Collapse, Continuity, or Growth? Investigating agricultural change through architectural proxies at the end of the Bronze Age in southern Britain and Denmark

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Abstract

At the end of the Bronze Age in Europe, new iron technologies and the waning of access to long-distance exchange routes had consequences for social organization, creating changes in social priorities. There is a recursive relationship between the political structure, exchange, and agricultural production, as each informs the other; what, then, was the impact of social reorganization on agricultural production? Through an investigation of domestic architecture, using dwellings, pits, and post-structures as proxies for production and consumption, this study explored a model focused on the changes in energy invested in domestic architecture within and between settlements from the Middle Bronze Age to the Early Iron Age to better understand the impact of socio-technical change on agricultural production in southern Britain and Denmark. Changes in productive (dwellings) and consumptive (pits and post-structures) architecture track a potential measure of agricultural production, demonstrating directly the effect of the wide sweeping social and economic changes, whether of decline, continuity, or growth, on agricultural activities.

If growth or even continuity is present in agricultural production during the final years of the Bronze Age, how can we account for it? By relating the changes in area and volume provided by domestic structures to energy, we can compare the effort expended on productive and consumptive architecture between settlements, constructing a geography of production that allows for further consideration of inter-settlement interaction. Sub-regional analysis within southern Britain and Denmark provided further detail regarding productive capacity on a site-by-site basis, permitting possible producer versus consumer relations to emerge.

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Introduction

Social change at the end of the European Bronze Age has been a focal point for archaeological research for decades. Every new theoretical paradigm has had a say in determining the cause and effects of the reorganization in the social order coinciding with the collapse of the long-distance exchange networks of the Bronze Age. Multiple facets of society, from prestige goods to cosmology, have been investigated in terms of change due to new technologies and a lack of access to established exchange routes (*e.g.* Gilman 1981, Friedman and Rowlands 1977, Frankenstein and Rowlands 1978, Renfrew 1986, Earle 1994, Brück 2000, Kristiansen and Larssen 2005). This study seeks to understand the impact of the fading exchange networks and new iron technologies on agricultural production, through the changes in domestic architecture in southern Britain and Denmark, regions with distinct cultural traits and discrete access to central European exchange routes. Past modelling for the Bronze Age to Iron Age transition across Europe has presented a recursive relationship of agricultural production as a function of the political structure, which in turn was a function of the ability to access long-distance exchange networks in order to gain access to the metal supplies necessary for agricultural production. The models (*e.g.* Friedman and Rowlands 1970, Renfrew 1986) therefore assumed loss of access to the long-distance exchange networks, already declining in the face of the introduction of iron, would dictate a cessation or decline in agricultural production as the social structure was forced to reorganize. Continuity or increase in agricultural efforts during the observed social restructuring is not accounted for in those models, and it is only recently that networks on local or regional scale, likely supporting the long-distance networks, have been considered as rising to the fore to maintain agricultural production during political reorganization from the new technologies and changing means of achieving status (Knappett 2011, Sharples 2013). Agricultural production in its own right has only come under scrutiny as an independent activity, rather than as a function of political power, in the recent past. Analysis of caches of carbonised grain (*e.g.* van der Veen and Jones 2006) and identification of field systems (*e.g.* Yates 1999, 2007; Johnston 2011) produce evidence of arable agriculture and provide details of species and investment in the land, yet patterns of production and consumption over time have seldom been studied discretely on a larger than settlement by settlement basis.

The questions being asked here are concerned with agricultural production in both southern Britain and Denmark, as examples of lowland northern Europe, over the period of transition, how we can recognize patterns of agricultural production/consumption through energy invested in architecture, and the possibilities such a model allows. This study utilized domestic architecture, in the form of dwellings and both subterranean and above ground storage, as proxy for settlement population and agricultural production/consumption. Dwellings, defined as roofed living and activity area (see Chapter IV for further detail), provide information regarding changes to the population. The number of dwellings per settlement indicates change in the structure of each settlement over time, for example a possible shift from a single-family farmstead to multiple families living together in village-like settlements, which directly relates to the available labour force and the number of on-site consumers. Changes in the total roofed area of buildings designated as dwellings signify growth or decline in the population of settlements within each region and a comparison over time provides critical information regarding alterations in settlement organization (see Chapter V and VII). Structures identified as processing/storage/crafting areas, namely subterranean pits or 4- to 6- post structures (see Chapter IV for further detail), were measured for total volume and additional area per settlement to provide a maximum consumptive capacity per settlement, per period. Changes in capacity over time illuminate trends in agricultural production and consumption, which directly address the question of the nature of agricultural production over the Bronze Age-Iron Age transition.

Regional analysis within both southern Britain and Denmark provides more in-depth details regarding patterns in energy expended toward activities for the maintenance of life (see Chapter VI and VIII). The division of settlements into their appropriate geologic regions indicates whether settlements on particular soils and landscapes were more successful agriculturally than others. Additionally, tracing consumption, via settlement evidence, over time between regions demonstrates contemporary awareness of both climatic conditions and soil productivity. Regional analysis also more clearly indicates the possibility of inter and intra-regional contact through comparison of consumption in each period. As each region presented a unique environment and therefore productivity, examining regional patterns of storage capacity over time highlights possible nodes of production. Settlements considered as active nodes of potential, gauged by population through number and total space of dwellings and productive and consumptive capacity through number and total space of storage structures, allows for an ebb and flow of grain on a sliding scale of geographical distance and provides a possible alternative model for understanding the intricacies of agricultural production at the end of the Bronze Age.

The essence of this project is to investigate, through domestic architecture, the maintenance of settlements in a productive/consumptive sense, during the period of change in flow of metal supplies via long-distance exchange networks, along with the impact of introduction of iron technologies. Are architectural proxies a viable method of measuring potential agricultural production and consumption? How does the energy invested in productive and consumptive architecture change over a period of new technologies and changing social priorities?

Chapter I: Social theory and the move toward dynamism

This preliminary chapter discusses the theoretical models that had, or continue to have, an impact on our thoughts regarding social change, leading to a discussion of the theoretical approach for this study. The move from static social typologies to an understanding of the dynamic flow of energy as both cause and effect of social continuity and change is given particular attention. The strengths and critical shortcomings of previous models are discussed in depth, leading into a discussion of the benefits of approaching social change, particularly one concerned with technological change such as that of the end of the Bronze Age into the Iron Age, as fluid, dynamic, and ultimately dependent on the interplay between people, objects, and the natural world.

1.1 Social theory: how we model change

The overarching target of this thesis is to approach the very obvious change in technology and social organization at the end of the European Bronze Age and into the Early Iron Age from a perspective of the dynamic interplay and exchange of energy, especially that of production and consumption, between people, objects, and the natural world. Such a perception of social change is based on an older idea (*e.g.* White 1943) that has occasionally been revisited and redeveloped over time (*e.g.* Binford 1962, Adams 1978, Latour 2005, Cottrell 2009), and deserves to be investigated fully. This study makes no claim to be a comprehensive and definitive statement of the consideration of social change, here understood as both creating and created by social-material-biological relationships. Instead, it seeks to begin a discussion of the value of such a model, particularly when contrasted against previous theoretical thought regarding change within the 'social'. While social change has been modelled very differently throughout the existence of archaeological thought on the matter, the paradigms may be generally grouped into two forms: those that treat society as static, something to be neatly parcelled and labelled, and those that allow for a more fluid entity, uncovering and respecting a dynamic social order. In order to explore the more active approaches with which this study is interested, it is necessary to discuss and discard those stagnant models of social typologies to ensure a lack of confusion regarding the stress on social change as a omnipresent flowing, relational possibility. In an attempt to avoid a lengthy, cumbersome chronological progression of social theory, past and present, this chapter will focus on first, social typologies and systems theory, and second, the structuralist and network models that explore instances of social fluctuation at least to some extent.

1.2 Static models: society as immovable and concrete

The earlier models discussed here sought to establish an understanding of discrete elements of society rather than explore active and on-going relationships between social and material components. Most simply, they employed an organic or machine-like analogy for societies as bounded machine-like systems. In order to establish a foundation for legitimating a fluid, dynamic model concerned with the exchange of energy between people, their habitat, and the material and natural world, the failings of the early models will be addressed. Social typologies in the early 20th century (Childe 1929, 1932, 1939; Kidder 1924), following on from Montelius' late 19th century work on the chronology of European prehistory, set the stage for acceptance of social change as an inevitable occurrence without understanding of the whys and wherefores attendant to it. Typologies sought instead to place societies in neat categories on the basis of organisation represented by patterns of material culture without consideration of how each arrived at a particular 'stage' (Trigger 1989). Societal change was regarded as an ill-defined evolutionary process moving from one typological stage to the next, as changing social complexity was considered in terms of a linear progression from 'primitive' toward 'civilization' (Morgan 1877). Superimposing a predetermined, specific 'type' of society on the basis of similar patterns of the material record allowed social change to be considered *fait accompli*, rather than something to be investigated in its own right. Energy was instead expended on analysis of material culture as a proxy for society, rather than an attempt to puzzle out the more evasive social structure and change thereof. There was also a distinct partitioning between 'spheres' of research, those termed 'social', 'environmental', 'economic', and 'political', which created difficulties for any consideration of interaction, influence, or overlap between the purportedly independent categories responsible for social change.

Such statically typological notations used in regard to social change carried into the later 20th century. The 1960s and 1970s were dominated by the principally nomothetic processual theory, which focused on generating laws and generalizations with cross-cultural application in order to predict social trajectories, which failed to deliver an understanding of change. New models were driven by the concept that a 'New Archaeology' could progress beyond artefact classification and begin to approach the past anthropologically (Binford 1962, Clarke 1968). Typological processes were even applied to fundamental archaeological processes. A series of 'theories' typified the various processes within archaeology (Clarke 1973). Predepositional theory addressed relationships between society, the environment, and their attendant activities, which direct deposition of an artefact as part of the archaeological record. Postdepositional theory delineated taphonomic processes, such as erosion, which act on an artefact after deposition. Finally, interpretative theory described how archaeologists should relate the artefact to its original social context. The last was specifically essential to the development of contemporary theory regarding social change, in that the artefacts remained the bulk of data regarding past societies available to be analysed. Social change, however, continued to be regarded in terms of the band/tribe/chiefdom/state sequence (White 1959, Sahlins and Service 1960, Service 1962, Sahlins 1968), as each stage of the sequence was believed to have evolved from the former in a linear progression. This critically limited the achievable comprehension of *how* and *why* the social organization manifested in a specific manner. The interest toward determining generalised statements regarding the state of the social order, rather than examining why a society's particular organization was reproduced and developed over time, allowed material cultural patterns to simply be charted onto a type of social organisation for identification, which followed the research aims of the era by seeking to construct laws of social change. In doing so, however, social typologists merely propagated acceptance of social change as fact.

The result of the new archaeological programmes was the creation of a dichotomy between human action and the social system that failed to fully appreciate that the former created the latter and avoided discussion of the actual causation of change. Functionalism rose to prominence as the theoretical framework of the New Archaeology, and continued the organic analogy derived from the sociological work of Spencer (1897) and Durkheim (1893, 1897): functionalism described the way in which society is like an organism with specific needs that must be met, sustained by particular social institutions analogous to the organs of a body. Each part of society could therefore be considered as a component of the 'social body' in serving some need and reproducing a stable system through the relationships of one aspect to another (Spencer 1897). Given that a 'body' must remain in a stable state to continue in existence, functional models were of a necessity focused on the adaptation of a system seeking equilibrium. Social change, realized by alterations in material culture, was considered reactive in order to preserve equilibrium (Durkheim 1893). Consideration of the 'adaptation' of society to stimuli, particularly the environment, remained a principally non-transformative process of an ambiguous change in one social institution sparking a reciprocal shift in another until equilibrium is re-established, refuting the dynamic interaction between factors influencing the reproduction and transformation of the social order. The social order was thought to exist to control the individual through the creation of standard behavioural patterns aimed at meeting the needs of society, rather than being a function of the relationships between people and the material world (Pope 1975).

Systems theory was developed as a means to describe and analyze the social realm in generalized terms, but at the cost of a disadvantage to our understanding of social reproduction and change. Society was considered a system of behavioural patterns satisfying systemic requirements and connected by a feedback loop of either negative feedback, stabilizing a system leaning toward instability, or positive feedback, allowing for deviation in the functioning of one subsystem in order to reach a new level of stability (Flannery 1968). Systems theory therefore described how a social system adjusts to equilibrium through change within a system, or change coming from external pressure on one or more subsystems, resulting in a shift in typical functioning, or maladaptation in the others (Rappaport 1977). Explanations and implications of social change, which is unavoidable in a social world, were not fully addressed, and undeniably made the application of systems theory problematic (Shanks and Tilley 1987). Overall, the relations between subsystems merely furnished the perception a static structure as the system sought to maintain its form to continue to meet social needs. There was still a lack of consideration of dynamic, shifting internal and external relationships as both cause and effect of the social order, and only an acknowledgement that there was said change.

A unlooked for and coincidental outcome of systems theory and its critique was that its omissions in the capability to deal with change provided critics the opportunity to consider manifold, interrelated causes of social change, rather than focus on a single aspect, through deliberation on the flaws inherent to systems theory. The oft-mentioned shortcomings included a lack of reason for artefacts to take a specific form (as opposed to satisfying a functional requirement) and that the landscape was regarded as simply a backdrop for adaptive response rather than an active participant in the formation of the archaeological record. Also difficult was that the guiding assertion that all social systems pursue homeostasis rebuffs the need to comprehend the genesis and morphology of social change (Shanks and Tilley 1987, Hodder 1992). Put simply, systems theory accounted only for cosmetic fluctuations in the subsystems to be noted. Comprehensive social change required an inherent conflict between the social objectives of groups, technologies, and the ecology. A push-and-pull of influence between any linked and competing elements making up the social order will affect the very foundations of the social structure and requires recognition of such change, which, as Salmon (1978) argues, is not possible with the theoretical vagueness of systems theory, although it does open the door for a further theoretical model encompassing a broader perspective. To move past the limits of systems theory, a changeable and changing social organization, along with the associated environmental and economic shifts that had an impact thereon and were themselves affected in return, should be considered together in terms of their respective relationships in order to explain, as well as define, social change.

1.3 Dynamic models: society as fluid and mutable

Now that the static, or at least stability-seeking, models of society have been discussed, we must turn our attention to those models that do acknowledge the process of transforming the social structure and seek to explain it. Some models, such as Friedman and Rowlands' (1977) structural Marxist epigenetic model, developed as a direct response to the prior problematic models, while others also reinterpreted older sociological ideas, such as agency. Although the models approached social change in a variety of ways, they all shared an emphasis on structural transformation as inherent to social institutions acting on and within environmental contexts, and therefore that change rather than stability might have been the norm. This was arguably one of the most significant achievements of social theory in archaeology in the later 20th century.

To rectify the issues of systems theory, attention focused on the exchange between resources, control, and the consequential establishment of status or ranking systems, allowing for economic networks that circulated materials and people to begin to be acknowledged as essential in understanding the dynamic formation of prehistoric society. Exchange, as it is currently understood, is therefore an active and transformative process. Irwin-Williams (1977: 143) defines exchange as "a form of interaction that creates and reflects specific socio-economic linkages between…social systems over a wide range of size and complexity." Mechanisms of exchange operate not merely to convey physical objects, but also to inform and reinforce social institutions. The formation and maintenance of a status system based on prestige-goods in the Bronze Age serves as a strong example of the social aspects of exchange. Hodder (1980: 199) succinctly encapsulates the byplay between social constructs and exchange, stating, "an exchange act involves an appropriate choice of gift within a social and ideological context…its associations and symbolism play an active part in the construction of social strategies." It has generally been accepted from the late 20th century (Polanyi *et al.* 1971, Hodder 1980, Pred 1984, Champion *et al.* 1984, Champion 1994) that exchange is 'embedded' within the social framework. There is therefore a recursive relationship in which social institutions come into being through exchange, while the processes of exchange are simultaneously required to validate the social institutions that uphold a particular social structure (Wright and Zeder 1977). Consequently, understanding social change requires an awareness of exchange, and the reverse, as one affects the other. Exchange is observable through the diffusion of physical objects, but it is also intrinsically fixed to the introduction of technologies and other intangible cultural facets, as well as the social restructuring that occurs with the inception of a new idea. Kohl (1975), Gilman (1981), Friedman and Rowlands (1977), Needham (2007), and Rowlands (1980), among others, have addressed social change as related to the control of resources and production, albeit through dissimilar means, yet there remains a need for acknowledgement of the social totality of exchange and its mechanisms. Production is a considerable facet of exchange relationships, but it must be examined in conjunction with the social organisation of labour, the social significance of consumption, and the social relationships formed through the exchange of things that are themselves active in structuring particular kinds of exchange relationship.

The economic direction of thought is exemplified by the Marxist critique of systems theory, which declared change resulted from internal pressures, with the conflicts of a fundamental, structural socio-economic relationship as the basis for change (Patterson 2003, Shanks and Tilley 1987). Certainly, Friedman and Rowlands (1977) considered the dynamic relationships of exchange and production crucial for change within the social context to occur. Friedman and Rowlands asserted that there are no static stages to culture, abolishing the rationale behind the earlier problematic typologies. Instead, the possibility for change is always present within social systems. This developed into the starting point for a profusion of models addressing social change as a function of shifting economic relationships. The motive for change in their structural Marxist model, instead of originating outside the system, lay with the relations of production combined with inter-societal interactions of competitive exchange and consumption (Friedman and Rowlands 1977). The model also directly addressed the major issues with previous functional approaches, arguing against constricting categories of social typologies. Instead, they suggested the critical point that stages or periods are simply segments of constant advancement generated by common structural conditions and not, therefore, discrete categories in themselves. Such stages can be used to interpret social order at that particular temporal point. Friedman and Rowlands stressed that social change is necessarily both a spatial and temporal event, providing a direct contrast to earlier models, and adding an increased dimensionality to consideration of change in social structures through temporally-bound social reproduction enacted by means of the medium of socially-delineated material culture production and exchange. Such spatial-temporal modelling is an essential component of understanding social change and has carried through into more recent modelling, particularly the network analysis model discussed later.

Despite their contributions to understanding social change, Friedman and Rowlands' model fails to provide adequate focus on the relationship between social and material components. Exchange, and the associations generated from such activities, certainly has a vast impact on social organization, primarily as production and consumption work together via exchange to construct and reproduce a distinct expression of social organization that is similarly reliant on environmental conditions to preserve access to resources. The model, however, maintains a division between the social and economic 'spheres' through the inability to consider a reciprocal relationship between social change and economic relationships. Per the model, social change occurs due to social demands resulting in changes to production, rather than allowing for technological changes to affect production and therefore impact the social order. This downplays the very conflicts between ecological and technological concerns and the demands of consumption and production Friedman and Rowlands acknowledge are at the heart of social change. Through seeking to explain wide-ranging economic interactions causing social change, the model exemplifies the challenges of a world systems perspective.

World systems theory came into prominence as a more dynamic approach to understanding geographical relationships between social units previously considered as discrete. Originally conceived by Wallerstein (1974) to describe the power relations of capitalism, world systems theory presented social units as geographically related (termed core, periphery, and margin, and intimating a scale of economic prominence) connected by networks of exploitation and exchange relationships (Sherratt and Sherratt 1991, 1993). The adoption of world systems theory into prehistoric archaeology furthered the discussion of social change as a function of exchange, as shifts in one region were acknowledged as determining shifts in the others as the flow of goods changed. The two major models formed under world systems theory, the core-periphery and peer-polity models, attempted to explain the structural aspect of social change by determining the relations of ranked societies through contact. The world systems theory also emphasized that social change is explanatory through establishment of patterns and is only able to be understood geographically and contextually, again moving past the functional and typological assignment of a particular manifestation of social order in favour of culturally specific investigation (Shanks and Tilley 1987). The models approached this challenge from opposite ends of the spectrum. The core-periphery model, as exemplified by Friedman and Rowlands' (1977) epigenetic model, appears to answer questions of interaction on a macro or broad geographic scale, particularly concerning those of the Bronze Age exchange networks (Harding 1993). It investigates the economic relationship between a wealthy, growing core that utilizes the periphery for labour and materials where the former develops its path of social reproduction at the expense of the latter (Wallerstein 1974, Champion 1995). In searching for dominant/subordinate relationships, the model examines influence and interaction on the macro scale, which illuminates particular configurations of relationships, yet neglects others. Social change is understood as the result of shifts in one sphere of influence spreading through the exchange relations to affect the other. The model also allows for the geographical make-up of the core versus the periphery to change, acknowledging that every social unit has the potential to change (Wallerstein 1974).

In Renfrew's (1986) somewhat weaker peer-polity interaction model, alternatively, the spotlight shifted to the interactions, rather than their structural consequences. The production of goods, including sourcing the raw material and associated exchanges, was equally as notable as comprehension of the distribution of the final product and the attendant exchanges (Renfrew 1993). Renfrew (1986) considered change *within* a region as an expression of the dealings among polities, yet the polities were also vaguely open to external stimuli. The peer-polity model focused on intermediate, or regional, economic relations, rather than long-distance trade and considered social change the effect of a series of internal conditions, such as competition, emulation, and exchange of knowledge (Renfrew 1986). The particular, and restraining, focus on emulation perceived social interaction as justified through exchange of goods. The social interaction was fundamental to the conduction of ideas, providing an explanation for shared cultural traits within a region, through a common material culture easing the progress of such relations. The model regrettably assumes a regional homogeneity without regard for geographical scope and therefore is best applied to data *ex post facto* in a case of seeing what one wants, which rather defeats the purpose.

The world systems theory formed an excellent starting point for a dynamic, economic approach to social change by addressing different scales of relationships and the intertwined nature of exchange relations with social change, and its derivatives were drawn on for the theoretical approach for this study, discussed below (see section 1.6). Combined with the acceptance of exchange as embedded within the social and therefore linked directly to social change, such an understanding of the processes and connections built through long-distance exchange allows for a deeper comprehension of both the relationships involved and the change in social order itself. There are, however, drawbacks to world systems as directly applied. Gledhill and Rowlands (1982), for instance, argued that world systems are only attributable to economic issues such as inter-regional trading networks and the local accumulation of wealth through production and consumption which do not fully explain the impetuses and outcomes of social change. Also problematic is the divide between macro and micro studies, derived from the problems of applying a world system to regions without a core. Wallerstein (1974) intended for world systems to describe social change of a capitalist world emergent in the sixteenth century, with a clear dominant core utilizing the resources and products from its periphery; not all social networks, particularly those in prehistory, demonstrate an acquisitive core. While the long-distance exchange networks of the Mediterranean Bronze Age can be assessed as a core-periphery relationship, the more regional and immediate networks between societies within that 'periphery' must be explained through a different mode. Studies utilizing either view present a definite divergence in approach according to which view, macro or micro, intra- or inter-regional, its authors promote. The divide in scale itself is simply a result of the traditional social change frameworks. Prehistory is often constrained by arbitrary structures fashioned for convenience and preserved out of a sense of convention, regardless of how those derived classifications and divisions continue to colour and even curb our perception of the past. The disconnection between levels of observation are artificial and established to interpret their specific frameworks, however, the macro and micro schism only serves to obscure the character of interaction. It creates a problem of perspective where there should be recognition of overlapping scales of interaction. This divide has created an either/or situation between studies focusing on the long-distance or the regional that researchers have struggled with continually.

As just discussed, the core-periphery model operates exceedingly well on large-scale studies, allowing investigation into a wider geographic scale of interaction. Applying the model, however, can be troublesome, particularly with the misleading focus on the terminology of dominant (core) versus subordinate (periphery/margin), in examples that developed without a defined core, such as the Bronze Age networks of central and north western Europe (Renfrew and Cherry 1986, Stein 1999). To achieve a well-rounded perspective of social change, an alternative micro-scale model should be used alongside the core-periphery model. A dual application of approaches would particularly address McGuire's (1996) charge that change in the social structure of the core does not automatically equal change in the periphery. On the opposite end of the spectrum, the peer-polity model is a model concerned with examining the development of social structure by means of analysis of all relations between autonomous socio-political units (polities) within a region. It still addresses primarily economic issues as the vehicle for transferring social change through emulation (Renfrew 1986), which cuts itself off from fully exploring the also important wider-ranging interactions as well as being inherently limited in its effectiveness even in regional studies by a lack of acknowledgement of other political and economic factors or processes of social change. Again, the peer-polity model requires additional analysis to fully appreciate the intricacies of social change, as its focus is limited, both in geographical scope and in consideration of factors involved in social change. Both models centre firmly on economic exchanges that emphasize human agency and human institutions as the drivers of history and obscure the entirety of dialectic interaction between things responsible for social change.

In final reflection, the world systems theory is a valuable tool for investigating the impact of relationships on change in the social structure of a society. Like any approach, there are strengths and weaknesses to address. It must be tweaked away from a solid economic focus that has often developed from world systems analyses, but the implication of studying pathways of energy transference in regard to shifts within a social order cannot be denied.

1.4 Agency: a recursive relationship of material and biological agents and social structure

Further enabling the investigation of relationships as driving social change, agency, an older sociological idea, also began to enter into archaeological social theory (Shanks and Tilley 1987; Barrett 1994) toward the end of the 20th century. Agency was employed in an attempt to recognize the individual within a society, in response to major critique of its lack in systems theory, and continues (*e.g.* Barrett 2001, 2012; Owoc 2005) to be a significant arguing point among social theorists. A key development in resolving the structure/agency dichotomy of systems theory disallowing a dynamic interpretation of change was the work of Giddens (1984) on structuration, which asserts that human agents act in reproducing themselves and the social institutions of which they are a part. Proponents of such an approach contended that agency, in the form of definite actions in response to specific stimuli, could be read into the context of the archaeological record. Consequently social systems always exist in a state of flux, which, they asserted, legitimates a consideration of social change (Barrett 2001; Hodder 1991, 1992). Agents must be actively orientated towards the on-going creation of their social structure in ways that are informed by those structures (Pred 1984; Barrett 1994, 2001). The use of agency for understanding dynamic social change suggests agents have intentions and changing needs, and therefore variability of practice. Intentions and needs can shift over time, thereby creating new forms of the social order.

Due to the amorphous terminology and interpretation of such an explanation, agency has crept into nearly every theoretical model, albeit in such significantly different ways that it is no wonder confusion and division over its application is rife, yet agency rightfully continues to play a large part in dynamic, structural explanations of social change (Dobres and Robb 2000). For instance, Owoc (2005) suggests practice (the socially recursive actions of individuals) and praxis (the dialectic relationships between individuals forming a society), both implicitly dealing with intent and action of agents, are an integral part of the process of creating and maintaining a network of relationships and exchange. This neatly summarizes the *en vogue* 'archaeology of practice' that proponents of agency tout. If the social is considered as constantly being created and thus carried forward by interactions and connections, agents must be able to act to create those connections, thereby providing a understanding of the dynamic shifts within social structures while simultaneously allowing for exploration of the socially-derived and –reproducing relationships between those structures.

Material culture is active in the reproduction of society, especially as it is grounded in space/time and has a dialectical relationship with the structures informing its creation, and allows for society and social change to be studied contextually (Tilley 1982; Barrett 2000, 2001). Latour (2005) definitively extends agency as a concept that allows for non-human actors, especially when paired with other social models, which can aid our understanding of the interaction between people and the material and environmental world. Accepting non-human agents certainly does not eliminate the individual, human agent; on the contrary, it places that agent and his or her actions solidly within the socially contrived relationships between each other, the social institutions created out of need, the material objects that propagate those institutions, and the resources available to create those objects. Recognition of agents beyond human and active in the creation and reproduction of social structures is a significant step forward in the formulation of a holistic approach to social change.

This, however, is not a universally accepted view. Recent work has further investigated the application of agency to material objects, in that objects are active in informing the social order, continuing the ongoing debate over whether admittedly active material things should be bestowed with the status of agent as well. Post-processualists, particularly subscribers to Giddens' (1984) structure/agency duality, take agency as an inherently human component whereby human agents can use the material world to enact their needs, but that material itself, including and especially the environment, is merely a tool to be utilized (*i.e.* Russell 2007, Ingold 2008). The dispute has incidentally sparked an entire sub-debate over what constitutes 'personhood', who or what can be said to acquire it, and under what circumstances. The argument for object agency (*i.e.* Barrett 2012; Knappett 2008; Gröhn 2004; Tilley 1999; Gell 1998; Latour 1993, 2005), coming from the further debate over 'personhood', is focused on two interlinked aspects. Namely, objects are a part of practice in that they both create and are created by needs and circumstances, and that people, who in themselves gain agency through interaction, exist in a material world, through interaction with that world, imbue material with a certain amount of agency. Given the earlier definitions of agent and agency, it is only logical to apply a form of human-endowed agency to the material world that, through use, helps maintain, and reconfigure as necessary, the social order. Objects are created through the innovation and technical skill of human agents and are only brought into being to perform tasks essential for living with no intention of their own; this is the general cry of those opposed to object agency (Russell 2007). While absolutely correct, the very fact of the object being made to specifications to perform a role in the reproduction of the social order adds an extra dimension of active social affect, or a secondary agency (Gell 1998). A different manifestation of an object would allow for a different function or regard, no matter how slight, influencing the continued activities or observations of human agents. A square structure serves the same function as a round structure in that it provides shelter, yet its inception obviously sprang from a different worldview or met a different need, which was then propagated throughout the use of the structure. Objects therefore, while not possessing a sentient intent or activity, quite literally embody the state of social organization and the intent of the creator at their moment of creation. Their continued use beyond that point speaks to their active role in maintaining those intentions and the status quo of the particular aspect of daily life for which they are created. A change in form, material, or decoration, observable in the record, is already taken as tacit evidence for at least some form of social change. The material 'record' is the physical representation and tool of the social conditions present at the time of use and therefore forms a significant window to the human agents, their actions, and guiding structures that brought the physical remains into being (Barrett 2000, 2001; Dobres and Robb 2000). Therefore, objects are active in the reproduction of the social and should be considered as such. The inclusion of the natural world beyond created objects in the general category of 'material' remains contentious; however, there is an understanding that the environment both informs and provides for the needs of human agents, making critical an understanding of the impact of the human-environment relationship on choices from arable farming versus animal husbandry, architectural designs, technical , settlement layout, *etc.* (Barrett 2012). There is therefore a direct correlation with the economy and the environment as relationships and available resources are activated to reproduce the social institutions.

Agency is obviously a valuable aspect of any investigation into social change, particularly as it introduces uncertainty and variability into the trajectory of social reproduction (Barrett 2000), but there remains a lack of consensus of meaning and use that continues to confuse and obfuscate its relevance. In response to the confusion surrounding the meaning and application of agency, Dobres and Robb (2000) affirm that agency as a concept is sound, but the diverse methods of employing it within a theoretical framework must be examined. Agency should be considered a socially pertinent aspect of action, rather than the more common misuse as an identification of the action itself. Agency based models allow for specific processes (technical, economic, social) to be pinpointed, examined, and reconstructed through exploration of their observable consequences, *i.e.* the archaeological record (Kohler 2012). Understanding that actionable intent, based on a need for change in the status quo, is both cause and effect of change to social organization illuminates a pertinent debate: the role of technology and its place as impetus or result (or both) of social change. Knowledge is an intangible, yet vital commodity we can only see through its material product, yet the innovation behind new technologies or architectural designs came from a drive to create, to go beyond what was already available. The passage of technical knowledge must be related to social relationships (Dobres and Hoffman 1994). Whether social relationships are driven by connection with craftwork and technical knowledge (*e.g.* Giles 2007) or the reverse (Hingley 2009) is still contested. Further, social relationships make technologies viable by providing the physical means and demand for the products thereof, and are therefore visible in technique, design, disposal, *etc.* (Sofaer 2006, Brück 2006, Dobres 2010). The next logical step is central to this study: as different technologies, such as those of metal, agriculture, and architecture, are social on a certain level, there must be a relationship or exchange between them, through which changes can be analyzed. While these processes are often limited to simplified ideas, given the nature of human comprehension, models with an agency component allow for a more in-depth and comprehensive understanding of the vagaries of human existence that create and reinforce social organization. This is not to say there are not issues remaining with the application of such studies. As Sofaer (2006: 127) states such studies concerning technical processes "...led to an emphasis on manufacturing processes and individual objects as the outcome of craft production, rather than highlighting *craftspeople*." Only through trial and error with modelling can we hope to clarify our understanding of the intentions and actions of the past that created the material remains we can access.

Each model discussed thus far brings us ever closer to a more holistic understanding of social change. Acknowledgement of the dynamic, recursive processes of structural transformation has allowed social theory to make great strides in understanding social processes. Friedman and Rowland's (1977) epigenetic model was a much needed response to the problems of systems theory, and the economic-focused models following after continued to explore the relationships of production and exchange as they concern the social order, albeit on widely different and difficult to reconcile scales. The introduction of agency allows for the individual to make an appearance by acknowledging that actors have intent, whether knowing or unknowing, and their actions in response to the socially prompted intent work to create, reproduce, and alter the social structure as necessary. Social change is understood as a shifting entity, able to be altered as situation necessitates, yet there remains in our models a disjointed emphasis on one aspect or another, such as technology change versus production versus *etc.*, that must be addressed. Going into an investigation of social change with a pre-set prominence of one set of relationships only leads to masking the importance of others; instead, the relationships and their impact on the transformation of social structures must be considered equitably. At the very least, the conjoined impact of varied relationships, even the founding and maintenance of those relationships, must be acknowledged, even as we focus on a single aspect for greater clarity.

1.5 Agents, energy, and social change

Theoretical frameworks, as described previously, have been driven by the ascribed and pre-conceived notions of what creates the social. Latour (2005), quite rightly, claims the term 'social' has become symbolic of specific assumptions about a state of organization that researchers utilize without reflection of how they ascribe material constraints on essentially immaterial relationships. The trend toward acknowledgement of agency within more humanistic approaches (*e.g.* Giddens 1984, Shanks and Tilley 1987, Dobres and Robb 2000, Knappett 2008) has underlined the importance of attempting to understand how the world was actively constructed by its inhabitants and the recursive relationships they form with their natural and built environments (*e.g.* Neustupny 1998; Latour 1999, 2005; Brown 2002; Broughmans 2013) Agency-based models focus on the observable agendas, rather than attempting to affix a preconceived agenda on the material, between people and their material world, and acknowledge that agents can have both active and tacit responses to their world (*e.g.* Barrett 2000, Latour 2005, Webmoor and Witmore 2005, Witmore 2006). Internal social institutions are formed by and generate relationships of production, consumption, and exchange of objects directly from the agendas of agents. In turn, the relationships reproduce social structures, creating not a two-dimensional social order, but a reflexive, multi-dimensional network of relationships (Neustupny 1998, Zubrow and Frachetti 1998). As archaeologists examining the contexts of past action, we depend on the material reality to enlighten us in regards of the transport of goods from place of manufacture to ultimate resting site. This in turn details interaction, or transmission of energy as labour, produce, exchange, and consumption, on a variety of scales. It is a given that how we model those connections, or networks of energy, is of extreme importance to our understanding of social organization at any given point and particularly how change in that specific ordering of the social occurs. The inclusion of the material as possessing active agency in regard to social organization, and thereby being considered as a throughput of energy from human agents and the natural world, creates a strong, holistic, and dynamic model for social change

Such an approach has recently come into focus under the term 'symmetrical archaeology' (Webmoor and Witmore 2005, Witmore 2006, Witmore 2015) that uses principles of network theory to look past preconceived notions of categorical relationships. Symmetrical archaeology examines the cause/effect of select factors in combination, without regard to dualistic schema that have plagued archaeological social theory and, as previously discussed, resulted in merely addressing the summation of those factors as played against an assumed 'other' set (Webmoor and Witmore 2005). In other words, we should consider how networks, created by relationships between people and objects, construct social institutions, rather than considering the social as created by people in order to develop relationships with objects. Objects are therefore capable of being agents outside the social (Witmore 2015). Of course, this "New Materialism" can be taken too far and objects or 'individual entities' reified beyond their creators or the process of creation, not to mention the difficulties inherent in practical application of an 'irreductionist' approach where the material world is created through holistic entities or parts that include natural elements such as rain (Ingold 2015, Edgeworth 2015). For these reasons, among others, symmetrical archaeology has yet to gain a firm foothold in archaeological social theory.

Also of specific interest to this study is the possibility of eliminating the macro/micro divide when investigating the concept of networks of interaction and of energy exchanges (in the form of interaction between agents such as production and exchange) driving social change. The interrelated local and inter-regional scales of interaction each provide information that the other lacks, yet there is still only a small number of studies addressing the merits and means to reconciling the two opposing ends of the spectrum (*e.g.* Thomas 2013). Rather than exclusively agent or structure based, society may be instead a fluid, "circulating entity" that can expand and contract as necessary, explaining our failure to securely define it (Latour 1999: 17). In network analysis (*e.g.* Wasserman and Faust 1994, Knappett 2008, Brughmans 2013), a broad set of approaches that begin from a perspective of assumed interaction between the elements creating the network, base units of entities or nodes form relationships between themselves to create a network or networks of relations. There is no proscribed limitation on the connections being formed, rather differentiation between the strength of those connections, which is both determined by and explicated through those relationships (Brughmans 2010, 2013). Bearing that in mind, preconceived ideas regarding the composition of the social sphere must be thrown out, allowing relationships to speak for themselves in regard to social change. Network analysis in archaeology has been appropriated from diverse disciplines, from hard science to social network analysis (SNA), and has been applied to archaeology in a number of ways. SNA in particular focuses on social actors that form relationships dependent on each other for structural integrity, where those relationships are the open conduit for action or inaction purely based on the structure of the network (Wasserman and Faust 1994, van der Leeuw 2013, Brughmans 2013). For instance, in Actor-Network Theory, a developed SNA model, the search for patterns and change within society is maintained through an understanding of networks of relationships, varying in intensity from node to node and region to region, which reproduce social structures adequate to forming those relationships, and therefore social structures, at any particular moment (Latour 2005, Law 1999).

Network theory has only recently begun to be applied to prehistory (*e.g.* Gamble 1998, Knappett 2008, 2011; Earle and Kristiansen 2010; Van Oyen 2015), instead being primarily applied to historical and modern issues of technology and information systems (*e.g.* Walsham 1997, Tatnall and Gilding 1999). The intrinsic problem with creating theoretical approaches to social change is that we as observers are required to reduce a complex, fluid, and all-encompassing structure, termed society, into components we can then further condense into graspable concepts for examination (Wilk 2001). In doing so, we are trapped in a false sense of accomplishment in garnering an understanding of one (essentially functionless without the whole) component. We can forget it relies on an incessant, adaptable interplay of all of our superficially prescribed categories to operate. Opening the discussion of social change to a model allowing for an expanded understanding of the factors at play in the influence and creation of social structures and the need to be able to examine those factors on multiple scales of study can only further our ability to interpret the material record. Network analysis refutes any division between the entities of the network, the network as a whole, and any part of the world not actively engaged in the relationships of the network (Knappett 2011, Brughmans 2013).

An earlier form of social network analysis, ego or anchored networks, specifically combats this issue (Mitchell 1969, Boissevain 1974). These "partial networks" (Mitchell 1969), particularly when anchored to a specific individual and their perception of interactions, are not reductionist, as one of the key tenets of network theory is that the whole is created from the parts. Relationships extending outward from the anchor or ego in varying degrees of familiarity and intimacy can be gauged through the reactions of the anchor, thereby additionally reducing scaling issues while allowing the focus to remain on the area of interest via the anchor (Wasserman and Faust 1994, Brughmans 2013). Kaufman (1975) theorized that networks could be anchored to specific groups as well, given that relationships emanating from the agenda of a group act as a particular experiential grounding. This can be extrapolated further to anchoring networks on a specific site, rather than an individual, and proceeding to examine relations extending from a specific domestic context, as described by Irwin-Williams (1977) (*cf.* Brughmans 2013). The settlement and its manifestation at any particular point in time is recursively influenced by social organization, itself informed by the relationships between agents and/or nodes. Agents and nodes themselves are taken as ever-changing influences, tangible or not, that have an effect on the manifestation of the social order at any particular point in time (Latour 2005, Jones and Cloke 2008, Law and Mol 2008, van der Leeuw 2013) and within any particular 'anchor'. For example, Wilson's (1998) study of Mexican migrant workers found that social networks naturally anchored themselves to the worksites, as the central focus in a production-based network that differed depending on the ego under investigation. Anchoring a network, in this case to the settlement and its constituent domestic architecture, allows for fluctuations in those agents to be seen from a grounded perspective, without the necessity of being able to trace the whole network. The energy used to produce that architecture is therefore representative of changes within social organization, and patterns and trends begin to emerge along the lines of networks of energy. If indeed domestic architecture is representative of agricultural production, anchoring the network of energy focused on production and consumption on the settlement, as the direct recipient of that energy, is only logical.

When addressing material culture, which is tangible and able to be traced between origin and final location, energy derived from the intentions and actions of agents can be useful in mapping connections between people and across locations through specific and interrelated sets of relationships, as well as noting when conditions and intentions change through a shift in the energy exchange at any part along the network. Knappett's (2011) network analysis of Bronze Age Aegean ceramics is an excellent example of the benefits of network theory as applied to material culture, wherein it is the network itself that works to create connections with outside networks. This last point is most salient to a discussion of energy networks, as the energy of production and consumption will not be equal between different anchor points, *i.e.* settlements. The success of one localized network will attract a less successful network nearby, expanding both networks with further exchanges of energy, much like a positive magnet attracts a negative. The model is also by its nature multi-scalar, providing a possible solution to questions of scale.

Cultural anthropology has considered the concept of energy and social change for decades, with varying attention and success. As White (1943: 335) stated, "Everything in the universe may be described as energy…Thus we see, on all levels of reality, that phenomena lend themselves to description and interpretation in terms of energy. " White's work, while largely addressing the issue of social change from an evolutionary standpoint, with all the issues attendant thereof already addressed above, posited the idea of energy, both input and output, in the creation, reproduction, and eventual change of the social order. Binford (1962) made an analogous study of the energy expended on copper tools as opposed to stone or bone, with a focus on economic energy and conservation versus expenditure. Adams (1978) continued the discussion of energy in a systems theory setting, with refinement to Colson's (1976) dissipative model. The dissipative model made strides in understanding that instability within and without the system is always present, allowing for adjustment to the system in relation to fluctuations in the status quo. The model, while dated and related to systems theory, also addressed the role of the human in providing and responding to those fluctuations, providing a platform for discussion of energy expenditure in an agency based model.

Energy (its source, expenditure, and affect on social change) is a viable, vibrant point of consideration paid far too little attention in recent models. Network analysis and ANT have begun to bring the concept back, although in a constricted manner by limiting discussion to exchange between nodes, rather than acknowledging more than tacitly the energy involved in the upkeep of each node in order to provide the necessary 'energy' required for the maintenance of those inter-nodal connections. This may be related to a lack of concrete definition or delineation of energy between the models. Even within a discussion of energy as related to social structures, Adams (1978) diverges into a *non sequitor* discussion of solar energy development necessary for feeding people with no clear indication that he is addressing energy input/output in regard to actions and activities and energy to provide power in modern living as one and the same. The treatment of both signifiers is fascinating, and provides interesting parallels in addressing modern energy consumption, in the form of power, and energy as applied to actions in the past, yet the clarity in the argument is still lacking.

If one takes energy as the possibility and the effort engaged in producing a certain outcome, by its nature it already involves the more physical form of energy as power, or mechanical energy. Cottrell (2009) suggests that the division of power versus activity springs from the Western absorption with technology and that the divide is, as with most issues, a consequence of mental conception providing a dichotomy where none exists. Energy, as suggested so long ago by White, exists in all interactions- people to objects, nature to people, and so on- and in all processes, not limited to the physical. Conception of space and the follow through to produce the imagined result is a definite demonstration of energy use.

Changes over time in spatial organization can only indicate changes in the assignment of energy directly related to changes in the amount of space required. As Cottrell (2009: 8) states: "Furthermore, we can see whether or not a given change in a society depends upon the attainment of a certain level of energy flow. In addition, we may be able to see what kinds of social conditions are required to operate given types of converters that are in their turn necessary to achieve and maintain an energy flow from a given energy source." In the case of this study, we can examine the energy expended upon certain types of domestic architecture in southern Britain and Denmark for changes in relation to the increasing lack of bronze flow from the south and the introduction of a more localized iron technology.

With the continued acceptance of economic activities as socially embedded and the addition of ideas of interchangeable scale, several recent studies have focused on understanding socioeconomic relationships on a scale of site to region (*e.g.* Greis 2002, Giles 2006, 2007). Giles (2006, 2007) has posited that the introduction and control of iron-working in Britain was possibly more autonomous than previously considered, with local craftsmen in charge of production and exchange, rather than a centralized redistribution structure (*i.e.* chiefdoms). With crafters as the driving force behind supply and capable of meeting, if not controlling, demand, she proposes that new relations were made possible. A similar situation may be visible in the agricultural production/consumption/exchange cycle, as tentatively broached by Greis (2002), yet the evidence remains problematic. As agricultural production has gained recognition as an item of exchange, identification of both flora and fauna in the record has become critical, creating methodological issues in recognizing exchange of perishable items (Wells 1986, Crabtree 1987). This study seeks to provide an alternative means of accessing agricultural production and consumption, not dependent on material culture, but on the architecture of settlements themselves. Therefore, as inter-nodal energy exchange relates most strongly to material culture when adapted to archaeological purposes, Actor-Network Theory, along with many other forms of network analysis, is inappropriate as a theoretical approach here. The idea, however, of energy expenditure, viewed through an anchored partial network focused on the settlement, as a viable signifier of social change is possibly valid and is the premise here.

1.6 Theoretical approach for the study

As addressed in this chapter, previous models for social change presented problems, either not fully considering the intricacies of socioeconomic relations or mandating a particular circumstance as the basis for all instances of change in social organization. Social evolution and its offshoots considered the social order as static formations, with no understanding of the interplay of factors responsible for social change. Core/periphery models only provided a full explanation for social change when there is a definite collapse of the social order through the failure of the prestige good exchange system in a specified region. There was an assumption of the social order being maintained primarily through long-distance exchange networks, with a particular focus on metal and metal technologies, which in turn were driven by local agricultural production. For those models to be accurate reflections of reality, once the long-distance exchange networks fail, social organization will be negatively affected, and conflict over land and labour will begin, disrupting the agricultural achievements. Even world systems models, as brought back into focus by Kristiansen (1994), assume some level of devolution as necessary for change. One can certainly not negate the existence of a variegated core/periphery/margin relationship, especially in regard to exchange relationships and the passing of raw materials and finished products. One, however, can question the necessity of a state of collapse, with all areas of the social-exchange-technology-agriculture cycle being subject to devolution, before a change in social order is enacted, as well as the macro/micro division of scale allowed by those models. More recent modelling focuses on the growing importance of multi-scalar relationships of interaction and control of production to the reproduction of the social order (*e.g.* Greis 2002, Latour 2005, Giles 2007). The interchange of energy, in the form of labour for production including construction of domestic structures, consumption of the products of that labour, and exchange of produce, is especially cogent in addressing the myriad force involved in social change.

An understanding of social change as a complex process, involving multiple factors in conjunction, especially those implicated in production and exchange relations, will allow us an appropriate understanding of the processes involved. Addressing a sliding scale of interaction from site to region to inter-region to observe the operation of networks and acknowledging the intertwined nature of the social order, exchange relations, and production, previously set apart, will provide a more comprehensive approach to social change. The theoretical premise for this study is to further examine the viability of approaching social organization, through domestic architecture, and changes thereof through the lens of energy, or effort expended, involved in the maintenance of life. The premise engaged is that energy, in terms similar to White (1943), expended in the creation of domestic architecture, here specified as dwellings, pits, and post-structures, can be measured and those measurements can be compared over time to gauge changes in the investment and involvement with the material setting for daily life. Latour's (2005) contention that non-human agents are active in social change, along with the acceptance of relationships of production possessing both technical and social aspects

(Rathje and Schiffer 1982, Schiffer 2001, Sofaer 2006, Brück 2006, Dobres 2010), is taken as justification for domestic architecture as the focal point for evaluating changes in consumption during a period of readjustment in socioeconomic and technical relationships. The question of whether there is a 'correct' interpretation of agency or merely varied 'right' views is far from settled; this study cannot claim to have made a definitive answer, but can attempt to put forth a particular consideration that the material world, through interaction with humanity, gains a form of agency and therefore must be critically considered in discussion of social change. Human agents are not isolated beings acting within a sterile field. The established environment, and the material world created to deal with that environment and further the itinerary of the human agents, necessarily plays a recursive role in the establishment, replication, and therefore change, of the social order, which in itself is designed to sustain the needs of its human actors. As Giles (2007) states "...metaphors are materially manifest in portable objects and structural features, as well as in speech, as part of broader social discourse...As metaphors arise through similarities in qualities or capacities between things, objects can come to stand for people, on the basis of attributes which represent aspects of their identity." Through their very interaction with the material in the creation/replication process, human agents create in turn agents out of objects, or material things that function solidly within the social order, thereby allowing domestic architecture to be understood as proxy for the activities and energy invested in daily life.

Given the varied and intricate changes to social structure at the end of the Bronze Age, the study area will serve as an excellent test for the viability of a multi-scalar model of relationships continuously primed to shift, rather than disintegrate, as the needs of the agents demand. The conduits of potential energy exchange, understood as the relationships between people, the created material world, and the natural world, in this model remain available even when not actively used in the reproduction of the social structure, ready to support the modification of the social structure, according to changes in the needs of the actors. Such a model, with roots in studies examining the interplay between settlements in regard to kinship and redistribution (*e.g.* Frankenstein and Rowlands 1978, Thomas 1997, Brück 2000, Fowler 2005), will be able to identify patterns of production/consumption through architectural proxies in southern Britain and Denmark at the end of the Bronze Age. Investigation of agricultural production and population on both a site-by-site and regional basis over time provides an excellent and necessary opportunity to explore the impact of social change on the consumption of domestic space.

Chapter II: Social change at the end of the Bronze Age in lowland northwest Europe

This chapter brings the previous discussion of past and present theoretical models regarding social change to life, demonstrating their initial attraction and advantages as well as their ultimate failure to fully address issues of change in lowland Europe at the end of the Bronze Age. The question of scale and appropriateness in modelling, particularly in consideration of relationships of production and consumption, is addressed. An overview of social change, economic restructuring, and settlement reorganization from the Middle Bronze Age into the Early Iron Age is provided. Does a fresh perspective, not limited to material culture, provide a reasonable and flexible approach to social change?

2.1 Determining a research area

The question of scale, both spatial and temporal, has long plagued archaeologists in both method and theory. How do we select an appropriate time period(s) or geographical area of study for the questions we want to ask? Are we too inclusive or too exclusive? How do we reconcile studies of differing scale (*i.e.* settlement versus region) in order to form a holistic and more realistic understanding of the period(s) in question? Wallace (2011) cautions that scale in archaeology can be used in a flagrantly subjective manner without (much) forethought. While beneficial as a relative and comparative tool (Smith 2000, Molyneaux 2006, Wallace 2011), scale within a study must be clearly laid out and appropriate to the phenomena/on being researched. Scale used methodologically allows for comprehension, interpretation, and contextualization of a complex system through the selection of a manageable and logical, to both the data under examination and the limits of human perception, spatial area (Ridges 2006, Harris 2006). Case in point, regionality has been a growing concern, with movement away from sweeping statements regarding a 'European' or 'British' Bronze or Iron Age toward an understanding of regional trends and interregional interaction (Piggott 1966, Jones and Graves-Brown 1996, Neustupny 1998,). The definition of region, however, remains vague and subjective. For instance, Wessex (*e.g.* Sharples 2010) is considered a region, yet a simultaneous comparative study of the Mediterranean, Central European, and Scandinavian 'regions' (Earle and Kristiansen 2010) was completed through examination of so-called 'microregions' of Thy in Denmark, Tanum in Sweden, Monte Polizzo in Italy, and Százhalombatta in Hungary. There is obviously a difference in meaning of 'region' as there is a contrast between a culturally defined area and geographically defined areas.

What, then, constitutes a region? Subjective use of a regional scale methodologically, as per Smith (2000), is currently acceptable practice, as long as use is clearly stated before analysis. Differing scales are as valuable as differing theoretical approaches, as they provide alternate perspectives of the same material (Wandsnider 1998, Burger and Todd 2006, Ridges 2006).

In order to test the theoretical premise for this study- that domestic architecture serving as proxy for energy devoted to living (production/consumption) can be examined diachronically on a multitude of scales, making social change and its impact on production/consumption relationships visible and relatable between sites and among regions- an area of research must be specified. The Bronze to Iron Age transition of northwest Europe (here termed 'zone' to indicate a wider geographic and multi-cultural unit used largely for conceptual purposes) serves the purpose nicely, as those periods have been intensely studied and the region provides a rich and diverse record of settlement, along with documented changes in social organization. Temperate Europe was increasingly regionally distinct over the Bronze Age. Contact with the Mediterranean and points south continued via exchange, which transmitted people, ideas, and material objects both ways, yet central and northern Europe were increasingly developing their own recognizable social structures (Rowlands 1984, Sherratt 1993, Graves-Brown *et al.* 1996, Bergerbrant 2007). Identifiable social structures were accompanied by particular physical expressions in the form of settlement structure, internal production, and regional specialization to meet internal demands. One cannot say these regional cultural institutions were entirely autonomous, as regional traditions and social organization were maintained through exchange and contact with neighbouring groups. Exchange routes, traced through the dispersal of goods throughout Europe, shifted away from northern and western Europe by the end of the Bronze Age (Kristiansen and Larssen 2005, Sharples 2010). Alternatives to long-distance exchange were required to acquire needed materials and maintain the social structure, making northwest Europe a strong candidate for focus when considering social and technological change.

Further refining the research area to make a manageable study, and to avoid the errors of assuming a single 'northwest European' Bronze or Iron Age, Denmark and southern Britain (here considered 'region' to indicate a sub-section of the broader zone, still with internal variability) were selected. Both regions of northwest Europe demonstrate a large corpus of work, particularly of settlement evidence, and a further internal geologic regionality, allowing for a site to sub-region to region analysis. While single scale studies have been emphasised as necessary for real comprehension of processes (Dunnell and Dancey 1983, Lourandos 1996), the benefits of a multi-scalar approach are slowly being recognized, particularly in settlement pattern analysis (Peterson and Drennan 2005, Ridges 2006, Bevan and Conolly 2006). Regional analysis is gaining favour as the scale by which interaction is most easily observed, yet can obscure the local level of interaction that forms the foundation for wider scale relations. As Barrett *et al*. (2011:441) state, "How we define 'local' and how we identify the most suitable level of analysis is much more difficult to characterize but it will lie at a sub-regional level, geographically speaking...the desire to grasp the lives as lived- routine and local." Context is critical when assessing motivation and energy expenditure, making a multi-scalar approach necessary. Wariness in multi-scalar approaches is still warranted, as it is when the scales being compared are too inclusive that comparison is unwise; the very processes being examined will be different simply by virtue of covering too many cultural groups, ecologies, *etc*. In this study, Denmark and southern Britain, although similar, are not being directly compared, but used as crosschecks for the proposed model. The cultural and ecological facets of each region are too distinct to form any kind of real interpretation of the processes of change in energy expenditure toward domestic architecture for the entire northwest European zone.

Significantly, both cases exemplify a lack of natural bronze sources and therefore dependence on the long-distance exchange networks in flux by the end of the Bronze Age, allowing for a clear examination of the impact of shifting technologies and the readjustment of socio-economic relationships on domestic architecture, standing proxy for production and consumption. Danish and southern British settlement organization in the periods under examination was distinct, and each had been connected to discrete exchange networks (Sherratt 1993), providing a strong control for the model. If both regions and their component sub-regions, equally under stress from a cessation of established exchange networks and the gradual introduction of a new iron technology, display observable patterns of devotion of energy toward domestic architecture as proxy for consumptive practices, the model can be presented as a viable approach to understanding socio-economic activities without material culture. A model that provides even a broad understanding of *sans* material culture must be considered useful as not every aspect of material culture is available across the board, is not in a fully translatable context (*i.e.* midden or post-hole *vs.* original site of use), or is not directly comparable, yet domestic architecture is comparable as evidence of energy expenditure and difficult to misplace out of context. Southern Britain in particular is a justifiable choice in research area, as the Regional Research Frameworks and Research Agendas for its sub-regions detail a need for multiple scale models, characterisation of settlement, work at transitional periods, and an understanding of regional variation (Haselgrove *et al.* 2001, Weekes 2007, Oake 2007, Last 2008, Webster 2008). For instance, the Research Agenda for south west England (Webster 2008) states, "Further work is needed at a larger scale to look at sub-regional area" (Research Aim 1h), as well as, "The Later Bronze Age is lacking in synthetic treatment and thus interpretation often remains at the site level" (Research Aim 2e). With the proposed model, the plentiful site-by-site data can be collated to form a sub-regional analysis of production and consumption, which can then be compared to provide a more generalized synthesis of both southern Britain and Denmark over time. By relating energy invested in domestic architecture with production/consumption, where the constructed areas of activity are measured rather than the product, the scale (site, sub-region, region) of research does not impact the findings, but rather simply provides additional layers of analysis. Trends in construction can be collated on multiple scales, which present cumulative data regarding investment in subsistence. Such an analysis provides a possible answer to the pleas to move away from the more generalized trends to focus on the actual happenings of a specific area (*e.g.* Barrett 1994, Roberts 2008). As described below, the generalized trends of change for northwest Europe at the end of the Bronze Age bring more questions to the table, making a rich target area for new interpretative models.

2.2 Social change in the Middle/Late Bronze Age of lowland Europe: a review

The way we have characterized social change in the European Bronze Age has changed over time, with new finds and theoretical paradigms influencing our understanding of the complexities of such a large region over a long period of time. All facets of interrelated exchange, production, and social organization have been debated as the single motivating factor behind social change across the Bronze Age-Iron Age transition. The movement of objects and their material components, along with the technology and knowledge to create them, has been in the spotlight to varying degrees from early typological studies concerned with social evolution. Social evolution considered 'primitive' tribes and bands naturally becoming 'civilized' chiefdoms and states through the rise of a social elite, although those models tended to portray social status as having simply occurred, with little regard for how it developed (Kossinna 1911, Childe 1951, Service 1962). Functionalist approaches, largely focused on the social itself instead of the cause and effect of social changes, were more economically driven when examining changes to social organizations. Those models required an elite to take control of distribution and acquisition of resources, particularly in outward exchanges to gain necessary materials for reproducing the social order (Gilman 1981, Adams 1981).

Production relationships, including the transmission of bronze and its components, therefore became a central focus of studies concerned with socio-economic relationships and status in Bronze Age Europe. Models for social change considered material objects as impelling the social system and development of power relations (Friedman 1976, Friedman and Rowlands 1977, Frankenstein and Rowlands 1978, Kristiansen 1984). The emergence of political systems is tied to exchange for access to prestige goods, which is determined by the control of land and agricultural production (Friedman and Rowlands 1977, Frankenstein and Rowlands 1978). Reciprocal exchange of the limited raw materials essential for bronze and the final products has long been considered one of the, if not the primary, driving forces behind the inception of multiple exchange networks across Europe, particularly as proponents of materially-driven social systems tend to be adherents to the world systems model (*e.g.* Friedman and Rowlands 1977, Kristiansen 1984, Sherratt 1993, Kristiansen and Larsson 2005). Access and control over redistribution and consumption provides status in the community, which is maintained as long as there is a network for attaining the items in demand (Friedman 1976). Given that the Bronze Age has been deemed a period of 'intensified' agriculture, implying increased devotion of energy to the production of agricultural consumables and the tools necessary thereof, the impact of such activities cannot readily be discounted from a discussion of social change, particularly as production requires internal cooperation and the marshalling of a labour force, which demand some form of social stratification in place (Coles and Harding 1979, Gilman 1981).

A socially propelled expansion of regional networks of contact occurred simultaneously with the rise of elites, providing more secured access to goods in demand or foodstuffs in times of struggle (Rowlands 1980, Bradley 1984). The intensity of exchange shifted, with differing impact, during and after iron was introduced and adopted in northern and western Europe (Rowlands 1984, Kristiansen and Larsson 2005). An observed shift westward in long-distance exchange routes took place during the Middle and Late Bronze Age of Europe (1500-750 BC). The new, discrete routes stretched from Italy to Scandinavia and from the Alps to southern Germany, a consequence of the detrimental effect of the collapse of the major Near East and Mediterranean societies on the more widespread routes of the previous period. The decline of access to bronze, never plentiful to begin with in northern and western Europe, required either the development of new contact relationships or the intensification of more regional networks already present, accompanied by an appropriate readjustment in the relationship between the creators of objects and the few in a position to command their creation (Barber 2003). Given that Scandinavia was among the furthest reaches of the adjusting exchange routes, it was the last to re-engage with the reconfigured flow of material. A duality in access to exchange networks was apparent by Period IV (1100-900 BC), which corresponds to the Late Bronze Age in western Europe. Denmark served as the gateway into the internal Scandinavian networks with access on opposing sides of the landmass (Kristiansen 1994, 1978). The origination of the westerly route, Voldtofte (Thrane 1984), in south-western Funen, gained standing as it managed imported goods, particularly gold, and was a major hub by Period V (900-700 BC). The latter centre was distinguished by a great grave mound containing gold and urns of bronze acquired through exchange (Kristiansen 1994, Thrane 1994). Burial traditions of the later Bronze Age were demonstrably suggestive of status, marking those in control of access to the exchange networks (Thrane 2003).

Britain and the near Continent in turn formed an inter-regional network of contact, probably formalization of more nebulous connections in place in the earlier period. The down-the-line contacts connected the western network with comparable regional networks in the central European Urnfield area (Champion 1994). Northwest France continued to serve as a regional interchange into the Late Bronze Age; cross-Channel cultural bonds solidified that particular interaction through continuous exchange of information and material (Darvill 2001). 'Atlantic' and Alpine stylistic traits are typically found in the same vicinity along the Atlantic corridor, despite intensification in competition between overlapping cultures, as seen across Europe in this period (Brun 1993: 174). Networks shifting in response to the need for goods and increasing competition over control thereof likely produced widespread kinship ties in an effort to further solidify status (Rowlands 1994). Access to exchange networks, based on control of production, allowed for access to neighbours of equal or greater status, as marrying in to that group would firmly establish status, and therefore access to exchange networks in an increasingly competitive environment. Competition increasing over control of access to networks and the acquisition of desired items by the Late Bronze Age is also substantiated by the effort in transportation observed across northern and western Europe. Low-lying or coastal land increasingly suffered wet, swampy conditions, which was ameliorated by the creation of major pathways and alternate modes of transportation. Pegged planks of wood over Tinney's Ground in Somerset, for instance, created a stable route over an otherwise impassable environment. Carts, indicated by artistic depictions and finds of bronze fittings, were necessary for the transport of both large and numerous items, indicating the state of exchange (Cunliffe 1994). Those in a burial context are suggestive of ceremonial intent, yet it is not extrapolation to consider the use of such vehicles in the movement of goods.

The Bronze Age networks of long-distance exchange were no longer accessible in the more remote north and west, naturally lacking in bronze sources, as they re-centred on the expanding and productive Mediterranean and immediate outposts by the Late Bronze Age. The bereft far reaches of Europe were forced to reconfigure economic and social strategies inward and toward their neighbours (Sørensen and Thomas 1989; Kristiansen 1987, 1994, Sharples 2010). The pervasive interpretation of the decline of long-distance exchange creating economic and/or social crisis was developed in response to the recognition of the relocation of the long-distance exchange routes (Bintliff 1984, Härke 1989, Snodgrass 1971). The world systems theory, and its derivatives, is the major model that necessitates a state of crisis at the end of the Bronze Age in Europe with the disruption of the long-distance exchange routes. Friedman and Rowlands' (1977) cycles of evolution following devolution were accepted as explaining the changes visible in the Late Bronze Age into the Iron Age in Europe, as the shifting exchange routes removed access to prestige goods, creating structural decline as the elites could not maintain their status. The consideration of the economic as linked to the social in terms of change along with the recognition of change always existing as a possibility were strong features of this version of the world systems model. Studies of the Bronze Age latched onto these models as a way to approach the seeming outpouring of prestige items and associated status differentiation. Kristiansen and Larsson's (2005) later version also had the benefit of seemingly addressing the issue of placing people back into the narrative by discussion of the 'traveller' as a conduit for goods and ideas. The emphasis on production relations as the impetus for social change appeared to be the solution to the question of modelling social change. When applied to the Bronze Age, however, particularly when addressing the consistent change apparent toward the end of the period, the core-periphery model flounders. The long-distance exchange routes, as already discussed, weakened, and reformed away from northern and western Europe, which reduced or eliminated access to the essential prestige goods necessary for the maintenance of status. According to the model, by all rights we should see the concurrent decline of social stratification and diminishing of production. The conditions set forth by the model, however, are not apparent through the end of the Bronze Age and into the Early Iron Age for northwest Europe; the social order continued to thrive even as the flow of foreign goods and materials declined. Lodge Farm (Woolhouse 2007), Park Brow (Curwen 1937), Danish sites on productive soils (Coles and Harding 1979), those west of the London gravel terraces (Yates 2001), and Springfield Lyons (Murphy 1990), to name a few, continued into the Early Iron Age, flourishing or at the very least surviving through a period with disrupted access to prestige goods and bronze. The increasing stress and ultimate petering out of the long-distance exchange networks from northwest Europe to the Mediterranean by the end of the Bronze Age thus is not sufficient to explicate the means of social organization across the Bronze Age-Iron Age transition as purported by those sweeping narratives. There is also a fixed divide between Mediterranean core and northern European periphery in those models, which limits the effectiveness of those models to a specific broad geographic level, thereby masking local and regional data that may shed light on social relationships.

The alternate world systems model, the peer-polity model (Renfrew 1986), at first blush seems a better fit for the evidence presented at the transition, especially as it deals on a more regional scale with a focus on interactions. If the effects from the decline and restructuring of the long-distance exchange networks cannot be considered as the single cause of social change at the end of the Bronze Age, then a model that looks inward at change within a region seems a reasonable alternative. Renfrew (1986) directly stated that the transmission of knowledge was the most important aspect of social change, particularly as it relates to production and consumption, so the model was attractive in light of observing the economic effect of the new iron technology. Unfortunately, just because the core-periphery models are limited in their assignment of cause to effect, the observable disruption of established long-distance modes of contact and material exchange is not easily dismissed as at least part of the cause of the social changes in Europe during the target periods. The peer-polity model does not allow, or rather is limited in its allowance, of outside influence to affect the region in question. It cannot provide a complete synopsis of the changes at the end of the Bronze Age as it neglects to consider the effect of a decline in material for the ever-important dominant technology, other than observation of the affect without necessarily acknowledgement of the source of the disruption. The emulation aspect of the model, focusing on the transmission of ideas through local and regional exchange, allows for the transmission of the newer iron technology, but assumes a standardized regional culture that is not necessarily present (Jones and Graves-Brown 1996, Roberts 2008). This is not to say types and groupings of objects based on style do not exist or that they are not critical to our understanding of relationships, but the gist of the peer-polity model is that it presents rather a blinkered approach to social change. In this particular case, the model can account for Denmark and southern Britain presenting very different domestic architecture and changes to the social organization at the transition, given their respective regional relationships, but only by applying it retroactively and subjectively drawing geographical 'regions', and without a complete apprehension of forces for change other than economic. Even considering the impact of economic relations toward the end of the Bronze Age, issues with the model become apparent. Both regions had to bear the effects of the lack of bronze and the introduction of iron technology that came from outside the region and the model should account for this disruption given its predication on economic relationships to drive social change. Again, without the driving force of bronze, the cornerstone of exchange networks and social organization, the model demands a crisis, if not collapse, of the social order.

Despite their flaws for application to the Bronze Age of Europe and often scathing commentary (*e.g.* Nordquist and Whittaker 2007), the world systems models are still utilized, whether out of a sense of familiarity or tradition, one cannot say (Fokkens and Harding 2013). Emphasizing the point, Iron Age studies (*e.g.* Gerritsen 2006, Cunliffe 2009, Zapatero 2011) have found an adaptation of a peer-polity model useful in interpreting more local levels of community interaction and providing a new lens of local to regional interaction, rather than focusing on assumptions of homogeneity by dint of 'culture group'.

More recently (*e.g.* Earle 1994, Harding 2000, Fokkens and Harding 2013), the relationship between production, exchange, and the political structure has been considered more complex and not limited by regionality or distance from a core. The rising importance of agriculture and investment in the worked landscape suggests a more localized, yet entangled, situation at the end of the northwest European Bronze Age. Earle (1994, 2002) postulates a natural social evolution, developing from a generally egalitarian state to a 'complex' by comparison stratified social organization that nevertheless arises from political restructuring as a result of a single group rising to organize labour and control the dispersal of its production. A determined, 'adaptionist' evolutionary model for social change provided a start toward acknowledging the recursive relationship between political structure and production (Brumfiel and Earle 1987, Earle 2002). Political elites gain status via the economy, through organization of specialization and control of exchange, given the developing necessity for a centralized leadership to manage various production and consumption activities. Acknowledging the inadequacy of redistribution when accounting for subsistence level agricultural specialization, as a redistributive, largely egalitarian society produces more agricultural variety, the ratio of population to production eventually reaches a plateau that demands access to new technologies, resulting in reorganization of the social order through a socio-technical driven economy (Earle 1991). Applied to the European Bronze and Iron Ages, this model generally describes and attempts to justify the rise of chiefdoms. For the British Bronze Age, chiefdoms are still largely an amorphous concept that is primarily dependent on assumptions made by the investigator (*e.g.* Kristiansen 1998 *vs.* Brück and Fontjin 2013). The Iron Age, however, has a long tradition of assumed chiefdoms, derived from Caesar in a desperate clinging to written sources, and a warrior elite driven by traditions of burial with weapons. Danebury (Cunliffe 1983, 1984) was, and remains, a leading candidate for Iron Age chiefly residence, although that interpretation has been challenged (Collis 1994, 2011). In southern Scandinavia, the rise of chiefdoms, or at least chiefly centres, appeared to have been evidenced by a new tradition, particularly in the Early Bronze Age (1800-1100 BC), of regional centres of control, which appeared concurrently with the shifts in exchange routes. The centres were discernible by an abrupt appearance of richly appointed burials along the new conduits of exchange (Kristiansen 1994, Rowlands 1980, Thrane 2003, Earle and Kolbe 2010). Chiefdom models (Kristiansen 1994, Earle 1997, Kristiansen and Larsson 2005) disregard traditional mapping of Europe as a periphery of the Mediterranean and Near East in favour of Sherratt's (1993) less rigid zones of core, periphery, and margin. The more fluid interpretation of interaction allows a network of interconnected and equal regional systems to engage in order to promulgate the flow of metal from its origination to areas in need of it (Artursson 2010). With these dendritic and interconnected systems of networks in mind, Bronze Age Europe can be considered as not simply a peripheral storehouse of raw material to be sent to the southern core, but as a vibrantly connected entity in its own right. If status was predicated on the control of exchange, forming alliances in order to access bronze through the creation of exchange relationships would only further status on both sides of the exchange. Whether chiefdoms existed at the time or not, it is essential to understand that "the processes were thus complex and European Bronze Age societies were on the whole less peripheral than often assumed," as stated by Kristiansen and Larsson (2005: 249). Instead of largely isolated and dependent peripheral communities, there was a trans-continental system of mutual aid, feeding off the already established southern networks. With a loss of access to long-distance exchange networks, northern and western Europe were able to reach out through their own system of contact, maintaining a local and regional socially driven reciprocal exchange of raw materials, goods, and their related institutions while simultaneously experiencing technical shifts and demonstrating changes in settlement pattern (Kristiansen 1987, 1994, Artursson 2010). The variability in ascribed impetus for social change at the end of the Bronze Age highlights the dangers of preconceptions regarding social organization (Fokkens and Harding 2013).

These models provide a description of general social change, yet do not provide an explanation for *why* those changes happened from the latter part of the Bronze Age into the Iron Age (1000-400 BC). There is also a lingering separation between what is Bronze Age and what is Iron Age. Sharples (2010) suggests this is largely due to the difference in emphasis on exchange processes between studies focused on the Bronze Age and those of the Iron Age, with a stronger emphasis for the former and more devotion to understanding domestic space in the latter. The models have provided an explanation of how specific factors can influence a shift in social organization, but the specific explication for the changes over the European Bronze Age to Iron Age transition is still controversial. Contacts for exchange increasing in the later Bronze Age were taken as justification of regarding the changes as 'progress' toward social complexity, resulting in the chiefdoms assumed in the Iron Age with little evidence. The social hierarchies appearing in the Middle and Late Bronze Age have been addressed by a variety of strategies, with the principal theme of increasing competition provoking less stable political structures, creating wide sweeping social change in order to eliminate the precarious position (Rowlands 1980, Brück 2000, Kristiansen and Larsson 2005). The resulting changes affected exchange relations, production, and the internal structures for the maintenance of the social order. By their own nature, each aspect is directly impacted by the others as it affects them in turn. Social position requires control of access and distribution of goods, while production allows that access is possible as the means through which alliances are established and goods obtained. Gift giving also cemented both local status and ensured contacts remained friendly, establishing the social connotations of land and production (Rowlands 1980). Exchange networks themselves affected political status, as the networks provided the means for status to be established and reinforced; change in access necessitated change in status and produced a competitive atmosphere with a direct impact on social organization (Bradley 1980, 1984). A related but slightly weighted alternative, proposed by Kristiansen and Larsson (2005), suggests social change was both cause and result of contact with regional exchange contacts. Control of the exchange networks resulted in regional centres, which maintained their status only through a continuous retention of control of production and consumption. These political economy models neglect the noteworthy transformations happening simultaneously at the internal level, driving the formation of European cultures. Northern and western Europe was rife with emerging cultural institutions by the Late Bronze Age, chief among them a reorganization of settlement reflecting an increased focus on agriculture (Cunliffe 1991, Kristiansen 1994, Thrane 2010). Consequently, agricultural production gained in significance and intensified, as settlements grew smaller and began to centre on field systems. Agricultural production and the organization of the labour force and surplus increased in social significance, as exemplified by the settlements of the Bronze Age Thames Valley reorienting to the surrounding field systems. Control of access to those fields has been considered as increasingly the purview of regional high-status settlements (Yates 1999). The attendant increase in production resulted in an adjustment of storage practices, as well as production strategies (Barber 2003). The land became increasingly important over the period, with more investment in agriculture prompting control of land and its productive capabilities to take on social features. Such consideration of a new social organizing principle led to the consensus (Cunliffe 1991) that Iron Age hillforts, with their plentiful storage capacity, demonstrated high-status control of production, although closer examination of the record has revealed only slight deviation from non-hillfort Iron Age settlements (Hill 1996, Bradley 2003).

Interpretative frameworks

By discarding models of social change based on premeditated assumption of conditions that need to be met for social change and a social hierarchy as demonstrably inadequate for our periods of interest, we remove purely economic crisis from the options of just what was going on in northwest Europe from the Bronze Age into the Iron Age and turn to either continuity with gradual economic change (Hodson 1964, Sørensen and Thomas 1989) or more rapid change in multiple, linked facets of society (Haselgrove and Pope 2007). The debate often provides contradictory and even circuitous arguments in the form of the-chicken-or-the-egg style discussions of whether the rise of social elites, contact with long-distance exchange networks, or an increase in agriculture is the precipitating factor in social reorganization, or whether multiple factors working together are responsible for the changes observed in northwest Europe by the end of the Bronze Age. An interpretive approach that takes the data as is and examines the unique circumstances with flexibility in understanding social change rather than demanding a specific manifestation is required, a fact acknowledged from the end of the 20th century (Hodder 1991, Andrews *et al.* 2000, Thomas 2000, Stein 2002). More recent studies (*e.g.* Hill 1995a, Brück 2000, Wells 2001, Fokkens and Harding 2013) have attempted to negotiate the vastly complex issues from the Bronze Age into the Iron Age by taking a step back from the sort of meta-narrative approach and examining the data first, and then crafting an understanding of the circumstances. Danish archaeology has already been focused on a more contextual and interpretive approach to changes in settlement organisation. Rather than the grand narratives of social change with trickle-down impact on settlement organisation, changes in house size and number have been studies in connection with the landscape, agriculture, and climate change (la Cour 1927, Overgaard 1932, Thrane 1989). Social hierarchy is concluded from differentiation in the settlement evidence itself (Artursson 2010). Fokkens and Harding (2013) recently explored a similar and growing movement away from sweeping general models appearing throughout other European archaeological traditions. Instead, they present an overview of the European Bronze Age through a compilation of interpretive articles organized by thematic *and* regional approaches that treat with the data itself without assumption or mental framework, with only the unavoidable underlying bias (due to historical teaching and acceptance) toward one particular approach or another. While not specifically discussing the changes in settlement patterns and landscape at the end of the Bronze Age, given the range of topics presented, their approach does present an intriguing alternative to the models that have become practically ingrained in our treatment of social change in the Bronze Age and Iron Age. While promising, this is unlikely as a viable, widespread approach until we break from our habits of ingrained theoretical approaches. Even Fokkens and Harding recognize that archaeology itself exhibits regional variability in practice that can be difficult to translate across methodologies. The possibilities in the approach are exciting, and certainly work for a compilation piece, however, much work into rethinking our customary, and perhaps lazy, means of applying theoretical models must take place before any significant change occurs. Individual studies such as this concerning production/consumption will challenge our standard theoretical *modus operandi* and hopefully instigate a much needed dialogue regarding staid theoretical models, social change, and all aspects of society involved in social reproduction that are by necessity intertwined.

Alternative approaches to the generalized changes proposed by the models described above have focused on interpreting the material in a more regional context and on its own merits, rather than making the evidence fit the theory. Let us take metal hoards, particular to the latter half of the Bronze Age in Britain, as an example of the various interpretations of the archaeological record influenced by the theoretical paradigm of the day. Hoards have been discussed in multiple ways, including the impact on the local and regional economies, effect on exchange relations, and understanding of ritual (Brück 2000). In adherence to the earlier socio-economic crisis models, local management of resources, and therefore the rise of status in the economically driven models, has been considered as necessitating a cutback in supply. The elite depended on limiting access to prestige items; a controlled circulation ensured status was maintained as those in charge continued to provide for the demand, reaffirming their status through distribution (Champion *et al.* 1984). Access to prestige items formed local associations between elites, with those connections eventually producing groups capable of interacting on an interregional level, further consolidating their position in the local community. Hoarding was therefore considered a tool utilized in the careful control of supply in order to sustain the position of the elite. Similarly, the alluvial deposition in the Thames and its estuaries were taken as serving an economic function (Champion *et al.* 1984, Bradley 1984). In accepting such a model, one can then consider the possibility of gaining an indication of the condition of the local economy, provided the state of the items at deposition, although interpretations of use wear largely vary, as in all aspects of addressing the archaeological record. Understanding the state of the economy will obviously provide further information regarding crisis or continuity. A society in economic crisis would indicate that there was less bronze in circulation to begin with, causing competition for few resources, as in Friedman and Rowlands' model. Continuity would suggest hoarding of older objects, replaced in daily use by locally produced goods, especially of iron toward 800 BC. It is difficult to validate one hypothesis over the other, given the same material evidence of a practice. There is, however, still value in investigating the condition of objects in hoards in Britain and northern Europe. Kristiansen (1978) implies a declining economy is evident from the apparent wear present on deposited objects. Items were used for longer periods as supply, predicated on external relationships, was unable to continue at a rate capable of meeting demand. There is also a reciprocal relationship between the appearance of wear patterns on deposited items and the agricultural productivity of the neighbouring land. As metal required importation into southern Scandinavia, and therefore was likely a highly sought-after prestige item, productivity could well have been a major factor in status (Champion *et al.*'s 1984). This appeared to justify the socio-economic models, as production determined status, which in turn determined access to prestige goods, and therefore the state of objects by the time of deposition. Locations with a more secure tie to exchange networks would be able to deposit newer objects, as access to replacements was reasonably assured (Bradley 1984). Runnymede and Flag Fen provide alternate examples of the practice of Bronze Age deposition for southern Britain. Flag Fen (*ca.* 1300-660 BC) appears to have been chiefly committed to deposition, while Runnymede (*ca.* 800-600 BC) suggests more activity focused on passage and production of bronze objects (Champion 1994). In regions where the record indicates a higher incidence of re-use of bronze, such as southeast Britain, virgin scrap metal forms the majority of hoards. The departure from used objects marks a change in practice, yet has continued to be considered as serving a similar purpose in the maintenance of supply and demand.

Any model based on modern supply and demand principles, with the attendant valuing of objects, is potentially problematic. Given the principles used by economic modelling of bronze deposition, limited bronze forced a sustainment of the status quo, forcing a continuation of contact and exchange in order to escape a loss of access to both bronze and the requirements to uphold power and status (Bradley 1984). While logical, the model falls short of demonstrating deposition as specifically related to the vagaries of supply and demand; it simply posits a plausible correlation given the present evidence and reigning paradigm. Local production of bronze, observable on a majority of Scandinavian settlements during the later Bronze Age, was not considered from the perspective of models dependent on prestige-based hierarchy and decline of long-distance exchange for forcing culture change. For example, the Danish sites of Voldtofte (Thrane 1984), Viksø (Norling-Christiansen 1946), and Mariesminde (Hatt 1960) exhibit various crafting paraphernalia including moulds, ingots, and crucibles. Such evidence for internal production appears over most of Scandinavia, in association with evidence for local creation of so-called lower prestige objects (Coles and Harding 1979, Sørensen 1989). In addition, there are regional stylistic variations, giving evidence for peripatetic craftsmen or village metalworkers in southern Britain. Evidence of stylistic differences from hoards, along with possible workshops within settlements strengthens the suggestion of local production (Darvill 2001, Barber 2003). This also suggests that deposition was not necessarily only affected by supply, but other factors as well.

A purely economic focus for activities, such as that of deposition, overlooks the inconsistent nature and use of artefacts throughout the network of exchange contacts, along with disregarding that bronze hoards were mainly found in demonstrably the most consistently agriculturally productive regions (Bradley 1984). The shift toward an east to west orientation for the Urnfield period provoked Scandinavian and British settlements to seek a substitute metal supply as access to bronze through familiar routes diminished. The Thames metal artefacts, dating between 1000-700 BC, indicate the majority of metal was sourced from central Europe (Champion 1994). This suggests an extension or intensification of contact, allowing transport of material over longer distances, as a result of demands for metal overtaking local supplies. Wear and increased lifespan of metal objects was prevalent, supported by apparent re-melting of hoarded metal for local production, which has been suggested as accounting for hoard deposits acting as a kind of secondary storage area (Champion 1994, Kristiansen 1994, York 2002).

In a more recent contextual approach, a lack of bronze in circulation has begun to be considered from a ritual or social perspective (*i.e.* votive deposits, hoards: Bradley 1998, Pryor 2001, York 2002, Brück and Fontjin 2013). Taken in consideration with an increase in activity in the 'domestic' sphere, we can observe a shift of attention to the settlement and activities closer to the home, which can be termed 'ritual' in the sense of action that is imbued with a sense of emphasis. Bradley (2003) rightly points out the issues with the way 'ritual' is defined. There is confusion between a ritual of actions with particular emphasis and a ritual indicative of religious practices controlled by a specified group. Highlighting the concern with terminology is the resistance to 'ritual' deposition on the basis of factors such as the quantity and quality of the metal being deposited, in conjunction with the non-metallic items found in association, with opponents being opposed to ritual in a more religious sense (Pendleton 2001). The conflict between technology and ritual is one of perception, whereby actions with a tangible effect, such as making and using a tool in order to produce sustenance, are typically and historically prioritized (Walker 2001). When considering economically driven social change, however, the suggestion of an added layer of ritual, or emphasis, to a practice considered social and economic allows us to achieve a more thorough understanding of the relationships between people and objects, as well as the role those objects played in maintaining or transforming social relations. The location of hoards, frequently placed along field boundaries, whether deliberate or incidental, also requires consideration as to the social impact of possibly marginalizing bronze, elevating the importance of agriculture, or territoriality (Barber 2001, Brück 2006). As Brück (2006: 306) states, "If metallurgy is all about transformation from one state to another, then materials such as casting debris and broken items awaiting recycling could have symbolized the process of change in general." This plainly illustrates the relationship between economic practices and the potential of a metaphysical connotation ascribed to everyday actions. The inception of deposition, the throwing away or removal of objects, and the repurposing of storage facilities as a resting place for deposited material, indicates a re-assessment of priorities or a re-evaluation of the social value of an item, particularly when taken in context with the development of domestic space and a focus on production (Bradley 2003, Needham 2007, Pryor 2010, Brück and Fontjin 2013). The devaluing of bronze as a status item and recasting as an item for ritual deposition may have occurred even without the lack of incoming material as a newer, more plentiful iron technology was introduced and adopted. While the control over smiths and iron production has been seen as the basis for chiefly power (Cunliffe 1983), more recent argument has been concerned with alternate, more egalitarian or cooperative societies with agricultural underpinnings of social reproduction where iron working and other crafting taking place within the practices of agricultural life (Collis 1994; Hill 1995b, 2011; Giles and Parker Pearson 1997; Giles 2007). The realignment of the social structure would thus not be subsequent to changing technology, but adapting to a more agrarian based society, with iron having a very different role to play in social reproduction than bronze.

We are able to translate the definition of ritual as purposeful action with an agenda to the broader category of domestic architecture (*e.g.* Hodder 1999). As we consider ritual an action created by a social agenda and practiced in an effort to promote said agenda, an analogy to domestic structures, which also demonstrate a social agenda, particularly those concerned with storage, can be made (Owoc 2005). Behaviour definitely changed toward the domestic in the later periods of the Bronze Age, with a shift away from monument building, and continued into the Iron Age, which has redirected attention to the architecture of a settlement. Houses are gaining a perception as multi-dimensional; instead of simply housing life activities, domestic structures are now understood as forming relationships within the family through daily use and internal ordering (*e.g.* Hingley 1990; Parker Pearson 1996; Hodder 1999; Sharples 2010; Brück and Fokkens 2013). Particularly in the British Bronze Age and Iron Age, such studies have largely focused on the house itself, defining what constitutes a 'house' from other structures and the cosmology inherent in creating it (*e.g.* Pope 2007, Brück 1999, Brück and Fokkens 2013). As with any conceptual model, there are many cosmological interpretations of the prehistoric house, from strict definition of internal space to more flexible interpretation of characteristics. Gender, lifecycle, orientation within the greater world, *etc.* have all been addressed through the lens of internal house structure (Hingley 1990; Parker Pearson 1996, 1999, Oswald 1997; Brück 1999, Pope 2007). In this study, space is expanded to encompass functional categories of domestic architecture beyond living/activity space to include structures, which, by virtue of being constructed, demonstrate energy invested for an activity pursuant to maintaining life.

What has been established is that by the end of the Bronze Age in northwest Europe, socio-economic relationships were changing and reconfiguring in the wake of changes in technology and access to long-distance exchange networks. There is a tendency toward regionality, even in approaches unconcerned with core-periphery relationships, which can obscure more local levels of interaction and activity. As bronze was limited in supply, particularly in northwest Europe which lacked local sources, in order to continue to gain access to material and technological knowledge, regional exchange systems were forced to extend and seek contacts in connection with long-distance exchange networks. Regional differences, given particular worldviews and existing relationships, allowed simultaneous avenues of contact to form in the search for goods (Harding 1993, Kristiansen and Larsson 2005). As the progression of social hierarchy has been attributed to control of exchange networks, the implications for social architecture from the middle to the end of the Bronze Age are significant (Brück 2000). Acknowledging these changes and the models that have been presented, the next question to ask is why these changes happened when they did. Was it a direct reaction to a lack of material for continuing bronze production, the new iron technology, or a combination of factors? How did these issues affect domestic architecture at the end of the Bronze Age in Europe? Answering, or at least exploring, these questions involves investigating the affect of a decline in bronze and a rise in dominance of a new technology, through the lens of domestic architecture and energy expenditure.

2.3 Production and consumption: impact on domestic architecture

Once we have acknowledged that production, and consumption, are entangled in social organization, and that domestic architecture forms a discursive relationship with the social, it stands to reason that changes in domestic architecture, particularly those structures related to storage and consumption, can be taken as physical proxies for understanding shifts in the social order. Bradley (1980: 251-256) made mention of using pit capacity as an indicator of settlement productivity in his discussion of Aldermaston Wharf. He used Reynolds' (1974) work at Butser Ancient Farm to calculate an approximate storage capacity per family unit for a year and contrasted that measurement with population figures to determine which farmsteads can be understood as having produced a surplus. An excess of agricultural produce is useful in solidifying ties with other groups as well as likely indicative of the productivity of the surrounding landscape. While Bradley was more concerned with productivity as linked to status and possible deviations from the 'typical' Deverel-Rimbury settlement, the argument is useful to this study as a precedent for the use of storage as proxy for agricultural production.

Production of non-metal items appeared on settlements in the later European Bronze Age, making the case for energy toward domestic architecture as proxy for production stronger as crafting would have occurred within structures to protect against inclement weather. The industries present were varied and quite possibly regional or local, adding emphasis to the need for multi-scalar approaches to locate trends from site to sub-region. Salt production along the coast, given finds of clay briquetage, some small evidence for woodworking, and textile production, evidenced by wool and flax remains, along with loomweights and spindle whorls across southern Britain indicate cottage industries at least (Harding 2002). Livestock, with all the attendant by-products, and textiles were visible on the Thames Valley's Marshall Group settlements. Flax was also intensely cultivated, with the product of flax retting pits demonstrating its multiple uses (Yates 1999). There is poor evidence for the process of arable agriculture in the Bronze Age (*i.e.* tools), although processed grain does appear on certain sites in variable amounts (Yates 1999).

Both the Scandinavian Late Bronze Age (Montelius 1885: Periods IV-VI 1100-500 BC) and the comparable period for southern Britain (1020-750 BC) witnessed an intensification of production, including arable agriculture, stockbreeding, and internal craft production (Cunliffe 1994). Crop variety (wheats, millets, oats, and rye) was introduced in this period, accompanied by an increased investment in labour toward pastoralism, in the form of increased management of animals, and agricultural production, in the form of large field systems and boundaries (McOmish 1998, Serjeanston 2007, Stika and Henrikson 2010, Stika and Heiss 2013). The Danish sub-region of Thy demonstrated a much later (*c.* 100 AD) shift from free-threshing to hulled barley than the rest of Denmark, which experienced a change in the Late Bronze Age, indicating again a need for sub-regional studies (Stika and Heiss 2013). In Scandinavia, variation in the arability of soil has been taken by as an indication of settlements shifting across southern Scandinavia (Kristiansen 1978, Thrane 2003). Settlements were constructed and the surrounding land farmed for a short period, followed by a removal of the settlement to another site. The cycle then began again, although settlement placement was not apparently dependent on the arability of the soil, given the range of settlement observed across the region, and tentative manuring evidence has been found, suggesting attempts to improve soil conditions (Robinson 2003). The "Celtic field" pattern was present across Scandinavia, beginning in the Late Bronze Age and continuing into the Pre-Roman Iron Age. Celtic fields were intensively farmed squares of up to 100 ha, providing further evidence of an increasing dedication to production over the course of the Bronze Age (Myhre 1979, Champion *et al.* 1984, Sørensen 1989). Dispersed settlements near to fields were standard, consisting of a small number of large houses likely housing an extended family (Myhre 1979, Artursson 2010). Further evidence for both shifting settlements and the importance of agricultural production comes from Gotland, in Sweden, where post-holes were found under a Bronze Age field (Myhre 1979). Agricultural strategy, as in arable versus stock raising, appears to be a consequence of settlement location. Poor soil would necessitate greater labour with little return, whereas stockbreeding, with more dispersed settlement providing the option to move to the next nearest grazing, was a more efficient practice in those regions. The more productive soils demonstrated an extensive field and pasture system next to, and maintained by a concentrated population (Kristiansen 1978, Sørensen 1989). Animals and animal raising were of obvious importance to the Scandinavian Bronze Age, given the widespread depiction of animals in art form. Likenesses of horses, fish, and duck on bronze exemplifies both the array of wild and domestic fauna as well as the importance of animal life, given the significance of bronze to regions without any natural sources (Sørensen 1989).

Similar shifts in settlement placement and organization were apparent for southern Britain. The Middle Bronze Age demonstrated more nucleated settlement plans, consisting of large enclosures containing on average two to five roundhouses. Settlements were increasingly located near or even within the co-axial field systems appearing over the course of the Bronze Age (Coles and Harding 1979, Brück 2007, Darvill 2001, Bradley 2007, Pryor 2010). Intra- and inter-regionality existed in settlement structure and placement. Enclosed settlements, such as Poundbury (Green 1987) and South Lodge Camp (Barrett and Bradley 1978), were present beside partly open or, increasingly, open sites, such as Thorny Down (Barrett and Bradley 1980, Field 2001). Non-agricultural production appeared mainly consistent, as local styles of goods were present alongside hardly any specialized tools and status item, particularly in contrast to later settlements (Ellison 1987, Brück 2007).

Settlement structure differentiation, present in small amounts in the Middle Bronze Age, increased in the Late Bronze Age (Brown and Murphy 1997). The Late Bronze Age continued to demonstrate the Middle Bronze Age settlement pattern just discussed, although new forms (middens, ringworks or ring forts, hilltop enclosures, and the earliest hill forts) were also present. As discussed above, the appearance of these forms of settlement combination have lead to an intense debate over social reorganization causing the emergence of social stratification or if social reorganization was an effect of the rise of a social hierarchy, or indeed if there was as great a social differentiation as we have historically considered (Cunliffe 1984, Bradley 1984, Collis 1994, Serjeanston 2007, Brück 2007). At the very least, hilltop enclosures and middens have been considered as communal assembly places. Middens have been considered as the remains of feasts, while hilltop enclosures, while containing little to no artefactual evidence yet typically large storage capacities, would have required a substantial organization of labour to be constructed (McOmish 1996, van der Veen and Jones 2006, Brück 2007, Needham 2007, Serjeanston 2007). Feasting remains and significant construction effort with little occupation evidence suggests both types of site were the setting for occasional community gatherings.

Needham (2007) further proposes a model for social reorganization as moving from an acquisition of prestige goods in the Bronze Age to elaborate feasting in the Iron Age. The ability to host a feast required an organization of production and a restructuring of social organization as a reaction to the dearth of bronzes after the collapse of the bronze standard and the lack of ability to acquire specific items of value. Given the requirements of an elite predicated on feasting and the resultant reorganization thereof, he argues against any social continuity from the Late Bronze Age into the Early Iron Age (*c.f.* Hodson 1964, Sørensen and Thomas 1989). A feasting culture also precludes a simple switch from bronze to iron, with social mechanisms of control of prestige goods remaining intact. Status was still dependent on control; it was reoriented on production and the more readily available materials to organize local industry, rather than the earlier reliance on imported goods. As with almost every facet of social change, the debate over the rise of a social hierarchy and the prospect of regional centres of power remains decidedly divisive, particularly when addressing the veracity, or degree, of considering production as related to status. Needham (2007) argues the reorganization from the later Bronze Age through to the Iron Age that created the extensive field systems was responsible for the emergence of later high status sites. He predicates the rise of the high status sites on the shift toward production and intensification of investment in the landscape, *i.e.* fields. The focus on production leading to the formation of an elite forms the basis of his defence for his model of social change in the Early Iron Age. While an exceedingly topical and useful model of the changing socio-economic relationships at the end of the Bronze Age, Needham suggests social change was unnecessarily abrupt, as the foundation for a social structure established from production was in place by the Late Bronze Age. The shift from a prestige dominated social order to a competitively productive organization was more of a punctuated equilibrium, as slow, smaller changes in and among local exchange relations, control of the landscape and production, and the social order worked in concert to form a new means of reproducing the social organization, with occasional stimulating events spurring more rapid change (Barrett *et al.* 2011).

Accompanying the appearance of communal sites, settlements in the Late Bronze Age appear larger than previous periods as more structures are apparent on each settlement; however, it is highly likely the record reflects longer term occupation with multiple phases of settlement in the same place. For example, the reinterpretation of the original excavation results of the Middle and Late Bronze Age site of Black Patch in East Sussex indicates two possible smaller phases, rather than a single large settlement (Harding 2002, Russell 1996, Tapper 2011). Rebuilding requires effort not observed in the majority of Middle Bronze Age settlements (Brück 1999). Such effort also indicates stronger connections to the land, promoting a change toward an inward focus and a social order centred on usage rights for land and production to gain status. An increased effort toward below ground storage (of grain, deposits, or rubbish is discussed in Chapter 4) is apparent by the Late Bronze Age, as pits become more common (Cunliffe 1992). The associated production also appears to have increased, as loomweights are nearly omnipresence, and spindle whorls and craft-specific tools ranging from wood- to metalworking are found throughout settlements of the period (Champion 1999, Serjeanston 2007), along with an increase in four-post structures which may have functioned as additional crafting areas or for cooking, as suggested by Ellison (1987) for Thorny Down, allowing crafting to take place within the roundhouse. A comparison of Plumpton Plain A (Holleyman and Curwen 1935) and New Barn Down (Curwen 1934) to Green Park (Brossler *et al.* 2004) and Mile Oak (Russell 2002) demonstrate the changing settlement patterns, with more structures being evident over time (Fig. 2.1).

Energy was being extended toward agriculture, arable and livestock, yet a completely sedentary lifestyle was not required, nor necessarily evidenced (Russell 1996, Pryor 2010). Seasonal pasturage, requiring movement for months at a time, was likely in southern Britain, indicating a more peripatetic lifestyle than previously presumed (Darvill 2001, Owoc 2005, Johnston 2013). Danish settlement has also been considered as wandering, with farmhouses reconstructed not far from the original position, within a particular area, prompting ideas of territoriality invisible in the record (Thrane 2003). Such a wandering population is not entirely accounted for by models focused on production and the attendant control and construction of the landscape for social change. The changes to the social order and production should be examined not merely as the necessary social adjustment to the sudden dearth of bronze, but

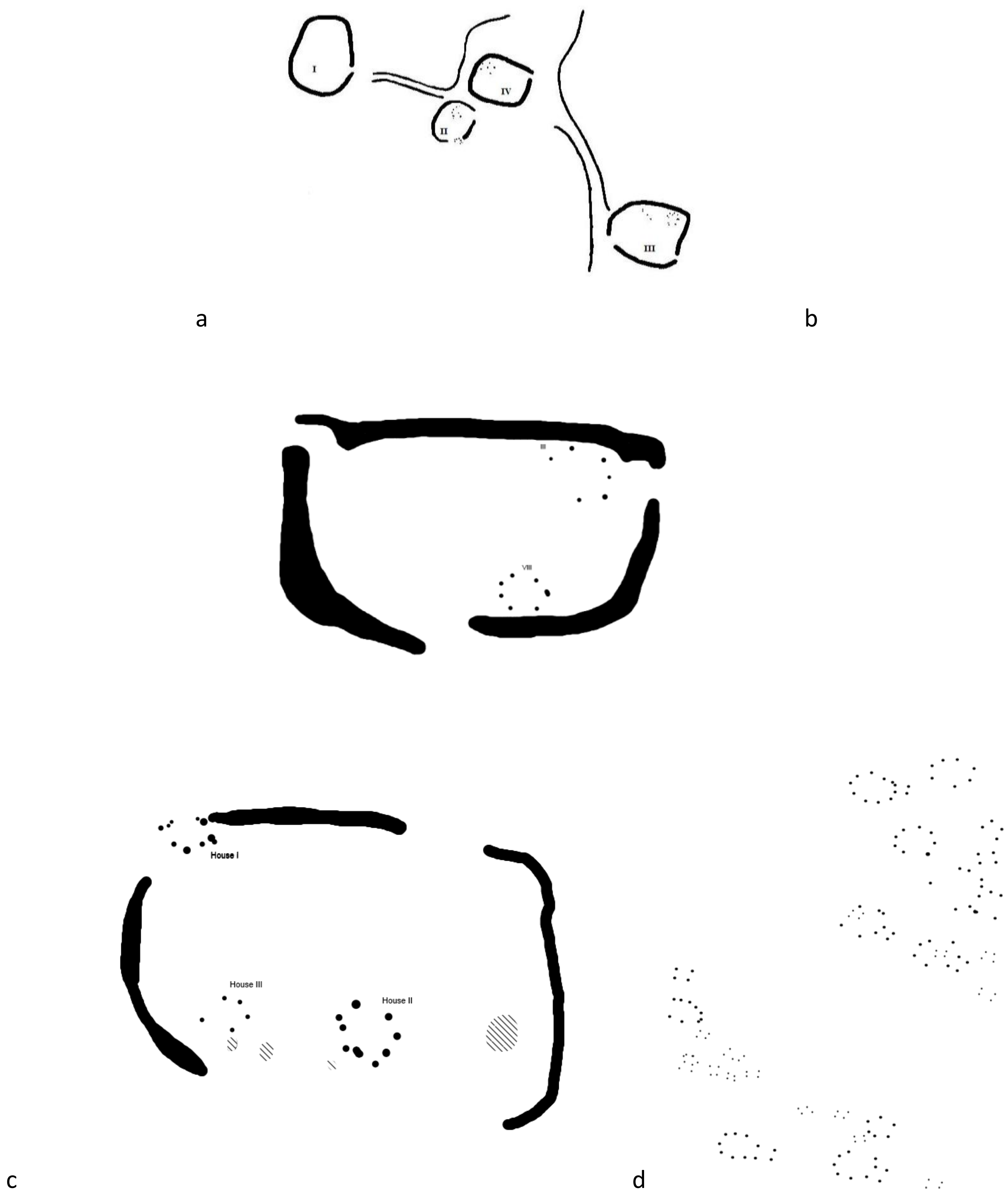


Figure 2.1 Comparison of Middle to Late Bronze Age settlements in southern Britain a) Plumpton Plain A after Holleyman and Curwen 1935, b) New Barn Down after Curwen 1934, c) Green Park after Brossler *et al.* 2004, d) Mile Oak after Russell 2000.

rather, as how each aspect of daily life (sustenance, shelter, relationships) works to adjust to changing circumstances and meet the needs of the actors. Energy expended toward domestic architecture is a viable angle of approach; it allows for differing regional and chronological trends than those of exchanged prestige goods to appear, not to mention it is largely entwined with the productive capability of the landscape, as well as command of the possible labour force.

2.4 An interpretative approach to changes in settlement organization

Now that the major theoretical models for social change have been discussed and placed in context for the Bronze Age-Iron Age transition, it is clear that past models driven by issues of a lack of bronze and increasing social hierarchy are not adequate to explain social change in northern Europe at the time. By limiting the conditions for change, we run the risk of seeing only what we want to see, rather than allowing the data to speak for itself. Interpretive models that consider each unique set of data as is, without a predetermined framework, are more applicable to the changes in social organization at the end of the European Bronze Age. Agency-based models in particular allow for the necessary flexibility in scale, both geographically and in consideration of discursive relationships, particularly when considering production and technology (Dobres and Hoffman 1994, Dobres 1995). Agency-influenced narratives of the social changes at the end of the Bronze Age (*e.g.* Barrett 1997, Bradley 1998, Gosden and Lock 1998, Owoc 2005, Kristiansen and Larsson 2005, Webley 2007) are slowly gaining favour as alternative discourses that do not exhibit the problems of models based on preconceived conditions for social change, spreading from a small core of early proponents (*e.g.* Barrett 1987, 1989) as ideas are refined and terminology redefined. Agency as a critical approach to social change allows not only for more clarity in dealing with specific data and unique circumstances than the world systems models, but also is of necessity essentially scale-less, other than to have a minimum value of a singular and individual 'agent'. Agent- and agency-based models allow for fluid geographical investigation, only limited by logical and practical concerns, as such frameworks are focused on interactions and actions (energy expended) with intent, which can be investigated micro- or macroscopically. Similarly, different facets of the social structure can be examined individually as a discourse between people and their material world, but with an understanding that all elements work in conjunction for social reproduction. As we use ritual and cosmology to frame actions regarding metal and internal house organization in intent, so too can we use the totality of effort expended toward domestic architecture to gain understanding of consumption. The organization of a settlement provides a geography of consumption.

Consideration of agency, and object agency, allows for a more flexible approach to social change that can be applied on local, sub-regional, and regional levels, and can illuminate relationships between groups and between the material aspects of society, as exchange is not considered separate from the social. This is especially essential for the end of the Bronze Age, as it allows for multiple factors (the inception of iron, a more land-based social structure, changes in settlement organization) to explicate changes in the social organization with adequate conclusions drawn from the individually presented data of the area of interest. Admittedly, allowing researches such *carte blanche* in determining both topical and geographical areas of interest will face accusations of subjectivity, chiefly from the old guard, however, is that not what archaeology is about? Moving through and beyond our historical consideration of Bronze and Iron Age 'regionalities', such as Wessex or the Thames Valley, provides possibilities for heretofore undiscovered connections and refreshing our thoughts on a well-worn period. As Jones and Graves-Brown (1996) argue, contextual approaches are necessary to present any sense of cultural identity and interaction. This study does maintain well-known geographical considerations, but to demonstrate a point in the usefulness of its theoretical approach; challenging too much of the established framework is beyond the scope of this project, which rather focuses on airing possibility for changing our approach to social change at the Bronze Age-Iron Age transition. Placing suggestions for a shift in consideration for the period within an understood geographical scope allows for stronger understanding of its impact.

Consideration of social organization as the result of input/output of energy takes the argument one further measure. The physical manifestation of a settlement (its architecture) is understood as a result of energy invested in a specific manner to suit the needs of a social group. We must then focus on the result of a decline in a previously steady flow of bronze (incoming energy both productive and economic) on that energy expenditure in architecture creation. The question raised is therefore one of the connection between the decline of bronze use and the taking up of iron and the socio-economic impact of the transition. While Needham (2007) posits either no relationship between bronze and iron use or a cause-effect relationship whereby bronze decreases because of iron or iron rises to prominence as bronze sources reduce, only the former takes the social aspect of bronze into account. Bronze and its transmission have been established as a facilitator for social relationships; iron does not simply replace bronze in maintaining exchange relationships (Sharples 2010). The impact to agricultural production should also be questioned. Bronze and iron tools possessed vastly different properties, both material and social, that by necessity would affect their productive capabilities. Sharples (2010:113) clearly states that the function of bronze tools was secondary to its social implications, although the fact that tools were created and used implies a productive capability. The social aspect of bronze cannot be denied; along with the exchange-dependent material, which limited the availability of bronze for tools in northern Europe, the social value of bronze also likely limited its use. This is in contrast to iron, which was plentiful throughout northern Europe, decreasing its social value and thus more readily available and accessed by a broader range of people (Hooke 2000, Sharples 2010). The greater availability of tools for agricultural production, along with a shift toward control of the land and its resources as the basis for social mobility therefore must result in a greater productive capacity, able to be observed from a consumptive geography of domestic architecture. The induction of iron to daily use, not limited to our superimposed Three Age System, should then be visible in the record through an increase in storage capacity, which tacitly suggests the concurrent social reorganization already discussed. Analyzing patterns of that consumptive geography on individual sites, which can be collated to a sub-region (*i.e.* the chalk downland), and further to regional analyses, will provide a model for bridging both the Bronze Age-Iron Age transition and the gap left by single scale models.

Chapter III Settlement studies

This chapter considers previous treatment of settlements and their surrounding landscapes. The move from treating landscape and settlements as background to human action and events, to central places within the landscape, to consideration as full, linked participants in forming the social order is discussed. The applicability of studying evidence for consumption via domestic architecture on settlements, particularly to answer questions regarding the impact of shifting exchange patterns and new technologies at the end of the Bronze Age, is developed.

3.1 Settlement as focal point

The understanding of how humans order space and the creation of an activity area, a settlement, somewhere for people to be and act, is of critical importance to any study of social organization, particularly one focused on social change. The way a group structures their living and working places is directly tied into how they conceive of their relationships, not only amongst themselves, but also with their transformation of the material and natural world. Energy is devoted into creating a very specific manifestation of built space, or place, out of the landscape to meet the needs of the community (Tilley 1994). In attempting to address issues of settlement, especially that of change in settlement patterns and domestic architecture, an acknowledgement of the physical landscape and the reciprocal relationship of people and the land is critical. In order to address the issues of social change through settlement evidence, we must understand settlements as a result of activities, or the throughput of energy, primarily those of consumption and production, which both creates and reflects a particular social order within landscapes, set in specific time/space (Ingold 1993, Souvatzi 2012). This is the emphasis that will be followed in this thesis. Metalworking, exchange, and agricultural production, all taking place within a socially defined and created space, have a direct impact on both a particular manifestation of social order, and therefore change, which is reflected in settlement organization. Resources and access to them, along with the production and distribution of goods, are directly related to the creation and maintenance of a social system, as previously discussed, and are also of a necessity related to environmental conditions.

Just as our understanding of social change has undergone a transformation over time with new theoretical approaches sparking new insights and furthering our knowledge of social organization and its far reaching affects, the way we have regarded settlement and landscape has changed over time, in no small part due to new thoughts and methods springing from shifting theoretical paradigms. Defining precisely what is meant by these terms and how to approach their study is also somewhat contentious, with various regional differences that can create confusion. A clear understanding of what is meant by *settlement*, *landscape*, *etc.* and how these elements play a part in the reproduction of the social order is necessary for validating the use of domestic architecture as a proxy for change.

The earliest phases of settlement study were largely focused on evidence of habitation, with little regard for the surrounding area or reciprocal impact of people on the surrounding landscape (Knapp and Ashmore 1999). In keeping with culture history and the more artefact-based nomothetic agendas, culture was considered as something separate from the surrounding environment; people and settlements were spread across the landscape, without overt regard to how the available resources or particular environmental setting may have shaped settlement structure or even impacted actions creating the social order (Anschuetz *et al.* 2001). It was not until the late 19^{th} and into the 20^{th} century that archaeologists and ethnologists began to look at settlements themselves as indicative of social organization. These models allowed for settlement patterns to be acknowledged as at the very least a proxy for, and thereby involved in, not mere backdrop to, the reproduction of the social order (*e.g.* Steward 1938; Phillips *et al.* 1951; Willey 1953). By the 1950s, awareness that settlement patterns and their changes could provide cultural information had set into the discipline's conscious (Parsons 1972). There was little set methodology or agreement on the social implications of specific patterns, yet the relationship between settlement organization and social change had been established.

With the advent of the newer, more holistic theoretical paradigms for social change beginning in the 1960s, areas of study previously considered separate, such as the natural environment and the socially created world, began to be investigated for causal relationships. While the wide-ranging acceptance of settlement organization as socially reflective and a centre for economic activities had only occurred by the previous decade, the new models also recognized a need to address the largely neglected affect of the landscape, as a socially structured part of the environment, and its productive capabilities on settlement organization, therefore considering how the landscape influences the social order (Parsons 1972, Trigger 1968). Studies acknowledging this point, such as Becker's (1971) work on Danish multi-period settlements, were focused on how settlements were situated in the environment, focusing on a particular environmental setting and possibly containing more than one settlement area (Stjernquist 1978). Winters (1969) defined 'settlement system' for nearly the first time, enabling settlements within a selected area to be investigated as part of a functional system of interaction mirroring the interest in systems theory for social change. Landscape was also defined as a culturally structured aspect of the natural environment, both the stage for human action and organizing perception that impacts the formation of social (Cosgrove 1985, Deetz 1999, Anschuetz *et al.* 2001). As Anschuetz *et al.* (20001:161) state, "Because landscapes embody fundamental organizing principles for the form and structure of peoples' activities, they serve both as a material construct that communicates information and as a kind of historical text." An understanding that the environmental conditions of the landscape being inhabited directly impacted the productive capability of settlements as well as the built environment, meaning physical constructions, required a change in focus for settlement studies.

Such investigations required attention to productive activities and seasonality, necessitating collection of data regarding the local environment, previously of little concern to settlement studies (Parsons 1972). Boserup's (1965) intensification model, which focused on frequency of cropping, made an interesting point regarding agricultural land-use and demographics. The model began to question the accepted causal relationship between population and agricultural production, claiming that population growth was an independent variable causal to intensification of agricultural production. This was diametrically opposed to earlier Malthusian concepts of agricultural production directly influencing population (Malthus 1798). Boserup's model remained focused on only a singular driving cause, *i.e.* population, for change in agricultural production, yet acknowledged a reciprocal connection to changes in cultivation practices and technology. The Boserup model had definite potential in acknowledging technological change as critical to agricultural production, but it neglected to suggest a reason *for* population increase, technological change, or possible recursive relationships behind shifting agricultural productivity and the aforementioned factors (Harding 1989; Morrison 1994). The impact of the model should not be discounted, particularly as it established a basis for linking agricultural production and population critical to this study, with both factors able to be observed through settlement architecture. It cannot, however, be taken as a viable model on its own, rather a stepping-stone for further work. Boserup's other major contribution to the consideration of land-use and agricultural production was to refute the traditional interpretation of productivity of the land as a static function of the environment, and instead acknowledge that population and changing cultivation methods and technologies had a direct impact on the productivity of a particular landscape. In her analysis of Boserup, Morrison (1994) explicated three types of intensification: space, labour, and technology. Intensification as multivariate adds an extra dimension to the concept, allowing us to regard changes in agricultural production and consumption as a process, consisting of deliberate changes in strategies of energy- the development and creation of technical strategies and tools, the input of labour, the reapportioning of land and productive space, *etc*.

Site-catchment analysis carried that relationship further in an attempt to reconcile energy expenditure toward production with the surrounding environment. Catchment areas began to be modelled for further understanding of how the landscape and environmental conditions surrounding a settlement could affect its production capabilities, with an added energy expenditure component (Vita-Finzi and Higgs 1970, Higgs and Vita-Finzi 1972, Jarman *et al.* 1972, Roper 1979). Site-catchment analyses allowed the landscape to be active in the organization of settlement through an understanding of possible land-use strategies, with emphasis on the varied availability/capability of natural resources. Although the site, or settlement, was taken as the focal point of the catchment area, the entirety of the area was taken into consideration in analysis of productive capability and economic activity. In analyzing the energy expenditure of the people moving around their catchment area, available technology was also considered, adding an essential, active component of social change onto a landscape-settlement analysis that had been lacking in previous approaches to settlement study. As technology changed, the energy expenditure changed, resulting in a shifting relationship with the catchment area, along with observed changes in settlement organization (Higgs and Vita-Finzi 1972). This was of definite benefit in progressing our understanding of the settlement-landscape productive relationship, as an understanding of settlements as active within the landscape, as well as providing a basis for the landscape to function as an agent/actor in the development of the settlement. Site-catchment was still limited, however, as each arbitrary area of site resources was taken in isolation, with little regard for how settlements and their site-catchment areas interacted or influenced each other (Roper 1979). The idea of examining energy use through evidence in the landscape and the settlement, however, remains a practicable approach to questions of production/consumption.

3.2 Relation of settlements

Once settlements were recognized as centres for the establishment of a social order and a relationship between people and the land, the relationship between settlements, and the productive/consumptive relationship of the settlement to the environment, within a research area became a pressing concern. The distribution of settlements through the landscape cannot simply be conflated with local communities, but must be understood through the motivation behind such dispersal (Dunnell and Dancey 1983). As Peterson and Drennan (2005:6) state:

> In a preindustrial agrarian society, one aspect of economic practicality can consistently be expected to spread households broadly across the landscape: the labor demands of cultivation...Pulling in the opposite direction are the economic practicalities of interactions with other households, which are facilitated if the interacting households are located in close proximity to each other...The presence of such a pattern cannot be assumed, but it can be sought as a fundamental analytical task.

With the understanding that treating settlements in isolation limited the totality of information to be gleaned regarding production and consumption, archaeologists sought to correct the oversight and include settlements in networks of exchange. The concept of sites as focal points within the target area was taken further in such approaches, with an acknowledgement that settlements required interaction between themselves, to meet their consumption needs and to allow for the reproduction of the social order. Particularly in southern Scandinavia (*e.g.* Thrane 1980, 1989, 1999), settlement studies began to be concerned with changing economic relations as reflected in the reorganization of regional settlement patterns, demonstrating the importance and effectiveness of integrating environmental data with settlement studies to make sense of the observable changes in production and give added depth to our interpretation of the record. Settlement studies began to explore the wealth of data, economic and social, available through an investigation of inter-settlement relationships and exchange.

Models concerning social exchange networks, as in Sahlins' (1974) Domestic Mode of Production model, began integrating settlements into exchange relationships through kinship relations. The exchange of marriage partners allowed for settlements to form various forms of reciprocal relationships, providing a means for continuity through exogenous reproduction, as well as through which goods were transmitted. The settlement served as the focal point for the economy, incorporating the kin group as a whole in an active engagement with "production-for-use" (Sahlins 1974:84). Simply, the formation of relationships through marriage opened pathways for the transference of the product of each settlement's energy expenditure. The domestic mode of production model fell short in actually incorporating a discussion of the process of production, economy in general, and was vague on consumption versus exchange (see Cook 1974); however, incorporation of settlements as units into this network was of significant value in settlement studies.

Central place theory, originally developed for urban planning (Christaller 1933), took a further step in that it allowed for the relationships between settlements to be examined from the perspective of a central, organizing site surrounded by an array of settlements providing support in the form of products and raw materials. The archaeological adaptation focuses more on providing a framework through which to investigate relationships of production and consumption along a hierarchy of settlements in a region, albeit restricted to attempting to answer a specific set of assumptions and/or inferences (Johnson 1977; Evans and Gould 1982). Central place theory in archaeological settlement analysis requires an understanding that an ideal of settlement will not be met, but the differentiation from that ideal is what is of interest. The most glaring issue with applying central place theory is the basic assumption of a hierarchy among settlements in the region of interest. As with site-catchment, the geographic issues with applying central place theory involve delimiting the area of interaction under investigation; arbitrary boundaries are necessary and by their nature will be exclusive of further interaction beyond the boundary, thus providing an inaccurate image of the range of human interaction. Johnson (1977) also points out that there is a tendency to conflate functional size of a settlement with population size, which is troublesome for a variety of issues, not the least that population size determination is in itself difficult. More alarmingly, there is an assumption of homogeneity in the physical landscape that is not met in reality; the variety in environment and landscape naturally has a direct impact on agricultural production and therefore the targeted economic relationships that is masked or even denied by the application of central place theory (Evans and Gould 1982).

