more visible and substantial archaeological remains from Roman villas and settlements, roads and tombs, against the more ephemeral traces of prehistoric activity in records such as the Carta dell'Agro.

Certainly, on the floodplain and delta the relative visibility of prehistoric sites is affected by the depth of some of these sites in relation to the modern topography (Chapter 6, Section 6.6). The presence of prehistoric sites including the Protohistoric Iron Age in part derives from sources such as the Carta Bibliografica, but also from the published excavation records for certain sites, and field projects with a focus on prehistory such as Bietti Sestieri (1984).

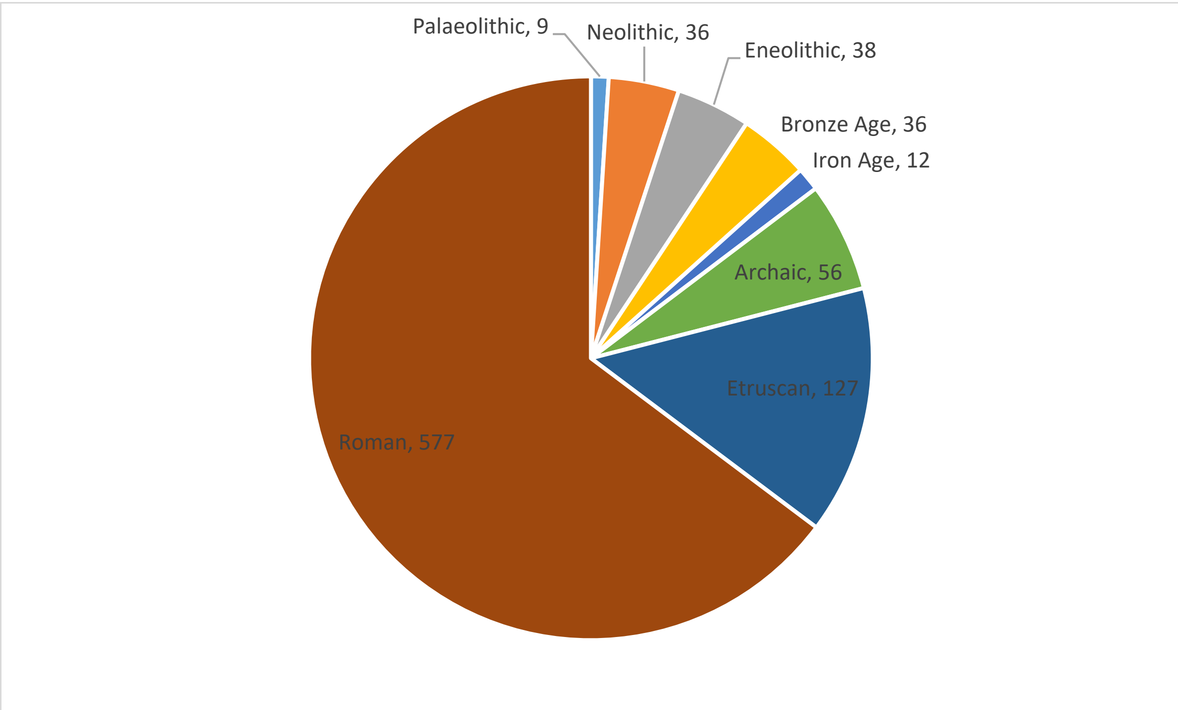


Figure 7.7 The proportion of sites representing different periods from the overall dataset (total = 891)

Period	Number	Percent
Palaeolithic	9	1.01%
Neolithic	36	4.04%
Eneolithic	38	4.26%
Bronze Age	36	4.04%
Iron Age	12	1.35%
Archaic	56	6.29%
Etruscan	127	14.25%
Roman	577	64.76%
Total	**891**	**100.00%**

Table 7.4 Number of sites by period

7.2.2 Published Excavation and Survey Data

Up to now, this chapter has dealt with the overarching point-based dataset used to compile a record of the pattern of settlement for the study area. This provides a well-populated dataset, reduced to the status of individual points per site or settlement ideal for basic statistical analysis of the distribution of known and recorded archaeology. However, more detailed resources have been researched, incorporating survey and excavation data (see Chapter 5, Section 5.3.1) for the study area. This incorporates excavation material published in academic sources, including the excavations at Le Cerquete-Fianello (Manfredini et al. 2002), the excavations and fieldwork at Ficana (Brandt, 1996), excavations on the *Campus Romanum Salinarum* of the Maccarese Plain (Morelli, Olcese and Zevi, 2004) and the extensive publications on the archaeological excavations on the Isola Sacra (Calza 1928; Calza 1940; 1940a; Baldassare 1997). In addition, the geophysical survey work conducted at Portus (Keay *et al.*, 2005; Keay, Millett and Strutt, 2008), Isola Sacra (Germoni *et al.* 2011) and the Fiume Morto (Strutt 2011) provides additional data for areas of the Tiber delta. Further digitised interpretation from air photographs and satellite imagery.

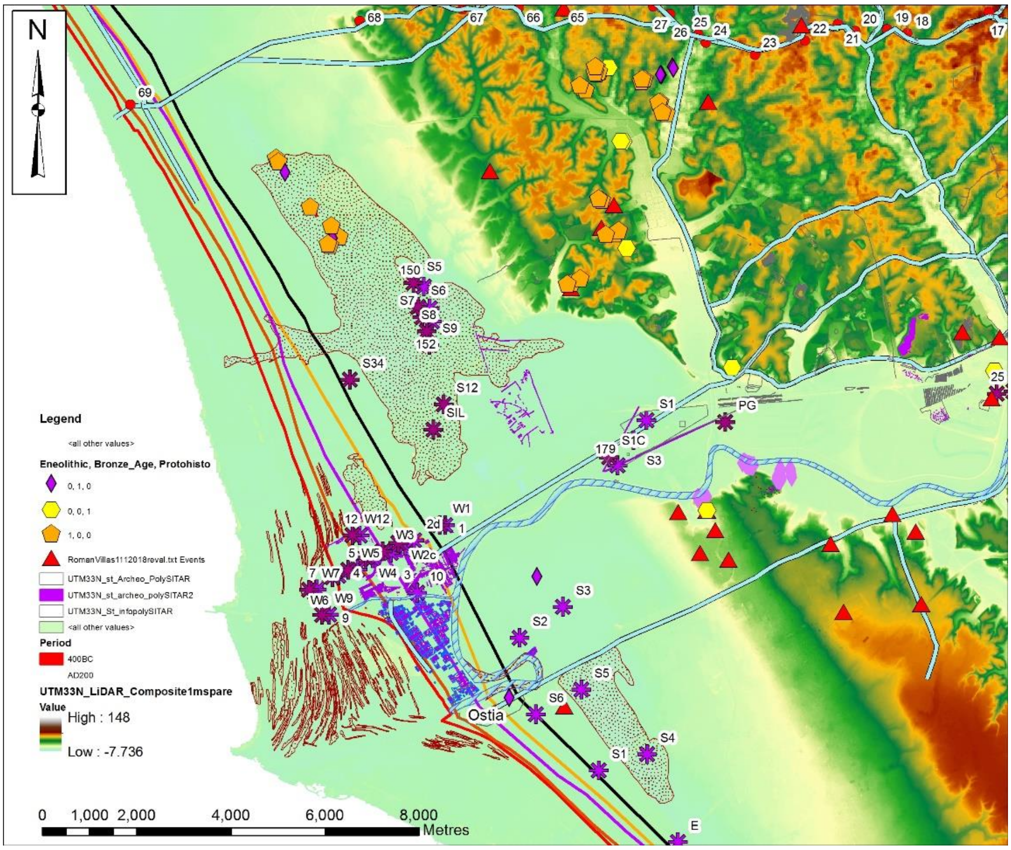


Figure 7.8 Composite map of published and archived data sources from survey and excavation, also digitised features from air photography, borehole data and other data sources

These datasets provide nuance and a counterpoint to the point-based analysis (see Chapter 8, Section 8.4). Whereas our knowledge of some of the point-based data is limited, certainly in terms of spatial resolution, the georeferenced mapping of archaeological data from these more intensive research projects enables more precise mapping of different parts of the delta and floodplain and provides greater granularity in terms of the archaeology or the study area. While the spatial nature of this data limits its use for the broad statistical analysis of the overall istribution of sites, it is invaluable for the more detailed modelling of the settlement and land use for the landscape proposed in this study.

7.3 Data Revalidation and Reclassification

The point-based dataset presented above, while giving a record in the database for every known archaeological entry for the area, required assessment and revalidation due to a number of inconsistencies and constraints related to the varying sources and quality of the data. Landscape studies of site records all present issues relating to the dataset in one form or another (Jeneson 2013, 51) and the reliability of the dataset here required evaluation. Several variables impacted on the quality of the data when brought together into a single database. Duplicate records for single sites were noted across different data sources, understandable as coverage of sites in sources such as the Carta Bibliografica (Amendolea 2004) relied on different source materials, and these sometimes overlapped with records for the Carta dell'Agro (Comune di Roma 1987) and other sources. Thus, a methodology to remove duplicate entries was required that compared spatial location and the resolution of the attribute data for sites.

The presence of multiple sites or records by period in a particular area also required checking. While proximity of entries in some instances indicated duplicate records, even in points from the same dataset, others were derived from distinct entries in the source material. Where such entries were identified as being separate, the question remains as to the nature of the archaeology and the broad spatial area of settlement sites of different types, including those for villas, broader rural settlement categories and prehistoric site locations. Thus, a standard for approaching these records was required.

7.3.1 Duplicate Records

To reconstruct a more reliable dataset of the pattern of settlement for different periods the existing data had to be evaluated and revalidated to ensure that no duplication of sites occurred, and to assess the spatial relationship between sites and incorporate groups of points where necessary. The variable nature of the different datasets incorporated into the overall analysis, as outlined in Chapter 5 and earlier in this chapter, highlighted the need for refining the data in terms of temporal and spatial information. The existing point dataset is based on a number of sources, and the representation of different forms of record and material, varying from concentrations and scatters of ceramic, to chance finds of ancient road paving, to excavated records. Many of the sources used were based on the input of point locations for particular concentrations of material, but in some instances were also represented through polygons of data (Fig. 7.9) that, for the purposes of this study, were converted into a point dataset. Some duplication therefore occurred in compiling the dataset.

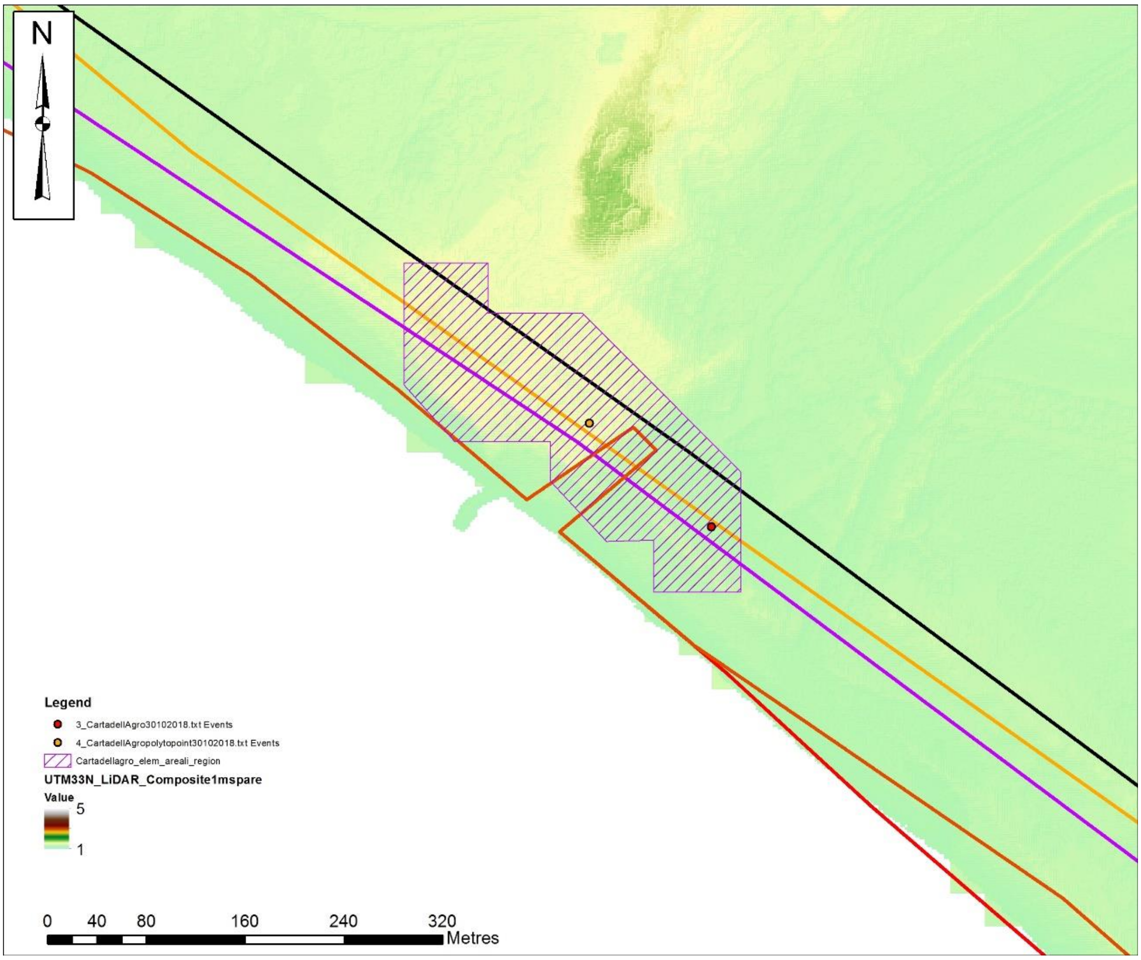


Figure 7.9 Site data for the area of San Nicola at the northern edge of the Maccarese Plain. The image shows a polygon for the area of the Roman villa from the Carta dell'Agro. The orange point indicates the site as derived from the polygon in producing a point dataset. The red point shows the Carta dell'Agro point entry for the site

To eradicate duplicate entries the Carta dell'Agro datasets were viewed together (Fig. 7.9) overlaid on the LiDAR data. The entries for the point datasets were viewed, and duplicate entries were noted and then deleted from the Access database. In many instances the derived point data was retained and the Carta dell'Agro point record removed, as the former invariably was located centrally to the area of settlement. In many instances a number of point records from the Carta dell'Agro exist where no polygon entry is present (Fig. 7.10). In these instances, the point records were retained as no duplication of a site was present. The check for duplicate sites was also extended to data from the other sources (Figs. 7.11), where multiple records for a site were encountered.

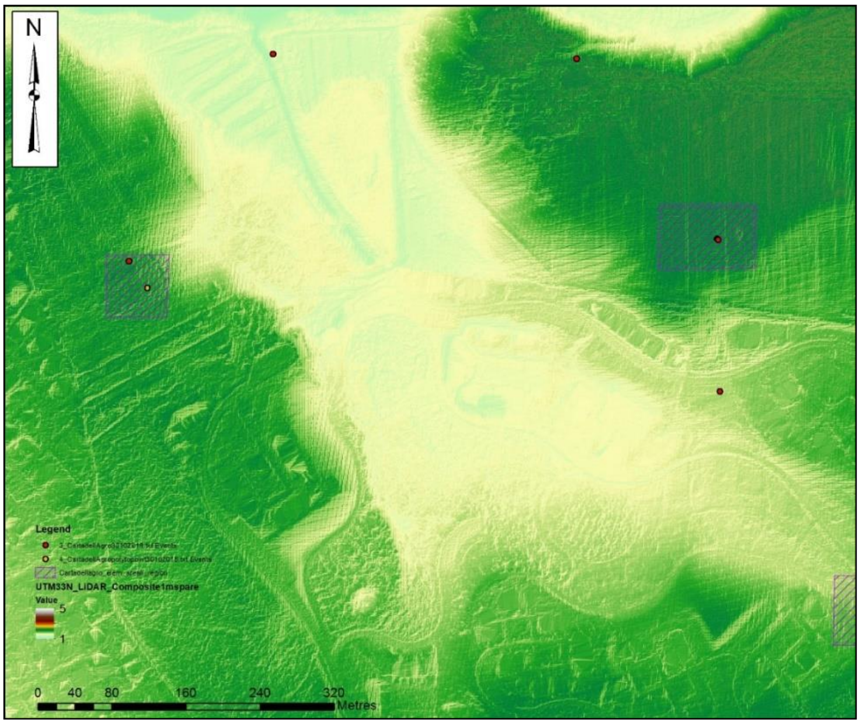


Figure 7.10 Carta dell'Agro datasets superimposed on the LiDAR, showing the polygon data areas, and a duplicate set of points in the westernmost site, but also three instances where no polygon area of data is given, and thus the only record for the sites is held in the point dataset

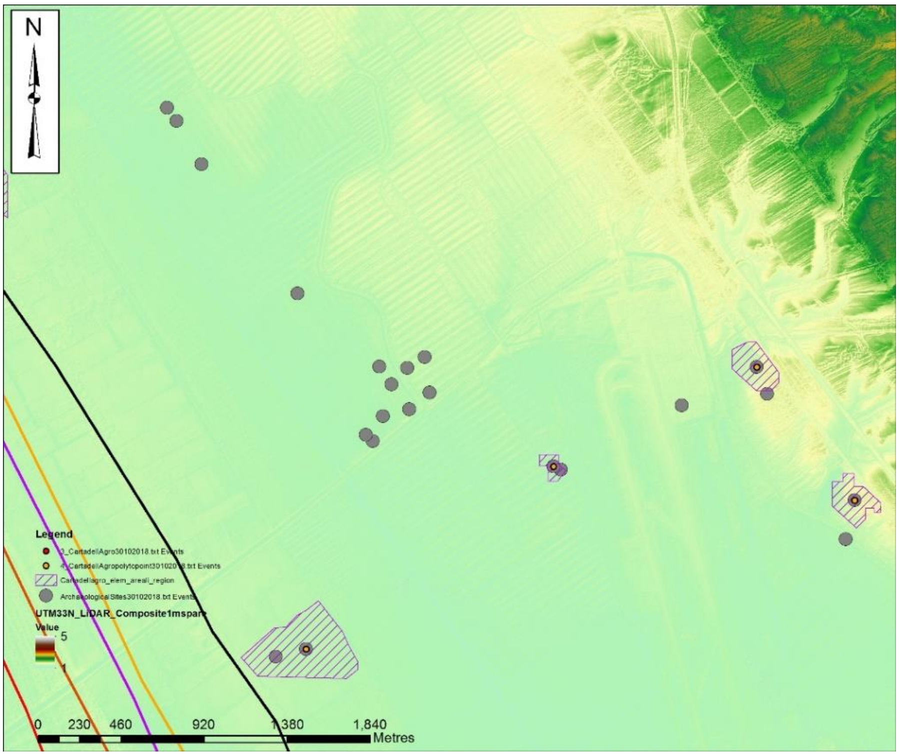


Figure 7.11 Area on the Maccarese Plain, indicating polygon and point data from the Carta dell'Agro, and other sites from the remaining datasets

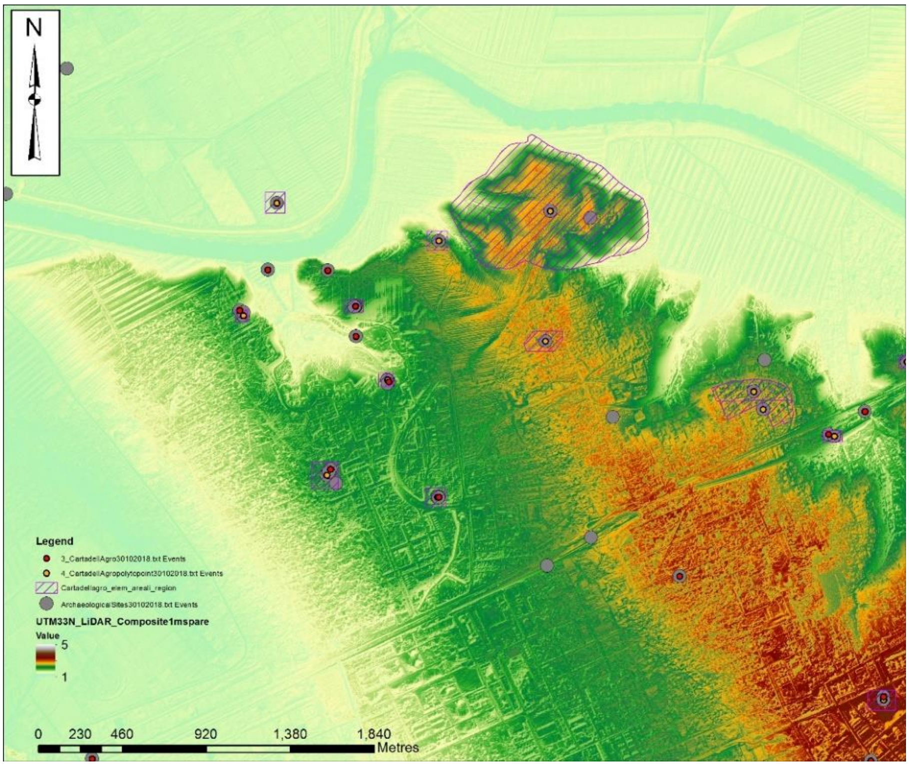


Figure 7.12 Sites in the vicinity of Ficana. Duplicates were then removed, however, the polygon representing the site of Ficana demonstrates a methodological issue with large-scale sites and large nucleated settlement

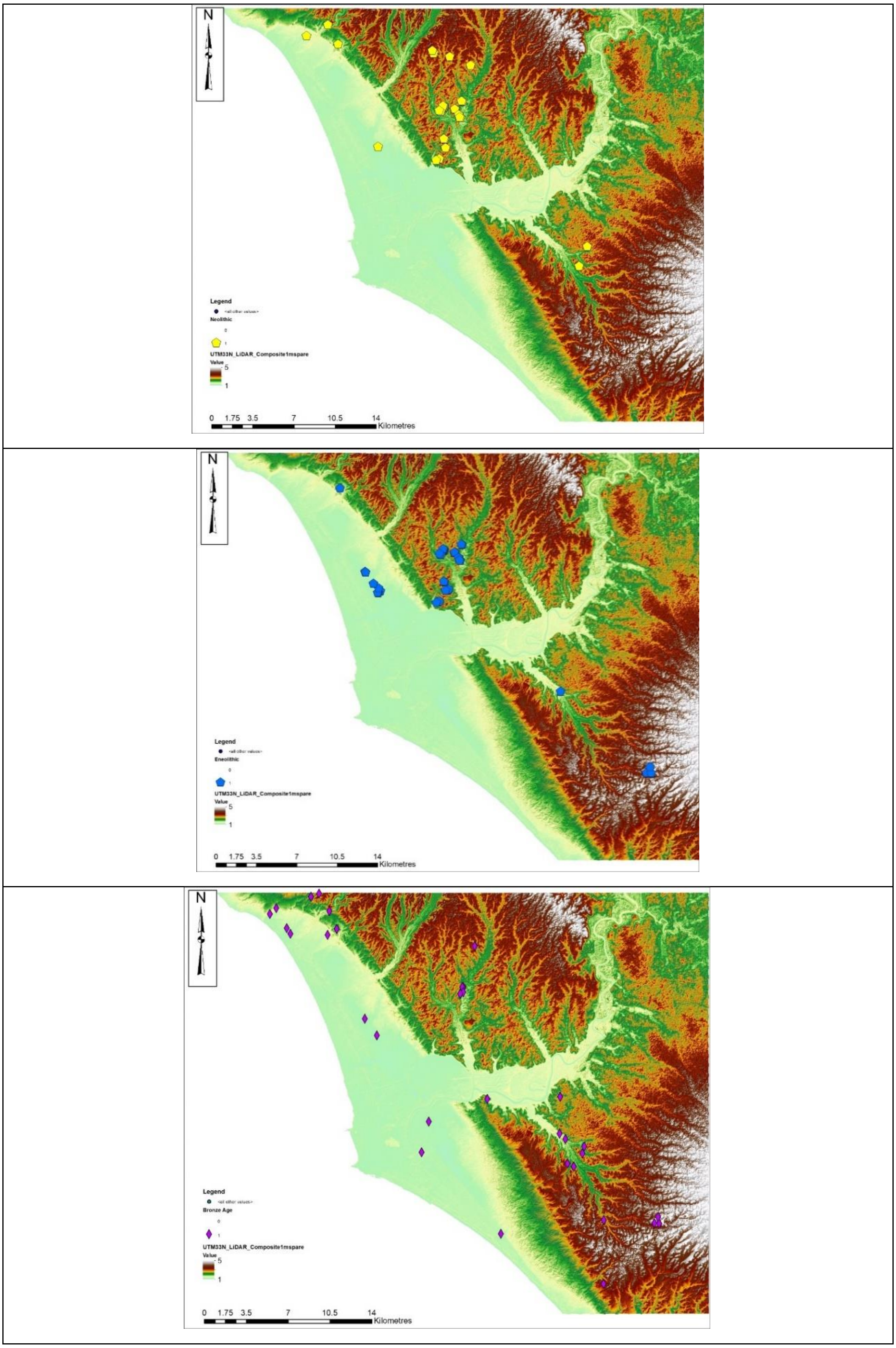


Figure 7.13 Distribution maps of the sites for Neolithic (top), Eneolithic (centre) and Bronze Age (bottom) classifications

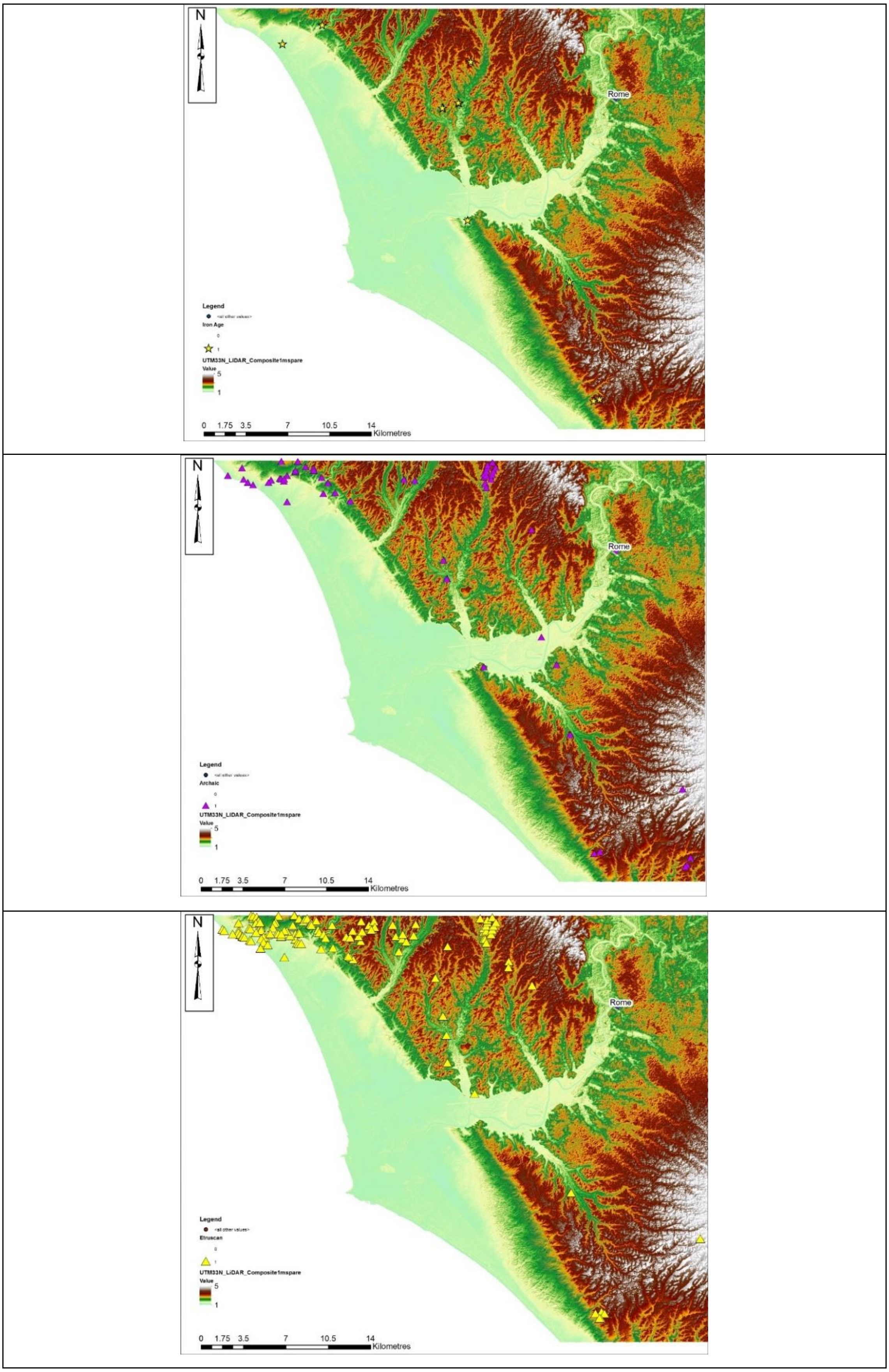
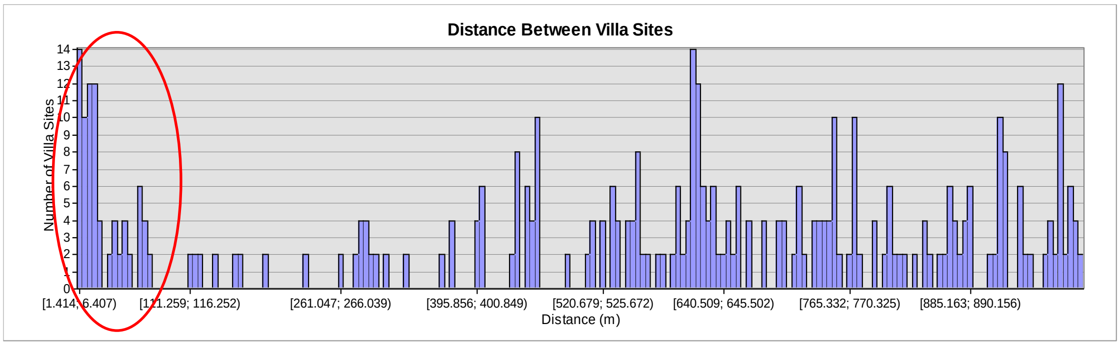
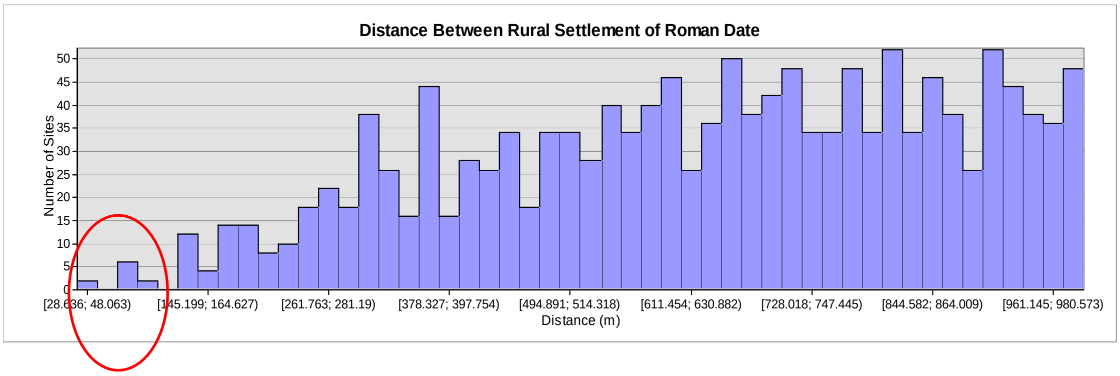


Figure 7.14 Distribution maps of the sites for Iron Age (top), Archaic (centre) and Etruscan (bottom) classifications

To assist in the search for duplicate entries sites were also compared by period, with the distribution of Neolithic, Eneolithic and Bronze Age records (Fig. 7.13) compared. Similar comparisons were made for Iron Age, Archaic and Etruscan records (Fig. 7.14). These comparisons indicated concentrations of site from different sources where specific fieldwork had been undertaken to record prehistoric sites (Fig. 7.13) or where published excavations formed the basis of the records. Similar concentrations occurred for the different classifictions of Protohistoric sites (Fig. 7.14) in particular Etruscan records associated with the Carta Bibliografica (Fig. 7.14, bottom).





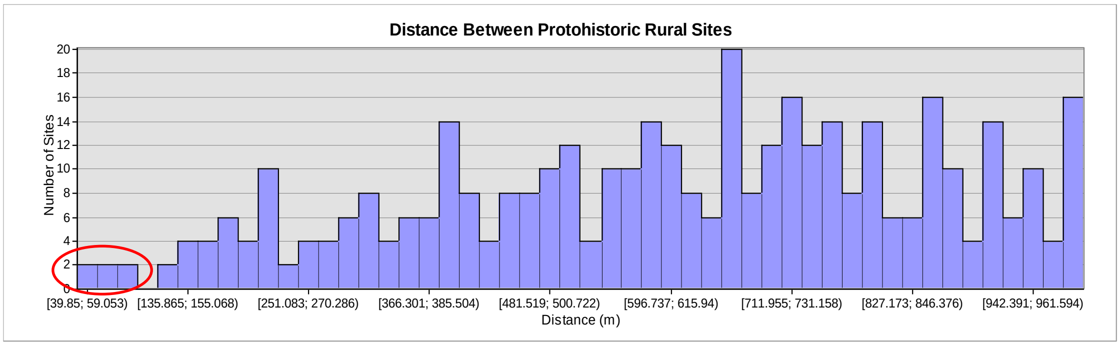


Figure 7.15 Three histograms indicating the frequency of sites at increasing distances of separation, for Roman villas (top), Roman rural settlements (centre) and Protohistoric (Iron Age, Archaic and Etruscan; bottom). Red outline marks the significant close proximity sites

Duplicate entries across the different datasets were removed manually, as this provided the only way of checking the information associated with each data point. The primary datasets where duplicate entries occurred was between the two different formats of data in the Carta dell'Agro, although some duplicates also occurred between other data sources. While a manual process of data comparison was used, spatial analysis in ArcGIS was used to form the basis of record removal, utilising the 'Point Proximity' tool. This calculated a series of entries for points within the same feature class giving a proximity value between points (Fig. 7.15). Different analysis for rural settlements, villas and protohistoric sites provided different outcomes for site proximity. A relatively high frequency of close proximity sites for Roman villas indicated duplicate records for these prominent sites (Fig. 7.15 top) up to a distance of 74m. Fewer records of close proximity were recorded for Roman period rural settlements and Protohistoric rural settlements.

For the Roman villa sites a high frequency of records were noted in the proximity analysis (Fig. 7.15) with 78 proximity records located between 1.4m and 74.6m (These records indicate distances in both directions, so two sites in close proximity generate two entries). The frequency then drops to a count of two, and then rises in frequency for distances of 500m and above, representing the spacing between different villa sites more generally.

On this basis sites with spacing up to 74m were checked and one entry for each duplicate was removed from the database, ensuring a match in the temporal data for the remaining record. From a distance of 113m to 265m, each pair of sites was inspected to check the source material and verify whether a duplication had occurred, or whether two separate villa sites were represented. Duplicate sites were removed.

A similar method was used to assess the proximity of Roman rural settlements, and protohistoric rural settlements. In these instances, very few sites indicated duplication, with two Roman rural records being removed, and one protohistoric rural record also being removed. All other entries of relatively close proximity represented different sites in the primary records, mainly from the Carta Bibliografica and the South Etruria Survey points.

The proximity analysis facilitated the identification of the records through the search function, and data for these records could then be compared in Access, identifying records using their unique ID number. Where duplicate records were identified entries were removed, and where sites were identified as having separate entries from their original data source, these were retained.

7.3.2 Site Proximity and Site Dimensions

A possible conflict was noted in this method of identifying duplicates. While the proximity analysis histograms (Fig. 7.15) seem to quite clearly identify the distances where duplicate records occur, as the distances increase, variations occur on the basis of the period classification of sites. The distance between possible Roman villa sites is greater than those for the proximity of Neolithic and Eneolithic records. These differences potentially relate to the nature of the records and the type of site they represent, and therefore the scale and dimensions of ssettlements of different periods need to be considered.

7.3.2.1 Neolithic and Eneolithic Sites

For the few Neolithic and Eneolithic sites excavated in the study area the nature of settlement is of small nucleated groups of structures and material, but with dispersed centres of material. The Neolithic to Bronze Age site of Le Cerquete-Fianello on the Maccarese Plain demonstrates this, with the main excavated area indicating a concentration of hut structures and associated features (Fig. 7.16) but with dispersed sites up to 1500m distant from the excavated area (Manfredini 2002 40). Dispersed material is also demonstrated by the site of Tor Spaccata (Anzidei et al. 1985, 105) with Late Neolithic through to Bronze Age material dispersed in a number of concentrations along up to a kilometre of landscape. These dispersals indicate the diverse nature of the economy of Neolithic and Eneolithic societies in the study area, and may represent different dwelling and working sites, or use of different locations over a long period of time (Manfedini 2002). However, for this study, the Neolithic and Eneolithic sites in the dataset have been kept as individual sites to represent the variable nature of the settlement in the landscape.

Figure 7.16 Plan of the excavations (from Manfredini 2002, 48; Fig. 17) showing posthole structures

7.3.2.2 Bronze Age

From the second half of the 3rd millennium BC the archaeology seems to represent an essentially pastoral economy similar to that of the Eneolithic, with a change to more stable settlement in the later Bronze Age. Many of the Bronze Age sites in the study area relate to this later phase, and the foundation of settlement along ridges and on ground overlooking river valleys, for instance the site of Ficana (Fig. 7.17) and Castel di Decima (Fig. 7.18). While evidence may indicate that the distribution of it may indicate a single settlement, equally either several phases of habitation in different locations or different areas of the same settlement. Site of Ficana, for instance, revealed a centre of habitation from excavated evidence, but a broader distribution of ceramic material indicated a larger area of settlement. The largest possible diameter for the settlement at Ficana measures up to 900m from east to west. Similarly, at Castel di Decima a diameter of up to 500m may be demonstrated from the scatter of material.

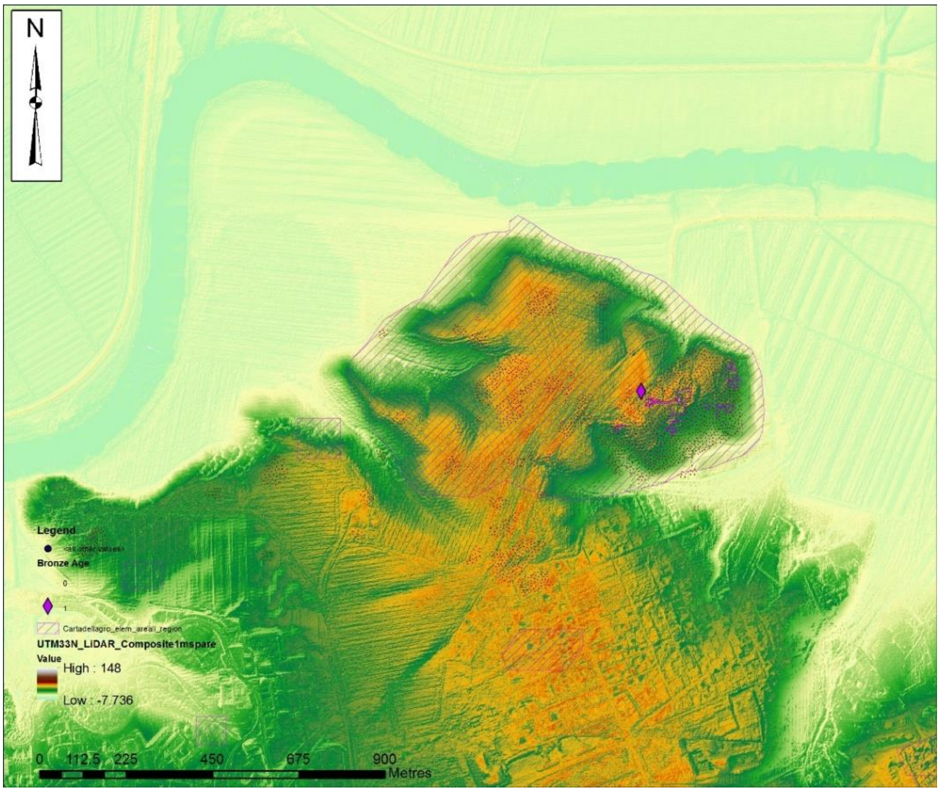


Figure 7.17 The landscape in the area of Ficana, indicating the Bronze Age site point, and the overall settlement area of the settlement

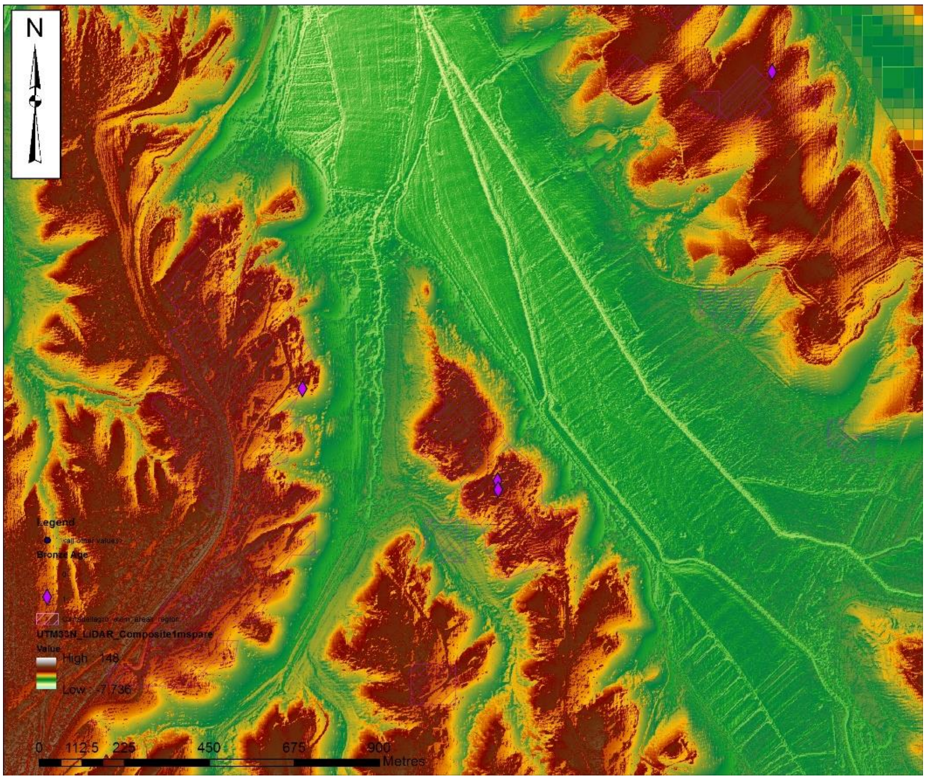


Figure 7.18 The landscape in the area of Castel di Decima, indicating the Bronze Age settlement sites, and the spread of settlement (centre) and later necropolis (west) along the hills overlooking the river valley

7.3.2.3 Roman Settlements: Castrum, Villa, Mansio

The variation in Roman settlement type provides a further consideration in dealing with duplicate sites and possible records related as one settlement. Firstly, a number of different site types exist, including nucleated settlement and villas, in addition to rural settlement in general. In addition, several Mansio sites are present in the dataset alongside roads in the Roman landscape. These represent road stations, but only four entries are present in the dataset. Thus, the principle issue in terms of site dimensions for the Roman period rests with villa sites and the rural settlement site, those associated with villas and otherwise.

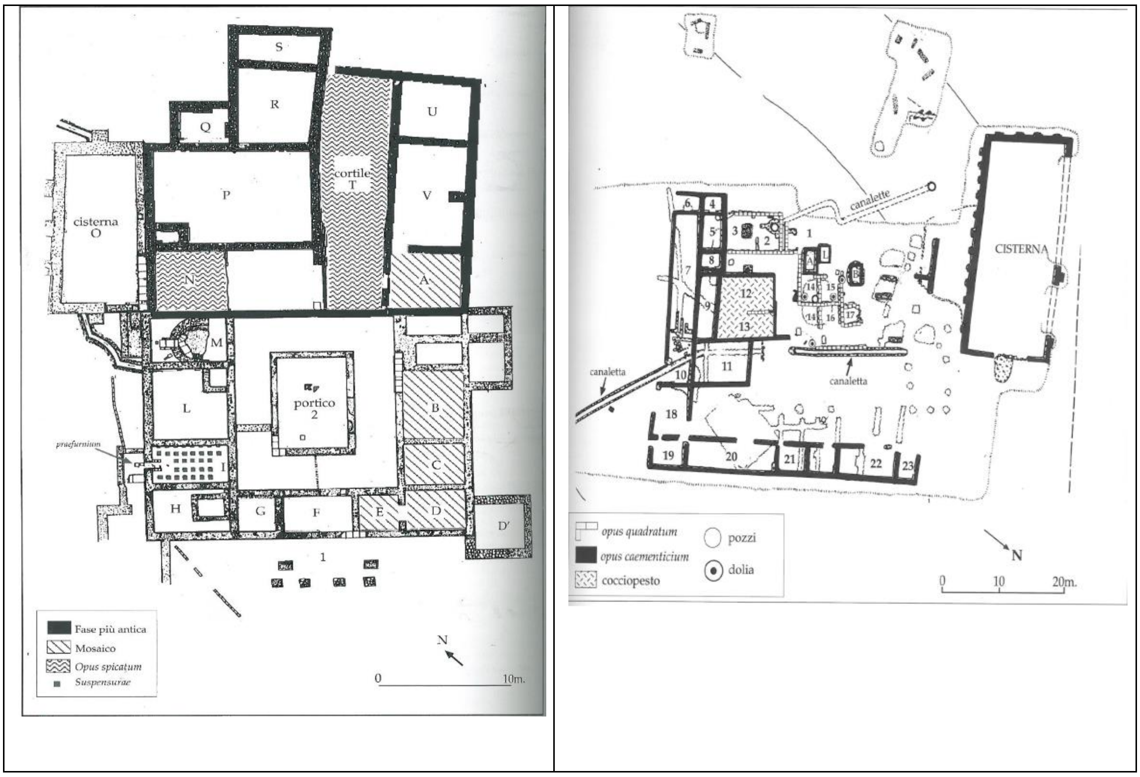


Figure 7.19 Plans of the villa complexes of Dragoncello Site F (left) and San Palomba (right) showing the extent of the main complexes, including cistern, outbuildings and work areas (De Franceschini 2007, 256; 269; Scarnicchia 1988)

Excavation records of different villa sites indicate the centre part of villa complexes measure between 80m and 100m (Fig. 7.19). These dimensions of the central complexes of villa sites, however, belie the greater extent of the settlement and its associated roads, drainage features and cemeteries. Some complexes extend over hundreds of metres (for instance villa complexes excavated at Vitinia and Torrino Mezzocammino) with recently excavated areas in the SITAR records showing the extent of agricultural landscapes associated with one villa covering several hectares. For the purposes of recognising duplication of villa sites in this study, the proximity analysis of the villas was used, together with LiDAR data and the existing polygon dataset for the Carta dell'Agro. In addition, measurements were taken for the location of tombs in close proximity of villa sites, and the villa landscape at Dragoncello was also utilised to assess the distance between sites. Finally, other landscape studies incorporating Roman villas were referred to (Franceschini 2005; Jeneson, 2013). These all seemed to indicate that the extent of the villa complex would be 200-300m across. The proximity analysis indicated that villa sites over 113m apart required assessment as to whether they represented the same site. In assessing the nature of villas in the dataset it was found that sites with proximity of 265m and above did not represent any duplication of site.

7.3.3 Data Classification

A further area for consideration is the number of sites that do not represent settlements in the study area, but instead provide contextual data for the landscape. A number of sites are identified indicating either tombs or necropolis associated with settlement, or areas of paving or scatters of material associated with roads and bridges, allowing a picture of the road networks in the Roman period to be established. Thus, maps of these datasets and some analysis provide a useful context for the pattern of settlement.

Site Type	Number	Percent
Acqueduct	5	0.22%
Baths	1	0.04%
Borg	1	0.04%
Bridge	27	1.19%
Casale	3	0.13%
Castrum	2	0.09%
Cave	40	1.77%
Church	6	0.26%
Cippus	5	0.22%

Cistern	1	0.04%
Cuniculum	18	0.79%
Dovecot	1	0.04%
Drainage Feature	16	0.71%
Findspot	25	1.10%
Flint Scatter	5	0.22%
Fountain	80	3.53%
Gateway	11	0.49%
Mansio	4	0.18%
Mill	1	0.04%
Nucleated Site	5	0.22%
Nympheum	2	0.09%
Outpost	3	0.13%
Port	9	0.40%
Road	70	3.09%
Rural Settlement	874	38.57%
Sanctuary	3	0.13%
Spring	3	0.13%
Temple	2	0.09%
Tomb	127	5.60%
Tower	35	1.54%
Unknown	602	26.57%
Villa	246	10.86%
Walls	29	1.28%
Working Site	4	0.18%
Total	**2266**	**100.00%**

Table 7.5 Original classification of sites by type

The original system of classification was derived in a relatively ad hoc manner, as data from different sources was entered into the datbse and different categories of site were recognised and established. The integrated dataset, however, when reviewed on the basis of type classification showed that some of the types could be amalgamated to improve the categorisation. The amalgamation of types is discussed above. However, the final list of classifications removed any records that post-dated the study period (churches, casale) and any superfluous entries associated with structures or complexes that were not adequately represented in the dataset or were deemed of limited use in comparison with the pattern of settlement and land use being analysed (mill, gatehouse).

Site Type	**Number**
Acqueduct	5
Baths	1
Bridge	25
Cave	40
Cippus	5
Cuniculum	18
Drainage Feature	16
Findspot	23
Flint Scatter	5
Mansio	4
Nucleated Site	8
Nympheum	2
Outpost	3
Port	9
Road	70
Rural Settlement	858
Sanctuary	3
Temple	2
Tomb	127
Tower	35
Villa	165
Walls	29
Working Site	4
Total	**1457**

Table 7.6 Reclassified types of site

The reclassified types (Table 7.6) provided a more functional series of site type, with the emphasis of settlement sites (Nucleated sites, villas, rural settlement) using the remaining classifications for comparative evidence.

7.3.4 Removal of Unknown Data Records

The quality of some datasets, for instance the Carta per la Qualità (Comune di Roma, 2002) provided no archaeological or temporal information, giving a location of a concentration of archaeological remains. Points derived from data with no information on the type of site required removal from the revalidated dataset, as they provided no real substance in terms of the archaeology, although these points were utilised to provide an idea of general density of archaeological material for the study area.

A significant proportion of the records for the study area (Fig. 7.20) at 48% contained no reference to a particular period, instead only carrying descriptions of general concentrations of ceramic fragments.

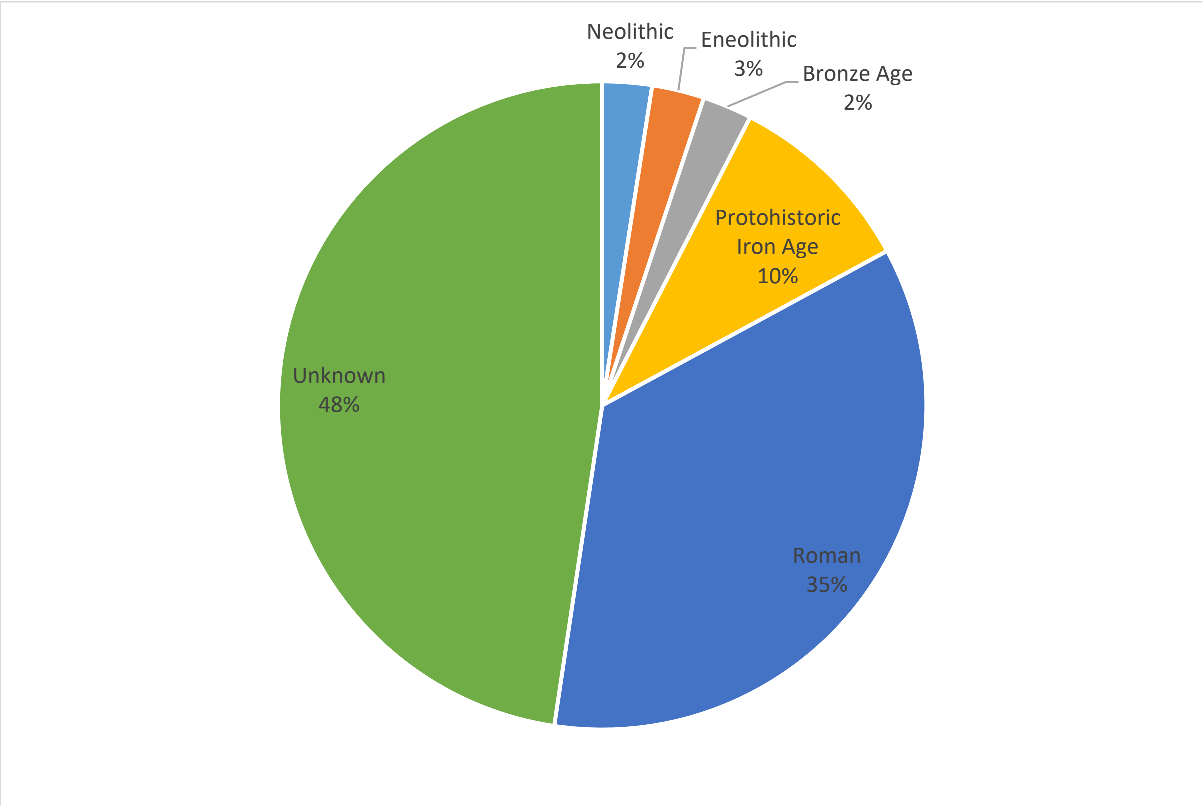


Figure 7.20 Total of sites of known and unknown date or period (total 1457)

While these were of limited use temporally, they added more general records of rural settlement for the study area and thus were retained in the overall database, with analysis based on each period relying on the sub-sets of different sites with definite chronological data.

7.4 The Revalidated and Reclassified Dataset

The revalidated and reclassified dataset reduced the number of records, whether duplicates, records of unknown period or type, from 2266 records down to 1457. Of these all belonged to a classification of site type, and 763 of the records had an indication of period of site occupation (Fig. 7.21). Of these the most significant number were Roman in date (67%) followed by those of Protohistoric Iron Age classification (18%) with 5% each representing the proportion of Neolithic, Eneolithic and Bronze Age sites.

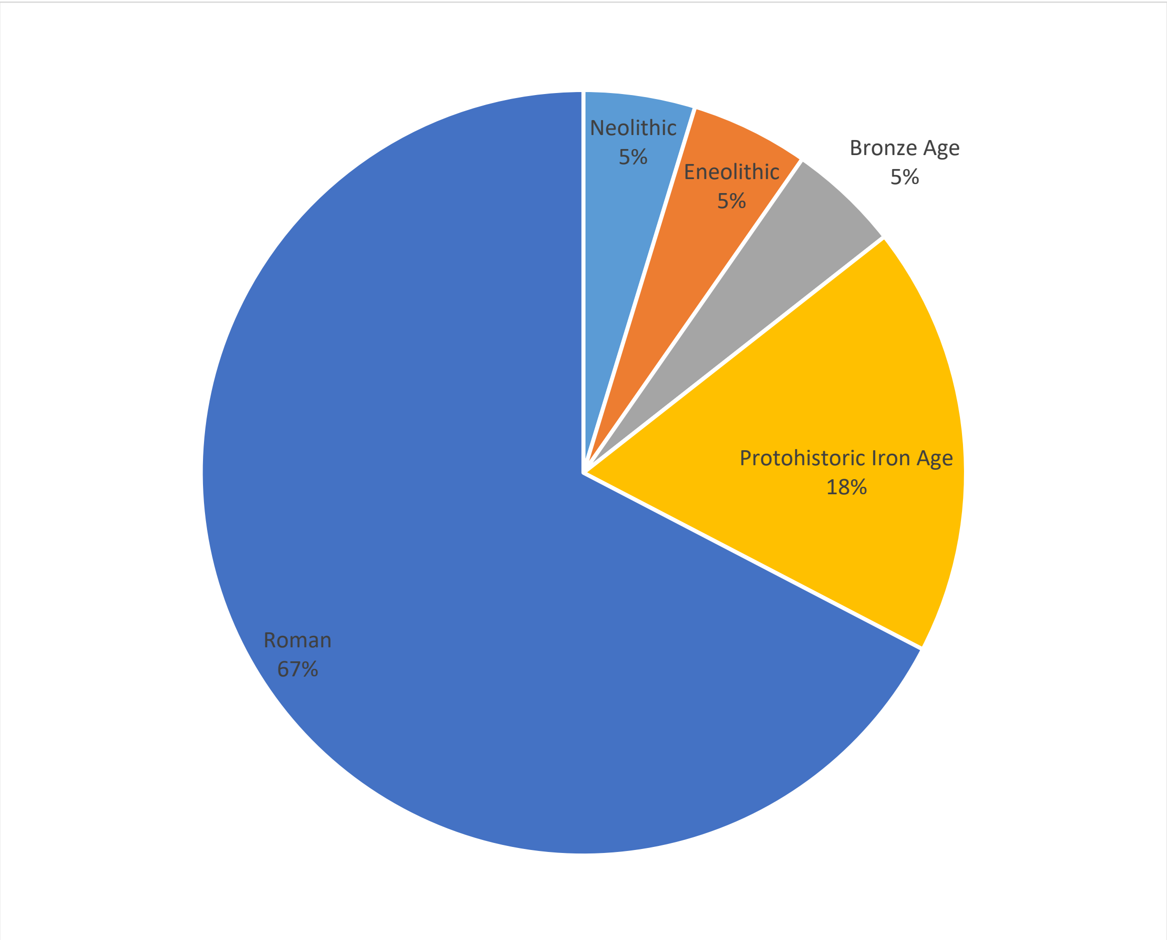


Figure 7.21 Percentage of sites of known date (total 763)

By site type, the most significant grouping is that of ‘Rural settlement’ at 58.9% (Fig. 7.22), followed by villa (11.3%), tomb (8.7%) and road (4.8%). The broad categorisation for ‘Rural Settlement’ underlies this significant proportion. Villa sites, on the other hand, are generally very clearly defined in the archaeological record. The tomb and road entries, indicating any form of burial (tombs, necropolis, sepulchre) and road material (basalt blocks, paving, stretches of road) serve for comparison with the general distribution of settlement.

Within the broad Protohistoric and Roman periods in the dataset, a number of sites provided a more nuanced indication of the dates of settlement. These give some indication of activity from 7th century BC to 6th century AD. This data stems from the greater granularity of some of the sources. For example, the sites from the South Etruria Survey indicate precisely the form and type of ceramic, inferring phases of settlement for the sites. Entries for the Carta Bibliografica, taken from the Formae Italiae entries also indicate centuries of settlement, as do the researched sites and entries from SITAR. Thus, an indication of settlement by century for villa sites, rural sites and other sites can be derived (Figs 7.23 and 7.24). The frequency of sites for villas and rural settlement seem to broadly correlate as the numbers increase and decrease. The relatively low numbers of ‘other’ sites do not show any great variation. The numbers indicate a general level of settlement in the 7th to 5th centuries BC for the study area, with an increase in villas and rural settlement from the 4th century BC to 1st century BC. There is a significant increase from 1st century AD onwards, then a decline in numbers from 4th century AD onwards. While this change may indicate a decrease in rural settlement in the 5th and 6th centuries AD, this trend may be an artefact of the nature of identifiable ceramic material demarcating the presence of sites. In this period more of the identifiable high status imported wares were sent to high status villa sites, and thus their absence elsewhere may not necessarily indicate an absence of lower status settlements. While this potential bias is recognised, its resolution falls outside of the scope of this research.

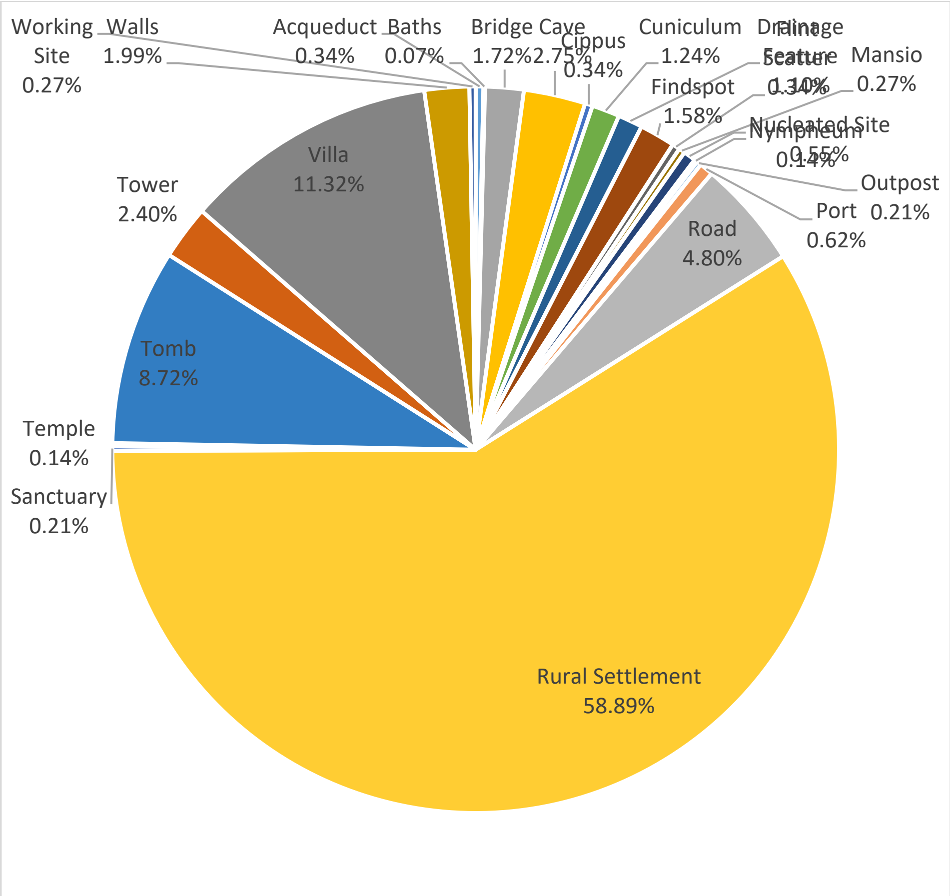


Figure 7.22 Percentage of sites by type based on the reclassified values

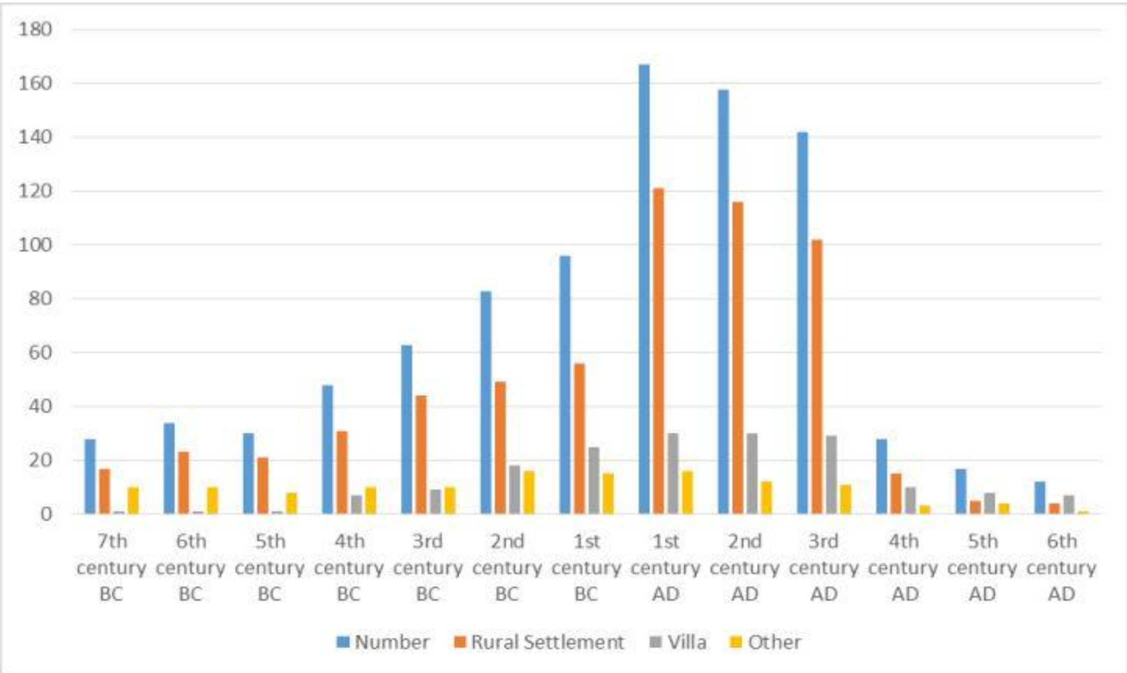


Figure 7.23 Number of sites by period from 7th century BC to 6th century AD where classified (total 906)

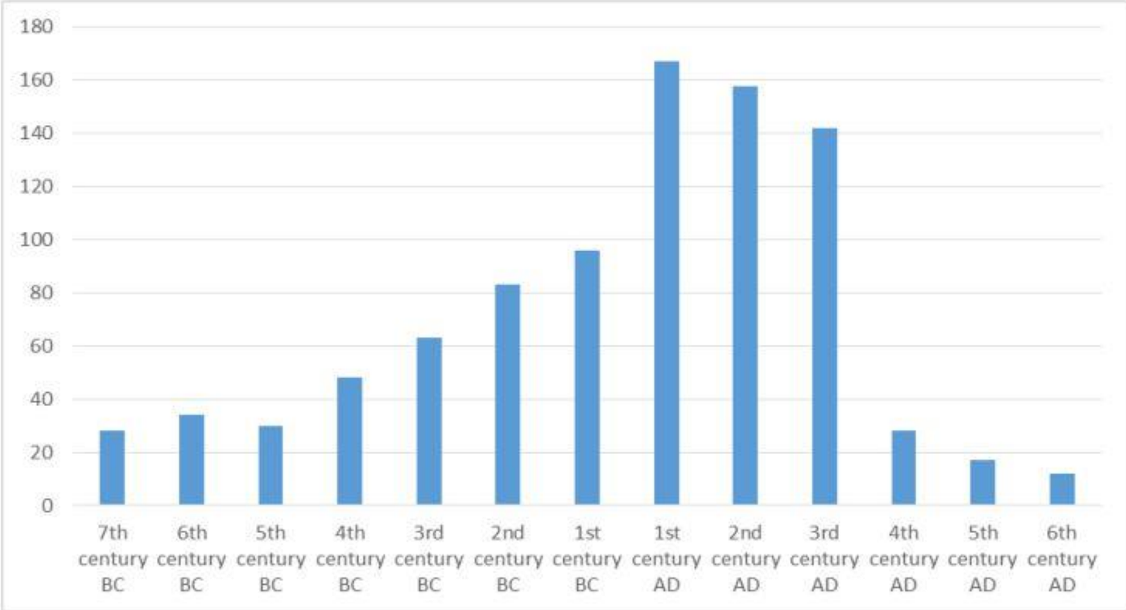


Figure 7.24 Villa sites by period from 7th century BC to 6th century AD where classified (total 176)

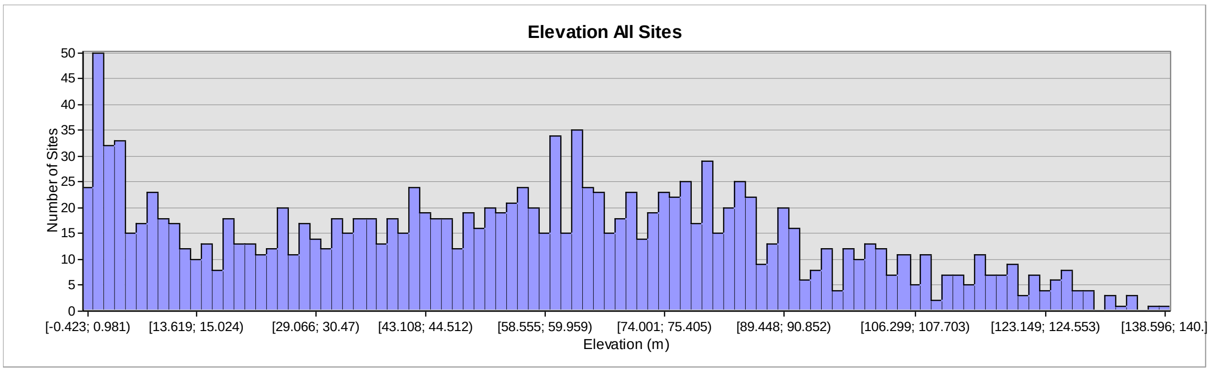


Figure 7.25 Range of sites by elevation for all sites (total=1457)

The revalidated and reclassified dataset of point-based site locations conflated 2266 original records down to 1460 providing a dataset with greater integrity in terms of the nature of site type and period. While the point-based data provides an integral part of the analysis of the pattern of settlement in the study area, and the potential for greater insight into the location of settlements based upon the topography, geology and land use of the landscape, it carries with it a number of caveats. These include the variability of the data ranging across so many different data sources and the continuing variable nature of the temporal resolution of the data. It is apparent that the greater granularity for the study area comes from the evidence from published excavations and fieldwork, and the greater spatial details of other data sources, including geophysical survey results and interpretation of air photographs and satellite imagery. In order to focus on the delta and surrounding topography, and to incorporate the point-based data and these other resources, the distribution of both the database sites and field survey data was used to indicate two case areas for focused study. On the basis of the data and the distribution of sites from different periods, an area of 13,500 hectares was derived across the Maccarese Plain, incorporating the Neolithic and Eneolithic site of Le Cerquete Fianello, and the prehistoric sites overlooking the delta to the east. A second case area of 17100 hectares was also selected focusing on the central delta and river floodplain and incorporating the locations of Ficana and Ostia.

7.5 Conclusion

The reclassified and revalidated dataset for the study area provides an extensive, low resolution, coverage for the archaeological material in the lower Tiber floodplain and delta, and for the surrounding hillslopes and zones adjacent to the wetland. The extensive nature of the area facilitates some statistical analysis of the location of different settlements for the periods covered in this research. This analysis in turn provides data for comparison with the material from the two case areas, incorporating more intensive study of the pattern of settlement for the different periods.

The extensive dataset is crucial to the reassessment of the pattern of settlement and its relationship to the landscape across different forms of geology, land use and topography. The reclassified dataset and forms the core of the extensive analysis of settlement distribution, in addition to the detailed analysis of two case areas, presented in Chapter 8.

Chapter 8 : Settlement and Land Use in the Tiber Delta

8.1 Introduction

Analysis of the pattern of settlement and land use is presented in this chapter, based on the GIS coverages and revalidated and reclassified archaeological database of sites for the overall study area. Results of intensive data analysis for two case study areas are then presented, providing greater spatial detail and nuance for use of the Tiber floodplain, delta and the areas overlooking the delta.

The analysis of the pattern of settlement in relation to the topography, drainage and land use of the study area is designed to explore the relationship between known archaeological sites and a number of key parameters associated with their location and their immediate environs. This addresses in part the aim to reassess the patterns and dynamics of settlement continuity and change, especially in relation to the nature of the topography and the model of land use for the area. Comparing the settlement pattern for the different periods in relation to several parameters will provide an assessment of which parameters of topography, drainage, slope, aspect and land use that may have provided optimal conditions for settlement and resource exploitation. The analysis will also investigate possible models of spheres of influence around settlements, and how these compare to resources.

The second part of this chapter focuses on two case areas within the overall study area, deepening the approach to settlement and land use through the archaeological record and associated datasets for these sections of landscape. With modelling of data in the GIS providing one approach to analysis of settlement, it seems key to also analyse the detail for these areas to provide a counterpoint with the GIS analysis. This second component will draw on LiDAR, air photographic and satellite image evidence together with the results of geophysical survey to complement the broader analysis and provide nuance to the interpretation of the human ecology for the areas in question.

Section 8.2 analyses the extensive dataset in terms of the pattern of settlement, including association with the forms of site elevation, aspect, slope, drainage and land use. Section 8.3 investigates the dataset in terms of period-specific analysis, for the Neolithic and Eneolithic, Bronze Age, Protohistoric and Roman periods, including assessment of the areas exploited by individual settlements, and their proximity to infrastructure such as roads.

Section 8.4 analyses the distribution of archaeology, incorportating the extensive data with evidence from published excavations, geophysics and remotely sensed imagery, for comparison with the environmental data. Finally, Section 8.5 provides concluding points. These will be used for comparison with other data from projects in the region in Chapter 9.

8.2 Pattern of Settlement

While the pattern of sites relating to different topographic and drainage variations can be seen in the GIS and the charts derived from the data, a Chi-squared test was applied to measure the association of sites with terrain types and proximity to resources (Shennan 1997, 104). The formula:

$$\chi_c^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

Where O=observed sites, E= expected sites are subtracted, and the value squared, then divided by the number of expected sites, indicates a value that can then be assessed against a table of percentage points (see Shennan1997, Table F) based on the level of significance (**α**) and the degrees of freedom (v, represented as the number of classifications minus 1; k-1).

While the overall area of the study area is utilised for images, the effects of measuring the distribution of sites chosen using a specific area avoiding the area around Rome meant that areas of key classificications had to be recalculated using the same area that was used to select the sites. Using the totality of the study area would lead to a skewing of the calculations for the Chi-squared test and the number of expected sites by percentage of classified areas. Thus, for the Chi-squared test, the percentage areas of geology, land use, slope, aspect, elevation and drainage, road and other buffer areas were recalculated to match the selection area and prevent skewing.

8.2.1 Site Location and the Topography

The topography of the study area provides one of the most important factors in the potential location and distribution of archaeological sites. Factors including the elevation and aspect of the immediate terrain may provide key reasons for the location of a settlement (Jeneson 2013, 186), in addition to other factors. These factors are especially important for the Lower Tiber and delta, as on the basis of the modern topography sites are located in a range of elevations from 6m below sea level up to 148m asl. Thus, the analysis of distribution and association with the topography provides some indication of the factors involved in the location of settlement. It is important to remember, however, the caveat that other significant factors may contribute to settlement location, as explored in the following sections.

8.2.2 Site Elevation

Analysis of the elevation of sites from different periods, and the total number of sites and rural settlements, was conducted to ascertain any pattern in terms of their distribution. In general, the number of sites, rural settlements, Roman rural settlements and villas all seem to show a distribution across all elevations across the study area, with sites occurring on the Tiber floodplain and wetland, and also in the more elevated reaches of the hills and ridges of the Roman Campagna (Figs 8.1 and 8.2). The measure of association for sites relating to the elevation of the terrain was calculated for all sites (total 1457), all rural settlements (total 858), Roman rural settlement (total 238, Roman villas (total 165), and Protohistoric (total 87), Bronze Age (total 36), Eneolithic (total 38) and Neolithic (total 36) settlement. A Chi-squared test was utilised to assess the level of association between sites and the area covered by the different elevation ranges.