Agency models and network-based analysis of settlements have begun to address the problems of regional, power/control-centric models, albeit in a non-uniform or clearly defined application, by considering the throughput of energy as the relational basis between settlements within a system or network. In Actor Network Theory, each settlement is treated as a node, or input, within the network; its energy involved in production and consumption can be added to the network at any point through exchange with other nearby or even down the line settlements, while not discounting its independence as a productive entity (*e.g.* Latour 2005, Knappett 2011). To use Latour's terminology, nodes of energy (settlements within specific landscapes of particular agricultural productivity), and aspects internal to those nodes (in the form of storage capability, agricultural production, technology, *etc.*), are constantly in action, or possessing the possibility of action, to create and recreate the social order. This neatly provides an alternative to the proscribed study areas of the previously discussed models, allowing for a multi-scalar investigation, which in turn allows for flexibility in research questions, along with the capability to target extremely specific aspects of social reproduction, agricultural production, and settlement organization. The reductionist issues of the more limited exchange network models are, in theory, eliminated by a more heterogeneous approach to what is considered an 'actor'. People, the environment, and material objects all work together to facilitate energy exchanges without reducing motivation to control or power (Latour 2005). In practice, however, determining ties between prehistoric settlements is difficult; in the relationship between three settlements, the flow of energy may take different forms, requiring broad research questions and inclusive data, or may be invisible in the archaeological record (*i.e.* exchange of marriage partners between groups with similar material styles), especially when in a dormant state.

While we have certainly progressed since the early days of settlement, landscape, and the environment as a backdrop to human activity, or even the mid to late 20th century models focused on single-variable causality, there still remains some disconnect in studies of settlement and agricultural production. Regional differentiation, found in most aspects of method and theory, also exists in the treatment of settlement and landscape (Gojda 2001). Western Europe, especially the northern countries, is more engaged with theoretical methodology, resulting in a stronger application of "systematic settlement pattern analysis" than eastern Europe (Galaty 2005: 293). Anglo-American landscape studies generally centre on the relation of landscape and the people engaging with it, especially through ascribing symbolic importance the physical landscape. Studies from Scandinavia primarily focus on settlement archaeology and how the environment plays a role in the structure of settlements, through inter-disciplinary studies concerning settlement, particularly those linking economic and ecological features to settlement structure (Stjernquist 1978). Central Europe has embraced the advancement of spatial archaeology and settlement studies are concerned with non-destructive survey methods (Gojda 2001, Galaty 2005). Although research methods differ and modern political divisions disrupt past territorial boundaries, the cultural aspect of the built environment, found beyond modern boundaries, allows for the possibility for both a broad geographical analysis as well as regional studies of social change, as the social relationships evident in constructed space occur on multiple scales (Rotman and Nassaney 1997).

The application and implication of the term 'settlement' is also regionally diverse; settlement archaeology in Europe has a tendency to focus on regional studies of habitation sites, as opposed to the New World emphasis on settlement pattern analysis, which includes any site of human activity (Galaty 2005, Gojda 2001). Researchers must be wary of the distinction; interpretation of a site will quite obviously not be similar and may include types of sites (*e.g.* middens) not considered as settlement evidence elsewhere. Middens, a largely Bronze Age phenomenon, are especially difficult to cohesively classify, as they are direct evidence of occupation and social activity within the landscape given they are created by acts of deliberate deposition of refuse, yet can be isolated from areas of habitation, in the sense of longer-term occupation and impact on a place (Needham and Spence 1997). Their interpretation as 'structured deposits' however denotes their significance as created aspects of life within the landscape, validating their inclusion in certain settlement analyses and providing information regarding economic and ritual processes in a similar fashion to other structured deposits such as pits (Hill 1995a, Brück 1995, McOmish 1996, Needham and Spence 1997). Differing approaches to what is 'settlement' should be considered instructive, as advantages and disadvantages are apparent through comparison, and attention paid to the research question as not every aspect of 'settlement' is reasonable to address in every case, nor is regional methodological divergence limited to definition. North American settlement archaeology tends to be more interdisciplinary, drawing on geography, geoarchaeology, ecology, and archaeobotany to produce a complex understanding of the physical setting for observed human action. The multiple-pronged approach also examines the impact of the setting on action, along with the reverse, which European studies have only begun to appreciate in the past decade or so (Galaty 2005). These issues are to be kept in mind in any development of a settlement study, particularly one focusing on two distinct research areas, each with their own response to settlement study. In this study, the focus is on domestic architecture, meaning that 'settlement' indicates a habitation site with above and below ground constructions.

3.3 Settlements, fields, and boundaries

Settlements cannot be considered in isolation, but require understanding of the totality of the landscape utilized by the inhabitants. Driven by the core-periphery and peer-polity models, the over-arching organizing principle of settlement studies, particularly in Britain, focused on interaction with and within exchange networks was seeking power or control over resources (see Chapter II; Stein 2002). Acquiring such items required interaction through networks of increasing distances; the increased power through control of access to the far- reaching networks and the items travelling through them would necessitate increased control over productive land, likely stimulating the social transformation at the end of the Bronze Age in Britain (Yates 2007). The later Bronze Age exchange networks were directly related to agricultural production through the supply of metal and material necessary for production of agricultural implements.

The changes in settlement patterns from the Middle to the Late Bronze Age discussed in the previous chapter are highly indicative of a growing concern with production and consumption, linked to contact and exchange. The change in focus originated in the Middle

Bronze Age, with the development of coaxial field systems and 'intensification' of agriculture concurrent with regions firmly in contact with the Continent and therefore access to further exchange systems (Bradley 2007). The dialectic between social organization, economic relationships, and settlement structure has been established and the viability of assessing changes to social organisation and economic relationships through domestic architecture has been demonstrated in recent studies (*e.g.* Mathiot 2011). Settlement patterns through the Late Bronze Age into the Iron Age increasingly reflect a need for control over production with the development of increasingly common linear boundaries for both fields and settlements, along with field systems encompassing thousands of hectares (Johnston 2013, Yates 2007). The development of enclosed or defended settlements in southern Britain in the first millennium BC, often directly associated with metal production as well as evidence for feasting, indicates control over both consumption and production, along with changing social relationships through increasingly us/them kinship relationships (Champion 1994, Thomas 1997, Bradley 2007). Mucking North Ring (Bond 1988) and Springfield Lyons (Murphy 1990) are excellent examples of 'defended' settlement, particularly as weapon moulds and crucibles were found within the defences (Champion 1994). Here again, however, is where terminology and definition becomes confusing. Intensification, as in the increase in devotion of energy (labour, technology) toward productive land (Brookfield 1972, Kaiser and Voytek 1983), and the relationship between producers and consumers are separate, albeit related, ideas when approaching agricultural production and its social impact (Greis 2002). Analysis of southern British has historically considered a direct relationship between an intensification of agricultural activities and social relationships resulting from a produced surplus and growing value to the land, which may or may not accurately reflect the state of interaction between settlements (Morrison 1994, Thomas 1997).

Field systems, and their boundaries, have increasingly come under investigation in both regions in recent years (Nielsen 1984, Liversage 1997, Fleming 1994, Kristiansen 2001, Yates 2007, Wickstead 2008, Leivers 2010, Johnston 2013). Where and how is the energy for agricultural production being spent? Understanding the relationship of settlements to fields and the boundaries built to contain or demarcate energy investment into land provides a much more detailed understanding of the production/consumption relationships responsible for organizing society. Yates (2007) considers the investment of energy in field construction as the Middle and Late Bronze Age the equivalent to earlier monuments, emphasising the shifting priorities toward control of land for access to long-distance exchange networks. The investment of energy into the construction of boundaries is also telling as to the priorities and social organization of the settlement as well as changes to inter-settlement relations.

Construction of ditches, embankments, and fences indicates a greater attachment to the land being enclosed, whether field or settlement, and often provides a sense of chronology (Johnston 2013). Wickstead (2008) suggests land tenure, demarcated by boundaries, was indicative of identity and therefore dependent on relationships between people, as well as their relation with the landscape, rather than simply a result of set planning determined by social hierarchy. Multiple levels of tradition, relationships, and social organization can therefore be observed through field boundaries, with large tracts of enclosed land being further divided on a more local level and renegotiated as priorities and relationships shifted (Brück *et al.* 2003, Wickstead 2008, Chadwick 2013).

Boundaries in particular are fascinating as liminal spaces, creating a physical between space of known/unknown and ours/yours, as well as perhaps serving as a metaphysical function with the addition of selected deposits (Thomas 1997, Brück 1999). The amalgamation of agricultural production and ritual is furthered when accounting for the repurposing of earlier barrows as field boundaries, accompanied in some cases by a continued deposition of cremations along those borders (Johnston 2013, Pryor 2010). Practical considerations of field boundaries include crop protection, control of both stock and movement across the landscape (Fowler 1981, Yates 1999), similar to consideration of enclosure of settlements (*e.g.* Cunliffe 2005).

Interpreting Britain in the first millennium BC in terms of regionality or interaction between bounded areas on multiple scales has precedent, as social change has long been considered through 'spheres' of contact and idea diffusion (Bradley 1984, Sharples 2010). Particularly focusing on the development of autonomous field systems, fluctuation in settlement patterns, metalwork, and the implications of the decline of the Thames Valley and the Wessex Culture, the spheres of contact continually formed more connections. In a system of down-the-line interconnected networks, settlements were in contact with their neighbours, resulting in a regional system of interaction that in turn initiated contact with neighbouring regions, creating a complex of interconnected, yet independent networks (Bradley 1984). The interplay between the Thames Valley and Wessex demonstrates such connectivity; Wessex largely dominated in the earlier part of the Bronze Age, yet began to fade in favour of the Thames Valley ascending through increased economic power due to agriculture into the Late Bronze Age (Sharples 2010). The Thames Valley exhibited intensification of agriculture around 1600 to 1500 BC, near the beginning of the Middle Bronze Age, and flourished through the Late Bronze Age (Champion *et al.* 1984). The key to success was the development of large systems of co-axial fields as Wessex and the surrounding settlements continued to practice traditional agricultural methods, allowing control of the flow of material to shift to the west

(Bradley 1980, Leivers 2010, Yates 1999). The Thames Valley has been identified by Yates (1999, 2007) as containing internal regional centres of power, as settlement evidence is clearly along one of four field system groupings: the Lechlade group, the Runnymede-Petters group, the Wallingsford group, and the Marshall's Hill group. The regions present approximate north-south, northeast-west, and southeast-west divisions of the surrounding arable and pasture land. The field systems formed both physical and cultural boundaries, the permeability of which is still under investigation, as the four regions of the Thames Valley contain bronze deposition coinciding with specific pottery types per region. It is clear, however, that field systems and their boundaries played a role in social identity and the redefining of the social order.

Existing field systems, and associated boundaries, maintained throughout the Bronze Age were abandoned in the Early Iron Age of southern Britain, with older fields being bounded differently or simply abandoned, implying a change of emphasis on the importance of arable agriculture and relationship with the land (Bradley and Yates 2006, Wickstead 2008). The continued presence of certain boundaries then suggests definite significance, possibly due to local identity or historical tradition on multiple scales (Wickstead 2008, Løvschal and Holst 2015). Champion (2007) suggests a cessation of ritually bounded field systems in the Early Iron Age of southeast England, matched by an apparent scarcity of settlement compared to the previous period (Pope and Haselgrove 2006). What evidence there is, however, indicates that settlements were nearly always enclosed, albeit through different 'types' of enclosure (Fig. 3.1) as exemplified by the circular enclosure with antennae ditches Little Woodbury (Bersu 1940) and the D-shaped enclosure of Winnall Down (Fasham 1985). These type-sites have been interpreted as self-contained units of varying status, with the Little Woodbury type, including Gussage All Saints (Wainwright and Spratling 1973), as a high-ranking single- family

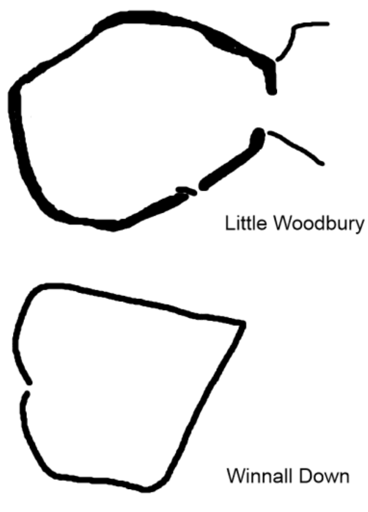


Figure 3.1 Iron Age Settlement Enclosure 'types'. Circular with antennae ditches: Little Woodbury (after Bersu 1940). D-shaped: Winnall Down (after Fasham 1985)

lowland settlement commensurate with defended hillforts, and the Winnall Down type as a lower status village (Cunliffe 1991, 2003). This simplistic view of Iron Age settlement has begun to be challenged (*e.g.* Moore 2007, Davis 2008, 2011) by the understanding that British Iron Age settlements were often in close proximity, suggesting a more complex relationship of settlements in a wider scale of enclosure. The hierarchical model of settlement for the Early Iron Age has largely been supplanted by consideration of settlements as unranked, yet competitive units that could combine forces for specific purposes (Hill 1995a, 1996; Collis 1996). Linear boundaries (ditches and trackways) connected neighbouring settlements set within a wider landscape context evidenced by cropmarks (Moore 2007, Davis 2011). Wider tracks of land than the earlier Celtic fields were demarcated by linear ditches and pit alignments, with great variation (Bradley and Yates 2006). The agricultural land was what connected Iron Age settlements, highlighting a continuation of the social importance of agricultural production, yet suggesting a more mutually dependent relationship between settlements than the previous period (Moore 2007, Sharples 2010, Davis 2011).

Settlements in Scandinavia reflect similar changes with an increase in land use over time for arable agriculture accompanied by grazing, mirrored in the palynological record as hazel, birch, and oak were cleared to make room for agriculture (Jensen 1994). Greater amounts of energy were apparently being expended on production, requiring a shift in social organization for the arrangement of labour and oversight of production and consumption. Unlike southern Britain, however, Danish settlement studies have until recently accepted a unilineal sequence of settlement development from Bronze Age farmsteads to aggregation of farmsteads to Iron Age villages with change and/or gaps in settlement due to changes in environmental conditions rather than social reorganization (Hänsel and Thrane 2003). Critique of a single interpretation of a settlement within an evolutionary context in favour of interpretation on the basis of the settlement itself has begun to influence Danish prehistoric settlement studies (Ejstrud and Jensen 2000, Herschend 2009, Løvschal and Holst 2015). Jensen (1994) suggests the change in settlement is indicative of a social shift toward control of agricultural production, as there was evidence for multiple occupations of the same sites, accompanied by an increase in the number of storage facilities. Smaller houses were also apparent in Periods V to VI (900-500 BC) and continued through to the Pre-Roman Iron Age, indicating smaller family groups likely the result of social restructuring (Artursson 2010). Fields, *digevoldinger*, in the Late Bronze Age and Early Pre-Roman Iron Age were enclosed similarly to British Celtic fields and linear boundaries were found around settlements and throughout landscape, again an indication of energy expended toward control of the landscape and production (Løvschal and Holst 2015). The boundaries (*i.e.* ditches, embankments, fences) around settlements occurred simultaneously with the advent of larger aggregate settlements, emphasising the switch to longer occupation, along with associated social changes regarding property (Mathiot 2011). There is also a tendency to assume the landscape was divided to best benefit arable agriculture, although critics (Holst and Rasmussen 2013) have begun to question reconsideration in favour of cattle husbandry and suggest a reconfiguration of the way the landscape was viewed in relation to settlements. The apparent shifts in energy expenditure toward more permanent, larger settlements and investment in the landscape in both southern Britain and Denmark suggest greater importance being placed on production, with an associated reorganization of consumption, throughout the later portion of the Bronze Age and into the Iron Age.

3.4 The landscape versus the settlement

Settlements have been established as socially contrived centres of activity set within the landscape. What remains, however, is an unclear understanding of what landscape *is* as an archaeological term. Anschuetz *et al.* (2001:158) address the concern that 'landscape' is used to discuss either natural or cultural qualities, as "a synonym for *natural environment* or *settlement pattern*", with little discussion of the reciprocal nature of the relationship between the natural environment and settlement patterns. The landscape is shaped by the needs of the inhabitants of the settlement (*e.g.* fields), yet the qualities of the landscape also define the productivity of the settlement by means of soil arability, topography, climate, *etc.* The acknowledgement of these factors has played a strong role in recent developments in interdisciplinary studies, providing a more comprehensive understanding of the relationship of the settlement to the landscape.

Archaeobotany has attempted to bridge the gap between the natural and built environments. The relationship between settlements based on agricultural production and consumption has been noted in recent attempts to address the issue (*e.g.* Stevens 2003, van der Veen and Jones 2007), and resolve issues arising from models such as Jones' (1985) model for tracing origination of crops. Even the definition of 'producer' versus 'consumer' has been varied and contentious, with nuances and cross-over in application making the distinction between labels difficult to both follow and defend. The labelling itself is problematic, as such terms tend to take on a more weighted aspect in our minds than should be ascribed a set of relational terms. An understanding of the fluidity of settlement relationships within a regional or inter-regional network, rather than a more static assignment of 'producer' and 'consumer' without appropriate re-assessment through time, is necessary to grasp the complexities of shifting populations and variable soil productivity. The assumptions made by Hillman (1981, 1984) and van der Veen (1992), for instance, are unfortunately reductionist and over-simplify classification of sites based on circumstantial evidence. Hillman focused on the location of processing waste to determine a producing settlement regardless of soil type and probable productivity, following the assumption that grain would be exchanged only after cleaning. The later van der Veen model assumes producer versus consumer settlements on the basis of settlement type, *i.e.* villa versus town, something not applicable to other periods, as evidenced by this study. Archaeobotany is also proving useful in understanding single dwellings and intra-settlement relationships between dwellings. Grabowski and Linderholm (2014) have proposed an archaeobotanical, geophysical, and geochemical model for assessing functional spaces (*i.e.* cereal cleaning, storage, cooking, consumption) within Scandinavian Iron Age longhouses. The archaeobotanical models are valuable in turning to a part of the record often ignored in determining inter-settlement relationships and internal dwelling functionality, yet by focusing solely on comparison of botanical remains in the record or reducing the complexities of interaction to settlement type, the models are inadequate, not to mention largely focused on the Late Iron Age, rather than earlier settlement by-play. This is a result of the record being more forgiving in the preservation of botanical samples on later periods, yet the changes in the Bronze Age to Iron Age transition require exploration as well.

Studies of climate change at the end of the Bronze Age are particularly critical in understanding the state of agricultural production/consumption, particularly with the changes to field boundaries in southern Britain. The ability to grow crops and feed livestock is contingent upon agreeable climatic conditions and change, especially rapid change, in those conditions can have an adverse affect on the standard of living. Such an abrupt shift of climate occurred in the Late Bronze Age (*c.* 800-750 BC) across north-western Europe, with cooler temperatures and wetter conditions prevailing across most of the region, affecting the growing season, soil condition, and availability of grazing (van Geel *et al.* 1996, Brown 2008, Amesbury *et al.* 2008). Certain studies (*e.g.* Caseldine 1999, Berglund 2003, Magny 2004, Turney *et al.* 2006, Brown 2008) have attributed population decline, the reorganization of the social order, and changes in field systems to the changes in climate, yet more recent data (Tipping 2002, Armit *et al.* 2014) has demonstrated a chronological lack of correlation between climate change, social change, and population decline. This does not preclude climatic impact on social change at the end of the Bronze Age, as environmental change requires flexibility in crop types, field organization, *etc.* (Dreslerová *et al.* 2013). The date and impact of the climate change was not equivalent across northwestern Europe and under-studied regions rely on inference from their neighbours, which may cause inaccurate assumptions. For instance, northern England and Scotland (Hughes *et al.* 2000, Barber *et al.* 2003) have been studied more thoroughly than southern England and demonstrate variation in intensity and inception of the climatic shift, yet studies for southern England tend to be predicated on those data (Amesbury *et al.* 2006). More regionally specific studies are required before any significant conclusions can be made about the impact of the climate shift to agriculture in southern Britain and Denmark, yet there is no denying conditions changed at the end of the Bronze Age and would have required alterations in agricultural strategy. The study of field systems discussed above has indicated a change in strategy, yet there remains a lack of model for grasping the fundamental changes to consumptive relationships from the Bronze Age to the Iron Age.

3.5 Energy and domestic architecture

Following with the argument of the previous chapters, this study aims to examine the impact of a decrease in bronze importation at the end of the Bronze Age on social organization by investigating energy expenditure, via the proxy of settlement architecture. Again, this study makes no claim to a miracle cure for the problems inherent in current models, but rather serves as a test for the applicability in examining social change as a result of changing energy flows through the lens of settlement architecture. Earle and Kolb (2010:58) stated clearly, "Settlement pattern studies are thus best used as means to construct models of prehistoric societies to be further evaluated..." They were discussing the intricacies inherent in regional sampling and the connection of surface finds to their occupational context, the latter of which does not apply to this study given the point of the model is to gain an understanding of consumptive practices without resorting to material culture. The point is taken, however, as grounds for settlement analysis as a valid platform for modelling prehistoric production and consumption. As this chapter discussed, settlements, agricultural production, and the landscape are interconnected through the application of energy, allowing the potential agricultural storage capacity on a settlement to function as a proxy for production and consumption, just as insight into population can be gleaned from living space Settlement must be understood as a geography of energy expenditure in the form of construction, interaction, and social activity taking place within a particular manifestation of time/space. Structures, through their construction, possess both external and internal, along with direct and indirect, relationships with production and consumption, which create and reproduce the social order and therefore facilitate change.

This study will focus on the throughput of energy as embodied by the post-structures and pits visible in each settlement to test the impact of the long-distance exchange networks, falling into disarray toward the end of the Bronze Age and essentially ceasing to provide the means for social reproduction to the areas under investigation, on settlement organization. In a similar manner to Thrane (1999, 2010), a genetic settlement or *Genetische Siedlungsforschung* approach developed from the German Historical Geography movement is appropriate here, indicating an emphasis on the changes in settlement patterns through time and developing a model of consumptive geography for the Bronze Age-Iron Age transition. There is support for a multi-scale approach in an historical geography approach, despite the strict regionality of Sauer (1941), as Wrigley (1998) emphasised the benefits of a microcosmic scale as foundational for interpretation of wider scale geographic data. The model flirts with behavioural archaeology only in that it attempts to explore energy invested by human action toward a specific goal, in this case construction of spaces utilized in production and consumption (Schiffer 1975). The energy expended on constructing domestic architecture in the research areas is essentially free of scale, presuppositions or ideas of culture areas- any activity toward the maintenance of life provides information on the organization of social relationships (Walker 2001). The socially imposed organization of domestic architecture will provide data on consumptive relationships within both settlements and regions in southern Britain and Denmark toward the end of the Bronze Age through the changes to spatial consumption and the energy expended thereof.

Chapter IV Methodology

In this chapter, the aims of the study and the methods used to answer the research questions are set forth. Terminology is defined and discussed. The variables, dwelling space, pits, and post-structures, are further defined and discussed. A brief overview of the dataset and regions under investigation is also included.

4.1 Aims and study outline

The central aim of this study is to assess whether the agricultural systems of the Bronze Age declined in scale, remained static, or grew over the transition from bronze to iron technology. To this end, settlement architecture (dwelling areas, pit sizes, and number of post-structures) was employed as a proxy for changes in possible levels of agricultural production and consumption, from the end of the Bronze Age into Early Iron Age in southern Britain and in Denmark. The period chosen was one that saw significant technological change, *i.e.* the adoption of iron working, and the regions selected were those that both provided adequately published data sets and were dependent upon imported alloys for bronze technologies. The changing technologies, along with the possible changes in social organization occurring as access to the socially significant material of bronze was abandoned in favour of locally produced iron, might indicate that the stimulant behind agricultural production changed over this period. Changes in levels of agricultural production should be visible by virtue of possible changes in the facilities that stored and consumed that product. The built environment, the physical constructions of the settlement, was chosen as the focus as the most visible context of the relationship between landscape productivity and the scale of human consumption.

Field systems, while critical to the actual production of foodstuffs necessary for consumptive relationships, were not included in this study as they are largely insecurely dated (often relying on construction of boundaries: see Chapter III) and difficult to place in context with settlements. Exceptions such as Yates' (2007) work in the Thames gravels and the Heathrow Terminal 5 project (Framework Archaeology 2006) are slowly changing the status quo, yet the majority of the field systems on the chalk remain unconnected with the neighbouring settlements (Woodward 2008). The analysis presented here may provide data regarding the productive capacity of specific settlements beyond what current field studies indicate, proposing targets for future work. The overall aim of the study was to provide a model of the productive/consumptive relationships of agriculture by means of the domestic architecture that could demonstrate changes to the throughput of that energy. The impact of a shift in technology and the concurrent social restructuring from the end of the Bronze Age into the Iron Age on agricultural production will thereby be demonstrated through the visible use of space, allowing positive, negative, or neutral influence to be observed. Such a model would posit a possible solution to the tendency of social theorists to examine macro-scale social issues with the built environment considered only in context (Hillier 2008), as it allows for the structures themselves to speak for changing relationships. Single settlements are often lost in analyses of social change in the Bronze Age-Iron Age transition; this study proposes a model allowing for multi-scale analysis from settlement to sub-region to region, demonstrating both overt and subtle reactions in productive and consumptive use of space to changing technologies and social reorganization. In progressing through ever-wider scales of interaction, the model will indicate the broader social changes accepted for the Bronze Age-Iron Age transition, while demonstrating the viability of regarding architecture as proxy for energy expenditure and changing social priorities.

The period selected, the later part of the Bronze Age (the Middle Bronze Age (1500 BC) in southern Britain and Early Bronze Age (1800 BC) in Denmark) into the Early Iron Age, was specifically targeted as a period of documented sweeping change in metal production with possible implications for social organization (see Chapters II and III). The chronology selected for organizing the selected southern British sites was taken from Needham's (1996, Needham *et al.* 1997) study of metalworking phases in which the Middle Bronze Age refers to 1500-1020 BC, the Late Bronze Age to 1020-750 BC, and the Early Iron Age to 750-450 BC. The Llyn Fawr phase (800-600 BC), which can be considered a transitional LBA/EIA phase equivalent to Cunliffe's (2004) Early and Late All Cannings Wares, was not used in this study. While the progression of LBA, LBA/EIA, and EIA settlements would provide interesting data for tracking the progression of space and energy stored in domestic architecture, our knowledge of transitional LBA to EIA settlement, in terms of habitation sites with dependably dated structures, while continuously increasing, remains thin (Tubb 2011). Chronology for the Late Bronze and Early Iron Ages is particularly troublesome for a multitude of reasons, most significantly due to the lack of correlation between stylistic material culture and radiocarbon dates, as well as the possibility of local, sub-regional, or regional style divergence (Greenwood 1997, Champion *et al.* 2007, Oake 2007, Webster 2008). Radiocarbon dating itself for the Hallstatt plateau of 800-400 cal BC remains problematic, despite advances in technique and Bayesian statistics, resulting in broad calendar date ranges difficult to translate into short transitional periods (Moore and Armada 2011). Reliable dating based on architectural form (enclosure shape, structures) for the LBA/EIA period has yet to be produced, although attempts have been made (see Cunliffe 2004), creating more uncertainty when attempting to narrowly date settlement architecture (Tubb 2011). Given the typical dearth of finds within

Late Bronze Age and Early Iron Age structures, especially in a period of ritual abandonment and deposition that can lead to non-contemporary artefacts located in and around structures, a transitional period derived solely from finds is difficult to apply (Hingley and Miles 1984, Webley 2007).

The Danish chronology was much less controversial and was based on Montelius' (1885) organization of the Bronze Age and Becker's (1961) Iron Age chronology. The Early Bronze Age, or Periods I-III, refers to 1800-1000 BC. The Late Bronze Age, Periods IV-VI, includes 1000-500 BC, while the Early Iron Age refers to 500-200 BC. The Early Iron Age is further divided into Becker's Iron Age Periods I-III, respectively the Early Pre-Roman Iron Age (500-300 BC) and Late Pre-Roman Iron Age (300-200 BC), in order to both match conventional dating and discussion and to further explore changes in domestic architecture.

Published site reports were the means of data collection. The grey literature was excluded from this study simply because of concerns of the quality of analysis that had not been through any detailed peer review for publication. In any case, the published material is by its nature representative of our current knowledge of later prehistoric settlement and the grey literature was felt unlikely to present additional information regarding the organization of settlements, particularly for the well-studied British Bronze Age. Given that the sample is representative, a larger data set simply produces "noise" in numerical form to the detriment of interpretation (Barnes 2013:299). The sheer amount of unpublished settlement evidence, particularly for Britain (*e.g.* the Archaeology Data Service, Online Access to the Index of archaeological investigations (OASIS)), provides its own dilemmas when constructing a manageable study. An overly large collection of data of uncertain quality provided by the grey literature would therefore reduce the quality of the analysis given current time constraints. While the published data do create problems of geographical bias (Brück 1995), the sites included in this study are well studied and representative of each time period. This selection of published rather than grey literature was therefore adopted for this study.

The published data are themselves of variable reliability for a number of reasons. The reports cover the chronological span of archaeological research and therefore mirror shifts in methodological paradigms. There is an increase in scientific structure over time, as well as increased recordation and interpretation. To mitigate the disparity, the sites under investigation display equivalent, or later reinterpretation under stricter methodology, standards of data recordation. Correction to the data of earlier sites only occurred in placing sites in a more specific chronology (Rams Hill: Needham and Ambers 1994), correcting for the error of earlier typographical chronologies, or in reinterpretation of phasing (Avery and Close-Brooks 1969). Bias or obfuscation due to specific research questions or simply still developing archaeological processes from the report authors is still possible, as is simple mechanical error in scale, as is the case in any study based from excavation reports. These reports are representative of our collective knowledge of the end of the Bronze Age and the Early Iron Age, possible error included.

4.2 Dating

Dating of prehistoric material across Europe is still problematic and can be controversial, particularly when dealing with two separate areas with differing relative dating traditions of metalwork and ceramics (Roberts *et al.* 2013). For the purposes of this study, chronological placement of sites was taken from the reports. Older reports using outdated relative typological basis for chronological assessment, especially the corpus of British reports published prior to the 1950s, were recalibrated using accepted methods of relating typologies to radiocarbon dates (*e.g.* Barrett 1980, Needham 1996, Needham *et al.* 1997). The older reports of well-known sites have often been supplemented with additional reconsideration in more recent publications (*e.g*. Rams Hill: Needham and Ambers 1994) providing more secure dating. When additional publications containing more recent dating information were available, they were accepted as valid for this study. In contrast to the British material, Danish prehistoric dwellings are usually of recent finding, most within the past six decades, and therefore utilized more scientific, reliable dating methods. Further supplemental dating was also available for certain sites (*e.g.* Hemmed and Højgård: Rasmussen 1991). Particular reports indicated problematic sequences (*e.g.* Cadbury Castle: Barrett *et al.* 2000), in which cases the structures with the most secure chronological sequencing were included, while tentative or undated structures were excluded. Radiocarbon dates, with appropriate post-1970 calibration, were accepted as accurate dates where provided.

Multi-phased settlements, such as Itford Hill (Burstow and Holleyman 1957) and Højgård (Ethelberg 1986), presented a challenge in grouping settlements by period for comparison. While the purpose of the study is to investigate maximum energy devoted to consumption within a period, many settlements presented clear, or at least agreed-upon, phasing within a period. To avoid inflating the results, the phases, as presented by the excavator or a later reinterpretation (*e.g.* Itford Hill: Burstow and Holleyman 1957 versus Ellison 1978), were considered as discrete entities within the period. For example, Itford Hill was a Middle Bronze Age settlement considered as four phases, Itford Hill i-iv, of clear contemporaneity in domestic architecture, as per Ellison (1978). The variables for each phase were treated as a progression of settlement organization through time, rather than as a lump sum for the period. This treatment of settlements with clear phases of contemporaneous structures provides more secure information regarding the maximal use of domestic space per period within the lifetime of the site, as changes to the utilization of space are acknowledged. The next generation may not require as much living space as the previous, or may require greater numbers of dwellings, or perhaps a catastrophe required rebuilding. By acknowledging that a settlement is not a static entity fixed at a singular point in time, the more subtle intra-settlement reflections of agricultural production and consumption will be visible. There were exceptions to this: Stannon Down (Mercer 1970) was thought to be phased, but the incomplete excavation made phasing the dwellings difficult, if not impossible. It has been included in this study, however, due to its significance in the record.

4.3 Terminology and Usage

Specific terminology regarding domestic architecture was adopted for this study. While this study is interested in the changes in agricultural production and consumption visible in domestic architecture over the Bronze Age-Iron Age transition, for the sake of comparison and comprehension, the architecture is separated into three broad functional categories to encapsulate the process of production and consumption: dwelling area, pit volume, and storage potential in post-structures. These categories were created by quantifiable and demonstrable attributes, as per Rathje and Schiffer (1982). 'Dwelling' refers to those larger structures assumed as living or working spaces, particularly post-structures constructed with more than four posts, which are representative of the scale of the human productive unit. Recent studies (*e.g.* Chadwick Hawkes 1994, Giles and Parker Pearson 1999, Webley 2007) concerning domestic structures have stressed that not all buildings were necessarily utilized solely for sleeping, eating, *etc.* but were likely involved in craft production or other domestic activities. This study considers all roofed floor area of structures not considered 'post-structures' as 'dwellings', a term meant to be indicative of available roofed space of specific size and form to carry out tasks devoted to daily life. The aim was simply to trace growth or contraction on the available area across time. The focus of this study is therefore to contrast *maximum* living/activity space with *maximum* cleaning/storage/crafting/disposal capacity. Dwellings henceforth refer to the roofed floor area of roundhouses, longhouses, and structures of more than four posts, except where noted by size as post-structures. The term 'Total Habitable Area' or 'THA' was used to establish the maximum possible covered floor area (m^2) of dwellings present per site, per period to provide information regarding the changes in scale of living space over time, as well as further details of possible regional shifts over time.

Post-structures constructed of four or six posts of small area (especially in the case of Denmark, discussed in detail below) are treated as structures associated with storage and consumption, either of the results of agricultural production or energy invested in crafting. Rather than referring to these as 'outbuilding', 'ancillary structure' (*cf*. Pope 2003), or 'økonomibygning' aka 'economy building' (*cf.* Siemen and Stoumann 1996), such structures are referred to as 'post-structures' and considered representative of agricultural productivity and energy consumption. While there may be overlap in function with dwellings, the divergent construction, and lack of interior features, for post-structures requires treatment as a separate variable. Post-structures are customarily considered primary storage in Scandinavia, pits being glaringly absent in the record through the periods under investigation. Certain Danish sites did report the existence of pits (*e.g.* Hemmed Church: Boas 1991), however the recording and stratigraphic sequencing remained variable and unreliable for a comparative study. Post-structures are a later addition to domestic architecture in southern Britain, and have been treated as possible secondary storage/processing areas (Bersu 1940, Gent 1983). Such structures have been referred to as 'granaries' in the literature after Bersu's (1940) study of Little Woodbury, particularly on defended or enclosed sites (Cunliffe 1976); while this is a contested term, the likelihood of above ground agricultural cleaning/processing/storage space separate from other activities is accepted in this study. Other explanations of such structures have been posited, such as shrines, stables, or platforms for excarnation similar to Native American traditions (Piggott 1968, Ellison and Drewett 1971, Harding 2012). Excarnation might have been an Iron Age tradition associated with hillforts (Cunliffe 1995, Harding 2012), which does not explain the presence of such structures on earlier settlements; however, such uncertainties of function have to be accepted as part of the wider uncertainties that accompany archaeological analysis. While the purpose of post-structures is therefore contested, the fact remains that small, squarish post-structures unlike other forms of construction in terms of size, shape, and interior architecture were created on settlements, indicating a need for such structures as part of the settlement process. The investment of energy in the construction or upkeep of post-structures is explored in this study as a proxy for consumption regardless of use as the physical reality of the structures speaks to some form of energy toward daily life being expended within their walls. In contrast to THA, the use of 'Total Additional Area' or 'TAA' indicates the total maximum covered floor area (m^2) of the post-structures to delineate the covered floor area of storage architecture from that of the productive architecture of dwellings.

Subterranean pits, simply termed 'pits', are accepted as representing below ground 'storage' and representative of the productive output of part of the agricultural system.

Regardless of what pits held, energy was expended in their creation and they were filled with the results of energy expenditure, whether used as grain silos, rubbish pits, or shallow scoops of indeterminate use. In Britain, the case for pits as storage was first made by Bersu (1940) at Little Woodbury and confirmed experimentally by Reynolds (1974, 1979) on the Butser Ancient Farm Project and by Bowen and Wood (1968). As with post-structures, alternative theories regarding the phenomenon of pits have been posited. Pits are an almost standard facet of Bronze Age and Iron Age settlement in southern Britain, making our understanding of their purpose essential; newer theories regarding pit usage do not by their existence negate previous interpretations, but rather add dimension to prehistoric life. Finds of rubbish, metal hoards, and human remains have questioned the practice of subterranean grain storage (Hill 1995a, Ruiz Zapatero 2013). Wainwright's (1979) excavation of Gussage All Saints was purposely designed to challenge consideration of pits as storage, yet there continue to be finds of grain within pits (*e.g.* Danebury: Cunliffe 1984), indicating the issue is ambiguous and likely multi-faceted. Indeed much of the use of pits for votive and rubbish disposal might well be a secondary use as the pit was infilled. For this study, as the maximum *possible* energy expended on consumption was sought for comparison through time, pits, with exceptions defined below, are considered representative of consumption regardless of initial or final use. Storage of grain and disposal of rubbish are both indicative of consumption and the creation of subterranean pits to deal with the overflow of daily life are a direct throughput of energy that will reflect changes over time in relation to changing priorities and technologies. This variable was treated separately from the post-structures; although both are proxies for consumption, the methods and labour involved in their creation differ significantly enough to warrant separate treatment. Subterranean storage is found across most of southern Britain, while little if any is found in Scandinavia. Here again is a distinction between the target regions that precludes direct comparison, while not impacting the significance of the data collected.

4.4 Dwellings

As stated above, dwellings refer to the productive capacity of the settlement, *i.e.* the population or labour force able to be marshalled toward agriculture. As the living and activity areas of the settlement, the Total Habitable Area indicates relational populations and changes to the THA over time indicate shifts in the availability of energy able to be expended on agricultural production. The floor areas of individual dwellings were taken or calculated from site reports and plans. When calculated, the total floor area for roundhouses was understood as the roofed floor area within the post-ring. For longhouses, the total area was recorded as that enclosed by an outer wall line (as per Becker 1968; see Fig 4.1). Where possible, porch structures were incorporated into the total covered floor value, again measuring from post to post. Where indicated as likely habited structures, penannular structures in southern Britain were included in the total covered floor area (*e.g.* Old Down Farm *EIA phase* (Davies 1981), Hog Cliff Hill *EIA phases* (Ellison and Rahtz 1987)). Such evidence in the reports, however, was rare and therefore penannular structures were often disregarded in this study. Certain dwellings were decidedly ellipsoid in structure, and the appropriate area equation was used (Fig. 4.1). The variation in shape and size of dwellings suggests variation in energy expended in construction. Differences in energy devoted to dwelling construction within a settlement resulting in structures of heterogeneous size and organization may reflect intra-settlement hierarchy (Cunliffe 1991, 2003). Similarly, variance between settlements possibly indicates sub-regional and regional trends in allocation of resources and was therefore of interest to this study in terms of possible labour organization toward agricultural productivity. The variation in dwelling area within each settlement was calculated as standard deviation within each settlement phase, within geologic regions, and as summary values for each period.

In collecting information regarding house sizes in Denmark, many site reports merely alluded to house 'type', *i.e*. longhouse with stalling versus small longhouse with double wall line, without providing specific dimensions (*e.g.* Becker 1968). The assumed dimensions for each type were typically then presented in average length and width or in a range of measurements. For instance, Becker's (1968; 238) discussion of Grøntoft indicates "eight of the houses were 7 to 11m long, with one house (Bii) up to 13.5m long. The width of the earlier excavated houses was fairly consistent at 5-5.5m, however, the width of the houses in village B were between 4 and 4.5m." Those averages or ranges, where applicable with no alternative measurements possible, were used in this study, albeit as seldom as possible, as demonstrative of the dwellings on those specific sites. Where no site plans were available, the minimum and maximum values were used once, with the remaining dwellings considered in terms of the median length and width derived from the provided range. There is inherent inaccuracy in relying on averages rather than the exact measurements of the specific dwellings, however, the averages are understood as commonly accepted as representative of the covered floor area of the period. The numbers derived from averages still provide a reflection of the trends in house/storage comparison.

For those reports which did not include averages and instead provided sites plans with structures marked by post holes, the floor area was measured from the inside of the outermost post holes to obtain maximum potential roofed living space. Dwellings were

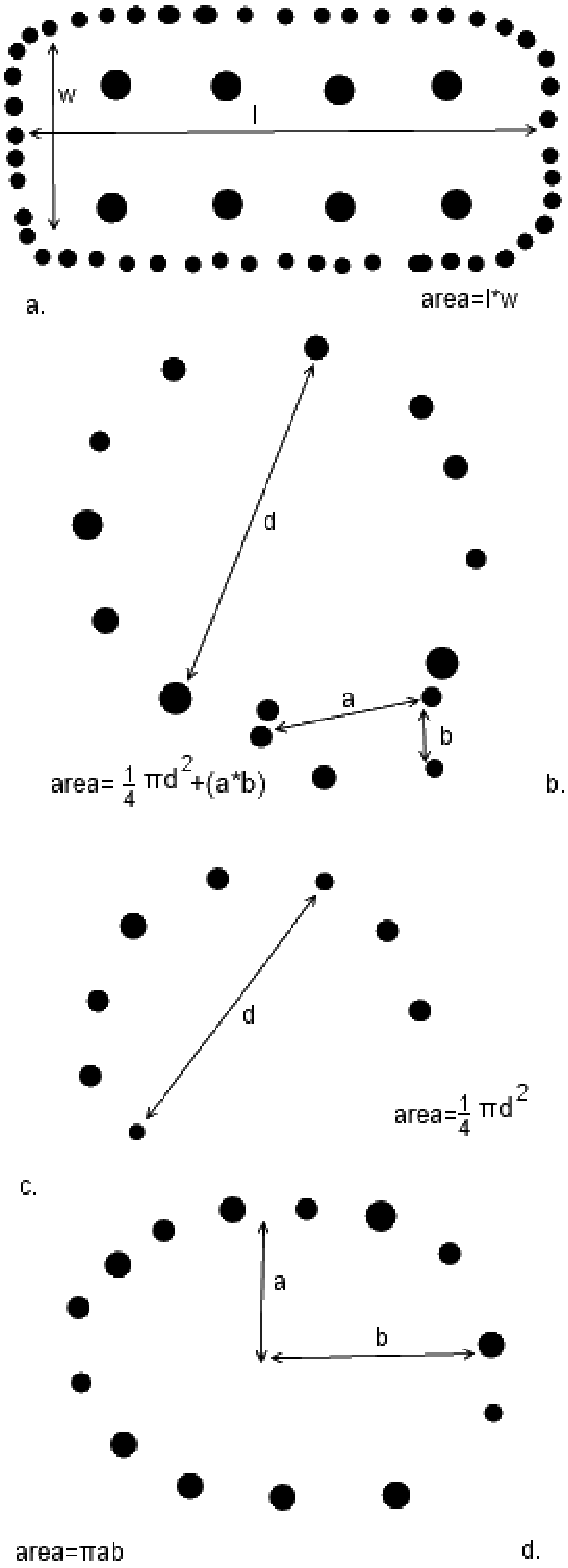


Figure 4.1 Area Equations and Dwelling Examples: a. Danish longhouse, b. British roundhouse with additional porch area, c. penannular structure, d. ellipsoid roundhouse

largely accepted as defined by excavators, as was contemporaneity. With the exception of EBA PI settlements, dwellings referred to three-aisled constructions, while post-structures were not internally differentiated. When no distinction between storage and dwelling structures was made within a report, dimensions were taken into account and the average dimensions of the traditional typology discussed above were used to delineate between dwelling and storage structures.

In both regions, it is accepted that 'dwelling' structures may also have included animals; however, the logic remains, stability, growth, or decline in the scale of the agricultural economy will be reflected in the growth, stability, or contraction in the floor areas of these building. As Fokkens (2003) notes, the consideration of stalling in the Northern European longhouses is problematic when discussing animal husbandry and thus is not taken into account in this study as separate from the residential area of the longhouse. Given the correlating issues in the southern British material, namely the lack of clear stabling or other animal-based architecture, the decision was made to exclude discussion of animal husbandry in the analysis of changes to the social structure via domestic architecture. Byres and stalling associated with Danish longhouses, even where evident in the literature, were therefore included in the possible living/activity space, rather than treated as potential storage. Activities such as milking, shearing, *etc.* would have occurred within the byre area, adding emphasis to energy expended toward living within the same structure. As byres were only present on three-aisled constructions, the link between residence of humans and residence of animals justifies consolidation as 'dwelling' when addressing changes over time to living/activity areas. As noted by Sørensen (2007), longhouses were both active social and economic units within the landscape.

4.5 Pits

The investigation of subterranean pits was focussed on the application of energy in creating the pits and the volumes of the pits as indicative of storage potential. Pit fill and any associated artefacts or remains were therefore considered as secondary to pit function in terms of its volume. Hearths and cooking pits, being more notable in their absence than their presence, were excluded in this analysis. 'Storage' or rubbish pits, on the other hand, were created specifically to hold the before and after affects of consumption and their volumes reflect the space deemed necessary by their creators.

Pit volume was derived directly from the text where possible or taken measured from plans and sections provided. Volumetric data were chosen as representative of the energy expended in creation of pits in each period, as pit architecture, and therefore the energy involved, was varied (see Appendix A) and construction of specific size and type at a specific time must have answered a specific need. This study recognizes the strong possibility that only a portion of the pits present in the record for a period were utilized at one time. With this being acknowledged, the sole interest of this study was to determine the maximum values of each variable to demonstrate the full potential consumptive architecture of both individual sites and arbitrary environment-based regions over time. Equalizing all maximum pit volumes across time decreases the error, while allowing patterns to develop.

Care was taken as to pit profile, *i.e.* conical, cylindrical, bucket, hemispheroidal, ellipsoid (Fig. 4.2), in order to ensure an accurate calculation of volume. The appropriate geometric formulas were used on the basis of general pit configuration. While unlikely to be geometrically perfect, the use of formulas for hemispheres, cylinders, cones, ellipsoids, and frustums were used in accordance with pit shape either as indicated by the excavators or as observed from the profiles illustrated within the reports. These geometric formulas were related as closely as possible to the common types of pits recorded by excavators. The possibility of re-cutting of pits was not taken into account due to the disparity in recording such phenomena and the goal of ascertaining the final maximum available storage area. The target agenda was to determine the maximum storage in any one period; therefore, the largest possible pit size and structure was taken, even when there was a strong suggestion of re-cutting. The variety of pit structure even within a settlement indicates differing levels of energy expended in their creation, and differing consumptive needs indicated by variation in the volume of each pit. As with the dwellings the variation was calculated by standard deviation for each settlement and was compared sub-regionally and regionally to identify trends in subterranean consumptive architecture.

Certain site reports did not include plans or dimensions of all pits, only providing a few sketches or a summary with either average or a range of width and depth, *e.g.* Winnall Down (Fasham 1985), Trethellan Farm (Nowakowski 1991), and Mucking North Ring (Bond 1988). Similar to the treatment of dwellings where no plan was provided and only a range of length and width, the pits in these cases were taken as representatively as possible, keeping in mind the target agenda of *maximum* storage capacity. For instance, in the case of the Early Iron Age pits at Winnall Down, the pit volumes were given in groupings of shape and volume: "There were five sub-rectangular pits with flat bottoms, four beehive-shaped, and seven cylindrical pits. The remainder were ovoid with flat bottoms or shallow with circular or oval plans. Thirteen pits had volumes of less than 0.5m^3, four of between 0.5 and 0.99m^3, six of 1-2m^3 and four greater than 2m^3" (Fasham 1985: 13). While this produces some inaccuracy, the

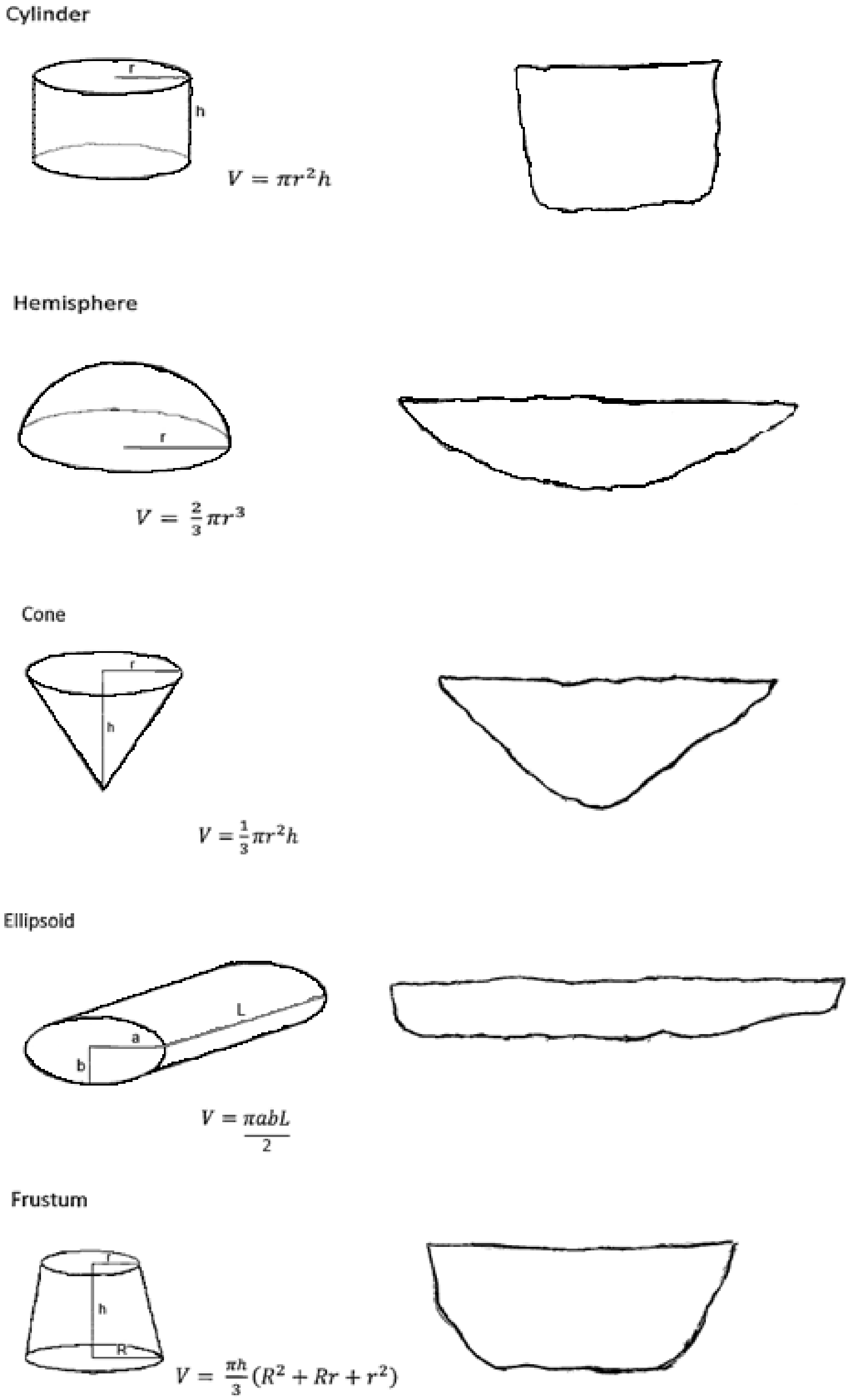


Figure 4.2 Volume Equations and Examples of Pit Profiles (after Fasham 1985, Bond 1988, and Brossler *et. al*. 2004).

specific number is not the focus of this study, rather the trends within each chronological period. Given these restrictions, the numbers of pits for some settlements may reflect only those pits for which data was available to calculate volume. Again, however, their presence or absence is more indicative of the aim of this study, rather than their specific count. The sites chosen for inclusion into this study are strongly representative of the published data accessible for the period, and therefore reflect the current level of potential research able to be gleaned, snags and all.

4.6 Post-Structures

Consideration of post-structures followed the accepted interpretation (*e.g.* Fokkens 1997: 365) of small aboveground 'granaries' or 'barns' (*i.e.* activity spaces), usually post-structures of four or six post construction, although small structures with more posts are also sometimes included in this category if not meeting the requirements for dwellings. Post-structures were therefore differentiated from dwellings by construction, as discussed above in *Terminology*. While nearly ubiquitous on Danish sites, post-structures were also present on several southern British sites and were considered proxy for consumption (storage/processing/crafting) similar to the pit volumes. For those British sites with both above and below ground proxies for consumption, a comparison of maximum capacity of both types, as well as presence over time, per settlement was examined for trends in energy expended toward consumption.

Again, the interior roofed area from post to post was measured to obtain the maximum possible covered aboveground storage. Similar issues to those of dwellings concerning the treatment of dimensions within reports were present on a number of sites, and treated in the same way as described above in *Dwellings*. The variation in dimensions within a settlement was calculated as standard deviation and contrasted on a sub-regional and regional basis to identify trends of consumptive architecture. The contrast between the volume of pit storage in southern Britain and the area of granary storage in Denmark is irrelevant to this study as direct comparisons were not sought, but rather the changing trends in dwelling against storage capacity through time within each region is being assessed.

4.7 Geologic Sub-Regions

The regions of southern Britain, extending from Cornwall in the west to the Lower Thames Basin in Essex to the east, and Denmark were divided further into sub-regions based on distinct landscape, including geology and topography, to investigate whether trends in agricultural production were also visible over time in relation to their environmental context. Although settlement and land use in Jutland, Denmark has been recently proposed as encompassing the whole of the peninsula (Holst and Rasmussen 2013), the settlements were placed within specific geological categories to investigate possible differing strategies of production. The treatment of sites per time period will provide data regarding the viability of considering Jutland as a large-scale system of settlement and production. The variable productivity of soils in the regions will supplement the search for trends in settlement over time, as shifts in regional dominance for settlement will provide insight into population movement. Visibility of sites and situation on particular soils were also considered.

Southern Britain

For southern Britain, forty-three settlements in total were selected, including a mixture of single and multi-phased settlements (Fig. 4.3). The multi-phased settlements were considered as discrete entities in each period, *e.g.* the four Middle Bronze Age phases of settlement at Itford Hill (Burstow and Holleyman 1957, Ellison 1978) were considered separately and count as four for the total settlement count. There were sixty-one total settlement phases for consideration in the study (Table 4.1).

The sub-regions include the chalk downland, the Lower Thames Valley, and southwest England (Fig. 4.1, Table 4.2). These regions have been studied as discrete units previously, with the majority of early attention paid to the chalk downland, largely due to their preservation and visibility of sites. Certain settlement trends are expected over time, given past investigation, which allows for both inter- and intra-regional comparison of agricultural production over time. The chalk downland sub-region encompasses the chalk of Dorset, Wiltshire, Hampshire, Sussex. The geology of the region includes combinations of either underlying chalk and rendzina soils or paleoargillic brown earth on top of the more acidic clay with flints, both allowing for high visibility of settlements, aided by the landscape of valleys and escarpments (Drewett 1978, Sheldon 1978, Bradley *et al.* 1991, Sharples 2012). The ecological variability of the region is of importance to a study of agricultural production and consumption, given differences in soil arability, available resources, topography, *etc.* and the implications thereof for changes in settlements patterns. Off the chalk, but included in the

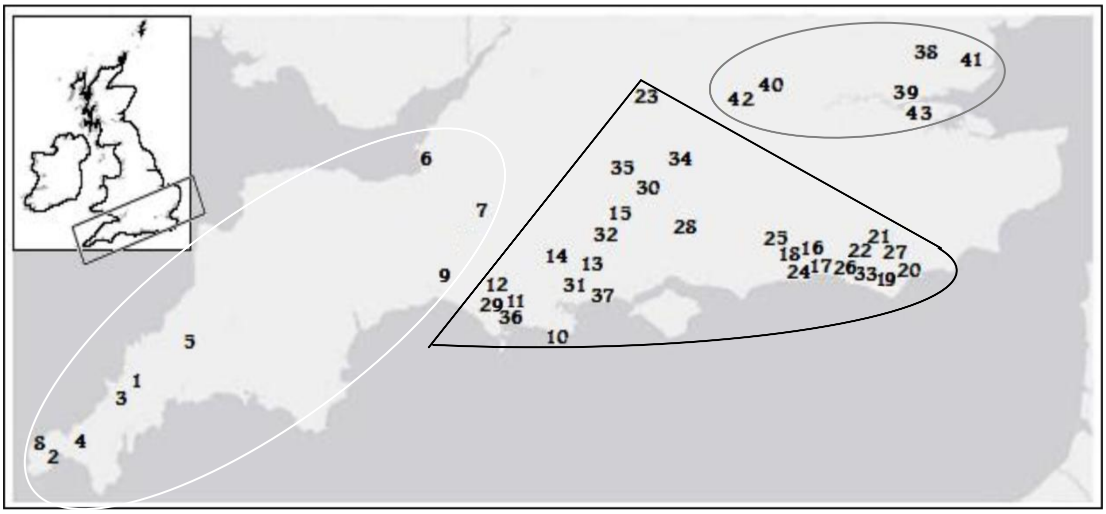


Figure 4.3 1 Trevisker 2 Trewey Downs 3 Trethellan Farm 4 Gwithian 5 Stannon Down 6 Brean Down 7 Cadbury Castle 8 Gurnard's Head 9 Pilsdon Pen 10 Eldon's Seat 11 Poundbury 12 Shearplace Hill 13 Down Farm 14 South Lodge Camp 15 Thorny Down 16 New Barn Down 17 Cock Hill 18 Blackpatch 19 Itford Hill 20 Black Patch 21 Plumpton Plain A and B 22 Heathy Brow 23 Rams Hill 24 Highdown Hill 25 Amberley Mount 26 Mile Oak 27 The Caburn 28 Winnall Down 29 Hog Cliff Hill 30 Old Down Farm 31 Gussage All Saints 32 Little Woodbury 33 Hollingbury 34 Winklebury Camp 35 Balksbury Camp 36 Chalbury Camp 37 Hengistbury Head 38 Springfield Lyons 39 Mucking North Ring 40 Green Park 41 Loft's Farm 42 Aldermaston Wharf 43 Mucking South Rings

White area denotes Southwest England; Black area denotes chalk downland; Grey area denotes Thames Valley

Period	Total Number of Settlement Phases
MBA	26
LBA	17
EIA	18

Table 4.1 Dispersal of sites in southern Britain arranged by time period

sub-region by virtue of geographic location, settlements are expected to be less visible. The environment was dry, with woodland clearance largely completed by the Early Bronze Age. The chalk downland produced the largest excavated sample across the time periods, with twenty-eight settlements, providing thirty-four phases of settlement. Thirteen settlements belonged to the Middle Bronze Age, including the type-site of Itford Hill (Burstow and Holleyman 1957), providing a total of twenty settlement phases. There were nine settlements containing Late Bronze Age phases of occupation (*i.e.* Ram's Hill: Bradley and Ellison 1975). Fourteen settlements provided sixteen Early Iron Age phases of occupation, including the type-site of Little Woodbury (Bersu 1940).

The gravel terraces of the Thames Valley, overlaid with areas of loess or brickearth, allow for a different visibility and preservation, and the wet, open environment of the end of the Bronze Age provides a comparative production rate (Allen and Sturdy 1980, Sharples 2012). The Lower Thames Valley region in this study consisted of those sites situated on the gravels and sands of the Thames River Basin in Essex and Berkshire. Six settlements were included in this study from this region. Very little Middle Bronze Age settlement evidence has been found and none was included in this study. Six settlements had a total of seven phases of occupation dating to the Late Bronze Age, including the well-known Mucking North Ring (Bond 1988). Mucking South Rings (Bond 1988, Clark 1993) was slightly earlier than the North Ring, given radiocarbon samples 750±80 bc (HAR-2911) and 680±110 bc (HAR 2893) from the outer ditch. Settlement in the Early Iron Age was more dispersed and the population appears to dissipate until the Middle Iron Age. The Mucking area alone contained at least 110 scattered roundhouses belonging to the earlier Iron Age, however phasing is problematic, and therefore the houses were not included in this study (Going 1993, Bryant 1997).

Region	Total Number of Settlements		Total Number of Settlement Phases	
Southwest England	MBA	6	MBA	6
	LBA	1	LBA	1
	EIA	2	EIA	2
Chalk Downland	MBA	13	MBA	20
	LBA	9	LBA	9
	EIA	14	EIA	16
Thames Valley	LBA	6	LBA	7

Table 4.2 Totals of settlements by sub-region in southern Britain

Southwest England, consisting of sites in Cornwall, Dorset, Somerset, and Devon, provides a distinct contrast to the other sub-regions, in that preservation in acidic or argillic soils is less certain and settlement traces are less visible (Nowakowski 1991). Pits are also less likely, with above ground storage more common, similar to the Danish material. The zone included nine settlements considered in this study. Six settlements included Middle Bronze Age phases of occupation, such as the well-known site of Trevisker (ApSimon and Greenfield 1972). There was one settlement containing Late Bronze Age phases of occupation. Two settlements included Early Iron Age phases.

Denmark

The Danish dataset contained eighteen settlements, a mixture of single and multi-phased settlements. The multi-phased settlements were considered discrete entities in each period of existence, formulating a grand total of thirty-three settlement phases for consideration in the study. Some sites have never been fully excavated, *e.g*. Omgård (Nielsen 1982b), and thus represent only a sample of the total population per period, however, those samples are still representative, given that this study is interested in trends of spatial division over time and the inclusion of those settlements within the general corpus of knowledge. Certain sites, *e.g*. Sejlflod (Nielsen 1982a), present structures assumed by the excavators and are included within this study if enough evidence is provided to obtain a viable measurement.

Where such uncertainty exists, the dimensions are rounded to the nearest square meter, signifying the approximation of the figure.

The Danish sites were divided similarly on the basis of geology and environment (Fig. 4.2; Table 4.4) across Funen and Jutland (Dewey 1926, Hedeager 1992). Again, previous studies have focused on geographic divisions, *i.e*. the Thy Project (Bech 2003), taking note of differing landscape and probable agricultural production. The sub-regions included in this study are dune, outwash plain, raised Littorina seabed, moraine clay, and moraine sand. The sandy moraine ecology includes the modern counties of eastern Viborg, northern Århus, southern North Jutland, and western Rinkøbing, Ribe and South Jutland. The sandy moraine included seven settlements. Three settlements presented four phases of occupation during the Early Bronze Age. One had phases of occupation in the Late Bronze Age. Four, including Grøntoft (Becker 1968, 1971), presented seven phases of occupation in the Early Pre-Roman Iron Age. Hodde (Hvass 1985, Mahoney 2008) presented two phases of occupation in the Late Pre-Roman Iron Age.

Period	Total Number Sites
EBA	11
LBA	6
EpRIA	9
LpRIA	7

Table 4.3 Dispersal of Danish sites arranged by time period

Six settlements were situated on the clayey moraine, which consists of Funen, Vejle, Århus, and northern Viborg. No Early Bronze Age settlements were included in this study for the clayey moraine ecology. Three settlements had Late Bronze Age phases of occupation. The Early Pre-Roman Iron Age was represented by two settlements. Three settlements, including Borremose (Martens 1988), had four phases of occupation which belonged to the Late Pre-Roman Iron Age. Two settlements were situated on the raised Littorina seabed, located on much of North Jutland and Thy. Both Bjerre (Bech and Mikkelsen 1999) and Vadgård (Rasmussen 1993), which presented two settlement phases, were occupied in the Early Bronze Age.

The outwash plain cutting through central Denmark was occupied from the Early Bronze Age into the Early Iron Age. Højgård (Ethelberg 1986, 1991) presented three Early Bronze Age phases of occupation. Højgård and Vorbasse (Hvass 1983) were occupied in the Late Bronze Age. One phase of occupation for Vorbasse also belonged to the Pre-Roman Iron Age.

The dune ecology consists of the west coast of Denmark, running along Thy, Rinkobing, Ribe, and the island off South Jutland. In the dune ecology, one settlement, Legard (Earle *et al.* 1998), was occupied in the Early Bronze Age. There were no other settlements in the dune ecology in this study.

The sub-regions are not cohesive geographically, but exhibit outcroppings spread across the country, typical of glacial landscapes. The obvious soil differences, from the richer moraine sediments to the sandy outwash plains, also include differing growing environments, making it necessary to investigate change in settlement patterns and agricultural production over time (Jensen 1982). The Danish topography is largely flat over the whole of the study area as a result of repeated incidences of solifluction; however certain areas, namely the moraine regions, containing low hills and rises (Odgaard 1985, Jørgensen *et al.* 2013). Settlements, particularly Bronze Age sites, are often located on promontories, slopes, or at least elevated points in the landscape throughout all the regions. Elevated settlements allow

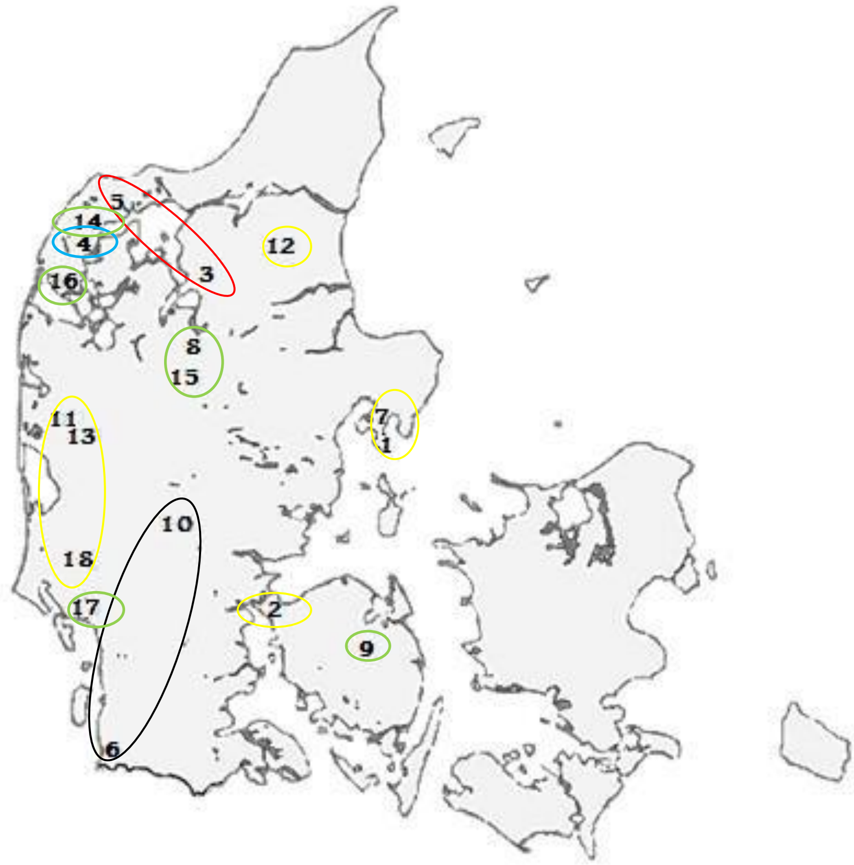


Figure 4.4 1 Egehøj 2 Røjle Mose 3 Vadgård 4 Legard 5 Bjerre 6 Højgård 7 Hemmed Church 8 Jegstrup 9 Højby 10 Vorbasse 11 Omgård 12 Sejlflod 13 Grøntoft 14 Skårup 15 Borremose 16 Heltborg 17 Kjærsing 18 Hodde

Green circle indicates clayey moraine, Black indicates the outwash plain, Yellow indicates sandy moraine, Red indicates raised Littorina seabed, Blue indicates dunes

Region	Total Number of Settlements		Total Number of Settlement Phases	
Dune	EBA	1	EBA	1
Raised Littorina Seabed	EBA	2	EBA	3
Outwash Plain	EBA	1	EBA	3
	LBA	2	LBA	2
	LpRIA	1	LpRIA	1
Moraine, Sandy	EBA	3	EBA	4
	LBA	1	LBA	1
	EpRIA	4	EpRIA	7
	LpRIA	1	LpRIA	2
Moraine, Clayey	LBA	3	LBA	3
	EpRIA	2	EpRIA	2
	LpRIA	3	LpRIA	4

Table 4.4 Totals of settlements by sub-region in Denmark

for better visibility, but the prevailing location also could indicate a preservation bias toward settlements located on higher ground to the detriment of lower sites (Davidsen 1982). Examination of the productive/consumptive architecture over time within each sub-region will provide data regarding population and agricultural production concurrent with the existing knowledge of later prehistoric settlement in Denmark.

4.8 Summary

With this discussion of how the data was gathered, organized, and analysed, it becomes clear that both southern Britain and Denmark presented a selection of sites with published reports that met the criteria for this study. The presence or absence of dwellings, pits, and post-structures, along with their dimensions, provide data regarding productive and consumptive capacity as indicated by potential population size and storage capacities on single settlements, which can be expanded to provide regional trends of changes in that expenditure of energy over the period with which we are concerned in this thesis. Dividing the target regions into sub-regions based on geology allows for comparison of domestic architecture in different environments, salient for agricultural productivity. The multi-scalar model allows for specific (settlement level) and general (regional level) trends of reaction in productive and consumptive architecture, and therefore agricultural production, to changing social priorities and newer, more local technologies to be revealed. The socio-technical changes at the end of the Bronze Age have been debated on the regional scale, yet the impact of those changes on agricultural production remains unclear. This model seeks to present a plausible approach to understanding changes in the productive-consumptive cycle, as well as addressing the gap between the micro and macro scales of settlement analysis. While the methods used were the same across both southern Britain and Denmark, no direct comparison was performed; rather, each area was used to independently investigate the viability of the model at the end of the Bronze Age. Bearing in mind both the research aims and the methods of data treatment, we must now focus on the analysis itself.

Chapter V: Shifts in population and agricultural production over time for southern Britain

A site-by-site analysis of the data, over time, for southern Britain illuminates patterns and trends relating to population size and agricultural production. Dwellings, pits and post-structures, standing as proxies for population and agricultural production, are discussed noting presence or absence, number per site, and size over time.

5.1 Population

This study is concerned with investigating, via architectural proxies, the changes in population and agricultural production in southern Britain and Denmark at the end of the Bronze Age, a period when convention implies great upheaval with the introduction of iron and petering out of access to bronze resources. Examining total roofed area of settlements, discussed as Total Habitable Area (THA) here, will provide a proxy for relative population size by giving a quantitative measurement of the maximum possible living space. Comparing the values over time will illuminate patterns and trends in the need for roofed space, and consequentially the labour force, thereby allowing us to make correlations with associated agricultural production.

Investigating patterns over time in the Total Habitable Area (THA) for southern Britain provides an indication of varying population size, which must have related to scale of agricultural production. This can then be compared with an investigation of potential storage capacity, or consumptive architecture, on the same settlements. The chronology is divided into three periods in southern Britain to enable comparison; these are the Middle Bronze Age (1500-1020 BC), the Late Bronze Age (1020-750 BC), and the Early Iron Age (750-450 BC) (as per Needham 1996). The size of the sample of settlements varies over time. The Middle Bronze Age contains the largest number of settlement phases (n=26), with the Late Bronze Age and Early Iron Age containing fewer sites (n=17 and n=18 respectively). This disparity, as already noted (see Chapter IV: Methodology), should be taken into account as a possible source of skew when seeking trends, although the results should not be significantly impacted, as the periods are investigated on a site-by-site basis with results compared directly. The sites included in this study are a fair representation of the research undertaken for each period. Note that bibliographic references for each site are contained in Appendix A; the numbers referenced after site names in this chapter refer to the number of that site in the site gazette.

The Middle Bronze Age

As is evident from Table 5.1, there was little variety in the number of dwellings per site in the Middle Bronze Age in southern Britain. Small, individual farmsteads dominated the settlement organization in the Middle Bronze Age, as between two to five contemporary dwellings appears to have been the normal configuration for this period, with ninety-two percent of the settlements included in that range. Stannon Down (n=8) and Trethellan Farm (n=7) exhibit a greater number of dwellings assumed by the excavators to be contemporary, although the excavators admit a possible issue with phasing for both settlements. Stannon Down (SE5) was not fully excavated due to creep from the neighbouring china clay works covering a large portion of the site, making it difficult to determine phasing (Mercer 1970). Phasing is likely as the entire site consisted of at least twenty-five dwellings, although was unable to be determined and therefore treated here as a single unit for the Middle Bronze Age. Nowakowski (1991) admitted difficulty in ascertaining contemporaneity for Trethellan Farm (SE3), although phasing of the dwellings was also unclear. Again, the settlement is treated as a whole in this study, providing a contrast to 'normal' Middle Bronze Age settlements.

Where applicable, *e.g.* Plumpton Plain A (CD11), multi-enclosure settlements were considered as a single entity. Exceptions were present; Itford Hill (CD9) and Black Patch (CD10) were both multi-enclosure settlements and interpretations of the chronology of each site suggest phasing of individual farmsteads over time. Down Farm (CD3) also likely consisted of two distinct phases of occupation. In order to provide a comparison of actual living area over time, and to maintain chronological control, the multi-phased settlements in all periods were considered in their component phases where possible and appropriate. This normalized the data from the large composite settlements and avoided unnecessary inflation of the results ensuing from regarding the total settlement as a single instance of occupation. Taking Itford Hill as an example, Burstow and Holleyman's (1957) original assumption was a set of contemporary enclosures creating a large composite settlement. Ellison (1978) reinterpreted the settlement as four sequential iterations of a single farmstead of two to five dwellings (Fig. 5.1), which was accepted in this study. Given the chronological adjustments to relative dating methods (*e.g.* Barrett 1980) produced after initial excavation and interpretation of many sites in southern Britain, each reinterpretation was taken into consideration based on chronological control and logical assumptions regarding settlement organization. Russell's (1996) proposed reinterpretation of Black Patch hut platform 4, for example, was rejected for this study as overly normalizing the settlement organization without compelling evidence. Further chronological information is detailed in the site

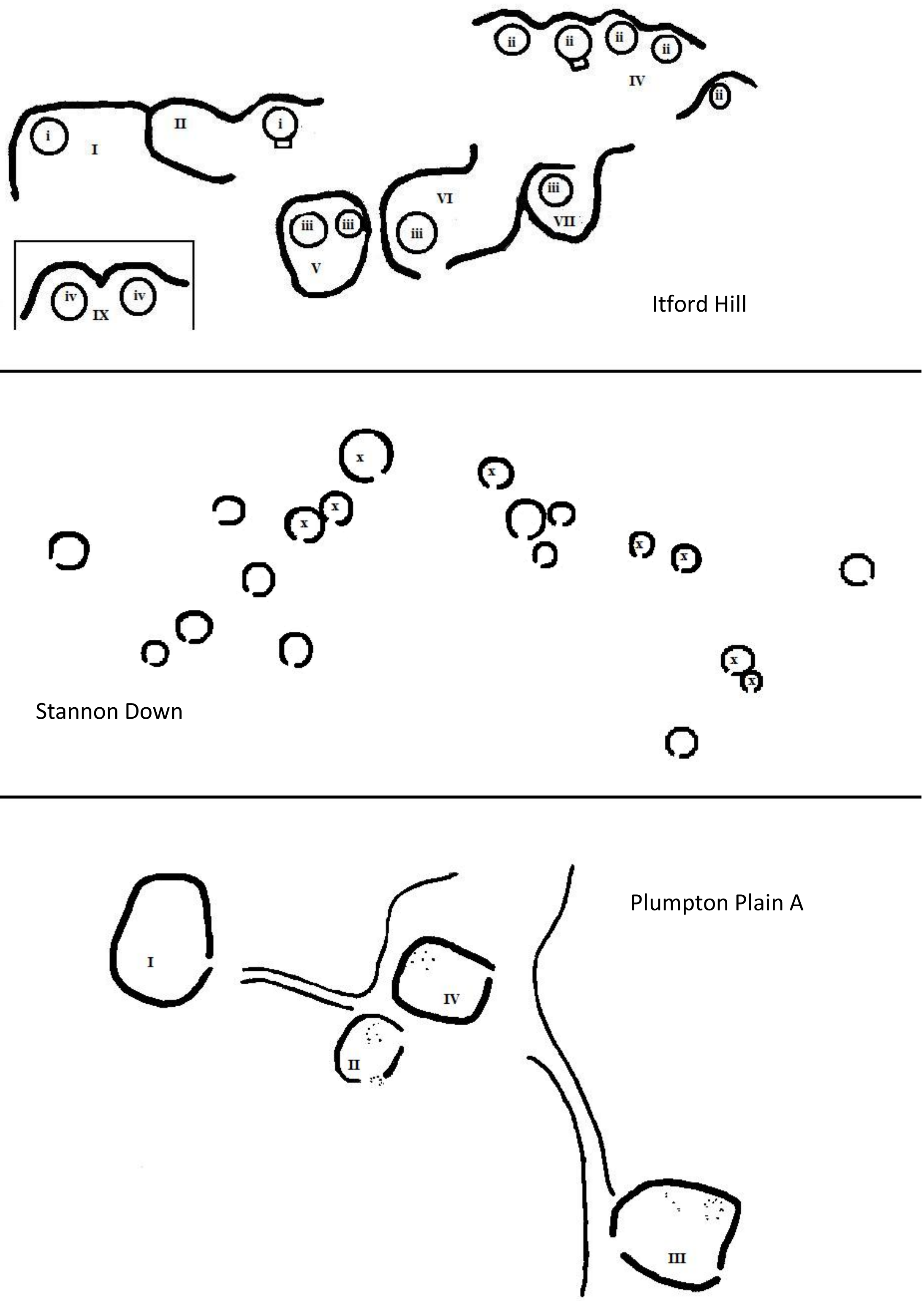


Figure 5.1 Site Plans: top: Itford Hill after Burstow and Holleyman (1957), with Ellison's (1978) numbered phases; middle: Stannon Down after Mercer (1970), excavated dwellings marked; bottom: Plumpton Plain A, after Holleyman and Curwen (1935)

Southern Britain	Number of Dwellings	THA m^2	Average Dwelling Area m^2	Standard Deviation S_X m^2
Trevisker	2	91.34	45.67	5.15
Trewey Down	3	56.1	18.7	0
Trethellan Farm	7	381.71	54.53	17.60
Gwithian	3	109.62	36.54	23.31
Stannon Down	8	361.21	45.15	18.45
Brean Down	2	40.84	20.42	11.10
Poundbury i	2	29.56	14.78	6.96
Poundbury ii	2	39.26	19.63	13.82
Shearplace Hill	2	102.46	51.23	46.75
Down Farm i	2	108.18	54.09	14.01
Down Farm ii	3	129.98	43.33	17.57
South Lodge Camp	2	63.19	31.60	22.20
Thorny Down i	2	56.37	28.19	19.33
Thorny Down ii	2	62.43	31.22	30.54
New Barn Down	2	64.02	32.01	14.24
Cock Hill	3	87.66	29.22	0
Blackpatch	1	29.22	29.22	N/A
Mile Oak	3	108.45	36.15	11.23
Itford Hill i	2	52.54	26.29	4.15
Itford Hill ii	4	109.74	27.44	6.96
Itford Hill iii	4	106.02	26.51	5.22
Itford Hill iv	2	58.44	29.22	0
Black Patch hut platform 4	5	147.85	29.57	15.62
Black Patch hut platform 1	2	40.84	20.42	11.10
Plumpton Plain A	3	96.86	33.85	6.55
Highdown Hill	3	58.71	19.57	9.62
Totals 26	76	2592.6	34.11	16.69

Table 5.1 Values of dwellings for Middle Bronze Age sites

descriptions in Appendix A.

While the number of dwellings per settlement was fairly consistent, a wide range of values of the Total Habitable Area (THA) for each site in the Middle Bronze Age (Fig. 5.2) is present. Seven settlements (Trewey Down (SE2), Brean Down (SE6), Blackpatch (CD8), Itford Hill i, Itford Hill iv, Plumpton Plain B (CD11), and Highdown Hill (CD13)) exhibited a THA of n<60 m^2, from one to four possibly contemporary dwellings. Seven settlements (Trevisker (SE1), Poundbury (CD1), South Lodge Camp (CD4), Thorny Down (CD5), Cock Hill (CD7), Black Patch hut platform 1, and Plumpton Plain A) exhibited a THA of between 60 and 100 m^2, with similar numbers of dwellings per site of two to four. Nine of the remaining settlements (Gwithian (SE4),

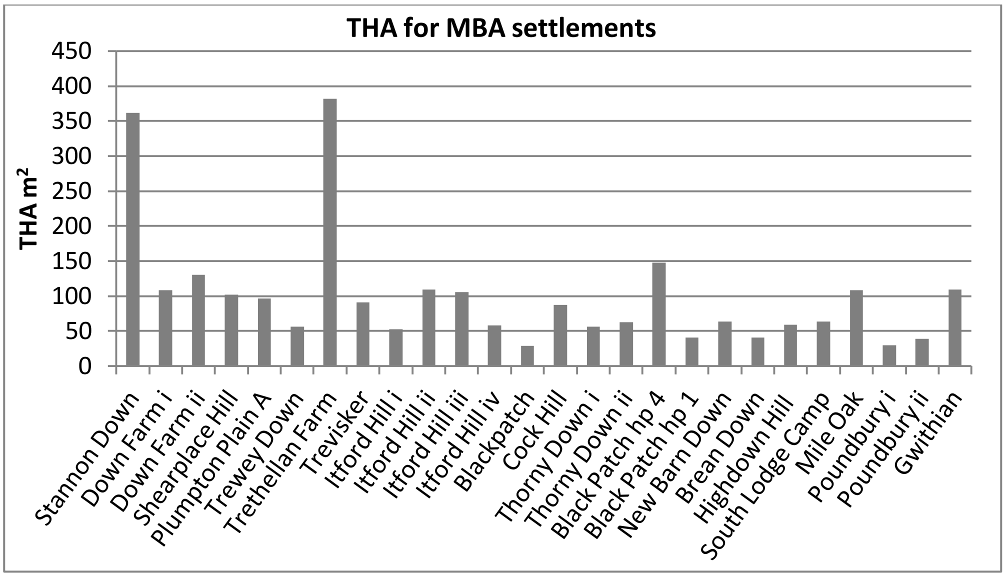


Figure 5.2 Distribution of Total Habitable Area per site for the Middle Bronze Age

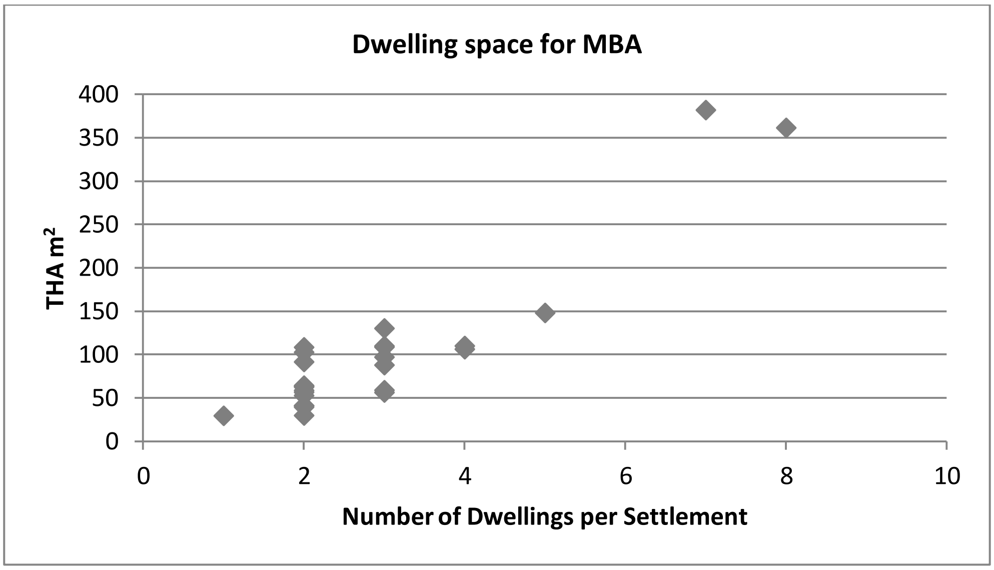


Figure 5.3 Contrast of number of dwellings and Total Habitable Area for the Middle Bronze Age

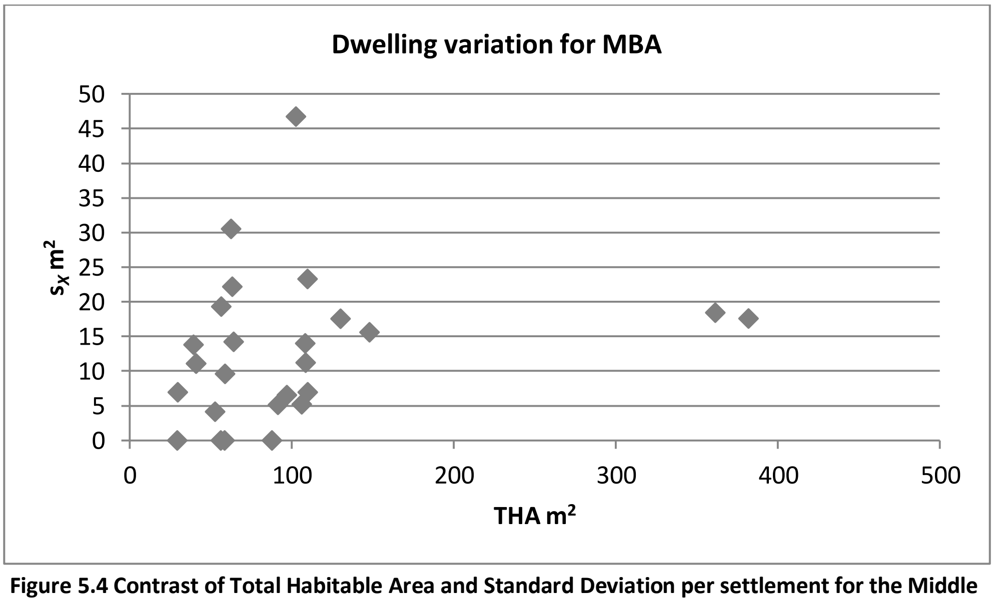


Figure 5.4 Contrast of Total Habitable Area and Standard Deviation per settlement for the Middle Bronze Age

Shearplace Hill (CD2), Down Farm i- ii, Mile Oak (CD15), Itford Hill ii-iii, Black Patch hut platform 4, and New Barn Down (CD6)) presented two to five dwellings, yet contained a THA of 100<*n*<150 m^2. Trethellan Farm and Stannon Down presented abnormally large values of THA for the period of 300<n<450 m^2, possibly indicative of a different settlement organization than otherwise present for the period.

Five settlements (Trewey Down, Poundbury, Itford Hill iv, Plumpton Plain B, and Highdown Hill), all of which presented the smallest category of THA, had an average dwelling area of 10<*n*<20 m^2 (Fig. 5.3). Eight settlements (Brean Down, South Lodge Camp, Cock Hill, Blackpatch, Itford Hill i-iii, and Black Patch hut platform 4), which displayed the full range of THA values, presented averages of 20<*n*<30 m^2. Five settlements (Gwithian, Thorny Down, Mile Oak, Black Patch hut platform 1, and Plumpton Plain A) had an average of 30<*n*< 40 m^2, while three (Trevisker, Trethellan Farm, and Down Farm ii) presented 40<*n*<50 m^2. The largest average dwelling areas, 50<*n*<60 m^2, were presented by four settlements (Stannon Down, Shearplace Hill, Down Farm i, and New Barn Down). Construction of dwellings was not consistent across southern Britain in this period, as noted by Barrett and Bradley (1980). The deviation in THA values for a specific number of dwellings indicates construction was likely needs based, or dependent on available materials, which may have affected the final size. Population of each settlement was therefore likely varied and dwellings constructed to reflect the differences.

The lack of correlation between Total Habitable Area and numbers of dwellings indicates variability in the size of dwellings per site, supported by the standard deviations presented in Table 5.1 and illustrated in Figures 5.4 and 5.5. It is interesting to note that two of the three MBA settlements (Itford Hill iv and Cock Hill) with no deviation in dwelling size (s_x =0 m^2) had dwelling areas of 29.22 m^2 or a diameter of 6.1 m, which is equivalent to the single dwelling at Blackpatch. All three settlements contained differing numbers of dwellings ranging from one to three, yet the dwellings were all of equal size, possibly suggesting some form of standardization or similarity in population per dwelling. The remaining MBA settlement without differentiation in dwelling size was Trewey Down, with three dwellings all of 18.7 m^2 or a consistent diameter of 4.88 m. The standard deviations per settlement indicate groupings of settlements with similarity in area differentiation, with twenty-seven percent of settlements (n=7) presenting a standard deviation of 0-5 m^2, fifteen percent (n=4) with a standard deviation of 6-10 m^2, twenty-seven percent with a standard deviation of 11-15 m^2, another twenty-seven percent ranging from 16-30 m^2, and a single settlement with a large deviation of 46.57 m^2. There appears to be only a small correlation between settlement size (number of dwellings) and variation, as the largest settlements (Trethellan Farm with

Figure 5.5 Comparison of selected MBA dwellings. Stannon Down after Mercer 1970, Gwithian after Nowakowski 2007, Shearplace Hill after Rahtz 1962, Cock Hill after Ratcliffe-Densham and Ratcliffe-Densham 1971.

seven and Stannon Down with eight dwellings) presented similar standard deviations, yet Down Farm ii with three dwellings had a standard deviation very similar to that of Trethellan Farm. The largest standard deviation occurred on Shearplace Hill with two dwellings and the smallest (s_X =0 m^2) on settlements with two and three dwellings, further suggesting settlement size was not the major influence on variation in dwelling construction. Nor was the Total Habitable Area, given the scatter of variation in area for settlements with similar THA (Fig. 5.4). The evidence is therefore strongly suggestive of an inconsistent investment of energy in dwelling construction both within and between settlements. As a dwelling of 5 m in diameter takes less energy and fewer resources than a dwelling of 10 m in diameter, the implication is one of either differing ability to muster resources and labour or differing requirements in living space, or even a combination. The latter is most likely, as the largest individual dwellings occurred on both large and small settlements (Trethellan Farm/Stannon

Down vs. Shearplace Hill/Down Farm i-ii), and with both comparatively average and large standard deviation (s_x =17.60 m^2/18.45 m^2 vs. 46.72 m^2/14.02 m^2, respectively). Greater variation in dwelling area within a settlement allows for the possibility of task-specific dwellings, where the population occupied larger dwellings and smaller dwellings housed daily activities, such as baking or cooking, as has generally been accepted for the period (*e.g.* Ellison 1978, 1981; Pope 2003). The lack of consistent similarity in dwelling size difference between settlements, however, is particularly intriguing, as not all settlements produced such variation in dwellings and therefore indicate different usage patterns. There is observable difference in the energy invested in productive architecture for the MBA of southern Britain. Even when excluding dwellings less than thirty metres in area as purely activity areas, the remaining range of individual dwelling size is considerable ($30<n<85$ m^2). A supposed standard Middle Bronze Age house and settlement consequently appears to be a fallacy and attention must be paid to the possible reasons for differentiation in house size. Possible regional trends will be addressed in the following chapter.

Settlement organization, as well, may not have been as standardized as previously expected. While farmsteads of two to five dwelling appear to be the normal configuration, Stannon Down and Trethellan Farm did not follow that pattern. Those settlements presented both the most dwellings per site, as well as the greatest value of THA, between $350<n<400$ m^2. If indeed those settlements represent a single phase of occupancy, the sites present a different pattern of settlement for the Middle Bronze Age, one with a larger population and greater investment of energy in construction of dwelling space. The similarity in both number of dwellings and Total Habitable Area for both sites does seem to support a non-accidental happenstance. Itford Hill and Down Farm, however, in their entirety also present a comparable profile, with each exhibiting approximately 300 m^2 of THA. Black Patch as a single unit also presents a THA nearly 100 m^2 greater than the next largest settlement. Whether the phasing of the latter settlements is correct and the necessary information is simply inaccessible for the former or these sites are representative of a larger settlement pattern is beyond the scope of this study. Given that when accepting the phased interpretation for Itford Hill, Black Patch, and Down Farm, ninety-two percent of the sample of Middle Bronze Age settlements presented a Total Habitable Area of $n<150$ m^2, the likelihood of at least Stannon Down being a phased settlement, rather than representing a second population of settlement organization, is high.

In regard to energy expended on creation of a domestic space, there is also little correlation between THA and additional energy invested in the construction of an enclosure surrounding the settlement. The majority of settlements were enclosed, with thirty-one percent (n=8) unenclosed (see Appendix A). The range of THA values, from the largest settlements (Stannon Down and Trethellan Farm) to those on the smaller end (Brean Down), was represented by open settlements. The number of dwellings for unenclosed settlements ranged from two to eight, again covering the breadth of MBA settlement size. The enclosed settlements reflected a similar range of THA values (Blackpatch= 29.22 m^2 to Black Patch hut platform 4= 147.85 m^2) and number of dwellings (one to five), suggesting size of the settlement was not a consideration for whether or not a settlement was enclosed. There is some correlation between average dwelling area and a lack of enclosure; six of the eight (75%) unenclosed settlements presented similar average dwelling areas of 35 to 56 m^2. These values are the larger end of the range of MBA average dwelling sizes, suggesting effort was focused on using labour and resources to construct larger dwellings, while the majority of enclosed settlements presented smaller dwellings as energy was expended on the construction of the enclosure.

The Late Bronze Age

Similar to the Middle Bronze Age sites, the settlements of the Late Bronze Age (Table 5.2) in southern Britain do not display great variability in number of dwellings per site and are

	Southern Britain	Number of Dwellings	THA m^2	Average Dwelling Area m^2	Standard Deviation S_X m^2
	Brean Down	0	0	0	N/A
	Eldon's Seat	4	144.26	36.07	1.61
	Cadbury Castle	0	0	0	N/A
	Springfield Lyons	3	77.74	25.91	10.88
	Mucking North Ring i	2	66.75	33.38	7.22
	Mucking North Ring ii	1	19.63	19.63	N/A
	Green Park	5	291.32	58.29	5.10
	Aldermaston Wharf	2	86.59	43.30	9.86
	Loft's Farm	2	133.1	66.55	50.28
	Plumpton Plain B	3	33.21	11.07	6.09
	Amberley Mount	2	61.93	30.97	20.70
	Mile Oak	1	49.01	49.09	N/A
	The Caburn	2	25.13	12.57	0.01
	Winnall Down	4	196.66	49.17	3.87
	Hog Cliff Hill	3	309.56	103.19	35.16
	Rams Hill	4	98.38	24.60	13.76
	Mucking South Rings	1	113.1	113.1	N/A
Totals	17	39	1706.37	41.62	30.35

Table 5.2 Values for dwellings on Late Bronze Age settlements

comparable to the Middle Bronze Age settlements. Brean Down and Cadbury Castle (SE7) do not demonstrate any dwellings for this period, whereas the remaining settlements demonstrate between two and four dwellings. Mile Oak decreased from three dwellings in the Middle Bronze Age to one dwelling in the Late Bronze Age. Green Park (TV35) presented evidence for the greatest number of dwellings (n=5). Green Park is possibly anomalous as, although the excavators determined that two phases of occupation were likely, they were unable to securely establish the chronological sequence (Brossler *et al.* 2004). It has been taken as a single occupation here, given its importance in the region.

While the number of dwellings per site among the Late Bronze Age settlements is similar, the Total Habitable Area of each settlement varies (Fig. 5.6). Three settlement phases (Mucking North Ring i-ii (TV2), and the Caburn (CD17)) displayed a THA n<50 m^2, from one to two dwellings. Four settlements (Springfield Lyons (TV1), Aldermaston Wharf (TV5), Amberley Mount (CD14), and Rams Hill (CD12)) presented a THA of 50<n<100 m^2. Five sites (Eldon's Seat (CD16), Mile Oak, Mucking South Rings (TV6), Winnall Down (CD18), Hog Cliff Hill (CD19)) presented a THA of 100<n<200 m^2. Green Park presented the greatest THA for a single site, with 291.32 m^2. Given Green Park also displayed the largest number of dwellings per site, the high value of THA is understandable, and again, the likelihood of two separate phases of occupation would normalize the otherwise irregular figures for the settlement.

The range of average dwelling areas was also similar to the Middle Bronze Age values, 10<n<60 m^2, although the later period demonstrated a tighter relationship between THA and average dwelling size, suggesting a more standardized construction. Given the variation in THA values for the same number of dwellings, there are observable trends, suggesting some level of correspondence in dwelling size. With each additional dwelling per settlement, the THA displayed trends toward growth (Fig. 5.7), suggesting distinct populations of dwelling construction. One tendency includes Loft's Farm, Winnall Down, Mucking South Rings, and Green Park with larger THA values per number of dwellings. Mile Oak, Aldermaston Wharf, and Eldon's Seat formed the intermediate pattern. The progression with the smallest THA values involved the Caburn, Mucking North Ring ii, Amberley Mount, Mucking North Ring i, Springfield Lyons, and Rams Hill. Hog Cliff Hill, with the greatest THA from three dwellings, did not conform to any tendency, suggesting it was the recipient of additional attention in dwelling construction. The obvious divergence between groupings of settlements suggests emerging differences in required roofed floor space, raising the possibility of ranked settlements as posited by Bradley and Ellison (1975). No determination as to the existence of possible settlement hierarchy can be made from this study; however, with three settlements (Winnall Down, Hog Cliff Hill, and Green Park) presenting over 150 m^2 of THA dwellings,

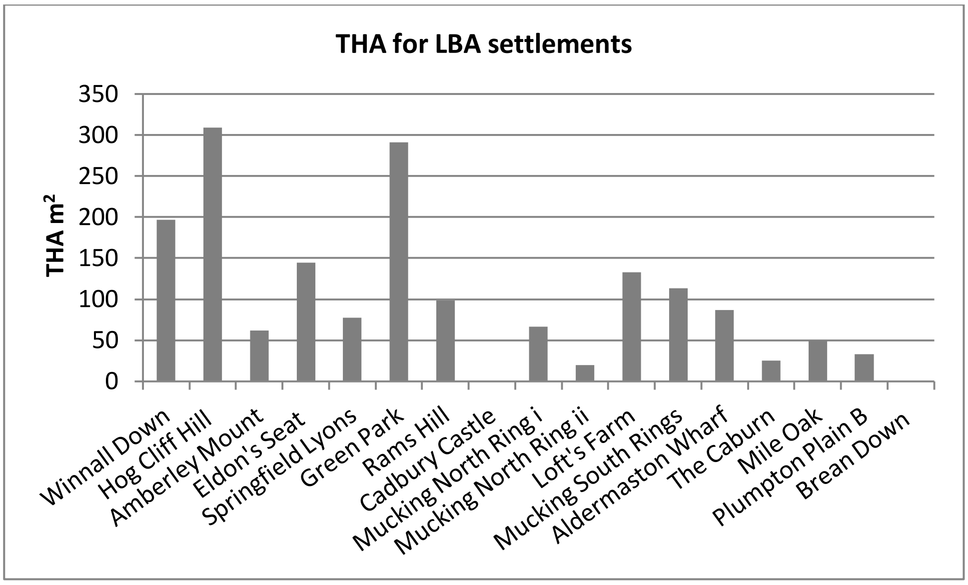


Figure 5.6 Distribution of Total Habitable Area for the Late Bronze Age

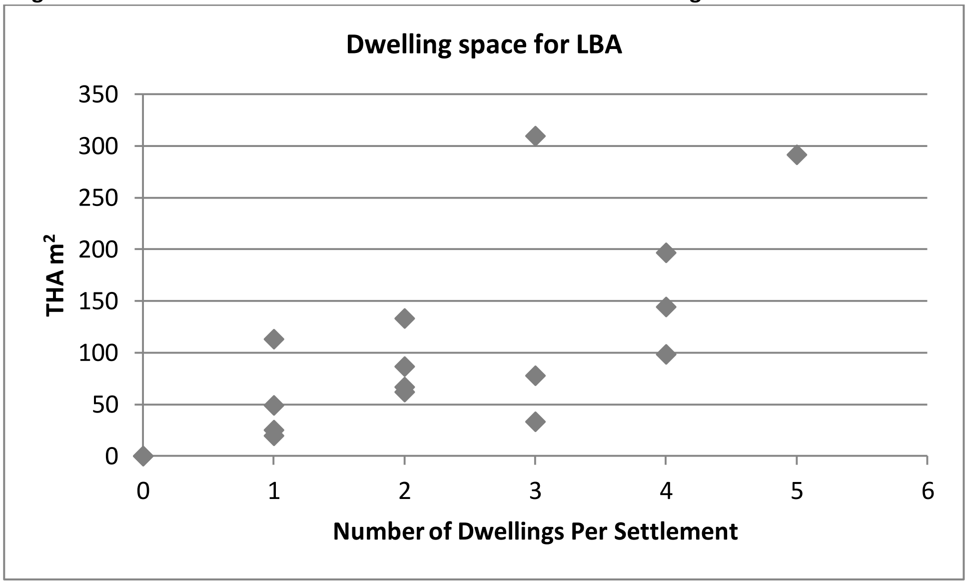


Figure 5.7 Contrast of Number of Dwellings and Total Habitable Area for the Late Bronze Age

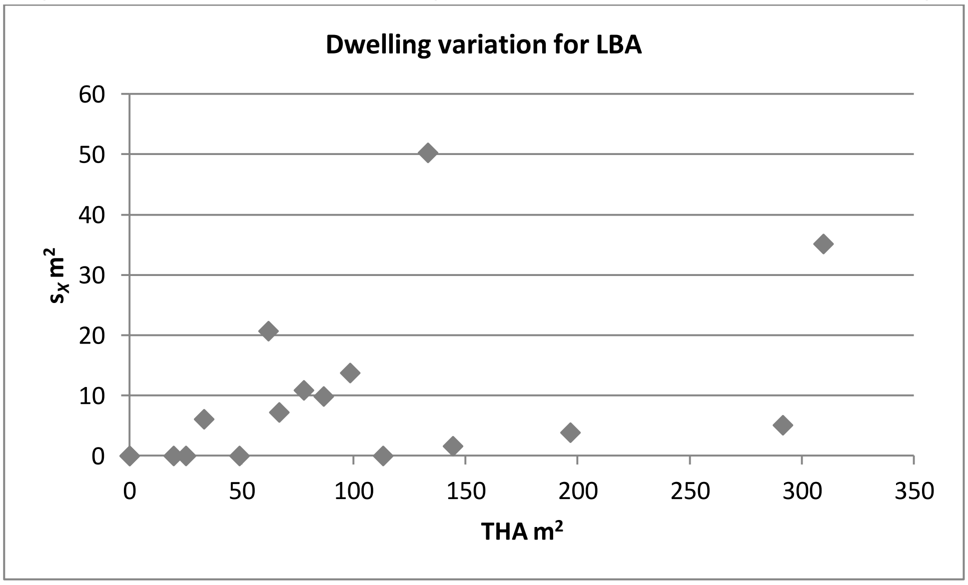


Figure 5.8 Contrast of Total Habitable Area and Standard Deviation per settlement for the Late Bronze Age

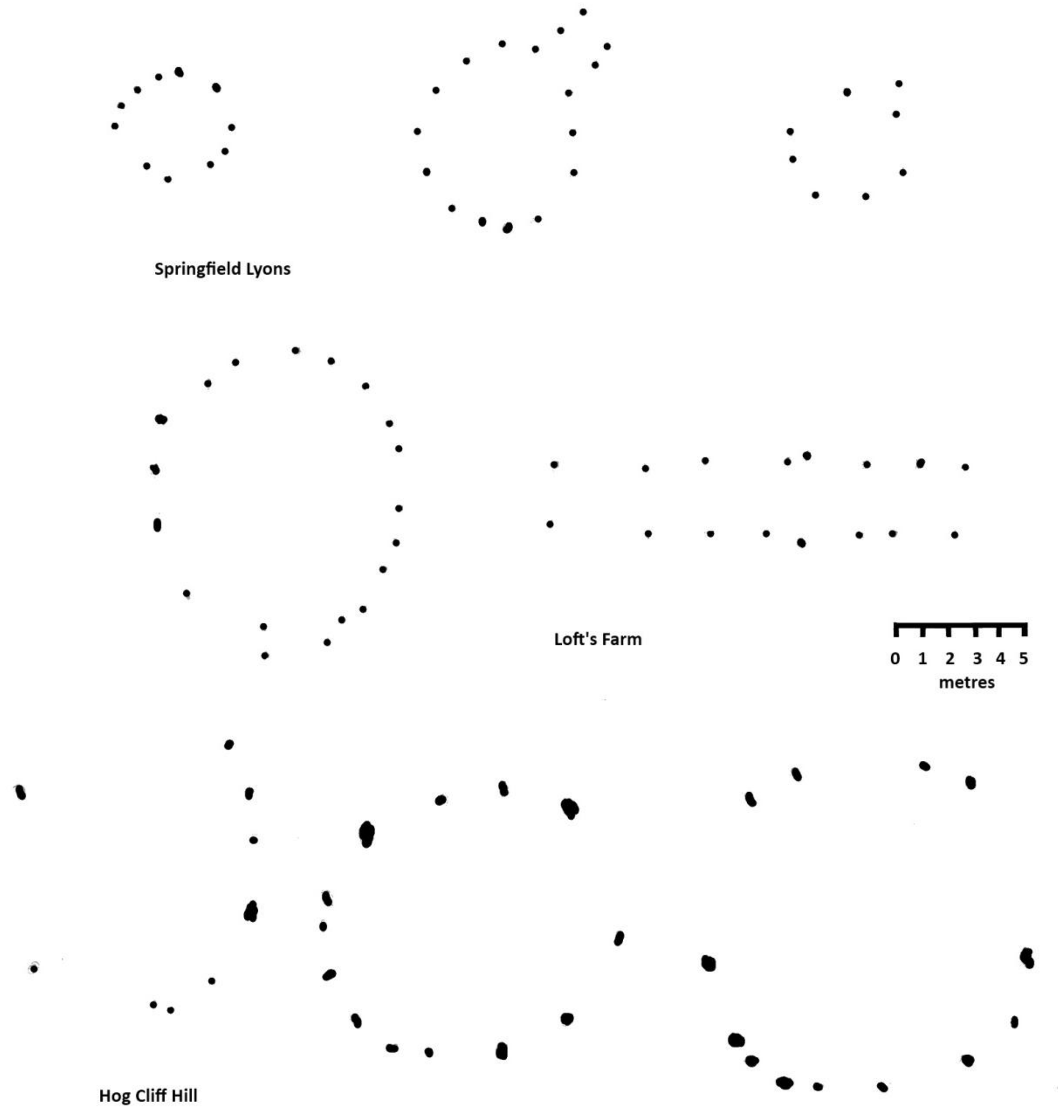


Figure 5.9 Comparison of LBA dwellings. Springfield Lyons after Buckley and Hedges 1987, Loft's Farm after Brown *et al.* 1988, Hog Cliff Hill after Ellison and Rahtz 1987.

the potential must be acknowledged. Alternately, and more likely given the general continuity with the MBA settlements, the larger THA values could signify the early stages of the Iron Age shift toward settlements larger than the family unit (Pryor 2010).

As with the Middle Bronze Age, the standard deviation demonstrated differentiation in dwelling size within settlements, as well as differing values of that variation between settlements (Fig. 5.8 and 5.9). Proportionally, the LBA settlements demonstrated less variation than the preceding period, further suggesting a more consistent construction in the Late Bronze Age. Forty-one percent (n=7) of the LBA settlements presented a standard deviation of only 0-5 m^2, followed by twenty-three percent (n=4) with a standard deviation of 6-10 m^2. Only approximately twelve percent (n=2) of settlements presented a standard deviation of 11-20 m^2, compared to the forty-three percent of the previous period. It should be noted that Brean Down and Cadbury Castle were not considered in the assessment of standard deviation, as both settlements lacked dwellings for the LBA. Settlement size appears to continue to have little effect on standard deviation, as the largest standard deviation (s_x = 50.28 m^2) occurred on Loft's Farm with two dwellings, while the smallest standard deviation (s_x =0.01 m^2) occurred on The Caburn, also with two dwellings. Nor does settlement size appear to affect the devotion of energy to the creation of dwelling space. Mucking South Rings and Mile Oak both presented only one dwelling of vastly differing dimensions. The dwelling for Mucking South Rings had a diameter of 12 m, while Mile Oak's dwelling was 7.9 m in diameter, indicating a large difference in energy and resources consumed in their construction, possibly due to consumptive potential discussed below.

Overall, the settlements of the Late Bronze Age demonstrated comparable THA values to the Middle Bronze Age. A slight increase in THA for the later period is apparent, as twenty-four percent of the LBA settlements presented a THA of approximately 150 m^2 or greater, compared to sixteen percent of the MBA settlements. The LBA settlements were also more similar to each other within the groupings of larger and smaller THA values. Small farmsteads, even with slightly increased Total Habitable Area, continued to be the conventional form of settlement organization. The settlements were a mixture of enclosed (59%) and unenclosed (41%), with a higher proportion of open settlements than the previous period. Again, THA and number of dwellings appear to have little correlation with enclosure or lack thereof; the unenclosed settlements include both small (Mile Oak= 49.01 m^2 with one dwelling) and large settlements (Green Park=291.46 m^2 with five dwellings). There is a small correlation with average dwelling size, as the majority of open settlements (67%) presented average dwelling areas between 30 and 60 m^2, similar to those of the previous period and suggesting continuity in construction. Only two of the enclosed settlements (Eldon's Seat and Mucking North Ring i) displayed similar average dwelling values to the unenclosed settlements. While smaller dwelling sizes for enclosed settlements continued into the Late Bronze Age, Hog Cliff Hill, Loft's Farm, and Mucking South Rings demonstrated larger dwellings on enclosed settlements, suggestive of a change in the investment of energy toward those settlements. There is a distinct lack of similarity in number of dwellings, area enclosed, THA, and standard deviation, yet the appearance of enclosed settlements with larger THA and average dwelling area than those of the unenclosed settlements is suggestive of a changing pattern in energy devotion toward enclosed or defended living spaces.

The Early Iron Age

In examining the number of dwellings per site for the Early Iron Age in southern Britain (Table 5.3), more disparity than in the previous periods becomes apparent. Twelve of the eighteen settlements (Eldon's Seat, Cadbury Castle, Gurnard's Head (SE8), Highdown Hill, Hog Cliff Hill ii, Heathy Brow (CD20), Old Down Farm i-ii (CD21), Gussage All Saints (CD22), Little Woodbury (CD23), Chalbury Camp (CD27), and Balksbury Camp (CD26)) presented one to four dwellings. Six settlements (Winnall Down, Hog Cliff Hill i-ii, Hollingbury (CD24), Winklebury Camp (CD25), and Pilsdon Pen (SE9)) presented five to eight dwellings. Hengistbury Head (CD28) presented the greatest number of dwellings with eleven. In contrast to the earlier periods, it appears that a shift in settlement organization, namely more dwellings per site, was beginning to take effect, with settlements hosting greater populations than in the Bronze Age.

In examining the Total Habitable Area of the Early Iron Age settlements in southern Britain (Fig. 5.10), further progression of settlement size becomes apparent. Heathy Brow was the smallest settlement with only 19.63 m^2 from a single dwelling. Four settlements (Gurnard's Head, Highdown Hill, Old Down Farm i, and Gussage All Saints) exhibited a THA of $50<n<70$ m^2

	Southern Britain	Number of Dwellings	THA m^2	Average Dwelling Area m^2	Standard Deviation s_x m^2
	Eldon's Seat	3	143.95	47.98	13.65
	Cadbury Castle	2	203.0	101.5	3.54
	Gurnard's Head	3	68.5	22.83	6.68
	Highdown Hill	2	65.57	32.79	0
	Winnall Down	8	507.37	63.42	37.17
	Hog Cliff Hill i	5	161.0	32.2	18.19
	Hog Cliff Hill ii	3	68.9	22.97	8.16
	Old Down Farm i	2	128.15	64.08	9.62
	Old Down Farm ii	4	118.1	29.52	6.94
	Gussage All Saints	1	63.62	63.62	N/A
	Little Woodbury	2	255.25	127.63	69.42
	Hollingbury	5	195.34	39.07	43.80
	Winklebury	5	403.9	67.32	16.15
	Pilsdon Pen	8	357.7	44.71	14.92
	Chalbury Camp	1	79.49	79.49	N/A
	Balksbury Camp	3	148.68	49.56	6.26
	Hengistbury Head	11	546.33	49.67	31.79
	Heathy Brow	1	19.63	19.63	N/A
Totals	18	69	3534.48	50.49	31.72

Table 5.3 Values for dwellings on Early Iron Age sites

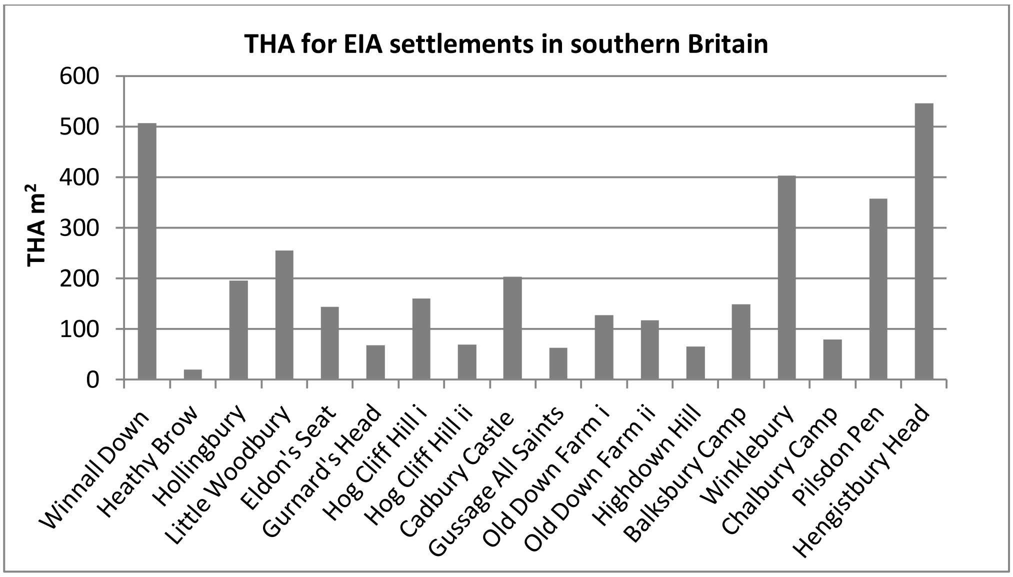


Figure 5.10 Distribution of Total Habitable Area for the Early Iron Age

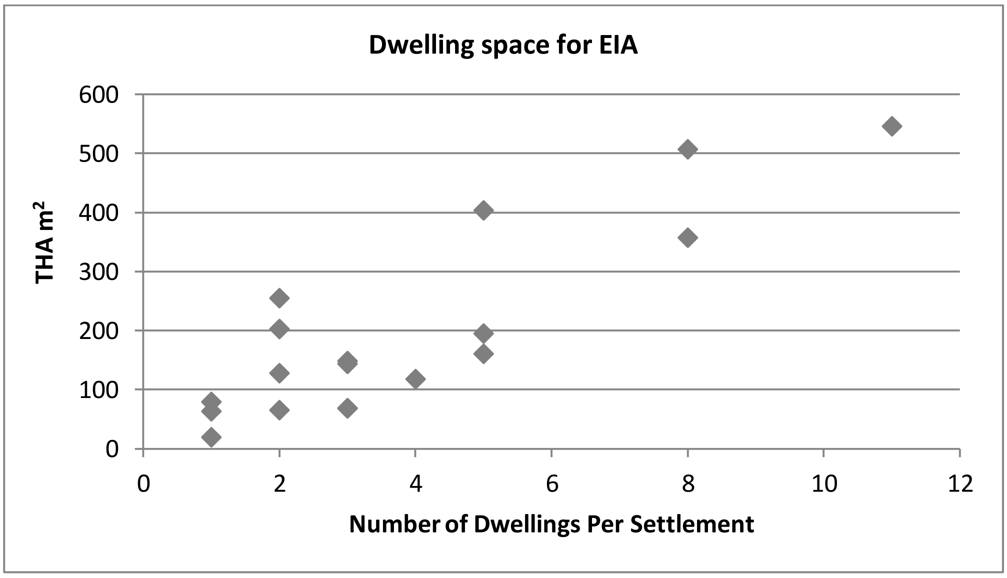


Figure 5.11 Contrast of number of dwellings and Total Habitable Area for the Early Iron Age

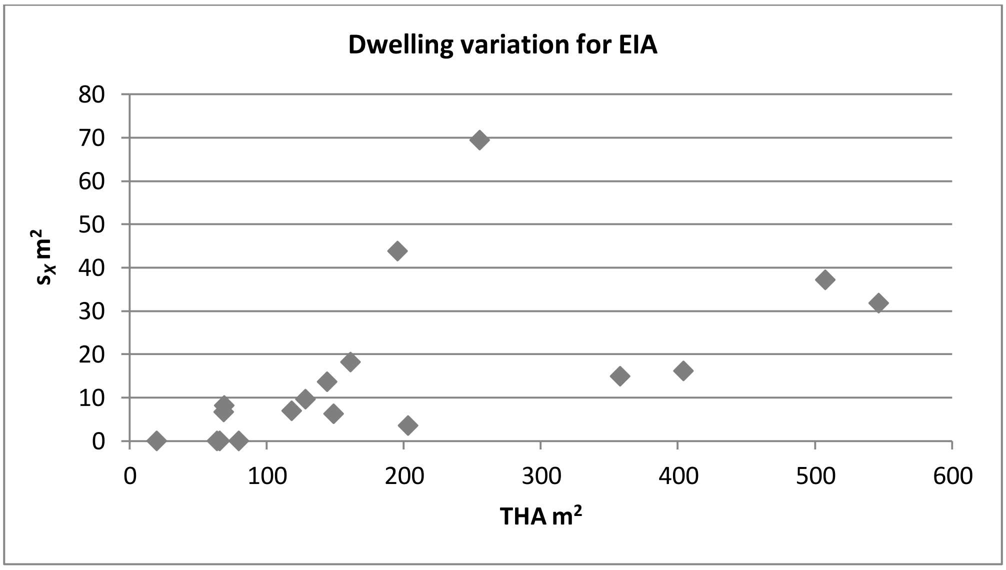


Figure 5.12 Contrast of Total Habitable Area and Standard Deviation per settlement for the Early Iron Age

derived from one to three dwellings. Three sites (Eldon's Seat, Old Down Farm ii, and Hollingbury) presented a THA of $100<n<200$ m^2, from one to five dwellings. Three settlements (Cadbury Castle, Hog Cliff Hill i, and Little Woodbury) presented a THA of $200<n<300$ m^2, from two to five dwellings. The remaining two sites, Winnall Down and Hog Cliff Hill ii, presented a THA of $450<n<550$ m^2, from seven to eight dwellings.