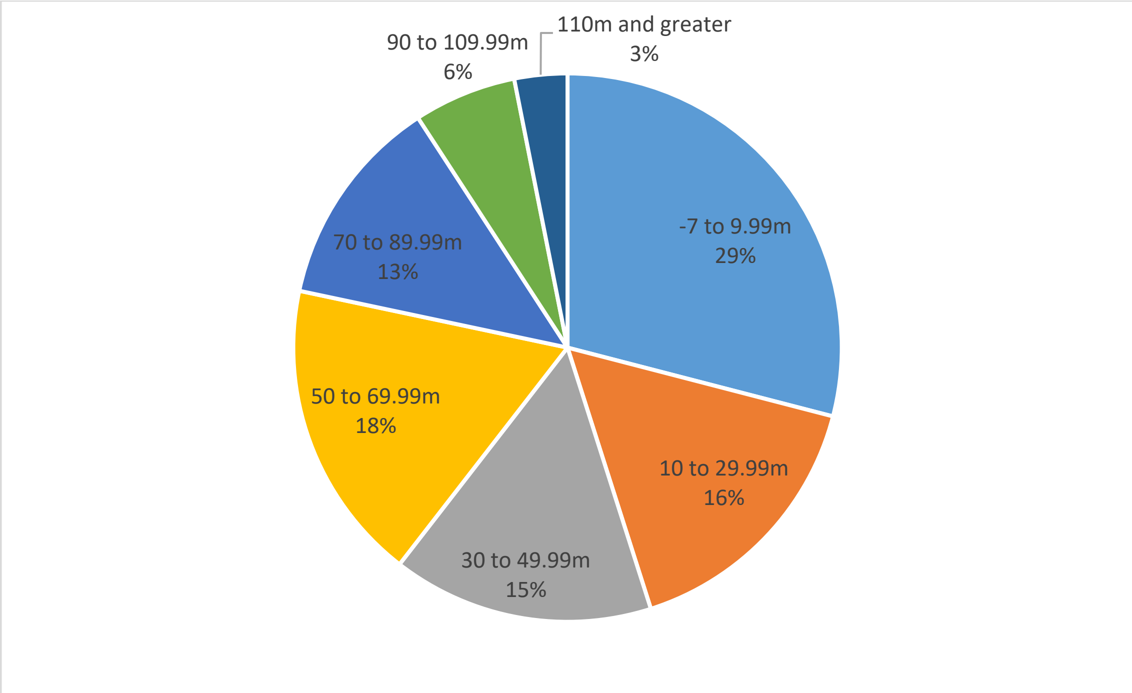


Figure 8.1 Pie chart of the number of sites distributed across the ranges of topographic elevation

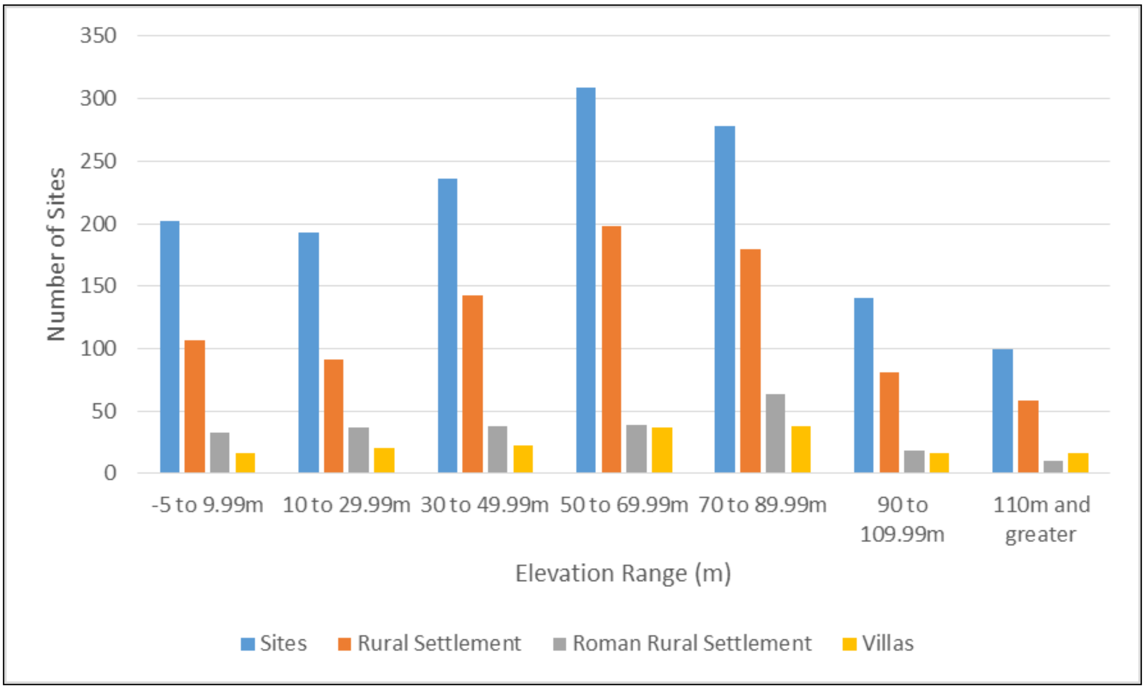


Figure 8.2 Bar chart of the number of sites, rural settlement, Roman rural settlement and Villas by category in the different ranges of elevation

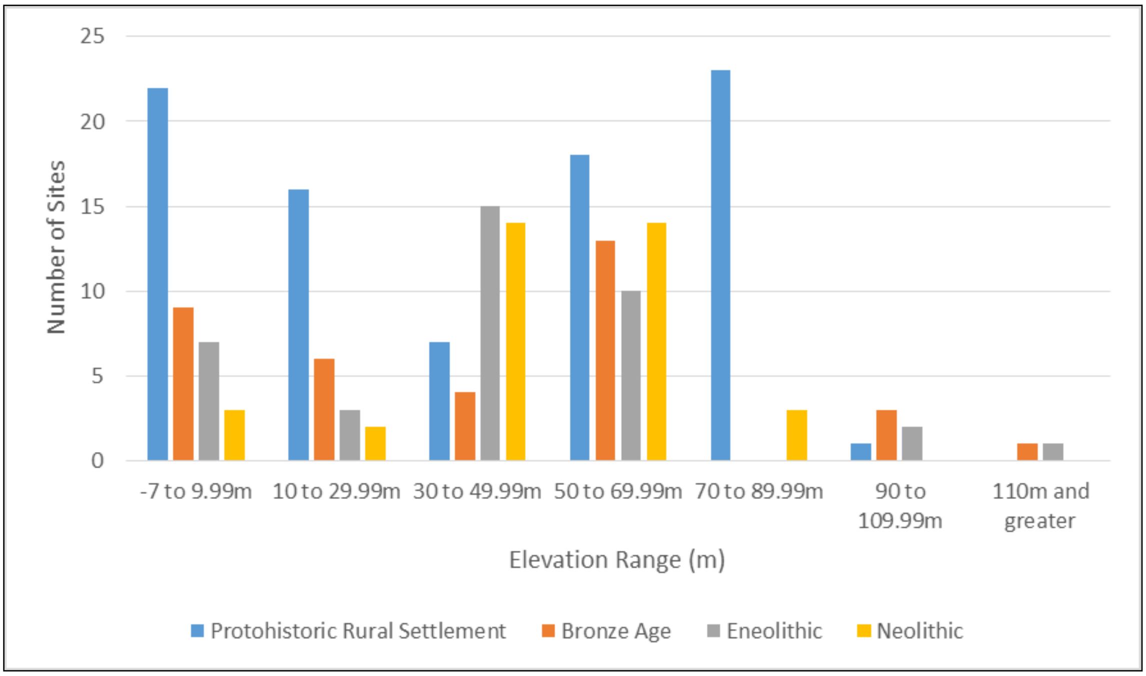


Figure 8.3 Bar chart of the number of Protohistoric, Bronze Age, Eneolithic and Neolithic settlements by category in the different ranges of elevation

The measure of association for sites relating to the aspect of the terrain was calculated for all sites (total 1457), all rural settlements (total 858), Roman rural settlement (total 238, Roman villas (total 165), and Protohistoric (total 87), Bronze Age (total 36), Eneolithic (total 38) and Neolithic (total 36) settlement.

For the association with ranges of elevation the hypotheses established were:

H0: Settlements are equally distributed across classifications of elevation

H1: Settlements are not equally distributed across classifications of elevation

The test was carried out for the different periods of settlement across seven ranges of elevation. Results of the test (Tables 8.1-8.5) indicate that, for all types of settlement by period with the exception of Bronze Age settlement, the calculated Chi-squared value is greater then the threshold (Table 8.5), and thus the null hypothesis of equal settlement distribution across the classification areas can be rejected.

Elevation	%	Sites Expected	Sites Observed	χ2	RS Expected	RS Observed	χ2
-5 to 9.99m	29.03%	423	202	115.49	249	107	81.07
10 to 29.99m	16.05%	234	193	7.14	138	91	15.85
30 to 49.99m	15.41%	225	236	0.59	132	143	0.88
50 to 69.99m	17.83%	260	309	9.34	153	198	13.26
70 to 89.99m	12.50%	182	278	50.56	107	180	49.42
90 to 109.99m	6.06%	88	140	30.28	52	81	16.18
110m and greater	3.12%	45	99	62.96	27	58	36.38
Total	**100.00%**	**1457**	**1457**	**276.35**	**858**	**858**	**213.04**

Table 8.1 Chi-squared test data associated with elevation for the overall sites and rural settlements for the study area

Elevation	%	RS Roman Expected	Roman Rural Settlement	χ2	Villas Expected	Villas	χ2
-5 to 9.99m	29.03%	69	33	18.86	48	16	21.25
10 to 29.99m	16.05%	38	37	0.04	26	20	1.59
30 to 49.99m	15.41%	37	38	0.05	25	22	0.46
50 to 69.99m	17.83%	42	39	0.28	29	37	1.96
70 to 89.99m	12.50%	30	63	37.20	21	38	14.66
90 to 109.99m	6.06%	14	18	0.89	10	16	3.60
110m and greater	3.12%	7	10	0.89	5	16	22.85
Total	**100.00%**	**238**	**238**	**58.20**	**165**	**165**	**66.36**

Table 8.2 Chi-squared test data associated with elevation for Roman rural settlement and Roman villas for the study area

Elevation	%	RS Protohistoric Expected	Protohistoric Rural Settlement	χ2	RS BA Expected	RS BA	χ2
-5 to 9.99m	29.03%	25	22	0.42	10	9	0.20
10 to 29.99m	16.05%	14	16	0.30	6	6	0.01
30 to 49.99m	15.41%	13	7	3.06	6	4	0.43
50 to 69.99m	17.83%	16	18	0.40	6	13	6.75
70 to 89.99m	12.50%	11	23	13.53	4	0	4.50
90 to 109.99m	6.06%	5	1	3.46	2	3	0.31
110m and greater	3.12%	3	0	2.72	1	1	0.01
Total	**100.00%**	**87**	**87**	**23.89**	**36**	**36**	**12.21**

Table 8.3 Chi-squared test data associated with elevation for the Protohistoric and Bronze Age rural settlements for the study area

Elevation	%	RS Eneolithic Expected	RS Eneolithic	χ2	RS Neolithic Expected	RS Neolithic	χ2
-7 to 9.99m	29.03%	11	7	1.47	10	3	5.31
10 to 29.99m	16.05%	6	3	1.57	6	2	2.47
30 to 49.99m	15.41%	6	15	14.28	6	14	12.88
50 to 69.99m	17.83%	7	10	1.54	6	14	8.96
70 to 89.99m	12.50%	5	0	4.75	4	3	0.50
90 to 109.99m	6.06%	2	2	0.04	2	0	2.18
110m and greater	3.12%	1	1	0.03	1	0	1.12
Total	**100.00%**	**38**	**38**	**23.68**	**36**	**36**	**33.42**

Table 8.4 Chi-squared test data associated with elevation for the Eneolithic and Neolithic settlements for the study area

	Sites (Total 1457)	RS (Total 858)	RS Roman (Total 238)	Villas (Total 165)	RS Protohistoric (Total 87)	Bronze Age (Total 36)	Eneolithic (Total 38)	Neolithic (Total 36)
χ2	276.35	213.04	58.20	66.36	23.89	12.21	23.68	33.42
a/r	12.592	12.592	12.592	12.592	12.592	12.592	12.592	12.592
k-1	6	6	6	6	6	6	6	6
α	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Table 8.5 Chi-squared calculations together with the accept/reject threshold for the test, by site type

The low-lying topography, while containing sites, indicates far fewer than what might be expected for all periods apart from the Protohistoric and Bronze Age (Fig. 8.3). For the Roman period fewer sites are located below 9.99m asl, with a greater number of sites than anticipated located over 70m asl. The lower than expected proportion of settlements below 9.99m might conceivably be due to the issues of visibility with archaeological sites on the floodplain and delta of the Tiber. Generally, while the distribution of sites across ranges of elevation is not even, sites from the Roman period are located across all classifications. The distribution is slightly less predictable for Protohistoric to Neolithic setlements (Fig. 8.3), with small numbers of Neolithic and Eneolithic sites below 30m, and a significant increase between 30m and 49.99m. By contrast Bronze Age sites show an increase in the range of 50m to 69.99m. Finally, Protohistoric sites show a significant increase for the range of 70m to 89.99m. This period seems to indicate a split between low-lying settlements and those over 70m. This perhaps indicates the presence of sites exploiting low-lying resources, but an increase in nucleated settlements taking advantage of greater elevation. In summary the rejection of the null hypothesis for all period settlements apart for the Bronze Age indicates an uneven distribution, suggesting that elevation may play a part in the location of settlement, although the visibility of the archaeology in the Tiber floodplain and delta is a mitigating factor.

8.2.3 Slope

The measure of association for sites relating to the aspect of the terrain was calculated for all sites (total 1457), all rural settlements (total 858), Roman rural settlement (total 238, Roman villas (total 165), and Protohistoric (total 87), Bronze Age (total 36), Eneolithic (total 38) and Neolithic (total 36) settlement.The Chi-squared test was used to measure association (Section 8.1). The slope coverage was utilised, with classifications of 2 degrees from 0 (0 to 1.99, 2 to 3.99…) and values over 14 degrees. For the association with aspect the hypotheses established were:

H0: Settlements are equally distributed across classifications of slope

H1: Settlements are not equally distributed across classifications of slope

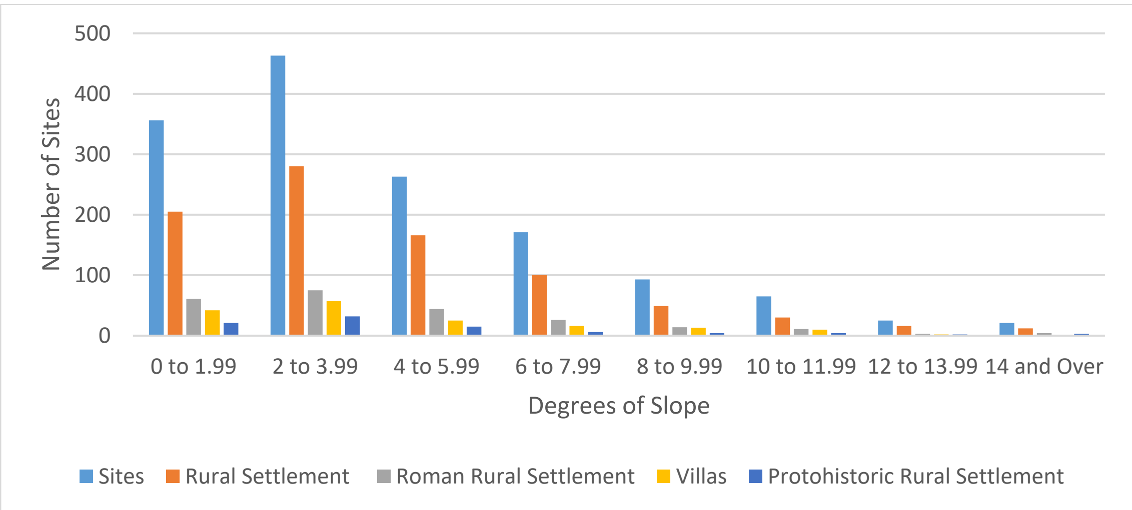


Figure 8.4 Bar chart of the number of sites, rural settlement, Roman rural settlement, Villas and Protohistoric settlement by category in the different ranges of slope

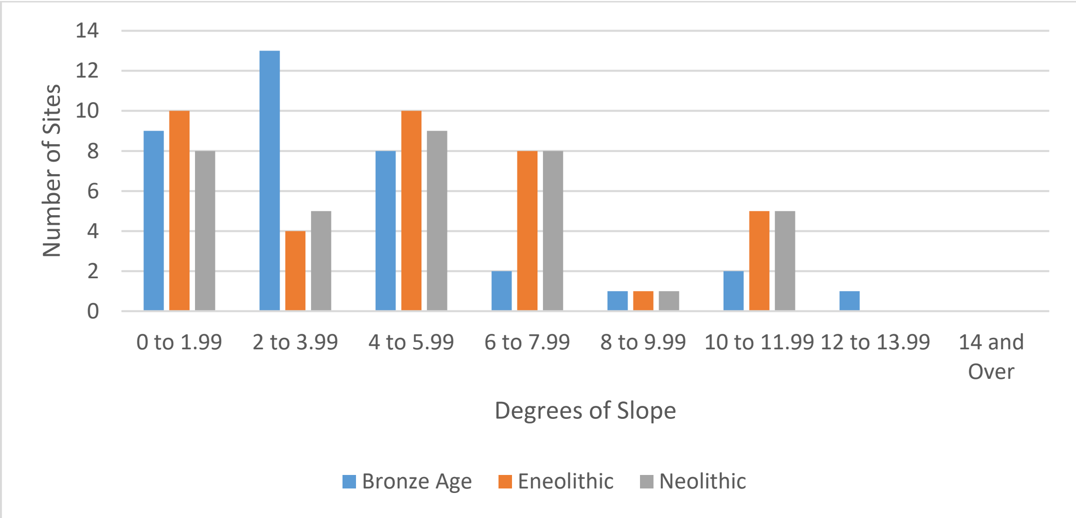


Figure 8.5 Bar chart of the number of Bronze Age, Eneolithic and Neolithic settlements in the different ranges of slope

Slope	%	Sites Expected	Sites Observed	χ2	RS Expected	RS Observed	χ2
0 to 1.99	53.04%	773	356	224.78	455	205	137.42
2 to 3.99	17.81%	260	463	159.50	153	280	105.80
4 to 5.99	11.53%	168	263	53.67	99	166	45.43
6 to 7.99	8.69%	127	171	15.56	75	100	8.68
8 to 9.99	4.03%	59	93	20.05	35	49	6.03
10 to 11.99	2.20%	32	65	33.94	19	30	6.58
12 to 13.99	1.22%	18	25	2.92	10	16	2.91
14 and Over	1.48%	22	21	0.01	13	12	0.04
Total	**100.00%**	**1457**	**1457**	**510.43**	**858**	**858**	**312.89**

Table 8.6 Chi-squared test data associated with slope in degrees for the overall sites and rural settlements for the study area

Slope	%	RS Roman Expected	Roman Rural Settlement	χ2	Villas Expected	Villas	χ2
0 to 1.99	53.04%	126	61	33.71	88	42	23.67
2 to 3.99	17.81%	42	75	25.07	29	57	25.93
4 to 5.99	11.53%	27	44	9.98	19	25	1.87
6 to 7.99	8.69%	21	26	1.37	14	16	0.19
8 to 9.99	4.03%	10	14	2.03	7	13	6.07
10 to 11.99	2.20%	5	11	6.36	4	10	11.20
12 to 13.99	1.22%	3	3	0.00	2	2	0.00
14 and Over	1.48%	4	4	0.07	2	0	2.44
Total	**100.00%**	**238**	**238**	**78.59**	**165**	**165**	**71.38**

Table 8.7 Chi-squared test data associated with slope in degrees for the Roman rural settlement and Roman villas for the study area

Slope	%	RS Protohistoric Expected	Protohistoric Rural Settlement	χ2	RS BA Expected	RS BA	χ2
0 to 1.99	53.04%	46	21	13.70	19	9	5.34
2 to 3.99	17.81%	15	32	17.57	6	13	6.77
4 to 5.99	11.53%	10	15	2.46	4	8	3.57
6 to 7.99	8.69%	8	6	0.32	3	2	0.41
8 to 9.99	4.03%	4	4	0.07	1	1	0.14
10 to 11.99	2.20%	2	4	2.28	1	2	1.85
12 to 13.99	1.22%	1	2	0.83	0	1	0.71
14 and Over	1.48%	1	3	2.29	1	0	0.53
Total	**100.00%**	**87**	**87**	**39.52**	**36**	**36**	**19.31**

Table 8.8 Chi-squared test data associated with slope in degrees for the Protohistoric and Bronze Age rural settlements for the study area

Slope	%	RS Eneolithic Expected	RS Eneolithic	χ2	RS Neolithic Expected	RS Neolithic	χ2
0 to 1.99	53.04%	20	10	5.12	19	8	6.45
2 to 3.99	17.81%	7	4	1.13	6	5	0.31
4 to 5.99	11.53%	4	10	7.20	4	9	5.66
6 to 7.99	8.69%	3	8	6.68	3	8	7.59
8 to 9.99	4.03%	2	1	0.18	1	1	0.14
10 to 11.99	2.20%	1	5	20.76	1	5	22.38
12 to 13.99	1.22%	0	0	0.46	0	0	0.44
14 and Over	1.48%	1	0	0.56	1	0	0.53
Total	**100.00%**	**38**	**38**	**42.10**	**36**	**36**	**43.50**

Table 8.9 Chi-squared test data associated with slope in degrees for the Eneolithic and Neolithic settlements for the study area

	Sites (Total 1457)	RS (Total 858)	RS Roman (Total 238)	Villas (Total 165)	RS Protohistoric (Total 87)	Bronze Age (Total 36)	Eneolithic (Total 38)	Neolithic (Total 36)
χ2	510.43	312.89	78.59	71.38	39.52	19.31	42.10	43.50
χ2 a/r	14.067	14.067	14.067	14.067	14.067	14.067	14.067	14.067
k-1	7	7	7	7	7	7	7	7
α	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Table 8.10 Chi-squared calculations together with the accept/reject threshold for the test, by site type

The Chi-squared test (Tables 8.6-8.10) indicates a rejection of the null hyothesis for all periods. The bar charts of settlement by period (Figs 8.4 and 8.5) indicate that the majority of settlements are located on terrain with slope of less than 8°, perhaps unsurprising given the need for reasonablly flat terrain certainly for large-scale settlement, and the wooded nature of the valley sides and hillslopes in the study area (see Section 8.2.6 below).

8.2.4 Aspect

Analysis of the correlation of sites with the aspect of terrain was conducted using the aspect coverage and the reclassified dataset for sites across the overall study area (Chapter 6). This was calculated for all sites (total 1457), all rural settlements (total 858), Roman rural settlement (total 238, Roman villas (total 165), and Protohistoric (total 87), Bronze Age (total 36), Eneolithic (total 38) and Neolithic (total 36) settlement.

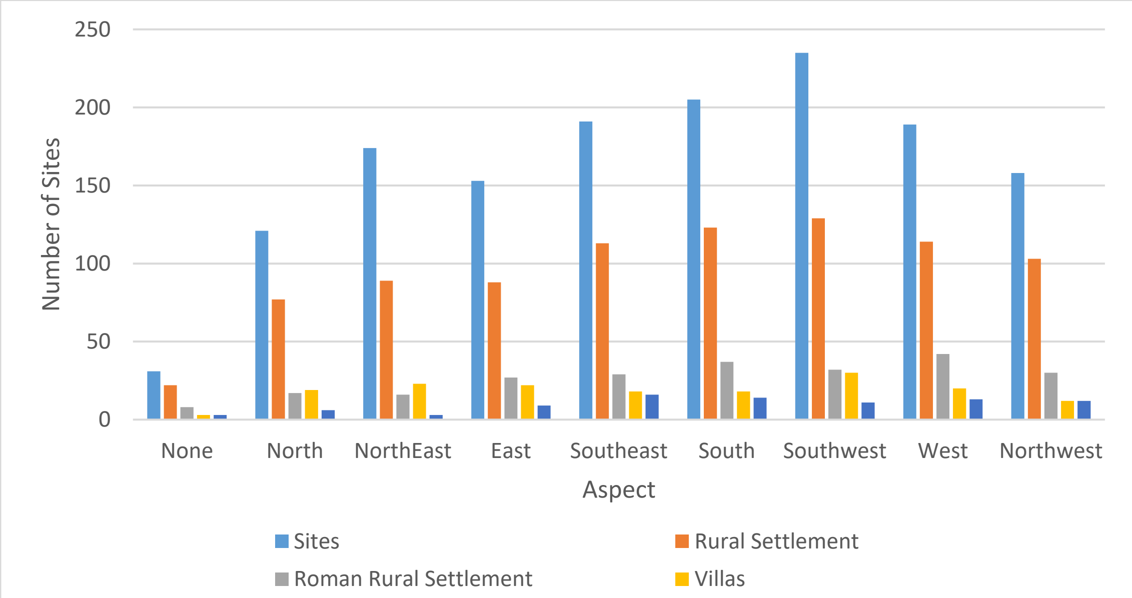


Figure 8.6 Bar chart of the number of sites, rural settlement, Roman rural settlement, Villas and Protohistoric settlement by category in the different ranges of aspect

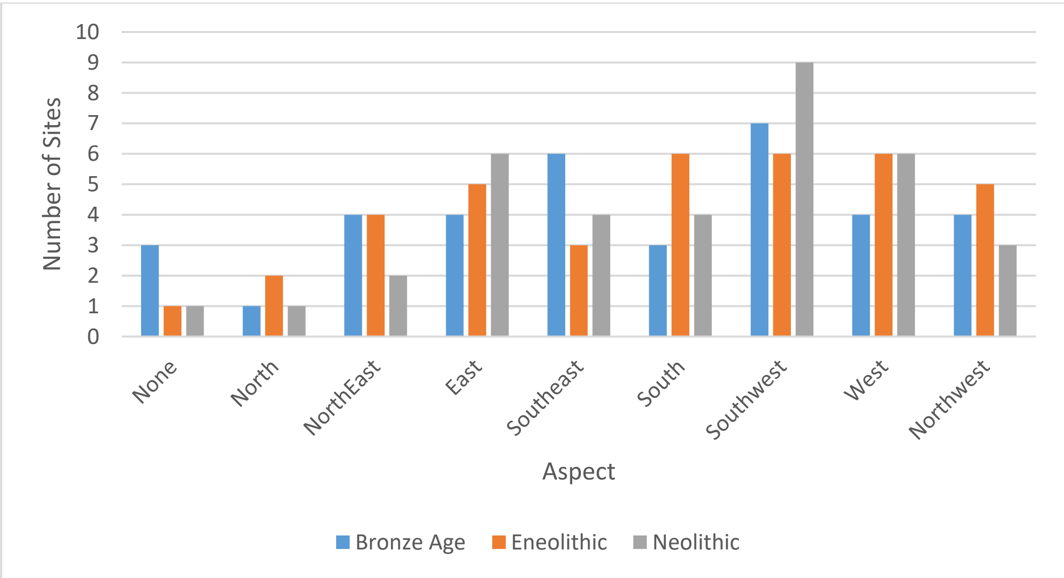


Figure 8.7 Bar chart of the number of Bronze Age, Eneolithic and Neolithic settlements in the different ranges of aspect

Broadly the distribution of sites by aspect seems to indicate greater site numbers for south-east, south and south-west facing aspects (Fig. 8.6) for sites, rural settlement ,and Roman rural settlement. A similar pattern seems to present itself with the Bronze Age, Eneolithic and Neolithic settlements (Fig. 8.7). However, to test whether these aspects were being preferred over others, it was necessary to test the level of association by classification area (Tables 8.11-8.15).

Aspect	%	Sites Expected	Sites Observed	χ2	RS Expected	RS Observed	χ2
None	0.83%	12	31	29.58	7	22	31.10
North	11.71%	171	121	14.39	100	77	5.47
NorthEast	11.34%	165	174	0.47	97	89	0.70
East	11.76%	171	153	1.96	101	88	1.65
Southeast	11.70%	170	191	2.48	100	113	1.59
South	13.26%	193	205	0.73	114	123	0.75
Southwest	13.89%	202	235	5.25	119	129	0.81
West	13.65%	199	189	0.48	117	114	0.08
Northwest	11.88%	173	158	1.31	102	103	0.01
Total	100.00%	**1457**	**1457**	**56.65**	**858**	**858**	**42.16**

Table 8.11 Chi-squared test data associated with aspect for the overall sites and rural settlements for the study area

Aspect	%	RS Roman Expected	Roman Rural Settlement	χ2	Villas Expected	Villas	χ2
None	0.83%	2	8	18.38	1	3	1.94
North	11.71%	28	17	4.23	19	19	0.01
NorthEast	11.34%	27	16	4.47	19	23	0.99
East	11.76%	28	27	0.03	19	22	0.35
Southeast	11.70%	28	29	0.05	19	18	0.09
South	13.26%	32	37	0.94	22	18	0.69
Southwest	13.89%	33	32	0.03	23	30	2.19
West	13.65%	32	42	2.79	23	20	0.28
Northwest	11.88%	28	30	0.11	20	12	2.95
Total	100.00%	**238**	**238**	**31.04**	**165**	**165**	**9.47**

Table 8.12 Chi-squared test data associated with aspect for the Roman rural settlement and Roman villas for the study area

Aspect	%	RS Protohistoric Expected	Protohistoric Rural Settlement	χ2	RS BA Expected	RS BA	χ2
None	0.83%	1	3	7.19	0	3	24.43
North	11.71%	10	6	1.72	4	1	2.45
NorthEast	11.34%	10	3	4.77	4	4	0.00
East	11.76%	10	9	0.15	4	4	0.01
Southeast	11.70%	10	16	3.33	4	6	0.76
South	13.26%	12	14	0.53	5	3	0.66
Southwest	13.89%	12	11	0.10	5	7	0.80
West	13.65%	12	13	0.11	5	4	0.17
Northwest	11.88%	10	12	0.27	4	4	0.02
Total	100.00%	**87**	**87**	**18.16**	**36**	**36**	**29.30**

Table 8.13 Chi-squared test data associated with aspect for the Protohistoric and Bronze Age rural settlements for the study area

The measure of association for sites relating to the aspect of the terrain was calculated for all sites (total 1457), all rural settlements (total 858), Roman rural settlement (total 238, Roman villas (total 165), and Protohistoric (total 87), Bronze Age (total 36), Eneolithic (total 38) and Neolithic (total 36) settlement. The Chi-squared test was used to measure association (Section 8.1). For the association with aspect the hypotheses established were:

H0: Settlements are equally distributed across all aspects

H1: Settlements are not equally distributed across all aspects

Aspect	**%**	**RS Eneolithic Expected**	**RS Eneolithic**	**χ2**	**RS Neolithic Expected**	**RS Neolithic**	**χ2**
None	0.83%	0	1	1.49	0	1	1.65
North	11.71%	4	2	1.35	4	1	2.45
NorthEast	11.34%	4	4	0.02	4	2	1.06
East	11.76%	4	5	0.06	4	6	0.74
Southeast	11.70%	4	3	0.47	4	4	0.01
South	13.26%	5	6	0.18	5	4	0.12
Southwest	13.89%	5	6	0.10	5	9	3.20
West	13.65%	5	6	0.13	5	6	0.24
Northwest	11.88%	5	5	0.05	4	3	0.38
Total	100.00%	**38**	**38**	**3.85**	**36**	**36**	**9.85**

Table 8.14 Chi-squared test data associated with slope in degrees for the Eneolithic and Neolithic settlements for the study area

	Sites (Total 1457)	**RS (Total 858)**	**RS Roman (Total 238)**	**Villas (Total 165)**	**RS Protohistoric (Total 87)**	**Bronze Age (Total 36)**	**Eneolithic (Total 38)**	**Neolithic (Total 36)**
χ2	56.65	42.16	31.04	9.47	18.16	29.30	3.85	9.85
χ2	15.50	15.50		15.50				
a/r	7	7	15.507	7	15.507	15.507	15.507	15.507
k-1	8	8	8	8	8	8	8	8
α	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Table 8.15 Chi-squared calculations together with the accept/reject threshold for the test, by site type

Results of the Chi-squared test (Table 8.15) indicate that, for the sites and rural settlements overall, the distribution is not even across types of slope aspect. Settlements for the Roman period are also not evenly distributed across all types of aspect, and sites for the Bronze Age and Protohistoric sites are similarly not evenly distributed. Results of sites for Roman villas, and the Eneolithic and Neolithic sites show even distribution across aspect types (Figs 8.8 and 8.9).

For the prehistoric sites in general the even distribution may be caused by the small sample sizes. Alternatively, the location of Neolithic and Eneolithic settlement in particular may be governed by proximity of resources or locations overlooking waterways and valley bottoms. The proximity of drainage features for accessing water and watering livestock may suggest that aspect of these sites is of a lower priority (see drainage below).

The lack of association for Roman rural settlement seems to be the result of preference for aspect facing south or south-west. A higher than expected number of Roman rural settlements are located on south-facing slopes (37 against an expected 32). While the calculation for Roman villas shows conformity with expected distribution, for south-west-facing slopes the number of observed sites against expected sites is 30 to 23, suggesting a greater number of villa sites than expected on these slopes. The position of Roman villas may also reflect the extent of farmed land by each site, with varying aspect represented over the total area being cultivated and exploited, with some crops requiring south-facing slopes and other forms of agriculture requiring pasture or woodland, on slopes of different aspect.

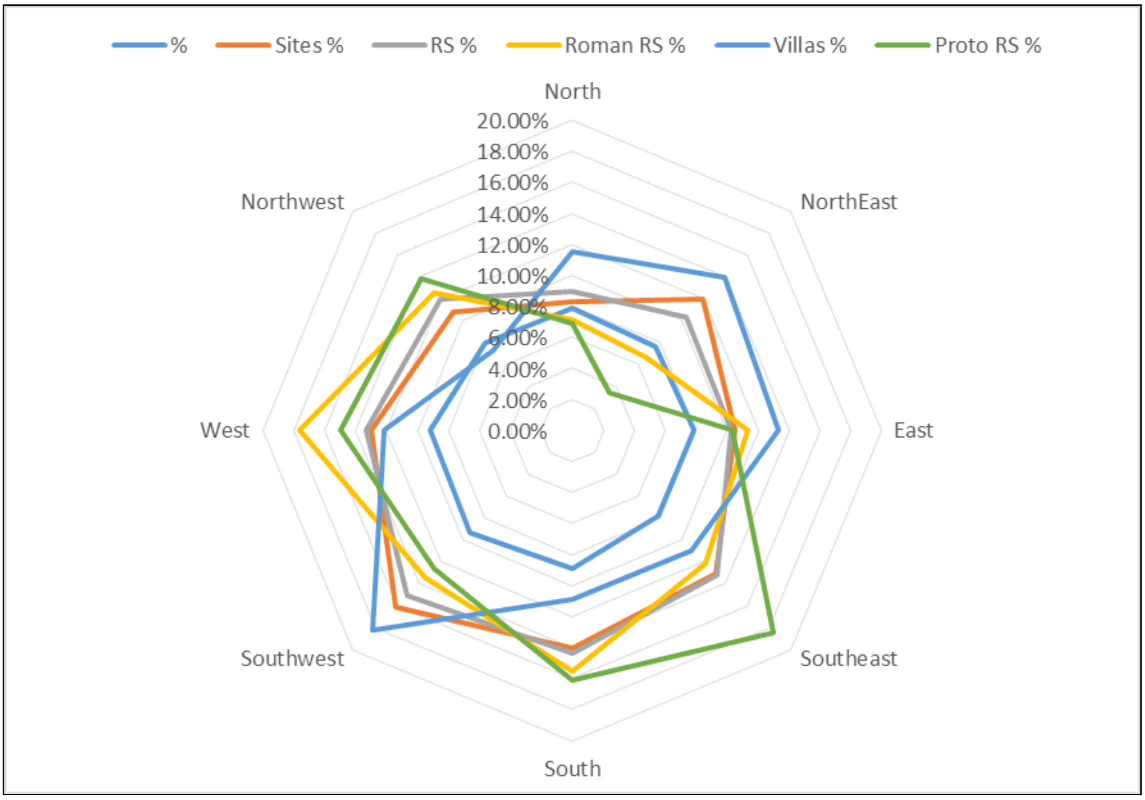


Figure 8.8 Spider diagram of sites by aspect, for sites, rural settlement, Roman settlements, villas and Protohistoric settlement

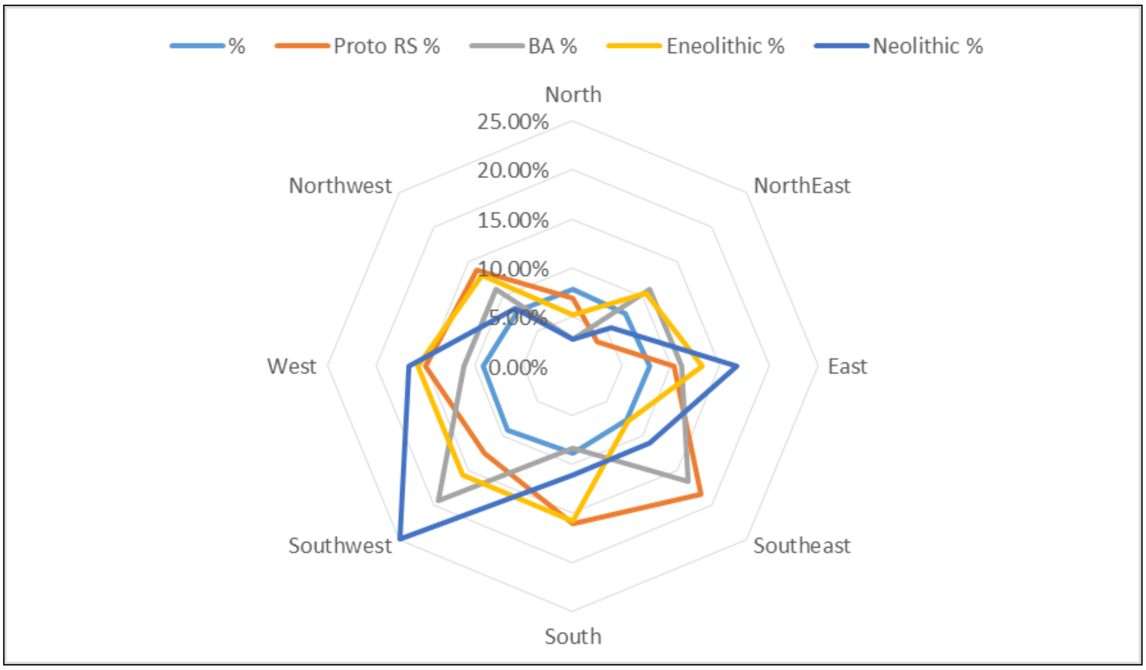


Figure 8.9 Spider diagram of sites by aspect, for Protohistoric and prehistoric settlements

Both Bronze Age and Protohistoric sites indicate a lack of association with aspect. A larger number of sites than expected are located on south-east and south-facing slopes in the Protohistoric period, with more on south-east and south-west slopes in the Bronze Age. Again, the small sample for this latter may affect the evaluation, together with the number of sites lovated on flat terrain and the lower than expected number located on north-facing slopes.

8.2.5 Site Location, Drainage and Flood Zone

Analysis of the settlement proximity to drainage and water was conducted utilising the reclassified and revalidated database of sites (Chapter 7, Section 7.3), and an edited version of the drainage polyline coverage for the study area. This latter had the modern drainage features of the Tiber delta and floodplain removed to leave the modern course of the Tiber and the natural drainage features. The potential extent of the Maccarese and Ostia lagoons was also added to the coverage. A Chi-squared test was applied to the data, calculated for all sites (total 1457), all rural settlements (total 858), Roman rural settlement (total 238, Roman villas (total 165), and Protohistoric (total 87), Bronze Age (total 36), Eneolithic (total 38) and Neolithic (total 36) settlement. The cumulative nature of sites and their proximity to water sources was not lost, and cumulative frequency charts were also produced.

The Chi-squared hypothesis was:

H0: Settlements are equally distributed across all areas of distance from drainage

H1: Settlements are not equally distributed across all areas of distance from drainage

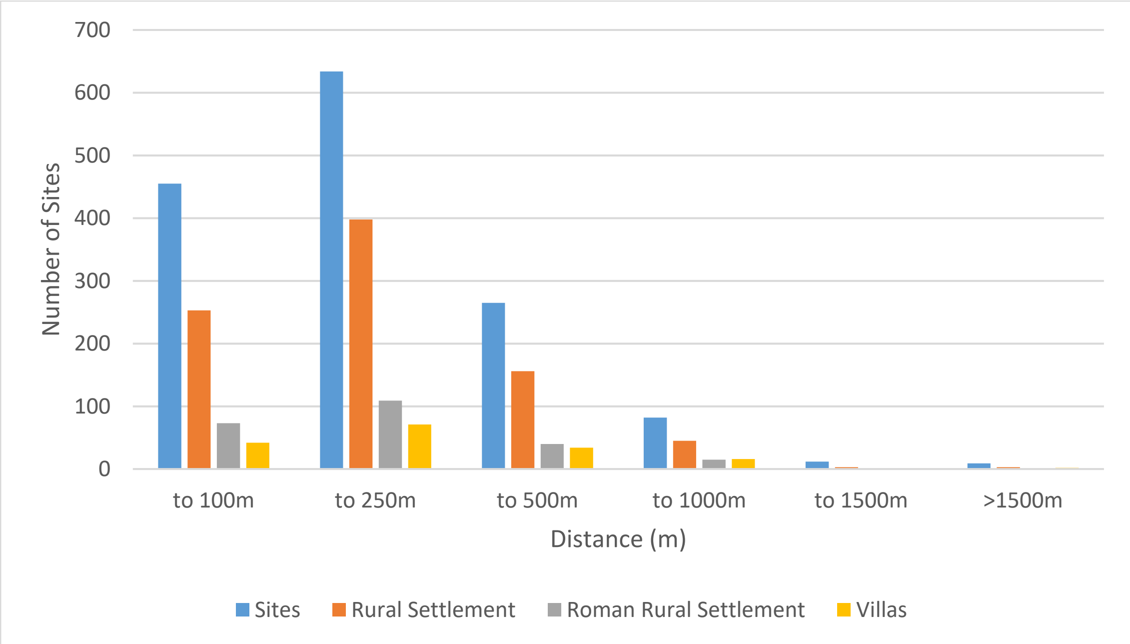


Figure 8.10 Number of sites, rural settlements, Roman settlements and villas by proximity to drainage for different classifications

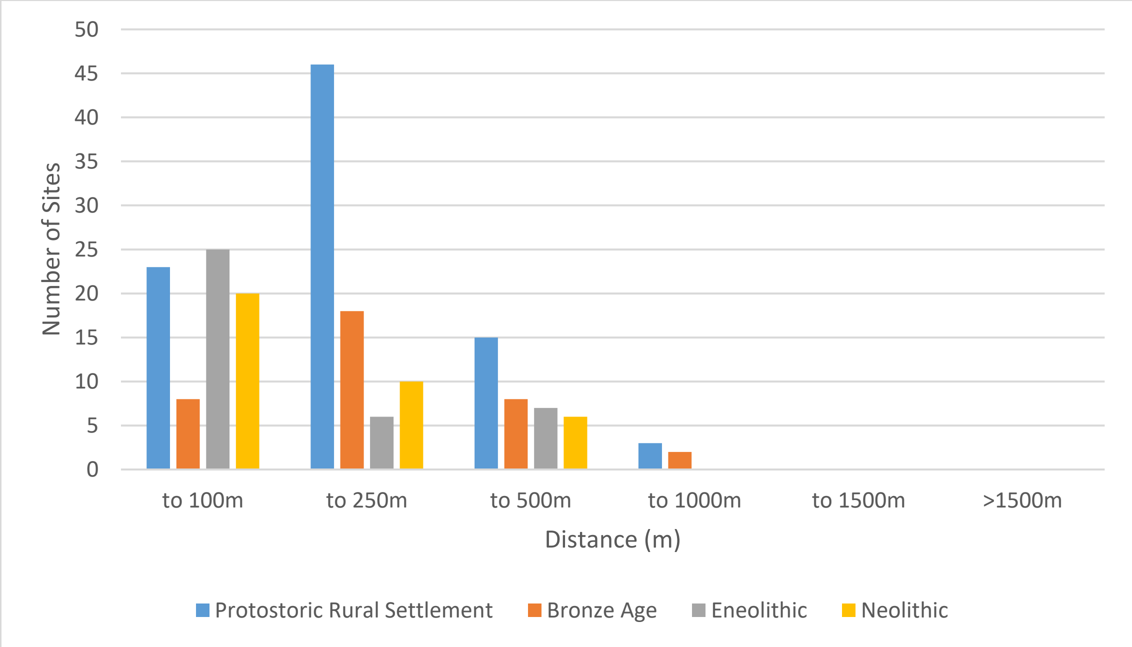


Figure 8.11 Number of Protohistoric, Bronze Age, Eneolithic and Neolithic settlements by proximity to drainage for different classifications

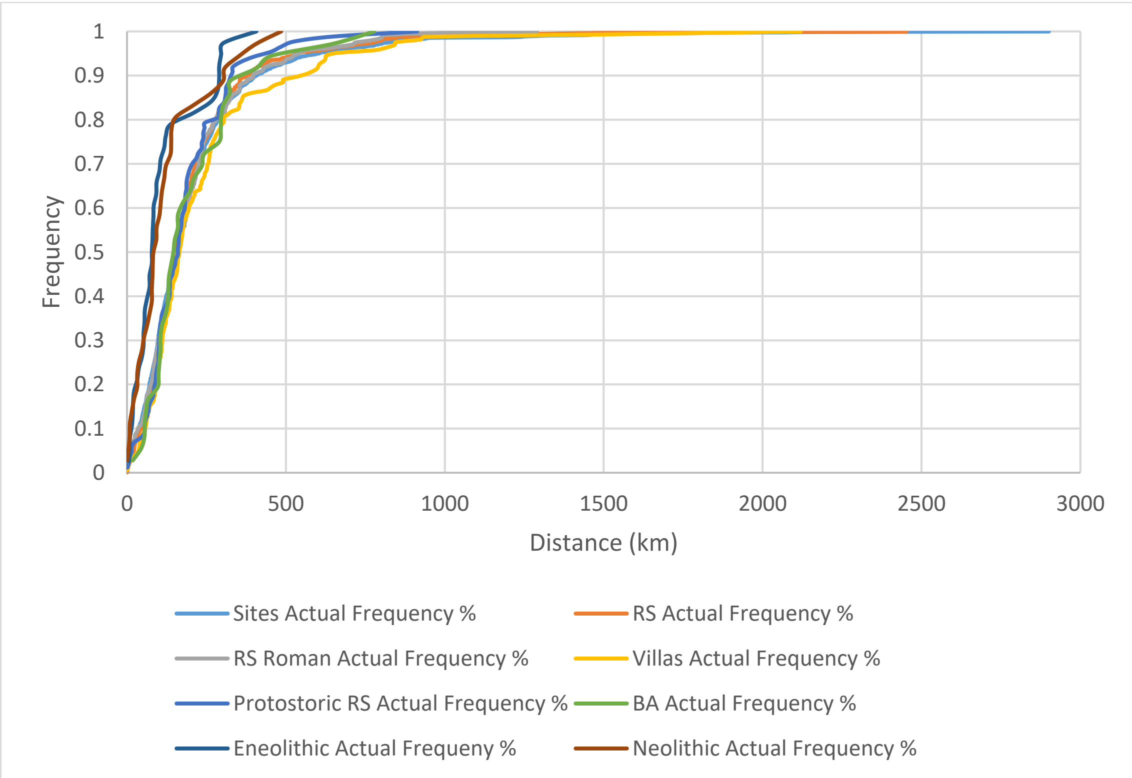


Figure 8.12 Cumulative frequency chart for proximity of sites and rural settlement to drainage

Drainage Proximity	%	Sites Expected	Sites Observed	χ2	RS Expected	RS Observed	χ2
to 100m	33.42%	487	455	2.09	287	253	3.97
to 250m	30.24%	441	634	84.90	259	398	73.98
to 500m	17.59%	256	265	0.30	151	156	0.17
to 1000m	10.52%	153	82	33.12	90	45	22.68
to 1500m	4.30%	63	12	40.93	37	3	31.12
>1500m	3.94%	57	9	40.78	34	3	28.05
Total	**100.00%**	**1457**	**1457**	**202.12**	**858**	**858**	**159.98**

Table 8.16 Chi-squared test data associated with proximity to drainage for the overall sites and rural settlements

Drainage Proximity	%	RS Roman Expected	Roman RS	χ2	Villas Expected	Villas	χ2
to 100m	33.42%	80	73	0.54	55	42	3.13
to 250m	30.24%	72	109	19.05	50	71	8.93
to 500m	17.59%	42	40	0.08	29	34	0.85
to 1000m	10.52%	25	15	4.02	17	16	0.11
to 1500m	4.30%	10	1	8.33	7	0	7.09
>1500m	3.94%	9	0	9.37	6	2	3.11
Total	**100.00%**	**238**	**238**	**41.39**	**165**	**165**	**23.22**

Table 8.17 Chi-squared test data associated with proximity to drainage for Roman rural settlements and villas

Drainage Proximity	%	RS Protohistoric Expected	RS Protohistoric	χ2	Bronze Age Expected	Bronze Age	χ2
to 100m	33.42%	29	23	1.27	12	8	1.35
to 250m	30.24%	26	46	14.74	11	18	4.65
to 500m	17.59%	15	15	0.01	6	8	0.44
to 1000m	10.52%	9	3	4.13	4	2	0.84
to 1500m	4.30%	4	0	3.74	2	0	1.55
>1500m	3.94%	3	0	3.43	1	0	1.42
Total	100.00%	87	87	27.31	36	36	10.25

Table 8.18 Chi-squared test data associated with proximity to drainage for Protohistoric and Bronze Age settlement

Drainage Proximity	%	Eneolithic Expected	Eneolithic	χ2	Neolithic Expected	Neolithic	χ2
to 100m	33.42%	13	25	11.92	12	20	5.28
to 250m	30.24%	11	6	2.62	11	10	0.07
to 500m	17.59%	7	7	0.01	6	6	0.02
to 1000m	10.52%	4	0	4.00	4	0	3.79
to 1500m	4.30%	2	0	1.63	2	0	1.55
>1500m	3.94%	1	0	1.50	1	0	1.42
Total	100.00%	38	38	21.68	36	36	12.12

Table 8.19 Chi-squared test data associated with proximity to drainage for Eneolithic and Neolithic settlement

	Sites (Total 1457)	RS (Total 858)	RS Roman (Total 238)	Villas (Total 165)	RS Protohistoric (Total 87)	Bronze Age (Total 36)	Eneolithic (Total 38)	Neolithic (Total 36)
χ2	202.12	159.98	41.39	23.22	27.31	10.25	21.68	12.12
χ2 a/r	11.071	11.071	11.071	11.071	11.071	11.071	11.071	11.071
k-1	5	5	5	5	5	5	5	5
α	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Table 8.20 Chi-squared calculations for proximity to drainage, together with the accept/reject threshold for the test, by site type

The null hypothesis for association by area of proximity was rejected for all periods (Tables 8.16-8.20) apart from Bronze Age settlements, indicating an uneven distribution by area. The majority of sites for all periods seem to be located within 500m of a drainage feature (Figs 8.9-8.11). The cumulative chart indicates that 90% of sites are within 300m of drainage, with a steeper curve for Neolithic and Eneolithic settlements.

In summary proximity to drainage seems to be a significant factor in settlement location, although the extent of the pattern of drainage across the study area is a contributing factor to the overall proximity. While this is a mitigating factor, however, there is no association of distribution by area for ranges of proximity. The steep curve for proximity of Neolithic and Eneolithic settlements in comparison with sites overall, and those from the Roman period is also intriguing. This may perhaps be an arefact relating to the pastoral economies of these periods and the development of settlement associated with grazing and watering the carpines and cattle as part of this economy.

It must also be noted that the location of known springs has not been added to this analysis. Coverage for these sites was uneven in the original datasets, with only a smallnumber of springs noted in the Carta dell'Agro.

8.2.6 Site Location, Geology and Land Use

A further potential contributor to settlement location is the proximity to different forms of land use for the study area. Location of settlements for different periods in the different classifications of land use may indicate the forms of resource being exploited. In addition, the proximity of settlements to different classifications of land use also seemed important. While sites may be located in prime locations based on terrain, their proximity to other forms of land use in the landscape seemed to provide a further mitigating factor in their location. In addition to the percentage of settlements by period being calculated based on their location in cladssifications of land use, a Chi-aquared test was calculated to assess the associated distribution by area of land use type.

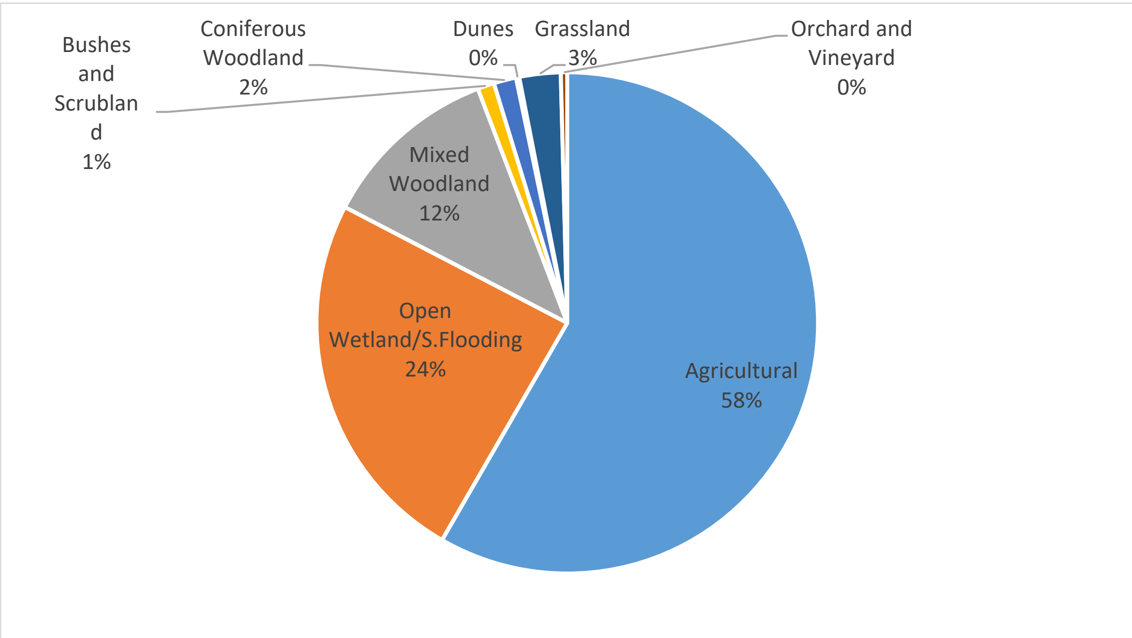


Figure 8.13 Percentages of land use by classification

This was calculated for all sites (total 1457), all rural settlements (total 858), Roman rural settlement (total 238, Roman villas (total 165), and Protohistoric (total 87), Bronze Age (total 36), Eneolithic (total 38) and Neolithic (total 36) settlement.

The Chi-quared hypothesis was:

H0: Settlements are equally distributed across all areas of land use classification

H1: Settlements are not equally distributed across all areas of land use classification

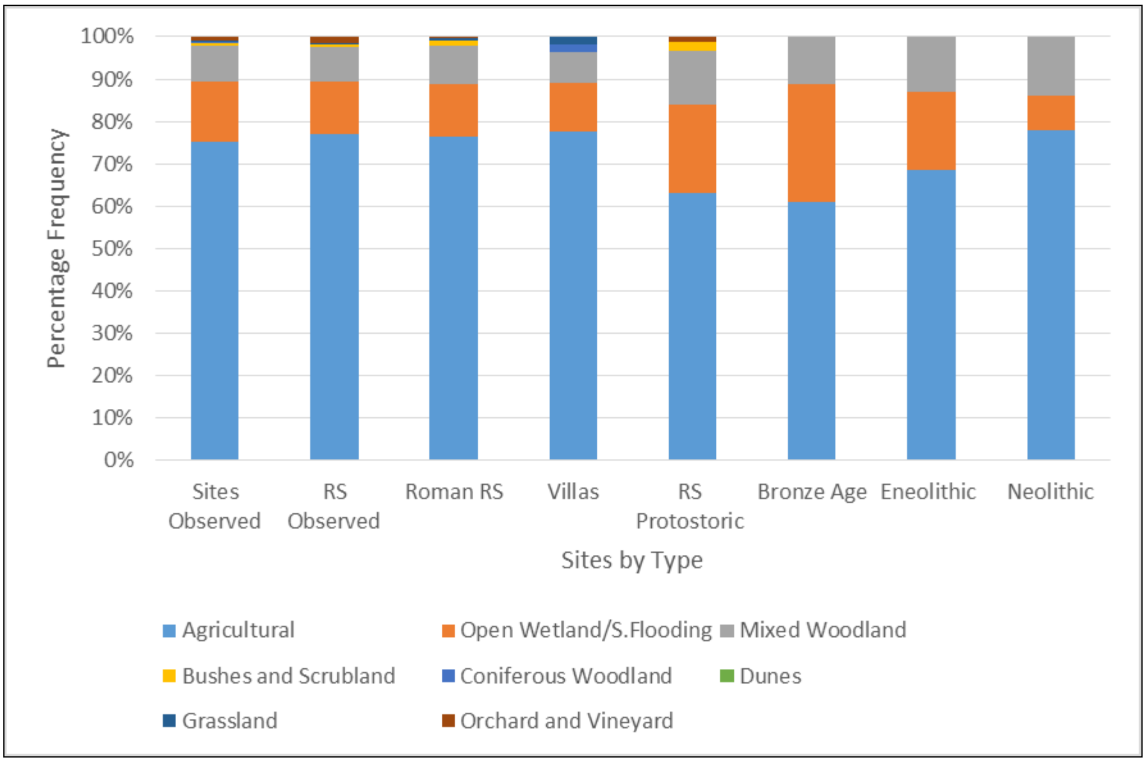


Figure 8.14 Bar chart indicating percentage of sites located by land use type for different categories of site and settlement

Land use	%	Sites Expected	Sites Observed	χ2	RS Expected	RS Observed	χ2
Agricultural	53.37%	778	1094	128.71	458	661	90.05
Open Wetland/S.Flooding	27.80%	405	208	95.81	238	106	73.60
Mixed Woodland	12.11%	176	126	14.39	104	71	10.40
Bushes and Scrubland	1.32%	19	5	10.56	11	4	4.75
Coniferous Woodland	1.78%	26	4	18.54	15	0	15.26
Dunes	0.08%	1	0	1.16	1	0	0.69
Grassland	3.04%	44	7	31.35	26	4	18.67
Orchard and Vineyard	0.51%	7	13	4.20	4	12	13.34
Total	**100.00%**	**1457**	**1457**	**304.73**	**858**	**858**	**226.76**

Table 8.21 Chi-squared test data associated with land use type to drainage for the overall sites and rural settlements

Land use	%	RS Roman Expected	Roman RS	χ2	Villas Expected	Villas	χ2
Agricultural	53.37%	127	182	23.79	88	128	18.11
Open Wetland/S.Flooding	27.80%	66	29	20.87	46	19	15.73
Mixed Woodland	12.11%	29	22	1.61	20	12	3.18
Bushes and Scrubland	1.32%	3	3	0.01	2	0	2.18
Coniferous Woodland	1.78%	4	0	4.23	3	3	0.00
Dunes	0.08%	0	0	0.19	0	0	0.13
Grassland	3.04%	7	1	5.37	5	3	0.81
Orchard and Vineyard	0.51%	1	1	0.04	1	0	0.84
Total	**100.00%**	**238**	**238**	**56.10**	**165**	**165**	**40.99**

Table 8.22 Chi-squared test data associated with land use type to drainage for the overall Roman rural settlement and villas

Land use	%	RS Protohistoric Expected	RS Protohistoric	χ2	Bronze Age Expected	Bronze Age	χ2
Agricultural	53.37%	46	55	1.58	19	22	0.40
Open Wetland/S.Flooding	27.80%	24	18	1.58	10	10	0.00
Mixed Woodland	12.11%	11	11	0.02	4	4	0.03
Bushes and Scrubland	1.32%	1	2	0.63	0	0	0.48
Coniferous Woodland	1.78%	2	0	1.55	1	0	0.64
Dunes	0.08%	0	0	0.07	0	0	0.03
Grassland	3.04%	3	0	2.64	1	0	1.09
Orchard and Vineyard	0.51%	0	1	0.70	0	0	0.18
Total	**100.00%**	**87**	**87**	**8.77**	**36**	**36**	**2.85**

Table 8.23 Chi-squared test data associated with land use type to drainage for Protohistoric and Bronze Age settlement

Land use	%	Eneolithic Expected	Eneolithic	χ2	Neolithic Expected	Neolithic	χ2
Agricultural	53.37%	20	26	1.61	19	28	4.02
Open Wetland/S.Flooding	27.80%	11	7	1.20	10	3	4.91
Mixed Woodland	12.11%	5	5	0.03	4	5	0.09
Bushes and Scrubland	1.32%	1	0	0.50	0	0	0.48
Coniferous Woodland	1.78%	1	0	0.68	1	0	0.64
Dunes	0.08%	0	0	0.03	0	0	0.03
Grassland	3.04%	1	0	1.15	1	0	1.09
Orchard and Vineyard	0.51%	0	0	0.19	0	0	0.18
Total	**100.00%**	**38**	**38**	**5.40**	**36**	**36**	**11.44**

Table 8.24 Chi-squared test data associated with land use type to drainage for Eneolithic and Neolithic settlements

	Sites (Total 1457)	RS (Total 858)	RS Roman (Total 238)	Villas (Total 165)	RS Protohistoric (Total 87)	Bronze Age (Total 36)	Eneolithic (Total 38)	Neolithic (Total 36)
χ2	304.73	226.76	56.10	40.99	8.77	2.85	5.40	11.44
χ2				14.06				
a/r	14.067	14.067	14.067	7	14.067	14.067	14.067	14.067
k-1	7	7	7	7	7	7	7	7
α	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Table 8.25 Chi-squared calculations for land use type, together with the accept/reject threshold for the test, by site type

The Chi-squared results (Tables 8.21-8.25) indicate that, for overall sites and rural settlement, and for Roman villas and rural settlements, there is no associated between distribution and areas of land use. However, for Neolithic, Eneolithic, Bronze Age and Protohistoric settlement, the null hypothesis can be accepted. The bar chart shows that, for Protohistoric, Bronze Age and Eneolithic settlements there is a greater proportion of settlements located on wetland than for other periods (Figs 8.13 and 8.14). Minimal sites are located on wetland for the Roman and Neolithic periods. This seems to be a factor in the position of the Eneolithic and Bronze Age settlement in particular, in addition to the close proximity of sites to drainage. It also needs to be remembered that between 60% and 80% of settlements still occur on the 'Agricultural' land classification. However, the periodic inundation of the floodplain and delta does not seem to preclude the location of later prehistoric and Protohistoric settlement in the wetland zone.

The broader classifications of solid and drift geology for the study area also have some bearing on the location of sites. Site distribution across solid geology (Fig. 8.15) indicates some degree of variation in the proportion of sites by different period located on alluvium, with deposits of gravels and sands, or deposits of volcanic origin forming the most likely locations of sites.

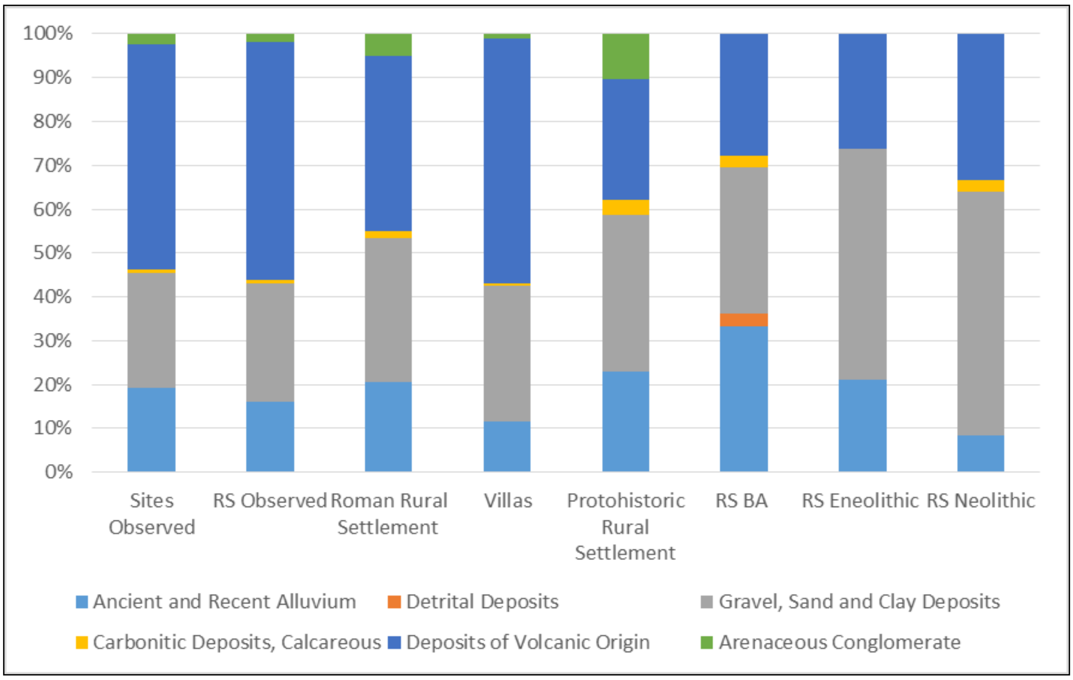


Figure 8.15 Proportion of solid geology on which settlements are located by type

Of interest in terms of the drift geology (Figs 8.16) is both the lack of villa sites on the drift classification of alluvium and the proportions of Bronze Age and Eneolithic settlements located on the same deposits. These more refined details are lost in the revalidated classifications for the geology, with alluvium classified with clays and silts (Fig. 8.17).

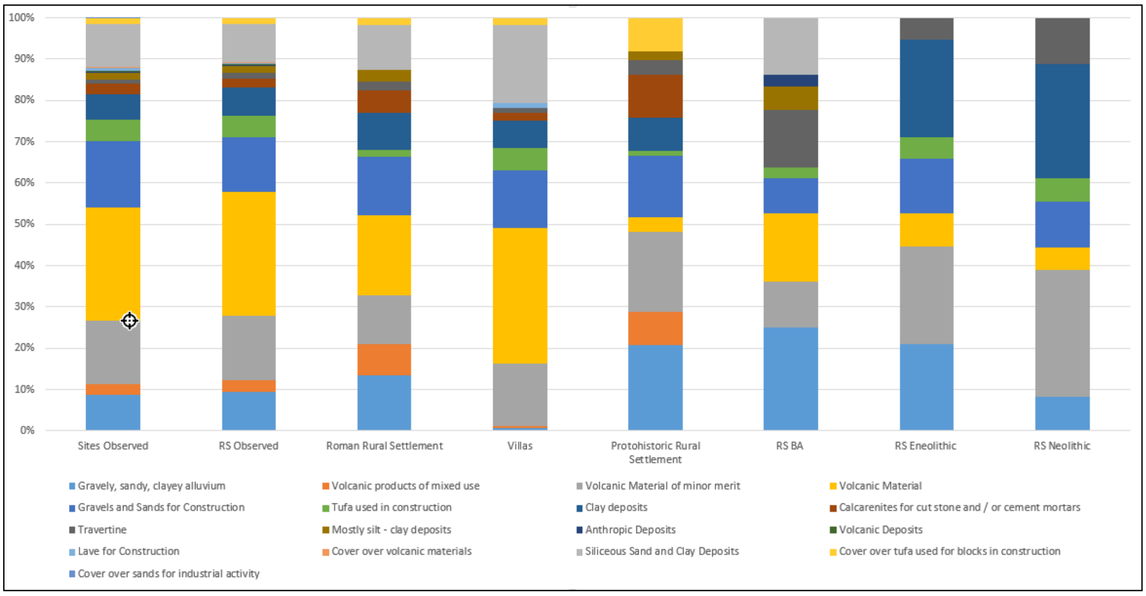


Figure 8.16 Original classifications of drift geology with with proprtion of settlement by period for each

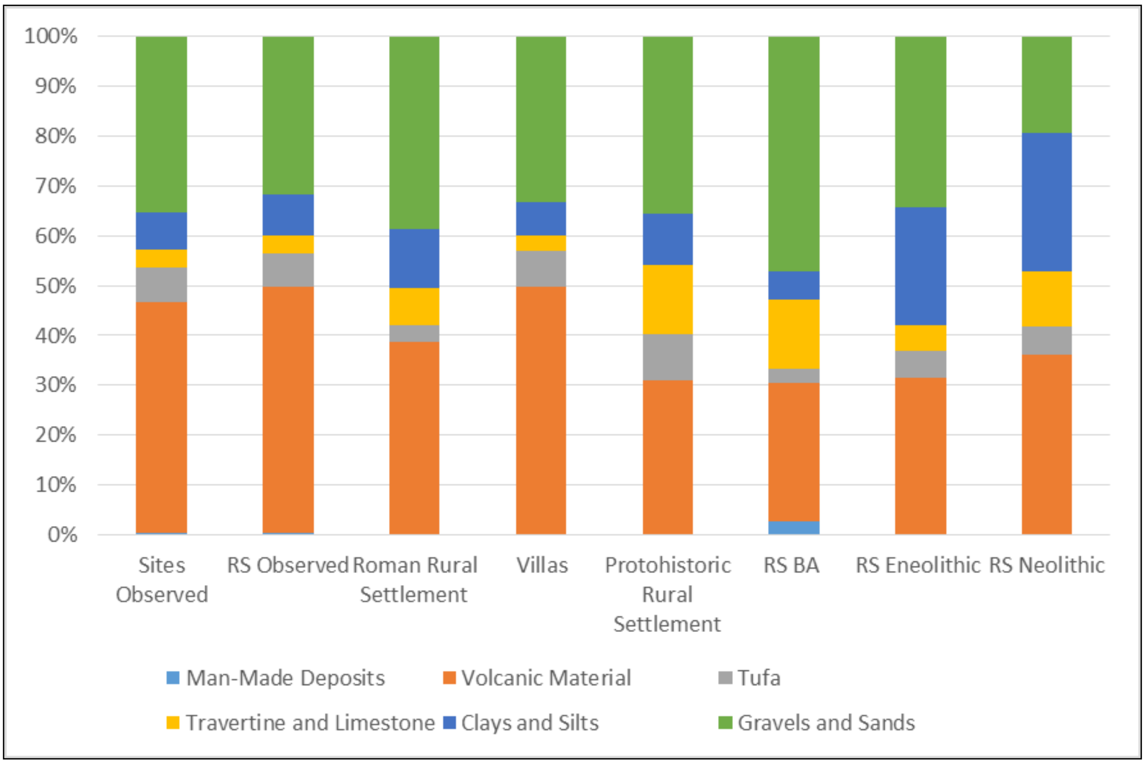


Figure 8.17 Reclassified drift geology with proportion of settlemernt by type for each

With regard to the distribution of sites across the different solid and drift geologies, a Chi-dquared test was performed on the data based on the following hypothesis:

H0: Settlements are equally distributed across all areas of geological classification

H1: Settlements are not equally distributed across all areas of geological classification

Description	%	Sites Expected	Sites Observed	χ2	RS Expected	RS Observed	χ2
Ancient Recent Alluvium	27.26%	397	279	35.18	234	138	39.32
Detrital Deposits	0.44%	6	2	3.00	4	0	3.75
Gravel, Sand and Clay	41.13%	599	383	78.03	353	231	42.10
Calc/Carb Deposits	0.10%	1	8	29.44	1	7	44.04
Volcanic Origin	30.62%	446	750	207.00	263	465	155.76
A. Conglomerate	0.45%	7	35	121.75	4	17	44.06
	100.00%	**1457**	**1457**	**474.38**	**858**	**858**	**329.04**

Table 8.26 Chi-squared test results for sites and rural settlement on solid geology

Description	%	RS Roman Expected	Roman Rural Settlement	χ2	Villas Expected	Villas	χ2
Ancient Recent Alluvium	27.26%	65	49	3.89	45	19	15.01
Detrital Deposits	0.44%	1	0	1.04	1	0	0.72
Gravel, Sand and Clay	41.13%	98	78	4.04	68	51	4.19
Calc/Carb Deposits	0.10%	0	4	59.55	0	1	4.23
Volcanic Origin	30.62%	73	95	6.72	51	92	34.05
A. Conglomerate	0.45%	1	12	110.31	1	2	2.09
	100.00%	**238**	**238**	**185.54**	**165**	**165**	**60.29**

Table 8.27 Chi-aquared test results for Roman rural settlement and villas on solid geology

Description	%	RS Protohistoric Expected	Protohistoric Rural Settlement	χ2	RS BA Expected	RS BA	χ2
Ancient Recent Alluvium	27.26%	24	20	0.58	10	12	0.49
Detrital Deposits	0.44%	0	0	0.38	0	1	4.51
Gravel, Sand and Clay	41.13%	36	31	0.64	15	12	0.53
Calc/Carb Deposits	0.10%	0	3	97.66	0	1	25.85
Volcanic Origin	30.62%	27	24	0.26	11	10	0.09
A. Conglomerate	0.45%	0	9	187.40	0	0	0.16
	100.00%	**87**	**87**	**286.93**	**36**	**36**	**31.64**

Table 8.28 Chi-squared test results for Protohistoric and Bronze Age sites across solid geology

Description	%	RS Eneolithic Expected	RS Eneolithic	χ2	RS Neolithic Expected	RS Neolithic	χ2
Ancient Recent Alluvium	27.26%	10	8	0.54	10	3	4.73
Detrital Deposits	0.44%	0	0	0.17	0	0	0.16
Gravel, Sand and Clay	41.13%	16	20	1.22	15	20	1.82
Calc/Carb Deposits	0.10%	0	0	0.04	0	1	25.85
Volcanic Origin	30.62%	12	10	0.23	11	12	0.09
A. Conglomerate	0.45%	0	0	0.17	0	0	0.16
	100.00%	**38**	**38**	**2.37**	**36**	**36**	**32.81**

Table 8.29 Chi-squared test results for Neolithic and Eneolithic settlements on solid geology

	Sites (Total 1457)	RS (Total 858)	RS Roman (Total 238)	Villas (Total 165)	RS Protohistoric (Total 87)	Bronze Age (Total 36)	Eneolithic (Total 38)	Neolithic (Total 36)
χ2	474.38	329.04	185.54	60.29	286.93	31.64	2.37	32.81
χ2 a/r	11.071	11.071	11.071	11.071	11.071	11.071	11.071	11.071
k-1	5	5	5	5	5	5	5	5
α	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Table 8.30 Results of the Chi-aquared tests for solid geology by settlement and site type

The results of the test for solid geology (Tables 8.26-8.30) illustrated a general lack of association for sites and settlements across the classifications of solid and drift geology. Overall the number of Roman rural settlements and villa sites located on alluvium or the gravels sands and clays of the solid geology were much lower than expected, potentially due to issues of visibility of buried sites on the alluvium or, in the case of the villa sites and absence of this site type on terrain prone to flooding. This is matched by the difference between expected and observed villa sites on the gravelly, clayey, sandy alluvium of the drift geology, a marked difference also indicating an absence of sites on this type of geology. This is in stark contrast to the slight increase in observed Roman rural settlement on this drift geology. If the low level of observation were due solely to the issues of visibility linked to depth of alluvium overlying Roman levels, then the observed number of rural settlements ought to be lower than the expected number, and this isn't the case. One explanation might be the absence of sites on the alluvium, particularly for the period of 1st century BC to 2nd century AD, due to the potential increased risk of flooding in this period due to the Roman Climate Optimum (Harper 2017, 39). The increased number of flood events in this period, due to the wrmer and wetter climate and increased discharge derived from more intensive farming meant that villa sites are located above the area of flood risk, although lower status settlement from the period is located on the alluvium.

Lithology_Type	%	Sites Expected	Sites Observed	χ2	RS Expected	RS Observed	χ2
Gravely, sandy, clayey alluvium	11.17%	163	126	8.27	96	80	2.61
Volcanic products of mixed use	0.98%	14	40	46.42	8	26	36.86
Volcanic Material of minor merit	8.32%	121	223	85.30	71	134	54.83
Volcanic Material	13.64%	199	398	199.80	117	257	167.41
Gravels and Sands for Construction	19.09%	278	236	6.39	164	112	16.38
Tufa used in construction	2.59%	38	76	38.99	22	45	23.46
Clay deposits	6.94%	101	88	1.69	60	59	0.00
Calcarenites for cut stone cement	0.43%	6	37	153.07	4	18	56.42
Travertine	0.19%	3	16	65.00	2	13	81.29
Mostly silt - clay deposits	1.42%	21	23	0.27	12	13	0.06
Anthropic Deposits	0.46%	7	5	0.41	4	3	0.22
Volcanic Deposits	14.07%	205	3	199.06	121	2	116.76
Lave for Construction	0.33%	5	8	2.14	3	3	0.01
Cover over volcanic materials	0.08%	1	5	13.57	1	2	2.76
Siliceous Sand and Clay Deposits	19.43%	283	150	62.61	167	79	46.17
Cover over tufa used for blocks	0.83%	12	22	8.25	7	12	3.41
Cover over sands for ind. activity	0.06%	1	1	0.02	1	0	0.51
	100.00%	**1457**	**1457**	**891.27**	**858**	**858**	**609.16**

Table 8.31 Chi-squared test results for sites and rural settlements across drift geology

Lithology_Type	%	RS Roman Expected	Roman Rural Settlement	χ2	Villas Expected	Villas	χ2
Gravely, sandy, clayey alluvium	11.17%	27	32	1.11	18	1	16.48
Volcanic products of mixed use	0.98%	2	18	105.36	2	1	0.23
Volcanic Material of minor merit	8.32%	20	28	3.38	14	25	9.24
Volcanic Material	13.64%	32	46	5.65	23	54	44.07
Gravels and Sands for Construction	19.09%	45	34	2.88	31	23	2.29
Tufa used in construction	2.59%	6	4	0.75	4	9	5.25
Clay deposits	6.94%	17	21	1.22	11	11	0.02
Calcarenites for cut stone cement	0.43%	1	13	141.93	1	3	7.52
Travertine	0.19%	0	5	46.81	0	2	9.32
Mostly silt - clay deposits	1.42%	3	7	3.91	2	0	2.34
Anthropic Deposits	0.46%	1	0	1.09	1	0	0.75
Volcanic Deposits	14.07%	33	0	33.49	23	0	23.22
Lave for Construction	0.33%	1	0	0.78	1	2	3.91
Cover over volcanic materials	0.08%	0	0	0.18	0	0	0.13
Siliceous Sand and Clay Deposits	19.43%	46	26	8.87	32	31	0.04
Cover over tufa used for blocks	0.83%	2	4	2.10	1	3	1.97
Cover over sands for ind. activity	0.06%	0	0	0.14	0	0	0.10
	100.00%	**238**	**238**	**359.66**	**165**	**165**	**126.87**

Table 8.32 Chi-squared test results for Roman rural settlement and villas on drift geology

Lithology_Type	%	RS Protohistoric Expected	Protohistoric Rural Settlement	χ2	RS BA Expected	RS BA	χ2
Gravely, sandy, clayey alluvium	11.17%	10	18	7.07	4	9	6.17
Volcanic products of mixed use	0.98%	1	7	44.37	0	0	0.35
Volcanic Material of minor merit	8.32%	7	17	13.15	3	4	0.34
Volcanic Material	13.64%	12	3	6.63	5	6	0.24
Gravels and Sands for Construction	19.09%	17	13	0.78	7	3	2.18
Tufa used in construction	2.59%	2	1	0.69	1	1	0.01
Clay deposits	6.94%	6	7	0.15	2	0	2.50
Calcarenites for cut stone cement	0.43%	0	9	201.23	0	0	0.15
Travertine	0.19%	0	3	49.67	0	5	362.71
Mostly silt - clay deposits	1.42%	1	2	0.48	1	2	4.36
Anthropic Deposits	0.46%	0	0	0.40	0	1	4.25
Volcanic Deposits	14.07%	12	0	12.24	5	0	5.07
Lave for Construction	0.33%	0	0	0.29	0	0	0.12
Cover over volcanic materials	0.08%	0	0	0.07	0	0	0.03
Siliceous Sand and Clay Deposits	19.43%	17	0	16.91	7	5	0.57
Cover over tufa used for blocks	0.83%	1	7	54.90	0	0	0.30
Cover over sands for ind. activity	0.06%	0	0	0.05	0	0	0.02
	100.00%	**87**	**87**	**409.08**	**36**	**36**	**389.35**

Table 8.33 Chi-squared test results for Protohistoric and Bronze Age settlement on drift geology

Lithology_Type	%	RS Eneolithic Expected	RS Eneolithic	χ2	RS Neolithic Expected	RS Neolithic	χ2
Gravely, sandy, clayey alluvium	11.17%	4	8	3.33	4	3	0.26
Volcanic products of mixed use	0.98%	0	0	0.37	0	0	0.35
Volcanic Material of minor merit	8.32%	3	9	10.77	3	11	21.37
Volcanic Material	13.64%	5	3	0.92	5	2	1.72
Gravels and Sands for Construction	19.09%	7	5	0.70	7	4	1.20
Tufa used in construction	2.59%	1	2	1.05	1	2	1.23
Clay deposits	6.94%	3	9	15.37	2	10	22.55
Calcarenites for cut stone cement	0.43%	0	0	0.16	2	0	2.50
Travertine	0.19%	0	2	52.56	0	4	96.63
Mostly silt - clay deposits	1.42%	1	0	0.54	1	0	0.51
Anthropic Deposits	0.46%	0	0	0.17	0	0	0.16
Volcanic Deposits	14.07%	5	0	5.35	5	0	5.07
Lave for Construction	0.33%	0	0	0.13	0	0	0.12
Cover over volcanic materials	0.08%	0	0	0.03	0	0	0.03
Siliceous Sand and Clay Deposits	19.43%	7	0	7.38	7	0	7.00
Cover over tufa used for blocks	0.83%	0	0	0.31	0	0	0.30
Cover over sands for ind. activity	0.06%	0	0	0.02	0	0	0.02
	100.00%	**38**	**38**	**99.16**	**38**	**36**	**161.01**

Table 8.34 Chi-squared test results for Neolithic and Eneolithic settlements on drift geology

	Sites (Total 1457)	RS (Total 858)	RS Roman (Total 238)	Villas (Total 165)	RS Protohistoric (Total 87)	Bronze Age (Total 36)	Eneolithic (Total 38)	Neolithic (Total 36)
χ2	891.27	609.16	359.66	126.87	409.08	389.35	99.16	161.01
χ2 a/r	26.296	26.296	26.296	26.296	26.296	26.296	26.3	26.296
k-1	16	16	16	16	16	16	16	16
α	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Table 8.35 Results of the Chi-squared test for drift geology

Description	%	Sites Expected	Sites Observed	χ2	RS Expected	RS Observed	χ2
Man-Made Deposits	0.46%	7	5	0.41	4	3	0.22
Volcanic Material	37.42%	545	677	31.86	321	424	33.01
Tufa	3.41%	50	98	46.92	29	57	26.27
Travertine and Limestone	0.61%	9	53	218.06	5	31	126.34
Clays and Silts	8.35%	122	111	0.94	72	72	0.00
Gravels and Sands	49.75%	725	513	61.91	427	271	56.90
Total	**100.00%**	**1457**	**1457**	**360.10**	**858**	**858**	**242.72**

Table 8.36 Chi-squared test by reclassified drift geology for sites and rural settlement

Description	%	RS Roman Expected	Roman Rural Settlement	χ2	Villas Expected	Villas	χ2
Man-Made Deposits	0.46%	1	0	1.09	1	0	0.75
Volcanic Material	37.42%	89	92	0.10	62	82	6.65
Tufa	3.41%	8	8	0.00	6	12	7.21
Travertine and Limestone	0.61%	1	18	187.99	1	5	15.78
Clays and Silts	8.35%	20	28	3.32	14	11	0.56
Gravels and Sands	49.75%	118	92	5.89	82	55	8.94
Total	**100.00%**	**238**	**238**	**198.38**	**165**	**165**	**39.88**

Table 8.37 Chi-squared test for Roman rural settlement and villas over reclassified drift geology

Description	%	RS Protohistoric Expected	Protohistoric Rural Settlement	χ2	RS BA Expected	RS BA	χ2
Man-Made Deposits	0.46%	0	0	0.40	0	1	4.25
Volcanic Material	37.42%	33	27	0.95	13	10	0.89
Tufa	3.41%	3	8	8.53	1	1	0.04
Travertine and Limestone	0.61%	1	12	247.09	0	5	103.74
Clays and Silts	8.35%	7	9	0.41	3	2	0.34
Gravels and Sands	49.75%	43	31	3.48	18	17	0.05
Total	**100.00%**	**87**	**87**	**260.87**	**36**	**36**	**109.30**

Table 8.38 Chi-squared test results for Protohistoric and Bronze Age settlement on reclassified drift geology

Description	%	RS Eneolithic Expected	RS Eneolithic	χ2	RS Neolithic Expected	RS Neolithic	χ2
Man-Made Deposits	0.46%	0	0	0.17	0	0	0.16
Volcanic Material	37.42%	14	12	0.35	13	13	0.02
Tufa	3.41%	1	2	0.38	1	2	0.49
Travertine and Limestone	0.61%	0	2	13.44	0	4	64.87
Clays and Silts	8.35%	3	9	10.70	3	10	16.27
Gravels and Sands	49.75%	19	13	1.84	18	7	6.65
Total	**100.00%**	**38**	**38**	**26.88**	**36**	**36**	**88.45**

Table 8.39 Chi-squared test results for Neolithic and Eneolithic settlements on reclassified drift geology

	Sites (Total 1457)	RS (Total 858)	RS Roman (Total 238)	Villas (Total 165)	RS Protohistoric (Total 87)	Bronze Age (Total 36)	Eneolithic (Total 38)	Neolithic (Total 36)
χ2	360.1	242.72	198.38	39.88	260.87	109.3	26.88	88.45
χ2 a/r	11.071	11.071	11.071	11.071	11.071	11.071	11.07	11.071
k-1	5	5	5	5	5	5	5	5
α	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Table 8.40 Results of the Chi-squared test for reclassified drift geology

The pattern for the drift geology indicated a rejection of the null hypothesis for all site and settlement types (Tables 8.31-8.35) and the hypothesis was also rejected for the reclassified drift geology (Tables 8.36-8.40). An increase in the number of observed settlements on the gravelly, sandy, clayey alluvium classification of drift geology is apparent for Protohistoric, Bronze Age and Eneolithic settlements, but none so pronounced as for the Roman period.

Some of the variations between the observed and expected numbers of sites seem to relate to the nature of the drift geology, with areas exposed for construction material such as tufa used for construction showing an increase between expected and observed sites. The volcanic deposits classification shows a distinct drop between expected and observed settlements for all periods, with 205 expected sites overall and only 3 observed, for an area representing over 14% of the area for sites. This may tacitly suggest a preference for the clays, silts and gravels of the study area, indicating deeper and more fertile soils based on the geology, although issues of erosion of archaeological sites may also play a part.

8.2.7 Extensive Distribution Analysis Conclusions

The analysis of distribution by different types of classification has illustrated a number of points. Broadly there are few criteria for which distribution of settlements suggests association of distribution with classifications. There is broad conformity for the Bronze Age settlements in terms of ranges of elevation, and proximity to drainage (Table 8.41), also for land use. There is also association for Roman villa sites for aspect, and broader association with classifications of land use for prehistoric settlement in terms of expected numbers of settlements by type. In general, however, across all periods the Chi-aquared tests suggest a lack of association in terms of distribution, and the proportions of different settlements when displayed against different criteria and classifications suggest some possible reasons for this.

	Sites	Rural Settlement	Roman Rural Settlement	Villas	Protohistoric Settlement	Bronze Age Settlement	Eneolithic Settlement	Neolithic Settlement
Elevation a/r	R	R	R	R	R	A	R	R
Elevation Preferred	-7m to 89.99m	-7m to 69.99m	-7m to 89.99m	-7m to 89.99m	-7m to 89.99m	-7m to 69.99m	-7m to 69.99m	-7m to 69.99m
Slope a/r	R	R	R	R	R	R	R	R
Slope Preferred	<8	<8	<6	<6	<6	<6	<8	<8
Aspect a/r	R	R	R	A	R	R	A	A
Aspect Preferred	O	W/SW	W	O	SE	SW	W/SW/S	SW
Drainage Prox. a/r	R	R	R	R	R	A	R	R
Drainage Prox. Preferred	<500m	<500m	<500m	<500m	<500m	<500m	<500m	<500m
Land use a/r	R	R	R	R	A	A	A	A
Land use Preferred								
S. Geology a/r	R	R	R	R	R	R	A	R
S.Geology Preferred								
D. Geology a/r	R	R	R	R	R	R	R	R
D. Geology Preferred								

Table 8.41 Levels of accept or reject for the Chi-squared tests, marking where appropriate the preferred ranges by site and settlement type

Settlement for the Late Neolithic and Eneolithic shows preference for a location with a west, south-west or south-facing aspect, preferring the agricultural land use classification, although this not withstanding the significant numbers of settlements on the wetland areas. The preferred degree of slope for these sites is <8 degrees, with proximity to drainage of <500m, and with 90% of Neolithic and Eneolithic settlements within 300m of a watersource. Overall the sites prefer the alluvium or clay deposits of the drift geology. Preference for location of sites covers the elevation range of -7 to 69.99m, with fewer sites in the -7m to 29.99m range, and a preference for sites in the 30m to 69.99m range. This pattern overall seems to represent a distribution of settlement utilising both lowland and wetland areas, also the ridges and higher ground but in close proximity to principal sources of drainage. The preference of south-west-facing aspect may indicate a preference for hillslopes for cultivation and grazing for these settlements. While difficult to quantify, the pattern of distribution of sites for the Neolithic and Eneolithic shows a pattern of close proximity to the borders of ecotones based on land use classification and geological type. Many of the sites are situated on the agricultural land use classification, but in close proximity to the border with mixed woodland or wetland.

The distribution of Bronze Age and Protohistoric settlements indicates some variation from the preceding periods of sites, in part due to the biases in the different field projects that provided data for the respective periods, but also in terms of the genuine location of material. Continuity of preference for a south-west aspect and range of elevation is visible for the Bronze Age sites, with a proximity of <500m from water sources preferred, but with 90% of sites within 400m of drainage, a factor shared with the Protohistoric sites. Protohistoric settlements, however, prefer south-east aspect, and a greater range of elevation up to the -7m to 89.99m classifications, a factor perhaps linked to the more defensive nucleated settlement locations represented in the data. A greater number of both Bronze Age and Protostroic settlements occur on the agricultural land use classification than expected, and while lower than expected numbes occur on the wetland the numbers are still significant. A greater number of Protohistoric settlements occur on the gravell, sandy clay alluvium classification of drift geology than expected, but there is no great inference in the distribution of Bronze Age and Protohistoric settlement by geology. Of interest in the distribution, however, is the pattern of Bronze Age settlement populating the Tiber delta along the edges of the lagoons and bayhead of the river, and then visible along the higher slopes surrounding the Malafede and Galeria valleys. While some continuity occurs between Bronze Age and Protohistoric settlement locations, this is mostly visible in the form of nucleated settlements, with the Protohistoric rural settlements not usually located in the vicinity of Bronze Age settlement. For the Protohistoric period there is a dominance of rural settment from the northern edge of the

Tiber delta, from the dataset in De Rossi (1968). There is also a pattern of major nucleated settlements developing along the ridges above the Tiber delta running from north to south, including the sites of Lavinium, Castel di Decima and Ficana, part of the settlements and pattern of territories linked to the Latial and Etruscan sites of Rome, Cerveteri and, further to the north, Veii. These sites, while demonstrating urban characteristics, and located on higher terrain, are located in proximity to agricultural and mixed woodland, but also clse to drainage and the valley floors of the Tiber, Rio Galeria and Malafede.

The distribution of Roman villas and rural settlement indicates a greater level of representation in terms of the archaeological record. The villa sites generally do not display a preference for aspect, although rural settlements indicate a preferred west-facing aspect. All sites cover a broad range of elevation from -7m to 89.99m. While some villas are located on the wetland/seasonal flooding areas of land use, the geological classifications for drift geology indicate just one Roman villa located on the alluvial sediment classification. Significant number of Roman rural settlements are, however, located on the wetland area. While some of these are located on the alluvial floodplain, a number are situated close to the edge of the floodplain, or on areas classified as agricultural but close to the wetland area. This pattern is represented to a degree with the location of villa sites, for those close to the Tiber valley and delta, although with both site types the overall distribution covers a variable range of terrain and is not restricted to proximity to the wetland area. The lack of villa sites on the wetland area, with the exception of those facing onto the sea, and one villa close to Ostia Antica, is telling. However, the presence of rural settlements of the period acros the wetland area demonstrates the inhabited nature of the zone.

8.3 Settlement by Period

The distribution of settlements by period was also analysed to explore their relative location and relationship to both land use and topography. The methods applied for this analysis were simple, utilising Theissen polygons and both Euclidean and cost distances on site locations for comparison with the distribution of land use. Cross-comparison between the boundaries of territory from the Theissen polygons was also compared with the cost distance and land use data. This limited spatial analysis and interpretation was conducted at a visual level through comparison of datasets.

A number of factors influence the results of this analysis. Firstly, the Theissen polygons and Euclidean extents perform very rigid geometric analyses in terms of the pattern of settlement distribution and spheres of potential influence or exploitation. This needs to be remembered when assessing the results. Secondly the cost distance analysis was performed utilising a slope raster model (Chapter 6, Section 6.6.1). This bases the cost as increasing with the degree of slope from the settlement locations, and thus assumes minimal cost over areas that are flat or of low gradient. While this assumption ignores the potential for cost of movement through the landscape caused by factors such as seasonal inundation of the wetland, it does provide a basic model for movement that assumes minimal friction over level terrain and represents one possible pattern of distance for exploitation of resources from different settlement locations.

8.3.1 The Neolithic and Eneolithic

The proximity and distribution of Neolithic settlements is almost entirely represented by the sites located to the north of the Tiber along the Rio Galeria and on the Maccarese Plain. Thus, the Theissen polygons (Fig. 8.18) give a more representative model for this area than in the area to the south of the Tiber. Of primary interest is the extent of the polygons, many of which encompass areas including varying topography and land use. The location of the settlements on the fringes of the lagoon on the Maccarese Plain encompass both the coastline and lower terraces and higher slopes adjacent to the plain. Those settlements located on the higher elevations of the study areato the north indicate some variation in the extent of polygons, caused in part by their close proximity to one another, but covering the spurs and ridges above the Aniene and Rio Galeria, and the valley bottoms of these rivers.

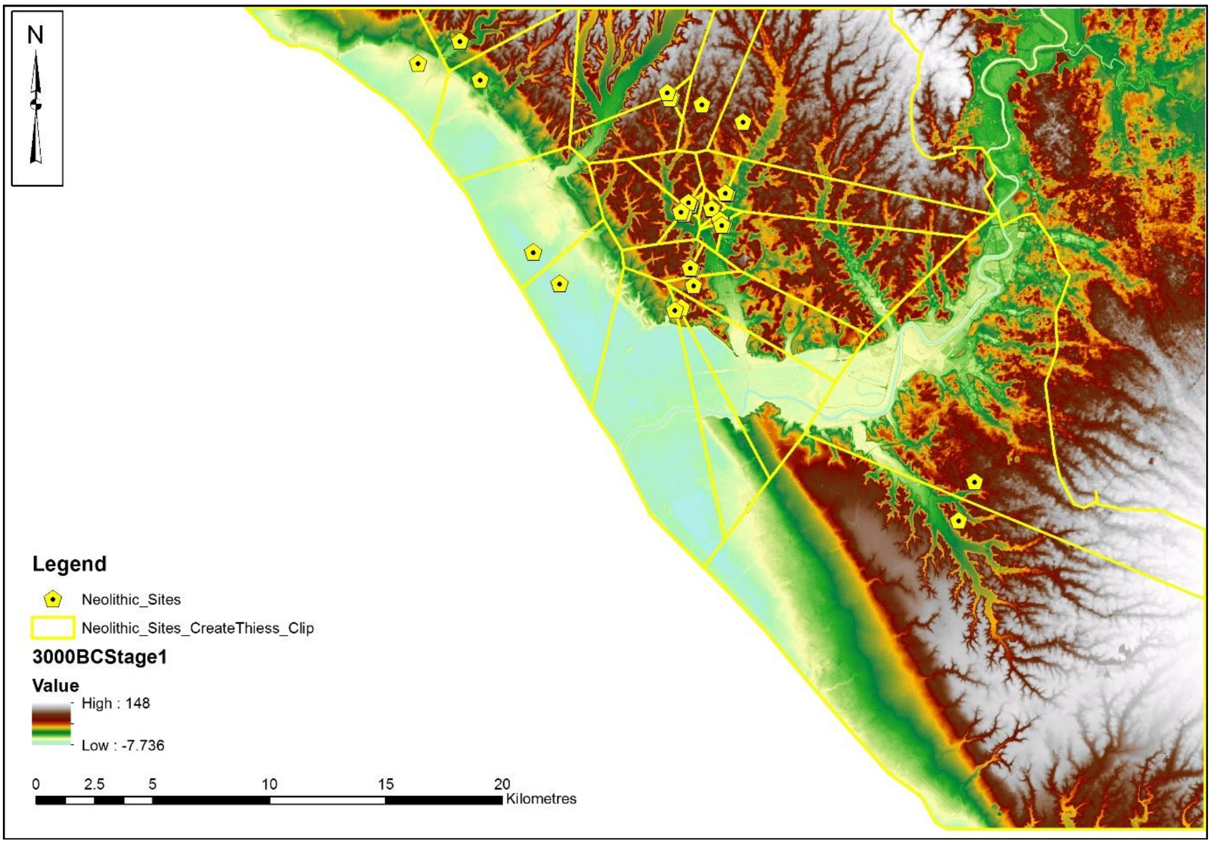


Figure 8.18 Theissen polygons for Neolithic settlements across the study area

The Euclidean and cost distances over land use (Figs 8.19 and 8.20) demonstrate the variable nature of the extents of land use covered by the settlement pattern. At least 6 of the settlements cover both primary agricultural land and wetland in their Euclidean distance thresholds, with those adjacent to the Maccarese lagoons even having mixed woodland on the fringes of their extents.

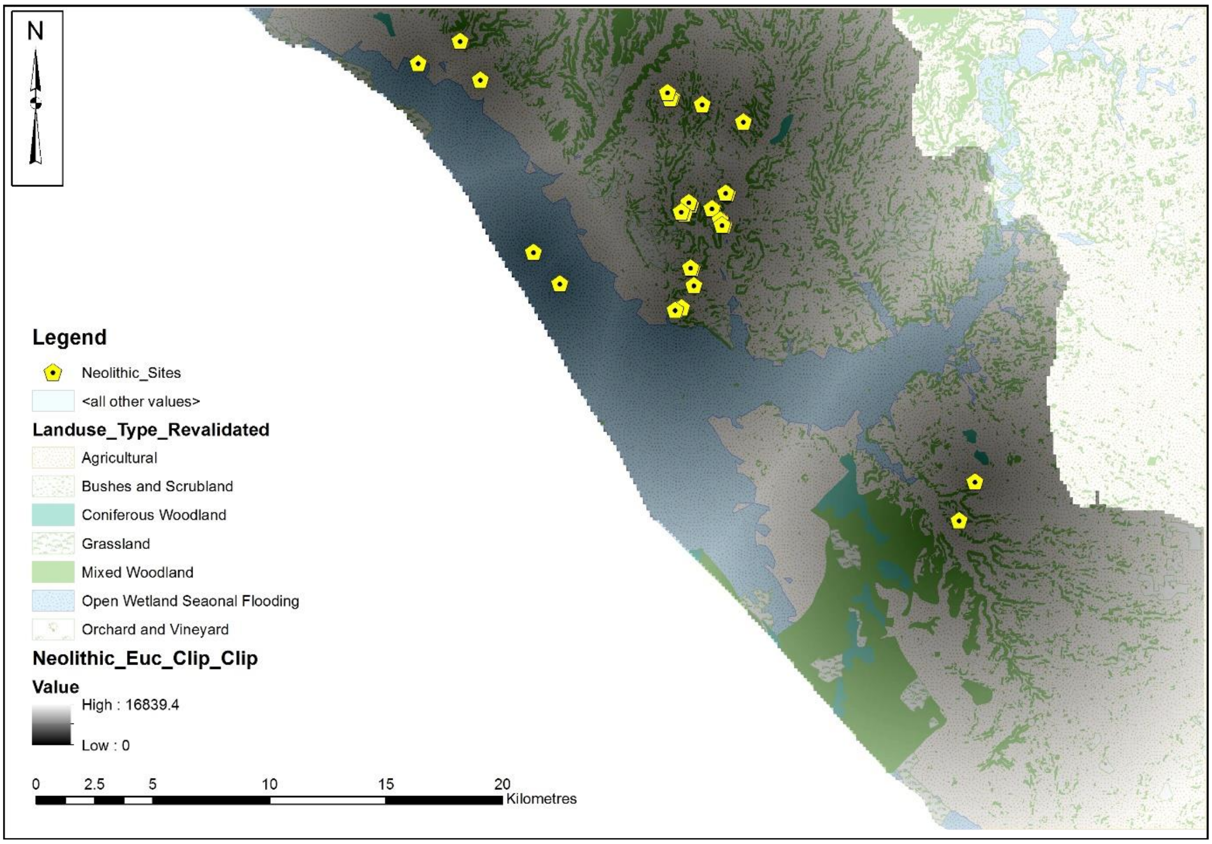


Figure 8.19 Land use for the study area displayed with the Euclidean distance from Neolithic settlement

The extent of the cost distance analysis (Fig. 8.20) over land use indicates a slightly different pattern, with the sites on the coastal plain indicating an extent up to the woodland fringes of the surrounding slopes, and the sites along the Rio Galeria indicating more influence over the ridges and woodlands inland, and the valley of the Rio Galeria.

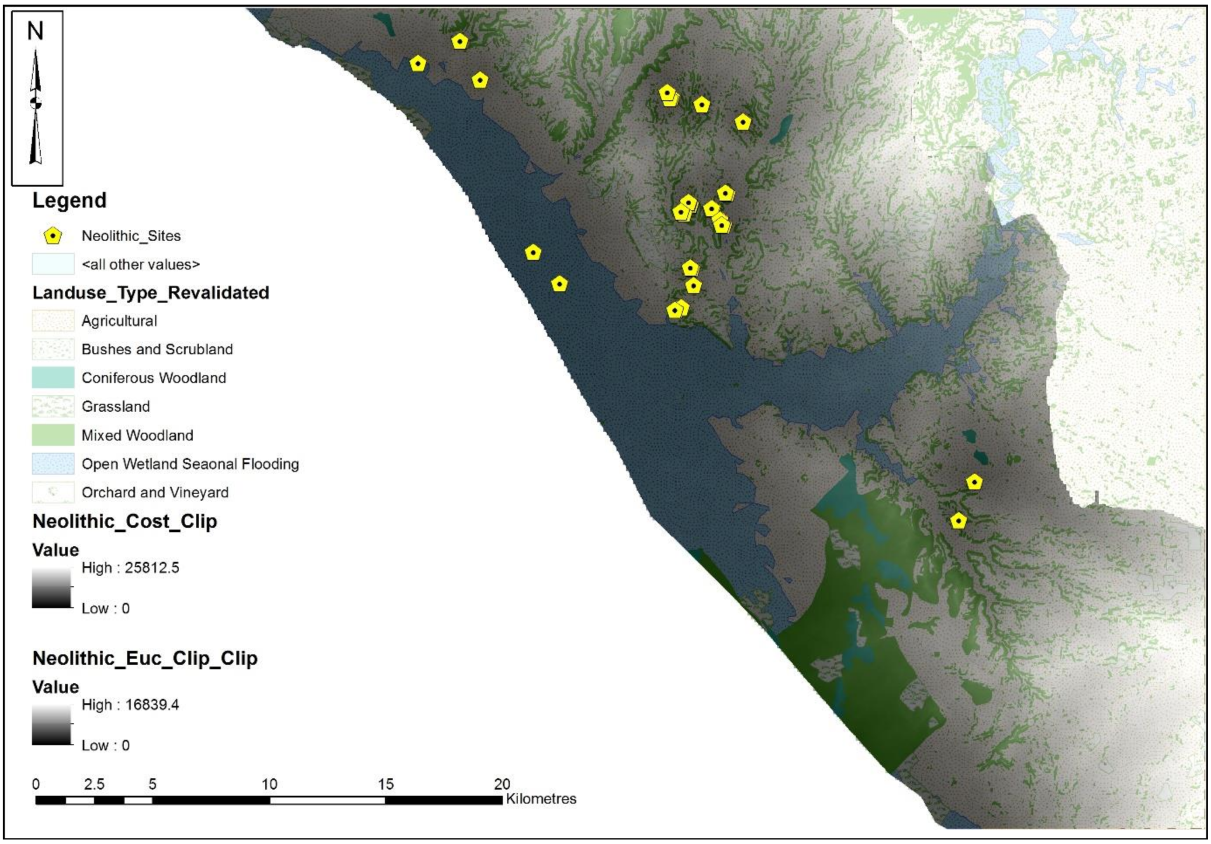


Figure 8.20 Land use for the study area displayed with the cost distance from Neolithic settlements

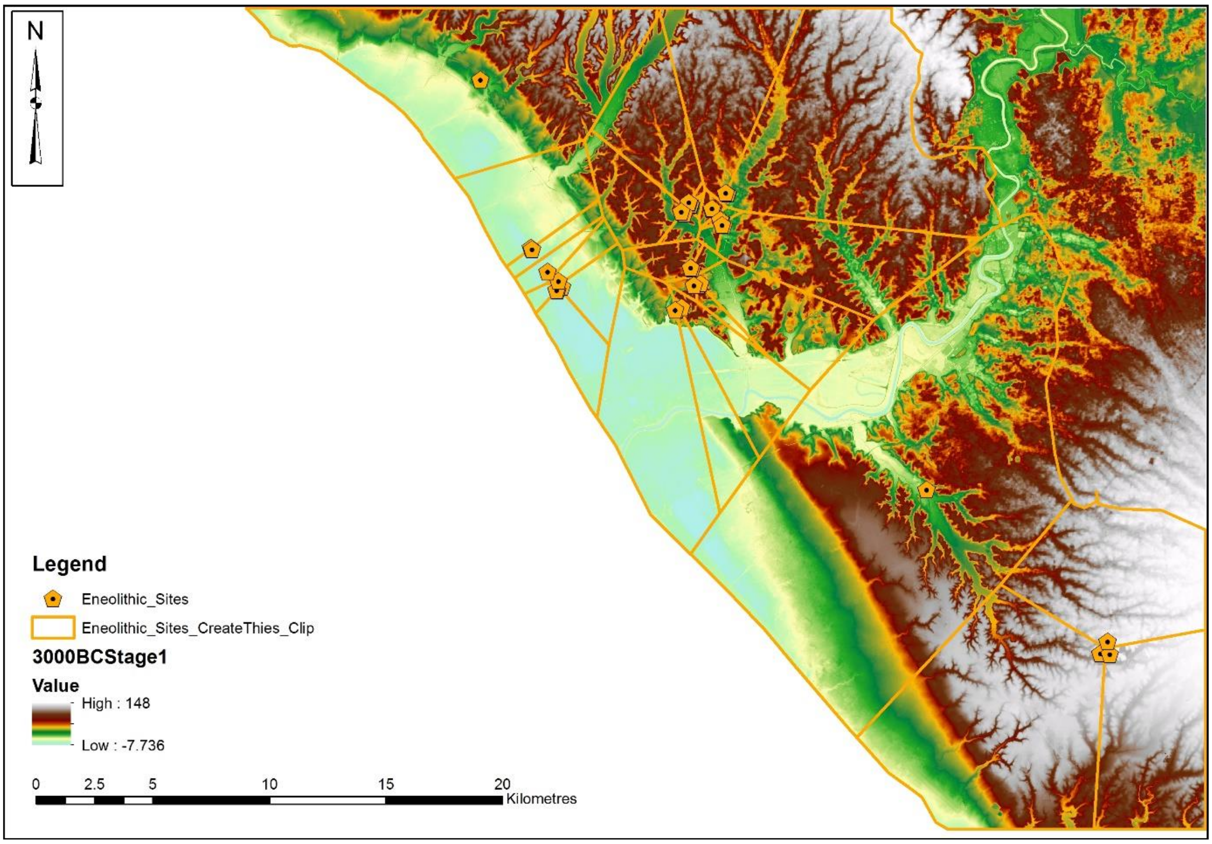


Figure 8.21 Theissen polygons for the Eneolithic settlements in the study area

The analysis for Eneolithic sites draws a similar pattern to that represented by the Neolithic settlements (Figs 8.21 to 8.23). Again, the results are heavily influenced by the concentration of sites along the Rio Galeria. The Theissen polygons also show a similar extent for the setlements, with sites on the coastal plain having polygons that extend up onto the terraces alongside the plain. An interesting outcome from the model is the delineation of a polygon edge lalong the northern edge of the valley bottom of the Aniene (Fig. 8.21). A similar line between the sites north of the Tiber and the northernmost site to the south cuts broadly along the line of the lower Tiber. The Euclidean distance model (Fig. 8.22) suggests extents that overlap all forms of land use (wetland, agricultural and mixed woodland) for all settlement groups. As for the Neolithic settlemnts, cost distance for the Eneolithic settlements indicates extents where the settlements on the coastal plain dominate the plain and the lower slopes and edge of the mixed woodland to the north of the Maccarese Plain (Fig. 8.23) with the inland settlements demonstrating a cost extent incorporating the inner Tiber delta and floodplain, the valley bottom of the Rio Galeria, and the agricultural land and woodland areas either side of the Rio Galeria.

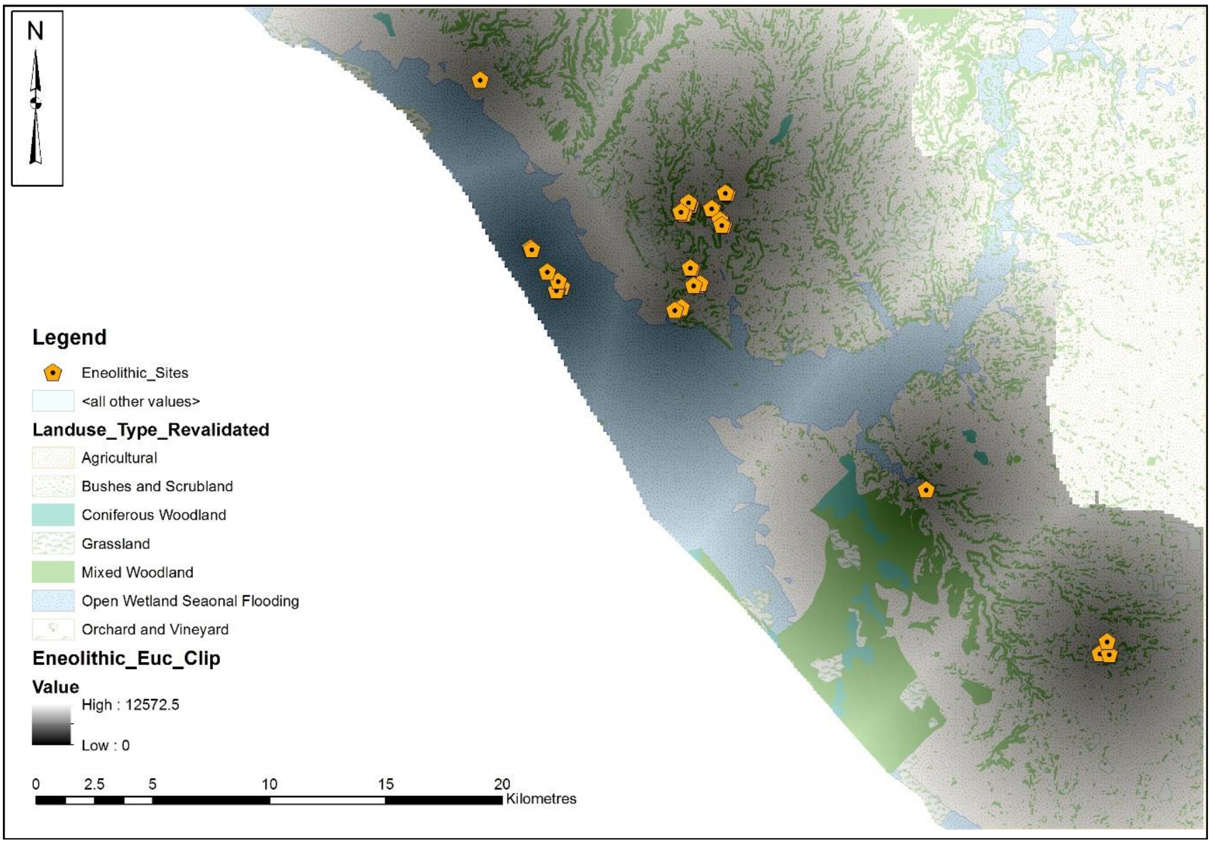


Figure 8.22 Land use for the study area displayed with the Euclidean distance for Eneolithic settlement

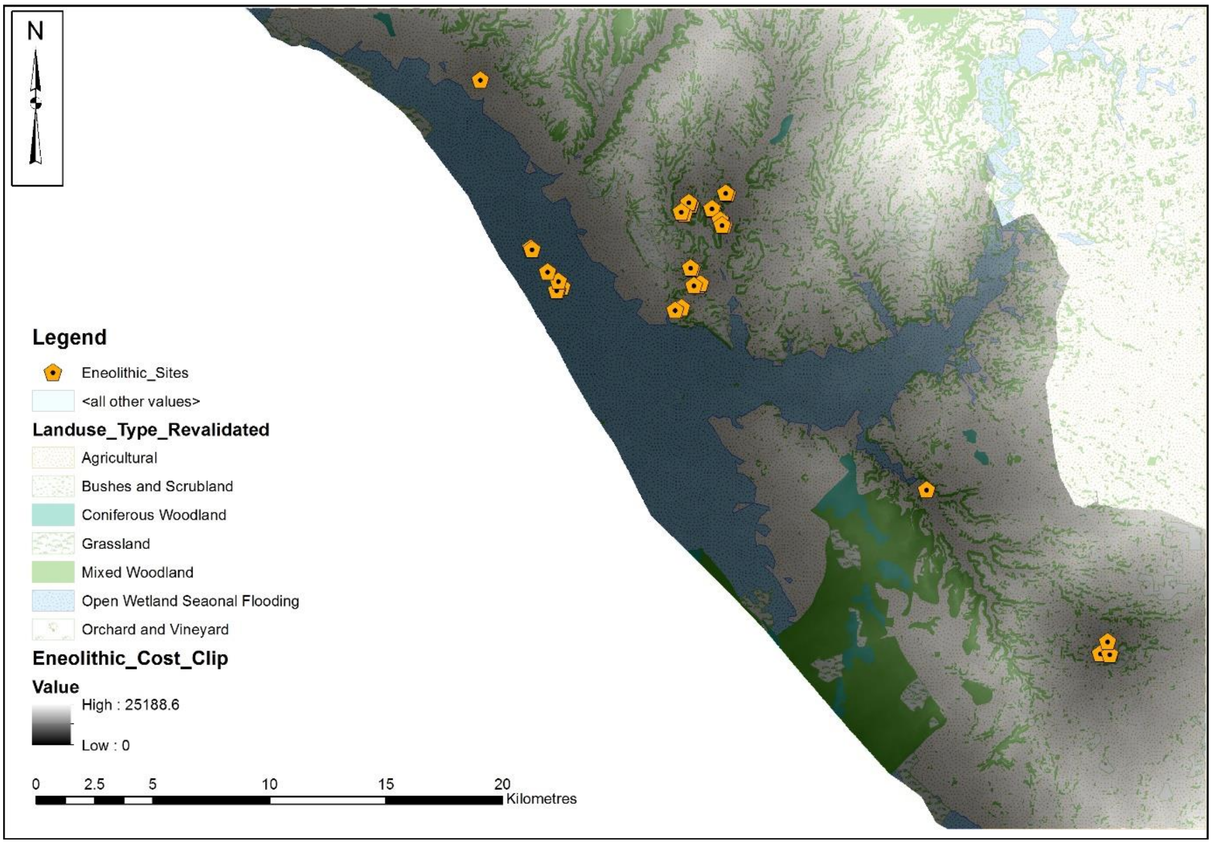


Figure 8.23 Land use for the study area displayed with cost distance for the Eneolithic settlements

While the number of settlements recorded to the south of the Tiber is limited, it is interesting to note the two areas of Eneolithic settlement, located on the lower and upper reaches of the Malafede. The former seems to demonstrate an extent covering the edge of the Tiber floodplain, the valley bottom of the Malafede and the wooded side valleys and agricultural land of the surrounding spurs and ridges. The latter has a discrete extent covering tributaries of the Malafede, and the agricultural land and woodland in between these tributaries.

In summary, both Neolithic and Eneolithic settlements seem to indicate an area of influence that covers a range of possible land use classifications. Sites seem to be less confined to the edges of possible ecotones, but are centred close to principal resources, but within a close enough distance to access other sets of resources. Bearing in mind the evidence for cattle and caprines at sites such as Cerquete-Fianello, and the envornment evidence for cereals being grown in the area of Maccarese in the Eneolithic, the area of influence from these sites covering the lower terraces of the plain as primary agricultural land away from the risk of potential flooding, is interesting, suggesting settlement close to the lagoon and wetland resources, but within close distance from agricultural land, and indeed the edge of mixed woodland on the hillslopes on the edge of the Maccarese Plain. The cost distance analysis presents a contrast to the Euclidean distance analysis. It suggests a cost involved in moving from the area of Cerquete-Fianello to the settlemernts upslope and *vice versa*, unless traversing the valley bottom of the Rio Galeria and the Tiber. While it might be assumed that the relatively close proximity of the se settlements to one another might indicate some seasonal settlement, and movement between settlements or camps, the cost model seems to reject this.

8.3.2 The Bronze Age

The pattern of Bronze Age settlements also formed the focus of basic spatial and cost analysis. The Theissen polygon analysis emphasises the distribution of settlement, with a series of sites located along the coastal plain and delta of the study area (Fig. 8.24), and second series of sites located along the north-west to south-east axis formed by the Rio Galeria and Malafede. The polygons, mainly as a result of the greater number of recogniseable settlements for this period, suggest greater even distribution and sub-division, with a number of settlements having polygons with their edges running along the edge of the wetland zone, and sites located above them on the lower terraces, particularly on the northern edge of the Maccarese Plain.

The Euclidean distance analysis (Fig. 8.25) indicates sites in the central part of the Tiber delta, with extents not encroaching on the areas of the agricultural or mixed woodland above the floodplain and delta. The vast majority of settlements, however, do seem to have extents that incorporate the wetland, woodland and agricultural areas. The cost distance analysis, by contrast, shows that sites located on the coastal plain and delta have a cost extent across the plain and incorporating the mixed woodland on the lower slopes of the hillsides alongside the Maccarese Plain, and to the hillslopes on the Laurentine Plain. The settlements on the second axis across the Galeria and Malafede valleys, show an extent that follows the valley sides and bottoms, extending to the Tiber floodplain, but with larger cost indicated for accessing the coastal plains from these settlements.

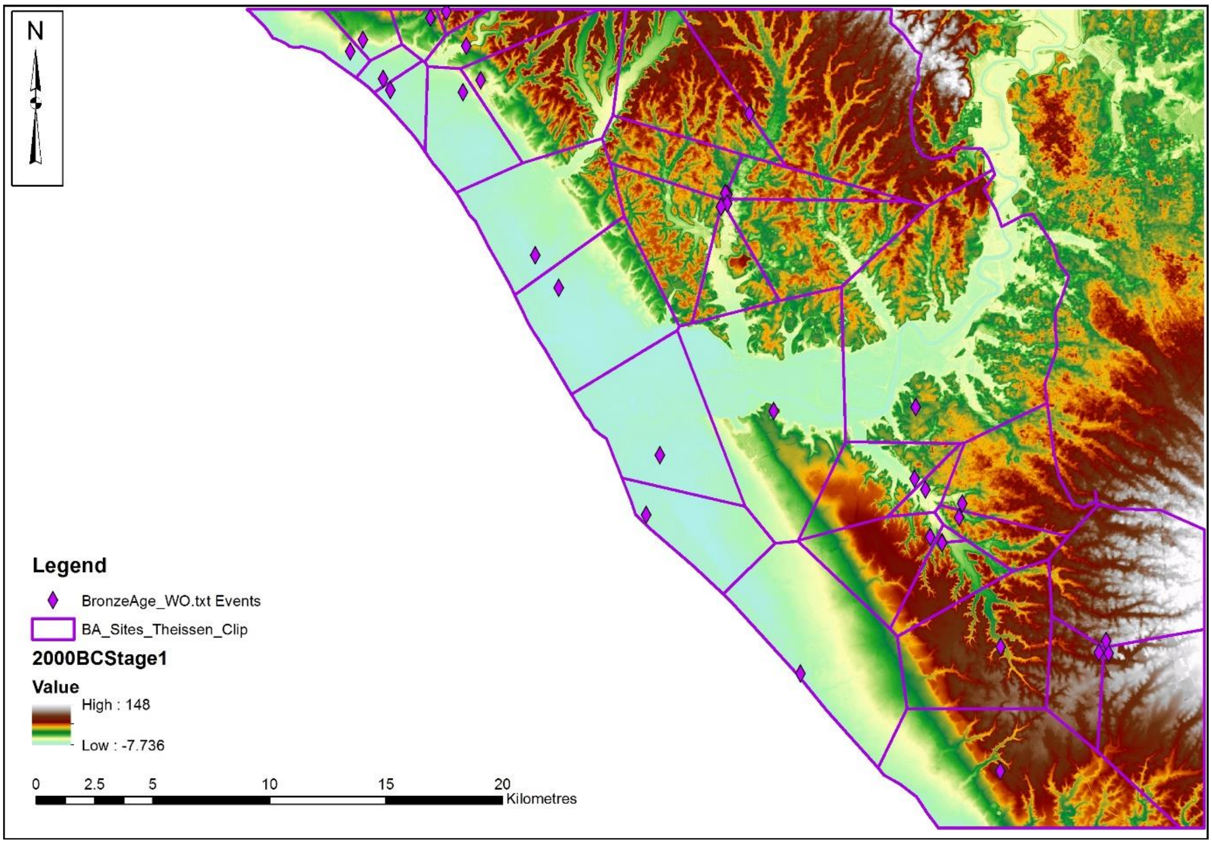


Figure 8.24 Theissen polygons for the Bronze Age settlement of the study area

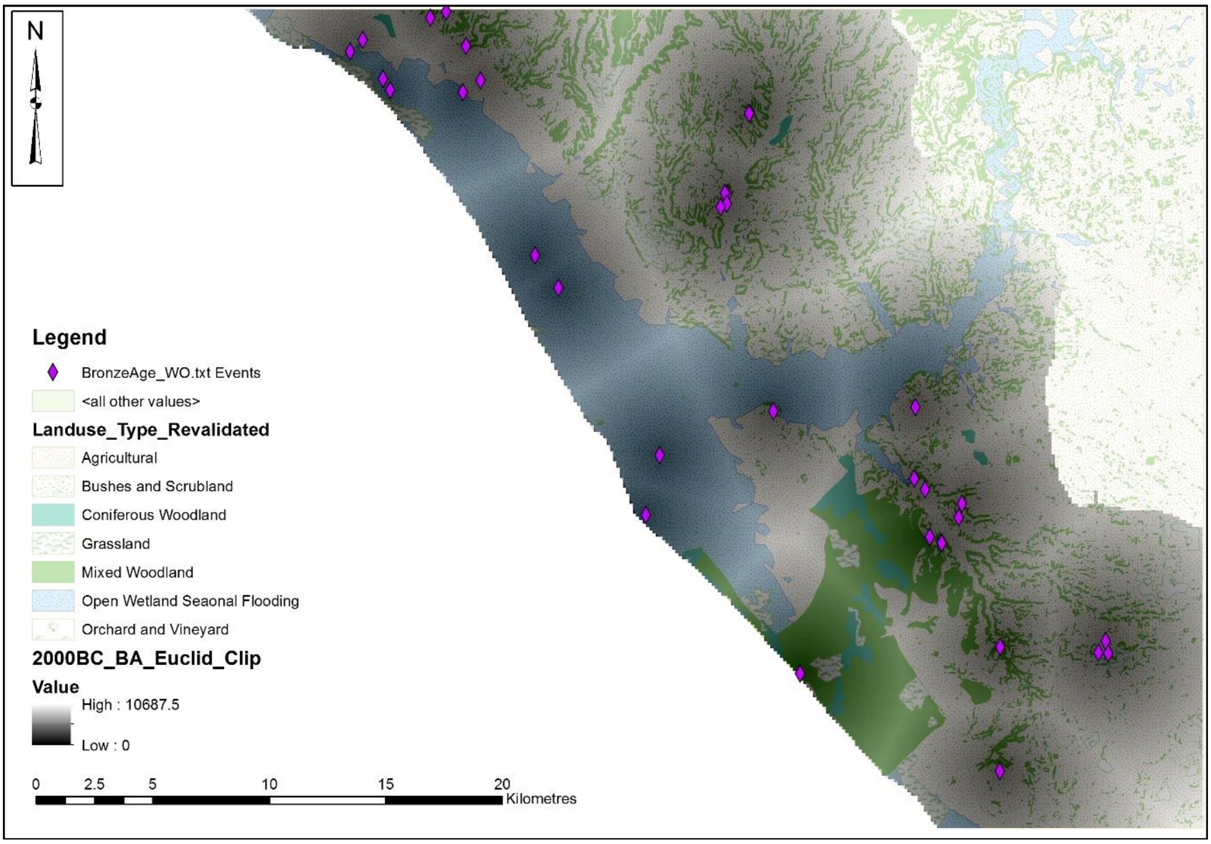


Figure 8.25 Land use for the study area with the Euclidean distance for Bronze Age settlements

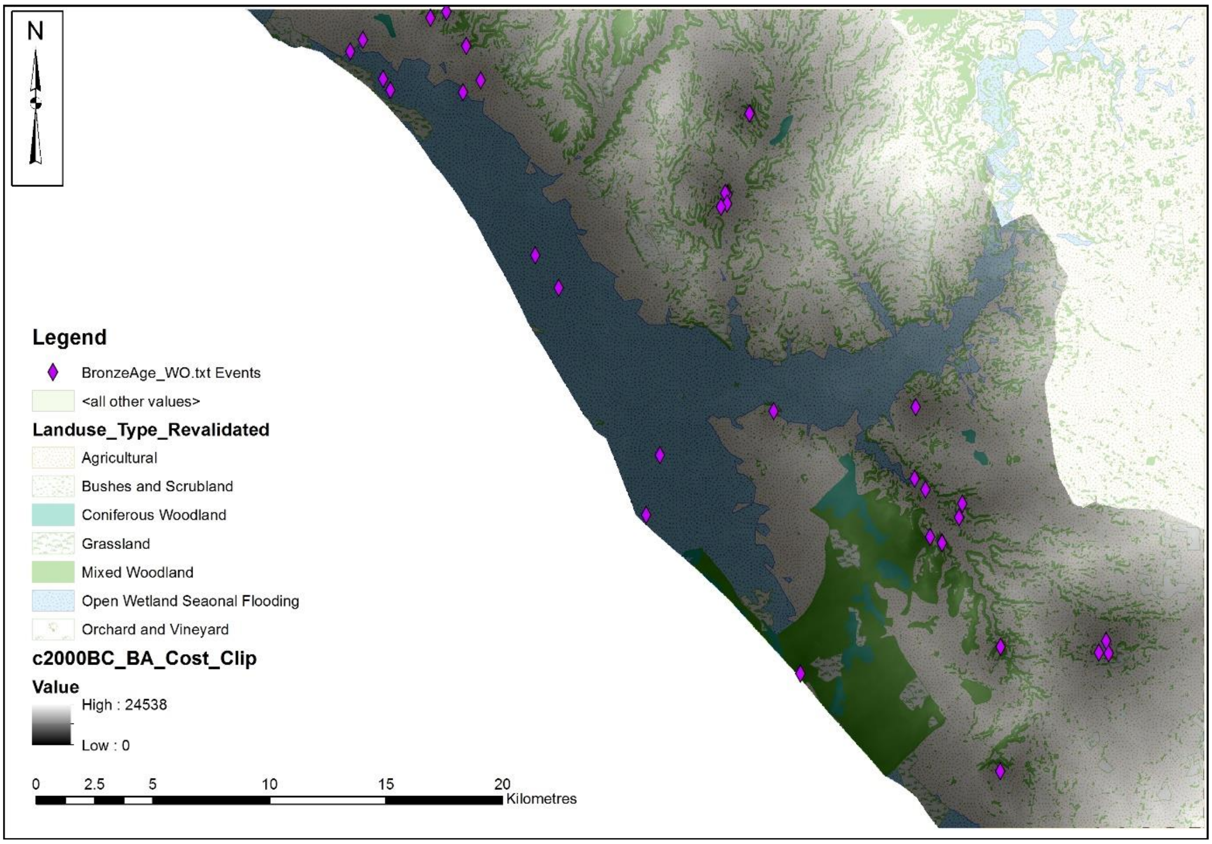


Figure 8.26 Land use for the study area displayed with the cost distance for Bronze Age settlement

The pattern of settlement for the Bronze Age thus indicates extensive settlement and use of the wetland area, and the two lines of possible settlement in the area. When first looking at the Bronze Age sites in the study area, it seemed that the distribution of settlement marked an indication of possible temporary sites linked to the pastoral economy and transhumance, in addition to the more permanent settlements. The cost analysis, however, suggests that movement between these settlements is not a given. This does not preclude movement between sites in any form, but might suggest more permanent settlement, and a focus on resources of different types, from the wetland and coastal plain, to the valley sides and bottoms inland.

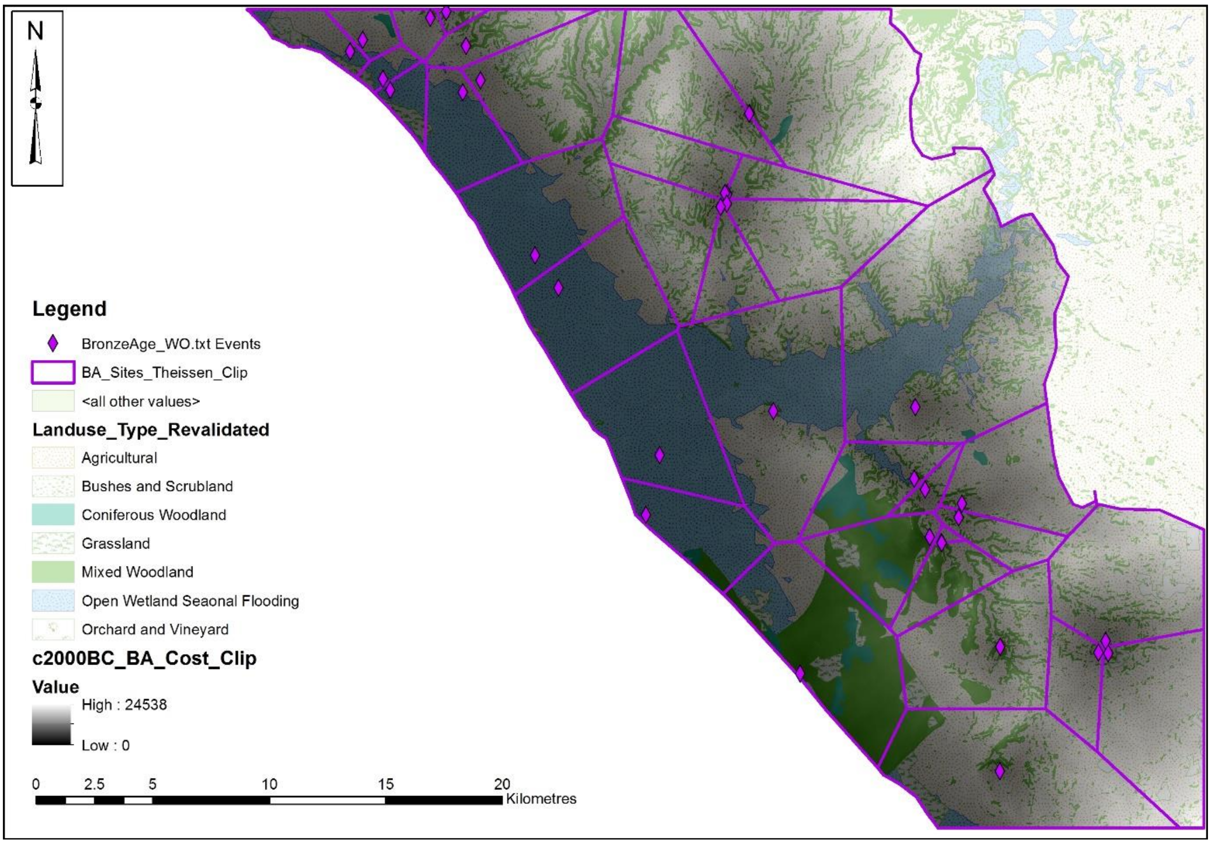


Figure 8.27 Land use for the study area displayed with the Theissen polgons and cost distance for Bronze Age settlement

A comparison between the Theissen polygons and cost distance (Fig. 8.27) is also worthwhile. These models represent very different approaches to the analysis of the pattern of settlement, but the correlation between the polygon edges and the extents of the coast analysis for the settlements along the coastal plain is certainly of interest, and suggestive of an extent that incorporates both wetland and agricultural/mixed woodland, but that is very constrained along the edges of the Pleistocene hillslopes overlooking the coastal plain. These settlements certainly seem to indicate that the wetland zone was populated with dispersed settlement along its length. The issue that underlies this pattern, however, is the date of the settlements, with those in the central delta area dating to the Final Bronze Age. The lack of refinement in terms of dates for the Bronze Age sites elsewhere is certainly problematic. However, the pattern is representative of settlements for the overall period.

8.3.3 The Protohistoric Period

A new dynamic was introduced in the Protohistoric period, with the presence of settlements but also larger nucleated settlements with necropolis at locations such as Castel di Decima. Thus, analysis included Theissen polygons and distance analysis from these key sites, and in terms of the overall distribution of rural settlement for the period.

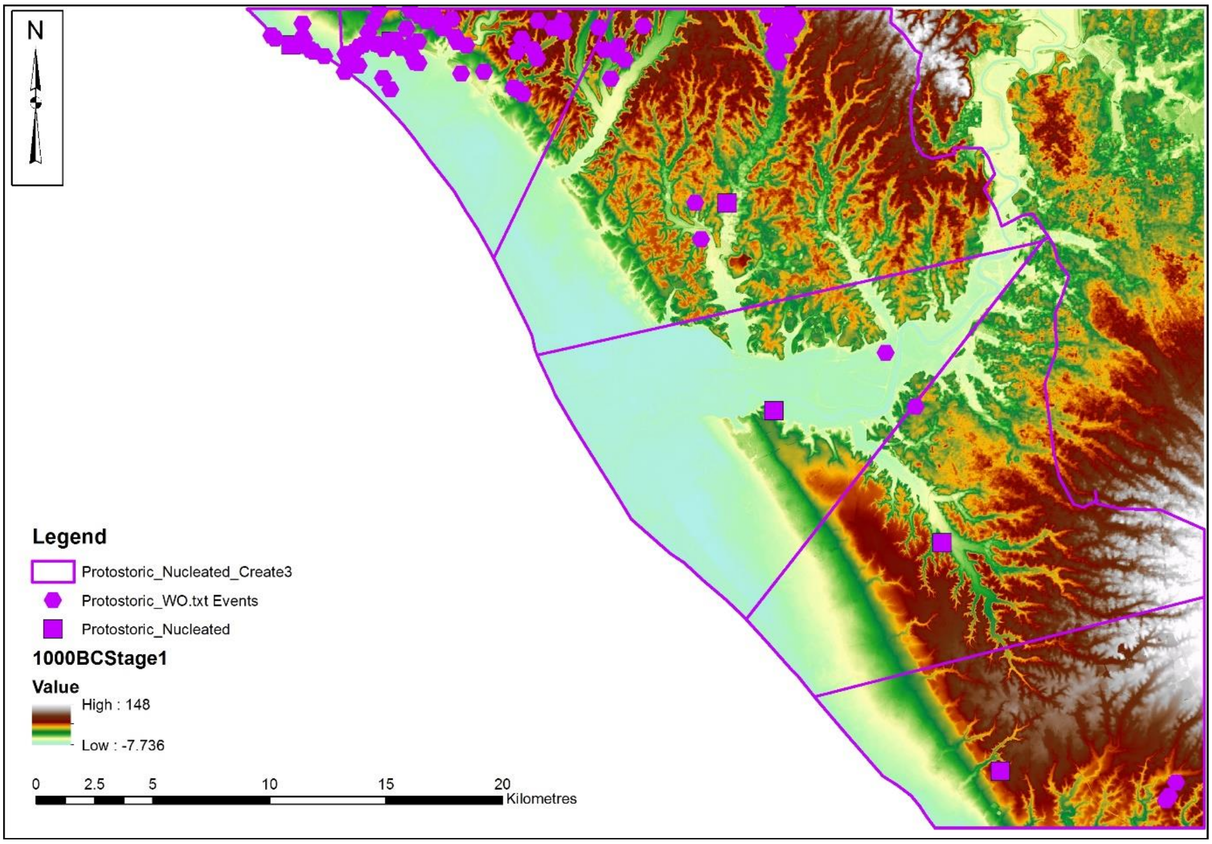


Figure 8.28 Theissen polygons for the nucleated Protohistoric settlements

The overall pattern for the Theissen polygons for the nucleated settlements (Fig. 8.28) indicates an evenly distributed range of settlement along the axis of the Galeria and Malafede, with approximately 10km between settlements. These polygons incorporate rural settlement from the Protohistoric period, with the Euclidean distance analysis showing extents covering all the main classifrications of land use (Fig. 8.29). The cost distance analysis (Fig. 8.30) provides a contrasting picture of the cost extents from the nucleated settlements. Rather than the extent for each settlement covering the wetland area, the cost distance indicates the settlement of Ficana dominating the wetland and delta of the Tiber, with the influence of Lavinium much further to the south, and the influence of Monte Roncione and Castel di Decima more constrained along the valleys of the Rio Galeria and Malafede respectively.

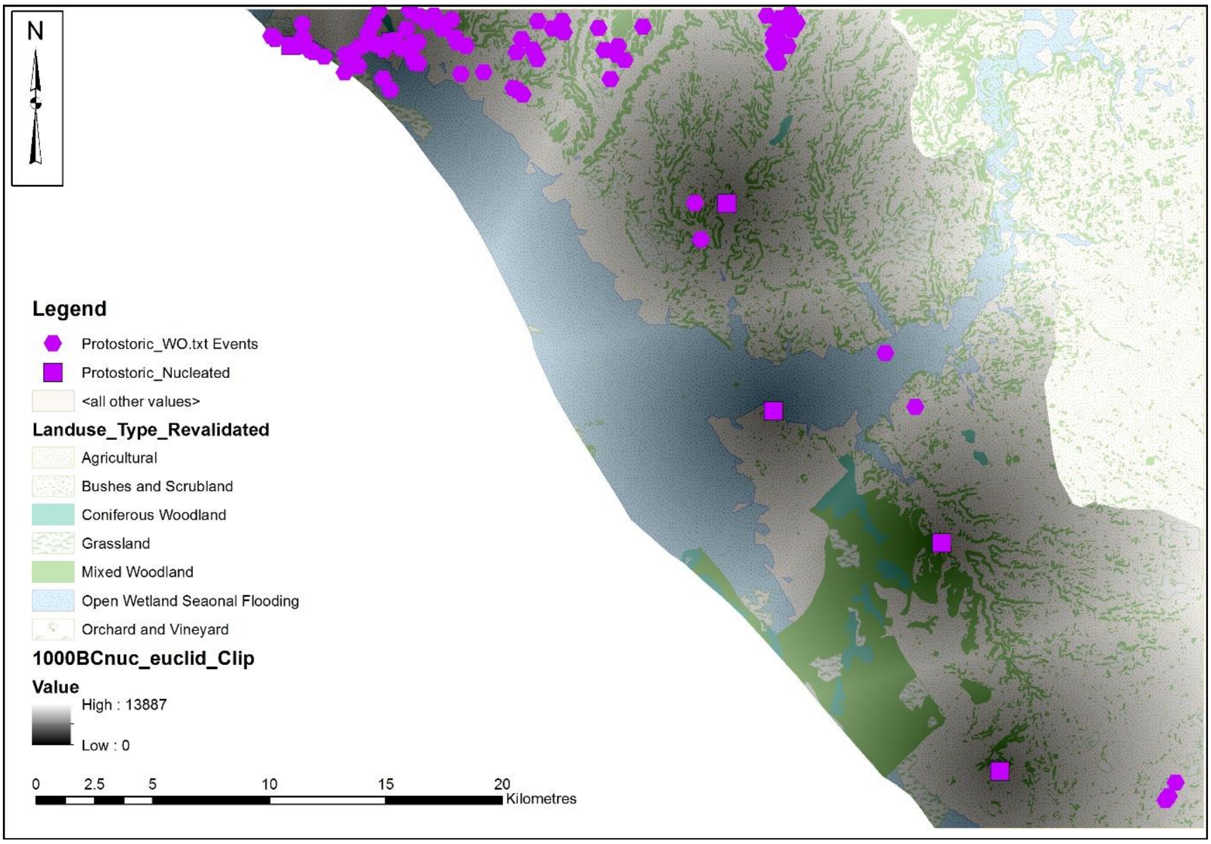


Figure 8.29 Land use for the area displayed with the Euclidean distances from the main nucleated Protohistoric settlements

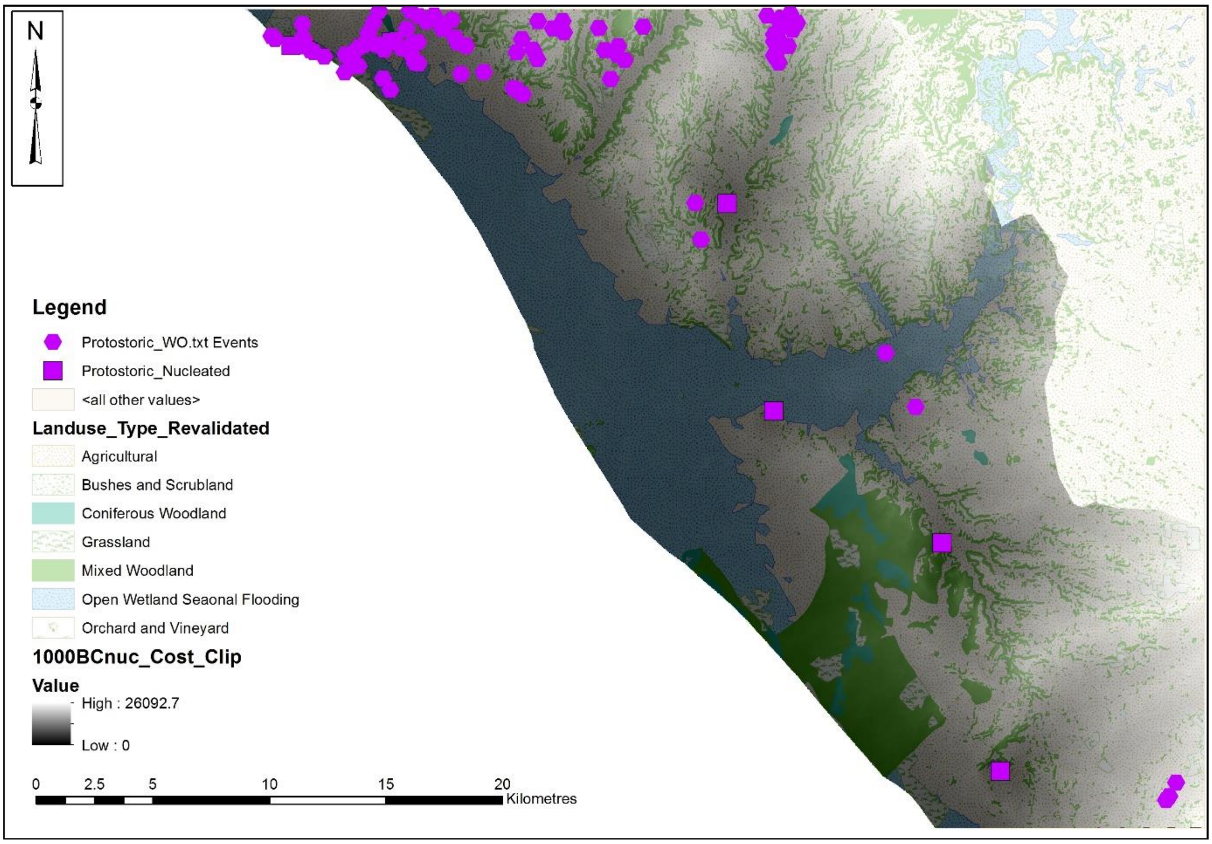


Figure 8.30 Land use for the study area displayed with the cost distance from the main Protohistoric nucleated settlements

It is difficult to draw patterns relating the cost distance to the presence of rural settlements in the area of each nucleated settlement. However, two settlements are located on the periphery of the cost distance for Monte Roncione along the Rio Galeria (Fig. 8.30), and three more are located on the easternmost periphery of Lavinium.

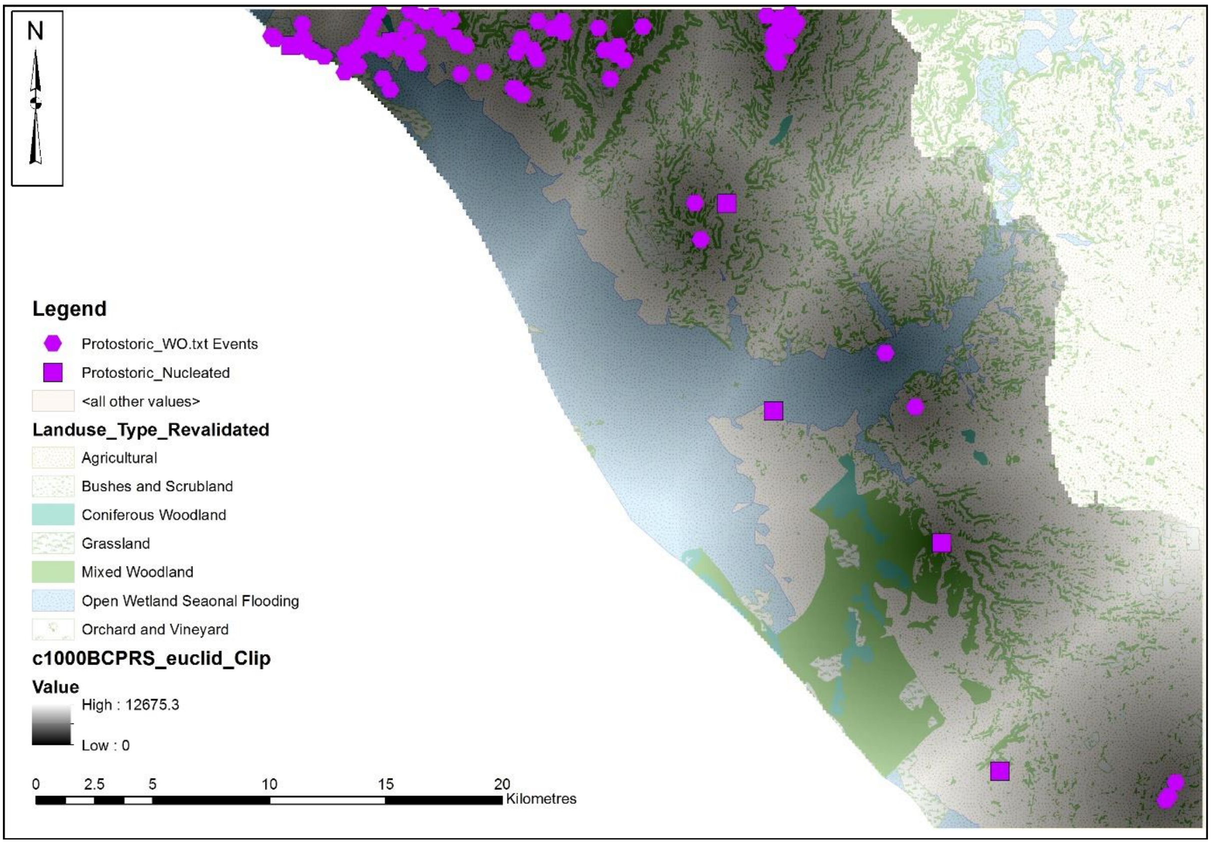


Figure 8.31 Land use for the study area displayed with the Euclidean distance from all Protohistoric settlement

Similar analysis was conducted for the rural settlements of the Protostoric period, with Euclidean and cost distance analyses (Figs 8.31 and 8.32) being conducted. These provide an inverted model from those utilising the nucleated settlements but indicate some Euclidean and cost distance proximity to the nucleated settlements. Of interest, particularly for the rural settlements in the vicinity of Monte Roncione, is that from their location there is still an evident cost to accessing the floodplain. In addition, the floodplain area is dominated by a series of Protohistoric settlements on the northern edge of the plain, a factor very much influenced by the detail in field surveys in the area, and the absence of information on Protohistoric sites in the Tiber delta area. Results of the model need, however, to also recognise that the Final Bronze Age settlements in the area of Ostia (see preceding section) may also be representative of Iron Age settlement in the Protohistoric period. Many of the rural settlements seem to be located close to the boundaries of ecotones, along the wetland edge of the Tiber floodplain, or either on the wetland or agricultural land on the Maccarese Plain. The majority are located on agricultural land close to mixed woodland.