The increase in settlement size is apparent in Figure 5.10. With two outlying exceptions, the Middle Bronze Age sites did not exceed a THA of 150 m^2, with a similar pattern evident for the Late Bronze Age. For the Early Iron Age, nearly half of settlements (44%) presented a THA above 150 m^2. Nearly twice the EIA settlements (66%) presented THA values greater than 100 m^2 compared to the LBA settlements (35%), demonstrating a definite increase in dwelling space for the later period and further suggesting a change toward a larger population per settlement.

The average dwelling area per site also indicated an increase in dwelling size in this period. Eight settlements (Eldon's Seat, Gurnard's Head, Highdown Hill, Hog Cliff Hill i, Hollingbury, Pilsdon Pen, Balksbury Camp, and Hengistbury Head) presented average dwelling areas of $20<n<50$ m^2. Another six (Winnall Down, Hog Cliff Hill ii, Old Down Farm i-ii, Gussage All Saints, and Winklebury Camp) displayed $50<n<70$ m^2. Chalbury Camp was the only settlement with an average dwelling area of $70<n<100$ m^2. The remaining settlements (Cadbury Castle and Little Woodbury) presented an average dwelling area of over 100 m^2. Winnall Down and Hog Cliff Hill ii presented the greatest amount of THA, yet their average dwelling size indicates a typical size of dwelling. Figure 5.11, contrasting number of dwellings and THA per site, supports a lack of standardized construction, suggesting dwellings were constructed on an as-needed basis with variation in the population of each settlement. The increase in THA and number of dwellings from the previous settlements is reflective of the increasing population and changing settlement organization of the Iron Age.

Interestingly, the standard deviation for the EIA settlements was not as proportionally small as the preceding period, indication a larger variation in dwelling size per settlement (Fig. 5.12 and 5.13). Approximately twenty-eight percent of settlements presented the smallest range of standard deviation of 0 to 5 m^2. Another twenty-eight percent of settlements presented a standard deviation of 6 to 10 m^2 and contained settlements with two to four dwellings. Twenty-two percent displayed standard deviations of 11 to 20 m^2. Nearly seventeen percent of settlements displayed a much greater differentiation with standard deviation values between 31 and 45 m^2. The 'type site' of Little Woodbury actually produced the most variation in size, suggesting it was perhaps not as standard for the Early Iron Age as it has been treated (*cf.* Davis 2011). Nearly half of standard deviation values (47%) for the EIA

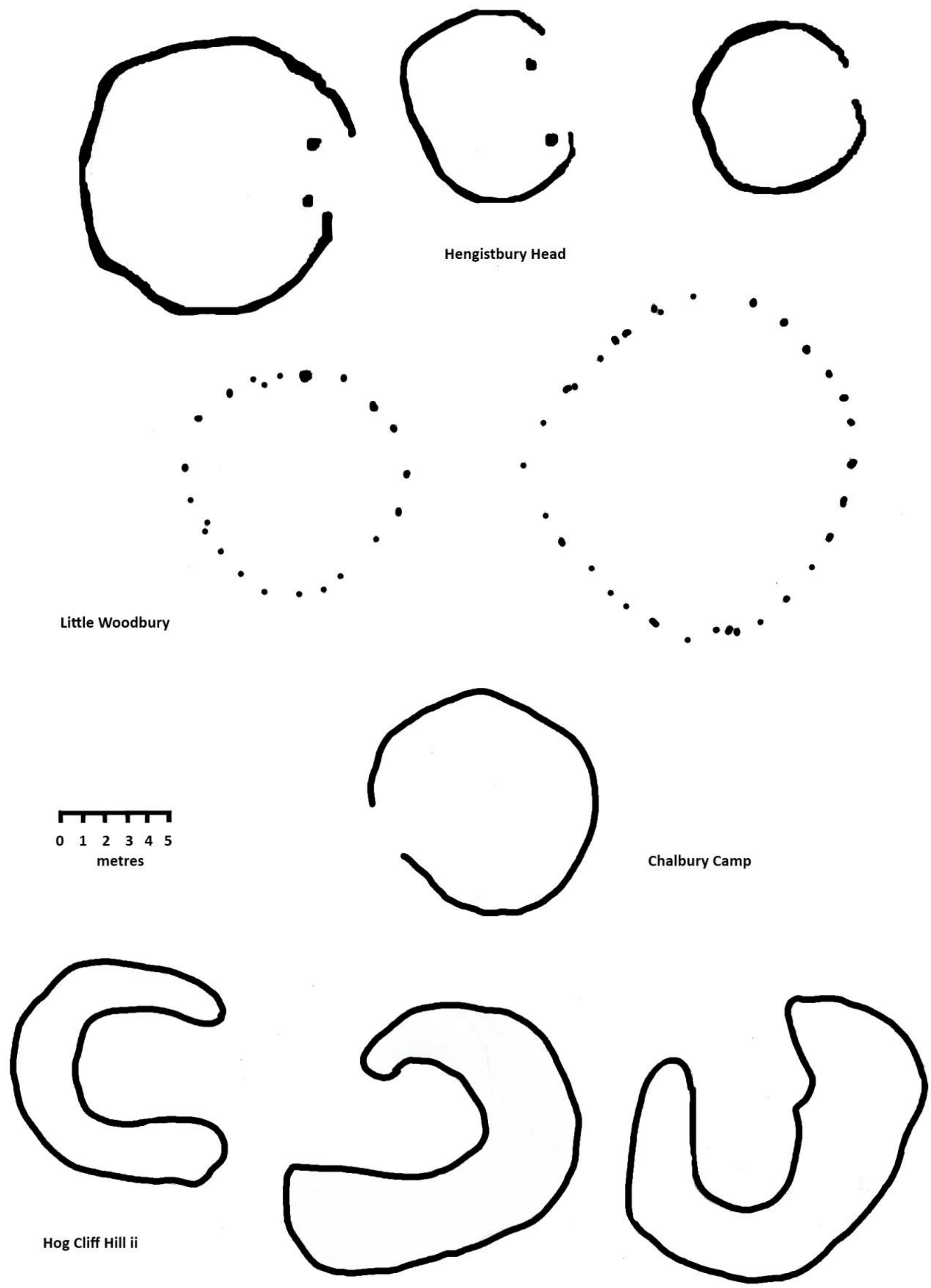


Figure 5.13 Comparison of EIA dwellings. Hengistbury Head after Cunliffe 1987, Little Woodbury after Bersu 1940, Chalbury Camp after Whitley 1943, Hog Cliff Hill after Ellison and Rahtz 1987

demonstrate fairly similar size dwellings (s_X =0≤n<10 m^2). Settlement size does appear to have some affect on the standard deviation, although the largest variation occurred on Little Woodbury with two dwellings, followed by Hollingbury with five dwellings, Winnall Down with eight dwellings, and Hengistbury Head with eleven dwellings. The smallest standard deviation

(s_x =0 m^2) was on Highdown Hill with two dwellings, followed by Cadbury Castle (s_x = 3.54 m^2) with two dwellings. With increasing settlement size and increasing deviation between sizes of dwellings on the same settlement, the Early Iron Age demonstrates an expanding population with dwellings built to reflect the scale of population, rather than a predetermined ideal of 'settlement' and 'dwelling'. The dwelling data for the EIA indicate a change from the small family units of the preceding periods toward more dwellings housing more people of more heterogeneous units.

Only three settlements (17%) were unenclosed for the Early Iron Age, marking a definite preference toward enclosure. There is no correlation between THA, average dwelling size, or number of dwellings between the unenclosed settlements. The only connection between all three open EIA settlements was that they presented small standard deviation in dwelling size of less than seven m^2. The majority of enclosed settlements presented greater differentiation. The data imply a growing concern with devotion of energy to enclosed settlements, perhaps for reasons of community identity (Hamilton and Gregory 2000). The enclosures took energy and resources, yet did not negatively impact the increasing size (THA and number of dwellings) of the EIA settlements as was visible in the MBA.

Synopsis

There are definite trends that emerge over time concerning dwellings and population for southern Britain. The Middle Bronze Age demonstrates a strong pattern of small individual farmsteads of two to four dwellings (Fig. 5.14), as observed by Harding (2002) and Pryor (2010) among others, with only two larger settlements that are possibly multi-phased. The majority of settlements were enclosed, with smaller dwellings than those present on open settlements. The smaller dwellings are understandable in the context of labour and resources, as more effort would be involved in the creation of the enclosure, whereas the unenclosed settlements only required energy involved in the construction of dwellings.

The pattern of small farmsteads largely maintained itself through the Late Bronze Age, although the data for the latter period suggests the potential of settlement variation emerging in the Late Bronze Age. This might simply be an early shift toward the larger settlements of the Iron Age, or some form of settlement hierarchy; dwelling data on its own is inconclusive. Overall, the Total Habitable Area was similar for both the Middle and Late Bronze Age, with the majority of the sample for both periods presenting a THA of less than 150 m^2. A slight overall increase in dwelling size was present in the latter period. There were a higher proportion of open settlements, although the majority of settlements remained enclosed. While the dwellings on unenclosed settlements remained similar in size, there was an increase of dwelling size on a portion of enclosed settlements, indicating shifting trends in settlement organization and the devotion of labour and resources.

Settlement organization began to change on a broader scale in the Early Iron Age, as both settlements and dwellings grew larger, providing more roofed floor area. While the majority of settlements (72%) continued to display one to four dwellings, nearly one-third presented five to eleven contemporary dwellings. The THA per site also increased in the EIA, as approximately two-thirds of settlements presented a THA greater than 100 m^2, compared to approximately one-third in both the MBA and LBA (Fig. 5.15). Populations increased into the Iron Age, with more dwelling space constructed for family units, resulting in larger dwellings, and the number of family units per settlement increasing, as indicated by more dwellings per settlement.

The variation in dwelling size demonstrated an interesting pattern (Fig. 5.16). Generally, the Middle Bronze Age and the Early Iron Age presented more variation in dwelling size than the Late Bronze Age. The Late Bronze Age settlements were largely more similar to each other than those of the preceding and following periods. The impetus for variation in dwelling size also varied. The differentiation was not related to settlement size for the Bronze Age settlements, yet there was a correlation with more variation on larger settlements in the Early Iron Age. The Middle Bronze Age demonstrated inconsistent dwelling construction, suggestive of a lack of standardized settlement organization or unequal access to labour

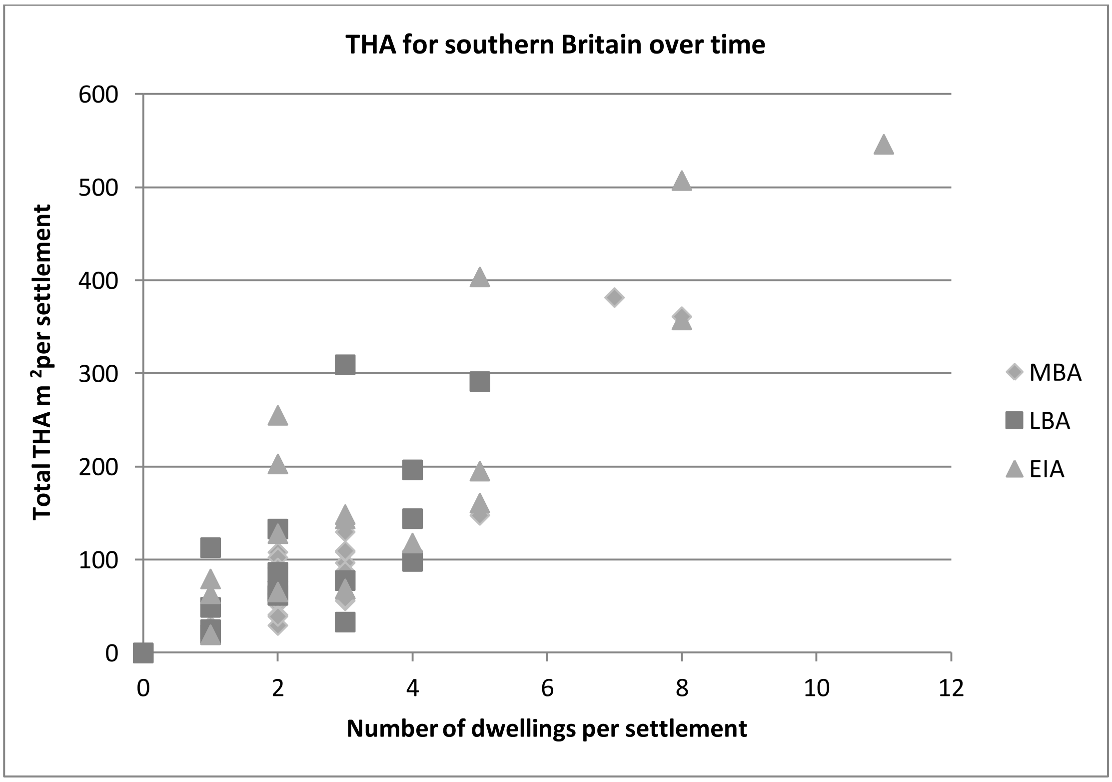


Figure 5.14 Contrast of Total Habitable Area with number of dwellings per settlement over time

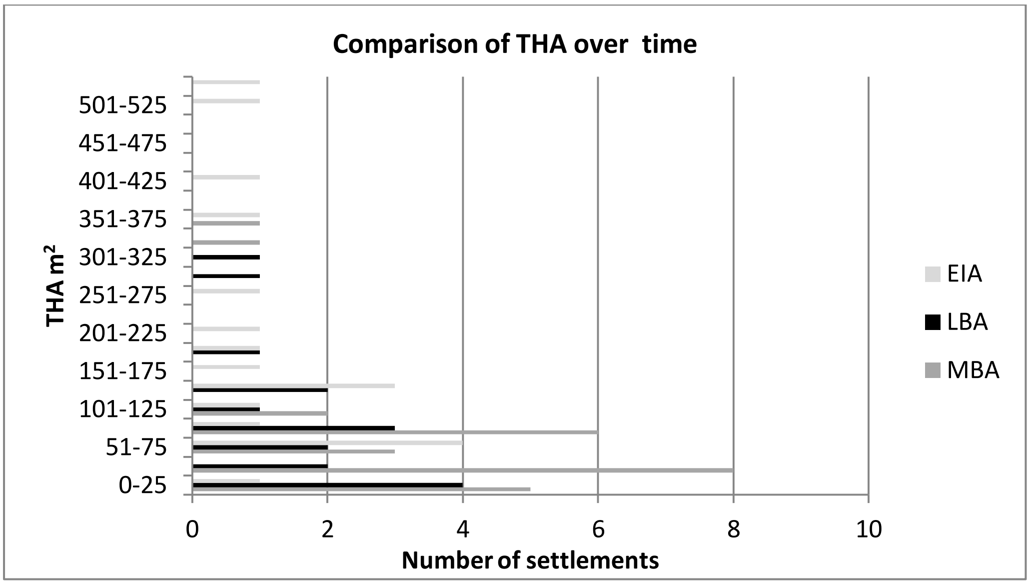


Figure 5.15 Comparison of Total Habitable Area over time

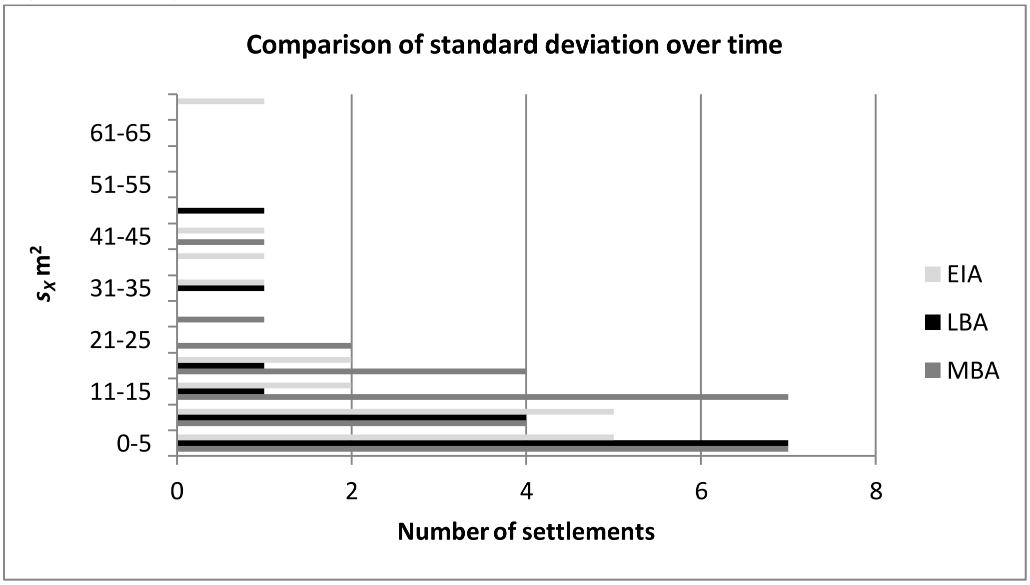


Figure 5.16 Comparison of Standard Deviation or dwelling area over time

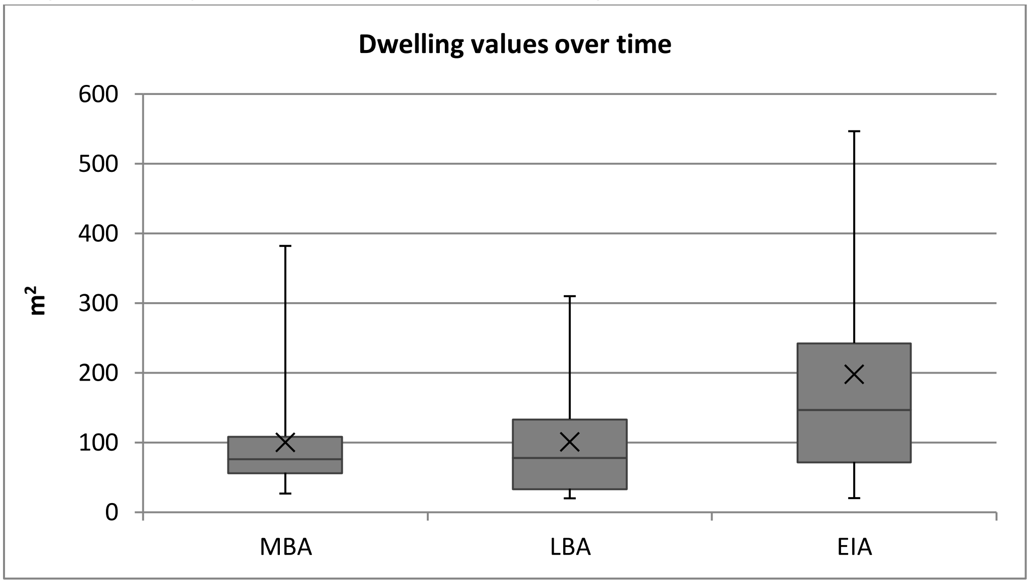


Figure 5.17 Total range of Total Habitable Area values overt time. X indicates average THA.

and resources. There is therefore no consistent Middle Bronze Age 'house', rather varied requirements of roofed floor area, quite probably directly related to the energy (labour and resources) able to be mustered for construction. The Late Bronze Age settlements, demonstrating less variation, in contrast indicate an increase in consistency in dwelling size. When combined with the apparent mixture of larger and smaller settlements (as per THA) and enclosed and unenclosed settlements, the more similar construction of dwellings appears counterintuitive. The greater variation for the Early Iron Age is more understandable, with larger settlements and an increase in settlement size. Larger and often more numerous dwellings would more likely be built to suit the needs of the settlement, rather than follow any particular trend of construction, as that would conserve both labour and resources.

The trend of increasing THA indicates a growing need for roofed area (Fig. 5.17), which signifies an increase or reorganization of population across the landscape. The increase between the Middle Bronze Age and the Late Bronze Age was slight, yet still present. The Late Bronze Age can be viewed as a transitional period in dwelling construction between the single-family farmsteads of the MBA and the larger settlements of the EIA, as it demonstrated smaller, comparable, and larger settlements than the preceding period. The significant change in settlement organization in the Early Iron Age is undeniable, even as the smallest settlements maintained the single-family structure from the Bronze Age. The shift toward settlements of more numerous and larger dwellings is suggestive of the beginning of a reorganization of population into more populous settlements. It is clear that more living/activity space was required over time. The next question to ask is if and how the changes in dwelling space, indicating an increase in available labour, were reflected in consumption through a comparison of pits and post-structures per site.

5.2 Evidence for consumption

Examining the patterns over time in maximum potential consumption, both subterranean and above ground, provides information regarding shifts in energy invested in agricultural production and activities toward life. Potential storage space relates directly to the need to store consumptive material, regardless of whether before or after consumption, standing as proxy for the habits of agricultural production per site. The southern British material consisted of two distinct types of storage: pits and post-structures. Both types must be addressed, particularly in the case of dual storage opportunities on a single settlement. Tracing patterns and shifts in storage over time allows for conclusions regarding the impact of shifting exchange routes and metal supplies on agricultural production. Further, when discussed in conjunction with the trends in population, a clearer picture of the agricultural production and site relations becomes apparent.

Pits

Subterranean pits on prehistoric sites have long been documented in Britain. Bersu's (1940) examination of Little Woodbury was the preeminent study suggesting use of pits as underground grain silos. The use of pits has been debated ever since (see Chapter IV), although experimental approaches such as Reynolds' (1974, 1979) Butser Ancient Farm Project have supported their use as long-term grain storage. This study considers pits, purposely constructed in specific dimensions and numbers per settlement, as representative of consumption. Whether storing grain or rubbish, pits stored the throughput of energy devoted to maintenance of life. This allows for pits with a volume of less than 1 m^3 to be included in this study, despite Bersu's (1940) discounting of pits of smaller volume as successful grain storage containers. As discussed in the excavations at Danebury (Cunliffe 1984) which located over 5000 total pits, continuous or contemporary use of all pits excavated is not assured, even among those that can be reliably phased. For the purpose of this study, however, the total maximum storage capacity for each settlement phase is investigated to provide values for comparison over time.

Pit shape and size often varies both within and across settlements of southern Britain. There is little evidence for a single type of 'storage pit' in the Bronze Age and Early Iron Age; pit shapes range from oval/round to rectilinear with any permutation of rounded to flat bottoms. From Bersu's study of Little Woodbury onward, typologies of pit characteristics have been attempted to understand the variability present and to further understand pit usage. Pit morphology has been attributed to environmental causes as well as usage, with experimental data indicating certain characteristics as more beneficial toward specific function (Bowen and Wood 1968, Jeffries 1979). The analysis of pit characteristics at Gussage All Saints did not identify any type of functional advantage of pit shape (Jeffries 1979). Pit shape is particularly of interest when examining the energy expended toward consumption, *i.e.* the construction of pits, as different pit shapes require different amount of energy, not to mention forethought in the purposeful creation of a specific type of pit. Even if the final shape (barrel, cylindrical, hemispherical, etc.) was influenced by soil type and difficulties in digging, the final outcome (depth and diameter) indicates a determined goal in storage; no one wants to do more work than necessary.

The Middle Bronze Age

The settlements of the Middle Bronze Age in southern Britain presented an array of subterranean storage capacities (Table 5.4). Nine of the twenty-six (35%) settlements for this period did not display storage pits. Nearly all (94%) of the settlements which did present pits, contained fewer than ten pits. The remaining site, Trethellan Farm, presented a large number of pits (n=32) although again, separate phases of occupation for the settlement are likely, but unable to be determined. Even if phased, the settlement demonstrated an abnormally large number of pits for the period, as even Itford Hill presented only twelve total pits from four phases.

	Southern Britain	Number of Pits	Total Volume m^3	Average Volume per pit m^3	Standard Deviation S_X m^3
	Trevisker	0	0	0	N/A
	Trewey Down	0	0	0	N/A
	Trethellan Farm	32	1.75	0.05	0.06
	Gwithian	0	0	0	N/A
	Stannon Down	0	0	0	N/A
	Brean Down	5	2.83	0.57	0.74
	Poundbury i	0	0	0	N/A
	Poundbury ii	0	0	0	N/A
	Shearplace Hill	1	0.67	0.67	N/A
	Down Farm i	1	0.33	0.33	N/A
	Down Farm ii	7	1.12	0.16	0.1
	South Lodge Camp	2	2.27	1.14	0.39
	Thorny Down i	3	0.35	0.12	0.11
	Thorny Down ii	0	0	0	N/A
	New Barn Down	1	0.72	0.72	N/A
	Cock Hill	2	1.02	0.51	0.42
	Blackpatch	1	0.17	0.17	N/A
	Mile Oak	6	1.36	0.23	0.11
	Itford Hill i	5	1.18	0.24	0.29
	Itford Hill ii	3	0.42	0.14	0.09
	Itford Hill iii	4	1.26	0.32	0.21
	Itford Hill iv	0	0	0	N/A
	Black Patch hut platform 4	5	3.12	0.62	0.59
	Black Patch hut platform 1	1	1.27	1.27	N/A
	Plumpton Plain A	1	0.44	0.44	N/A
	Highdown Hill	0	0	0	N/A
Totals	26	29	10.96	0.34	0.87

Table 5.4 Values of pits for Middle Bronze Age settlements

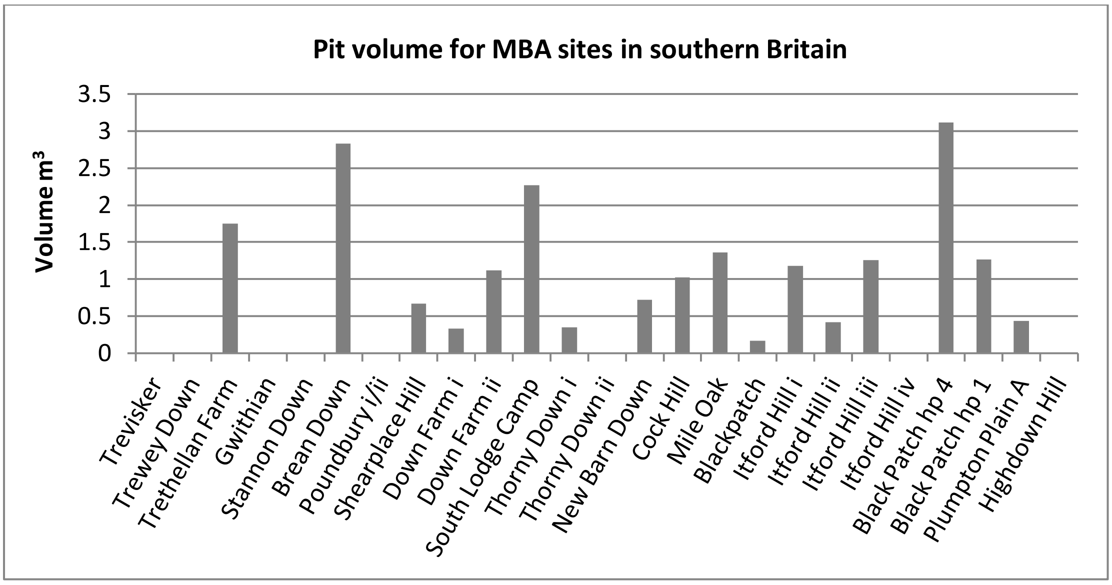


Figure 5.18 Distribution of total pit volume per site for the Middle Bronze Age

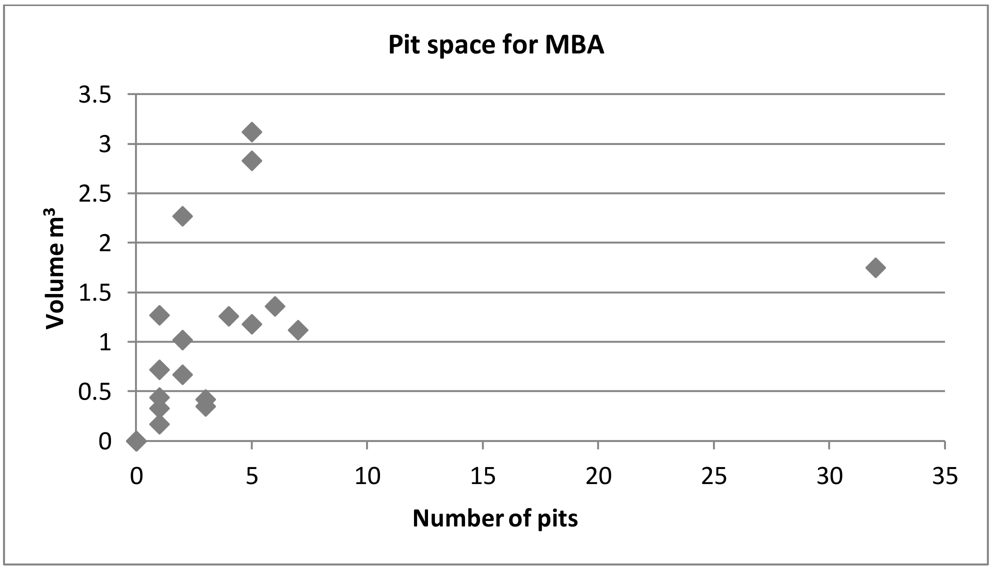


Figure 5.19 Contrast of total pit volume and number of pits per site for the Middle Bronze Age

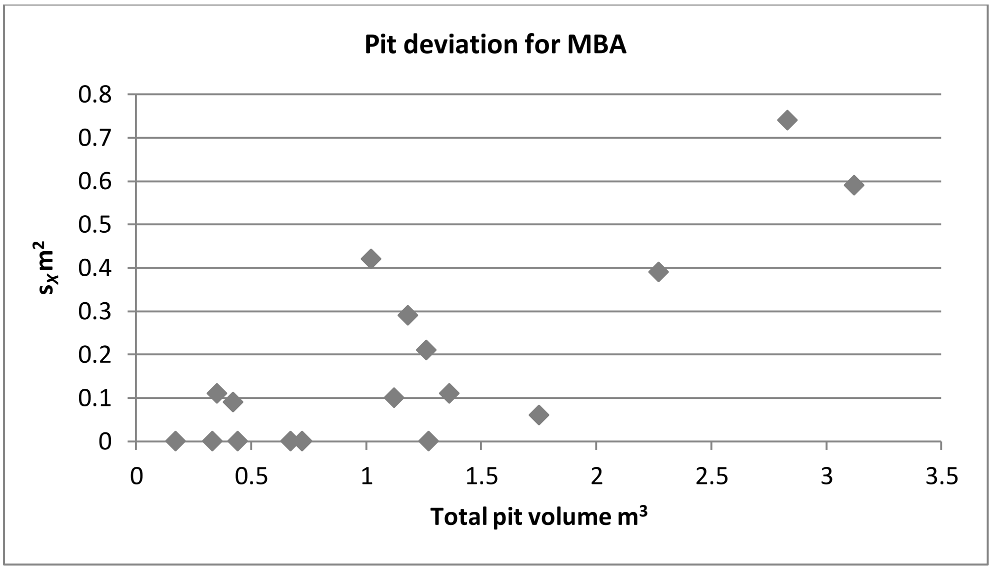


Figure 5.20 Contrast of total pit volume and standard deviation per settlement for the Middle Bronze Age

Regarding the total subterranean storage potential for the Middle Bronze Age sites (Fig. 5.18), pit sizes, and therefore capacities, varied. Seven settlements (Shearplace Hill, Down Farm i, Thorny Down i, New Barn Down, Blackpatch, Itford Hill ii, and Plumpton Plain A) presented one to three pits providing $n<1m^3$ of total pit volume. Seven settlements (Trethellan Farm, Down Farm ii, Cock Hill, Mile Oak, Itford Hill i, Itford Hill iii, and Black Patch hut platform 1) present $1<n<2\ m^3$ of total pit volume. The number of sites in this category of pit volume differed, with Black Patch hut platform 1 and Cock Hill containing one and two pits, respectively; however, Mile Oak, Down Farm ii, and Itford Hill i and iii presented between four and seven pits, while Trethellan Farm the largest number with thirty-two pits. Again, this suggests variability in pit capacity and provides an indication of agricultural production, as pits were likely constructed on an as-needed basis (Whittle 1984). Five sites (Brean Down, South Lodge Camp, Itford Hill i, Itford Hill iii, and Black Patch hut platform 4) presented total volumes of $4<n<8\ m^3$, again derived from a range of three to six pits.

The suggestion of variability in pit capacity is further demonstrated, as Black Patch hut platform 4 presented four pits that created 3.12 m^3 of storage volume, yet the thirty-two pits of Trethellan Farm provided just over half the volume with 1.75 m^3 of storage capability. Generating average pit capacity for each site, 0.05 m^3 for Trethellan Farm and 0.62 m^3 for Black Patch platform 4, emphasizes the difference in storage capability between the sites. As fifty-two percent of the settlements presented average pit values less than one cubic metre, pit size and number per site were not standardized across the Middle Bronze Age (Fig. 5.19), likely indicating the creation of pits as needed and grain storage in amounts for supporting the small population of the farmstead until the next harvest. Given that Trethellan Farm may actually present two to three distinct phases of occupation, the deviation may be exaggerated, however, that does not explain the similarities in Brean Down, South Lodge Camp, and Black Patch hut platform 4. The larger amount of potential storage capacity on those settlements may be indicative of highly productive settlements with a greater need for storage. There is a lack of correlation with THA between the settlements, which raises questions of why certain settlements presented larger pit capacities. While Black Patch platform 4 displayed large values of both THA and total pit capacity, Brean Down and South Lodge Camp presented comparably small THA values. Blackpatch did present the smallest values of both THA and total pit capacity, yet, Down Farm i presented one of the smallest total pit capacities and over 100 m^2 of THA. For the six settlements with 1 to 1.5 m^3 of pit capacity, the THA values ranged from 40 to 130 m^2. Dwelling space, and therefore labour force and the consumptive population, was not an influence on pit capacity. The settlements with greater storage capacity, yet smaller potential populations may have relied on neighbouring

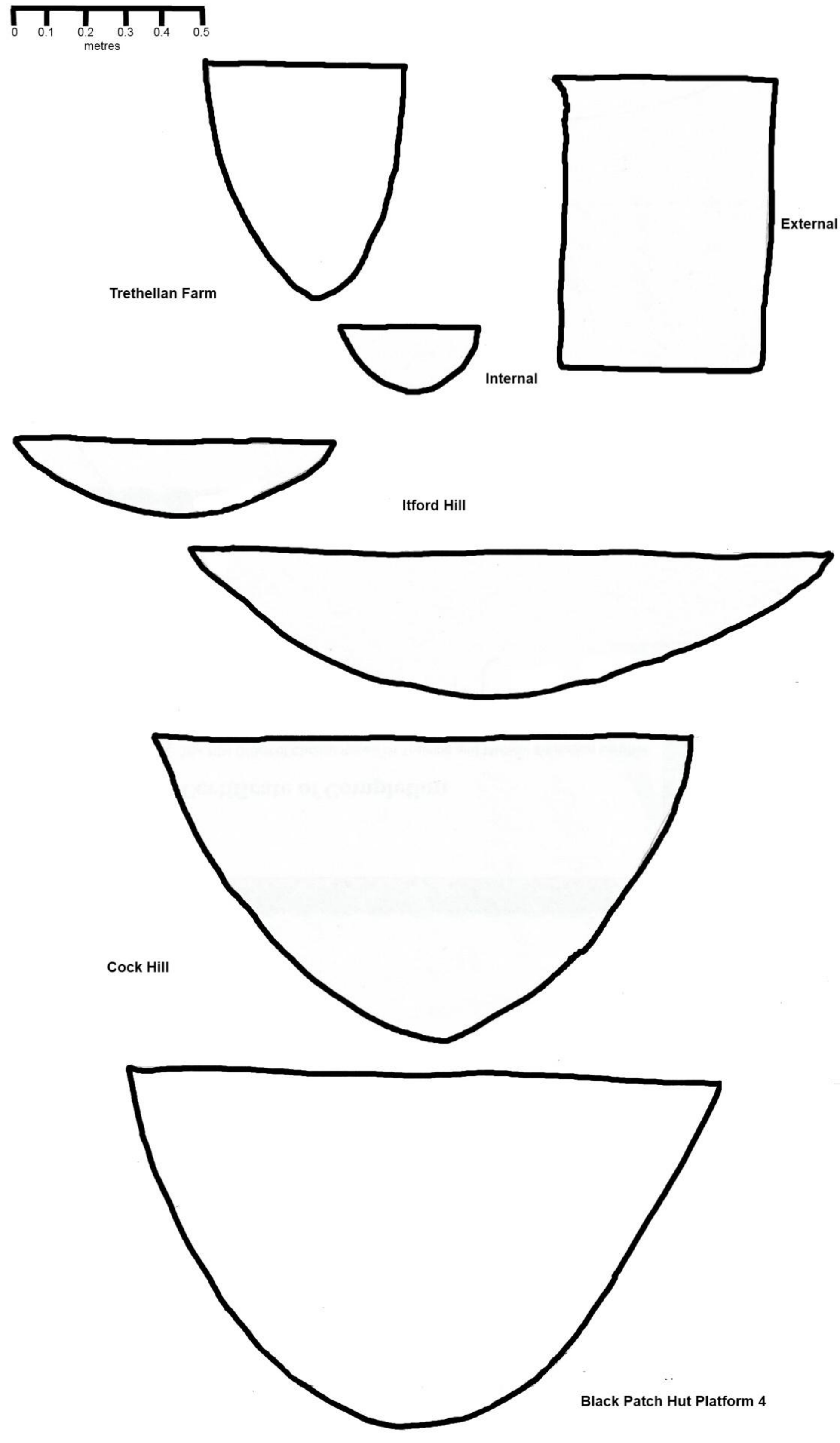


Figure 5.21 Comparison of selected MBA pit morphology. Trethellan Farm after Nowakowski 1991, Itford Hill after Burstow and Holleyman 1957, Cock Hill after Ratcliffe-Densham and Ratcliffe-Densham 1961, Black Patch after Drewett 1982

settlements for additional labour, which would have allowed for harvests greater than necessary for the maintenance of their population. Cock Hill, for example, shared a field system with Blackpatch and New Barn Down (Ratcliffe-Densham and Ratcliffe-Densham 1953, 1961), and could have formed a supportive relationship with the settlements with less pit capacity.

The standard deviation for the total volume of MBA settlements was 0.87 m^3, confirming a tendency toward variation in total pit volume between the settlements (Fig. 5.20 and 5.21). Conversely, the standard deviations of pit volumes per settlement were largely comparable. Eleven settlement phases presented less than 0.2 m^3 in standard deviation, followed by three settlements with $0.21<n<0.4$ m^3, two with a standard deviation of $0.41<n<0.6$ m^3, and the remaining settlement (Brean Down) displayed 0.74 m^3. When contrasted with number of pits and the total volume per settlement, the similarity in pit size suggests a varied need for underground consumptive space, yet a strong continuance in creating that space within each settlement. Pit variation is related to total pit volume (Fig. 5.20), as the settlements with the most pit volume (Brean Down, Black Patch hut platform 4, South Lodge Camp) tended toward greater variation ($\mathbf{s}_X>0.35$ m^2). The number of pits on those settlements (five pits for Brean Down and Black Patch 4; two pits for South Lodge Camp) suggests differing strategies to creating the necessary subterranean storage space on settlements with the greatest need for consumptive space, *i.e.* the greatest total pit volumes. The duration of the settlement may be at play, as Brean Down was occupied into the Late Bronze Age and may have required upkeep on aging pits, or the success of a harvest season, if each pit represents the need of that season's crops. The greater variation for South Lodge Camp may be accounted for by pit location.

Pit location is informative when tracking agricultural production, as changes thereof indicate shifts in storage strategy. For the Middle Bronze Age, the majority (97%) of pits were located within dwellings or structures (Fig. 5.22). Three settlements (Trethellan Farm, South Lodge Camp, and Down Farm ii) which presented external pits also displayed internal pits (Table 5.5). Given that these three sites presented the full range of total pit volume, it becomes difficult to assess the significance in pit location for the period. Plumpton Plain A and New Barn Down presented the only settlements with solely external pits. Both sites only presented evidence for single pits, although their average pit volumes (0.44 m^3 and 0.72 m^3, respectively) are in the middle of the range of Middle Bronze Age pits. With such a small sample, the import of external versus internal pit location is not readily apparent. What can be gleaned from the data for the Middle Bronze Age, however, is that is that internal pits, suggestive of everyday use rather than long-term storage, were the dominant mode of subterranean storage.

Enclosure of the settlement appears to have an impact on the presence of pits, as seventy-one percent (n=12 or 46% of the total MBA settlements) of settlements with pits were enclosed. The open settlements with pits totalled five (19% of the total MBA settlements), suggesting a trend toward pits on enclosed settlements by this period. There is also a correlation between enclosure and the location of pits, as all settlements with external pits, excepting Trethellan Farm, were enclosed. The presence of external pits on enclosed settlements suggests more confidence in possession of goods for consumption stored outside direct control, *i.e.* within dwellings, and may indicate a change in storage strategy closely linked with new patterns of settlement organization. There is, however, little impact of enclosure on the total pit volume or on the differentiation of pit size per settlement. The number of pits per settlement also displays little correlation with enclosure, as the unenclosed settlements contained one to thirty-two pits, while the enclosed settlements contained one to seven pits or the majority of range for number of pits.

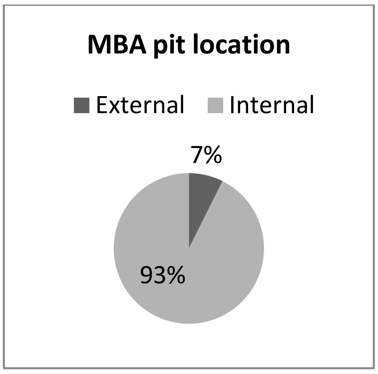


Figure 5.22 Ratio of pit location for the Middle Bronze Age

	Internal	External	N/A
Trevisker			x
Trewey Down			x
Trethellan Farm	x	x	
Gwithian			x
Poundbury			x
Stannon Down			x
Shearplace Hill	x		
Itford Hill i-iv	x		
Black Patch 1,4	x		
Plumpton Plain A		x	
Brean Down	x		
Mile Oak	x		
Cock Hill	x		
New Barn Down		x	
Blackpatch	x		
Thorny Down i	x		
Thorny Down ii			x
South Lodge Camp	x	x	
Down Farm i	x		
Down Farm ii	x	x	
Highdown Hill			x

Table 5.5 Pit location within Middle Bronze Age settlements. N.B.: All phases of Itford Hill and Black Patch had internal pits.

The Late Bronze Age

For the Late Bronze Age, the same proportion of settlements (35%) did not present any evidence of storage pits as in the Middle Bronze Age (Table 5.6). Four settlements (Brean Down, Cadbury Castle, Amberley Mount, and Winnall Down) displayed evidence of a single pit. Three settlements (Mucking North Ring i, Mile Oak, and Rams Hill) presented between three and nine pits. The remaining three sites presented greater numbers of pits: The Caburn with twelve pits, Aldermaston Wharf with forty-nine pits, and Green Park with sixty-eight pits. While the majority of settlements were comparable to the Middle Bronze Age settlements, the latter grouping indicates an increase from the preceding period. The variety present is suggestive of the continuation of an as-needed basis for the creation of pits, with a more exaggerated difference in production between settlements in the Late Bronze Age.

The difference in potential capacity per site for subterranean storage (Fig. 5.22) is carried through in the total volume per site, as an assortment of pit volumes is present. Four settlements (Cadbury Castle, Amberley Mount, Mile Oak, and Winnall Down) presented a total pit volume of less than one cubic metre, from a single pit on each site. Four settlements

	Southern Britain	Number of Pits	Total Volume m^3	Average Volume per pit m^3	Standard Deviation S_X m^3
	Brean Down	1	2.45	2.45	N/A
	Eldon's Seat	0	0	0	N/A
	Cadbury Castle	1	0.36	0.36	N/A
	Springfield Lyons	0	0	0	N/A
	Mucking North Ring i	9	4.19	0.47	0.3
	Mucking North Ring ii	0	0	0	N/A
	Green Park	68	51.09	0.75	0.84
	Aldermaston Wharf	49	9.56	0.21	0.1
	Loft's Farm	0	0	0	N/A
	Plumpton Plain B	3	0.54	0.18	0.14
	Amberley Mount	1	0.86	0.86	N/A
	Mile Oak	1	0.37	0.37	N/A
	The Caburn	12	12.27	1.6	0
	Winnall Down	1	0.02	0.02	N/A
	Hog Cliff Hill	0	0	0	N/A
	Rams Hill	6	1.61	0.27	0.2
	Mucking South Rings	0	0	0	N/A
Totals	17	151	83.32	0.56	0.67

Table 5.6 Values of pits for Late Bronze Age sites

(Brean Down, Mucking North Ring ii, Aldermaston Wharf, and Rams Hill) displayed $1<n<10$ m^3 of total pit capacity. The number of pits per site in this group varied, with Rams Hill presenting the smallest pit capacity from six pits, while Mucking North Ring contained nine pits, yet presented 4.19 m^3 of storage volume. Brean Down displayed 2.45 m^3 of storage volume from a single pit, similar to the capacity of its previous MBA phase. Aldermaston Wharf presented a large number of pits (n=49), yet only 9.56 m^3 of storage capacity. The remaining two settlements presented over ten cubic metres of subterranean storage capacity. Green Park presented a remarkable 51.09 m^3 of storage capacity from sixty-eight pits, while the Caburn presented 12.27 m^3 of underground storage capacity from a mere twelve pits. The distinction between the pit capacity groupings is strongly suggestive of differing needs for storage and thus different productive capabilities, with an increase from the MBA, as all MBA settlements demonstrated less than four m^3 of pit capacity.

The disparity between the number of pits and total volume is marked, which substantiates both a lack of standardization in pit construction for the Late Bronze Age and an inconsistent need for agricultural storage per site (Fig. 5.24). The average pit capacity per site was similar to that of the preceding period, as the majority of settlements presented an average capacity of less than one cubic metre. The Caburn and Brean Down presented much larger pits, which according to Yates (2001) is to be expected from the end of the Bronze Age and into the Iron Age. The possibility of settlement phasing also suggests a probable as-needed basis for pit construction. Given, however, that seventy-two percent of the settlements with pits present less than five cubic metres of total potential storage volume, it appears that, for the most part, there was a comparable amount of necessary agricultural storage between LBA settlements. This supports the dwelling evidence for individual farmsteads with perhaps a slight increase in population from the MBA, suggesting agricultural production and surplus or seed grain storage on a single-family scale. The larger pit capacities of Green Park, Aldermaston Wharf, and The Caburn therefore likely demonstrate a change in productive strategy, with the energy invested in agriculture resulting in a need for drastically greater amounts of subterranean storage. The dwelling evidence is unhelpful in explaining the disparity between settlements with similar pit capacities to the MBA and those with greater potential storage. There is still little correlation between pit volume and THA; Green Park presented high values for both pit volume and dwelling area, however, the remaining settlements did not demonstrate any particular relationship between values. Hog Cliff Hill and Eldon's Seat presented large THA values, yet did not present any pits, suggesting either alternate storage or an inter-settlement relationship for the purpose of obtaining grain beyond daily use.

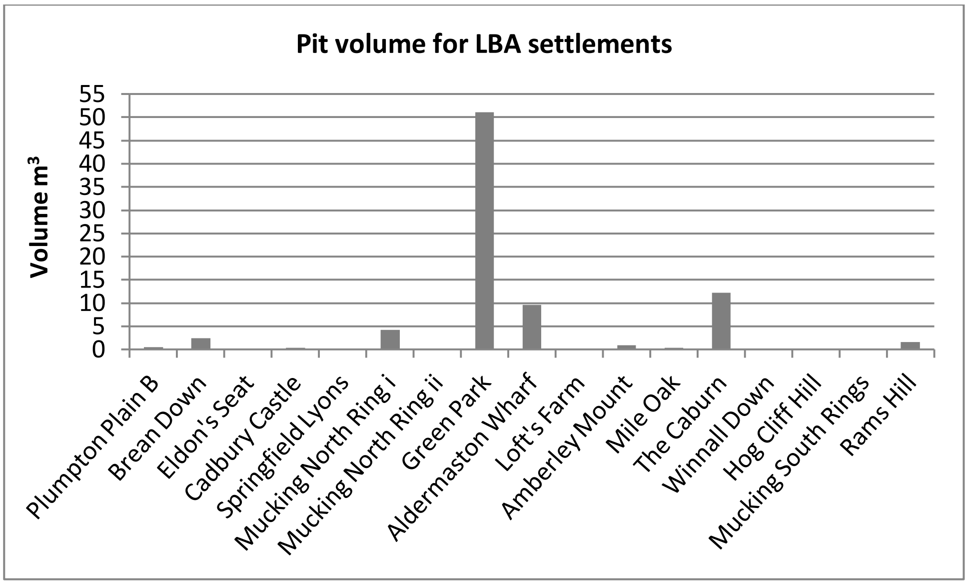


Figure 5.23 Distribution of total pit volume for the Late Bronze Age

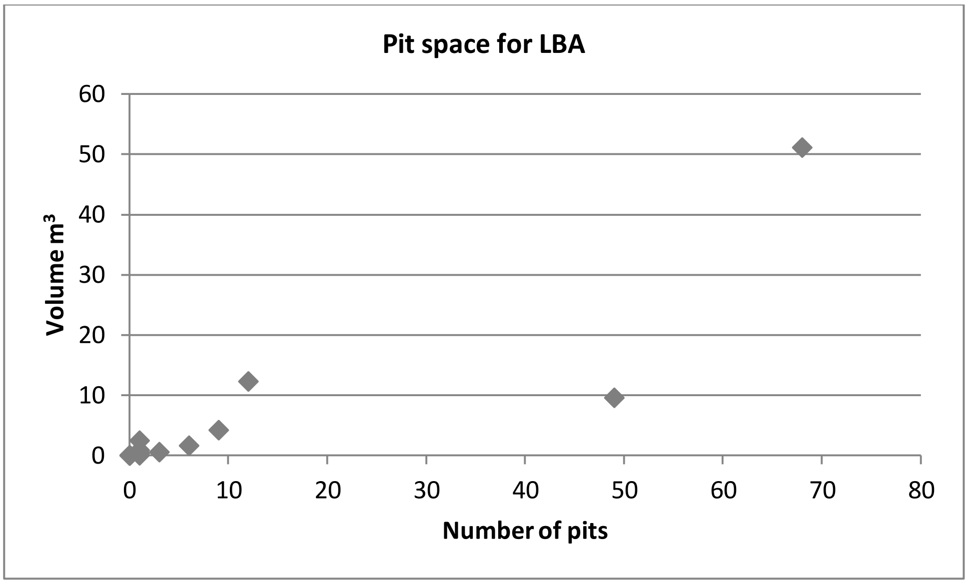


Figure 5.24 Contrast of total pit volume and number of pits per site for the Late Bronze Age

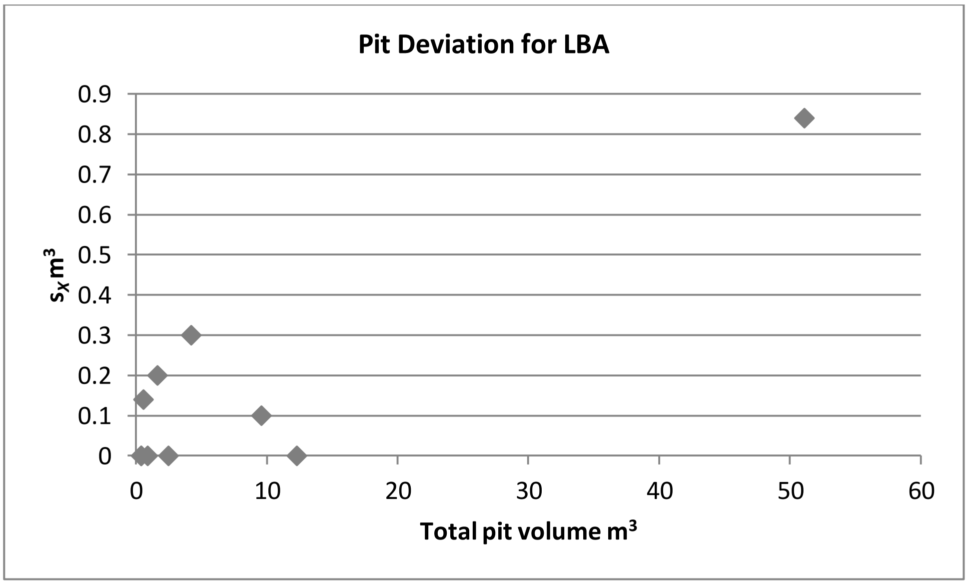


Figure 5.25 Contrast of total pit volume and standard deviation for the Late Bronze Age

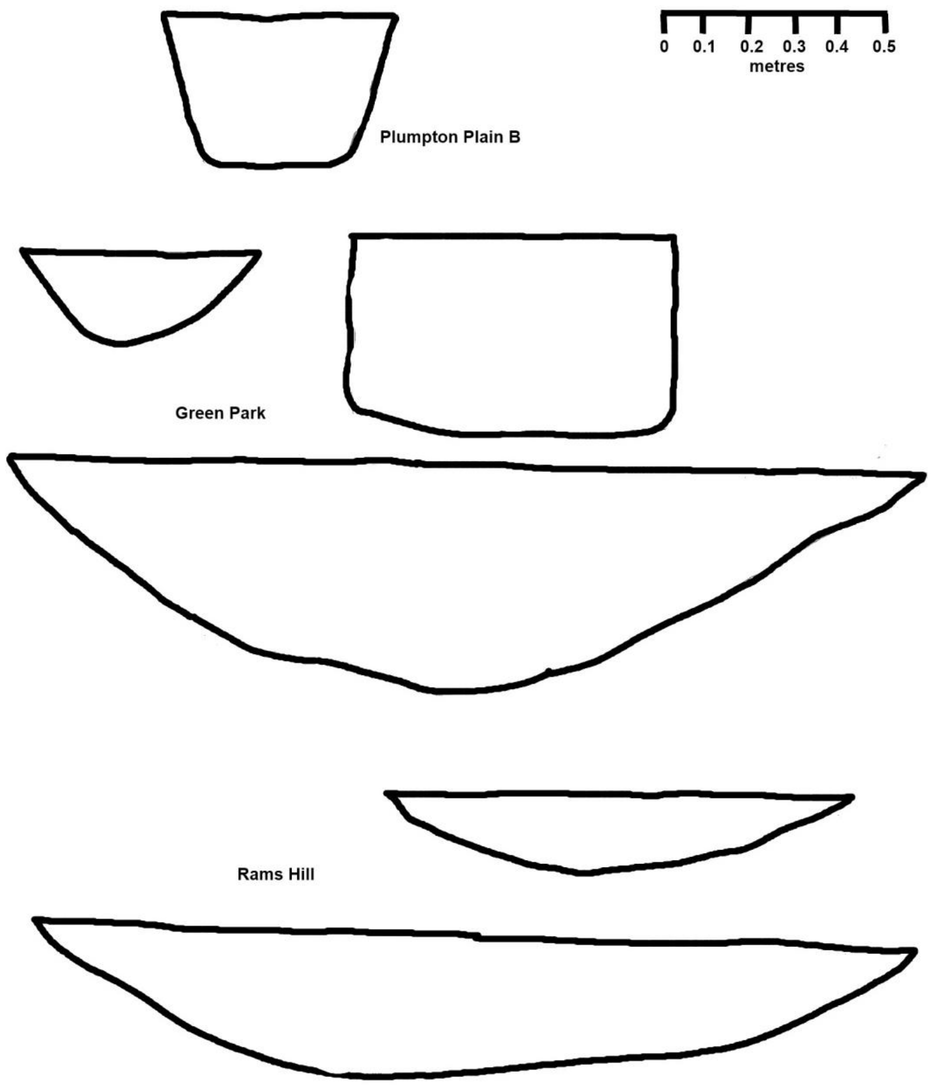


Figure 5.26 Comparison of selected LBA pit morphology. Plumpton Plain B after Holleyman and Curwen 1935, Green Park after Brossler *et al.* 2004, Rams Hill after Bradley and Ellison 1975.

Given the disparity in total pit capacity, it is surprising that the standard deviation in pit capacity for the period was less than the preceding period with s_x=0.67 m^3. The variation of pit size within settlements, however, was similar to the Middle Bronze Age settlements (Fig. 5.25 and 5.26). Nine of the eleven settlements with pits presented $0<n<0.2$ m^3 of standard deviation, while Mucking North Ring i presented 0.3 m^3 of standard deviation. Green Park demonstrated a connection between a large total pit volume, great number of pits, and a high amount of variation in size. The correlation was not carried out by the next largest settlement, as The Caburn pit dimensions were reported with negligible variation. This may be excavator error, yet incredibly precise pit construction on the same settlement is visible on the Middle Bronze Age settlements of Trethellan Farm, which also presented a great number of pits, and Itford Hill ii. Even Aldermaston Wharf for the Late Bronze Age demonstrated many pits, the third largest total pit volume, and a small standard deviation of 0.1 m^3, indicating the correlation between total pit volume and variation in individual pit volume observed in the previous period was not present. Instead, the discrepancy may be related to greater variation in pit shape, as the Late Bronze Age settlements began to demonstrate a wider array than the hemispherical and cylindrical pits of the Middle Bronze Age. As the number of pits increased, the energy expended on pit construction would increase, making new, more conservative in terms of effort, forms desirable. A frustum-shaped pit would require fewer cuts than one with sloping sides and a rounded bottom, not to mention the possibility of better conservation of grains, discussed further below.

There was a definite shift in pit location from the Middle Bronze Age, as ninety-four percent of pits in the Late Bronze Age were external to structures (Fig. 5.27). Three sites (Green Park, Mucking North Ring, and Mile Oak) contained both internal and external pits (Table 5.7). This period appears to be transitional, as Winnall Down, Plumpton Plain, and Amberley Mount continued to display only internal pits, but a movement toward external pits is obvious with thirty-one percent of settlements with pits displaying only external pits. Again, it is difficult to make definitive conclusions regarding the shift from internal to external storage pits; the fact of the change itself is worth noting. A supposition regarding access can be broached, as external pits would not provide as immediate access to their contents

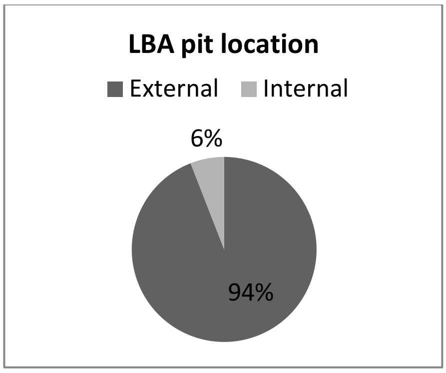


Figure 5.27 Ratio of pit location for the Late Bronze Age

	Internal	External	N/A
Green Park	x	x	
Hog Cliff Hill			x
Eldon's Seat			x
Springfield Lyons			x
Mucking North Ring i	x	x	
Winnall Down	x		
Brean Down		x	
Rams Hill		x	
Mile Oak	x		
Amberley Mount	x		
The Caburn		x	
Cadbury Castle		x	
Lofts Farm			x
Aldermaston Wharf		x	
Mucking South Rings			x
Plumpton Plain B	x		

Table 5.7 Pit Location within Late Bronze Age settlements

as internal pits. As demonstrated by experimental data (*e.g.* Reynolds 1974), pits which are sealed with clay caps and only accessed once will prevent bacteria and rot better than those under more frequent use. Such a consideration possibly indicates their use as longer-term storage and thereby raises the possibility of increased agricultural production with an increased need for surplus storage.

While external pits increased in the Late Bronze Age, the association with enclosures appears to have reversed for the period. Four of the eleven settlements with pits were enclosed, decreasing the proportion of enclosed settlements with pits from seventy-one to thirty-six percent. This may be a reflection of the general decrease in enclosed settlements for the Late Bronze Age demonstrated by the sample, as a ten percent decrease was observed. While external pits were demonstrated on both enclosed and open settlements, all but one settlement with internal pits were located on open settlements, demonstrating a continuity in strategy from the Middle Bronze Age. Again, pits being internal to dwellings on unenclosed settlements suggests a need for direct control over consumptive architecture. The Late Bronze Age demonstrates a blend of both internal and external pits on unenclosed settlements, indicating it was a period of transition, with multiple strategies being attempted. The appearance of external pits on unenclosed settlements may also reflect an increasing need for storage of agricultural produce, as those settlements with external pits produced the largest total pit volumes. Green Park and Mucking North Ring I presented both internal and external pits, along with the greatest variation in pit size per settlement, suggesting location of pits was in fact directly related to size of pits and thus different demands for subterranean storage space. The fewer enclosed settlements with pits could also reflect a different or changing status or primary occupation of enclosed settlements, as six of the seven settlements without pits were enclosed. The lack of storage facilities on enclosed settlements suggests agriculture was not the result of labour for those settlements. While pits were more numerous and settlements began to display greater total volume, suggesting an increase in agricultural production that pits were able to contain, there is no doubt that the Late Bronze Age was a period of restructuring, easily observed in settlement organization. New trends (larger, external pits) were explored alongside older traditions (internal pits/unenclosed settlements), marking a period of transition and readjustment.

The Early Iron Age

Pits were more prevalent on Early Iron Age settlements. Only four (22%) of the Early Iron Age settlements (Cadbury Castle, Highdown Hill, Hengistbury Head, and Heathy Brow) in southern Britain did not exhibit evidence for storage pits (Table 5.8). Eight (44%) settlements (Eldon's

Seat, Gurnard's Head, Hog Cliff Hill i-ii, Hollingbury, Winklebury, Pilsdon Pen, Chalbury Camp) displayed one to three pits. Winnall Down, Balksbury, and Old Down Farm i-ii presented evidence for fifteen to forty-five pits. The remaining two settlements, Gussage All Saints (n=86) and Little Woodbury (n=71), displayed just under 100 pits. The increase in number of pits per site is obvious when compared to the previous periods.

There was also an apparent shift in available storage volume toward greater total capacity per site (Fig. 5.28). Three sites (Eldon's Seat, Gurnard's Head, and Hog Cliff Hill i) displayed a pit capacity of less than one cubic metre, from one to two pits, akin to the averages of the Bronze Age settlements. Five settlements (Hollingbury, Hog Cliff Hill ii, Winklebury, Pilsdon Pen, and Chalbury Camp) presented a subterranean storage capacity of $2<n<6$ m^3, derived from one to seven pits. Winnall Down presented a total pit volume of 38.34 m^3 from twenty-seven pits. Both phases of Old Down Farm presented total pit volumes between$50<n<80$ m^3. The remaining two sites (Gussage All Saints and Little Woodbury) displayed a storage capacity of $150<n<250$ m^3 from nearly one hundred pits, each. Considering that the majority of settlements in the Bronze Age presented a total pit volume of less than five cubic metres, an exponential increase in storage capacity is visible. Fifty percent of Early Iron Age settlements with pits presented total pit volumes greater than five cubic metres, with twenty-nine percent presenting total volumes greater than fifty cubic metres. This again suggests two apparent populations in the data, possibly reflecting differing storage needs and agricultural potential, although not related to population as demonstrated by THA. The settlements with a greater storage capacity (Old Down Farm i-ii, Winnall Down, Gussage All Saints, and Little Woodbury)presented total pit volumes at least six times greater than the next total pit volume. Of those settlements, only Winnall Down also presented a larger settlement population, given the comparatively higher THA values. As in the preceding period, little correlation between THA and pit volume was present in this period, suggesting the possibility of interconnected producer and consumer settlements. Hengistbury Head demonstrated the greatest THA, yet no pits, while the settlements with the greatest pit capacity produced both above and below average values of THA. The larger producing sites, based on storage evidence, would have been able to store far more than needed for their estimated populations, indicating effort and labour directed at agriculture above and beyond the necessary subsistence level. Differing levels of energy devoted to agriculture between settlements can be viewed through the presence, and extent thereof, of pits. Settlements with smaller storage capacities are more likely to have invested labour elsewhere, perhaps in animal husbandry, which remains difficult to identify in the record. Such specialisation

Southern Britain	Number of Pits	Total Volume m^3	Average Pit Volume m^3	Standard Deviation s_x m^3
Eldon's Seat	1	0.01	0.01	N/A
Cadbury Castle	0	0	0	N/A
Gurnard's Head	2	0.11	0.06	0.01
Highdown Hill	0	0	0	N/A
Winnall Down	27	38.34	1.42	2.04
Hog Cliff Hill i	1	0.21	0.21	N/A
Hog Cliff Hill ii	7	6.07	0.87	0.7
Old Down Farm i	25	76.45	3.06	1.7
Old Down Farm ii	17	53.98	3.18	1.84
Gussage All Saints	86	154	1.79	1.18
Little Woodbury	71	240.06	3.38	10.19
Hollingbury	3	2.05	0.68	0.15
Winklebury	3	4.33	1.44	0.84
Pilsdon Pen	3	2.13	0.71	0.42
Chalbury Camp	1	2.21	2.21	N/A
Balksbury Camp	27	100.49	3.72	4.34
Hengistbury Head	0	0	0	N/A
Heathy Brow	0	0	0	N/A
Totals 18	274	680.44	2.80	6.60

Table 5.8 Values of pits for Early Iron Age sites

would follow the trends in later Bronze Age craft production (Harding 2002), and would be mitigated by exchange with nearby settlements with divergent foci. Hengistbury Head and Gussage All Saints demonstrate nearby settlements with vastly divergent amounts of pit capacity, suggesting such a local specialisation. Neighbouring settlements could also pool their labour forces for seasonal work, allowing a greater amount of energy toward agriculture that would necessitate the increased pit volume for the period and explicate certain settlements with consumptive architecture greater than necessary for the population observed through the THA. Winklebury, Balksbury Camp, and Old Down Farm were in the same vicinity and the values of THA and total pit volume provide an interesting contrast, if contemporaneity is assumed for example. Winklebury had the greatest THA value, indicating the largest labour force, with the smallest pit capacity. Conversely, Balksbury Camp presented nearly one-third the THA, yet over twenty-five times the pit capacity, suggesting the labour force was generated elsewhere. Both phases of Old Down Farm presented comparably moderate values of THA and pit capacity, which taken in isolation would suggest self-sufficiency. In context with neighbouring settlements, however, the situation becomes less unambiguous. The EIA settlements likely worked in tandem to provide the necessary agricultural products and by-products in a local setting, which was feasibly only limited by means of transport, established relationships, and the necessity of access to specific goods.

The average volume of pits per site is more equalized than in previous periods; with the exception of the lower end of Eldon's Seat and Gurnard's Head, the average pit volume per site is approximately $1.0<n<3.0$ m^3. This indicates a more standard, larger pit size than in previous periods, although the range of total storage capacity still suggests differing potential capacity needs. Contrasting number of pits with total pit volume per site demonstrates the variety of potential pit capacity per site, but also highlights the larger number of pits per site from the previous periods (Fig. 5.29). The disparity in the number of pits per site when arrayed against the potential subterranean storage capacity demonstrates a large increase in pit storage potential in this period. If we accept that pits were constructed on an as-needed basis, and are indicative of agricultural storage, as suggested by the previous periods, we can only conclude that agricultural production increased drastically and across the board in the Early Iron Age.

The variation per settlement in individual pit volume increased from the Bronze Age settlements, once again in conjunction with increasing numbers of pits per settlement. The settlements with more than fifteen pits displayed a standard deviation of over one cubic metre. The correlation with total pit volume was more tenuous, but the settlements with greater total pit volumes did demonstrate the greatest variation (Fig. 5.30). The greater amounts of differentiation per settlement suggest less consistency in pit construction than in previous periods, verified by the settlements with the greatest variation demonstrating the most variety in pit shape (see Appendix A; Fig. 5.31). Whether the variation was a result of varied harvest, requiring differing sizes of pits at different times over the lifetime of the settlement, or was an indication of differing amounts of energy able to be expended on pit construction is beyond the scope of this study. The presence of varied shapes and dimensions within settlements, creating much larger standard deviations for the Early Iron Age, must be purposeful. As discussed in the analysis of pits at Gussage All Saints (Jeffries 1979), form is not necessarily functional. The appearance of differing pit shapes, therefore, must be taken as specific, as large numbers of very different types of pits are present on individual settlements. A conical pit or frustum shaped pit, both appearing at the end of the Bronze Age and only external to dwellings, requires less energy than a hemispherical pit with rounded bottom or cylindrical pit with straight walls and a flat bottom. The deepest pits across the EIA, however, remained cylindrical or barrel shaped. Considering the construction of pits as a throughput of energy toward consumption, it becomes apparent that the Early Iron Age experienced greater consumptive activity, along with increasing creativity in conservation of energy used for pits.

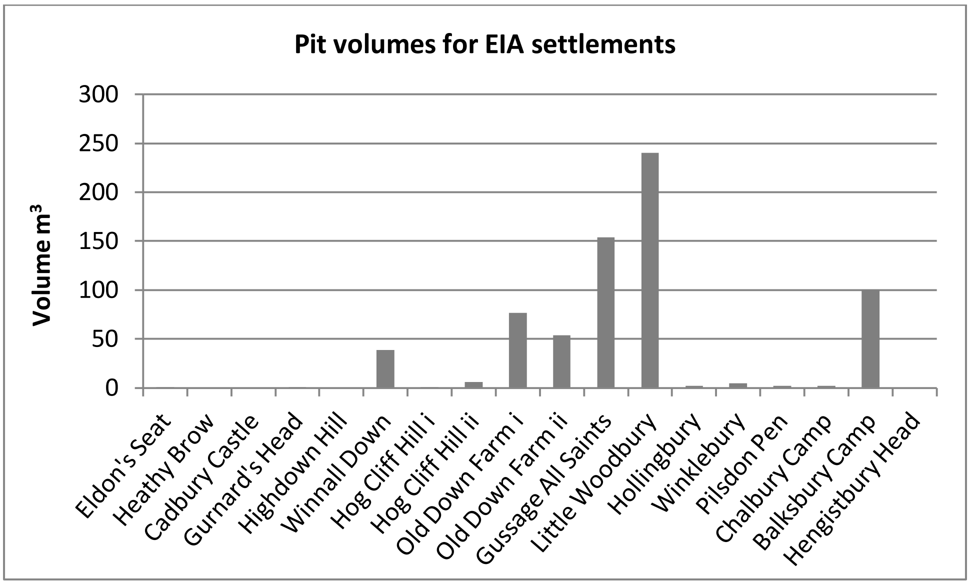


Figure 5.28 Distribution of total pit volume for the Early Iron Age

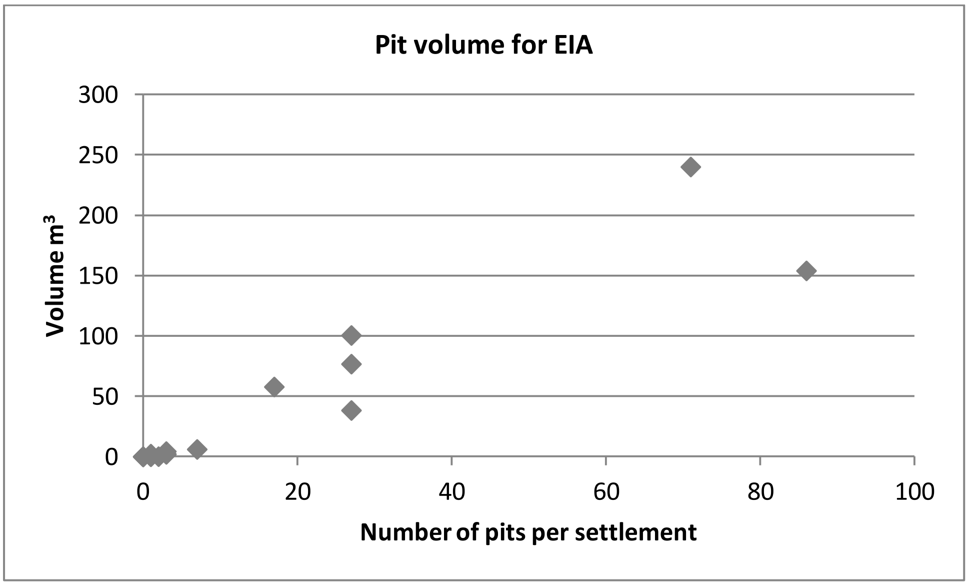


Figure 5.29 Contrast of total pit volume and number of pits per site for the Early Iron Age

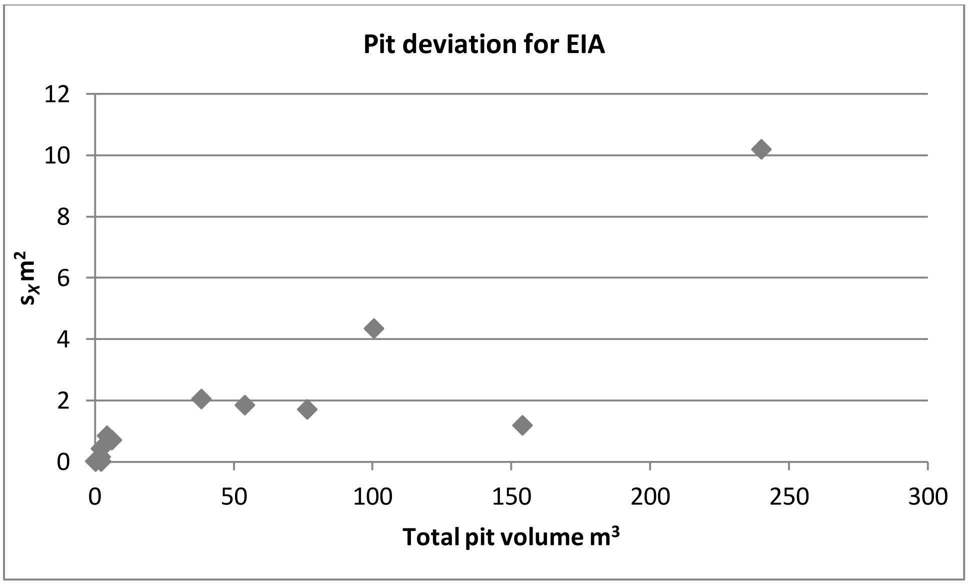


Figure 5.30 Contrast of total pit volume and standard deviation for the Early Iron Age

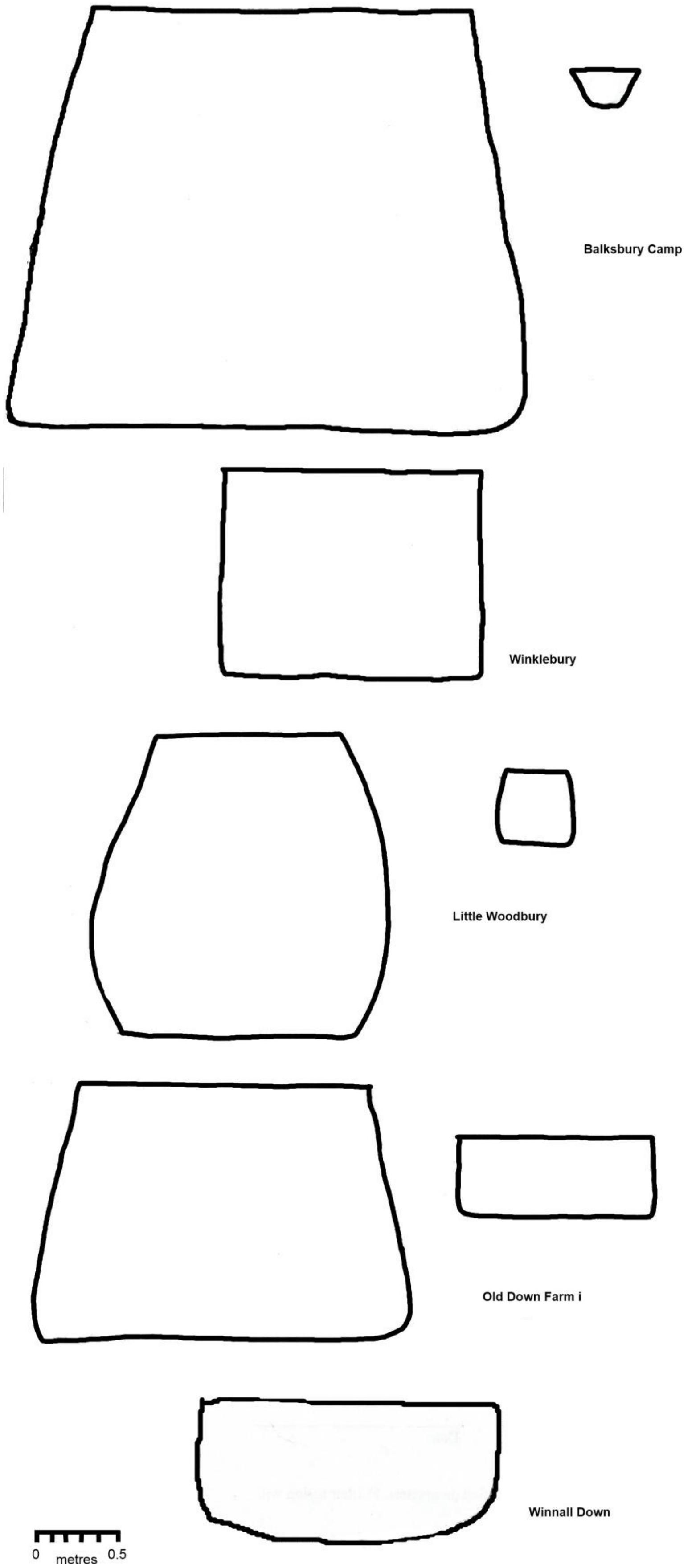


Figure 5.31 Comparison of EIA pit morphology. Balksbury Camp after Wainwright and Davies 1995, Winklebury after Smith 1977, Little Woodbury after Bersu 1940, Old Down Farm after Davies 1981, Winnall Down after Fasham 1985

Also interesting is that variation in both dwelling and pit construction within the settlements increased over time. Increasing social stratification, especially when discussing the rise of chiefdoms, has been set forth as a possible explanation for dwelling variation (Rowlands 1980, Earle 1991), yet that does not explain the differing pit volumes, unless ownership over pits and their contents was introduced into Iron Age society, with larger pits belonging to higher status persons. Little Woodbury, long held as the type-site for a particular form of Early Iron Age settlement organization, displays the greatest variety in both THA and total volume, lending credence to a socially-derived variation. The remaining settlements, however, demonstrate an utter lack of correlation between the standard deviation of pits and dwellings per settlement. This suggests something other than rank is the driver for varied pit construction on each settlement, likely related to specific demands for consumptive space.

The Early Iron Age settlements continued the shift toward external pits, as ninety-eight percent of pits were external to dwellings (Fig. 5.32). Unlike the heterogeneous location of the previous period, Early Iron Age pit location was clearly defined. Four settlements (Eldon's Seat, Gurnard's Head, Hog Cliff Hill i, Chalbury Camp) continued to practice solely internal pit construction, while the sites which presented external pits were solely external (Table 5.9). The evidence for this period again indicates both larger and external pits, signifying the move to pits outside dwellings could be attributable to an increased production and a need for increased pit size, which would be inconvenient within a dwelling space. Demonstrably, the internal pits included the smallest in volume, with no single pit on Eldon's Seat, Gurnard's Head, or Hog Cliff Hill i exceeding 0.25 m^3. Eldon's Seat and Hog Cliff Hill i only presented a single pit attributable to their respective phases of occupation. The external pits were invariably larger, and with the exception of Chalbury Camp, were more numerous per settlement. Also possible as a factor in the shift to external pits is the need for longer-term storage. Given the effort involved in creating clay-lined pits and a secure seal to prevent decay, the use of external storage pits as day-to-day storage is unlikely, leaving the possibility that external storage pits suggest an increase in agricultural production, allowing for long-term surplus. Losing immediate access to part of the harvest to longer-term storage is only reasonable if a settlement produces, or acquires, enough grain to support the population while a portion is sealed and to justify the additional labour in creating larger sealed pits. It is therefore logical to treat the appearance of larger, external pits as evidence of increased agricultural production and the advent of long-term storage. Even if used daily with no seal, there is definite indication of increase in production.

Enclosure became the norm for the Early Iron Age, suggesting an escalation of the settlement pattern begun in the Middle Bronze Age. As only one settlement phase containing

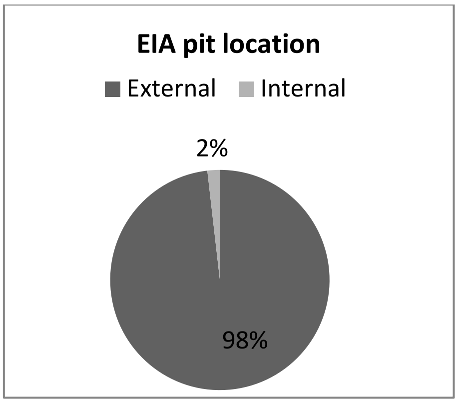


Figure 5.32 Ratio of pit location for the Early Iron Age

	Internal	External	N/A
Eldon's Seat	x		
Cadbury Castle			x
Gurnard's Head	x		
Highdown Hill			x
Winnall Down		x	
Hog Cliff Hill i	x		
Hog Cliff Hill ii		x	
Old Down Farm i-ii		x	
Gussage All Saints		x	
Little Woodbury		x	
Hollingbury		x	
Winklebury Camp		x	
Balksbury Camp		x	
Chalbury Camp	x		
Pilsdon Pen		x	
Hengistbury Head			x
Heathy Brow			x

Table 5.9 Pit location within Early Iron Age settlements

pits (Old Down Farm ii) was unenclosed, the presence of pits was primarily on enclosed settlements, reflecting and extending the Middle Bronze Age pattern. While pits internal to dwellings decreased again in the Early Iron Age, both internal and external pits were located on enclosed settlements, and the pits of Old Down Farm ii were external. Enclosure provides security for the storage capacity not directly within dwellings, and with the continued increase in both number of pits and total volume displayed in the Early Iron Age, indicative of an increasing consumption of agricultural product, enclosure and external pits went hand in hand with controlling access to the results of agricultural labour.

Synopsis

Both continuity and growth in potential subterranean storage are apparent over time in southern Britain. The Middle Bronze Age and Late Bronze Age both contained seventy-five percent of settlements with pits. The percentage increased slightly in the Early Iron Age, as eighty percent of sites presented pits.

Following the increase in pit presence, an increase in total pit volume per site over time for southern Britain was apparent (Fig. 5.33). The Late Bronze Age settlements showed continuity in total pit volume per site from the Middle Bronze Age sites as well as a large increase for certain settlements, a trend that increased drastically in the Early Iron Age (Fig. 5.34). The similarity between the Middle Bronze Age and Late Bronze Age values suggests only slight growth in agricultural production, with a secondary population of settlements with higher production by the end of the period. More variation in pit construction per settlement is apparent over time (Fig. 5.35), suggesting a greater variety in need for consumptive space, if one accepts the premise that pits were created on an as-needed basis, reflecting a scale of production. This was emphasised by the increasing types of pit shape appearing over time (see Appendix A).

The number of pits also increased over time, along with the average pit volume, suggesting a growth in subterranean storage needs and a change in construction strategy toward larger pits. The Late Bronze Age sites displayed similar average volumes per pit to the Middle Bronze Age. The average pit volume for the Early Iron Age displayed an increase in

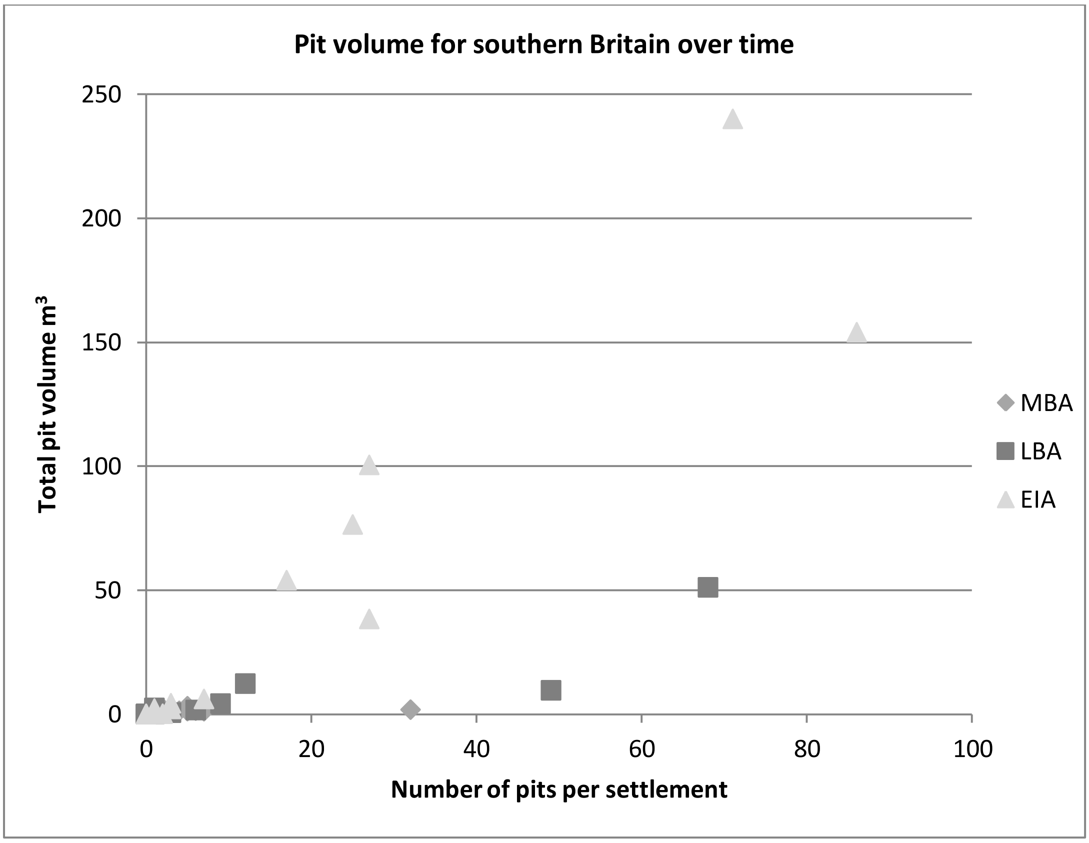


Figure 5.33 Contrast of total pit volumes and number of pits per site over time for southern Britain.

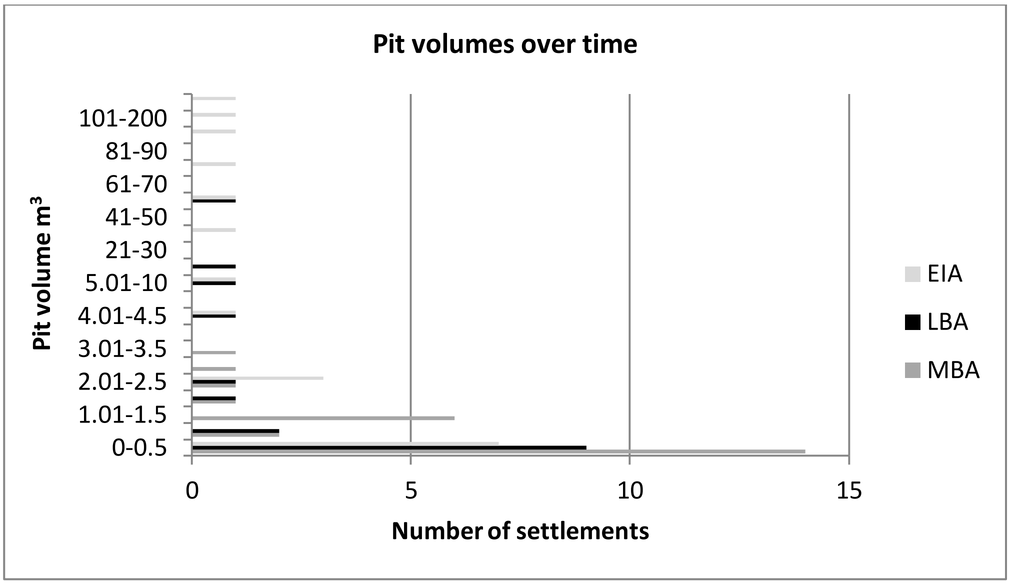


Figure 5.34 Comparison of total pit volumes over time

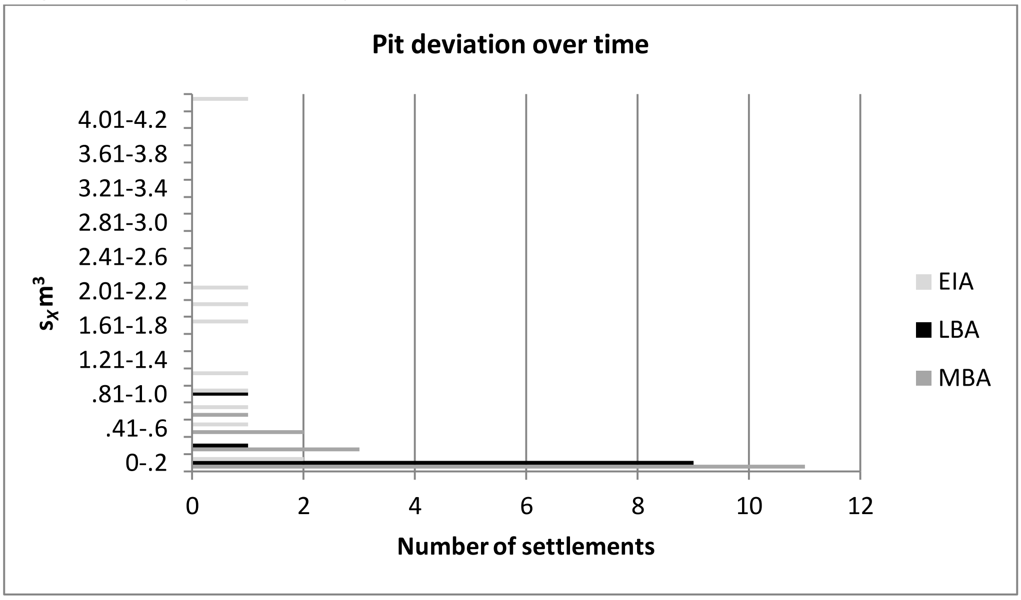


Figure 5.35 Comparison of standard deviation of pit volumes per settlement over time

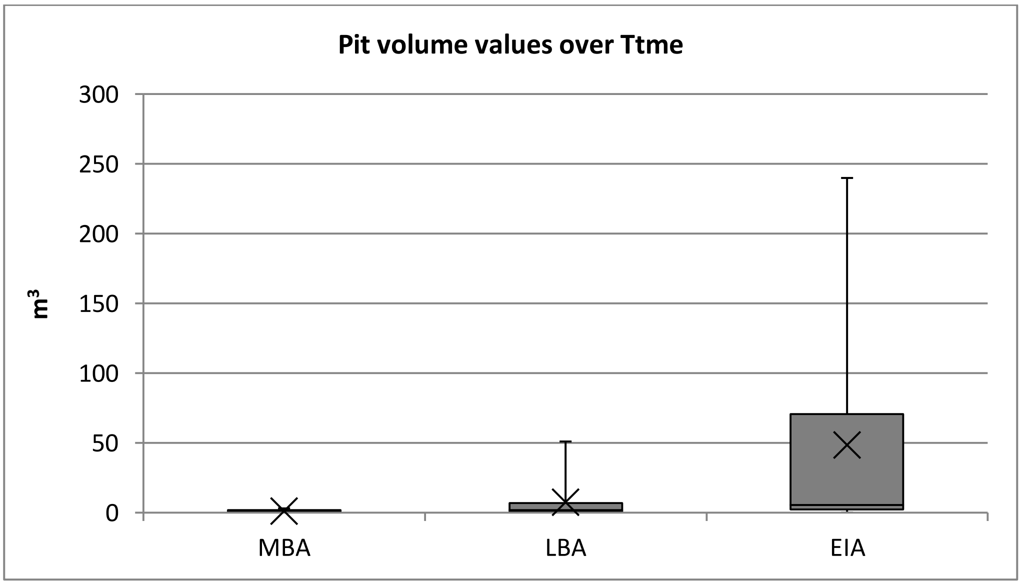


Figure 5.36 Total range of pit volume values over time

potential volume per pit (Fig. 5.36). This pattern, especially when paired with the increase in number of sites with pits in the later period, denotes an overall increase in agricultural production via consumptive architecture in the Early Iron Age.

Smaller, mostly internal pits of the Middle Bronze Age began to give way to slightly larger, more often external pits in the Late Bronze Age, with the pattern continuing and exaggerating into the Early Iron Age. Given the likely needs-based construction of pits, larger pits convincingly indicate greater volumes of agricultural produce to be consumed or greater amounts of waste from consumption. The definite movement over time away from internal pits toward external pits is also supportive of an increase in agricultural production, as external pits are more likely to be sealed for long-term storage. Longer-term storage would signify the simultaneous use of short-term storage, whether in unsealed pits or above ground, of grain for daily use. The presence of long-term storage is unlikely unless a community is already producing enough for day-to-day means, therefore the presence of external pits, if taken as sealed for long- term storage, can be seen as evidence of surplus, or at least increased productivity from periods with few or no external pits. The shift in pit location also allowed for larger pits, as already indicated, which is also suggestive of a greater need for agricultural storage in the Early Iron Age.

The lack of correlation between pit volume and THA in all periods also suggests interplay between settlements producing more than subsistence levels of agricultural product and those without the storage capacity to support their populations. As THA represents the population of a settlement, and therefore the labour force able to be mustered toward agricultural production, settlements with small THA and large pit capacities, or *vice versa,* indicate discrepancy in agricultural product and the population intended to consume it. As a lack of correlation, with only few exceptions, between THA and pit capacity was demonstrated in all periods, presence of consumptive space is not necessarily reflective of population, or even the agricultural energy investment, of a single settlement. Instead, the variation in total potential pit capacity between settlements of differing populations suggests cooperation between neighbouring settlements toward agricultural production. The increase in population is simultaneous to the increase in pit capacity, suggesting an increase in devotion of energy toward agriculture over the Bronze Age-Iron Age transition. Settlements with greater potential pit capacity and smaller or average populations would require assistance in producing the amount of grain indicated by the specific construction of pits. Alternately, the settlements with large populations and small pit capacities would somehow need to acquire grain necessary to the maintenance of that population; assistance in tending local fields or devoting that energy toward stock raising and trading with local grain-producing settlements would allow access to grain, while the bulk was stored on specific organizing settlements. Along similar lines, the enclosure of settlements with pits increases over time, with all but one settlement enclosed by the Early Iron Age. The simultaneous increase in enclosure and larger, external pits is suggestive of an increase in agricultural production needing to be secured by controlled access.

In summation, pit volumes increased at least slightly over the end of the Bronze Age, with a drastic increase in the Early Iron Age (Fig. 5.36). While all three periods demonstrated settlements with similar values, it is apparent, given the presence and available volumes of pits, that agricultural production at bare minimum continued on an equivalent scale throughout the end of the Bronze Age and increased rapidly in the start of the Iron Age. The introduction of iron and social reorganization after losing access to the long-distance exchange networks at the end of the Bronze Age most definitely did not have a detrimental effect on agricultural production; if anything, iron tools allowed an incredible advancement in techniques for producing arable agriculture while a reprioritizing of agricultural production as socially significant resulted in increased energy expended toward consumptive architecture.

Post-Structures

Post-structures present a different alternative in both forethought and treatment of space compared to dwellings and pits. Post-structures, meaning small, often rectangular, structures built with four to six posts, have been interpreted and generally accepted as granaries after Bersu's (1940) excavations at Little Woodbury. There has been a tendency (*e.g.* Gent 1983, Champion *et al.* 1984) to relate such granaries and later defensive settlements, although four and six post-structures were present on both earlier and contemporary non-defended settlements and can be considered an optional aspect of traditional southern British settlement organization from the Middle Bronze Age (Brück 2007). The previous sections established a trend of increasing dwelling space along with fairly regular pit use from the Middle Bronze Age onward in southern Britain. The simultaneous use of post-structures indicates a need for additional space, whether for crafting or the processing and storing of agricultural produce or even both, which must be accounted for in a study concerned with architectural proxies for consumption and production. For southern Britain, with pit storage dominating most discussions of grain storage, post-structures are usually termed 'ancillary' and their contribution to storage noted, yet not fully explored. For this study, post-structure area is considered in total as potential activity space, supplementing dwellings and pits yet consumptive space in its own right.

Issues arise when attempting to map the changes in storage capacity from post-structures. Unlike pits, with comparatively straightforward volume measurements, the height and internal configuration of four- and six-post structures are largely unknowable, except in extrapolation, and variable; therefore, a predictive model of storage capacity for post-structures is inconceivable. Again, however, the aim of this study is to investigate possible shifts in agricultural production and is concerned with trends of growth or decline in architecture denoted as possible storage, rather than a concrete value of the amount of grain stored within. Changes within the evidence for above ground storage over time, especially when considered along with subterranean storage, will indicate trends in agricultural production. Patterns over time and shifts in the treatment of agricultural surplus also possibly indicate responses to the environment or to new ideas brought in with the impact of shifting metal technologies and thus changes in productivity.

The Middle Bronze Age

Post-structures were not common on the Middle Bronze Age sites of southern Britain (Table 5.10). Only six settlements (23%) presented evidence of above ground storage. Trevisker, Trethellan Farm, Gwithian, Down Farm i, and Thorny Down i presented one post-structure. Thorny Down ii presented two post-structures.

The distribution of the Total Additional Area (TAA) attributed to post-structures presents a range of storage area, suggesting differing post-structure size and therefore differing storage requirements per settlement (Fig. 5.37). Gwithian, Thorny Down i, and Down Farm i presented $4<n<7$ m^2 of additional storage area. Trevisker, Trethellan Farm, and Thorny Down ii presented $10<n<16$ m^2 of additional storage area. Thorny Down contained two post-structures, yet presented less TAA than the single post-structure at Trevisker. Similar to the pit volumes, there is no apparent standardization in number of post-structures and additional area in the Middle Bronze Age, further implying an as-needed basis for agricultural storage and a scale of production between settlements. The standard deviation for the period was 3.51 m^2, which was similar to the size of the Gwithian post-structure, indicating a lack of consistency in construction between settlements and further suggesting post-structure construction on a purely necessary basis, with each structure built to meet specific needs of the settlement (Fig. 5.39). Thorny Down ii was the only settlement with more than one post-structure and produced a standard deviation of 1.06 m^2, suggesting similarity in size within the settlement, although the presence of post-structures for the Middle Bronze Age is too small to definitively provide patterns. There is a trend toward appearance of post-structures on enclosed settlements, as two-thirds of the settlements with post-structures were enclosed.

With so few post-structures present, little analysis other than presence and typical size can be gleaned from the data.

When the Total Additional Area is contrasted against the number of post-structures per site, the range of area per structure becomes apparent (Fig. 5.38). The small numbers of post-structures per site for the period are also highlighted, particularly in contrast to pits, which were more widespread for the period. Comparison of the six settlements with post-structures and the seventeen settlements with pits for the Middle Bronze Age, post-structures appear to be either an emerging trend in agricultural storage or simply secondary activity/storage space constructed on an as-needed basis. Of the five settlements with post-structures, three settlements (Trethellan Farm, Down Farm ii, and Thorny Down i) contained both pits and post-structures for the period. The total pit volume per site varied, as did the reciprocal TAA, suggesting post- structure presence was not specifically related to potential pit capacity.

	Southern Britain	Number of Post-Structures	TAA m^2	Average Post-Structure Area m^2	Standard Deviation s_x m^2
	Trevisker	1	15.05	15.05	N/A
	Trewey Down	0	0	0	N/A
	Trethellan Farm	1	10.24	10.24	N/A
	Gwithian	1	4.67	4.67	N/A
	Stannon Down	0	0	0	N/A
	Brean Down	0	0	0	N/A
	Poundbury i	0	0	0	N/A
	Poundbury ii	0	0	0	N/A
	Shearplace Hill	0	0	0	N/A
	Down Farm i	0	0	0	N/A
	Down Farm ii	1	6.19	6.19	N/A
	South Lodge Camp	0	0	0	N/A
	Thorny Down i	1	6.00	6.00	N/A
	Thorny Down ii	2	15.00	7.5	1.06
	New Barn Down	0	0	0	N/A
	Cock Hill	0	0	0	N/A
	Blackpatch	0	0	0	N/A
	Mile Oak	0	0	0	N/A
	Itford Hill i-iv	0	0	0	N/A
	Black Patch 4/1	0	0	0	N/A
	Plumpton Plain A	0	0	0	N/A
	Highdown Hill	0	0	0	N/A
Totals	26	7	57.15	8.16	3.51

Table 5.10 Values of post-structures for Middle Bronze Age sites

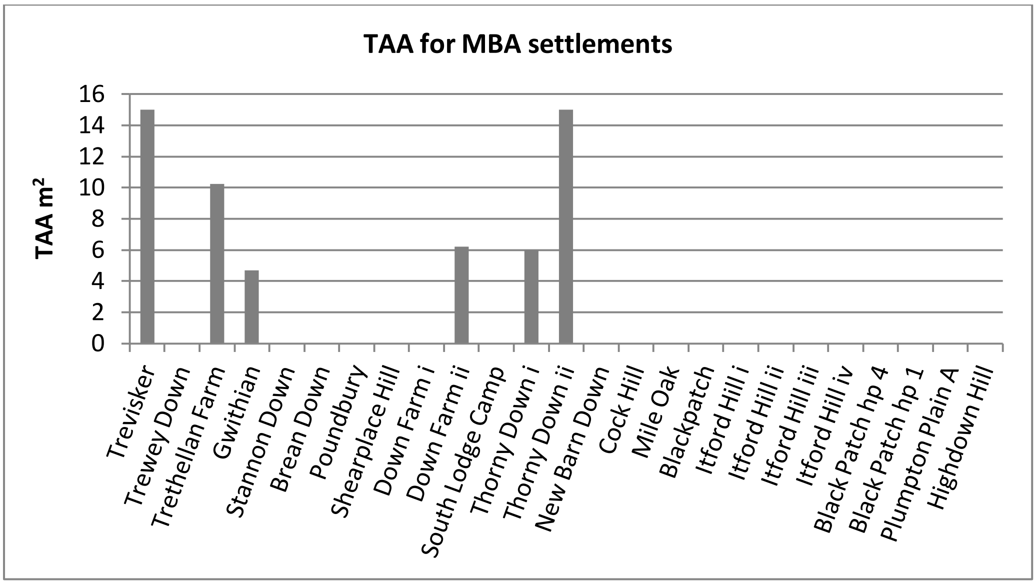


Figure 5.37 Distribution of Total Additional Area for the Middle Bronze Age

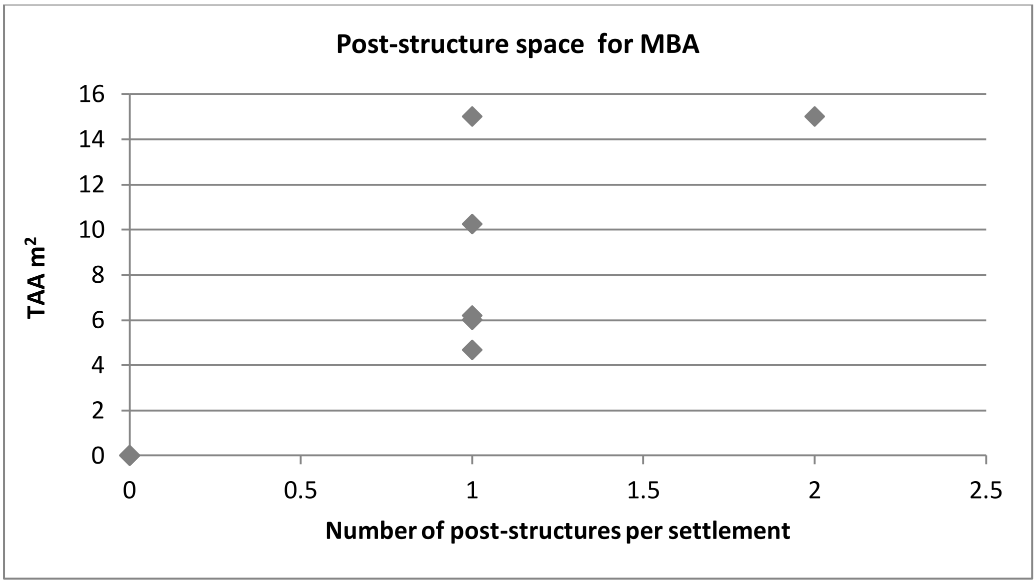


Figure 5.38 Contrast of number of post-structures per site and Total Additional Area for the Middle Bronze Age

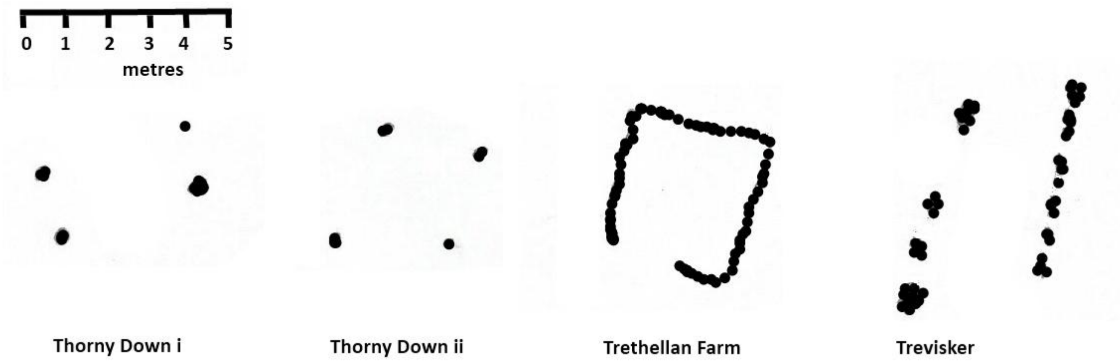


Figure 5.39 Comparison of selected MBA post-structure morphology. Thorny Down after Stone 1937, Trethellan Farm after Nowakowski 1991, Trevisker after ApSimon and Greenfield 1982.

Interestingly, Thorny Down i presented the least amount of pit volume and the smallest THA for settlements with post-structures, yet the second highest TAA. Trethellan Farm, with its large amount of THA and total pit volume, presented a high value of TAA as well, suggesting high productivity on the site matched by a comparably large population. The THA of the settlements with post-structures did not demonstrate any correlation with TAA, as post-structures appeared on settlements with THA values of $50<n<400$ m^2. Of the phased settlements, both later phases demonstrated an increase in TAA, matched by an increase in THA, suggesting a growing acceptance of post-structures as useful consumptive architecture. The lack of correlation with pit volume and THA indicates post-structures were regarded as a distinct category of consumptive architecture; neither large or small populations, nor greater or lesser pit capacities resulted in the appearance of post-structures on MBA settlements, suggesting their construction was entirely based on a need for specific small, four to six post structures. The small number of post-structures in the MBA might suggest changing climatic conditions, or simply experiments in settlement organization as access to resources allowed.

The Late Bronze Age

The number of settlements with post-structures increased considerably in the Late Bronze Age, with fifty-three percent presenting post-structures compared to the earlier twenty-three percent. Eight of the seventeen settlements of the Late Bronze Age (Eldon's Seat, Mucking North Ring ii, Aldermaston Wharf, Plumpton Plain B, Amberley Mount, The Caburn, Winnall Down, and Hog Cliff Hill) did not present any evidence of post-structures (Table 5.11). Five settlements (Brean Down, Cadbury Castle, Springfield Lyons, Loft's Farm, and Mile Oak) presented between one and three post-structures, similar to the preceding period. The remaining three sites (Green Park, Mucking North Ring i, Mucking South Rings, and Rams Hill) presented five to fifteen post-structures.

Examining the Total Additional Area per site for the Late Bronze Age provides a range of values (Fig. 5.40). Loft's Farm presented the least TAA with 2.25 m^2. Four settlements (Brean Down, Cadbury Castle, Springfield Lyons, and Mile Oak) presented a TAA of $5<n<10$ m^2 from one to two post-structures. Two settlements, Mucking North Ring i and Rams Hill, displayed a TAA of$10<n<20$ m^2 from five and nine post-structures, respectively. Green Park presented a TAA of 44.53 m^2, while Mucking South Rings presented the greatest TAA of 84.38 m^2. While TAA is definitively linked to number of post-structures, there is again variability in post-structure size. Green Park exhibited the largest number of post-structures (n=14), although Mucking South Rings presented the greatest TAA from ten post-structures. Rams Hill, with nine post-structures, demonstrates a drastic decline in post-structure size with a TAA of only 19.77 m^2. The standard deviation, however, suggests more variability in post-structure area on settlements with fewer post-structures. The largest standard deviations were on Cadbury Castle, Brean Down, and Mile Oak, each with two post-structures. The differentiation was more moderate for settlements with greater numbers of post-structures (Fig. 5.41 and 5.43). This disparity further suggests construction on an as-needed basis, with settlements with larger consumptive needs more practiced in construction of post-structures to best utilize labour and resources to meet the requirements of the settlement.

The patterns presented by the data also suggest differing scales of agricultural production, particularly when contrasted with total pit volume. Green Park presented a great amount of both above and below ground storage for the period, indicating a high productivity centred at the settlement. Springfield Lyons, Loft's Farm, and Mucking South Rings did not present any pits, yet did present post-structures, with vastly different TAA values. On the other hand, Aldermaston Wharf, the Caburn, Plumpton Plain B, Amberley Mount, and Winnall Down presented pits with no post-structures. Cadbury Castle and Mucking North Ring i presented similar values of Total Additional Area, yet had exceedingly different total pit volumes. There again appears to be little correlation between total pit volume and TAA from post- structures. It is more likely to find post-structures on settlements with pits as

	Southern Britain	Number of Post-Structures	TAA m^2	Average Post-Structure Area m^2	Standard Deviation S_X m^2
	Brean Down	2	8.33	4.17	1.99
	Eldon's Seat	0	0	0	N/A
	Cadbury Castle	2	8.75	4.38	3.71
	Springfield Lyons	1	5.76	5.76	N/A
	Mucking North Ring i	5	13.1	2.62	1.26
	Mucking North Ring ii	0	0	0	N/A
	Green Park	14	44.53	3.18	1.48
	Aldermaston Wharf	0	0	0	N/A
	Loft's Farm	2	2.25	1.62	0.88
	Plumpton Plain B	0	0	0	N/A
	Amberley Mount	0	0	0	N/A
	Mile Oak	2	7.29	3.65	1.97
	The Caburn	0	0	0	N/A
	Winnall Down	0	0	0	N/A
	Hog Cliff Hill	0	0	0	N/A
	Rams Hill	9	19.77	2.2	0.94
	Mucking South Rings	10	84.38	8.44	1.46
Totals	17	47	194.16	4.17	2.74

Table 5.11 Values of post-structures for Late Bronze Age settlements

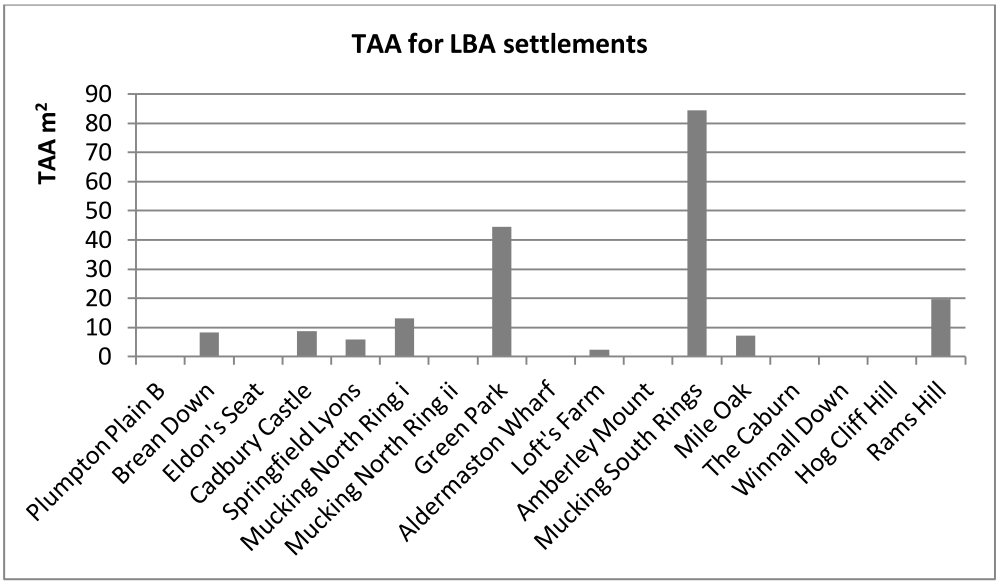


Figure 5.40 Distribution of Total Additional Area for the Late Bronze Age

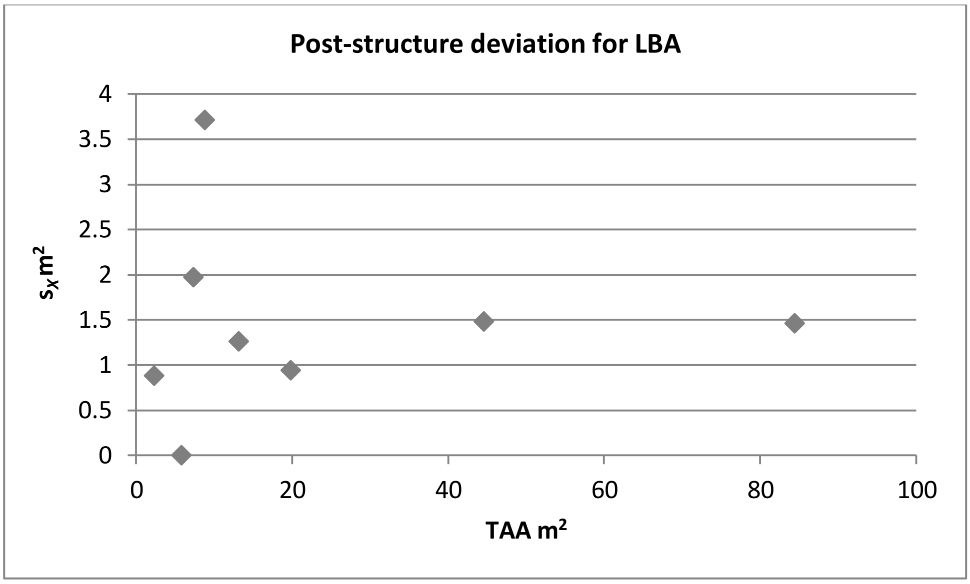


Figure 5.41 Contrast of TAA to standard deviation for the Late Bronze Age

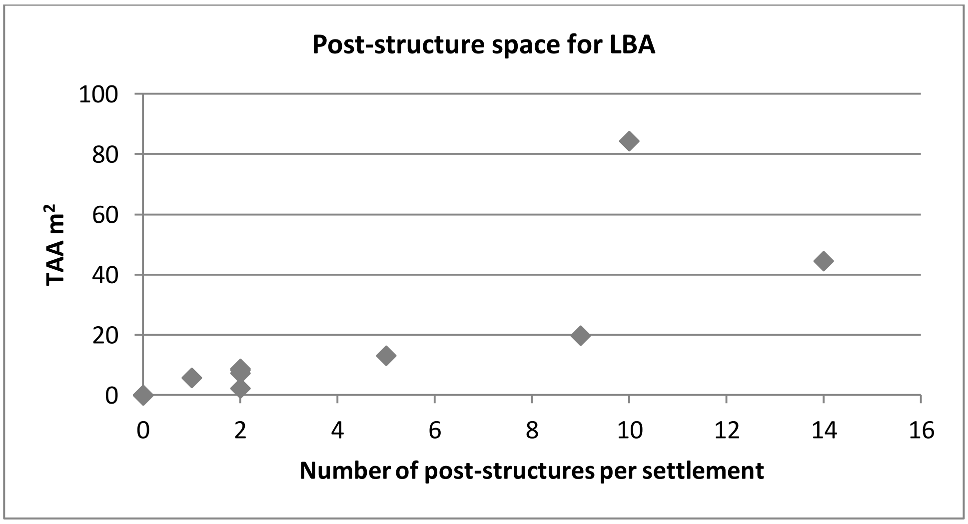


Figure 5.42 Contrast of number of post-structures per site and Total Additional Area for the Late Bronze Age

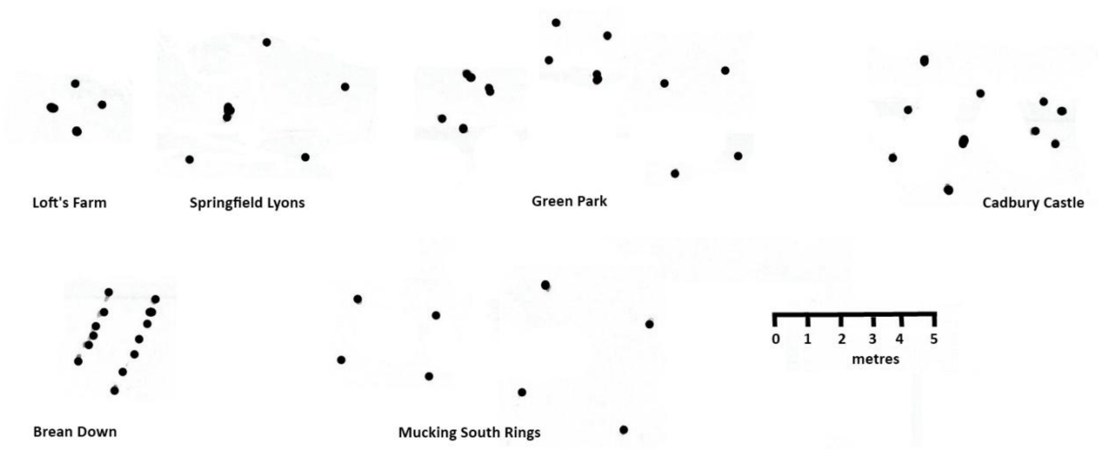


Figure 5.43 Comparison of selected LBA post-structure morphology. Loft's Farm after Brown *et al.* 1988, Springfield Lyons after Buckley and Hedges 1987, Green Park after Brossler *et al.* 2004, Cadbury Castle after Barrett *et al.* 2000, Brean Down after Bell 1990, Mucking South Rings after Clark 1993.

two-thirds of settlements with post-structures also displayed pits, although that might speak more to the widespread phenomenon of pits than to the utilization of post-structures. The trend does suggest, however, that post-structures in the Late Bronze Age were more likely to be secondary storage for the period, perhaps as overflow of grain for daily use. The continued lack of correlation of TAA with THA also suggests a more haphazard appearance of post-structures. Post-structures appeared on settlements with no dwellings to five dwellings, with THA values ranging to n<300 m^2. While the largest THA, TAA, and total pit volume for the LBA settlements with post-structures were all located on Green Park, the remaining THA and TAA values do not demonstrate any further relationships. The smallest TAA (2.25 m^2 for Loft's Farm) occurred with no pits and a comparably large THA value (133.1 m^2).