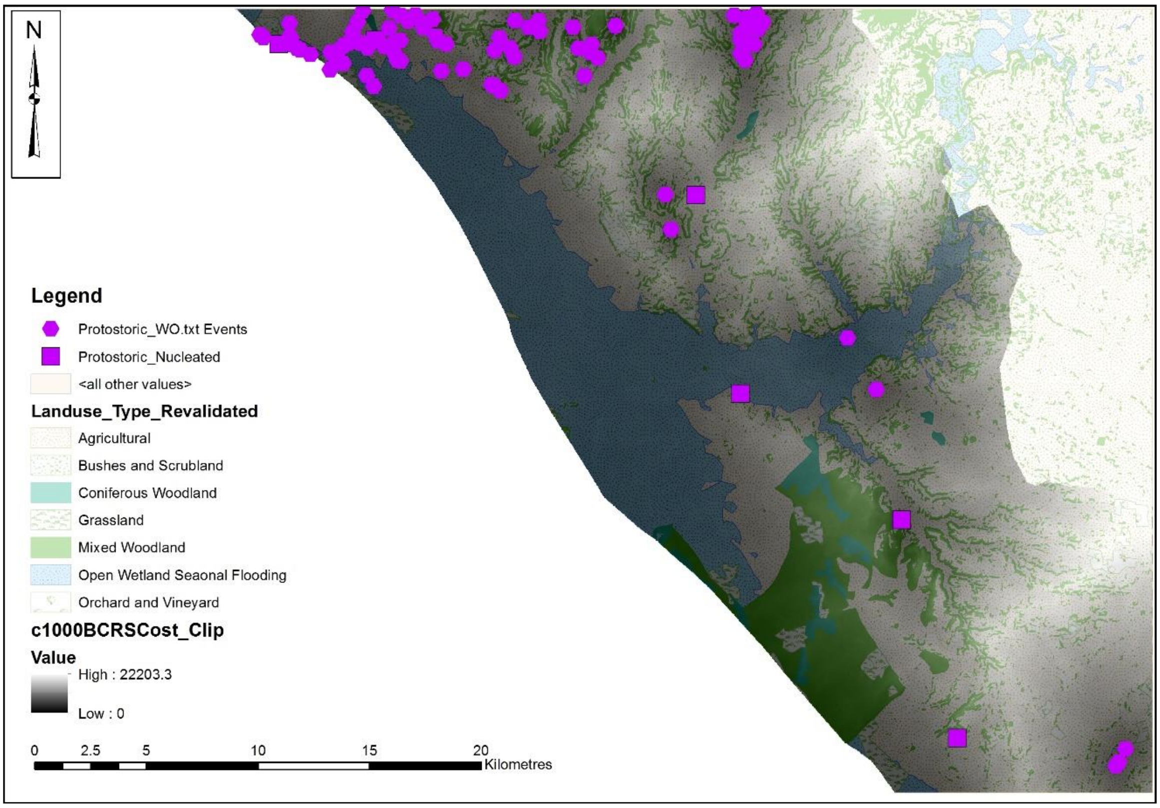


Figure 8.32 Land use for the study area displayed with the cost distance from all Protohistoric settlements

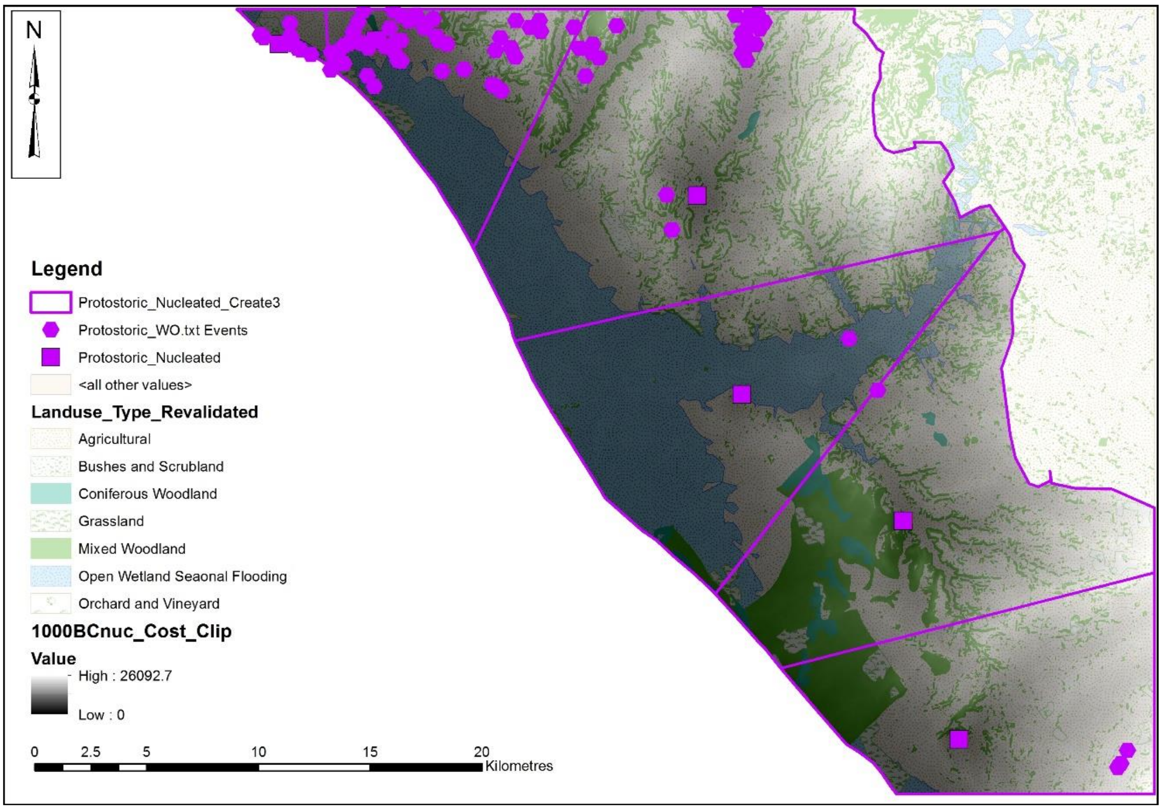


Figure 8.33 Land use for the study area displayed with the Theissen polygons foir the nucleated settlements and the cost distance for all Protohistoric settlements

An overlay of the Theissen polygons with the cost distance for the nucleated settlements (Fig. 8.33) give an indication of the location of rural settlement in relation to the larger nucleated settlements, and generally this seems to give the impression of minor settlements located in the polygons of larger settlements on the edge of the cost distance extents for those settlements. This gives a rudimentary impression of some degree of settlement hierarchy, with rural settlement located within reach of the larger settlements, and alongside the boundaries between types of land use, allowing cultivation and animal husbandry, and access to mixed woodland for resources. Of note here is the location of the recently discovered settlements on the edge of the wetland to the east of Fiumicino airport (De Castro *et al*. 2018). The site is not represented in the analysis but is located on the wetland below Monte Roncione.

In summary the pattern of Protohistoric settlement and its relationship to types of land use seems to be more complex than for the previous periods. Firstly, the larger nucleated settlements are located away from the coastal plain, with Lavinium representing the settlement with closest proximity to the coast. To this are added the rural settlements, located within the cost distance extents of the major settlements, and in locations on the boundaries of ecotones for exploitation of agriucultural land, wetland and wooded zones. While this is the case, there are few settlements on the coastal plain or Tiber delta, certainly when compared to the Bronze Age. Those that do exist are exploiting the wetland, but the limited settlements may indicate a lack of visibility in the record, or a change in the pattern of settlement. This latter is perhaps associated with the changing environment of the plain to a more saline and brackish lagoon setting, and sites established to exploit these resources for salt production.

8.3.4 The Roman Period

The spatial analysis of Romen period settlement followed the pattern for that of the preceding sections. However, the presence of data relating to Roman roads in the study area also allowed a basic proximity analysis and Chi-squared test to be conducted based on the location of villa sites and rural settlements and the road network.

8.3.4.1 Proximity to Roman Roads

For the Roman sites in the study area, the proximity to the line of Roman roads was a further factor to consider. A number of issues exist with the definition of the roads, and the coarse nature of the chronology present for many of the rural settlements and villa sites for the area. Firstly, some roads classified as Roman, were preceded by Etruscan roads in South Etruria (Potter 1976, 16), and the dates of stretches of principal roads, while dateable, often have different phases of use. Secondly the road network and pattern of settlement may well have developed in tandem, indicating that an association between sites and proximity to the road network may produce a self-fulfilling hypothesis. Thus, rural settlement and villa sites for the Roman period were considered separately to identify any difference in association.

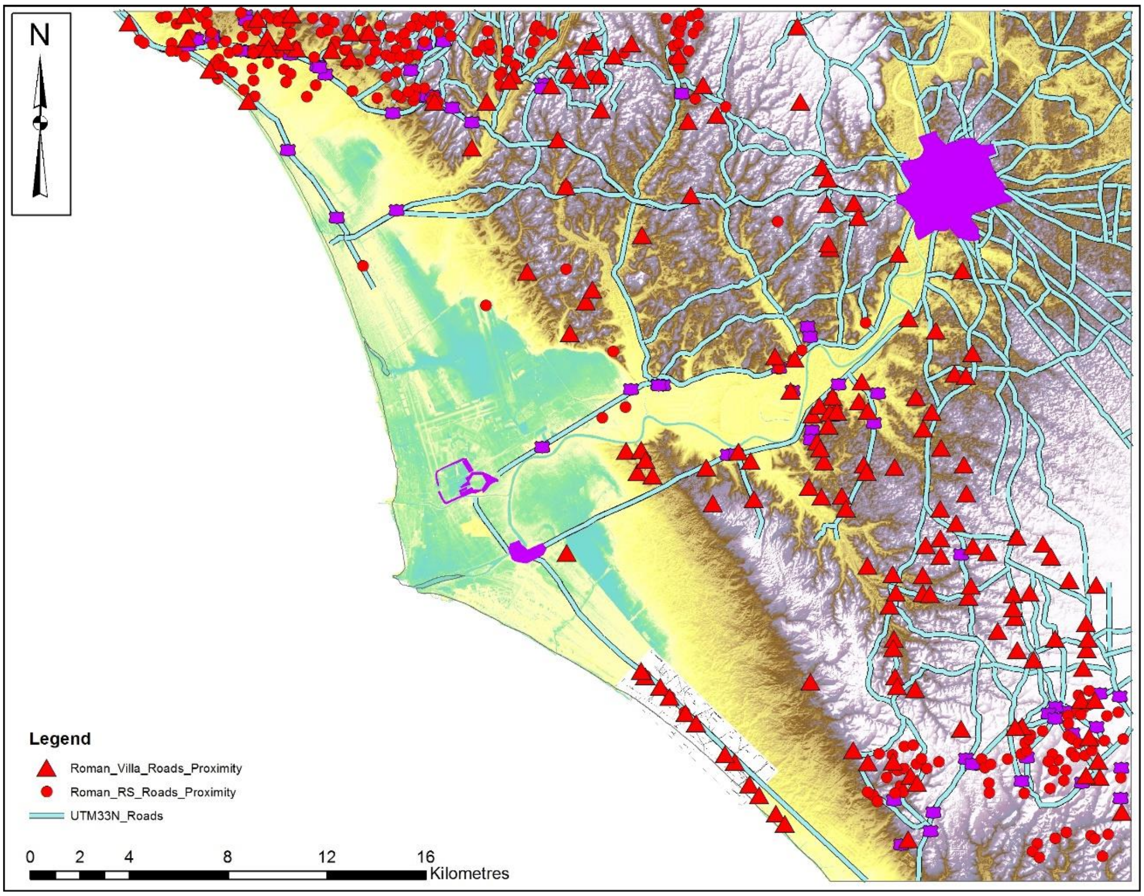


Figure 8.34 Location of Roman villas and rural settlements across the study area, in relation to the road network

The road network (Fig. 8.34) was derived from a coverage created for the Tiber Valley Project and clipped to the extent of the study area. To this coverage the digitised layout of roads from the *Forma Italiae* volumes (De Rossi *et al.* 1968; Tartara *et al.* 1999) were added. Finally, the supposed line of the Via Severiana along the coastal plain to the south of Ostia Antica was derived from Lanciani's map (Chapter 4, Figs 4.42 and 4.43) of the area, running adjacent to the maritime villas in the area.

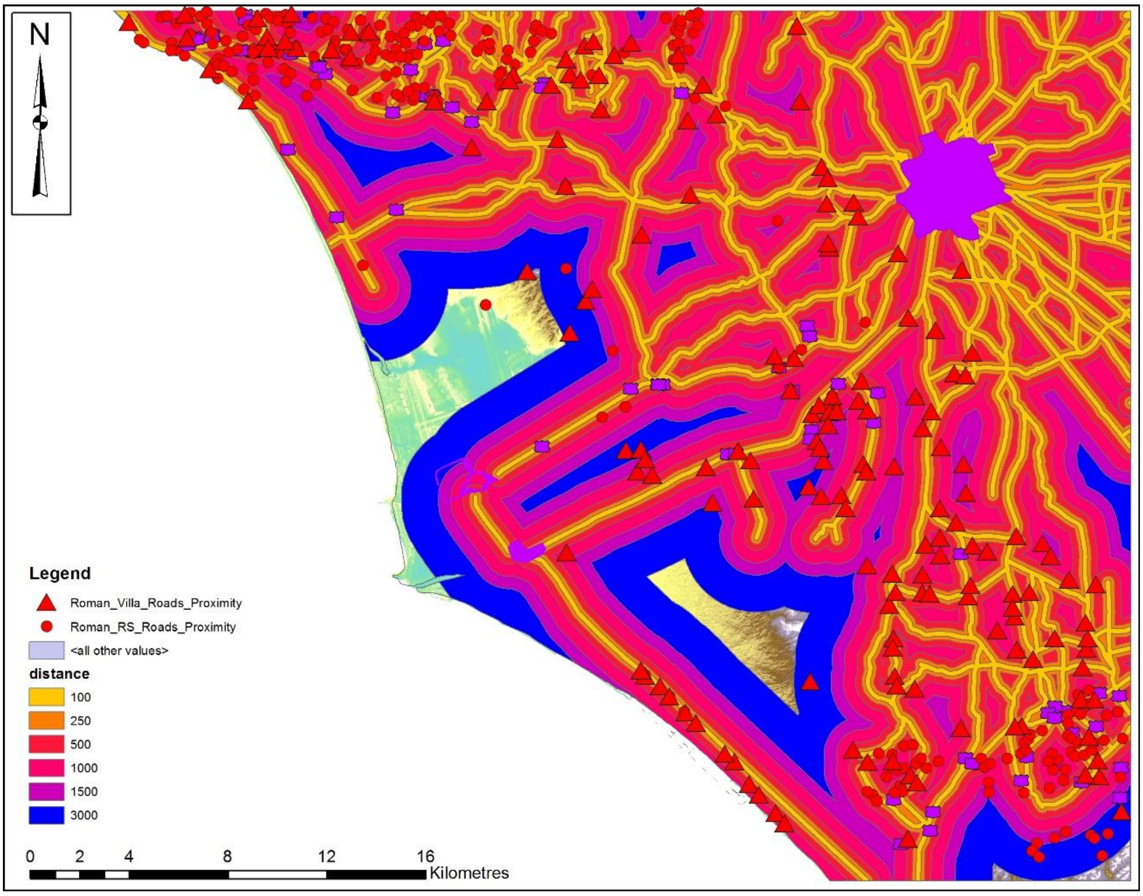


Figure 8.35 Multiple buffer zones around the roman road network, relating to location of Roman villas, rural settlements and archaeological remain of road infrastructure

Multiple ring buffers for the road network were created in ArcGIS (Fig. 8.35) at 100m, 250m, 500m, 1000m, 1500m and 3000m distances. These were then used to produce a spatial join of the buffer area domain for Roman rural settlements and villas. In addition a Chi-aquared test was conducted using the area of each buffer to assess the distribution of the sites. The hypothesis was formulated as:

H0: Settlements are equally distributed across all buffer polygons

H1: Settlements are not equally distributed across all buffer polygons

Results of the Chi-squared test indicate that no even distribution across the areas exists, with location of both rural settlements and villas strongest in close proximity to Roman roads. Most villa sites, 144 of the 165 sites, are located within 1000m of a Roman road, and 209 of the 238 Roman rural settlements located within 1000m. While no Roman villa sites are located more than 3km from a road, 11 rural settlements are over 3km from roads, indicating a small number of rural sites a long distance from the road network.

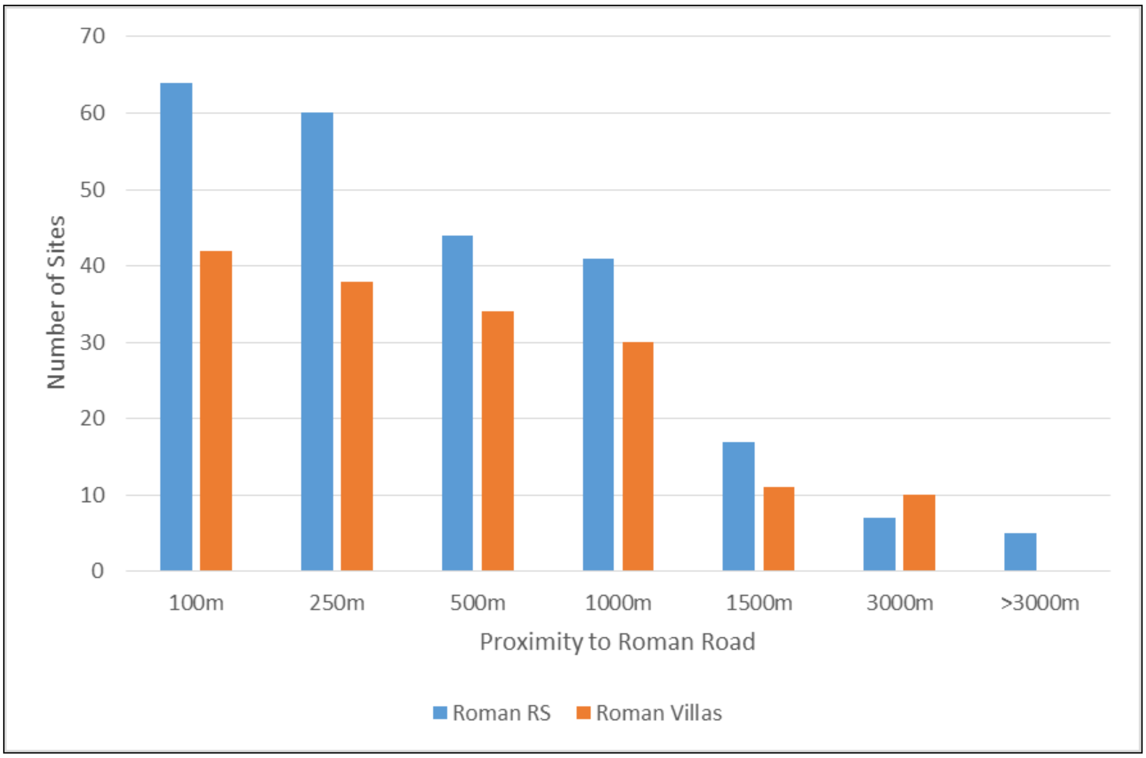


Figure 8.36 Proximity to Roman roads for Roman villas and rural settlements

Distance	%	Roman RS Expected	Roman RS	χ2	Roman Villas Expected	Roman Villas	χ2
100m	13.37%	32	64	32.51	22	42	18.00
250m	17.02%	41	60	9.38	28	38	3.50
500m	20.36%	48	44	0.41	34	34	0.01
1000m	21.92%	52	41	2.39	36	30	1.05
1500m	10.42%	25	17	2.45	17	11	2.23
3000m	12.22%	29	7	16.78	20	10	5.13
>3000m	4.68%	11	5	3.38	8	0	7.72
Total	**100.00%**	**238**	**238**	**67.31**	**165**	**165**	**37.64**

Table 8.42 Results of the Chi-squared test for proximity of Roman villas and Roman rural settlements to roads

	RS Roman (Total 238)	Villas (Total 165)
χ2	67.31	37.64
χ2 accept/reject	12.592	12.592
k-1	6	6
α	0.05	0.05

Table 8.43 Results of Chi-squard test for proximity to Roman roads indicting the accept/reject threshold

Results of this analysis (Tables 8.42 and 8.43) are, perhaps, unsurprising, demonstrating the close proximity of sites in the Roman period to appropriate networks of transportation (Fig. 8.36), allowing agricultural goods and materials to be transported by road. The results belie the complexity of the road network in the study area, in terms of the phases of road constructon into the floodplain and delta area of the Tiber. Certainly, the road network associated with major population centres such as Ostia Antica, and the maritime villas to the north and south of the Tiber are closely related to the development of the settlements.

8.3.4.2 Settlement Distribution and Land Use

The spatial analysis for villas and rural settlements in the study area incorporated Theissen polygons, Euclidean and cost diatances from sites. As with the Porotohistoric period, some degree of greater complexity was present in the dataset with two levels of settlement represented. Thus, the analysis was conducted for villa sites, allowing comparison with the distribution of rural settlement. The Theissen polygons for the villa sites (Fig. 8.37) indicate a very diverse picture. Many enclose viariable topography, and the number of known sites facilitates a far more nuanced picture of the pattern than for preceding periods. A numbestal plain, and these show an extent that encroaches on the wetland area. However, on the Laurentine Shore the presence of the maritime villas dominates the wetland zone in terms of Euclidean distance (Fig. 8.38) and extends into the woodland and agricultural land on the fringes of the wetland in terms of cost distance (Fig. 8.39).

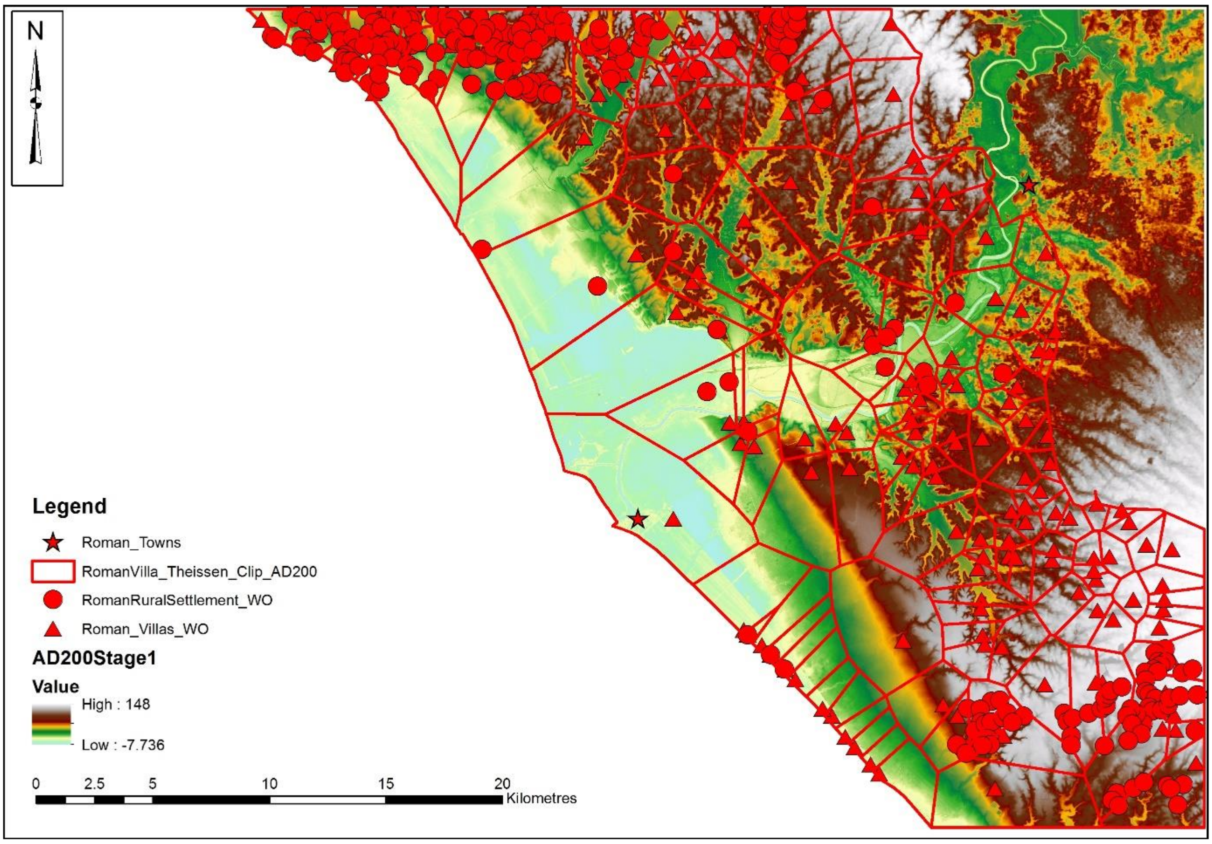


Figure 8.37 Theissen polygons for Roman villas in the study area

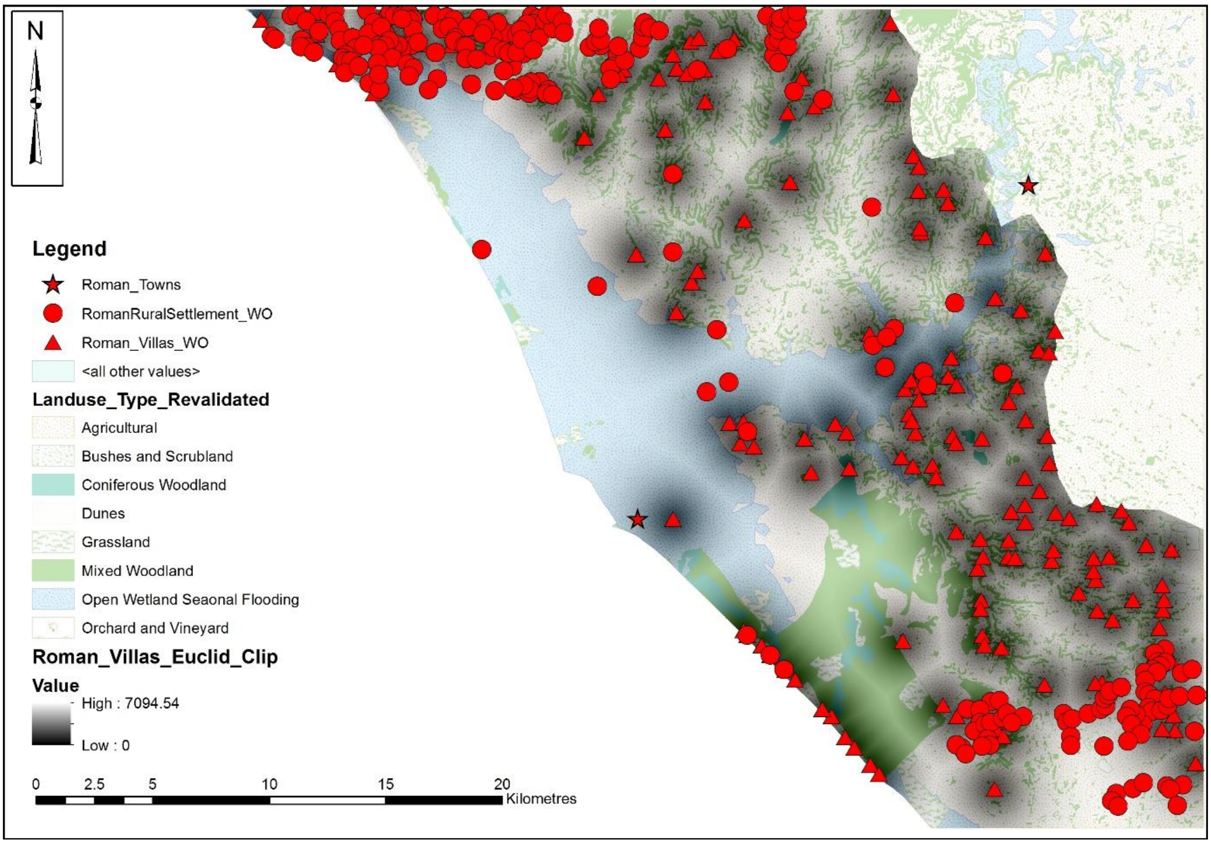


Figure 8.38 Land use for the study area displayed with the Euclidean distances from Roman villas

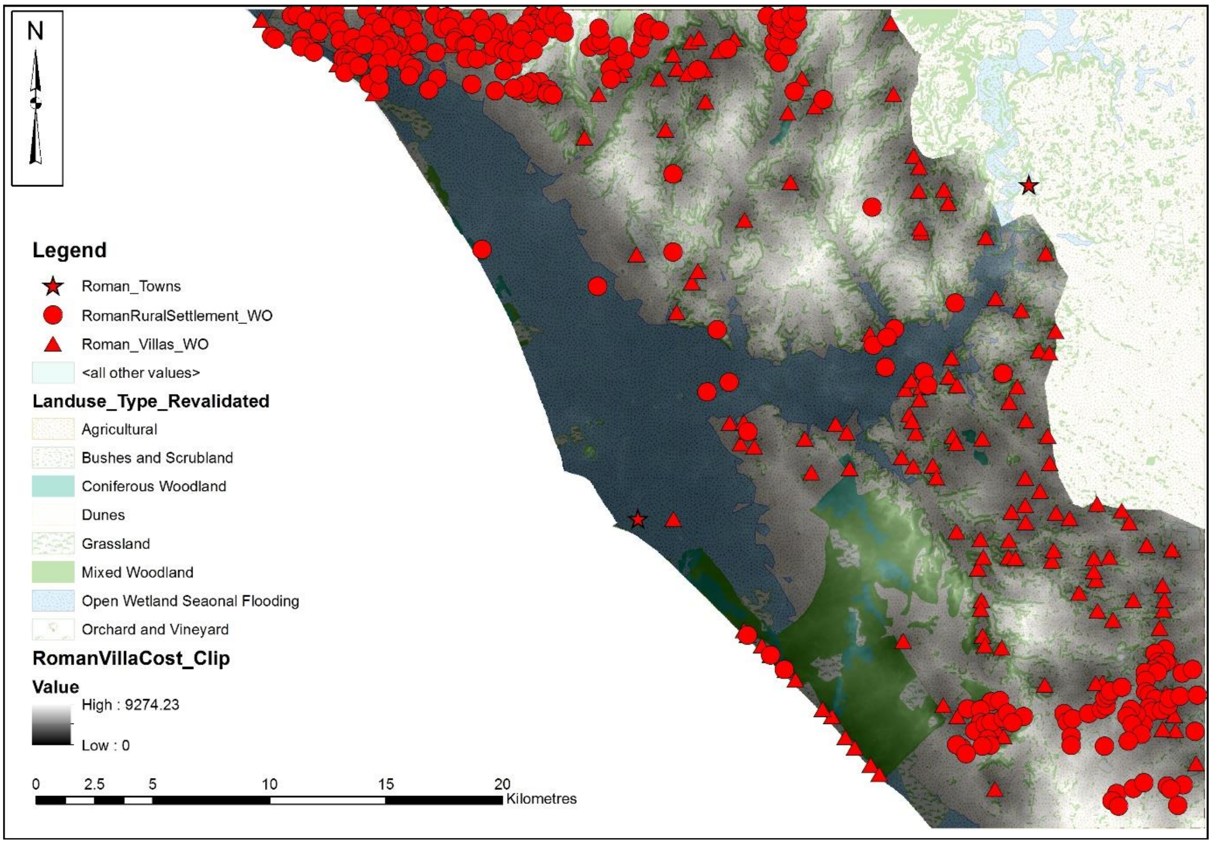


Figure 8.39 Land use for the study area displayed with cost distances from the Roman villas

Of note in terms of the Euclidean distance analysis, is the lack of villa sites or rural settlement sites from the central delta area, with sites present on the coastal plains to the north and south. This may indicate something associated with the status of this area, especially in terms of the visibility of the archaeological record, and the relatively late inhabiting of the zone. It may also be indicative of the status of the area, associated with the role of the Imperial ports at Ostia and Portus, and control of the central delta area (see below). The Euclidean distance analysis also points to the location of villas along the boundary of the agricultural and wetland ecotones for some of the sites, with others showing extents associated with access to valley bottoms, agricultural land and wooded areas. What is also apparent is the general spacing of villa sites, with between 1km and 2km between sites. There are exceptions to this, where complexes of villa sites can be noted, for instance at Dragoncello, and the maritime villas of the Laurentine shore. The cost distance analysis (Fig. 8.39) shows much similarity with the Euclidean analysis, a by-product of the network of villa sites presented in the study area, especially for the hinterland of the Tiber delta and coastal plain, where villa sites located on the agricultural land to the north and south of the Tiber indicate relatively even distribution and extent over the land surrounding each site evenly. The villas located on the edge of the agricultural ecotone in close proximity to the wetland show through the cost distance model the range of influence from these sites that could be achieved, covering much of the coastal plain and delta area.

The analysis does indicate a distribution of rural settlement within the Theissen polygons of each villa, and in particular a small distribution of rural settlement on the coastal plain to the north of the Tiber.

8.3.5 Summary of the Spatial Analysis

The spatial analysis for settlements of different periods marks a preliminary analysis for assessing the model of settlement distribution and its relationship to the areas of land use and ecotones in the study area. While rudimentary, it does highlight a number of trends across the different periods in terms of the settlement pattern and the extents from which different settlements may have exploited resources. These can be summarised as indicating settlement in the Neolithic and Eneolithic on the coastal plain and on the spurs and ridges overlooking the principal Tiber tributaries. The former settlements accessed the resources around the lagoon of the Maccarese, possibly associated with periodic transhumance and grazing across the wetland, and access to agricultural land and woodland overlooking the plain. The latter seem to access the agirucltural land and woodland on the higher ground, and the valley bottom of the Rio Galeria and the Tiber floodplain.

In the Bronze Age the borad pattern changes, with settlement across the entire coastal plain and delta, and a further series of settlements overlooking the Galeria and Malafede rivers. The patern shows extents that include access to wetland, woodland and agricultural land, even fro mthe settlements located in the wetland, but with a cost distance analysis that suggests higher cost in terms of access between the settlements on the coastal plain and those further inland. The pattern changes in the Protohistoric period, suggestive of a more hierarchical system of principal nucleated sites with rural settlements close to the periphery of their areas of influence designed to access resouces on different land use types.

Finally, the most detailed dataset provides evidence for a complex network of villas and rural settlements in the Roman period, with some villas located on agricultural land close to the ecotone boundary with the wetland, and others in the more elevated hinterland of the coastal plain with access to varying resources, and rural settlements located within their spatial extents. Some rural settlement is still located on the coastal plain, possibly associated with saltworking and exploitation of resources here, but the Euclidean distances from villa sites indicates that the central delta area is of limited access, possibly as a newly stabilised environment, but also possibly associated with the port complex of the Imperial period.

8.4 Data from Two Case Areas

The preceding sections have established the nature of the pattern of settlement for the study area, from 3000 BC to AD300. These relate both quantatively and visually the association of settlements with the forms of topography, geology, land use and drainage by period, and the patterns that seem to be present in the distribution of settlement and its location relating to forms of land use and the boundaries between different ecotones in the landscape. These represent extensive analytical views of the area and the data. However, the patterns represented here relate to more detailed and descriptive archaeological data for the study area. Thus, two separate case areas have been adopted in the centre of the study area where more intensive investigation of the archaeology could be conducted. This was undertaken through published archaeological evidence, and the conducting of fieldwork and interpretation of the data (see Chapter 5, Sections 5.4-5.7). This section presents a more detailed analysis of the archaeological record, in light of the preceding sections, to develop the archaeological narrative and add nuance to the extensive analysis.

8.4.1 Case Area 1 Le Cerquete Fianello and the Neolithic, Eneolithic and Bronze Age

The case area was chosen as a sample area incorporating evidence from the Carta Bibliografica (Amendolea 2004), the fieldwork of Bietti Sestieri (1984). It also contains the site of Le Cerquete – Fianello (Manfredini, 2002). The representation of Neolithic to

Bronze Age settlements was limited by the nature of the type of surveys where material had been considered, and the overall poor visibility of the remains, associated with scatters of ceramic fragments and lithics. Thus the decision was taken to use a case study area that covered a sample of well-represented site locations, and a cross section of the topography, geology and potential land use. The area in some ways provides a counterpoint to the second case area (Section 8.4.2), located along the Tiber floodplain and the hills to the south of the Tiber valley, and incorporating parts of the central delta area.

Case Area	**Area (Hectares)**	**Number of Sites**	**Rural Settle.**	**Neolithic**	**Eneolithic**	**Bronze Age**	**Proto.**	**Roman**	**Roman Villas**
Case Area 1	13500	141	108	26	33	8	2	5	6
Case Area 2	17100	207	113	2	1	11	5	4	31

Table 8.44 Area of case study areas 1 and 2, and the number of sites, rural settlements and settlement by period for each area

8.4.1.1 Neolithic and Eneolithic

The Neolithic and Eneolithic sites in Case Area 1 range from ceramic and lithic scatters on the slopes about the Tiber valley, to excavated remains on the Maccarese Plain (Fig. 8.40 and 8.41). Site 2307 (Bietti Sestieri 1984, 13S, 45) represents a concentration of Neolithic, Eneolithic and Bronze Age material on the confines of the plain, including a cup and fragment of a strainer (Bietti Sestieri 1984, 28), and this located some 100m to the north west of a flint scatter (Site 1850). A concentration of sites (Sites 2315, 2316, 2317, 1901, 1904 and 1912) mark further Neolithic flint scatters from Bietti Sestieri (1984; 22N, 8-10) including impasto and blade lithics. On the ground immediately adjacent to the Maccarese lagoon, material of Neolithic, Eneolithic and later date was located (Site 2206) 200m from a concentration of impasto of Neolithic date located by Bietti Sestieri (1984, 22N, 32).

The distribution of Eneolithic material on the delta plain is almost entirely represented by discoveries made on the Le Cerquete Fianello excavations and survey. Sites N and D (Sites 2304 and 2294) indicate Neolithic material. Site D indicated the presence of a Neolithic burial (Carboni and Salvadei 1993), with material indicating the Lagozza facies at the end of the Neolithic, with ceramics including bowls and cups

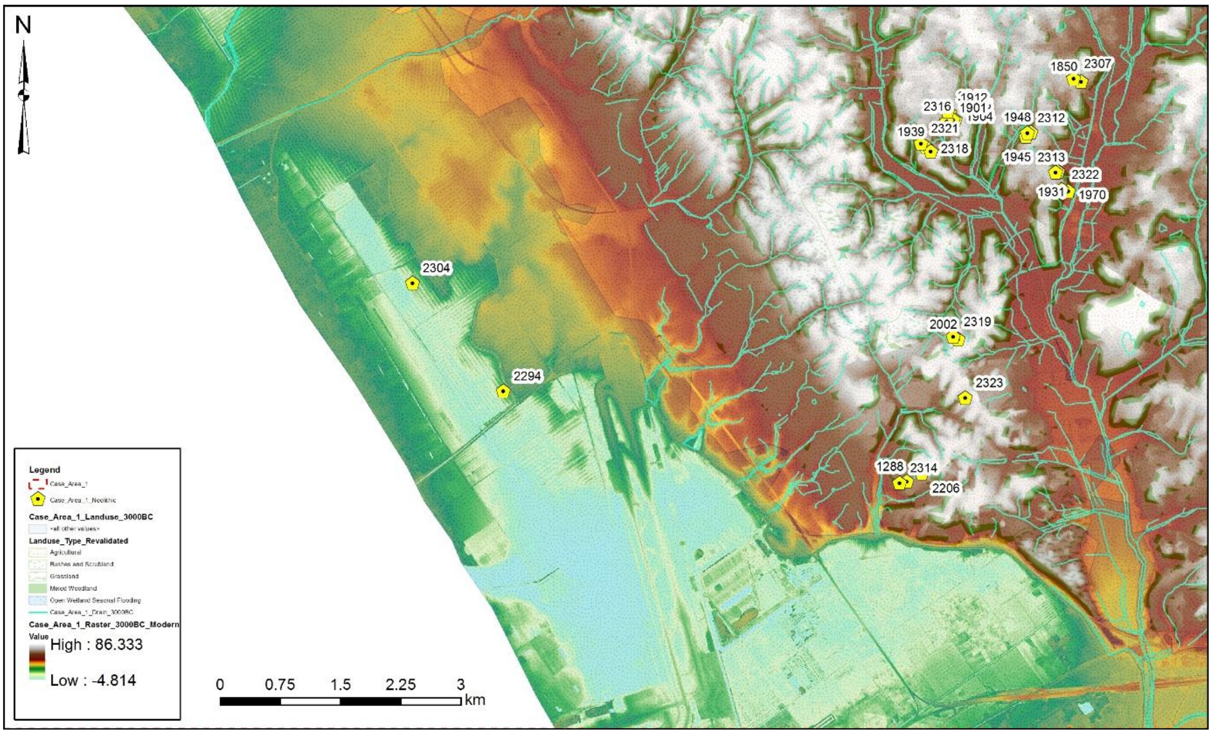


Figure 8.40 Case Area 1 showing Neolithic settlements with topography, drainage and land use

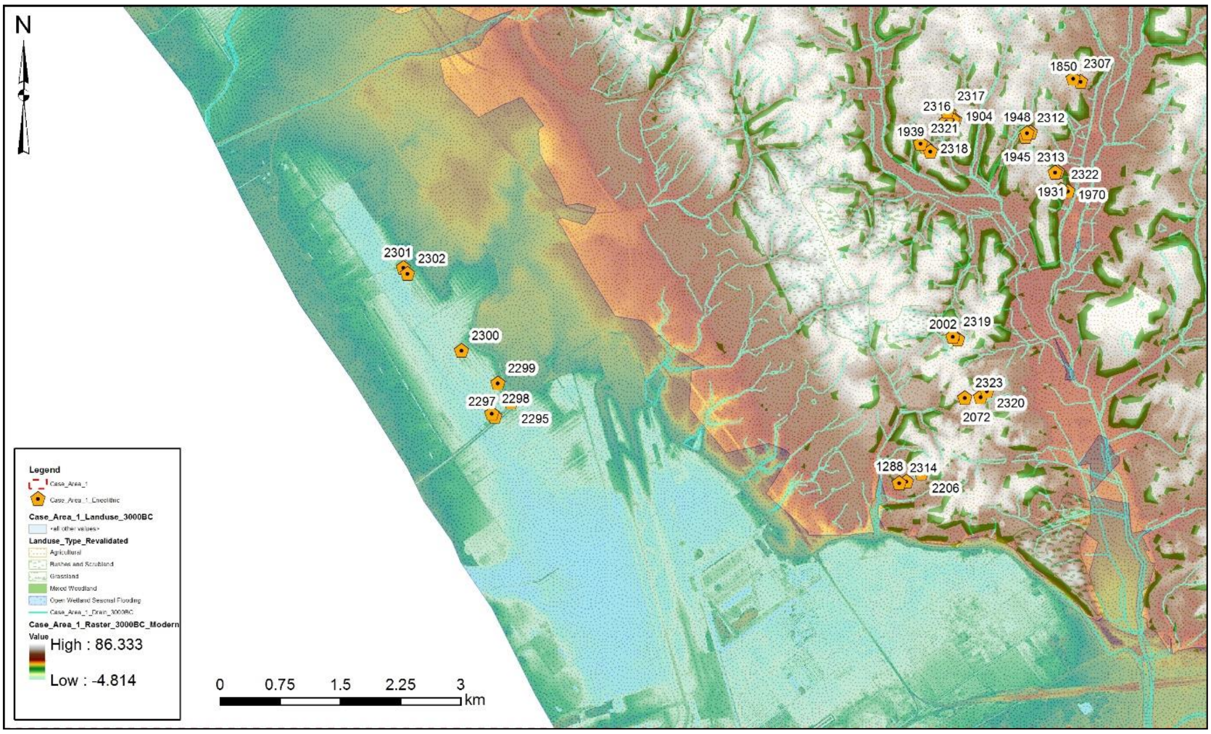


Figure 8.41 Case Area 1 showing Eneolithic settlements with topography, drainage and land use

Lithics appear to be made from local flint and obsidian, truncated flints, some microliths, flint for graters, arrow points and, in obsidian, unretouched flint and pyramidal cores. There aree also indications of debitage suggesting working of flint, including use of fire, and forms of bowls similar to those in the vicinity of Rome from Torre Spaccata (Carboni and Salvadei 1993, 62). The burial of a female aged 40-50 formed part of the site, recovered together with a vessel, flint arrowhead and arrow cusp.

The late Neolithic presence on the fringes of the Maccarese lagoon are matched by Eneolithic material at Sites 2300 (Fianello J), 2299 (Le Cerquete I), 2295, 2297 and 2298 (Le Cerquete E, G and H). Site 2300 comprised deposits and material excavated from the section of a modern canal (Carboni and Salvadei 1993, 264) some 0.25m from the modern ground surface. The deposits represent an open settlement, with simple ceramic forms of globular, cylindrical and triconical vessels of impasto grossolano with scarce decoration (Carboni and Salvadei 1993, 265). Material includes ‘a barbotine’ ceramic, a distinctive type associated with the Bronze Age and settlement along the Appennines, in addition to ‘a spazzola’ ceramic from northern Lazio.

Vessels included remains of a boiling funnel, suggesting the working and production of dairy products in the area. The lithics, exclusively in selce, were represented solely by debitage. There were also two travertine grinding stones.

Site 2297 (G) was located through a scatter of ploughed out material, indicating three burials, ceramic material of vessels of central-southern Italian type from the end of the Eneolithic. In addition, some lithics in flint indicating blades, scrapers and arrow points (Carboni and Salvadei 1993, 275).

In summary, the landscape along the fringes of the Maccarese lagoon indicates a potentially long phase of activity from the middle of 3rd millennium to the 2nd millennium BC, from the last phase of the Neolithic through to the Bronze Age. There is a presence of settlement activity but also burials for the Neolithic and Eneolithic. The female burial indicates, together with other examples for the final Neolithic, burial of both males and females with lithics and ceramics. Carboni and Salvadei (1993, 277) postulate that this may indicate burial not based on gender, but rather age or status within the tribal group. The material found on the Maccarese also indicates a more fluid movement between the recognised Gaudo and Rinaldone cultures of the area.

Faunal remains indicate domesticated cattle, goat and pig (Ruffo 1993), with a small assemblage attesting to the predominance of domesticated livestock, with some evidence of hunting and foraging. This domination of the record by domesticated species is reinforced with the minimal proportions of wild species from the excavations at Le Cerquete-Fianello (Tagliacozzo et al. 2002, 235), in contrast to Eneolithic sites such as Conelle, Ortucchio and Grotta della Madonna, where the role of wild goat and wild pig formed a significant proportion of the assemblages. There is, on the Maccarese, a complete absence of fish and fowl remains. Exploitation of pond and tortoise did occur. Domesticated species in the assemblage are dominated by goat and sheep, with strong representation of pig and cattle. The age range of goat and sheep indicates that they were raised for both meat and dairy and wool (Tagliacozzo et al. 2002, 236). Domestic pig were killed at both young age and between 18-24 months, for the quality and quantity of meat respectively. Cattle were used as much for weight-bearing activity as for dairy produce as well as meat. The record overall suggests the grazing and breeding of livestock, and the production of varied products comprising wool, milk, cheese and meat, and the use of cattle as beasts of burden.

The structures of the settlement are represented by habitations and structures associated with the economy of the settlement. The form and dimensions of the structures at the site and their similarity to those of modern use for charcoal burners, shepherds and agricultural labourers show parallels, albeit coincidentally (Manfredini 2002, 87).

8.4.1.2 Bronze Age Sites

Several Bronze Age sites exist in Case Area 1 (Fig. 8.42), ostensibly from the early Bronze Age. On the hillslopes overlooking the Tiber a cluster of four sites is present. Site 2307 (Bietti Sestieri site 13S, 45) is represented by four early Bronze Age ceramic fragments of the Gaudo facies. There are also sherds of late Bronze Age and early Iron Age date including a cup and fragment of a strainer. Site 2324 (Bietti Sestieri N22, 1, also possibly incorporating Site 1908) meanwhile indicates the site of Monte Roncione, over one hectare of late Bronze Age material of Sub-Appenine and Protovillanovan date. A small scatter of material, Site 2325 (Bietti Sestieri N22, 2) is also present, comprising late Bronze Age ceramic fragments. Two sites, 2296 and 2303 are located alongside the Maccarese lagoon, marking Le Cerquete F and M. Recent excavations also found remains of Bronze Age and Protohistoric settlement in the area to the east of Fiumicino Airport (Acconcia *et al*. 2018; De Castro *et al.* 2018)[44] The lower stratigraphy of the sites dates to between 4,000 and 3,000 BC, with stratification including material from 3,000 BC to the 10th and 9th centuries BC (De Castro *et al.* 2018). The malacofauna on the site indicate fresh water in the area for the middle and final Bronze Age. From the 10th century BC a significant change in the environment seems to have occurred, with the Maccarese lagoon becoming a saline environment. In sectors P and 24, structures from the middle to the

[44] The results of the excavation and finds analysis for this area were not included in the site database for this study, as this had been completed when the results of the excavation were published. The work is open access through the École française de Rome publications website at https://books.openedition.org/efr/3637. The spatial extent of reported archaeology has been added to the archaeological coverage and discussion of this chapter.

final Bronze Age were located, with evidence of drainage channels, reinforced with ceramic and lithic material. The deposits seem to suggest the creation of layers to increase the frequency of waterflow and access to the water. To the east the sandy terraces indicate occupation with Bronze Age ceramics, lithics and faunal remains (De Castro *et al.* 2018, para. 19). Area 7/34 indicates the remains of a number of hearths and other structures, superimposed on a base of wooden piles and preparation for the settlement. Faunal remains indicate an assemblage dominated by domesticated mammals, including goat, sheep, pig, cattle, dog and horse (De Castro *et al.*, 2018, para. 39) with some remains of deer antler and fish bone.

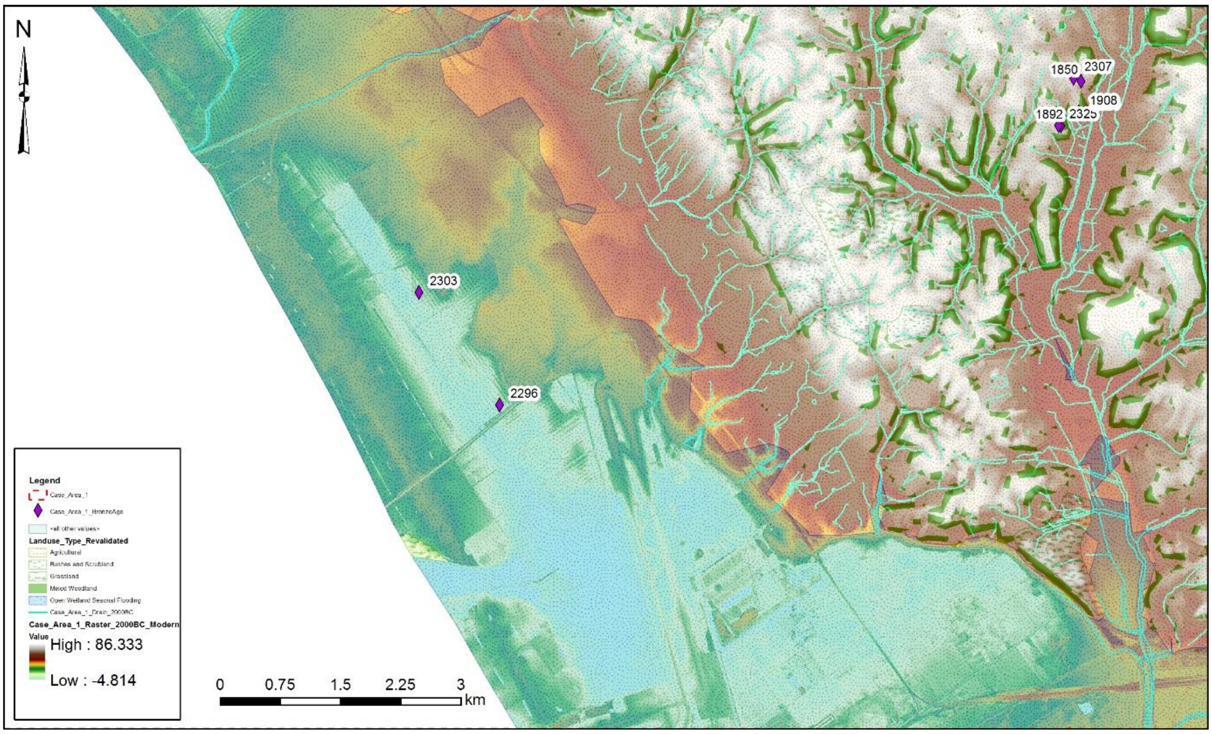


Figure 8.42 Case Area 1 showing Bronze Age settlements with topography, drainage and land use

8.4.1.3 Protohistoric Iron Age

Within the case area few sites are visible on the delta plain (Fig. 8.43), with four sites located on the summits of hills extending alongside the Fosso Galeria. These are Site 1911, a possible tomb site (2327) and a further area of 12 tombs (Site 2207) and an

Etruscan outpost structure (Site 2215) overlooking the Tiber valley. The later phases of the settlement and possible salt working located to the east of Fiumicino Airport (de Castro *et al.* 2018), including the Sablone Area excavations, do indicate the presence of some Protohistoric settlement of the floodplain. Excavations on the plain from 2001 to 2008 recovered Protohistoric remains in the form of an Archaic settlement close to the Tiber where the Rio Galeria disgorges into the Tiber (De Castro *et al.*, 2018, para. 58). Two buildings are associated with the settlement, one with dry stone walling in rectilinear plan, the second curvilinear in dry stone with an abundance of ceramic material (De Castro *et al.* 2018, para. 60) probably used to consolidate the underlying clay stratigraphy. This site suggests the presence of small rural sites on the floodplain, certainly from the 7th and 6th centuries BC (De Castro *et al.* 2018, para. 66). Ceramic materials for the site show an abundance of reddish-brown impasto, of pots, basins lids, fitting with Etruscan types from the 7th to 6th centuries BC (Acconcia *et al*. 2018, paras 15; 22).

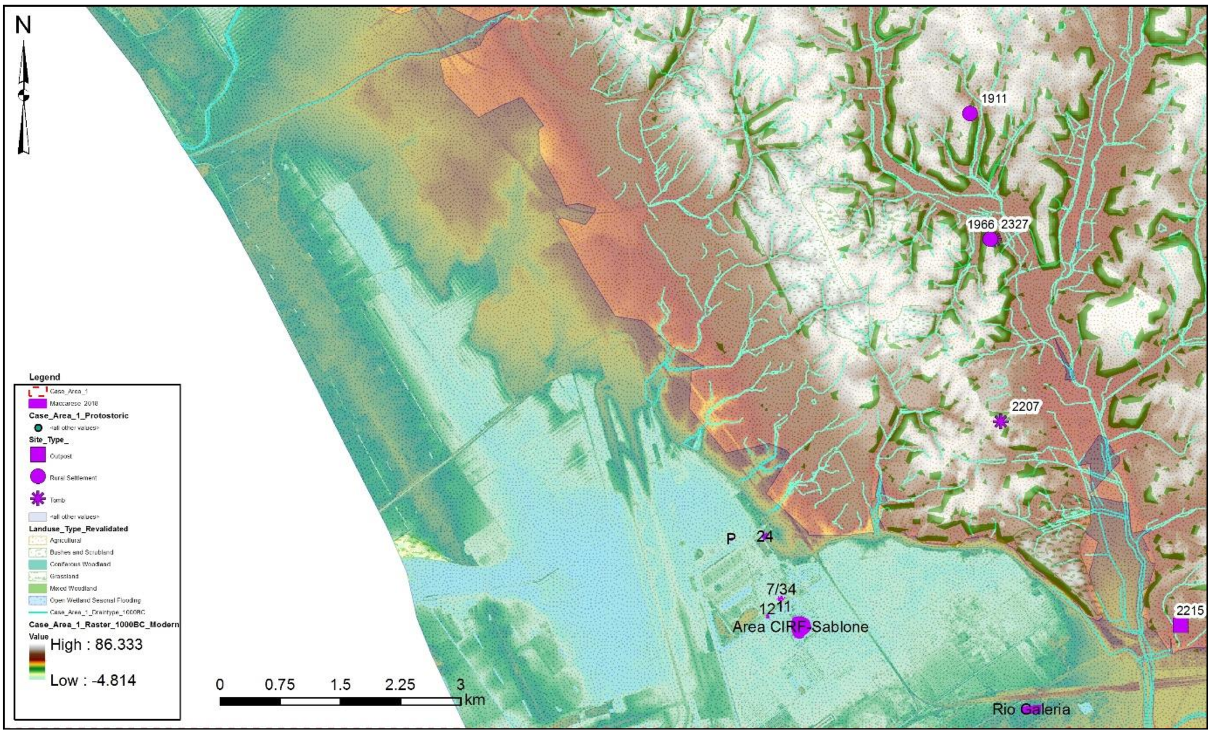


Figure 8.43 Case Area 1 showing Protohistoric settlements with topography, drainage and land use

8.4.1.4 Republican and Imperial Roman

Roman sites extend cross much of the area, with a number of potential settlements on the plain in addition to sites across the hillslopes to the east. Site 150 marks the location of ancient Fregenae listed in De Rossi 1968, 42-43. Site 153 marks the line of a hypothesised road linking Fregenae along the coast to the north, and Site 152 a road running to the east. A further building, Site 151, is located on the dunes to the south.

A Roman rural settlement, with walls indicating the site, is located to the south along the low terrain on the edge of the plain (Site 302). An area of seven sites is located on the hillslopes overlooking the Maccarese Plain. Several villa sites (Sites 2000, 1287, 2205 and 2206) are located on agriculatural land but along the edge of the wetland ecotone boundary. Several further villa sites (644, 2070, 2066, 2207) are situated on spurs overlooking the Rio Galaeria.

On the lower reaches of the hillslopes, Site 2208 marks an area of tombs, On the valley floor three sites (2277, 2212 and 2213 mark remains of the Via Portuense, acqueduct (Site 2230, and a burial (2281). The nature of the sites belies the presence of archaeological remains below the alluvium of the floodplain. In particular the area to the east of the Maccarese lagoon has been excavated extensively, revealing canal features associated with Imperial Roman and earlier saltworks. (Morelli *et al.* 2011).

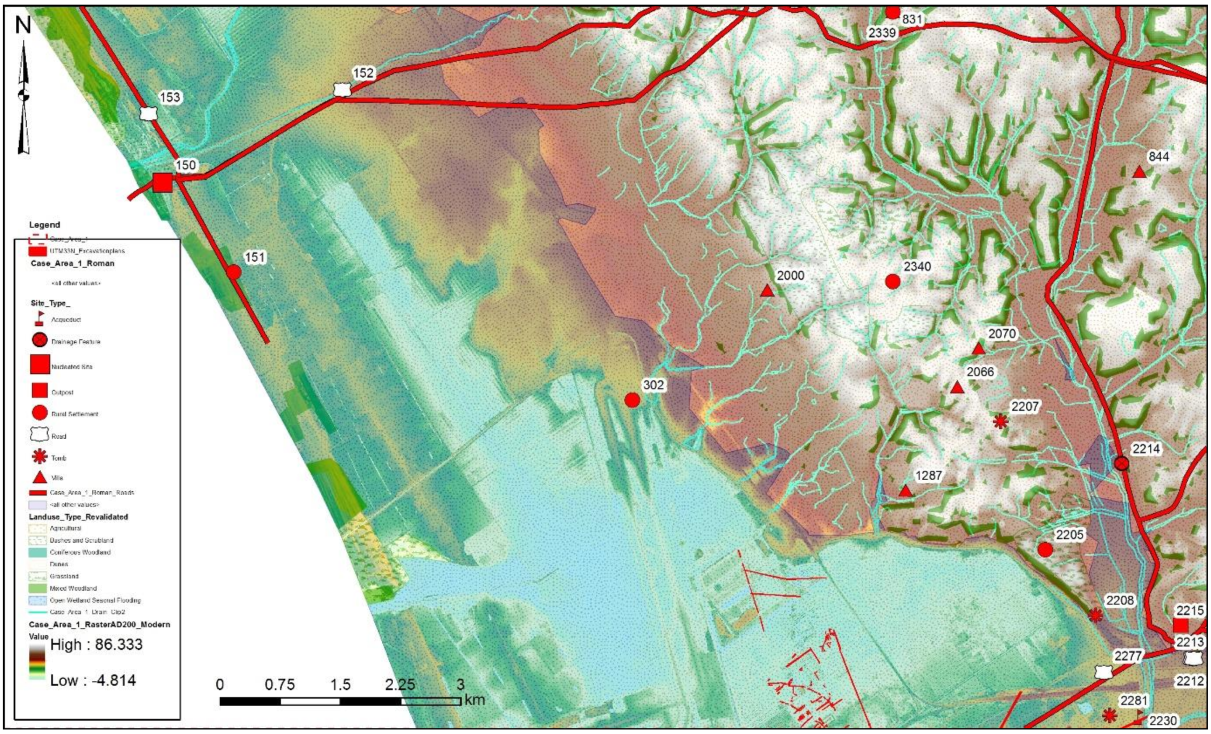


Figure 8.44 Case Area 1 showing Roman villas and rural settlement with topography, drainage and land use

The excavated features from the floodplain show extensive canalization for saltworks and associated outbuilding structures and some settlement. A further rural settlement site (302) is located some 3km to the north-west, and also may indicate settlement owithin the wetland area.

8.4.2 Case Area 2 The Central Delta, Ostia and Ficana

The second case area represents a zone that is topographically and geomorphologically different from the cross-section provided on the Maccarese Plain. The area was chosen for the inclusion of the hillslopes overlooking the Tiber, similar to case area 1. Here the similarities end in terms of the nature of the archaeological material, and the development of the floodplain and Tiber delta and rivermouth. Neolithic and Eneolithic sites are not represented in the majority of the area, a product of the depth of alluvial deposits and the archaeological research conducted in the area, although the presence of surveys by Bietti Sestieri (1984) in the eastern part of the area indicate the presence of some Neolithic and Eneolithic archaeology (Figs 8.45 and 8.46). The principle focus of the area is on the Bronze Age and Archaic settlements, centred on Ficana and Castel di Decima, and on the exploitation of the river floodplain and delta in the early Republican period, culminating in the founding of the *castrum* at Ostia.

8.4.2.1 The Neolithic and Eneolithic

The delta and major part of the hillslopes overlooking the mouth of the Tiber show no indication of Neolithic and Eneolithic sites in this case area (Figs 8.45 and 8.46). In part this represents the modern vegetation of Castelporziano and the coniferous woodland surrounding the area, but the focus of fieldwork by Bietti Sestieri (1984) on the area of the Malafede also means that the weighting of Neolithic and Eneolithic sites occurs in favour of the area of this research. Thus, the valley of the Malafede shows an indication of final Neolithic and Eneolithic activity, in a tributary valley overlooking and with access to the Tiber floodplain.

Two sites, 2328 and 2329, indicate Neolithic activity (Bietti Sestieri 1984, 31N, 10 and 16), the first with evidence of impasto ceramics and blade lithics, the second taking the form of a lithics scatter. The sites are located on ridges overlooking the principal water courses in the area.

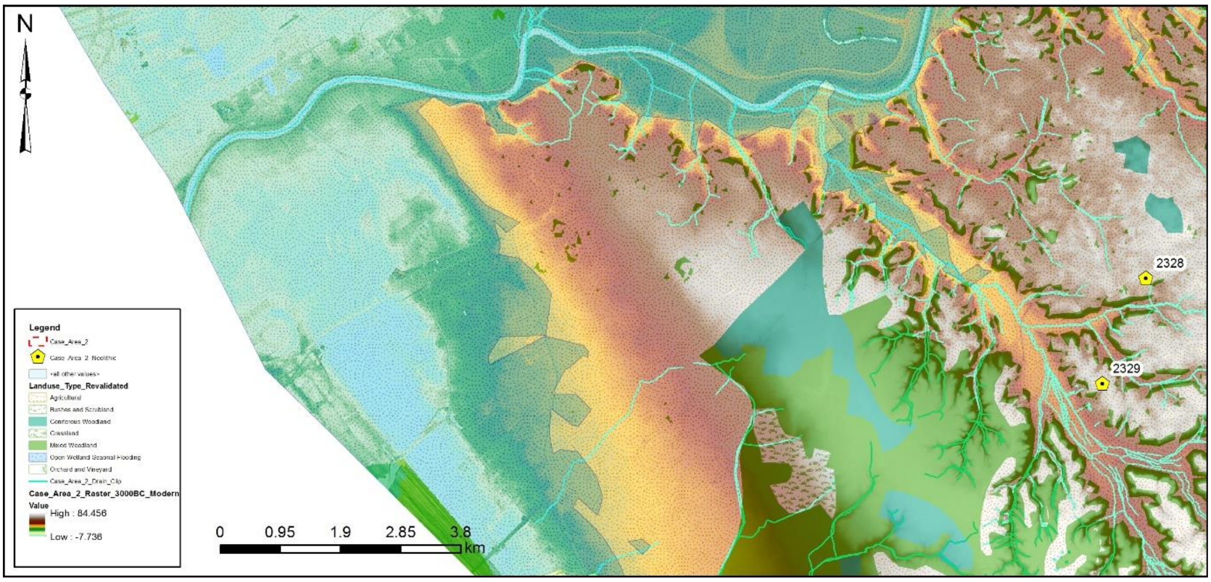


Figure 8.45 Case Area 2 showing Neolithic settlements with topography, drainage and land use

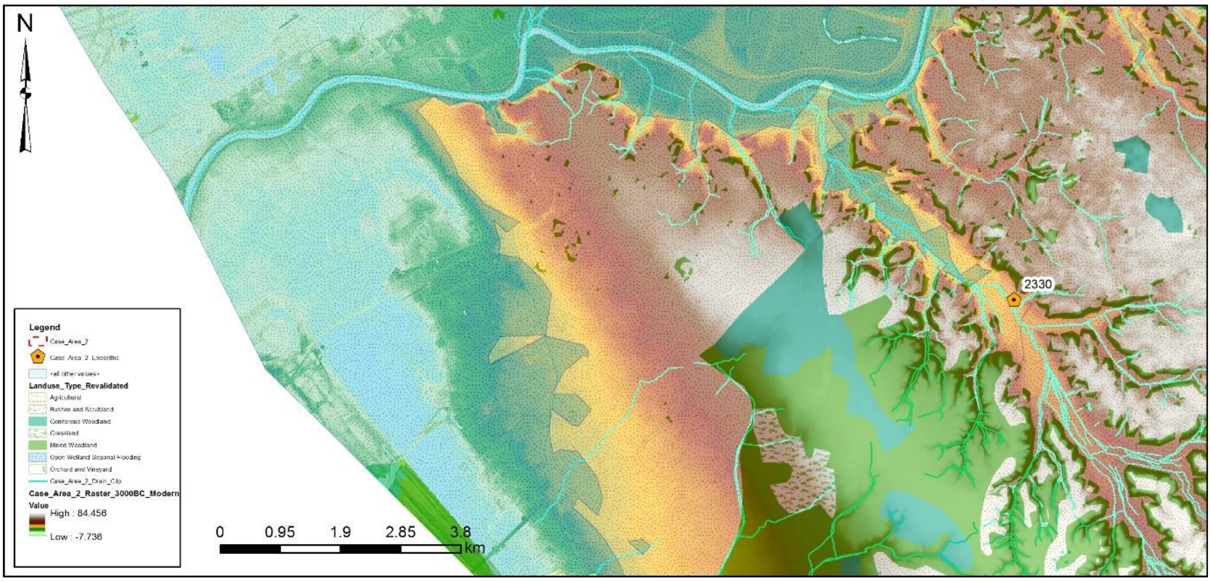


Figure 8.46 Case Area 2 showing Eneolithic settlements with topography, drainage and land use

An Eneolithic site is located on the lower slope of the valley side (Site 2330; Bietti Sestieri 1984, 31N, 6) comprising handmade impasto.

Two sites are located on the valley bottom of the Malafede: 2330 and 2335. The first comprises a scatter of handmade impasto (Bietti Sestieri 1984, 31N, 6) with the second indicating further fragments of handmade impasto (Bietti Sestieri 1984, 31N, 5).

8.4.2.2 The Bronze Age

The Malafede valley also forms the focus of Bronze Age activity (Fig. 8.47), most significantly with material associated with the nascent settlement of Castel di Decima. For the Bronze Age scatters of material on both west and east ridges either side of the Malafede valley are recorded (Bietti Sestieri 1984, 31N 18, 19) with a further spread of lithic material to the east (Site 2329, Bietti Sestieri 1984, 31N, 16). A further site (2336), on the western end of a ridge comprised ceramic material from the final Bronze Age (Bietti Sestieri 1984, 31N, 14). A further site (2252) indicates some prehisotirc material as part of extensive excavations.

In addition to the dispersed material along the Malafede, the Tiber and delta also indicate some presence in the Bronze Age. The most intensively studied area being that of Ficana (see below). However, two find locations are referenced of material from the final Bronze Age on the floodplain in the vicinity of Ostia. The first, Site 2282, comprises late Bronze Age/Iron Age material[45] at a depth of around 3-5m below the modern ground level remains of bone, horn, burnt wood, iron waste and daub from a hut were located (Alessandri 2007, 43). The extent and condition of the material, badly abraded and representing a very small assemblage, is difficult to ascribe any pattern of extensive settlement to. However, the presence of material, including daub, between the Tiber and the Ostia lagoon, opens up the possibility of resource exploitation along the alluvial zone of the River Tiber, especially considering the bayhead form of the Tiber and the propensity for the river system to deposit alluvium during annual inundations. The second site (2283) relates to a single sherd of vessel handle, located in a secondary deposit below the mosaic of Scilla in the Baths of Neptune at Ostia Antica, and a reference to other Bronze Age sherds in the vicinity (Alessandri 2007, 46; Zevi 1968, 35). While these finds do cannot attest to Bronze Age settlement in the immediate location of Ostia Antica, their presence needs to be taken into account when assessing the nature of Bronze Age activity on the floodplain of the Tiber.

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[45] Alessandri 2007 records the finds to the final phase of the Bronze Age, due to the ceramic forms comparable with those from other sites of this phase (Alessandri 2007, 46) although the original paper (Conti 1982, 31) ascribes the material to the Iron Age, to the second half of the 9th century BC. Furthermore Conti ascribes the pottery types with some similar to those from Latium and south of the Tiber, and others from the areas of Veii and Cerveteri.

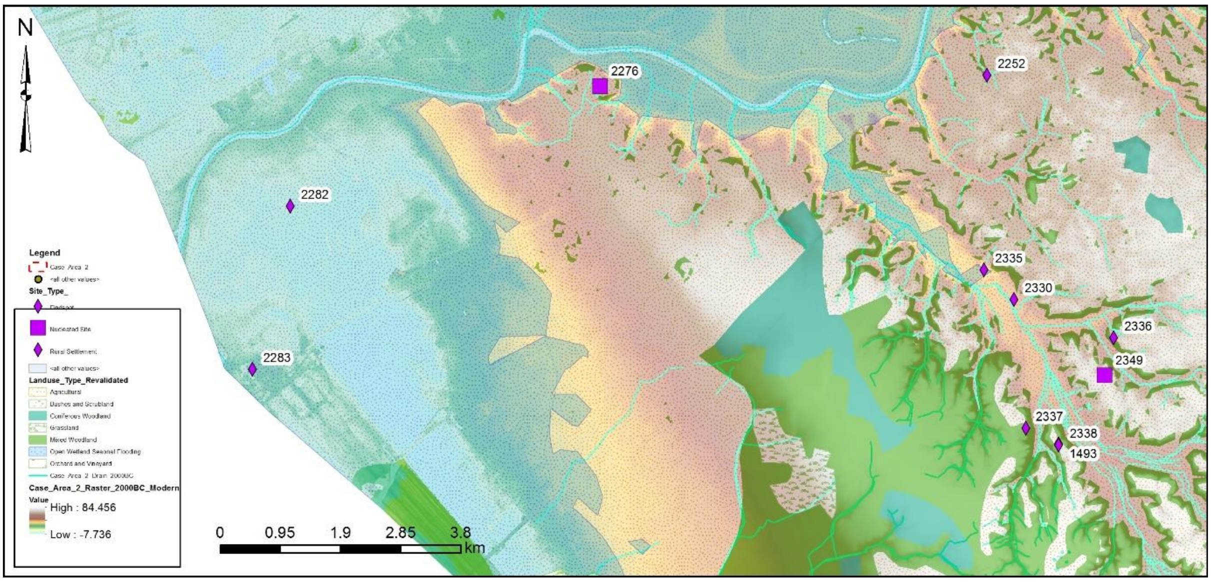

Figure 8.47 Case Area 2 showing Bronze Age settlements with topography, drainage and land use

The principal site for this period (2276) and running into the Iron Age is that of Ficana (Fischer Hansen 1990; Brandt 1996), located on the top of Monte Cugno, overlooking the Tiber valley and the inner zone of the river delta.

8.4.2.3 The Protohistoric Period

The Protohistoric Iron Age for case area 2 (Fig. 8.48) is dominated by the nucleated settlements of Ficana (Site 2276) and Castel di Decima[46] (Sites 1493 and 2284). Castel di Decima represents a zone of habitation and a necropolis, including tombs dating to the 8th and 7th centuries BC (Alessandri 2007, 53). Excavation of the settlement revealed remains of capanne, a defensible acropolis area and reinforced defences to the east and north of the main habitation, dating to 6th century BC (Alessandri 2007, 53). Ficana, overlooking the Tiber floodplain includes sectors 3b and 3c, including traces of capanne, of Iron Age date (Alessandri 2007, 43). The faunal remains from Ficana indicate a drop in the herding and breeding of sheep and an increase in cattle for the second half of the 8th

[46] This site has been linked to the latin city of Politorium (Alessandri 2007, 53).

century BC and the first half of 6th century BC (Brandt 1996, 418) and a continuation in consumption of domestic pig. Cattle were used essentially for agricultural work, or for meat. Also milk and cheese. Dogs used for guarding and hunting. Presence of red deer, wild goat and boar indicates extensive macchia woodland.

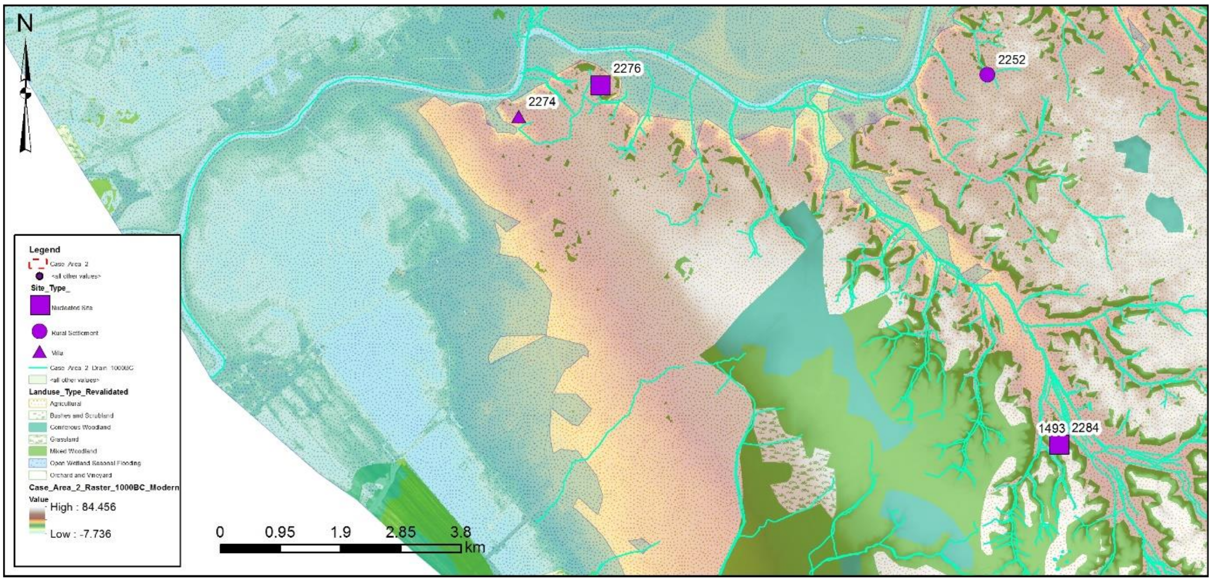

Figure 8.48 Case Area 2 showing Protohistoric settlement with topography, drainage and land use

8.4.2.4 The Roman Period

The record for settlement in the Roman period for case area 2 is dominated by villa sites of Republican (Fig. 8.49) and Imperial (Fig. 8.50) date. These include the complex of villas at Dragoncello (Pellegrino 1983; 1984; 1995; 2004), but also sites along the Malafede in the vicinity of Castel di Decima, and in the area of modern Vitinia and Torrino Mezzocammino. A villa site (Site 2255) was located in excavations, including drainage and canal features. A second villa listed in the Carta dell'Agro (Site 1158) is situated 550m to the south –west. A series of further villa sites are located along the south-west facing slopes along the Malafede (Sites 1503, 811, 809, 804), and across the hillside to the east (Sites 798, 799, 1360) and on the slopes overlooking the Tiber floodplain (Sites 1399, 1402, 795, 751, 755, 764). To the west the villa of Fralana (Site 2289) is located, with three further villa sites (Sites 1377, 1376 and 1389) in the vicinity to the north, and one site (1383) located on the Tiber floodplain alongside the Via Ostiense.

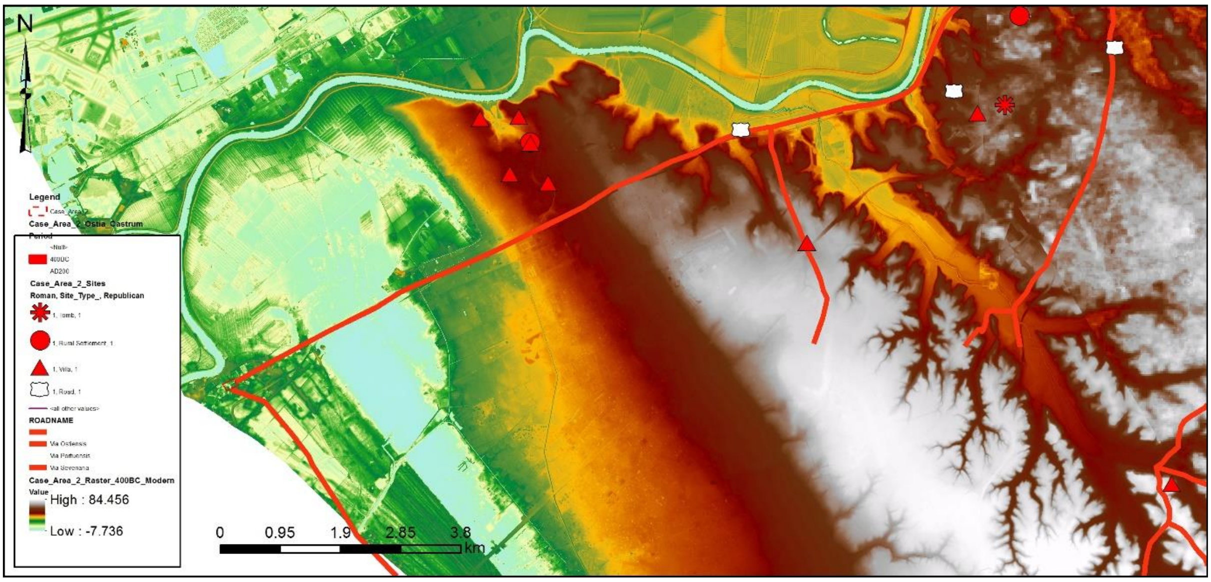

Figure 8.49 Case Area 2 showing Republican villas, rural settlement and roads

To the west the villas at Dragoncello (Sites 2356, 2274, 2360, 2358 and 2355) are situated around a small valley some 700m in length, fronting onto the Tiber floodplain. These villas seem to be located on fertile agricultural land, close to the line of the Via Ostiense and the course of the Tiber (De Franceschini 2005, Sites 90-92, 253-256; Fascitiello 2018, 15), highlighting the location of some villa complexes in close proximity to wthe wetland environment, but situated on prime farmland, and with evidence both of impressive residential structures and buildings associated with storage of produce (Olcese *et al*. 2017, 10). One villa is recorded in the case area on the delta plain to the west of the Ostia lagoon (Site 714) in the vicinity of Ostia Antica.

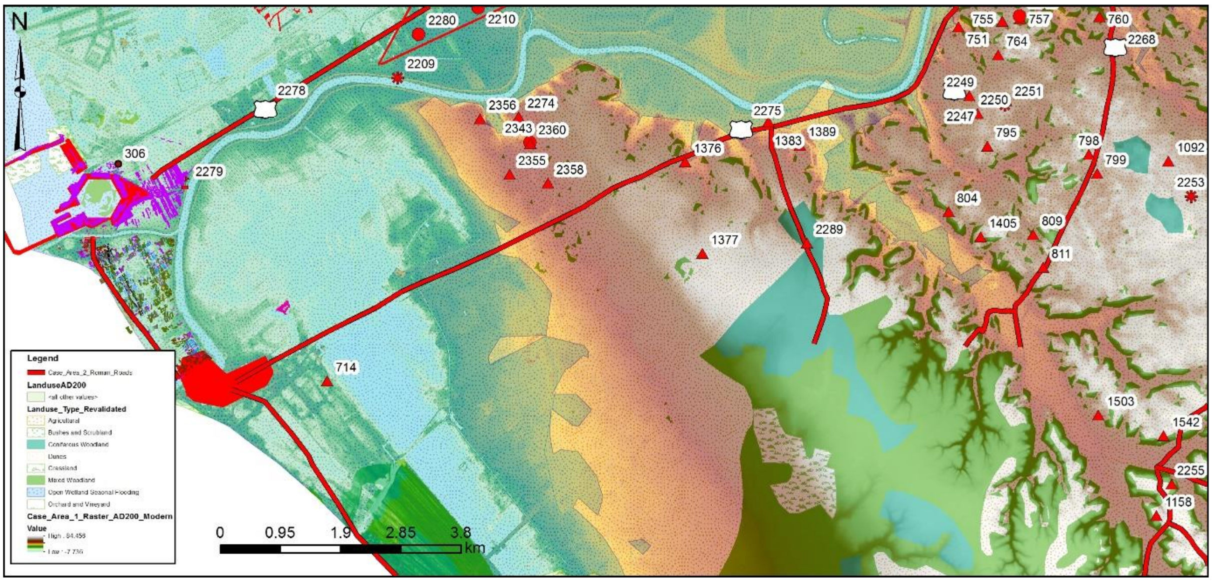

Figure 8.50 Case Area 2 showing Roman villas, rural settlement and roads

The dispersal of these sites indicates the presence of a villa in the vicinity of Castel di Decima, Vitinia, and Fralana in the Republican period, with five sites in the complex at Dragoncello. A similar pattern is represented in terms of those villas in the Imperial period. This single record belies the presence of Republican and, predominantly, Imperial archaeological sites in the central part of the Tiber delta. The vast majority of sites relate to the drainage, road and related infrastructure for the Imperial port at Portus (Sites 2278, 2209, 2280 and others along the Via Portuense), also including mausolea and structures along the course of the Tiber. To the south the city of Ostia and the Via Ostiense provides a further focus for archaeological sites in the Imperial period. The road network and associated necropolis also occupies the area between Portus and Ostia with the Necropolis di Porto, the Via Flavia and the complexes at the Episcopio and San Ippolito. The archaeology of this central zone shows a complete absence of prehistoric archaeological remains.

8.5 The Air Photographic, Satellite and Geophysical Data for the Central Delta

For the area of the central delta, the data presented above was also integrated with air photographic, Worldview 2 satellite imagery, and the results of extensive geophysical survey over the area (Chapter 5, Sections 5.4-5.8). The high and low altitude swaths of RAF photographs (Fig. 8.51).

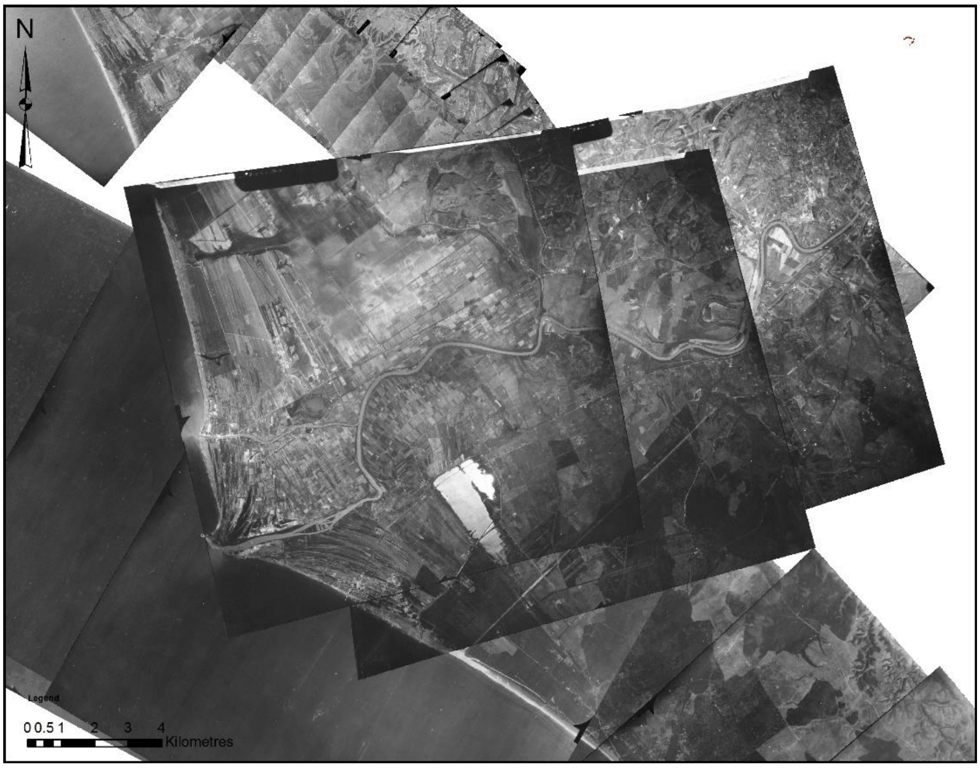

Figure 8.51 Overlaid high and low altitude RAF photographs for the Tiber delta (source: ICCD)

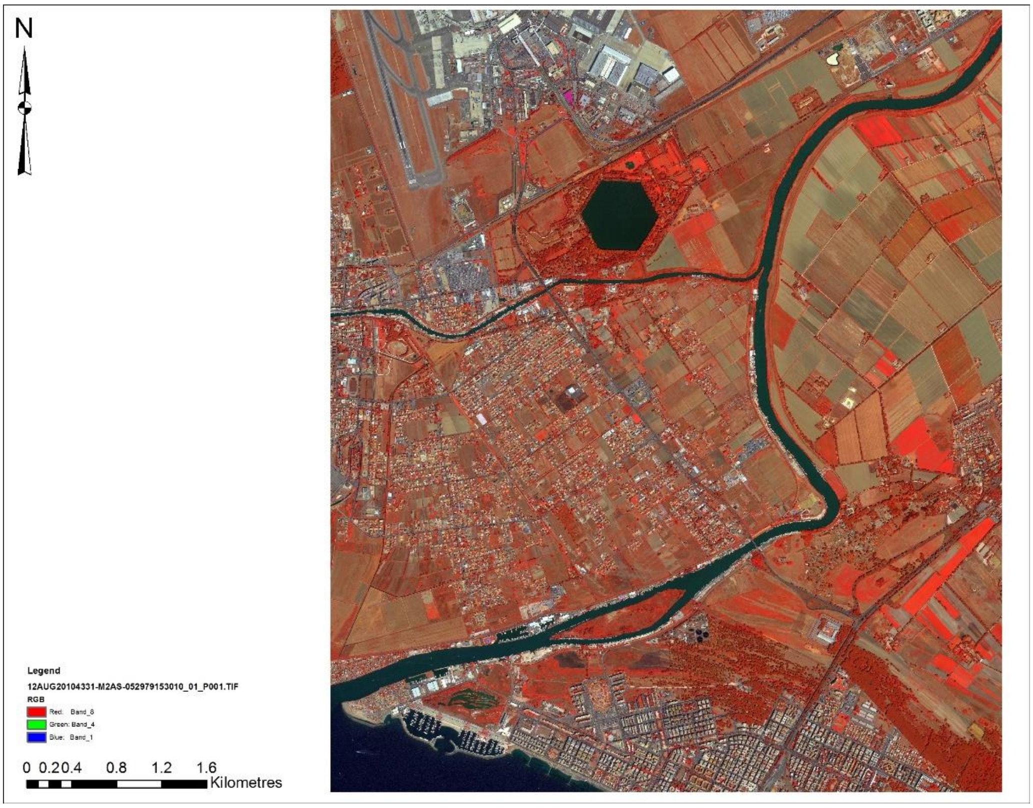

Figure 8.52 Worldview 2 satellite imagery coverage for the delta area. RGB set to NIR2, Yellow, Coastal)

The air photographic and satellite imagery (Figs 8.51. and 8.52) provided evidence for the changes in the course of the Tiber river, particularly in the area of the Fiume Morto and near Ostia Antica. Evidence of features in the landscape from the air photos and multispectral datasets were digitised (Figs 8.53 and 8.54) into a coverage for visualisation with the background LiDAR topography and the results of geophysical survey and digitised features from excavations in the area. The digitised results highlighted the dune covicinity of Ostia and Portus, but also revealed the presence and extent of the canal to the north of Portus, and the presence of a series of canal features extending the features from the results of excavation in the area of the *Campus Salinarum Romanum*, also indicating a series of parallel canal features (Fig. 8.54) running to the Maccarese lagoon, and suggesting a planned system of canals associated with the saltworking to the north of the Via Portuense.

In the area of the Isola Sacra, the air photographic evidence revealed the presence of the east side of a canal associated with the network of canals for trans-shipment of material between Portus and Ostia, providing further evidence for integration with the results of the geophysics (see below).

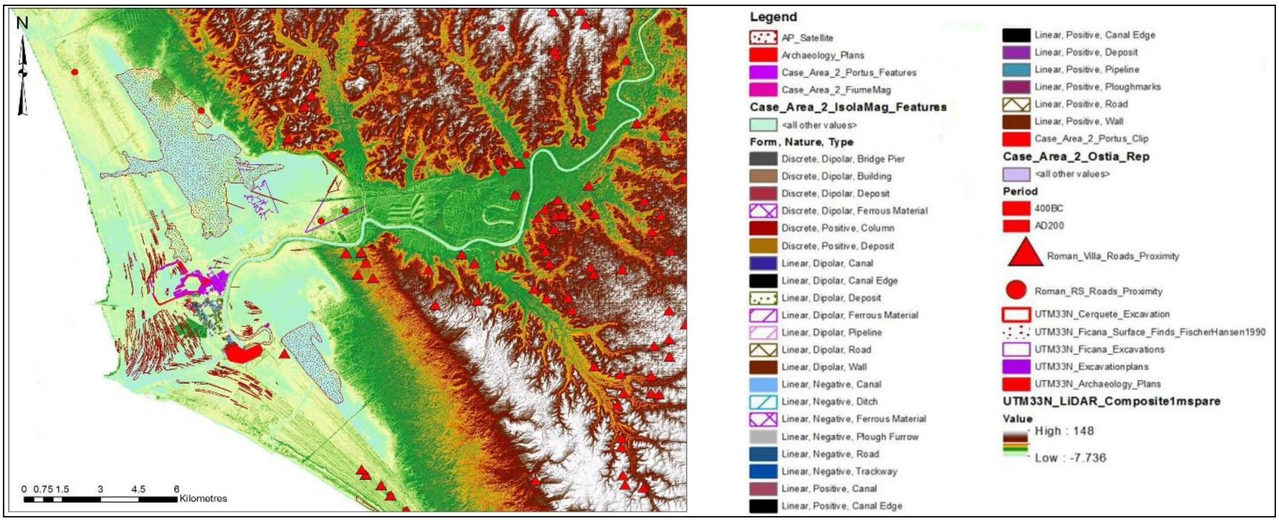

Figure 8.53 Digitised interpretation from air photos and satellite imagery, overlaid with LiDAR and digitised features from excavation and geophysics

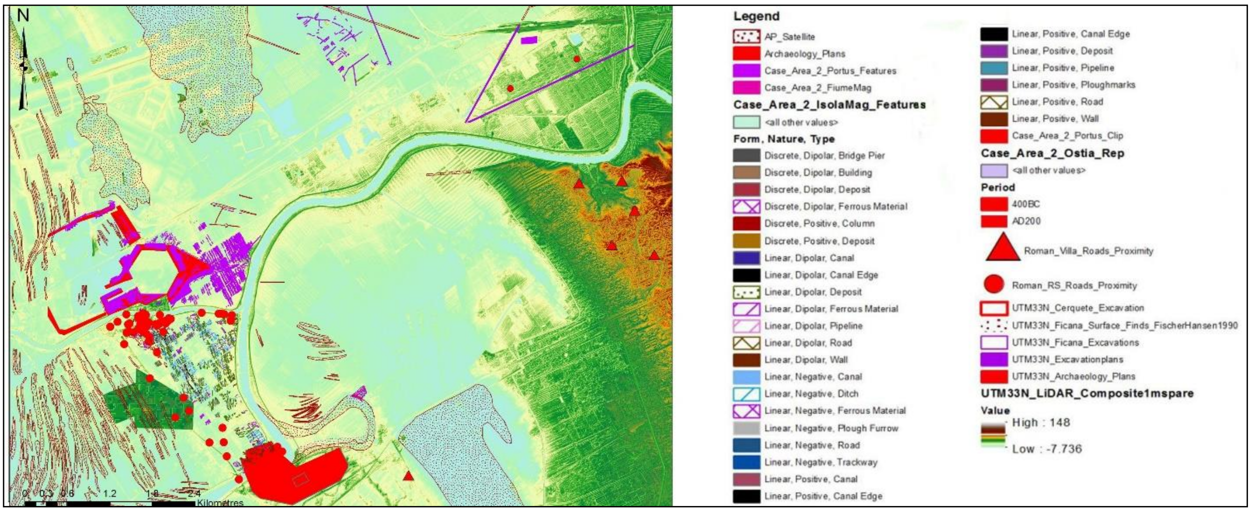

Figure 8.54 Detail of Figure 8.53, showing interpretation layers

Results of geophysical survey across the case study area (Strutt, 2005b, 2009, 2011; Strutt, Richardson and Millett, 2008) on both sides of the Tiber present the extensive nature of Roman deposits and features in the landscape, comprising canals and areas for salt production, roads and tombs associated with Portus and Ostia, and warehouse and horrea associated with the Republican and early Imperial port at Ostia and the construction and operation of Portus from the Claudian period (Keay *et al.*, 2005). The overall coverage of the magnetometer surveys conducted from 1998 to 2012 (Figs 8.55 and 8.56) provide the highest resolution dataset for the presence of buried archaeological features in the central Tiber delta. The ramifications for the Imperial port complex are dealt with elsewhere (Keay et al. 2005; Germoni et al. 2011; Keay 2012), but these results highlight the complexity of features associated with the maritime complex in the Imperial period. Some evidence in the results of the magnetometry in its easternmost extent suggest canal and other features possibly extending south from the area of the *Campus Romanum Salinarum*. Alongside the Tiber, and in the areas of the Isola Sacra, a complex hinterland of features is visible. Dateable evidence for the area (see the Gazetteer of records in Germoni *et al.* 2011, 239-255) corresponds to tombs and structures dating from 1st century AD onwards.

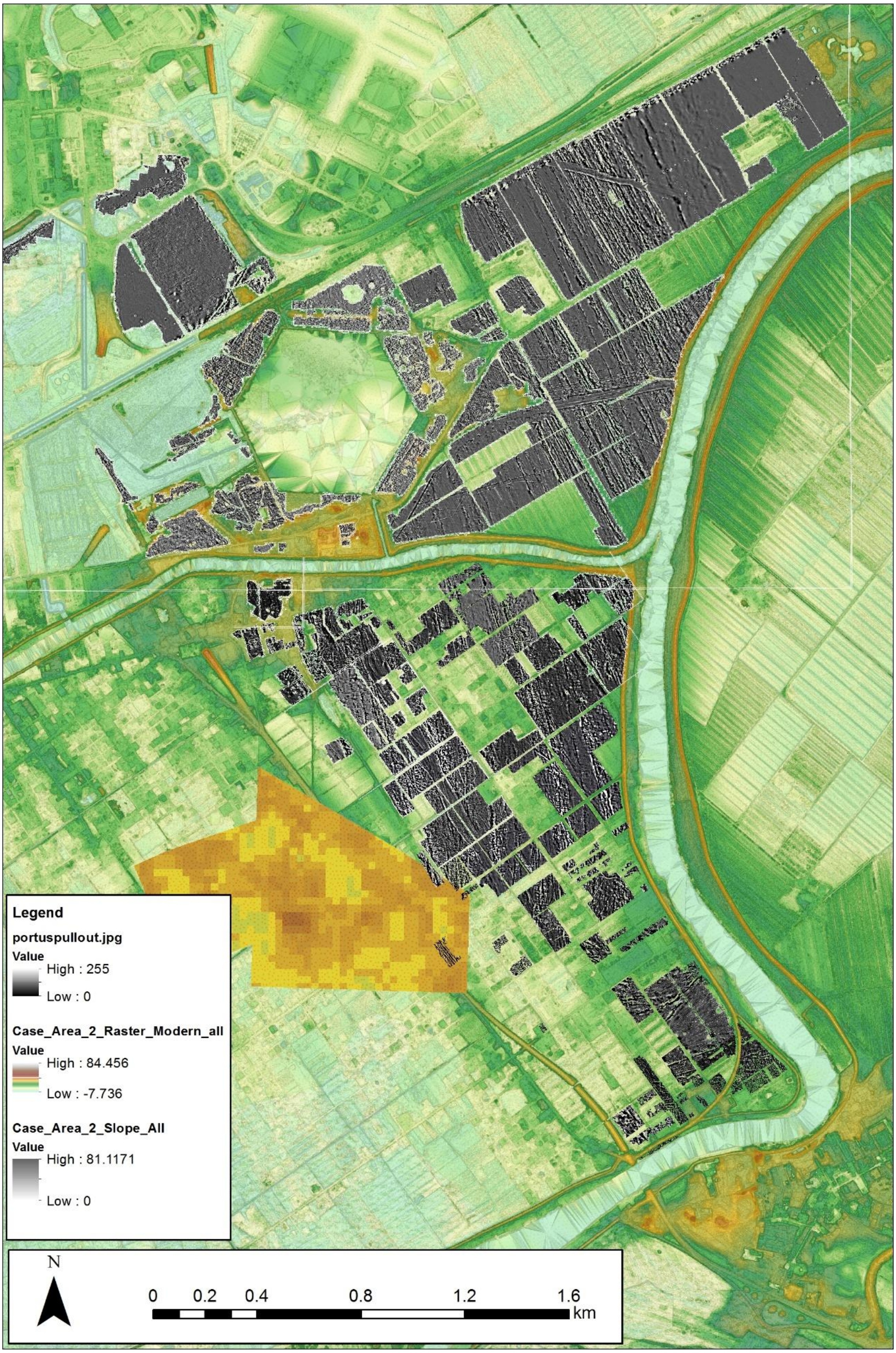

Figure 8.55 Geophysical survey data for the Isola Sacra – Fiume Morto case area

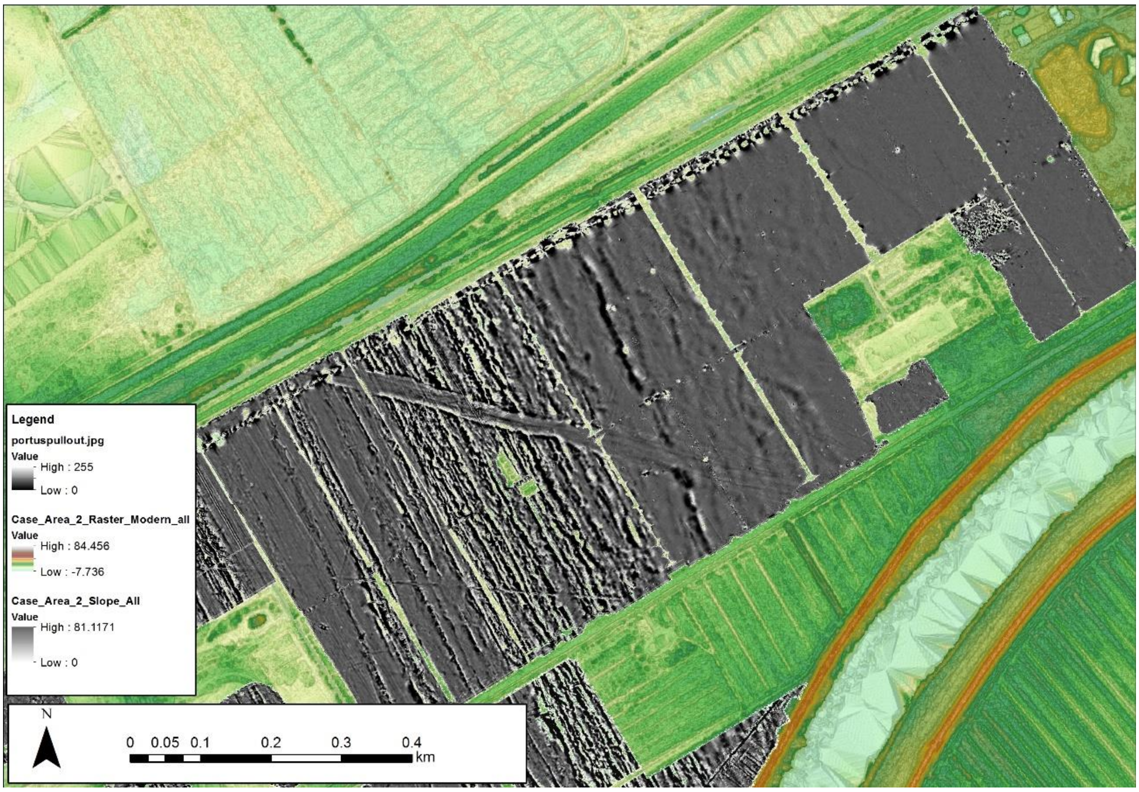

Figure 8.56 Magnetometer survey data for the area of the Claudian Canal and floodplain

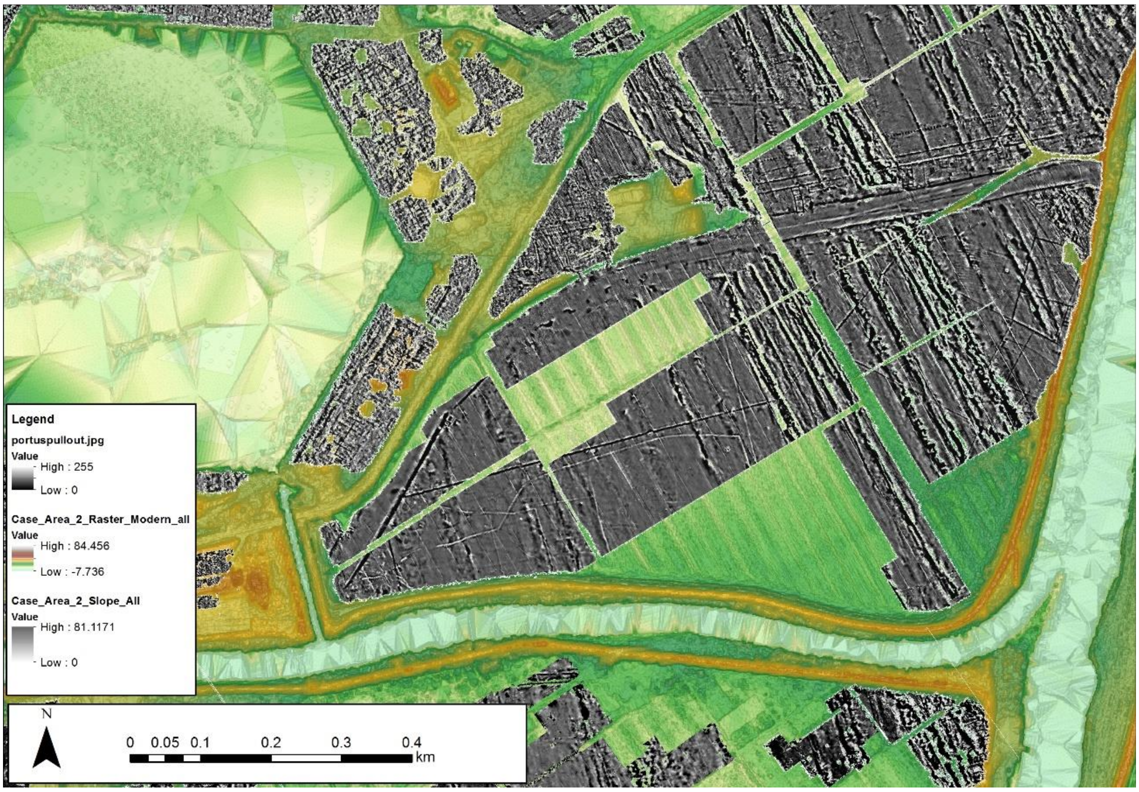

Figure 8.57 Magnetometer survey data showing the complex of Portus surrounding the Trajanic Basin, and the canal traversing the floodplain from the basin to the course of the Tiber

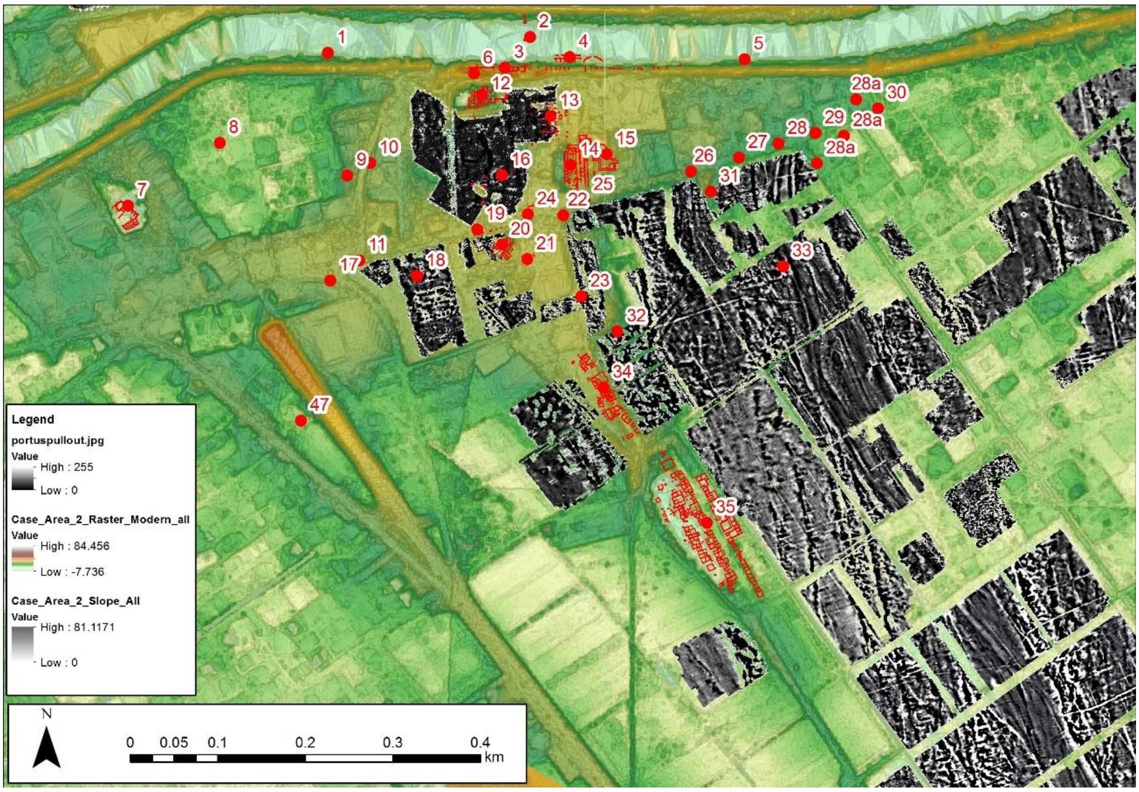

Figure 8.58 Results of the magnetometer survey for the north part of the Isola Sacra, indicating the main canal traversing the area, and the east-west small canals to the east of the Necropolis di Porto. Points shown are from the gazetteer in Germoni *et al*. (2011)

Principally the presence of the Via Flavia and the extensive necropolis along this route are noteable (Figs 8.58 and 8.59). However, a significant portion of the Isola Sacra is covered by a series of small canals, usually 3-4m in width (Fig. 8.60). These demarcated a system of fields across the area of the central delta, respecting or cut by the major port infrastructure, but suggesting the apportionment of land with sub-divisions, and an extensive effort at improvement of the central delta area. The features seem to differ in form from the saltwork features revealed through excavation. If these represent canals and fields, the excavation of the canals would aid in the draining of the land area, facilitating either pastoral farming or the growing of crops in the area of the delta. Pre- and post-bonifica evidence is present for the pastoral ecomony, habitation and fields in this zone (Chapter 4; Figs 4.15, 4.16 and 4.25). These features therefore indicate an early example of land apportionment and improvement for an area of delta that effectively would have stabilised in the Republican period, although bearing in mind the nature of the Roman Climate Optimum, and the potential for shrinkage of the improved and drained land, risk of inundation may still have been a seasonal occurrence, and this may explain the lack of high status villa sites in the central delta.

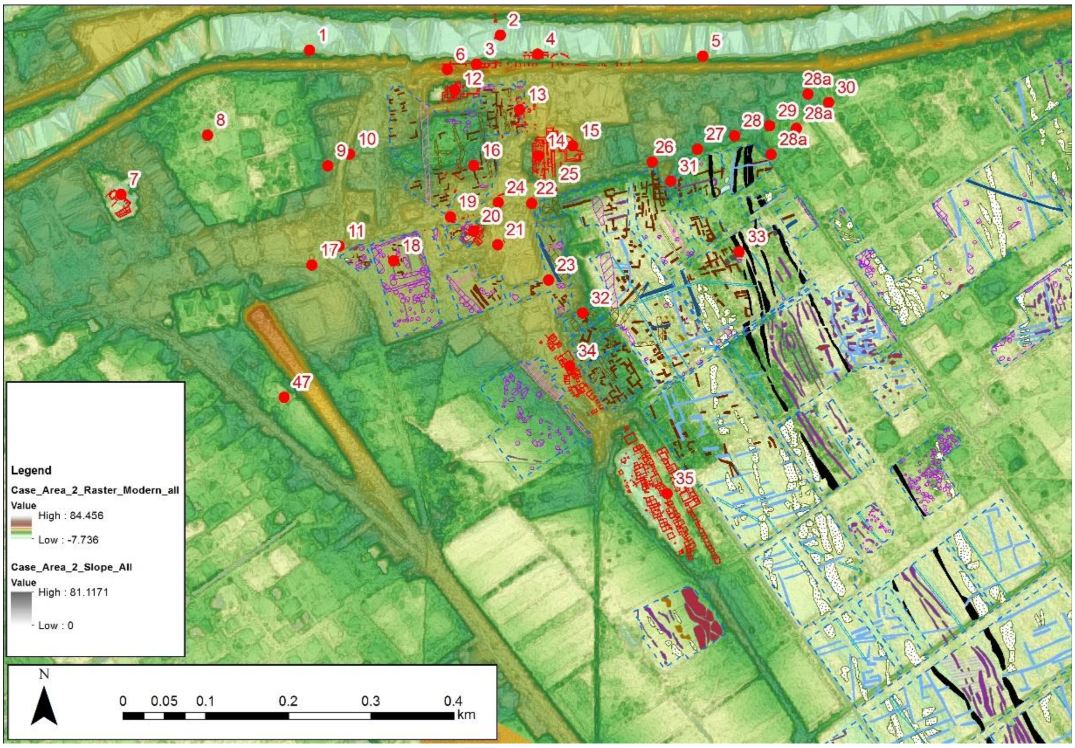

Figure 8.59 Interpretation plot for the northern part of the Isola Sacra, including the gazetteer points from Germoni *et al.* (2011)

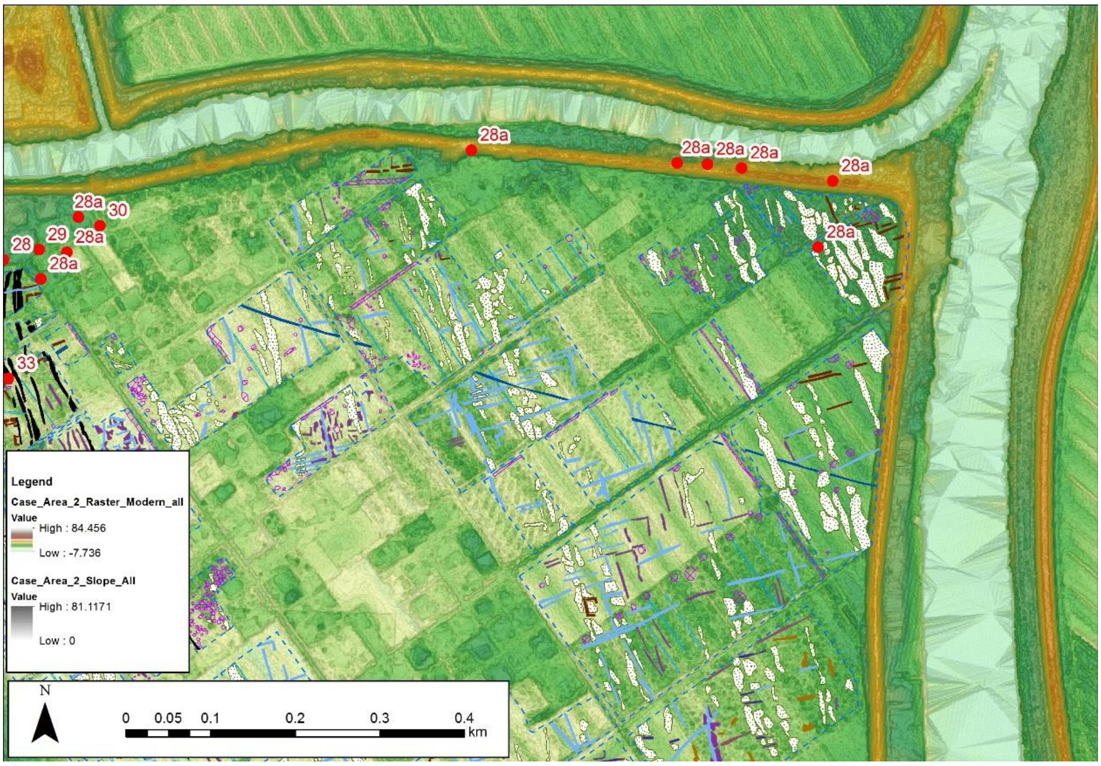

Figure 8.60 Interpretation plot of the magnetometer survey results from the Isola Sacra, indicating the canals and drainage features, and Roman mausolea along the line of the Tiber. Gazetteer points from Germoni *et al.* (2011)

These features are located either side of a sizeable canal (up to 80m across) that traverses the Isola Sacra from Portus to Ostia Antica. This is visible in part through the geophysics, and also in the Italian Air Force air photos from 1957 (Figs 8.61 and 8.62). The canal, located immediately to the east of the Via Flavia, marks a principle compoenent of the port infrastructure, connecting to the Tiber, the Fossa Traiana and other associated waterways.

Figure 8.61 Air photograph from 1957 with magnetometry superimposed from the Isola Sacra (Keay *et al*. 2014)

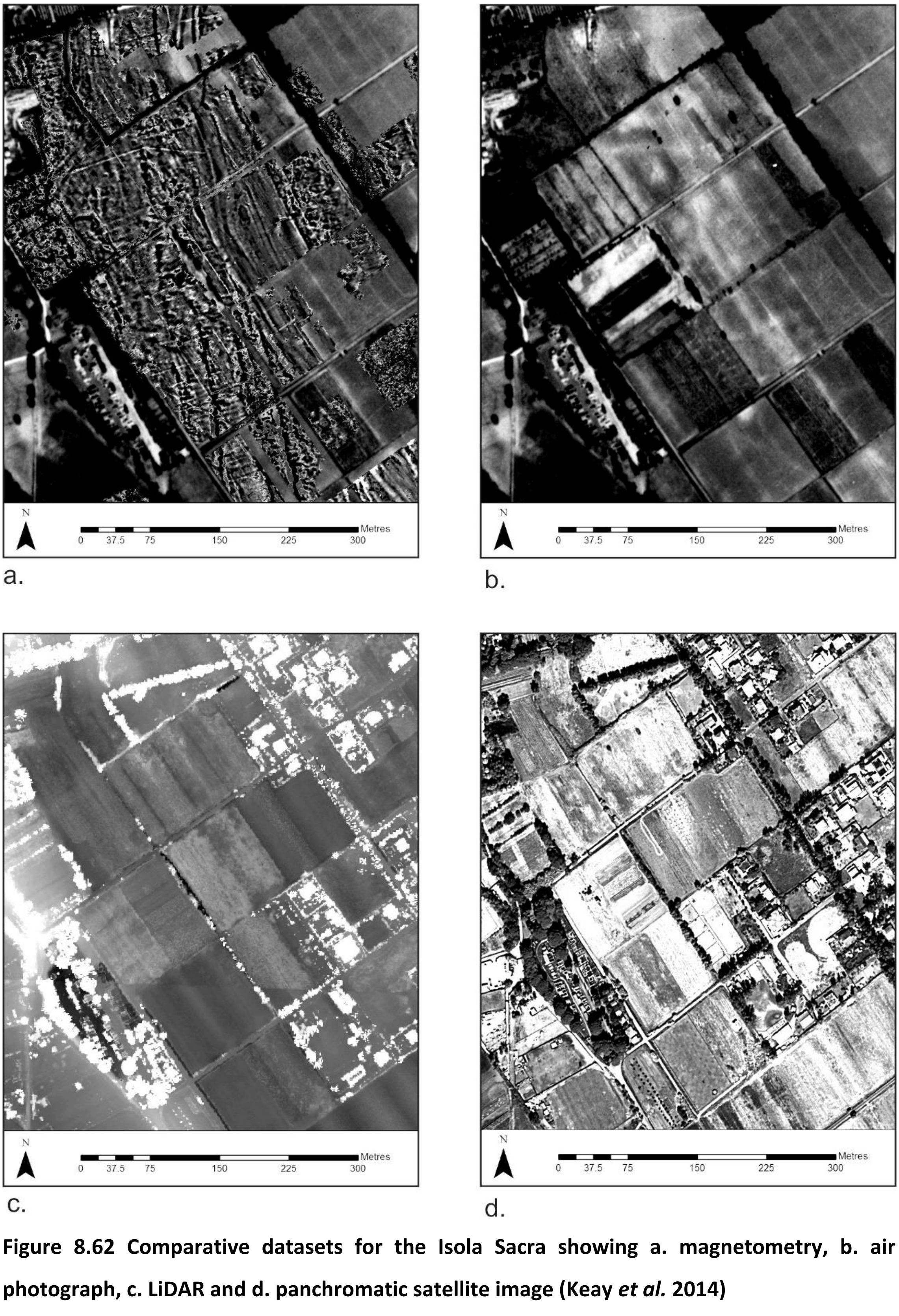

Figure 8.62 Comparative datasets for the Isola Sacra showing a. magnetometry, b. air photograph, c. LiDAR and d. panchromatic satellite image (Keay *et al.* 2014)

The results of the geophysical survey also indicated the presence of a road with bridge traversing the canal, running from east to west from the Via Flavia towards the Capo Due Rami and the bend of the Tiber where the Fosso Traiana diverts from the main river course. This indicates a main route for accessing the hinterland of the Isola Sacra.

Figure 8.63 Results of the magnetometry for the southern part of the Isola Sacra, showing the warehouse structures and defensive wall of the suburb of Ostia Antica (Germoni et al. 2018, para 18; Germoni et al. forthcoming)

In the southern part of the Isola Sacra the results of magnetometry indicate the extent of parts of the Imperial port complex associated with Ostia and Portus. These results show the town of Ostia extending north of the Tiber river (Figs 8.63 and 8.64), with the remains of warehouses along the bank of the Tiber, and a defensive wall enclosing this part of the complex. This indicates, together with the line of the canal traversing the Isola Sacra, the impressive extent of the Imperial port complex.

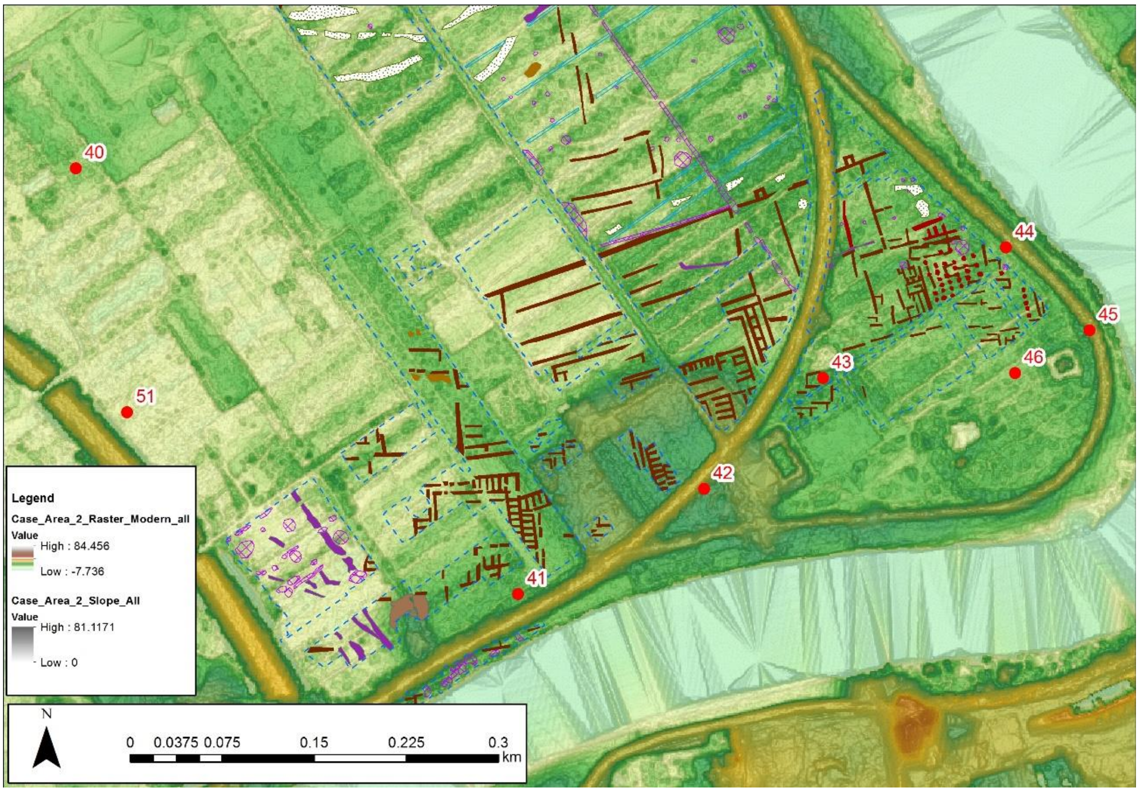

Figure 8.64 Interpretation plot for the southern part of the Isola Sacra, indicating warehouses and other structures. Gazetteer points from Germoni et al. (2011)

To the south of the Tiber, the geophysical data and satellite imagery for the area gives a strong indication for the geomorphology and settlement pattern in the area for the Republican and Imperial periods, showing the pattern of meanders of the Tiber in relation to the settlements across the zone. Again, similar to other areas of the delta, the air photographic records indicate a large number of features associated with settlement of the period, including trackways, canals and other archaeological deposits, associated with the adaptation of the wetland of the area from the mid 4th century BC onwards. The Bronze Age sites of Ostia Antica Collettore (Conti 1982) and Ostia Antica Terme di Nettuno (Attema and Alessandri 2012) mark the most salient prehistoric sites in the area[47].

[47] Although Bronze Age evidence is attested at Ostia Antica (Alessandri, 2007) the site at the Terme di Nettuno seems in fact to refer to a ceramic sherd, and inference of the presence of settlement here in prehistory (Pini & Seripa 1986, 17).

8.6 Preliminary Conclusions

The combined datasets presented and analysed in this chapter contrinbute a significant amount of evidence for the pattern of settlement and its relationship to the different ecological zones of the study area. The extensive datasets have assisted in modelling the settlement distribution and relationship between different types of settlement, and the delta of the Tiber. The remotely sensed and geophysical survey datasets have assisted in provinig greater resolution and nuance to the data for the central part of the Tiber delta, highlighting the presence of features associated with settlement, drainage of the area, field systems and saltworking, in addition to the presence of the infrastructure for the Imperial port complex. This section provides a summary by period of the settlement pattern and forms of potential land use. Theis summary then leads into Chapter 9 with a borader consideration of the implications of the study, and assessment in the context of other landscapes and surveys.

8.6.1 The Neolthic and Eneolithic

The pattern of settlement for the Neolithic and Eneolithic seem relatively similar to one another in terms of location. Evidence for settlement is located on the terraces above the principal river valleys of Rio Galeria and Malafede for both periods, suggesting exploitation of the terrain overlooking the floodplains and catchment areas leading down to the Lower Tiber. In addition, the presence of Neolithic and Eneolithic evidence on the Maccarese plain, in the form of an extensive settlement at Cerquete-Fianello, demonstrates the use of resources in the wetland, and some potential degree of continuity from the Neolithic into the Eneolithic (Manfredini 2002).

The plan of settlement at Cerquete-Fianello demonstrates a long period of habitation in the wetland, with houses built in the a capanna style, utilising the local woodland resources from the floodplain and the lower reaches of the terraces overlooking the delta. The form of structure is in some ways comparable to those represented from settlement on the delta and floodplain from the 19th and early part of the 20th century (see Chapter 4; Manfredini 2002, 90; Shepherd 2006).

While the evidence from the excavations provides most detail for the periods, the relationship between the settlements on the delta plain and to the east overlooking the Rio Galeria suggests an interesting dynamic between settlements. While it is impossible to definitively state that these sites co-existed, bearing in mind the long duration of the Late Neolithic and Eneolithic periods, these do perhaps point towards permanent settlement with some degree of exploitation of different resources within the area and across ecotones. The presence of settlement on the wetland, with permanent structures represented, and with the faunal remains dominated by domesticated animals act as a counterpoint to the material scatters located on the hillslopes overlooking the Rio Galeria and the Malafede valley. These latter appear within the 'agricultural' land use classification, but in close proximity to the mixed woodland of the valley slopes, and to drainage. A number of Neolithic/Eneolithic sites are located on the ridges above the main branch of the tributaries flowing into the Rio Galeria, and these, together with sites on the western ridges along the river, show some degree of continuity from the late Neolithic and into the Eneolithic (24 sites in total, including sites 2316, 2317, 2318, 2315, 1901 and 1948). These locations seem to broadly conform to other examples of Neolithic and Eneolithic settlement in the area around Rome, for instance at Casale di Cavaliere, where evidence for a settlement, including a capanna structures, located on the hillside above the Aniene floodplain is suggested as being favourable for the location of deep cultivable soils and proximity to water (Huyzendveld *et al.*, 2005, 518), although other factors, including visibility of sites, erosion and bias in survey methodology for sites of the period all may affect the representation of Neolithic/Eneolithic settlements in these locations.

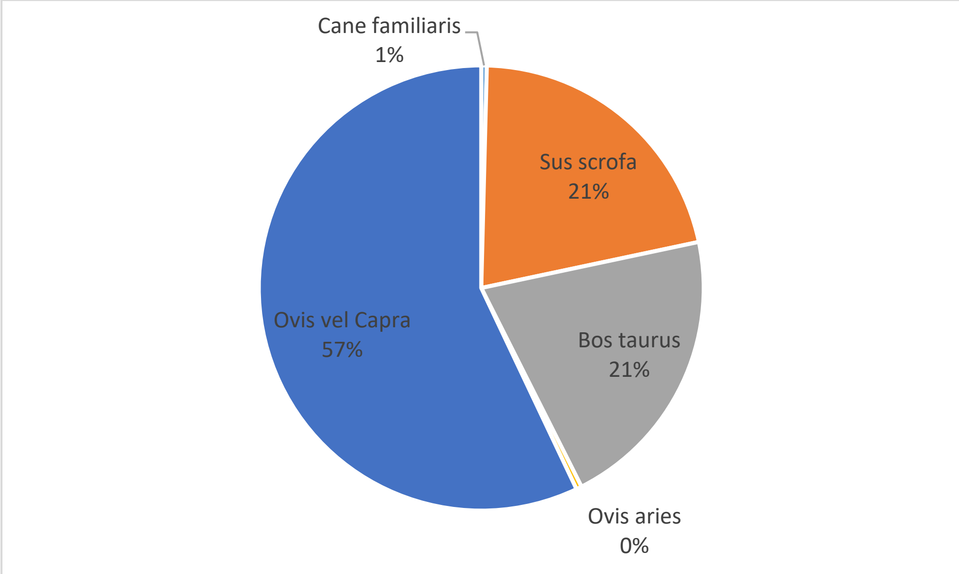

Figure 8.65 Percentage of faunal assemblage by mammal type for Area A at Le Cerquete-Fianello (Manfredini 2002)

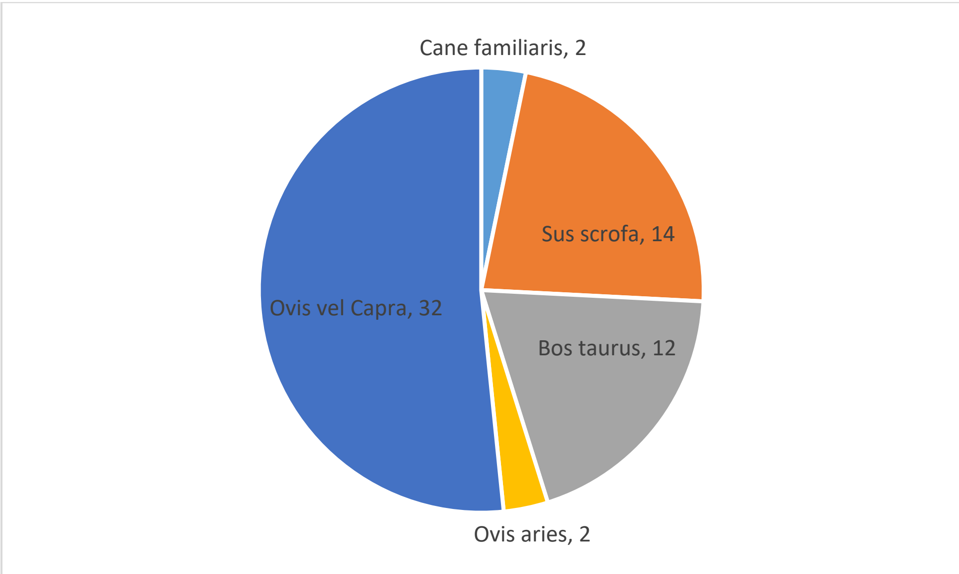

Figure 8.66 Total number of individuals by mammal species for Area A at Le Cerquete-Fianello (Manfredini 2002) (total=62)

The faunal remains from the Eneolithic settlement at Cerquete demonstrates that the majority of surviving fauna are derived from domesticate species (Figs 8.65 to 8.66), predominantly goat, pig and cattle. The pollen records for the area indicate the presence of cereal cultivation, presumably in the areas immediately above the delta plain (Di Rita *et al.* 2009), and the nature of the settlement has been deemed to represent a permanent settlement on the margins of the Maccarese lagoon. Thus, the archaeological evidence suggests a degree of continuity between the Late Neolithic and the Eneolithic, a relatively sedentary population subsisting on mixed cultivation and pastoral animal husbandry. This was occurring close to the ancient coastline on the edge of a lagoon, however, scant evidence survives of foraging, fishing or hunting of wildfowl, in spite of the abundant wetland environment. The relationship between the wetland settlement and the Eneolithic settlement evidence on the surrounding hillslopes and ridges deserves investigation. They suggest a degree of sedentary settlement, but with possible transhumance of livestock, particularly the caprines and cattle. This is maybe indicated with the proximity of settlments to mixed woodland, drainage and location overlooking the principal river valleys of the Rio Galeria and Malafede.

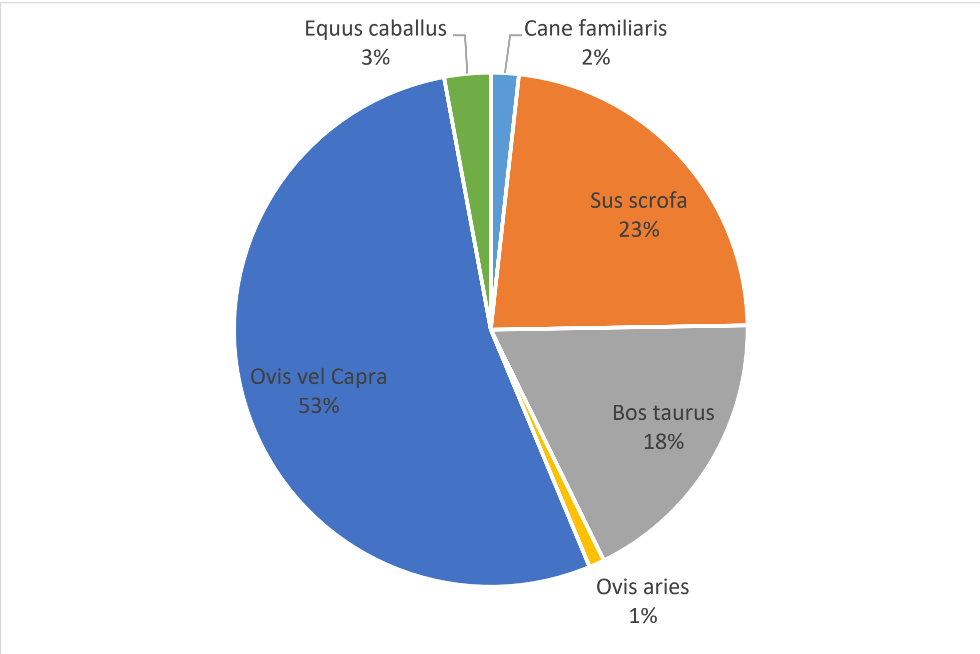

Figure 8.67 Percentage of mammal assemblage by species for Area B at Le Cerquete-Fianello (Manfredini 2002)

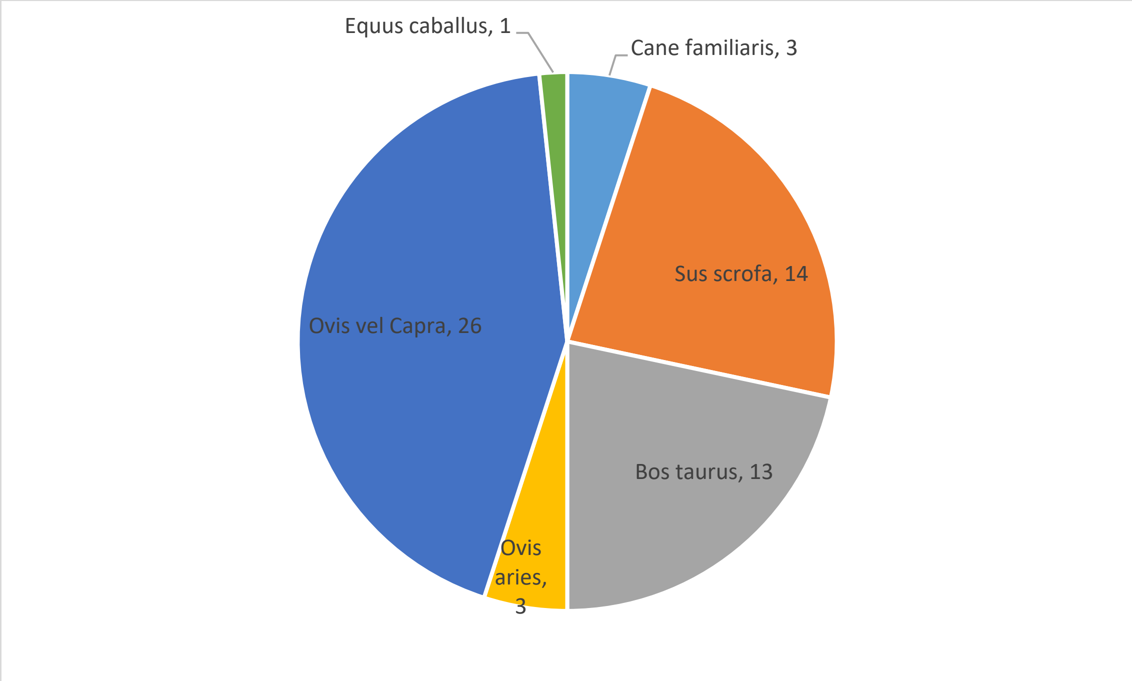

Figure 8.68 Total number of individuals of mammals for Area B at Le Cerquete-Fianello (Manfredini 2002) (total=60)

8.6.2 The Bronze Age

Bronze Age settlement in the study area highlights the distribution of a series of settlements along the coastal plain to both north and south of the mouth of the Tiber, including Final Bronze Age evidence on the Tiber strandplain between the river and the Ostia lagoon. A further series of settlements exploit the main tributary valleys of the Malafede and Rio Galeria. The location of settlements seems to suggest some degree of continuation into the Protohistoric period, but the location of settlements for this period perhaps shows the greatest extent of settlements within the wetland ecotone of the Tiber delta. Faunal evidence from sites in the area indicates a continuation of reliance on carpine species and cattle.

8.6.3 The Protohistoric Period

The evidence for Protohistoric settlement presents a more socially complex series of settlements. Firstly, a number of nucleated settlemnts a positioned along the edges of the

Rio Galeride, including Ficana, Castel di Decima and Monte Roncione. These sites indicate a level of settlement hierarchy, with these nucleated sites located off the wetland, but with evidence of rural settlements within the cost distance extents of these settlement, on the river floodplain, the coastal plain and in the primarily agricultural areas above the Malafede and Rio Galeria. There is evidence of settlement on the floodplain, with further evidence of hearths, drainage canals and possible saltworking. The ceramic evidence indicates types associated with Veii to the north of the Tiber, perhaps indicating the influence from the larger Etruscan settlements to the north of the study area.

Faunal remains from sites such as Ficana, indicate reliance on cattle and caprines, but an increase in the representation of domestic pig in the assemblages (Fig. 8.69 to 8.72). The presence of wild fauna may indicate hunting and a sphere of influence that includes the Tiber floodplain and the wooded areas alongside the agricultural ecotone. However, the contexts with these remains indicates that they may have been restricted to those with higher social status.

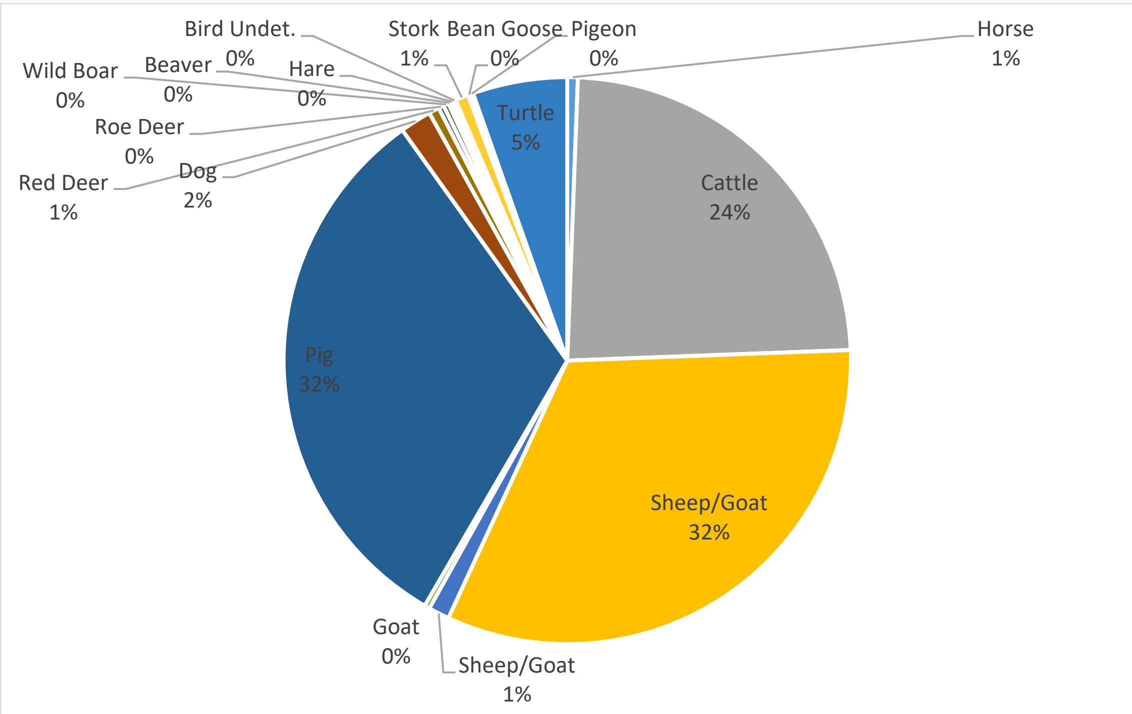

Figure 8.69 Percentage of assemblage by species for Ficana Period II (Brandt 1996)

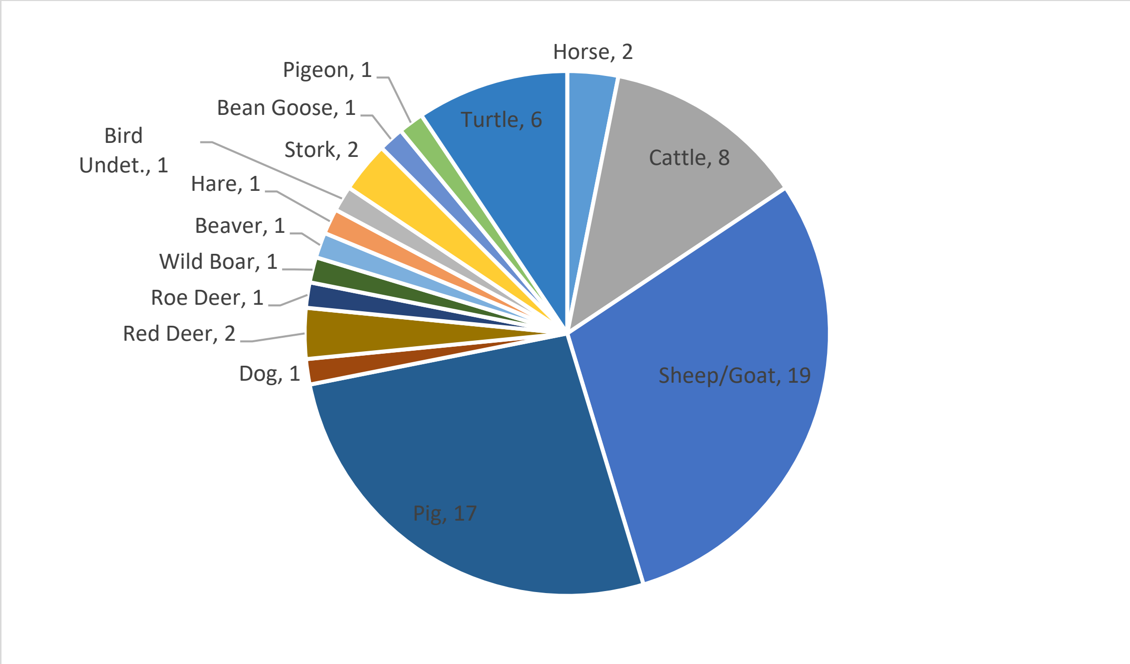

Figure 8.70 Total number of individuals by species for Ficana Period II (Brandt 1996)

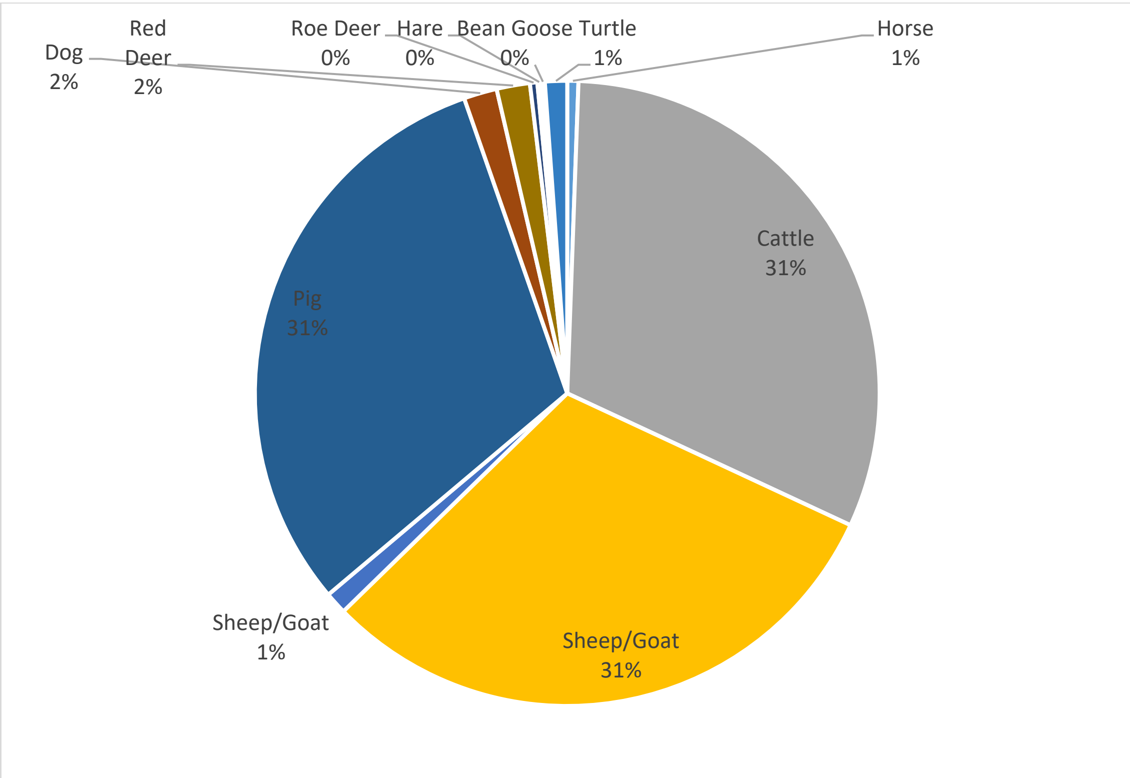

Figure 8.71 Percentage of assemblage by species type for Ficana Period III (Brandt 1996)

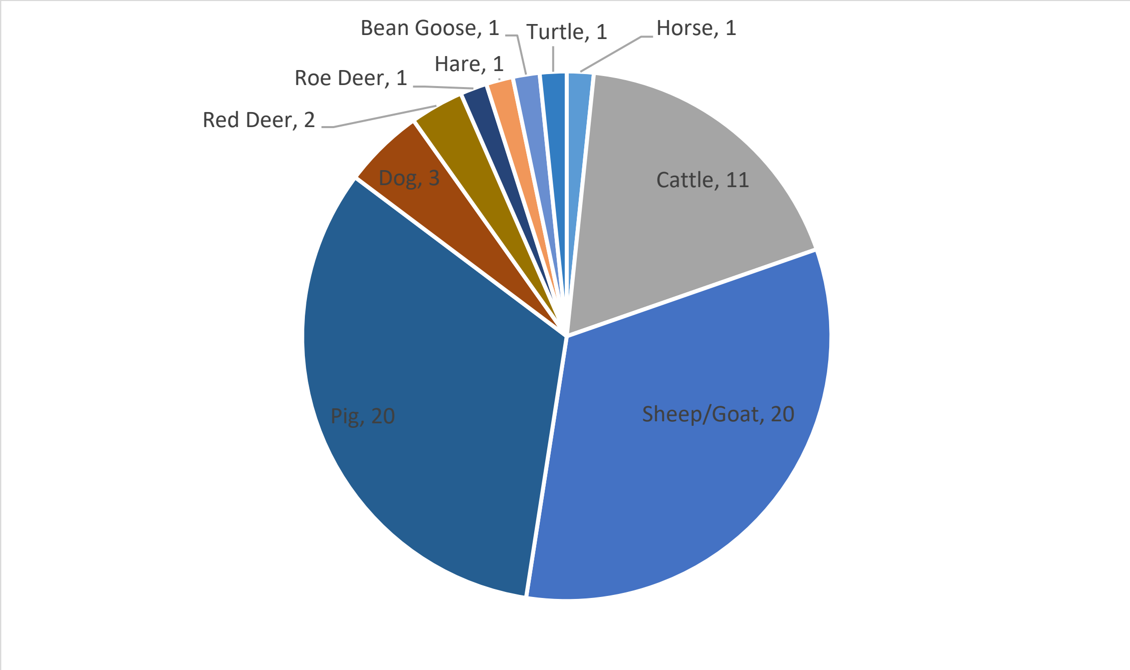

Figure 8.72 Total number of individuals by species for Ficana Period III (Brandt 1996)

8.6.4 The Republican Period

The establishing of the *castrum* at Ostia Antica, certainly in the 4th or 3rd century BC, marks the increased influence of Rome in the area of the Tiber delta. A number of key villa sites are established to the south of the Tiber, principally at Dragoncello, and the establishing of the *castrum* went hand in hand with the creation of the Via Ostiense, and with construction of the Via Campana to the north of the Tiber from 3rd century BC. These developments occur close to the settlement of Ficana and may indicate continuation of use of the delta area with power passing from Ficana to Rome. The 3rd to 1st centuries BC show a steady increase in the number of villas and rural settlements in the study area, including those in the delta. The spread of these sites is linked to the increased influence of Rome in this period but is also linked to the changing climatic conditions of the Roman Climate Optimum, and the increasingly beneficial conditions for agiculture in the study area (Harper 2017).

8.6.5 The Imperial Period

The Imperial period for the study area shows a sudden increase in both villas and rural settlements in the study area, linked to expanding agricultural settlement associated with Imperial exploitation of the area and improvement of conditions. These are located along the edge of the wetland above the coastal plain and the valley floor of the Tiber, Malafede and Galeria. The stabilising of the central delta led eventually to the creation of a new port for the city of Rome to the north of the Tiber mouth, as part of an overarching port complex, comprising Portus, Ostia, the Tiber and the ports in Rome. A complex system of port infrastructure including canals, warehouses and other features were constructed in the 1st and 2nd centuries AD. In addition, the creation of a maritime façade of villas along the coast to the south of Ostia, and to the north of the Maccarese lagoon occurred. A significant road network and a series of necropolis were also commenced, this latter along the roads but also along the banks of the Tiber. Finally, evidence for saltworking continues in the Imperial period, but also evidence for land improvement in the central part of the river delta is present, including field systems demarcated with canals. Occasional evidence for rural settlement is visible in the delta, however, much removed from the port complex in terms of extensive data.