Of interest in this period is the increase in number of post-structures per site, along with the increase in Total Additional Area per site from the previous period. When contrasting number of post-structures against the Total Additional Area per site, the increase in both is apparent as is the variability in size suggested by the lack of linearity in the data points (Fig. 5.42). Both of the two sites with phases in the Middle and Late Bronze Age, Brean Down and Mile Oak, demonstrate an increase from no post-structures to two post-structures. A small majority of settlement with post-structures (56%) were enclosed, continuing the trend from the previous period. Number of post-structures and TAA were apparently not a factor in presence of post-structures on enclosed settlements. As with dwellings and pits, the Late Bronze Age appears to be a transitional period, with various strategies regarding productive and consumptive architecture. It is apparent, however, that the Late Bronze Age evidence suggests a definite emergence of post-structures, with construction on an as-needed basis. Yates (2001) suggests the appearance of post-structures in this period, with the addition of increasingly larger pits, is indicative of self-sufficiency. The continued presence of settlements without either pits or post-structures, however, suggests an alternative of interconnected settlements on a local scale, and even beyond. The notion of post-structures as a changing strategy in the storage of grain for daily use, supplementing the longer-term storage in pits, would allow for increased agricultural production in the Late Bronze Age, as both types of storage increased in both number and volume/area per settlement. Even taking post-structures as activity areas, focused on the production of craft items, indicates an increase in activity in the Late Bronze Age.

The Early Iron Age

The increase in post-structure presence per site continued into the Early Iron Age, although the overall trend for the period presented fewer settlements (39%) with post-structures. Eleven settlements (Eldon's Seat, Gurnard's Head, Highdown Hill, Hog Cliff Hill ii, Old Down Farm i-ii, Hollingbury, Pilsdon Pen, Chalbury Camp, Balksbury Camp, and Hengistbury Head) did not present any evidence of post-structures for this period. Three sites, Hog Cliff Hill i, Heathy Brow, and Little Woodbury, presented fewer than ten post-structures. The remaining four settlements (Cadbury Castle, Gussage All Saints, Winnall Down, and Winklebury Camp) displayed evidence for ten to twenty post-structures. There is a definite increase in post-structure presence per settlement in this period with nearly one quarter of the sites presenting evidence for more than ten post-structures, compared to twelve percent in the Late Bronze Age (Table 5.12).

There is a related increase in the Total Additional Area for the period (Fig. 5.44). While three settlements presented TAA values within the range of the LBA settlements, the remaining settlements had greater TAA values than the Bronze Age settlements. Winnall Down presented 63.33 m^2 of TAA. Three settlements, Cadbury Castle, Gussage All Saints, and Winklebury presented a TAA of $100<n<175$ m^2. Similarity in post-structure size to the Late Bronze Age settlements was apparent on three settlements with approximately $3<n<6.5$ m^2 of average additional area per post- structure. The remaining settlement demonstrated larger post-structures, more similar to the MBA evidence.

Of the four settlements that had phases in both the Late Bronze Age and Early Iron Age, three (Cadbury Castle, Winnall Down, and Hog Cliff Hill) increased the number of post-structures in the later period. Eldon's Seat did not display any post-structures for either period. Contrasting the number of post-structures with the Total Additional Area per site confirms the increase in total above ground storage potential per site, indicating a greater need of consumptive architecture and reaffirming post-structures as need-based

Southern Britain	Number of Post-Structures	TAA m^2	Average Post-Structure Area m^2	Standard Deviation S_X m^2
Eldon's Seat	0	0	0	N/A
Cadbury Castle	14	155.75	10.38	2.95
Gurnard's Head	0	0	0	N/A
Highdown Hill	0	0	0	N/A
Winnall Down	20	63.33	3.15	2.16
Hog Cliff Hill i	1	3.92	3.92	N/A
Hog Cliff Hill ii	0	0	0	N/A
Old Down Farm i-ii	0	0	0	N/A
Gussage All Saints	17	116.00	6.82	5.5
Little Woodbury	7	18.88	2.69	1.16
Hollingbury	0	0	0	N/A
Winklebury Camp	18	141.7	7.87	2.22
Pilsdon Pen	0	0	0	N/A
Chalbury Camp	0	0	0	N/A
Balksbury Camp	0	0	0	N/A
Hengistbury Head	0	0	0	N/A
Heathy Brow	1	24.00	24.00	N/A
Totals 18	78	523.58	6.62	4.65

Table 5.12 Values of post-structures for Early Iron Age settlements

constructions (Fig. 5.45). Interestingly, despite the increase in number of post-structures per site, and therefore the TAA, more settlements (78%) continued to produce pits in the Early Iron Age than post-structures (39%). The presence of post-structures continued to be independent of THA and was more unrelated to pit presence than in the previous period.

Hollingbury (THA=195.34 m^2) and Hengistbury Head (THA=546.33 m^2) did not present either post-structures or pits. Cadbury Castle (THA=203 m^2) and Heathy Brow (THA=19.63 m^2) were the only settlements that did not present pits, yet did present post-structures for the period. Nine settlements presented only pits, with a range of above and below average THA values. Winnall Down, Gussage All Saints, and Little Woodbury presented high values of both TAA and pit volume, despite varied amounts of THA, lending credence to local networks of interaction and consumptive architecture not based on population. Gussage All Saints, for example, demonstrated a relatively small amount of THA, yet large amounts of TAA and pit capacity. The population from the dwelling for the period would not need the amount of consumptive space simply for maintenance.

As with both pits and dwellings, the variation of post-structure area per settlement increased in the Early Iron Age (Fig. 5.46). The Late Bronze Age standard deviations were less

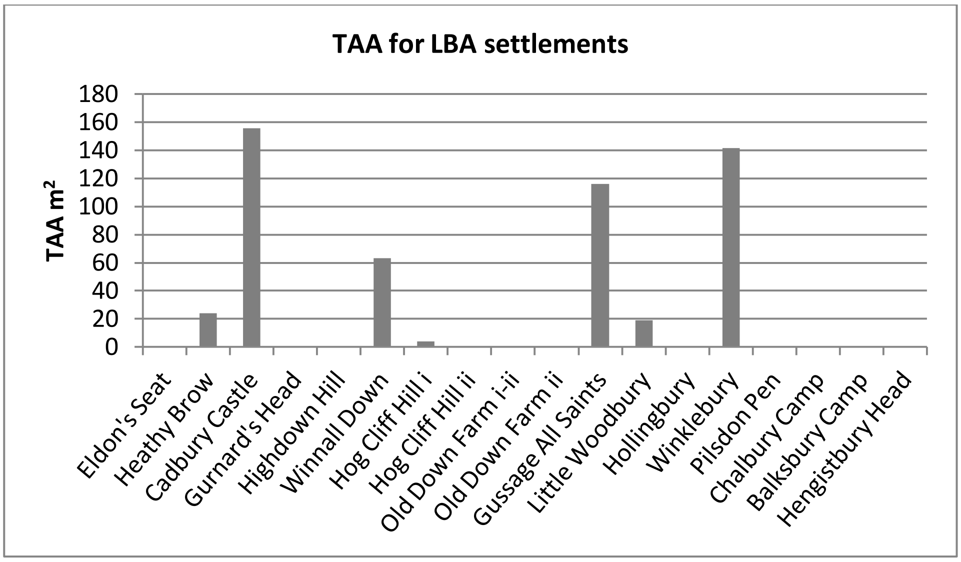


Figure 5.44 Distribution of Total Additional Area for the Early Iron Age

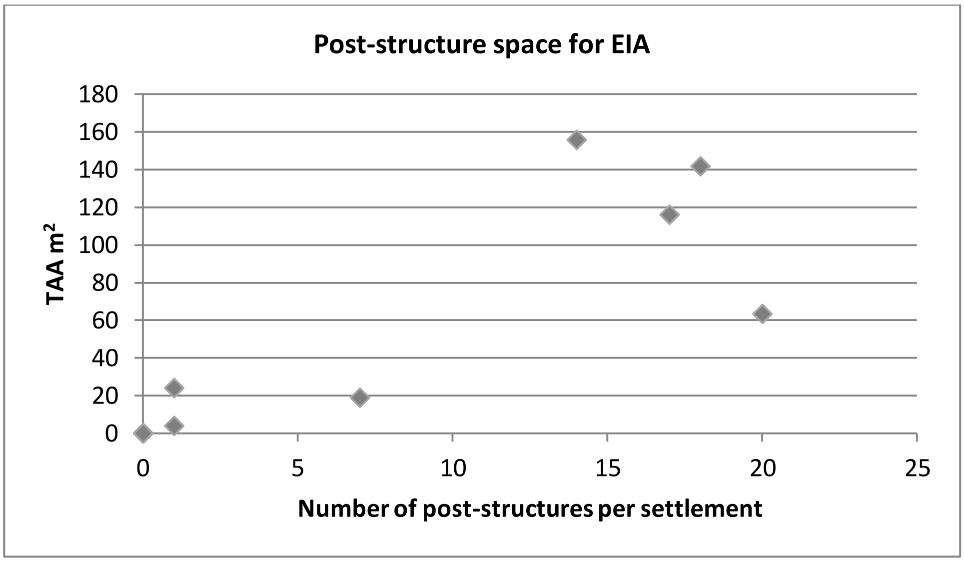


Figure 5.45 Contrast of number of post-structures per site and Total Additional Area for the Early Iron Age

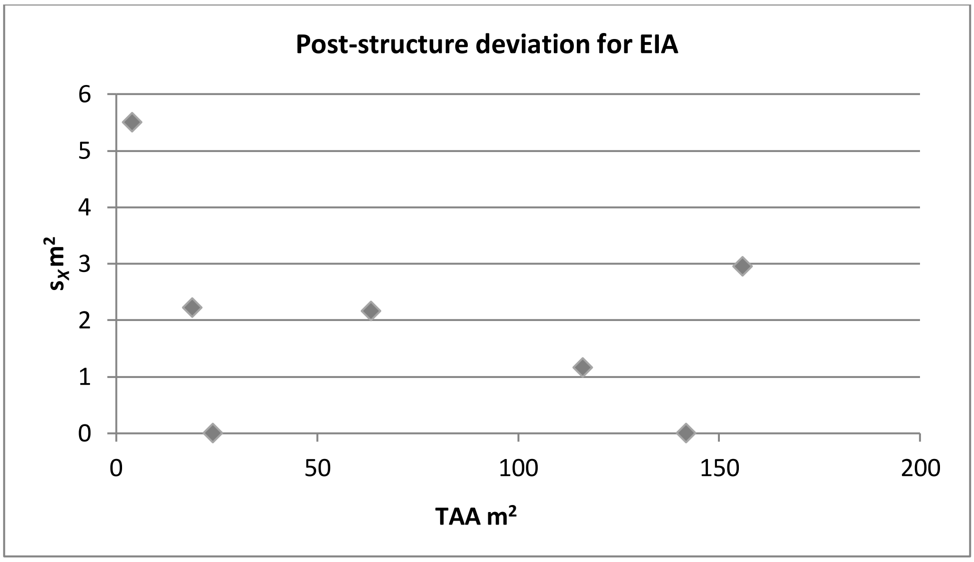


Figure 5.46 Contrast of Total Additional Area to standard deviation per settlement for the Early Iron Age

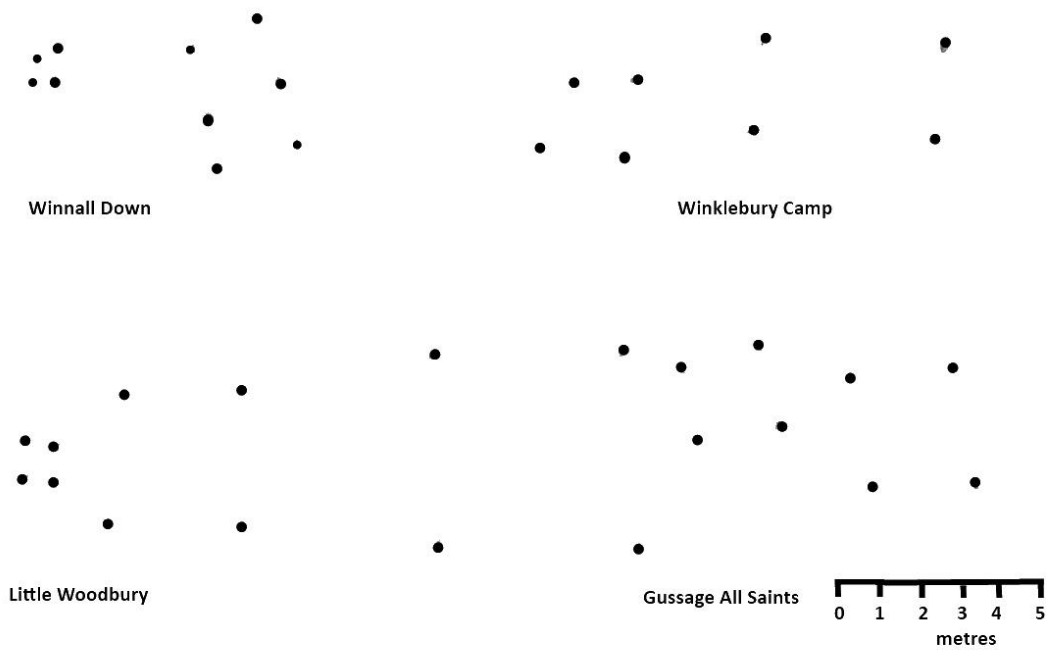


Figure 5.47 Comparison of selected EIA post-structure morphology. Winnall Down after Fasham 1985, Winklebury Camp after Smith 1977, Little Woodbury after Bersu 1940, Gussage All Saints after Wainwright 1979.

than two square metres, yet the majority (57%) of Early Iron Age post-structures presented standard deviations greater than two square metres. Greater variation in size was linked to greater numbers of post-structures and therefore larger values of TAA, albeit not directly. The largest standard deviation, 5.5 m^2 at Gussage All Saints, came from the third largest number of post-structures and TAA. The total standard deviation for the period also increased by nearly two times the LBA amount, providing 4.65 m^2. There was much more divergence in the energy expended to create post-structures in the EIA than in the Bronze Age (Fig. 5.47). Larger and more numerous post-structures along with similar size and number to the previous period indicate post-structures were more firmly a part of EIA settlement organization, when present, and yet each settlement set about construction in varied ways.

Enclosed settlements continued to be the dominant (71%) settlement pattern to demonstrate presence of post-structures. The largest and smallest TAA values belonged to open settlements, further indicating need for above ground consumptive space was not related to settlement form, or to a need to limit access to the contents of post-structures. As enclosed settlements became the prevailing settlement type by the Early Iron Age, the presence of post-structures on both open and enclosed settlements, which demonstrated a range of TAA values, suggests the requirements and construction of post-structures were not as formulaic in practice as pits.

Synopsis

There is definite growth in both post-structure presence and amount of additional roofed area over time in southern Britain (Fig. 5.48). Only twenty-three percent of the Middle Bronze Age sites presented post-structures, while fifty-three percent of the Late Bronze Age sites displayed post-structures and thirty-nine percent in the Early Iron Age. Despite the fewer number of settlements presenting post-structures in the Early Iron Age, the number of post-structures per site increased greatly, as fifty-seven percent of the settlements with post-structures presented ten or more, compared to twenty-two percent in the Late Bronze Age. A slight decline in post-structure size in the Late Bronze Age is also apparent, with larger post-structures becoming apparent again in the Early Iron Age.

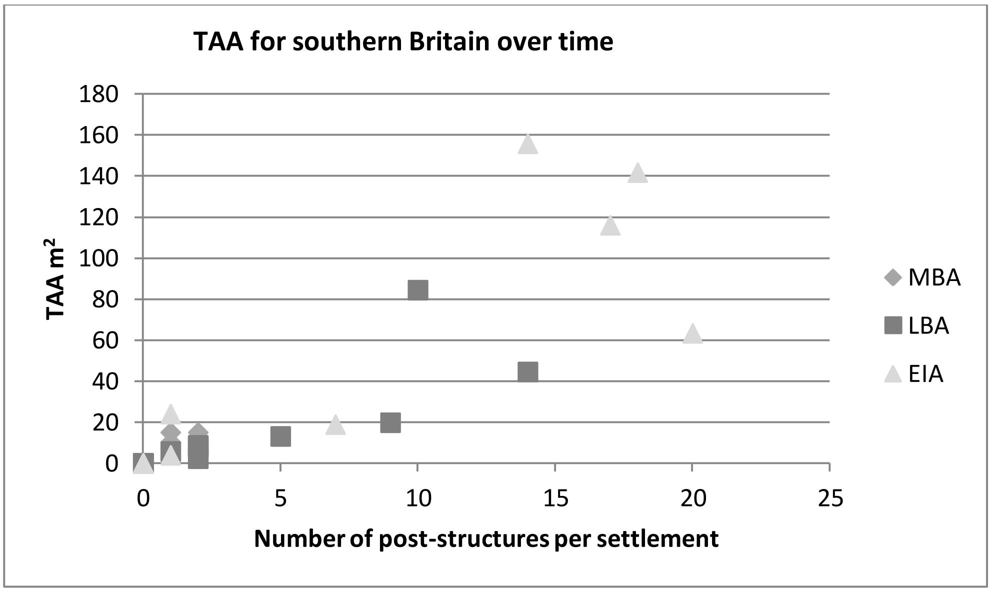


Figure 5.48 Contrast of number of post-structures and Total Additional Area over time

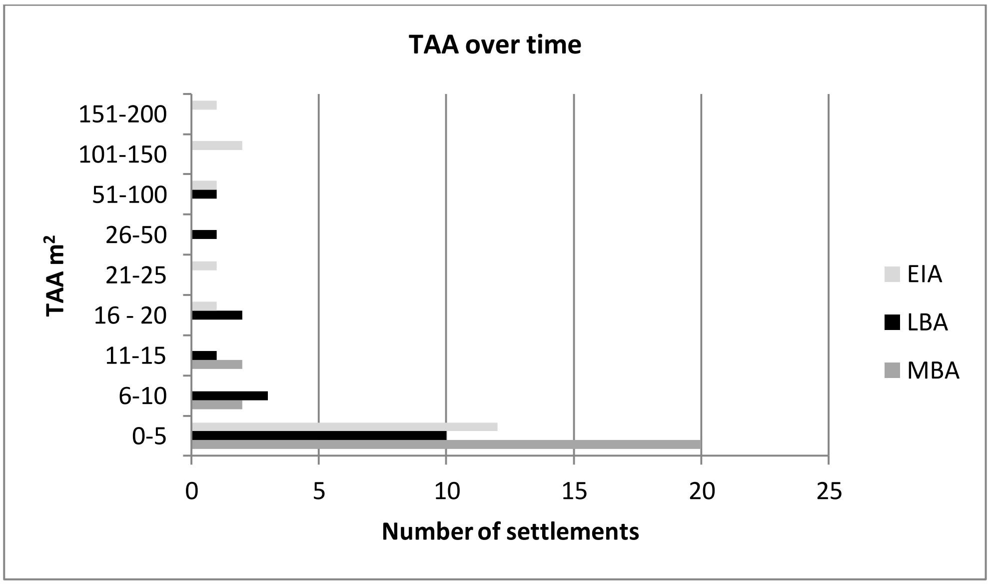


Figure 5.49 Comparison of Total Additional Area over time

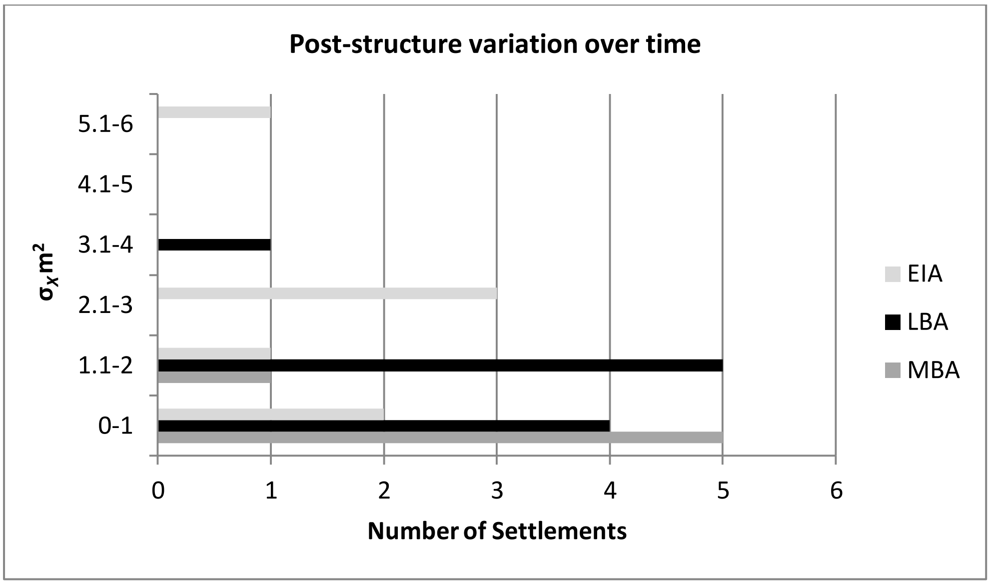


Figure 5.50 Comparison of standard deviation of post-structure area per settlement over time

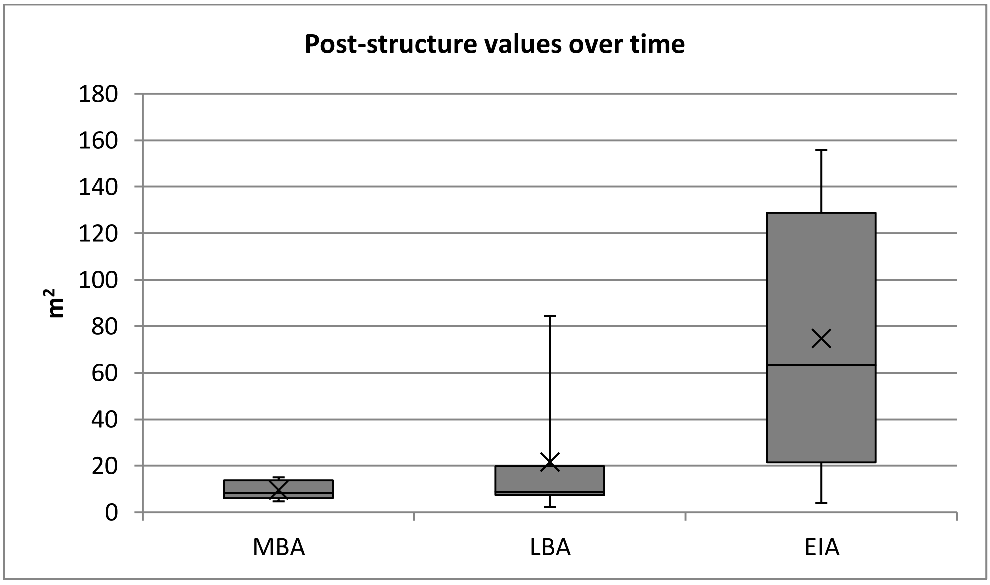


Figure 5.51 Total range of Total Additional Area values over time. X indicates average TAA for the period.

The data indicate an increasing trend toward above ground storage in the Late Bronze Age and Early Iron Age, both in number of post-structures and Total Additional Area, on settlements with post-structures (Fig. 5.49). This is a change in storage strategy, although as is evident from the above discussion, pits remained the dominant storage presence for southern Britain, available on the majority of settlements and in increasing volumes. The appearance of post-structures on settlements with or without pits is inconclusive as to the motivation behind differing methods of consumptive architecture. Post-structures are more labour intensive than pits, and their appearance alongside pits indicates an amount of produce and/or consumptive activities that make the extra energy worthwhile. Post-structures without pits, pits without post-structures, or a combination of pits and post-structures demonstrate three distinct approaches to consumptive architecture with little evidence to provide a reason behind a settlement electing to expend energy on a specific type. The simultaneous growth in post-structure construction over time, however, supports a consistent or even increasingly productive agricultural strategy in southern Britain. Given the increasing variation in size over time (Fig. 5.50), construction appears need-based, and the increase over time can only indicate a growing need for small, square four and six post structures built to specific needs, as well as a scale of production between settlements. While the internal organization is unknown, post-structures are typically classed as above ground storage, if interpretation as granaries is accepted. Regardless of their specific use, the increase in activity space afforded by the deliberate appearance of post-structures over time indicates a society that was not struggling for resources to feed their labour force (Fig. 5.51). Combined with the evidence for a movement toward larger, external pits over time, the evidence for agricultural storage suggests an increase in production, with post-structures providing storage for daily use and pits, which involve more work and a solid seal, for longer storage.

5.3 Comments

There are definite trends that emerge from the data when laid out site-by-site and by period. In southern Britain, the data suggest a shift in settlement structure toward larger dwellings and more storage, both above and below ground, over time. Settlements in the Middle Bronze Age, with some variability, consisted of two to four dwellings, creating small individual farmsteads. Larger congregations of dwellings such as Stannon Down and Trethellan Farm may actually have been phased settlements similar to Itford Hill. Interestingly, when Ellison's (1978) reinterpretation of Itford Hill is discarded and Burstow and Holleyman's (1957) original interpretation of a single occupation is accepted, a comparable settlement organization and THA value to the large outliers is apparent. Whether that indicates an alternate settlement organization to the farmsteads earlier than anticipated or phasing invisible in the record of Stannon Down and Trethellan Farm is unclear. The average dwelling area for the period was 34.11 m^2, with a standard deviation of 16.69 m^2. Despite the surface similarities in settlement organization, the variation in dwelling size within settlements presented as four clusters of similar standard deviations (see above), suggesting some similarity in effort expended toward productive architecture between particular settlements. The range of individual dwelling areas, however, was great (n<85 m^2), even when excluding dwellings of less than thirty square metres as activity areas. The differentiation in size was not affected by THA or dwelling area, indicating the energy and resources available to each settlement differed. The difference in dwelling size was therefore most likely related directly to specific needs of each settlement, suggesting variable activities, populations, and organization between settlements, as well as the availability of materials. Enclosed settlements were dominant, with smaller dwellings more apparent on enclosed settlements than on open settlements. The difference in dwelling size was likely a result of the energy dedicated to creating the enclosure; labour and resources would need to be conserved as ditches and banks were also constructed, as well as enclosure resulting in circumscribed space for structures and the activities of daily life.

Consumptive architecture for the Middle Bronze Age was primarily small pits internal to the dwellings, with scattered post-structures just beginning to appear in the record. Only twenty-three percent of settlements presented post-structures, compared to sixty-five percent of settlements with pits for the period. Those settlements only produced one or two post-structures each, with vastly different TAAs, apparently testing a new type of domestic architecture built to suit specific needs of each settlement. The variation in pit size was related to the total pit volume per settlement, as more pit capacity demonstrated larger standard deviations. The variation in pit volume was also related to location. Successive pits, constructed to suit specific harvests, also cannot be ruled out when discussing variation in volume.

There was no apparent correlation between THA, pit volume, and TAA. For example, Down Farm i and Mile Oak presented nearly equal values of THA, yet produced a difference in pit volume of 0.74 m^3. Post-structures were present on large and small settlements and on settlements with and without pits. There was a disparity between settlements producing above subsistence levels of storage and those without enough potential storage to feed their populations, indicating cooperation at the local level, whether that is an exchange of labour toward the fields or the result of trade between settlements with differing focus, *i.e.* arable agriculture vs. stock raising. The nearly omnipresent appearance of pits, even with differing total volumes, on MBA settlements suggests at least a minimum amount of agricultural produce per settlement, whether produced on site or acquired through exchange. Only nineteen percent of settlements produced no form of storage for the period, indicating the majority of settlements were able to support themselves or at least gain access to grain.

Small farmsteads continued to dominate the record into the Late Bronze Age, although the period appears to be transitional in settlement organization. The number of dwellings remained the same as the Middle Bronze Age, with all settlements presenting one to five dwellings. The majority of Total Habitable Areas remained under 150 m^2, similar to the preceding period; however, potential variation in settlement structure suggests either the beginnings of a settlement hierarchy or an early precursor of changes in settlement organization seen later. Along with an increase in THA on certain settlements was a rise in the average dwelling area for the period (41.62 m^2) and a greater standard deviation of individual dwelling areas (30.35 m^2). Despite the rise in variation for the period, a greater proportion of LBA settlements presented standard deviations of less than ten square metres than the in the MBA. While the dwellings were increasing in area, many settlements were devoting more similar amounts of energy and resources to their construction than in the preceding period. Again, the differentiation was not directly affected by settlement size; however, the greatest variation was present on settlements with either one dwelling over 100 m^2 or with a difference of approximately thirty square metres between two dwellings. The large increase in size of a single dwelling from the preceding period would have consumed energy in both labour and resources, perhaps to the detriment of other dwellings on the same settlement. The presence of a significant construction on Hog Cliff Hill, Mucking South Rings, and Loft's Farm speaks to a change in settlement organization, possibly resulting from a greater aggregation of population on a single settlement, or a more competitive local social structure where impressive dwellings provided a form of status. While enclosure remained the dominant settlement form, there was a greater proportion of open settlements. The average dwelling size on enclosed settlements also increased, mirroring the general trend for the period.

Particularly of note is the almost dramatic appearance of post-structures in the Late Bronze Age, becoming nearly ubiquitous in the Early Iron Age. Pits remained the dominant form of agricultural storage, found on a majority (59%) of settlements and becoming more numerous per site, yet the advent of post-structures suggests a change in storage practices, particularly when taken in conjunction with the increasing presence (63%) of pits external to structures. The shift in location was accompanied by an increase in average pit volume (0.56 m^3 from 0.34 m^3) and a decrease in the standard deviation in individual pit volumes for the period. The larger pits required more energy, indicating a definite increase in production. The tendency toward more standard capacity per pit possibly suggests a conservation of energy through more planned, rather than ad hoc construction. Planning in construction is exemplified by external pits, as they were more likely to have been used as long-term storage, with carefully constructed seals only opened once. Alternatively, post-structures could, depending on the internal organization invisible to the record, store grain for both short and longer-term use. Even as pits remained, a similar percentage (53%) of settlements in the LBA presented post-structures. The post-structures of the Late Bronze Age were on average smaller than the previous period (4.17 m^2), with less variation in individual area for the period. The differentiation was affected by number of post-structures, as fewer post-structures per settlement produced greater variety, suggesting the LBA as a transitional stage not yet practiced in the construction of post-structures. Given the increase in post-structure presence, it is unsurprising that eighteen percent of LBA settlements presented post-structures with no pits, compared to twelve percent in the MBA. Only twenty-four percent (n=4) of settlements presented pits with no post-structures in this period. Twenty-nine (n=2) percent of settlements with post-structures presented ten or more, demonstrating an increase from the MBA settlements, which contained at maximum two post-structures. The rise in post-structures along with increasing numbers of pits where present suggests an increase in storage necessitated by an increase in agricultural production, along with a shift toward above ground storage. The possibility of more above ground storage as a reaction to environmental conditions is discussed in the following sub-regional analysis.

Settlements in the Early Iron Age were a mixture of the two to four dwelling farmsteads seen in previous periods and more complex aggregations of five to eight dwellings. The dwellings were larger in the latter period as well, indicating that population was not only being reorganized into larger, possibly multi-family groupings, but that the population also required greater living/activity floor space. The average dwelling area for the period again increased to 50.49 m^2, with a slightly greater standard deviation in individual dwelling area of 31.72 m^2. Again, groupings of standard deviation were present, although the range extended to include much greater values. In the EIA, settlement size (number of dwellings) impacted the standard deviation of dwelling size, as more dwellings indicated greater variation. This change from the Bronze Age pattern was perhaps related to more than one family group within the larger settlements, each responsible for construction of their own dwelling(s) and therefore the difference a result of variable labour and access to resources. Enclosed settlements became the typical settlement form, regardless of dwelling size or differentiation, although the few open settlements demonstrated only small variation in dwelling size.

The continued shift toward large, external pits (67%) in the Early Iron Age, accompanied by an increase in post-structures, suggests a pattern of increased production allowing for longer-term storage without detriment to the activities of an increasing population. The presence of pits (80%) increased from the previous period, accompanied by an increase in number of pits per settlement and increased total pit volume and average pit volume (2.80 m^3). The standard deviation of the individual pit volumes for the period increased drastically, from 0.67 to 6.6 m^3. The variation was related to both number of pits per settlement and variety in pit form, as new shapes appeared from the end of the Bronze Age. The new pit forms were more economical in terms of energy expended on their creation, which was necessary as the number of pits per settlement increased. All but one settlement with pits were enclosed, suggesting a need to control access to the larger, more external pits. Thirty-nine (n=7) percent of settlements presented post-structures for the period, less than previously, yet the numbers of post-structures per site increased with fifty-seven percent of settlements with post-structures demonstrating ten or more. The average post-structure area again decreased, while the variation in individual post-structure areas increased. As with pits, the more post-structures present on a settlement, the greater the variation. Unlike pits, however, post-structures require greater energy and resources the larger they are, with no mitigating circumstances in terms of form available. The greater numbers of smaller post-structures with larger variation indicates construction as needed, as the smaller post-structures conserved energy, even as more were constructed. Half (n=9) of the EIA settlements presented only pits, which emphasises the continued reliance on pits in southern Britain and another shift back toward subterranean storage. Only two settlements presented neither form of storage and only two settlements presented only post-structures.

Overall, the growth in maximum potential consumptive space over time strongly indicates a continual and growing investment in post-structures and pits, particularly when contrasted with the continuance of small farmsteads. There appears to be little overt correlation between the number of pits and the number of dwellings, between the presence of pits and the presence of post-structures, or between Total Habitable Area, total pit volume, and Total Additional Area. The appearance of larger, more numerous dwellings per settlement coupled with an increase in total pit volume and Total Additional Area over time, however, suggests a reciprocal relationship. More floor area provided by dwellings allowed for a greater population, supported by an increased agricultural strategy, which stored its product in an increasing amount of above and below ground consumptive architectures. While the pits and post-structures do not appear to be specifically linked in their presence on settlements, there does appear to be a slight connection between available storage capacities on settlements where both forms are present. Certain settlements, such as Winnall Down, presented large values of all types of domestic architecture, while other settlements such as Gussage All Saints presented little THA yet large amounts of both pit volume and TAA. Still other settlements presented high THA values, yet little to no pit volume or TAA whatsoever. The evidence from architectural proxies indicates a continuation of investment of energy in creating structures for the offshoots of consumption through the end of the Bronze Age, and a sharp rise into the Early Iron Age. Iron and its new forms of tools most certainly did not have a negative impact on agricultural production, as seen through domestic architecture. While settlements and dwellings tended to become larger into the Early Iron Age, reorganizing the population as social priorities changed, the energy devoted to agricultural production appears at least constant. The results indicate we need to be careful in how we model the impact of new technologies and the decline of long-distance exchange routes by the close of the Bronze Age on agricultural production. The combination of trends in the data suggest local networks of interaction, allowing sites with higher productivity, based on storage capacity, to assist settlements with populations, based on dwelling area, larger than their own storage capacity could support.

Chapter VI: Shifts in population and agricultural production sub-regionally for southern Britain

Exploring the differences in population and agricultural production inter- and intra-regionally will produce further patterns over time. Each region had unique productive capabilities, and the shifts in movement of people and potential for agricultural surplus will reflect the changing needs at the end of the Bronze Age.

6.1 Population

The changes in settlement organization within each sub-region of southern Britain over time are critical to understanding the varied productive capabilities of different environments and the reaction of the population to external pressures. Tracking changes in energy devoted to consumptive architecture in areas with greater or lesser agricultural potential, as indicated by storage capacity and known environmental data, implies information regarding the needs of the population over time.

Population: southern Britain intra-regionally

There were three sub-regions in southern Britain included in this study, stretching across the island: southwest England, the Thames Valley, and the chalk downland (Fig. 6.1). A brief overview of regional geography is included below. Specific information regarding location and soil type is detailed in Appendix A.

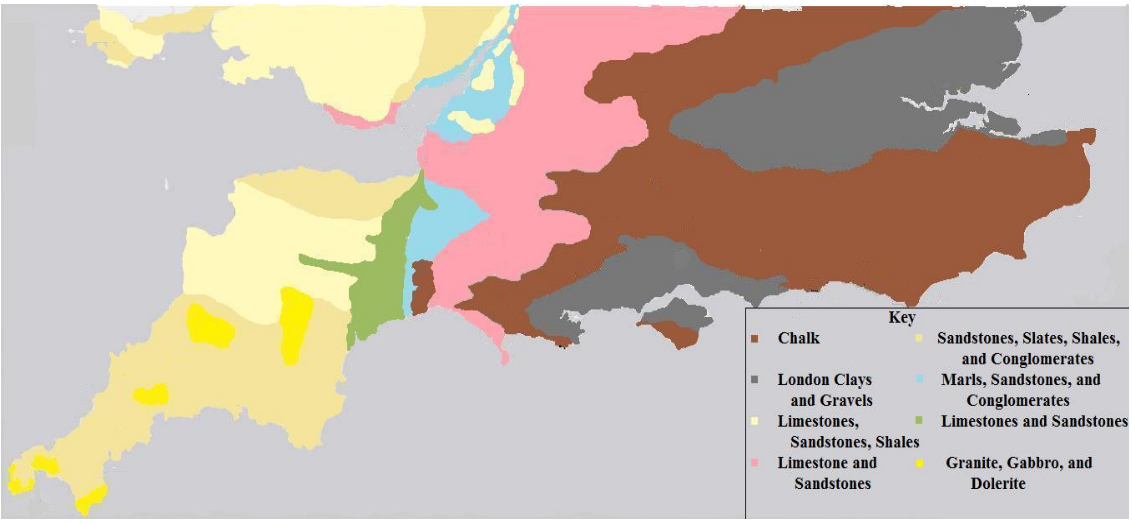


Figure 6.1 Geology of southern Britain.

Southwest England

The southwest England sub-region, encompassing sites in Cornwall, Dorset, Somerset, and Devon, demonstrated evidence of settlement for all three periods (Table 6.1). The variability over time in the Total Habitable Area, and therefore population and productive labour force, is notable.

In the Middle Bronze Age, all six settlements displayed evidence of dwellings. Four settlements (Trevisker, Trewey Down, Gwithian, and Brean Down) displayed two to three dwellings. The remaining two settlements, Trethellan Farm and Stannon Down, presented evidence for seven and eight dwellings, respectively. Stannon Down and Trewey Down may have consisted of greater numbers of dwellings; however, their excavations were not completed due to various complications. Overall, the general appearance of Middle Bronze Age settlement in southwest England was that of small, individual farmsteads, with larger village-type congregations of dwellings possible.

The Total Habitable Area for each settlement varied (Figure 6.2). Trevisker, Trewey Down, and Brean Down presented a THA of n<100 m^2 from two to three dwellings. Gwithian presented a THA of 109.62 m^2 from three dwellings. Trethellan Farm and Stannon Down presented a THA of 350<n<400 m^2, a much greater value than anticipated, which has already been discussed as possibly due to phases of settlement unable to be distinguished in the

	SW England	**Number of Dwellings**	**THA m^2**	**Average Dwelling Size m^2**	**Standard Deviation S_X m^2**	**Period**
	Trevisker	2	91.34	45.67	5.15	MBA
	Trewey Down	3	56.10	18.70	0	MBA
	Trethellan Farm	7	381.771	54.53	17.60	MBA
	Gwithian	3	109.62	36.54	23.31	MBA
	Stannon Down	8	361.21	45.15	18.45	MBA
	Brean Down	2	40.84	20.42	11.10	MBA
Totals	6	25	1040.881	41.63	19.72	
	Brean Down	0	0	N/A	N/A	LBA
	Cadbury Castle	0	0	N/A	N/A	LBA
Totals	2	0	0	N/A	N/A	
	Cadbury Castle	2	203.0	101.50	3.54	EIA
	Gurnard's Head	3	68.50	22.83	6.68	EIA
	Pilsdon Pen	8	357.70	44.71	14.91	EIA
Totals	3	13	629.20	48.40	27.94	

Table 6.1 Values of dwellings and Total Habitable Area over time for southwest England

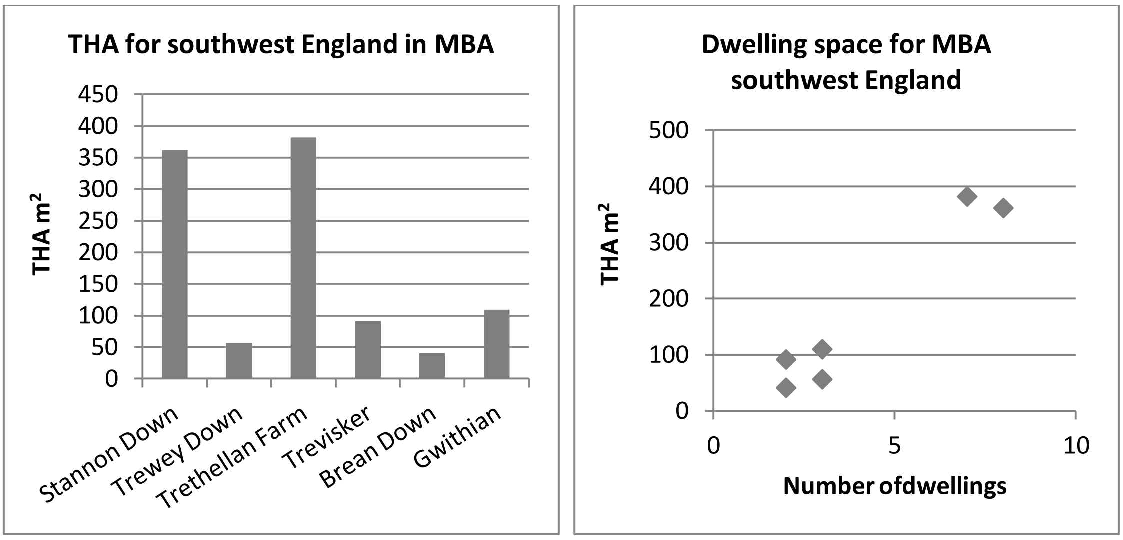


Figure 6.2 Middle Bronze Age values for Total Habitable Area and number of dwellings per site in southwest England

record (see Chapter V). The range of THA values appears to match the size of the settlement, as per number of dwellings. When the average dwelling size per site is compared, it becomes apparent that there was variety in structure size for the region. Trewey Down and Brean Down presented an average dwelling size of 15<*n*<~20 m^2. The remaining sites were relatively similar, presenting an average dwelling size of 35<*n*<55 m^2. This indicates small farmsteads of relatively standardized construction as the standard for southwest England in the MBA, following the general trend for the period described in the previous chapter. The difference in average dwelling size, while not apparently great, would be appreciable in terms of labour and resources used. The smallest dwelling (THA=9.26 m^2, Gwithian) would be far less intensive in energy exerted than the largest dwelling (THA=80.12 m^2, Stannon Down). Difference in dwelling construction indicates a difference in possible population within each dwelling, suggesting family groupings varied in size, as well as the possible wealth, in both energy and materials, able to be commanded. Over seventy square metres of area is a large difference in dwelling construction and impacts the usefulness of each dwelling. Larger dwellings would be able to house more people, as well as provide more room for activities. The difference in dwelling construction on each settlement also provides data regarding social organization, as well as energy expended.

The variation in dwelling size for the Middle Bronze Age of southwest England was on the smaller end of the total region, with no standard deviation greater than 25 m^2. Variation was not linked to settlement size, as the greatest and least variety occurred on settlements with three dwellings, although the settlements with the largest THA values did present the greatest standard deviations. Nor does it follow the regional pattern of smaller dwellings on enclosed settlements. Open settlements were dominant in southwest England, with only a single enclosed settlement (Trevisker) present in the period. Trevisker demonstrated a small

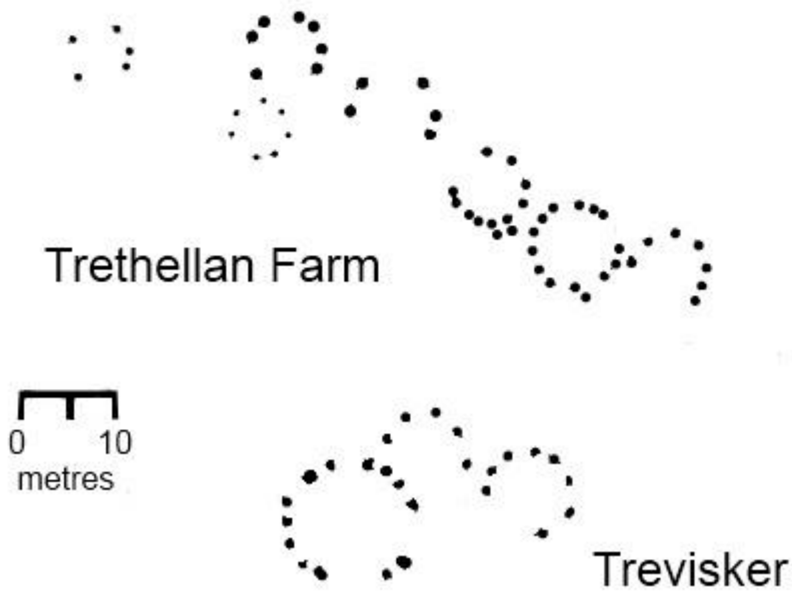
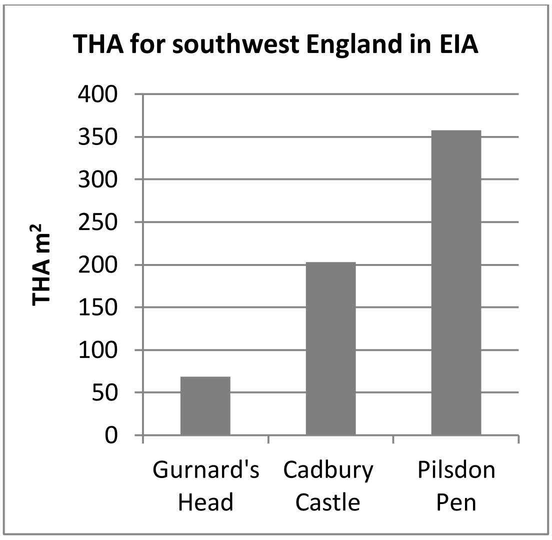


Figure 6.3 Comparison of selected MBA settlement plans. Trethellan Farm after Nowakowski 1991, Trevisker after ApSimon and Greenfield 1972.

standard deviation and moderate THA, yet a comparably large average dwelling size (Fig. 6.3). There might be evidence of hierarchical architecture on Gwithian and Stannon Down, as both settlements presented the largest standard deviation, as well as at least one dwelling at least twenty square metres larger than the next. A greater variety of dwelling size on an individual settlement may be suggestive of a more ad hoc construction, with dwellings, either large or small, being added as becomes necessary, or as resources become available. Greater variation also suggests the possibility of specific activities assigned to specific dwellings, with construction reflecting the space required for a select range of tasks. Settlements with more similar dwellings are more indicative of a population careful with resources and possibly some form of pre-planning to account for both living and activity space within more standardized dwellings. Trewey Down and Trevisker presented the smallest standard deviations in dwelling size, yet the dwellings were vastly different in size (average dwelling areas: Trewey Down=18.7 m^2, Trevisker=45.67m^2). Whether the difference was due to population differences or simply different requirements for space, the THA values indicate a definite difference in the total amount of energy expended upon productive architecture.

The Late Bronze Age of southwest England presented different population evidence. Neither of the two settlements in this period presented evidence for dwellings, marking a change in Brean Down, which presented dwellings in the MBA phase. The small sample could present skew not actually present in the period, as the lack of dwelling evidence is most likely a factor of preservation. Considering preservation bias, as settlements typically require living space that was most likely simply not uncovered by excavation, we can assume only a few dwellings per settlement. A small number of dwellings per settlement hidden in the archaeological record is understandable and would be comparable to the small farmsteads present in the other regions for the period.

Settlement evidence for southwest England in the Early Iron Age demonstrates continuity in settlement structure from the Bronze Age (Fig. 6.4). While all three sites presented evidence for dwellings, the number of dwellings on Gurnard's Head and Cadbury Castle remained similar to the small farmsteads of the Middle Bronze Age, with two to three dwellings. Pilsdon Pen, on the other hand, was more analogous to Stannon Down and Trethellan Farm with eight dwellings. Gurnard's Head presented a THA of 68.5 m^2, within the smaller values of the MBA settlements. Cadbury Castle increased from no evidence of dwellings in the LBA to 203.00 m^2. Pilsdon Pen presented the greatest THA with 357.7 m^2. These values were similar to the range of Middle Bronze Age values, suggesting a strong continuity in settlement organization and population over time.



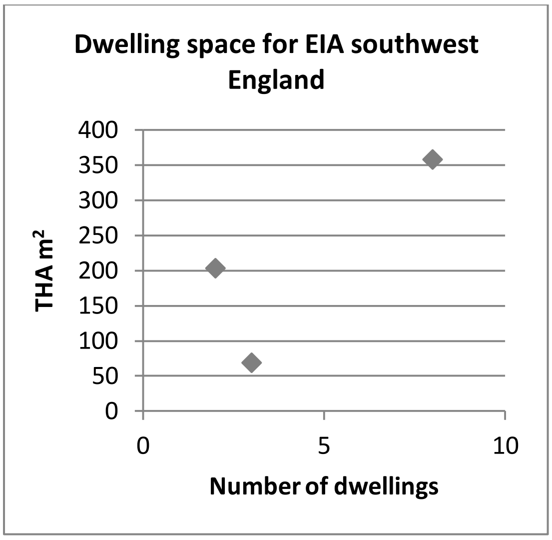


Figure 6.4 Early Iron Age values for Total Habitable Area and number of dwellings per site in southwest England

The average dwelling size per site for Gurnard's Head and Pilsdon Pen also fit within MBA values. Cadbury Castle, however, featured larger dwellings than the earlier period, indicating more energy devoted to productive architecture. Greater amounts of resources and labour would have to have been marshalled on Cadbury Castle to produce dwellings over sixty square meters larger than the average dwelling size for the MBA. Pilsdon Pen, in both THA and number of dwellings, suggests Stannon Down and Trethellan Farm were perhaps not anomalous, but rather early iterations of aggregate farmsteads.

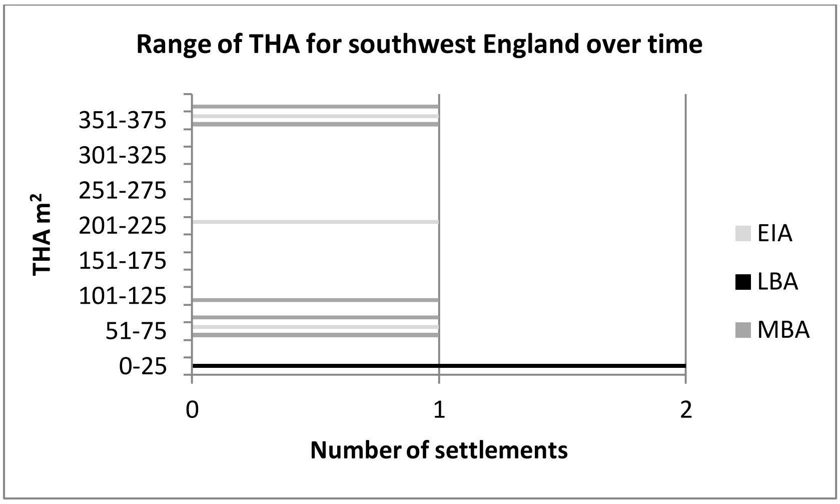


Figure 6.5 Contrast of Total Habitable Area values over time for southwest England

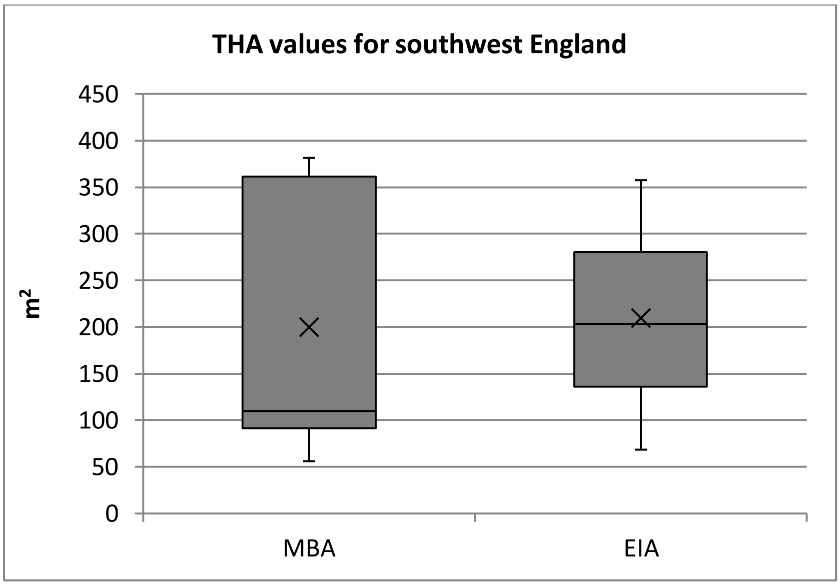


Figure 6.6 Total range of Total Habitable Area values. X indicates average THA value.

The variation in dwelling size per settlement was more similar than that of the MBA, with two settlements presenting $3<n<7$ m^2 of standard deviation. Pilsdon Pen presented the largest standard deviation for the period (14.91 m^2), still within the smaller grouping of variation present in the MBA. The range of individual dwelling area was larger, as the smallest dwelling was 15.9 m^2, while the largest was 104 m^2. The variation was unlinked to THA, although it increased with the number of dwellings present. Even on Pilsdon Pen with eight dwellings, the dwellings of EIA settlements in southwest England were more similar to each other. The greatest difference between individual dwellings was approximately thirteen square metres, although the range of dwelling area for Pilsdon Pen was $29.22<n<70.14$ m^2. Again, there was a contrast between settlements with similar sized dwellings and one that presented greater variety. The difference in dwelling size within Pilsdon Pen demonstrates divergent energy expenditure toward productive architecture; labour and resources would not be utilized without a clear necessity, resulting in buildings built to suit a particular need within the settlement. Task-specific architecture is again a possible impetus for differing dwelling size, while a larger population on settlements with more variation would provide a larger labour pool necessary for the construction of a greater number of dwellings. The consumptive architecture must be examined to clearly understand differences in investment in productive architecture.

Patterns of enclosure also changed in the Early Iron Age. Enclosure occurred on two of the three settlements of southwest England for the period, increasing in proportion from the MBA and reversing the earlier trend of settlement organization. The open settlement produced the median THA value, yet the largest average dwelling area and least number of dwellings, contrary to the broader regional trend for southern Britain, discussed in Chapter V.

Southwest England was dominated by small farmsteads of two to three dwellings in the Middle Bronze Age, which was followed by similar settlement structure in the Early Iron Age. While no dwellings were excavated on the Late Bronze Age settlements included in this study, it is not unreasonable to assume a similar pattern for the end of the Bronze Age. The majority of MBA and EIA settlements displayed similar THA values (Fig. 6.5). While the largest dwellings were visible on the EIA phase of Cadbury Castle, the MBA demonstrated the most variability in settlement (Fig. 6.6). Settlement in the sub-region appeared to be consistent and continuous, as Brean Down presented both MBA and LBA phases and Cadbury Castle displayed LBA and EIA phases. The people in the region demonstrated an attachment and dedication to the land, as well as little need to alter their living/working space. If the lack of dwellings in the LBA is assumed as the result of preservation issues, the labour and resources devoted to settlement construction remained consistent over time, indicating no significant social restructuring occurring at the Bronze Age-Iron Age transition, although an increase in enclosed settlements occurred over time.

The Thames Valley

The Thames Valley region, consisting of those sites situated on the gravels and sands of the Thames River Basin in Essex and Berkshire, demonstrates a very different pattern of population dispersal over time. There were no settlements from the Middle Bronze Age included in this study. The published evidence for settlements in this period is negligible, which may indicate a preservation bias, excavation bias, or a lack of settlement in the Middle Bronze Age.

There were seven Late Bronze Age settlements for the Thames Valley included in this study. All presented evidence of one to five dwellings. The small groupings of dwellings indicate single farmsteads as the standard unit of settlement, similar to the contemporary

	Thames Valley	Number of Dwellings	THA m^2	Average Dwelling Size m^2	Standard Deviation s_x m^2	Period
	Springfield Lyons	3	77.74	25.91	10.88	LBA
	Mucking North Ring i	2	66.75	33.38	7.22	LBA
	Mucking North Ring ii	1	19.63	N/A	N/A	LBA
	Green Park	5	291.46	58.29	5.10	LBA
	Loft's Farm	2	133.1	66.55	50.28	LBA
	Aldermaston Wharf	2	86.59	43.30	9.86	LBA
	Mucking South Rings	1	113.1	N/A	N/A	LBA
Totals	7	16	828.72	49.27	27.31	

Table 6.2 Values for dwellings and Total Habitable Area for the Thames Valley region

settlement pattern for the entirety of the southern British region.

The values of Total Habitable Area for the Late Bronze Age in the Thames Valley support the small farmstead plan (Fig. 6.8; Table 6.2). The majority of settlements displayed a THA of n<100 m^2. Mucking North Ring ii presented the least THA with 19.63 m^2 from one dwelling. Green Park displayed the greatest THA with 291.46 m^2, from the most dwellings per site (n=5). As both Mucking North Ring and Mucking South Rings were in the same vicinity, a comparison between the nearly contemporary settlements provides a closer examination of the settlement pattern of the Thames Valley within the Late Bronze Age. The earlier South Rings presented fewer dwellings than its sister site, yet the THA was much greater. The North Ring, however, contained two phases of settlement, indicating a continuity of occupation.

The average dwelling size per site presented a range of dwelling sizes from 19.63 to 113.1 m^2, suggesting variability in construction within the region, and therefore differing needs for living/activity space. The values, however, were similar to those of the MBA and EIA for southwest England, suggesting some continuity in construction between the regions. The variation in dwelling area, while mostly similar to the preceding period in the southwest, displayed a greater range. The majority of settlements presented standard deviations of 5<n<~10 m^2. The largest standard deviation was at Loft's Farm (50.28 m^2). The smallest individual dwellings for the sub-region were 19.63 m^2, while the largest was 113.1 m^2. The very large standard deviation for Loft's Farm again raises questions, as the difference in energy used in creating a dwelling over seventy square metres larger than the other on the same settlement is obvious and deliberate. While task-based dwelling size remains possible, the smaller dwelling on Loft's Farm was more similar to the average dwelling area of the LBA for the Thames Valley, suggesting instead that the difference was a function of occupancy. Whether the discrepancy was due to size of the individual units residing in each dwelling or a social hierarchy is unclear. The difference in energy use is remarkable either way.

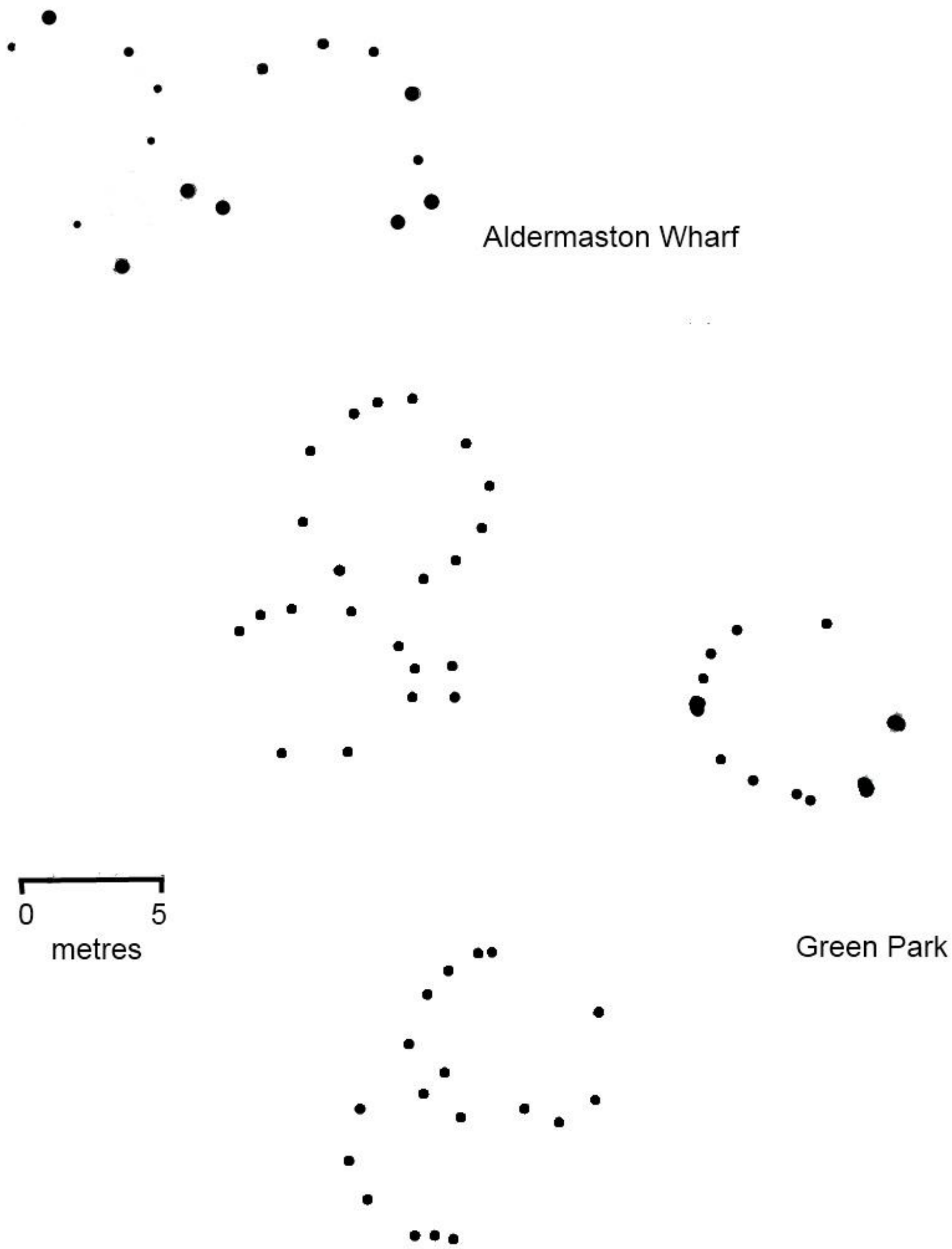


Figure 6.7 Comparison of selected LBA settlement plans. Aldermaston Wharf after Bradley *et al.* 1980, Green Park after Brossler *et al.* 2004.

The patterning of dwelling differentiation was dissimilar to that of either period in southwest England. THA and size of the settlement demonstrated no correlation with dwelling variation, as the settlement with the greatest THA and most dwellings exhibited the smallest standard deviation. The smallest variations, however, appeared on the only open settlements (Green Park and Aldermaston Wharf) of the period (Fig. 6.7). Enclosure appeared to have little to no correlation with size of the settlement, as enclosed settlements contained one to three dwellings. THA was also not a factor in enclosure; although the largest settlement was open, the enclosed settlements displayed nearly the full range of THA values. This is suggestive of enclosed settlements responding more specifically to the needs of the

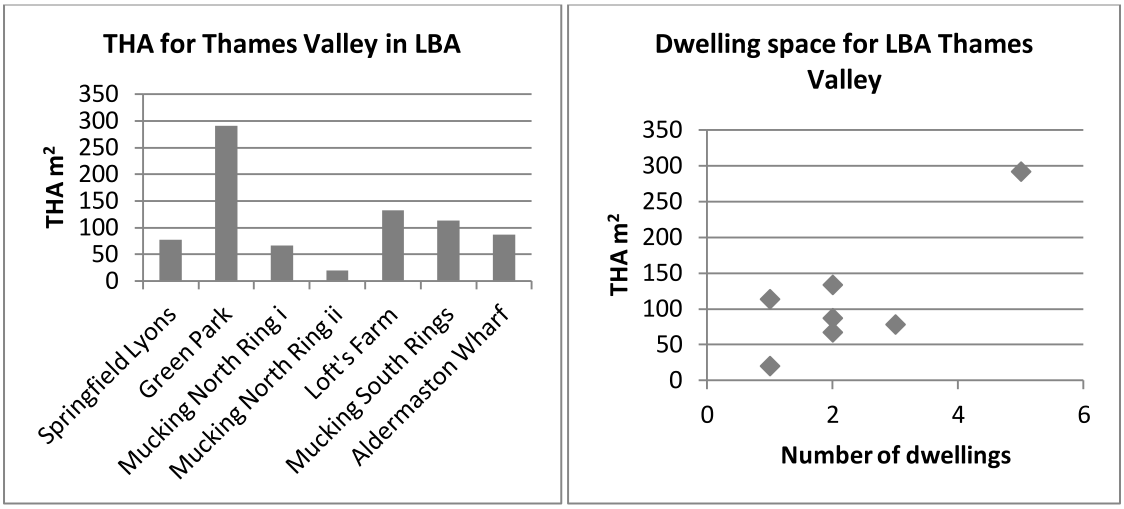


Figure 6.8 Late Bronze Age values for Total Habitable Area and number of dwellings per site in the Thames Valley

population and constructing dwellings as necessary, while the open settlements did not have to respond to restricted amounts of space.

Given the lack of dwellings in the southwest for the LBA in this study, comparison with the Thames Valley is unfeasible. The THA values were comparable to the settlements of similar number of dwellings in the MBA and EIA of the southwest; there is little doubt that the focus of the overall LBA population of southern Britain was shifting toward the fertile gravels of the Thames Valley and people would carry their building techniques and styles with them (Barrett and Bradley 1980, Cunliffe 2000). The sub-region likely had other enticements for contact, given the economic ties to the Continent through cross-Channel exchange routes still plentiful in the Late Bronze Age (Rowlands 1980).

There is a dearth of published material on settlement in the region for the Early Iron Age, likely reflecting a lack of reliable phasing of the scattered settlement evidence present in the region for the final years of the first millennium BC (Bryant 1997). Preservation bias could also be a factor; however, the data corroborate a movement of population away from the Thames Valley in the Early Iron Age until the Middle Iron Age (Sharples 2010).

The Chalk Downland

The chalk downland, comprised of the chalk and clay with flints of Dorset, Wiltshire, Hampshire, and Sussex, has a longer history of excavation at the end of the Bronze Age. Whether this is related to population or preservation bias or a mixture of both is uncertain, however, there different trends in population congregation appear on the downs than in the other sub-regions of southern Britain. Every settlement in all three periods for the region presented evidence of dwellings (Table 6.3).

	Chalk Downland	Number of Dwellings	THA m^2	Average Dwelling Size m^2	Standard Deviation s_x m^2	Period
	Poundbury i	2	29.56	14.78	6.96	MBA
	Poundbury ii	2	39.26	19.63	13.82	MBA
	Shearplace Hill	2	102.46	51.23	46.75	MBA
	Down Farm i	2	108.18	54.09	14.01	MBA
	Down Farm ii	3	129.98	43.33	17.57	MBA
	South Lodge Camp	2	63.19	31.60	22.20	MBA
	Thorny Down i	2	56.37	28.19	19.33	MBA
	Thorny Down ii	2	62.43	31.22	30.54	MBA
	New Barn Down	2	64.02	32.01	14.24	MBA
	Cock Hill	3	87.66	29.22	N/A	MBA
	Blackpatch	1	29.19	29.19	N/A	MBA
	Mile Oak	3	108.45	36.15	11.23	MBA
	Itford Hill i	2	52.57	26.29	4.15	MBA
	Itford Hill ii	4	109.74	27.44	6.96	MBA
	Itford Hill iii	4	106.02	26.51	5.22	MBA
	Itford Hill iv	2	58.44	29.22	N/A	MBA
	Black Patch hut platform 1	2	40.84	20.42	11.10	MBA
	Black Patch hut platform 4	5	147.85	29.57	15.62	MBA
	Plumpton Plain A	3	96.86	33.85	6.55	MBA
	Highdown Hill	3	58.71	19.57	9.62	MBA
Totals	20	57	1551.78	30.43	14.91	
	Eldon's Seat	4	144.26	36.07	1.61	LBA
	Plumpton Plain B	3	33.21	11.07	6.09	LBA
	Amberley Mount	2	61.93	30.97	20.70	LBA
	Mile Oak	1	49.01	N/A	N/A	LBA
	The Caburn	2	25.13	12.57	0.01	LBA
	Winnall Down	4	196.66	49.17	3.87	LBA
	Hog Cliff Hill	3	309.56	103.19	35.16	LBA
	Rams Hill	4	98.38	24.60	13.76	LBA
Totals	8	23	918.14	39.92	31.03	
	Highdown Hill	2	65.57	32.79	N/A	EIA
	Winnall Down	8	507.37	63.42	37.17	EIA
	Hog Cliff Hill i	5	161.00	32.20	18.19	EIA
	Hog Cliff Hill ii	3	68.90	22.97	8.16	EIA
	Old Down Farm i	2	128.15	64.08	9.62	EIA
	Old Down Farm ii	4	118.10	29.53	6.94	EIA
	Heathy Brow	1	19.63	N/A	N/A	EIA
	Gussage All Saints	1	63.62	N/A	N/A	EIA
	Little Woodbury	2	255.25	127.63	69.42	EIA
	Hollingbury	5	195.34	39.07	43.80	EIA
	Eldon's Seat	3	143.95	47.98	13.64	EIA
	Balksbury Camp	3	148.68	49.56	6.27	EIA
	Winklebury Camp	5	403.9	67.32	16.15	EIA
	Chalbury Camp	1	79.49	79.49	N/A	EIA
	Hengistbury Head	11	546.33	49.67	31.79	EIA
Totals	15	56	3108.28	50.97	32.73	

Table 6.3 Values for dwellings and Total Habitable Area for the chalk downland

The Middle Bronze Age of the chalk downland is well represented in this study, with thirteen settlements and a total of twenty phases of settlement. Poundbury, Itford Hill, Down Farm, Thorny Down, and Black Patch were phased settlements, with each phase treated discretely according to excavation reports or reinterpretation (see Appendix A). All settlement phases presented between one and five dwellings.

As with the contemporary settlements of southwest England, the general trend for the Middle Bronze Age across southern Britain appears to be small farmsteads. Of note is that if the phasing of settlements such as Itford Hill is not actually correct and the settlement is treated as a single iteration of a settlement, the number of dwellings was greater than Trethellan Farm and Stannon Down in southwest England. The phasing, however, corresponds with the organization of the remaining settlements on the chalk, providing a strong case for individual farmsteads.

The Total Habitable Area per site for the Middle Bronze Age also supports farmsteads as the major settlement unit (Fig. 6.9). Blackpatch and Poundbury i displayed similar THA values of just under 30 m^2. Black Patch hut platform 1 and Poundbury ii presented around 40 m^2 of THA. Seven settlements (Itford Hill i-iv, Thorny Down i-ii, New Barn Down, South Lodge Camp, and Highdown Hill) presented a THA $50<n<65$ m^2. Eight settlements (Shearplace Hill, Down Farm i-ii, Plumpton Plain A, Itford Hill ii-iii, Cock Hill, and Mile Oak) presented a THA of $80<n<130$ m^2. Black Patch hut platform 4 was the largest settlement, with over 140 m^2 of THA. With the exception of the possibly phased outliers of Stannon Down and Trethellan Farm, the THA values for southwest England and the chalk downland were similar. The similarity in THA suggests either phasing that was not accounted for in the latter settlements or that the phasing accepted for the chalk settlements is incorrect and there are two distinct settlement patterns present in both regions. As even the excavators suggested phasing was likely, we can therefore extrapolate considerable correlation in dwelling area between southwest England and the chalk downland.

The average dwelling size per site is similar to the Middle Bronze Age settlements of southwest England. The majority of settlements (n=13) presented an average dwelling size of $15<n<35$ m^2. Poundbury i presented the smallest average dwelling size of 14.78 m^2.

Shearplace Hill, Mile Oak, and Down Farm i-ii displayed $35<n<60$ m^2. Again, the values are similar to those of southwest England, reinforcing the suggestion of interaction between the chalk downland and settlements further west via similarity in construction. The variation in dwelling size per settlement reinforces similar trends with contemporary southwest England. Nine settlements displayed $0\leq n<10$ m^2 of standard deviation, while eight settlements presented $10<n<20$ m^2. The three remaining settlements displayed greater variety. The variation was again unlinked to THA or number of dwellings. The smallest individual dwelling was 9.62 m², the same area as the smallest dwelling for contemporary southwest England. The largest was 84.29 m², slightly larger than its contemporary in the neighbouring sub-region. The settlements with the largest standard deviations all presented two dwellings, with a difference of 30<*n*<70 m² in area. Unlike with southwest England, the largest differences in dwelling size for the chalk downland were located only on small farmsteads. Small farmsteads have traditionally been regarded as single-family settlements, where one would not expect to see any form of social hierarchy reflected in the architecture. The smaller dwellings on South Lodge Camp, Shearplace Hill, and Thorny Down ii were all less than twenty square metres, which would be extremely small for more than one person. Twenty to approximately thirty square metres per capita have been estimated for prehistoric

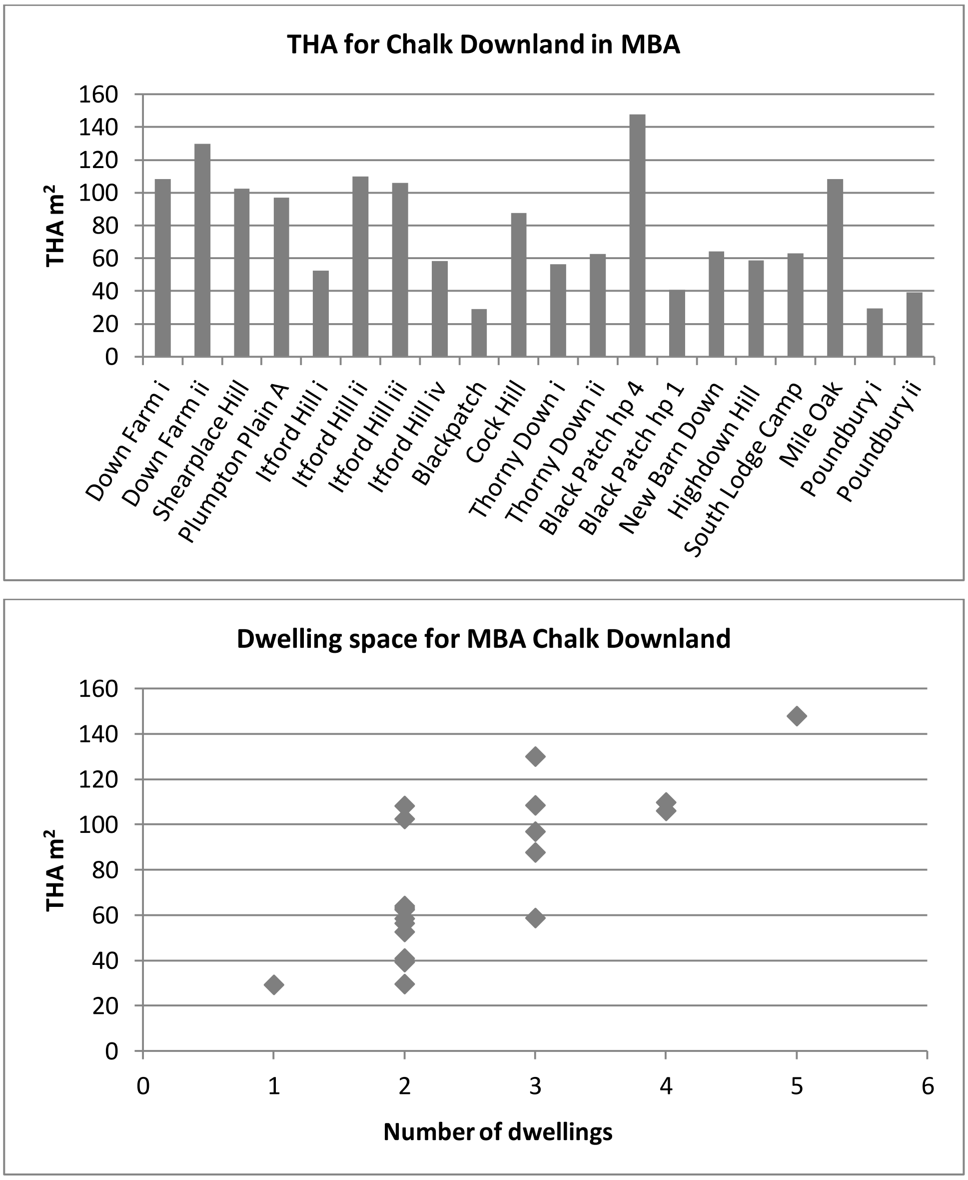


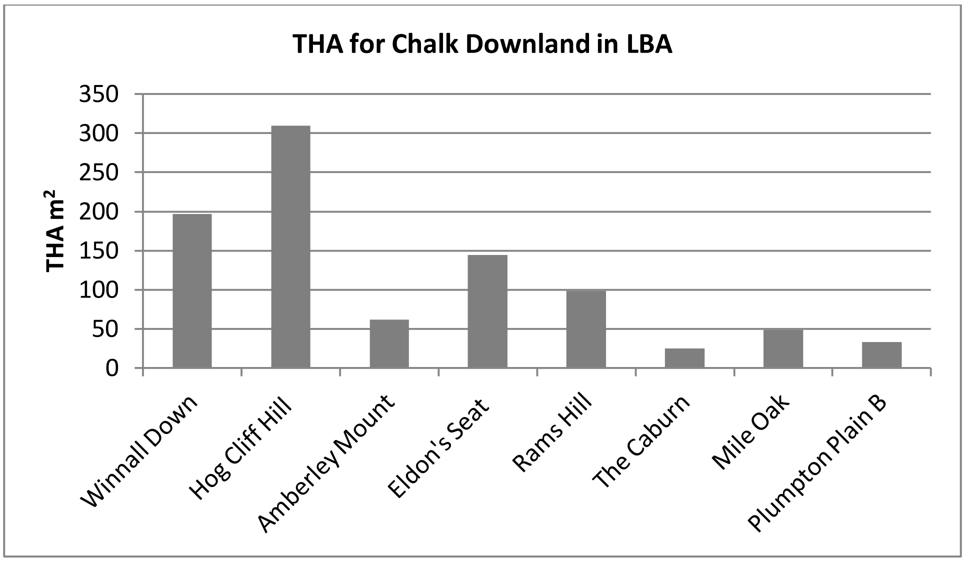
Figure 6.9 Middle Bronze Age values of Total Habitable Area and number of dwellings per site in the chalk downland

urban centres (Renfrew 1972, Holladay 1992), which may not precisely equate to rural farmsteads, yet the premise of expending effort to create a dwelling only fit for one or two people at most when the population was demonstrably able to construct larger dwellings is unsound. The largest standard deviations are therefore likely a function of living versus activity areas. Similar differences are apparent on settlements with standard deviations greater than ten square metres. The settlements with smaller standard deviations likely used the more similarly sized dwellings as both living and activity areas, as little distinction in size was apparent and the size chosen was likely purposeful. The settlements with four and five dwellings displayed dwellings of similar size within the settlement, along with at least one dwelling less than twenty square metres. There are clearly two trends of productive architecture present in the MBA for the chalk downland able to be read from interpretation of architecture as the throughput of energy: one that expended similar energy on dwellings, with no clear distinction of usage, and one that had marked differentiation, with effort resulting in distinctly different structures. The implications for consumptive architecture will be discussed in the following section.

Enclosed settlements were more prominent in the Middle Bronze Age of the chalk downland than the southwest. Eighty percent of settlements were enclosed. While THA and enclosure were not closely linked, the four open settlements did display among the largest THA values. The open settlements also presented more similar dwelling areas per settlement. The enclosed settlements were more likely to present at least one dwelling with an area less than twenty square metres, as well as larger standard deviations. Whether the settlement pattern of one larger and one smaller dwelling was a reflection of the need to conserve space within enclosures is beyond the determination of this study. Larger individual dwellings were, however, consistently present on open settlements where space was not finite.

The Late Bronze Age demonstrated continuity in the number of dwellings from the preceding period (Fig. 6.10). All eight settlements presented evidence for one to four dwellings. Such a consistent pattern is suggestive of a maintained dispersal of population; there was no decline or growth in the number of dwellings per site, indicative of a similar number of people occupying each settlement. The number of dwellings for the period was consistent across southern Britain as well, indicating a consistent family grouping in small farmsteads for the Late Bronze Age.

Regarding the Total Habitable Area of the Late Bronze Age settlements of the chalk downland, the suggestion of continuity in population continues. Three settlements (Plumpton Plain B, Mile Oak, and The Caburn) presented $n<50$ m^2 of THA. Amberley Mount and Rams Hill displayed THA values of $50<n<100$ m^2. Winnall Down and Eldon's Seat presented THA values



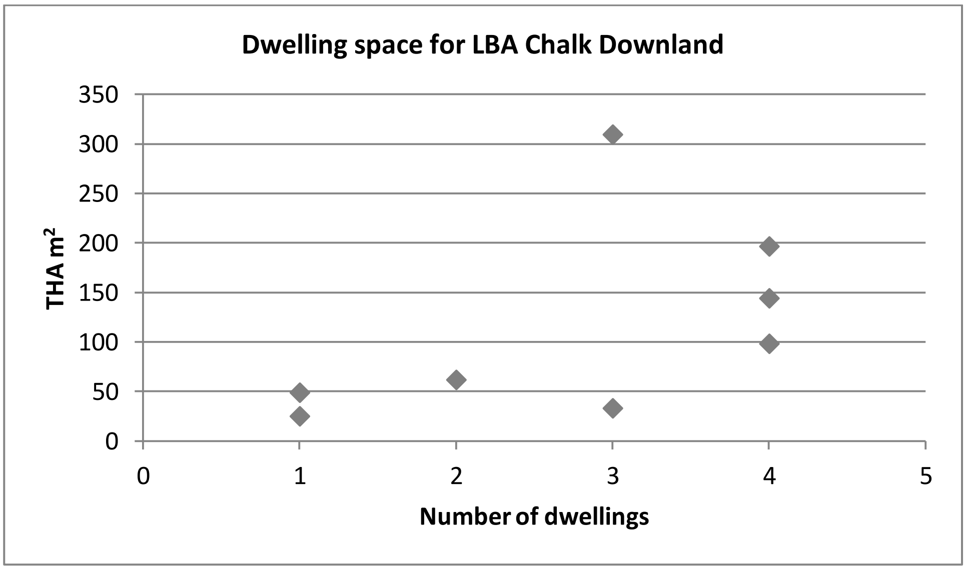


Figure 6.10 Late Bronze Age values of Total Habitable Area and number of dwellings per site in the chalk downland

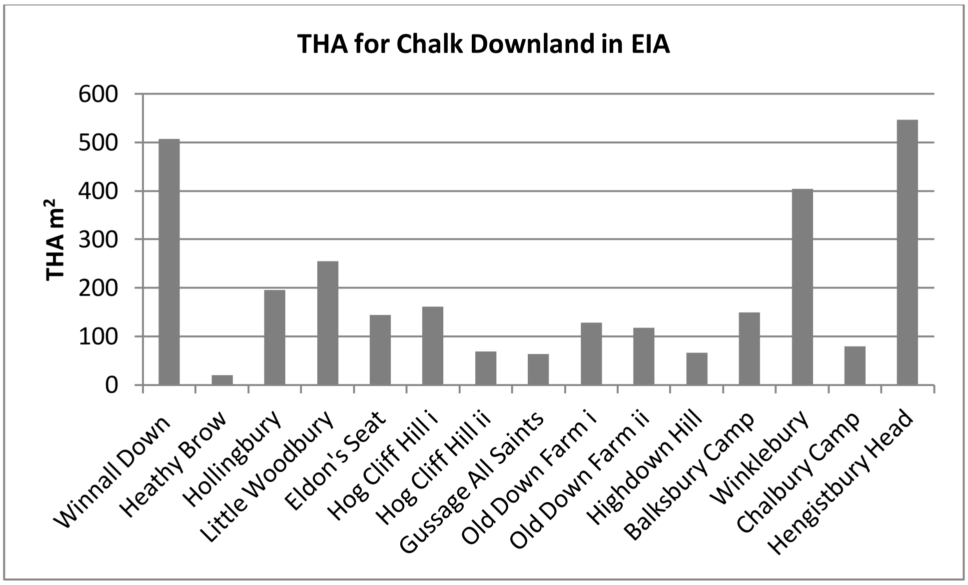
of 100<n<200 m^2. Hog Cliff Hill presented the largest THA value of over 300 m^2 (Figure 6.10). The clear difference of settlement organization between settlements with less than 100 m^2 of THA and those with larger THA values possibly represents early stages of a shift toward larger settlement groups. The larger THA values were present on settlements with more dwellings, albeit the relationship was not linear. The THA values overall were similar to the preceding period, with only Winnall Down and Hog Cliff Hill presenting larger THA values than present in the MBA, strengthening the idea of continuity in population for the region. There was no apparent reorganization of settlement structure and dispersal of population one would expect as a result of new technologies and reorganized social priorities.

The average dwelling areas were similar to the median values of the preceding period. Fifty percent were between 20<n<50 m^2. Hog Cliff Hill presented the greatest THA and the largest average dwelling size. The remaining settlements presented less than 20 m^2 of average dwelling area. A slight increase in the proportional distribution of dwelling size was apparent in the LBA. The standard deviation in dwelling size per settlement remained weighted to under 10 m^2, although the small standard deviations were overall smaller than those of the preceding period. The remaining three settlements displayed standard deviations of $13<n<35$ m^2, again within the MBA values. The range of individual dwelling size increased, with a difference of nearly 140 m^2 between the largest and smallest dwellings, compared to 74.4 m^2 in the MBA. Hog Cliff Hill, in addition to the largest THA value, also presented the greatest standard deviation, from the largest individual dwellings of the period. Unlike the previous period, and the remaining settlements of the LBA, the large variation did not indicate a dwelling of less than twenty metres squared. The smallest dwelling on Hog Cliff Hill in the LBA was 76.98 m^2, while the largest was 143.14 m^2. The large dwelling size was abnormal for the LBA chalk, although it resulted in a THA value similar to the largest settlements of the MBA in southwest England and the contemporary Thames Valley. Amberley Mount and Rams Hill, alternatively, continued the trend of small farmsteads with large standard deviations and the smallest dwelling with an area of less than twenty metres squared. The settlements with smaller standard deviations demonstrated larger, more similar dwellings more likely to be used as multi-purpose structures.

As with the contemporary settlements of the Thames Valley, enclosure dominated settlement organization. The three open settlements (Winnall Down, Mile Oak, and Amberley Mount) spanned the range of settlement size in both THA values and number of dwellings. Variation in area was not related to enclosure for the Late Bronze Age of the chalk downland, unlike both the preceding period and the contemporary Thames Valley. Overall, the comparative values of the LBA settlements in southern England suggest continuity in the farmstead pattern, as well as similarity in dwelling size. A strongly similar settlement and population per settlement pattern was apparent for the whole of southern England at the end of the Bronze Age.

The Early Iron Age presented thirteen settlements, with a total of fifteen phases of settlement. The number of dwellings per site Early Iron Age in the chalk downland was largely similar to those of the contemporary settlements in southwest England, as well as the preceding periods in the region. The majority of settlements (92%) presented one to five dwellings, suggesting individual farmsteads remained the dominant form of settlement, although with an increase in larger aggregate settlements. Winnall Down and Hengistbury Head demonstrated between eight and eleven dwellings. These larger settlements are possibly indicative of a shift in settlement organization toward larger settlements, reflecting changing social priorities toward agriculture and the land.

The Total Habitable Area per site for the Early Iron Age demonstrated a definite increase in roofed space, suggesting an increasing population in this period (Fig. 6.11). Heathy Brow, Highdown Hill, Hog Cliff Hill ii, Chalbury Camp and Gussage All Saints presented n<80 m^2. These THA values were similar to the Early Iron Age values for southwest England, again displaying continuity across southern Britain, providing evidence for inter-regional contact and similar patterns of settlement organization. The remaining settlements demonstrated a larger proportion of bigger settlements. Hollingbury, Old Down Farm i-ii, Eldon's Seat, Hog Cliff Hill i, and Balksbury Camp presented THA values of 100<n<200 m^2, while Little Woodbury presented 255.25 m^2. Winklebury, Winnall Down, and Hengistbury Head displayed 400<n<550 m^2. The number of settlements with THA values over 150 m^2 increased by nearly twenty-five percent from the LBA. Winnall Down, Eldon's Seat, and Hog Cliff Hill, which presented phases of occupation in the Late Bronze Age and Early Iron Age, demonstrated strong growth in THA,



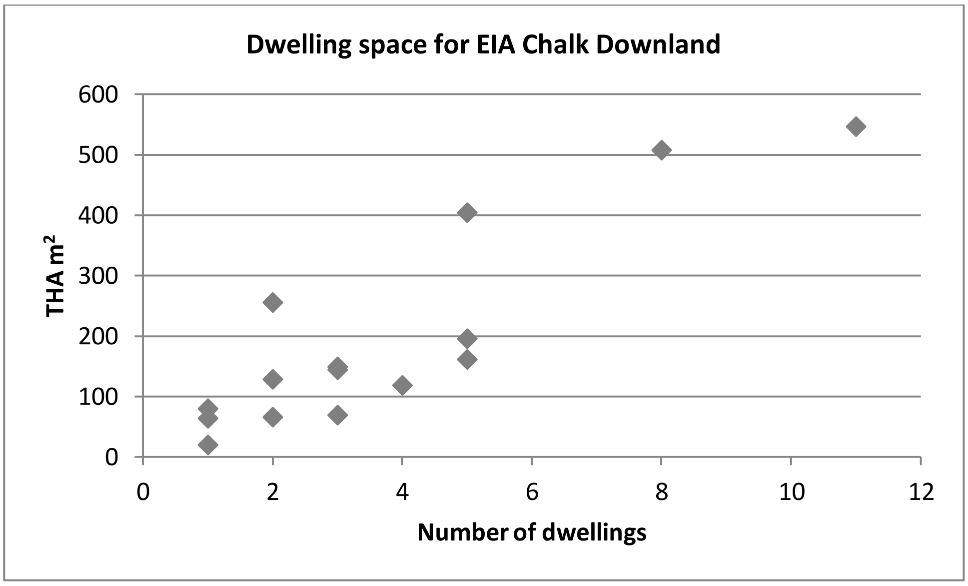


Figure 6.11 Early Iron Age values for Total Habitable Area and number of dwellings per site in the chalk downland

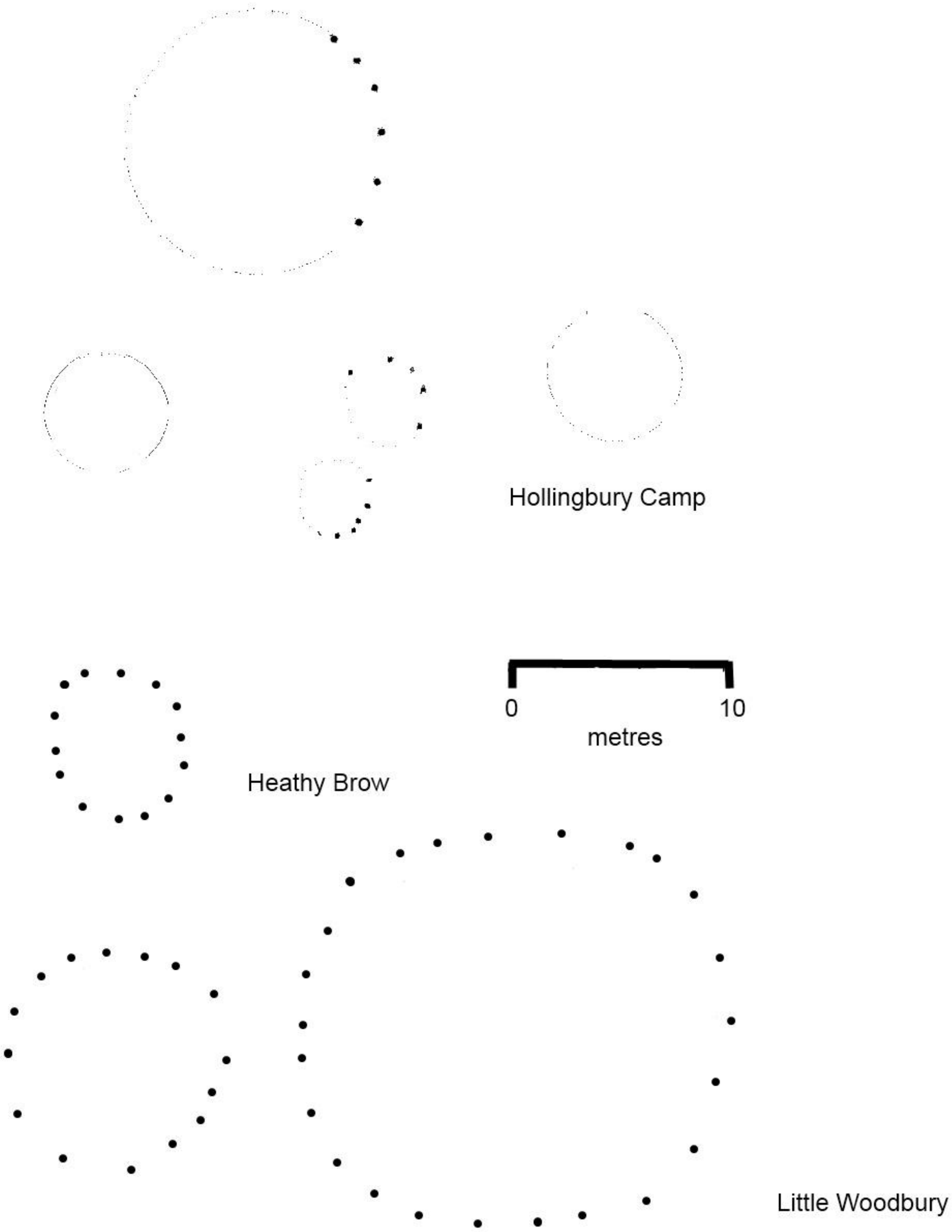


Figure 6.12 Comparison of selected EIA settlement plans. Hollingbury Camp after Holmes 1984, Heathy Brow after Bedwin 1982, Little Woodbury after Bersu 1940.

more dwellings, or both. The change in settlement organization suggests an increase in population in the latter period, as well as reorganization toward more numerous dwellings. The THA for Hog Cliff Hill decreased in the Early Iron Age, although the number of dwellings for the initial EIA phase increased. The THA for the EIA phase of Winnall Down was over two and half times larger than the preceding period, from twice as many dwellings. Eldon's Seat demonstrated a nearly equivalent THA to the preceding phase from fewer dwellings.

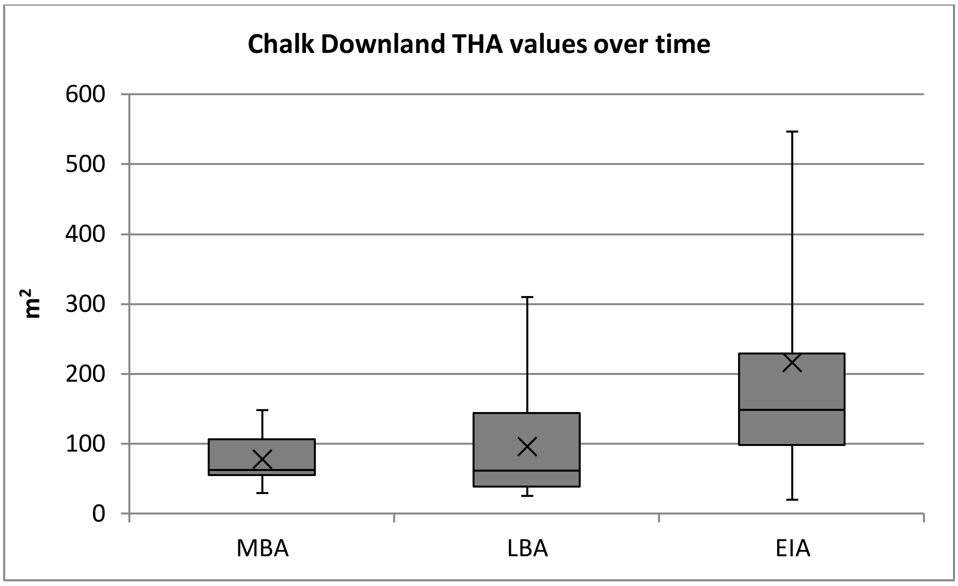


Figure 6.13 Total range of Total Habitable Area values over time for the chalk downland over time

The average dwelling size also supports an expansion of population in the Early Iron Age on the chalk. The majority of settlements presented an average dwelling size of 35<*n*<70 m^2, a definite increase from the previous period. Little Woodbury demonstrated the largest average dwelling size (n=127.63 m^2). These values are also larger than the majority of the Early Iron Age settlements in the southwest. The chalk downland was apparently more affected by a need to reorganize into larger settlements, in terms of available roofed space and number of dwellings. Interestingly, the standard deviations for dwelling size per settlement were smaller than the preceding period, which reflects the variation of the LBA settlements of southwest England. One-third of the settlements displayed 0≤*n*<10 m^2 of standard deviation, followed closely by over one-fourth with a standard deviation of 10<*n*<20 m^2. The remaining four settlements presented 30<*n*<70 m^2. Of the settlements with the largest standard deviations, Hengistbury Head and Hollingbury Camp continued the trend of at least one dwelling less than twenty metres, even as the average dwelling size increased for the period. Little Woodbury and Winnall Down were similar to the LBA phase of Hog Cliff Hill, as the smallest dwelling was over thirty square metres, yet the largest dwelling was approximately 100 square metres larger than the next (Fig. 6.12). Given the increase in dwelling size for the period, task-specific dwellings were larger, yet the standard deviations indicate a continuation of appreciable size difference on settlements. The larger standard deviations were present on settlements with more dwellings, suggesting that larger groupings of the population required and were able to construct additional structures to cater to activities central to living. A smaller proportion of settlements continued to construct dwellings of similar size, indicating the continued use of multi-functional structures. What impact this change had on consumptive architecture will be explored later.

Enclosure continued to dominate in the Early Iron Age, with a continued decrease in the proportion of open settlements. In a reversal from the earlier periods, the smallest THA value was present on an open settlement (Heathy Brow). As the majority of settlements (87%) were enclosed, THA, number of dwellings, and differentiation in dwelling size were apparently not a factor in using resources to create ramparts, banks, and ditches. Control over access to living/activity space of the settlement quite apparently became more critical for the settlements of the Early Iron Age, demonstrating at least one aspect of settlement organization that changed over the Bronze Age-Iron Age transition across southern Britain. Otherwise, the chalk downland demonstrates more of reaction in dwelling space and settlement organization over time (Fig. 6.13). A demonstrable increase in number of dwellings, size of dwellings, and total living/activity space occurred from the Bronze Age into the Iron Age, reflecting a change toward greater populations living within settlements.

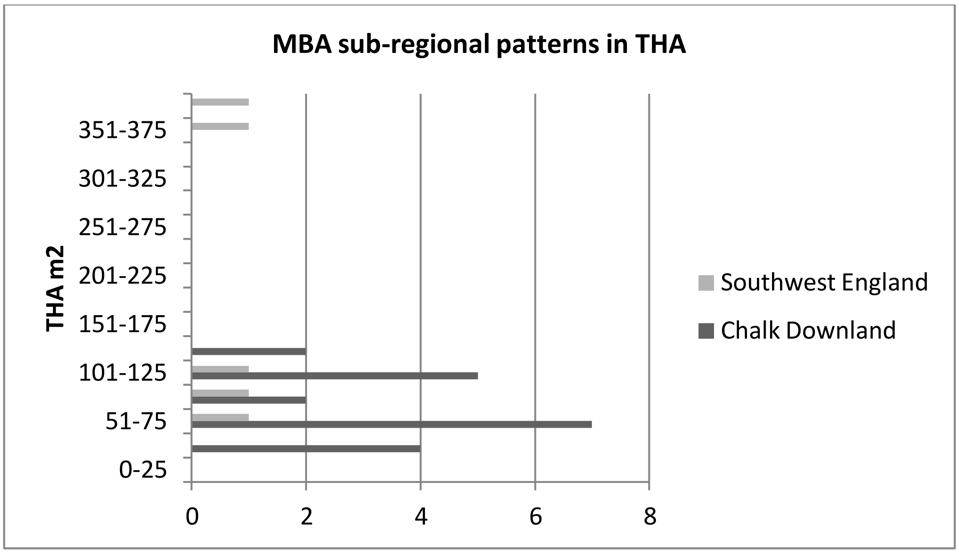
Population: Southern Britain Inter-Regionally

When the sub-regions are compared to each other within the same period, further trends are developed. Comparing the sub-regions allows for understanding of the particular requirements of each unique location, as well as providing information on dispersal of population and agricultural potential.

The Middle Bronze Age

The Middle Bronze Age was represented by the chalk downland and southwest England (Fig. 6.14). No settlements in the Thames Valley were included in this study for the period. Both the chalk downland and southwest England displayed a similar range of Total Habitable Area values, although the chalk downland presented consistently smaller values. Southwest England displayed sites with the greatest Total Habitable Areas, with Stannon Down and Trethellan Farm presenting $350<n<450$ m^2. The proportion of settlements with a THA less than 100 m^2 were similar; the chalk downland presented sixty-five percent of settlements in this range, while fifty percent of southwest England settlements were contained in this category. Similar numbers of dwellings per site were presented by both sub-regions, although southwest England presented two settlements with larger groupings of dwellings. The commonality between dwelling area and number of dwellings suggests interaction between the geographically neighbouring regions. Comparable family groupings occupied similarly organized farmsteads in the Middle Bronze Age.

Despite the similarities, the chalk downland presented smaller, more similar patterns of THA for the MBA. Enclosure was also more prevalent on the chalk, with southwest England favouring open settlements. Each sub-region displayed unique trends in dwelling size differentiation per settlement. The enclosed settlements of the chalk downland presented the largest standard deviations, indicating difference in size was more of a pattern of use. A larger living dwelling was accompanied by smaller dwellings likely used for specific activities. Southwest England presented smaller standard deviations overall, with more similarly sized dwellings per settlement. There was a trend of greater THA values resulting in comparably more variation in the sub-region. The individual dwellings were more similar per settlement, although at least one dwelling on settlements with three or more dwellings was much larger. The pattern for southwest England was more indicative of possible hierarchical architecture than the chalk.



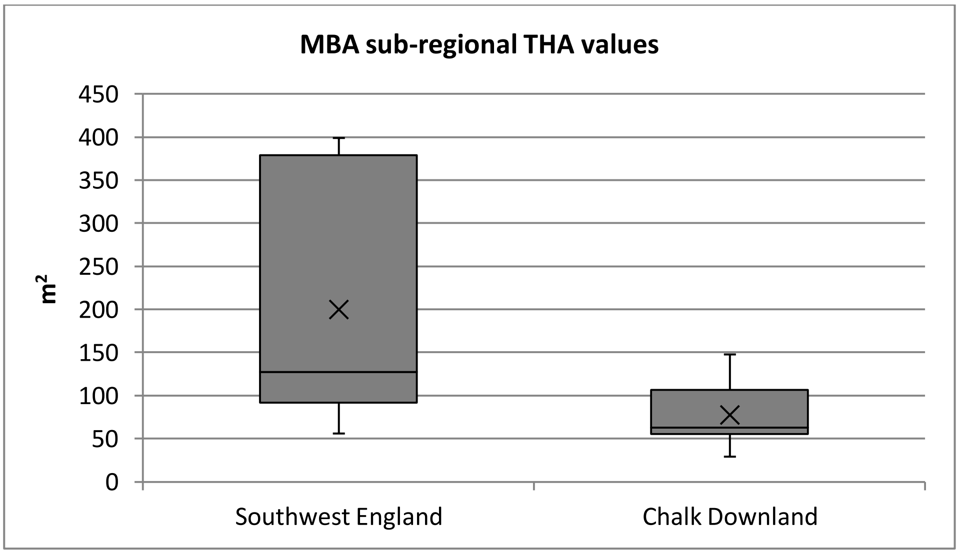


Figure 6.14 Values of Total Habitable Area for Middle Bronze Age sites by sub-region

The Late Bronze Age

All three regions presented settlements for the Late Bronze Age, of similar configuration to the preceding period (Fig. 6.15). The presence of sites in southwest England decreased, with only two sites for this period, neither of which displayed evidence for dwellings. The chalk downland retained a strong presence of settlement, with two settlements presenting THA values that surpassed the greatest amount of the MBA. The Thames Valley rose in prominence as well, presenting similar Total Habitable Areas to the chalk downland. Small farmsteads of one to four dwellings remained the ubiquitous settlement form across southern England for the period, although a slight increase in THA demonstrated by certain settlements suggests an increase in required space, which indicates a possible increase in population within the farmsteads.

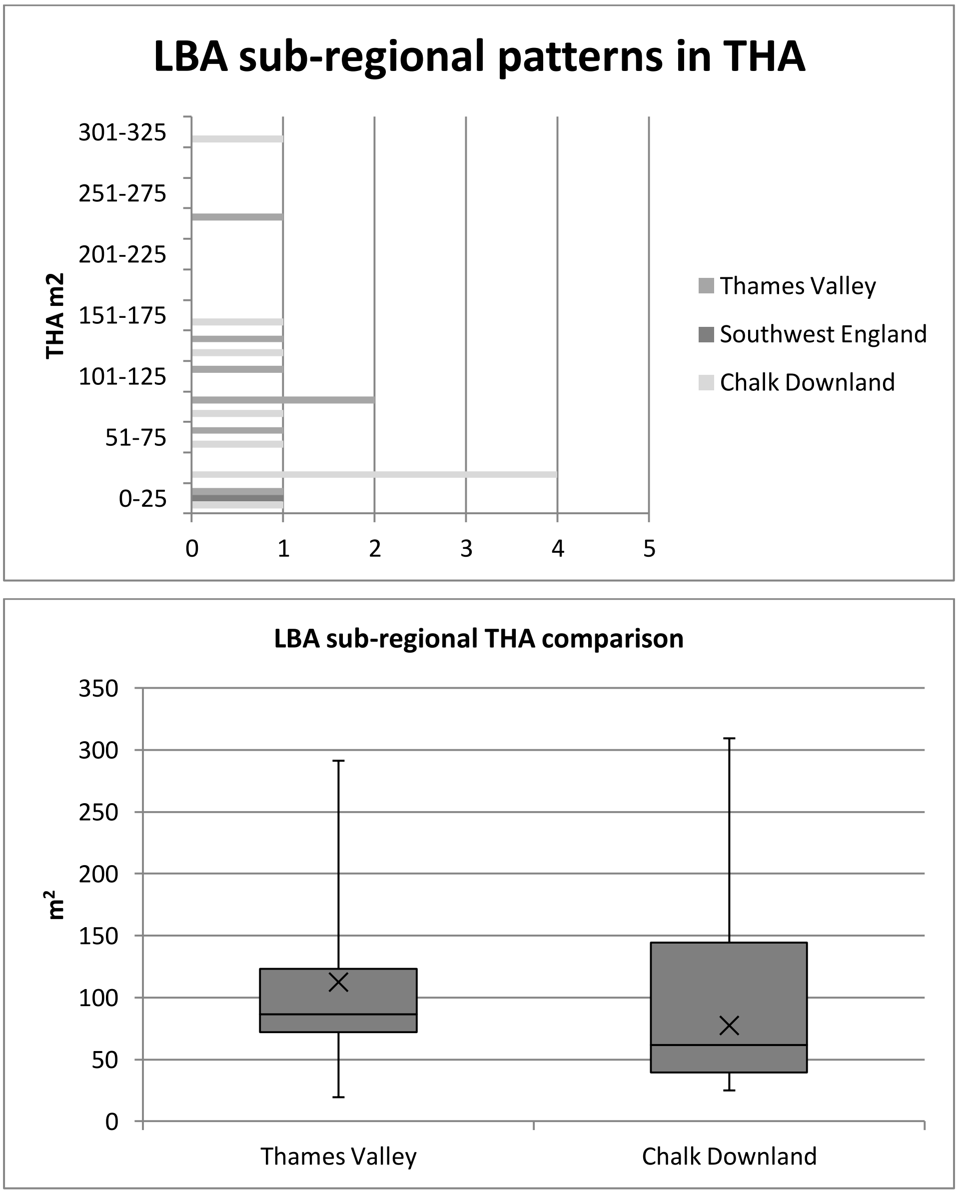


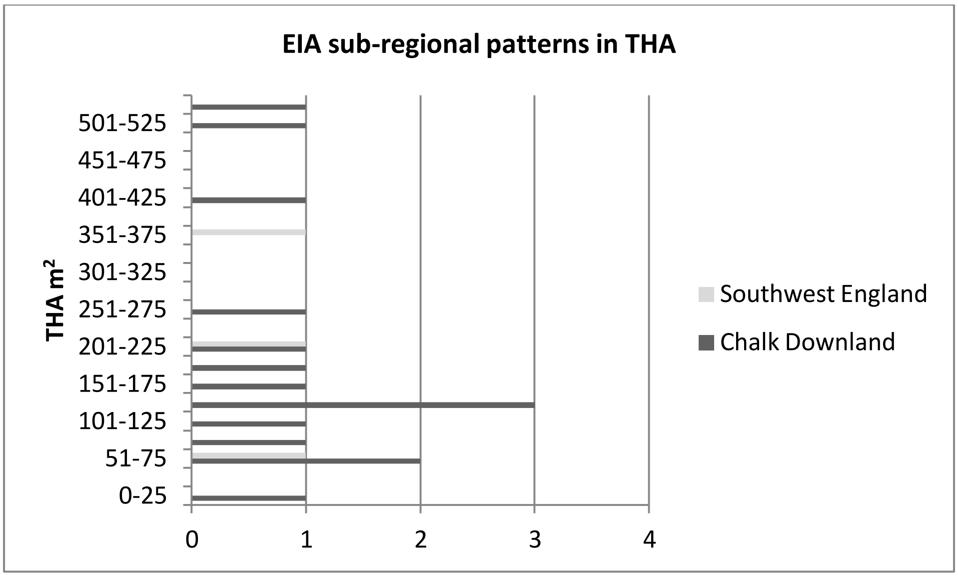
Figure 6.15 Values of Total Habitable Area for Late Bronze Age sites by sub-region

The chalk downland presented a greater range of THA values than the Thames Valley settlements. The median and average THA values for the Thames Valley were greater than the chalk, indicating a greater proportion of larger settlements on the river gravels for the LBA. Alternatively, the chalk demonstrated continuity in dwelling construction, settlement size, and standard deviation from the earlier period. A slight increase was apparent on the larger sites. Enclosure dominated in both sub-regions. Open settlements presented larger dwelling values and less variation in the Thames Valley, although there was no relationship between dwelling variables and lack of enclosure on the chalk downland.

The Early Iron Age

The Early Iron Age again demonstrates a shift in settlement patterns (Fig. 6.16). The Thames Valley appears to decline in prominence, while the chalk downland regained its dominance. Greater THA values, indicating an increased population, were present per settlement. Farmsteads of two to five dwellings remained the dominant form of settlement organization, although an increase in settlements with eight or more dwellings was apparent for the chalk downland. The settlements of the chalk downland also displayed the greatest number of dwellings and THA, which suggests the preliminary stages of a shift toward larger settlements on the more productive chalk and clay of the downland region. Southwest England presented continuity from the MBA in the Early Iron Age and presented a range of THA values within the values of the chalk. The settlements were more diverse in size, presenting a similar average THA and larger median value than the chalk.

Larger dwellings were increasingly common for both sub-regions. Two-thirds of both sub-regions presented settlements with THA values of over 100 m^2. The variation in dwelling size per settlement decreased in both sub-regions, although the chalk continued to display apparent task-specific structures. Enclosure increased on both the chalk and in southwest England, although the relationship between THA and enclosure differed. The largest settlement in southwest England was an open settlement, continuing the earlier pattern in the sub-region. The chalk downland settlements were larger when enclosed.



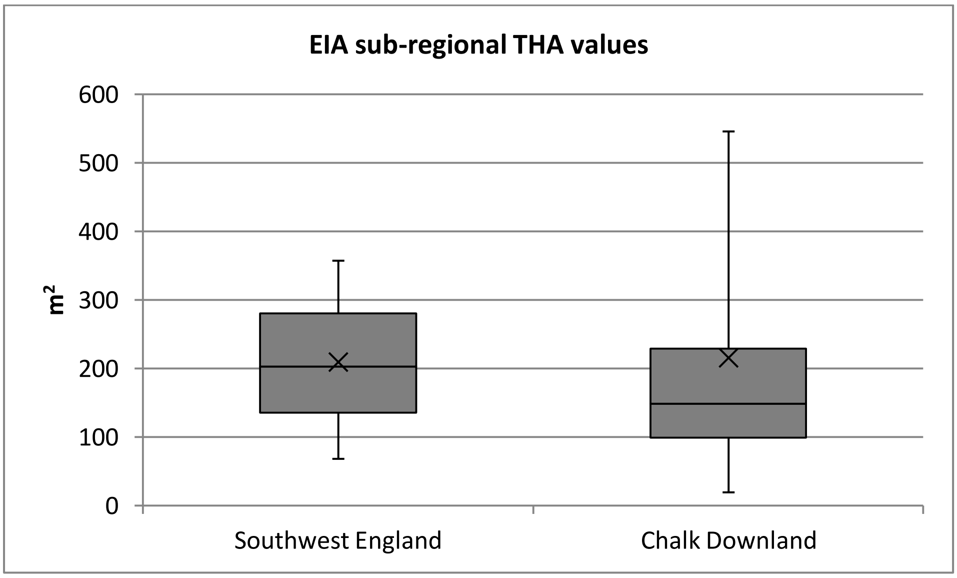


Figure 6.16 Values of Total Habitable Area for Early Iron Age sites by sub-region

Synopsis

Sub-regional trends in dwelling space are apparent. The chalk downland, while remaining a strong presence throughout, dominates in the Middle Bronze Age and again in the Early Iron Age. The Thames Valley region appears to surge into prominence in the Late Bronze Age and then fade in the Early Iron Age. Southwest England presented its strongest presence in the Middle Bronze Age, with two THA values greater than those of the chalk downland, yet declined in the succeeding periods to a lesser presence. With the exception of Mucking North Ring in the Late Bronze Age of the Thames Valley, all accounted-for multi-phased settlements were located within the chalk downland. The continuation of settlement in one location indicates a successful habitation, through either agricultural production or access to foodstuffs through exchange. The settlements that presented phases in both the MBA and the LBA, such as Brean Down and Mile Oak, along with the multi-phased settlements, such as

Itford Hill and Mucking North Ring, within those periods, appear to have decreased in available roofed floor area over time. The population was more spread out in the Late Bronze Age, with habitation in all three regions, and was likely less settled as people migrated between regions. This is in direct contrast to the trends of the multi-phased settlements in the Early Iron Age, such as Hog Cliff Hill, and the settlements, such as Winnall Down, which had both LBA and EIA phases. Those settlements displayed an increase in THA, indicating an increased and more settled population in the start of the Iron Age.

While the available Total Habitable Area increased into the Early Iron Age and sub-regional trends were apparent in dwelling construction and enclosure, there does not appear to be any evidence of major reorganization of settlement structure at the end of the Bronze Age. This is in contrast to what is expected by modelling social change as dependent on exchange routes. The dwelling evidence for southern Britain indicates continuity in settlement organization throughout the regions and over time, with new forms of larger settlement possibly beginning as early as the Middle Bronze Age.

6.2 Agricultural production

Agricultural production can be measured by the proxy of consumptive architecture in the form of storage capacity. Storage space, used for both to-be consumed materials and waste from consumption, provides data regarding the success of agricultural strategies and possible changes thereof. The deliberate construction of spaces specifically to deal with the offshoots of consumption indicates a level of agricultural production; consumptive architecture, as a throughput of energy, was created to fulfil a need. For southern Britain, storage was both above and below ground from pits and post-structures. Examining the regional variations in available storage capacity will provide insight into agricultural production over time.

Pits: southern Britain intra-regionally

Subterranean storage is prevalent in southern Britain. Pits, as stated earlier, have been considered the dominant form of agricultural consumptive architecture, with granaries making a later and likely subsidiary appearance. Much experimental research has been done on the logistic of subterranean grain storage, *e.g.* Reynolds 1974, demonstrating the likely methods and capacities of pits. The variation in capacity per site, along with location within the settlement, will provide information regarding agricultural output over time, indicating regional agricultural productivity.

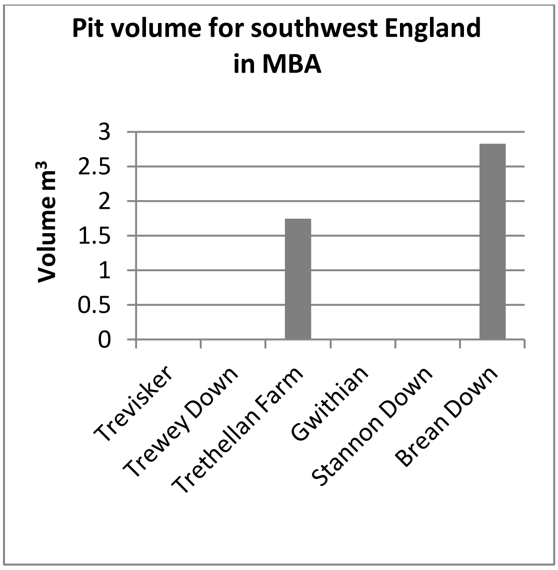
Southwest England

The acidic soil of most of southwest England has been noted as likely preventing subterranean storage as a viable agricultural storage option. There was, however, evidence of pits on certain sites that provided trends in agricultural storage over time for the sub-region (Table 6.4).