Chapter 9 : Discussion of Patterns, Trends and Their Broader Implications

9.1 Introduction

The primary aim of this study is to model the patterns and dynamics of settlement and land use in the changing landscape from 3000 BC to AD 300, with an emphasis on broader trends in the pattern of settlement and land use for the area. A second aim is to develop and provide a methodology for modelling the past landscape using an integration of different approaches from archaeological and geomorphological methods, harnessing results from field survey techniques, archives of remotely sensed data, and publications. The observations and discussion in Chapter 8 lay out the results of the analysis for the archaeological record in the area of the Lower Tiber for different periods. In this Chapter the the broad trends for settlement and land use for the study area will be given in Section 9.2. An appraisal of the methodology will be produced in Section 9.3.

9.2 The Context for Settlement, land Use and the Landscape

The broad nature of the model proposed for the study area provides a heuristic device to assess the changes in the settlement pattern and exploitation of a dynamic landscape. The prograding nature of the Tiber delta, and the changing environmental conditions over the longer term mean that the temporal variations provide an excellent opportunity to assess the developing ways in which the stabilising wetland and delta were transformed through human interaction. These changes are highlighted in Chapter 8, but the implications of this study bear scrutiny in the light of other studies of later prehistory and Roman archaeology for central Italy. This section explores some of the broader implications of this study by period.

9.2.1 The Late Neolithic and Eneolithic

The integrated dataset for the Neolithic and Eneolithic periods for the study area suggest the presence of settlement in the Tiber delta wetland, and on the surrounding ridges and terraces of the hillsides overlooking the delta and the principal river valleys and tributaries flowing into the Tiber. The faunal remains and pollen evidence suggest predominantly a mixed economy of cereals and animal husbandry, with possibly a mix of transhumance and sedentary settlement. Missing from the faunal record from sites like Le Cerquete is evidence of exploitation of wild resources, including deer, shellfish and other local resources (although evidence exists for sites exploiting these resources in the Iron Age period (see below). This may be due to exploitation of resources in different locations across the wetland outside of the village of Le Cerquete. The settlement here has been defined as most probably permanent. It is conceivable that resources such as shellfish and wildfowl were being exploited, but in close proximity to their source. The archaeological evidence therefore indicates settlements close to the boundaries of different forms of land use, and settlement within the wetland zone. Overall the distribution of Neolithic/Eneolithic sites suggests even distribution by land use type, perhaps reflecting the presence of settlements across the dominant 'agricultural' and 'wetland' forms of land use, in close proximity to mixed woodland and other forms of land use. There also seems to be a degree of continuity from the late Neolithic throughout the Eneolithic period in terms of settlement location and agricultural practices.

Results of this study are comparable with results of other landscape works in central Italy. The general pattern in the late Neolithic in the Tiber area is of sedentary communities located in close proximity to drainage and tributary valleys, with sites generally overlooking the streams and valleys of the area. The location of sites such as Le Cerquete-Fianello also show evidence of permanent long-term settlement on the delta plain, in close proximity to stream and lagoons. The overall pattern of settlement seems to continue into the Eneolithic. This pattern is broadly comparable to sites elsewhere in central Italy. Barker's (1995) analysis of data in the Biferno valley points to lowland sites in the Neolithic, with animals being butchered and consumed at the settlements (Barker 1995, p144). Barker notes that, with the Eneolithic there is an expansion into peripheral areas and some deforestation attested in the pollen diagrams (Barker 1995 129) with cattle being important in the lowlands and shepherding inland (Figs 9.1 and 9.2). Animal secondary products also seem to be important. This pattern is broadly consistent with that for the lower Tiber and delta, with settlement indicating close proximity to river valleys and lowland settlement, and proportions of faunal remains indicating broadly similar reliance on goat, sheep and cattle (Tagliacozzo et al. 2002).

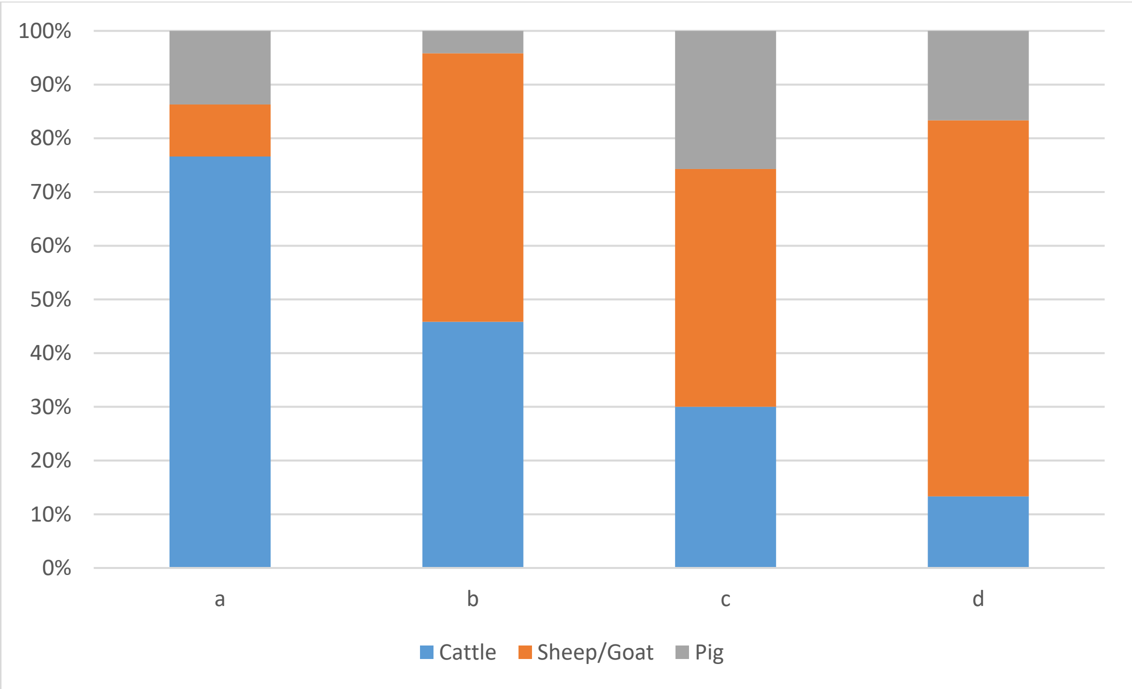

Figure 9.1 Summarised percentages of cattle, sheep/goat and pig from Neolithic sites in the Biferno Valley (after Barker 1995a, 151, Table 4, a-d refer to Neolithic sites excavated in the valley)

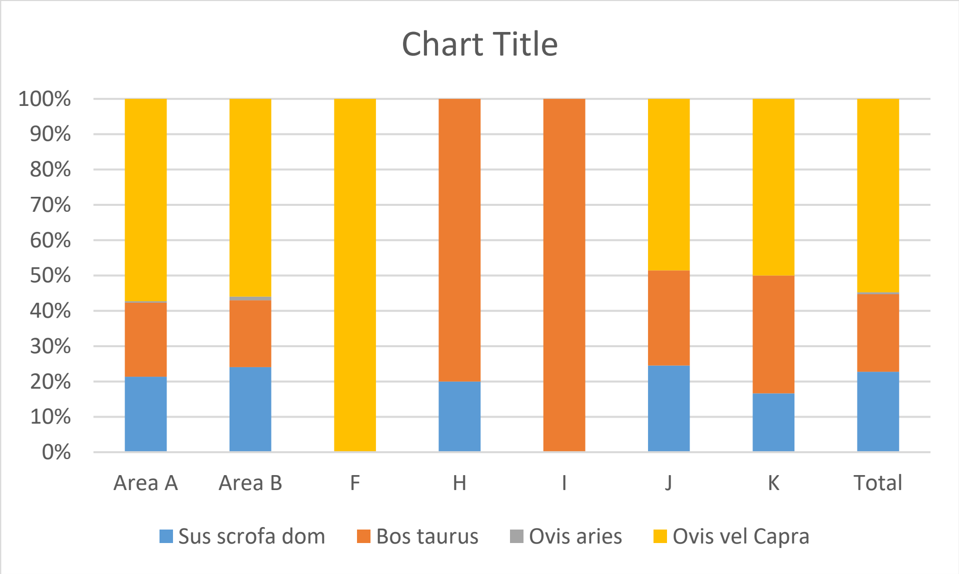

Figure 9.2 Fauna from Le Cerquete-Fianello (After Tagliacozzo 2002)

9.2.2 The Bronze Age and Protohistoric Periods

The Bronze Age and Protohistoric periods suggest several broad patterns in terms of settlement location and distribution. Firstly, evidence for some degree of continuity from the Eneolithic into the Bronze Age is apparent in the close proximity of finds for settlements at Le Cerquete-Fianello and in the Rio Galeria valley. Location of these sites in some way contrasts with sites from the Final Bronze Age, most notably the sites in the vicinity of Ostia in the Tiber delta. Evidence for the excavated site indicated finds that included daub, ceramic, cattle bone and horn, but also flakes of iron (Conti 1982, 29). These Final Bronze Age sites perhaps relate more strongly with the transition from the Final Bronze Age into the Iron Age, and the Protohistoric settlements in the study area.

These sites are notable in their location on the hilltops alongside the principal valleys of the Malafede and Galeria, but also overlooking the course of the lower Tiber, most notably the site of Ficana.

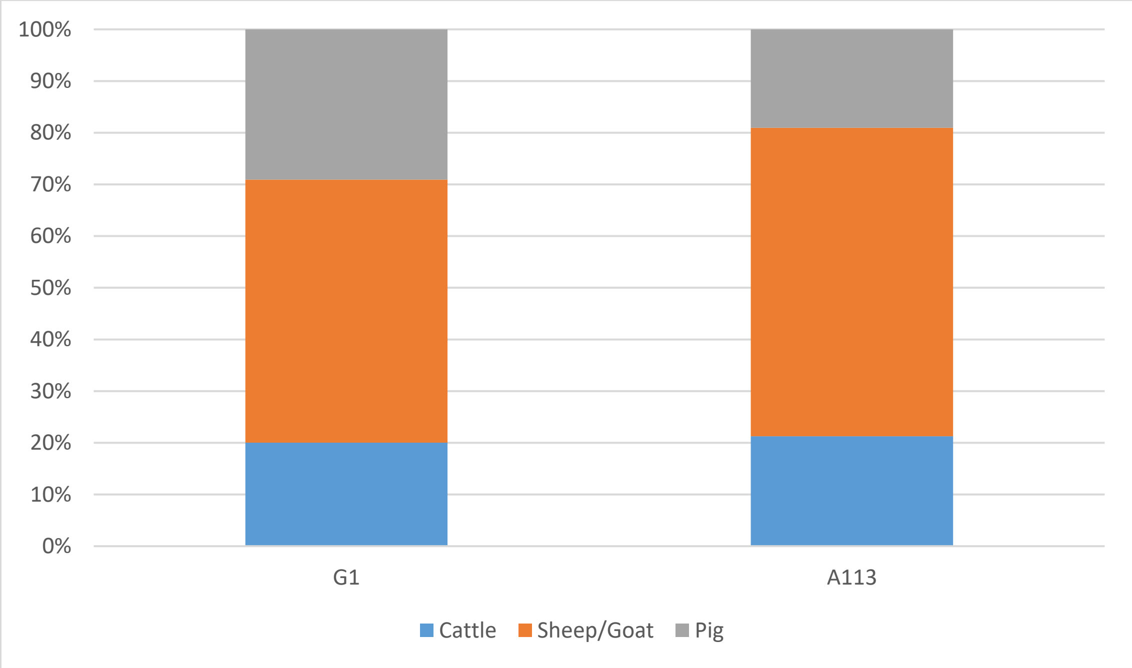

Figure 9.3 Bronze Age sites G1 and A113 from the Biferno Valley (after Barker 1995a, 153, Table 6) with summarised percentages of cattle sheep/goat and pig remains

Apart from evidence for the Final Bronze Age around Ostia, the other main source of evidence for Late Bronze Age/Protohistoric settlement in the wetland of the Tiber derives from the excavations to the east of Fiumicino Airport, indicating a settlement with wooden platform, drainage channels revetted with ceramic, and hearths (De Castro *et al*. 2018, para 36). The evidence suggests both settlement in the floodplain and the manipulation of the lagoon and possible saltworking. The ceramic assemblage here suggests close links to the ceramic assemblages at Veii (Acconcia *et al.* 2018, para 5) indicating that the Protohistoric sites in the area fell under the influence of the territory of this site. The formation of nucleated urban centres in the late Bronze Age and Protohistoric period is a factor noted across the Italian peninsula (Anzidei *et al.* 1985) and it is visible in the study area in the formation of nucleated sites at Ficana, Castel di Decima, Castel di Perna, Monte Roncione and Lavinium (Alessandri 2007, 46; Bietti Sestieri 2009, 12; Bietti Sestieri 2012, 262; Brandt 1996).

So, what about the broader implications for land use in this period? The predominance of domesticated species (Fig. 9.3), with small quantities of game is also matched in the Biferno Valley for the Bronze Age (Barker 1995a). For the Biferno valley most settlement occurs in the middle valley, although Barker notes an issue with the data, that some of the Bronze Age sites may represent settlement in the 1st half of the 1st millennium BC rather than the latter part of the 2nd millennium BC (Barker 1995, 138; an issue reflected in the sites in the lower Tiber area). Cereals were cultivated (emmer wheat and barley) in addition also cultivation of flax, millet and oats (Barker 1995, 149). The pattern of settlement here is similar to changes in South Etruria, with mixed farming and first indications of settlement hierarchy (Potter 1979, 36).

The pollen record for the area of the Maccarese Plain, however, is heavily represented by species of oak, alder and willow, (Di Rita eta al. 2009, 57), aligned with the alder carr environment of the plain for the Bronze Age, changing to a more saline enviornment at the end of the second millennium approached. This is in marked contrast to the portrayal of mixed pastoral and cereal economies in evidence elsewhere, reflecting the very local conditions of the delta environment. The evidence for Bronze Age settlement along the coastal plain suggests that some settlements were located explicitly to exploit the Alder Carr environment for grazing livestock and access to woodland resources.

The faunal evidence from sites of the protohistoric period (Fig. 9.4), especially for Ficana, indicates an increase in the presence of pig bone in the assemblages for the Iron Age, suggesting a shift towards pig farming as a source of meat. Caprines are still represented, also indicating continued animal husbandry for production of meat, wool and dairy products (De Grossi Mazzorin 2001, 329). The assemblages from Ficana also indicate a percentage of wild animal remains, including pigeon, hare, deer, boar and others (see Chapter 8, Section 8.5.3), indicating exploitation of the surrounding woodland and floodplain for resources. Evidence for settlement on the floodplain, with the exception of the aforementioned sites, is lacking. In part this relates to the depth of alluvial deposits over parts of the delta (3-5m) down to deposits from the final Bronze Age in the case of the area around Ostia), but the distribution of Protohistoric sites also suggests a change towards a series of territories incorporating different classifications of land, centred on nucleated settlement (Alessandri 2007; Bietti Sestieri 2012)[48].

[48] The territorial nature of the landscape in the Protohistoric period is perhaps reflected in the location of an outpost (Site 2215 in the database) located to the north of the Tiber overlooking the valley. This site is located in the SITAR records for the area.

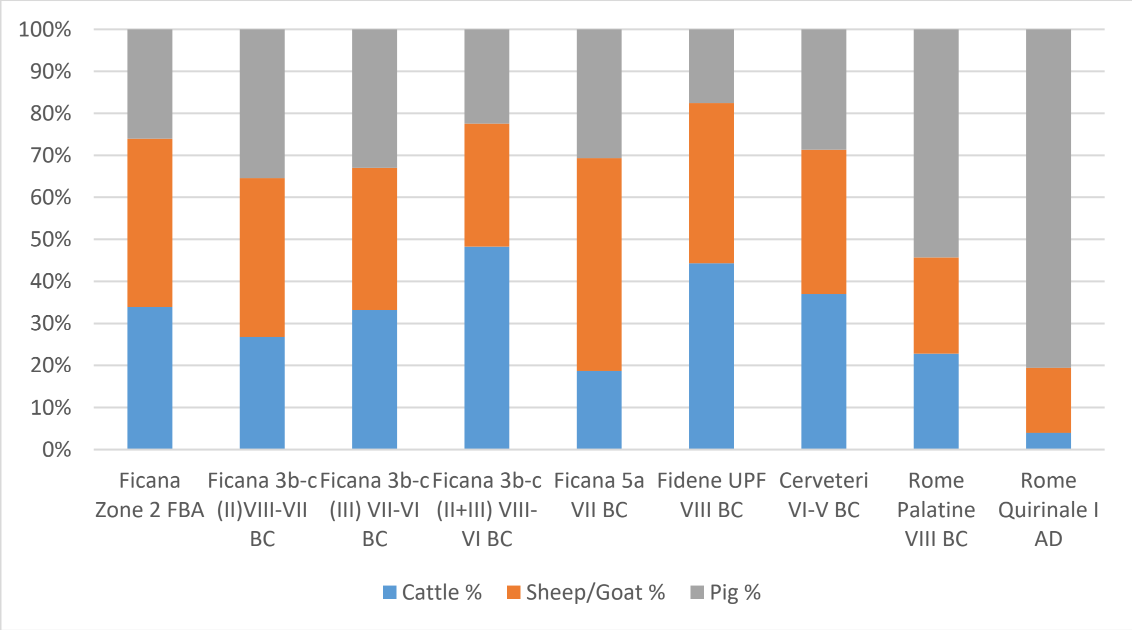

Figure 9.4 Comparative faunal data for Iron Age sites, Ficana, Fidene, Cerveteri and Rome (from De Grossi Mazzorin, 2001)

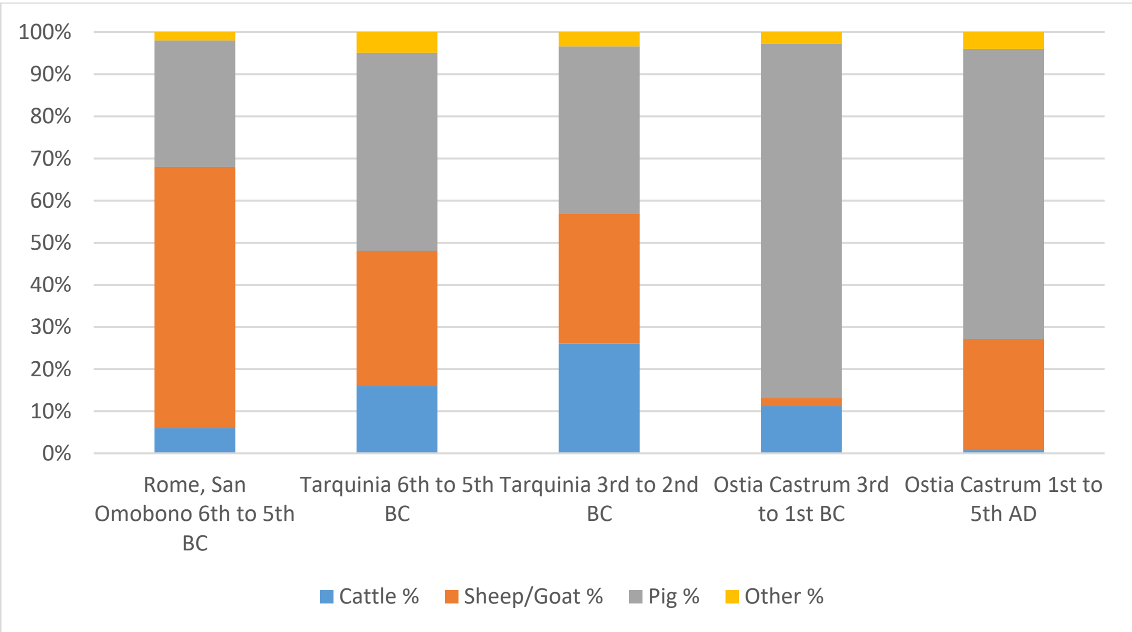

Figure 9.5 Comparative faunal data for Tarquinia, Ostia and Rome (from Mackinnon 2001)

The Iron Age material from the Biferno Valley shows an increase in settlement hierarchy, with nucleated settlements in defensible locations relating to the Samnite region (Barker, 1995, 48). The pattern for the Biferno valley indicates scarce cattle at sites, with cattle breeding in the high valley (Barker 1995, 147). Scarcity of cattle elsewhere may be caused by the issues surrounding the supply of food for cattle in the winter months.

The data for the area is also skewed by the two sanctuary sites from which faunal remains wer analysied (sites at Campochiaro and C36; Barker 1995). Sheep and goat remain important, with pig also represented (Barker 1995, 146).

For the Biferno Valley Barker portrays a landscape of hamlets and farms at the end of the Bronze Age (Barker 1995, 159). For the Tiber valley the development of the cultures of Latium and the Etruscan cities marks a comparable phase to the formation of the Samnite settlement of the 1st millennium BC. The area was marked by a stratified hierarchy of cities, local centres and hamlets and farms (Barker 1995, 159). Settlement distribution and status consists of many sites of ceramic material with a spread of 50m by 50m or less (Barker 1995, 162), but also much larger sites. There also seems to be a level of consistency between early Iron Age sites and Samnite settlement. Major nucleated settlement is located some 10-15km apart (Barker 1995, 163). Settlement structures in the Biferno Valley seem to comprise wattle and daub huts, with floors of river cobbles (Barker 1995, 164)or beaten clay around the hearths. For the Biferno Valley the evidence suggests the growth of lowland villages, and the beginnings of hillfort settlement in the mountains (Barker 1995, 167). The palynological evidence for the Biferno Valley in 1st millennium BC is dominated by emmer and barley similar to earlier prehistoric systems. There is evidence also for the start of grape cultivation (Barker 1995, 168) and, together with the fineware cups of the period, the production of wine. This fits in with the pattern of winemaking in Etruscan society. There is little evidence of olive cultivation except on the coast (Barker 1995, 170), unlike Etruscan society. There is also a marked emphasis on secondary animal products (Barker 1995, 171). Especially wool production.

The pattern of settlement from the Protohistoric Period, comprising the Etruscan, Archaic and Iron Age sites in the lower Tiber area can be compared with several surveys in central Italy, and with studies of faunal remains across the region. Of these the synthesis of Mazzorin (2001) is useful. This indicates the percentages of minimum number of individuals from Ficana from the final Bronze Age onwards, but also the same data for sites at Fidene, Cerveteri and the Palatine and Quirinale in Rome (Figs 9.4 and 9.5). The earlier assemblages denote the dominance of sheep, goat and cattle (for instance at Ficana Zone 2, for the Final Bronze Age), and an increase in the proportions of pig in the settlement on the Palatine in Rome for the 8th century BC.

9.2.3 The Roman Republican and Imperial Periods

The Republican and Imperial periods mark the timeframe with the most visible and representative archaeological record for the lower Tiber, with the crystalising of a system of rural settlements and higher status villas developing for the study area. The nature of the lower Tiber area and the Tiber delta means that a very specific set of conditions influenced the changes in this area, with a pattern of exploitation dominated by the Etruscan states to the north and Rome along the valley. Thus, by the 4th century BC the formation of the *castrum* site of Ostia, the continued exploitation of the resources in the delta for salt production, together with farming, are key. By the end of 3rd century BC the lower reaches of the Tiber and the delta all came under the sphere of influence of Rome, and from 1st century AD the establishing of the port of Rome and the maritime infrastructure of canals, land improvement, maritime villas and other associated settlement all form the major dynamic of the Lower Tiber.

Site distribution shows some change in the Republican period. The floodplain and delta environment became the location for the *castrum* of Ostia close to the mouth of the Tiber (Brandt 2002; Martin 1996, 22; Zevi 1996; Zevi 2002, 12)[49], and the establishing of the Via Ostiense. A number of villa sites are also located to the south of the Tiber, most notably the complex of villas at Dragoncello (Pellegrino 1983; 1984; 1995; Olcese et al. 2017) and two further villa complexes on the terrain to the west of the Malafede valley. These sites contrast with the presence (or rather absence) of Republican villa sites to the north of the Tiber.

The Imperial distribution of settlements for the Lower Tiber provides a picture of a unified territory, and represents a complex system of sites, including rural settlement, villas, roads, cemeteries and the settlement and ports at Ostia and Portus. Behind the maritime façade of Ostia and Portus a number of Roman Imperial rural settlements are present on the river floodplain and on the Maccarese Plain to the north of the Tiber. Villa sites are located generally off the floodplain, but on the hillslopes and ridges overlooking

[49] Zevi (2002) covers the issues surrounding the founding of the castrum at Ostia, including Vaglieri's observation that 'tutti gli avanzi…rinvenuti non risalgano nella migliore ipotesi oltre il terzo secolo (Paschetto 1912), and Calza's later notes from excavation that '…le identificazione del primo centro abitato di Ostia, cioé della prima colonia romana databile per due elementi positive…agli ultimi anni del IV secolo a.C.' (Calza 1953, 63-77). The assumption for this study is based on the archaeological evidence for a foundation no earlier thatn the 4th century BC.

both. These sites are in contrast to rural settlements represented by scatters of ceramic material, and excavated structures on the floodplain, suggesting close proximity of territories for villa sites on the delta and floodplain, but with the more elaborate villa sites situated out of the range of potential flooding.

Results of the geophysics also indicate the presence of an extensive imperial wetland landscape of canals, some measuring 4-5m in width, extending across the Isola Sacra and relating in part to the network of port canals located as part of the Imperial port infrastructure. These may indicate some degree of drainage for saltworking, however, the pattern of canals is more indicative of field systems and drainage features, perhaps marking improvement of the wetland behind the port, for cultivation and agriculture. Saltworking is still in evidence for the areas of the *Campus Salinarum Romanum* to the north of the Via Portuense, and in the lagoon area to the east of Ostia (Morelli et al. 2011, 266). It is the counterpoint of the wetland environment between the formal infrastructure of roads, cemeteries, salines and the ports themselves, and the presence of masonry agricultural buildings and also scatters of ceramic material marking further rural settlement in the area that is intriguing.

These conditions and influences are very specific to the area in question. However, some comparisons can be made with other areas along the Tiber valley and in central Italy. In the Biferno Valley settlement trends comprise persistence of a late Iron Age settlement system, with a greater settlement density in the lowlands, and nucleated settlement in the uplands. (Barker 1995, 187). Farmsteads and villas (Barker 1995, 192) also form part of the pattern of settlement. More specialised animal husbandry was key in the Biferno Valley in the later Iron Age (Barker 1995, 203), with localised Roman period exploitation of Samnite pastoral resources. Animals most frequently killed were pig, followed by sheep and goat, then cattle (Barker 1995, 241), with *in situ* slaughter. Pigs were farmed intensively, a move away from secondary products to intensive farming and production for urban centres. The intensification of pastoral and agricultural practices led to a more open landscape and high erosion rates (Barker 1995, 212). Evidence of finewares and coarsewares suggest that Imperial rural sites did not continue much further than the start of 3rd century (Barker 1995, 225). Villa sites show continuity from the Samnite period (Barker 1995, 230). What is intriguing from Barker (1995, 230) is the presence of an inscription referring to 'the household gods of the cottagers/hut-dwellers (lar[ibus] cas[anicis] (CIL IX: 725) indicating a community of low economic status.

For the Tiber valley in the 8th and 7th centuries BC evidence suggests a population explosion (Potter 1979, 72). Evidence points to a steep rise in the rural population, (Potter 1979, 72) with the focal point being the nucleated settlements of the region, with smaller nucleated district centres in the area. As a general guide (Potter 1979, 133), the overall trend for rural settlement reaches a peak in the 1st century AD (Figs 9.6 and 9.7), with site density of 2-3 sites per sq km not uncommon. Building of sites such as the Giardino villa repeated throughout the landscape of South Etruria (Potter 1979, 133). In the Ager Capenas north area it isn't until the 2nd century AD that marginal land comes into cultivation, but in the area around Rome most land is cultivated by the mid 1st century AD. There are also continuous occupations of farms near Rome. This expansion in use of farmland is of interest and may link to the evidence for improvement of the land in the central Tiber delta. These field systems seem to be contemporaneous with the establishing of the Necropolis di Porto in the 1st and 2nd centuries AD. Thus, it may be that the apportionment of land in the wetland zone for pastoral farming would relate to the overall increase and intensification of agriculture in this period.

Much of the initial work by Potter for the Tiber valley has been reassessed as part of the Tiber valley Project (Patterson et al. 2000), especially the work by Di Giuseppe (2008), Goodchild (2007) and Witcher (2006; 2008). The list of Orientalizing and Republican sites in the Tiber valley (Di Guiseppe, 2008, 433) shows increase in occurrence of evidence and archaeological sites for periods from 6th century BC onwards, but with decreases in possible sites in the 5th and 3rd centuries BC. The middle of the 8th century to the start of 6th century BC marks the period when nucleated and defended settlements such as Veii were expanding their territories (Di Guiseppe 2008, 433), with intensification of contacts across the Tiber, and an opening of communication and trade with other parts of the Italian peninsula (Di Guiseppe 2008, 434). A proper explosion in the population in the South Etruria and Sabine data from the 6th century only (Di Guiseppe 2008, 437), with numerous small-scale habitations measuring 16-40m sq (Di Guiseppe 2008, 437). The number of sites present from the second half of the 3rd century BC is indisputable. From the start of the 2nd century BC to the end of the 1st century AD the rural landscape is intensively occupied (Di Guiseppe 2008, 453) with a high proportion of new farmsteads and sites created between 150-30BC (Di Guiseppe 2008, 453). This is suggestive of some form of population redistribution, with internal colonisation farmsteads built at the confines of territories. A massive increase in sites for the early Imperial period and 1st century AD (Di Guiseppe 2008, 440) is visible from the record.

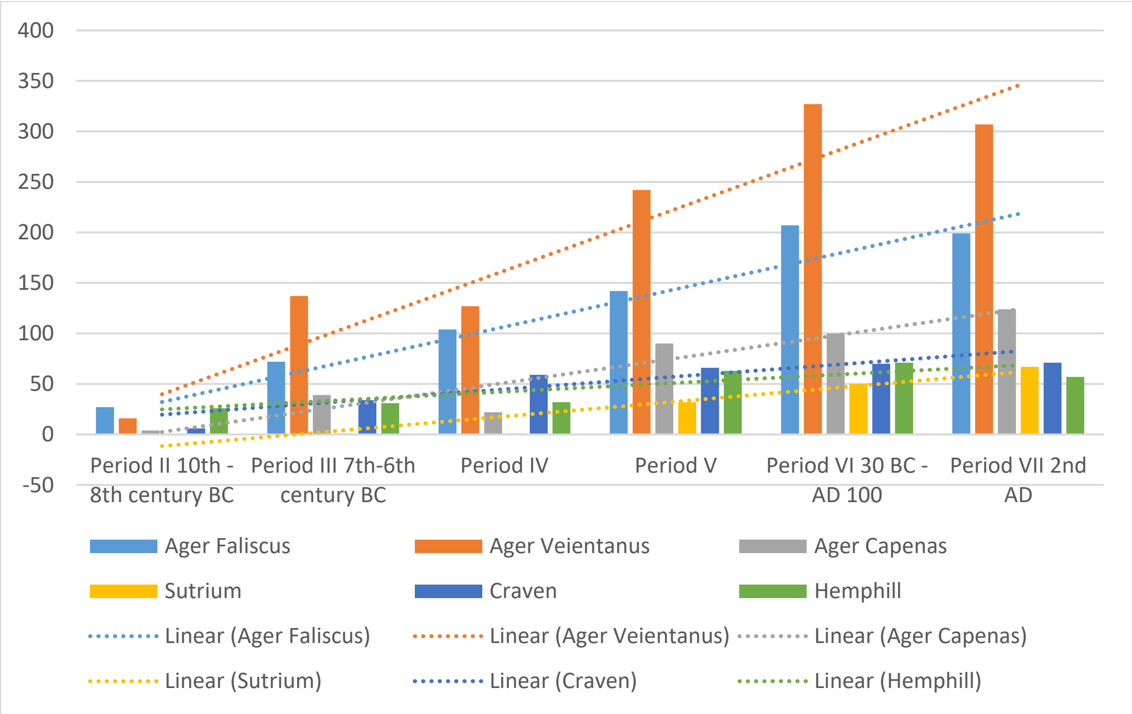

Figure 9.6 Bar chart of collated sites for different projects in S. Etruria across different periods from 10th century BC to 2nd century AD (from Potter 1979)

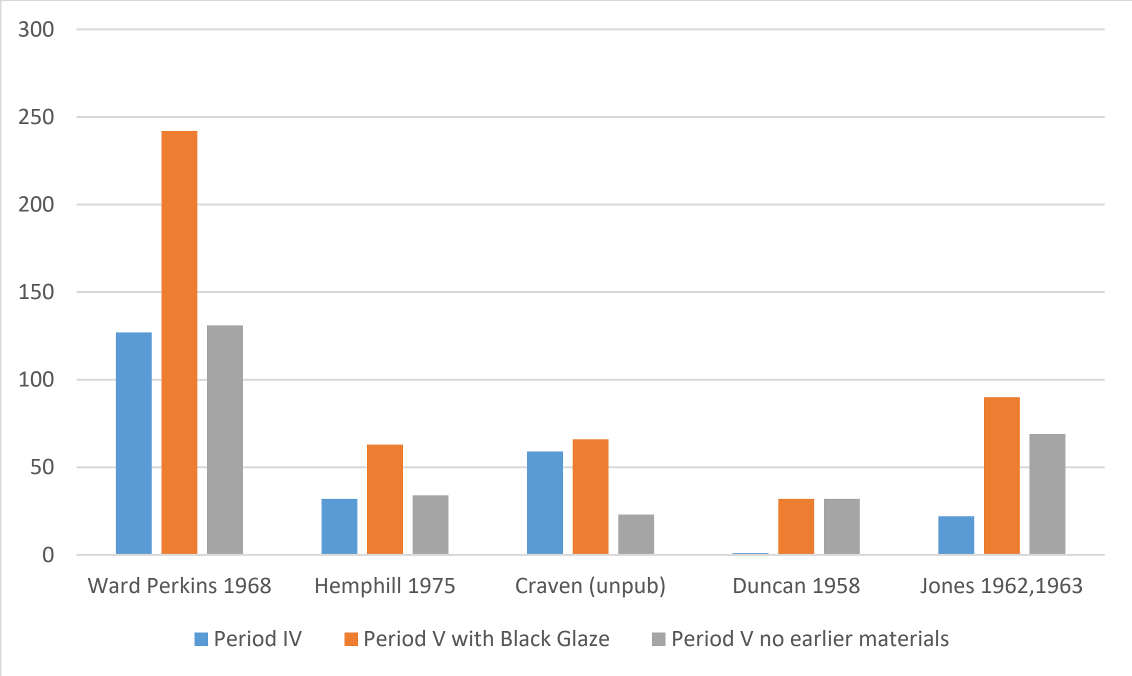

Figure 9.7 Ceramic material for different published sites in S. Etruria, showing the increase in post-conquest farms (from Table 4 in Potter 1979, 96)

Witcher (2008, 468) indicates an increase in sites in the middle Republican period (375-225 BC) and a decline in the 3rd century AD. The methodology, as with other projects, is not ideal (Witcher 2008, 471) particularly the attribution of sites to a very broad chronological period. However, this is the same for the lower Tiber sites. The pattern of sites may indicate the breakdown of the urban territories (Witcher 2008, 474) and their reorganisation into the larger productive hinterland of Rome.

The early Imperial period marks, however, more than just the intensification of rural settlement and agriculture, but a rapid change, and represents a broad change in socio-economic relations (Witcher 2008, 475) and intensification of small farmsteads in the 1st century AD marks a new structure by new forces. It is noteable that Rome's population increased in 1st century BC, but an increase in farmsteads is seen in 1st century AD, indicating a complex relationship between Rome and its hinterland, as Rome was supplied from afar, and some rural sites such as villas don't simply represent production but also consumption of wealth.

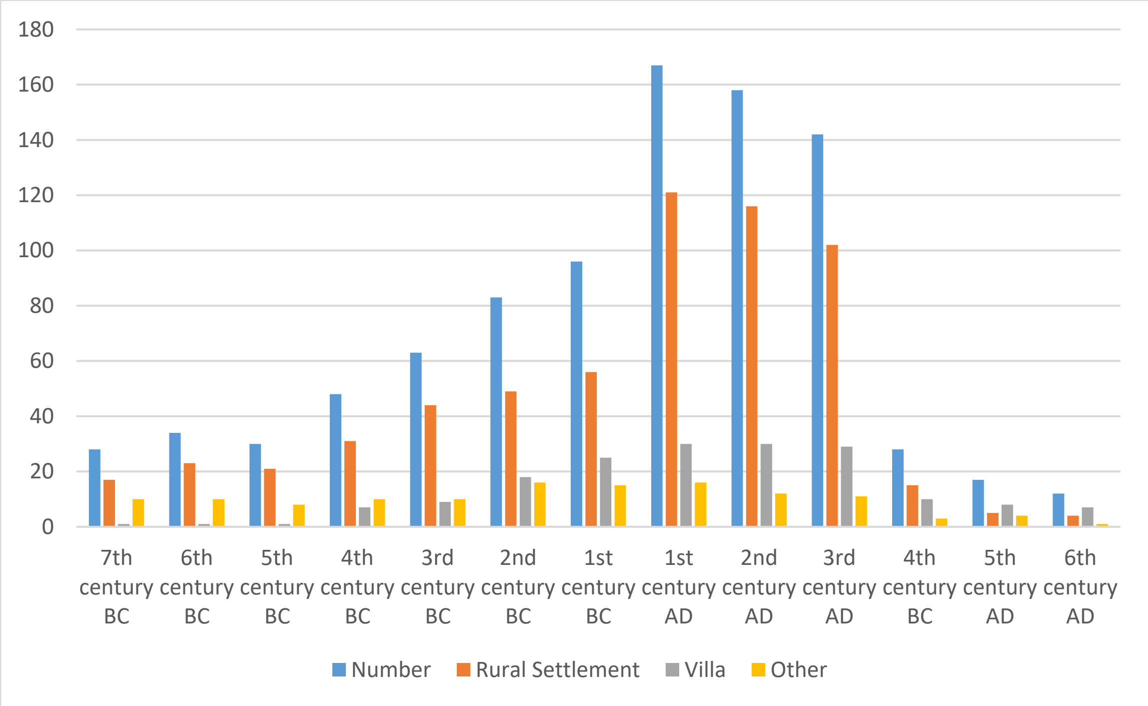

Figure 9.8 Number of sites, rural settlements, villas and other sites for the study area from 7th century BC to 6th century AD

The settlement trend of towns, villages, villas and farmsteads centres on open low-lying ground on major routes. This may be much different, however, to the lower Tiber area, due to the later conquest of the Etruscan territories by Rome. In the Lower Tiber valley there was certainly Roman influence by 4th century BC with the foundation of the *castrum* at Ostia, with probable influence of the settlement at Ficana much earlier. Thus, a pattern of villas and rural settlements in the study area was influenced by both Etruscan and Roman political and social dominance on either side of the Tiber. A series of smaller settlements seems to be represented to the north of the Tiber, represented by a range of structures from farmsteads to outbuildings.

The pattern of rural settlement and villas, in particular the increase of these from the Archaic to Roman periods (Fig. 9.8) seems to be broadly in line with the pattern of an increase of farmsteads and villas in the Orientalising and Archaic periods in the middle Tiber valley (Giuseppe, 2008, 433), and with the much greater increase of farmsteads and villas in the 1st century AD (Witcher 2008). The lack of more refined temporal data for the Roman period settlements and villas for the lower Tiber valley and the study area presented here makes it difficult to compare results of the analysis by century. However, more refined temporal data from De Rossi *et al*. (1968), synthesised in Amendolea (2004), facilitates some analysis of the pattern of settlement around the north edge of the Maccarese Plain at Palidoro (Figs 9.8 and 9.9). The pattern of Republican Roman settlement here illustrates the extension of rural settlement in the area from the 6th to 1st centuries BC, including 5 settlements for the 3rd and 2nd centuries BC, marked by concentrations of ceramic material. The data for settlement is again strongest for the north-western area of the plain, away from the lacustrine deposits in the south-eastern portion of the Maccarese lagoon. The heaviest concentration of material is for the 1st and 2nd centuries AD, after which a decline in the concentration of material occurs (Fig. 9.10). It is also worth noting that many of the rural settlements are located within 2km of the line of the Via Aurelia running along the edge of the plain.

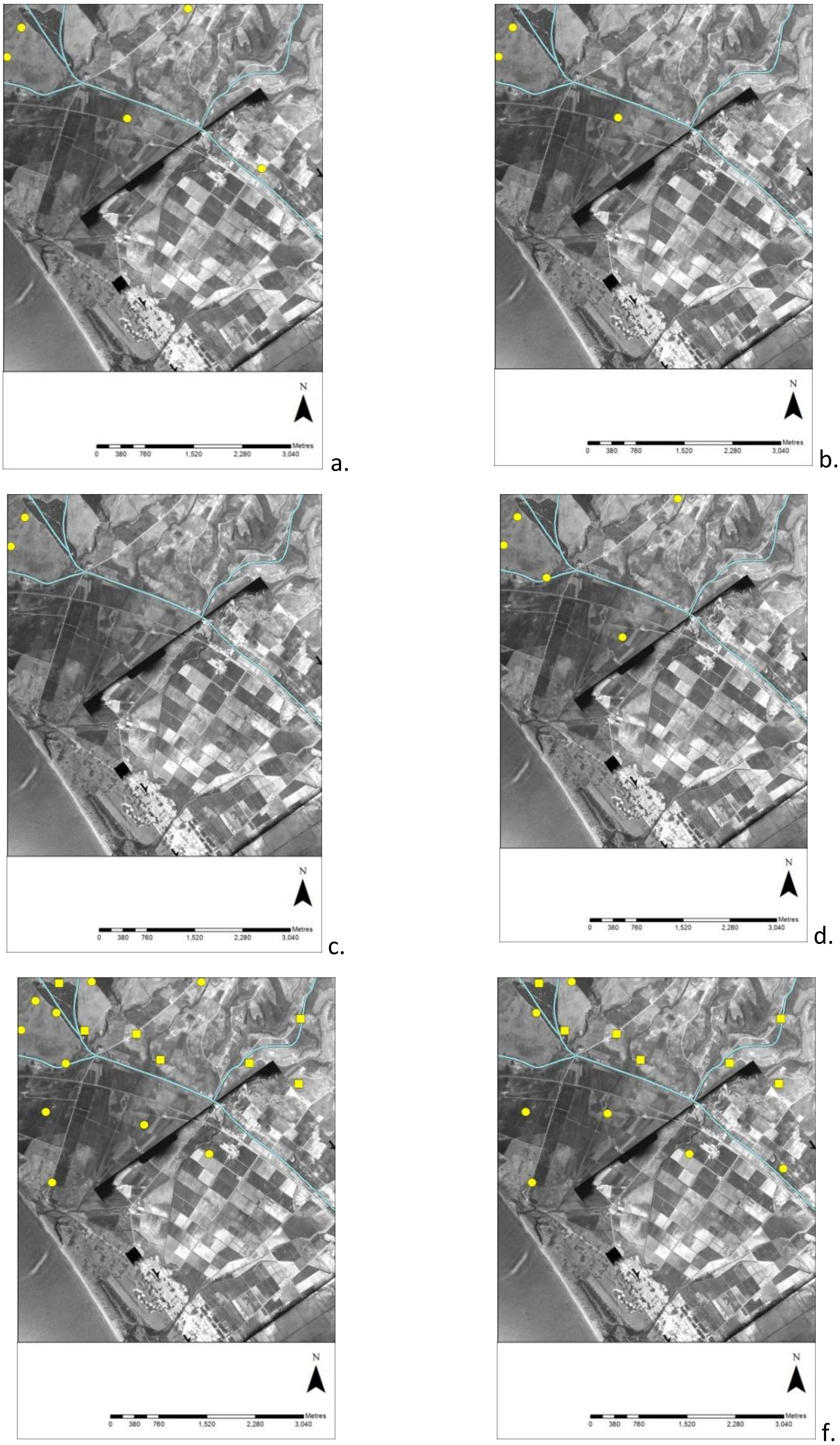

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Figure 9.9 Distribution of rural settlements and villas from 6th to 1st centuries BC a-f by century

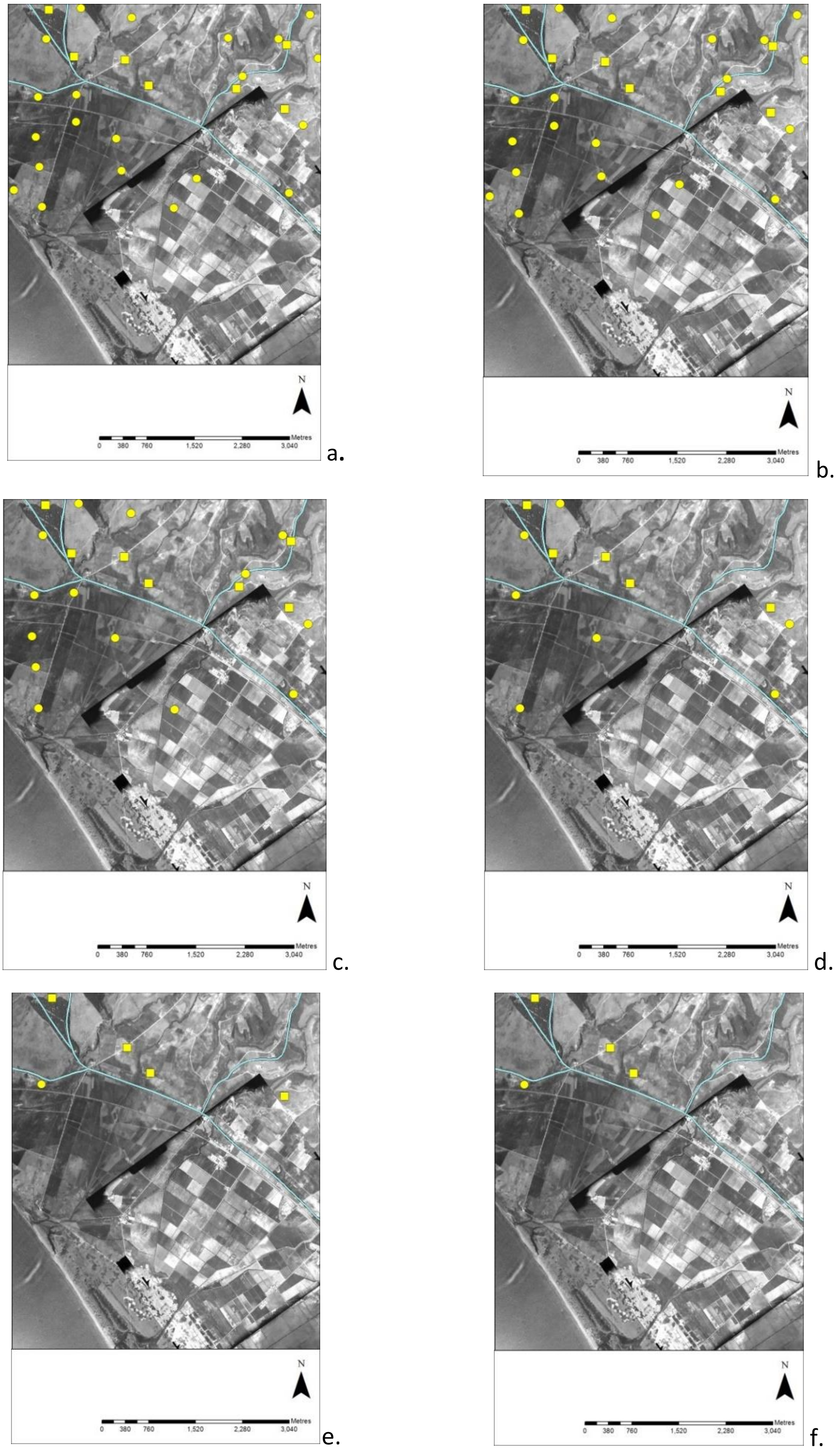

Figure 9.10 Distribution of rural settlements and villas from 1st to 6th centuries AD, a-f by century

9.3 The Context of the Methodology

Use of an integrated methodology of data collation and collection for the study area seems to provide a comprehensive datset for analysis of the settlement pattern and possible forms of land use. Certainly, the balance of extensive site data relating to GIS coverages of drainage, geology, land use and topography proved essential in the analysis of factors contributing the the location and distribution of settlement. Individually the different methods applied here are recognised strategies and approaches to archaeological research. Use of geophysical survey, air photographic and analysis, and other forms of remotely sensed data such as LiDAR data and satellite imagery are not unknown in central Italy. However, reflection on the methodology and comparison with other survey projects and syntheses of data provides some insights into the implications for this approach.

The most extensive archaeological survey conducted in the region is the South Etruria Survey. This project, undertaken over four decades (see Chapter 3, Sections 3.2.5 and 3.2.6; Jones 1962; 1963; Ward Perkins 1962) was also the focus of a reassessment of material (Patterson *et al.* 2000). The scope and nature of this project cannot be compared with the modest undertakings of the present study but serves to outline the limitations of the extensive dataset used for analysing the pattern of settlement for the lower Tiber. The dataset from the South Etruria Survey has its limitations (Witcher 2006; 2008), but at least was collected using a systematic methodology. The data from this research stems from seven separate sources of information, and thus provides a very limited and coarse tool for assessing the location and pattern of settlement (see Chapter 7). The sub-division of data, however, by classification and, where possible, by temporal sub-divisions for different centuries, has provided some nuance beyond the very broad periods modelled in this study.

Evidence from remotely sensed data, including air photographic evidence, satellite imagery and geophysical survey, provides greater resolution and information. These methods offer standard techniques for archaeological fieldwork in Italy, with extensive work undertaken in Puglia, Calabria and Basilicata (Lasaponara and Masini 2007; Lasaponara *et al.* 2010) and geophysical survey in central Italy (Campana 2018; Campana and Piro 2009). The extensive nature of the data collection and interpretation of these methods, in particular for geophysics and magnetometry, offers an unparalleled dataset in terms of high resolution sampling for the landscape. The issues with the application of these methods rather lie in the formation processes of the study area presented here. The central part of the Tiber delta stabilised in the 4th and 3rd centuries BC. Thus, the depth of deposits for the later prehistoric period are beyond the blanket use of magnetometry, or representation in parchmarks and other featues from air photographic records and satellite imagery. While these provide some evidence for the areas on the confines of the wetland zone, the depth of Bronze Age and Protohistoric material for the central delta means that these intensive methods do not provide any evidence for pre-Roman habitation of the central delta area. Thus, comparison of these datasets with evidence of excavation, and unique interventions where prehistoric sites were found in the wetland zone, are crucial. Notwithstanding these limitations, the evidence from these methods has facilitated the mapping of Roman field sysems, canals and other associated areas of land use for the delta.

Chapter 10 : Conclusion and Future Directions

10.1 Introduction

This study has explored the pattern of settlement and potential land use for the area of the Lower Tiber floodplain and delta from 3000 BC to AD300. In this concluding chapter we will return to the stated aims and outcomes for the research. Section 10.2 will address the pattern of settlement for the area, and the contribution made from the data and analysis to each period. Section 10.3 will assess the methodology and look at the advantages and issues surrounding the work. Section 10.4 will address possible future directions in terms of different areas of research.

The principal aims of the study was to model the patterns and dynamics of settlement and land use in a changing landscape from 3000 BC to AD 300, with an emphasis on the broader trends, and to develop and provide a methodology for modelling the past landscape using an integration of different approaches from archaeological and geomorphological methods. This study has achieved this through the integration of different datasets and has elucidated the changes which occurred in this broad timeframe.

Returning to the two research questions presented in Chapter 1, the results of the analysis provide some preliminary indications in addressing these points:

- How has the changing environment affected the nature and presence of archaeological evidence for settlement and land use in the zone between the mouth of the Tiber and Rome?

- How and why has the pattern of settlement and land use changed or continued as a result of the development of the Lower Tiber valley?

As this work outlines, the variable conditions in the study area, and particularly along the coastal plain, and on the Tiber floodplain and delta, have very real implications for the visibility of the archaeological record. The presence of later prehistoric settlement in some areas is affected by the depth of overburden from the inundation of the Tiber, and this certainly has affected the use of survey techniques and data analysis in the area. However, the use of excavated evidence, and site records from intrusive archaeological work, has assisted in populating the study area with evidence to support a pattern of settlement including the wetland zone.

The pattern of settlement and land use in the study changed significantly in the period 3000 BC to AD 300. This is dealt with in Section 10.2, however, the reasons for such change include the varying conditions of the Tiber floodplain and delta over 3,300 years, from stabilising ment of dune cordons, with its contemporaneous evidence of settlement, agriculture and resource explotation, to the change to an Alder Carr and sedge fenland environment, and the use of the wetland zone for grazing of livestock. Finally, the greater social hierarchies and exploitation of a saline environment for salt production and the estyablishing of a port complex. The reasons for why this occurred involve both the developing environment of the wetland of the Tiber and its delta but were invariably influenced by the systems of interaction from the human population of the area. This was not a barren landscape, but a very pivotal resource for the populations in the different periods.

10.2 The Pattern of Settlement and Land Use Change 3000 BC – AD 300: spatial distribution and human ecology

The changing environment, primarily through the pro-grading coastline and the variable depth of alluvial deposits for the river valley and delta, has been instrumental in affecting the type of settlement and land use in the study area, and the presence and extent of settlement. As might perhaps be expected, much of the settlement in the Bronze Age and Archaic and Etruscan periods occurs along the small valleys and ridges above the delta, and thus further study is necessary to properly characterise these. The data does, however, also suggest the presence of settlement along the coast and in the delta, with an increase in the concentration of settlement and use of the delta in the Roman Republic, with villas, drainage features, and possible salt pans among the types of use applied to the area. Where prehistoric material marks the presence of settlement, further integration of data to characterise settlement, and possibly some field survey to augment the desk-based data, is necessary to help in identification. It may be that many of the Bronze Age and Etruscan settlements on the plain are comprised of settlement associated with the pastoral economy as at Cerquete – Fianello.

The strongest trend in settlement for the delta occurs in the Republican and Imperial periods. The presence of evidence for settlement, in particular rural villas, might indicate a more regimented pattern of settlement and use of land prone to seasonal flooding. In particular the presence of drainage features located in the vicinity of possible settlement on the Maccarese plain and close to the course of the Tiber suggest adaptation of the floodplain and delta to agriculture and settlement. The analysis of all archaeological sites in the datasets for the entire study area will facilitate further study of this trend, particularly relating the location of material remains with known supporting infrastructure such as larger towns and cities and Roman roads.

10.2.1 The Neolithic and Eneolithic

The data for the Neolithic and Eneolithic periods provides the least in terms of quantity of information and location of possible settlements across the landscape. This is in part due to the depth of deposits in areas of the Tiber delta, but also the ephemeral nature of the archaeological record outside of the principal excavated area of Cerquete-Fioanello. In spite of this a number of factors can be ascribed to the location of these settlements. At an extensive level of analysis several corresponding factors seem to dictate the location of settlement. The Neolithic and Eneolithic sites are all located close to drainage and water sources (Chapter 8, Section 8.3) with 80% of sites located within 100m of a drainage feature, and 90% located within 300m. There is also a significantly higher proportion of Neolithic and Eneolithic sites located on clay, silt, and gravel, sand, clay geologies, compared with other periods of settlement. A difference does occur in terms of the number of settlements within the wetland land use zone (Chapter 8, Section 8.4), with proportionately fewer Neolithic sites in this zone compared with Eneolithic, probably a result of those Neolithic sites located in the Bietti Sestieri (1984) survey overlooking the Rio Galeria. In fact, there is more in common with the wetland location of Eneolithic sites with the increase in terms of Bronze Age sites in this zone. The excavation and environmental evidence provide detail for the subsistence practices of the period, with mixed cereal cultivation and pastoral animal husbandry being practised.

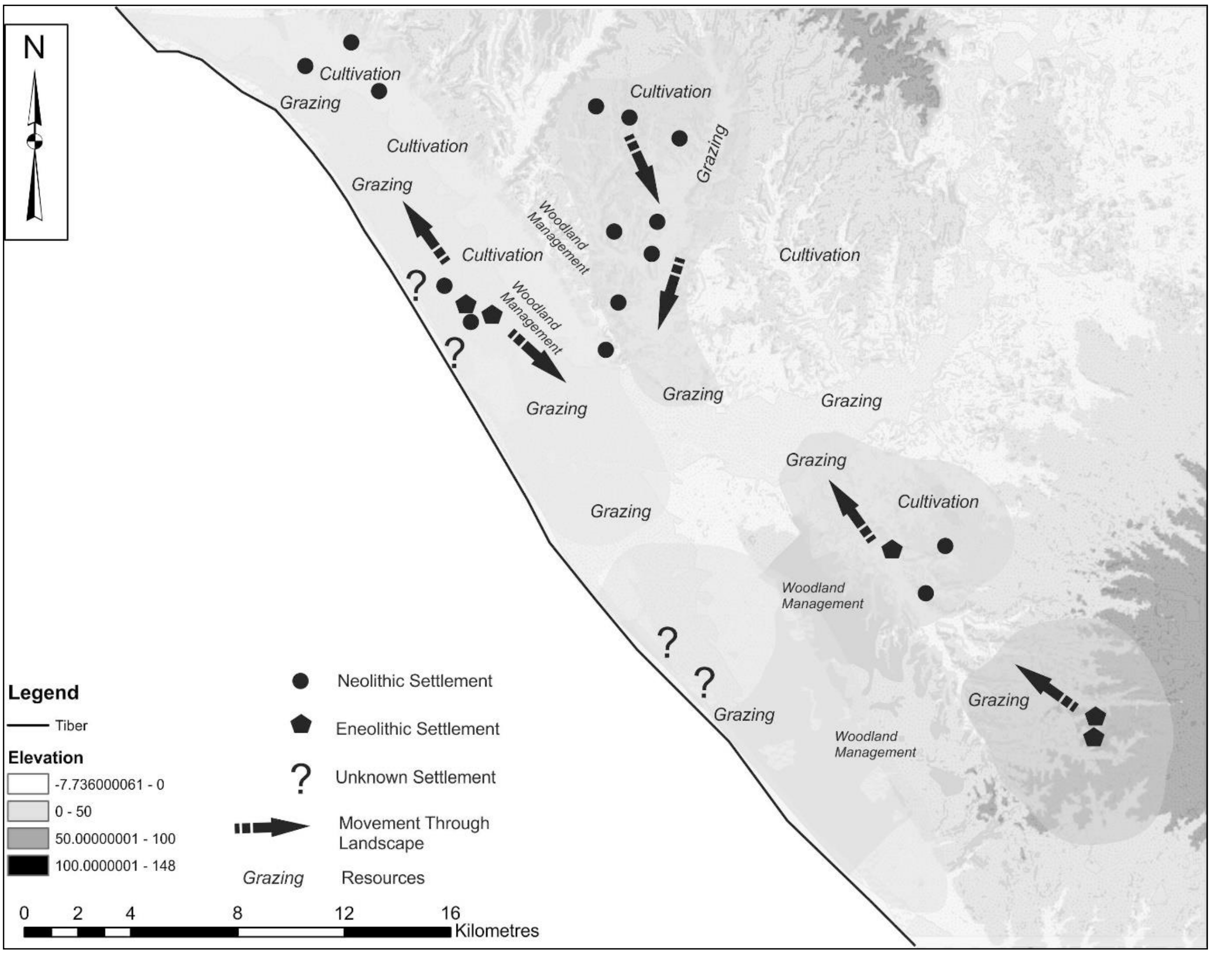

Figure 10.1 Schematic plan of settlement and areas of resource use for the study area, for the Neolithic and Eneolithic periods

The faunal record is dominated by caprines and cattle, with wool and milk produce as well as meat forming part of the economy, similar to other parts of central Italy. The immediate environment of the wetland seems to indicate herbaceous plants and cereal pollens (De Rita et al. 2009; Chapter 6, Section 6.2) attesting to the cultivation of crops. The location of permanent settlement adjacent to the wetland lagoon on the Maccarese Plain and potential settlement on the ridges to the north-east of the plain are of interest (Fig. 10.1). It is impossible to ascribe detailed social or economic influences on these settlements. However, their distribution could indicate a mixture of permanent settlement, temporary working sites overlooking the principal Tiber tributaries, and evidence of transhumance of livestock from upland to lowland across the seasons. The almost complete absence of wild fauna from the Cerquete-Fianello site indicates that, in that settlement at least, animal husbandry was of primary economic value (Fig. 10.2), with cereals also present in the environmental record. Small scale horticulture, appearing elsewhere in central Italy (Barker 1995, 114) may have provided part of the subsistence, but is not apparent in the environmental record. However, the caprine and cattle-heavy faunal evidence shows that secondary products from livestock were important, and evidence of ceramics for potential milk processing, and charcoal and wood burning all point towards processing of milk into storable and portable products such as cheese.

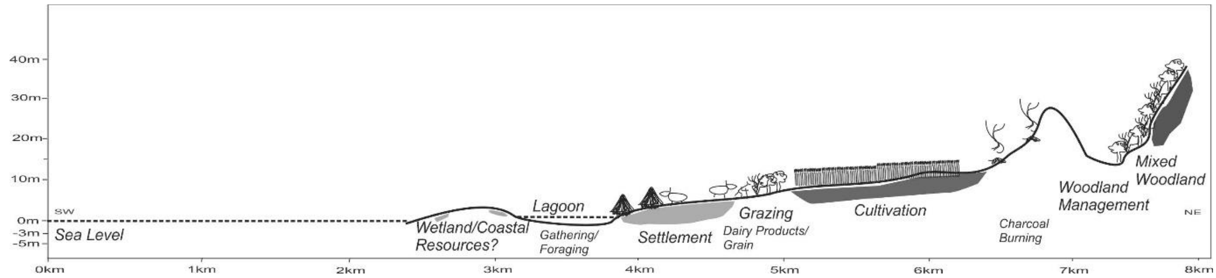

Figure 10.2 Schematic section of the Maccarese Plain, showing settlement and land use for the plain and hillslopes (topography based on LiDAR data)

The distribution of settlements for the late Neolithic and Eneolithic at first glance seem to indicate some form of movement of population and livestock from one site or area to another. However, the spatial analysis suggests that this may not be the case, with the groups of settlements representing different populations. One possibility is that cattle and caprines were grazed and moved along the delta plain (see Chapter 4, Fig. 4.13 for a modern example). It must also be remembered that many of the late Neolithic and Eneolithic sites fall on the silts and clays, providing fertile soils for cultivation. While far removed in time from this period, parallels of a broadly horticultural and pastoral economy with the production of dairy products, is extremely visible in the photographic and documentary record (Chapter 4, Figs 4.15, 4.16, 4.18, 4.24, 4.25 and 4.26), with hand cultivated fields, movement of livestock across the wetland zone, and evidence of dairy products being stored. A further possible dynamic is the almost complete absence of wild fauna in the assemblage at Cerquete-Fianello. While such material may not survive in the record, it seems surprising that access to the Tiber delta and its resources would not have led to the exploitation of the wild fauna. One possibility is that sites for the exploitation of such resources occurred at separate sites closer to the natural resources in question; gathering of shellfish and fish closer to the inlets of the Maccarese lagoon, hunting and preparation of wildfowl closer to the reedbeds away from the principal settlement.

10.2.2 The Bronze Age and Final Bronze Age

The pattern of Bronze Age settlement in the study area shows some degree of continuity with the Eneolithic, with a number of settlements located on the wetland zone, and across recent and ancient alluvium and the sands and gravels. The majority of Bronze Age settlements are within 500m of drainage features (Chapter 8, Section 8.3), further away than the Neolithic and Eneolithic examples, and in line with Protohistoric and Roman settlements. There seems to be a preference for south-west–facing locations (Chapter 8, Section 8.2), although this is perhaps predicated on the settlements located in the Tiber delta and along the eastern side of the Malafede river. A significant number of settlements are located on the alluvium and the sands and gravels of the study area, and this reflects a number of sites marked by scatters of impasto ceramic located on the northern edge of the Maccarese Plain below Torrimpietra, together with the settlement at Cerquete-Fianello.

In addition to the coastal area, a number of concentrations of settlement occur on the ridges overlooking both Malafede and the Rio Galeria. A number of settlements, and a possible concentrated settlement are located at Castel di Perna along the Malafede, with settlements on the opposite side of the valley at Castel di Decima. A number of settlements are located at higher altitude to the south-east of Castel di Decima, and to the north of the main nucleus of activity alongthe Rio Galeria. The landscape to the south of the Tiber is dominated by the sites of Ficana, Castel di Decima, Castel di Perna and Ficana for the Bronze Age and Final Bronze Age, located along the ridge overlooking the Ostia coastal plain and along the Malafede.

The environmental record for the Tiber delta for this period indicates the development of an Alder Carr, and the dominant alder, ash and other riparian species around the Maccarese lagoon, with extensive forests. The conditions of the Ostia lagoon indicate sedge fenland around a freshwater lagoon, with oak dominated mixed woodland (Chapter 6). The cereal pollen and evidence of charcoal on the Maccarese Plain is not evident in the Bronze Age. The Chi-squared test on distribution of settlement across all types of land use resulted in association with equal distribution across the land use types, and the location of material suggests a broader range across land use and elevation for the study area. In spite of the distribution of settlements, the environmental evidence for Bronze Age use of the wetland is weak (Di Rita *et al*. 2009), and certainly not as evident in the record as for the Eneolithic and Etruscan periods. The range of settlements for the study area does, however, suggest a Bronze Age presence on the floodplain and delta, perhaps as part of a more transhumant pattern of subsistence and pastoral economy. Sites are located on the wetland, close to the margin with the agricultural land and mixed woodland of the hillslopes to the north and east (Figs 10.3 and 10.4), with sites located on the higher ridges surrounding the concentration of settlement along the valley edges.

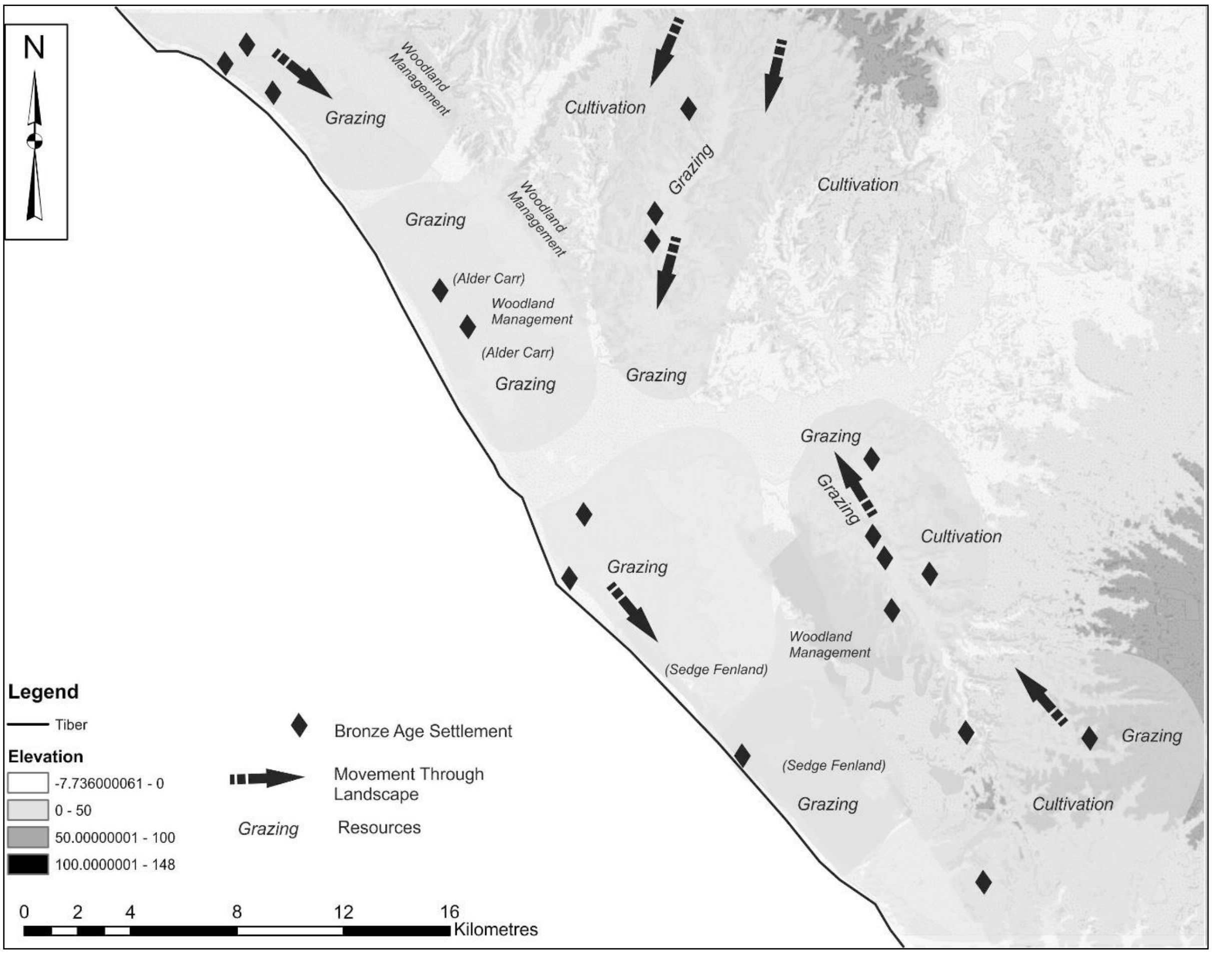

Figure 10.3 Schematic plan of the pattern of settlement and areas of resource use for the Bronze Age

Of interest for this period is the presence of some Final Bronze Age settlements that seem to be occupied in the FBA to Iron Age transition. A number of these are associated with sites that become key nucleated settlements in the Iron Age, at Lavinium, Castel di Decima and Monte Roncione among others. However, there seems also to be settlement associated with the Tiber delta, including deposits at the mouth of the Tiber close to the Ostia lagoon. This may indicate location of settlements and the crystallising of sites that were to become the basis for the Iron Age city states (Barker 1995, 157) in South Etruria and elsewhere in central Italy.

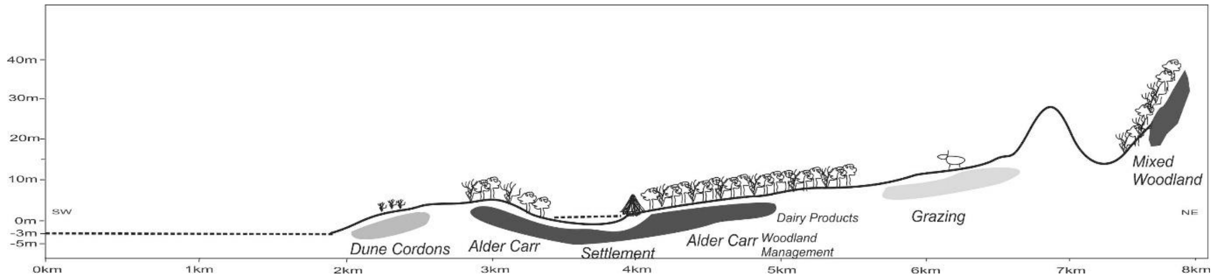

Figure 10.4 Schematic section through the Maccarese Plain showing the settlement and land use for the Bronze Age

10.2.3 The Protohistoric Period

The limitations of the number of sites visible for the preceding periods presented less of an issue for the Iron Age, Archaic and Etruscan material. The extensive pattern of settlement indicates a range of location by elevation, with a larger proportion of settlements located within the higher elevation ranges, suggestive of a proportion of sites located at high altitudes, possibly associated with more elevated and defensible positions. A preference for south and south-east facing aspect seems to be present, with the results of the Chi-squared test against land use classification giving (as with the other prehistoric periods) an association with even distribution across types.

The environmental evidence for the Tiber delta indicates a destabilitsation of the area (De Rita et al. 2009) with the Maccarese lagoon becoming more saline and the first evidence of saltworking on the plain from c. 600BC (Giraudi 2012). The Ostia lagoon instead shrinks in size, with a discharge from the Tiber then occurring into the lagoon, and an increase in oak woodland surrounding the lagoon (Bellotti et al. 2011, 1115). An intrusion of saltwater occurred by 600 BC into the lagoon. Overall the destabilising of the wetland environment is matched by limited evidence for settlement in the central and southern part of the delta (Fig. 10.5). However, the changes in the wetland were exploited, a factor represented in the archaeological record with a concentration of settlements on the northern fringes of the delta below Cerveteri and Torrimpietra (Fig. 10.6), and in the presence of settlement, hearths and canalization of sections of the area of wetland (De Castro et al. 2018).

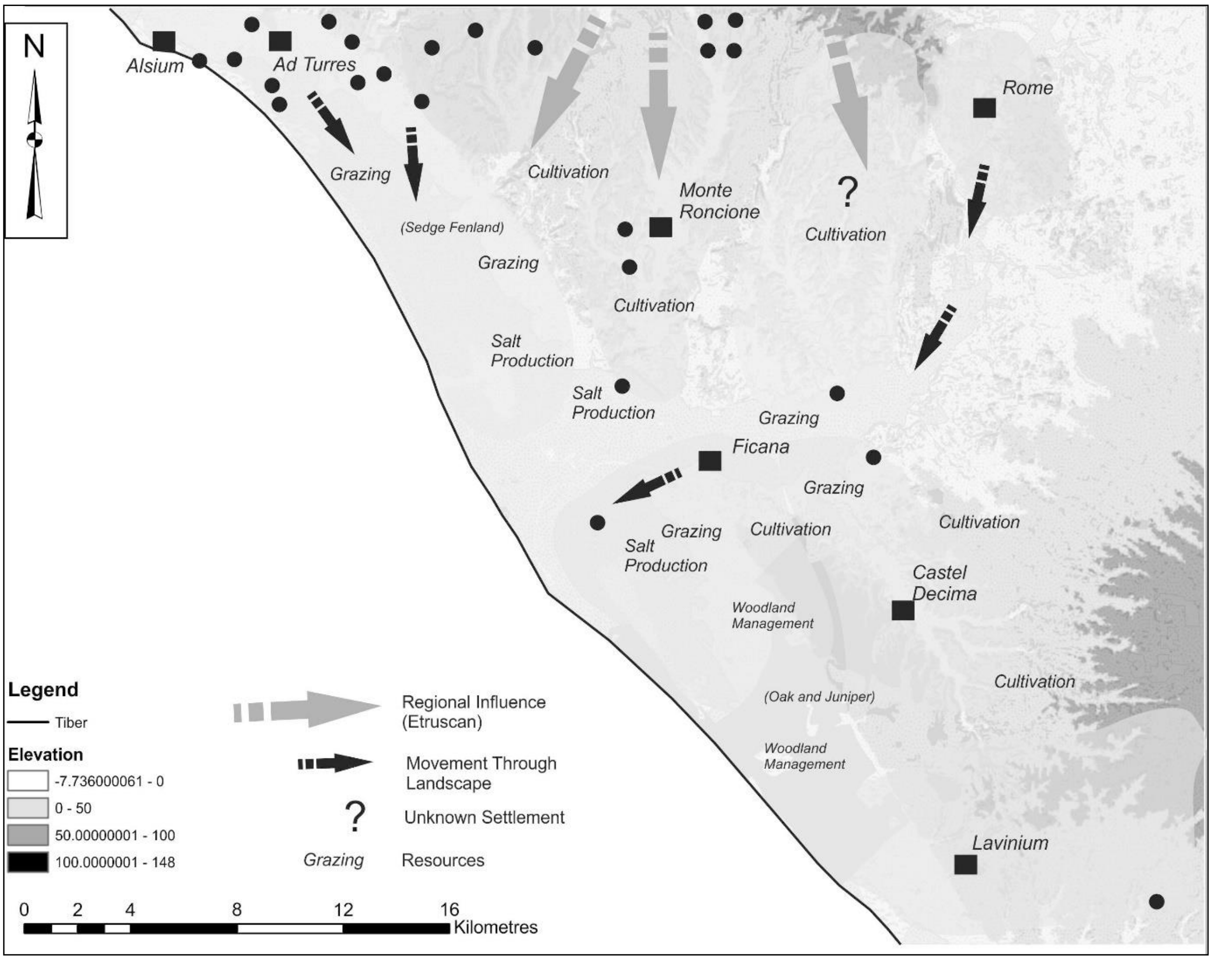

Figure 10.5 Schematic plan showing the Protohistoric pattern of settlement and resource use for the study area

Notwithstanding these habitations, the overarching framework of settlement in the dataset indicates concentration of populations at nucleated sites, at Ficana, Lavinuim, Castel di Decima and, outside of the area od selected sites, Rome. Beyond the study area these reflect the general pattern leading towards the creation of nucleated settlement at Veii, Cerveteri, Tarquinia and elsewhere in the Archaic period. These settlements also have in some cases established necropolis, and the presence of Etruscan roads is noted in some of the more intensive surveys conducted in the area (De Rossi *et al.* 1968).