Only two settlements in southwest England displayed pits in the Middle Bronze Age (Fig. 6.17). Trethellan Farm and Brean Down presented varied number of pits, as Trethellan Farm presented evidence for thirty-four pits, while Brean Down displayed five. The total volume was also diverse, as Trethellan Farm presented 1.75 m^3 of volume, while Brean Down displayed 2.83 m^3. The average pit volume indicated drastic variability in size. Trethellan Farm presented an average volume of 0.05 m^3, contrasted to the 0.57 m^3 of average volume from Brean Down. This variation was reflected in the standard deviation of pit size per settlement, as Trethellan Farm, despite the greater number of pits, displayed more similarity in size. More similar pits, particularly in large numbers, suggest the creation of pits to fulfil very specific needs, as well as a more defined response to those needs. Brean Down presented more variability, with a range of 0.01 to 1.84 m^3, suggesting a more ad hoc approach to subterranean storage and creation of pits to suit needs at the time, rather

	SW England	**Number of Pits**	**Total Volume m^3**	**Average Pit Volume m^3**	**Standard Deviation S_X m^2**	**Period**
	Trevisker	0	0	N/A	N/A	MBA
	Trewey Down	0	0	N/A	N/A	MBA
	Trethellan Farm	32	1.75	0.05	0.06	MBA
	Gwithian	0	0	N/A	N/A	MBA
	Stannon Down	0	0	N/A	N/A	MBA
	Brean Down	5	2.83	0.57	0.74	MBA
Totals	6	7	4.58	2.29	0.76	
	Brean Down	1	2.45	2.45	N/A	LBA
	Cadbury Castle	1	0.36	0.36	N/A	LBA
Totals	2	2	2.81	1.4	1.48	
	Cadbury Castle	0	0	N/A	N/A	EIA
	Gurnard's Head	2	0.11	0.06	0.01	EIA
	Pilsdon Pen	3	2.13	0.71	0.42	EIA
Totals	3	5	2.24	1.1	1.48	

Table 6.4 Values for pits and total pit volume in southwest England



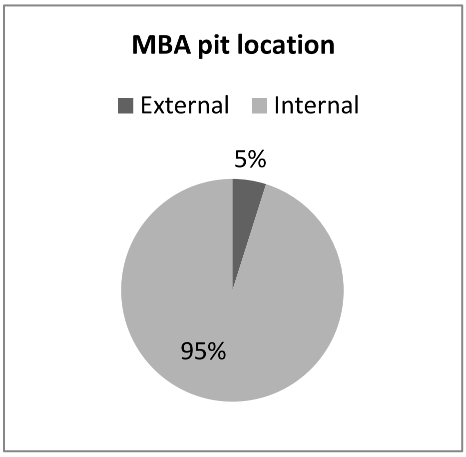


Figure 6.17 Middle Bronze Age values of total pit volume and pit location in southwest England

than a series of smaller pits that combined fulfil a storage requirement. The larger pits of Brean Down were more similar to Bersu's (1940) determination of pits at least one cubic metre in volume as viable storage. As discussed in the previous chapter, smaller pits are not discounted as consumptive architecture, as they were the deliberate throughput of energy. The noted disparity in size, similarity, and total pit volume is strongly indicative of varied levels of production requiring individual responses. The majority of pits were internal to structures, similar to the results for the Middle Bronze Age of southern Britain as a whole. Both settlements with pits were open, which may reflect more on the dominance of unenclosed settlements than on pit presence. The lack of pits in the remaining settlements again is not necessarily a reflection of a lack of production; Stannon Down presented large dwellings, which could have stored grain internally without the use of pits in inhospitable soil, and post-structures were present on a number of sites, discussed in detail in the following section.

In the Late Bronze Age, both settlements of southwest England, located on less acidic soil than the majority of Middle Bronze Age settlements, presented evidence of pits (Fig. 6.18). Brean Down displayed a decline in the number of subterranean storage pits, decreasing from five in the Middle Bronze Age to one in the Late Bronze Age. The decrease reflects the decline in observed dwellings for the site from the MBA to the LBA, which may indicate changing use of the site. Cadbury Castle also produced evidence of a single pit for the period. Again, there was disparity in the total volume per site, as Brean Down provided 2.45 m^3, decreasing from the previous period, while Cadbury Castle presented 0.36 m^3. Brean Down presented a much larger pit than any from its previous phase, despite the decline in total pit volume. The pit at Cadbury Castle was similar to two of the MBA pits on both Trethellan Farm and Brean Down, and was much larger than the majority of individual pits on Trethellan Farm.

The location of pits changed in this period, with both pits external to structures. Given that no dwellings were excavated for the period, the assumption of external pits is ambiguous, although rational. The flaw in accepting location without hard evidence is the correlation in size and location of pits discussed in the previous chapter. Larger pits were more likely to be external with smaller pits internal for differing storage needs, long-term versus immediate access. Cadbury Castle presented only 0.36 m^3 of total pit volume, which is anomalously undersized for an external pit. Without evidence of dwellings, however, classification as an external pit is unavoidable. Both settlements were open and the appearance of solely external pits marked a change from the previous period. The general trend for the region as a whole was an increasing appearance of external pits on both enclosed and open settlements, although there tended to be a more apparent size difference toward larger external pits than the settlements of the southwest suggest. As with dwellings, the southwest appears to have been less affected by the general trends of settlement organization for southern Britain as a region.

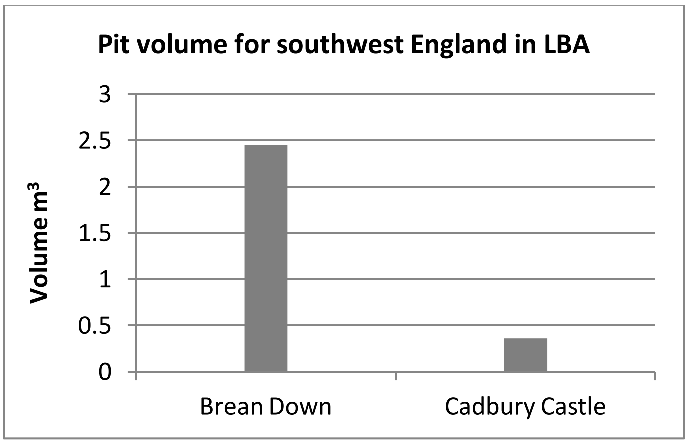


Figure 6.18 Late Bronze Age values of total pit volume in southwest England

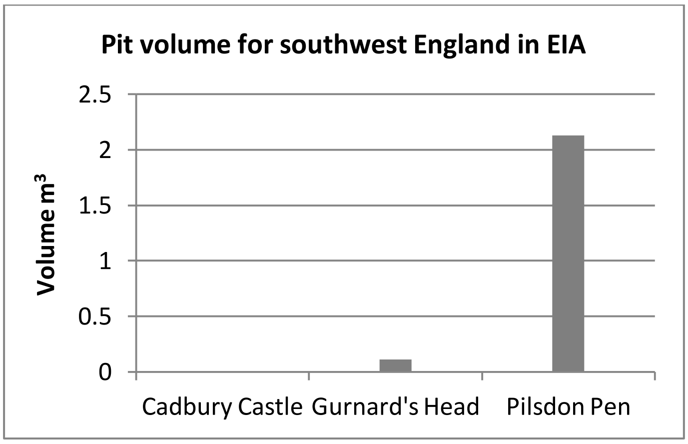


Figure 6.19 Early Iron Age values of total pit volume in southwest England

Only one of the Early Iron Age settlements did not present pit evidence (Fig. 6.19). Cadbury Castle did not present any distinguishable pit evidence in this period, although phasing on the site is difficult. Gurnard's Head demonstrated two pits. Pilsdon Pen presented three pits. The total pit volume declined from the previous periods. Gurnard's Head presented 0.11 m^3, a value greatly reduced from the previous periods. Pilsdon Pen displayed a greater total pit capacity of 2.13 m^3. The disparity in total pit volume is not directly related to THA values for the period. Cadbury Castle presented a larger THA than Gurnard's Head, yet did not present securely dated pits. Pilsdon Pen, however, presented a much larger THA than Gurnard's Head, which is reflected in the general trend of pit capacity. The average pit volume per site also declined in the Early Iron Age, suggesting that pits were not as important to agricultural storage over time in the sub-region (Fig. 6.20). Continuing the reversal of general trends for pits across southern Britain, Gurnard's Head contained pits internal to structures, similar to the Middle Bronze Age, and suggestive of use as daily storage, rather than long-term surplus storage. Pilsdon Pen presented only external pits, which were larger than the pit at Gurnard's Head, following the regional trend. Both EIA settlements with pits were enclosed, yet the smaller, internal pits are counter to the majority of EIA settlements. Southwest England displayed patterns of settlement organization contrary to conventional and expected trends. The decrease in pit capacity over time does appear to be a decline in agricultural production, with fewer, smaller pits being constructed. While pits are uncommon for the sub-region, the pits that are present clearly demonstrate a decrease in available subterranean consumptive architecture. There was variability in the individual dwelling areas on both Gurnard's Head and Pilsdon Pen that could indicate a contrast between living and activity areas, as discussed above. Storage above ground could have taken place within

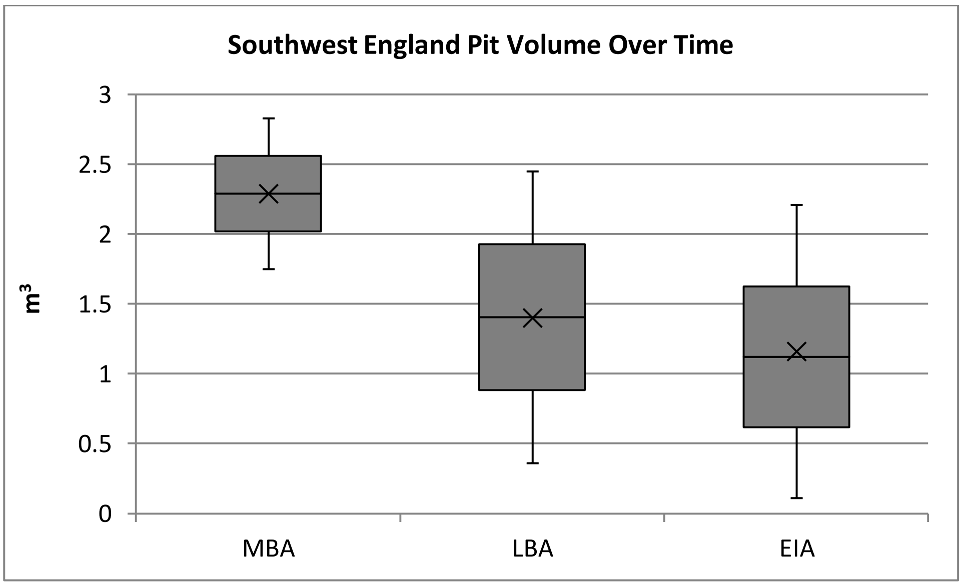


Figure 6.20 Total range of total pit volume over time for southwest England. X indicates average pit volume.

dwellings, yet left no trace in the archaeological record. Before further conclusions regarding agricultural production and the impact of iron technologies and social reorganization can be made, post-structure presence must be examined, particularly given the lack of suitability for pits in southwest England.

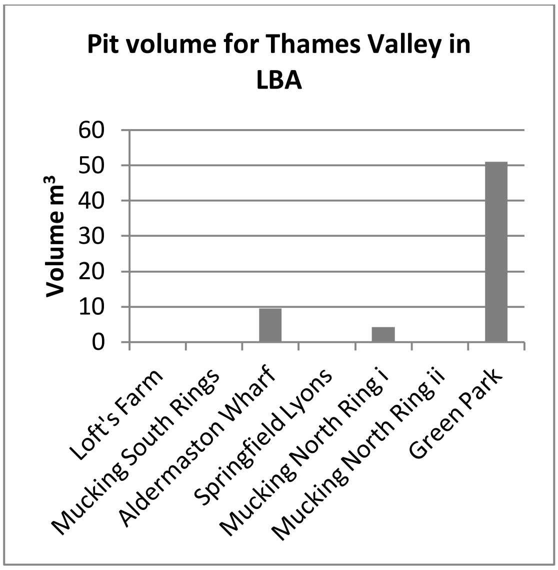
The Thames Valley

The Thames Valley presented different patterns in subterranean storage from southwest England (Table 6.5). Three of the settlements in the Late Bronze Age presented evidence of pits. Mucking North Ring i displayed nine pits, while Green Park and Aldermaston Wharf presented sixty-eight and forty-nine, respectively. The total volume of pits per site was also a large range, with Aldermaston Wharf and Mucking North Ring presenting less than ten cubic metres, while Green Park displayed an incredible 51.06 m^3 (Fig. 6.21). The average pit volume per site continued to display variety, with an average volume per pit of $0.20<n<0.75$ m^3. These values were less than the Late Bronze Age in southwest England, yet both the total pit volume and number of pits per site were greater in the Thames Valley. The greater total pit volumes suggest either a greater production in the Thames Valley or alternate storage in southwest England.

The location of pits followed the general pattern for southern Britain discussed in the previous chapter, as the majority of pits (98%) were external to structures. Given the high numbers of pits per settlement, the external location makes sense, as exterior pits allow more choice in location selection than those constrained to the interior of dwellings. Two of the three settlements with pits were enclosed, although the largest pit capacity was present on an open settlement. Internal and external pits were located on both enclosed and open

Thames Valley	**Number of Pits**	**Total Volume m^3**	**Average Pit Volume m^3**	**Standard Deviation S_X m^2**	**Period**
Springfield Lyons	0	0	N/A	N/A	LBA
Mucking North Ring i	9	4.19	0.47	0.30	LBA
Mucking North Ring ii	0	0	N/A	N/A	LBA
Green Park	68	51.09	0.75	0.84	LBA
Loft's Farm	0	0	N/A	N/A	LBA
Aldermaston Wharf	49	9.56	0.21	0.1	LBA
Mucking South Ring	0	0	N/A	N/A	LBA
Totals 7	126	64.84	21.61	25.67	

Table 6.5 Values for pits and total pit volume in the Thames Valley



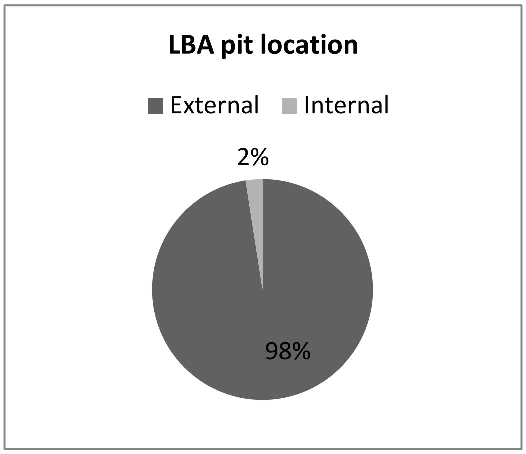


Figure 6.21 Late Bronze Age values of total pit volume and pit location in the Thames Valley

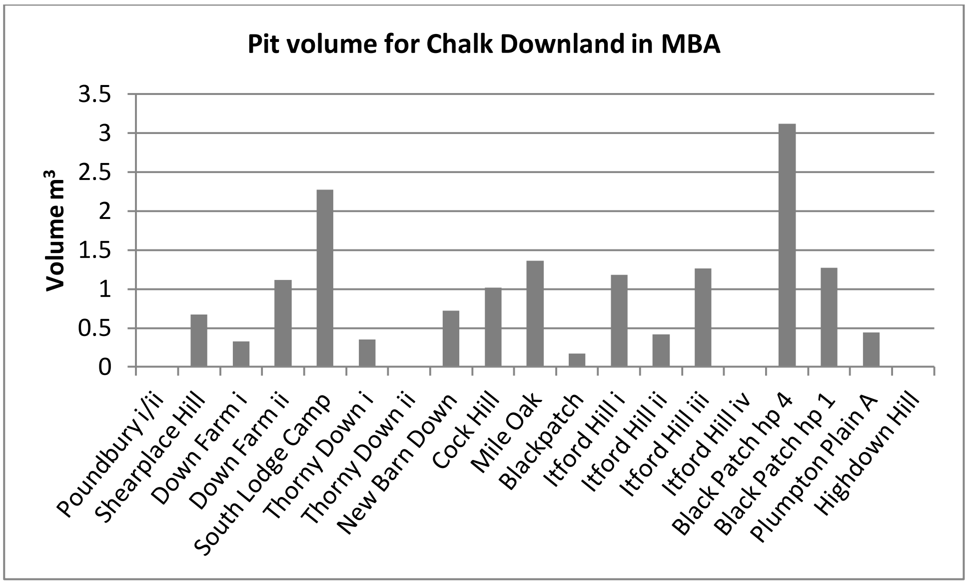
settlements, again following the trend for southern Britain as a whole. The largest variation in pit size was present on the settlements with both internal and external pits, further suggesting location was a function of pit size. The presence of larger, external pits for the period indicates a greater need for agricultural storage than apparent in the contemporary settlements of the southwest. Even if the pits were not used concurrently, but rather consecutively, the larger total pit volumes suggest a greater need for subterranean storage in the Late Bronze Age for the Thames Valley than for southwest England. The settlements without pits must be examined for evidence of post-structures before determination can be made as to the full state of consumptive architecture in the Thames Valley. Differing trends of consumptive architecture portray a lack of standardized settlement organization and perhaps differing influences regarding the investment of energy in developing above or below ground storage.

The Chalk Downland

The Middle Bronze Age of the chalk downland presented stronger pit presence than that of southwest England (Table 6.6). Only four settlements did not present evidence of pits (Fig. 6.22). Three of the settlements without pits presented at least one much smaller dwelling, where storage could have taken place within activity areas without a need for consumptive architecture. Such multi-functional architecture would suggest a smaller productive amount than the settlements with dedicated consumptive architecture. Of the settlements with pits, eleven (55%) displayed one to four pits. Black Patch hut platform 4 and Itford Hill i presented five pits each, while Mile Oak presented six pits. Down Farm ii presented the most pits (n=7).

	Chalk Downland	Number of Pits	Total Volume m^3	Average Pit Volume m^3	Standard Deviation s_X m^2	Period
	Poundbury i/ii	0	0	N/A	N/A	MBA
	Shearplace Hill	1	0.67	0.67	N/A	MBA
	Down Farm i	1	0.33	0.33	N/A	MBA
	Down Farm ii	7	1.12	0.16	0.1	MBA
	South Lodge Camp	2	2.27	1.14	0.39	MBA
	Thorny Down i	3	0.35	0.12	0.11	MBA
	Thorny Down ii	0	0	N/A	N/A	MBA
	New Barn Down	1	0.72	0.72	N/A	MBA
	Cock Hill	2	1.02	0.51	0.42	MBA
	Blackpatch	1	0.17	0.17	N/A	MBA
	Mile Oak	6	1.36	0.23	0.11	MBA
	Itford Hill i	5	1.18	0.24	0.29	MBA
	Itford Hill ii	3	0.42	0.14	0.09	MBA
	Itford Hill iii	4	1.26	0.32	0.21	MBA
	Itford Hill iv	0	0	N/A	N/A	MBA
	Black Patch hut platform 4	5	3.12	0.62	0.59	MBA
	Black Patch hut platform 1	1	1.27	1.27	N/A	MBA
	Plumpton Plain A	1	0.44	0.44	N/A	MBA
	Highdown Hill	0	0	N/A	N/A	MBA
Totals	20	43	15.7	1.05	0.79	
	Eldon's Seat	0	0	N/A	N/A	LBA
	Plumpton Plain B	3	0.54	0.18	0.14	LBA
	Amberley Mount	1	0.86	0.86	N/A	LBA
	Mile Oak	1	0.37	0.37	N/A	LBA
	The Caburn	12	12.27	1.6	0	LBA
	Winnall Down	1	0.02	0.02	N/A	LBA
	Hog Cliff Hill	0	0	N/A	N/A	LBA
	Rams Hill	6	1.61	0.27	0.20	LBA
Totals	8	24	299.21	2.61	4.76	
	Eldon's Seat	1	0.01	0.01	N/A	EIA
	Highdown Hill	0	0	N/A	N/A	EIA
	Winnall Down	27	38.34	1.42	2.04	EIA
	Hog Cliff Hill i	1	0.21	0.21	N/A	EIA
	Hog Cliff Hill ii	7	6.07	0.87	0.7	EIA
	Old Down Farm i	25	76.45	3.06	1.70	EIA
	Old Down Farm ii	17	53.98	3.18	1.84	EIA
	Gussage All Saints	86	154.00	1.79	1.18	EIA
	Little Woodbury	71	240.06	3.38	10.19	EIA
	Hollingbury	3	2.05	0.68	0.15	EIA
	Heathy Brow	0	0	N/A	N/A	EIA
	Winklebury Camp	3	4.33	1.44	0.84	EIA
	Chalbury Camp	1	2.21	2.21	N/A	EIA
	Balksbury Camp	27	100.49	3.72	4.34	EIA
	Hengistbury Head	0	0	N/A	N/A	EIA
Totals	15	268	678.19	56.51	75.93	

Table 6.6 Values for pits and total pit volume in chalk downland



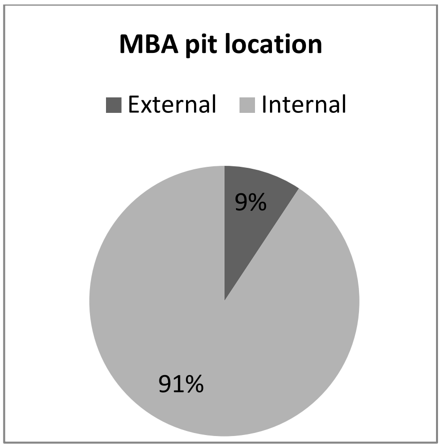


Figure 6.22 Middle Bronze Age values of total pit volume and pit location in the chalk downland

The chalk downland displayed fewer pits per site for the Middle Bronze Age than southwest England, although a higher percentage of settlements (75% to 25%) contained pits. Pits were apparently more utilized in the chalk downland, which suggests a more localized and successful production strategy, although alternate storage on the acidic soils of southwest England is also possible and would allow for similar production and storage needs. The pit evidence, however, strongly indicates two different production/storage traditions between the chalk downland and southwest England.

Seven settlements (Shearplace Hill, Down Farm i, Thorny Down i, New Barn Down, Blackpatch, Itford Hill ii, and Plumpton Plain A) presented total volumes from pits of less than one cubic metre. Five settlements (Down Farm ii, Cock Hill, Mile Oak, Itford Hill i/iii, Black Patch hut platform 1) presented total volumes of $1<n<2$ m^3. South Lodge Camp and Black Patch hut platform 4 displayed the largest total pit volume, with 2.27 m^3 and 3.12 m^3, respectively. Only Black Patch hut platform 4 had correspondingly large values of total pit volume and THA; storage capacity therefore does not appear to be related to population.

South Lodge Camp and Thorny Down ii presented similar THA values, yet only the former presented evidence of pits, and a large pit capacity at that. The lack of correlation between population and production could indicate production for exchange, rather than use by the initial harvesters.

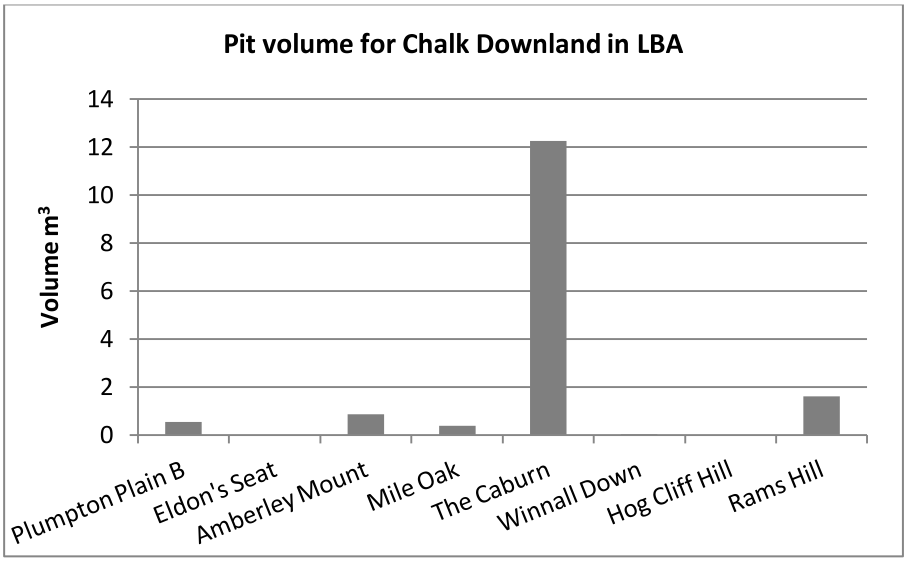
The average volume per pit was more consistent, indicating similarity in pit construction. The majority of sites (65%) presented an average pit volume of $n<1$ m^3. Black Patch hut platforms 1 and South Lodge Camp presented much larger average pit volumes of over 1 m^3. The majority of average values were consistent with those of southwest England for the Middle Bronze Age, suggesting some similarity in size across the regions. Pit location was also similar, as pits in both regions were predominantly internal to dwellings. South Lodge Camp and Trethellan Farm, containing large total pit volumes, presented both internal and external pits, which supports the suggestion of different strategies based on size and location. Smaller internal pits for daily use and larger external pits for long-term storage can be inferred from the data.

The deviations in pit size per settlement were between the values demonstrated by the contemporary southwest settlements. There was greater similarity in the standard deviations demonstrated by the settlements on the chalk downland, as all values were less than 0.6 m^3, suggesting similar construction techniques. There was more variety in pit form on the chalk than in the southwest, which was likely the cause of greater variation on settlements with fewer pits, such as South Lodge Camp and Cock Hill. Total pit capacity was not a factor in pit variation, nor was a greater number of pits responsible for more variation as might be expected.

Enclosure was also not responsible for pit presence, pit size, or total pit capacity. The second largest number of pits was found on an open settlement (Mile Oak), while all four settlements without pits were located on enclosed settlements. Both the largest and smallest total pit volumes were on enclosed settlements, as were internal and external pits. All external pits were located on enclosed settlements, suggesting a need to control access to more exposed storage.

Six of the eight settlements in the Late Bronze Age displayed evidence for pits, maintaining the proportion (75%) of pit presence from the previous period (Fig. 6.23). Amberley Mount, Mile Oak, Plumpton Plain B, and Winnall Down displayed one to three pits, similar to the number of pits per site for the LBA of southwest England. Rams Hill presented six pits, while the Caburn presented twelve. While fewer total pits per site than the preceding period and that of the contemporary Thames Valley were present, the total volume per settlement largely remained similar. The settlements with one to three pits presented less than one cubic metre of total volume. Rams Hill presented 1.61 m^3 of pit volume. The Caburn displayed the greatest total volume with 12.27 m^3. Pit volume was definitively linked to number of pits.

The average pit volumes were also similar to the preceding period and to the Late Bronze Age values for southwest England and the Thames Valley. All but the Caburn presented an average pit volume of less than one cubic metre. The differentiation, on the other hand, was the reverse of what could be logically expected, given the number of pits per settlement, as the Caburn presented the least amount of standard deviation, followed by Rams Hill and Plumpton Plain B. As with southwest England in the MBA, the larger number of more similar pits suggests a very specific response to subterranean storage needs, while more variation indicates creation of pits in direct response to storage needs at the moment of creation. The variation in pit size overall demonstrates differing production results, with production similar overall to the previous period, although the Caburn demonstrated significant increase from the available subterranean storage of the MBA.



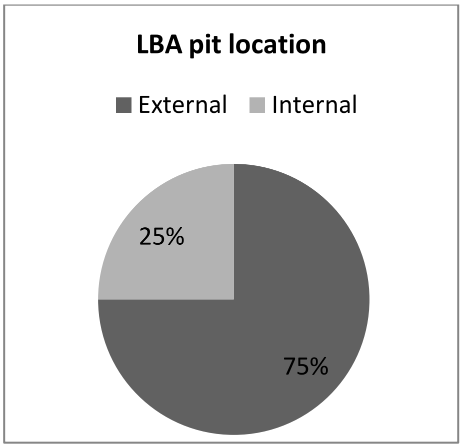


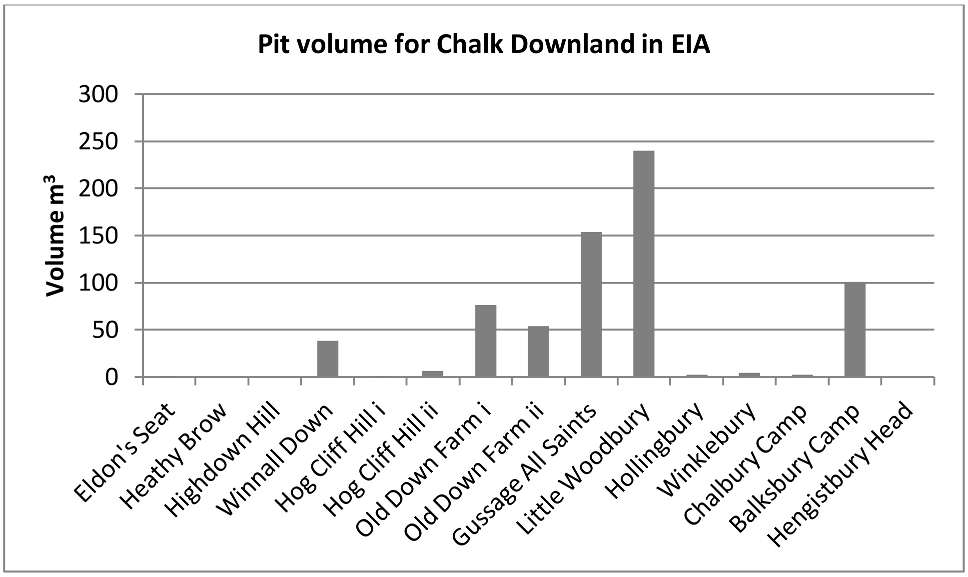
Figure 6.23 Late Bronze Age values of total pit volume and pit location in the chalk downland

The location of pits demonstrated significant change, as ninety-one percent of pits were external to dwellings in the Late Bronze Age, reversing the trend of the previous period and making external pits the dominant form. Size was not a significant factor in the change in location, nor was there a greater number of pits per site; the shift in location is not necessarily attributable to greater need for storage. An alternate strategy, for instance longer-term storage external to dwellings, is a rational explanation for the shift in location. Enclosure on the other hand, played a more overt role in pit location and pit size, as all open settlements contained internal pits. External pits were largely relegated to enclosed settlements. There was a little crossover, as Plumpton Plain B was an enclosed settlement with only internal pits and Mile Oak, an open settlement, contained both internal and external pits. The largest number of pits and the greatest total pit capacities were located on enclosed settlements, making a more definite switch from the preceding period. The location of pits was more similar to the Thames Valley, although a clearer distinction between enclosed and open settlements was more apparent for the chalk downland.

The Early Iron Age demonstrated growth in both number of pits and volume (Fig. 6.24). All but three settlements (Highdown Hill, Heathy Brow, and Hengistbury Head) presented evidence for pits, increasing the proportion to eighty percent. Five settlements (Hollingbury, Eldon's Seat, Winklebury, Pilsdon Pen, and Hog Cliff Hill i) presented one to three pits, while Winnall Down, Balksbury Camp, and Old Down Farm i-ii displayed evidence for fifteen to thirty pits. Gussage All Saints and Little Woodbury displayed between seventy and ninety pits. These values are much larger than the preceding periods in the chalk downland and the contemporary values for the southwest, indicating a need for more subterranean consumptive architecture in the Early Iron Age. The increase in energy devoted to construction of pits is a distinct change from the Bronze Age patterns.

The total volumes from pits support a growth in available pit storage. Eldon's Seat, Hog Cliff Hill i-ii, Hollingbury, Winklebury, and Chalbury Camp presented total pit volumes of $n<10$ m^3. Winnall Down, Old Down Farm i and ii presented total pit volumes of $30<n<80$ m^3. Balksbury Camp presented approximately 100 m^3 of total pit volume. Gussage All Saints and Little Woodbury presented a total volume $150<n<250$ m^3. Given that all contemporary pit volumes for southwest England were less than three cubic metres, this is a significant amount of available subterranean storage. The five settlements with the least amount of total pit volume presented an average pit volume of less than one cubic metre. Winnall Down, Gussage All Saints, and Winklebury presented an average pit volume of one to two cubic metres. The remaining settlements presented much larger average pit volumes of $3<n<3.5$ m^3. These values, larger than the average pit sizes for southwest England for the period, were present on the settlements with the largest total pit volumes and (excepting Winklebury) the most pits per settlement. This demonstrates a change in the allocation of energy toward larger, more numerous pits.

The variation in pit volumes per settlement was not a function of number of pits or total pit volume. Little Woodbury and Balksbury Camp presented the largest standard deviations, from vastly different numbers and total volume of pits. A small majority of settlements presented standard deviations in pit size of less than one cubic metre, similar to the preceding period, while the remaining settlements presented much greater variation. Pit construction was therefore more varied both between and within settlements in the Early Iron Age, likely a reflection of greater variety of pit form than in previous periods. The EIA settlements of the chalk demonstrated an increase in types of pits; the Bronze Age settlements largely demonstrated cylindrical and hemispherical pits, while the start of the Iron Age saw the inception of frustum, barrel, bell, and other forms of pits (see Chapter IV and Appendix A).



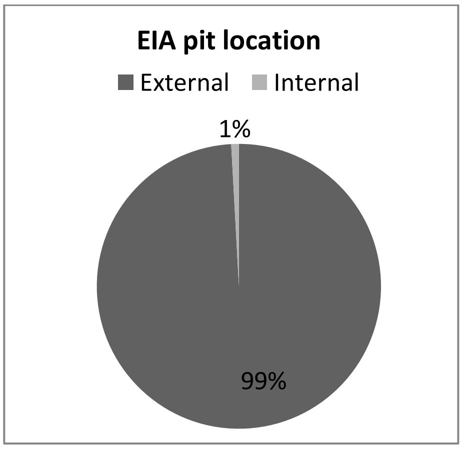


Figure 6.24 Early Iron Age values of total pit volume and pit location in the chalk downland

Barrel pits were increasingly common on settlements with greater numbers of pits, although variety continued to exist, creating much larger standard deviations of pit volume per settlement.

As can now be expected of larger pits, nearly all of the pits (99%) in the Early Iron Age of the chalk downland were external to dwellings, following the pattern for southern Britain demonstrated in the previous chapter. Only the settlements with the smallest total pit volumes (Eldon's Seat, Chalbury Camp, and Hog Cliff Hill i) displayed internal pits, again suggesting pit location was a function of pit size. The argument for enclosure as a factor in pit location is strengthened by all but one settlement with pits being enclosed. Total pit volume and pit size, however, were not a function of enclosure, as the entire range of each variable was present on enclosed settlements.

Unlike the previous periods, the Early Iron Age displayed an increase in number of pits per settlement and total volume of pits (Fig. 6.25), suggesting a greater need for agricultural storage. The exponential increase in available subterranean consumptive space in the Early Iron Age, following from a small increase in the Late Bronze Age, clearly demonstrates an increase in devotion of energy toward agricultural production. Despite this overall increase, settlements with small amounts of consumptive space remained into the Early Iron Age; not all settlements possessed storage capable of supporting their populations. The chalk downland dominated the period in regard to THA values, indicating greater settlement populations. The chalk downland displayed greater variety in available storage over time than its neighbours, perhaps suggesting more cooperation between settlements as a consequence of changing social organization.

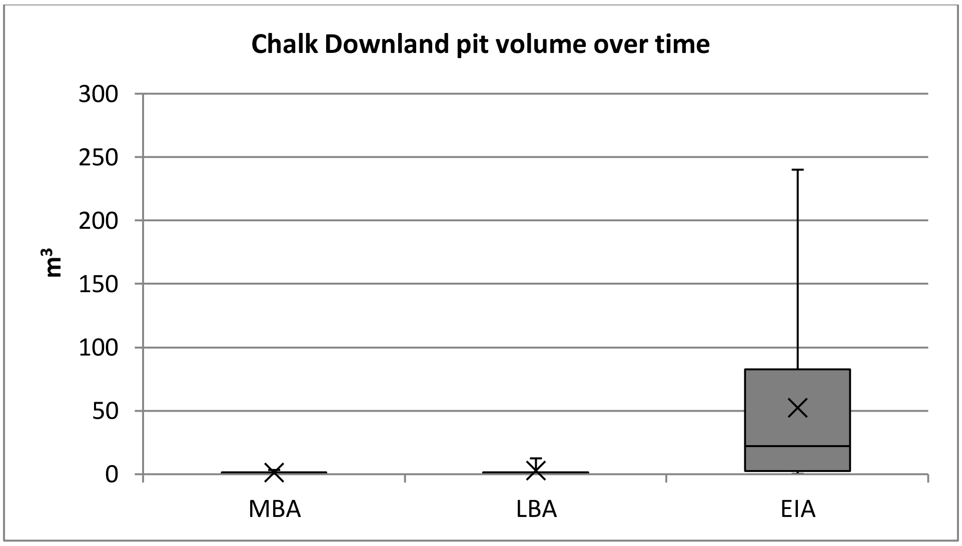


Figure 6.25 Total range of total pit volumes over time for the chalk downland

Pits: southern Britain inter-regionally

The Middle Bronze Age

The Middle Bronze Age demonstrated a strong tendency toward sites with a scattering of small, internal pits (Fig. 6.26). The chalk downland settlements had a stronger pit presence, with seventy-five percent of settlements providing evidence for subterranean storage, while only twenty-five percent of settlements in the southwest England region presented pits. While Trethellan Farm in southwest England presented the greatest number of pits for the period, pits were more consistent in number and volume across the chalk downland. Given the inhospitable soil in southwest England, alternate storage strategies may have taken precedence over pits, providing a different strategy to contemporary settlements on the chalk.

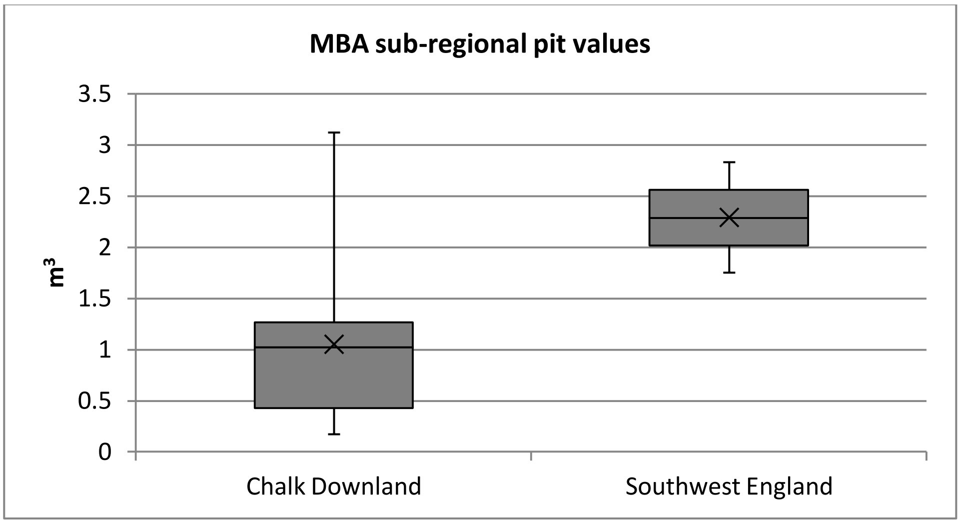


Figure 6.26 Total range of total pit volumes for the Middle Bronze Age by sub-region

The average pit volume for southwest England was much greater than that of the chalk and the total pit volumes were greater by nearly one cubic metre. The range of pit volumes for the chalk was greater than southwest England, indicating more variety in production via differences in energy devoted to the creation of subterranean consumptive space. The greater proportion of settlements with smaller amounts of pit volume in the chalk downland may not be a direct commentary on greater production, given the acidic soil of the southwest and the comparably large total pit volumes on the settlements where pits were present. The chalk downland may have presented more consistent amounts of pit volume, yet the larger amounts available on the settlements of the southwest indicate a greater requirement for storage on the settlements with pits.

The Late Bronze Age

In the Late Bronze Age, pits appear in all three regions (Fig. 6.27). With the exception of the Caburn, the Thames Valley and southwest England settlements displayed greater total pit volumes than the chalk downland. The settlements of the Thames Valley also produced the greatest number of pits per site, with Green Park and Aldermaston Wharf displaying over four times the number of pits present in the other regions. As in the Middle Bronze Age, however, the chalk downland settlements were more consistent with pit presence, presenting largely similar amounts of pit volume per settlement. The array of pit capacity reflects the pattern of THA dispersal, as the Thames Valley dominated in this period.

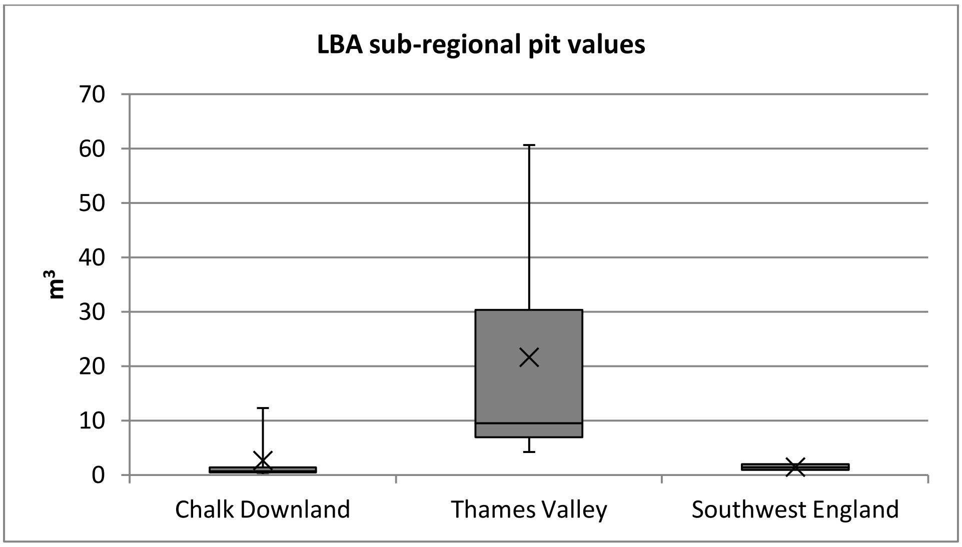


Figure 6.27 Total range of total pit volumes for the Late Bronze Age by sub-region

While southwest England and the chalk downland proceeded to demonstrate continuity from the earlier period, the Thames Valley demonstrated great numbers of pits and total pit volume, indicating highly productive settlement on the river gravels. Only one settlement on the chalk was similar to the amount of subterranean storage produced by the settlements of the Thames Valley. Productive capacity displayed clear sub-regional trends in the Late Bronze Age, with no overall decline as a result of social change and new technologies. The Thames Valley, displaying the closest ties to the Continent in the LBA, was able to require vast amounts of subterranean storage, while the chalk downland continued to demonstrate consistent pit presence. The settlements of the southwest did demonstrate smaller pit volumes than the previous period, although the issues with subterranean storage in that area make any consideration of production based solely upon pits problematic.

The Early Iron Age

In the Early Iron Age, the settlements of the chalk downland presented demonstrably greater total pit volumes per settlement than both the preceding period and the contemporary settlements of the southwest (Fig. 6.28). The two settlements with pits for southwest England presented total pit volumes of less than three cubic metres. In contrast, forty percent of the chalk downland sites presented total pit volumes of $30<n<450$ m^3, accompanied by an increase in the number of pits per settlement. Two settlements (Gussage All Saints and Little Woodbury) even presented nearly 200 pits, a significant increase from the previous period. The trends reflect an emphasis on the chalk downland for settlement in the Early Iron Age, with the subterranean storage capacity to support a growing population.

The smallest pit volumes on the chalk demonstrated continuity with the previous periods, suggesting certain settlements required only small amounts of subterranean storage. The majority of those settlements also lacked post-structures, indicating a continuation of subsistence level agricultural production contrasted with definite growth on other settlements. Intra-settlement cooperation becomes more likely with such an obvious difference in productive capacity. Southwest England continued to demonstrate decline in pit volume, clearly decreasing in necessary subterranean storage and indicating alternative storage practices were likely.

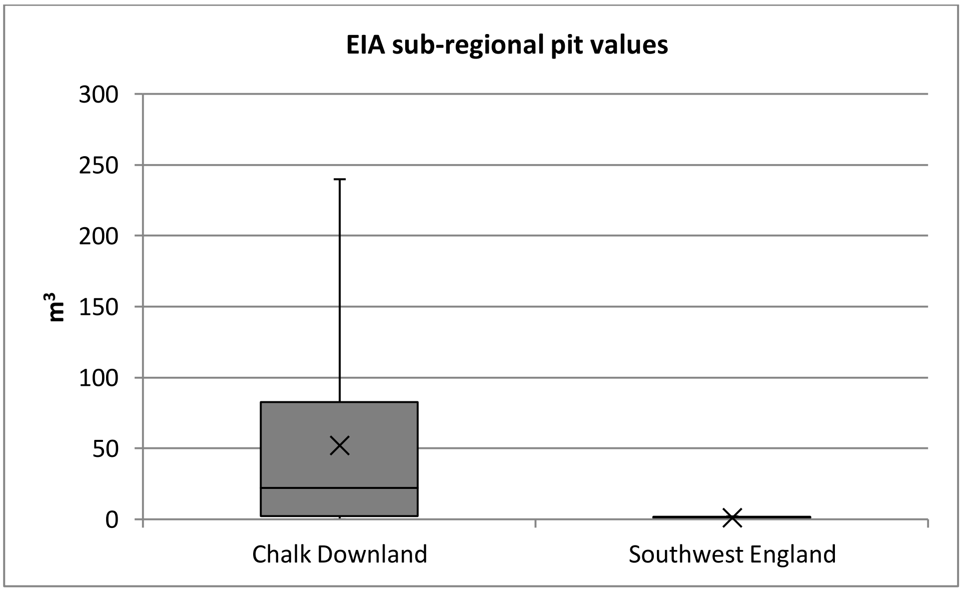


Figure 6.28 Total range of total pit volumes for the Early Iron Age by sub-region

Synopsis

It is apparent that pit presence was influenced by sub-region for southern Britain. Pits especially gained ground in the chalk downland in the Early Iron Age, after fairly consistent presence in the Bronze Age. The settlements of southwest England demonstrated a decline over time. The Thames Valley displayed extraordinary amounts of subterranean consumptive space in the Late Bronze Age, vastly out-producing the chalk and southwest settlements. While pit presence in the chalk downland and Thames Valley reflected the shifts in population via THA over time, the decline in pit storage in southwest England did not. The differing investment in subterranean storage likely relates to the soil conditions of each region, as the settlements of southwest England were more often found on inhospitable soil. Above ground storage must also be examined to provide a complete picture of agricultural production in the regions and then contrasted with dwelling trends to understand possible population shifts within and between regions. It is apparent, however, that pit storage, even on a variable scale, was maintained throughout the end of the Bronze Age.

Post-structures: southern Britain intra-regionally

Above ground storage represents a different response to agricultural surplus and consumption than subterranean storage and must be dealt with separately, before trends in agricultural storage over time become apparent. Above ground storage provides an alternative to subterranean storage in inhospitable soils, and provides easier access than sealed pits, although the life expectancy of grain stored above ground is more variable.

Southwest England

In the Middle Bronze Age of southwest England, half (n=3) of the settlements demonstrated post-structures (Table 6.7). Trevisker, Trethellan Farm, and Gwithian all presented evidence of a single post-structure. The Total Additional Area provided by post-structures varied in this period. Gwithian presented 4.67 m^2 of additional area, while Trevisker and Trethellan Farm presented $10<n\leq15$ m^2 (Fig. 6.29). Given that Trethellan Farm presented the greatest amount of pit storage for the period, the large amount of TAA is intriguing. Trethellan Farm was also among the largest THA values, provided a lack of phasing, and the storage values reflect the larger population. Stannon Down, however, the largest settlement based on Total Habitable Area in the Middle Bronze Age, did not present any evidence of above or below ground storage. Trevisker and Gwithian did not present any evidence of pits, yet did present post-structures as the only form of storage for the period. The TAA to THA ratio is inverted for those settlements, as Gwithian presented a THA value larger by half again the value of Trevisker. Trevisker presented the smallest THA of the three settlements, yet the largest TAA. Trevisker was also the only enclosed settlement with post-structures, which as it was the only enclosed MBA settlement for southwest England may only reflect trialling of a new form

	SW England	Number of Post-Structures	TAA m^2	Average Post-Structure Area m^2	Standard Deviation S_x m^2	Period
	Trevisker	1	15	15	N/A	MBA
	Trewey Down	0	0	N/A	N/A	MBA
	Trethellan Farm	1	10.24	10.24	N/A	MBA
	Gwithian	1	4.67	4.67	N/A	MBA
	Stannon Down	0	0	N/A	N/A	MBA
	Brean Down	0	0	N/A	N/A	MBA
Totals	6	3	29.96	9.97	5.17	
	Brean Down	2	8.33	4.17	1.99	LBA
	Cadbury Castle	2	8.75	4.38	3.71	LBA
Totals	2	4	17.08	8.54	0.30	
	Cadbury Castle	14	155.75	10.38	2.95	EIA
	Gurnard's Head	0	0	N/A	N/A	EIA
	Pilsdon Pen	0	0	N/A	N/A	EIA
Totals	3	14	155.75	10.38	2.95	

Table 6.7 Values for post-structures and Total Additional Area in southwest England

Figure 6.29 Middle Bronze Age values of Total Additional Area in southwest England

of consumptive architecture. The appearance of post-structures may also be related to the difference of dwelling size per settlement. Based on the varied energy devoted to productive architecture, post-structures may reflect additional roofed consumptive space where strictly necessary. Gwithian with its large dwellings would be more able to store agricultural produce within the living space, supplemented by a small post-structure, while the small dwellings of Trevisker required greater additional roofed area for storage purposes. Trethellan Farm was supplemented by pits, as well as comparably large dwellings, therefore requiring only a median TAA value, despite the large overall settlement size. Trethellan Farm, therefore, could be viewed as the largest producing settlement on the basis of potential storage capacity, although the ability to store within dwellings must be remembered.

As each of the settlements only displayed a single post-structure, the difference in size is readily apparent. Difference in needed above ground consumptive space is a rational explanation for the divergent application of energy and resources to construction of post-structures. The variable evidence of storage in the MBA of southwest England suggests variable production with little to no impact from probable population size, although possible influence from dwelling size, and plausible interaction between settlements with high production (Trethellan Farm) and those with less (Stannon Down).

For the Late Bronze Age, both settlements presented evidence of post-structures. There was an increase in number of post-structures per settlement in this period, as both Brean Down and Cadbury Castle presented evidence of two post-structures. Brean Down demonstrated growth from the preceding period, as the Middle Bronze Age phase did not demonstrate any post-structures. The Total Additional Area per site was relatively equal, with Brean Down presenting 8.33 m^2 of additional area and Cadbury Castle presenting 8.75 m^2 (Fig. 6.30), suggesting similar storage requirements. This was a slight decline in post-structure area from the preceding period, although still greater than that displayed at Gwithian in the MBA. Both Cadbury Castle and Brean Down presented pits, which may have accounted for the decline in TAA and average post-structure area for the period as storage was supplemented by pits. The average post-structure area for both sites in the Late Bronze Age was similar to that of Gwithian in the preceding period, indicating some continuity in construction weighted toward smaller post-structures. The differentiations in post-structure area per settlement were similar, with Cadbury Castle presenting a slightly larger standard deviation and matching larger TAA. Neither settlement displayed evidence of dwellings, so a contrast of consumptive to productive architecture is unavailable for the period. Both settlements were open, continuing the MBA trend of post-structures on open settlements, which was likely a sub-regional tendency. The implication is an increase in production, requiring greater energy investment in the construction of post-structures, along with two different types of storage becoming more common when considered with the increase in pit presence. There were no dwellings in this period to contrast with potential productive force or possible storage within dwellings.

For the Early Iron Age, only Cadbury Castle presented evidence of post-structures. The above ground storage for this phase of settlement increased from the Late Bronze Age. The number of post-structures increased from two to fourteen. The Total Additional Area also increased to 155.75 m^2 (Fig. 6.31). The Early Iron Age also evidenced an increase in structure size, as the average area per post-structure was 10.38 m^2, more similar to the Middle Bronze Age than the Late Bronze Age. The lack of reliably phased pits in Cadbury Castle, and their presence on Gurnard's Head and Pilsdon Pen, which lacked post-structures, indicates different storage strategies. Unlike the previous period, which presented both pits and post-structures, the EIA settlements were more definitively divided along types of consumptive architecture. The post-structures were present on the settlement with the median THA value, suggesting potential population was not responsible for a specific type of storage. Cadbury Castle, however, did present both the largest dwellings of the period and the most similar in size, again suggesting post-structures served as additional consumptive architecture for excess grain when dwellings were capable of storage in smaller amounts. The difference in type of consumptive architecture is no less marked even when acknowledging the potential for pits on Cadbury Castle; the remaining EIA settlements of southwest England did not present post-structures. The settlements without post-structures presented much greater variation

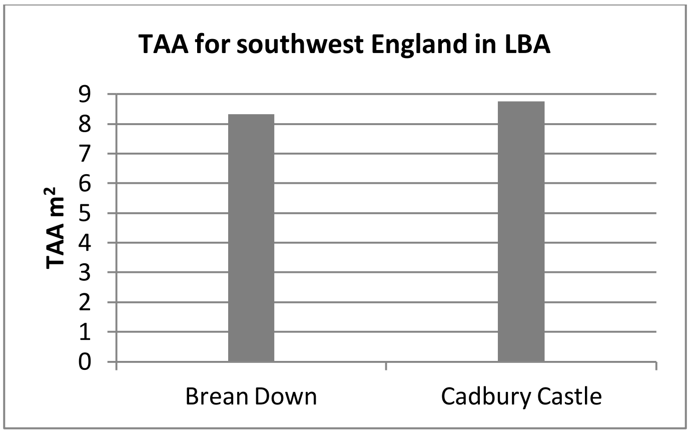


Figure 6.30 Late Bronze Age values of Total Additional Area in southwest England

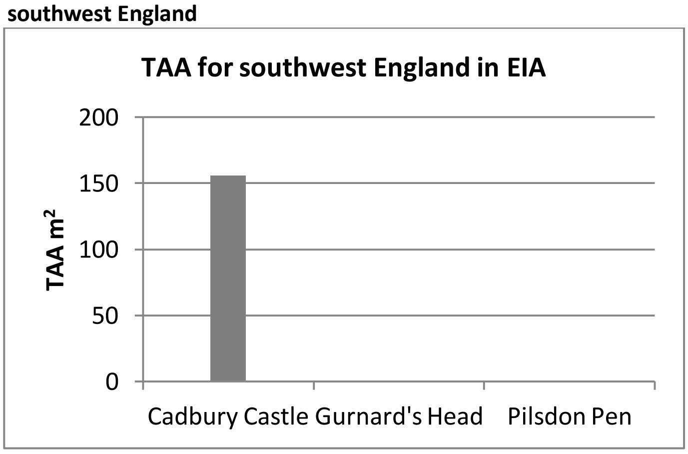


Figure 6.31 Early Iron Age values of Total Additional Area in southwest England

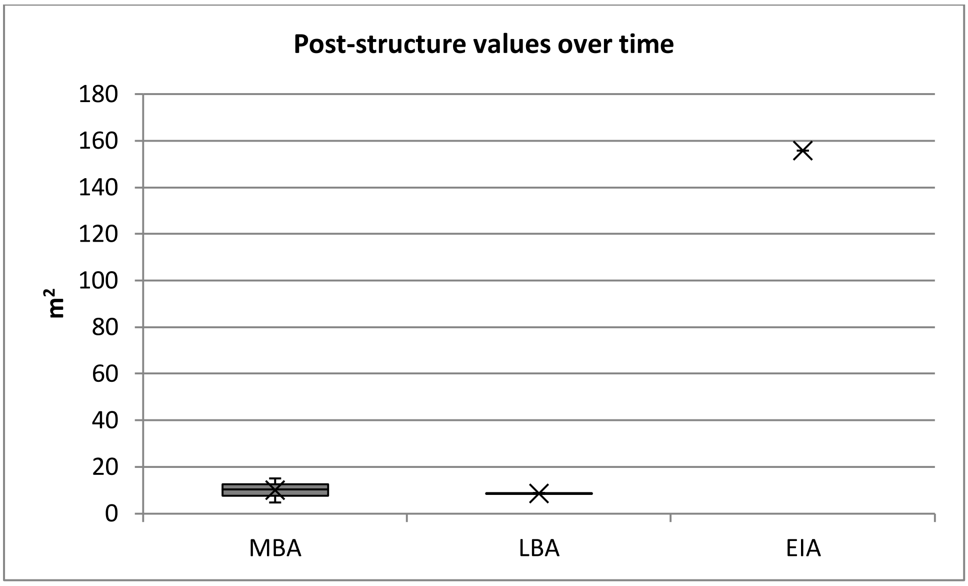


Figure 6.32 Total range of Total Additional Area values over time for southwest England

in dwelling size; the smaller dwellings, although of roundhouse construction, may have been used as storehouses when necessary. Pilsdon Pen and Gurnard's Head presented more dwellings than Cadbury Castle and, as production from season to season would have been variable, the energy utilized in construction of dwellings may have reflected an initial need for living/activity space that could at any time have been co-opted for above ground storage with more immediate access than pits, rather than expend more resources on construction of post-structures. There is no way to determine whether this was the case. Consideration of post-structures as above ground consumptive architecture indicates a great increase in production on Cadbury Castle from the LBA to the EIA. The possibility of pits dated to the latter period cannot be discounted either, further solidifying the assertion of increased agricultural production into the Iron Age.

Slight trends toward growth over time are suggested (Fig. 6.32). As discussed above, the THA suggests a decline in population in the Late Bronze Age that is reversed in the Early Iron Age. The TAA reflects this as, despite the increase in number of post-structures per settlement, the TAA and average post-structure size for the LBA are on the smaller end of the values presented in the MBA. The significant increase in available above ground storage in the EIA reflects a greater amount of agricultural production, which in turn suggests an increase in available labour force and consumers of said produce reflected in the increase in THA for the period.

The Thames Valley

The Thames Valley presented a different pattern in above ground storage (Table 6.8). For the Late Bronze Age, all but two of the settlements demonstrated evidence of post-structures. Springfield Lyons, Mucking North Ring i, and Loft's Farm presented one to five post-structures, while Green Park and Mucking South Rings displayed between ten and fifteen post-structures. The Total Additional Area per site from post-structures was greater than the corresponding period in southwest England (Fig. 6.33). Springfield Lyons and Loft's Farm presented TAA values of $1<n<\sim 5$ m^2. Mucking North Ring i presented a median value of 13.10 m^2 of TAA. Green Park and Mucking South Rings presented TAA values of $40<n<85$ m^2. The definite difference in available above ground storage indicates differing production capabilities. Despite the varied capacities, the average area per post-structure suggested a similarity in construction, as all five settlements presented average areas of $1<n<9$ m^2. While the TAA values are on the most part larger than southwest England, the average post-structure areas indicate much smaller structures in the Thames Valley.

	Thames Valley	Number of Post-Structures	TAA m^2	Average Post-Structure Area m^2	Standard Deviation S_X m^2	Period
	Springfield Lyons	1	5.76	5.76	N/A	LBA
	Mucking North Ring i	5	13.1	2.62	1.26	LBA
	Mucking North Ring ii	0	0	N/A	N/A	LBA
	Green Park	14	44.53	3.18	1.48	LBA
	Loft's Farm	2	2.25	1.62	0.88	LBA
	Aldermaston Wharf	0	0	N/A	N/A	LBA
	Mucking South Rings	10	84.38	8.44	1.46	LBA
Totals	7	30	150.02	30.00	34.68	

Table 6.8 Values for post-structures and Total Additional Area in Thames Valley

Green Park presented both the greatest total pit volume and one of the greatest TAA values, suggesting the settlement required extraordinary amounts of consumptive architecture. Mucking South Rings, presenting almost twice as much TAA as Green Park, did not present any pits, which suggests the greater TAA could have served as the single type of consumptive architecture for the settlement. In addition to the great TAA values, Green Park and Mucking South Rings displayed comparatively large values of THA. The correlation between THA and TAA is only present on sites with larger values of TAA, as the remaining settlements varied greatly in THA values on sites with post-structures. Loft's Farm presented a larger THA than Mucking South Rings, yet the smallest TAA. Loft's Farm did present the greatest standard deviation in dwelling size, which as mentioned for southwest England could indicate storage within the smaller dwelling likely a devoted activity area. The difference in TAA could also simply indicate varied productive capacities

The variation in post-structure size within settlements was similar to those of contemporary southwest England, albeit on the smaller end. The majority of settlements presented standard deviations of less than two square metres, indicating extremely similar construction of post-structures within a settlement. The similarity in size suggests, rather than construction to suit the total requirement of above ground storage, a more template-type of post-structure was constructed as needed. This accounts for the large difference in number of post-structures per settlement; another post-structure would be built in a similar fashion to those in existence, as necessary. The small areas used fewer resources and less energy than a single large post-structure, and adding a structure as necessary eliminates wasted space.

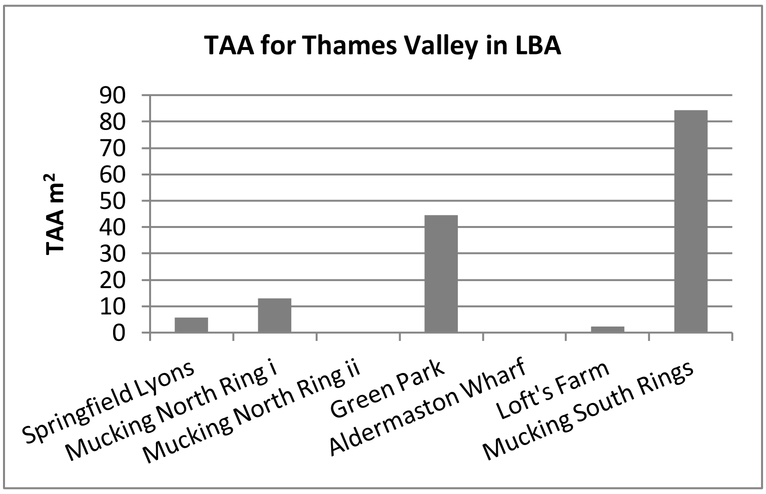


Figure 6.33 Late Bronze Age values of Total Additional Area in the Thames Valley

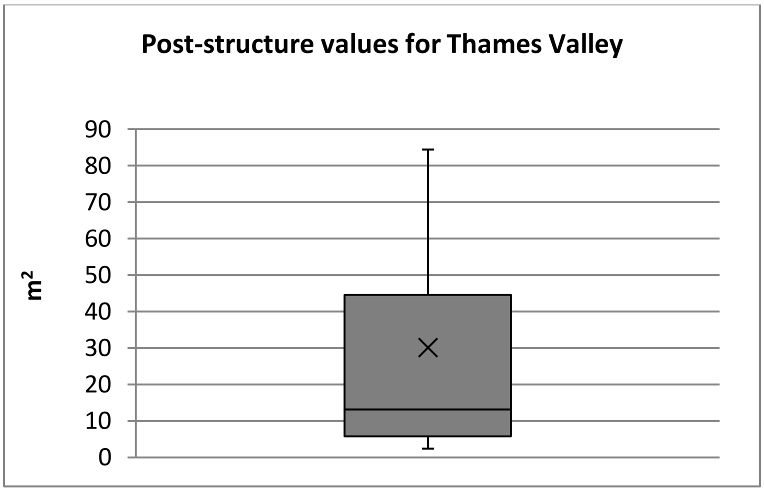


Figure 6.34 Total range of Total Additional Area values for the Thames Valley

Enclosure was more prevalent in the Thames Valley for settlements with post-structures, as all but one was enclosed. Green Park, with the second greatest TAA, was the only open settlement, suggesting enclosure was not linked to post-structure presence, size, or area.

The greater availability of post-structures for the Thames Valley compared to southwest England mirrors the reorganization of the population into the area in the Late Bronze Age. The more pervasive presence of above ground storage in the Thames Valley also speaks to contact with between sub-regions (Fig. 6.34). While the tendency toward post-structures in southwest England was largely due to soil inhospitable to subterranean storage, the presence of post-structures in the Thames Valley at the same time as part of the population likely exited the southwest indicates continuity in storage practices. Likewise, the presence of pits suggests a similar migration from the chalk downland already evidenced in the discussion of dwellings, creating three distinct patterns of storage in the Thames Valley. Aldermaston Wharf presented a large amount of pit storage, yet no post-structures. Loft's Farm, Mucking South Rings, and Springfield Lyons presented post-structures instead of pits. Green Park and Mucking North Ring i presented both above ground and subterranean storage, although post-structures and pits were absent on the following LBA phase of Mucking North Ring. The difference in storage on specific settlements is unclear from a small sample; however, the fact of distinct practices should be noted.

The Chalk Downland

The chalk downland displayed similar trends over time in above ground storage to southwest England (Table 6.9). Only three of the twenty settlements (15%) presented evidence of post-structures in the Middle Bronze Age (Fig. 6.35). Down Farm ii and Thorny Down i displayed one post-structure. Thorny Down ii increased to two post-structures. The Total Additional Area was varied between the sites. Down Farm ii presented 6.19 m^2 of TAA, similar to Thorny Down i with 6.00 m^2. Thorny Down ii again increased to over twice the TAA. The average area per post-structure was again similar for Down Farm ii and Thorny Down i, while Thorny Down ii presented a slightly larger average area. The values are at the smaller end of those for the same period in southwest England. Few post-structures in the Middle Bronze Age for the sub-region were offset by the greater proportion of settlements with pits. There was no correlation between THA and presence of post-structures; there were settlements with greater and lesser THA that did not present post-structures. There was also no overt correlation between pit presence and post- structure presence. Down Farm ii and Thorny Down i presented pits, while Thorny Down ii did not. The total pit volumes present were on the smaller end of the range of values for the MBA, yet both larger and smaller total pit

	Chalk Downland	Number of Post-Structures	TAA m^2	Average Post-Structure Area m^2	Standard Deviation S_X m^2	Period
	Poundbury i/ii	0	0	N/A	N/A	MBA
	Shearplace Hill	0	0	N/A	N/A	MBA
	Down Farm i	0	0	N/A	N/A	MBA
	Down Farm ii	1	6.19	6.19	N/A	MBA
	South Lodge Camp	0	0	N/A	N/A	MBA
	Thorny Down i	1	6.00	6.00	N/A	MBA
	Thorny Down ii	2	15.00	7.50	1.06	MBA
	New Barn Down	0	0	N/A	N/A	MBA
	Cock Hill	0	0	N/A	N/A	MBA
	Blackpatch	0	0	N/A	N/A	MBA
	Mile Oak	0	0	N/A	N/A	MBA
	Itford Hill i-iv	0	0	N/A	N/A	MBA
	Black Patch hut platform 1	0	0	N/A	N/A	MBA
	Black Patch hut platform 4	0	0	N/A	N/A	MBA
	Plumpton Plain A	0	0	N/A	N/A	MBA
	Highdown Hill	0	0	N/A	N/A	MBA
Totals	20	4	27.19	9.06	5.14	
	Plumpton Plain B	0	0	N/A	N/A	LBA
	Amberley Mount	0	0	N/A	N/A	LBA
	Mile Oak	2	7.29	3.65	1.97	LBA
	The Caburn	0	0	N/A	N/A	LBA
	Winnall Down	0	0	N/A	N/A	LBA
	Hog Cliff Hill	0	0	N/A	N/A	LBA
	Rams Hill	9	19.77	2.20	0.94	LBA
	Eldon’s Seat	0	0	N/A	N/A	LBA
Totals	8	11	27.06	11.94	6.82	
	Highdown Hill	0	0	N/A	N/A	EIA
	Winnall Down	20	63.33	3.15	2.16	EIA
	Hog Cliff Hill i	1	3.92	3.92	N/A	EIA
	Hog Cliff Hill ii	0	0	N/A	N/A	EIA
	Old Down Farm i/ii	0	0	N/A	N/A	EIA
	Gussage All Saints	17	116.00	6.82	5.5	EIA
	Little Woodbury	7	18.88	2.69	1.16	EIA
	Hollingbury	0	0	N/A	N/A	EIA
	Eldon’s Seat	0	0	N/A	N/A	EIA
	Heathy Brow	1	24.00	24.00	N/A	EIA
	Winklebury	18	141.7	7.87	2.22	EIA
	Chalbury Camp	0	0	N/A	N/A	EIA
	Balksbury Camp	0	0	N/A	N/A	EIA
	Hengistbury Head	0	0	N/A	N/A	EIA
Totals	15	75	177.59	83.26	64.15	

Table 6.9 Values for post-structures and Total Additional Area in chalk downland

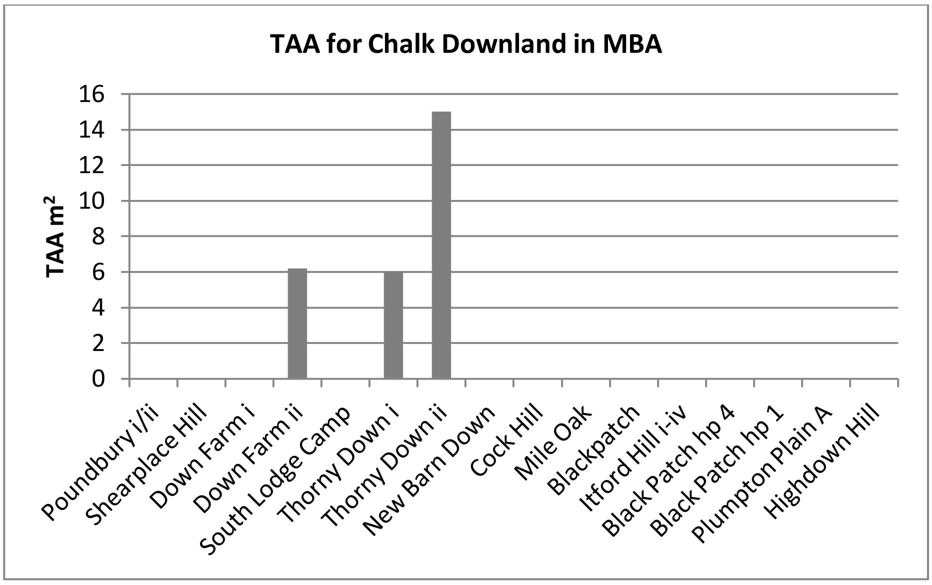


Figure 6.35 Middle Bronze Age values of Total Additional Area in the chalk downland

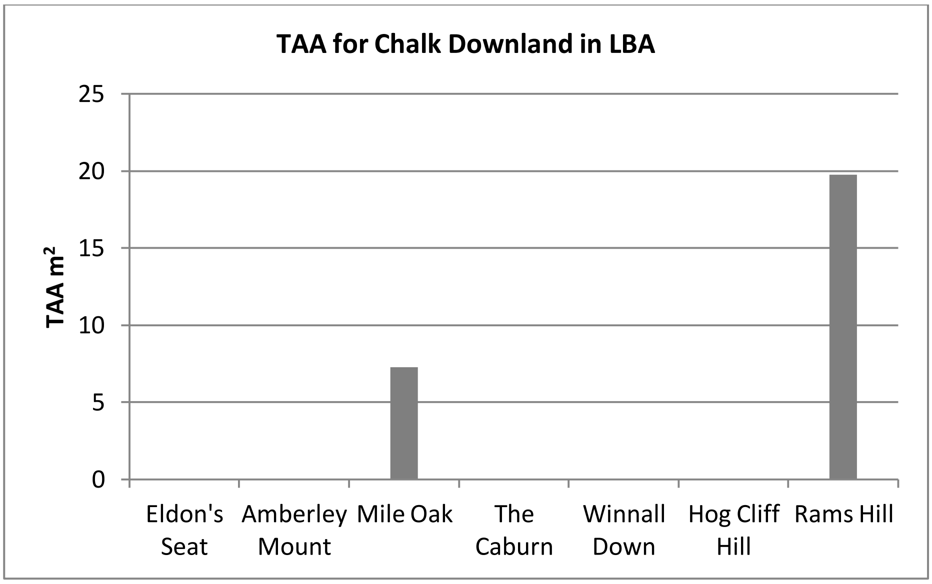


Figure 6.36 Late Bronze Age values of Total Additional Area in the chalk downland

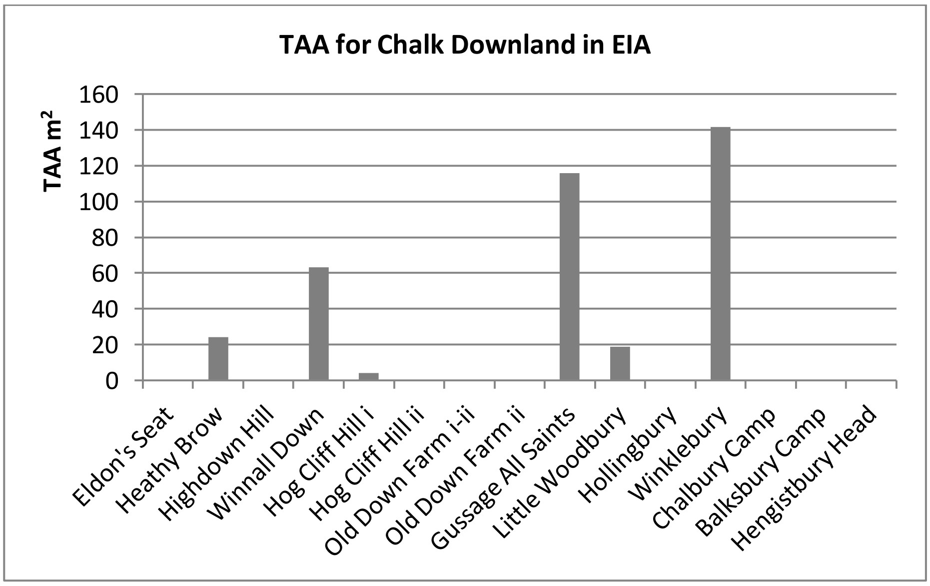


Figure 6.37 Early Iron Age values of Total Additional Area in the chalk downland

volumes were present on settlements lacking post-structures. All three settlement phases with post-structures were enclosed, yet the small presence of post-structures cannot provide further information regarding trends of settlement organization. Unlike southwest England, post-structures appeared on settlements with the largest standard deviation in dwelling size for the period. Thorny Down ii presented the greatest difference in dwelling size, along with the largest TAA. If we accept dwellings less than twenty square metres in area as activity areas and potential storage in times of excess, the largest above ground storage was on a settlement with the smallest of such dwellings for the period. Thorny Down i also presented a dwelling less than twenty square metres, with a post-structure serving as possible supplemental storage. Down Farm ii, conversely, presented larger dwellings, with one of the largest dwellings of the period, which may have allowed for storage internally and the post-structure served as additional above ground storage. If the pattern of the smallest and largest dwellings serving as minimal storage for the MBA explains the general lack of above ground storage, the appearance of post-structures indicates exceedingly successful settlements, which required enough additional consumptive architecture to justify the expenditure of energy on construction of post-structures. Compared to southwest England, a smaller proportion of settlements displayed post-structures, although the similarities suggest perhaps an initial phase of post-structure construction on an as-needed basis.

In the Late Bronze Age, the proportion of post-structure presence increased, as two of the settlements (25%) demonstrated post-structures, although again, there was variability (Fig. 6.36). Mile Oak presented two post-structures. Rams Hill displayed nine post-structures. The Total Additional Area also demonstrates growth from the previous period. Mile Oak presented 7.29 m^2, while Rams Hill displayed just under 20 m^2. These values were similar to the TAA values of the Thames Valley and larger than those of southwest England. Also similar to the Thames Valley was the appearance of post-structures on enclosed settlements.

The average areas per post-structure for the LBA were similar. Rams Hill presented 2.20 m^2, while Mile Oak displayed 3.65 m^2 of average post-structure area. These values were smaller than southwest England, although similar to those of the Thames Valley. The TAA values may have been influenced by population. Mile Oak presented comparatively small THA values, matched by similarly small TAA and total pit volume values. Rams Hill presented nearly 100 m^2 of THA, yet a small by comparison amount of total pit volume for the period; the large amount of TAA possibly served as alternate storage under different influences we are unable to determine from the record. Rams Hill continued the trend of post-structures appearing on settlements with a small dwelling less than twenty metres square; Mile Oak continued the trend of a comparably large dwelling accompanied by a post-structure. Both trends would allow for storage within dwellings, making the purposeful construction of post-structures curious and likely indicative of greater production, particularly as pits were present on both settlements. It is clear that post-structure presence was changing on the chalk downland. While apparently not as significant to agricultural consumption as in the Thames Valley for the Late Bronze Age, the post-structures present indicate the continuation of a trend in above ground consumptive architecture.

The Early Iron Age in the chalk downland demonstrated a considerable increase in above ground storage (Fig. 6.37). There was a slight increase in post-structure presence as six settlements (40%) presented post-structures. Winnall Down and Hog Cliff Hill, which presented phases of occupation in the Late Bronze Age and Early Iron Age, increased the amount of available above ground storage from the previous phase of settlement. Highdown Hill, which also demonstrated a Middle Bronze Age phase of settlement, did not display any post-structures in either period, raising questions of historical trends in storage and the acceptance of post-structures, along with the reliability of the record. Hog Cliff Hill i and Heathy Brow each displayed a single post-structure. Little Woodbury presented seven post-structures. Winklebury, Winnall Down, and Gussage All Saints presented between fifteen and twenty post-structures. The latter grouping was larger than the previous periods, as well as the contemporary southwest.

The Total Additional Area per site for the EIA also indicated an increase in above ground storage in this period. Hog Cliff Hill i only presented 3.92 m^2 of TAA. Heathy Brow and Little Woodbury presented $15<n<25$ m^2 of TAA, still within the range of the preceding period. Winnall Down presented a TAA of 63.33 m^2, larger than the LBA values for the chalk downland, yet still within the range of LBA values for the Thames Valley. The remaining sites displayed much greater values of TAA, between $100<n<150$ m^2. The TAA values were smaller than those of southwest England, suggesting a greater reliance on pits in the chalk settlements. The average area per post-structure indicates a slight increase in post- structure construction. The majority of sites with post-structures presented an average area of $2<n<8$ m^2. Heathy Brow presented the largest post-structure for the period across the sub-regions. The variation in post-structure size per settlement also increased, indicating larger post-structures than those of the Bronze Age.

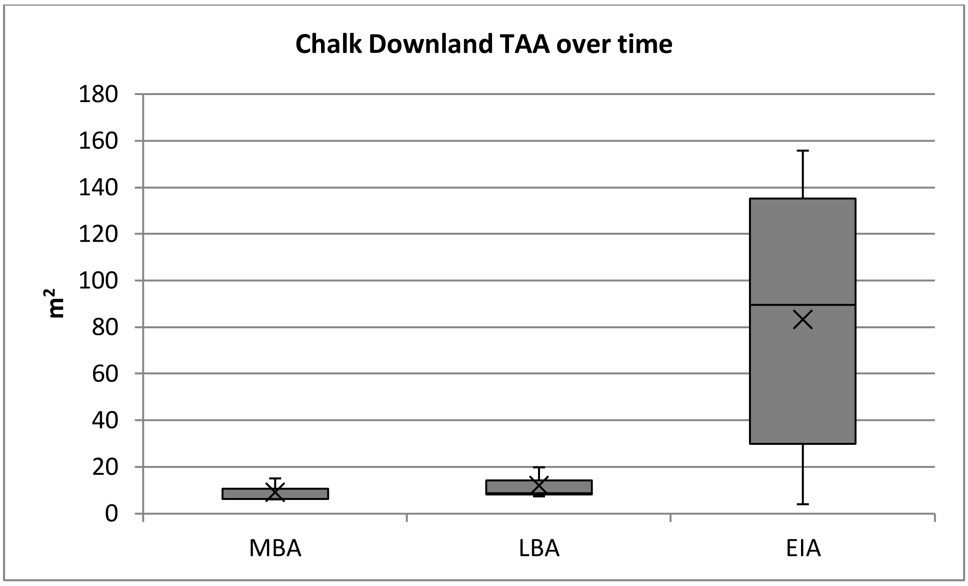


Figure 6.38 Total range of Total Additional Area values for the chalk downland over time. X indicates the average TAA for the period.

The settlements which presented post-structures, with the exception of Heathy Brow and Hog Cliff Hill i, also presented among the largest total pit volumes for the region. Again, however, there is no overt correlation between post-structures and pits, as Old Down Farm i and ii presented large total pit volumes, yet did not present any post-structures. This period did not demonstrate any correlation between TAA and THA, as post-structures were present on settlements with both the greatest and least amount of THA. Larger THA did not equate to larger TAA, suggesting population was not a determining factor in additional roofed area. Consumptive architecture for the EIA suggests post-structures were secondary storage, or perhaps treatment areas before storage, as large TAA was correlated to large total pit volumes. There was also a continuation of the largest individual dwellings, and subsequent large standard deviations in dwelling size, present on settlements with post-structures, suggesting post-structures as additional to dwellings for above ground storage. Post-structures were also present on certain settlements with a dwelling smaller than twenty square metres in area, as well as settlements with at least a thirty square metre difference between the smallest dwellings. While not all settlements displaying these characteristics produced post-structures, likely due to the use of smaller dwellings as activity areas and storage if necessary, the appearance of post-structures indicates greater production on those settlements. The energy expended on construction of apparent discretionary structures would only be justified if necessary to account for greater consumptive needs. The smaller proportion of post-structure presence to pit presence also suggests post-structures as optional aspects of settlement organization. Enclosure of the settlement was not a factor, as all but one settlement (Heathy Brow) with post-structures was enclosed.

The trends of above ground storage in the chalk downland indicate an increase in available post- structures over time, with no significant change in construction (Fig. 6.38). A slight increase in post-structure presence and size was apparent in the Late Bronze Age, with post-structures coming into their own in the Early Iron Age. The minimum TAA values remained similar over time. Regardless, it is clear post-structures were becoming more common on the chalk over time, particularly after the movement of the population from regions where post-structures were more prevalent.

Post-structures: southern Britain inter-regionally

The Middle Bronze Age

Only six settlements across both the chalk downland and southwest England presented evidence of post-structures (Fig. 6.39). Post-structures were slightly regionally distributed in this period, as southwest England presented more settlements with post-structures (50%), as well as settlements with only post-structures. Above ground storage was supplemental to pits for the chalk downland settlements, as only fifteen percent of settlements presented post-structures. Settlements evinced few post-structures per site as all but Thorny Down, which had two, presented a single post-structure of varying TAA. There was a lack of standardized construction, indicating differing above ground storage needs. There was no correlation between post- structures, pits, and dwellings, indicating all storage was on an as-needed basis with varied production among and within the regions.

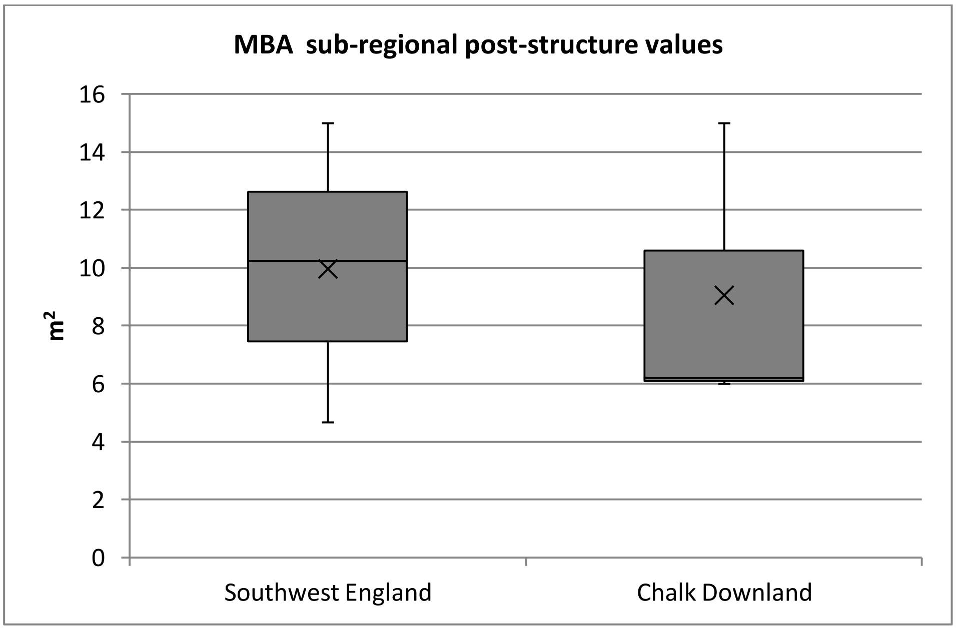


Figure 6.39 Total range of Total Additional Area values for the Middle Bronze Age by sub-region. X indicates the average TAA.

While the largest TAA values were similar between the sub-regions, the average and median TAA values were smaller for the chalk downland settlements. The majority of settlements presented TAA values smaller than the average value of the settlements of southwest England. The average post-structure areas were also more similar on the chalk, suggesting a similar construction between settlements within the sub-region. The settlements of southwest England presented much greater variety in post-structure size, reflected in the TAA values. Above ground consumptive architecture was not a typical addition to settlement organization for the MBA of southern Britain, although more common in the southwest.

The Late Bronze Age

All three sub-regions presented evidence of post-structures in the Late Bronze Age (Fig. 6.40), as above ground storage apparently became more common. There was much variability in post-structure presence and amount of TAA available between the sub-regions. Southwest England presented the greatest proportion of settlements with post-structures (100%), yet the sample was small and is possibly misleading. The Thames Valley presented seventy-one percent of settlements with post-structures, as well as the greatest, and smallest, TAA values. The settlements of the chalk downland increased in post-structure presence to twenty-nine percent in the LBA. In the Thames Valley, two populations of TAA appeared, suggesting a difference in production. Certain settlements presented a TAA less than approximately ten square metres and others greater than twenty square metres. This possibly represents production for population sustainment contrasted with production for exchange.

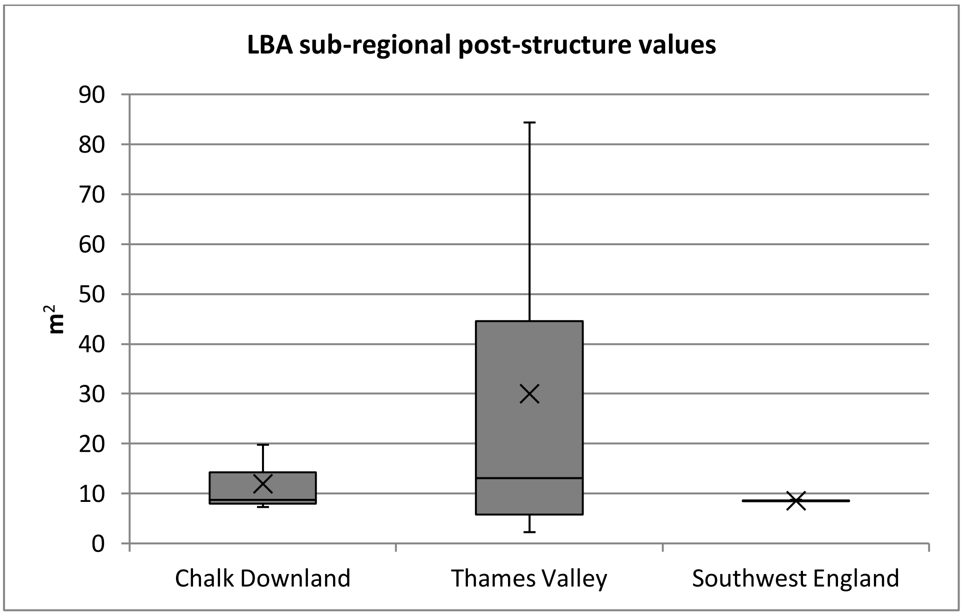


Figure 6.40 Total range of TAA values for the Late Bronze Age by sub-region. X indicates the average TAA.

Southwest England and the chalk downland presented similar median values (8.45 m^2 and 8.75 m^2, respectively, although the majority of TAA values for the chalk were more similar to the median value (13.1 m) of the Thames Valley. The great amount of above ground consumptive space for the Thames Valley, paired with the large amount of subterranean consumptive space, strongly suggests extremely productive settlements along the river gravels for the LBA. The increase in post-structure presence and TAA for the chalk downland and southwest England also reflects a changing devotion of energy toward above ground storage. When taken into consideration with the occurrence of pits, post-structures appeared only on settlements with pits, indicating post-structures as supplemental to pits in the central and western sub-regions. The overall storage capacities for the LBA in those sub-regions were much smaller than the contemporary settlements in the Thames Valley.

The Early Iron Age

The values of Total Additional Area increased for the chalk downland and southwest England in this period (Fig. 6.41). Southwest England produced the settlement with the greatest value of TAA (Cadbury Castle: n=155.75 m^2), increasing from its earlier phase of occupation, although losing definitively phased pits. The settlements of the chalk downland presented Total Additional Areas of 30<*n*<80 m^2, also demonstrating a definite increase in available above ground storage. While the percentage of settlements with post-structures (40%) increased for the EIA of the chalk downland, pits remained the more common form of agricultural storage.

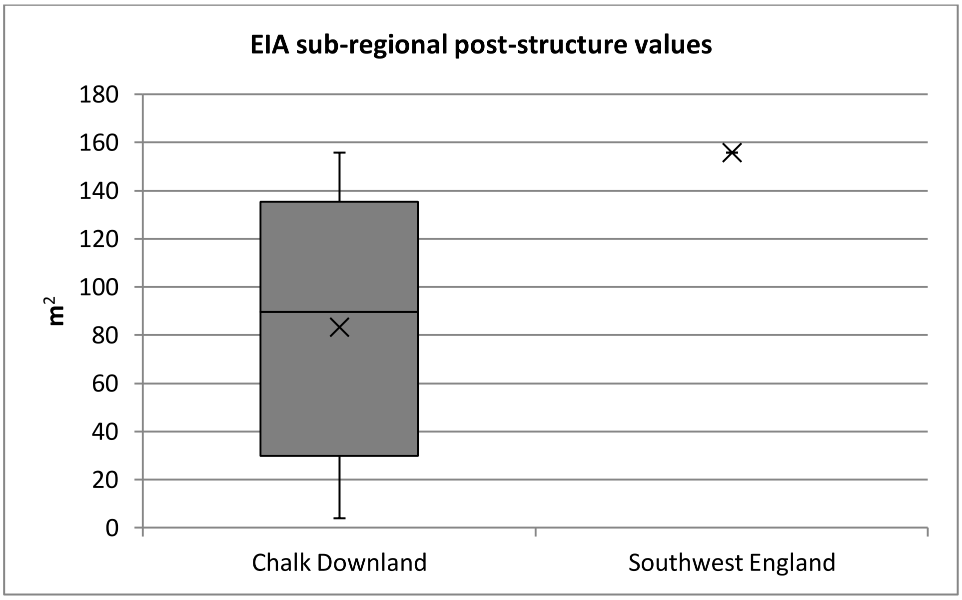


Figure 6.41 Total range of TAA values for the Early Iron Age by sub-region. X indicates the average TAA.

The presence of post-structures on the chalk is likely retention of storage practices after the migrations into and out of the region through the beginning of the Iron Age. The increase of post-structures on both sub-regions, however, reflects an increase in above ground storage practices. The large increase across southern Britain in above ground consumptive architecture not only reflects an increase in the construction of post-structures, which require much greater amounts of energy and resources than pits, but a tendency toward storage above ground, often on settlements with large subterranean storage capacities. Taking post-structures as consumptive architecture, whether for storage or processing of grains, the increase in TAA by the Early Iron Age definitively indicates an increase in agricultural production.

Synopsis

Post-structures grew in presence for all of southern Britain over time. The chalk downland presented the most consistent growth in sites with post-structures, number of post-structures per settlement, and Total Additional Area, yet post-structures remained secondary to pits in the region. Southwest England and the Thames Valley, on the other hand, presented a weighted interest in above ground storage. While above ground storage became increasingly more common by the Early Iron Age, it was largely a sub-regional tradition, focused on southwest England. The differing storage traditions appearing over time were quite possibly the result of shifting populations carrying their own practices regardless of soil type and suitability.

6.3 Comments

Distinct patterns in energy directed toward domestic architecture emerged in southern Britain regarding population and agricultural production in the three sub-regions under investigation. Summarizing briefly, southwest England and the chalk downland dominated in the Middle Bronze Age. The former receded in favour of the rich gravels of the Thames Valley in the Late Bronze Age, with the fertile chalk downland maintaining a strong presence. The chalk downland and southwest England were again dominant in the Early Iron Age, to the detriment of the Thames Valley. The majority of multi-phase settlements, which demonstrate increased attachment to the land and labour directed at sustaining a population on a specific location, were located on the chalk downland in the Middle Bronze Age and Early Iron Age. A single multi-phase settlement in the Late Bronze Age was present in the Thames Valley.

All sub-regions displayed settlements with phases in successive periods, also indicative of successful population maintenance. Brean Down in southwest England was occupied in both the Middle and Late Bronze Age. Two of the Late Bronze Age settlements in the region also produced Early Iron Age occupation. The Thames Valley produced no direct continuity in settlement, although the neighbouring settlements of Mucking North and South Rings were inhabited consecutively. The chalk downland also presented settlements with phases of occupation in multiple periods, with permanence increasing over time. Mile Oak produced both Middle and Late Bronze Age evidence, while Winnall Down and Hog Cliff Hill were present in both the Late Bronze Age and Early Iron Age. Unusually, Highdown Hill contained both Middle Bronze Age and Early Iron Age phases, although any Late Bronze Age occupation may not have survived.

Each sub-region presented at least continuity in THA over time. Southwest England and the chalk downland settlements were similar in THA values in the Middle Bronze Age, with the former presenting the largest settlements. The difference in variation in dwelling size within settlements in both sub-regions suggests different strategies of settlement organization. Greater standard deviation suggests either hierarchical architecture or specific functions assigned to particular dwellings based on size, while a smaller standard deviation possibly indicate a more heterogeneous use of individual dwellings. The Thames Valley and the chalk downland were comparable in THA values in the Late Bronze Age, with a slight decline in the latter settlements. The standard deviation in dwelling area per settlement decreased slightly, but the difference in settlement organization continued, even as consumptive architecture increased. The difference in the Thames Valley, however, was more strongly indicative of differences of occupancy, rather than task-based architecture. Both the chalk downland and southwest England presented larger THA values in the Early Iron Age, suggesting an increase in population per settlement. Despite the larger dwellings and greater THA values, the standard deviations in dwelling area for both sub-regions decreased, requiring other storage options. Larger populations require greater amounts of agricultural production, which results in greater amounts of storage.

There was a definite regionality to the array of subterranean and above ground storage. Southwest England produced the least amount of subterranean storage across all three periods, likely given the acidic nature of the soil in the majority of the region. It is somewhat unsurprising, then, that the settlements of southwest England presented a greater proportion of post-structures than the other regions. In the Middle Bronze Age, Trethellan Farm and Brean Down did produce among the greatest total pit volumes, however possible phasing for Trethellan Farm should be taken into account, which may normalize the amount of available pit storage. Brean Down was located on more hospitable soil, allowing pit storage to be easier to maintain. Post-structures for the period were located on settlements with large values of THA (Fig. 6.42 and 6.43), although Stannon Down with the largest THA did not present any evidence of storage. The Late Bronze Age settlements presented both pits and post-structures, although no dwellings, which makes attempting to correlate THA with storage impossible. The settlements, however, did provide a suggestion of increasing storage in the LBA. The Early Iron Age settlement of Cadbury Castle appeared to follow the trends, as a large THA value was paired with a large TAA. The smaller settlement of Gurnard's Head presented a small pit volume, again demonstrating the mix of storage strategies present in the region with no overt rationale behind the appearance of pits, post-structures, or both. It is clear, however, that an increase in energy spent on consumptive architecture, regardless of form, occurred over the BA-IA transition.

The Thames Valley presented a mix of storage. With the exception of Springfield Lyons, Mucking South Rings, and Loft's Farm, all Late Bronze Age settlements with post-structures also presented pits. Only Aldermaston Wharf presented pits with no post-structures (Fig. 6.44). While Green Park presented the greatest values for THA and total pit volume, and a large amount of TAA in the period, there was little correlation between THA and available storage on the remaining LBA settlements. Mucking North Ring i presented only 43.39 m^2 of THA, yet comparatively large amounts of storage, both subterranean and above ground. The lack of pits may be due to increasingly wet conditions in the region by the end of the Bronze Age, making post-structures a more reasonable mode of storage (Pryor 2010). Post-structure presence because of migrations from southwest England is also a strong possibility. The regional trend demonstrates an awareness of and effort toward the most applicable form of consumptive architecture. Why waste energy constructing pits if the product of labour in the field will not be preserved?

The chalk downland presented an entirely different storage tradition. Pits dominated all three periods (Fig. 6.43). Post-structures increased in presence over time (Fig. 6.42 and Fig. 6.44), yet pits were present on all but one settlement by the Early Iron Age. There was little to no correlation between THA and pit presence. For example, Highdown Hill and Plumpton Plain B in the Middle Bronze Age displayed nearly equivalent THA values, yet the former had no pits while the latter presented three. The Caburn in the Late Bronze Age presented the greatest amount of total pit volume, yet the smallest THA for the period in the region. Post-structures as well expressed little correlation with either pit presence or dwellings. A slight correlation in the Late Bronze Age between post-structure presence and smaller THA values is apparent, although it is not comprehensive and likely not real. The progressive increase in pit

Figure 6.42 Dispersal of settlements with both pits and post-structures over time

Figure 6.43 Dispersal of settlements with pits and no post-structures over time

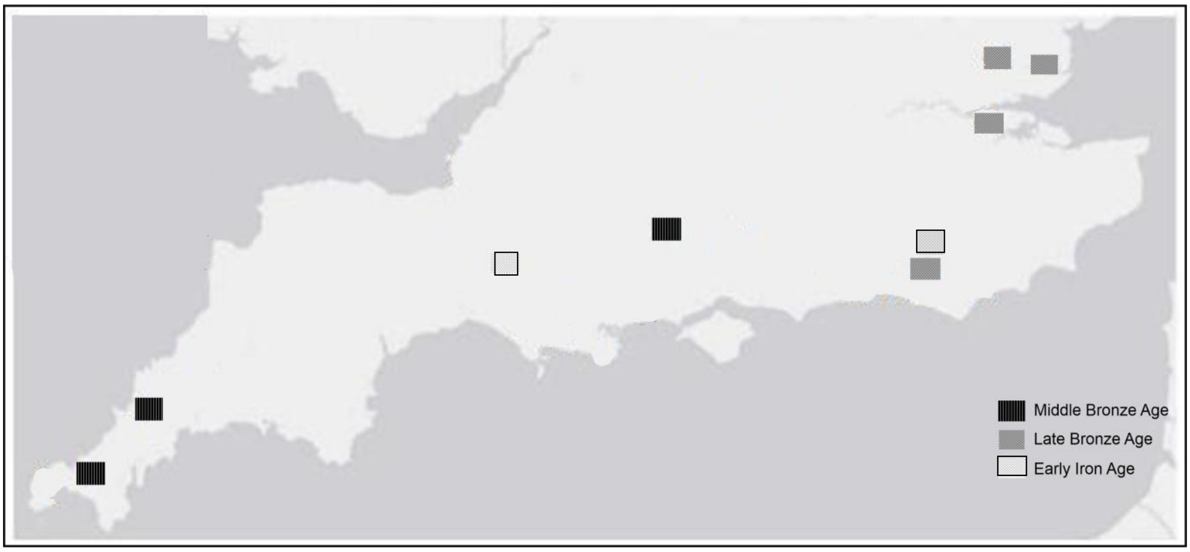


Figure 6.44 Dispersal of settlements with post-structures and no pits over time

volume, pit size, and shift toward external pits on enclosed settlements was the major hallmark of storage in the chalk downland.

Understanding larger external pits as long-term storage with internal pits as daily use is corroborated by the sub-regional analysis. Southwest England maintained above ground storage and pits internal to dwellings over time, with only a few larger external pits. The Thames Valley presented a mixture of internal and external pits and an increasing number of post-structures. The chalk downland largely relied on pits with little alternative storage. The larger pits external to dwellings were a phenomenon of the chalk downland, also present on certain Thames Valley settlements in the Late Bronze Age after the population had shuffled itself between regions. With an apparent lack of post-structures as a regional tradition in the chalk and exemplary conditions for preservation of grain long-term, increasing agricultural production with an increasing surplus would require alternate means of storage resulting in large, sealed pits external to dwellings allowing for access to grain long past the harvest.

Enclosure had a definite impact on the appearance of consumptive architecture. The Thames Valley and chalk downland displayed post-structures predominately on enclosed settlements. External pits, already discussed as larger than internal pits, were also more present on enclosed settlements in the middle and eastern sub-regions toward the end of the Bronze Age and into the Iron Age. The correlation between enclosure and consumptive spaces indicates a need to control access to consumptive material, as has been posited for field boundaries (Fowler 1981). The correlation could indicate an increase in competition between settlements, an increasing prioritization of agricultural product, or a mixture of both.

The lack of correlation between dwellings and storage, read as population and agricultural production, for all sub-regions suggests a variable production strategy for each settlement, allowing certain settlements, regardless of the necessary amount of grain for sustenance, to over produce while other settlements did not produce a surplus. Gussage All Saints is an excellent example of the greatest amounts of both above and below ground storage for the period with only a single dwelling. The lack of storage on certain settlements suggests a probable production of grain for daily use in storage invisible to the record, which would not necessarily provide for a population through the winter. The settlements without storage or with negligible amounts were likely in contact with the 'over producers' and, given a smaller investment in agriculture whether based on lack of labour or less arable soil, could have been more heavily involved in other industries allowing for regional exchange. This is only one interpretation of the data, yet such a consideration allows for variable settlement organization and provides an explanation for the unequal effort expended on construction of productive and consumptive architecture throughout time on southern British settlements.

Chapter VII: Shifts in population and agricultural production over time for Denmark

A site-by-site analysis of the data, over time, for Denmark illuminates patterns and trends relating to population size and agricultural production. Dwellings and post-structures, standing as proxies for population and agricultural production, are discussed noting presence or absence, number per site, and total area over time.

7.1 Population

Investigating patterns over time for the whole of Denmark provides information regarding population size and agricultural production, via the proxies of dwellings and post-structures. The Danish periods under consideration are the Early Bronze Age (1800-1000 BC), Late Bronze Age (1000-500 BC), and Early Iron Age (500-100 BC) from Montelius (1885). Per Becker (1961), the Early Iron Age is further divided into the Early Pre-Roman Iron Age (EpRIA 500-250 BC) and the Late Pre-Roman Iron Age (LpRIA 250-100 BC). The sample size varied per period, given the foibles of the record and the available publication of excavations. As with the southern British material, multi-phased settlements were considered in their component phases (Fig. 7.1). The Early Bronze Age sample consisted of eleven phases of settlement, while the Late Bronze Age contained six settlements. The Early Pre-Roman Iron Age sample contained ten settlement phases. The Late Pre-Roman Iron Age sample produced seven phases of settlement. Dwellings are considered as loci of living and activity areas not directly related to the storage of arable agricultural production; possible stalling of animals within longhouses beginning in the LBA and continuing into the Iron Age is considered here as an aspect of the activity area for a settlement and not counted as storage space. Again, the bibliographic references for each site are located in the full site descriptions in Appendix B; the specific site reference number from the site gazette is referenced after the site name below. The multi-phased settlements are discussed in total in the Appendix and therefore a single reference number was assigned to all phases of each settlement.

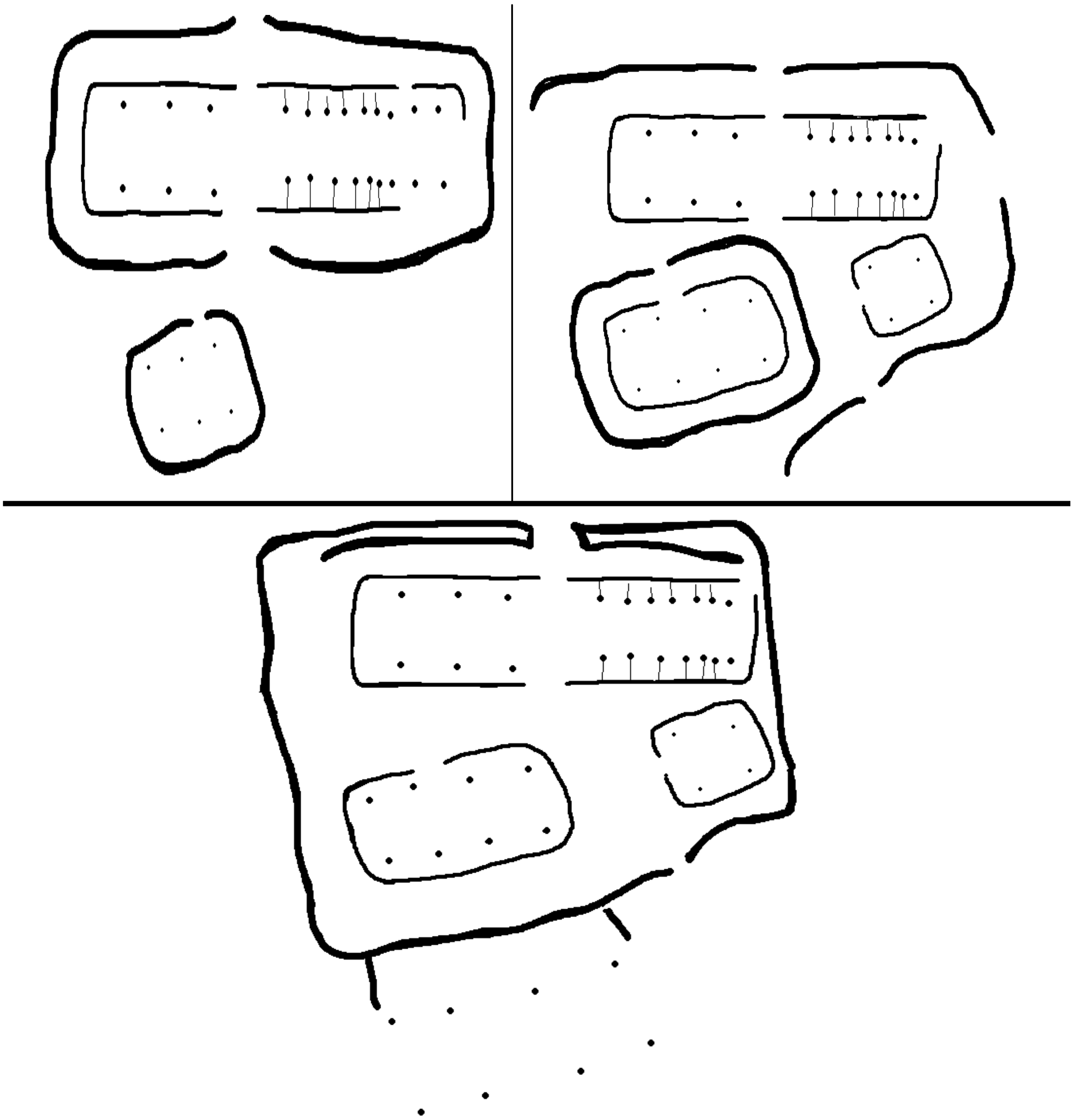


Figure 7.1 Three successive phases of a single farmstead at Hodde, considered individually. After Hvass 1985.

The Early Bronze Age

There is little variation in the number of dwellings per site for the Early Bronze Age in Denmark (Table 7.1). Eleven phases of settlement were present in this period. All but two presented evidence of one to three dwellings. The outliers, Højgård i and iii, presented six and four dwellings respectively. The small numbers of dwellings follow the observed pattern for the Danish Early Bronze Age; small farmsteads were the common form of settlement organization (Harding 2000). Højgård (OP1), Vadgård (RLS2), and Egehøj (MS3) are notable as early examples of a multi-phased settlement, not usually observed until the Iron Age, although of varying size, which indicates an increasing permanence in settlement from the

	Denmark	Number of Dwellings	THA m^2	Average Dwelling Size m^2	Standard Deviation s_x m^2
	Røjle Mose	1	32.00	32.00	N/A
	Hemmed Church	1	301.00	301.00	N/A
	Bjerre	3	361.75	120.58	13.78
	Legard	2	489.00	244.5	27.58
	Vadgård i	1	66.00	66.00	N/A
	Vadgård ii	1	66.00	66.00	N/A
	Egehøj i	1	126.00	126.00	N/A
	Egehøj ii	2	222.00	111.00	4.24
	Højgård i	6	663.30	110.60	45.22
	Højgård ii	3	676.82	225.61	53.43
	Højgård iii	4	550.65	137.66	33.77
Totals	11	25	3554.52	142.19	70.99

Table 7.1 Values of dwellings for early Bronze Age

wandering settlements noted for earlier Scandinavian prehistory (Ethelberg 1991, Webley 2008).

When examining the Total Habitable Area of each site in this period, great variation becomes apparent (Fig. 7.2). THA was linked to size of the settlement, as settlements with more dwellings generally displayed greater THA values. There was, however, definite variation in total roofed area. Højgård ii presented the largest THA from only three dwellings, while the range of THA from single dwelling farmsteads was 30<n<~300 m^2. Røjle Mose (MS1) presented less than 50 m^2 of THA from a single dwelling, making for an unusually small site. Both phases of Vadgård presented 66 m^2 of THA from a single dwelling. Egehøj i presented 126 m^2 of THA from one dwelling. Hemmed Church (MS2), Bjerre (RLS1), and Egehøj ii presented a THA of $200<n<400$ m^2. Legard (D1) presented a THA of 489 m^2 from two dwellings. The phases of settlement at Højgård presented the greatest THA values. The earlier period, belonging to EBA PI/II, presented 663.38 m^2 from six dwellings. The EBA PII phase, presented 676.82 m^2 from three dwellings, while the later PIII phase decreased to four dwellings that provided 550.65 m^2 of THA. There was an obvious distinction between settlements with THA values less than 300 m^2 and those with THA values greater than 300 m^2. All but one (Hemmed Church) of the larger group contained more than one dwelling. The large THA values and greater number of dwellings likely indicates a changing settlement organization toward multi-family farmsteads, perhaps a precursor to the village-type settlements of later prehistory.

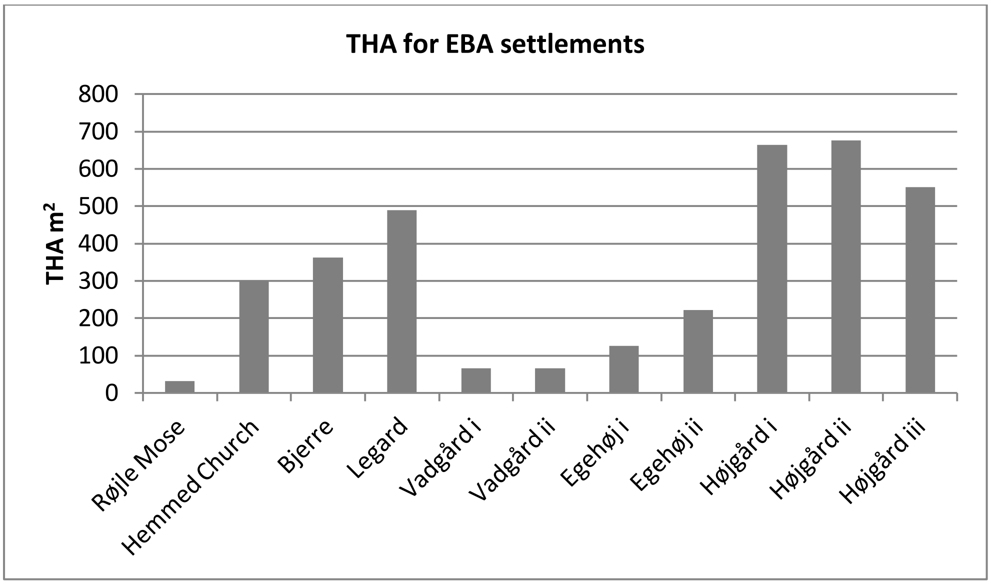


Figure 7.2 Distribution of Total Habitable Area per site for the Early Bronze Age

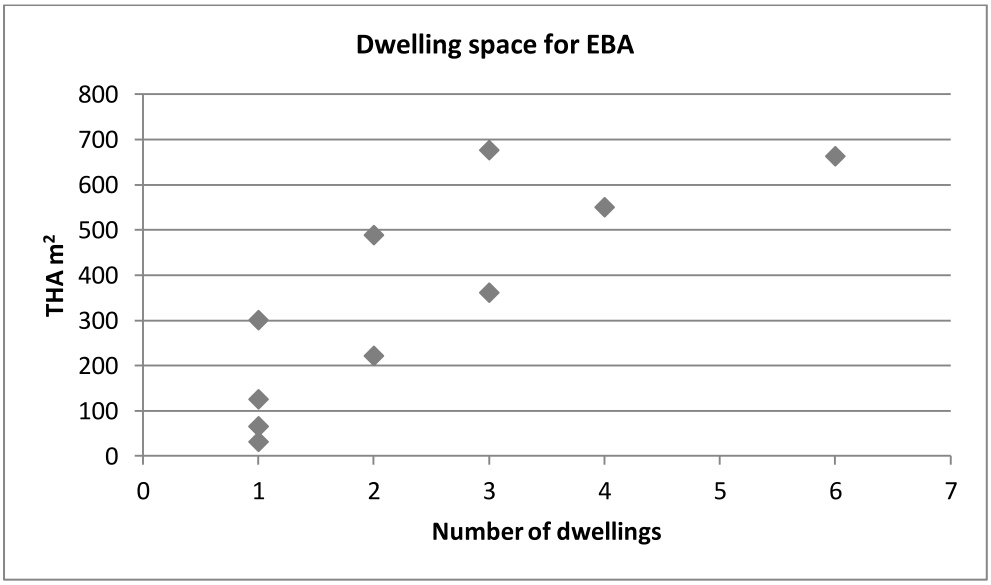


Figure 7.3 Contrast of number of dwellings and Total Habitable Area per site for the Early Bronze Age

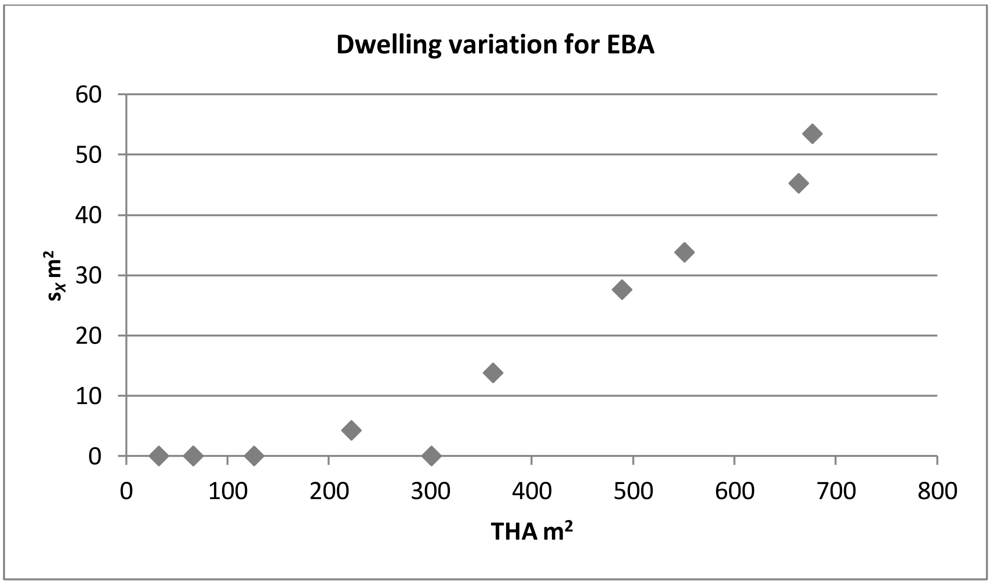


Figure 7.4 Contrast of Total Habitable Area and standard deviation per settlement for the Early Bronze Age

The average area of dwellings per site also suggests heterogeneity in construction. Røjle Mose and Vadgård i-ii presented an average dwelling area of $n<70$ m^2. Bjerre, Egehøj i-ii, Højgård i, and Højgård iii displayed an average dwelling area of $100<n<150$ m^2. Hemmed Church, Legard, and Højgård ii presented the greatest average dwelling area of $200<n<305$ m^2. The groupings of average dwelling size are further illuminated by contrasting the number of dwellings per site with THA values (Fig. 7.3). The data appear to present two populations of settlement size progression, with differing dwelling needs and the accompanied construction. The first trend includes Egehøj i-ii, Bjerre, and Højgård iii. Vadgård i-ii and Røjle Mose, the smallest settlements, were below the trends, indicating they were anomalously small for the period. The second trend, indicating greater THA values, included Hemmed Church, Legard, and Højgård ii. Højgård i, with one of the largest THA values, was more in line with the former trend, which could be attributed to problems of phasing on the site (see Appendix B). The appearance of two trends, along with the early multi-phased settlement at Højgård, Egehøj, and Vadgård, likely indicates changes in settlement organization and dwelling construction. Hemmed Church, Højgård i-iii, and Legard contained three-aisled longhouses, which appear in the record in the later part (PII-III) of the period. The two populations likely represent the preliminary phases of a change in settlement organization observed more fully in the following periods.