The faunal remains for sites in this period indicate a balance of cattle, caprine and pig in terms of domestic animal remains, particularly at Ficana (3b-c), Fidene and Cereveteri

(Chapter 9). There is also evidence of exploitation of wild fauna, particularly for Ficana (Brandt 1996, 417; de Grossi Mazzorin 1989).

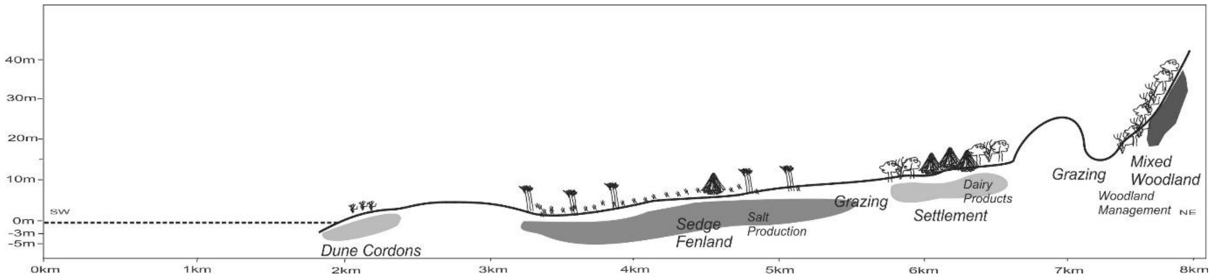

Figure 10.6 Schematic section through the Maccarese Plain showing settlement and land use

The overall pattern of settlement for this period, then, is for large nucleated settlement with necropolis, but with some satellite settlements and, towards the end of the Archaic period, proto-villa sites, with more ephemeral vestiges of settlement on the wetland zone predominantly associated with saltworking and some agriculture. The main settlements are invariably focused on the prime agricultural sediments above the floodplain cultivation and pastoral farming extending along the ridges of the hillsides around the principal tributaries of the Tiber. The overall picture for this period is of a concentration of settlement around these principal settlements, a pattern associated with more structured and elite societies in central Italy (Barker 1995, 176). The difficult dynamics to map for this period consist of the major city states in Etruria and the development of Rome as a major settlement during the Archaic period. As mentioned in Chapter 1 these are major players in the Archaic period, positioned at the edges of the study area, but all relatively close to the Tiber delta and the resources of the saline lagoons and floodplain present by 600BC. The settlements located in the study area along the northern fringes of the Maccarese Plain in part reflect the depth of information held in De Rossi *et al.* (1968) relating to the archaeology along the Via Aurelia. However, this is also a symptom of increased influence from the Etruscan cities to the north in exploiting the Tiber delta, evident in the forms of ceramic located on the sits of the *Campus Romanum Salinarum* (Acconcia *et al.* 2018; De Castro *et al.* 2018).

10.2.4 The Roman Period to AD 300

The primary change to the delta landscape from c. 400BC is the change in the nature of the central delta. Prior to 650BC and the period in which the Tiber fed into the Ostia lagoon, the central portion of the area lacked the stability needed for large scale settlement. While evidence persists of settlement in the area (Conti 1982) from the start of the Iron Age, possibly associated with the relict Tiber mouth and lagoon, the sand deposits of the Roman river delta took time to form a cusp and the stability needed for extensive settlement (Bellotti *et al.* 2011, 1115). The visibility of archaeology in this central zone is affected by the prograding nature of the delta, and the depth of alluvial deposits originally forming the Tiber bayhead, and then extending across the central part of the Tiber delta. Settlement of this area was only possible from c. 450BC and corresponds to the period of extending influence from Rome out towards the delta and the river and saline resources located there.

The extensive analysis indicates a pattern of settlement for the Roman period overall that shows both villas and rural settlements located in close proximity (Fig. 10.7). The range of elevations is broadly the same, although more rural settlements are located on the lowest elevation range than villa sites, a point that also corresponds to low numbers of villas on the wetland land use classification and and on recent and ancient alluvium. Re balanced in terms of the aspect of slope that they prefer, and this may represent an artefact of their overall location as sites on ridges and spurs in the landscape. Villa sites seem to prefer locations which overlook topography of varying aspect and, with the exception of the maritime villas to the south of Ostia and to the north around Palo, preference for these forms of aspect seems representative in the analysis of settlement aspect for villa sites. For Roman rural settlement there is an indication of a prevalence of location on aspect of slope facing west, south-west and south which seems to represent a pattern of settlement on the lower slopes surrounding villa sites, and generally on west and south facing slopes. Where represented a large number of rural settlements are located on the wetland area of the Tiber delta when compared to the number villa sites, marking perhaps a simple division in the hierarchy of settlement between either temporary or low status habitation, and more substantial settlements built both for agricultural purposes and as higher status residences.

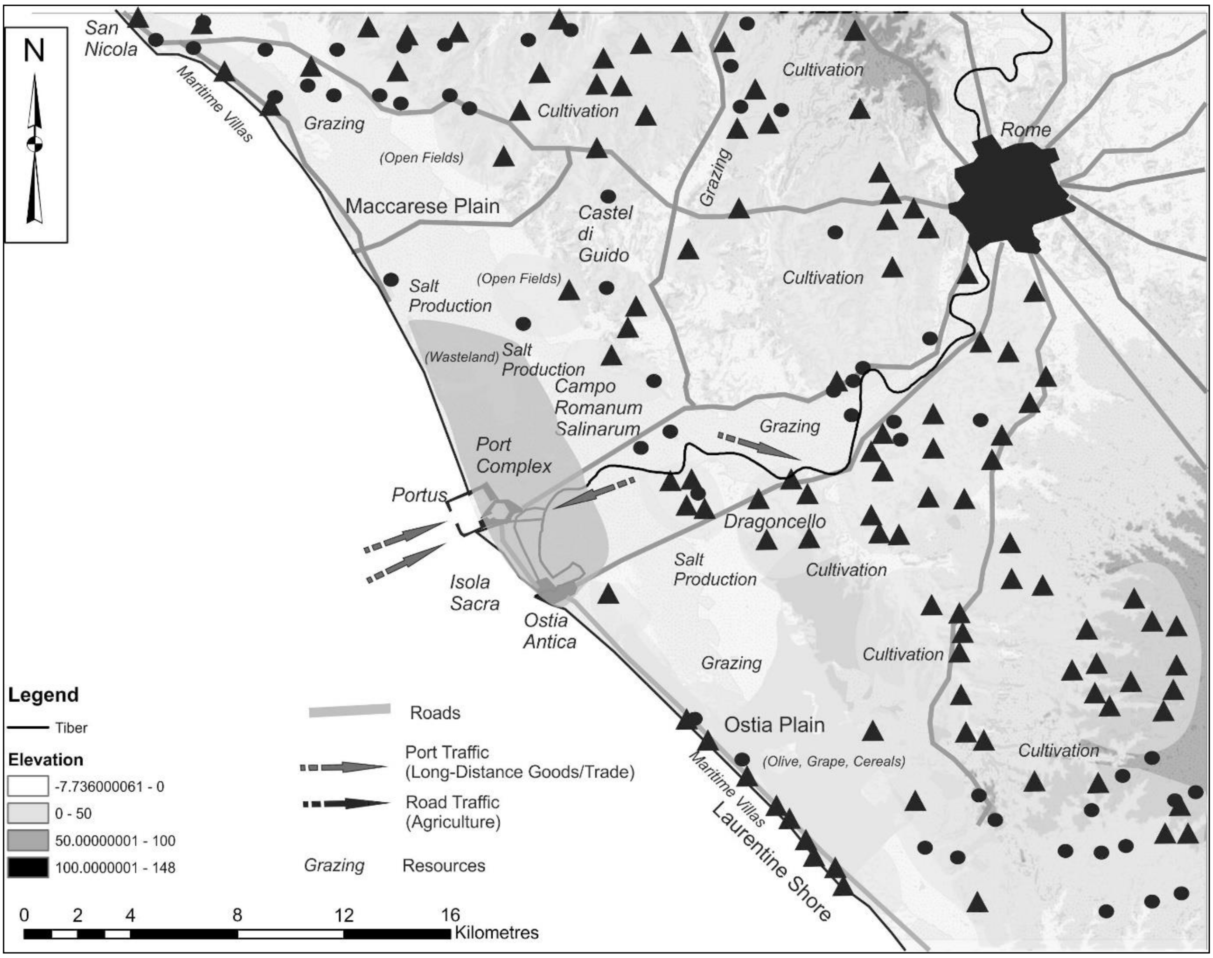

Figure 10.7 Schematic plan for settlement in the Roman Imperial period for the study area

Where finer-grained temporal data is available the datasets indicate few established villas and rural settlements in the area of the Tiber delta before 3rd century BC. From this point a steady increase in villa and rural settlements in the study area can be noted (Chapter 9). However, it is from the 1st century AD that the number of sites increases most rapidly, an increase also noticeable from results of other surveys in the vicinity of Rome.

The environmental evidence for this period is represented principally by the changes on the Maccarese and Ostia plains, with increased salinity on both and evidence of saltworking from 5th century BC, and increased evidence of cultivated cereals and fruiting species in the area around and to the south of Ostia. The overarching influence from c. 400BC is that is Rome, and the expansion of settlement into the delta area, the establishing of the *castrum* at Ostia, attested through the archaeological evidence (Martin 1996) and evidence for structures and early phases of roads to the north of the Tiber including the Via Campana (Serlorenzi et al. 2004, 61) dated to the second half of the 3rd century BC. From 3rd century BC onwards an increase in settlements including villas is visible for the study area (Fig. 10.8).

The ultimate pattern of settlement therefore is representative of an agricultural and portual landscape for the study area dominated by the city of Rome. Roman villas are rural, and located off the floodplain and delta, or maritime villas along the coast from Ostia. A number of villas seem to be located off the floodplain but in close proximity to the fluvial and wetland environments, representing areas of industry in the form of saltworks, or access to routes oof communication, such as the villas at Dragoncello located close to a small area of floodplain, and with the Via Ostiense to the south. Dispersed Roman rural settlements are still visible on the wetland zone, in the northern part of the Maccarese Plain, alongside the Maccarese lagoon, and in the extensive roads, buildings and drainage features associated with the saltworking on the *Campus Romanum Salinarum* (Morelli et al. 2011, 281).

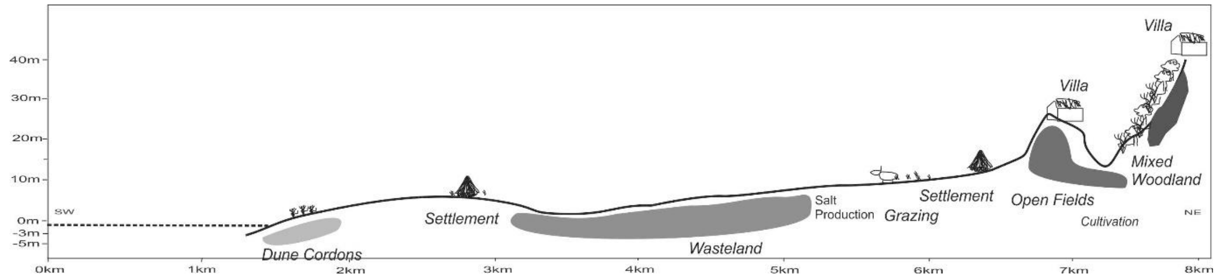

Figure 10.8 Schematic section through the Maccarese Plain for the Roman period, indicating settlement and land use

The stability of the area around the Tiber mouth, and the establishing of the Roman port at Portus marks the point at which this area of the delta was developed. Survey results and the air photographic record indicate the extensive port structures, the canal system associated with the port and connecting the harbour basin with the Tiber at Ostia, and the road and necropolis associated with the port and the major settlement at Ostia. These datasets also indicate an extensive hinterland behind this frontage, with a series of parallel canals potentially associated with land improvement and allocation of land for cultivation, either for cereals or more probably animal husbandry and horticulture. These features in the geophysics cover most of the northern part of the Isola Sacra.

The archaeological deposits in this area all relate to the settlement of the landscape from 1st century AD onwards (Germoni *et al.* 2011), with no evidence preceding this date either due to its complete absence or the lack of visible remains due to the depth of deposits. The non-intrusive archaeological evidence for the area shows Ostia to be a port town far larger than once thought. In addition to this there seems to be evidence for potential land improvement in the area of the newly formed delta cusp associated with the major settlement and port.

The faunal evidence for this period indicates reliance on pig and small proportions of cattle or caprines in assemblages. The *castrum* of Ostia indicates a majority of pig bone in the assemblages, in 3rd century BC, and this increases in the first centuries AD. This seems in keeping with the increased quantities of domestic pig in faunal assemblages, including Rome for the period, and suggests provision of economic sources of meat for essentially urban populations. The environmental evidence does, however, suggest increased cultivation, certainly for the area around Ostia.

10.3 The Methodological Approach: the spatial dataset and integrating data

One of the two primary aims of this research was to develop an integrated methodology to model and analyse an area of landscape. The methodology laid out in Chapter 5, and developed through Chapters 6 and 7, provides one approach to the analysis of the archaeological record, to draw out trends in the pattern of settlement and potential systems of land use for the area. It strives to combine both geomorphological and archaeological data, and to reconcile extensive datasets and their analysis with more detailed excavation and survey material. As a result of applying these methods it is apparent that the complexity of the study area and, in particular the delta environment of the Tiber, does not easily lend itself to an extensive archaeological approach. A complex array of geomorphological dynamics are at play in this area, from the prograding nature of the delta and the changing mouth and discharge of the Tiber, to the depths of alluvium and the varying conditions of the delta itself. The conditions and resulting visibility of the archaeology, from extensive site locations to the presence of anomalies or features in air photographic records and geophysical survey data, is variable across the floodplain and delta.

The issue with the extensive dataset of sites (Chapter 7) was the variable nature of the record across different surveys and resources. Once the site database had been reclassified, there was still significant variation in the level of detail and the number of sites recorded across the entire study area. In part the presence of sites was affected by the visibility in the wetland area, particularly along the lower Tiber floodplain and the central delta. In other areas concentrations of sites appeared, particularly along the northern edge of the study area where the Formae Italiae surveys (De Rossi *et al.* 1968; Tartara *et al.* 1999) produced an abundance of records. The dataset was still essential in formulating an analysis of the overall pattern of settlement, and its potential relationship to different forms of land use, drainage and other aspects of the topography. It also provided an extensive counterpoint to the more detailed records for excavation and survey in the study area. The relationship between the pattern of villas and rural settlements for the Roman period provided a useful context for areas of the study, for instance in the form of the villas overlooking the *Campus Romanum Salinarum*.

The integration of detailed survey results in the central portion of the delta, mainly derived from geophysical surveys undertaken from 1998 to 2012, provided some of the most high resolution data for the study area particularly from the wetland zone. The exceptional resolution of this data was, however, tempered by the nature of the central delta, revealing a part of the landscape dating effectively from the 1st century AD onwards. The intrinsic value of the data and the interpretation, compared with the air photography and satellite imagery, did, however, assist in defining the features and sub-divisions in this area for the Imperial period. The main limitations of the use of this data were the spatial constraints for the area, and the varying depth of deposits which mask the deeper later prehistoric or Protohistoric remains such as there are. The methodology presented here ultimately underscores the supposedly stable (in terms of sea level rise) but essentially unstable (in terms of increased salinity and river discharge) environment of the central delta, and the lack of visibility of prehistoric remains of any quantifiable extent or resolution. This method provided the best fit for a variable landscape, to map the pattern of settlement and its relationship to the changing environment of the wetland.

10.4 The Contribution of the Research

Returning to the statement in Chapter 1, the results of the research and the model and analysis presented above show that a demonstrable contribution has been made to the study of the archaeology of the lower Tiber valley. The model of the landscape, and the analysis of the pattern of settlement and land use of the area presented above, provides a heuristic way of viewing the landscape. The results raise a number of key factors and issues in the changing dynamic of the land use and human ecology of the area.

This has been achieved by integrating a number of different datasets, including extensive site data, topography, LiDAR data, and coverages for geology, land use and other topographic data. In addition, geophysical survey, air photographic data and published evidence for excavations and boreholes in the area of the Tiber delta have been used. These datasets, combined into a GIS, have facilitated the modelling and investigation of this area of landscape, to provide an overall picture of human settlement in the landscape of the Tiber valley that has not been attempted before across the entire area.

In addition, the study presents an integrated strategy for modelling and assessing the landscape, detailing the contribution of different techniques and methods to the research, and the areas where successful application of the integrated strategy is demonstrable, and where elements of the methodology were less relevant or applicable.

Finally, it must be remembered that the nature of this study is broad and overarching by its very nature. Thus, a number of themes and issues are raised that could provide the basis for future analysis, in terms of deepening our knowledge of the pattern of settlement relating to the archaeological record, the application of field survey methods, of analysis and modelling through use of GIS and other computer processes. Section 10.5 outlines some avenues and future directions.

10.5 Future Directions

The broad nature of this research means that a number of areas for further investigation became apparent during the stages of analysis and in completion of the final thesis. These fall broadly into three categories; deepening of research into specific aspects of settlement patterns for individual periods, applied archaeology through excavation, survey and remote sensing in the field, and further extensive analysis and modelling through GIS and other computer-based processes.

For the period-specific record, a variety of areas present themselves for deepening research. For the Final Neolithic and Eneolithic settlement pattern the visibility of sites in the archaeological record is a perennial issue, and there is a need to increase the material evidence for the location and layout of settlement along the edge of the Tiber delta for this period. The sites located through the ground-breaking work of Bietti Sestieri (1984) and the excavations at Cerquete-Fianello (Manfredini 2002) provide a tantalising record of what may be a far more extensive body of evidence. Thus, future fieldwork in the areas of greatest potential, along the boundary of the wetland ecotone on the lower terraces of the Maccarese Plain and on the ridges and spurs overlooking the delta and the Rio Galeria would be beneficial. Such work could also be augmented by use of geophysical survey at Cerquete-Fianello, expanding outwards over the area surrounding the sites. Magnetometry would provide the most beneficial technique, able to map pits, hearths, gullies and other features. However, the variable nature of the deposits across the area need to be considered, together with the limitations of the technique in terms of depth of prospecting. Such a methodology could be extended to areas surrounding the Maccarese lagoon, and the search for evidence of other settlements, potentially associated with satellite camps associated with the permanent settlement at Cerquete-Fianello.

For the Bronze Age and Protohistoric pattern of settlement and subsistence, further investigation of the key transition phases between the established periods would be integral to further establishing the changes in settlement. In particular further integration of data from newly-discovered sites (De Castro *et al.* 2018) is key to developing these ideas. The transition from the Final Bronze Age to the Iron Age, and the use of the Tiber floodplain in this period is certainly a theme that could be developed further, linked to the nucleation of settlement on elevated terrain and the evidence for hunting and other forms of subsistence at these sites, and for evidence of saltworking and other forms of industry and temporary settlement on the floodplain. Further investigation along the edge of the wetland in the area of Ficana and on the Maccarese Plain could play a part in this, especially through use of geophysical survey.

The extent and nature of the archaeological record for the Republican and Imperial periods for the Tiber floodplain and delta provides a further period-based area for future analysis. At an extensive level the limitations of the phasing for many of the recorded sites in the study area provided issues in terms of comparing the extent and expansion of villa sites and other forms of settlement from the Republican to the Imperial period. Further research into the detail of the sites used in this study would be of benefit in terms of creating greater nuance in studying the agricultural landscape of the lower Tiber, in line with such surveys for the Upper and Middle Tiber (Patterson et al. 2000; Witcher 2008).

While the expansion of Roman settlement in the lower Tiber area is evident from this study, the social and political forces behind the establishing of sites and the building of farms, roads and other infrastructure in the delta could provide a further theme. Many of the changes witnessed in the extensive and intensive datasets here seem to relate to the development of the portscape in the central Tiber delta. This would be an exciting theme to develop further through archaeological and documentary research, and in fact forms part of the ongoing research of the Portuslimen Project. However, relating the development of the portscape to the fortunes and adaptations of the surrounding agricultural landscape, outside of the immediate sphere of the trade networks of the port, would be key in our understanding of the local dynamic. This would require more detailed scrutiny of the archived evidence for Roman settlement in the immediate area of the delta.

The modelling of the landscape, conducted principally through the use of GIS, served to elucidate on many of the preferred conditions and relationships to different forms of land use, drainage and other key factors in subsistence. While a number of the methods used gave useful outputs in terms of the pattern of settlement, a number of other processes were either limited, failed or were not conducted for this study. Thus, further investigation of the spatial distribution and dynamics of the settlement would be a particularly useful area for future research. At one level further efforts to reproduce a pre-modern model of the topographic landscape would provide the basis for comparative statistical analysis for topographic location, slope and aspect analysis. In addition, furthering the modelling process to incorporate a model of the ancient ground surfaces for the broad periods would give the model greater nuance, and could be achieved using the pre-modern raster model and subtracting rasters based on TINs of the elevation differences. The methodology exists for this approach, although attempts to do this across the area of the delta failed for this study. The resulting model could, however, be used to rerun the analysis presented in this study, and to assess any potential deviation in the range and distribution of resulting factors from the analysis – a compare and contrast of the modern and pre-modern topographic landscape.

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Appendix 1: Gazetteer of Sites for the Study Area

This appendix presents a list of the sites from the study area. While the study area as a whole included 2266 sites, which were reduced down to 1457 sites through validation and reclassification (see Chapter 7), case areas 1 and 2 contained 141 and 207 sites respectively in the database (see Chapter 8, Table 8.28). The 1457 sites are listed below with their coordinates in WGS 84 UTM36 N and with associated information.

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
3	258381	4647548	Villa	False	False	False	No	True	Carta Bibliografica, 128; de Rossi et al. 1968, 52-53.
4	258445	4647346	Findspot	False	False	False	No	False	Carta Bibliografica, 128
5	258822	4646845	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 128
6	258976	4646726	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 128
7	259029	4646716	Rural Settlement	False	False	False	No	False	Carta Bibliografica, 128; Mengarelli 1938, Fig. 1
8	259064	4646706	Drainage Feature	False	False	False	No	False	Carta Bibliografica, 128
9	259184	4646624	Findspot	False	False	False	No	False	Carta Bibliografica, 128
10	259388	4646521	Tomb	False	False	False	No	True	Carta Bibliografica, 128; Arch VG 1926, s.n. prot. /Palo
12	259683	4647736	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 129

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
13	259919	4647793	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 129
14	260452	4647639	Findspot	False	False	False	No	False	Carta Bibliografica, 129; Arch GAR sd Ladispoli.
15	260657	4647852	Villa	False	False	False	No	True	Carta Bibliografica, 129
17	260871	4647922	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 129
18	260318	4647503	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 129
19	260160	4647365	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 129
20	260214	4646715	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 129
21	260119	4646698	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 129
22	260135	4646553	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 129
23	260292	4646404	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 129
24	260076	4646391	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 129
26	260458	4646264	Port	False	False	False	Yes	True	A. Naz. F. 149, RAF 22.10.43, s. 972, n. 153760;
27	260491	4646242	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 129
28	260640	4646171	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 129

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
29	260775	4646629	Road	False	False	False	No	True	Arch VG Cerveteri IX, 13.7.1913; Carta Bibliografica, 129
30	260746	4646907	Villa	False	False	False	No	True	Carta Bibliografica, 129
31	260858	4647059	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 129
32	261023	4646932	Road	False	False	False	Yes	True	Carta Bibliografica, 129
33	261134	4646856	Road	False	False	False	Yes	True	Carta Bibliografica, 129
34	261183	4647857	Tomb	False	False	False	No	True	Carta Bibliografica, 129
36	261183	4647947	Tomb	False	False	False	Yes	False	Carta Bibliografica, 129
37	261280	4647775	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 129
38	261378	4647740	Tomb	False	False	False	Yes	False	Carta Bibliografica, 129
39	261357	4647911	Tomb	False	False	False	Yes	False	Carta Bibliografica, 129; Arch GAR 1971, Cerveteri
40	261537	4647952	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 129
43	261645	4647841	Tomb	False	False	False	Yes	False	Carta Bibliografica, 129; de Rossi et al. 1968, 35.
44	261663	4647680	Flint Scatter	False	False	False	No	False	Carta Bibliografica, 129

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
45	261786	4647577	Tomb	False	False	False	Yes	False	Carta Bibliografica, 129; Abeken 1839, pp81-83; Canina 1846, Table XL.
46	261811	4647533	Tomb	False	False	False	Yes	False	Carta Bibliografica, 129; Abeken 1839, pp81-83; Canina 1846, Table XL., fig. 7-9.
47	261556	4647474	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 129
48	261579	4647322	Drainage Feature	False	False	False	Yes	False	Carta Bibliografica, 129
50	261744	4647097	Findspot	False	False	False	No	False	Carta Bibliografica, 129
51	261727	4647142	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 129
52	261771	4647016	Road	False	False	False	No	True	Carta Bibliografica, 129
53	261974	4647006	Tomb	False	False	False	Yes	False	Carta Bibliografica, 130; de Rossi et al. 1968, 34,35
55	261757	4646929	Road	False	False	False	No	True	Carta Bibliografica, 130
56	261777	4646668	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 130

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
57	261958	4646713	Tomb	False	False	False	Yes	False	Carta Bibliografica, 130
58	262027	4646745	Drainage Feature	False	False	False	Yes	False	Carta Bibliografica, 130
59	262304	4646791	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 130
60	262679	4646558	Findspot	False	False	False	No	True	Carta Bibliografica, 130
61	261086	4645955	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 130
62	261160	4645908	Tomb	False	False	False	No	True	Carta Bibliografica, 130
63	261193	4645891	Port	False	False	False	Yes	False	Carta Bibliografica, 130; Mengarelli 1938, fig. 1; De Rossi et al. 1968, p48, fig. 114
64	261634	4646614	Cave	False	False	False	No	False	Carta Bibliografica, 130; Nardi 1972, 57
65	262587	4646365	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 130
66	262440	4646334	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 130
67	262380	4646143	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 130
68	262185	4646102	Findspot	False	False	False	No	False	Carta Bibliografica, 130
69	262211	4646199	Tomb	False	False	True	Yes	True	Carta Bibliografica, 130

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
70	262013	4646057	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 130
71	261884	4645909	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 130
72	262006	4645796	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 130
73	262230	4645769	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 130
74	261770	4645525	Port	False	False	False	No	True	Carta Bibliografica, 130; A. Naz. F. 149, IGM, Ril VB, 1954/55 S. 25 n. 13370
76	261784	4645445	Port	False	False	False	No	True	Carta Bibliografica, 130; Arch. VG. 1972, n. 1161/3 San Nicola
77	261973	4645276	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 130; Arch GAR 1981, Cerveteri
78	262251	4645263	Port	False	False	False	No	False	Carta Bibliografica, 130; A. Naz F. 149, RAF 12/5/44, S. 262 n. 86816
79	262560	4645558	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 130
80	261607	4646566	Tomb	False	False	False	Yes	False	Arch VG. 1968, n.

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
									2145/3 Palo
81	259661	4646442	Nucleated Site	False	False	False	Yes	True	Tomassetti 1913, 511; De Rossi et al. 1968, 113-119; Enei 1993, 44-45
82	262759	4646689	Rural Settlement	False	False	True	No	False	Carta Bibliografica, 130
83	262921	4647948	Rural Settlement	False	False	False	No	True	Arch VG Cerveteri IX, 18.12.1913.
84	263116	4647837	Road	False	False	False	No	True	Carta Bibliografica, 130
85	263453	4647939	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 130
86	263827	4647860	Findspot	False	False	False	No	True	Mengarelli 1931, 421, 422; Cristofani, Nardi, Rizzo 1988, 73, n. 100.
87	263934	4647890	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 130
88	264097	4647733	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 131
89	263317	4647520	Road	False	False	False	No	True	Arch VG Cerveteri IX 18.12.1913
90	263132	4647651	Road	False	False	False	No	True	Brunetti Nardi 1981, 141
91	263213	4647432	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 131
92	263115	4647312	Tomb	False	False	False	Yes	False	Carta Bibliografic

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
									a, 131; Arch VG 1990, n. 6089/2 Ladispoli
93	262984	4646968	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 131
94	263984	4646959	Villa	False	False	False	No	True	Carta Bibliografica, 131
95	264125	4647130	Flint Scatter	False	False	False	No	False	Carta Bibliografica, 131
96	263540	4647244	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 131
97	264429	4647739	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 131
98	264530	4647776	Findspot	False	False	False	No	True	Carta Bibliografica, 131
99	264822	4647923	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 131
100	264971	4647885	Villa	False	False	False	No	True	Carta Bibliografica, 131
103	264725	4647834	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 131
104	264904	4647580	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 131
105	264734	4647542	Rural Settlement	False	False	False	No	True	Mengarelli 1938, Fig. 1; Carta Bibliografica, 131
106	264914	4647125	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 131
107	264641	4647055	Tomb	False	False	False	Yes	False	Carta Bibliografica, 131

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
108	264548	4647160	Drainage Feature	False	False	False	No	True	Carta Bibliografica, 131
109	264850	4646458	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 131
110	264928	4646261	Road	False	False	False	No	True	Carta Bibliografica, 131
111	264870	4646007	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 131
112	264988	4645951	Tomb	False	False	False	No	True	Carta Bibliografica, 131
113	264419	4646318	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 131
114	264355	4646452	Tomb	False	False	False	No	True	Carta Bibliografica, 131
115	264257	4646480	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 131
116	264020	4646352	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 131
117	263669	4646253	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 131
118	264142	4646666	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 131
119	263938	4646736	Tomb	False	False	False	Yes	False	Carta Bibliografica, 131
120	263882	4646654	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 131; Arch GAR s. d. Cerveteri
121	263980	4646548	Mansio	False	False	False	No	True	Carta Bibliografica, 131; De Rossi et al. 1968, 32-33;

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
									Cosentino 1990, 297-304; Enei 1991, 95-108.
123	263316	4646486	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 131
124	263433	4646454	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 131
125	263689	4646442	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 132
126	263457	4646334	Road	False	False	False	No	True	Carta Bibliografica, 132
127	263409	4646318	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 132
128	263369	4646364	Road	False	False	False	No	True	Carta Bibliografica, 131
129	263415	4646356	Road	False	False	False	No	True	Carta Bibliografica, 131
130	262912	4646402	Road	False	False	False	No	True	Carta Bibliografica, 132
131	262777	4646462	Rural Settlement	False	False	False	Yes	True	Enei 1993, 36, table 57; Carta Bibliografica, 132
132	264015	4645919	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 132
133	264990	4645698	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 132
134	264661	4645652	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 132
135	264920	4645474	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 132

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
136	264769	4645508	Rural Settlement	False	False	False	No	False	Carta Bibliografica, 132
137	264741	4645141	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 132
138	263375	4645677	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 132
139	263024	4644830	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 132
140	263471	4644563	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 132
141	263430	4645204	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 132
142	263624	4645019	Rural Settlement	False	False	True	Yes	False	Carta Bibliografica, 132
143	263941	4644539	Rural Settlement	False	False	True	Yes	False	Carta Bibliografica, 132
145	264772	4647975	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 132
146	263583	4647707	Villa	False	False	False	No	True	Carta Bibliografica, 132
147	264636	4647148	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 132
148	264434	4647599	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 132; Arch GAR 1970 Cerveteri
149	261922	4647399	Tomb	False	False	False	Yes	False	Carta Bibliografica, 132; Arch GAR 1970 Cerveteri
150	266975	4638806	Nucleated Site	False	False	False	No	True	Carta Bibliografica, 136; de

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
									Rossi et al. 1968, 42-43
151	267864	4637688	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 136; de Rossi et al. 1968, 43
152	269216	4639960	Road	False	False	False	No	True	Carta Bibliografica, 136; de Rossi et al. 1968, 42
153	266803	4639660	Road	False	False	False	No	True	Carta Bibliografica, 136; de Rossi et al. 1968, 43
154	266702	4638827	Rural Settlement	False	False	False	No	False	Carta Dell'Agro f. 20, 6; Carta Bibliografica, 136
155	268699	4639718	Rural Settlement	False	False	False	No	False	Carta Dell'Agro f. 12, 194; Carta Bibliografica, 136
156	268022	4637350	Rural Settlement	False	False	False	No	False	Carta Dell'Agro f. 21; Carta Bibliografica, 136
157	267642	4644539	Mansio	False	False	False	No	True	Carta Bibliografica, 132; de Rossi et al. 1968, 26; CIL XI, 3750; CIL XI, 3759
158	266069	4645814	Road	False	False	False	No	True	Carta Bibliografica, 132; de Rossi et al. 1968, 26

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
159	270039	4645864	Rural Settlement	False	False	False	No	False	Carta Bibliografica, 132
160	270130	4645792	Findspot	False	False	False	No	True	Carta Bibliografica, 132; Tartara 1999, n. 417
161	270257	4645856	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 132; Tartara 1999, n. 418
162	270010	4647727	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 132; Tartara 1999, n. 240
163	270303	4647626	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 132; Tartara 1999, n. 248
164	270052	4647401	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 132; Tartara 1999, n. 250
165	269785	4647381	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 132; Tartara 1999, n. 251
166	269215	4646461	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 132; Tartara 1999, n. 255
167	268968	4646970	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 132;

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
									Tartara 1999, n. 256
168	269372	4646916	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 132; Tartara 1999, n. 253
169	268068	4647113	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 132; Tartara 1999, n. 261
170	268546	4647418	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 132; Tartara 1999, n. 258
171	269784	4646234	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 132; Tartara 1999, n. 285
172	269665	4646103	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 132; Tartara 1999, n. 281
173	270588	4647516	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 296
174	270340	4646768	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 289
175	269202	4645544	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 133;

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
									Tartara 1999, n. 270
176	268813	4645358	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 271
177	268439	4644506	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 274
178	269532	4647104	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 252
179	269325	4646740	Findspot	False	False	False	No	False	Carta Bibliografica, 133; Tartara 1999, n. 254
180	268565	4646225	Findspot	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 265
181	269158	4644771	Rural Settlement	False	False	False	No	False	Carta Bibliografica, 133; Tartara 1999, n. 277
182	269055	4646226	Findspot	False	False	False	Yes	False	Carta Bibliografica, 133; Tartara 1999, n. 283
183	269186	4644668	Tomb	False	False	False	Yes	False	Carta Bibliografica, 133;

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
									Tartara 1999, n. 275
184	268343	4646781	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 262
185	268156	4646030	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 267
186	268365	4646370	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 264
187	268788	4646229	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 266
188	269010	4646117	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 282
189	268953	4645269	Rural Settlement	False	False	False	No	False	Carta Bibliografica, 133; Tartara 1999, n. 272
190	269371	4646156	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 133; Tartara 1999, n. 284
191	269580	4646702	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 133;

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
									Tartara 1999, n. 290
192	270930	4647168	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 133; Tartara 1999, n. 298
193	270068	4646252	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 133; Tartara 1999, n. 298
194	270379	4646661	Road	False	False	False	Yes	True	Carta Bibliografica, 133; Tartara 1999, n. 288
195	270283	4647487	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 133; Tartara 1999, n. 295
196	270690	4647784	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 303
197	271015	4647791	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 302
198	271518	4647595	Tomb	False	False	False	No	False	Carta Bibliografica, 133; Tartara 1999, n. 409
199	271350	4647482	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 133;

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
									Tartara 1999, n. 410
200	270342	4644886	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 411
201	271412	4647005	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 133; Tartara 1999, n. 412
202	269395	4644519	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 133; Tartara 1999, n. 423
203	271124	4646788	Road	False	False	False	Yes	True	Carta Bibliografica, 133; Tartara 1999, n. 413
204	269983	4644871	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 421
205	269899	4644388	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 425
206	269913	4644557	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 426
207	269680	4644753	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 133;

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
									Tartara 1999, n. 422
208	269629	4644338	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 133; Tartara 1999, n. 424
209	270387	4644537	Road	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 427
210	270418	4644470	Tomb	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 428
211	270480	4644562	Road	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 429
212	270651	4644596	Road	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 430
213	270735	4644554	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 431
214	270800	4644523	Mansio	False	False	False	No	True	Carta Bibliografica, 133; Tartara 1999, n. 432
215	270746	4644481	Road	False	False	False	No	True	Carta Bibliografica, 134;

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
									Tartara 1999, n. 433
216	270642	4644374	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 134; Tartara 1999, n. 434
217	270901	4644329	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 134; Tartara 1999, n. 435
218	266347	4645462	Road	False	False	False	No	True	Carta Bibliografica, 134; De Rossi et al. 1968, 32
219	269802	4645625	Road	False	False	False	No	True	Carta Bibliografica, 134; De Rossi et al. 1968, 26
220	269068	4643890	Road	False	False	False	No	True	Carta Bibliografica, 134; De Rossi et al. 1968, 26
221	271485	4644110	Road	False	False	False	No	True	Carta Bibliografica, 134; De Rossi et al. 1968, 26
222	265157	4647704	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 134
223	265487	4647471	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 134
224	265619	4647630	Tomb	False	False	False	Yes	False	Carta Bibliografica, 134; Arch VG Cerveteri XIII, 12.11.1910

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
225	265653	4647635	Rural Settlement	False	False	True	No	False	Carta Bibliografica, 134
226	265819	4647729	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 134
227	266335	4647901	Rural Settlement	False	False	True	No	False	Carta Bibliografica, 134
228	266358	4647694	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 134
229	266147	4647368	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 134
230	266589	4647543	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 134; Arch GAR s.d. Cerveteri
231	266673	4647569	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 134; Arch GAR s.d. Cerveteri
232	267758	4647629	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 134
233	266092	4647233	Tomb	False	False	False	Yes	False	Carta Bibliografica, 134; Arch GAR 1972 Cerveteri; Carta dell'Agro F11, n. 26
234	266177	4647151	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 134
235	266446	4647257	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 134
236	267252	4647241	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 134

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
237	267384	4647151	Villa	False	False	False	No	True	Carta Bibliografica, 134
238	267882	4647145	Drainage Feature	False	False	False	Yes	False	Carta Bibliografica, 134
239	267936	4647220	Rural Settlement	False	False	False	No	False	Carta Bibliografica, 134
240	268024	4647171	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 134
241	267887	4646936	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 134
242	265133	4646582	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 134; Arch GAR 1970 Cerveteri
243	265301	4646642	Drainage Feature	False	False	False	No	True	Carta Bibliografica, 134
244	265474	4646745	Drainage Feature	False	False	False	No	True	Carta Bibliografica, 134
245	265177	4646502	Villa	False	False	False	Yes	True	Carta Bibliografica, 134
246	266730	4646791	Rural Settlement	False	False	False	Yes	True	Carta Bibliografica, 134
247	266681	4646647	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 134
248	266580	4646448	Villa	False	False	False	No	True	Carta Bibliografica, 134
249	266820	4646564	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 134
250	266951	4646602	Rural Settlement	True	False	False	No	False	Carta Bibliografica, 134; Blanc 1955, 308-309; Peroni

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
									1965, 309-311; Bietti 1976, 149-384
251	266934	4646425	Rural Settlement	False	False	False	No	False	Carta Bibliografica, 134; Arch. GAR 1970 Cerveteri
252	267109	4646450	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 134; Arch. GAR 1970 Cerveteri
253	267192	4646435	Rural Settlement	False	False	True	Yes	True	Carta Bibliografica, 134; Arch. GAR 1970 Cerveteri
254	265879	4646149	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 134
255	266873	4645960	Findspot	False	False	False	No	False	Carta Bibliografica, 134
256	267355	4646122	Villa	False	False	False	Yes	True	Carta Bibliografica, 134
257	267187	4645881	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 135
258	267644	4645868	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 135
259	267897	4646014	Findspot	False	False	False	No	True	Carta Bibliografica, 135
260	265142	4645661	Rural Settlement	True	False	False	Yes	False	Carta Bibliografica, 135
261	265331	4645653	Tomb	False	False	False	Yes	False	Carta Bibliografica, 135; Arch GAR

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
									1973 Cerveteri
262	266015	4645797	Road	False	False	False	No	True	Carta Bibliografica, 135
263	266110	4645739	Road	False	False	False	No	True	Carta Bibliografica, 135; De Rossi et al. 1968, 26; AA.VV. 1986, 200
264	266382	4645608	Tomb	False	False	False	No	True	Carta Bibliografica, 135; Arch VG 1985, n. 6352/3 Palidoro
265	267959	4645302	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 135
266	266978	4645222	Rural Settlement	False	False	False	Yes	False	Carta Bibliografica, 135
267	267821	4644952	Rural Settlement	True	True	True	No	False	Carta Bibliografica, 135
268	265948	4645015	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 135
269	265578	4644542	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 135
270	267056	4644447	Rural Settlement	False	False	True	No	False	Carta Bibliografica, 135
271	267423	4644784	Rural Settlement	False	False	False	No	True	Carta Bibliografica, 135
272	272264	4643513	Road	False	False	False	No	True	De Rossi et al. 1968, 23
273	272885	4644350	Villa	False	False	False	No	True	Tartara 1999, No. 436

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
274	272485	4646376	Rural Settlement	False	False	False	No	True	Tartara 1999, No. 442
275	273150	4646238	Rural Settlement	False	False	False	Yes	False	Tartara 1999, No. 443
276	272981	4646449	Rural Settlement	False	False	False	No	True	Tartara 1999, No. 444
277	272750	4646605	Rural Settlement	False	False	False	No	True	Tartara 1999, No. 445
278	272985	4646681	Rural Settlement	False	False	False	No	True	Tartara 1999, No. 446
279	272895	4647193	Rural Settlement	False	False	False	Yes	True	Tartara 1999, No. 447
280	273788	4647567	Rural Settlement	False	False	False	No	False	Tartara 1999, No. 520
281	273689	4647074	Tomb	False	False	False	No	False	Tartara 1999, No. 521
283	273685	4646046	Rural Settlement	False	False	False	Yes	True	Tartara 1999, No. 523
284	273470	4645543	Rural Settlement	False	False	False	No	True	Tartara 1999, No. 524
285	273378	4645443	Rural Settlement	False	False	False	No	True	Tartara 1999, No. 525
286	273414	4644994	Rural Settlement	False	False	False	Yes	True	Tartara 1999, No. 526
287	274010	4645808	Rural Settlement	False	False	False	Yes	True	Tartara 1999, No. 527
288	274648	4646323	Rural Settlement	False	False	False	No	True	Tartara 1999, No. 528
289	274773	4646796	Rural Settlement	False	False	False	No	True	Tartara 1999, No. 529

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
290	274810	4647256	Rural Settlement	False	False	False	Yes	True	Tartara 1999, No. 530
291	274581	4647295	Tomb	False	False	False	No	False	Tartara 1999, No. 531
292	274869	4647422	Rural Settlement	False	False	False	No	True	Tartara 1999, No. 532
293	275081	4647203	Rural Settlement	False	False	False	No	True	Tartara 1999, No. 533
294	275494	4647087	Rural Settlement	False	False	False	No	True	Tartara 1999, No. 620
296	258133	4647632	Port	False	False	False	No	True	Mengarelli 1938, fig. 1
297	264828	4642396	Road	False	False	False	No	True	De Rossi et al. 1968, 43
298	271230	4632510	Rural Settlement	False	False	False	No	False	Carta dell'Agro, foglio 21
299	270582	4634699	Rural Settlement	False	False	False	No	False	Carta dell'Agro, foglio 21
300	270312	4632784	Rural Settlement	False	False	False	No	False	Carta dell'Agro, foglio 21
301	272163	4635738	Tomb	False	False	False	No	False	Carta dell'Agro, foglio 21, No. 45
302	272834	4636095	Rural Settlement	False	False	False	No	True	Carta dell'Agro, foglio 21, lettera
303	273307	4636159	Rural Settlement	False	False	False	No	False	Carta dell'Agro, foglio 21, No. 40
304	273742	4635351	Rural Settlement	False	False	False	No	False	Carta dell'Agro, foglio 21, No. 48
305	271092	4630833	Tomb	False	False	False	No	False	Carta dell'Agro,

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
									foglio 21, No. 82
306	272806	4629510	Port	False	False	False	No	True	Carta dell'Agro, foglio 21, No. 29
307	297240	4620500	Rural Settlement	False	False	False	No	True	De Rossi 1970, 97, 201
308	297067	4620522	Sanctuary	False	False	False	Yes	False	De Rossi 1970, 95-97, n.200
309	296806	4620327	Rural Settlement	False	False	False	No	True	De Rossi 1970, 98, N. 206
310	296636	4620375	Tomb	False	False	False	No	True	De Rossi 1970, 98, n. 207
311	296647	4620110	Drainage Feature	False	False	False	No	False	De Rossi 1970, 98, n. 208
312	296927	4620139	Villa	False	False	False	No	True	De Rossi 1970, 98, n. 209
313	296938	4619966	Rural Settlement	False	False	False	No	True	De Rossi 1970, 98, n. 210
314	297487	4620114	Villa	False	False	False	No	True	De Rossi 1970, 97-98, n. 202
315	297262	4619937	Rural Settlement	False	False	False	No	True	De Rossi 1970, 98, n. 203
316	297029	4619808	Rural Settlement	False	False	False	No	True	De Rossi 1970, 98, n. 204
317	296740	4619639	Rural Settlement	False	False	False	No	True	De Rossi 1970, 98, n. 205
318	296379	4619502	Rural Settlement	False	False	False	No	True	De Rossi 1970, 118, 309
319	296909	4619528	Rural Settlement	False	False	False	No	True	De Rossi 1970, 118, n. 310

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
320	297969	4619480	Rural Settlement	False	False	False	No	True	De Rossi 1970, 118, n. 312
321	298422	4619631	Rural Settlement	False	False	False	No	True	De Rossi 1970, 100, n. 215
322	296434	4619664	Road	False	False	False	No	False	De Rossi 1970, 118
323	295896	4619848	Road	False	False	False	No	False	De Rossi 1970, 118
324	295609	4619572	Road	False	False	False	No	False	De Rossi 1970, 7-11
325	295867	4619381	Road	False	False	False	No	False	De Rossi 1970, 119, n. 339-341
326	297693	4620382	Road	False	False	False	No	False	De Rossi 1970, 7-11
327	298485	4620268	Road	False	False	False	No	False	De Rossi 1970, 89
328	288304	4617607	Villa	False	False	False	No	True	De Rossi 1970, 141, 479
329	288746	4617947	Rural Settlement	False	False	False	No	True	De Rossi 1970, 141, 478
330	289766	4618246	Rural Settlement	False	False	False	No	True	De Rossi 1970, 141, n. 470
331	290130	4618297	Rural Settlement	False	False	False	No	True	De Rossi 1970, 141, 469
332	289288	4617901	Rural Settlement	False	False	False	No	True	De Rossi 1970, 141, 472
333	289311	4617639	Villa	False	False	False	No	True	De Rossi 1970, 141, n. 473
334	289307	4617363	Rural Settlement	False	False	False	No	True	De Rossi 1970, 143, n. 476
335	289049	4616991	Rural Settlement	False	False	False	No	True	De Rossi 1970, 141, 477
336	289504	4617276	Rural Settlement	False	False	False	No	True	De Rossi 1970, 141, 475

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
337	289743	4617359	Rural Settlement	False	False	False	No	True	De Rossi 1970, 141, 474
338	290258	4617543	Rural Settlement	False	False	False	No	True	De Rossi 1970, 141, n. 482
339	290456	4617750	Rural Settlement	False	False	False	No	True	De Rossi 1970, 141, 480
340	291155	4617612	Rural Settlement	False	False	False	No	True	De Rossi 1970, 142, 483
342	290667	4617354	Rural Settlement	False	False	False	No	True	De Rossi 1970, 141, n. 481
343	290019	4617060	Villa	False	False	False	No	True	De Rossi 1970, 142, n. 485
344	290290	4616761	Villa	False	False	False	No	True	De Rossi 1970, 142, n. 486
345	289610	4616646	Rural Settlement	False	False	False	No	True	De Rossi 1970, 142, n. 487
346	289720	4616393	Rural Settlement	False	False	False	No	True	De Rossi 1970, 142, 488
347	289376	4616343	Rural Settlement	False	False	False	No	True	De Rossi 1970, 143, 489
348	288884	4616251	Tomb	False	False	False	No	True	De Rossi 1970, 144, n. 495
349	288502	4616265	Rural Settlement	False	False	False	No	True	De Rossi 1970, 144, 492
350	288383	4616421	Bridge	False	False	False	No	True	De Rossi 1970, 144, n. 491
351	288281	4616407	Rural Settlement	False	False	False	No	True	De Rossi 1970, 144, n. 490
352	288677	4616016	Rural Settlement	False	False	False	No	True	De Rossi 1970, 144, n. 493
353	290157	4615272	Nucleated Site	False	False	True	Yes	True	Castagnoli 1972;

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
									Fenelli 1990; Fenelli 1995
354	289651	4615138	Tomb	False	False	False	Yes	True	Sommella 1972, 1974, 1976
355	290382	4615736	Cave	False	False	False	No	False	Fenelli 1984, 338
356	290603	4615322	Sanctuary	False	False	False	No	True	Fenelli 1984
357	290415	4615125	Tomb	False	False	False	Yes	True	Guaitoli 1995
358	290111	4614709	Tomb	False	False	False	Yes	False	
359	289992	4614737	Sanctuary	False	False	False	Yes	False	
360	289923	4614488	Villa	False	False	False	No	True	
361	289348	4616065	Road	False	False	False	No	True	De Rossi 1970, 7-11
362	290047	4616704	Drainage Feature	False	False	False	No	True	De Rossi 1970, 7-11
363	290952	4615573	Road	False	False	False	No	False	De Rossi 1970, 7-11
364	289647	4614281	Road	False	False	False	No	False	Guaitoli 1995, 561
365	290833	4614819	Road	False	False	False	No	False	Guaitoli 1995, 561
366	292567	4618024	Rural Settlement	False	False	False	No	False	De Rossi 1970, 422, n. 129
367	292894	4617736	Rural Settlement	False	False	False	No	True	De Rossi 1970, 129, 421
368	293028	4617383	Rural Settlement	False	False	False	No	True	De Rossi 1970, 129, 424
370	293196	4616763	Rural Settlement	False	False	False	No	True	De Rossi 1970, 129, 426
371	293200	4616367	Rural Settlement	False	False	False	No	True	De Rossi 1970, 129, 427
372	293256	4617521	Rural Settlement	False	False	False	No	True	De Rossi 1970, 129, n. 423
374	293949	4617740	Rural Settlement	False	False	False	No	True	De Rossi 1970, 130, n. 430

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
375	294495	4617930	Rural Settlement	False	False	False	No	True	De Rossi 1970, 130, n. 429
376	294706	4618063	Rural Settlement	False	False	False	No	True	De Rossi 1970, 119, 338
377	294650	4618390	Rural Settlement	False	False	False	No	True	De Rossi 1970,119, n. 337
378	294805	4618528	Rural Settlement	False	False	False	No	True	De Rossi 1970, 119, n. 336
379	294870	4618708	Rural Settlement	False	False	False	No	True	De Rossi 1970, 119, 335
380	294543	4619061	Villa	False	False	False	No	True	De Rossi 1970, 128, n. 406
381	295369	4618876	Rural Settlement	False	False	False	No	True	De Rossi 1970 119, 334
382	296075	4619066	Tower	False	False	False	No	False	De Rossi 1970, 118, n. 316
383	296402	4619173	Rural Settlement	False	False	False	No	True	De Rossi 1970, 119, 317
384	296406	4618670	Rural Settlement	False	False	False	No	True	De Rossi 1970, 119, n. 318
385	296552	4618558	Rural Settlement	False	False	False	No	True	De Rossi 1970, 119, n. 319
386	296811	4618381	Rural Settlement	False	False	False	No	True	De Rossi 1970, 119, n. 319
387	296535	4617994	Rural Settlement	False	False	False	No	True	De Rossi 1970, 119, n. 324
388	296673	4617826	Rural Settlement	False	False	False	No	True	De Rossi 1970, 119, 323
389	297077	4617882	Rural Settlement	False	False	False	No	True	De Rossi 1970, 119, n. 322

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
390	297361	4618084	Rural Settlement	False	False	False	No	True	De Rossi 1970, 119, n. 321
391	297430	4618394	Rural Settlement	False	False	False	No	True	De Rossi 1970, 118, 314
392	297254	4618622	Villa	False	False	False	No	True	De Rossi 1970, 118, 313
393	297873	4618480	Rural Settlement	False	False	False	No	True	De Rossi 1970, 118, n. 315
394	298618	4618532	Rural Settlement	False	False	False	No	True	De Rossi 1970, 104, n. 219
395	297972	4618149	Findspot	False	False	False	No	True	De Rossi 1970, 104, n. 220
396	297624	4617667	Villa	False	False	False	No	True	De Rossi 1970, 104, n. 222
397	298373	4617757	Tower	False	False	False	No	False	De Rossi 1970, 104, n.221
398	298528	4616983	Rural Settlement	False	False	False	No	True	De Rossi 1970, 105, n. 232
400	297684	4617013	Villa	False	False	False	No	True	De Rossi 1970, 104, n. 224
401	297129	4617073	Villa	False	False	False	No	True	De Rossi 1970, 104, n. 223
402	296294	4617288	Rural Settlement	False	False	False	No	True	De Rossi 1970, 119, n. 329
403	295997	4617706	Rural Settlement	False	False	False	No	True	De Rossi 1970, 119, 325
404	295765	4617930	Rural Settlement	False	False	False	No	True	De Rossi 1970, 119, n. 326
405	295588	4617628	Rural Settlement	False	False	False	No	True	De Rossi 1970, 119, n. 327

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
406	295816	4617267	Rural Settlement	False	False	False	No	True	De Rossi 1970, 119, 328
407	296212	4616854	Rural Settlement	False	False	False	No	True	De Rossi 1970, 119, n. 331
408	295653	4616552	Rural Settlement	False	False	False	No	True	De Rossi 1970, 119, n. 332
410	294629	4616346	Rural Settlement	False	False	False	No	True	De Rossi 1970, 130, n. 431
411	295154	4614302	Rural Settlement	False	False	False	No	True	Crescenzi, Quilici, Quilici Gigli 1971, 22, n. 109
412	294951	4613992	Rural Settlement	False	False	False	No	True	Crescenzi, Quilici, Quilici Gigli 1971, 22, n. 117
413	295106	4613759	Cuniculum	False	False	False	No	False	Crescenzi, Quilici, Quilici Gigli 1971, 22, n. 119
414	295227	4613755	Rural Settlement	False	False	False	No	True	Crescenzi, Quilici, Quilici Gigli 1971, 22, n. 118
415	295877	4614515	Rural Settlement	False	False	False	No	True	Crescenzi, Quilici, Quilici Gigli 1971, 21, n. 95
416	296322	4614776	Rural Settlement	False	False	False	No	True	Crescenzi, Quilici, Quilici Gigli 1971, 21, n. 94
417	298567	4615588	Villa	False	False	False	No	True	Crescenzi, Quilici, Quilici Gigli 1971, 20, n. 59

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
418	297325	4614629	Rural Settlement	False	False	False	No	True	Crescenzi, Quilici, Quilici Gigli 1971, 21, n. 93
419	297726	4614769	Rural Settlement	False	False	False	Yes	False	Crescenzi, Quilici, Quilici Gigli 1971, 20, n. 65
420	298012	4614681	Rural Settlement	False	False	False	No	True	Crescenzi, Quilici, Quilici Gigli 1971, 20, n. 64
421	297876	4614501	Rural Settlement	False	False	False	No	False	Crescenzi, Quilici, Quilici Gigli 1971, 66
422	297468	4614497	Rural Settlement	False	False	False	No	True	Crescenzi, Quilici, Quilici Gigli 1971, 21, 96
423	297428	4614177	Rural Settlement	False	False	False	Yes	False	Crescenzi, Quilici, Quilici Gigli 1971, 21, 97
424	297285	4614008	Rural Settlement	False	False	False	Yes	False	Crescenzi, Quilici, Quilici Gigli 1971, 21, 98
425	297781	4613799	Rural Settlement	False	False	False	No	True	Crescenzi, Quilici, Quilici Gigli 1971, 20, 67
426	298593	4613644	Rural Settlement	False	False	False	No	False	Crescenzi, Quilici, Quilici Gigli 1971, 21, 76
427	292260	4617746	Road	False	False	False	No	False	De Rossi 1970, 7-11
428	292681	4617525	Road	False	False	False	No	False	De Rossi 1970, 7-11