Intriguingly, the standard deviation in dwelling size per settlement presented an almost linear progression when contrasted with THA (Fig. 7.4). The largest variations in dwelling size were directly related to total roofed activity area. The more space required for living, the more varied the dwelling construction (Fig. 7.5), suggesting either an ad hoc construction based entirely upon spatial needs as they occurred or, following the suggestion of proto-villages, early evidence for hierarchy within the settlement. Larger settlements, with more dwellings and more variation in dwelling size, would have been more subject to the appearance of a social hierarchy, reflected in dwelling construction, than single-family farmsteads. The population was beginning to be reorganized into communal settlements, which pooled labour and increased resource demand in the immediate landscape. Højgård is an interesting case, as the THA and number of dwellings varied over its lifetime. Højgård i presented the greatest number of dwellings, yet the following phase contained half the dwellings with greater THA. Building size increased in the second phase of occupation, as larger three-aisled longhouses became more common, suggesting an increase in population. The contraction of the settlement to only three dwellings, however, could indicate a number of scenarios. Resources could have become scarcer, requiring a consolidation of the population into multi-family dwellings. The population itself could have contracted, yet the

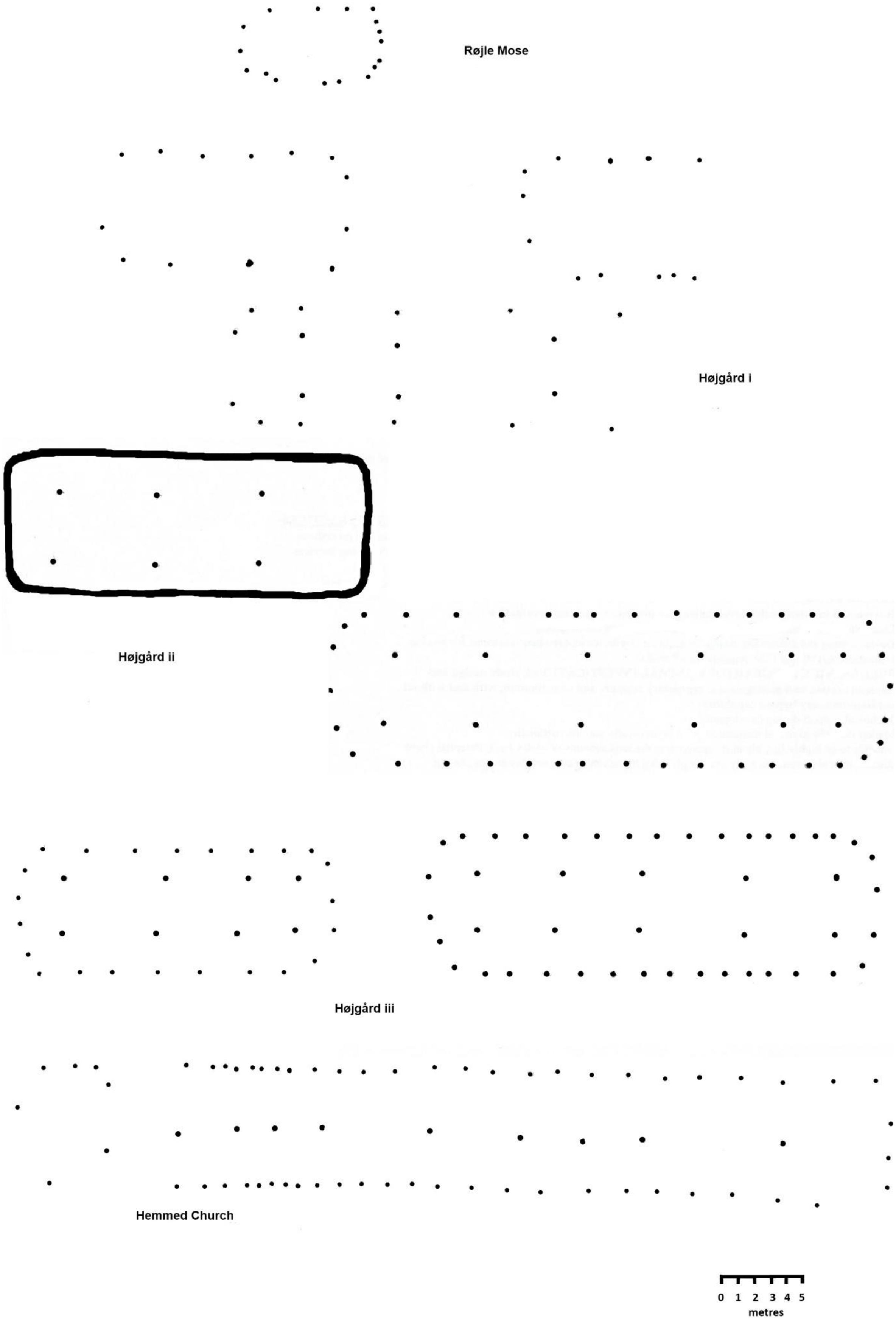


Figure 7.5 Comparison of selected EBA dwelling morphology. Røjle Mose after Jæger and Laursen 1983, Højgård after Ethelberg 1986, 1991, Hemmed Church after Boas 1989, 1991. N.B.: The solid line denotes estimated dimensions.

settlement remained able to muster resources and labour for dwellings with more space per capita. Taking the possibility of social hierarchy into account, the second phase also presented the greatest variation in dwelling size; settlement reorganization could reflect changing social structure with higher status families claiming larger dwellings. The final EBA phase of Højgård demonstrated a smaller variation, THA, and dwelling size, which at first glance appeared to contradict the scenarios presented, yet possibly indicates an early example of settlement organization typical to later prehistory.

The Late Bronze Age

Six Late Bronze Age settlements were included in this study. The number of dwellings per settlement in the Late Bronze Age in Denmark did not change substantially from the previous period. The majority of settlements (71%) displayed one to two dwellings (Table 7.2). The LBA phase of Højgård demonstrated an increase from its final EBA phase to nine dwellings. There does not appear to be an overall increase in the number of dwellings per site from the Early Bronze Age, indicating continuity in population organization in small farmsteads.

	Denmark	Number of Dwellings	THA m^2	Average Dwelling Area m^2	Standard Deviation S_X m^2
	Jegstrup	2	267.00	133.5	14.85
	Hemmed Church	2	468.00	234.00	98.34
	Højgård	9	788.10	87.57	23.76
	Vorbasse	2	326.00	163.00	7.07
	Heltborg	1	87.50	87.50	N/A
	Højby	1	137.90	137.90	N/A
Totals	6	17	2074.5	122.03	58.27

Table 7.2 Values of dwellings for Late Bronze Age

In contrast with the number of dwellings, the size of the dwellings and the Total Habitable Area appear to have increased greatly from the Early Bronze Age (Fig. 7.6). Only one settlement, Heltborg (MC6), presented a THA of $n<100$ m^2. Jegstrup (MC1) and Højby (MC2) presented a THA of $100<n<300$ m^2. Two sites (Hemmed Church and Vorbasse (OP2)) displayed a THA of $300<n<600$ m^2. Højgård again presented the greatest THA, with 788.10 m^2 from nine dwellings, although the excavators could not firmly ascertain contemporaneity, which is a possible source of skew. It is likely that, if representing phases of occupation, the data would be more similar to the earlier phases of the settlement. It is also possible that the data do represent a single phase, as earlier iterations of village structures typical to the Iron Age in Scandinavia have been dated to the Late Bronze Age (Jensen 1982). THA was largely

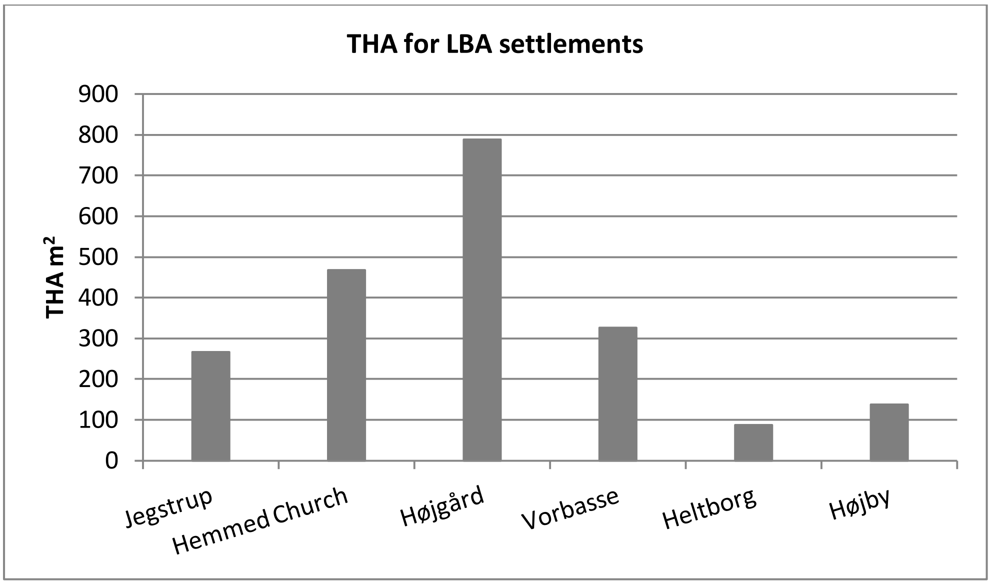


Figure 7.6 Distribution of Total Habitable Area per site for the Late Bronze Age

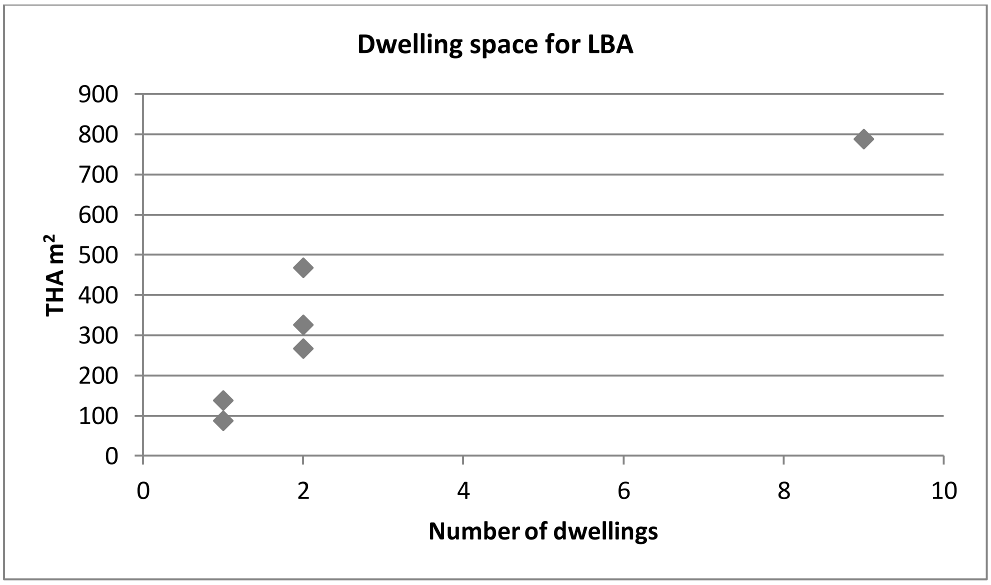


Figure 7.7 Contrast of number of dwellings and Total Habitable Area per site for the Late Bronze Age

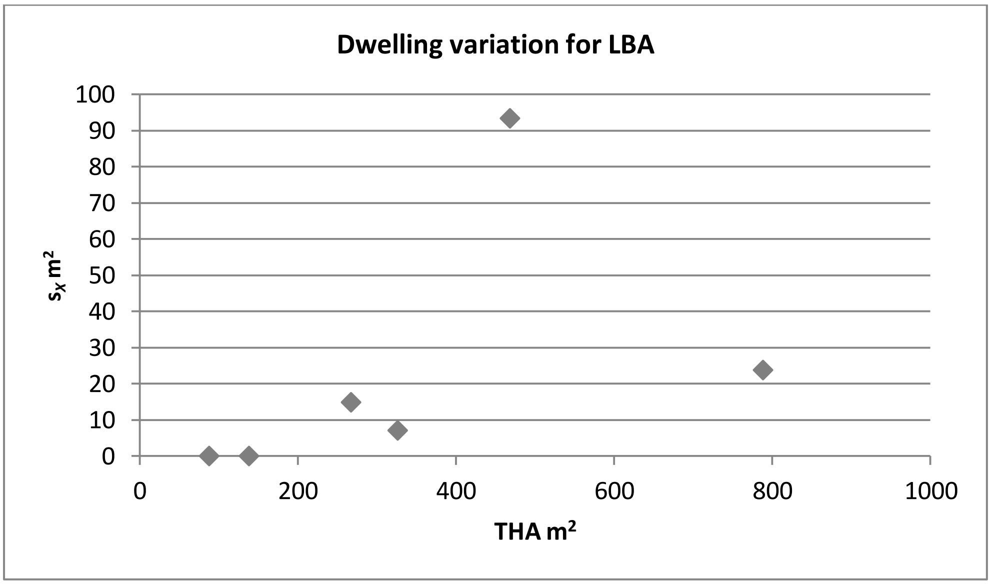


Figure 7.8 Contrast of Total Habitable Area and standard deviation per settlement for the Late Bronze Age

related to number of dwellings, as the single dwelling settlements were the smallest and Højgård with nine dwellings presented the greatest THA. The two dwelling settlements varied by over two hundred square metres of THA.

When contrasting the number of dwellings per site to the Total Habitable Area per site, the pattern is again inclined toward the linear, suggesting a continuation of the similarity in dwelling construction from the preceding period (Fig. 7.7). Four settlements (67%) displayed an average dwelling area of $100<n<200$ m^2, similar to the EBA settlements. Both the smallest and largest settlements, Heltborg and Højgård respectively, produced a mere 87.5 m^2 of average dwelling area, while Hemmed Church, the next largest settlement, presented an average dwelling area greater than 200 m^2. The variation in dwelling size was similar to the smaller end of the range present in the previous period (Fig. 7.8 and 7.9), although Hemmed Church displayed a much larger standard deviation of nearly 100 square metres between two dwellings. The standard deviations, excepting Hemmed Church, tended to follow THA values,

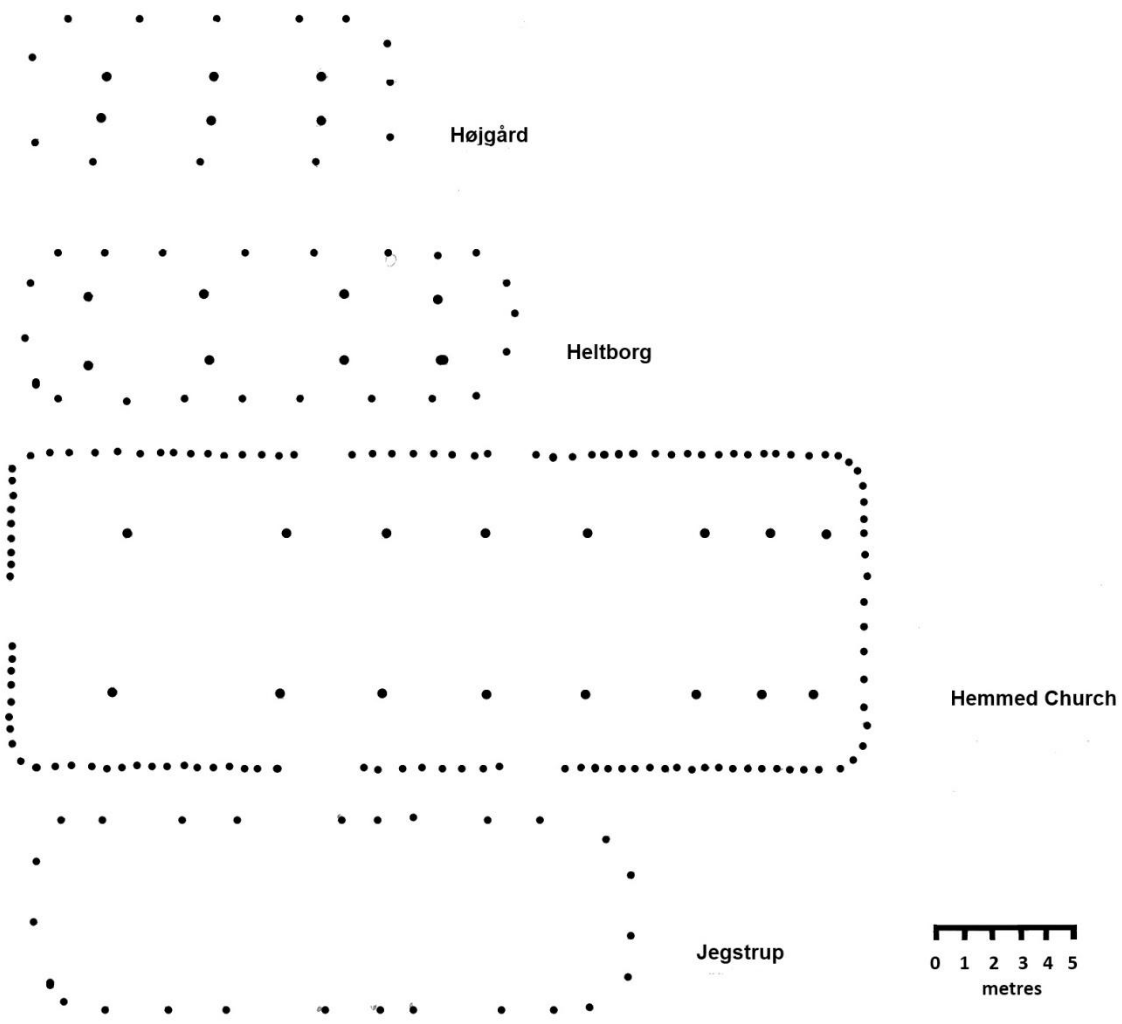


Figure 7.9 Comparison of selected LBA dwelling morphology. Højgård after Ethelberg 1986, 1991, Heltborg after Bech 1985, Hemmed Church after Boas 1989, 1991, Jegstrup after Davidsen 1982.

although Vorbasse, with a larger THA, presented a slightly smaller standard deviation than the smaller Jegstrup. The large variation at Hemmed Church, with only two dwellings, is interesting. Two dwelling settlements have been considered single-family farmsteads, where a social hierarchy reflected in domestic architecture would be unexpected. It is possible that Hemmed Church, which displayed a comparatively large THA for a single dwelling farmstead in the EBA, is representative of a very small multi-family settlement. A family able to command the resources and labour to construct a large dwelling in the preceding period could conceivably attract a labour force, expanding the settlement. Højgård in the LBA, alternatively, presented a larger THA and more dwellings than any of the EBA phases, yet the trend of smaller dwellings and standard deviation continued into the LBA. The large number of dwellings would immediately suggest a village-type settlement, yet there was only a small variation in dwelling size, suggesting if a hierarchy existed, it was not reflected in domestic architecture.

Organization into farmsteads of one to two dwellings continued to dominate the record and dwellings were of similar size from the previous period. Three-aisled longhouses continued from the end of the previous period, likely induced by a reorganization of family structure and animal stalling needs (Fokkens 2003). The domestic architecture of the Late Bronze Age appears less affected by possible social reorganization, as the variation in dwelling size was unremarkable (with the exception of Hemmed Church). The suggestion of higher status families with larger dwellings, more apparent on EBA settlements, is more opaque for the LBA.

The Early and Late Pre-Roman Iron Age

Montelius' (1885) Early Iron Age is treated here as further divided into Becker's (1961) Early and Late Pre-Roman Iron Age periods in order to avoid arbitrarily condensing multi-phased settlements and inflating the data. There were nine total settlements included in the Early Iron Age period, which included the multi-phase settlements of Grøntoft (MS6), Hodde (MS7), and Heltborg, resulting in seventeen phases of occupation. Multi-phased settlements were more common in the Iron Age (Ethelberg 1991), as reflected in the sample. Each phase was placed into its appropriate period, allowing us to more accurately observe the changes over time. Dividing the phased settlements into their respective further chronological categories, the Early Pre-Roman Iron Age sample contained ten settlement phases, while the Late Pre-Roman Iron Age contained seven settlement phases.

Denmark	Number of Dwellings	THA m^2	Average Dwelling Area m^2	Standard Deviation S_x m^2
Sejlflod	2	140.00	70.00	28.28
Omgård	1	82.50	82.50	N/A
Grøntoft i	36	1588.00	44.11	16.24
Grøntoft ii	35	1719.00	49.11	10.43
Grøntoft iii	9	451.00	50.11	9.16
Grøntoft iv	9	503.00	55.89	14.22
Hodde i	10	827.00	82.70	60.99
Hodde ii	17	935.00	71.59	27.52
Borremose	3	253.00	84.33	31.56
Skårup	17	935.00	55.00	3.95
Totals 10	139	7433.50	55.58	25.81

Table 7.3 Values of dwellings for Early Pre-Roman Iron Age

There is a definite increase in number of dwellings per site in the Early Iron Age from the previous periods. For the Early Pre-Roman Iron Age, the number of dwellings per site is largely greater than in the Late Bronze Age (Table 7.3). Three settlements (Sejlflod (MS4), Omgård (MS5), and Borremose (MC3)) demonstrated one to three dwellings, indicating a continuation in small family farmsteads. Grøntoft i and ii presented nine dwellings each, reminiscent of the LBA phase of Højgård. Three settlements (Hodde i-ii, and Skårup (MC4)) presented a range of 10≤*n*< 20 dwellings, more than any previous settlement. Grøntoft i and ii presented the most dwellings, with thirty-six and thirty-five respectively. It is interesting to note that the phases of Grøntoft decreased in number of dwellings over the EpRIA, which possibly indicates an increasingly smaller population with a lessened need for dwelling space over time. Hodde presented an opposite pattern, with the later phase displaying both more dwellings and a greater THA value. Drawing a conclusion is therefore difficult, other than to state that the population was still shifting, even as settlements became more permanent.

Observing the Total Habitable Area for the period, increase in roofed floor area continues to be apparent in this period (Fig. 7.10). Only Omgård presented a THA of $n<100$ m^2. Sejlflod and Borremose each presented a THA of $200<n<300$ m^2, within the typical Bronze Age values. Grøntoft iii and iv presented 450<n<~500 m^2 of THA, still within the LBA values. Hodde i-ii and Skårup displayed a THA of 800<n<1000 m^2, while the remaining settlements (Grøntoft i, Grøntoft ii, and Hodde ii) presented a THA of $1000<n<1800$ m^2. The increase from the Late Bronze Age is appreciable, as none of the earlier settlements presented a THA above 800 m^2 and the majority of THA values were less than 400 m^2. The increase in Total Habitable Area for the period is suggestive of an increasing need for roofed floor area and, paired with

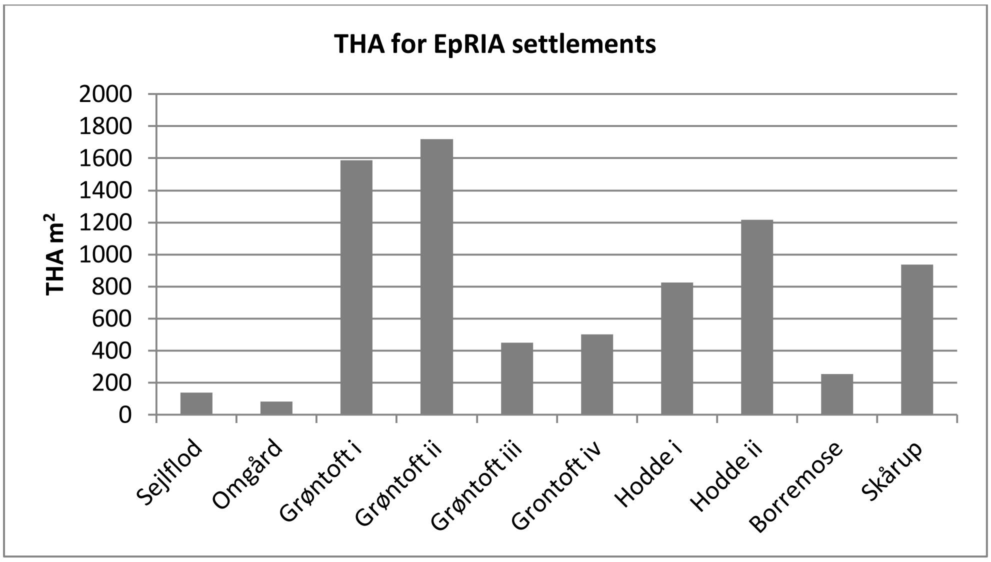


Figure 7.10 Distribution of Total Habitable Area per site For the Early Pre-Roman Iron Age

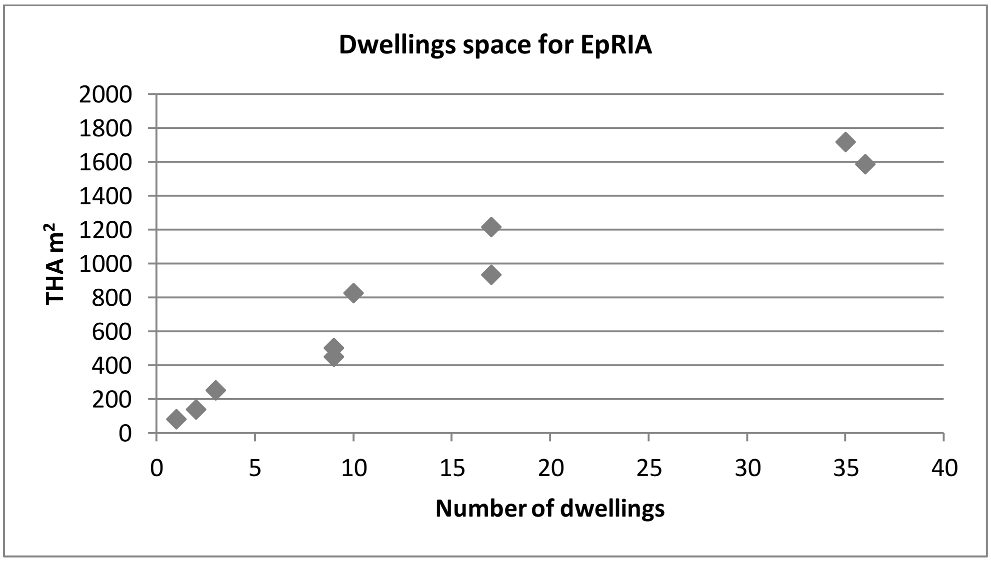


Figure 7.11 Contrast of number of dwellings and Total Habitable Area per site for the Early Pre-Roman Iron Age

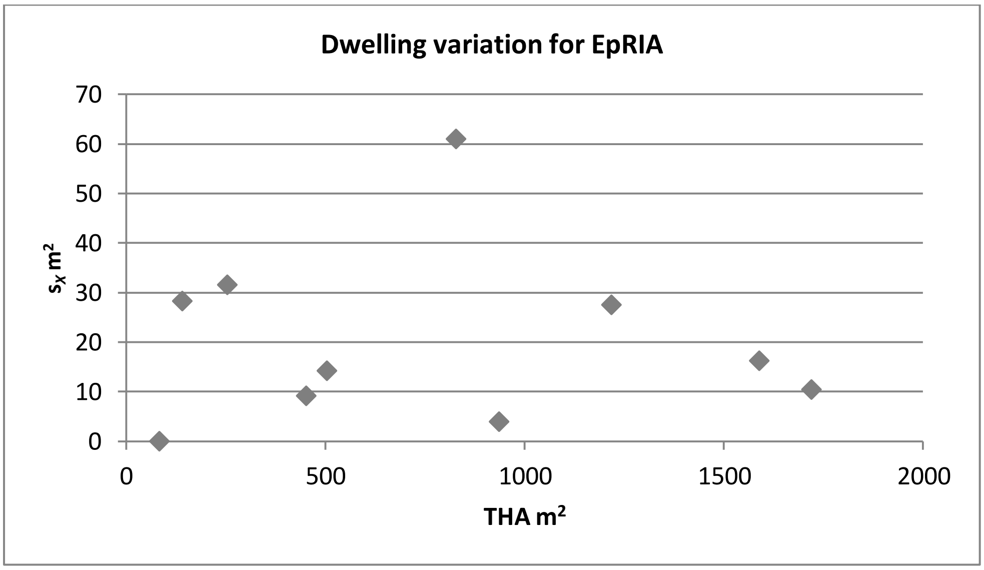


Figure 7.12 Contrast of Total Habitable Area and standard deviation per settlement for the Early Pre-Roman Iron Age

the increase in number of dwellings, a continued shift in settlement organization. The proto-villages of the Bronze Age were apparently becoming village-type settlements, with larger aggregations of the settlement living and working in a particular active landscape. Given that stabling of livestock accounted for approximately one-third to a maximum of one-half of longhouse area, and a consistent increase in available roofed floor space, it is reasonable to conclude that settlements in the EpRIA required more space for a greater accumulation of population in one location.

The average habitable area per dwelling is lesser than the previous period, indicating smaller dwellings sizes, despite the increase in number per site. All EpRIA settlements displayed an average dwelling area of $40<n<85$ m^2, as opposed to all LBA settlements presenting average dwelling areas greater than 85 m^2. This strongly demonstrates decreasing

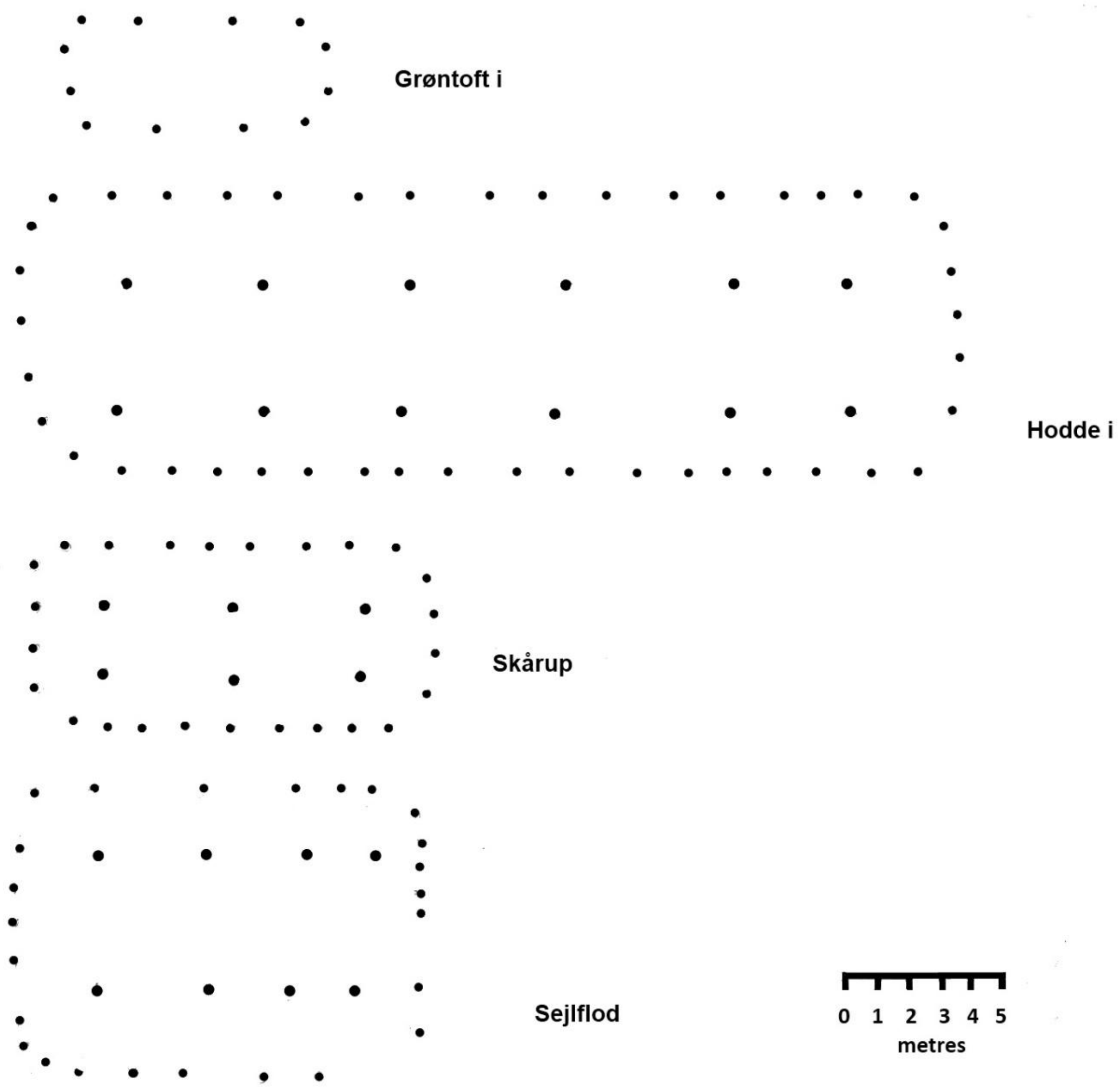


Figure 7.13 Comparison of selected EpRIA dwelling morphology. Grøntoft after Becker 1968, 1971, Hodde after Hvass 1983, Skårup after Olsen and Olsen 1982, Sejlflod after Nielsen 1982.

dwelling size over time in Denmark, which reflects the accepted pattern of settlement reorganization in the Danish Iron Age. Village-type settlements of farmstead units, formed by a collection of smaller dwellings, became increasingly common in the Early Pre-Roman Iron Age (Jensen 1982, Webley 2000). Grøntoft i-ii and Hodde i-ii presented a population of village-type settlements with ten to thirty-five dwellings providing a THA of nearly to well over 1000 m^2 (Fig. 7.11). Sejlflod, Borremose, and Omgård maintained the Bronze Age pattern of smaller groupings of dwellings, indicating two separate settlement strategies.

The variation in dwelling size per settlement continued to display a wide range (Fig. 7.13). As for the Late Bronze Age, the majority of settlements presented a standard deviation of less than 30 m^2. The variation displayed no correlation with THA (Fig. 7.12), marking a definite change from the Bronze Age. Number of dwellings also appeared to have little effect on standard deviation; Skårup and Hodde ii both presented seventeen dwellings, yet the former had a standard deviation of 3.95 m^2, while the latter of 27.52 m^2. Grøntoft i-iii indicated fewer dwellings over time, with a corresponding decrease in variation of size, yet Grøntoft ii had a THA over 1000 m^2 larger than the preceding phase. Grøntoft iv, despite containing one-fourth the number of dwellings and more than three times greater THA, presented a standard deviation similar to Grøntoft i. The possibility of hierarchical architecture is thus further obscured. Grøntoft i, Hodde i-ii, and Borremose all contained at least one dwelling larger than 100 m^2, with at least thirty-five square metres difference between the two largest dwellings per settlement. As those settlements, with the inclusion of Sejflod, presented the largest standard deviations of n>15 m^2, the appearance of ranked architecture in the EpRIA is suggested. The presence of a social hierarchy on Hodde i and ii, which has been determined by analyses of finds and grave morphology (Hedeager 1992, Mahoney 2008), cannot be denied through the architecture, as the initial phase presented two dwellings, the smaller of which was 100 m^2 larger than the next, with fifty-nine square metres between them. Hodde ii continued the disparity, with an incredible eighty-five square metres of difference between the two largest dwellings. Sejlflod, although representative of a small farmstead, also demonstrated a comparatively large variation, and a difference of forty square metres between the two dwellings. As with Hemmed Church in the LBA, Sejlflod may be representative of a smaller settlement that nonetheless contained a population of heterogeneous rank.

The settlements dated to the Late Pre-Roman Iron Age (see Appendix B) continued the shift toward a greater amount of dwelling space over time. Heltborg i and ii presented a settlement structure similar to that of the Bronze Age, with three dwellings in each phase. Borremose and Vorbasse displayed eight and nine dwellings, respectively, again continuing the proto-village structure found in both the preceding period and the Bronze Age. Hodde iii-iv and Kjærsing (MC6) presented evidence for 20<n<30 dwellings. These values suggest continuity in settlement size from the Early Pre-Roman Iron Age (Table 7.4). Two settlements, Hodde and Borremose, with phases of settlement in both the Early and Late Pre-Roman Iron Age demonstrated an increase in the number of dwellings in the latter period.

The Total Habitable Area per site for the period does not demonstrate an increase from the Early Pre-Roman Iron Age, although more settlements (57%) present a THA of over 1000 m^2 (Fig. 7.14). Borremose and Heltborg i-ii appear to highlight a different population than Vorbasse, Hodde iii-iv and Kjærsing (MC5). Both phases of Heltborg presented a THA of n<200 m^2, while Borremose presented a THA of 563.70 m^2. In contrast, Vorbasse, Hodde iii-iv, and Kjærsing displayed a THA of 1000<n<1700 m^2. The data suggest the continuance of two settlement patterns: smaller farmsteads similar to the Bronze Age and a continuation of the village-like agglomeration of farmsteads from the EpRIA (Fig. 7.15).

The average dwelling area per site suggests consistency with those of the EpRIA (Fig. 7.16). With the exception of Vorbasse, the settlements in the Late Pre-Roman Iron Age presented an average dwelling area of n<75 m^2, which was comparable to the preceding period. Vorbasse, which also produced a Late Bronze Age phase of settlement, continued to produce dwellings of similar, albeit slightly smaller, size to its preceding phase. The similarity to the EpRIA values suggests continuity in dwelling construction of smaller dwellings than in the Bronze Age. The variation in dwelling size per settlement is much smaller than the preceding periods (Fig. 7.17). While the largest standard deviations are connected to the settlements with greater THA, the association is not linear. Kjærsing presented the greatest differentiation, although Hodde iv displayed the largest THA. The association between large standard deviation and possible hierarchical architecture is less clear. Kjærsing did indeed present a dwelling of over 100 m^2, yet the differential to the next largest dwelling was only ten square metres. Hodde iii and iv had a difference of 30 m^2. A standard deviation of

	Denmark	Number of Dwellings	THA m^2	Average Dwelling Area m^2	Standard Deviation s_X m^2
	Vorbasse	9	1080.00	120.00	0.05
	Hodde iii	26	1475.00	56.73	14.58
	Hodde iv	28	1674.00	59.79	13.79
	Borremose	8	563.70	70.46	13.45
	Kjærsing	22	1470.00	66.82	15.55
	Heltborg i	3	192.50	64.17	5.84
	Heltborg ii	2	67.84	33.94	8.60
Totals	7	99	6523.04	66.56	23.28

Table 7.4 Values of dwellings for Late Pre-Roman Iron Age

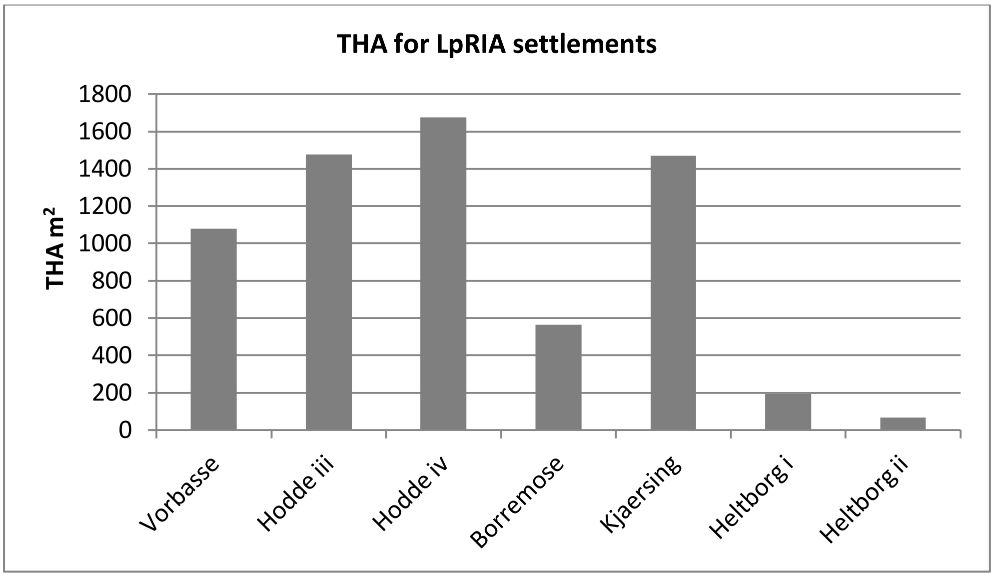


Figure 7.14 Distribution of Total Habitable Area per site for the Late Pre-Roman Iron Age of Denmark

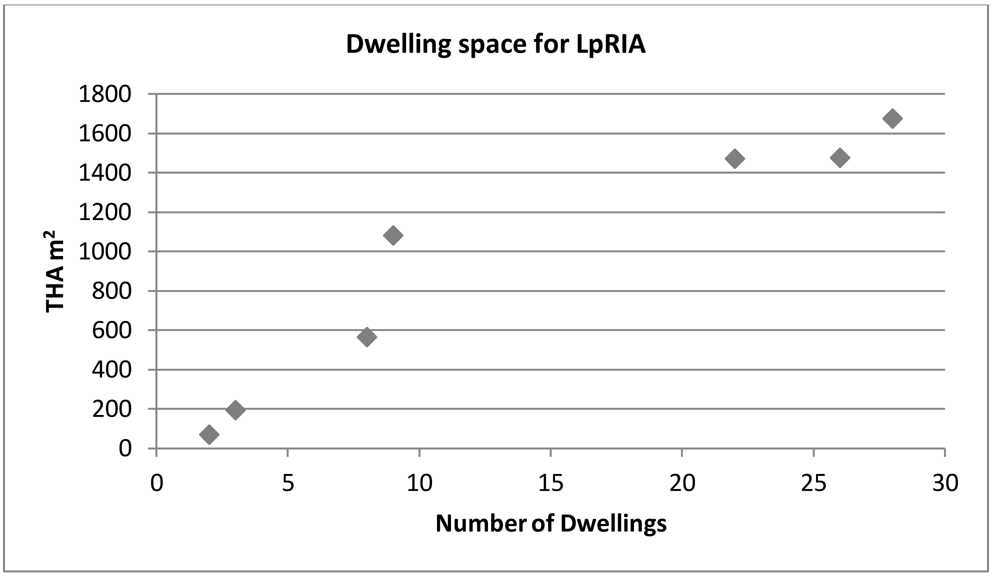


Figure 7.15 Contrast of number of dwellings and Total Habitable Area per site for the Late Pre-Roman Iron Age

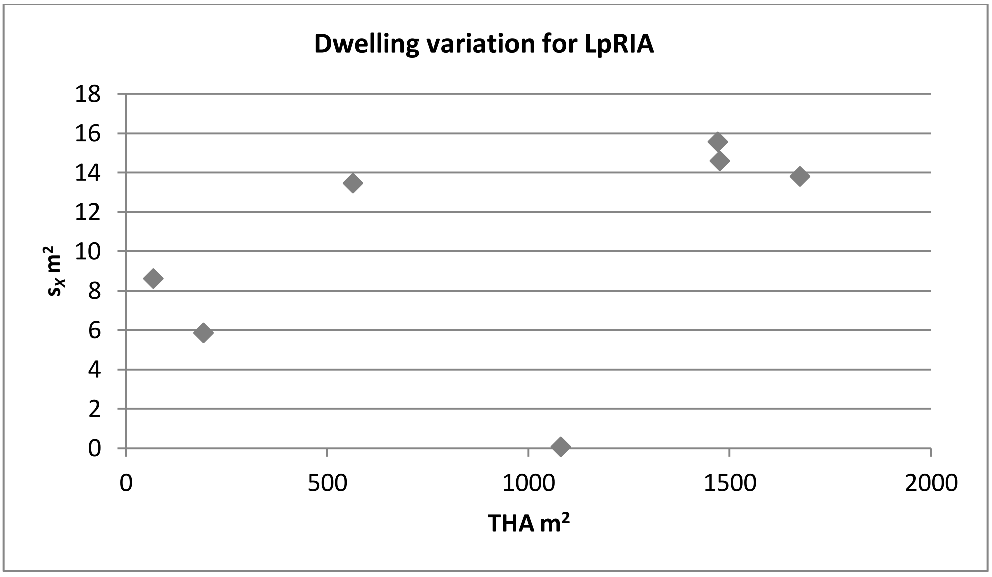


Figure 7.16 Contrast of Total Habitable Area and standard deviation per settlement for Late Pre-Roman Iron Age

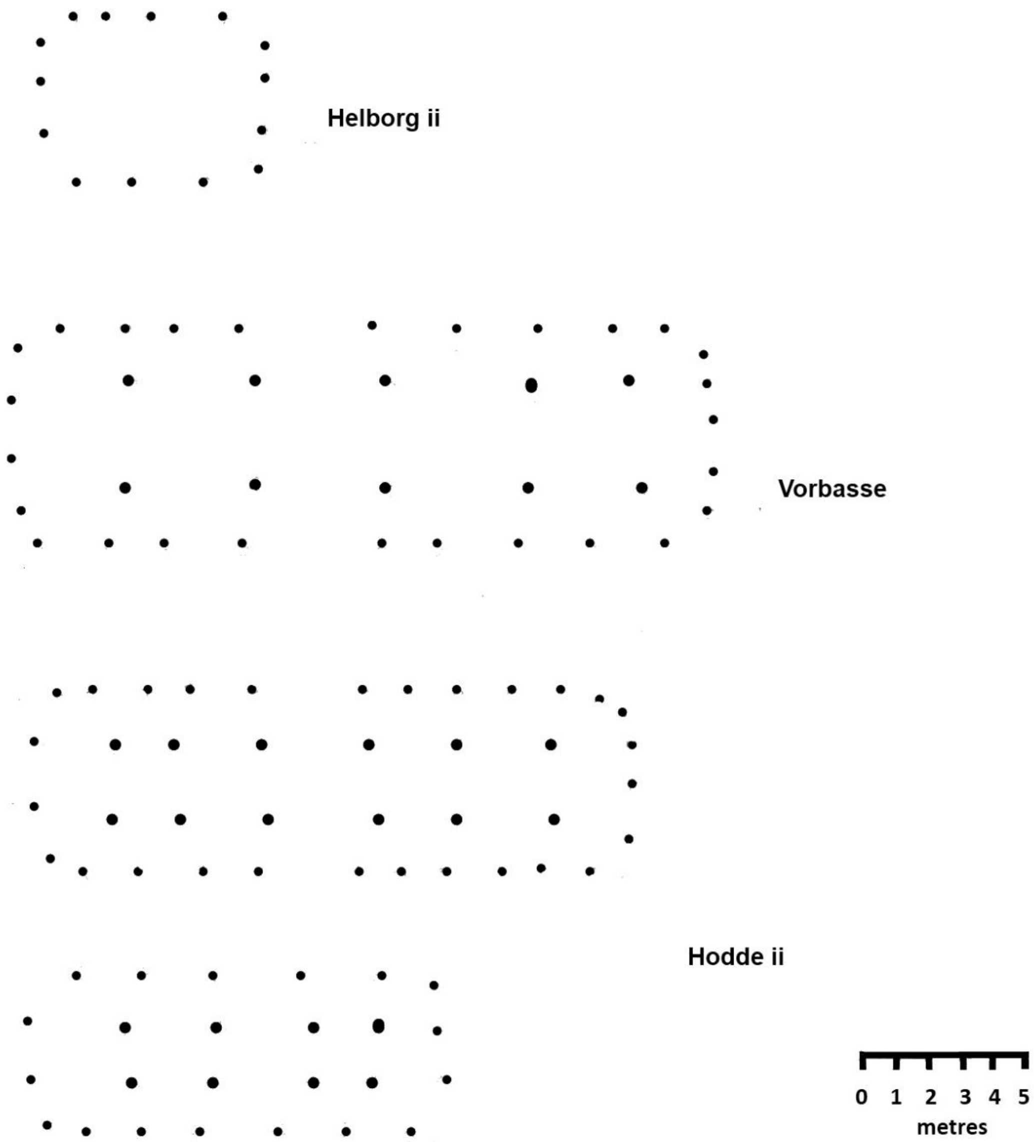


Figure 7.17 Comparison of selected LpRIA dwelling morphology. Heltborg after Bech 1985, Vorbasse after Hvass 1983, Hodde after Hvass 1985.

over 15 m^2 is apparently not a clear indication of possible ranked architecture. While there is no set differential marking ranked buildings from more egalitarian settlements, a difference of at least ten square metres is present on every Danish settlement with more than one dwelling included in this study. Hodde, meanwhile, consistently demonstrated at least one dwelling of 30<n<100 m^2 larger than the other dwellings.

Synopsis

There are definite trends in THA for each period (Fig. 7.18). All but one site, the LBA phase of Højgård, for both periods of the Bronze Age presented THA of n<600 m^2. Half of the Early Iron Age settlements exceeded 600 m^2, while over half (57%) of the LpRIA settlements displayed a THA n>1000 m^2. The number of dwellings per site presented a similar trend; the Bronze Age sites presented fewer than ten dwellings each, while half of the EpRIA settlements displayed between ten and thirty-six dwellings. Intriguingly, the smallest settlements of one to three dwellings remained of similar THA throughout the BA-IA transition. The dwelling size per settlement for the LBA did not display clear increase or decrease toward the end of the Bronze Age, although there was a tendency toward larger dwellings on the smaller settlements. Individual dwelling area then decreased into and throughout the Early Iron Age. This was reflected in the average dwelling area per period (EBA: 142.19 m^2, LBA: 122.03 m^2, EpRIA: 55.58 m^2, LpRIA: 67.34 m^2), although the averages indicate a slight tendency toward growth in the LpRIA, due to the continuance of three settlements with a single dwelling100 m^2 or more. Simultaneously, the number of dwellings per site increased on the majority of settlements, indicating larger settlements of smaller houses. There was strong continuity in

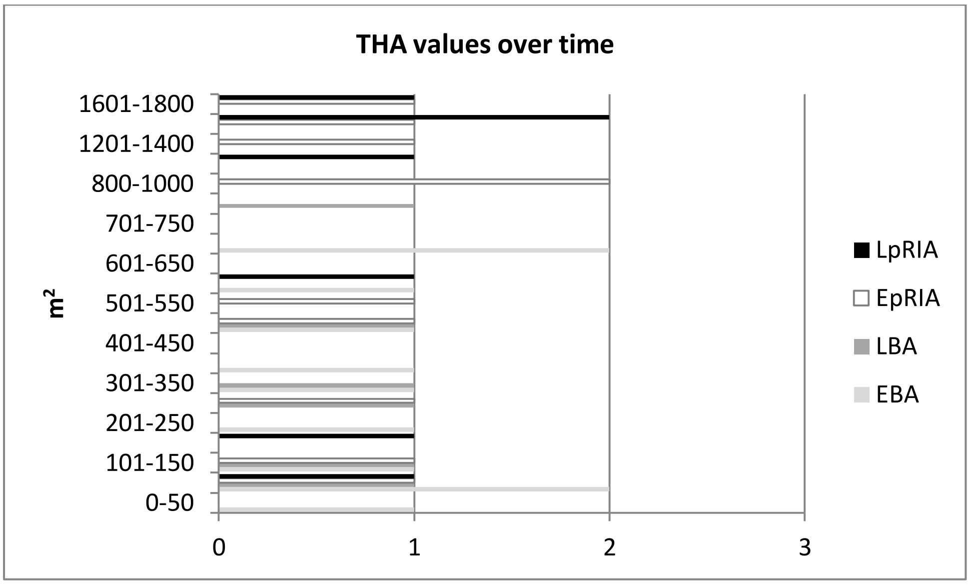


Figure 7.18 Range of Total Habitable Area for Denmark over time

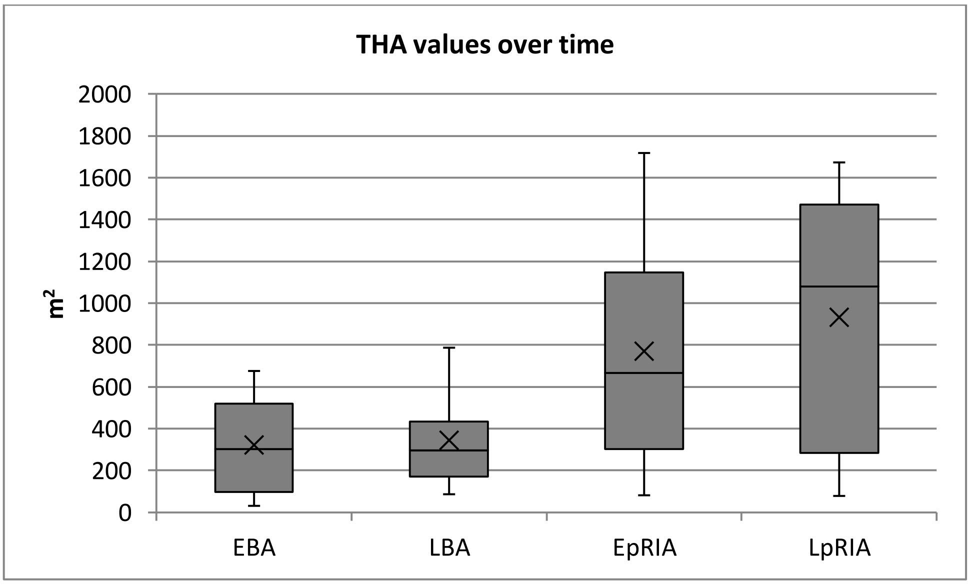


Figure 7.19 Total range of Total Habitable Area values over time. X indicates average TAA for the period.

individual farmsteads over time, even as the number of single-family farmsteads declined into the EIA (81% in the EBA, 83% in the LBA, 30% in the EpRIA, and 21% in the LpRIA) and the majority of the population formed village-type settlements.

There was both continuity and growth over time in Total Habitable Area of the Danish material. The LBA displayed a larger minimum and maximum THA value, yet the bulk of the settlements were decidedly similar to the preceding period. Even as the smallest settlement remained similar to the LBA, there was an abrupt increase in THA for the Early Pre-Roman Iron Age. The smaller settlements were similar to the larger Bronze Age settlements, while the larger settlements were much larger. The trend of growth continued at a lower rate in the LpRIA, as the breadth of THA values increased, weighted more heavily toward larger settlements. An examination of the average THA values (Fig. 7.19) indicates the similarity present in the Bronze Age, followed by a definite tendency toward increasingly larger settlements that proceeded through the Early Iron Age. The variation in dwelling size decreased over time (EBA: 70.99 m^2, LBA: 58.27 m^2, EpRIA: 25.81 m^2, LpRIA: 22.45 m^2). Dwellings were increasingly more similar over time. The larger dwelling differentiation in the Bronze Age periods is suggestive of hierarchical architecture, as individual settlements displayed 30 to 100 m^2 difference between the largest dwellings. The smaller differentiation in the later periods does not suggest a lack of social hierarchy, but that status could have been primarily displayed through means other than architecture. Select settlements (*e.g.* Hodde i-iv) continued to display large differentials in individual dwelling area throughout the EIA, although even the later phases presented dwellings that were more similar to each other.

Small, independent farmsteads of one to three large dwellings dominated in the Bronze Age, shifting to village-like settlements of grouped farmsteads of smaller dwellings. The Pre-Roman Iron Age presented an interesting blend of settlement type, albeit consisting of the smaller dwellings typical to the Iron Age. The introduction of the larger, agglomerated settlements and the continuance of small farmsteads would suggest a community in transition; however, the presence of both settlement types throughout the target periods indicates two separate populations. This variation in settlement pattern has definite implications for agricultural production that will be investigated in the rest of this chapter.

7.2 Agricultural production

As stated previously, this study examines the use of storage capacity as a proxy for agricultural production. Trends in the available storage will provide information regarding the maximum productive capacity, particularly when examined in relation to changes in dwelling, as population proxy. The Danish material displayed primarily evidence of post-structure storage. A small percentage of sites contained pits; however, they were not prolific enough for a comparison and are therefore not included.

The Early Bronze Age

The majority (72%) of settlements in the Early Bronze Age did not present any evidence for post-structures (Table 7.5). Røjle Mose and Vadgård i-ii presented evidence of two to three additional structures. Vadgård is a unique settlement, as the additional structures were not post-structures, but turf-walled structures more commonly located in Norway at the time (Lomborg 1976, Rasmussen 1993). The excavators, however, interpreted the small structures as additional to a single dwelling per phase. The lack of dedicated above ground storage on the majority of settlements indicates a lack of agricultural surplus for those sites, or the possibility of storage now invisible in the archaeological record.

The three settlement phases that demonstrated post-structures presented different total additional areas. Røjle Mose displayed 27.48 m^2 of TAA from two post-structures. Vadgård i presented 85.50 m^2 of TAA while Vadgård ii presented 128.25 m^2 (Fig. 7.20). Even when reduced to average post-structure area, the sites remain distinct. Vadgård displayed an average post-structure area of 43.25 m^2, while Røjle Mose presented an average post-structure area of 13.74 m^2. Figure 7.21 illustrates the contrast between the numbers of post-structures with the Total Additional Area per site. The turf-walled structures of Vadgård were much larger than the post-structures of Røjle Mose, creating over three times the TAA from the same number of dwellings (Fig. 7.22). The differing amount of potential agricultural storage suggests varied production and construction based on need. The amount of variation present in the post-structures of Røjle Mose, as large as select differentiation in dwellings for the period, does indicate the structures were built to suit specific needs, rather than an ideal of a 'granary', and thus providing indication of a scale of production for the Early Bronze Age. The increase from Vadgård i to Vadgård ii, with the addition of another similarly sized turf-walled structure does suggest an increase in necessary consumptive space. Resources would not have been wasted on labour-intensive turf-walled structures without a strong impetus, such as need for storage/activity space. The similarity in size apparent in additional storage for both phases of Vadgård, while unusual, is reflected in the continuity of dwelling construction between the consecutive phases of EBA occupation. With such a small sample of post- structures for the period, it is difficult to make any conclusions regarding agricultural

	Denmark	Number of Post-Structures	TAA m²	Average Post-Structure Area m²	Standard Deviation s_x m²
	Røjle Mose	2	27.48	13.74	2.63
	Hemmed Church	0	0	N/A	N/A
	Bjerre	0	0	N/A	N/A
	Legard	0	0	N/A	N/A
	Vadgård i	2	85.50	42.75	0
	Vadgård ii	3	128.25	42.75	0
	Egehøj i	0	0	N/A	N/A
	Egehøj ii	0	0	N/A	N/A
	Højgård i	0	0	N/A	N/A
	Højgård ii	0	0	N/A	N/A
	Højgård iii	0	0	N/A	N/A
Totals	11	7	241.23	34.46	14.20

Table 7.5 Values of post-structures for Early Bronze Age sites in Denmark

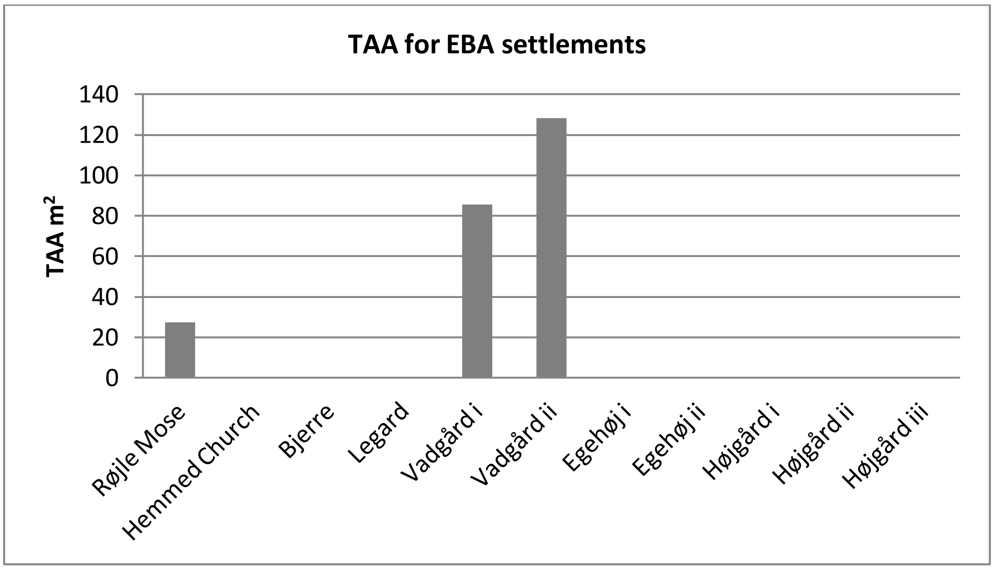


Figure 7.20 Distribution of Total Additional Area per site for the Early Bronze Age

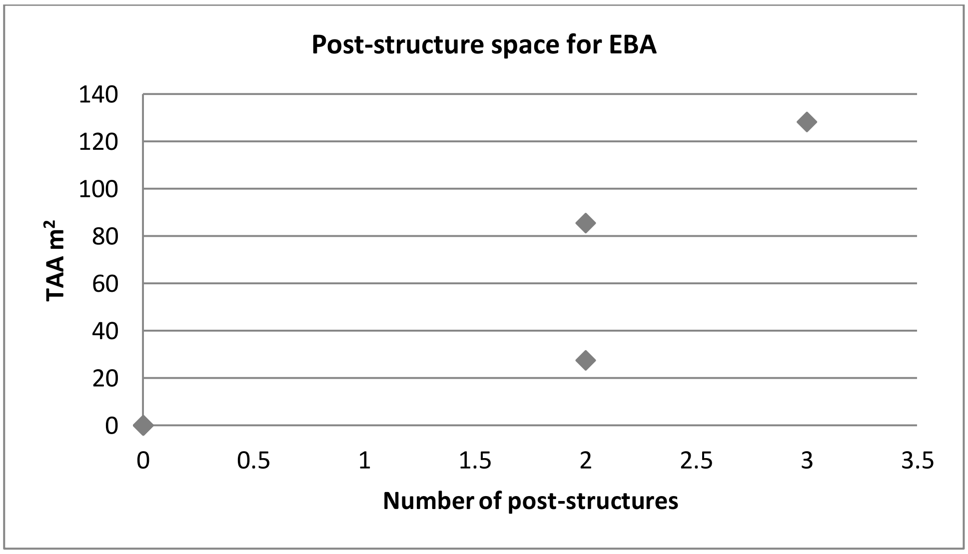


Figure 7.21 Contrast of Total Additional Area and number of post-structures per site for Early Bronze Age

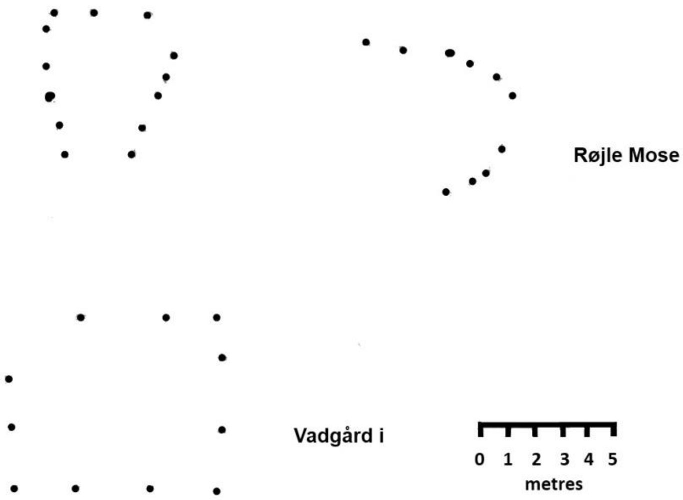


Figure 7.22 Comparison of selected EBA post-structure morphology. Røjle Mose after Jæger and Laursen 1983, Vadgård after Lomborg 1976.

production. The lack of post-structures on the majority of settlements is noteworthy; those settlements required grain that is not visible in the architecture, which may imply either production in such small amounts as to be able to be kept within dwellings or interaction between neighbouring settlements with a higher agricultural productivity that is not directly observable from the record. Given the extremely small portion of settlements within the sample that produced post-structures, the former option appears the most likely in this instance, particularly as Røjle Mose and Vadgård presented the least amounts of THA, yet were the only representation of storage for the period.

The Late Bronze Age

Post-structure presence increased in the Late Bronze Age, with half the settlements presenting post-structures. Three of the six Late Bronze Age settlements (Jegstrup, Heltborg, and Højby) did not display evidence of post-structures. The remaining three sites (Hemmed Church, Vorbasse, and Højgård) did not display any great change in number of post-structures from the previous period, as all presented between two and three post-structures (Table 7.6).

When examining the Total Additional Area per site, there is a definite increase from the previous period in potential above ground storage capacity (Fig. 7.23). Højgård and Hemmed Church presented nearly equivalent TAA, with values reminiscent of Vadgård ii in the EBA. Vorbasse presented a TAA value of 135 m^2, slightly larger than the preceding period. The average additional areas from post-structures per settlement were comparable than that of Vadgård in the preceding period. All three settlements displayed an average additional area per post-structure of 45≤*n*<75 m^2, suggesting a more consistent construction than in the previous period. Contrasting the number of post-structures with the Total Additional Area per site illustrates the similarity in available above ground storage space (Fig. 7.24).

The similarity in average post-structure area between Højgård, Vorbasse, and Hemmed Church is a marked change from the EBA. The small differentiation in post-structure size per settlement (n<5 m^2) continued from the previous period (Fig. 7.25). In the LBA, there was very little variation in post-structure size, even from three distinct settlements, rather than successive phases of the same settlement. The data indicate a much stronger continuity in post-structure construction, and thus the energy invested in consumptive architecture, in the Late Bronze Age.

Unlike the EBA settlements, the LBA settlements with post-structures were the largest settlements in regard to dwellings. The values of TAA (agricultural production) partially reflect the values of THA (population) for the period. Højgård presented both the greatest THA and TAA. Hemmed Church and Vorbasse, however, presented different relationships between dwellings and post-structures; Hemmed Church presented the least TAA, yet Vorbasse

	Denmark	Number of Post-Structures	TAA m^2	Average Post-Structure Area m^2	Standard Deviation S_x m^2
	Jegstrup	0	0	N/A	N/A
	Hemmed Church	2	74.00	37.00	2.83
	Højgård	2	78.00	39.00	4.24
	Vorbasse	3	135.00	45.00	0
	Heltborg	0	0	N/A	N/A
	Højby	0	0	N/A	N/A
Totals	6	7	287.00	41.00	4.36

Table 7.6 Values of post-structures for Late Bronze Age sites in Denmark

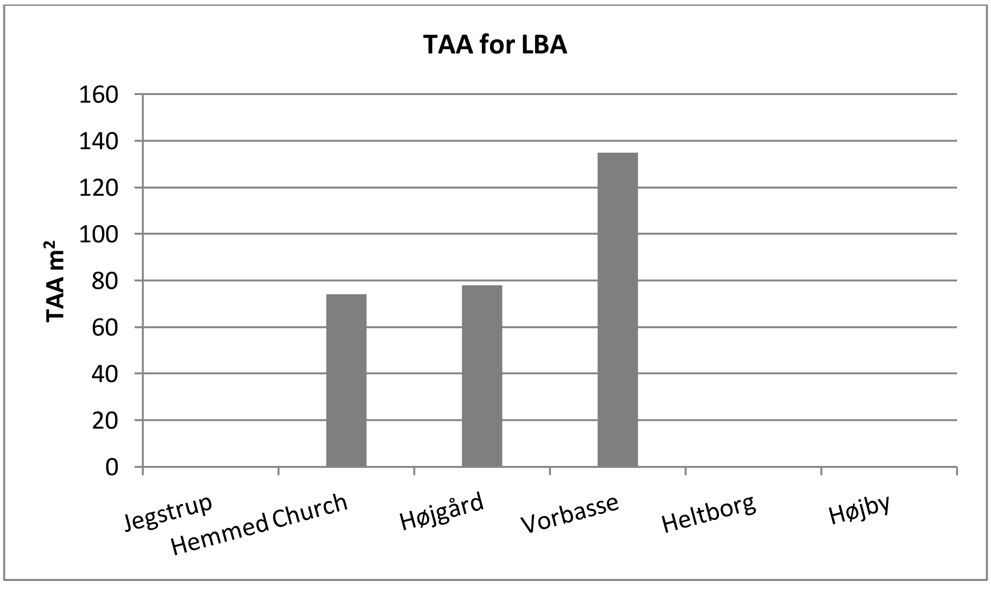


Figure 7.23 Distribution of Total Additional Area per site for the Late Bronze Age

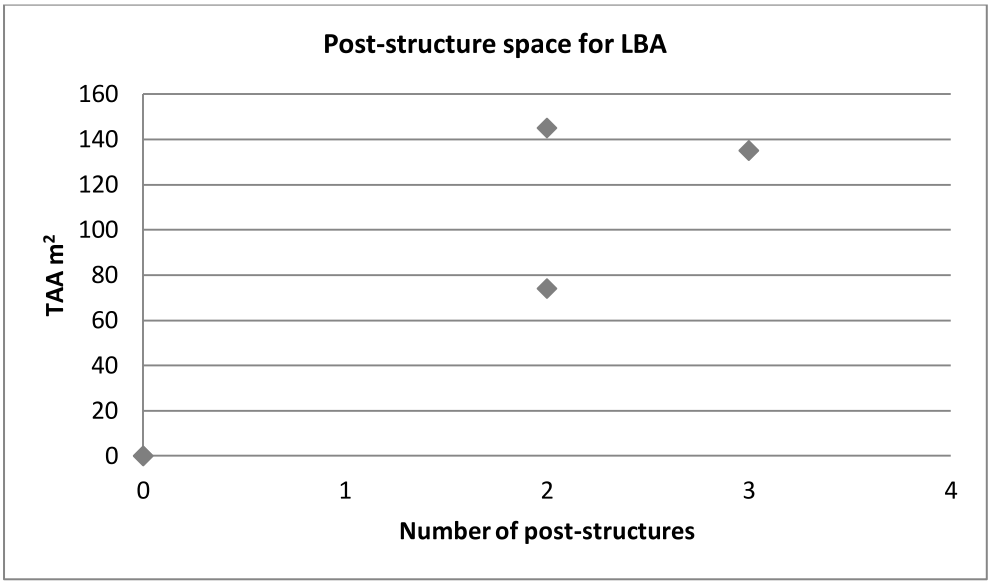


Figure 7.24 Contrast of TAA and number of post-structures per site for Late Bronze Age

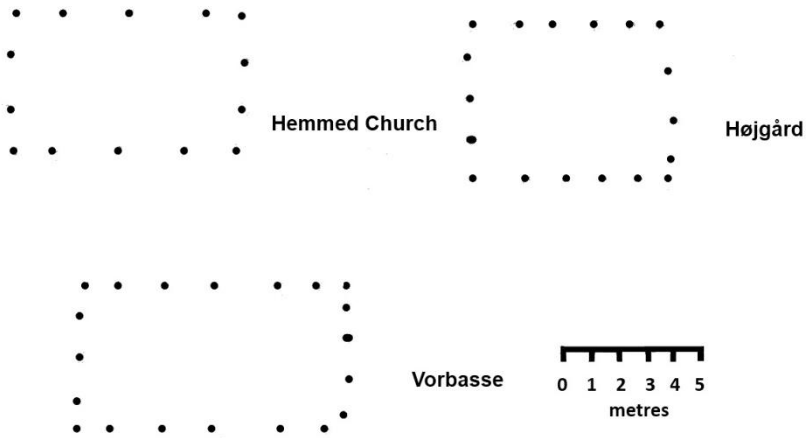


Figure 7.25 Comparison of selected LBA post-structure morphology. Hemmed Church after Boas 1989, Højgård after Ethelberg 1986, 1991, Vorbasse after Hvass 1983.

presented the least THA of the settlements with post-structures. The differing relationship between population and agricultural production suggests variable investment in arable agriculture, and raises the question of interaction between settlements with little to no above ground storage and smaller populations, and those with plentiful storage and larger populations. The continuity in THA, with a slight increase, from the EBA to the LBA is matched by the continuity in TAA. There does not appear to be an increase in energy invested in construction of consumptive architecture; agricultural production likely continued at a similar level throughout the end of the Bronze Age. An increase in production would be reflected in more settlements with post-structures and/or larger TAA values. Settlements lacking post-structures, although proportionally smaller in the LBA sample, indicate production at a level easily stored within dwellings with no need for specialized architecture. Even if post-structures served multiple purposes as crafting/processing space, the continuity in appearance and construction indicates no great change from the EBA to the LBA.

The Early and Late Pre-Roman Iron Age

Again, the Early Iron Age was divided further into the Early and Late Pre-Roman Iron Age. A total of seventeen settlement phases were included in the Early Iron Age sample for this study, from nine settlements. The Early Pre-Roman Iron Age sample consisted of ten settlement phases, while the Late Pre-Roman Iron Age included seven settlements. Not only is the presence of post-structures greater in this period than the preceding, but the number of post-structures per site increased. This is indicative of a growing need for above ground agricultural storage, suggesting an increase in production.

The Early Pre-Roman Iron Age settlements continued the trend of increasing post-structure presence over time. Six of the ten settlement phases in this period presented evidence of post-structures (Table 7.7). Three of the settlements (Omgård, Grøntoft iii, and Borremose) presented less than five post-structures, maintaining the pattern of consumptive architecture present in the Bronze Age. Two settlements (Grøntoft ii and Hodde i) presented between five and ten post- structures. Hodde ii presented the most post-structures (n=12), four times the greatest number of post-structures in the Bronze Age. An increase in number of post-structures marks a shift toward more consumptive architecture being necessary, and therefore an increase in production or at least a reorganization of storage practices made visible.

	Denmark	Number of Post-Structures	TAA m^2	Average Post-Structure Area m^2	Standard Deviation s_x m^2
	Sejlflod	0	0	N/A	N/A
	Omgård	3	141.25	47.09	35.45
	Grøntoft i	0	0	N/A	N/A
	Grøntoft ii	9	167.00	18.56	8.11
	Grøntoft iii	1	22.50	22.50	N/A
	Grøntoft iv	0	0	N/A	N/A
	Hodde i	5	73.50	14.70	2.39
	Hodde ii	12	306.50	25.54	7.52
	Borremose	2	67.06	33.53	7.82
	Skårup	0	0	N/A	N/A
Totals	10	32	777.81	24.31	14.20

Table 7.7 Values of post-structures for Early Pre-Roman Iron Age sites

Borremose, Hodde i, and Grøntoft iii presented a TAA of less than eighty square metres, similar to the Bronze Age values. The remaining settlements presented a TAA of $100<n<310$ m^2 (Fig. 7.26), demonstrating an increase from the previous period. Overall, there was an increase in the amount of available consumptive architecture for the EpRIA. While Omgård, Borremose, and Hodde i presented values similar to the preceding period, Hodde ii presented over twice the greatest amount of TAA from the Late Bronze Age. The differences in necessary storage capacity suggest a variable production, dependent on individual settlement location, and raise the question of inter-settlement relations. The increase in both number of post-structures and TAA, however, indicates an overall increase in production, as the energy and resources invested in creating consumptive architecture reflect a need for additional roofed space not able to be met by dwelling space. This may be a reflection of the decrease in dwelling size beginning to appear at the start of the Iron Age.

The average post-structure area per settlement for the period was $15<n<50$ m^2, a greater range than the previous periods. Grøntoft ii-iii and Hodde i-ii demonstrate smaller average values than the Late Bronze Age. This suggests smaller, more numerous post-structures over time, again mirroring the trend in dwellings. The contrast of number of post-structures to Total Additional Area per site suggests a fairly standardized construction (Fig. 7.27). Two trends are apparent in the data. Grøntoft ii, Hodde i, and Hodde ii, presenting the greatest number of post-structures per site for the period, formed a linear progression offset from the trajectory of the remaining settlements, representing similar numbers of post-structures to the Bronze Age. The possibility of these larger settlements, in terms of THA, practicing a different approach to arable agriculture and producing greater amounts requiring more storage cannot be overlooked.

The differentiation in post-structure size per settlement was slightly larger than the LBA values (Fig. 7.28). A greater variation in size is suggestive of successive construction following an increase in demand for consumptive architecture. The majority of settlements presented less than ten square metres of standard deviation, while Omgård presented an incredible 35.45 m^2 of standard deviation. Differentiation in post-structure size was neither a function of number of post-structures nor TAA, further indicating post-structures were constructed purely on an as-necessary basis, reflecting changes in requirements for consumptive architecture (Fig. 7.29).

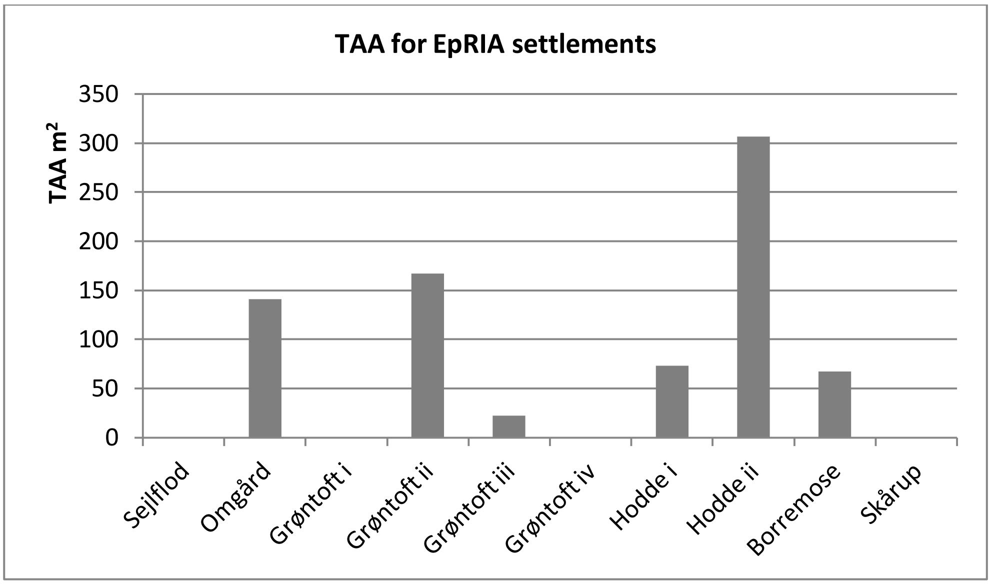


Figure 7.26 Distribution of Total Additional Area per site for the Early Pre-Roman Iron Age

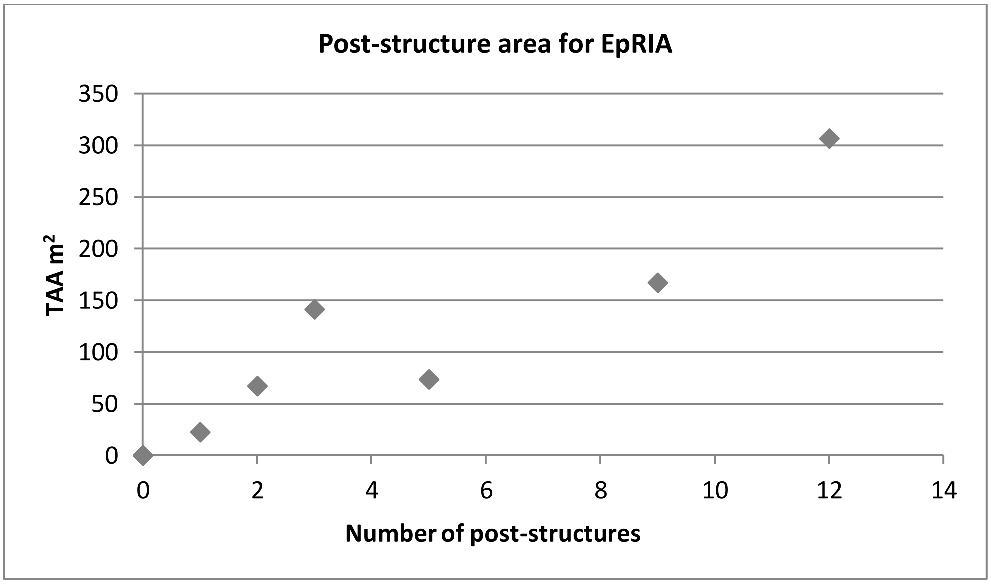


Figure 7.27 Contrast of TAA and number of post-structures per site for Early Pre-Roman Iron Age

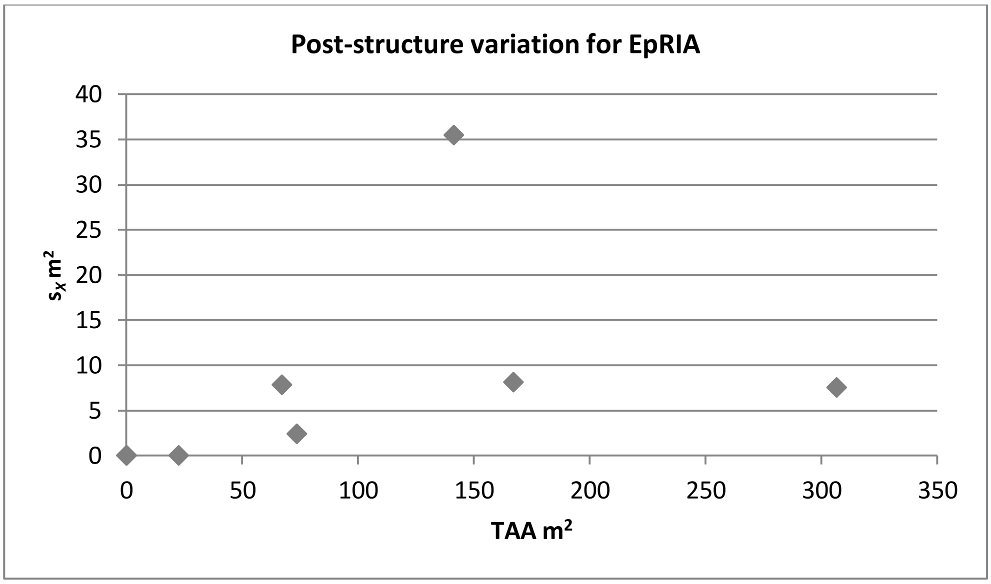


Figure 7.28 Contrast of Total Additional Area and standard deviation per settlement for the EpRIA

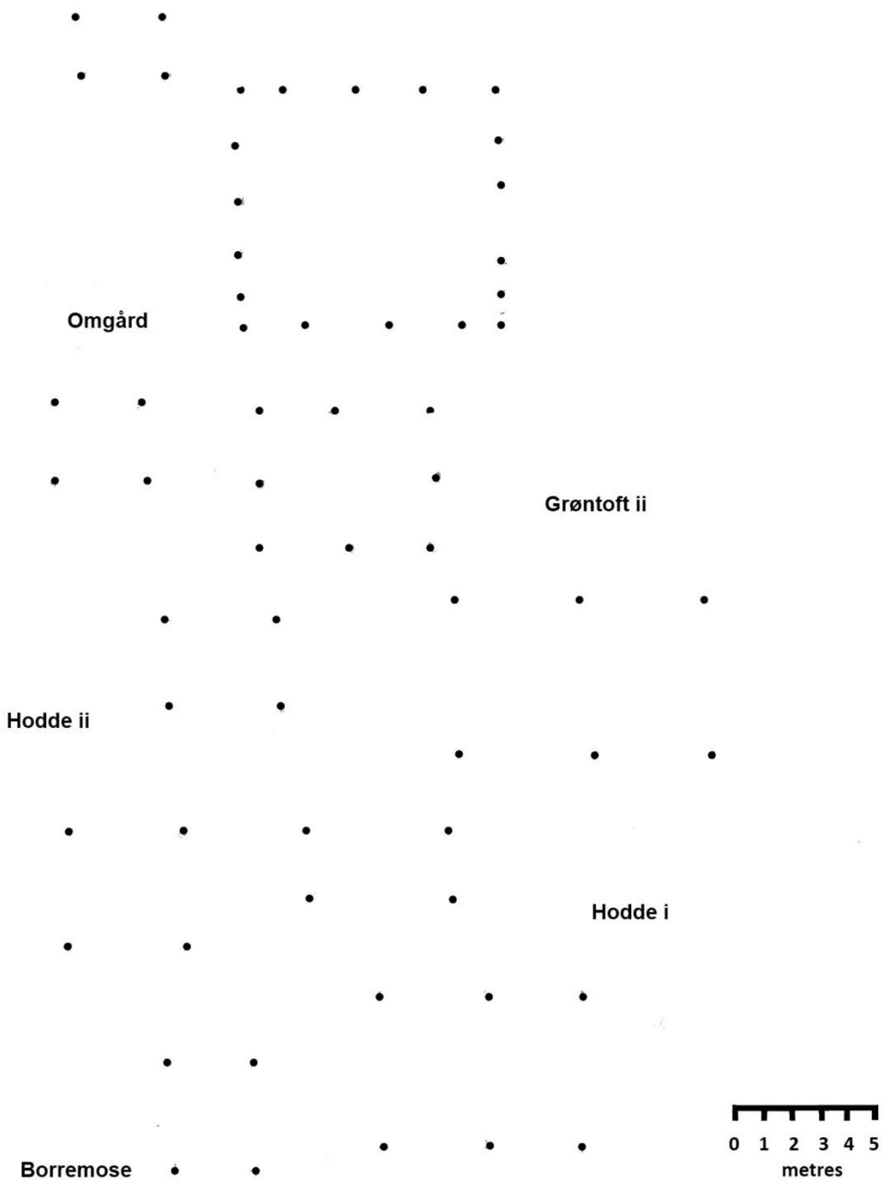


Figure 7.29 Comparison of selected EpRIA post-structure morphology. Omgård after Nielsen 1982b, Grøntoft after Becker 1968, 1971, Hodde after Hvass 1985, Borremose after Martens 1988.

Post-structure presence and amount of TAA were not directly linked to THA. Grøntoft i and Skårup presented large THA values, yet no post-structures, while Omgård presented the smallest THA and the third largest TAA. The decline in the available storage space over time for Grøntoft, however, mirrored the pattern visible in dwellings for the settlement over time. The increase in post-structure number and TAA over time for Hodde also reflects the trend apparent in dwellings for that settlement, indicating that energy invested in agricultural production was linked to population on at least some settlements. While population estimates based on dwelling area (Naroll 1962, Clarke 1974, Kramer 1979, Casselberry 1974, Brown 1987) are problematic, and determination of production of an agricultural surplus based on those estimates is imprecise, we can at the very least track the available storage and compare trends of growth or decline with the contemporary trends in dwellings on the same

Denmark	Number of Post-Structures	TAA m^2	Average Post-Structure Area m^2	Standard Deviation S_X m^2
Vorbasse	7	315.00	45.00	0.01
Hodde iii	16	317.00	19.81	6.59
Hodde iv	25	533.00	21.32	9.97
Borremose	9	284.50	31.61	15.91
Kjærsing	7	112.00	16.00	0
Heltborg i	9	222.54	24.73	10.45
Heltborg ii	1	11.70	11.70	0
Totals 7	74	1795.74	24.27	12.05

Table 7.8 Values for post-structures in Late Pre-Roman Iron Age sites

settlements. Comparing these data illuminates which settlements had labour available and invested in agricultural production, based on storage capacity, and which settlements did not, likely relying on other means, *i.e.* exchange, for access to grain. The Early Pre-Roman Iron Age of Denmark strongly suggests differing trends of production, indicating some form of relationship for exchange. The Late Pre-Roman Iron Age is notable in that all of the settlements produced evidence for post-structures (Table 7.8). An increase in both post-structure presence and number of post-structures per settlement was observable from preceding periods. The post- structures for Vorbasse increased from three in the Late Bronze Age to seven in the later period. Four of the settlements (Borremose, Kjærsing, Vorbasse, and Heltborg i) presented between five and ten post-structures, firmly in higher range of the previous period. The LpRIA phases of Hodde continued the increase in number of post-structures in each phase, progressing from five and twelve in the EpRIA to sixteen and twenty-five in the later period. The number of post-structures on the Late Pre-Roman Iron Age for Borremose also increased from two in the Early Pre-Roman Iron Age to nine. These results demonstrate an increase in available agricultural storage from the Bronze Age and throughout the Pre-Roman Iron Age.

The Total Additional Area per settlement also implies growth in agricultural production with a continuation of the growth of storage area per site (Fig. 7.30). All the TAA values, with the exception of Kjærsing and Heltborg ii, were greater than 200 m^2. Heltborg ii presented the least amount of TAA, followed by Kjærsing with almost ten times greater the TAA (n=112 m^2). Borremose and Heltborg i presented a TAA of $200<n<300$ m^2. Vorbasse presented a TAA of 315 m^2. Hodde iii, demonstrating growth from the Early Pre-Roman Iron Age, presented a similar value of 317 m^2 of TAA, while the following phase presented over one and half times greater the TAA (n=533 m^2).

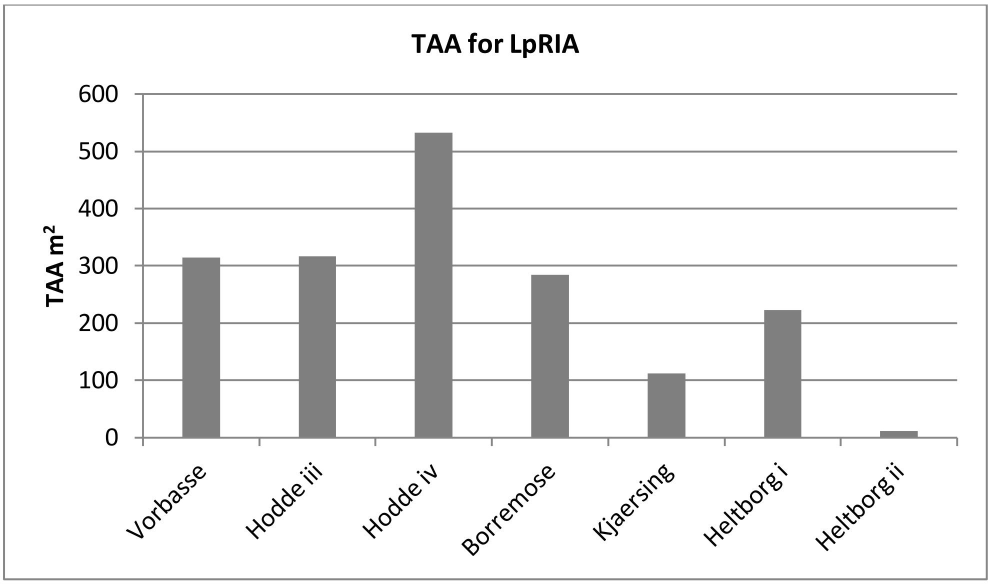


Figure 7.30 Distribution of Total Additional Area per site for the Late Pre-Roman Iron Age

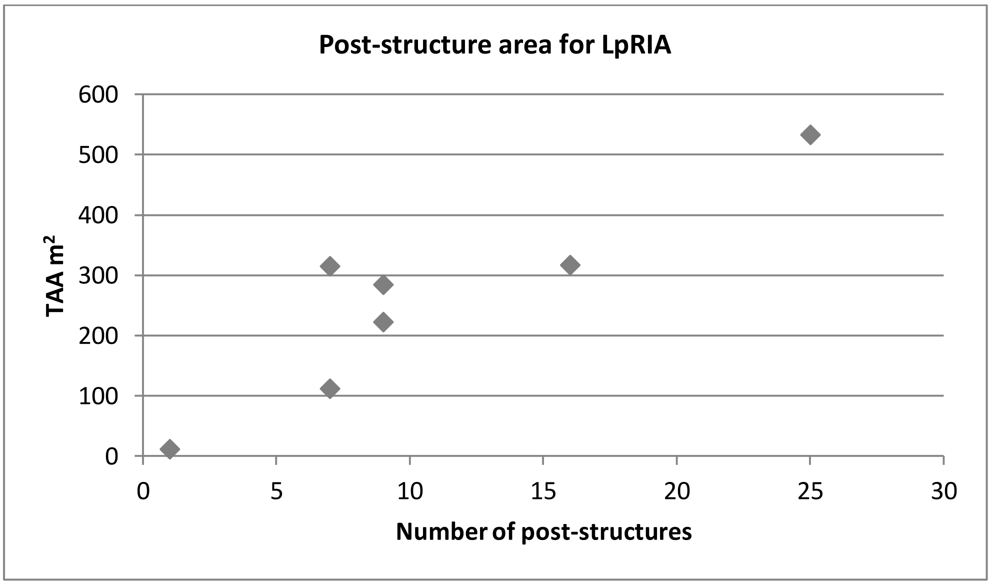


Figure 7.31 Contrast of TAA and number of post-structures per site for Late Pre-Roman Iron Age

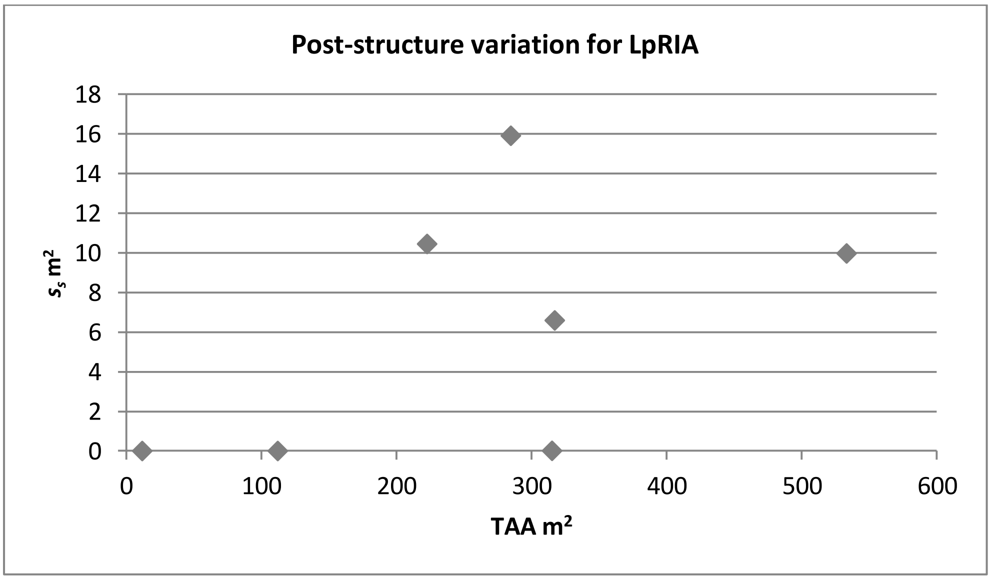


Figure 7.32 Contrast of Total Additional Area and standard deviation per settlement for the LpRIA

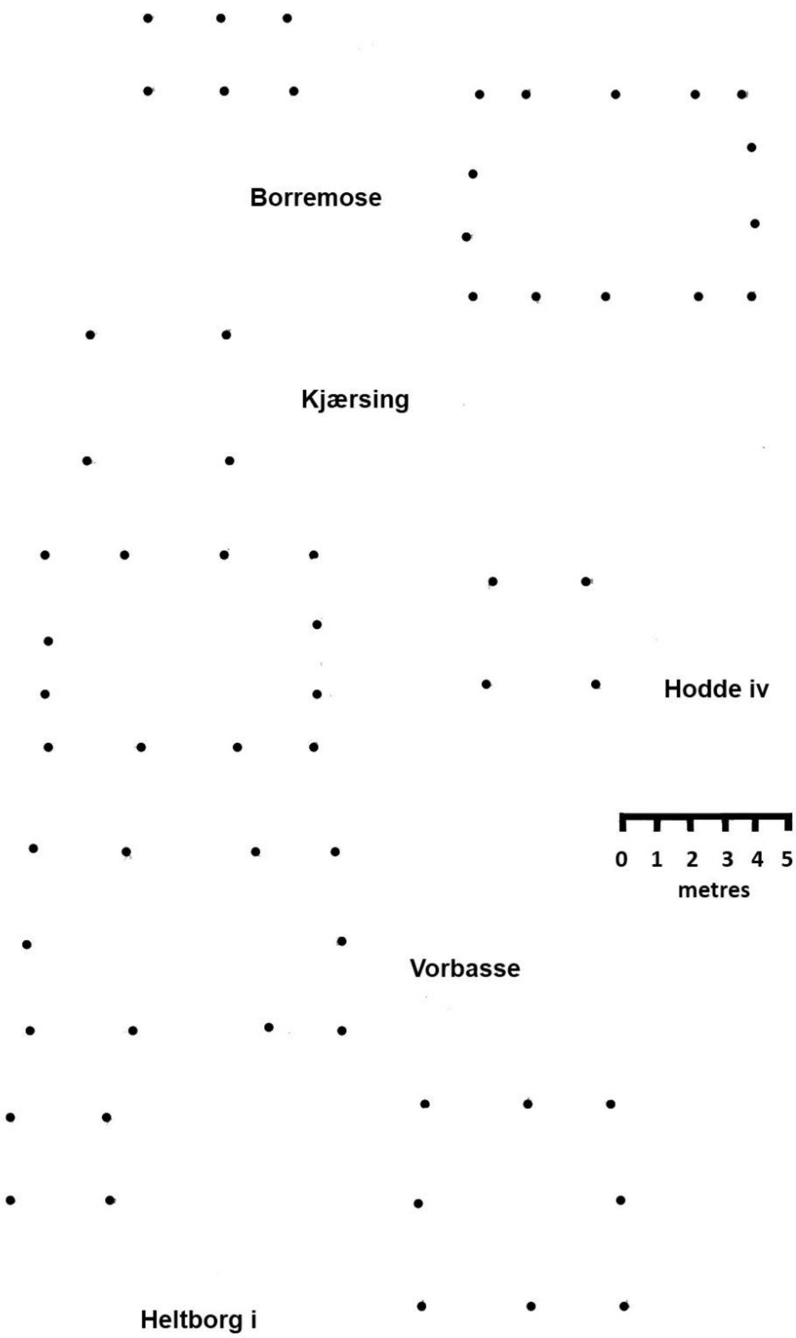


Figure 7.33 Comparison of selected LpRIA post-structure morphology. Borremose after Martens 1988, Kjaersing after Kristiansen 1985, Hodde after Hvass 1985, Vorbasse after Hvass 1983, Heltborg after Bech 1985.

The average additional area per post-structure demonstrates continuity from the Early Pre-Roman Iron Age. The average post-structure area was analogous to the preceding period, although with a smaller range of values ($11<n<35$ m^2). The largest values decreased slightly from the previous period, although remained within the EpRIA range, continuing the trend of smaller, yet more numerous post-structures per site over time (Fig. 7.31). Average post-structure area was linked to number of post-structures, as the progression was nearly linear, with the exception of Borremose and Vorbasse, which presented larger TAA and average post-structure values than those of similar post-structure count.

The variation in post-structure size per settlement continued to increase into the LpRIA. While the majority (57%) of settlements presented less than ten square metres of standard deviation, the proportion of settlements with standard deviations greater than ten square metres increased (Fig. 7.32). The increase in differentiation is not a direct function of either TAA or number of post-structures, as the largest standard deviations were found on settlements with median values of each. The greater differentiation (Fig. 7.33) paired with increasing numbers of post-structures and TAA is strongly indicative of construction following increasing demand for consumptive architecture, suggesting an increase in agricultural production into the Early Iron Age.

Interestingly, when post-structures were compared to the trends of dwellings for the period, the correlation existing in the EpRIA was not as present. Kjærsing presented the second greatest THA and the least TAA. Hodde ii and Kjærsing presented nearly equal THA values, yet vastly differing TAA values. The post-structures for both phases of Hodde followed the increase over time in dwellings, although the increase in post-structure area was more dramatic than the increase in dwelling area. The phases of Heltborg also presented a decline in both THA and TAA, although the values of THA were similar whereas post-structures appear to have vanished in the later phase. Borremose presented the closest THA and TAA values, with a dwelling area only approximately double the available storage area. The varied relationship between dwellings and post-structures supports a non-standardized investment in arable agriculture, with possible local or regional networks of producers and consumers.

Synopsis

As the main form of agricultural storage for Denmark, the trends shown over time in post-structure presence and area are indicators of agricultural production (Fig. 7.34). In terms of presence, twenty-seven percent of Early Bronze Age sites demonstrated post-structure evidence, which increased to forty-three percent in the Late Bronze Age. The percentage of sites with post-structures continued to rise, with seventy-six percent of sites in the Early Iron Age presenting post-structures. Dividing the Early Iron Age into the Early and Late Pre-Roman Iron Age, the growth over time is more obvious; sixty percent of the Early Pre-Roman Iron Age settlements demonstrated post-structures while all of the later sites contained post-structures. The number of post-structures per site also increased over time. The Early and Late Bronze Age sites both displayed only two to three post-structures, while the Early Iron Age periods demonstrated an increase over time with a range of one to twenty-five post-structures. Post-structure size followed dwelling construction and increased toward the end of the Bronze Age, then decreased into the Early Iron Age, reflected in the average

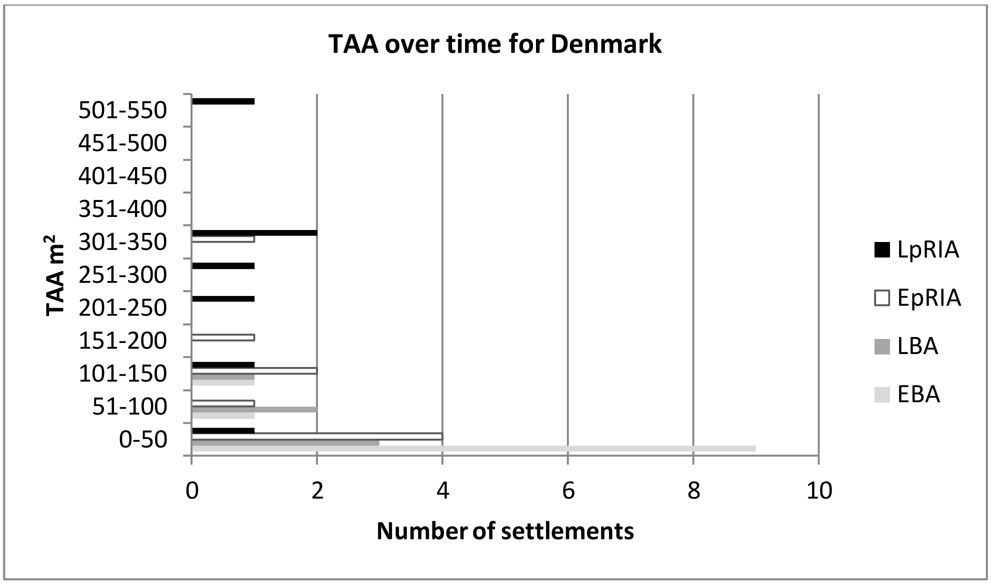


Figure 7.34 Range of Total Additional Area for Denmark over time

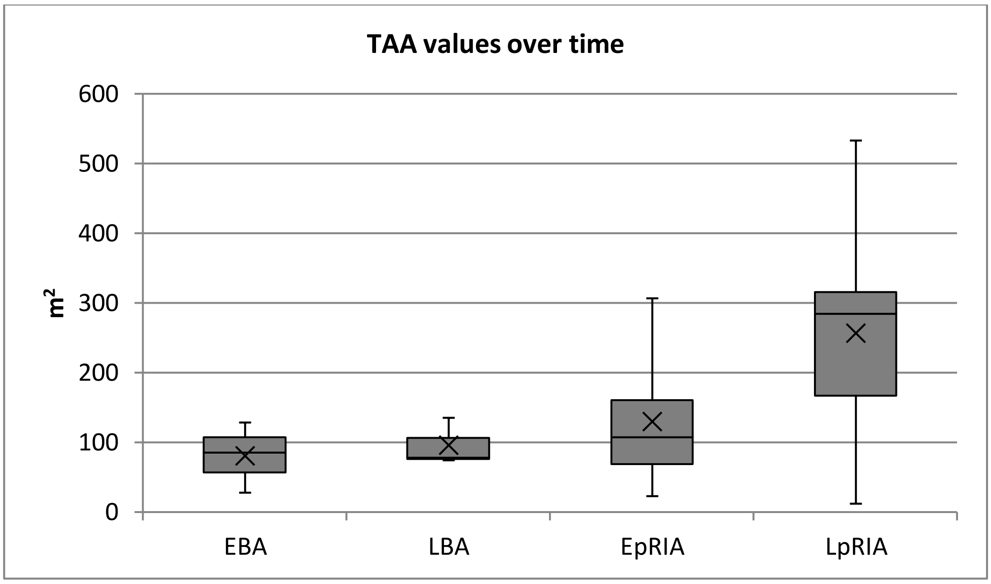


Figure 7.35 Total range of Total Additional Area values over time. X indicates average TAA for the period.

post-structure area per period (EBA: 34.46 m^2, LBA: 41 m^2, EpRIA: 24.31 m^2, LpRIA: 24.27 m^2). Despite the decrease in post-structure size, the Total Additional Area per site increased over time. For the Bronze Age periods, only one settlement per period presented a TAA greater than one hundred square metres. The EpRIA settlements increased to fifty percent displaying over one hundred square metres of TAA, while for the LpRIA, all but one presented a TAA value of over one hundred square metres.

The data suggest a growth in agricultural production, with a greater need for storage over time (Fig. 7.35). Following the trend of dwellings, the post-structures decreased in size over time while becoming more numerous per settlement, as well as increasing in general presence. This is certainly suggestive of a growing need for storing agricultural surplus, indicating an increase in agricultural production over time. The variable numbers of post-structures, while at times mirroring the trend of dwellings per settlement, strongly signifies the investment in agricultural production. Post-structures for Grøntoft and Hodde followed the population, increasing and decreasing with the number of dwellings, which suggests agricultural production as tied to the labour force and used for sustaining the population. Other settlements, however, did not have a correlation between the available dwelling area and storage capacity, indicating a different relationship between the population and agricultural production and raising the possibility of inter-settlement relations.

7.3 Comments

In Denmark, specific patterns in population and agricultural production became apparent over time. The Early Bronze Age settlement pattern was dominated by small farmsteads of two or three large dwellings. Larger settlements of four to six dwellings were also present following the advent of three-aisled longhouses in PII of the Early Bronze Age, providing larger values of Total Habitable Area and presenting early precursors to the later village-type settlements. Multi-phased settlements such as Højgård were also present in the EBA, indicating an increasing permanence of settlement and investment in the land. Only twenty-seven percent of settlements presented post-structures. The amount of Total Additional Area available was not influenced by the amount of THA; Vadgård i and ii presented equal THA, yet a nearly 50 m^2 difference in TAA. The lack of post-structures on the majority of settlements is likely suggestive an alternative form of storage for the period not recognizable in the record, rather than a lack of at least subsistence level agricultural production. Storage of grain for daily use within the dwellings cannot be discounted and would leave little if any trace in the archaeological record. The differentiation in dwelling area per settlement supports such an occurrence, as the larger the settlement (THA), the greater the standard deviation. The presence of larger and smaller dwellings on a single settlement strongly suggests a difference in usage, which could be accounted for by storage of agricultural product within living structures as allowed by space. The post-structures of the period were present on settlements with the smallest THA of the period, which could corroborate storage within dwellings on settlements with more floor space.

The Late Bronze Age settlements presented a similar blend of small farmsteads and larger settlements of five to six dwellings. The THA values increased from the EBA, as seventy-one percent of settlements presented over 200 m^2 of THA compared to sixty-three percent in the previous period. Dwellings increased in size in the Late Bronze Age, nearly simultaneous with the advent of animal stalling within longhouses. The differentiation in dwelling area per settlement, still affected by THA, concurrently declined, with the majority of settlements presenting more similar dwellings than the EBA settlements. Understandably, the presence of post-structures increased as well with fifty-seven percent of settlements presenting above ground storage. The number of post-structures per settlement remained similar to the previous period; however, the values of TAA were both larger and more comparable in the LBA. Storage within dwellings, despite the increase in dwelling size, was less likely with a greater appearance of post-structures, and the change in settlement organization along with the increase in TAA suggests an increase in agricultural production.

The periods of the Early Iron Age demonstrate an exaggerated division between farmsteads and larger aggregations of dwellings. Dwellings obviously became the focal point for the settlements, with the population shifting to form village-type aggregations and multi-phased settlements re-emerging. In the Early Pre-Roman Iron Age, three settlements (30%) presented less than ten dwellings, indicating the persistence of independent farmsteads. The remaining seventy percent of settlements presented between ten and thirty-five dwellings, providing the first true village-type settlements. Thirty percent of settlements presented over 1000 m^2 of THA, demonstrating a considerable increase from the Bronze Age. Despite the more numerous dwellings per site and the increased THA, dwellings decreased in size, indicating a shift in settlement organization with both farmsteads and larger congregations of smaller dwellings. The majority of differentiation in dwelling size per settlement continued to be small, yet was unlinked to THA or number of dwellings. The standard deviation, however, provided direct confirmation on Hodde and possibly Grøntoft of a social hierarchy, already discussed in relation to material culture, reflected in domestic architecture. The benefits of a model concerned with the exertion of energy therefore extend to the impact of social organization on architecture, which can be useful in regions less studied or with poor preservation of material items.

Post-structure presence increased to sixty percent, accompanied by an increase in number of post-structures per site. The TAA per settlement demonstrated a slight increase from the Bronze Age, although the increase in number of settlements with post-structures indicates a widespread increase in agricultural production. The rise in storage per settlement is explained by the growth in population per settlement; larger populations require greater amounts of grain to sustain them.

The Late Pre-Roman Iron Age continued to exhibit both farmsteads and village-type settlements, although in nearly equal numbers. Forty-three percent of the settlements presented twenty to thirty dwellings, while the other fifty-seven presented less than ten dwellings. The THA continued to increase as well, with fifty-seven percent of settlements presenting over 1000 m^2. Dwellings maintained a smaller average area similar to the EpRIA, continuing the trend of smaller, more similar dwellings. Only one settlement did not present post-structures, with eighty-six percent of settlements presenting post-structures. Again, the increase in available storage, and therefore agricultural production, per settlement follows the rise in population, although there is little correlation between actual values of THA to TAA. The continuation of smaller dwellings and increase in post-structures for the Early Iron Age demonstrates a definite change in strategy that reflects greater investment in consumptive architecture.

The correlation between larger settlements and greater numbers of post-structures in the later periods is also suggestive of flourishing agricultural production, at least to the point of self-sustenance for larger villages. The shift from production for farmsteads to villages indicates a shift in agricultural strategy which would, as discussed previously, create some measure of social disorganization, yet the record does not reflect any periods of decline, suggesting continuous ability to sustain the population with no evidence of the expected waning. There is variable correlation between the available dwelling area and storage area. Certain settlements, such as Grøntoft, have reciprocal trends in THA and TAA over time while others appear to have little relationship between dwellings and post-structures. Settlements, such as Kjærsing in the LpRIA, with large THA and little TAA, or the reverse, indicate differing investment in agricultural production not linked to population. The variation in storage, as agricultural proxy, and dwelling space, as population proxy, suggests a network of producer/consumer settlements.

Chapter VIII: Shifts in population and agricultural production sub-regionally for Denmark

Exploring the differences in population and agricultural production inter- and intra-regionally will produce further patterns over time. Each of the five regions had unique productive capabilities, and examining dwelling and storage patterns will reflect the changing needs at the end of the Bronze Age.

8.1 Population

The changes in settlement organization within each sub-region over time are critical to understanding the varied productive capabilities of different environments and the reaction of the population to external pressures. Tracking the shift of populations to areas with greater or lesser agricultural potential, as indicated by storage capacity and known environmental data, implies information regarding the needs of the population over time.

Denmark intra-regionally

The Danish material was divided into five sub-regions on the basis of geology and environment across Funen and Jutland. The regions included in this study are dune, outwash plain, raised Littorina seabed, moraine clay, and moraine sand (Fig. 8.1).

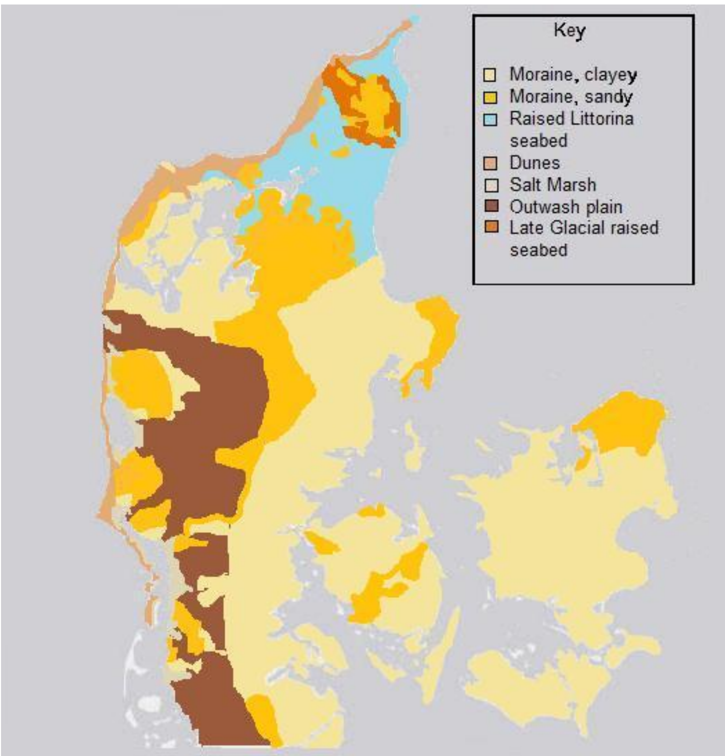


Figure 8.1 Soil Geography of Denmark

The Outwash Plain

The outwash plain, cutting through lower central Denmark, presented settlement evidence for both the Bronze Age and Iron Age (Table 8.1). The Early Bronze Age settlement, Højgård, displayed three phases of occupation within the period. All three phases presented similar THA from a range of number of dwellings, indicating a change in dwelling size over the period (Fig. 8.2). Højgård i presented a THA of 663.30 m^2 from six dwellings, which increased to 676.82 m^2 from only three dwellings in Højgård ii. The final phase for the EBA demonstrated a smaller THA (n=550.65 m^2) from four dwellings. The average dwelling sizes for each phase reflect the changing structure size, as the second phase increased to dwellings over twice as large as the previous phase, while Højgård iii demonstrated a decline. The differentiation in dwelling size followed much the same pattern. The initial EBA phase presented three dwellings *c.* 150 m^2, contrasted with three smaller dwellings of 50<n<100 m^2. The following phase displayed an increased deviation in size, with two dwellings *c.* 250 m^2 and the other approximately 100 m^2 smaller. The dwellings of the final EBA phase were more similar, with a maximum of 50 m^2 difference in size. The number of dwellings suggests a large, multi-family farmstead with changing population throughout the period. The presence of much larger dwellings contrasted with smaller dwellings also suggests some form of hierarchical architecture present in all phases, even as the dwellings became smaller from Højgård ii to iii. Modern standards of living divide developed countries from third-world countries on an average of 20 m^2 of floor area per capita (United Nations 2000), which is similar to Renfrew's (1972) estimate of 33 m^2 for the urban Aegean in the Late Bronze Age. While determining population from floor area has already been discussed as difficult and controversial, we can

	Outwash Plain	**Number of Dwellings**	**THA m^2**	**Average Dwelling Size m^2**	**Standard Deviation S_X m^2**	**Period**
	Højgård i	6	663.30	110.60	45.22	EBA
	Højgård ii	3	676.82	225.61	53.43	EBA
	Højgård iii	4	550.65	137.66	33.77	EBA
Totals	3	13	1890.77	145.47	62.02	
	Vorbasse	2	326.00	163.00	7.07	LBA
	Højgård	9	788.10	87.57	23.76	LBA
Totals	2	11	1208.60	101.28	37.25	
	Vorbasse	9	1080.00	120.00	0.05	LpRIA
Totals	1	9	1080.00	120.00	0.05	

Table 8.1 Values of dwellings and Total Habitable Area for outwash plain

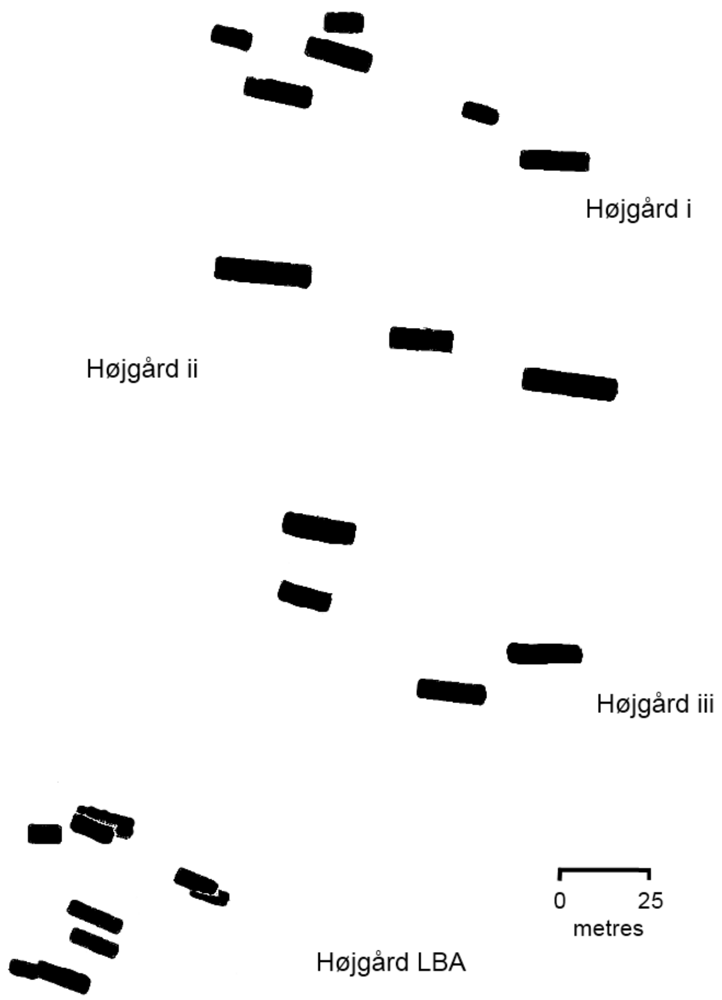


Figure 8.2 Comparison of Bronze Age Højgård, after Hvass 1983.

take a large standard deviation to indicate a distinction between dwellings of otherwise similar construction. Whether that distinction is due to the social status of the occupants is beyond a study purely based on architecture; the very fact of the distinction is notable and must be considered when discussing population and the investment of energy into the creation of productive architecture. Larger dwellings require more energy and resources to construct, and would result from a specific design, whether socially prescribed or merely practical. While the larger dwellings could simply be a function of existing family units, or a prediction of growth thereof, there appears to be too much variation within and between settlements to be specifically limited to family/occupation size.

There were two settlements dating to the Late Bronze Age for the outwash plain in this study. Vorbasse presented evidence for two dwellings in this period, while Højgård continued from the preceding period with six dwellings, increasing from the final EBA phase. The disparity between the numbers of dwellings per settlement is suggestive of differing settlement patterns in the Late Bronze Age. The smaller grouping at Vorbasse indicates a small farmstead, while Højgård continued as a larger, multi-family settlement. The TAA values contrasted as well, with Vorbasse presenting over 400 m^2 less than Højgård. The average dwelling size per settlement, however, demonstrated the reverse, as Vorbasse displayed an average dwelling size of 163 m^2, nearly half again as large as that of Højgård (n=87.57 m^2). The Højgård dwellings continued to decrease in size from the preceding period, suggesting a continual change in construction style toward a smaller dwelling. The Vorbasse evidence indicates the shift was not ubiquitous. The variation in dwelling area, however, for both LBA settlements was smaller than the previous period. Vorbasse presented very similar dwellings, while the greatest size difference for Højgård was 18 m^2, much decreased from its preceding phases. The possibility of ranked architecture is less clear for the LBA of the outwash plain. The population remained arrayed against the landscape in much the same way as the EBA.

Occupation of Vorbasse continued in the Late Pre-Roman Iron Age, increasing to a village-type settlement with nine dwellings providing 1080 m^2 of Total Habitable Area. The average size of the dwellings decreased slightly from the earlier period, suggesting the change in settlement pattern to a larger grouping of population contained in more plentiful, yet smaller houses as observed over the course of occupation at Højgård was becoming more normative into the Iron Age. The dwellings were nearly the same size, with a miniscule variation. Ranked architecture was not visible in the LpRIA of the sub-region; the exacting attention to construction to create identical dwellings indicates the opposite.

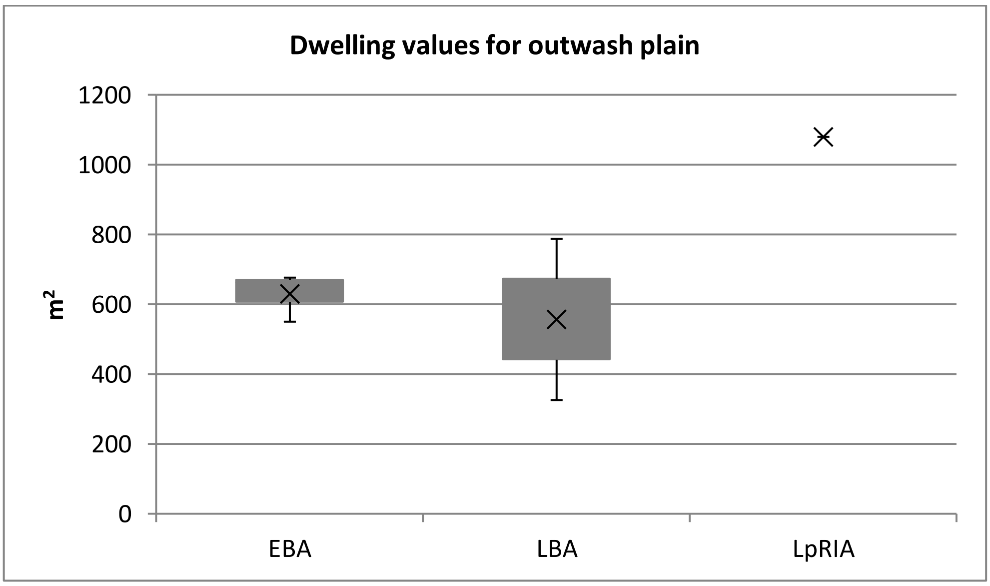


Figure 8.3 Total range of Total Habitable Area values for outwash plain over time. X indicates average THA.