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
429	292533	4617535	Road	False	False	False	No	False	De Rossi 1970, 7-11
430	294529	4616836	Road	False	False	False	No	False	De Rossi 1970, 130
431	294742	4617807	Road	False	False	False	No	False	De Rossi 1970, 119, n. 339-341
432	296583	4618766	Road	False	False	False	No	False	De Rossi 1970, 118
433	297548	4619030	Road	False	False	False	No	False	De Rossi 1970, 118
434	298552	4617364	Road	False	False	False	No	False	De Rossi 1970, 118
435	296959	4616774	Road	False	False	False	No	False	De Rossi 1970, 104
436	298524	4616152	Road	False	False	False	No	False	De Rossi 1970, 68
677	275519	4634538	Walls	False	False	False	No	False	
679	276677	4634563	Rural Settlement	False	False	False	No	False	
684	276141	4630901	Rural Settlement	False	False	False	No	False	
685	276213	4630958	Rural Settlement	False	False	False	No	False	
687	278649	4630458	Rural Settlement	False	False	False	No	False	
688	278977	4630453	Rural Settlement	False	False	False	No	False	
692	281922	4629680	Bridge	False	False	False	No	False	
695	271093	4629531	Port	False	False	False	No	False	
696	274083	4629538	Tomb	False	False	False	No	False	
697	274108	4629590	Tomb	False	False	False	No	False	
700	280906	4628776	Rural Settlement	False	False	False	No	False	
702	282629	4628611	Rural Settlement	False	False	False	No	False	
704	272362	4628368	Bridge	False	False	False	No	False	
708	277685	4627776	Rural Settlement	False	False	False	No	False	
709	280237	4627312	Tomb	False	False	False	No	False	
710	280281	4627334	Tomb	False	False	False	No	False	
711	281955	4627766	Rural Settlement	False	False	False	No	False	
714	276102	4626088	Villa	False	False	False	No	True	
715	273664	4625902	Tower	False	False	False	No	False	
716	275674	4624936	Tomb	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
717	275708	4624879	Tomb	False	False	False	No	False	
718	275731	4624936	Tomb	False	False	False	No	False	
722	276775	4624071	Rural Settlement	False	False	False	No	False	
724	281644	4637138	Rural Settlement	False	False	False	No	False	
725	288881	4637130	Cave	False	False	False	No	False	
727	288955	4637049	Cave	False	False	False	No	False	
730	289137	4636568	Tomb	False	False	False	No	False	
731	286148	4636463	Rural Settlement	False	False	False	No	False	
734	287334	4635909	Rural Settlement	False	False	False	No	False	
735	282175	4635724	Rural Settlement	False	False	False	No	False	
736	277179	4635734	Rural Settlement	False	False	False	No	False	
737	282183	4635696	Rural Settlement	False	False	False	No	False	
739	276567	4635322	Rural Settlement	False	False	False	No	False	
740	286707	4634626	Temple	False	False	False	No	False	
742	287870	4633731	Bridge	False	False	False	No	False	
743	287899	4634108	Tomb	False	False	False	No	False	
744	286737	4634458	Baths	False	False	False	No	False	
747	276111	4635049	Walls	False	False	False	No	False	
749	288058	4633020	Villa	False	False	False	No	True	
750	286860	4632413	Villa	False	False	False	No	True	
751	286065	4631676	Villa	False	False	False	No	True	
752	286282	4632077	Cave	False	False	False	No	False	
753	286332	4632039	Villa	False	False	False	No	True	
754	286512	4631814	Tomb	False	False	False	No	False	
755	286756	4631763	Villa	False	False	False	No	True	
757	287042	4631801	Villa	False	False	False	No	True	
758	287190	4632082	Tomb	False	False	False	No	False	
759	287937	4632216	Villa	False	False	False	No	True	
760	288292	4631835	Villa	False	False	False	No	True	
761	288312	4631744	Rural Settlement	False	False	False	No	False	
762	288814	4632155	Walls	False	False	False	No	False	
763	288097	4631218	Tomb	False	False	False	No	False	
764	286695	4631232	Villa	False	False	False	No	True	
765	288134	4631260	Tomb	False	False	False	No	False	
766	288508	4631260	Rural Settlement	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
767	288180	4631282	Tomb	False	False	False	No	False	
769	284869	4630465	Bridge	False	False	False	No	False	
771	285292	4630645	Bridge	False	False	False	No	False	
772	275885	4643252	Tomb	False	False	False	No	False	
773	276089	4643269	Tomb	False	False	False	No	False	
774	273083	4643229	Bridge	False	False	False	No	False	
775	273198	4642987	Bridge	False	False	False	No	False	
776	275703	4642836	Tomb	False	False	False	No	False	
777	275747	4642826	Villa	False	False	False	No	True	
778	276486	4642826	Tower	False	False	False	No	False	
779	284276	4643116	Tomb	False	False	False	No	False	
780	284307	4642447	Rural Settlement	False	False	False	No	False	
781	286390	4642312	Tomb	False	False	False	No	False	
782	286439	4642293	Cuniculum	False	False	False	No	False	
783	272269	4642487	Villa	False	False	False	No	True	
784	272375	4642120	Tower	False	False	False	No	False	
788	275487	4642679	Bridge	False	False	False	No	False	
789	275627	4642635	Tomb	False	False	False	No	False	
790	275681	4642738	Cuniculum	False	False	False	No	False	
792	285554	4631004	Cave	False	False	False	No	False	
793	285766	4631121	Cave	False	False	False	No	False	
795	286521	4629794	Villa	False	False	False	No	True	
796	285037	4630107	Walls	False	False	False	No	False	
797	283862	4630285	Bridge	False	False	False	No	False	
798	288125	4629661	Villa	False	False	False	No	True	
799	288253	4629360	Villa	False	False	False	No	True	
800	285185	4629389	Cave	False	False	False	No	False	
802	287826	4629530	Tower	False	False	False	No	False	
803	284249	4629000	Cave	False	False	False	No	False	
804	285910	4628756	Villa	False	False	False	No	True	
805	286048	4628675	Rural Settlement	False	False	False	No	False	
806	287464	4628167	Walls	False	False	False	No	False	
809	287245	4628396	Villa	False	False	False	No	True	
810	288009	4627805	Rural Settlement	False	False	False	No	False	
811	287400	4627884	Villa	False	False	False	No	True	
812	287410	4628019	Walls	False	False	False	No	False	
814	288258	4627331	Rural Settlement	False	False	False	No	False	
816	287560	4627570	Cave	False	False	False	No	False	
817	288652	4626937	Rural Settlement	False	False	False	No	False	
819	286915	4627139	Cippus	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
822	288226	4627235	Rural Settlement	False	False	False	No	False	
826	287474	4625589	Tomb	False	False	False	No	False	
829	283785	4640904	Tower	False	False	False	No	False	
830	284986	4640929	Tower	False	False	False	No	False	
831	276081	4640932	Villa	False	False	False	No	True	
832	275799	4640623	Bridge	False	False	False	No	False	
834	281006	4640713	Rural Settlement	False	False	False	No	False	
835	279048	4640234	Bridge	False	False	False	No	False	
837	281043	4640283	Rural Settlement	False	False	False	No	False	
839	279877	4640033	Rural Settlement	False	False	False	No	False	
840	282000	4640146	Cave	False	False	False	No	False	
841	286650	4640199	Villa	False	False	False	No	True	
843	277242	4638854	Rural Settlement	False	False	False	No	False	
844	279154	4638946	Villa	False	False	False	No	True	
846	284118	4638870	Rural Settlement	False	False	False	No	False	
849	285691	4639060	Nympheum	False	False	False	No	False	
850	286752	4638418	Villa	False	False	False	No	True	
851	284576	4638431	Tower	False	False	False	No	False	
852	283020	4638576	Rural Settlement	False	False	False	No	False	
853	286707	4638601	Villa	False	False	False	No	True	
855	276034	4642036	Rural Settlement	False	False	False	No	False	
856	276304	4642473	Cave	False	False	False	No	False	
857	276343	4642444	Cave	False	False	False	No	False	
858	276346	4642542	Cave	False	False	False	No	False	
859	276383	4642512	Cave	False	False	False	No	False	
860	276424	4642721	Cave	False	False	False	No	False	
861	276456	4642743	Cave	False	False	False	No	False	
863	286432	4641706	Villa	False	False	False	No	True	
866	273240	4641288	Rural Settlement	False	False	False	No	False	
867	275512	4641217	Rural Settlement	False	False	False	No	False	
868	277916	4641033	Walls	False	False	False	No	False	
869	286678	4641227	Villa	False	False	False	No	True	
871	286763	4641406	Rural Settlement	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
872	287142	4641298	Nympheum	False	False	False	No	False	
873	290215	4620570	Villa	False	False	False	No	True	
874	279905	4620662	Villa	False	False	False	No	True	
880	279295	4621101	Villa	False	False	False	No	True	
881	291368	4621221	Rural Settlement	False	False	False	No	False	
882	279130	4621309	Villa	False	False	False	No	True	
883	294612	4619238	Cave	False	False	False	No	False	
892	291969	4619287	Rural Settlement	False	False	False	No	False	
895	293268	4621376	Rural Settlement	False	False	False	No	False	
896	293385	4620017	Rural Settlement	False	False	False	No	False	
897	293432	4620765	Tower	False	False	False	No	False	
898	293449	4620753	Tower	False	False	False	No	False	
899	293486	4621341	Rural Settlement	False	False	False	No	False	
900	293518	4621383	Rural Settlement	False	False	False	No	False	
902	294136	4619337	Tomb	False	False	False	No	False	
903	294255	4619035	Villa	False	False	False	No	True	
904	294326	4620369	Rural Settlement	False	False	False	No	False	
911	282918	4617617	Villa	False	False	False	No	True	
914	290774	4634680	Rural Settlement	False	False	False	No	False	
915	290707	4634683	Rural Settlement	False	False	False	No	False	
916	292295	4634883	Walls	False	False	False	No	False	
918	286234	4646040	Cuniculum	False	False	False	No	False	
919	286769	4646059	Tomb	False	False	False	No	False	
920	267372	4646182	Tomb	False	False	False	No	False	
923	277019	4645929	Walls	False	False	False	No	False	
924	279821	4646285	Rural Settlement	False	False	False	No	False	
931	267196	4645907	Tomb	False	False	False	No	False	
933	266625	4645626	Tomb	False	False	False	No	False	
935	280383	4645326	Bridge	False	False	False	No	False	
938	273950	4645417	Villa	False	False	False	No	True	
939	277134	4645420	Rural Settlement	False	False	False	No	False	
943	274968	4645252	Tomb	False	False	False	No	False	
945	280003	4645294	Tomb	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
947	273785	4645188	Villa	False	False	False	No	True	
948	280320	4645194	Cippus	False	False	False	No	False	
949	280547	4645195	Bridge	False	False	False	No	False	
950	280207	4645199	Tomb	False	False	False	No	False	
951	280396	4645201	Cippus	False	False	False	No	False	
955	275495	4645217	Rural Settlement	False	False	False	No	False	
956	285633	4644942	Rural Settlement	False	False	False	No	False	
959	275061	4645020	Rural Settlement	False	False	False	No	False	
961	281626	4645032	Villa	False	False	False	No	True	
962	275219	4645072	Road	False	False	False	No	False	
963	280523	4645113	Walls	False	False	False	No	False	
964	274571	4644707	Cuniculum	False	False	False	No	False	
965	269132	4644746	Tower	False	False	False	No	False	
969	275108	4644897	Road	False	False	False	No	False	
972	263396	4644314	Tower	False	False	False	No	False	
973	280670	4644338	Bridge	False	False	False	No	False	
974	285559	4644347	Villa	False	False	False	No	True	
975	270752	4644351	Villa	False	False	False	No	True	
976	270221	4644272	Cuniculum	False	False	False	No	False	
977	276023	4644280	Tomb	False	False	False	No	False	
979	277545	4644202	Rural Settlement	False	False	False	No	False	
980	285714	4644232	Walls	False	False	False	No	False	
981	283349	4644232	Cuniculum	False	False	False	No	False	
982	282273	4643829	Tomb	False	False	False	No	False	
983	274243	4643998	Walls	False	False	False	No	False	
984	277822	4643716	Tomb	False	False	False	No	False	
985	282097	4643811	Tomb	False	False	False	No	False	
987	283235	4643676	Cuniculum	False	False	False	No	False	
990	281621	4643629	Tomb	False	False	False	No	False	
991	281543	4643656	Cuniculum	False	False	False	No	False	
993	290715	4635895	Walls	False	False	False	No	False	
994	295664	4624148	Tower	False	False	False	No	False	
995	297670	4623880	Rural Settlement	False	False	False	No	False	
996	297596	4623067	Rural Settlement	False	False	False	No	False	
997	297154	4623094	Rural Settlement	False	False	False	No	False	
1000	295005	4621764	Villa	False	False	False	No	True	
1002	295045	4622065	Bridge	False	False	False	No	False	
1003	295734	4622077	Cave	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1005	295192	4622124	Tomb	False	False	False	No	False	
1007	297160	4622181	Villa	False	False	False	No	True	
1008	295094	4622195	Rural Settlement	False	False	False	No	False	
1011	295867	4622614	Villa	False	False	False	No	True	
1012	296079	4620742	Cave	False	False	False	No	False	
1013	296140	4620762	Tomb	False	False	False	No	False	
1014	296590	4620850	Cave	False	False	False	No	False	
1015	296591	4621355	Rural Settlement	False	False	False	No	False	
1016	296625	4620840	Cave	False	False	False	No	False	
1017	297007	4621426	Villa	False	False	False	No	True	
1018	297323	4620768	Rural Settlement	False	False	False	No	False	
1019	280277	4620245	Villa	False	False	False	No	True	
1023	266896	4639188	Tower	False	False	False	No	False	
1024	291584	4638785	Walls	False	False	False	No	False	
1025	289849	4639114	Tomb	False	False	False	No	False	
1028	290830	4638479	Walls	False	False	False	No	False	
1029	291204	4638034	Rural Settlement	False	False	False	No	False	
1030	289529	4638198	Villa	False	False	False	No	True	
1031	289416	4638358	Tomb	False	False	False	No	False	
1032	292260	4637758	Rural Settlement	False	False	False	No	False	
1033	291627	4637805	Rural Settlement	False	False	False	No	False	
1034	292058	4637652	Rural Settlement	False	False	False	No	False	
1035	291157	4637704	Rural Settlement	False	False	False	No	False	
1036	292065	4637719	Rural Settlement	False	False	False	No	False	
1037	291012	4637564	Rural Settlement	False	False	False	No	False	
1038	292119	4637517	Villa	False	False	False	No	True	
1039	290533	4637096	Tomb	False	False	False	No	False	
1040	291288	4637268	Rural Settlement	False	False	False	No	False	
1043	292210	4637382	Rural Settlement	False	False	False	No	False	
1045	292286	4636896	Tower	False	False	False	No	False	
1047	290434	4636176	Cave	False	False	False	No	False	
1048	292619	4636235	Rural Settlement	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1049	292759	4636132	Cave	False	False	False	No	False	
1051	291930	4635829	Rural Settlement	False	False	False	No	False	
1052	292705	4635836	Tomb	False	False	False	No	False	
1055	290756	4635864	Walls	False	False	False	No	False	
1056	290491	4635868	Cuniculum	False	False	False	No	False	
1058	290513	4635817	Cuniculum	False	False	False	No	False	
1059	290043	4635728	Rural Settlement	False	False	False	No	False	
1060	292703	4635765	Tomb	False	False	False	No	False	
1061	292789	4635620	Tomb	False	False	False	No	False	
1062	290397	4635622	Rural Settlement	False	False	False	No	False	
1063	290050	4635640	Rural Settlement	False	False	False	No	False	
1065	289947	4635590	Villa	False	False	False	No	True	
1066	290749	4634624	Rural Settlement	False	False	False	No	False	
1067	291049	4635069	Villa	False	False	False	No	True	
1068	291096	4633681	Tower	False	False	False	No	False	
1069	291012	4633708	Cuniculum	False	False	False	No	False	
1070	292316	4633725	Rural Settlement	False	False	False	No	False	
1071	291742	4634037	Tomb	False	False	False	No	False	
1072	292524	4634172	Villa	False	False	False	No	True	
1074	292354	4634477	Rural Settlement	False	False	False	No	False	
1075	291812	4633329	Villa	False	False	False	No	True	
1076	292260	4633243	Villa	False	False	False	No	True	
1077	292316	4632906	Walls	False	False	False	No	False	
1078	290263	4632349	Rural Settlement	False	False	False	No	True	
1079	290246	4632396	Villa	False	False	False	No	True	
1080	290891	4631783	Villa	False	False	False	No	True	
1082	290487	4631244	Bridge	False	False	False	No	False	
1083	290497	4631249	Bridge	False	False	False	No	False	
1084	290494	4631266	Bridge	False	False	False	No	False	
1086	290537	4631115	Villa	False	False	False	No	True	
1088	291264	4630329	Villa	False	False	False	No	True	
1089	292003	4630272	Rural Settlement	False	False	False	No	False	
1090	289411	4629971	Tower	False	False	False	No	False	
1092	289378	4629554	Villa	False	False	False	No	True	
1093	292187	4629663	Villa	False	False	False	No	True	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1097	289317	4629115	Rural Settlement	False	False	False	No	False	
1098	290545	4629167	Rural Settlement	False	False	False	No	False	
1099	290621	4629301	Cave	False	False	False	No	False	
1100	290848	4628761	Rural Settlement	False	False	False	No	False	
1102	291399	4628751	Rural Settlement	False	False	False	No	False	
1103	291485	4629182	Rural Settlement	False	False	False	No	False	
1104	292319	4628579	Cuniculum	False	False	False	No	False	
1105	292280	4628489	Villa	False	False	False	No	True	
1108	291998	4627917	Rural Settlement	False	False	False	No	False	
1109	294236	4627297	Cave	False	False	False	No	False	
1112	293311	4626737	Tomb	False	False	False	No	False	
1114	294284	4626864	Rural Settlement	False	False	False	No	False	
1115	292377	4626948	Rural Settlement	False	False	False	No	False	
1116	292296	4626158	Rural Settlement	False	False	False	No	False	
1117	294269	4626163	Rural Settlement	False	False	False	No	False	
1119	294524	4626249	Rural Settlement	False	False	False	No	False	
1122	293312	4626379	Tomb	False	False	False	No	False	
1123	292175	4626484	Rural Settlement	False	False	False	No	False	
1124	291198	4626520	Cave	False	False	False	No	False	
1125	293726	4626586	Rural Settlement	False	False	False	No	False	
1126	291238	4625961	Villa	False	False	False	No	True	
1127	294711	4626031	Cave	False	False	False	No	False	
1128	293997	4626058	Rural Settlement	False	False	False	No	False	
1129	293651	4626070	Rural Settlement	False	False	False	No	False	
1130	293365	4626077	Tomb	False	False	False	No	False	
1132	291989	4625852	Tower	False	False	False	No	False	
1134	294084	4625448	Rural Settlement	False	False	False	No	False	
1135	290001	4625481	Cave	False	False	False	No	False	
1136	292174	4625708	Rural Settlement	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1137	291913	4625800	Tower	False	False	False	No	False	
1138	286887	4625091	Cippus	False	False	False	No	False	
1140	289954	4625241	Cave	False	False	False	No	False	
1141	290084	4625234	Cave	False	False	False	No	False	
1143	290785	4625155	Cave	False	False	False	No	False	
1145	292044	4624848	Rural Settlement	False	False	False	No	False	
1146	293025	4624987	Tower	False	False	False	No	False	
1147	293873	4625110	Cave	False	False	False	No	False	
1148	294175	4624948	Cave	False	False	False	No	False	
1149	292369	4624305	Villa	False	False	False	No	True	
1150	291665	4624385	Rural Settlement	False	False	False	No	False	
1151	288167	4624394	Tower	False	False	False	No	False	
1154	292657	4624480	Rural Settlement	False	False	False	No	False	
1155	289309	4624486	Rural Settlement	False	False	False	No	False	
1158	289192	4623967	Villa	False	False	False	No	True	
1162	292327	4623961	Tower	False	False	False	No	False	
1163	292416	4623662	Tomb	False	False	False	No	False	
1164	292433	4623714	Tomb	False	False	False	No	False	
1165	292499	4623728	Tomb	False	False	False	No	False	
1166	292587	4624253	Rural Settlement	False	False	False	No	False	
1168	294313	4623959	Tomb	False	False	False	No	False	
1171	294431	4624157	Bridge	False	False	False	No	False	
1172	293546	4622927	Villa	False	False	False	No	True	
1173	292288	4623280	Rural Settlement	False	False	False	No	False	
1174	293119	4623500	Tower	False	False	False	No	False	
1176	293137	4623525	Tower	False	False	False	No	False	
1177	290251	4622228	Rural Settlement	False	False	False	No	False	
1181	289346	4622600	Villa	False	False	False	No	True	
1182	294874	4622119	Tower	False	False	False	No	False	
1183	294450	4622141	Cave	False	False	False	No	False	
1184	294334	4622143	Villa	False	False	False	No	True	
1185	292793	4622716	Rural Settlement	False	False	False	No	False	
1186	292796	4622676	Rural Settlement	False	False	False	No	False	
1187	292815	4622726	Rural Settlement	False	False	False	No	False	
1189	294018	4622312	Walls	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1191	273673	4647093	Tomb	False	False	False	No	False	
1192	274545	4647122	Tomb	False	False	False	No	False	
1193	273710	4647132	Tomb	False	False	False	No	False	
1194	274585	4647167	Tomb	False	False	False	No	False	
1195	266033	4647259	Tomb	False	False	False	No	False	
1196	280190	4647329	Cave	False	False	False	No	False	
1197	280240	4647373	Cave	False	False	False	No	False	
1198	285444	4647402	Villa	False	False	False	No	True	
1199	275591	4646687	Bridge	False	False	False	No	False	
1200	283259	4646692	Cave	False	False	False	No	False	
1204	285053	4647002	Cave	False	False	False	No	False	
1205	285726	4647006	Tomb	False	False	False	No	False	
1206	286062	4646401	Walls	False	False	False	No	False	
1207	286163	4646647	Cuniculum	False	False	False	No	False	
1212	280440	4646385	Rural Settlement	False	False	False	No	False	
1214	295373	4626452	Villa	False	False	False	No	True	
1217	295368	4625996	Rural Settlement	False	False	False	No	False	
1218	295922	4626048	Rural Settlement	False	False	False	No	False	
1222	296986	4625872	Rural Settlement	False	False	False	No	False	
1224	295701	4625937	Villa	False	False	False	No	True	
1225	295554	4625942	Cave	False	False	False	No	False	
1226	296558	4625698	Rural Settlement	False	False	False	No	False	
1227	296302	4625706	Tower	False	False	False	No	False	
1228	297471	4625755	Rural Settlement	False	False	False	No	False	
1229	297329	4625771	Rural Settlement	False	False	False	No	False	
1230	297341	4625800	Rural Settlement	False	False	False	No	False	
1231	297366	4625802	Rural Settlement	False	False	False	No	False	
1232	295386	4625257	Rural Settlement	False	False	False	No	False	
1233	296442	4624975	Villa	False	False	False	No	True	
1234	297316	4625008	Cuniculum	False	False	False	No	False	
1235	297349	4625065	Cuniculum	False	False	False	No	False	
1236	297573	4625308	Bridge	False	False	False	No	False	
1237	297049	4624274	Rural Settlement	False	False	False	No	False	
1238	296386	4624746	Walls	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1239	296289	4624746	Rural Settlement	False	False	False	No	False	
1240	296085	4624774	Rural Settlement	False	False	False	No	False	
1242	295275	4623655	Rural Settlement	False	False	False	No	False	
1243	295297	4623674	Rural Settlement	False	False	False	No	False	
1245	287702	4618102	Villa	False	False	False	No	True	
1249	291462	4619599	Rural Settlement	False	False	False	No	False	
1262	280661	4636014	Rural Settlement	False	False	False	No	False	
1266	280755	4636034	Rural Settlement	False	False	False	No	False	
1271	270750	4634741	Rural Settlement	False	False	False	No	False	
1272	272123	4635756	Rural Settlement	False	False	False	No	False	
1273	273248	4636309	Rural Settlement	False	False	False	No	False	
1274	273792	4635568	Rural Settlement	False	False	False	No	False	
1275	274099	4636623	Rural Settlement	False	False	False	No	False	
1276	275409	4636103	Rural Settlement	False	False	False	No	False	
1278	275529	4635130	Rural Settlement	False	False	False	No	False	
1279	275779	4635903	Rural Settlement	False	False	False	No	False	
1280	275808	4636104	Rural Settlement	False	False	False	No	False	
1281	275801	4636565	Rural Settlement	False	False	False	No	False	
1287	276239	4634977	Villa	False	False	False	No	True	
1288	276249	4635089	Rural Settlement	True	True	False	No	False	Bietti Sestieri 1984
1290	276250	4635374	Rural Settlement	False	False	False	No	False	
1291	276278	4635760	Rural Settlement	False	False	False	No	False	
1295	276447	4635096	Rural Settlement	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1297	276453	4636359	Rural Settlement	False	False	False	No	False	
1302	278770	4633187	Rural Settlement	False	False	False	No	False	
1303	279484	4633152	Tower	False	False	False	No	False	
1307	280107	4633362	Rural Settlement	False	False	False	No	False	
1308	278391	4633391	Rural Settlement	False	False	False	No	False	
1310	279906	4633439	Rural Settlement	False	False	False	No	False	
1312	280629	4633726	Rural Settlement	False	False	False	No	False	
1313	280692	4633778	Rural Settlement	False	False	False	No	False	
1314	280340	4633917	Rural Settlement	False	False	False	No	False	
1315	281876	4633994	Rural Settlement	False	False	False	No	False	
1316	285411	4634031	Rural Settlement	False	False	False	No	False	
1318	280138	4634117	Rural Settlement	False	False	False	No	False	
1319	286272	4634485	Walls	False	False	False	No	False	
1320	277743	4634500	Rural Settlement	False	False	False	No	False	
1326	278469	4634997	Rural Settlement	False	False	False	No	False	
1329	285965	4635106	Rural Settlement	False	False	False	No	False	
1332	278130	4635144	Rural Settlement	False	False	False	No	False	
1333	286827	4634770	Tomb	False	False	False	No	False	
1334	286919	4634962	Rural Settlement	False	False	False	No	False	
1335	288348	4633134	Rural Settlement	False	False	False	No	False	
1336	290790	4633458	Tomb	False	False	False	No	False	
1338	292238	4634300	Rural Settlement	False	False	False	No	False	
1339	278698	4630824	Tower	False	False	False	No	False	
1340	280198	4630779	Nucleated Site	False	False	False	No	False	
1341	279971	4632107	Rural Settlement	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1342	283616	4631952	Rural Settlement	False	False	False	No	False	
1344	285212	4632612	Rural Settlement	False	False	False	No	False	
1345	285265	4632230	Rural Settlement	False	False	False	No	False	
1348	286462	4630910	Rural Settlement	False	False	False	No	False	
1352	288564	4631304	Rural Settlement	False	False	False	No	False	
1353	289348	4631237	Rural Settlement	False	False	False	No	False	
1354	290956	4631114	Rural Settlement	False	False	False	No	False	
1355	287641	4630267	Rural Settlement	False	False	False	No	False	
1357	287895	4630279	Rural Settlement	False	False	False	No	False	
1359	288866	4630620	Rural Settlement	False	False	False	No	False	
1360	289383	4629566	Rural Settlement	False	False	False	No	False	
1363	289729	4629082	Rural Settlement	False	False	False	No	False	
1365	290934	4629406	Rural Settlement	False	False	False	No	False	
1372	279586	4630616	Rural Settlement	False	False	False	No	False	
1373	280171	4630066	Tomb	False	False	False	No	False	
1376	281754	4629545	Villa	False	False	False	No	True	
1377	282024	4628098	Villa	False	False	False	No	True	
1379	282634	4630047	Rural Settlement	False	False	False	No	False	
1380	282676	4629941	Rural Settlement	False	False	False	No	False	
1381	282905	4628386	Rural Settlement	False	False	False	No	False	
1382	282929	4628078	Rural Settlement	False	False	False	No	False	
1383	283066	4630180	Villa	False	False	False	No	True	
1384	283145	4630026	Rural Settlement	False	False	False	No	False	
1385	283189	4629689	Rural Settlement	False	False	False	No	False	
1386	283308	4628416	Rural Settlement	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1387	283450	4628238	Rural Settlement	False	False	False	No	False	
1388	283414	4628930	Rural Settlement	False	False	False	No	False	
1389	283560	4629804	Villa	False	False	False	No	True	
1390	285129	4630455	Rural Settlement	False	False	False	No	False	
1391	285207	4630584	Rural Settlement	False	False	False	No	False	
1393	285549	4630798	Rural Settlement	False	False	False	No	False	
1394	285676	4629442	Rural Settlement	False	False	False	No	False	
1395	285801	4630741	Rural Settlement	False	False	False	No	False	
1397	285831	4629463	Rural Settlement	False	False	False	No	False	
1399	286220	4630641	Rural Settlement	False	False	False	No	False	
1400	286179	4628915	Rural Settlement	False	False	False	No	False	
1401	286223	4628745	Rural Settlement	False	False	False	No	False	
1402	286278	4630335	Rural Settlement	False	False	False	No	False	
1405	286415	4628360	Villa	False	False	False	No	True	
1406	286725	4629075	Rural Settlement	False	False	False	No	False	
1407	286796	4628889	Rural Settlement	False	False	False	No	False	
1408	286813	4627940	Rural Settlement	False	False	False	No	False	
1409	286871	4628699	Tomb	False	False	False	No	False	
1410	286940	4630723	Rural Settlement	False	False	False	No	False	
1413	287396	4629547	Rural Settlement	False	False	False	No	False	
1415	271105	4630815	Tomb	False	False	False	No	False	
1416	271370	4628560	Rural Settlement	False	False	False	No	False	
1417	271718	4628067	Rural Settlement	False	False	False	No	False	
1418	272091	4628269	Rural Settlement	False	False	False	No	False	
1419	272525	4629816	Tomb	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1421	272610	4629714	Rural Settlement	False	False	False	No	False	
1422	272944	4628202	Rural Settlement	False	False	False	No	False	
1423	273440	4628687	Rural Settlement	False	False	False	No	False	
1424	273630	4629813	Rural Settlement	False	False	False	No	False	
1425	273557	4629516	Rural Settlement	False	False	False	No	False	
1426	273414	4627904	Rural Settlement	False	False	False	No	False	
1427	274378	4627850	Rural Settlement	False	False	False	No	False	
1429	291222	4627859	Villa	False	False	False	No	True	
1431	290735	4627982	Rural Settlement	False	False	False	No	False	
1434	288358	4628131	Rural Settlement	False	False	False	No	False	
1435	292075	4628409	Rural Settlement	False	False	False	No	False	
1436	288223	4628514	Rural Settlement	False	False	False	No	False	
1437	290617	4628529	Tower	False	False	False	No	False	
1438	291700	4628579	Rural Settlement	False	False	False	No	False	
1440	288427	4628775	Rural Settlement	False	False	False	No	False	
1441	290776	4628825	Walls	False	False	False	No	False	
1442	297052	4625808	Rural Settlement	False	False	False	No	False	
1443	293904	4625877	Rural Settlement	False	False	False	No	False	
1444	294497	4625899	Rural Settlement	False	False	False	No	False	
1446	296584	4626007	Rural Settlement	False	False	False	No	False	
1448	296885	4626064	Rural Settlement	False	False	False	No	False	
1449	295123	4626169	Rural Settlement	False	False	False	No	False	
1452	296201	4626340	Rural Settlement	False	False	False	No	False	
1453	294434	4626349	Rural Settlement	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1455	295928	4626452	Rural Settlement	False	False	False	No	False	
1456	294319	4626746	Villa	False	False	False	No	True	
1458	291685	4626123	Rural Settlement	False	False	False	No	False	
1459	291697	4625853	Rural Settlement	False	False	False	No	False	
1460	291702	4626807	Rural Settlement	False	False	False	No	False	
1461	291797	4626458	Rural Settlement	False	False	False	No	False	
1462	291835	4626821	Rural Settlement	False	False	False	No	False	
1463	291854	4625565	Rural Settlement	False	False	False	No	False	
1464	291895	4626004	Rural Settlement	False	False	False	No	False	
1465	291998	4626275	Rural Settlement	False	False	False	No	False	
1466	292187	4625766	Rural Settlement	False	False	False	No	False	
1467	292195	4626648	Rural Settlement	False	False	False	No	False	
1468	292350	4626569	Rural Settlement	False	False	False	No	False	
1469	292396	4626038	Rural Settlement	False	False	False	No	False	
1470	292456	4624750	Villa	False	False	False	No	True	
1471	292554	4626362	Villa	False	False	False	No	True	
1472	292626	4626602	Rural Settlement	False	False	False	No	False	
1473	292796	4626426	Rural Settlement	False	False	False	No	False	
1475	293039	4625116	Rural Settlement	False	False	False	No	False	
1476	293133	4626123	Villa	False	False	False	No	True	
1477	293103	4627103	Rural Settlement	False	False	False	No	False	
1478	293667	4625131	Rural Settlement	False	False	False	No	False	
1483	276382	4625339	Rural Settlement	False	False	False	No	False	
1484	275949	4625548	Rural Settlement	False	False	False	No	False	
1485	276113	4625138	Rural Settlement	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1486	278680	4624745	Tomb	False	False	False	No	False	
1487	282205	4627455	Rural Settlement	False	False	False	No	False	
1488	282268	4627463	Rural Settlement	False	False	False	No	False	
1489	286955	4625187	Tomb	False	False	False	No	False	
1491	287163	4627297	Rural Settlement	False	False	False	No	False	
1492	287491	4624556	Rural Settlement	False	False	False	No	False	
1493	287651	4625097	Rural Settlement	False	False	True	Yes	False	
1494	287528	4624942	Rural Settlement	False	False	False	No	False	
1495	287629	4626884	Rural Settlement	False	False	False	No	False	
1496	287830	4627601	Rural Settlement	False	False	False	No	False	
1497	287842	4627257	Rural Settlement	False	False	False	No	False	
1499	288032	4627428	Rural Settlement	False	False	False	No	False	
1501	288197	4627318	Walls	False	False	False	No	False	
1502	288212	4626091	Rural Settlement	False	False	False	No	False	
1503	288274	4625551	Villa	False	False	False	No	True	
1504	288258	4627573	Rural Settlement	False	False	False	No	False	
1505	288316	4626102	Rural Settlement	False	False	False	No	False	
1507	288522	4626849	Rural Settlement	False	False	False	No	False	
1508	288471	4626105	Rural Settlement	False	False	False	No	False	
1509	288565	4627811	Rural Settlement	False	False	False	No	False	
1510	289851	4627358	Rural Settlement	False	False	False	No	False	
1511	290073	4625261	Rural Settlement	False	False	False	No	False	
1512	289976	4624718	Rural Settlement	False	False	False	No	False	
1513	290250	4624535	Rural Settlement	False	False	False	No	False	
1514	290329	4625184	Rural Settlement	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1515	290406	4625820	Rural Settlement	False	False	False	No	False	
1516	290492	4626077	Rural Settlement	False	False	False	No	False	
1517	290523	4625175	Villa	False	False	False	No	True	
1518	290518	4624459	Villa	False	False	False	No	True	
1519	290630	4626402	Villa	False	False	False	No	True	
1520	290813	4624421	Villa	False	False	False	No	True	
1521	290871	4625121	Rural Settlement	False	False	False	No	False	
1522	291059	4624975	Rural Settlement	False	False	False	No	False	
1523	291021	4626213	Rural Settlement	False	False	False	No	False	
1524	291029	4625608	Rural Settlement	False	False	False	No	False	
1525	291120	4624430	Rural Settlement	False	False	False	No	False	
1526	291221	4626679	Villa	False	False	False	No	True	
1527	291257	4627532	Rural Settlement	False	False	False	No	False	
1528	291239	4626988	Rural Settlement	False	False	False	No	False	
1529	291283	4625962	Rural Settlement	False	False	False	No	False	
1530	291342	4627369	Rural Settlement	False	False	False	No	False	
1531	291322	4627227	Rural Settlement	False	False	False	No	False	
1532	291388	4625529	Rural Settlement	False	False	False	No	False	
1533	291419	4626824	Rural Settlement	False	False	False	No	False	
1534	291563	4627630	Rural Settlement	False	False	False	No	False	
1536	288597	4625193	Rural Settlement	False	False	False	No	False	
1539	289097	4625450	Rural Settlement	False	False	False	No	False	
1540	289205	4625579	Rural Settlement	False	False	False	No	False	
1541	289237	4625254	Rural Settlement	False	False	False	No	False	
1542	289301	4625227	Villa	False	False	False	No	True	
1543	289293	4627014	Rural Settlement	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1544	289347	4627222	Rural Settlement	False	False	False	No	False	
1545	289348	4624400	Rural Settlement	False	False	False	No	False	
1546	289526	4627130	Rural Settlement	False	False	False	No	False	
1547	289542	4625501	Rural Settlement	False	False	False	No	False	
1548	294184	4624398	Villa	False	False	False	No	True	
1549	294851	4624466	Villa	False	False	False	No	True	
1550	296122	4624510	Rural Settlement	False	False	False	No	False	
1551	296580	4624566	Rural Settlement	False	False	False	No	False	
1552	297417	4624571	Rural Settlement	False	False	False	No	False	
1553	295523	4624602	Rural Settlement	False	False	False	No	False	
1554	296333	4624595	Rural Settlement	False	False	False	No	False	
1555	294104	4624690	Rural Settlement	False	False	False	No	False	
1556	297531	4624781	Villa	False	False	False	No	True	
1557	296567	4624765	Rural Settlement	False	False	False	No	False	
1558	296364	4624836	Rural Settlement	False	False	False	No	False	
1559	294456	4624830	Rural Settlement	False	False	False	No	False	
1560	296177	4624887	Rural Settlement	False	False	False	No	False	
1561	297024	4625120	Rural Settlement	False	False	False	No	False	
1562	296942	4625388	Rural Settlement	False	False	False	No	False	
1563	296497	4625509	Rural Settlement	False	False	False	No	False	
1565	293221	4623050	Rural Settlement	False	False	False	No	False	
1566	293599	4623070	Rural Settlement	False	False	False	No	False	
1567	294871	4623162	Rural Settlement	False	False	False	No	False	
1568	294017	4623167	Rural Settlement	False	False	False	No	False	
1569	297125	4623235	Villa	False	False	False	No	True	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1570	297328	4623287	Rural Settlement	False	False	False	No	False	
1571	294267	4623482	Villa	False	False	False	No	True	
1572	292644	4623472	Rural Settlement	False	False	False	No	False	
1573	292021	4623482	Rural Settlement	False	False	False	No	False	
1575	294177	4623842	Villa	False	False	False	No	True	
1576	294376	4624119	Bridge	False	False	False	No	False	
1579	292909	4624119	Rural Settlement	False	False	False	No	False	
1580	291529	4624130	Rural Settlement	False	False	False	No	False	
1581	291813	4624186	Rural Settlement	False	False	False	No	False	
1582	291153	4624215	Rural Settlement	False	False	False	No	False	
1583	297808	4624243	Rural Settlement	False	False	False	No	False	
1584	297481	4624257	Rural Settlement	False	False	False	No	False	
1585	291533	4624307	Rural Settlement	False	False	False	No	False	
1586	292727	4624319	Rural Settlement	False	False	False	No	False	
1587	292825	4621354	Rural Settlement	False	False	False	No	False	
1588	296541	4621365	Cuniculum	False	False	False	No	False	
1589	293532	4621401	Rural Settlement	False	False	False	No	False	
1590	293362	4621545	Rural Settlement	False	False	False	No	False	
1593	294778	4621756	Rural Settlement	False	False	False	No	False	
1595	293022	4621962	Rural Settlement	False	False	False	No	False	
1596	294805	4622028	Rural Settlement	False	False	False	No	False	
1597	295112	4622106	Rural Settlement	False	False	False	No	False	
1598	295716	4622124	Rural Settlement	False	False	False	No	False	
1599	296622	4622205	Rural Settlement	False	False	False	No	False	
1600	296043	4622243	Rural Settlement	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1601	296435	4622244	Rural Settlement	False	False	False	No	False	
1602	295018	4622372	Rural Settlement	False	False	False	No	False	
1603	295387	4622475	Rural Settlement	False	False	False	No	False	
1604	297200	4622613	Villa	False	False	False	No	True	
1605	296202	4622720	Rural Settlement	False	False	False	No	False	
1606	290872	4622764	Rural Settlement	False	False	False	No	False	
1607	296402	4622781	Rural Settlement	False	False	False	No	False	
1608	297537	4622832	Rural Settlement	False	False	False	No	False	
1609	291078	4622880	Rural Settlement	False	False	False	No	False	
1610	296097	4620613	Rural Settlement	False	False	False	No	False	
1613	291022	4620597	Rural Settlement	False	False	False	No	False	
1614	291217	4620382	Rural Settlement	False	False	False	No	False	
1615	291635	4620300	Rural Settlement	False	False	False	No	False	
1616	292174	4620102	Rural Settlement	False	False	False	No	False	
1617	292408	4620385	Rural Settlement	False	False	False	No	False	
1618	292508	4620035	Rural Settlement	False	False	False	No	False	
1619	292582	4620700	Rural Settlement	False	False	False	No	False	
1620	292594	4619690	Rural Settlement	False	False	False	No	False	
1621	292971	4620078	Rural Settlement	False	False	False	No	False	
1622	294366	4620271	Rural Settlement	False	False	False	No	False	
1628	287696	4624127	Rural Settlement	False	False	False	No	False	
1629	287931	4619109	Rural Settlement	False	False	False	No	False	
1630	287968	4624130	Rural Settlement	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1634	288565	4619096	Rural Settlement	False	False	False	No	False	
1640	289322	4622228	Villa	False	False	False	No	True	
1641	289315	4621425	Rural Settlement	False	False	False	No	False	
1642	289327	4621761	Rural Settlement	False	False	False	No	False	
1643	289396	4621071	Villa	False	False	False	No	True	
1647	289488	4620679	Villa	False	False	False	No	True	
1649	289622	4619929	Rural Settlement	False	False	False	No	False	
1650	289675	4620609	Rural Settlement	False	False	False	No	False	
1651	289635	4620752	Rural Settlement	False	False	False	No	False	
1653	289844	4619888	Rural Settlement	False	False	False	No	False	
1655	289847	4623468	Rural Settlement	False	False	False	No	False	
1656	289904	4622954	Temple	False	False	False	No	False	
1657	289941	4619478	Rural Settlement	False	False	False	No	False	
1658	290003	4621091	Bridge	False	False	False	No	False	
1662	290203	4622011	Rural Settlement	False	False	False	No	False	
1663	290226	4622279	Rural Settlement	False	False	False	No	False	
1664	290245	4623687	Tomb	False	False	False	No	False	
1670	293181	4618407	Rural Settlement	False	False	False	No	False	
1676	292717	4618838	Rural Settlement	False	False	False	No	False	
1678	292071	4618964	Villa	False	False	False	No	True	
1681	292311	4619084	Rural Settlement	False	False	False	No	False	
1687	292216	4619352	Rural Settlement	False	False	False	No	False	
1688	292014	4619461	Rural Settlement	False	False	False	No	False	
1689	294169	4619516	Rural Settlement	False	False	False	No	False	
1691	279902	4621310	Rural Settlement	False	False	False	No	False	
1692	279743	4623521	Rural Settlement	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1694	280586	4619651	Rural Settlement	False	False	False	No	False	
1695	280585	4619903	Rural Settlement	False	False	False	No	False	
1696	280753	4619768	Rural Settlement	False	False	False	No	False	
1697	280926	4619596	Villa	False	False	False	No	True	
1698	281353	4619181	Villa	False	False	False	No	True	
1699	282513	4617930	Villa	False	False	False	No	True	
1700	282641	4617228	Rural Settlement	False	False	False	No	False	
1701	283497	4616720	Villa	False	False	False	No	True	
1702	283901	4616266	Villa	False	False	False	No	True	
1703	284578	4615530	Villa	False	False	False	No	True	
1704	284945	4615121	Villa	False	False	False	No	True	
1705	285972	4620856	Villa	False	False	False	No	True	
1706	286032	4620550	Rural Settlement	False	False	False	No	False	
1707	286494	4624029	Rural Settlement	False	False	False	No	False	
1708	286627	4620895	Rural Settlement	False	False	False	No	False	
1709	286792	4619530	Rural Settlement	False	False	False	No	False	
1710	287106	4619168	Rural Settlement	False	False	False	No	False	
1711	287205	4618108	Rural Settlement	False	False	False	No	False	
1713	261667	4645633	Villa	False	False	False	No	True	
1715	264714	4646771	Villa	False	False	False	No	True	
1716	268108	4647172	Villa	False	False	False	No	True	
1718	269142	4645570	Rural Settlement	False	False	False	No	False	
1719	271285	4645771	Rural Settlement	False	False	False	No	False	
1720	273623	4645808	Rural Settlement	False	False	False	No	False	
1721	273742	4646389	Rural Settlement	False	False	False	No	False	
1722	273745	4647433	Rural Settlement	False	False	False	No	False	
1724	274739	4645135	Rural Settlement	False	False	False	No	False	
1725	274917	4647442	Rural Settlement	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1726	275108	4645302	Rural Settlement	False	False	False	No	False	
1727	275588	4646234	Rural Settlement	False	False	False	No	False	
1728	275679	4645185	Rural Settlement	False	False	False	No	False	
1729	275890	4645760	Rural Settlement	False	False	False	No	False	
1730	276086	4646055	Villa	False	False	False	No	True	
1731	276248	4645445	Villa	False	False	False	No	True	
1732	276363	4646953	Rural Settlement	False	False	False	No	False	
1733	276507	4646355	Rural Settlement	False	False	False	No	False	
1734	276509	4646135	Rural Settlement	False	False	False	No	False	
1735	276686	4645227	Villa	False	False	False	No	True	
1736	276835	4646593	Villa	False	False	False	No	True	
1738	277194	4646770	Villa	False	False	False	No	True	
1739	277245	4646097	Rural Settlement	False	False	False	No	False	
1740	277541	4645381	Rural Settlement	False	False	False	No	False	
1741	278725	4646713	Villa	False	False	False	No	True	
1749	279562	4645848	Tomb	False	False	False	No	False	
1752	279761	4645457	Rural Settlement	False	False	False	No	False	
1755	280069	4645513	Rural Settlement	False	False	False	No	False	
1756	280186	4647411	Rural Settlement	False	False	False	No	False	
1757	280601	4645978	Rural Settlement	False	False	False	No	False	
1758	280635	4646304	Rural Settlement	False	False	False	No	False	
1760	282382	4646530	Rural Settlement	False	False	False	No	False	
1761	282408	4645416	Rural Settlement	False	False	False	No	False	
1767	284609	4646186	Rural Settlement	False	False	False	No	False	
1768	284897	4647054	Rural Settlement	False	False	False	No	False	
1769	263213	4644371	Villa	False	False	False	No	True	
1770	269192	4644761	Tower	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1771	273395	4644938	Rural Settlement	False	False	False	No	False	
1773	274420	4643734	Rural Settlement	False	False	False	No	False	
1774	274658	4644689	Rural Settlement	False	False	False	No	False	
1779	275476	4645010	Villa	False	False	False	No	True	
1781	276020	4644191	Rural Settlement	True	False	False	No	False	Bietti Sestieri 1984
1784	277335	4644921	Rural Settlement	False	False	False	No	False	
1786	277357	4644253	Rural Settlement	False	False	False	No	False	
1787	277485	4644032	Villa	False	False	False	No	True	
1790	280864	4644733	Rural Settlement	False	False	False	No	False	
1791	282139	4644802	Rural Settlement	False	False	False	No	False	
1792	283374	4644358	Rural Settlement	False	False	False	No	False	
1796	284442	4642213	Rural Settlement	False	False	False	No	False	
1797	284519	4642590	Rural Settlement	False	False	False	No	False	
1798	284629	4642315	Rural Settlement	False	False	False	No	False	
1799	284659	4642539	Rural Settlement	False	False	False	No	False	
1801	284975	4642564	Rural Settlement	False	False	False	No	False	
1804	272757	4642969	Rural Settlement	False	False	False	No	False	
1812	274500	4642524	Rural Settlement	False	False	False	No	False	
1814	274932	4642572	Rural Settlement	False	False	False	No	False	
1816	275067	4643508	Rural Settlement	False	False	False	No	False	
1818	275158	4642327	Rural Settlement	False	False	False	No	False	
1819	275671	4642700	Rural Settlement	False	False	False	No	False	
1820	275825	4643627	Rural Settlement	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1822	276125	4642251	Rural Settlement	False	False	False	No	False	
1824	276235	4642491	Rural Settlement	False	False	False	No	False	
1825	276386	4642745	Rural Settlement	False	False	False	No	False	
1826	277822	4643163	Rural Settlement	False	False	False	No	False	
1827	277830	4643692	Tomb	False	False	False	No	False	
1829	279385	4643536	Rural Settlement	False	False	True	No	False	Bietti Sestieri 1984
1830	281016	4643555	Villa	False	False	False	No	True	
1835	274861	4641085	Rural Settlement	False	False	False	No	False	
1838	275036	4642109	Rural Settlement	False	False	False	No	False	
1839	275382	4640810	Rural Settlement	False	False	False	No	False	
1841	276013	4641959	Rural Settlement	False	False	False	No	False	
1847	277741	4641165	Rural Settlement	False	False	False	No	False	
1848	278030	4640910	Rural Settlement	False	False	False	No	False	
1849	278098	4640762	Rural Settlement	False	False	False	No	False	
1850	278419	4640066	Rural Settlement	True	True	True	No	False	Bietti Sestieri 1984
1853	278632	4640246	Rural Settlement	False	False	False	No	False	
1854	279794	4640019	Rural Settlement	False	False	False	No	False	
1855	270982	4641128	Rural Settlement	False	False	False	No	False	
1858	271671	4640539	Rural Settlement	False	False	False	No	False	
1864	273678	4640439	Rural Settlement	False	False	False	No	False	
1865	273847	4640611	Rural Settlement	False	False	False	No	False	
1870	274341	4640961	Rural Settlement	False	False	False	No	False	
1871	274368	4640815	Rural Settlement	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1875	281141	4640177	Rural Settlement	False	False	False	No	False	
1877	281223	4640651	Rural Settlement	False	False	False	No	False	
1880	281888	4640619	Rural Settlement	False	False	False	No	False	
1884	283330	4640541	Rural Settlement	False	False	False	No	False	
1886	284366	4641670	Rural Settlement	False	False	False	No	False	
1888	287738	4640242	Villa	False	False	False	No	True	
1889	287459	4640760	Tomb	False	False	False	No	False	
1890	288824	4640271	Tomb	False	False	False	No	False	
1892	278167	4639509	Rural Settlement	False	False	True	No	False	Bietti Sestieri 1984
1897	278067	4639511	Rural Settlement	False	False	False	No	False	
1898	284738	4639513	Rural Settlement	False	False	False	No	False	
1901	276774	4639552	Rural Settlement	True	True	False	No	False	Bietti Sestieri 1984
1902	279563	4639578	Rural Settlement	False	False	False	No	False	
1903	287918	4639670	Villa	False	False	False	No	True	
1904	276853	4639592	Rural Settlement	True	True	False	No	False	Bietti Sestieri 1984
1906	277759	4639624	Rural Settlement	False	False	False	No	False	
1908	278392	4639684	Rural Settlement	False	False	True	No	False	Bietti Sestieri 1984
1911	277044	4639666	Rural Settlement	False	False	False	Yes	False	Bietti Sestieri 1984
1912	276783	4639681	Rural Settlement	True	True	False	No	False	Bietti Sestieri 1984
1913	281574	4639701	Rural Settlement	False	False	False	No	False	
1914	281568	4639770	Rural Settlement	False	False	False	No	False	
1915	278383	4639786	Rural Settlement	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1916	277567	4639819	Rural Settlement	False	False	False	No	False	
1918	268772	4639945	Rural Settlement	False	False	False	No	False	
1921	267511	4638830	Rural Settlement	False	False	False	No	False	
1922	281375	4638767	Rural Settlement	False	False	False	No	False	
1923	277240	4638787	Rural Settlement	False	False	False	No	False	
1925	266886	4638826	Rural Settlement	False	False	False	No	False	
1927	289681	4638820	Rural Settlement	False	False	False	No	False	
1930	281359	4638882	Rural Settlement	False	False	False	No	False	
1931	278132	4638946	Flint Scatter	True	True	False	No	False	Bietti Sestieri 1984
1932	286221	4638945	Rural Settlement	False	False	False	No	False	
1936	277706	4639033	Rural Settlement	False	False	False	No	False	
1937	276592	4639170	Rural Settlement	False	False	False	No	False	Bietti Sestieri 1984
1939	276487	4639256	Rural Settlement	True	True	False	No	False	Bietti Sestieri 1984
1944	289483	4639350	Tomb	False	False	False	No	False	
1945	277734	4639379	Flint Scatter	True	True	False	No	False	Bietti Sestieri 1984
1947	278234	4639423	Rural Settlement	False	False	False	No	False	
1948	277795	4639434	Flint Scatter	True	True	False	No	False	Bietti Sestieri 1984
1950	283071	4638480	Rural Settlement	False	False	False	No	False	
1951	284029	4638719	Rural Settlement	False	False	False	No	False	
1952	284241	4638283	Rural Settlement	False	False	False	No	False	
1953	284261	4638723	Rural Settlement	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
1955	286655	4638225	Rural Settlement	False	False	False	No	False	
1956	289215	4638147	Rural Settlement	False	False	False	No	False	
1957	289282	4638139	Rural Settlement	False	False	False	No	False	
1958	289542	4638349	Tomb	False	False	False	No	False	
1959	289586	4638408	Tomb	False	False	False	No	False	
1961	290165	4638707	Bridge	False	False	False	No	False	
1962	290314	4638288	Walls	False	False	False	No	False	
1963	272746	4638519	Rural Settlement	False	False	False	No	False	
1966	277344	4638094	Tomb	False	False	False	Yes	False	Bietti Sestieri 1984
1970	278262	4638704	Rural Settlement	True	True	False	No	False	Bietti Sestieri 1984
1979	280474	4637812	Rural Settlement	False	False	False	No	False	
1981	280943	4638364	Rural Settlement	False	False	False	No	False	
1984	290531	4637820	Rural Settlement	False	False	False	No	False	
1987	283984	4637487	Rural Settlement	False	False	False	No	False	
1988	285296	4637449	Rural Settlement	False	False	False	No	False	
1989	285620	4637524	Rural Settlement	False	False	False	No	False	
1992	289676	4637352	Walls	False	False	False	No	False	
1993	290162	4637324	Walls	False	False	False	No	False	
1995	291208	4637448	Tomb	False	False	False	No	False	
1996	291946	4637131	Rural Settlement	False	False	False	No	False	
1997	292174	4637695	Rural Settlement	False	False	False	No	False	
1998	268960	4637343	Rural Settlement	False	False	False	No	False	
2000	274517	4637469	Villa	False	False	False	No	True	
2002	276891	4636858	Rural Settlement	True	True	False	No	False	Bietti Sestieri 1984
2015	281545	4637073	Rural Settlement	False	False	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
2027	282034	4637337	Rural Settlement	False	False	False	No	False	
2040	281516	4636524	Rural Settlement	False	False	False	No	False	
2050	282405	4635624	Rural Settlement	False	False	False	No	False	
2051	282587	4636608	Rural Settlement	False	False	False	No	False	
2052	289312	4636464	Walls	False	False	False	No	False	
2053	290072	4635668	Rural Settlement	False	False	False	No	False	
2054	290566	4635818	Cuniculum	False	False	False	No	False	
2057	291181	4636421	Rural Settlement	False	False	False	No	False	
2059	292374	4636243	Rural Settlement	False	False	False	No	False	
2060	292525	4635827	Rural Settlement	False	False	False	No	False	
2061	292661	4636200	Rural Settlement	False	False	False	No	False	
2062	292856	4636180	Walls	False	False	False	No	False	
2063	293065	4636479	Rural Settlement	False	False	False	No	False	
2066	276882	4636265	Villa	False	False	False	No	True	
2067	276875	4636466	Rural Settlement	False	False	False	No	False	
2068	276960	4636102	Rural Settlement	False	False	False	No	False	Bietti Sestieri 1984
2070	277151	4636745	Villa	False	False	False	No	True	
2072	277174	4636139	Rural Settlement	False	True	False	No	False	Bietti Sestieri 1984
2077	277504	4636157	Rural Settlement	False	False	False	No	False	
2080	277772	4636429	Rural Settlement	False	False	False	No	False	
2082	278221	4635154	Rural Settlement	False	False	False	No	False	
2085	280130	4647710	Rural Settlement	False	False	False	Yes	True	1684
2086	280430	4646010	Rural Settlement	False	False	False	Yes	True	1693
2087	280430	4646610	Rural Settlement	False	False	False	Yes	True	1694

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
2088	280430	4646910	Rural Settlement	False	False	False	Yes	False	1695
2089	280530	4646010	Tomb	False	False	False	Yes	True	1698
2090	280530	4646110	Rural Settlement	False	False	False	Yes	False	1699
2091	280530	4647210	Rural Settlement	False	False	False	No	True	1700
2092	280630	4645710	Rural Settlement	False	False	False	Yes	True	1702
2093	280630	4646210	Villa	False	False	False	No	True	1703
2094	280630	4646710	Rural Settlement	False	False	False	Yes	True	1704
2095	280630	4647110	Rural Settlement	False	False	False	Yes	True	1705
2096	280630	4647510	Rural Settlement	False	False	False	No	True	1706
2097	280730	4647410	Rural Settlement	False	False	False	Yes	True	1710
2098	280730	4647610	Rural Settlement	False	False	False	Yes	True	1711
2099	281030	4646410	Rural Settlement	False	False	False	Yes	True	1719
2100	281130	4646810	Findspot	False	False	False	Yes	True	1721
2101	281130	4647810	Rural Settlement	False	False	False	Yes	True	1722
2102	281230	4647110	Rural Settlement	False	False	False	Yes	True	1726
2103	281430	4647410	Rural Settlement	False	False	False	Yes	True	1731
2104	281430	4647910	Rural Settlement	False	False	False	No	True	1732
2105	282430	4645610	Rural Settlement	False	False	False	No	False	1760
2106	290229	4647810	Findspot	False	False	False	No	True	2635
2107	269230	4644610	Rural Settlement	False	False	False	Yes	True	3099
2108	269230	4644710	Tower	False	False	False	No	False	3100
2109	269730	4645610	Tower	False	False	False	No	False	3102
2110	273730	4646410	Rural Settlement	False	False	False	Yes	True	3108
2111	274630	4646310	Tomb	False	False	False	Yes	False	3111
2112	274830	4646610	Rural Settlement	False	False	False	No	False	3113
2113	277130	4645410	Rural Settlement	False	False	False	No	True	3114
2114	277430	4645410	Villa	False	False	False	Yes	True	3119

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
2115	278030	4646210	Villa	False	False	False	No	True	3123
2116	278430	4646310	Rural Settlement	False	False	False	No	True	3125
2117	264030	4646510	Villa	False	False	False	No	True	3261
2119	291029	4629410	Tower	False	False	False	No	False	3281
2120	296229	4625710	Tower	False	False	False	No	False	3282
2121	296329	4625910	Findspot	False	False	False	No	True	3283
2123	276430	4642810	Findspot	False	False	False	Yes	True	3320
2124	295329	4620110	Findspot	False	False	False	No	False	3326
2126	298329	4621310	Findspot	False	False	False	Yes	True	3328
2127	284430	4642210	Findspot	False	False	False	Yes	False	3329
2205	277983	4634230	Rural Settlement	False	False	False	No	True	SITAR
2206	276438	4635190	Rural Settlement	True	True	False	No	False	SITAR
2207	277428	4635828	Tomb	False	False	False	Yes	True	SITAR
2208	278609	4633413	Tomb	False	False	False	No	True	SITAR
2209	277213	4630872	Tomb	False	False	False	No	True	SITAR
2210	278488	4631976	Rural Settlement	False	False	False	No	True	SITAR
2211	280011	4632864	Road	False	False	False	No	True	SITAR
2212	279812	4632879	Road	False	False	False	No	True	SITAR
2213	279833	4632877	Road	False	False	False	No	True	SITAR
2214	278933	4635305	Drainage Feature	False	False	False	No	True	SITAR
2215	279667	4633292	Outpost	False	False	False	Yes	True	SITAR
2216	281126	4634853	Rural Settlement	False	False	False	No	False	SITAR
2218	281249	4640922	Tomb	False	False	False	No	True	SITAR
2219	281130	4640567	Villa	False	False	False	No	True	SITAR
2220	280243	4643219	Working Site	False	False	False	No	True	SITAR
2221	280771	4644678	Road	False	False	False	No	True	SITAR
2222	280663	4645157	Acqueduct	False	False	False	No	True	SITAR
2223	281298	4644473	Rural Settlement	False	False	False	No	True	SITAR
2224	282504	4644177	Tomb	False	False	False	Yes	False	SITAR
2225	282537	4644129	Rural Settlement	False	False	False	No	True	SITAR
2226	282332	4643747	Rural Settlement	False	False	False	No	False	SITAR
2227	282472	4643688	Tomb	False	False	False	Yes	False	SITAR
2228	282159	4632857	Acqueduct	False	False	False	No	True	SITAR
2229	280251	4632617	Acqueduct	False	False	False	No	True	SITAR
2230	279144	4632147	Acqueduct	False	False	False	No	True	SITAR

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
2231	284391	4632774	Walls	False	False	False	No	False	SITAR
2232	284160	4632184	Drainage Feature	False	False	False	No	False	SITAR
2233	284658	4632424	Outpost	False	False	False	No	True	SITAR
2234	285243	4632640	Road	False	False	False	No	True	SITAR
2235	285200	4632632	Cippus	False	False	False	No	False	SITAR
2236	285170	4632640	Villa	False	False	False	No	True	SITAR
2237	284544	4634046	Villa	False	False	False	No	True	SITAR
2238	284547	4633896	Rural Settlement	False	False	False	No	False	SITAR
2239	284691	4633563	Rural Settlement	False	False	False	No	True	SITAR
2240	284663	4633549	Drainage Feature	False	False	False	No	True	SITAR
2241	284699	4633554	Road	False	False	False	No	True	SITAR
2242	285339	4633933	Villa	False	False	False	No	True	SITAR
2243	285227	4633217	Rural Settlement	False	False	False	Yes	False	SITAR
2244	285607	4634281	Rural Settlement	False	False	False	No	True	SITAR
2245	285293	4634117	Drainage Feature	False	False	False	No	True	SITAR
2246	286043	4631020	Road	False	False	False	No	False	SITAR
2247	285999	4630656	Road	False	False	False	No	True	SITAR
2248	285784	4631018	Drainage Feature	False	False	False	No	False	SITAR
2249	286235	4630588	Villa	False	False	False	No	True	SITAR
2250	286368	4630310	Villa	False	False	False	No	True	SITAR
2251	286797	4630442	Tomb	False	False	False	No	True	SITAR
2252	286520	4630914	Rural Settlement	False	False	True	Yes	False	SITAR
2253	289739	4629002	Tomb	False	False	False	No	True	SITAR
2254	289521	4627371	Drainage Feature	False	False	False	No	False	SITAR
2255	289430	4624464	Villa	False	False	False	No	True	SITAR
2256	288715	4632536	Road	False	False	False	No	True	SITAR
2258	288715	4632640	Mansio	False	False	False	No	True	SITAR
2259	288682	4632395	Tomb	False	False	False	No	True	SITAR
2260	287105	4632902	Road	False	False	False	No	True	SITAR
2261	288205	4635382	Rural Settlement	False	False	False	No	True	
2262	289321	4636360	Tomb	False	False	False	No	True	
2263	289081	4636252	Tomb	False	False	False	No	True	
2264	284646	4639498	Rural Settlement	False	False	False	No	True	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
2265	285857	4635246	Road	False	False	False	No	True	
2266	285958	4634823	Road	False	False	False	No	True	
2267	286744	4634439	Tomb	False	False	False	No	True	
2268	288537	4631346	Road	False	False	False	No	True	
2269	289910	4632454	Tomb	False	False	False	No	True	
2270	291865	4627285	Villa	False	False	False	No	True	
2271	291552	4626254	Tomb	False	False	False	No	False	
2272	291707	4626289	Drainage Feature	False	False	False	No	False	
2273	292071	4626015	Road	False	False	False	No	False	
2274	279127	4630255	Villa	False	False	False	Yes	True	
2275	282631	4630046	Road	False	False	False	No	True	
2276	280416	4630741	Nucleated Site	False	False	True	Yes	False	
2277	278711	4632703	Road	False	False	False	No	True	
2278	275122	4630366	Road	False	False	False	No	True	
2279	273868	4629214	Acqueduct	False	False	False	No	True	
2280	277546	4631559	Rural Settlement	False	False	False	No	True	
2281	278785	4632165	Tomb	False	False	False	No	True	
2282	275521	4628844	Rural Settlement	False	False	True	No	False	
2283	274926	4626275	Findspot	False	False	True	No	False	
2284	287648	4625075	Nucleated Site	False	False	False	Yes	False	
2285	273667	4625897	Port	False	False	False	No	False	
2286	272514	4628489	Outpost	False	False	False	No	False	
2287	282965	4630081	Road	False	False	False	No	False	
2288	282184	4643819	Villa	False	False	False	No	True	
2289	283677	4628266	Villa	False	False	False	No	True	
2290	283650	4628323	Tomb	False	False	False	No	False	
2291	271407	4636364	Working Site	False	False	False	No	False	
2292	271311	4636303	Working Site	False	False	False	No	False	
2293	271435	4636166	Working Site	False	False	False	No	False	
2294	271223	4636212	Rural Settlement	True	False	False	No	False	
2295	271322	4636074	Rural Settlement	False	True	False	No	False	
2296	271177	4636035	Rural Settlement	False	False	True	No	False	
2297	271120	4635897	Rural Settlement	False	True	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
2298	271082	4635932	Rural Settlement	False	True	False	No	False	
2299	271156	4636311	Rural Settlement	False	True	False	No	False	
2300	270703	4636717	Rural Settlement	False	True	False	No	False	
2301	269979	4637749	Rural Settlement	False	True	False	No	False	
2302	270032	4637675	Rural Settlement	False	True	False	No	False	
2303	270170	4637435	Rural Settlement	False	False	True	No	False	
2304	270092	4637558	Rural Settlement	True	False	False	No	False	
2305	278627	4640247	Nucleated Site	False	False	False	No	False	
2306	279102	4643154	Rural Settlement	True	False	False	No	False	
2307	278329	4640104	Rural Settlement	True	True	True	No	False	
2308	275943	4644149	Rural Settlement	True	False	False	No	False	
2309	275841	4644406	Rural Settlement	True	False	False	No	False	
2310	277325	4643899	Rural Settlement	True	False	False	No	False	
2311	279369	4643525	Rural Settlement	False	False	True	No	False	
2312	277751	4639427	Rural Settlement	True	True	False	No	False	
2313	278102	4638936	Rural Settlement	True	True	False	No	False	
2314	276161	4635070	Rural Settlement	True	True	False	No	False	
2315	276829	4639590	Rural Settlement	True	True	False	No	False	
2316	276747	4639572	Rural Settlement	True	True	False	No	False	
2317	276756	4639699	Rural Settlement	True	True	False	No	False	
2318	276547	4639200	Rural Settlement	True	True	False	No	False	
2319	276829	4636890	Rural Settlement	True	True	False	No	False	
2320	277251	4636213	Rural Settlement	False	True	False	No	False	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
2321	276425	4639295	Rural Settlement	True	True	False	No	False	
2322	278176	4638723	Rural Settlement	True	True	False	No	False	
2323	276978	4636127	Rural Settlement	True	True	False	No	False	
2324	278413	4639651	Rural Settlement	False	False	True	No	False	
2325	278139	4639516	Rural Settlement	False	False	True	No	False	
2327	277297	4638101	Rural Settlement	False	False	False	Yes	False	
2328	289031	4627718	Rural Settlement	True	False	False	No	False	
2329	288345	4626054	Rural Settlement	True	False	False	No	False	
2330	286946	4627375	Rural Settlement	False	True	True	No	False	
2331	294400	4620356	Rural Settlement	False	True	True	No	False	
2332	294808	4620330	Rural Settlement	False	True	True	No	False	
2333	294710	4620867	Rural Settlement	False	True	True	No	False	
2334	290168	4620612	Rural Settlement	False	False	True	No	False	
2335	286475	4627839	Rural Settlement	False	False	True	No	False	
2336	288520	4626768	Rural Settlement	False	False	True	No	False	
2337	287135	4625341	Rural Settlement	False	False	True	No	False	
2338	287653	4625074	Rural Settlement	False	False	True	No	False	
2339	276080	4640931	Rural Settlement	False	False	False	No	True	
2340	276080	4637571	Rural Settlement	False	False	False	No	True	
2341	285209	4632613	Rural Settlement	False	False	False	No	True	
2342	285280	4633911	Rural Settlement	False	False	False	No	True	
2343	279303	4629853	Rural Settlement	False	False	False	No	True	
2344	286855	4632415	Rural Settlement	False	False	False	No	True	

Site_ID	UTM33N_X	UTM33N_Y	Site_Type_1	Neolithic	Eneolithic	Bronze Age	Protohistoric Iron Age	Roman	References
2345	287032	4631846	Rural Settlement	False	False	False	No	True	
2346	279285	4621102	Rural Settlement	False	False	False	No	True	
2347	280269	4620250	Rural Settlement	False	False	False	No	True	
2348	280869	4619634	Rural Settlement	False	False	False	No	True	
2349	288378	4626180	Nucleated Site	False	False	True	No	False	
2350	290112	4615345	Rural Settlement	False	False	False	No	False	
2351	290005	4614732	Rural Settlement	False	False	False	No	False	
2352	290005	4614732	Rural Settlement	False	False	False	No	False	
2353	290285	4615403	Rural Settlement	False	False	False	No	False	
2354	281559	4619468	Rural Settlement	False	False	True	No	False	
2355	278982	4629348	Villa	False	False	False	No	True	
2356	278516	4630223	Villa	False	False	False	No	True	
2357	279122	4630255	Villa	False	False	False	No	True	
2358	279583	4629208	Villa	False	False	False	No	True	
2360	279305	4629834	Villa	False	False	False	No	True	

Appendix 2: Modelling Terrain to Create a Pre-Modern Landscape

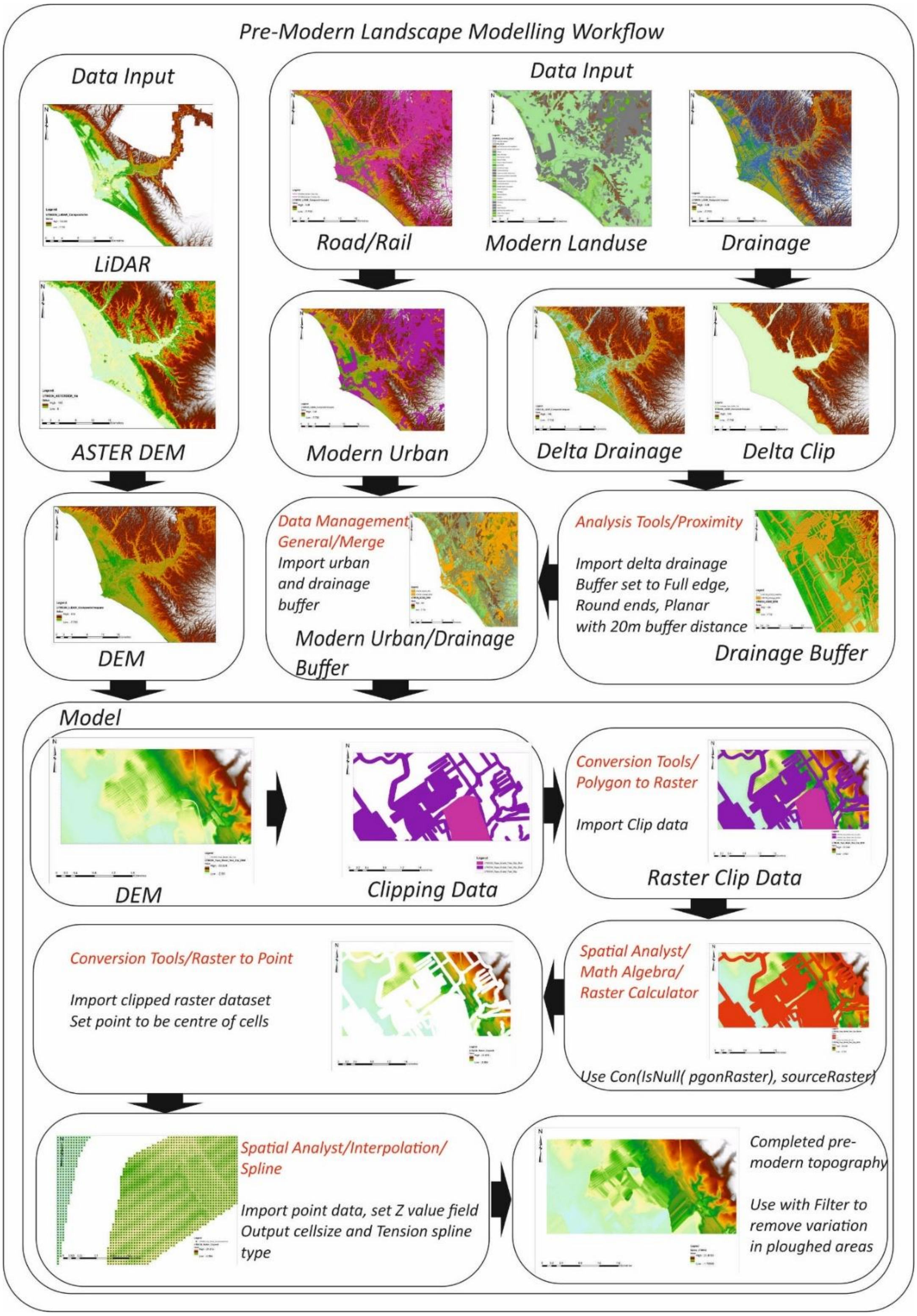
2.1 Introduction

The combined LiDAR and ASTER DEM, while creating a comprehensive topographic dataset for the study are, produced certain limitations in terms of the affect of modern infrastructure represented in the data. While the DTM LiDAR data provided a dataset with many of the buildings, tree canopies and other effects on the toipography removed, some modern features remained, most demonstrably those representing large modern features such as the drainage channels of the Bonifica, modern roads and rail services, and large infrastructure complexes such as the buildings and runways of the airport at Fiumicino.

To remove or limit the effects of these features, it was decided to attempt to revalidate the topographic raster data using polygons from coverages of modern infrastructure. While a summary of the process is given above, together with the finished datasets, this appendix outlines the workflow and procedure used. The methodology utilised the work of (Schmidt, Werther and Zielhofer, 2018) in modelling a pre-modern area of landscape in northern Europe. In this case, however, ArcGIS was used to conduct the work.

2.2 Data Preparation

Modelling of the pre-modern landscape requires the incorporation of data showing the extent of modern urban features. Thus three coverages were used to run the process; the modern drainage, road and rail routes, and the urban and built environment polygons from the land use data. These vector datasets were used together with the DEM derived from the resampled and integrated ASTER DEM and LiDAR data. The drainage coverage contained a significant number of watercourse that marked the line of the natural water features in the tributary valleys of the delta and Tiber valley. However, a large number of man-made drainage features required removal from the model. To remove the natural stream and leave the man-made drainage features in place a basic polygon feature class was created and the area of the Tiber delta and lower reaches of the larger tributary valley was digitised. The polygon was then used to clip (Analysis Tools/Extract/Clip) the drainage vector dataset.



App 2.1 Basic workflow for the processing of the topographic and modelling data for producing a topographic dataset of the pre-modern landscape

The road and rail data were derived from datasets from OpenStreetMap, under the Open Database License 1.0 (www.openstreetmap.org). Both the derived drainage polylines and the road and railway polylines formed the basis of a vector coverage designed to blank out modern topographic variations caused by drainage, road and rail features respectively. In order for the data to do this the polyline datasets were merged (Data Management/General/Merge) into one single polyline dataset. This was then processed using a buffer function (Analysis Tools/Proximity/Buffer) with full edges, round ends and a 20m buffer distance, to produce a polygon dataset for the features.

A new dataset was also derived from the land use vector data, utilising the polygons associated with modern infrastructure and disturbance.

To create a modern feature polygon dataset to use in clipping the topography, all polygons from both datasets were merged into one feature class. The merge function under the Editor menu was then used to merge the different polygons into one polygon. At this stage two datasets were ready for moving onto the modelling stage; the DEM and the polygon feature class.

2.3 Modelling of the Pre-Modern Topography

Several stages were necessary to arrive at the final pre-modern landscape raster. Firstly the DEM and clipping datasets were overlaid to ensure that features that required masking out were correctly positioned in relation to the clipping feature class. No function exists in ArcGIS to successfully use the vector polygon to remove the data within the polygon from the raster dataset (see SetNull as a possible function but with limitations). Thus the vector feature class was converted to a raster dataset (Conversion Tools/To Raster/Polygon to Raster). The raster calculator (Spatial Analyst/Math Algebra/Raster Calculator) was then used with the sql script 'Con(IsNull(pgonRaster), sourceRaster)' to derive a raster dataset with the cells removed from the area covered by the raster mask.

To interpolate new topographic values for the removed cells using a spline function, the raster dataset had to be converted to a point feature class. Thus the raster to point (Conversion Tools/From Raster/Raster to Point) was used with point values set to the centre off the raster cells. This new feature class was then used with the Spline Interpolation function (Spatial Analyst/Interpolation/Spline) with a Tension type of spline. This function creates the modelled topographic raster dataset.

Appendix 3: Remote Sensing and Geophysical Survey Methods

3.1 Development of Remote Sensing

For archaeological purposes, one of the first uses of satellite imagery was for the identification of ancient Hohokum canal systems in the USA (Giardino 2011; 2003) utilizing black and white and infrared photography (Schaber and Gumerman, 1969), and the use of satellite photography to study images of Messenia, Greece, and the site of Cosa in Tuscany. Realizing the utility of satellite imagery for archaeological approaches, a report was commissioned by NASA which summarized six projects using NASA data (Giardino 2011, 2004) and highlighting the potential for future archaeological application of the technology The launch of the Skylab missions in the 1970s added 35,000 images to the archives of earth photographs (Giardino 2011, 2004). However it was the 1971 launch of the Earth Resources Technology Satellites (ERTS 1) which helped revolutionize archaeological research using remote sensing (Giardino, 2011). The programme was later renamed Landsat, and provided the base for Multispectral Scanner (MSS) and Thematic Mapper (TM) data collection. These technological developments occurred in parallel with increased use of remote sensing by the USA National Parks Service for identification of archaeological sites.

3.2 Principles of Satellite Imagery Collection

Collection of satellite imagery is based on satellite platforms orbiting the globe at a height of up to 36,000km above the earth[50]. A range of different cameras and sensors are carried by satellite, allowing collection of imagery and data. Image collection such as visible light photography and multispectral imagery is based on collection of light from the electromagnetic spectrum (Campbell 1996, 22). All objects emit electromagnetic radiation, in some cases reflecting radiation emitted by other objects, and it is an understanding of

[50] The elevation of 36,000km provides a satellite with the same period as the earth, meaning that the satellite would remain in a geostationary orbit, ideal meteorological and communications satellites (Campbell 1996, 159)

these principles and the behaviour of the radiation as it passes through the earth's atmosphere that forms the basis of image analysis.

Electromagnetic energy is generated at an atomic level by changing energy levels in electrons, by acceleration of electrical charges, decay of radioactive substances and thermal motion of atoms and molecules. Some energy is reflected back to the earth by the planet's atmosphere, however, the natural and man-made radiation that passes through the atmosphere forms the basis of remote sensing (Campbell, 1996).

Electromagnetic radiation consists of an electrical field E that varies in magnitude in a direction perpendicular to that of propagation (fig. x). A magnetic field H is orientated at right angles to the electrical field and is propagated in phase with E (Campbell 1996, 23). The speed of electromagnetic energy (C) is constant at 299,893 km/s-1:

$$C = \lambda v \quad \text{where } \lambda \text{ is the wavelength}$$
$$\text{And } v \text{ is the frequency}$$

Dependent on the wavelength of the energy, different electromagnetic radiation is emitted (Table 3.1)

Division	**Range of Wavelength**
Gamma Rays	0.03nm
X Rays	0.03-300nm
Ultraviolet radiation	0.30-0.38µm
Visible	0.38-0.72µm
Infrared Radiation	
Near infrared	0.72-1.30µm
Mid infrared	1.30-3.00µm
Far infrared	7.00-1,000µm (1mm)
Microwave Radiation	1-300mm
Radio	≥300mm

Table 3.1 Principal divisions of the Electromagnetic Spectrum

Among these different divisions of the electromagnetic spectrum, several pertain to satellite image analysis and, in particular, to archaeological research.

3.2.1 Ultraviolet Spectrum

This represents a zone of short wavelength between the X ray and visible spectra. This part of the spectrum was discovered in 1801 by Johann Wilhelm Rutter. The division is also sub-divided into near and far. This electromagnetic radiation is easily dispersed by the earth's atmosphere so has more application for ground-based or near-earth forms of sensor platforms.

3.2.2 Visible Spectrum

An obvious area for remote sensing, this form of electromagnetic radiation is used for black and white and colour photography. Sensors record the radiation as proportions of blue, green and red light.

3.2.3 Infrared Spectrum

Discovered in 1800 by British astronomer William Herschel, this division of the spectrum encompasses radiation with a variety of properties. Near infrared survey can utilise conventional camera with filters. The application of far infrared, relating to emission of thermal energy, is of particular interest and use for detecting archaeological deposits.

3.2.4 Microwave Energy

Work in this spectrum originated with Jones Clerk Maxwell and Heinrich Hertz.

In considering results of satellite remote sensing for analysis, the interaction of the radiation with the earth's atmosphere and with surfaces from which the radiation is being reflected both need to be considered (Campbell, 1996). Whereas effects from atmosphere on data from sensors carried by low-flying aircraft are negligible, the effects of the earth's atmosphere on satellite-based imagery are more constraining. Scattering of radiation caused by energy particles in atmospheric gases is one consideration, together with absorption caused by ozone oxygen. In addition refraction of rays of light caused by humidity and temperature may affect the results of remote sensing. Ultimately the most appropriate data is collected from radiation passing through atmospheric windows where the radiation is relatively unimpeded.

The spectral properties of objects affect the nature of the radiation being emitted. Dependent on the surfaces reflection of electromagnetic radiation may be specular or diffuse, with the former representing a potentially clearer resulting image. However, specular data are also affected by distance and time and are less use for detail of potential features (Campbell 1996, 39).

3.3 Geophysical Survey Rationale and Methods

Use of geophysical survey for mapping the nature and extent of buried archaeological deposits is commonplace practice. Different methods including earth resistance and magnetometry stemmed from technological developments during and after the Second World War (Clark, 1996) and the creation of research laboratories in the late 1940s and 1950s[51]. Instruments and technology were developed in a number of different laboratories for archaeological research.

3.3.1 Magnetometer Survey

Magnetic prospection of soils is based on the measurement of differences in magnitudes of the earth's magnetic field at points over a specific area. The iron content of a soil provides the basis for its magnetic properties, with the presence of minerals such as magnetite, maghaemite and haematite iron oxides all affecting the magnetic properties of soils (Scollar et al. 1990, 388-390). Although variations in the earth's magnetic field (Fig. 3.1) which are associated with archaeological features are weak, especially considering the overall strength of the magnetic field of between 25 and 65 microtesla (µT) or 25,000 to 65,000 nanotesla (nT).

Three basic types of magnetometer are available to the archaeologist; proton magnetometers, fluxgate gradiometers, and alkali vapour magnetometers (also known as caesium magnetometers, or optically pumped magnetometers). Fluxgate instruments are based around a highly permeable nickel iron alloy core, which is magnetised by the earth's magnetic field, together with an alternating field applied via a primary winding.

[51] These include the Oxford Research Laboratory founded in 1957, and the Lerici Foundation in Italy.

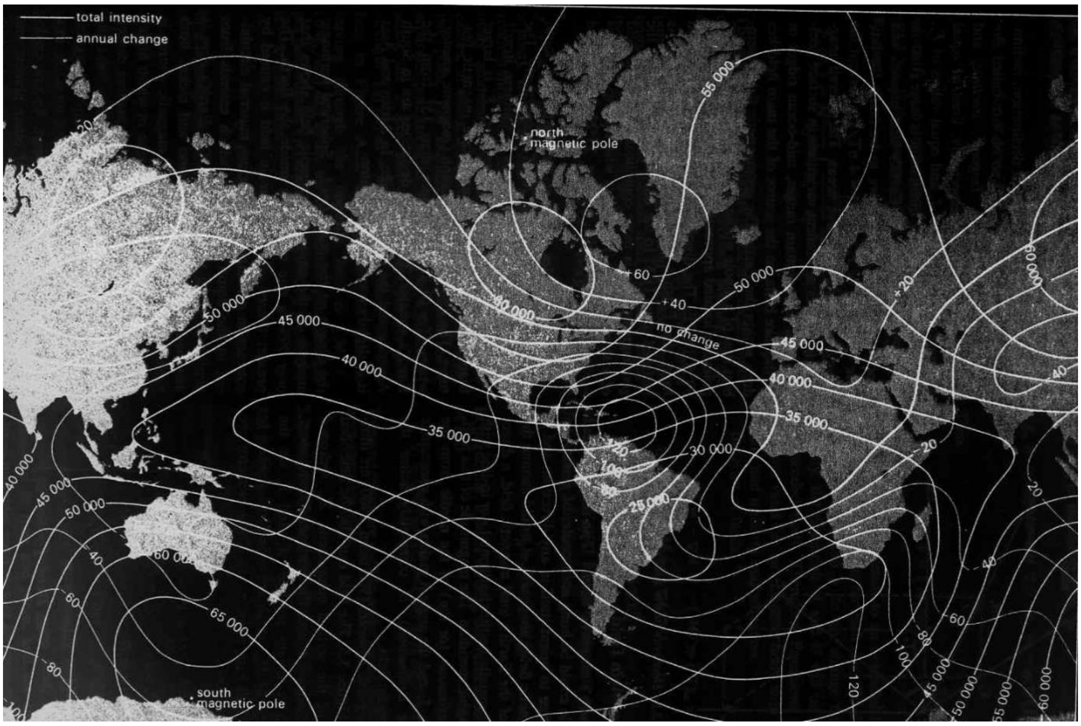


Figure 3.1 Map of the earth showing the total intensity of the magnetic field (Telford 1990, 71)

Due to the fluxgate's directional method of functioning, a single fluxgate cannot be utilised on its own, as it cannot be held at a constant angle to the earth's magnetic field. Gradiometers therefore have two fluxgates positioned vertically to one another on a rigid staff. This reduces the effects of instrument orientation on readings. Fluxgate gradiometers are sensitive to 0.5nT or below depending on the instrument. However, they can rarely detect features which are located deeper than 1m below the surface of the ground. Archaeological features such as brick walls, hearths, kilns and disturbed building material will be represented in the results, as well as more ephemeral changes in soil, allowing location of foundation trenches, pits and ditches. Results are however extremely dependent on the geology of the particular area, and whether the archaeological remains are derived from the same materials.

3.3.2 Earth Resistance and Electrical Resistivity Tomography (ERT)

Resistivity survey is based on principles of electrical resistance, and the ability of sub-surface materials to conduct an electrical current. All materials will allow the passing of an electrical current to a greater or lesser extent. There are extreme cases of conductive and non-conductive material (Scollar et al. 1990, 307), but differences in the structural and chemical make-up of soils mean that there are varying degrees of resistance to an electrical current (Clark 1996, 27).

The technique is based on the passing of an electrical current from probes into the earth to measure variations in resistance over a survey area. Resistance is measured in ohms (Ω), whereas resistivity, the resistance in a given volume of earth, is measured in ohm-metres (Ωm). Four probes are generally utilised for electrical profiling (Gaffney et al. 1991, 2), two current and two potential probes. Survey can be undertaken using a number of different probe arrays; twin probe, Wenner, Double-Dipole, Schlumberger and Square arrays.

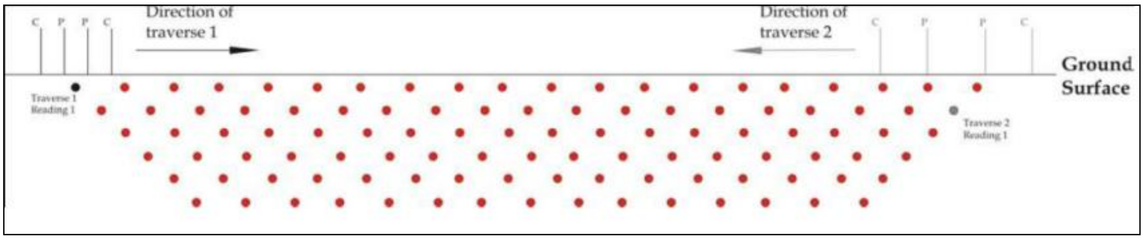


Figure 3.2 Diagram showing the use of an expanding Wenner array to conduct ERT survey

The relatively arid nature of some of the deposits in the Tiber Delta, especially in the summer months, and the use of magnetometry as the most efficient method for survey in the area, precluded the use of earth resistance survey for many of the surveys conducted at Portus, Isola Sacra and Ostia Antica. Some earth resistance was conducted at Portus in 2001 (Keay *et al.*, 2005) and gave a clear indication of the form of magazzini and late antique habitation associated with the port in the vicinity of the Basilica Portuense. However, the varying depth of archaeological and geomorphological deposits has meant that ERT (Fig. 3.2) has proven a better potential system for understanding deposits in the Tiber Delta.

3.3.3 Ground Penetrating Radar (GPR)

Ground Penetrating Radar (GPR) uses an electromagnetic radar wave propagated through the soil to search for changes in soil composition and structures (Conyers & Goodman 1997, 23), measuring the time in nanoseconds (ns) taken for the radar wave to be sent and the reflected wave to return. The variations in the Relative Dielectric Permittivity (RDP) in different deposits produces reflections in the profile data of the survey (Fig. 3.3). Lower frequency survey antennae (50MHz or 100MHz) are generally used for geological survey, whereas higher frequency antennae (250MHz, 500MHz or 800MHz) are utilised for archaeological surveys. The technique has been applied successfully on a range of archaeological sites, in particular over substantial urban archaeological remains (Leckebusch 2001; Neubauer et al. 2002; Gaffney et al. 2004, 207ff; Leckebusch 2001, 52ff; Nishimura & Goodman 2000; Neubauer et al. 2002).

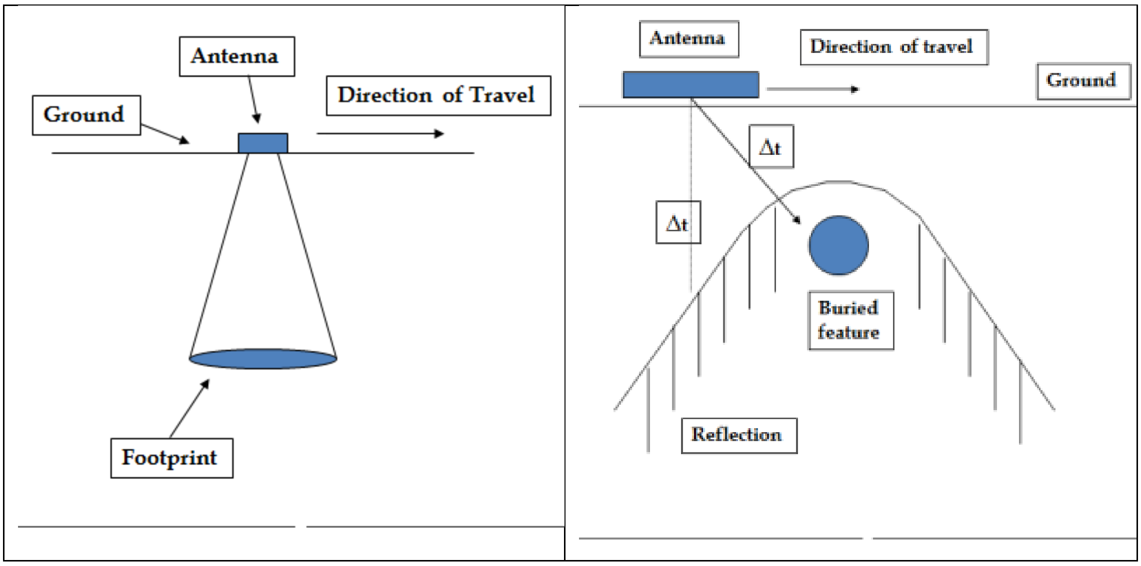


Figure 3.3 Simplified diagrams showing the radar wave footprint for a GPR antenna and the reflection for a circular or ovate object buried under the ground and the antenna moves across it (after Conyers & Goodman 1997)