Dwellings became increasingly smaller over time, while the maximum TAA for each period increased (Fig. 8.3). The minimum TAA decreased between the EBA and the LBA, suggesting a continuation of smaller farmstead contemporary with increasingly village-like settlements. Højgård continued to be occupied from the EBA into the LBA, just as Vorbasse exhibited both LBA and LpRIA occupation. Continuity in settlement location, even in the case of returning settlement after an absence, over time implies both a connection to the land and a successful subsistence strategy throughout the BA-IA transition in the outwash plain.

The Dunes

The dunes run along Thy, Rinkøbing, and Ribe. Only one settlement in the dunes was included in this study, as there is a dearth of published material for the region. This likely reflects both preservation and excavation bias, given the constantly shifting sand and wetland that composes the sub-region, as well as a lack of settlement in the periods under consideration. Given the rising sea levels and increasingly wet environment at the end of the Bronze Age in Denmark, a lack of settlement evidence for later periods is reasonable (Jensen 1982). Legard, dating to the Early Bronze Age, presented evidence of two dwellings that provided a THA of 489 m^2 (Table 8.2). The settlement, suggestive of a farmstead, was smaller than the Early Bronze Age settlement at Højgård in the outwash plain, indicating some variety in settlement structure for the period. The average dwelling size was 244.5 m^2, larger than that of the same period in the outwash plain. The differentiation between the dwellings was more similar to the LBA phase of Højgård, although with a larger maximum difference of 39 m^2. The disparity between the two dwellings was smaller than all phases of EBA Højgård, although it is close to the final EBA phase. Either occupancy was more similar between dwellings on the dunes, or social status was based only in small part on architecture. The smaller settlement, with larger dwellings of more similar size to each other, may be a function of the environment. The dunes could conceivably only support a small farmstead, given the marshy ecology with little wooded area. Resources for post-built structures would be more difficult to source than in other ecologies. In order to conserve energy, construction of dwellings larger than necessary would allow for multi-functional structures (see discussion of post-structures below; Appendix B).

Dune	Number of Dwellings	THA m^2	Average Dwelling Size m^2	Standard Deviation s_x m^2	Period
Legard	2	489.00	244.50	27.58	EBA

Table 8.2 Values of dwellings and Total Habitable Area for dunes

The Raised Littorina seabed

The two settlements included in this study on the raised Littorina seabed, which is spread across much of North Jutland and Thy, were both dated to the Early Bronze Age. Bjerre site 2 presented three dwellings (Table 8.3). Vadgård presented two phases for the period, each with a single dwelling. The amount of roofed floor area varied. Bjerre presented a Total Habitable Area of 361.75 m^2, while both phases of Vadgård displayed a THA of 66 m^2. The Vadgård i and ii values were much smaller than the contemporary dune and outwash plain settlements, while Bjerre was more similar to the dune settlement.

	Littorina	Number of Dwellings	THA m^2	Average Dwelling Size m^2	Standard Deviation S_x m^2	Period
	Bjerre	3	361.75	120.58	13.78	EBA
	Vadgård i	1	66.00	66.00	N/A	EBA
	Vadgård ii	1	66.00	66.00	N/A	EBA
Totals	3	5	493.75	164.58	31.45	

Table 8.3 Values of dwellings and Total Habitable Area for raised Littorina seabed

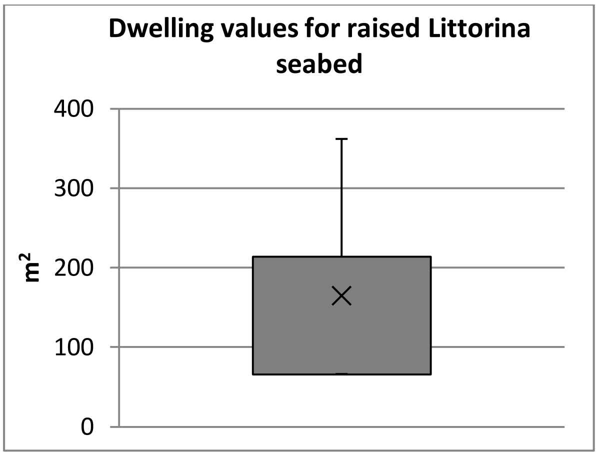


Figure 8.4 Total range of Total Habitable Area values for raised Littorina seabed settlements. X indicates average THA.

The average dwelling size for each site was also varied (Fig. 8.4). Bjerre presented 120.25 m^2. Vadgård had an average dwelling size of 66 m^2. Bjerre presented a small differentiation in dwelling size, particularly in comparison to the larger standard deviations of the outwash plain and dune settlements. Two of the dwellings, however, were nearly identical with a difference of only 0.25 m^2, making the 24 m^2 difference to the final dwelling more interesting. Again, the question of occupancy versus status is raised, although on a far smaller scale than the settlements of the outwash plain. The small samples in each sub-region present difficulties in a comparative analysis, however, the population of the Early Bronze Age in Denmark appears to have been varied across the landscape. Small single-family farms and larger groupings of population occupied the same regions, indicating two distinct patterns of settlement in the same period.

The Moraine Sand

The moraine sand region, present in the modern counties of eastern Viborg, northern Århus, southern North Jutland, western Rinkøbing, Ribe, and South Jutland, presented evidence of settlement for all periods (Table 8.4). Four settlement phases were dated to the Early Bronze Age in this region (Fig. 8.4). All displayed evidence of one to two dwellings, again solidifying the suggestion of the farmstead as the major unit of settlement for this period across Denmark for the EBA. The settlements of the moraine sand provided less THA than the outwash plain and the dune settlements. Egehøj ii and Hemmed Church presented similar amounts of THA, 200<n<~300 m^2. The remaining settlements were smaller, as Egehøj i presented a THA value of 126 m^2 and Røjle Mose presented a THA of only 32 m^2. The Early Bronze Age of the moraine sand further suggests variety in dwelling size, albeit with a smaller range than other contemporary sub-regions, and a variation in groupings of population both within the region and across Denmark. Both large and small dwellings were present in the moraine sand. The average dwelling sizes of Egehøj i-ii and Hemmed Church were

	Moraine sand	Number of Dwellings	THA m^2	Average Dwelling Size m^2	Standard Deviation s_X m^2	Period
	Egehøj i	1	126.00	126.00	N/A	EBA
	Egehøj ii	2	222.00	111.00	4.24	EBA
	Røjle Mose	1	32.00	32.00	N/A	EBA
	Hemmed Church	1	301.00	301.00	N/A	EBA
Totals	4	5	681.00	136.20	99.26	
	Hemmed Church	2	468.00	234.00	93.34	LBA
Totals	1	2	468.00	234.00	93.37	
	Omgård	1	82.50	82.50	N/A	EpRIA
	Hodde i	10	827.00	82.70	60.99	EpRIA
	Hodde ii	17	1217.00	71.59	27.52	EpRIA
	Grøntoft i	36	1588.00	44.11	16.24	EpRIA
	Grøntoft ii	35	1719.00	49.11	10.43	EpRIA
	Grøntoft iii	9	451.00	50.11	9.16	EpRIA
	Grøntoft iv	9	503.00	55.89	14.22	EpRIA
	Sejflod	2	140.00	70.00	28.28	EpRIA
Totals	8	119	6527.50	54.85	26.18	
	Hodde iii	26	1475.00	56.73	14.58	LpRIA
	Hodde iv	28	1674.00	59.79	13.79	LpRIA
Totals	2	54	3149.00	58.31	14.12	

Table 8.4 Values of dwellings and Total Habitable Area for moraine sand

comparable to those of the other regions with EBA settlement; the dwelling at Røjle Mose was smaller than both phases of Vadgård on the raised Littorina seabed. Egehoj ii was the only settlement with more than one dwelling and the standard deviation was the least of any EBA settlement at only 4.24 m^2. There was no apparent hierarchical architecture for the EBA settlements of the moraine sand, implying a different settlement organization than that of contemporary sub-regions.

The Late Bronze Age in the moraine sand region was represented by one settlement. Hemmed Church demonstrated an increase in number of dwellings for this period, as it grew to two dwellings from the single dwelling in the EBA. The Total Habitable Area correspondingly increased from the previous period. Hemmed Church presented a THA of 468 m^2, similar to the Late Bronze Age of the outwash plain. The average dwelling size per site again indicates slight decline in dwelling size from the preceding period. Hemmed Church,

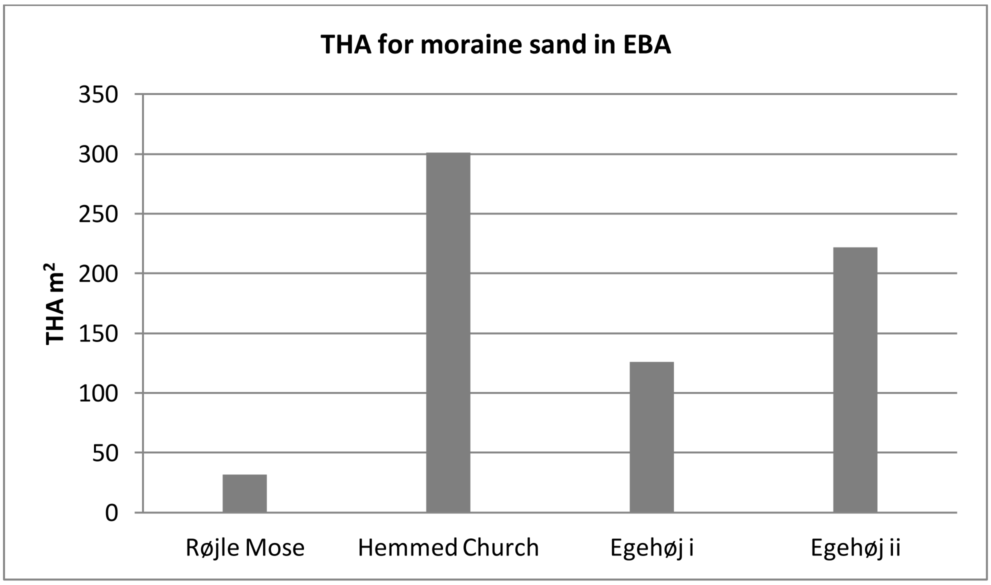


Figure 8.5 Values for Total Habitable Are for Early Bronze Age of the moraine sand

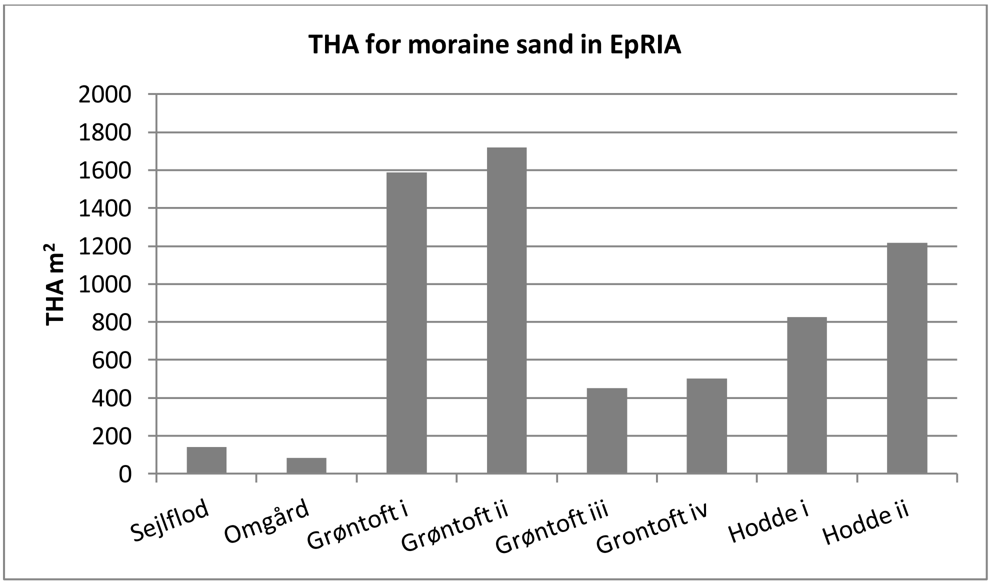


Figure 8.6 Values of Total Habitable Area for Early Pre-Roman Iron Age of the moraine sand

while displaying more dwellings for the period, presented a smaller average dwelling size (n=234 m^2) than the earlier phase of settlement. The variation between dwellings on the LBA phase of Hemmed Church was the largest of any settlement, strongly suggestive of hierarchical architecture. Unlike the contemporary outwash plain, such a variation in dwelling construction must be deliberate.

The Early Pre-Roman Iron Age was strongly represented in the moraine sand region with eight settlement phases displaying evidence of dwellings (Fig. 8.6). A substantial increase in the number of dwellings per settlement was obvious in this period. Hodde and Grøntoft both presented unambiguous evidence of a rise in a village-type settlement structure with a minimum of nine dwellings and multiple phases of occupation. Hodde presented two phases of occupation in the EpRIA. Hodde i presented ten dwellings, which increased to seventeen dwellings in Hodde ii. Grøntoft presented four phases of settlement with decreasing numbers of dwellings over time (Fig 8.7). Grøntoft i displayed thirty-six dwellings, Grøntoft ii thirty-four dwellings, and Grøntoft iii and iv only nine dwellings each. Sejlflod and Omgård, dissimilarly, presented one to two dwellings, indicating that not all settlements were of village-type in the EpRIA. Variety in settlement structure was still apparent with two distinct settlement types: farmstead and village. The increased longevity of the village settlements offers insight into an intensified focus on settlement and a likely similar intensification into agricultural production that will be examined in the following section.

The Total Habitable Area for the period correspondingly increased, although the settlements with only one or two dwellings remained largely similar to those of comparable size in the Early Bronze Age. Hodde i-ii presented THA values of $900<n<1220$ m^2. Grøntoft i presented over 1500 m^2 of THA, which increased in the following phase to over 1700 m^2. These large values of THA substantiate an increase of population into the region, with more people living closer together than in previous periods. Sejlflod and Omgård, with THA values of less than 150 m^2, indicate that more isolated single-family farmsteads had continuity in form and occupancy over the BA-IA transition.

The average dwelling size decreased from the previous period, matching the pattern for the region as a whole with smaller dwellings present in the EIA. The differentiation in dwelling size also decreased from the preceding period, with all but Hodde i presenting less than 30 m^2 of standard deviation. The variation in dwelling size for Hodde and Grøntoft was discussed in the previous chapter. All that needs to be stated here is that the variation decreased over time for both settlements. Hodde i-ii and Grøntoft i presented at least one dwelling over 100 m^2, with a differential of $35<n<100$ m^2. While the standard deviation for Grøntoft decreased in accordance with number of dwellings, Hodde presented the opposite

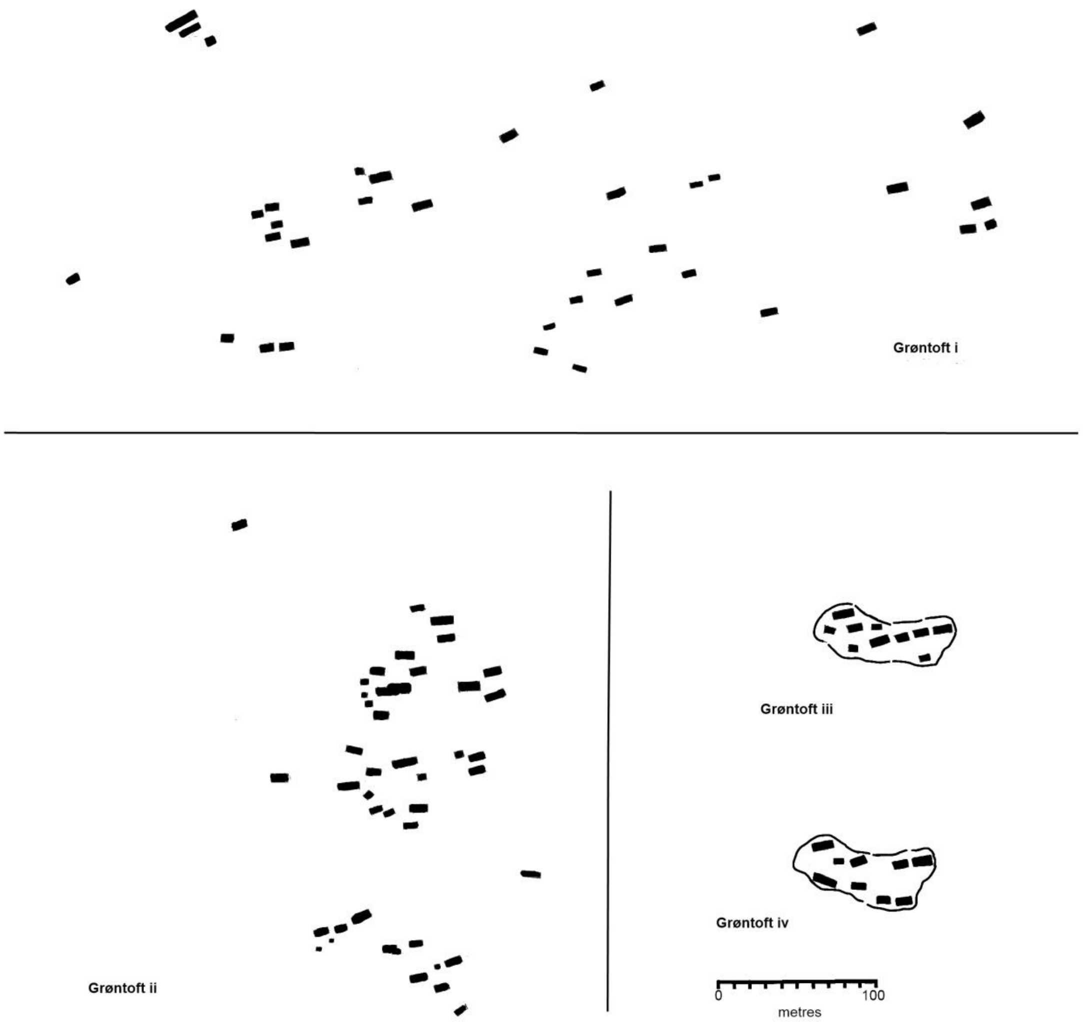


Figure 8.7 Comparison of Iron Age Grøntoft, after Rindel 2001.

pattern. Sejlflod also presented a 40 m^2 differential, larger than Grøntoft i, from only two dwellings and a small THA.

Hodde also presented two phases of occupation in the Late Pre-Roman Iron Age (Fig. 8.8). Unlike Grøntoft, all phases of Hodde displayed an increase in number of dwellings and THA over time. Hodde iii presented 1475 m^2 from twenty-six dwellings, while Hodde iv presented 1674 m^2 from twenty-eight dwellings. While still smaller than the EpRIA values for Grøntoft, the LpRIA phases of Hodde exceeded the THA values of both the previous phases and that of the LpRIA for the outwash plain. The average dwelling areas continued to decrease from the EpRIA phases and were more similar to the later phases of Grøntoft. The differentiation in dwelling size was also more similar to Grøntoft i, as no dwelling for Hodde iii or iv exceeded 110 m^2. The greatest difference in dwelling size for both LpRIA phases was 30 m^2, demonstrating a stronger similarity in the energy and resources devoted to dwelling construction than in the previous period.

There was definite decrease in the average size of dwellings, supporting the suggestion in the outwash plain of larger groupings of smaller dwellings in the Early Iron Age. All the settlements displayed an average dwelling size 45<n<85 m^2, smaller than those of the preceding periods. The LpRIA phases of Hodde presented nearly the same average dwelling area, indicating greater constancy in construction. Figure 8.6 illustrates the growth in both number of dwellings and Total Habitable Area over time. The nearly linear progression over time is indicative of an increased continuity in dwelling construction and settlement organization.

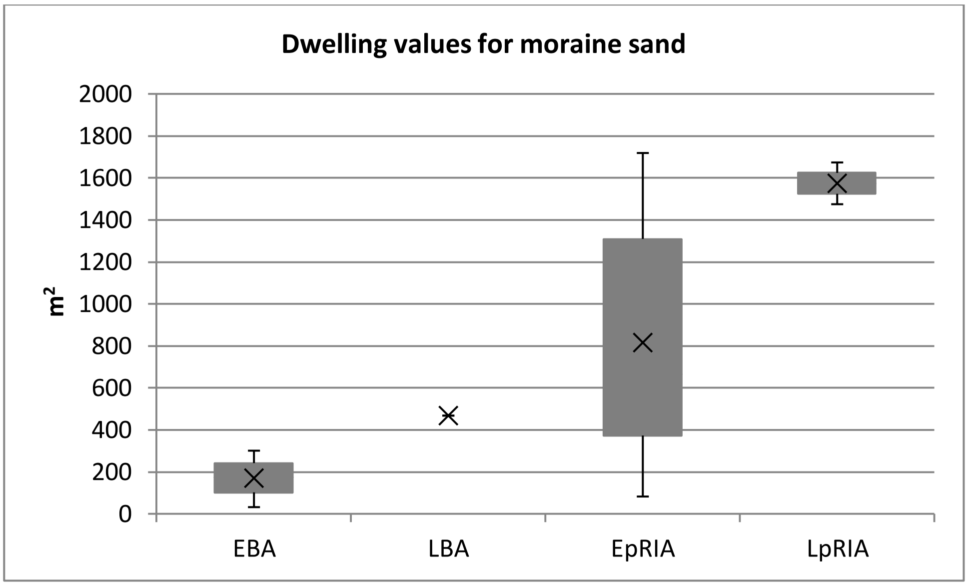


Figure 8.8 Total range of THA values for moraine sand over time. X indicates average THA.

While the EpRIA demonstrated the greatest range of settlement, emphasizing the abrupt increase in THA in the EIA, small farmsteads were maintained over the BA-IA transition in the moraine clay. It is not until the LpRIA that larger villages take precedence, which may be a factor of preservation or excavation bias. It is undeniable, however, that there was a definite change to settlement organization over time, with the population congregating on settlements with ever increasing number of dwellings, despite those dwellings decreasing in size.

The Moraine Clay

The moraine clay region, consisting of Funen, Vejle, Århus, and northern Viborg, presented nine settlements across the Late Bronze Age and Early Iron Age (Table 8.5). All displayed evidence of dwellings. For the Late Bronze Age, all three settlements displayed evidence of one to two dwellings, indicating small farmsteads similar to those of the smaller contemporary settlements in the outwash plain and moraine sand regions. The Total

	Moraine Clay	Number of Dwellings	THA m^2	Average Dwelling Size m^2	Standard Deviation s_X m^2	Period
	Højby	1	137.90	137.90	N/A	LBA
	Jegstrup	2	267.00	133.50	14.85	LBA
	Heltborg	1	87.50	87.50	N/A	LBA
Totals	3	4	492.4	123.10	25.32	
	Borremose	3	253.00	84.33	31.56	EpRIA
	Skårup	17	935.00	55.00	3.95	EpRIA
Totals	2	20	1188	59.40	15.28	
	Kjaersing	22	1470.00	66.82	15.55	LpRIA
	Heltborg i	3	192.50	64.17	5.84	LpRIA
	Heltborg ii	2	67.84	33.94	8.60	LpRIA
	Borremose	8	563.70	70.46	13.45	LpRIA
Totals	4	35	2294.04	65.54	16.02	

Table 8.5 Values of dwellings and Total Habitable Area for moraine clay

Habitable Area per site was smaller than the other Late Bronze Age settlements in the regions previously discussed. All three settlements displayed a THA of $80<n<270$ m^2 (Fig. 8.9). Smaller THA values and fewer dwellings suggest smaller populations per settlement, with fewer people living together in smaller farmsteads. Despite the lack of variety in settlement organization, the average dwelling size per site was analogous to that of the settlements of the same period in the moraine sand and outwash plain regions, signifying a general consistency in settlement structure. Jegstrup demonstrated a difference of nearly 20 m^2 between two dwellings, providing the only indication of possible social differentiation in dwelling construction for the period.

The Early Iron Age settlements demonstrated the trends in population and settlement structure implied by the moraine sand and outwash plain regions (Fig. 8.10). There was an increase in the number of dwellings per site from the Late Bronze Age, resulting in a mix of small farmsteads and larger groupings of dwellings. For the Early Pre-Roman Iron Age, Borremose presented three dwellings, while Skårup presented seventeen dwellings. Borremose presented 253 m^2 of THA. Skårup presented a THA of 935 m^2, over three times larger. Both values were greater than the preceding period in the region. Skårup was comparable to the EpRIA settlements in the outwash plain and moraine sand. The sudden appearance of larger settlements in the moraine clay supports an influx of population moving from the more coastal regions and forming more densely inhabited settlements. The smaller settlement evinced a greater standard deviation in dwelling size, as Skårup, despite the greater number of dwellings, displayed nearly equivalent individual dwelling areas. Such a

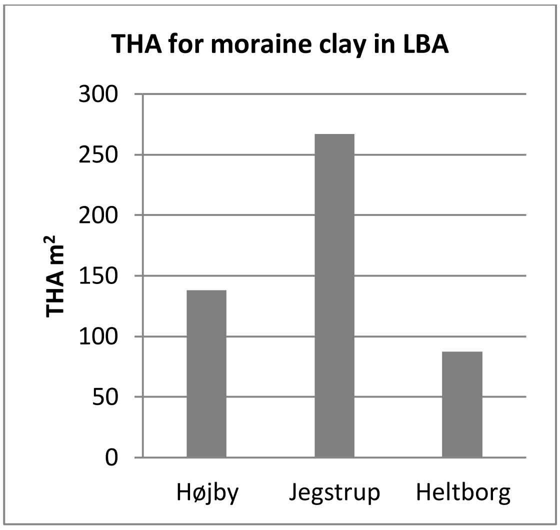


Figure 8.9 Values for Total Habitable Area of Late Bronze Age for the moraine clay

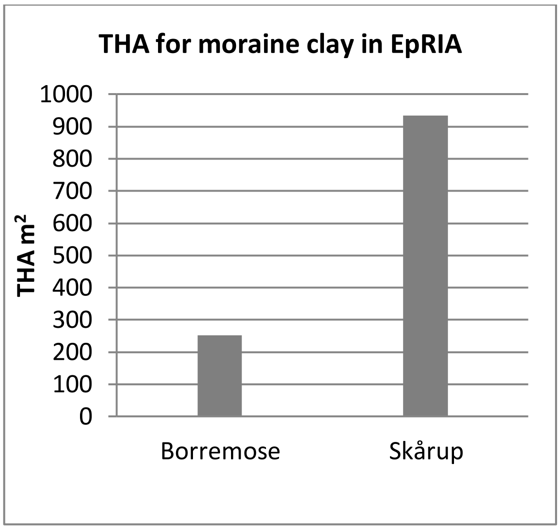


Figure 8.10 Values for Total Habitable Area for Early Pre-Roman Iron Age of the moraine clay

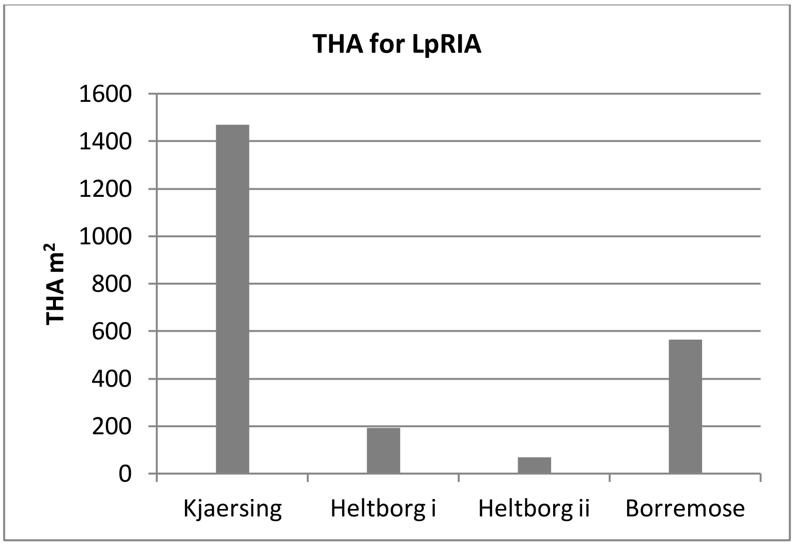


Figure 8.11 Values for Total Habitable Area for Late Pre-Roman Iron Age of the moraine clay

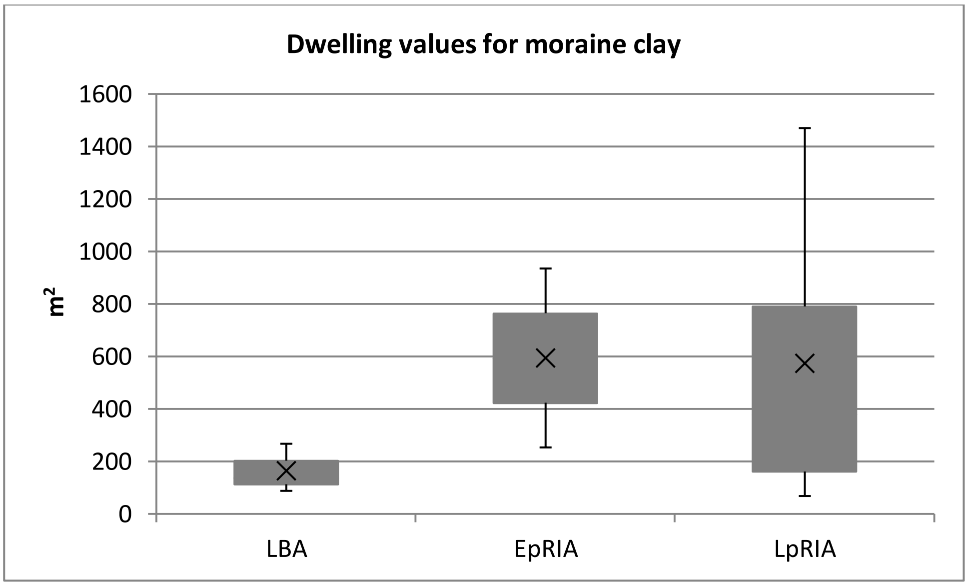


Figure 8.12 Total range of Total Habitable Area values for the moraine clay over time. X indicates average THA.

pattern continues the trend observed over time for Denmark; the more dwellings and greater THA a settlement produces, the more similar in size each dwelling becomes.

The Late Pre-Roman Iron Age also demonstrated a mix of farmsteads and village-type settlements. The Total Habitable Area of each settlement increased (Fig. 8.11), while the average dwelling area per site decreased. Heltborg, with phases of occupation in both the Late

Bronze Age and Late Pre-Roman Iron Age, adequately demonstrates the changes. The THA for the Late Bronze Age was 87.5 m^2 from one dwelling, which increased to 195.5 m^2 from three dwellings for the initial LpRIA phase and 107.5 m^2 from three dwellings in the final LpRIA phase. The average dwelling area declined from 87.5 m^2 to 65.17 m^2 and 35.83 m^2. Borremose in the LpRIA also increased in both number of dwellings and THA. Eight dwellings provided 563.7 m^2 of THA, over twice the amount available from less than half of the number of dwellings in the earlier phase. Kjærsing presented the greatest amount of THA for all of Denmark with 2296 m^2 form twenty-two dwellings. The pattern of larger conglomerations of dwellings, indicating greater population, in smaller dwellings for the Pre-Roman Iron Age is further bolstered (Fig. 8.12).

Denmark inter-regionally

The Early Bronze Age

The dune, raised Littorina seabed, moraine sand, and outwash plain sub-regions displayed evidence of settlement in the Early Bronze Age, making the period the most diverse ecologically (Fig. 8.13). The moraine sand and raised Littorina seabed regions displayed the most similar values of Total Habitable Area, with the majority of values between 100 and 350 m^2, although both presented smaller settlements as well. The dunes and outwash plain regions demonstrated larger values of THA between 450 m^2 and 700 m^2, although the settlements of the outwash plain were notably the largest. All settlements in the dunes, raised Littorina seabed, and moraine sand sub-regions were small farmsteads of one to three dwellings. The outwash plain settlements displayed a larger collection of three to six dwellings. Only the moraine sand and outwash plain regions presented multi-phased settlements representing a more permanent interaction with the landscape, which is interesting as those are the only sub-regions to be thoroughly occupied from the Bronze Age into the Iron Age.

The variation between dwelling sizes within settlements for each sub-region indicated intriguing patterns. With the exception of the settlements of the moraine sand, all

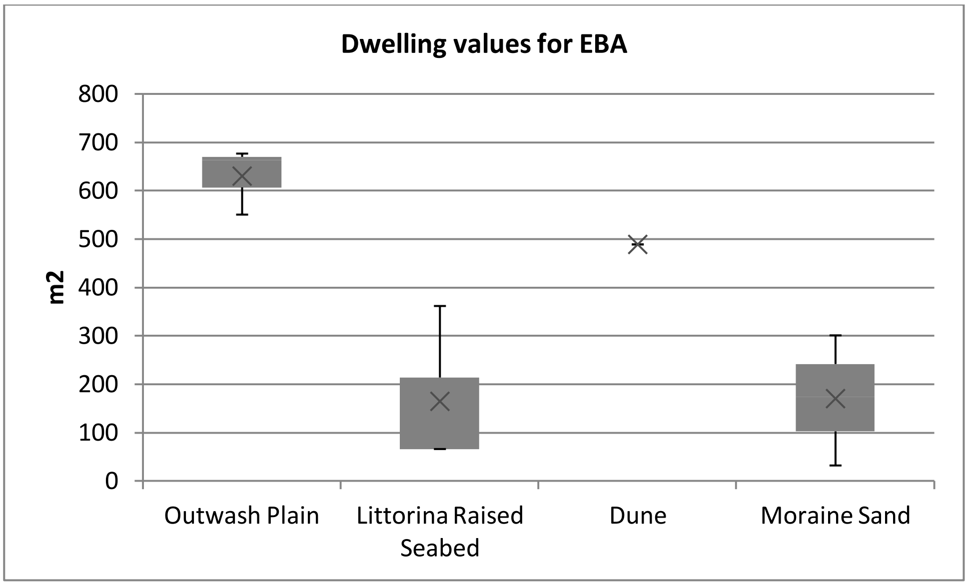


Figure 8.13 Total range of Total Habitable Area values for the Early Bronze Age by sub-region. X indicates average THA.

settlements with more than one dwelling presented at least one dwelling of definitely greater area. The outwash plain demonstrated the greatest standard deviation in dwelling size, with Højgård ii presenting a dwelling 100 m^2 larger than the next. The appreciable difference in dwelling area within each settlement phase is possibly indicative of a hierarchical architecture, with a family of higher rank enjoying more space. The settlement on the dunes contained larger dwellings with a smaller standard deviation, which is possibly reflective of a social status based only partially on architecture, or simply the inability to access enough resources to justify a larger disparity. The raised Littorina seabed settlement with more than one dwelling presented the smallest standard deviation. While the sample is small, the difference between standard deviations within each sub-region is marked and suggestive of individual trends. The larger differentiations appearing in the sub-regions which demonstrated the greatest THA values is not likely to be coincidental. Curiously, the extremely productive moraine soils demonstrated among the smallest THA values, while the dunes, largely wetland, managed to acquire enough resources for larger dwellings. The Early Bronze Age exhibited great variation in settlement pattern, from individual farmsteads to multi-family settlements, from small to large dwellings, from nearly equivalent dwellings on the same settlement to large standard deviations.

The Late Bronze Age

The Late Bronze Age, represented by the moraine clay, moraine sand, and outwash plain regions, displayed greater variety in the values of Total Habitable Area (Fig. 8.14). The moraine clay, more populated in this period as the coastal and wetland ecologies began to exhibit wetter conditions, presented the least amount per site of Total Habitable Area

(50<n<300 m^2), while the THA values of the moraine sand increased to 300<n<800 m^2. The moraine sand demonstrated the highest consistent values of THA, for similar numbers of dwellings. The outwash plain presented both larger and smaller THA values than the preceding period, presenting between 300<n<900 m^2. Settlement organization for the period was again a mix of small farmsteads of one to two dwellings and a larger farmstead of nine dwellings. Unlike the EBA, the outwash plain clearly demonstrated both types of organization. The moraine clay and moraine sand only presented small farmsteads. The number of settlements with only one dwelling decreased, just as Hemmed Church in the moraine sand increased to two dwellings from its previous phase.

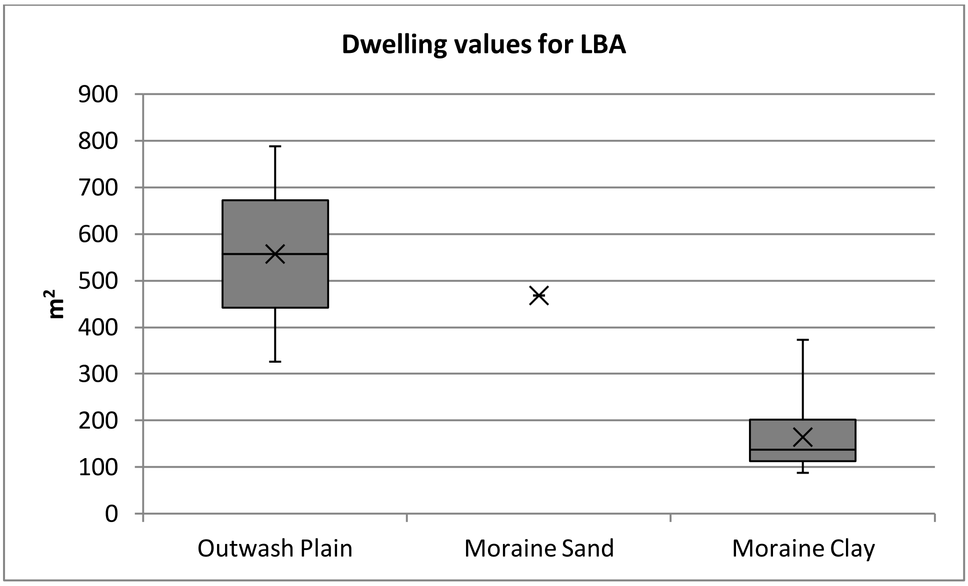


Figure 8.14 Total range of Total Habitable Area values for the Late Bronze Age by sub-region. X indicates average THA.

Dwellings tended to increase in size in the LBA, explaining the general increase in THA. Hemmed Church in the moraine sand and Højgård in the outwash plain demonstrated a decrease in dwelling size from the previous phases of those settlements, despite or perhaps due to the increase in dwellings on the latter phases. The overall area of individual dwellings was larger than all but the EBA dune settlement and more similar to the previous moraine sand settlement. The variation in dwelling area also decreased, with the exception of Hemmed Church, which displayed the largest standard deviation of any period. The incredible amount of differentiation between the two dwellings can only have been purposeful, suggesting an increase in hierarchical architecture for the sub-region. The definite increase in presence and THA, despite the smaller dwellings, may indicate a shift in access to resources and exchange toward the moraine sand. While the outwash plain presented smaller standard deviations than the previous period, the largest dwellings were similar in area to the median EBA dwellings, indicating some continuity in construction. The decrease does not necessarily denote a decline in social hierarchy, but rather indicates a change in overall settlement structure.

The Early and Late Pre-Roman Iron Age

The same regions (moraine clay, moraine sand, and outwash plain) were represented in the Early Iron Age periods (Fig. 8.15; Fig. 8.16). The Early Pre-Roman settlements were represented by the moraine clay and moraine sand; the Late Pre-Roman period included settlements on the moraine sand, moraine clay, and outwash plain. The moraine sand dominated in the Early Pre-Roman Iron Age, as the largest settlements and the multi-phased settlements, indicating continuity in population over time, were situated in that region. Again, a variety of settlement types was present, as the period presented the first true village-type settlements of ten to thirty-five dwellings while also maintaining smaller farmsteads. Both the moraine sand and moraine clay presented large and small settlements, indicating a change in settlement pattern for the sub-regions from the earlier single-family farmsteads. The increase in number of dwellings implies an increase in population per settlement to multiple families, each with their own dwelling. A tighter congregation of population is understandable in the context of the condensation of the widespread population of the Early Bronze Age to habitation in fewer regions as the environment became increasingly wet.

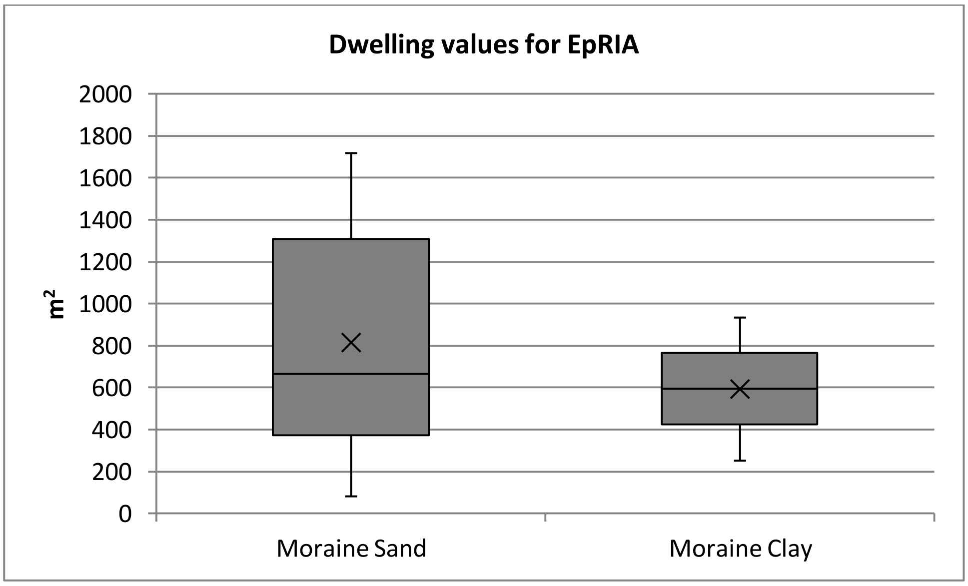


Figure 8.15 Total range of THA values for the Early Pre-Roman Age by sub-region. X indicates average THA.

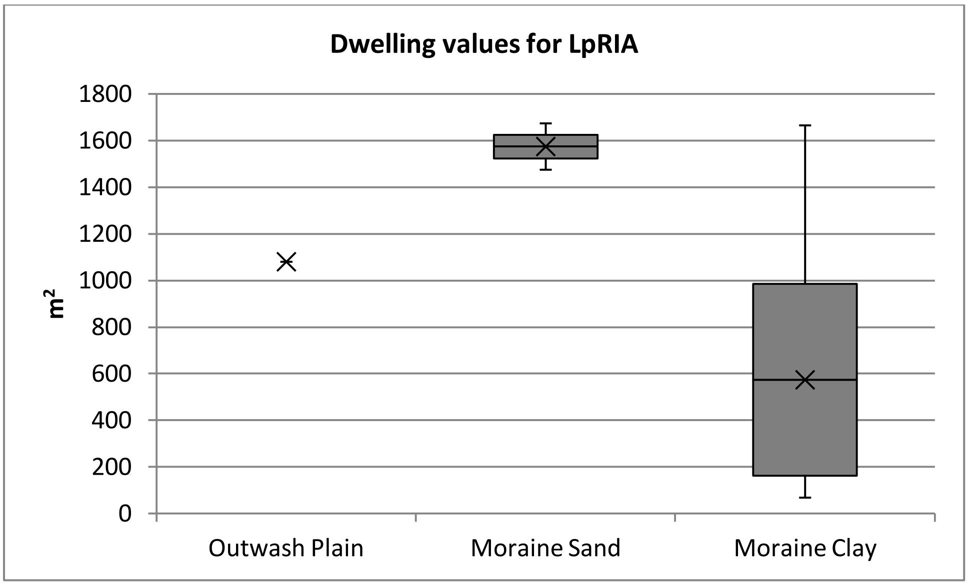


Figure 8.16 Total range of THA values for the Late Pre-Roman Iron Age by sub-region. X indicates average THA.

As the number of dwellings increased, so too did the THA. The small farmsteads of the moraine sand remained similar in size to the LBA, while the village-type settlements exhibited large growth, providing a range of $82<n<1720$ m^2. The moraine clay displayed large growth compared to the LBA settlements of the same, yet remained smaller than the contemporary moraine sand settlements. Dwelling size decreased for the majority of dwellings, although the larger settlements of the moraine sand demonstrated at least one dwelling of similar size to the LBA. Accompanying the decrease in dwelling size was a tendency toward more similar dwellings. The greatest variation in both sub-regions was found on settlements with fewer dwellings and therefore smaller THA values.

A greater number of LpRIA settlements were present on the clay rather than the sand, although those settlements remained smaller than the settlements of the moraine sand. The continued presence of the largest settlements, in both THA and number of dwellings, on the moraine sand is possibly a commentary on the success of agricultural strategy in the sub-region, especially given the greater arability of the moraine sand over the clay. Kjærsing on the moraine clay was similar to the final phases of Hodde on the moraine sand. The outwash plain presented the next largest settlement, demonstrating greater aggregations of the population in all sub-regions. The THA values increased again from the EpRIA as a village-type settlement structure increased in prominence. Despite the increase in THA, dwelling area continued to decrease. The smaller dwellings were also increasingly similar across Denmark, with the largest of the moraine clay and moraine sand settlements presenting similar standard deviations of $13.45 \leq n \leq 15.5$ m^2. Kjærsing and Hodde iii-iv displayed at least one dwelling with an area of 100 m^2 or more. Vorbasse in the outwash plain presented a large THA, yet the smallest standard deviation with only slight variation in dwelling area. The population gathered on larger settlements positioned on the most fertile soils.

Synopsis

The values of Total Habitable Area, standing as proxy for population, suggest a more widespread pattern of settlement in the Early Bronze Age that contracted in later periods to the more agriculturally productive regions of the outwash plain, moraine sand, and moraine clay. The settlements increased in size, with larger clusters of smaller dwellings found in all the regions with later settlement, indicating a consistent change in settlement pattern. Individual farmsteads continued throughout the Bronze Age-Iron Age transition. Proto-villages apparent in the Bronze Age matured into definite village-type settlements by the Iron Age, as the population congregated on the more hospitable soils. The Total Habitable Area of the later sites indicates an increase in roofed floor area, regardless of the decrease in dwelling size, providing a basis for interpretation of increased population per settlement.

8.2 Agricultural Production

Using above ground storage capacity, in the form of post-structures, as a proxy for regional agricultural production will provide insight into changing intensity of production. Understanding variation in regional trends of storage capacity allows probable connections between settlements to become clear.

Denmark intra-regionally

The Outwash Plain

The Early Bronze Age settlement on the outwash plain did not present any evidence of post-structures. Lack of post-structures, considered the primary agricultural storage for Denmark, may indicate a low level of production, or subsistence level grain acquired through external exchange, able to be stored within dwellings. As Højgård demonstrated the largest THA values for the EBA, it is not unlikely that any extra space may have been used for storage, rather than utilizing more resources and labour to create specific storage structures. Both of the Late Bronze Age settlements presented evidence of two or three post-structures (Table 8.6). The abrupt appearance of large values of TAA, nearly equal or exceeding the smallest dwelling on each settlement, strongly suggests a change in agricultural production.

	Outwash Plain	Number of Post-Structures	TAA m^2	Average Post-Structure Area m^2	Standard Deviation s_X m^2	Period
	Højgård i-iii	0	0	N/A	N/A	EBA
Totals	3	0	0	N/A	N/A	
	Vorbasse	3	135.00	45.00	0	LBA
	Højgård	2	78.00	39.00	4.24	LBA
Totals	2	5	280	106.5	3.91	
	Vorbasse	7	315.00	45.00	0	LpRIA
Totals	1	7	315	45	0	

Table 8.6 Values for post-structures and Total Additional Area in outwash plain

The majority of dwellings for Højgård were similar to those of the previous phases and were more plentiful, yet two distinctly different smaller post-structures were constructed concurrently. Agricultural production on the same level as the EBA phases would not require additional structures. An increase in agricultural production would require alternate means of storage and processing space so as not to infringe on living space. The Total Additional Area provided by the post-structures varied between the settlements, presenting a range of $75<n\leq135$ m^2. The average area from post-structures differed slightly, with Vorbasse presenting 45 m^2 of average area and Højgård presenting 39 m^2. The similarity in post-structure size further suggests the appearance of specific architecture for agricultural storage, and therefore an increase in production for the period. The standard deviation for both settlements was small, indicating purpose-built structures of similar construction.

Vorbasse also presented evidence of post-structures in the Late Pre-Roman Iron Age, demonstrating an increase from three to seven post-structures. Taking the evidence for purpose built structures, such an increase indicates an expansion of agricultural production for the outwash plain settlements into the Early Iron Age (Fig. 8.17)). The Total Additional Area also increased in the latter period, providing over twice as much TAA (n=315 m^2). The average area per post-structure remained the same as that of the earlier period, however, indicating a consistency in construction and furthering the design of post-structures as directly related to agricultural storage and processing.

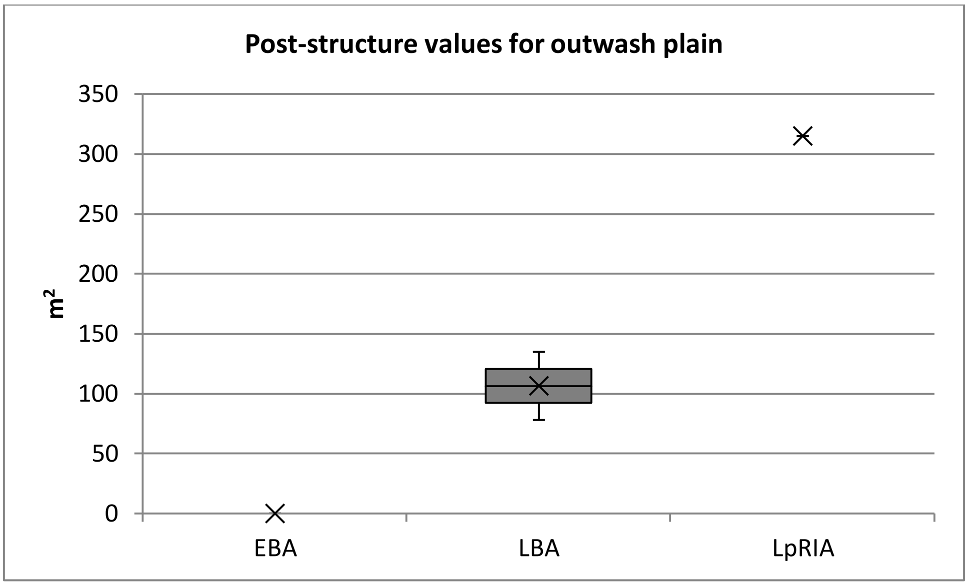


Figure 8.17 Total range of TAA values for outwash plain over time. X indicates average TAA.

The Dunes

The dune settlement did not present any evidence of post-structures. As mentioned in the above discussion of dwellings for Legard, the dwellings of the dune settlement were larger than any of the EBA settlements of the outwash plain. In order to conserve resources, likely having to come from further away than more forested sub-regions (see Appendix B), the larger dwellings could have served as living/activity/storage areas, similar to the discussion of contemporary Højgård in the outwash plain. The EBA settlements of the more marginal sub-regions presented alternatives to standard 'granary' storage, possibly as a result of agricultural production on subsistence level only, or as a result of grain acquired through exchange.

The Raised Littorina Seabed

Two of the Early Bronze Age settlement phases in the raised Littorina seabed region presented evidence of post-structures (Table 8.7). Bjerre presented larger dwellings than either phase of Vadgård, again suggesting a difference in storage practice based on dwelling size where larger dwellings were able to serve multiple functions. Vadgård i displayed evidence of two post-structures, which increased to three in the following phase. The Total Additional Area from post-structures for Vadgård I was 85.5 m^2, followed by an increase to 128.25 m^2, which is the largest TAA for the period across Denmark. The TAA for both phases was greater than the THA, suggesting an extraordinary amount of necessary storage space. All post-structures for Vadgård were of equivalent size (n=42.75 m^2), indicating continuity in construction. Similar continuity, and size, was apparent in the LBA and LpRIA settlements of the outwash

	Littorina	Number of Post-Structures	TAA m^2	Average Post-Structure Area m^2	Standard Deviation s_x m^2	Period
	Bjerre	0	0	N/A	N/A	EBA
	Vadgård i	2	85.5	42.75	0	EBA
	Vadgård ii	3	128.25	42.75	0	EBA
Totals	3	5	216.25	85.5	0	

Table 8.7 Values for post-structures and Total Additional Area on raised Littorina seabed

plain, suggesting the structures were created to certain specifications. Instead of producing a single, large storage structure or even a dwelling-type structure used solely for storage, multiple structures of similar size and configuration were created. Obviously, these served a specific function of either social or economic significance within the settlement.

The Moraine Sand

One of the four Early Bronze Age sites in the moraine sand region presented evidence of post-structures (Table 8.8). Røjle Mose displayed evidence of two post-structures, providing a Total Additional Area of 27.48 m^2, less than the TAA of the Littorina seabed settlements for the same period. The average area per post-structure was 13.74 m^2, also smaller than that of the Littorina seabed settlements. As for Vadgård on the Littorina seabed, Røjle Mose presented the smallest THA value for the period in the sub-region, yet was the only settlement to display post-structures. The suggestion of storage practices based on dwelling size is therefore furthered. In the case of Røjle Mose, the TAA was only slightly less than the THA. The smaller post-structure size, nearly one-third the size of the post-structures on Vadgård, suggests less agricultural production as would be expected of smaller THA and therefore population values. The appearance of two small structures for storage rather than one larger structure, however, is intriguing and indicative of deliberate use of resources to create storage space.

The Late Bronze Age settlement of the moraine sand presented evidence of two post-structures. Hemmed Church presented 74 m^2 of TAA, increasing from the lack of post-structures in the earlier phase of settlement. Similar to the LBA phase of Højgård, post-structures appeared as the dwelling size decreased even while the THA increased. An increase in agricultural production is reflected in the construction of structures of specific size and shape, marking a change in storage practices. A small variation in post-structure size further indicates post-structures were built as a sub-regional reaction to agricultural production exceeding the amount of space available within dwellings. Post-structures were deliberate constructions of similar size, built to perform a specific function. The average area from

	Moraine sand	Number of Post-Structures	TAA m^2	Average Post-Structure Area m^2	Standard Deviation s_x m^2	Period
	Egehøj i	0	0	N/A	N/A	EBA
	Egehøj ii	0	0	N/A	N/A	EBA
	Røjle Mose	2	27.48	13.74	2.63	EBA
	Hemmed Church	0	0	N/A	N/A	EBA
Totals	4	2	27.48	13.74	2.63	
	Hemmed Church	2	74.00	37.00	2.83	LBA
Totals	1	2	74.00	37.00	2.83	
	Omgård	3	141.25	47.09	35.45	EpRIA
	Hodde i	5	73.50	14.70	2.39	EpRIA
	Hodde ii	12	306.50	25.54	7.52	EpRIA
	Grøntoft i	0	0	N/A	N/A	EpRIA
	Grøntoft ii	9	167.00	18.56	8.11	EpRIA
	Grøntoft iii	1	22.50	22.50	0	EpRIA
	Grøntoft iv	0	0	N/A	N/A	EpRIA
	Sejlflod	0	0	N/A	N/A	EpRIA
Totals	8	33	766.25	23.69	14.40	
	Hodde iii	16	317.00	19.81	6.59	LpRIA
	Hodde iv	25	533.00	21.32	9.97	LpRIA
Totals	2	41	916	20.73	8.74	

Table 8.8 Values for post-structures and TAA in moraine sand

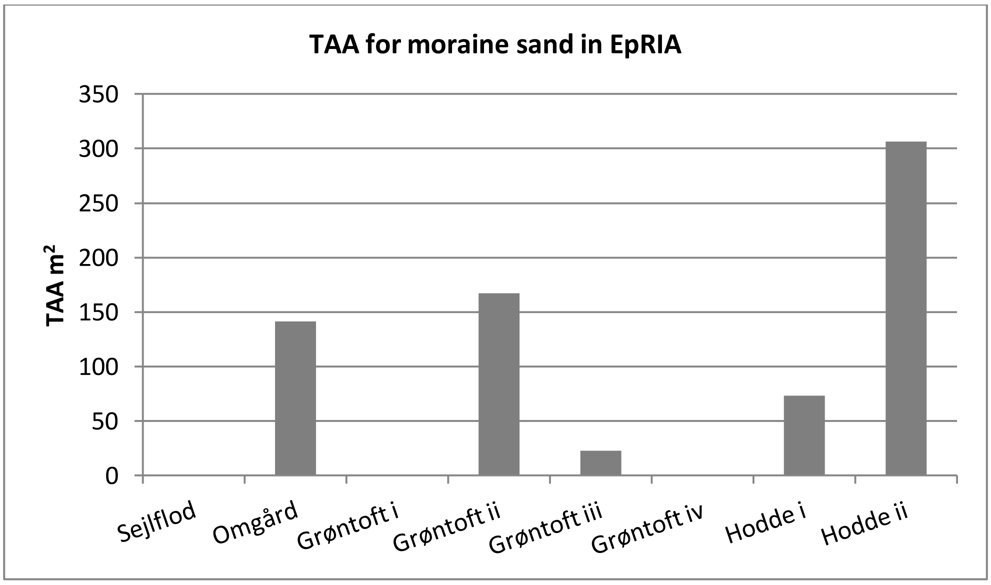


Figure 8.18 Values of Total Additional Area for Early Pre-Roman Iron Age of the moraine sand

post-structures was 37 m^2, again similar to the same period in the outwash plain.

The increase over time in additional area from post-structures continued into the Early Iron Age in the moraine sand (Fig. 8.18). The number of post-structures per site also increased. Omgård presented evidence of three post-structures. Hodde i presented eight post-structures, which increased in the following occupation phase to twelve. The phases of Grøntoft followed the trend of dwellings, which increased to nine post-structures in Grøntoft ii from no post-structures in Grøntoft i and then decreased to a single post-structure in the final phase. The TAA values were greater than the preceding period in the region, and similar to the LpRIA outwash plain values. Omgård, and Grøntoft ii presented similar values of TAA with $140<n<170$ m^2. Hodde ii presented a large increase in TAA of over four times the previous phase to 313.5 m^2. Grøntoft iii decreased to 22.5 m^2. Overall, smaller post-structures were apparent. Omgård presented an average post-structure area of 47.92 m^2, more similar to the preceding period in the region.

While greater numbers of post-structures and therefore large TAA values were present on settlements with large THA values, the correlation between dwelling size and post-structure presence largely continued. Hodde ii presented a much greater TAA than the preceding EpRIA phase, which matches the decrease in difference between dwelling size present. Omgård contained the smallest THA for the sub-region, yet post-structures only slightly smaller than its dwelling. Sejlflod presented a comparably small THA, yet no post-structures. The standard deviation for dwellings was much greater than the majority of EpRIA settlements for the moraine sand; the pattern of storage within dwellings where space allowed may have continued. As with dwellings, Grøntoft presented the opposite pattern to contemporary settlements. Grøntoft i did present the greatest difference in dwelling size and no post-structures, however the following phases demonstrated increasingly similar dwelling sizes, with a decrease in post-structure presence. An alternative storage pattern may have been tried for the later phases of Grøntoft that left little trace in the record. The standard deviations for the dwellings of Grøntoft i and iv were similar, however, despite the decrease in dwelling size, and internal storage may have continued in dwellings that allowed for it.

The Late Pre-Roman Iron Age for the moraine sand region was represented by the final phases of Hodde. These values were greater than the preceding period, suggesting a continuous increase in need for above ground storage. Hodde iii presented 317 m^2 from sixteen post-structures, which increased in the final phase to 533 m^2 from twenty-five post-structures. The rise in available storage mirrors the expansion over time in THA, as well as the decrease in difference in dwelling size. A growth in population necessitates an increase in

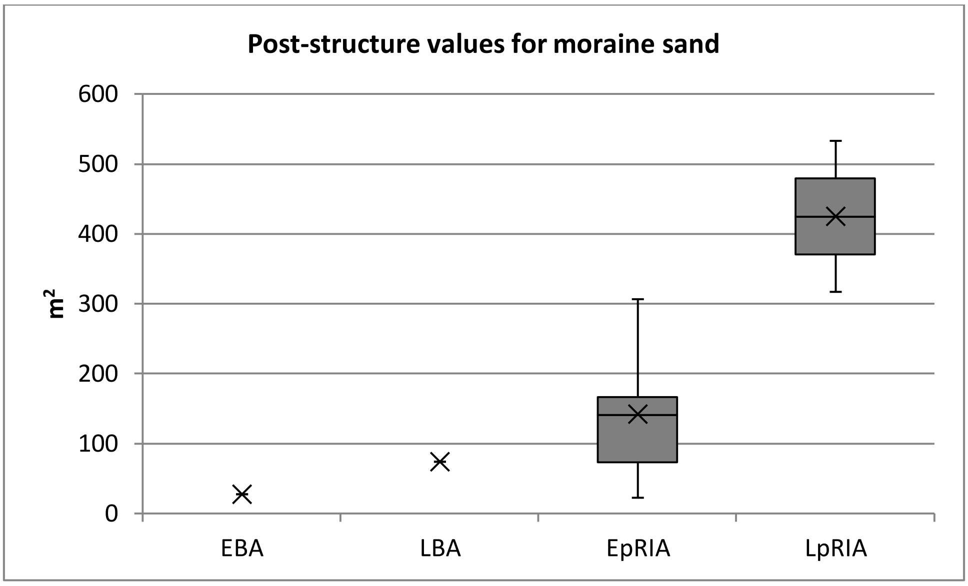


Figure 8.19 Total range of Total Additional Area values for moraine sand over time. X indicates average TAA

agricultural production, prompting the construction of more storage space. Given the decrease in average area per post-structure for both Pre-Roman Iron Age periods, smaller post-structures were likely easier to construct on an as-needed basis and used fewer resources than the larger structures of previous periods. Smaller post-structures over time also account at least partially for the increase in number per settlement. It is apparent that agricultural production increased over the BA-IA transition in the moraine sand, with larger amounts of additional area from post-structures, despite the decline in size, occurring over time (Fig. 8.19).

The Moraine Clay

The moraine clay settlements of the Late Bronze Age did not present any evidence of post-structures (Table 8.9). The dwellings for Højby, Jegstrup, and Heltborg again demonstrated fairly large dwellings, comparable to the contemporary settlements of the outwash plain and moraine sand. While Vorbasse and Hemmed Church, from different sub-regions, presented larger dwellings as well as post-structures, the lack of post-structures on comparably large settlements in the moraine clay may be indication of a sub-regional trend in agricultural production. The moraine clay, slightly less hospitable than the aforementioned sub-regions, could have maintained a subsistence-level production that required only the amount of storage space available within the dwellings.

Only Borremose in the Early Pre-Roman Iron Age presented post-structures. Here, the trend of more similar, smaller dwellings prompting post-structure construction falters. Skårup presented incredibly similar dwellings of comparably small area, yet no post-structures.

Borremose, on the other hand, presented a large standard deviation between comparably large dwellings, while two post-structures provided 67.06 m^2 of TAA. The TAA was smaller than contemporary settlements in the moraine sand and outwash plain regions, although larger than the TAA of Grøntoft iii in the moraine sand region.

All of the settlements (Borremose, Kjærsing, and Heltborg i-ii) in the Late Pre-Roman Iron Age of the moraine clay presented evidence of post-structures (Fig. 8.20). The number of post-structures per site ($1<n\leq9$) is greater than the settlements of the preceding, although less than the contemporary settlements of the moraine sand. The Total Additional Area of each settlement suggests growth in potential storage with $110<n<300$ m^2 of TAA. The amount of storage continued to be smaller than contemporary settlements in other sub-regions. The average area per post-structure for the three settlements ($15<n<35$ m^2) however, was similar to the averages of the outwash plain for the period and continued to demonstrate smaller post-structures per site. Again, the relationship between dwellings and post-structures was tenuous. Heltborg ii and Borremose presented similar differences (n=~12 m^2 and n=15 m^2, respectively) between the largest dwellings, yet drastically different values of TAA. Kjærsing presented the greatest THA and the most standard deviation, yet a comparably small TAA. For the moraine clay, production was obviously not a function of dwelling size or population. Heltborg i and Borremose presented relatively similar TAA values from THA values nearly three times different.

	Moraine Clay	**Number of Post-Structures**	**TAA m^2**	**Average Post-Structure Area m^2**	**Standard Deviation s_x m^2**	**Period**
	Højby	0	0	N/A	N/A	LBA
	Jegstrup	0	0	N/A	N/A	LBA
	Heltborg	0	0	N/A	N/A	LBA
Totals	3	0	0	N/A	N/A	
	Borremose	2	67.06	33.53	7.82	EpRIA
	Skårup	0	0	N/A	N/A	EpRIA
Totals	2	2	67.06	33.53	7.82	
	Borremose	9	284.50	31.61	15.91	LpRIA
	Kjærsing	7	112.00	16.00	0	LpRIA
	Heltborg i	9	222.54	24.73	10.45	LpRIA
	Heltborg ii	1	11.70	11.70	N/A	LpRIA
Totals	4	25	650.59	24.26	12.68	

Table 8.9 Values for post-structures and Total Additional Area in moraine clay

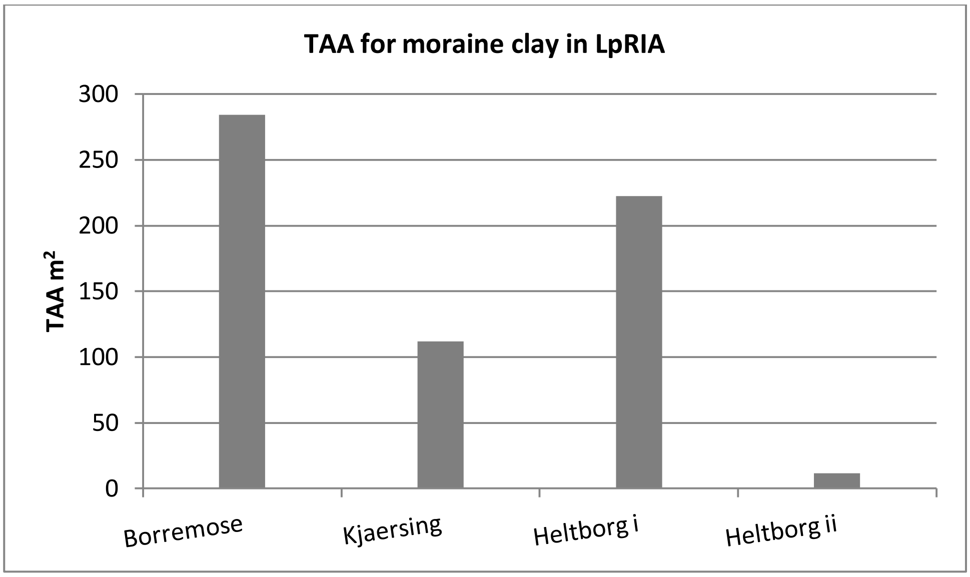


Figure 8.20 Values of TAA for Early Iron Age of moraine clay

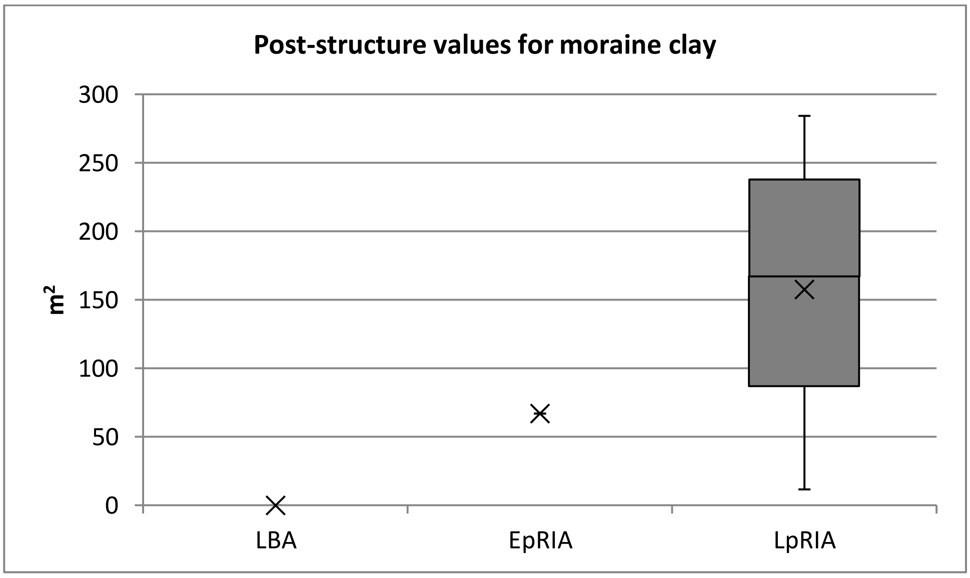


Figure 8.21 Total range of TAA values for moraine clay over time. X indicates average TAA.

Production was more likely a product of the specific environment each settlement was situated within and post-structure presence reflects the productive capacity directly. The more ad hoc approach to post-structure construction was exhibited by the difference in average post-structure size. Borremose and Heltborg presented the same number of post-structures, yet over 60 m^2 difference in TAA. Those settlements presented a range of individual post-structure size of thirty to forty square metres. The variation was greater than the majority of previous settlements across Denmark. Kjærsing, however, displayed post-structures of equivalent size. It is apparent the moraine clay exhibited an increase in agricultural production over time (Fig. 8.21), although the manifestation of consumptive architecture was more variable than the other sub-regions.

Denmark inter-regionally

The Early Bronze Age

Only the Littorina seabed and moraine sand sub-regions presented evidence of post-structures in the Early Bronze Age (Vadgård i-ii and Røjle Mose, respectively; Fig. 8.22). The dune ecology did not display evidence of post-structures. While the number of post-structures was similar, the Total Additional Area for each sub-region differed. The raised Littorina seabed presented much larger post-structures, resulting in TAA values at least three times larger than the moraine sand. The disparity is likely a function of differing levels of agricultural production; both sub-regions presented small standard deviations for post-structure size, indicating similarity and purpose behind post-structures of specific construction.

Interestingly, post-structures were only present on settlements with the smallest THA values for the period. Both periods of Vadgård along with Røjle Mose presented less than 100 m^2 of THA, yet were the only settlements with post-structures. The sample is too small to determine whether this is a false correlation, however, the possibility offers intriguing alternatives to the traditional acceptance of post-structures as granaries. Perhaps in the Early Bronze Age, larger settlements were able to store grain within dwellings without needing to put effort into specific storage structures. Smaller settlements might have been more pressed for living space and found post-structures to be more economical than constructing additional dwellings.

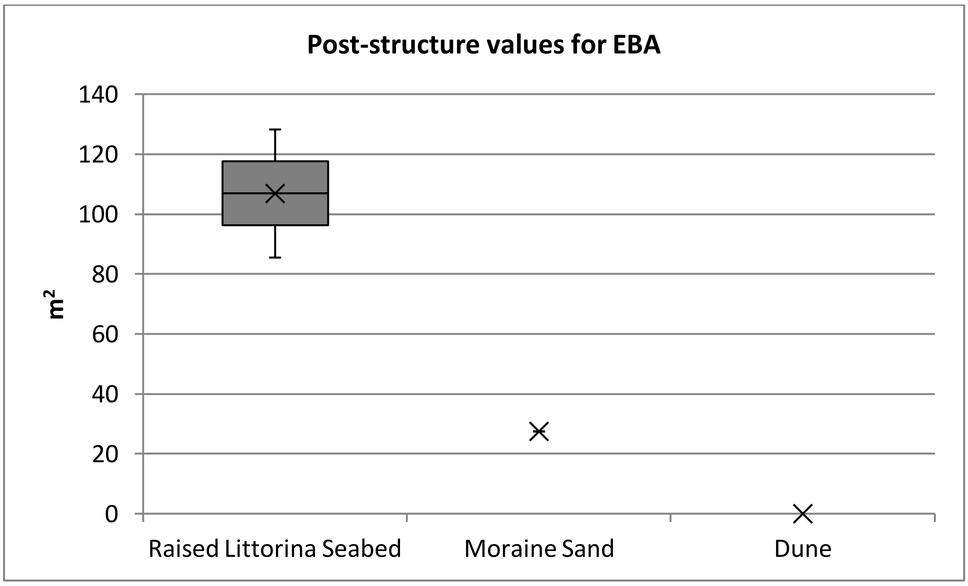


Figure 8.22 Total range of Total Additional Area values for the Early Bronze Age by sub-region. X indicates average TAA.

The Late Bronze Age

The moraine sand and outwash plain sub-regions displayed post-structure evidence for this period, while the settlements of the moraine clay did not (Fig. 8.23). All the values for Total Additional Area were between $70<n<150$ m^2. All LBA settlements with post-structures presented two to three post-structures. The outwash plain displayed the greatest values of TAA, although the TAA of the moraine sand settlements increased from the previous period. The average size of post-structures was similar across the sub-regions, with an increase demonstrated in the moraine sand.

Every settlement in the moraine sand and outwash plain regions presented post-structures. The rise in post-structure presence in the period suggests either an increase in agricultural production or a change in storage strategy from a method invisible to the record in the previous period, in which case a growth in agricultural production necessitating such a change is not illogical. The lack of post-structures on the moraine clay, conversely, was more likely evidence of either a sub-regional variation in storage practice or a continuation of subsistence-level agricultural production well able to be stored within the confines of dwellings similar in size to the EBA settlements without post-structures.

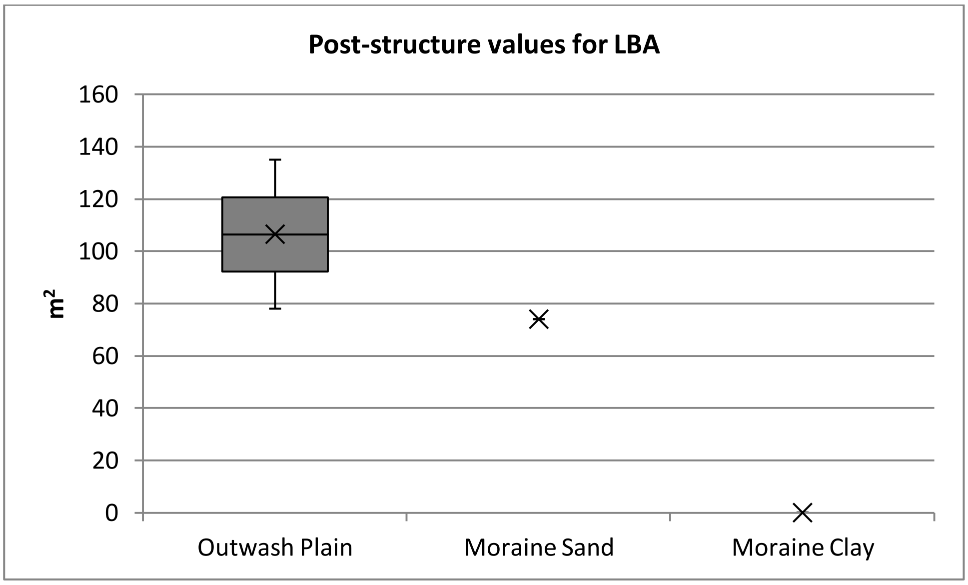


Figure 8.23 Total range of TAA values Late Bronze Age. X indicates average TAA.

The Early and Late Pre-Roman Iron Age

The moraine clay and moraine sand regions demonstrated post-structures for the Early Pre-Roman Iron Age periods (Fig. 8.24). All but one settlement in the moraine sand presented over 50 m^2 of TAA, with three of the settlements demonstrating an increase from the previous period. The numbers of post-structures per settlement also increased ($1 \le n \le 12$), implying an increase in needed agricultural storage. The moraine clay displayed smaller values, with only two post-structures and the second smallest TAA for the period.

The appearance of post-structures on settlements with smaller, more similar dwellings continued for the moraine sand, although the overall decrease in dwelling size for the period prompted some confusion. Grøntoft presented a challenge to the correlation between dwelling area, subsequent standard deviation, and post-structure presence. Internal storage, and therefore a more subsistence -level rate of agricultural production, may have been present on the phases without post-structures, given the similarity in standard deviation of dwelling area. The moraine clay continued to present a different trend, as the settlement

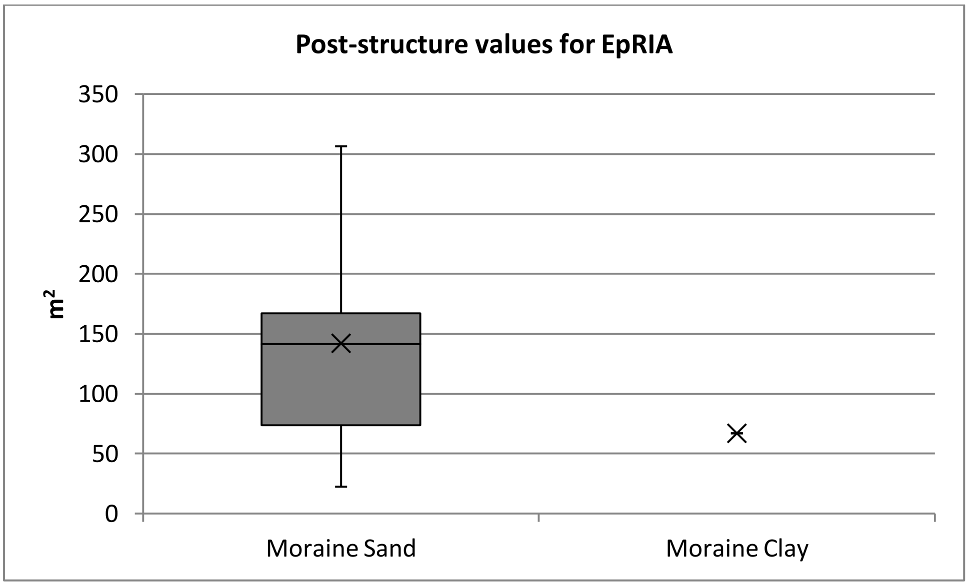


Figure 8.24 Total range of Total Additional Area values for the Early Pre-Roman Iron Age. X indicates average TAA.

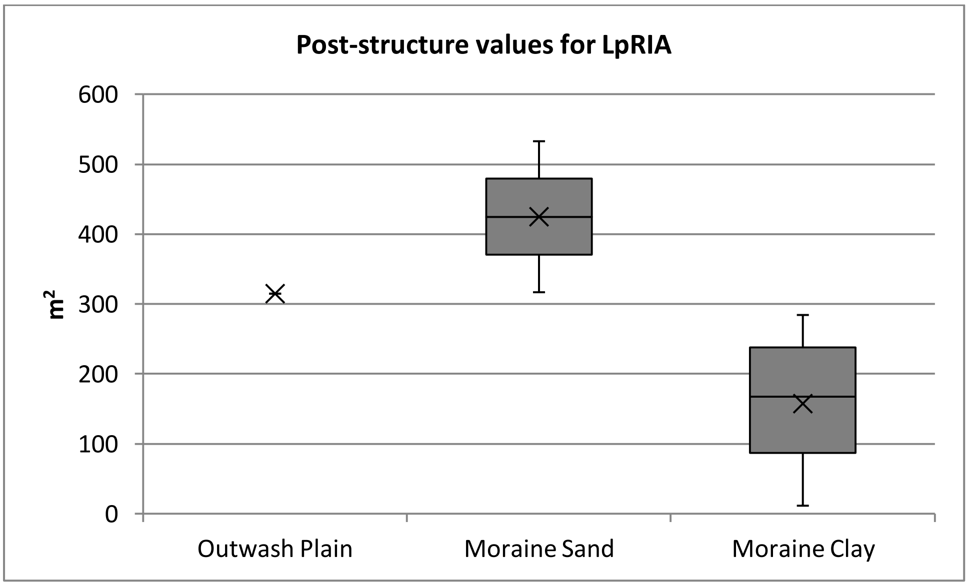


Figure 8.25 Total range of Total Additional Area values for the Late Pre-Roman Iron Age. X indicates average TAA.

with post-structures presented two comparably large dwellings and one much smaller one, resulting in a large standard deviation. The settlement without post-structures presented a dwelling profile more likely to display consumptive architecture if present on the moraine sand.

The Late Pre-Roman Iron Age presented post-structures in all three regions settled in the period (Fig. 8.25). The amount of TAA increased from the previous period as all the settlements presented values greater than 100 m^2. Apparent sub-regional variation in agricultural production was visible, as was a reduction in the consistency of post-structure construction. The moraine clay presented more settlements with post-structures for the period, yet the moraine sand presented by far the greatest amount of TAA, $300<n<550$ m^2. The outwash plain demonstrated similar numbers of post-structures to the moraine clay, yet a greater TAA more similar to the smallest settlement of the moraine sand, which had twice the number of dwellings. The settlements of the moraine sand also presented more post-structures per site than those of the moraine clay, which were more similar to the EpRIA settlements. The increase in population is reflected in the increase of agricultural production via the proxy of storage area; a larger population per site requires greater production and somewhere to store the surplus.

Synopsis

As the primary form of agricultural storage for Denmark, the results of intra-regional analysis of post-structures are particularly interesting. Given that there were few post-structures in the Bronze Age periods, and none whatsoever in the dune region, it is difficult to gain an appreciation for agricultural storage, and therefore production. Contrasting THA and standard deviation in dwelling area, however, presents the appearance of subsistence-level agricultural production and storage within larger dwellings. The EBA settlements with the smallest THA, and most similar dwelling areas within each settlement, were the only settlements with post-structures. The LBA settlements for the outwash plain and moraine sand continued the correlation; the moraine clay presented the opposite, intimating the sub-region had its own storage practices.

Examining the broader trend of increase in the number of post-structures and the amount of Total Additional Area per site over time, however, indicates that the need for storage of agricultural produce grew. The outwash plain, a strong presence in the Bronze Age, declined into the Iron Age to a single settlement, although the TAA for that settlement (Vorbasse) increased in the latter period from its earlier phase. The moraine sand, the only region to demonstrate post-structures throughout all periods, rose to prominence in the Early

Pre-Roman Iron Age. The Late Pre-Roman Iron Age demonstrated relatively analogous amounts of TAA across the moraine sand, moraine clay, and outwash plain. It is perhaps unsurprising that the greatest accumulation of above ground storage was located on the most productive soil. The appearance of post-structures, along with the definite increase in TAA from increasingly smaller post-structures, firmly indicates an increase in agricultural storage across Denmark.

8.3 Comments

Examined individually, the Danish regions present interesting trends of population movement and agricultural production. The Early Bronze Age was represented by the largest array of regions, with settlement on the dunes, raised Littorina seabed, outwash plain, and moraine sand regions. The population shifted in the Late Bronze Age to centre on the outwash plain, moraine sand, and moraine clay regions, following the more fertile soil and avoiding the rising sea level. The Early Pre-Roman Iron Age condensed to settlement only on the moraine soils, while the Late Pre-Roman Iron Age expanded to the same regions as the Late Bronze Age.

Permanence in settlement varied throughout the regions. Multi-phased settlements, indicating greater investment in the land, were present on the raised Littorina seabed, outwash plain, and moraine sand in the Early Bronze Age. No multi-phased settlements were present in the Late Bronze Age. The outwash plain and moraine sand regions each presented one settlement with phases in both the EBA and LBA. For the Early Pre-Roman Iron Age, the moraine sand again presented multi-phased settlements, along with a single settlement with LBA and EpRIA phases. The outwash plain also produced a settlement with LBA and LpRIA phases. Both the moraine sand and moraine clay presented multi-phased settlements in the LpRIA, along with settlements in both periods of the Early Iron Age. The continuity in settlement demonstrates a more settled population that increased an attachment to location over time, investing greater effort and extending the longevity of the settlements on increasingly productive soils.

In the Early Bronze Age, there was a regional difference in Total Habitable Area. The outwash plain presented the largest THA values, while certain raised Littorina seabed and moraine sand settlements presented the least amount of THA. The dune settlement and the remaining raised Littorina and moraine sand settlements presented similar values of THA. In the Late Bronze Age, the outwash plain presented the largest value of THA, while the settlements of the moraine clay and sand displayed similar values to each other. The EpRIA settlements were largely comparable, with the moraine sand demonstrating greater variability than the outwash plain and moraine clay settlements. There was little variability between the LpRIA settlements of the moraine soils, suggesting similar population per settlement between the sub-regions.

While storage increased over time, sub-regional trends indicate settlement on more productive soils. Twenty-five percent of the moraine sand settlements and sixty-seven percent of the settlements on the raised Littorina seabed presented post-structures in the EBA. The dune and outwash plain settlements did not produce post-structures. While post-structures stand as proxy for agricultural production, their lack does not necessarily indicate a lack of production, but rather a lack of surplus. Subsistence level production could easily have been stored on the larger settlements that did not produce post-structures in means otherwise invisible or undetermined in the record. In the LBA, all of the moraine sand and outwash plain settlements presented post-structures, while none of the moraine clay settlements displayed storage. Again, the moraine clay settlements possibly stored grain in a manner invisible to the record; however, the regionality of the storage trend is intriguing.

The moraine sand settlements decreased to seventy-one percent of settlements with post-structures, although the number of post-structures per site increased. Only one of two settlements on the moraine clay produced post-structures for the period, possibly indicating a movement of population into the region bearing different modes of storage. The LpRIA displayed similar trends. All of the moraine sand settlements presented an increase in post-structure presence. Only sixty-seven percent of the moraine clay settlements presented post-structures.

It is obvious the decline in agricultural production predicted by certain theoretical models was not present in Denmark over the close of the Bronze Age. Production, as indicated by the proxy of post-structure area, increased over time, causing a necessary reinterpretation of the impact of shifting exchange routes, new technologies, and social change. Given the increasing THA over time, the variable amount of storage suggests exchange with neighbouring sites. Even in regions where all settlements presented post-structures, the amount of TAA was varied and there was a distinct lack of correlation between THA and TAA. Large settlements such as Grøntoft ii with over 2000 m^2 of THA in the EpRIA presented over two and half times less the amount of TAA as the contemporary Hodde ii, which presented a THA of 1189 m^2. While there is no reliable method to measure the amount of grain able to be stored within post-structures and compare that value to a figure of population, the inconsistent relationship between THA and TAA does suggest not all settlements, even those with post-structures, were unlikely to have produced and stored the amount of grain needed to maintain an increasing population. It is rational to consider a series of producer/consumer relationships between those settlements with ratios of THA and TAA suggesting a supply outweighing the requirements of the population and those with the inverse ratio. As the Danish geology changes abruptly, with multiple geologic ‘regions’ within a not considerable distance, it does not strain credulity that settlements nominally in segregate regions and therefore differing productivity would be in contact with neighbours. The very fact of varied productivity and environmental setting would encourage such interaction. More sparse growing environments, such as the dune region, would be best suited to craft production or perhaps light grazing and established connections with neighbouring settlements on the more productive sandy moraine would ensure the ability to feed the family.

Chapter IX: Discussion

This chapter will pull together the trends noted in the previous chapters and apply them to the study questions of population and agricultural production. The implications of the data will be discussed, with particular attention paid to the benefits of using domestic architecture as proxy for agricultural production and understanding said architecture as the throughput of energy.

9.1 Data and the research questions

The data presented in the previous chapters suggest patterns and have implications regarding agricultural production and population from the Bronze Age into the Iron Age in southern Britain and Denmark. The facets of domestic architecture under investigation, dwelling size, subterranean and above ground storage, and regional distributions over time, have been examined individually. In order to form a comprehensive understanding of the trajectory of agricultural production at the end of the Bronze Age, we must now return to the questions asked by this study and collate the individual analyses presented in the preceding chapters.

The aim of this study was to examine the impact of social and technical change on agricultural production and consumption toward the close of the Bronze Age through the standpoint of variation in energy devoted to the creation of domestic architecture. In economically-driven models, such as the core/periphery model of Friedman and Rowlands (1977), Renfrew's (1986) peer-polity model, or Kristiansen's (1994) world systems re-iteration, political structure is dependent on access to exchange, which is in turn dependent on agricultural production of a surplus, through the promulgation of the contemporary political structures. Exchange is socially embedded, reinforcing the recursive relationships between political structure, agricultural production, and exchange at the centre of those models, yet the conditions on which social change is predicated may not be reflected in the actuality of the end of the Bronze Age in northern and western Europe. The models require the exceedingly intertwined facets of social order, agricultural production, and for the overall structure to demonstrate a decline with the waning access to long-distance exchange networks at the end of the Bronze Age. Agricultural production, driven by the demands of exchange in order to sustain the social order, should diminish with the lack of demand to maintain connections through exchange, in turn forcing changes to the political structure. Excess production would only result in the further establishment of the social organization as connections to exchange are reaffirmed. More recent modelling (*e.g.* Latour 2005, Giles 2007) has instead focused on relationships of production as the cornerstone for social change, rather than a predetermined set of if-then conditions, making an understanding of the state of agricultural production at the BA-IA transition even more critical.

Control of land is acknowledged as the focal point for social organization in the Iron Age, establishing *ipso facto* that social change occurred at the end of the Bronze Age. What was the effect of the process of social change on production as the political structure was re-established as dependent on investment in the land and its produce? The questions asked in this study centre on investigating agricultural production and population on their own merits to determine the state of agricultural production across the Bronze Age-Iron Age transition. It might be predicted that agricultural production would by necessity decline during the reorganization of the social order. Due to the introduction of iron and the dwindling access to exchange mechanisms, and given that agriculture is understood as both driven by and driving the political structure as the means through which exchange is accomplished, agricultural production would lose its social impetus. Conversely, control of land and local production may have arisen as the basis for social order, aided by more local production of tools with the inception of iron, and as control over exchange items became increasingly difficult. The trajectory of agricultural production towards steady state, growth, or decline at the end of the Bronze Age into the Iron Age must be determined. Producing a measure of consumption by the proxy of subterranean and above ground storage over time and sub-regionally provides an alternative perspective to the impact of changing technologies and contact with the greater Late Bronze Age and Early Iron Age world. As agricultural production is dependent on population as a source of labour and as consumers, tracking the congregation of people over time through the proxy of potential dwelling areas supplies a relational measure of agricultural success. Investigating agricultural production and population through architectural proxies allows the conditions for social change set forth by the models described above to be tested, and provides a stage on which alternative approaches might be discussed.

This study, as with every archaeological study relying on likely incomplete reconstruction and hypotheses derived from modern minds with unconscious biases, was possessed of certain problems that must be acknowledged. Preservation is a factor in these findings, as is the excavation method and recordation for each site. The project was not exhaustive, as it relied on published reports rather than the wide-ranging grey literature. The sample selected was, however, representative of the range of settlements present in each region over time and should be taken as such. These findings are also by necessity generalized, as climate would have affected both harvest and storage built on an as-needed basis. Pit size and shape would naturally affect the storage potential in terms of preservation throughout the year, as demonstrated by the Butser Ancient Farm experiments (Reynolds

1974, 1979; Hill *et al* 1983). The variation in pit form and volume, however, speaks to differing scales of consumptive architecture. Post-structures, although often regarded as consumptive architecture, provide tenuous results for storage area, as the unknown internal organization (*i.e.* shelves, drying racks, storage in bags or pots) would greatly affect the total amount of grain stored. The option of grain invisible to or misunderstood within the record is always possible as well, with storage other than pits and post-structures always a potential strategy. This does not invalidate the idea of visible consumptive architecture representing agricultural production over time; the sheer amount of potential storage over time suggests an increase in production and additional grain not accounted for would only support an increase in production. As this study does not seek to determine concrete production rates per settlement, only to investigate trends in agricultural production, speculation about practices that leave no trace is little more than an academic exercise, although understanding the possibility aids in interpretation of differences in potential storage between settlements.

9.2 Interpreting the data

An increase for both potential dwelling space and storage space over time has been established in the preceding chapters. Thus far, these factors have been treated largely independently, other than to establish any possible correlation, in an attempt to understand their potential trajectory in the target periods. To fully comprehend the agricultural situation at the end of the Bronze Age, the individual components must be related back to the question of production/consumption and examined in conjunction with each other. The raw amount of both subterranean and above ground storage increased, yet what do these measurements indicate in relation to grain storage and sustainability? What does the increase in storage mean, unless the population it is meant to sustain is taken into account? Do the sub-regional patterns shed any light on possible interaction between settlements in terms of agricultural production?

Pit volumes to sustainability

The first question addressed is the applicability of storage measurements to the real question of sustainability. One approach would be to formulate a grain to population ratio. According to Reynolds (1974), 1,300,000 cm^3 of grain is the minimum necessary to support four people for a year. Conversion of the total pit volume per site to cubic centimetres would provide a measure of whether each settlement was able to support itself; however, doing so requires a population estimate per settlement from the Total Habitable Area. Deriving population estimates from settlement size is highly contentious and problematic. While Naroll's "constant" (1962) has been previously used for southern British sites (*e.g.* Aldermaston Wharf: Bradley *et al.* 1980), the critique and general dismissal of the accuracy of the data used (Leblanc 1971, Casselberry 1974, and Brown 1987) has made population estimates from floor space based on a universal 'constant' even more unaccepted. Region-specific (*e.g.* Clarke 1974, Kramer 1979) or population type specific (*e.g.* Wiessner 1974) models are more accurate, as they solely address a certain dwelling design and can more readily account for variability than a cross-cultural attempt. No such study has been published regarding the areas of interest for this study, however, making such a calculation both tentative and flawed.

Instead, a comparison of the raw amount of total pit volume, as provided in Chapter 5, provides an indication of the changes in agricultural production over time in the sub-regions of southern Britain that suitably answers the research questions (Fig. 9.1). Sixty-eight percent of the Middle Bronze Age settlements produced pits. The period also produced the least amount of pit storage, in terms of total pit volume per settlement, as forty-one percent of settlements with pits produced less than one cubic metre of pit storage. With the exception of the large amount of storage available on Black Patch platform 4, the remaining settlements presented between one and three cubic metres of pit volume. Despite a smaller proportion of settlements with pits (65%), the Late Bronze Age demonstrated an increase in pit volume, as fifty-five percent of settlements with pits presented more than one cubic metre of pit volume. Two settlements presented two to ten cubic metres of pit volume. The Caburn presented over 10 m^3, while Green Park presented over 50 m^3.

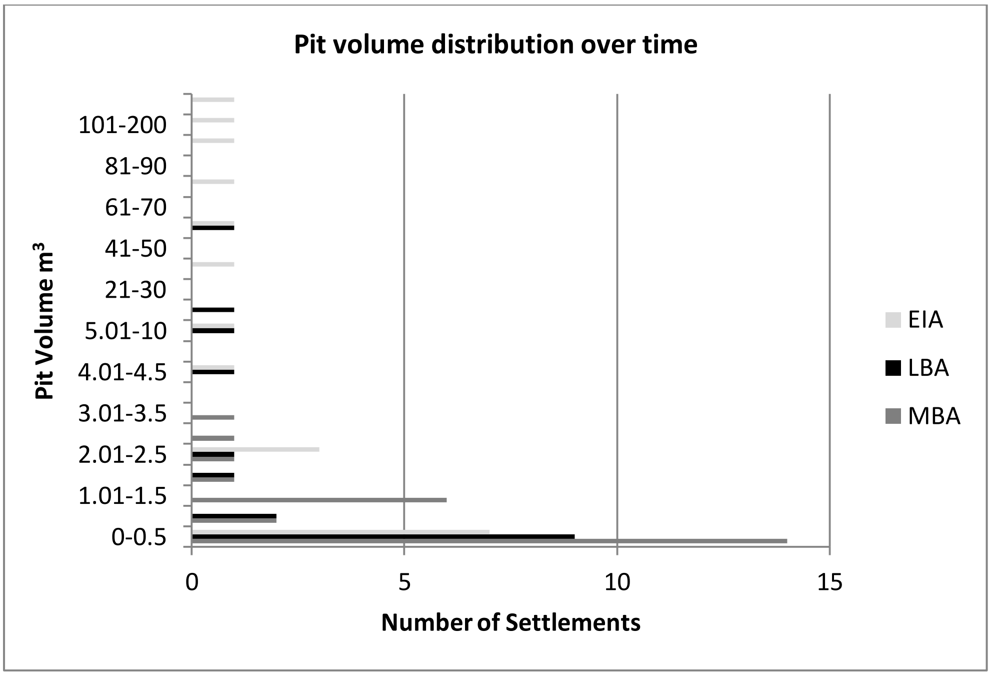


Figure 9.1 Distribution of total pit volumes over time for southern Britain

The increase in pit volume surged in the Early Iron Age, accompanied by a rise in number of settlements with pits (78%), demonstrating an increased investment in agricultural production. Only twenty-one percent of settlements with pits presented less than one cubic metre of total pit volume. Thirty-six percent presented between two and approximately six cubic metres, while another twenty-one percent displayed between thirty-five and eighty cubic metres of pit volume. The remaining settlements presented between 100 and 250 m^3. The variation in pit volume per settlement, linked to increasing numbers of pits, suggests varied production. Energy would only be invested in pit construction when necessary, allowing the increase in pit volume between the MBA and LBA, and in turn the LBA and EIA, to imply a regional trend of increase in production. Agricultural produce for consumption or waste from consumption requires storage space, therefore an increase in subterranean consumptive architecture, which requires energy to construct to specific size and form, equates to more produce available over time. The variation in pit volume between settlements in turn suggests interaction between settlements. The small amount of pit volume available across the MBA settlements certainly suggests storage on a subsistence level only, yet the settlements without storage capacity also required grain to survive. The increasing variety in potential storage capacity into the LBA and EIA indicates both subsistence level storage and beyond. The great quantities of available storage on Little Woodbury and Gussage All Saints would almost certainly be more than adequate for maintaining the population of those settlements; local networks between sites with large storage capacities and consumer sites with larger populations and storage capacity incapable of supporting it are not only likely, but also apparent. Settlements with smaller populations, given smaller THA values, yet large pit capacity must be somehow invested in agriculture to the extent that great numbers and total volume of pits were required, despite the apparent lack of labour force. An interactive local community of settlements, with a pooled labour force and storage on a single settlement, perhaps more prominent socially or simply with more suitable soil and available space, becomes increasingly probable.

Pit storage was apparently a more sub-regional tradition than previously assumed. The chalk downland has historically been the most extensively surveyed; it is therefore no wonder that its nearly ubiquitous pit tradition would be noted as a Bronze Age and Iron Age phenomenon across the whole of southern Britain if one assumes a relatively uniform culture with little variation. The Middle Bronze Age, however, demonstrates a very great difference in pit volumes present within and between sub-regions (Fig. 9.2). The Late Bronze Age demonstrates pits in all three sub-regions (Fig. 9.3), possibly the result of immigrants bringing their own storage traditions into areas where pits are not typical, although there is clear sub-

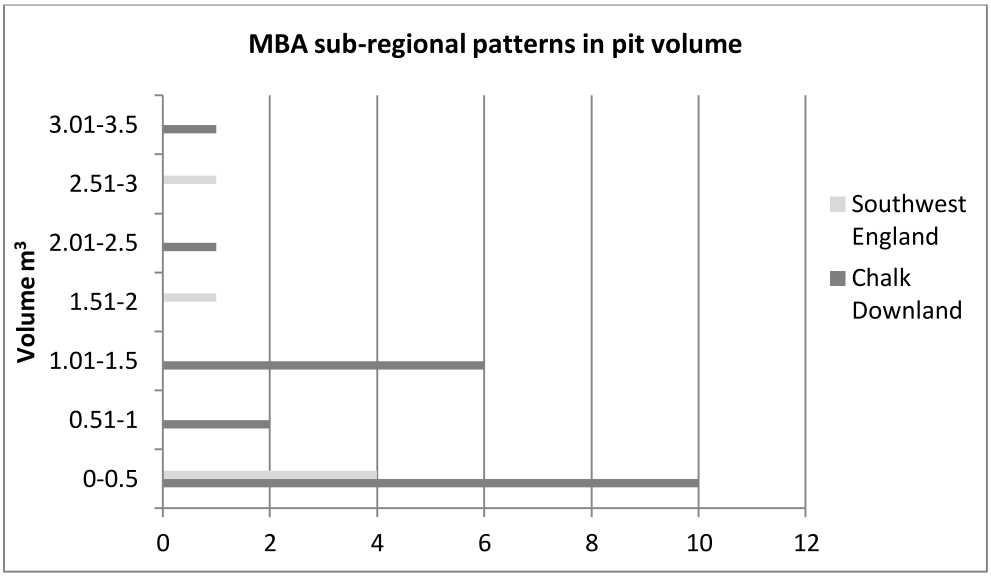


Figure 9.2 Range of Middle Bronze Age pit volumes by sub-region

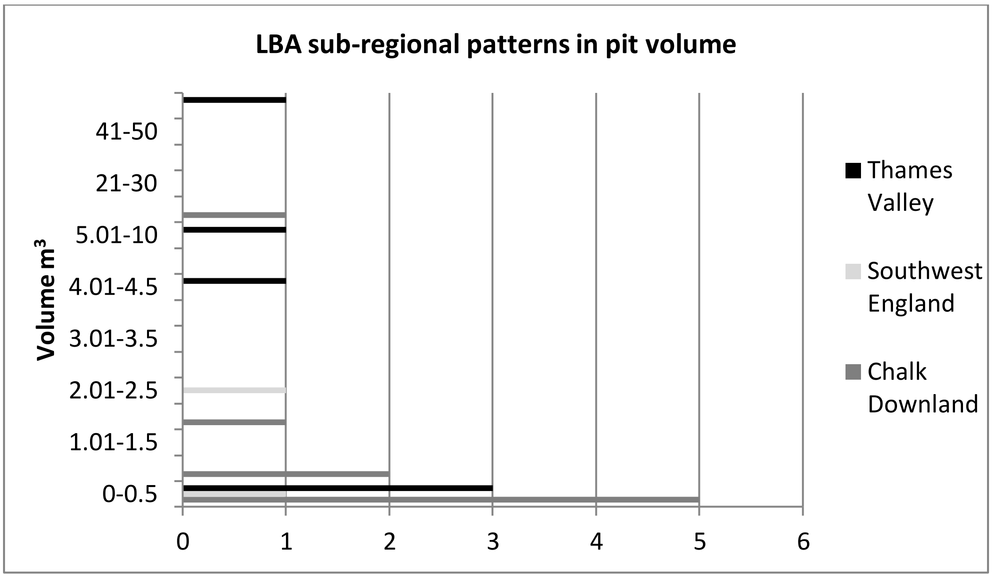


Figure 9.3 Range of Late Bronze Age pit volumes by sub-region

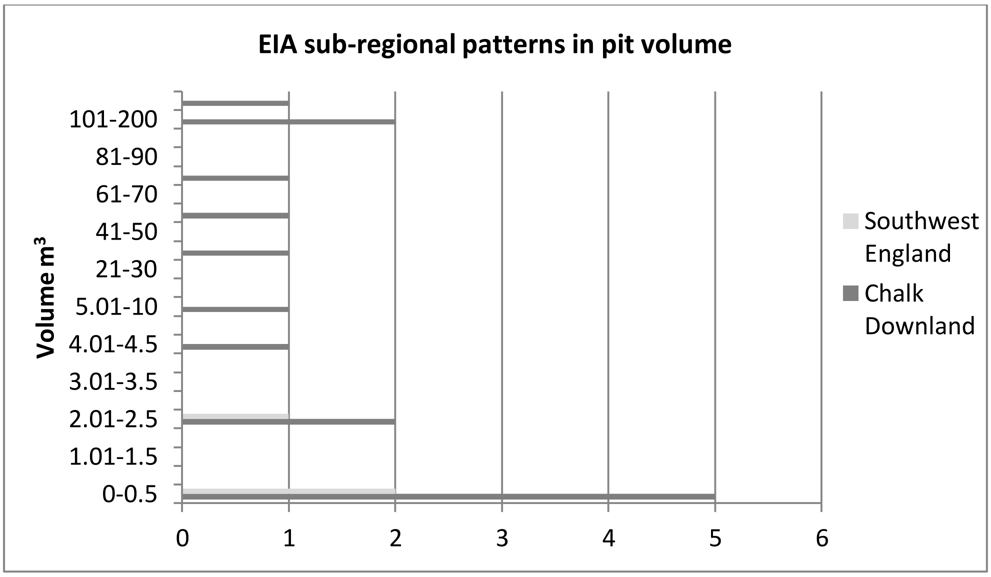


Figure 9.4 Range of Early Iron Age pit volumes by sub-region

regional trending in the dispersal of pit volume for the period. The LBA settlements of the Thames Valley produced the greatest amount of pit volume, while one of the settlements of southwest England presented a greater volume than the majority of settlements on the chalk. The subterranean storage of the Early Iron Age of the chalk increased, demonstrating the greatest pit capacities (Fig. 9.4). As for southwest England, there was a definite decline in pit presence into the Iron Age, although the pit capacities remained consistent. The settlements of southwest England never displayed greater than three cubic metres of volume, even as their contemporary settlements in the LBA and EIA began to display volumes over ten cubic metres. The chalk downland is the only sub-region to consistently gain pit volume over time.

Increasing amounts of subterranean storage into the Late Bronze Age, with the exception of the southwest England settlements that maintained a consistent pit capacity, indicate growth of agricultural production, especially when paired with the increasing size and external location of pits. As previously discussed, external pits with appropriate clay seals likely functioned as long-term storage. Locking away a portion of the harvest is only a wise decision if there is enough of a surplus to allow for such a change in storage habits. The increase in pit form variation in the Early Iron Age, with a greater proportion of barrel, bell, and frustum shapes supplementing the earlier hemispherical and cylindrical pits, also suggests experiments with storage habits likely as a result of greater volumes per pit. Changing the form of pits, where functional forms were already present, would be a reaction to increased amounts of consumptive material. The trend of increased agricultural production as evidenced by pit volume continued into the Early Iron Age for at least the chalk downland settlements, refuting any decline in agricultural production as corollary to disarray and re-organization of the social order due to new technologies and a lack of long-distance exchange. The varied storage capacities between settlements also begin to suggest a local network of interaction to compensate for settlements with less storage, therefore less immediate access to grain. As determined in Chapters V and VI, population, the productive labour force, was not a factor in subterranean storage capacity per settlement; where THA was relatively small with large total pit volume, a local pool of labour from neighbouring settlements geared toward agricultural production was possible. Larger consumptive capacities would serve as storage or waste disposal for a local community of settlements, without the need to devote energy in multiple locales to construct consumptive architecture.

Post-structure Area to Sustainability

We are able to plot the growth in number and potential floor area of post-structures as a potential measure of increasing need for storage, understood as probable increase in agricultural production. As Denmark predominantly, nearly exclusively, utilized post-structures on settlements, accounting for post-structure floor area as grain storage is necessary. Southern Britain presented different trends of storage, focusing greater amounts of energy on pit storage, yet the shifting use of post-structures over time tells a compelling story about production and changing strategy over time.

Southern Britain

Given the increasingly adequate amount of subterranean storage discussed above, the phenomenon of post-structures in southern Britain is even more worthy of note. As discussed in the analysis, the amount of Total Additional Area per settlement increased over time for southern Britain. Post-structures appeared throughout southern Britain in all three periods under discussion (Fig. 9.5), although the greater proportion of settlements with post-structures in the Middle and Late Bronze Age were in the Thames Valley and southwest England, the sub-regions with smaller amounts of pit storage. Only twenty-three percent of all Middle Bronze Age settlements presented post-structures, breaking down to fifty percent of the southwest England settlements and fifteen percent of the chalk downland settlements displaying post-structures. Three of the six total settlements with post-structures presented a TAA of less than ten square metres, while the other three presented between ten and fifteen square metres (Fig. 9.6). The variation in post-structure area, particularly as all but one settlement contained a single post- structure, is indicative of very different above ground storage space. Presence of post-structures, despite the small percentage, is indicative of a new type of consumptive architecture, which in southwest England was likely a response to inhospitable soil. The presence of post-structures on the chalk on settlements with pits, however, speaks to either inter-regional contact or simply similar reactions to greater production. The presence of a new form of structure is notable, even if not widespread and must have served a very specific purpose, given the greater amount of energy used in construction of a post-structure as compared to a pit.

Post-structure presence increased in the Late Bronze Age to fifty-three percent; all Late Bronze Age settlements of the southwest England region and seventy-one percent of the Thames Valley settlements presented post-structures, while only twenty-five percent of the chalk settlements exhibited post-structures (Fig. 9.7). The area provided by post-structures

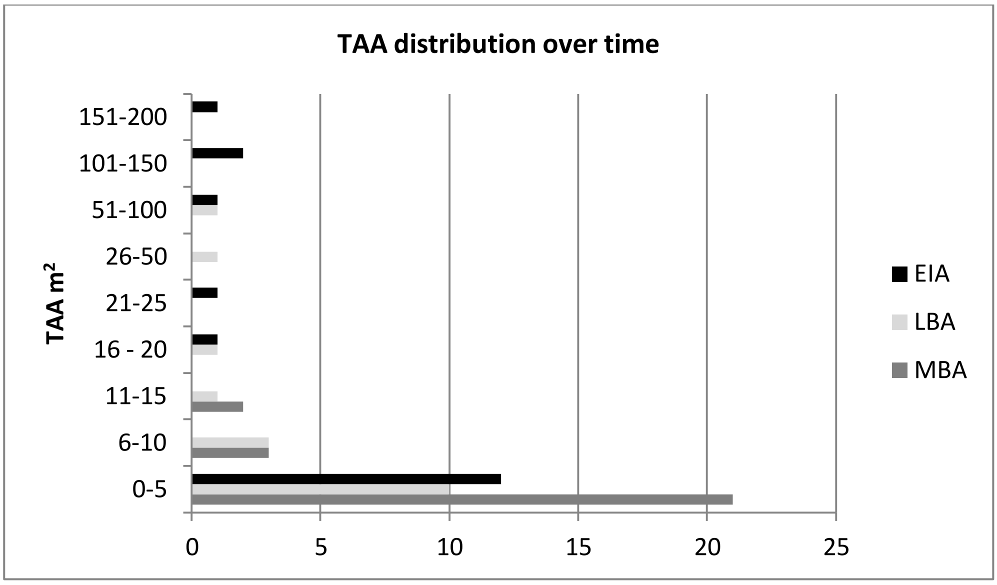


Figure 9.5 Distribution of Total Additional Area values over time for southern Britain

was analogous to the preceding period, with the same proportions of TAA on the settlements with post-structures, although an increase was apparent on the later settlements. Just over half (55%) of the TAA values were less than ten square metres. The remaining forty-four percent increased from the MBA to between ten and forty-five square metres. While the Early Iron Age settlements with post-structures demonstrated greater values of Total Additional Area (43% greater than 100 m^3) from the earlier periods, the actual proportion of post-structure presence declined to thirty-nine percent (Fig. 9.8). The presence of post-structures was weighted more toward the chalk downland in the EIA. One of three settlements in southwest England presented post-structures, while the chalk downland settlements increased post-structure presence to forty percent. It appears that post-structures, largely centred in the southwest England and Thames Valley regions in the Bronze Age, were a sub-regional phenomenon that were incorporated into settlement structure in the more densely populated and arable land on the chalk by the Early Iron Age.

There was no direct correlation between post-structure presence and pit presence or total volume, or between dwelling and post-structures. Little variation in post-structure size was present within settlements, although it increased over time; when considered with the great differences in TAA present in the LBA and EIA, post-structure presence was most likely a reaction to specific needs, with each post-structure being built as necessary. The difference in probable storage presence indicates sub-regional treatment of agricultural storage, possibly due to higher water tables or inhospitable soil, yet also highlights that agricultural produce was a continual concern with appropriate action taken regarding its storage. The increase in both forms of storage over time is undeniable. Changing strategies regarding consumptive architecture, even as pits were increasing over the same period of time, denotes an

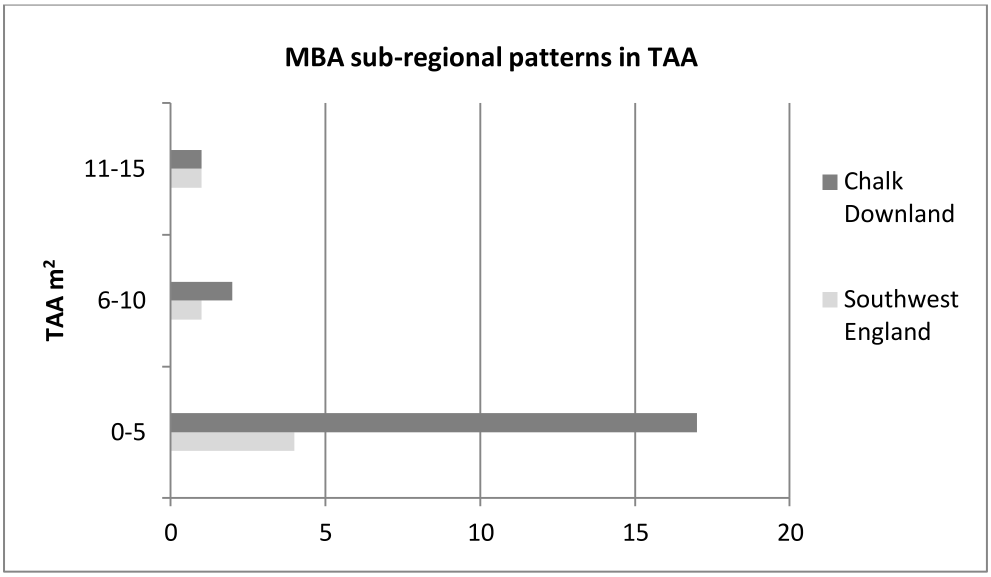


Figure 9.6 Range of Middle Bronze Age Total Additional Area values by sub-region

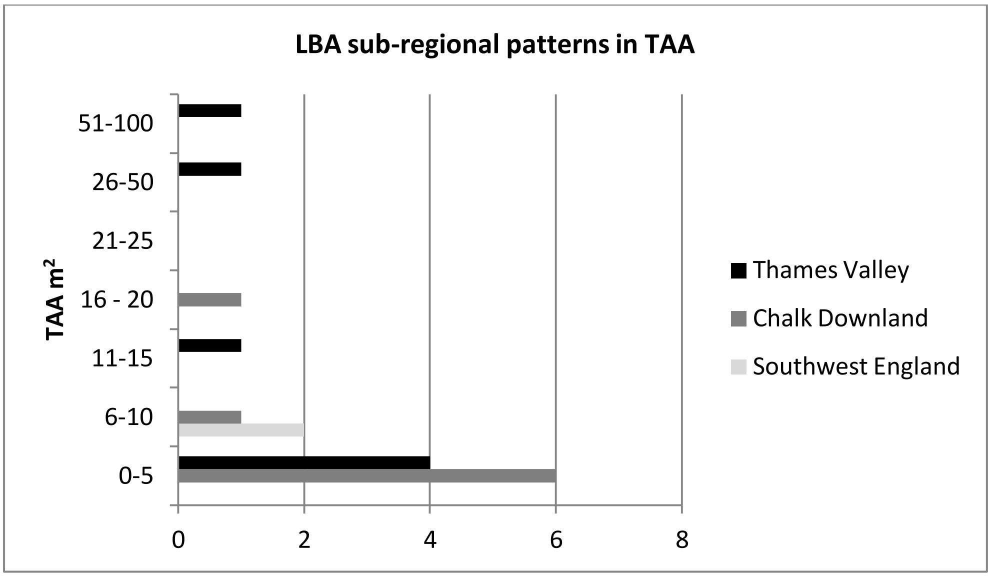


Figure 9.7 Range of Late Bronze Age Total Additional Area values by sub-region

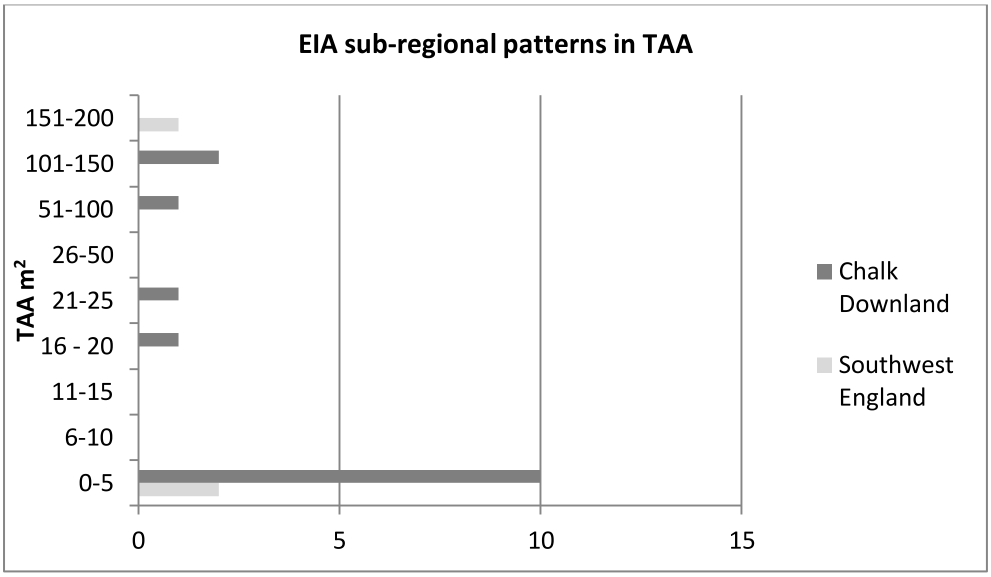


Figure 9.8 Range of Early Iron Age Total Additional Area values by sub-region

increase in necessary space for the treatment of agricultural product. While settlements remained varied in the amount of storage, both subterranean and above ground, presented, total storage capacity largely increased over time throughout southern Britain. There was no overt decline in the amount or presence of storage that would indicate a disruption in agricultural production. The data strongly suggest agricultural production continued and even increased unabated into the Iron Age, with positive impact from the social changes at the end of the Bronze Age.

Denmark

Post-structures are the predominate estimation of storage for Danish sites. While in southern Britain, recent discussion suggests above ground storage of grain was for immediate use supplemental to long-term storage via pits, the Danish material does not present the option of two modes of storage. Above ground storage must be accepted as the visible method for storage of agricultural produce, at least until the record demonstrates an alternative, with the additional likelihood of daily grain kept in jars or bags invisible to the record and therefore not able to be accounted for in this study, other than as possible explanation for differentiation in dwelling size and absence of post-structures. In order to relate the amount of available area from post-structures to the estimated population of Danish settlements, a dwelling to post-structure ratio is needed. As discussed in the previous chapters, individual post-structure size differed even on the same settlements; attempting to directly compare post-structure area to population is problematic. However, comparing general trends of growth or decline to patterns in population, settlement configuration, and regional movement will provide an indication of probable need for storage of agricultural produce.

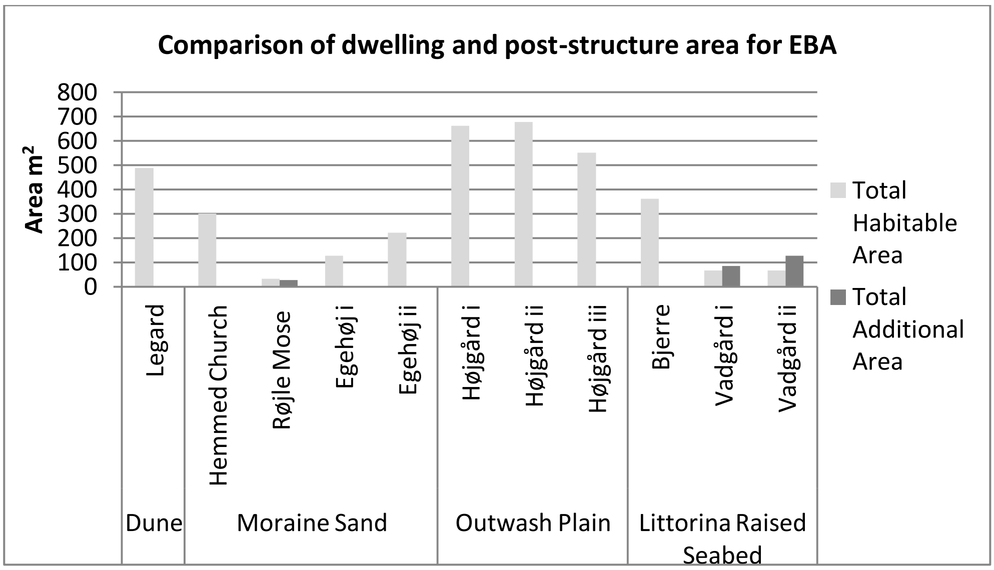


Figure 9.9 Regional comparison of Total Habitable Area and Total Additional Area per settlement for Danish Early Bronze Age

The majority of Early Bronze Age settlements did not display evidence of post-structures. Only twenty-seven percent (n=3) of settlements did present post-structures; all three settlements presented more post-structures than dwellings (Fig. 9.9). Vadgård ii, in the raised Littorina seabed region, actually presented a TAA of nearly twice the amount of THA with a ratio of 1:3. Røjle Mose, with a dwelling to post-structure ratio of 1:2, presented a TAA nearly equal to the THA. Of note is that the post-structures in this period were located on the settlements with the smallest estimated population. The smaller total dwelling space may not have provided adequate internal storage, requiring the construction of post-structures.

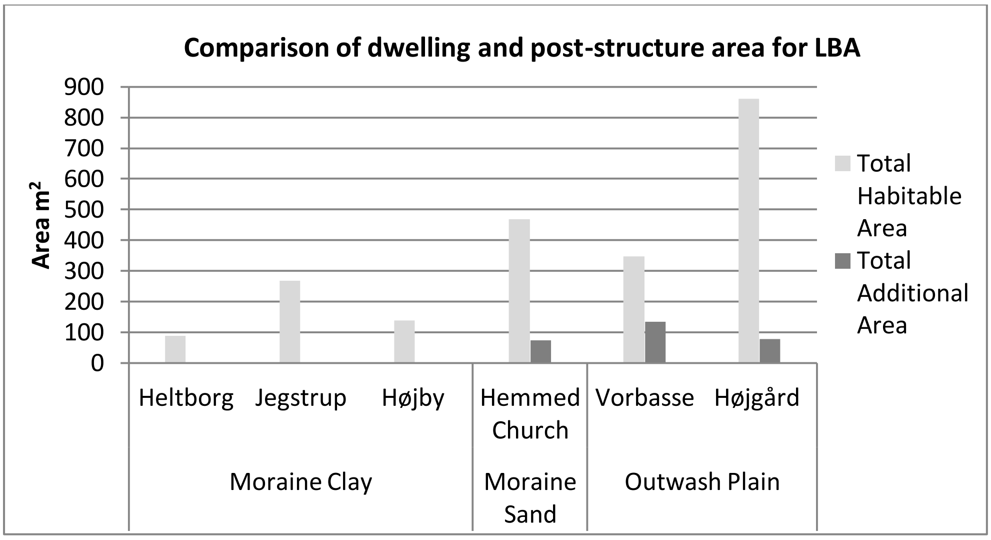


Figure 9.10 Regional comparison of Total Habitable Area and Total Additional Area per settlement for Danish Late Bronze Age

The Late Bronze Age saw an increase in post-structure presence (50%) in select sub-regions, even as the dwelling to post-structure ratio for the period largely reversed, with more dwellings than post-structures present. Post-structures were also present only on settlements with the largest values of THA, contrasting with the pattern of the previous period (Fig. 9.10). The moraine clay settlements did not present post-structures, while all of the moraine sand and outwash plain settlements displayed post-structures. Vorbasse, with a ratio of 2:3, was the exception in the dwelling to post-structure ratio, as well as having the smallest difference between Total Habitable Area and Total Additional Area. The other settlements displayed a THA between four and six times the amount of TAA. The individual dwellings were still largely able to contain storage spaces; the switch to larger settlements with post-structures suggests an increase in production on the larger settlements requiring space for surplus.

The Early Pre-Roman Iron Age settlements presented more settlements (67%), both large and small in terms of THA, with post-structures and increasing values of TAA (Fig. 9.11). Half of settlements with post-structures presented between $100<n<310$ m^2 of TAA. The size of the settlement did not have an impact on agricultural production, unlike what the data

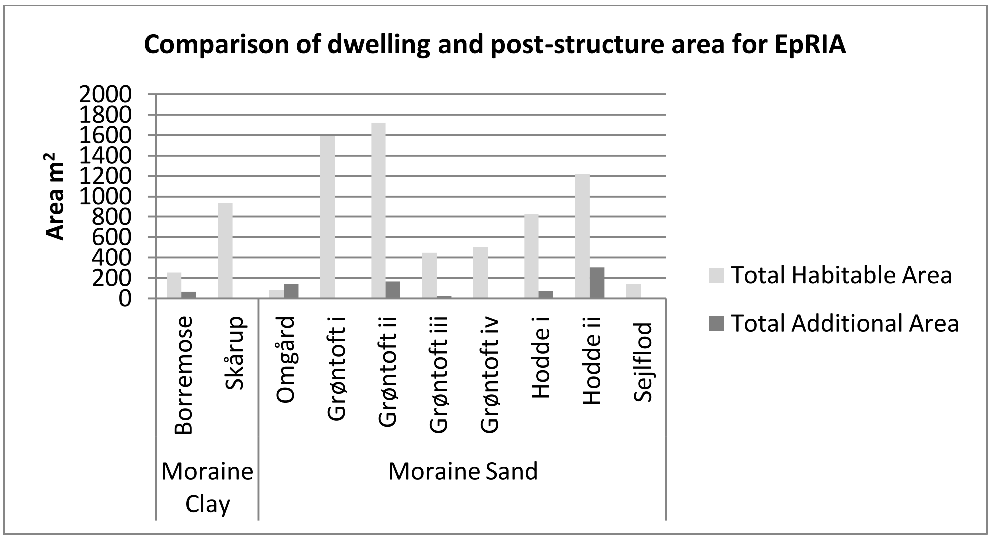


Figure 9.11 Regional comparison of Total Habitable Area and Total Additional Area per settlement for Danish Early Pre-Roman Iron Age

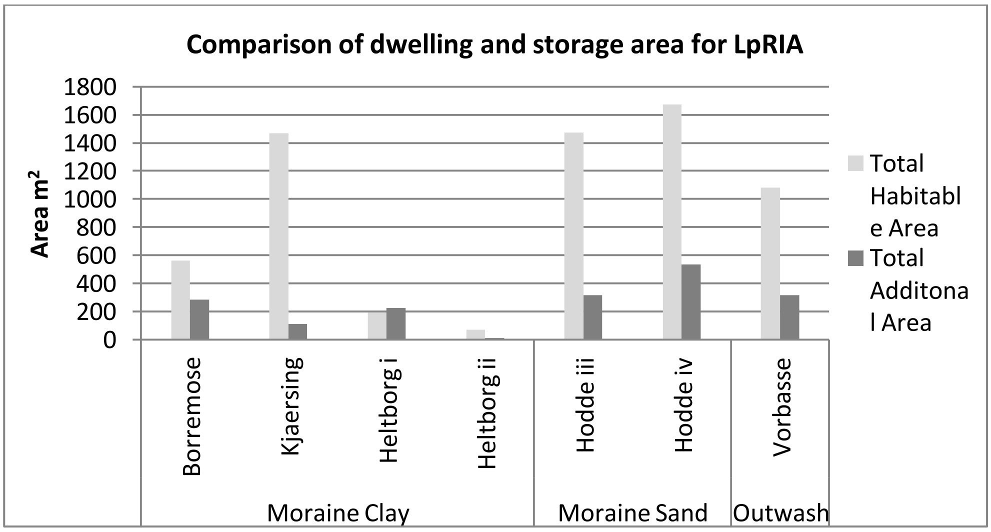


Figure 9.12 Regional comparison of Total Habitable Area and Total Additional Area per settlement for Danish Late Pre-Roman Iron Age

indicate for the Bronze Age. Post-structures were uncommon on the moraine clay until the EpRIA, whereas the moraine sand displayed post-structures throughout the end of the Bronze Age and into the Iron Age. The increase in both post-structure presence and amount of TAA continued in the LpRIA, with all settlements presenting post-structures (Fig. 9.12). All but one of the settlements presented TAA values of over 100 m^2. The only settlement with a smaller TAA displayed the least amount of THA.

Stalling within dwellings arrived in the mid to late Early Bronze Age with the advent of three-aisled long-houses and was adopted as the common dwelling configuration by the Late Bronze Age. The switch to emphasis on post-structures on larger settlements with greater THA and more dwellings in the LBA suggests a greater devotion of energy to settlements that are more permanent and the agricultural production necessary to support increasing populations. The increase in both THA and TAA continued into the Iron Age, with a larger percentage of settlements demonstrating storage capacity for agricultural produce. The reorientation of exchange networks in the end of the Bronze Age did not negatively affect the investment in arable agriculture; if anything, it appears to have been a catalyst for an increase with more settlements able to provide for themselves. The variability in TAA to THA discussed in the previous chapters does indicate storage was not linked to population; sites with greater THA values did not predicate the largest TAA values. Conversely, smaller settlements, based on THA, were not limited to small amounts of TAA. While an increasing number of settlements presented storage capacity, the varied amount when contrasted with total storage capacity suggests interaction between settlements able to store more than necessary for the maintenance of their population, and those with smaller capacities and larger populations. Again, the amount of grain able to be stored in post-structures is not necessarily possible to determine with any great accuracy, given the lack of knowledge concerning internal architecture (*e.g.* drying racks, shelving) and height. A benefit of consideration of structures as the throughput of energy is that sheer presence is enough to denote changes in priorities and available labour; the expense of both labour and resources for creating structures would only be justified if there was a specific need and the increase in number of post-structures and TAA, even as the average size of post-structures declined, indicates a growing need for consumptive architecture, regardless of population. The discrepancy between storage capacities and probable population based on dwellings, however, suggests a scale of agricultural production and therefore at least local networks of exchange.

9.3 How do we account for growth?

Given that the data present evidence for at least continuity in agricultural production through the final years of the Bronze Age and for the most part growth into the Iron Age, the question that remains is how to account for growth. There is no noticeable decline or sudden change in agricultural production; the effect of the social changes due to new technologies and a diminishing access to long-distance exchange was apparently not as disruptive on settlement organization and agricultural investment as expected. A more adaptable scheme allowing for growth and flexible production status over time is required. Rather than modelling the status of agricultural production with any preconceived notions derived from social models, we can approach the issue with the understanding of domestic architecture, proxies for production and consumption, as the throughput of energy, the result of labour and resources invested in constructing specific structures at specific times to perform specific purposes.

As noted previously (see Chapters V-VIII), the amount of storage capacity per settlement in both southern Britain and Denmark does not appear to be predicated by population size on the same sites. Sites with both greater and lesser Total Habitable Area produced both large and small values of total pit volume and/or Total Additional Area, with no overt patterning to available storage. The variation in storage capacity per settlement indicates particular settlements (*e.g.* Green Park, Omgård) were perhaps storing far more than necessary for their own populations, while other settlements (*e.g.* Springfield Lyons, Kjærsing) were storing far less than necessary. Given the continual escalation in amount of storage over time, the lack of storage or inadequate amounts of pit and/or post-structure storage on a portion of settlements does not necessarily equate to lack of agricultural production due to disruption from social change. Rather, the variation in storage capacity speaks to local interaction between 'producer' and 'consumer' settlements. Those settlements with an overabundance of storage, which could well be indicating greater quantities of produce, would be in a position to support the settlements producing or storing less than required, through smaller-scale exchange networks replacing long-distance exchange routes, or simply coming to the fore as the more visible routes faded away. There was likely a community cooperative labour pool, which allowed for the increasingly large dwellings, pits, post-structures, and/or settlements, as well as field labour; in Denmark, the community was increasingly the village settlement, while southern Britain retained individuality of settlement, yet likely formed a neighbourhood of satellite occupations. The relative lack of storage capacity on otherwise successful earlier settlements, MBA for southern Britain and EBA for Denmark, suggests a longer than anticipated presence of internal networks. With the dissolution of wider-ranging exchange networks bringing in prestige items, the local and regional networks were likely already in place to cushion any upheaval in agricultural production. Storage would still be necessary on sites not invested in arable agriculture, as smaller amounts of storage would be capable of supporting a larger population if filled more frequently than just at harvest time. Certain settlements, such as Poundbury, Shearplace Hill, Eldon's Seat, and Amberley Mount, with little to no storage appeared to be devoted to stock-raising rather than arable agriculture (see Appendix A); specialization would facilitate inter-settlement interaction to provide what each lacked.

The relationship between settlements based on agricultural production and consumption has been noted in recent attempts to address the issue (*e.g.* Stevens 2003, van der Veen and Jones 2007), and resolve issues arising from models such as Jones' (1985) archaeobotanical model for tracing origination of crops discussed previously. Even the definition of 'producer' versus 'consumer' has been varied and contentious, with nuances and cross-over in application making the distinction between labels difficult to both follow and defend. The labelling itself is problematic, as such terms tend to take on a more weighted aspect in our minds than should be ascribed a set of relational terms. An understanding of the fluidity of settlement relationships within a regional or inter-regional network, rather than a more static assignment of 'producer' and 'consumer' without appropriate re-assessment through time, is necessary to grasp the complexities of shifting populations and variable soil productivity.

This study provides at least an initial indication that local and regional networks of producers, consumers, and communal labour pools adequately compensated for the social transformation that must have accompanied both the introduction of new technologies and the cessation of reliable long-distance exchange. The labels of 'producer' and 'consumer' are considered as relational and temporally determined, with settlements changing designation over time in response to the amount of storage capacity contrasted with population. No specific assignment of terms to each settlement was accomplished in this study, as the settlements compared here are broadly contemporary in that they were inhabited in the same period. Rather, the data presented trends indicating the presence of settlements that were able to store (produced) more than necessary, settlements that were able to maintain their populations, and settlements which did not appear to store enough to sustain the population, as well as changes to settlement organization affecting storage potential. The object of the study was to establish the state of agricultural production at a time of disrupted access to socially important long-distance exchange networks. As the data present evidence of continuity and growth, while confirming aspects of changes to settlement organization previously acknowledged, the viability of determining agricultural production through the energy devoted to productive and consumptive architecture is thus potentially affirmed. The floor is now open to future discourse on the validity of local networks, based on agricultural production, as an appropriate model for the changes at the end of the Bronze Age.

Further work concerning both method and theory used in this study is recommended. The foremost task is to further test the applicability of examining the state of agricultural production via the proxy of domestic architecture. Independent confirmation of the reliability of dwellings and storage providing information as to the inhabitants and their agricultural activities is essential to eliminate the possibility of a false positive. Similar studies in other regions where settlement evidence is plentiful would serve as repeated hypothesis testing and substantiate the possibility of using architecture, one of the more abundant aspects of the archaeological record, as proxy for agricultural production, one of the more elusive aspects of the record. An exhaustive study of a single area could also be used to form a predictive model regarding trends exposed in this study, such as the appearance of hierarchical architecture that would not rely on material culture. Also, as field systems have increasingly come under examination in recent years in both regions (*e.g.* Nielsen 1984, Liversage 1997, Kristiansen 2001, Yates 2007, Leivers 2010, Johnston 2013), establishing a relative productivity or at least placing settlements within their appropriate field system would provide contextual evidence for the maximum potential production. Investigation into other regions with differing levels of connection to the fading exchange networks will indicate whether the continuity and growth of agricultural production present in the further reaches of the networks was a common response, or if it was a function of internal networks already in place, given a more varied reliability on the longer distance and hazards necessary to traverse across Bronze Age Europe. Further studies will additionally test the reliability of using domestic architecture as proxy for population and agricultural production.

Modelling the energy invested in productive and consumptive architecture allows for supplemental information when investigating local and/or regional networks of exchange supporting and eventually replacing the declining long-distance exchange networks. While one of the benefits of modelling domestic architecture as energy involved in production and consumption is that material culture is not necessary, the studies concerned with tracing material between settlements and regions are producing valid work, which can be supplemented by application of an energy-focused model. Examining archaeobotanical evidence for movement of specific species of agricultural produce and flows of other, non-botanical local or regionally produced items would confirm or disprove connections between settlements. Such work is attempting to trace routes of exchange and interaction, allowing us to map inter-settlement contact. Studies (Hillman 1981, 1984; van der Veen 1992, Stevens 2003, van der Veen and Jones 2007) have begun exploring connections between Late Iron Age settlements on grounds of local or imported species; combining a broader range of contemporary findings with the results of this study would provide valuable information regarding settlement relationships during the tumultuous end of the Bronze Age. Of course, grain is difficult to locate in both adequate quantities and preservation for analysis, which highlights the attractiveness of a material-less model. Grain was found on only a portion of the settlements used in this study (*e.g.* Trethellan Farm, Aldermaston Wharf, Røjle Mose), making archaeobotanical analysis difficult. Sourcing the finds and comparing between settlements illuminate intra and inter-regional connections (*e.g.* Freestone 1982, Mommsen 2001, Gomez *et al*. 2002, Bray and Pollard 2012); while typographies are largely unhelpful, given the similarity of local metal and ceramic items during the periods of interest, combining the patterns evidenced by architectural proxies with studies that track the location of raw material such as clay or temper would solidify evidence of exchange routes. A model focused on the expenditure of energy toward life can easily incorporate materials into a discussion, yet does not rely on the appearance of material culture.

9.4 Conclusion

The implication of this study is that for both southern Britain and Denmark, two disparate regions with separate, yet equally disturbed flows of materiel in the form of disrupted Bronze Age long-distance exchange networks, do not appear to have suffered any catastrophic or even chaotic restructuring in agricultural production over a period of significant technological change. Progressively more common iron technologies most certainly allowed production to increase in the Early Iron Age, nevertheless the data do not suggest any period of acclimation or observable disruption to agricultural production. The social reorganization is present in the changes to settlement structure, yet agricultural production, through the proxy of storage capacity, appears to continue over time without interruption. The opposite is in fact implied, as total storage capacities increased over time in both regions. The core/periphery models, and those concerned with socio-economic relations as driving social change, predicate social change from a state of collapse in exchange, political structure, and production, due to the acknowledged recursive relationships between those facets of society. The data presented in this study for the end of the Bronze Age do not support a decline, collapse, or any apparent wide spread cessation in agricultural production for southern Britain and Denmark. Rather, continuity and growth in the amount of storage, standing as proxy for agricultural production and consumption, is present. Reading the changes in domestic architecture as differing investments of energy demonstrates differing levels of production and consumption between individual settlements, sub-regions, and regions, which indicate multi-scalar trends not visible through other approaches.

As it allows for flows of energy and contact between settlements, the model presented accounts for the disparity in production observed between settlements and sub-regions. Variance in energy expended on specific productive and consumptive structures, built to fulfil a certain need, can demonstrate more specialized dwellings, indicate ad hoc construction built as needed that reflect trends in production/consumption, and provide glimpses of changing storage traditions and capacities. Examining the different levels of energy invested in the creation of domestic architecture can also indicate those settlements more careful with resources, those that required strategic planning to allow for specific multi-functional space. By interpreting structures as the throughput of energy, the variation in settlement organization on an individual settlement and sub-regional basis becomes more apparent, and provides further information regarding the state of agricultural production and inter-settlement relationships. Settlements with larger storage capacity than required by internal population, as indicated by dwelling area, would therefore be able to support those with less storage than capable of supporting their population, through the ever-present, if not always active, local, regional, and inter-regional networks of interaction. The model also allows for non-human actors, allowing for the growth of production itself to not only be representative, but also stand as an active participant in the change in social order observed into the Iron Age, influenced and influencing the development of new settlement patterns, the acquisition of tools, the dispersal of labour, etc. Network analysis stands as a strong contender for appropriately addressing the many faceted changes present at the end of the Bronze Age in northern and western Europe, although more work is required.

For southern Britain overall, dwellings and settlements grew in size, with larger congregations of bigger dwellings allowing more people to live closer together and work the same land. Pits were a sub-regional phenomenon, although by the Early Iron Age were mainly located on chalk settlements. Pit storage increased over time, with pits generally becoming larger and external to dwellings, likely indicating an increase in agricultural production, which allowed for long-term storage. Post-structures, initially occurring on settlements which produced fewer pits, also increased in presence, size, and number over time providing greater above ground storage and also suggesting an increase in agricultural production. No detrimental effect on arable agriculture from the fading long-distance exchange networks and social reorganization apparent by the Iron Age were observable in southern Britain. Sub-regionally, the dispersal of settlements changed at the end of the Bronze Age, yet the reorganization did not affect the investment in agriculture; there was a steady continuity and overall increase over time in storage capacity, read as agricultural production.

Denmark's population continually contracted over time to the richer soils of the moraine sand and clay and the outwash plain. A rising water table also pushed the population away from the lower coastal areas populated in the Early Bronze Age. Agricultural production increased over time. Post-structures, located on only the smallest settlements in the Early Bronze Age, became nearly ubiquitous by the Late Pre-Roman Iron Age. Both dwellings and post-structures increased per settlement, simultaneously decreasing in size, in the later periods. Post-structures likely became more common as dwellings shrank, creating a need for storage unable to be contained within, as was likely for the larger dwellings of the Early Bronze Age. The earliest post-structures in this study were found on settlements with the smallest THA and individual dwelling areas, suggesting a change in construction and storage strategy over time, mirroring changing social organization, as well as greater productive output over time, which only analysis as the throughput of energy would expose. Village-type settlements and farmsteads co-existed, with varied amounts of storage apparently unrelated to population. Agricultural production appears to have been a function of location and arability; the greatest values of TAA per period and region were independent of THA. The variation in TAA to THA ratios suggest at least some form of inter-settlement relationship to adequately support the increasing population of each settlements. There was no point of decline in agricultural production over time, indicating agricultural production continued unabated regardless of the upheaval of the social order at the end of the Bronze Age.

What should be gleaned from this study is that a model that understands production and consumption, on both local and regional scale, as the throughput of energy, determined by the proxies of domestic architecture, provides valuable information regarding intra- and inter-settlement response to changing social priorities that is hidden by approaches that are more conventional. Domestic architecture as agricultural proxy provides information regarding self-sufficiency and over-production that is otherwise hidden in the record. The small caches of grain found *in situ* on settlements, while useful, cannot provide the entire sequence of agricultural investment of a settlement. The differences in energy output in dwelling, post-structure, and pit size both between settlements within a period and within a single settlement directly imply differing availability of labour and resources, not to mention the presence and morphology of consumptive architecture baldly implicates the state of agricultural productivity. Approaching the question from the more readily available aspect of pits and post-structures, without a need for specific artefacts or botanical remains, provides answers, supplementing and furthering our understanding of the agricultural activities of the past.

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Appendix A: Southern Britain Site Summaries

This section provides a brief overview of the southern British sites analysed in this study, with particular focus on the domestic architecture recorded, namely the maximum number of dwellings, pits, and post-structures along with their cumulative areas and volumes per site, per phase. This section provides a layout of the data pertinent to the study, represented in table form in Chapter VIII, along with further information, including whether the settlement was enclosed or open and the location of pits either internal or external to the structures, which forms the basis of the later analysis. Also contained within this chapter is a brief overview of the environmental setting of each site for a comparative of domestic space use over time within certain ecologies. The sites are arranged by ecological setting (Fig. A1), *e.g.* chalk downland, and then by chronological order from the Middle Bronze Age to the Early Iron Age (1500 to 400 BC) in order to establish the progression of domestic architecture over time within those ecologies.

As previously stated, the term 'dwelling' is used to intimate roundhouses, unless stated otherwise. Porches are included within the roofed floor area when present and not distinctly stated, as they simply provide additional area. Post-structures are assumed as constructions of at least four posts, elsewhere termed 'ancillary structures'. A number of sites have never been fully excavated, *e.g.* Stannon Down (Mercer 1970), and thus represent only a sample of the total population per period, however, those samples are still representative, given that this study is interested in trends of spatial division over time. Certain sites, *e.g.* Trevisker (ApSimon and Greenfield 1972) or Mile Oak (Russell 2002), present structures assumed by the excavators and are included within this study if enough evidence was provided to obtain a viable measurement.

For the purposes of this study, if two or more phases of occupation per site exist within a single period, such as the Middle Bronze Age, the phases are considered discretely, providing a Total Habitable Area (THA) per phase. Consideration of contemporary structures demonstrates the maximal habitable space at a single point in time as well as growth within the period (*e.g.* Itford Hill: Burstow and Holleyman 1957 versus Ellison 1978). The site gazette (Table A1) includes each phase under one reference number.

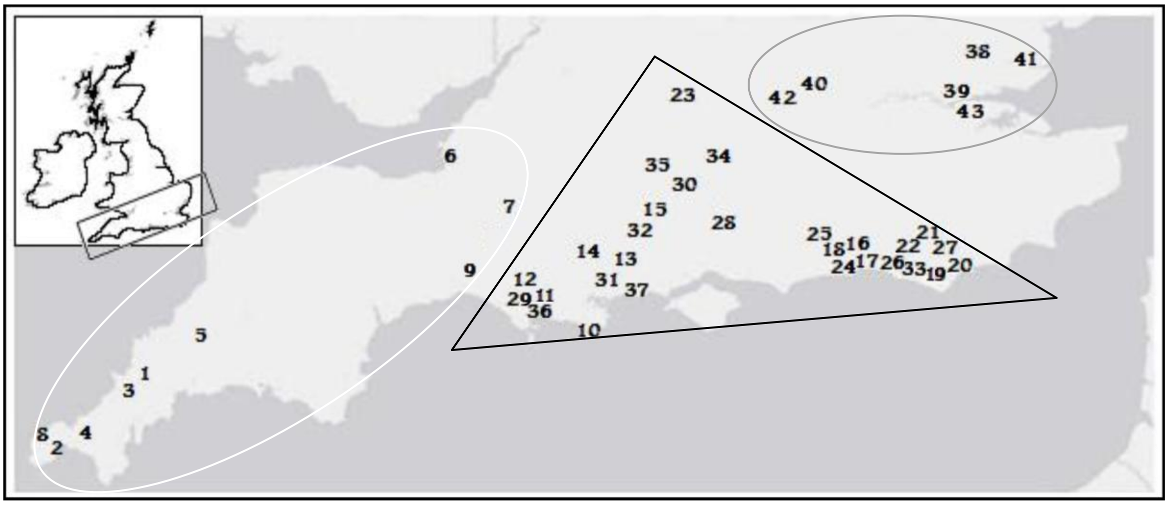

Figure 1 Location of southern British settlements. 1 Trevisker 2 Trewey Downs 3 Trethellan Farm 4 Gwithian 5 Stannon Down 6 Brean Down 7 Cadbury Castle 8 Gurnard's Head 9 Pilsdon Pen 10 Eldon's Seat 11 Poundbury 12 Shearplace Hill 13 Down Farm 14 South Lodge Camp 15 Thorny Down 16 New Barn Down 17 Cock Hill 18 Blackpatch 19 Itford Hill 20 Black Patch 21 Plumpton Plain A and B 22 Heathy Brow 23 Rams Hill 24 Highdown Hill 25 Amberley Mount 26 Mile Oak 27 The Caburn 28 Winnall Down 29 Hog Cliff Hill 30 Old Down Farm 31 Gussage All Saints 32 Little Woodbury 33 Hollingbury 34 Winklebury Camp 35 Balksbury Camp 36 Chalbury Camp 37 Hengistbury Head 38 Springfield Lyons 39 Mucking North Ring 40 Green Park 41 Loft's Farm 42 Aldermaston Wharf 43 Mucking South Rings
White area denotes Southwest England; Black area denotes chalk downland; Grey area denotes Thames Valley

Southwest England

Southwest England is defined here as the sites within Cornwall, Dorset, Somerset, and Devon. The environments include moorland, coastal dunes, and upland.

SE1 Trevisker SW 8871 6859

Trevisker, also known as Trevisker Round, was scheduled in 1951 and excavated in 1955 and 1956 as conservation archaeology (ApSimon and Greenfield 1972). The site sits 106.68 m above OD on folded slate or shillet, near the northern end of the Staddon Grit. Only the northern end of the site was excavated prior to construction. Given the floral species present in the analysed charcoal samples, it is likely the site was situated within a scrub landscape, or one beginning to be cleared of woodland. Trevisker is an enclosed settlement with both Middle Bronze Age and Middle Iron Age phases, with an interior area around 11129 m².

The phase of interest to this study, the Middle Bronze Age phase, consists of two double-ring dwellings (42.03 m² and 49.31 m²), with a Total Habitable Area of 91.34 m², as well as a long stone building, possibly a byre, providing approximately 15 m² of additional floor area. No pits were found for this phase (ApSimon and Greenfield 1972).

SE2 Trewey Downs SW 46477 37016

Trewey Downs is located on a plateau of grey biotite granite 182-213 m above sea level and is an open Middle Bronze Age settlement on the moorland (Dudley 1941). Lynchets surround the settlement, which is placed within the field system. At the time of occupation, the environment was scrubland, given molluscan evidence.

The settlement, excavated in 1941 by Dudley, produced three dwellings of equivalent area (18.70 m²), providing 56.10 m² of THA, although more were suspected beyond the extent of the excavation. Trackways connect two of the dwellings, as well as run through the site. No storage pits or post-structures were located.

SE3 Trethellan Farm SW 80126 61238

Trethellan Farm is a Middle Bronze Age settlement 30 m above OD, located by the Gannel River (Rose and Preston-Jones 1987). The settlement is situated on a hillside terrace between two E-W field boundaries, marking fields above and below the site. An Iron Age cemetery was also located in the vicinity by excavators.

The initial 1987 investigation of Trethellan Farm located three dwellings; however, subsequent excavation determined the remains of a total seven dwellings (Nowakowski 1991). While the excavators made a distinction between three dwellings and four non-residential roundhouses, all roundhouses are termed dwelling for this study, which indicates both residential and activity space. Eight (UB 3116, UB 3115, UB 3114, UB 3118, UB 3112, UB 3113, UB 3120, UB 3119) of eleven radiocarbon dates from the dwellings were interpreted by the excavators as an indication of contemporaneity, providing a range of 1500-1200 BC. The seven dwellings provided a Total Habitable Area of 381.71 m² from a range of individual areas (28.27 m² to 78.53 m²). Note the report contains dwelling dimensions as taken from the house hollow. The measurements included in this study are taken from the diameter of the post-ring. The roofed floor area available was supplemented by a single rectangular structure, considered as additional area in this study, enclosing an area of 10.24 m². The latter excavation also determined thirty-two hemispherical and cylindrical storage pits, all but two internal to the dwellings, with a maximum individual pit volume of 0.27 m^3 for a total pit volume of 1.75 m³. Grain was still present in a portion of the pits, although no function was assigned within the report. Pits were located on both the east and west quadrants of the dwellings, although individual dwellings tended to favour one quadrant. Trethellan Farm was a large settlement for the Middle Bronze Age, with only Stannon Down and all the enclosures of Itford Hill producing similar anomalous results. Nowakowski (1991) however suggests the possibility of phasing that was not easily reconcilable among the dwellings. The excavators left chronological consideration at "broadly contemporary", which was accepted with concern for this study (Nowakowski 1991: 102).

SE4 Gwithian SW 59031 42290

Gwithian was first excavated from 1953 to 1958 as part of an overall survey of archaeology and landscape in the coastal headland region of West Cornwall. Further excavation occurred throughout the 1960s, with slightly different research foci uncovering different aspects of the site (Thomas 1964). The archived results of the mid-20th century work were reinvestigated in 2003 to 2006 (Nowakowski 2007). While Gwithian was home to human activity from the Early Bronze Age and likely earlier, this study is concerned with 'Phase 5', the Middle Bronze Age settlement.

The open settlement was set on dunes in a coastal environment. Two major N-S field boundaries were established in the early Middle Bronze Age period of Phase 3 or 'layer 5', demarking 120 m² of contemporary plough marks, and were reinforced during Phase 5 when the settlement was constructed on part of the formerly ploughed area. The evidence suggests arable farming, which matches the floral and faunal evidence for scrub to open landscape (Davies 2007, Nowakowski 2007).

The Middle Bronze Age settlement consisted of three definite dwellings (9.62 m², 50.00 m², and 50.00 m²) and one possible dwelling incomplete on the published plans, which provided at least 109.62 m² of THA. A smaller circular post-structure was called a granary by excavators and provided 4.67m² of additional roofed floor space. No pits, as typical for Cornish sites, were recorded for the site.

SE5 Stannon Down SX 1327 8032

Stannon Down is a Middle Bronze Age settlement on the western edge of Bodmin Moor, occupied from around 1500-1000 BC on the basis of stratigraphy and the finds (Mercer and Dimbleby 1978). The settlement was built on an organic layer that underlay all activity areas of the site. The pollen analysis suggests woodland environment at the time of site construction with scrub species becoming more dominant over the lifetime of the settlement.

It is estimated that over twenty roundhouses existed at one time, but creep from the waste tip of the neighbouring china clay works has completely covered or made full excavation impossible for a majority of the evidence. Eight roundhouses were completely excavated in the 1960s (Mercer 1970). The individual dwelling areas presented a range with areas from 26.42 m² to 80.12 m². The THA was 361.21 m^2, as the excavators considered all the dwellings as contemporary although they acknowledged the chronology was difficult to determine with confidence. The roundhouses were stone walled structures, which were constructed differently than the typical post-built roundhouses of the chalk. Given the inhospitable acidic soil, it is unsurprising that no storage pits were found within the remains of the settlement. No post-structures were found either, in keeping with typical Cornish settlement layout discussed in the text.

SE6 Brean Down ST 296 587

Brean Down was excavated from 1983 to 1987 (Bell 1990, 1991). The site sits 10.3 to 11.34 m above OD on a limestone promontory, part of the Mendip Hills, jutting into the Bristol Channel. The primary geological section is called Brean Down sandcliff, consisting of blown sand with breccias deposits that rises to a maximum of 33 m above OD on the north of the Down. The site was on the northern edge of a salt marsh, which experienced periodic flooding. Brean Down is an open settlement with two major phases of occupation in the Middle and Late Bronze Age.

In the Middle Bronze Age phase, two dwellings (12.57 m² and 28.27 m²) provided 40.84 m² of roofed floor area. Five pits, internal to the dwellings, provided 2.83 m³ of maximum storage volume. The pits were ellipsoid, cylindrical, hemispherical, and frustrum shaped, with a range of volumes from 0.01 to 1.84 m^3. The pits were located on both the east and west quadrants, with four pits to the east of one dwelling. No post-structures were recorded for this phase.

The Late Bronze Age phase consisted of no discernible dwelling; however, a single cylindrical pit, providing 2.45 m³ of storage volume, one post-structure, providing 2.76 m² of roofed floor area, and one stone structure, approximately 5.57 m², were dated to this phase. The TAA for the LBA was 8.33 m^2.

SE7 Cadbury Castle ST 6280 2510

Cadbury Castle is a hillfort with multiple iterations of occupation from the Neolithic to post-Roman periods, set on a hill of Inferior Oolite limestone and Yeovil Sands, 150 m above OD (Torrens 2000, Riley and Dunn 2000). The molluscan evidence for both phases of Early Cadbury suggests an open grassland environment (Rouse 2000). The site was excavated between 1966 and 1970 and in 1973 by Leslie Alcock, who developed a series of cultural phases. Later work (Barrett *et al.* 2000) compiled a chronology derived from radiocarbon dates, ceramic comparisons, and metalwork assemblages. Of interest to this study in the phase called 'Early Cadbury', which encompasses the Late Bronze Age (Cadbury/Ceramic Assemblage 4) and Early Iron Age (Cadbury/Ceramic Assemblage 5/6) occupation of the site. While the authors refute the use of sequencing based on conventional period distinctions in order to make sense of the convoluted sequencing of the site, their relative sequences have been translated for the comparative purpose of this study.

The Late Bronze Age phase was open and centred to the east of the site. The record is vague as to full structures or the relationships between structures, but there does not appear to be a dwelling during this phase. Two post-structures provided 8.05 m² of roofed floor space. There are at least five pits west of the post-structures; however, the report states the majority were too disturbed to provide an accurate record. The single pit of this phase that was measurable provided 0.36 m³ of maximum storage volume.

The Early Iron Age phase consisted of two dwellings of similar size (99.00 m² and 104.00 m²), providing 203.00m² of roofed floor area. While no pits were necessarily equated with the second phase of Early Cadbury, at least fourteen post-structures provided an additional 155.75 m² of roofed floor space. The individual post-structures ranged from 7.5 to 14 m^2 in area (Barrett *et al.* 2000).

SE8 Gurnard's Head SW432386

Gurnard's Head, also known as Trereen/Treryn Dinas, is an Early Iron Age site on a slate and greenstone promontory on the Penwith coast. Excavated in 1939 (Gordon 1940), the settlement, called a cliff castle by the excavator, is situated on the eastern side of the cliffs. Noted in the report was that the sea had eroded the cliff and an unknown number of hut remains had been at least partially lost. The settlement was likely larger than what remained at the time of excavation.

While thirteen hut circle platforms were found within the enclosure, only three dwellings, making up 68.50 m² of Total Habitable Area, were excavated. The individual dwelling areas were 15.90 m², 23.38 m², and 29.22 m². No post-structures were recorded for the site. Two small hemispherical pits (0.05 and 0.06 m^3) were found internal to the dwellings, providing 0.11 m³ of maximum storage volume.

SE9 Pilsdon Pen ST 413013 Dorset

Pilsdon Pen hillfort, on a hill 908 ft above OD, is set within an active landscape, with other hillforts located nearby. Excavated from 1964 to 1971, the multivallate ramparts enclose 31363.14 m^2.

Eight dwellings, out of a possible eleven, provided a THA of 357.7 m^2. Two 'huts' were not fully excavated or not clearly defined as a structure and were therefore disregarded. The individual dwelling areas were varied from 29.22 m² to 70.14 m². Three rectilinear pits were determined as related to the structures, providing a total pit volume of 2.13 m^3. The individual pit volumes ranged from 0.47 to 1.19 m^3. No post-structures were recorded (Gulling 1977).

Chalk Downland

The chalk downland region is defined here as the chalk of Dorset, Wiltshire, Hampshire, Sussex.

CD1 Poundbury SY 6825 9112

Poundbury was occupied from the Early Bronze Age to the Middle Iron Age, with differing levels of activity. The site was cursorily excavated in 1966 and 1967, followed by a more intensive investigation from 1968 to 1980 (Sparey Green 1987). The settlement is located on a bluff of Upper Chalk overlooking the River Frome, with a superficial deposit of clayey drift utilised in constructing the western rampart in the second phase of occupation (Richardson 1940, Sparey Green 1987). The molluscan evidence suggests scrub or grassland as the primary environment for the period. Sparey Green (1987) suggests an emphasis on stock raising rather than grain cultivation, particularly given the dominance of cattle in the faunal assemblage.

There is a lack of full occupation evidence in the Late Bronze and Early Iron Age phases, although Sparey Green (1987) suggests the unexcavated area at the time of publication would demonstrate a Late Bronze Age settlement. The phases of interest to this study area those of the Middle Bronze Age, set within the 1431.73 m² ditched enclosure. Four dwellings, rectangular and square rather than round, provided 69.16 m^2 of total roofed floor area. Poundbury i presented two dwellings, with a THA of 29.56 m^2. The individual dwelling areas were 9.86 m² and 19.70 m². Poundbury ii increased to 39.26 m^2 from two dwellings. The individual dwelling areas were 9.86 m² and 29.40 m², with one larger dwelling in the latter phase. No pits or post-structures were recorded for the site.

CD2 Shearplace Hill SY 64102 98516

Shearplace Hill is a Middle Bronze Age settlement with a series of ditch and bank enclosures over 668.9 m^2. The settlement is on the east side of a north-south running ridge and built on Upper Chalk, with a thin overlay of small flints, and was excavated in 1958 (Rhatz 1962). The site lies between the River Cerne and Sydling Brook valleys. Track ways connected the individual enclosures within the main enclosure. The only faunal remains were of domesticated stock species, which suggests an open environment and an economy not dependent on woodland species.

Two dwellings, one with evidence for reconstruction, were excavated. Interpretation for whether the dwellings were contemporary has been challenged as representing different phases of a single dwelling farmstead (Avery and Close-Brooks 1969). Given the lack of dating or verification of this re-interpretation, and the typical chalk downland settlement pattern of two to three dwellings, the original configuration of two dwellings will be considered here. The earlier phase of the reconstructed dwelling, House A, provided 53.20 m^2 of roofed floor area, while the later phase provided 83.76 m^2 of roofed floor area. House B provided 18.7 m^2 of roofed floor area, providing a total area of 71.90 m^2 with the initial configuration of House A and 102.46 m^2 with the final construction. Following the interest of this study in the maximum roofed floor area, and the lack of indication of the life expectancy of each phase of House A, the final configuration will be used as the THA value for Shearplace Hill. No post-structures were recorded for the settlement. Two pits, vaguely conical in shape, internal to the structures provided 0.67 m³ of total maximum storage volume (Rhatz 1962; Avery and Close-Brooks 1969).

CD3 Down Farm SU 0004 1467

Down Farm is a Middle Bronze Age enclosure on the Upper Chalk of Cranborne Chase, excavated from 1977 to 1979 (Green *et al.* 1991). The 1400 m² enclosure contained two phases of occupation within the Middle Bronze Age. The environment was likely actively changing from scrub to open, given the molluscan evidence, and at a faster rate than around South Lodge Camp. The faunal assemblage, dominated by sheep, furthers the interpretation of a scrub or open landscape (Green *et al.* 1991).

Six dwellings provided 300.98 m² of THA for the Middle Bronze Age. Eight pits, one external and eight internal to the dwellings, provided 1.67 m³ of total maximum storage volume. Taking each phase as a discrete entity, the earlier phase of settlement, Down Farm i, consisted of two dwellings, providing 108.18 m² of roofed floor area. The individual dwelling areas were 44.18 m² and 64.00 m². No post-structures were recorded for this phase. A single pit, internal to the dwelling, provided 0.33 m³ of storage volume for the earlier phase.

The later phase, Down Farm ii, consisted of three dwellings, providing 129.98 m² of roofed floor area. The individual dwelling areas were 33.18 m², 33.18 m², and 63.62 m². A single post-structure supplied an additional 6.19 m² of roofed floor space. Seven pits, one external and the remainder internal to the dwellings, provided 1.12 m³ of storage volume, with a range of individual pit volumes from 0.07 to 0.35 m^3 (Green *et al.*1991).

CD4 South Lodge Camp ST 9538 1746

South Lodge Camp is a Middle Bronze Age enclosure on a chalk hill at the edge of the clay with flints of Cranborne Chase, with earthworks enclosing 3035.14 m² (Barrett and Bradley 1991). Originally excavated by Pitt Rivers from 1880 to 1893, the site was re-examined in 1977. The molluscan evidence, largely woodland snails, suggests a shaded environment, with increasing variety over the lifetime of the settlement, indicating a gradual change to a more open environment. The lack of scrub species and the dominance of ash present in charcoal samples further promote this interpretation, as does the dominance of deer in the faunal assemblage. These species suggest woodland or at least a partially covered landscape. Lynchets surround the enclosure, likely preceding its construction and it is probable that the fields nearest the enclosure were not cultivated after its appearance (Barrett and Bradley 1991).

Two dwellings (15.90 m² and 47.29 m²) provided 63.19 m² of roofed floor area. No post-structures were recorded as being present in the settlement. While at least ten pits were recorded by Pitt Rivers, only two pits, one internal and one external, were plotted and re-interpreted. Those large pits (1.41 and 0.86 m^3) provided 2.27 m³ of maximum storage volume (Barrett and Bradley 1991).

CD5 Thorny Down SU 2028 3382

Thorny Down is a Middle Bronze Age settlement on the South Downs, approximately 91.44 m above the River Bourne and next to Thorny Down Wood on a band of Tertiary clay with flints next to the chalk. The site was excavated from 1936 to 1939 (Stone 1937, 1941).

The ditch and bank enclosed 1605.36 m² of slightly lower ground, the clay with flints being scraped off and reused in forming the bank. Nine structures were recorded and considered 'houses', yet the majority were of uncertain configuration. Only those with measureable plans were included here. Two phases were present. Thorny Down i presented two dwellings, 14.52 m² and 41.85 m², with a THA of 56.37 m^2. Three pits (two cylindrical, one conical), internal to the dwellings give a maximum storage volume of 0.35 m³. One post-structure provided 6.00 m^2 of additional area. Thorny Down ii displayed two dwellings, 9.62 m² and 52.81 m², with an increased THA of 62.43 m^2. No pits were recorded for this phase. Two post-structures (6.75 and 8.25 m^2) provided 15.00 m^2 of additional area (Stone 1937, 1941; Ellison 1987).

CD6 New Barn Down TQ 0846 0922

New Barn Down is an enclosed Middle Bronze Age settlement, with a rectangular ditch and bank encompassing 2657.03 m² (Curwen 1934). The site was set on the southern slope of a chalk hill in the South Downs and was excavated in 1933. There is an extensive field system surrounding the site and broadens to include the nearby settlements of Cock Hill and Blackpatch, also included in this study. The exact relationship between the three sites is unknown.

Two dwellings (21.94 m² and 42.08 m²) provided 64.02 m² of roofed floor area. No post-structures were recorded as present on the settlement, as apparently typical of the chalk in the Middle Bronze Age. One hemispherical pit, external and to the north of the dwellings, provided 0.72 m³ of maximum storage volume (Curwen 1934).

CD7 Cock Hill TQ 0892 0974

Cock Hill is an open Middle Bronze Age settlement 700 yards to the northeast of New Barn Down and shares its field system with Blackpatch (Ratcliffe-Densham and Ratcliffe-Densham 1961). The settlement is situated on a chalk hill overlooking the South Downs. The environment was likely typical open chalk downland, similar to the other Bronze Age sites on the South Downs.

The settlement consisted of three dwellings of equivalent size (29.22 m²) with 87.66 m² of roofed floor area. No post-structures were recorded for the settlement. Two pits, hemispherical (0.21 m^3) and cylindrical (0.81 m^3), were internal to the dwellings and provided 1.02 m³ of maximum storage volume (Ratcliffe-Densham and Ratcliffe-Densham 1961).

CD8 Blackpatch TQ 0915 0908

Blackpatch is a Middle Bronze Age settlement consisting of 1170.58 m² of enclosed space (Ratcliffe-Densham and Ratcliffe-Densham 1953). It is located within the same field system on the chalk of the South Downs as New Barn Down and Cock Hill, indicating connections between the three settlements to negotiate land rights. The apparent links between settlements suggest a stronger environmental impact as one ecosystem supports three settlements with little recourse to expand into neighbouring territory. A poor harvest would affect all three settlements, although the closer probable relationship between New Barn Down, Cock Hill, and Blackpatch do not preclude interaction with a broader range of settlements that could supplement an inadequate season.

A single dwelling provided 29.19 m² of roofed floor area. No post structures were recorded for the site. The dwelling contained one hemispherical pit with a maximum storage volume of 0.17 m³ (Ratcliffe-Densham and Ratcliffe-Densham 1953).

CD9 Itford Hill TQ 447 053

Itford Hill is located on colluvial soils over chalk (Bell 1981). The site, excavated between 1949 and 1953 (Burstow and Holleyman 1957), is an enclosed Middle Bronze Age settlement. Given the molluscan evidence, the site was set in open or opening environment (Bell 1981).

The site is unusual in that contained within the 7357.92 m² total enclosed space were ten smaller enclosures with hut platforms, forming smaller farmstead units in association with each other. While Burstow and Holleyman (1957) considered all the enclosures a single contemporary community, Ellison (1978) suggested four phases of occupation, with contemporary enclosures being replaced by a new set over time. Going with Burstow and Holleyman's interpretation, considering the settlement as a contemporaneous whole within the enclosure, twelve dwellings provided 300.41 m² of THA for the Middle Bronze Age. Twelve cylindrical pits, internal to the dwellings (Hut A, Hut C, Hut D, Hut L), provided 25.03 m³ of maximum storage volume. No post-structures were recorded for any of the phases. These values are large for the period, yet are similar to contemporary Trethellan Farm and Stannon Down.

Considering Ellison's (1978) interpretation, each of the four phases included two or three of the enclosures. The earliest phase, consisting of enclosures I, II, and III, presented two dwellings, 23.35 m² and 29.22 m², for a total roofed area of 52.57 m². Five pits for Itford Hill i (0.75, 0.2, 0.0.4, 0.11, and 0.08 m^3) provided a total maximum storage volume of 1.18 m³. Itford Hill ii, including enclosures IV and VIII, consisted of four dwellings (18.70 m², 26.35 m², 29.22 m², and 35.47 m²), providing 109.74 m² of total roofed floor area. The second phase presented three pits (0.24, 0.11, and 0.07 m^3) with a maximum storage volume of 0.42 m³. Enclosures V, VI and VII were present in Itford Hill iii, with four dwellings (18.68 m², 29.22 m², 29.22 m², 28.90 m²) providing 106.02 m² of total roofed floor area. The third phase produced four pits (0.56, 0.4, 0.24, and 0.06 m^3), providing 1.26 m³ of maximum storage volume. Itford Hill iv consisted of two dwellings of equal area (29.22 m²) in enclosures IX and X which provided 58.44 m² of roofed floor area. Phase iv did not contain any pits recorded by the excavators. This interpretation was accepted for this study.

CD10 Black Patch TQ 495 086

Black Patch is a Middle Bronze Age settlement consisting of a series of enclosed hut platforms. The site, excavated between 1977 and 1979, is located on the west slope of a chalk valley on the South Downs, 3 km west of the River Cuckmere (Drewett 1982). Predominantly domestic species were recorded in the faunal assemblage in low qualities. Combined with the floral evidence from the carbonised seeds, it is likely the environment was typical open downland.

Hut platform 1 contained two dwellings, forming 40.84 m² of THA from individual areas of 12.57 m² and 28.27 m². One pit was internal to one of the dwellings, providing 1.27 m³ of maximum storage volume (Drewett 1982).

Hut platform 4 consisted of at least five dwellings (19.44 m², 19.63 m², 23.76 m², 28.27 m², 56.75 m²) with a total roofed floor area of 147.85 m². Five cylindrical pits (1.58, 0.67, 0.57, 0.17, and 0.13 m^3), internal to the dwellings, provided a maximum storage volume of 3.12 m³. Neither platform demonstrated post-structures (Drewett 1982). Russell (1996) proposed an alternate phasing of platform 4 that was discounted for this study on the basis for overly normalizing the settlement organization and a lack of adequate evidence.

CD11 Plumpton Plain A and B TQ 357 122

Plumpton Plain is a multi-enclosure Bronze Age site, with two distinct settlements 182.88 m above sea level on the South Downs (Holleyman and Curwen 1935). Plumpton Plain A is 457.20 m from the north edge of the Downs, between the Moutone Valley and Faulkners Bottom, with Plumpton Plain B on a spur 0.25 mi to the southeast sloped slightly downhill. The environmental setting was open fields with erosion from extensive use (Allen 2005).

Plumpton Plain A consists of four enclosures, joined by trackways. Within three of those enclosures were three dwellings, providing 96.86 m² of THA. It is likely the fourth contained a dwelling; however, it was not excavated. While the original (Holleyman and Curwen 1935) interpretation was of a contemporary hamlet, later reinterpretation (Cunliffe 2005) has questioned that view in favour of successive single farmsteads. Enclosure II enclosed one dwelling that provided 29.22 m² of roofed floor area. Enclosure III had a single dwelling of similar size but with a possible porch, providing 38.48 m² of roofed floor area. Enclosure IV's dwelling was also of similar size and provided 29.16 m² of roofed floor area. This reinterpretation was rejected for this study as overly normalizing the data without adequate evidence, although it should still be considered along with other site reinterpretations as possible challenge to habitual understanding of Middle Bronze Age settlement. No post-structures were recorded for the settlement. At least one cylindrical pit, external to the dwellings, provided 0.44 m³ of storage volume (Holleyman and Curwen 1935).

The Plumpton Plain B enclosure encompassed 9290.30 m² and was later than site A, in the Late Bronze Age. Three smaller dwellings (4.23 m², 13.08 m², and 15.90 m²) provided 33.21 m² of roofed floor area. Three cylindrical pits (0.05, 0.16, and 0.33 m^3) internal to the dwellings provided 0.54 m³ of maximum storage volume. No post-structures were recorded for the settlement (Holleyman and Curwen 1935).

CD12 Rams Hill SU 3143 8630

Rams Hill was partially excavated in 1972 and 1973 by Bradley and Ellison. The site is situated on a rise of the northern edge of the chalk grassland of the Berkshire and Marlborough Downs. Three concentric enclosures, dating to the Late Bronze Age, Early Iron Age, and Roman period, encircled the rise. The phase of occupation of interest to this study is the Late Bronze Age phase, is a ditched oval enclosure encompassing 1000 m², carbon dated (BM-2790) to 1370-920 BC (Bradley and Ellison 1975, Needham and Ambers 1994). Double palisaded entrances existed to the south and west. Palynological evidence suggests a scrub environment, or woodland setting just beginning to become open land, for the period, with both open and woodland species present (Bradley and Ellison 1975).

The Late Bronze Age settlement consisted of four dwellings, with a total roofed floor area of 98.38 m². The individual dwelling areas were 6.1 m², 23.56 m², 30.24 m², 38.48 m². Nine post-structures, four round or oval and the rest rectangular, provided a total floor area of 19.77 m². The individual post-structure areas ranged from 1.00 to 3.80 m^2. A large number of pits in the interior of the ditch were irregular and unable to be accurately excavated, although it is assumed their purpose was not domestic. Six definite pits (0.12, 0.27, 0.50, 0.52, 0.08, and 0.12 m^3), oval with rounded bases, were external to the dwellings, located along the post-structures as well as central to the enclosure. The pits provided a maximum storage volume of 1.61 m³ (Bradley and Ellison 1975).

CD13 Highdown Hill TQ 0927 0434

Highdown Hill was constructed on an 82.3 m high chalk ridge, overlooking the surrounding downlands (Wilson 1940). The site was excavated in 1939 and again in 1947. The two phases of interest to this study are the Middle Bronze Age and Early Iron Age settlements. Both were contained within the same large, ditched enclosure surrounding 11148.36 m² or 2.4 acres.

The Middle Bronze Age settlement consisted of three dwellings (10.03 m², 19.42 m², 29.26 m²) providing 58.71 m² of roofed floor area. No pits and no post-structures were recorded for this phase (Wilson 1940). Bradley (1975) suggests the possibility of two phases in this period, however he indicates stratigraphic sequencing was not possible based on the report.

The Early Iron Age phase consisted of two dwellings of equal area (32.79 m²) with a total 65.57 m² of roofed floor area. No post-structures were recorded for this period. The report mentions one external pit, the dimensions of which were not recorded (Wilson 1940, 1950).

CD14 Amberley Mount TQ 0421 1232

Amberley Mount is a Late Bronze Age settlement situated on a promontory to the north of the South Downs on *Holaster planus* Chalk, the lowest zone of the Upper Chalk (Ratcliffe-Densham and Ratcliffe-Densham 1966). As is typical of Bronze Age downland sites, the faunal assemblage is largely domesticated stock species, suggesting an open environment, also supported by the species discerned from analysis of the charcoal.

The open settlement encompassed 59,457.95 m². Two dwellings (16.33 m² and 45.60 m²) provided 61.93 m² of roofed floor area with one internal pit providing 0.86 m³ of maximum storage volume. No post-structures were recorded for the settlement (Ratcliffe-Densham and Ratcliffe-Densham 1966).

CD15 Mile Oak TQ 248 079

Mile Oak is an open Middle and Late Bronze Age settlement on the southern edge of the South Downs on Upper Chalk. The site was excavated between 1989 and 1991 as rescue archaeology in advance of motorway construction (Russell 2002). Given the floral species present at the site, a scrub or woodland margin environment can be assumed. Such a conclusion is supported by the molluscan evidence, which was largely open dwelling but a few shade-preferring species were also represented in decreasing quantity throughout the lifetime of the site. It can be taken then, that the openness of the site was increasing over time.

Three dwellings, one definite and two assumed by the excavator, provided 108.45 m² of roofed floor area in the Middle Bronze Age. Six cylindrical pits, internal to the dwellings, provided 1.36 m³ of maximum storage volume. The individual pit volumes ranged from 0.29 to 0.80 m^3. No post-structures were recorded for this period (Russell 2002). Radiocarbon dating provided a range of 1400-1030 cal BC (OxA-5108, OxA-5109).

The Late Bronze Age evidence provided the excavators with a number of possible interpretations. The most convincing, and the one accepted here, is a single dwelling with an internal floor area of 49.01 m^2. Two post-structures (5.04 and 2.25 m^2) provided 7.29 m^2 of above ground storage. One pit, internal to the dwelling, presented 0.37 m^3.

CD16 Eldon's Seat SY 939776

Eldon's Seat is a Late Bronze and Early Iron Age enclosed settlement, located 79.25 m above sea level on the east-facing side of a valley on Kimmeridge clay (Cunliffe and Phillipson 1968). The site was rudimentarily excavated in 1950, with further excavation taking place over the course of 1963, 1964 and 1966, although only a portion of the supposed extent of the site was investigated. Given the predominance of domesticated stock animals over deer and wild species indicated in the faunal assemblage, it is likely the settlement was in an open environment providing grazing for a large enough herd to take care of the needs of the settlement. The enclosure for both phases encompassed 2500 m².

The Late Bronze Age settlement consisted of four similarly sized dwellings, providing 144.26 m² of roofed floor area. The individual dwelling areas were 35.26 m², 35.26 m², 35.26 m², and 38.48 m². No pits or post-structures were recorded for this phase.

The Early Iron Age settlement consisted of three larger dwellings, providing 143.95 m² of roofed floor area. The individual dwelling areas were 38.48 m², 41.85 m², and 63.62 m². One pit, internal to a dwelling, provided 0.01 m³ of maximum consumptive volume. No post-structures are associated with this phase.

CD17 The Caburn TQ 4443 0891

The Caburn is a Late Bronze Age to Iron Age hillfort, with the Late Bronze Age settlement enclosed within a palisade surrounding 14000 m². Set on a chalk hilltop on the South Downs, above the River Ouse valley, the site was initially excavated in 1877 by Pitt-Rivers, then again in 1925 by the Curwens.

One dwelling provided 25.13 m² of roofed floor area for the Late Bronze Age. No post-structures were recorded for the site. The Caburn is notable for the large pits of varying shapes (Curwen and Curwen 1927); most pits were rectangular with rounded corners and convex sides, but oval, circular, and triangular or conical pits were recorded as well, however the triangular may have been excavator error (Drewett and Hamilton 1999). Twelve pits, with an average volume of 1.06 m^3 and external to the dwelling, provided 12.27 m³ of maximum floor volume (Curwen 1931).

CD18 Winnall Down SU 4985 3035

Winnall Down was discovered in 1974 and excavated in 1976 and 1977 to prevent destruction due to motorway expansion (Fasham 1985). Situated on Upper chalk at 67 m above OD, the site overlooks a valley, 800 m east of the River Itchen. While evidence for activity from the Neolithic to Medieval periods was found, the site had two phases of occupation of interest to this study. Evidence for the type of environment is scarce and the nearby field systems have been ploughed over too often to be certain of their relationship to the settlement.

The Late Bronze Age phase was an unenclosed settlement containing four potentially contemporary dwellings, with a roofed floor area of 196.66 m². The individual dwelling areas were 44.18 m², 48.46 m², 50.72 m², and 53.30 m². While the purpose of hemispherical pit 6482, with a volume of 0.02 m^3 internal to House C, was debated within the report, it has been included as consumptive architecture for this report, as it served no structural purpose and did not portray the characteristics of a hearth or cooking pit. This phase had no recorded post-structures (Fasham 1985).

The Early Iron Age phase was enclosed with a ditch surrounding an area of 4000 m². Consistent with the pattern emerging in the sample population, this later phase demonstrated growth in both the area of dwelling space and volume of storage space. Eight dwellings provided 507.37 m² of roofed floor space, increasing the living area by nearly three times after doubling the number of dwellings from the previous period. The individual dwellings were largely similar to the previous period (38.48 m², 44.18 m², 50.27 m², 50.27 m², 55.33 m², 56.75 m², 58.15 m²), with one much larger structure (153.94 m²). Twenty post-structures, both square and rectangular of differing construction, provided a range of individual areas from 0.80 to 7.50 m^2, for a total additional area of 63.33 m². Twenty-seven pits external to dwellings were recorded, ranging from 0.25 to 7.55 m^3 and provided 38.34 m³ of total storage volume. The pits can be grouped by shape, which included sub-rectangular with flat bottoms (n=5), beehive (n=4), cylindrical (n=7) and oval with flat bottoms (n=11) (Fasham 1985).

CD19 Hog Cliff Hill SY 624 965

Hog Cliff Hill is an oval Late Bronze Age and Early Iron Age enclosed settlement on a ridge of Middle Chalk between the River Frome and Sydling Brook, excavated from 1959 to 1960 (Ellison and Rahtz 1987). The excavators noted that chronology of the site was difficult; however, a chronology of five phases into the Roman period was developed.

The Late Bronze Age ditch and bank enclosed 5202.57 m² and consisted of three dwellings, providing 309.56 m² of roofed floor area. The individual dwelling areas were 76.98 m², 89.44 m², and 143.14 m², much larger than most contemporary structures. No pits or post-structures were recorded for this phase.

The two Early Iron Age phases were located within an enlarged enclosure, encompassing 105,218.27 m². Five dwellings in the earlier phase, Hog Cliff Hill i, provided 161.00 m² THA. The individual dwelling areas were 13.09 m², 21.45 m², 29.45 m², 36.19 m², and 60.65 m². A single post-structure belonging to this phase was recorded, providing an additional 3.92 m² of floor area. The earlier phase included one pit internal to a dwelling with 0.21 m³ of storage volume.

Hog Cliff Hill ii consisted of three later penannular dwellings, providing 68.90 m² THA. The individual dwelling areas were 13.80 m², 25.65 m², and 29.45 m². These contained seven conical and hemispherical pits, ranging from 0.22 to 2.02 m^3 in individual volume and providing 6.07 m³ of storage volume. More pits were discussed in the report, but dimensions were not provided.

CD20 Heathy Brow TQ 32651 12250

Heathy Brow is an Early Iron Age settlement on the chalk of the South Downs (Bedwin 1982). The site is situated near the Plumpton Plain sites, although of later date, and likely shared a similar environmental setting. The settlement was surrounded by likely contemporary field systems.

The settlement consisted of one dwelling, providing 19.63 m² of THA. A single rectangular post-structure provided 24.00 m² of additional area. No pits were recorded for the site.

CD21 Old Down Farm SU 356465

Old Down Farm is an enclosed settlement on the chalk of the Hampshire downs. Similar to Winnall Down, which is in the vicinity of Old Down Farm, the paleoenvironment of the area is difficult to determine. Of the seven occupation phases of Old Down Farm, this study is interested in the two from the Early Iron Age (Davies 1981).

The first occupation phase, Old Down Farm i dating to the earliest Iron Age *c.* 7th century B.C., consisted of two dwellings (57.28 m² and 70.88 m²) with a roofed floor area of 128.15 m². Twenty-seven pits external to the dwelling were recorded; however, only twenty-five were charted with adequate dimensions to generate estimated volume. A mixture of pit morphology was present, as there were fourteen cylindrical pits, eight barrel shaped pits, four bell shaped pits, and one U shaped pit. The deepest bell, barrel and cylindrical pits were of similar depth. The cylindrical pits included the shallowest pits. The range of individual pit volumes was 0.05 to 7.22 m^3. The total volume from all pits was 76.45 m³. No post-structures were present in this phase.

The final phase, Old Down Farm ii, in existence from the 6th to the 4th centuries B.C., contained four dwellings with a total roofed floor area of 118.10 m². The individual dwelling areas were 22.09 m², 25.13 m², 35.44 m², and 35.44 m². The excavators reported two post-structures that were unable to be assigned to a specific phase of occupation. Seventeen external storage pits were recorded with a maximum volume of 53.98 m³. The pits of in this phase were a combination of bell (n=1), barrel (n=6), and cylindrical (n=9) shapes. The cylindrical pits included both the shallowest and deepest pits, while the barrel and bell pits were consistently of median depth, with a total range of 0.63 to 6.55 m^3.

C22 Gussage All Saints ST 9977 1015
Gussage All Saints is an Early Iron Age settlement within the 12000 m² ditched enclosure, completely excavated in 1972 (Wainright and Spratling 1973). The site sits 76.2 m above OD on a chalk ridge that overlooks Gussage Brook. The site was set within a probably open environment, suggested by the array of scrub species of carbonised plants represented in samples and supported by the dominance of sheep in the faunal assemblage, similar to the chalk of the South Downs (Corney 1991).

One dwelling provided 63.62 m² of Total Habitable Area. Seventeen post-structures provided an additional 116.00 m² of floor area. The site is notable for its excess of pits, graded in shape in regard to depth: cylindrical up to 50 cm, barrel up to 2 m, bell up to 3 m deep. One hundred and twenty-six pits associated with Phase 1 were external to the dwelling; however, only eighty-six were planned within the report. Fifty-five were barrel shapes, twenty-five cylindrical, and six bell shaped. The pits provided 154.00 m³ of maximum storage volume (Wainright and Spratling 1973, Jeffries 1979).

CD23 Little Woodbury SU 1488 2792
Little Woodbury is an Early Iron Age settlement with a palisade enclosing 16000 m², partially excavated in 1938 and 1939 (Bersu 1940). The site is situated 82.3 m above sea level on chalk of the South Downs, between the River Avon and the River Ebble. To the south lie the sites on Cranborne Chase and Gussage All Saints, while Thorny Down is north of Little Woodbury. There are no deer represented in the faunal assemblage; there is a predominance of domesticated species over wild, suggesting a more open environment than woodland (Brailsford and Jackson 1948).

Two dwellings (78.54 m² and 176.71 m²) provided 255.25 m² of roofed floor area. One hundred and ninety pits external to the dwellings provided 285.00 m³ of maximum storage volume, although Bersu (1940) hypothesized only twelve were open at any one time, providing 1.5 m³ of storage volume, which is reasonable for the projected size of the settlement. While Bersu considered seven distinct pit profiles based on depth, condensing the similar shapes provides ninety-nine cylindrical pits, eighteen bell shaped pits, thirty-six barrel shaped pits, eight frustrum shaped pits, and nine undetermined. Only seventy-one pits were planned within the report, providing dimensions for thirty-two cylindrical, twenty-six bell, eight barrel, and five frustrum shaped pits. The total pit volume from these pits was 240.06 m^3, with a range of individual pit volumes from 0.10 to 10.00 m^3. Seven post-structures provided an additional 18.88 m² of roofed floor space, with a range of individual areas of 1.00 to 14.00 m^2.

CD24 Hollingbury TQ 3221 0787
Hollingbury, also known as Hollingbury Camp, is an enclosed Early Iron Age settlement on a hill of Upper Chalk with a thin overlay of clay with flints (Holmes 1984). The site was originally excavated in 1937 by E.C. Curwen and further examined from 1967 to 1969. There is a lack of faunal and floral evidence to confidently state the environmental setting of the site, but it was likely similar to the other Early Iron Age sites on the chalk.

The enclosure contained 37231.08 m² of land, with five dwellings with 195.34 m² of roofed floor area. The individual dwelling areas were 14.30 m², 16.42 m², 18.68 m², 29.19 m², and 116.75 m². There was evidence of reconstruction that was unable to be phased, however, one dwelling was consistently larger than the others, regardless of reconstruction. The presence of a dominant dwelling is unusual for the period and suggests a change toward an overt social hierarchy and ranked dwellings. Three external hemispherical pits (0.54, 0.83, and 0.68 m^3) gave a maximum storage volume of 2.05 m³. The pits were located in the centre of the grouping of excavated dwellings, toward the south of the enclosure. No post-structures were present (Holmes 1984).

CD25 Winklebury Camp SU 6135 5290
Winklebury Camp hillfort sits on Upper Chalk in the North Hampshire Downs (Smith 1977). The ramparts enclosed 7.6 ha, or 76000 m^2. The site was excavated at the turn of the twentieth century and the ramparts were uncovered in 1959. Large scale excavation commenced in 1976, in advance of construction. Two Iron Age phases, dating respectively to the 6th/5th century BC and the 3rd-1st centuries, were uncovered. The first is of interest to this study.

Phase 1 of Winklebury Camp presented six post-built circular structures, providing a THA of 403.90 m^2. The individual dwelling areas were 38.48 m², 63.62 m², 66.48 m², 70.88 m², 81.71 m², and 82.73 m². Three cylindrical pits (2.27, 1.46, and 0.6 m^3) were associated with Phase 1, providing a total pit volume of 4.33 m^3. Of significant interest is the large number of post-structures associated with this phase. Forty-two post-structures were suggested as belonging to the earlier phase of occupation. Dimensions and/or plans were only provided for eighteen of the forty-two, providing a TAA of 141.70 m^2 for this study. The individual post-structure areas ranged from 4.00 to 12.25 m^2.

CD26 Balksbury Camp SU 350445

The univallate enclosure of Balksbury Camp is situated 91 m OD on Upper Chalk with an internal area of 180000 m^2 (Wainwright and Davies 19). Excavation on the defences was undertaken in 1939, with further excavation in 1967. Rescue excavations were performed in 1973 and 1981. The site demonstrated activity, of differing levels and likely not continuous, from the Neolithic to the end of the Iron Age.

This study is interested in the Early Iron Age phase. Only a few tentative 4/5 post-structures were dated to the Late Bronze/Early Iron Age and are not considered here. The Early Iron Age demonstrates a definite increase in activity and construction within the settlement. Three circular post-built structures were considered dwellings, providing a THA of 148.68 m^2. The individual dwelling areas were 45.36 m^2, 46.57 m^2, and 56.75 m^2. While 197 pits were recorded for Balksbury Camp, only twenty-seven could be phased through association with the dwellings, providing a total pit volume of 100.49 m^3. There were three types of pit shape present. Eighteen pits were bell shaped, eight were frustrum shaped, and one was cylindrical, with a range of volumes from 0.03 to 18.90 m^3. This pattern emphasized the change in pit structure toward bell and barrel shaped noted for the Iron Age (Jeffries 1979). No post-structures were securely associated with the EIA phase.

CD27 Chalbury Camp SY 694 838

Chalbury Camp was initially excavated in 1939. The surrounding area demonstrated much prehistoric activity, with Maiden Castle, the large later Iron Age hillfort, nearby. Chalbury sits on an oolitic promontory at the northern edge of Rimbury Ridge in the southern Dorset downs, overlooking Weymouth Bay. The site is enclosed by a single rampart.

While three potential 'huts' were discussed by Whitley (1943) on the basis of probable platforms, only one provided evidence of post-holes. The other two were tentative and therefore not considered in this study, although mention must be made in case of further investigation to the site. The dwelling had an internal diameter of 10.06 m, providing a THA of 79.49 m^2. Smaller 'hut circles' were also discussed, although only one was excavated and revealed a cylindrical pit providing a volume of 2.21 m^3. No post-structures were found on the site, although the excavations were not renewed the following year due to concern with international tensions prior to WWII.

CD28 Hengistbury Head SZ 171 909

Hengistbury Head hillfort is positioned on a promontory overlooking the Solent, surrounded on three sides by the waters of the English Channel and Christchurch Harbour. The geology is Tertiary sand and clay, affected by wind and water action, as well as subsequent historical mining. While settlement at Hengistbury Head continued throughout the Iron Age and into the Roman period, this study focuses on the Early Iron Age phase. Both recognition of structures and phasing thereof were markedly difficult (Cunliffe 1987: 82). Only structures most securely interpreted and phased were included in this study, allowing for the possibility of a larger settlement.

Ten circular trench-built structures were tentatively associated with the Early Iron Age on the basis of pottery, yet only seven were considered as possibly Early Iron Age, providing an area of 209.39 m^2. The individual areas of the trench-built structures were 19.24 m^2, 19.24 m^2, 25.13 m^2, 31.80 m^2, 35.44 m^2, 39.27 m^2, and 39.27 m^2. Four of five circular post-built structures were considered Early Iron Age, providing an area of 336.94 m^2. These were larger, with individual areas of 50.27 m^2, 78.54 m^2, 95.03 m^2, and 113.10 m^2. The Total Habitable Area for the period was 546.33 m^2. One post-structure was likely Early Iron Age, although precise dating was unavailable. No pits were apparently associated with the Early Iron Age settlement.

Thames Valley

The Thames Valley region consists of those sites situated on the gravels and sands of the lower Thames River Basin in Essex and Berkshire.

TV1 Springfield Lyons TL 735 081

Springfield Lyons is a Late Bronze Age ditched enclosure encompassing 2827.43 m^2 excavated in the late 1980s by the Essex County Archaeology Section (Buckley and Hedges 1987). The settlement is 36 m above OD at the edge of the Chelmer Valley, overlooking the river. The site sits on glacial sand and Chelmsford gravels, which underlie the clayey Springfield Till close by. The flora suggests a wetland/grassland environment, with cultivation likely along the river floodplain.

Three dwellings provided 77.74 m² of total roofed floor area. The individual dwelling areas were 35.26 m², 35.26 m², 35.26 m², 38.48 m². One post-structure provided 5.76 m² of additional floor space. The excavators report the existence of pits, but they are unrecorded and unphased, so are not able to be included in this study, but it is noted that the pits were clustered around the outside of the larger dwelling (Buckley and Hedges 1987).

TV2 Mucking North Ring TQ 6755 8111

Mucking North Ring was originally observed in 1960 and fully excavated from 1965 to 1978 (Bond 1988). The site is located on the eastern edge of the lower Thames Boyn Hill terrace, on a subsoil of gravel over clay. The nearby, down slope Mucking Creek and Thames estuary provided easy access to water.

The North Ring had two phases of occupation during the Late Bronze Age, dated from radiocarbon samples (750±80 bc (HAR-2911) and 680±110 bc (HAR 2893)), both within a ditched enclosure of 2000.00 m², with entrance to the east. The Late Bronze Age settlement as a whole consisted of three dwellings for a THA of 106.43 m².

Taking each phase separately posits an earlier phase of two dwellings and a later phase of one dwelling. A 15 m fence in Mucking North Ring i separated the entrance and open space from the two dwellings of that phase, 28.27 m² and 38.48 m² in area, which provided 66.75 m² of roofed floor area. Five post-structures, one oval and the rest rectangular, provided an additional 13.10 m² of floor area for the earlier phase. Nine pits, one internal and eight external to the dwellings, varied in profile from shallow circular and oval to deeper more rounded pits, with a range of volumes from 0.01 to 0.79 m^3, providing a total of 4.19 m³ of maximum storage volume.

The later phase, Mucking North Ring ii, consisted of one dwelling, providing 19.63 m² of roofed floor area and contained no reported post-structures or pits (Bond 1988, Clark 1993).

TV3 Green Park SU 470170

Green Park, also known as Reading Business Park, is an open Late Bronze Age settlement, excavated in 1987 and 1995 by Oxford Archaeological Unit (Brossler *et al.* 2004). The site is situated on what was exposed floodplain, consisting of clayey alluvium from London clay on top of second terrace gravel of Thames Valley gravels, 38 m above OD. The charcoal analysis suggests a woodland environment suitable for acidic gravels. A series of ditched field boundaries were found to the north and east of the excavated area.

Five dwellings, two with porches, provided 291.46 m² of roofed floor area. The individual dwelling areas were 51.77 m², 54.11 m², 60.27 m², 61.69 m², 63.62 m². The excavators determined two occupation phases were likely for the dwellings, however, the stratigraphic sequence was indeterminate. All the Late Bronze Age features are considered as a unit, providing the maximum available THA for the period. One 6-post and thirteen 4-post-structures provided an additional 44.53 m² of roofed floor space. The post-structures were in groupings to the east, west, and centre of the settlement. Sixty-eight pits, two internal to the dwellings, were present. Four main types (23 oval or circular with a rounded base, 15 oval or circular with a flat base, 7 oval or circular with a v-shaped profile, or 14 oval or circular and a deep rounded base) and nine irregular pits provided 51.09 m³ of maximum storage volume. The individual volumes ranged from 0.01 to 5.32 m^2. The two small internal pits were oval with a rounded base. The external pits were located to the west of the dwellings.

TV4 Loft's Farm TL 8689 0935

Loft's Farm is a Late Bronze Age settlement on the low gravels north of the Blackwater Estuary (Brown 1988). The surrounding environment included salt marshes to the south and grassland around the settlement. Rescue excavation from 1977 to the late 1980s uncovered occupation evidence from the Neolithic to a medieval enclosure. A sub-rectangular enclosure surrounding 2016 m^2 was dated to the Late Bronze Age.

Two dwellings, one typically circular double-ring roundhouse (31.00 m²) and one rectangular 16-post structure, provided 133.10 m^2 of THA. The rectangular structure (102.1 m²) was considered domestic by the excavators, with possible animal stalling reminiscent of contemporary Scandinavian and Low Country dwellings, and may reflect interaction between the Thames Valley region and the Continent. No pits were recorded for this period. Two post-structures presented an additional area of 2.25 m^2.

TV5 Aldermaston Wharf SU 605678

Aldermaston Wharf is a Late Bronze Age settlement on the River Kennet (Bradley *et al.* 1980). The settlement was on alluvium and Hamble series soil, suggesting an open landscape. The surrounding area was investigated sporadically throughout the 1960s and 1970s, with Aldermaston Wharf uncovered accidentally toward the latter end.

Two dwellings, 36.32 m² and 50.27 m² in area, provided a THA of 86.59 m^2. There were forty-nine external pits in two main clusters, with a few outliers, ranging from 0.11 to 0.35 m^3. The total pit volume for the period was 9.56 m^3. One pit (68) provided radiocarbon dates of 1050±40 bc (BM-1590) and 835±35 bc (BM-1591) from carbonized grain. Charcoal from the bottom of another pit provided a radiocarbon date of 1290±135 bc (BM-1592).

TV6 Mucking South Rings TQ 6711 8021

Mucking South Rings is c. 1 km south of the North Ring site in similar environmental setting, albeit to the south-east edge of the Boyn Hill gravel terrace (Clark 1993). The site dates to slightly earlier than the North Ring, placing it within the Late Bronze Age. The region was rife with contemporary settlement mainly composed of scattered dwellings (Etté 1993).

The double-ringed earthworks enclosed 4400 m^2, with a settlement of one dwelling providing 113.10 m^2. Ten post-structures were associated with this phase, ranging from 6.00 to 10.50 m^2, and provided 84.38 m^2 of additional roofed floor area. Pits were present but un-phased and unplanned, therefore not able to be accurately represented in this study (Bond 1988, Clark 1993).

Table A1 Southern British Site Gazette

Reference Number	Site Name	Location	Region	Period	Open or Enclosed	Number of Dwellings	Total Habitable Area m^2	Number of Pits	Total Volume m^3	Pit Location	Number of Post-Structures	Total Additional Area m^2
SE1	Trevisker	Cornwall	Southwest England	MBA	Enclosed	2	91.34	0	-	-	1	15.00
SE2	Trewey Downs	Cornwall	Southwest England	MBA	Open	3	56.10	0	-	-	0	-
SE3	Trethellan Farm	Cornwall	Southwest England	MBA	Open	7	381.71	32	1.75	2 External/ 30 Internal	1	10.24
SE4	Gwithian	Cornwall	Southwest England	MBA	Open	3	109.62	0	-	-	1	4.67
SE5	Stannon Down	Cornwall	Southwest England	MBA	Open	At least 8	361.21	0	-	-	0	-
SE6	Brean Down	Somerset	Southwest England	MBA	Open	2	40.84	5	2.83	Internal	0	-
CD1	Poundbury i	Dorset	Chalk Downland	MBA	Enclosed	2	29.56	0	-	-	0	-
	Poundbury ii	Dorset	Chalk Downland	MBA	Enclosed	2	39.26	0	-	-		
CD2	Shearplace Hill	Dorset	Chalk Downland	MBA	Enclosed	2	102.46	2	0.67	Internal	0	-
CD3	Down Farm i	Wiltshire	Chalk Downland	MBA	Open	2	108.18	1	0.33	Internal	0	-
	Down Farm ii	Wiltshire	Chalk Downland	MBA	Enclosed	3	129.98	7	1.12	7 Internal/1 external	1	6.19
CD4	South Lodge Camp	Wiltshire	Chalk Downland	MBA	Enclosed	2	63.19	2	2.27	1 Internal/ 2 External	0	-

Reference Number	Site Name	Location	Region	Period	Open or Enclosed	Number of Dwellings	Total Habitable Area m²	Number of Pits	Total Volume m^3	Pit Location	Number of Post-Structures	Total Additional Area m²
CD5	Thorny Down i	Wiltshire	Chalk Downland	MBA	Enclosed	2	56.37	3	0.35	External	1	6.00
	Thorny Down ii	Wiltshire	Chalk Downland	MBA	Enclosed	2	62.43	0	-	-	2	15.00
CD6	New Barn Down	West Sussex	Chalk Downland	MBA	Enclosed	2	64.02	1	0.72	External	0	-
CD7	Cock Hill	West Sussex	Chalk Downland	MBA	Open	3	87.66	2	1.02	Internal	0	-
CD8	Blackpatch	West Sussex	Chalk Downland	MBA	Enclosed	1	29.22	1	0.17	Internal	0	-
CD9	Itford Hill i	East Sussex	Chalk Downland	MBA	Enclosed	2	52.57	5	1.18	Internal	0	-
	Itford Hill ii	East Sussex	Chalk Downland	MBA	Enclosed	4	109.74	3	0.42	Internal	0	-
	Itford Hill iii	East Sussex	Chalk Downland	MBA	Enclosed	4	106.02	4	1.26	Internal	0	-
	Itford Hill iv	East Sussex	Chalk Downland	MBA	Enclosed	2	58.44	0	-	-	0	-
CD10	Black Patch hut platform 4	East Sussex	Chalk Downland	MBA	Enclosed	5	145.85	5	3.12	Internal	0	-
	Black Patch hut platform 1	East Sussex	Chalk Downland	MBA	Enclosed	2	40.84	1	1.27	Internal	0	-
CD11	Plumpton Plain A	East Sussex	Chalk Downland	MBA	Enclosed	3	96.86	at least 1 pit	0.44	External	0	-

Reference Number	Site Name	Location	Region	Period	Open or Enclosed	Number of Dwellings	Total Habitable Area m²	Number of Pits	Total Volume m^3	Pit Location	Number of Post-Structures	Total Additional Area m²
CD16	Mile Oak	Sussex	Chalk Downland	MBA	Open	3	108.45	6	1.36	Internal	0	-
CD14	Highdown Hill	West Sussex	Chalk Downland	MBA	Enclosed	3	58.71	0	-	-	0	-
TV1	Springfield Lyons	Essex	Thames Valley	LBA	Enclosed	3	77.74	Present but unphased	-	Unplanned	1	5.76
TV2	Mucking North Ring i	Essex	Thames Valley	LBA	Enclosed	2	66.75	9	4.19	1 Internal/ 4 External	5	13.10
	Mucking North Ring ii	Essex	Thames Valley	LBA	Enclosed	1	19.63	0	-	-	0	-
TV3	Green Park	Berkshire	Thames Valley	LBA	Open	5	291.46	68	51.09	2 Internal/66 External	14	44.53
TV4	Loft's Farm	Essex	Thames Valley	LBA	Enclosed	2	133.10	0	-	-	2	2.25
TV5	Aldermaston Wharf	West Berkshire	Thames Valley	LBA	Enclosed	2	86.59	49	9.56	External	0	-
TV6	Mucking South Rings	Essex	Thames Valley	LBA	Enclosed	1	113.10	Present but unphased	-	Unplanned	10	84.38
CD11	Plumpton Plain B	East Sussex	Chalk Downland	LBA	Enclosed	3	33.21	3	0.54	Internal	0	-
CD13	Rams Hill	Berkshire	Chalk Downland	LBA	Enclosed	4	98.38	6	1.61	External	9	19.77
CD15	Amberley Mount	Sussex	Chalk Downland	LBA	Open	2	61.93	1	0.86	Internal	0	-

Reference Number	Site Name	Location	Region	Period	Open or Enclosed	Number of Dwellings	Total Habitable Area m²	Number of Pits	Total Volume m^3	Pit Location	Number of Post-Structures	Total Additional Area m²
CD16	Mile Oak	Sussex	Chalk Downland	LBA	Open	1	49.01	1	0.37	1 Internal/ 3 External	2	7.29
CD20	Hog Cliff Hill	Dorset	Chalk Downland	LBA	Enclosed	3	309.56	0	-	-	0	-
CD17	Eldon's Seat	Dorset	Chalk Downland	LBA	Enclosed	4	144.26	0	-	-	0	-
CD18	The Caburn	East Sussex	Chalk Downland	LBA	Enclosed	1	25.13	12	12.27	External	0	-
CD19	Winnall Down	Hampshire	Chalk Downland	LBA	Open	4	196.66	0	-	-	0	-
SE6	Brean Down	Somerset	Southwest England	LBA	Open	0	N/A	1	2.45	External	2	8.33
SE7	Cadbury Castle	Somerset	Southwest England	LBA	Open	Possible but no secure phasing	N/A	At least 1	0.36	External	2	8.75
CD12	Heathy Brow	East Sussex	Chalk Downland	EIA	Open	1	19.63	0	-	-	1	24.00
CD14	Highdown Hill	West Sussex	Chalk Downland	EIA	Enclosed	2	65.57	Present but unmeasured	-	External	0	-
CD17	Eldon's Seat	Dorset	Chalk Downland	EIA	Enclosed	3	143.95	1	0.01	Internal	0	-
CD19	Winnall Down	Hampshire	Chalk Downland	EIA	Enclosed	8	507.37	27	38.34	External	20	63.33

Reference Number	Site Name	Location	Region	Period	Open or Enclosed	Number of Dwellings	Total Habitable Area m²	Number of Pits	Total Volume m^3	Pit Location	Number of Post-Structures	Total Additional Area m²
CD20	Hog Cliff Hill i	Dorset	Chalk Downland	EIA	Enclosed	5	161.00	1	0.21	Internal	1	3.92
	Hog Cliff Hill ii	Dorset	Chalk Downland	EIA	Enclosed	3	68.62	7	6.07	Internal	0	-
CD21	Old Down Farm i	Hampshire	Chalk Downland	EIA	Enclosed	2	128.15	25	76.45	External	0	-
	Old Down Farm ii	Hampshire	Chalk Downland	EIA	Open	4	118.10	17	53.93	External	Present but unphased	-
CD22	Gussage All Saints	Dorset	Chalk Downland	EIA	Enclosed	1	63.62	86	154.00	External	17	116.00
CD23	Little Woodbury	Essex	Chalk Downland	EIA	Enclosed	2	255.25	71	240.06	External	7	18.88
CD24	Hollingbury	Sussex	Chalk Downland	EIA	Enclosed	5	195.34	3	2.05	External	0	-
CD25	Winklebury Camp	Hampshire	Chalk Downland	EIA	Enclosed	5	403.90	3	4.33	External	18	141.70
CD26	Balksbury Camp	Hampshire	Chalk Downland	EIA	Enclosed	3	148.68	27	100.49	External	0	-
CD27	Chalbury Camp	Dorset	Chalk Downland	EIA	Enclosed	1	79.49	1	2.21	Internal	0	-
CD28	Hengistbury Head	Dorset	Chalk Downland	EIA	Enclosed	11	546.33	0	-	-	1	
SE7	Cadbury Castle	Somerset	Southwest England	EIA	Open	2	203.00	Possible but unphased	-	-	14	155.75
SE8	Gurnard's Head	Cornwall	Southwest England	EIA	Enclosed	3	68.50	2	0.11	Internal	0	-
SE9	Pilsdon Pen	Dorset	Southwest England	EIA	Enclosed	8	357.70	3	2.13	External	0	-

Appendix B: Danish Site Summaries

This section provides a brief overview of the Danish sites analysed in this study, with particular focus on the domestic architecture recorded, namely the maximum number of dwellings and post-structures along with their cumulative areas per site, per phase. This appendix provides a layout of the data pertinent to the study, represented in table form in Chapters VII and VIII, along with supplementary information regarding each settlement, which forms the basis of the analysis. Also contained within this chapter is a brief overview of the environmental setting of each site for a comparative of domestic space use over time within certain ecologies. The sites are arranged by ecological region (Fig. B1) and subsequently chronologically, according to Montelius' (1885) Bronze Age chronology (1800-500 BC) and Becker's (1961) further Iron Age chronology (500-100 BC), to provide an idea of spatial distribution over time in Denmark.

When dwelling dimensions are provided as a range of values, an average was used to provide the most accurate value for roofed floor space possible. Certain sites, *e.g.* Grøntoft, present a large number of houses covering several phases of shifting settlements. In those cases, the Total Habitable Area (THA) is given per settlement phase within each period, in order to establish the variability in settlement organization within each period. Dwellings are distinguished by either three-aisled construction, comparative length, or in the Late Bronze Age, the appearance of stalls at one end. Post-structures are the catchall term for outbuildings or 'outhouses' (see Rindel 2001) or the small, four to six post-structures without stalling. The total area provided by post-structures per period is given as a Total Additional Area (TAA).

Some sites, *e.g.* Omgård (Nielsen 1982b), have never been fully excavated and thus represent only a sample of the total population per period, however, those samples are still representative, given that this study is interested in trends of spatial division over time. Certain sites, *e.g.* Sejlflod (Nielsen 1982a), present structures assumed by the excavators and are included within this study if enough evidence is provided to obtain a viable measurement. In cases of ambiguity, an approximate value is given. On the site gazette (Table B1), those values are denoted by ~.

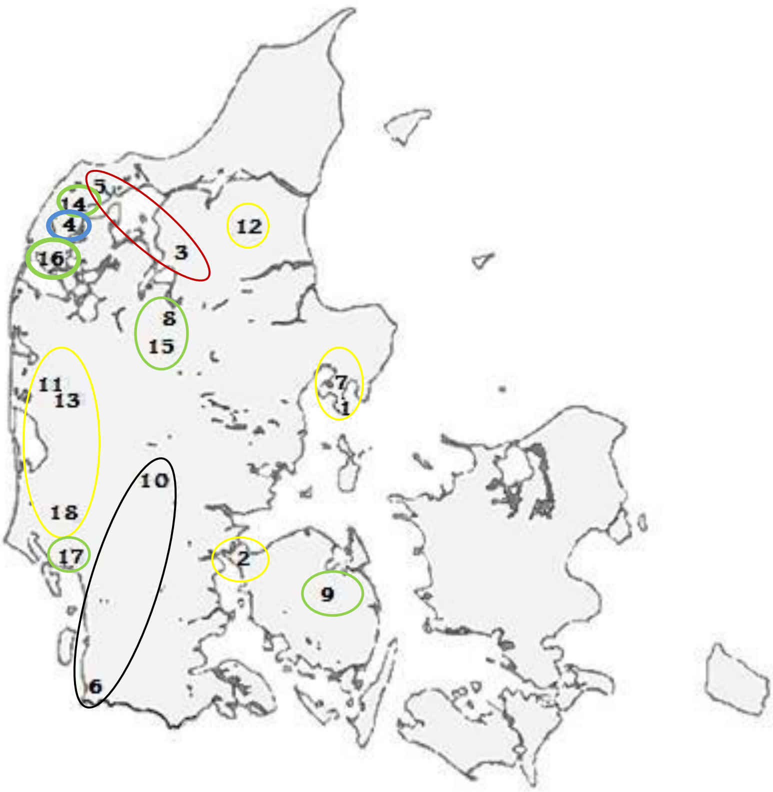

Figure B1 1 Egehøj 2 Røjle Mose 3 Vadgård 4 Legard 5 Bjerre 6 Højgård 7 Hemmed Church 8 Jegstrup 9 Højby 10 Vorbasse 11 Omgård 12 Sejlflod 13 Grøntoft 14 Skårup 15 Borremose 16 Heltborg 17 Kjærsing 18 Hodde

Green circle indicates clayey moraine, Black indicates the outwash plain, Yellow indicates sandy moraine, Red indicates raised Littorina seabed, Blue indicates dunes. Note the regions are only indicated in areas of settlement; there are further divisions in the rest of Denmark.

Moraine Sand

The moraine sand region consists of the widespread sandy soils and gravels of eastern Viborg, northern Århus, southern North Jutland, western Rinkøbing, Ribe, and South Jutland.

MS1 Røjle Mose

Røjle Mose is an Early Bronze Age PII settlement on a hummocked promontory of moraine sand projecting into Røjle bog on Funen (Jæger and Laursen 1983). The modern bog was likely a shallow fiord, before the current northern dune blocked access to the sea. The site is notable in that it was only accessible from the south, given its watery surroundings. There was likely 15 ha of sandy soil around the settlement and 47 ha of clay soil further south suitable for arable farming, which is suggested by the carbonised grain and residue on sickles found within the site. Rescue excavations investigated 5000 m of surrounding area in 1974-1977.

A single rectangular dwelling provided 32 m^2 of roofed floor area. Burnt stone provided a thermo-luminescence date of 1860 +- 200 B.C. Two 'C-shaped' constructions, interpreted as activity areas based on a possible hearth and cooking pit, provided 27.48 m^2 of additional roofed floor area (Jæger and Laursen 1983).

MS2 Hemmed Church

Hemmed Church is an Early and Late Bronze Age settlement excavated in 1987 and 1988 in east Jutland. The excavation encompassed 800 m^2 on moraine gravel (Boas 1989).

The Early Bronze Age phase consisted of at least one dwelling, which provided 301 m^2 of roofed floor area (Boas 1989). A radiocarbon date of 1670-1450 BC Cal 1σ (K-5168) was derived from charcoal (Rasmussen 1991).

For the Late Bronze Age settlement, two dwellings (300 m^2 and 168 m^2) provided about 468 m^2 of roofed floor area. Two post-structures provided an additional 74 m^2 of roofed floor area (Boas 1989, 1991).

MS3 Egehøj

Egehøj is an Early Bronze Age PI/PII site set four km south of the east coast on a south-facing slope of moraine gravel in east Jutland (Boas 1983). The site covers around 20000 m^2 of open land; only 1225 m^2 were fully excavated. The site overlooks the Hemmed and Brøndstrup rivers.

The PI settlement, Egehøj i, consisted of a single dwelling with 126 m^2 of roofed area. Charcoal (K-2238) from the dwelling provided a radiocarbon date of 1520-1320 BC Cal 1σ (Rasmussen 1991). No post-structures were present in this phase.

Egehøj ii, the PII settlement consisted of two smaller dwellings (108 m^2 and 114 m^2) with a total 222 m^2 of roofed floor area (Boas 1983). No post-structures were recorded for the period.

MS4 Sejlflod

Sejlflod is a dual phased Pre-Roman Iron Age PI-II and IIIb-Roman Iron Age settlement in north Jutland. The dwellings are longhouses with sunken floors, uncommon for the Iron Age. The settlement is situated on moraine gravel and was excavated in advance of gravel digging in 1979 (Nielsen 1982a).

The earlier Pre-Roman Iron Age settlement is of interest to this study. Two period-typical small dwellings (50 m^2 and 90 m^2) provided 140 m^2 of roofed floor area. No post-structures were associated with this phase.

MS5 Omgård

Omgård is an Early Pre-Roman Iron Age PIa/Ib settlement, excavated in 1975-1976 and 1979-1981. A pair of Late Bronze Age farmsteads was located in the vicinity, but not fully excavated. The site, situated on mica clay and sand, was within a gated palisade (Dewey 1926, Nielsen 1982b).

The excavators determined the farmstead consisted of a single dwelling, a smithy, and two probable storehouses. A hollow-way extended west to ford the River Tim north of the settlement. The single dwelling provided around 82.5 m^2 of roofed floor area and was radiocarbon dated to 80±70 BC (K-3566) and 200±70 BC (K-3567). The three post-structures (6.25 m^2, 65 m^2, and 70 m^2) provided an additional 141.25 m^2 of roofed floor area, with one providing a radiocarbon date of 90±70 BC (K-3568). A possible Pre-Roman Iron Age PIIIa farmstead was not fully explored (Nielsen 1982b).

MS6 Grøntoft

The site of Grøntoft consists of a series of shifting settlements in west Jutland dating from the Early Pre-Roman Iron Age (Becker 1968, 1971). The site is notable as among the earliest evidence for shifting settlements in Denmark. Given the relative dearth of artefacts, the structures are difficult to phase within periods, but Rindel's (1999, 2001) typology of house structures allows for some understanding of the maximum number of structures per period. Grøntoft is situated on a west-facing slope and subsequent plateau of Saalian sandy till (Odgaard 1985). The palynological evidence suggests a dry heathland in the Bronze Age with evidence for increasing cultivation in the Pre-Roman Iron Age.

The Early Pre-Roman Iron Age PI settlement is indicated by house types IA, IB, IIA, IIA/B, and IIB. Both house types I and II are thought to represent open settlements, with the earlier Type I being more scattered than Type II. Eleven Type IIA houses provided 405 m^2 of roofed floor area. Five Type IIA/B houses provided 217 m^2 of roofed floor area. Twenty Type IIB houses provided 966 m^2 of roofed floor area (Rindel 2001). As a whole for the EpRIA PI phase, Grøntoft i, thirty-six dwellings provided a THA of 1588 m^2. No post-structures were associated with these house types (Becker 1968, 1971).

The Pre-Roman Iron Age PI/PII settlement, Grøntoft ii, is indicated (Rindel 1999) by house types IIIA, IIIA/B, and IIIB, which are clustered on the northern slope of the hill in association with outhouse types a and b. The clustering and association of specific longhouses and outhouses suggests a move to small, closed settlements. Sixteen Type IIIA houses provided 715 m^2 of roofed floor area. Four associated type a outhouses provided 42 m^2 of additional roofed floor area. Eleven Type IIIA/B houses provided 532 m^2 of roofed floor area. Eight Type IIIB houses provided 446 m^2 of roofed floor area. Five associated type b outhouses provided 125 m^2 of additional roofed floor area. The THA for EpRIA PII was 1719 m^2, provided by thirty-five dwellings. A total additional area of 167 m^2 was provided by nine post-structures.

Grontoft i	Grontoft ii		Grontoft iii		Grontoft iv
Dwellings	Dwellings	Post-Structures	Dwellings	Post-Structures	Dwellings
24	24	9	36	22.5	40
25	36	9	40		48
25	36	12	45		50
27	36	12	45		50
27	36	25	50		50
27	36	20	55		55
27	40	25	60		60
27	40	25	60		60
35	40	30	60		90
36	40				
36	44				
36	45				
40	45				
40	48				
40	48				
40	50				
40	50				
44	50				
44	50				
44	50				
44	50				
45	50				
50	55				
50	55				
50	55				
50	55				
50	55				
50	60				
50	60				
55	60				
55	60				
55	60				
55	60				
60	65				
75	75				
110					

The final settlement of the site is known as Grøntoft village A, termed here Grøntoft iii, a fenced and gated Pre-Roman Iron Age PII/III village, clustered together on the plateau, which underwent modifications over time (Rindel 1999). Two phases of the enclosed settlement, consisting of Type IV A and B houses, have been excavated. Grontoft iii contained nine dwellings, providing 451 m^2 of THA. A single post-structure presented 22.5 m^2 of additional roofed area. Grontoft iv presented nine dwellings with a THA of 503 m^2. No outhouses were associated with this phase. The combined THA for village A is 962 m^2 provided by eighteen dwellings, with one post-structure providing an additional 22.5 m^2.

MS7 Hodde

Hodde, similar to the earlier Grøntoft, was a mobile settlement, moving around a single hilltop enclosure in west Jutland during the Pre-Roman Iron Age. The settlement was in an ideal location, as the hill was surrounded on three sides by rivers (Jensen 1982). Unusually, the structures were placed around the edges of the fence, leaving an open village centre throughout all the phases of occupation (Hvass 1985, Mahoney 2008).

Hodde i		Hodde ii		Hodde iii		Hodde iv	
Dwellings	Post-Structures	Dwellings	Post-Structures	Dwellings	Post-Structures	Dwellings	Post-Structures
44	10.5	44	12	40	9	44	9
44	15	44	21	40	15	44	12
50	16	55	22	44	16	48	12
55	16	55	24	44	16	48	15
55	16	60	25	48	16	50	15
60		60	25	48	16	50	16
64		65	25	50	20	50	16
66		65	25	50	20	50	16
165		65	25	50	20	50	16
224		70	27.5	50	20	55	16
		70	30	50	20	55	20
		75	45	50	20	55	20
		78		50	20	55	20
		78		55	24	55	20
		80		55	25	55	20
		85		55	40	56	20
		168		56		60	20
				60		60	20
				60		60	20
				60		64	20
				64		64	30
				65		65	40
				66		66	45
				75		75	50
				80		75	
				110		75	
						80	
						110	

The earliest phase of the settlement, Hodde i, covered 11,000 m^2 and consisted of twelve farmsteads, each enclosed within their own fence (Mahoney 2008). Ten dwellings provided 827 m^2 of roofed floor area. Five post-structures provided an additional 73.50 m^2 of roofed floor area (Hvass 1985).

Seventeen dwellings provided 1217 m^2 of roofed floor space in Hodde ii, the second EpRIA phase. Twelve post-structures provided an additional 306.5 m^2 of roofed floor area.

Hodde iii, dating to the Late Pre-Roman Iron Age, consisted of twenty-six dwellings, which provided 1475 m^2 of roofed floor area. Sixteen post-structures provided an additional 317 m^2 of roofed floor area.

Twenty-eight dwellings created the phase three village, Hodde iv, and provided 1674 m^2 of roofed floor area. Twenty-five post-structures provided an additional 533 m^2 of roofed floor area (Hvass 1985).

Raised Littorina Seabed

The raised Littorina seabed, in North Jutland and much of Thy, is a sandy, coastal environment.

RLS1 Bjerre

Bjerre is an Early Bronze Age PII-III to Late Bronze Age settlement. Bjerre, on the north of Thy, is situated on the dunes of a raised Littorina seabed (Bech and Mikkelsen 1999). The landscape of Thy in the Early Bronze Age was one of increasingly deforested dune wetland, although some reforestation occurred in the Late Bronze Age (Bech 2003). The area was rife with settlement; only a few sites have been fully excavated.

The well-excavated Early Bronze Age settlement, Site 2, consisted of three dwellings (112.50 m^2, 112.75 m^2, 136.50 m^2), which provided 361.75 m^2 of roofed floor area. Bech (1997) notes that successive farmsteads were likely, although the specific ordering of dwellings was not determined. Two circular stake-built structures likely functioned as stock pens, but were not considered post-structures for the purposes of this study.

RLS2 Vadgård

Vadgård is an Early Bronze Age PII settlement situated 10 to 15 m^2 above sea level on a Littorina slope of moraine sand in north Jutland (Rasmussen 1993). One third of the land within a one-kilometre zone was arable at the time of occupation, making the site advantageous for settlement.

Two post-built structures were excavated, but Vadgård is unusual in that it also contained five turf-walled structures of similar size, which provided additional roofed floor area (Lomborg 1976). Turf-walled structures were not a local tradition and were more common to the Norwegian Bronze Age. Rasmussen (1993) suggests that two phases were present, each with one post-built house and two to three turf-walled houses serving as outbuildings. The structures were not radiocarbon dated; however, extrapolation provides two groupings. Vadgård i consists of a post-built dwelling providing about 66 m^2 of roofed floor area with two turf-walled structures (42.75 m^2 each) providing approximately 85.5 m^2 of additional roofed floor area. A second grouping, Vadgård ii, presented one post-built dwelling of 66 m^2 and three turf-walled structures (again approximately 42.75 m^2) providing approximately 128.25 m^2 of additional roofed floor area.

<u>Dunes</u>

The dune region includes the coastal areas of Thy, Rinkøbing, and Ribe. The settlement presence is difficult to determine as publication is lacking for the region.

D1 Legard

Legard is an Early Bronze Age PII settlement on Thy. Typical of the Early Bronze Age on Thy, the environment was wetland with few areas of accessible forest (Bech 2003). Although in a different ecological setting, Legard was in a highly populated area, not far from Bjerre.

Two dwellings, 225 and 264 m^2 respectively, provided 489 m^2 of roofed floor area. No post-structures were recorded for the site (Earle *et al.* 1998).

<u>Outwash Plain</u>

The outwash plain is located in lower central Denmark and includes both sandy and clayey soils.

OP1 Højgård

Højgård is a Bronze Age PI-IV settlement, situated on an elevated plain of sandy gravel between the Gels and Gram streams in south Jutland. Excavated in 1984-1985 with further excavation in the later 1980s, the site consists of several houses of varying types, dating from the Neolithic-Bronze Age transition and into the Late Bronze Age (Ethelberg 1986, 1991). Of interest to this study are the Early Bronze Age and Late Bronze Age settlements. For the Early Bronze Age, there were three phases of settlement, a phenomenon not usually seen until the Late Bronze Age/Pre-Roman Iron Age.

Three framehouses, longhouses without interior roof supports, provided 216.15 m^2 of roofed floor area and likely date to PII. These were smaller than the average EBA dwelling, with individual areas of 50.45 m^2, 67.00 m^2, and 98.70 m^2. Three three-aisled longhouses also belonged to the PII settlement, providing 447.45 m^2 of roofed floor area from dwellings with areas of 144.95 m^2, 145.05 m^2, and 157.45 m^2. The PII phase, Højgård i, consisted of a THA of 663.30 m^2 provided by six dwellings. No post-structures were recorded for this phase.

Højgård ii, the PII/III phase, consisted of three dwellings (164.32 m^2, 250.10 m^2, and 262.40 m^2) that provided 676.82 m^2 of roofed floor area. No post-structures were recorded for this phase. Three radiocarbon dates (K-5019, K-5020, K-5021) provided an average of 1610-1510 cal BC 1σ, placing this phase of settlement firmly in the Early Bronze Age (Rasmussen 1991).

The PIII phase, Højgård iii, consists of four dwellings, providing 550.65 m^2 of roofed floor area. The dwellings were more similar in size than previous periods: 105.40 m^2, 130.00 m^2, 130.00 m^2, and 185.24 m^2. No post-structures were recorded for this phase.

The Late Bronze Age PIV phase consisted of nine dwellings, providing 788.10 m^2 of roofed floor area. Dwellings decreased in size, with individual areas of 54.00 m^2, 60.00 m^2, 71.50 m^2, 80.60 m^2, 90.00 m^2, 90.00 m^2, 108.00 m^2, 108.00 m^2, and 126.00 m^2. Two post-structures provided approximately 78.00 m^2 of additional roofed floor area from individual areas of 36.00 m^2 and 42.00 m^2 (Ethelberg 1986, 1991). A radiocarbon date (K-5018) of 1190-920 cal BC 1σ from this cluster of dwellings firmly dates to the Late Bronze Age (Rasmussen 1991).

OP2 Vorbasse

The area around Vorbasse is complex, with activity from Late Neolithic into the Viking age, with probable continuity from around 100 BC into the 11th century AD (Hvass 1983). The two phases of interest to this study are those of the Late Bronze Age and the Late Pre-Roman Iron Age PIIIa. Around 150000 m^2 in total were excavated on clayey soil in an increasingly deforested area.

The Late Bronze Age settlement had two dwellings providing 326.00 m^2 of roofed floor area. The dwellings were similarly sized, with areas of 158.00 m^2 and 168.00 m^2. Three post-structures of equivalent size (45.00 m^2) provided approximately 135 m^2 of additional roofed floor area.

The Pre-Roman Iron Age PIIIa phase covered 1600 m^2 of open land. The settlement consisted of nine dwellings of approximately equivalent area (120.00 m^2) in two rows, providing 1080.00 m^2 of roofed floor area. Seven post-structures of equal size to the preceding phase (45.00 m^2) were situated close to the longhouses and provided approximately 315.00 m^2 of additional roofed floor area (Hvass 1983). The continuity in construction is remarkable.

<u>Moraine Clay</u>

The moraine clay region consists of scattered loci of clay soils across Funen, Vejle, Århus, and northern Viborg.

MC1 Jegstrup

Jegstrup is a Late Bronze Age settlement near Skive in central Jutland. Originally discovered in 1968 and excavated in 1978, the site is situated on a sandy promontory of mica clay and mica sand above what used to be Lake Tastum (Dewey 1926, Davidsen 1982).

Two definite houses make up the Late Bronze Age settlement, while a possible third was not fully excavated. House I had two phases of construction, moving from 144.00 m^2 to 135.00 m^2 of roofed floor area, with the stable end gaining approximately two square metres at the expense of the living area. The relationship between House I and II was not discussed other than to discuss a general dating to the Late Bronze Age based on typology. Therefore, the initial House I was used to provide a maximum roofed floor area for the period. House II produced 123.00 m^2 of roofed floor area. The THA for Jegstrup in the Late Bronze Age is 267.00 m^2 provided by two dwellings. No post-structures were recorded for the site (Davidsen 1982).

MC2 Højby

Højby is a Late Bronze Age single farmstead site in central northeast Funen on highly arable boulder clay. The settlement was excavated in 1984 in advance of the laying of a gas-pipeline.

One dwelling was excavated during rescue work prior to construction, which provided 137.90 m^2 of roofed floor area. No additional structures were located for the settlement (Fyns Stiftsmuseum 1984).

MC3 Borremose

Borremose is an Early to Late Pre-Roman Iron Age settlement, with two phases of occupation, in central Jutland. The settlement is situated on a strip of gravel moraine in the raised bog. The settlement is enclosed within ramparts, with only one entrance to the southeast. Three houses appear to have burned and been abandoned. Phasing is difficult, with two definite house types dating respectively to PII and PIII, as well as a third group that displayed traits of both periods which was not considered here as it could not be securely dated.

The Early Pre-Roman Iron Age PII settlement consisted of three dwellings, providing 253.00 m^2 of roofed floor area. The individual dwelling areas were varied, with 48.00 m^2, 100.00 m^2, and 105.00 m^2. Two post-structures (28.00 m^2 and 39.06 m^2) provided an additional 67.06 m^2 of roofed floor area.

The Late Pre-Roman Iron Age PIIIa phase consisted of eight dwellings, providing 563.70 m^2 of roofed floor area. The dwellings were much closer in area than the previous period. The dwellings were 58.50 m^2, 60.00 m^2, 60.00 m^2, 64.00 m^2, 65.00 m^2, 75.00 m^2, 90.00 m^2 and 91.20 m^2. Nine post-structures provided an additional 284.50 m^2 of roofed floor area. The post-structures were more varied in individual area than the preceding phase, with areas of 8.00 m^2, 10.00 m^2, 24.50 m^2, 27.00 m^2, 32.00 m^2, 36.00 m^2, 48.00 m^2, 49.50 m^2, and 49.50 m^2 (Martens 1988).

MC4 Skårup

Skårup is an Early Pre-Roman Iron Age PII settlement, covering around 12000 m^2 in north-west Jutland. The settlement was excavated from 1980 to 1981 and found to be phased, although attempts to phase the dwellings themselves were inconclusive. It was evident, however, that there were burning and rebuilding episodes (Olsen and Olsen 1982).

While only six house-sites were fully investigated, there were seventeen definite dwellings in the settlement providing about 935.00 m^2 of Total Habitable Area across several phases of building. The dwellings were of similar area: five were 50.00 m^2, seven were 55.00 m^2, and five were 60.00 m^2. No post-structures were recorded for the site (Olsen and Olsen 1982).

MC5 Kjærsing

Kjærsing is an open Late Pre-Roman Iron Age PIII settlement in Esbjerg, originally excavated in the 1930s by Hatt, Kjær, and Glob and further excavated in 1984 (Christiansen 1985). The later excavations covered an area of 10,000 m^2.

The settlement consisted of two contemporary groupings of structures, both aligned in rows. A total of twenty-two dwellings provided 1470.00 m^2 of THA. Two were 45.00 m^2, three were 50.00 m^2, one was 55.00 m^2, six were 60.00 m^2, five were 75.00 m^2, two were 80.00 m^2, two were 90.00 m^2, and the largest dwelling was 100.00 m^2. Seven post-structures of equivalent size (16.00 m^2) provided an additional 112.00 m^2 of area (Christiansen 1985).

MC6 Heltborg

Heltborg is an Iron Age village mound on Thy, situated on a hill of hummocky moraine overlooking the Visby river valley (Bech 1985). The site was found to contain a single Late Bronze Age dwelling and houses dating from the Pre-Roman Iron Age PIIIa/b into the Late Roman Iron Age/Early Germanic Iron Age. The Iron Age houses follow the north-west Jutland pattern of turf walls, understandable given that Thy in the Iron Age was largely deforested (Bech and Mikkelsen 1999). The excavation covered 1600 m^2, which the excavators estimated to be approximately 1/3 of the complete site (Bech 1985).

The Late Bronze Age phase consisted of one dwelling, providing 87.50 m^2 of roofed floor area. No additional structures were recorded for this period.

The phasing of the Late Pre-Roman Iron Age houses is difficult, but the excavators suggest three groupings of buildings as discrete farmsteads within the village. Contemporaneity between the farmsteads has not yet been confirmed. Three dwellings provided 192.5 m^2 of THA for Heltborg i, belonging to the Pre-Roman Iron Age PIIIa. The dwellings were small (59.00 m^2, 63.00 m^2, and 70.50 m^2), consistent with early Iron Age dwellings Nine smaller associated structures provided an additional TAA of 222.34 m^2. The variation was greater for the post-structures, with a range in area from 7.29 m^2 to 36.00 m^2.

The Pre-Roman Iron Age PIIIb settlement, Heltborg ii, consisted of two small dwellings (27.84 m^2 and 40.00 m^2), providing 67.84 m^2 of roofed floor area. A single post-structure presented 11.70 m^2 of additional area.

Table B1 Danish Site Gazette

Reference Number	Site Name	Location	Region	Period of Occupation	Number of Dwellings	Total Habitable Area m^2	Number of Post-Structures	Total Additional Area m^2
MS1	Røjle Mose	Funen	Moraine Sand	EBA PII	1	32.00	2	27.48
MS2	Hemmed Church	E Jutland	Moraine Sand	EBA	1	301.00	0	-
MS3	Egehøj i	E Jutland	Moraine Sand	EBA PI	1	126.00	0	-
	Egehøj ii	E Jutland	Moraine Sand	EBA PII	2	222.00	0	-
D1	Legard	Thy	Dunes	EBA PII	2	489.00	0	-
RLS1	Bjerre Site 2	Thy	Raised Littorina Seabed	EBA PII	3	361.75	0	-
RLS2	Vadgård	N Jutland	Raised Littorina Seabed	EBA PII	1	66.00	2	85.50
	Vadgård	N Jutland	Raised Littorina Seabed	EBA PII	1	66.00	3	128.50
OP1	Højgård i	S Jutland	Outwash Plain	EBA PII	6	663.30	0	-
	Højgård ii	S Jutland	Outwash Plain	EBA PII/PIII	3	676.82	0	-
	Højgård iii	S Jutland	Outwash Plain	EBA PIII	4	550.65	0	-

Reference Number	Site Name	Location	Region	Period of Occupation	Number of Dwellings	Total Habitable Area m2	Number of Post-Structures	Total Additional Area m2
MS2	Hemmed Church	E Jutland	Moraine Sand	LBA	2	468.00	2	74.00
MC1	Jegstrup	C Jutland	Moraine Clay	LBA	2	267.00	0	-
MC2	Højby	Funen	Moraine Clay	LBA	1	137.90	0	-
MC6	Heltborg	Thy	Moraine Clay	LBA	1	87.50	0	-
OP1	Højgård	S Jutland	Outwash Plain	LBA	9	788.10	2	78.00
OP2	Vorbasse	S Jutland	Outwash Plain	LBA	2	326.00	3	~135.00
MS6	Omgård	W Jutland	Moraine Sand	EpRIA PIa/Ib	1	82.50	3	141.25
MS5	Sejlflod	N Jutland	Moraine Sand	EpRIA PI-PII	2	140.00	0	-
	Grøntoft i	W Jutland	Moraine Sand	EpRIA PI	36	1588.00	0	-
MS7	Grøntoft ii	W Jutland	Moraine Sand	EpRIA PI/II	35	1719.00	9	167.00
	Grøntoft iii	W Jutland	Moraine Sand	EpRIA PII/III	9	451.00	1	22.50
	Grøntoft iv	W Jutland	Moraine Sand	EpRIA PII/III	9	503.00	0	-
MS8	Hodde i	W Jutland	Moraine Sand	EpRIA PII	10	827.00	5	73.50
	Hodde ii	W Jutland	Moraine Sand	EpRIA	17	1217.00	12	306.50

Reference Number	Site Name	Location	Region	Period of Occupation	Number of Dwellings	Total Habitable Area m2	Number of Post-Structures	Total Additional Area m2
MC3	Borremose	C Jutland	Moraine Clay	EpRIA PII	3	253.00	2	67.06
MC4	Skårup	NW Jutland	Moraine Clay	EpRIA PII	17	935.00	0	-
OP2	Vorbasse	S Jutland	Outwash Plain	LpRIA PIIIa	9	~1080	7	~315.00
MS8	Hodde iii	W Jutland	Moraine Sand	LpRIA	26	1475.00	16	317.00
	Hodde iv	W Jutland	Moraine Sand	LpRIA	28	1674.00	25	533.00
MC3	Borremose	C Jutland	Moraine Clay	LpRIA PIIIa	8	563.70	9	284.50
MC5	Kjaersing	Esbjerg	Moraine Clay	LpRIA	22	1470.00	7	112.00
MC6	Heltborg i	Thy	Moraine Clay	LpRIA PIIIa	3	192.5	9	222.54
	Heltborg ii	Thy	Moraine Clay	LpRIA PIIIb	2	67.84	1	11.70